



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.

Significant/Major Changes Incorporated in This Edition

Technical changes described in this clause are related to TS 0420 revision 3.0, dated 12 July 2021.

- Updated section 1.2 Glossary
- Updated section 1.3 References
- Updated section 1.4 Definitions
- Added detail to section 3 Approval to Commence Work
- Added standardised TS paragraphs to section 4 Quality Requirements
- Section 6 changed title to Welding Personnel. Added qualifications and section 6.4
- Added Section 7.2 Testing of Welds for Rolled and Longitudinal Welded Pipe
- Updated testing requirements for section 7.3 Testing of Welds for Spiral Welded Pipe - Removed materials grade notification requirements and added pipe run length
- Updated amount of testing for section 7.3.1 Alternative testing requirements for Spiral Welded Pipe. Added small order requirements
- Updated section 7.4.1 Testing Requirements for Specials
- Updated section 7.4.2 Testing Requirements for Stainless Steel Specials
- Added section 7.4.3 Tying into Existing Piping
- Updated section 7.5 Testing of Structural Welds (steel and stainless steel)
- Added Section 7.5.4 Testing of Reinforcing Steel
- Updated section 9 Pickling and Passivation of Stainless-Steel Welds
- Added Appendix A Schedules of Hold Points, Witness Points and Identified Records
- Added Appendix B NDT Requirements
- Added Appendix C Weld review Process
- Updated sample forms in Appendix D.




Document Controls

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1 Introduction

SA Water is responsible for the operation and maintenance of an extensive amount of engineering infrastructure.

This standard applies to all metal fabrication, pipe tie-ins and repair work involving welding, carried out by SA Water and Contractors / Sub Contractors.

1.1 Purpose

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

1.2 Glossary

The following glossary items are used in this document:

Term	Description
API	American Petroleum Institute
ASTM	American Society for Testing Materials
CE	Carbon Equivalent
DPI	Dye Penetrant Inspection
FCAW	Flux Cored Arc
FSBW	Full Strength Butt Weld
GMA	Gas Metal Arc
GTAW	Gas Tungsten Arc
ITP	Inspection and Test Plan/s
MDR	Manufactures Data Report
MMA	Manual Metal Arc
MPI	Magnetic Particle Inspection
MSCL	Mild Steel Cement Lined
MSCACL	Mild Steel Calcium Aluminate Composition Lined
NATA	National Association of Testing Authorities
NDT/NDE	Non-Destructive Testing / Examination
PQR	Procedure Qualification Record
RFEE	Request for Engineering Engagement
RT	Radiographic (X-ray) Testing
SA Water	South Australian Water Corporation
SAW	Submerged Arc Welding
TG	SA Water Technical Guideline
TS	SA Water Technical Standard
UT	Ultrasonic Testing
WPS	Welding Procedure Specification: is a Qualified Weld Procedure which has been developed, tested and approved
WQMS	Welding Quality Management
WQR	Welder Qualification Record
WSP	Welding Service Provider
WTIA	Welding Technology Institute of Australia (Weld Australia)

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, the latest revisions apply:

Number	Title
AS 1171	Non-destructive testing - Magnetic Particle Testing of Ferromagnetic Products, Components and Structures
AS 1554.1	Structural Steel Welding
AS 1554.2	Stud Welding (Steel Studs to Steel)
AS 1554.3	Welding of Reinforcing Steel
AS 1554.4	Welding of High Strength Quenched & Tempered Steels
AS 1554.5	Welding of Steel Structures Subject to High Levels of Fatigue Loading
AS 1554.6	Welding of Stainless Steel for Structural Purposes
AS 1554.7	Welding of Sheet Steel Structures
AS 1579	Arc-Welded Steel Pipes and Fittings for Water And Waste-Water
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 2214	Certification of Welding Supervisors – Structural Steel Welding
AS 2980	Qualification of Welders for Fusion Welding of Steels
AS 3545	Welding Positions
AS 3834	Quality Requirements for Welding
AS 3978	Non-Destructive Testing - Visual Inspection of Metal Products and Components
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 4854	Welding Consumables – Covered Electrodes for Manual Metal Arc Welding of Stainless and Heat Resistant Steels
AS 4855	Welding Consumables – Covered Electrodes for Manual Metal Arc Welding of Non-Alloy Fine Grain Steels
AS 4882	Shielding Gases for Welding
AS 5131	Structural Steelwork Fabrication and Erection
AS 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 14174	Welding Consumables - Fluxes for submerged arc welding and electroslog welding
AS 14341	Welding Consumables - Wire Electrodes and Weld Deposits for GMAW of Non-Alloy and Fine Grained Steels
AS 17632	Welding Consumables - Tubular Cored Electrodes for Gas Shielded and Non-Gas Shielded FCAW of Non-Alloy and Fine Grain Steels
ISO 9606-1	Qualification testing of welders - Fusion welding - Part 1: Steels
ISO 17637	Non-destructive testing of welds - Visual testing of fusion-welded joints

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

Number	Title
TS 0132	Operations and Maintenance Manuals
TS 0230	Gate and Butterfly Valve Requirements
TS 0400 (TS16)	Protection of Steelwork in Atmospheric Environments
TS 0401 (TS15)	Protection of Steelwork in Submersible Environments
TS 0402 (TS18)	Protection of Steelwork in Buried Environments
TS 0465	Mortar Repair Systems

1.4 Definitions

The following definitions are applicable to this document:

Term	Description
CSWIP	Certification Scheme for Personnel. Historically referred to as "Certification Scheme for Welding Inspection Personnel".
Prime Contractor	The contractor engaged by SA water to carry out construction works. E.g., Major or Minor Framework Partner (MFP) or SA Water Workshops.
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.
Responsible Discipline Lead	The engineering discipline expert responsible for TS 0420 defined on page 3 (via SA Water's Representative).
Non-destructive Examination (NDE)	An inspection of a weld via visual means and / or other testing (RT, UT, MPI or DPI) that does not destroy the sample.
Visual Examination	To conduct a visual examination of the weld and defects including the use of visual aids and measuring devices to determine the weld quality has been achieved with respect to alignment, weld size, defect etc.
Visual Inspection (Visual NDE)	Conducting Visual Scanning (complete welds and gross defects) of the weld followed by a Visual Examination in detail assessment of the gross defects and other areas to ensure compliance.
Visual Scanning	Determine all weld on the drawings are included and to detect gross defects.
Welder Qualification Period	Demonstration that the Welder is within his Qualification Period for a particular Welding Procedure within a previous six-month period.
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 6.2 Welding Inspector).
Welding Supervisor	All welding shall be supervised by Welder Supervisor qualified, employed by or contracted to the organisation responsible for undertaking the welding work, Qualifications are defined in Section 6.1 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.
Welding Service Provider	Welding Service Provider is the person, organisation, contractor, subcontractor who will undertake the welding work.

2 Scope

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 (MMA), Gas Metal Arc (GMA), Flux Cored Arc (FCAW), Gas Tungsten Arc (GTAW), Submerged Arc Welding (SAW) and other processes approved by the Responsible Discipline Lead.

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

1. AS 5131 construction category 3 (CC3) and requirements of ISO 3834.2 where specified
2. TS-0420
3. Australian 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 1554
- Shop welding of "Specials" (fittings/bends/tapers etc); AS/NZS 4041 Class 2P or Class 3 with additional requirements as stated in this document
- Site welding of pipes, pipe fittings & flanges; AS/NZS 4041 Class 2P or Class 3 with additional requirements as stated this document
- Structural Steel Welding; AS 1554.1
- Reinforcement Welding; AS1554.3
- Stainless Steel Welding; AS 1554.6
- Welding of Aluminium Structures; AS 1665.

This Technical Standard does not remove the Contractors or Subcontractors responsibilities to provide a safe workplace, systems, and methods in accordance with Work Health & Safety Regulations (2012) 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.

3 Acceptance Prior to Commencement of Work

The Welding Service Provider shall submit the following documents to SA Water's Representative at contract award and as a minimum of fifteen (15) business days prior to the commencement of cutting or welding work for review and acceptance. This is a **HOLD POINT**.

Note that if the documents and supporting information is insufficient or are not accepted; a second submission and review (and additional reviews as required) will be required. Once updated documents are received this will require a further 15 business day turn around per review. Therefore, acceptance shall be requested as soon as possible and well in advance of construction.

The process for initiating a review is via the Request for Engineering Engagement (RFE) system where the SA Water Project Manager / Project Engineer shall provide the documents and workorder for the project. This is available on the engineering business home page [Engineering \(sharepoint.com\)](#)

The Engineering review process map is set out in Appendix C

The documents which shall be provided are:

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

Other supporting documentation such as a welder qualification register, or weld procedure register should also be considered to facilitate the review process.

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

A letter of acceptance will be sent to the SA Water Project Manager, Prime Contractor and the Welding Service Provider. Upon a letter of acceptance, the hold point can be released for each project.

4 Quality Requirements

4.1 Quality Assurance

Welding Service Providers shall provide sufficient information, to enable SA Water's Representative to assess their suitability for the Works.

Construction 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 shall be used, or a SA Water approved equivalent.

Appendix D7 contains a sample MDR Index as does TS 0132 Appendix D.

4.2 Quality Management System

Establish and maintain a Quality Assurance System in accordance with AS/NZS ISO 9001.

The Contractor and its major subcontractors and suppliers shall, from the commencement of the Contract until the Date of Practical Completion, establish, file and maintain quality records that demonstrate implementation of the Contractor's Quality Management System (QMS), for inspection by SA Water's Representative.

4.3 Quality System Audits

Undertake internal audits in accordance with the requirements of AS/NZS ISO 9001.

SA Water's Representative may carry out audits of the Contractor's quality system by way of review and verification of Contractor's records or external inspection and testing.

4.4 Quality Plan

Submit within 15 days of the Date of Acceptance of Tender for approval by SA Water's Representative, a draft Quality Plan which includes details of the Contractor's proposals for the management and control of quality for the Contract.

Provide a finalised Quality Plan within 15 days of receiving comments from SA Water's Representative.

4.5 Identification & Traceability

Divide the works into lots for the purpose of:

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

Define a system of lot numbering which is 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.

4.6 Inspection and Test Plans

In consultation with product suppliers, applicators and the design engineer, standardise ITPs for the work activities commonly encountered at various sites or group of structures that form the works.

Submit to SA Water's Representative at least 15 business days before each work activity commences proposed inspection and test plans covering all materials supply, construction/installation and testing/commissioning work elements of the Works.

ITPs shall include at least 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 particular 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.

The ITPs will be reviewed and returned to the Contractor within 15 business days of receipt, including nomination of witness points required by SA Water's Representative.

Provide SA Water's Representative with one copy of each signed off ITP within 5 working days of completion of the activity to which the ITP relates.

Provide to SA Water's Representative, for monthly site meetings, a summary report listing completed ITPs, and number of status of all non-compliance reports.

4.7 Hold Points and Witness Points

4.7.1 Hold Points

1. A Hold Point is a critical stage of the work that requires inspection by SA Water's Representative, beyond which the Subcontractor shall not proceed without written approval of SA Water's Representative.
2. If after the Hold Point inspection further work is required prior to proceeding, a subsequent request for re-inspection by SA Water's Representative is required prior to written approval being given.
3. Notwithstanding the requirement for 48 hours' notice, do not undertake any further work on the hold point item for at least one working day after the hold point items is actually reached. If SA Water's Representative does not respond to the Contractor within this one working day, the Contractor may proceed with the work.
4. The minimum required Hold Points in the Technical Standard are detailed below.
 - a. Upfront submission of Inspection & Test Plan (ITP), Qualified Welding Procedure Specification (WPS), Welder Qualification Records (WQR), Welding Supervisors qualifications and Welding Inspector qualifications (TS 0420 Section 3)

- b. Submission of the first 5 welds of each WPS/welding operator
- c. Submission of Welding Management System with materials
- d. Confirmation of defect areas and repair
- e. Submission of the As-Repaired/Constructed Report
- f. Specific **HOLD POINTS** required.

4.7.2 Witness Points

1. A Witness Point will be used in the ITPs at a stage of the work to verify compliance of the constructed works with the Drawings and approved WMS.
2. Inform SA Water's Representative of the witness point inspections and tests. Attendance by SA Water's Representative will be at their discretion.
3. SA Water's Representative may nominate witness points during the progress of the works. Provide a minimum of 24 hours' notice to SA Water's Representative of a witness point being reached. Work may proceed if SA Water's Representative has not viewed the work within the 24-hour period.

4.8 Non-Compliance

Promptly advise SA Water's Representative of any non-compliance together with its location and proposals for corrective action.

Notify SA Water's Representative of each non-conformance within one working day of its detection where:

1. There is potential for progress of the work to be seriously affected
2. The proposed action to correct the non-conformance will result in work not complying with the requirements of the Technical Standard
3. The time requirements of the Technical Standard have not been complied with
4. The non-conformance may cause a health and safety hazard
5. The non-conformance has resulted from a deficiency in the drawings or Technical Standard; and/or
6. Material or serious environmental harm has occurred.

Each such notification shall include details of:

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

Do not proceed to cover up or otherwise incorporate the non-conforming work or materials before SA Water's Representative has approved of the proposed action in writing.

In the absence of a non-compliance report issued by the Contractor, SA Water's Representative shall have the right to issue non-compliance reports on the Contractor's work.

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

4.9 Materials Testing

Propose an independent authority for laboratory testing of materials for approval by SA Water's Representative.

Provide any data as is necessary to fully demonstrate to SA Water's Representative that such testing authority is adequately equipped, supervised and staffed and has relevant previous experience, including NATA accreditation where required for each specific proposed test methods. Once a testing authority has been approved by SA Water's Representative, it shall be termed the Approved Testing Authority for the tests listed within such approval.

SA Water's Representative reserves the right to take whatever samples and carry out whatever testing they consider necessary to verify that the requirements of the Technical Standard are being adhered to.

4.10 Permits and Certificates

Obtain all necessary permits, certificates and other like consents from SA Water, government and other relevant authorities required to carry out the Works and submit copies of all such permits to SA Water's Representative.

4.11 Site Records

Throughout the progress of the work:

1. Keep at least one copy of any standard or other document quoted or referred to in the Technical Standard on site readily available to personnel for reference purposes
2. Maintain 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
3. Maintain records 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 may inspect daily records at any time during the works.

5 Welding Procedures

5.1 Welding Procedure Specifications (WPS)

SA Water has developed specific Welding Procedure Specifications (WPS's) to meet the needs of the individual SA Water Workshops (Berri, Crystal Brook, South Para, etc.) that perform welding on the assets of or for SA Water.

Contractors/Sub-contractors performing welding on SA Water assets (or intended assets), are required to develop Welding Procedure Specifications, and have them approved by SA Water's Representative, for the work they will be undertaking.

5.1.1 Preparation of Edges for Welding

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 or other foreign matter that could prevent proper welding or cause a defective weld.

5.2 Qualification of Pressure Piping Welding Procedures

Each Welding Procedure that is intended to be used on assets of the Principal (SA Water) shall be suitably qualified, in accordance with AS 3992, and this Technical Standard.

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 requirement
- The intended user's 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 of 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
 - 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 i.e., pickled & passivated, heat treated etc.
- 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, with evidence that they are within the Welder Qualification Period, shall be submitted to SA Water's Representative for review and approval.

Typical Welding Procedure Specifications (WPS) & Procedure Qualification Records (PQR) information and templates can be found in the Appendixes' of AS 3992.

5.3 Qualification of Structural Steel Welding Procedures

Each Welding Procedure that is intended to be used on SA Water assets shall be suitably qualified, in accordance with AS 1554, and this Technical Standard.

Welding Procedure Specifications (WPS) are required to undergo the same qualification requirements as those stated in 5.2 above, however the welding code to be qualified against shall be AS 1554.

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

5.4 Qualification of Aluminium Welding Procedures

Each Welding Procedure that is intended to be used on SA Water assets shall be suitably qualified, in accordance with AS 1665, and this Technical Standard.

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

5.5 Qualification of Spiral Welded Pipe Welding Procedures for Butt Welds

Each Welding Procedure that is intended to be used to manufacture spiral welded pipe on intended assets of SA Water 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 5.2 above, however the welding code to be qualified against shall be AS 1554.

6 Welding Personnel

6.1 Welding Supervisors Qualifications

The Welding Supervisor shall be at the place where the welding is undertaken and be responsible for all WPS, qualified welders, fit up, quality monitoring and inspection activities.

The Welding Supervisor shall hold as a minimum one of the following:

- Current certification to AS 1796 Certificate 10 WTIA Welding Supervisor; or
- Current certification to AS 2214 WTIA Welding Supervisor; or
- Current certification to WTIA Welding Workshop Supervisor
- Hold a WTIA International Institute of Welding Qualification to IWS, IWT, or IWE level; or
- Another current qualification/certification acceptable to SA Water's Representative.

The Welding Service Provider shall provide details of the Welding Supervisor's qualification(s), certification, and experience records to SA Water's Representative prior to the commencement of any welding.

The Welding Service Provider's Welding Supervisor cannot be the same person as the Welding Inspector without the prior approval of SA Water's Representative.

6.2 Welding Inspectors Qualifications

The Independent Welding Inspector (independent of the welding service provider, engaged by the welding service provider, Prime Contractor or SAW Project Manager) shall review all drawings, specifications, documentation, view the preparation / fit up, conduct final visual examination and shall produce a report of findings.

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.

The welding inspector shall inspect the required percentage across all items, joint types and welders and weld procedures.

The Independent Welding Inspector shall hold as a minimum one of the following:

- Current WTIA Welding Inspection Certification; or
- CSWIP Senior Welding Inspector 3.2.2 Level 3
- CSWIP Welding Inspector 3.1 Level 2
- CSWIP Visual Welding Inspector 3.0
- Level 1-IIW International Welding Inspector Standard (IWI S)
- WTIA Certified Senior Inspector (CWSI)
- WTIA Certified Inspector (CWI)
- Weld Australia Welding Inspector Grade 1
- Weld Australia Welding Inspector Grade 2; or
- Another current qualification/certification acceptable to SA Water's Representative.

The Welding Service Provider (or Prime Contractor) shall provide details of the Inspector's qualification(s), certification, and experience records to SA Water's Representative.

For all weld inspections the Welding Inspector shall provide a written report of the inspection results including the standard, welds, percentage results signed by the inspector showing it meets the requirements of this technical standard.

The Welding Service Providers Welding Inspector cannot be the same person as the Welding Supervisor without the prior approval of SA Water's Representative.

6.3 Welding Non-Destructive Testing Contractor

The non-destructive testing Contractor conducting:

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

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

A report of the results and subsequent test shall be provided.

The independent welding inspector and NDT Technician may be the same person.

6.4 Weld Procedure Specification Development and Approval

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

- Qualified Welding Supervisor (See Section 6.2)
- 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 Inspector (as stated in Section 6.2 above).
- Weld Supervisor (as stated in Section 6.1 above).

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

- Qualified Welding Inspector (as stated in Section 6.2 above).
- Weld Supervisor (as stated in Section 6.1 above).

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

7 Inspection and Testing

A summary table of the following section requirements for Inspection and NDT is provided in Appendix B.

7.1 Inspection & Test Plan (ITP)

The Welding Service Provider shall:

- Provide an Inspection and Test Plan (ITP) for the specific welding work to SA Water's Representative, not less than 10 working days prior to commencement of the welding work. A standard SA Water sheet shall be used; or SA Water approved equivalent; Appendix D1 contains a sample ITP.
- Ensure that the Inspection and Test Plan (ITP) contains the necessary elements to ensure the completed welding work complies with the specified standards/codes and/or other specified requirements.
- Ensure that the Inspection and Test Plan (ITP) contains the necessary witness points for SA Water representative to audit the welding work so as it complies with the specified WPS and standards requirements.

7.2 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.

Reinforcement height shall not exceed 3.0 mm. Misalignment shall be less than 1.5 mm for pipe thicknesses less than 12 mm and 3.0 mm for pipe thicknesses equal to or greater than 12mm.

Pipes which are not hydrostatically tested shall be 100% non-destructively tested via radiograph (RT) or ultrasonic testing (UT) to AS1554.1 Structural Purpose (SP).

7.3 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 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:

- 100% of the welds for the first two (2) pipes of each pipe size. Following a test failure 100% of the next pipe length from the mill is required to undergo non-destructive testing until compliance is achieved.
- Thereafter; 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). Following 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.
- 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.
- 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 the Standard and provided to the SA Water's Representative.

SA Water's Representative shall reserve the right to attend witness and audit manufacturing aspects of the production activity or documentation associated with Production.

The above testing 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.

7.3.1 Alternative testing requirements for Spiral Welded Pipe

This clause is intended to be implemented by the SA Water's Representative for the supply of MSCL and MSCACL pipe for the replacement of individual pipe sections (or low volume) or pipe sections in burst situations. This clause is not intended to be an alternative for NDT requirements as outlined in clause 7.2 above.

- Spiral welded pipe that has been produced and tested per clause 7.2 above, as a batch run, no further testing needs to be applied to the available pipe, if it can be demonstrated the available pipe(s) is (are) are from the batch run that the testing regime was applied to.
- Spiral welded pipe that has not undergone the testing requirements per clause 7.2 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 Category SP with acceptance standards as specified in AS1554.1.
- For small quantities such as bursts or minor replacement eight (8) or less lengths of pipe (or less than 100m) from supplier stock.

7.4 Testing of Pressure Piping Butt, Branch and Fillet Welds

The following testing regime applies to fabrication and welding work for new projects, workshops and field tie-in situations. Requirements are based on AS 4041 Class 2P (Class 2A for stainless steel) with qualifications associated with risk of failure and lessons learnt from previous projects. Piping shall be examined in accordance with AS 4037 and as per AS 4041 Section 6.4.

7.4.1 Testing Requirements for Steel Specials

- All Welding shall be:
 - 100% Visually Scanned by a qualified Welding Supervisor and
 - 100% Visually Scanned and 100% Visually Examined by an independent qualified Welding Inspector.
- Full Strength Butt Welds (FSBW), which are in line Butts, shall be 100% NDE'ed (RT for <10mm and UT plus MPI for ≥10mm) for the first 5 welds of each WPS/welding operator, and 10% for remaining welds for that WPS/welding operator.

Note: It is important to get a representation of the various operators and pipe diameters/wall thicknesses within the WPS limitations when applying these percentages. This is a one-off requirement if the welder remains within qualification period.

See Clause 7.5.2 for Stainless Steel Piping.

- FSBW's connections which are branches or offtakes shall be inspected as specified below:
 - 100% MPI of the branch / pipe FSBW's shall occur prior to fitment of compensation plates, wrapper plates or crotch plates if specified in the design
 - No NDE required on the pipe / branch /compensation plates FSBW

- 100% MPI of the branch / compensation plate fillet welds shall be undertaken.

See Clause 7.5.2 for Stainless Steel Piping.

- Fillet Welds (other than branch / compensation plate fillet) shall be 100% MPI for the first 5 welds of each WPS/welding operator, and 10% for remaining welds for that WPS/welding operator. This is a one-off requirement, as long as they are within their welder qualification period.

Note: It is important to get a representation of the various operators and pipe diameters/wall thicknesses within the WPS limitations when applying these percentages.

Note that the frequency of Non-Destructive Examination (NDE) stated above applies to each weld procedure/welding operator for each Contractor. It is important to get a representation of each operator against pipe diameters/wall thicknesses within the WPS limitations when applying these percentages.

SA Water's Representative shall reserve the right to witness the first 5 welds of each weld procedure per operator. After the completion of the first 5 welds, the testing records shall be inspected by the SA Water's Representative. The Welding Service Provider is to give SA Water's Representative ten (10) days' notice prior to the start of welding work.

SA Water shall reserve the right for SA Water's Representative to attend witness and audit all aspects of the construction/welding activity or documentation associated with any work for or intended for SA Water.

Where previous history and competency relative to a particular Operator and Welding Procedure Specification (WPS) can demonstrate where the Operator has achieved the requirements of clause 7.4.1 above within the last 6 months, consideration may be granted to apply only the ongoing 10% testing. This consideration is at the discretion of the SA Water Representative and shall only be considered on an individual case by case basis.

7.4.2 Testing Requirements for Stainless Steel Specials

The requirements are the same as above in Section 7.4.1 with the following modification using DPI instead of MPI as the NDT technique.

All Welding shall be:

- 100% Visually Scanned by a qualified Welding Supervisor.
- 100% Visually Scanned and 20% Visually Examined by an independent qualified Welding Inspector with a report provided.
- FSBW's shall be:
 - 10% RT'ed for each WPS/welding operator.
- FSBW's which cannot be RT'ed due to wall thickness restrictions or joint design, shall be:
 - 10% Dye Penetrant (DPI) examined for each WPS/welding operator.
- FSBW's which are branches or offtakes shall be 100% DPI inspected.
- Note: 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.
- Fillet Welds shall be 10% DPI examined for each WPS/welding operator.

7.4.3 Testing Requirements for Regional and Metropolitan Areas

- The general testing requirements for Regional and Metropolitan areas are to be the same testing regime as stated in clause 7.4.1 above for fabrication and welding work in workshops or for fabrication and welding working for and or 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).

- The testing requirements for fabrication and welding on pipework in Regional areas (outside of Pump Stations) or within SA Water workshops for pipework destined for Regional areas (outside of Pump Stations) are based on AS4041 Class 3 with additional requirements as stated below.
- All welding shall be:
 - 100% Visually Scanned by a qualified Welding Supervisor and
 - 100% Visually Inspected by an independent qualified Welding Inspector.
- Full Strength Butt Welds (FSBW), which are in line Butts, shall be 100% Visually Examined and 100% RT'ed for the first 5 welds of each WPS/welding operator, this is a one-off requirement, as long as they are within their welder qualification period.
 - After the above has been achieved, Full Strength Butt Welds (FSBW's) will require Visual Inspection and 10% Magnetic Particle Inspection (MPI) surface NDT on steel (10% DPI on stainless steel).
- FSBW's connections which are branches or offtakes shall be inspected as specified in section 7.4.1 for the first 5 welds of each WPS/welding operator, this is a one-off requirement, as long as they are within their welder qualification period:
 - 10% MPI of the branch / pipe FSBW's shall occur prior to fitment of compensation plates, wrapper plates or crotch plates if specified in the design
 - No NDE required on the pipe /branch /compensation plates FSBW
 - 10% MPI of the branch / compensation plate fillet welds shall be 100% MPI inspected.
- SA Water Engineering reserve the right to nominate additional RT/UT/MPI as required.

7.4.4 Tying into Existing Piping

When cutting and tying into existing piping it is recommended that the location have their coating removed (note that coating may contain asbestos, see SA waters Working with Asbestos Containing Materials (ACM) or company guidelines), the surface cleaned (by power tool or abrasive blasting), inspected and Ultrasonically Thickness tested to ensure there is sufficient remaining wall thickness on the existing pipe to conduct the tie-in welding.

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

Testing of planned tie ins shall be tested to Section 7.4.1.

7.4.5 Testing Requirements for Emergency Field Repairs on Pipes

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 5.2 above, however the welding code to be qualified against shall be AS 1554.

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

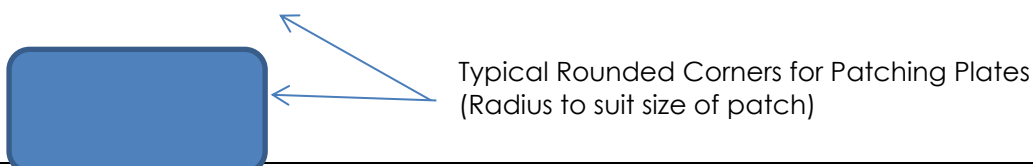


Figure 1 - Patching plate

- All patching (and repair collar) welds shall be 100% Visually Examined by a qualified Welding Supervisor.
- In the metropolitan area and within all pump stations all patching welds shall be 100% MPI for the full length of the welds around patching plates (collars) on carbon steel. In Regional areas the NDT does not apply.
- In the metropolitan area and within all pump stations all patching welds shall be 100% DPI tested for the full length of the welds around patching plates on stainless steel or aluminium. In Regional areas the NDT does not apply.

7.5 Testing of Structural Welds

The following testing regime applies to fabrication and welding work in both workshops and all field situations (including additions, repairs, and modification).

When applying the percentages of NDT below it is important to get a representation from each of the various operators and variety of plate thicknesses within limitations of the WPS.

7.5.1 Testing Requirements for Steel Structures

- All Welding shall be 100% Visually Scanned by a qualified Welding Supervisor.
- All Welding shall be 100% Visually Examined and 50% Visually Inspected by an independent qualified Welding Inspector with a report provided.
- FSBW's shall be 10% RT if <10mm or 10% UT if ≥10mm examined for each WPS/welding operator.

Note: FSBW's which cannot be RT or UT examined due to wall thickness restrictions, shall be 10% MPI for each WPS/welding operator.

- Fillet Welds shall be 10% MPI examined for each WPS/welding operator.

7.5.2 Testing Requirements for Stainless Steel Structures

- All Welding shall be 100% Visually Scanned by a qualified Welding Supervisor.
- All Welding shall be 100% Visually Scanned and 20% Visually Examined by an independent qualified Welding Inspector with a report provided.
- FSBW's shall be 10% RT'ed for each WPS/welding operator.
- FSBW's which cannot be RT'ed due to wall thickness restrictions or joint design, shall be 10% Dye Penetrant (DPI) examined for each WPS/welding operator.
- Fillet Welds shall be 10% DPI examined for each WPS/welding operator.

7.5.3 Testing Requirements for Aluminium Structures

- All Welding shall be 100% Visually Scanned by a qualified Welding Supervisor.
- All Welding shall be 100% Visually Scanned and 50% Visually Inspected by an independent qualified Welding Inspector with a report provided.
- FSBW's shall be 10% RT'ed or UT'ed for each WPS/welding operator.
- FSBW's which cannot be RT'ed or UT'ed due to wall thickness restrictions, shall be 10% Dye Penetrant (DPI) examined for each WPS/welding operator.
- Fillet Welds shall be 10% DPI examined for each WPS/welding operator.

7.5.4 Testing of Reinforcing Steel

- All Welding shall be 100% Visually Scanned by a qualified Welding Supervisor.
- All Welding shall be 100% Visually Scanned and 50% Inspected by an independent qualified Welding Inspector with a report provided.
- All load bearing welded joints for reinforcing steel are considered equivalent to weld category SP as specified in AS1554.1.
- Inspection amount based on clause 7.3 and 7.4 of AS1554.1 and SP shall be inspected as follows:
 - All Welding shall be 100% Visually Scanned by a qualified Welding Supervisor.
 - 100% visual examination for the first 5 welds of each welder to each procedure, then 50% of the remaining welds to AS1554.3 acceptance criteria of table 6.2 of AS1554.3.
 - 100% MPI for the first 5 welds of each welder to each procedure, then 10% of the remaining welds to AS1554.3 acceptance criteria of table 6.2.
- Note: if a weld fails inspection the next 5 welds are to be tested as above.

8 Quality Requirements

8.1 Preface

This Standard requires all Welding Service Providers to demonstrate to SA Water's Representative that welders to be used on SA Water assets 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.

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 Categories

For assets intended for use by SA Water, the following applies:

- The manufacture of Spiral Welded Pipe shall be in accordance with AS 1579 with the welding to AS 1554 – SP
- The welding of pressure pipe shall be to AS 4041 Class 2P and 3
- The welding of structural steel shall be to AS 1554.1 – SP
- The welding of stainless steel shall be to AS 1554.6 – Class 2 B II
- The welding of aluminium shall be to AS 1665 – Category B.

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 Welding Service Provider to ensure that all the essential variables and mechanical testing conducted to the previous standard still meets the current standard. This assumes that the work being performed has been designed to the current standards.

8.4 Quality Systems

Welding Service Providers shall ensure all fabrication and welding related activities for work on assets intended for SA Water are managed under a suitable Welding Quality Management System (WQMS) which complies to AS/NZS ISO 3834.

8.5 Edge Preparations

Surfaces and edges to be welded shall be free of extraneous material and other defects that would affect the quality or strength of the weld.

8.6 Pressure Testing

Where required by the Contract Specification, e.g., Closing Collars, Pressure Testing shall be carried out and recorded. A Standard SA Water sheet shall be used; or SA Water approved equivalent.

8.7 Additional Testing of Welds

Where there is a specific reason to question the welder's ability, SA Water's Representative may request additional NDE/NDT for any welding carried out on any asset or intended asset of SA Water, that the welder in question has worked on.

Where such testing detects non-compliance (defects), the Welding Service Provider shall bear the cost of the repair and the additional cost of retesting the welds.

8.8 Welder Performance Monitoring

The Welding Service Provider shall monitor the performance of welding operators working on SA Water assets or intended assets of the Principal.

Where unsatisfactory welds are produced by a welding operator, the Welding Service Provider will notify SA Water's Representative as soon the discoveries of 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, SA Water's Representative may request the welding operator be removed from the work and offered training by the Welding Service Provider.

The welding operator should not be permitted to continue to work until such time/s as it can be demonstrated the welding operator is able to achieve the requirements of the WPS which defects were recorded against. The welder/WPS is required to start over; qualification and test the next 5 welds of each weld procedure per operator after 5% defects have been recorded.

8.9 Weld Traceability

The Welding Service Provider shall maintain Weld Traceability Records for all welding work carried out on the assets or intended assets of SA Water. Where practical, the pipe spool number used for traceability records.

Sample Weld Mapping is shown at Appendix D3 and a sample Weld Traceability Sheet is shown at Appendix D4. A Standard SA Water sheet shall be used; or SA Water approved equivalent.

9 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.

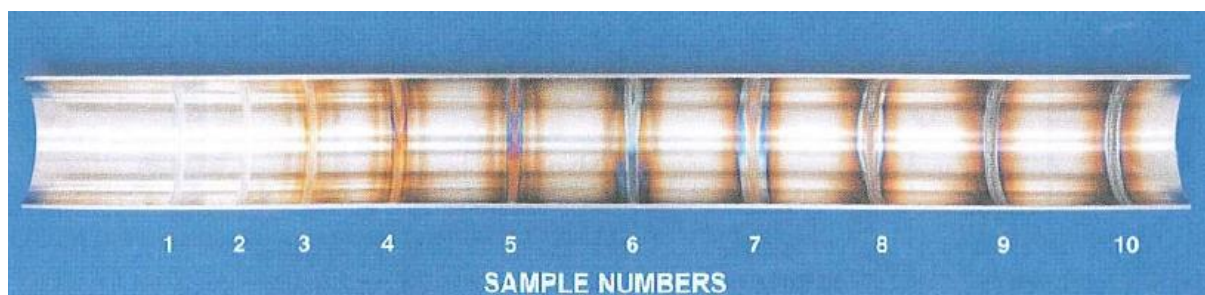


Figure 2 - Levels of weld discolouration on inside of 316L stainless steel (AS 1554.6)

9.1 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 PQR, WPS, and WQR.

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, mechanically remove the weld heat tint 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 1). 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).

9.2 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, and other surface defects shall be removed by new stainless steel flap disc grit grade 240 or finer.

Also note that pickling gels/paste contain the highly dangerous chemical hydrofluoric acid which is a Schedule 7 poison. 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 1), 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. The particular 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.

9.3 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.

10 Additional Construction Considerations

Additional construction considerations must cover the following aspects of work, which are additional to the above-mentioned requirements and are to be submitted to SA Water's Representative for review and comment.

10.1 Thermal Link-in Considerations

Link-in temperatures must be considered when working on either below ground mains, or above ground mains. Refer to TS 0230 clause 4.5.9 for further information.

- Above ground installation temperature range: 12°C to 20°C
- Below ground installation temperature range: 13°C to 27°C.

It is preferable to be within the above ranges when cutting a steel pipe, if possible, to minimise movement, otherwise anchor block may be required to restrain the pipe movement during cutting.

10.2 Lifting Plans

To avoid overloading at pipe connections/joints (including gaskets) welding service providers should be aware that pipe specials with valves built into them, should have lifting plans developed and built into ITP's when they are handling pipe specials with valves. Lifting plans and ITPs are to be sent to SA Water's Representative for review and comment prior to the lifting of pipe specials with valves attached.

10.3 Access

SA Water's Representative shall have access to inspect / review work on intended SA Water assets at all times.

Appendix A Schedules of Hold Points, Witness Points and Identified Records

A1 Schedule of Hold Points and Witness Points

Clause	Type	Description
3.0	Hold	The Welding Service Provider shall submit the following documents to SA Water's Representative's at contract award (as a minimum of fifteen (15) business days prior to the commencement of cutting or welding work for review and acceptance.
4.0	Hold	Review all documentation and acceptance of MDR
7.0	Review	Welding inspection and NDT testing reports
8.8	Hold	Where unsatisfactory welds are produced by a welding operator, the Welding Service Provider 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)

A2 Schedule of Identified Records

Clause	Description of Identified Record
3.0	Inspection & Test Plan (ITP)
3.0	The Qualified Welding Procedures, (WPS) intended for use on the work, including: <ul style="list-style-type: none"> ○ Welding Procedure Specification ○ Procedure Qualification Record, (PQR) ○ Mechanical and Non-Destructive Test Results, (NATA endorsed) for the PQR ○ Material Certification ○ Consumable Certification
3.0	Welder Qualification Records (Inclusive of NDT Results)
3.0	Welding Supervisors Qualifications
3.0	Welding Inspectors Qualifications
4.0	Manufacturers Data Report (MDR)
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
9.0	Picking and passivation inspection for stainless steel
10.2	Lifting Plans

Appendix B NDT Requirements

Australian Standard	Clause	Minimum Recommended extent of inspection	Structure Class	Weld Joint Type	TS 0420 Clause	TS 0420 Visual examination Requirement	TS 0420 NDT Requirement
AS 4041	AS 4041 Table 1.5	Visual 100% MPI or DPI 0 to 10% RT or UE 0 to 10%	Class 2P steel	All	N/A	-	-
AS 4041	AS 4037 Table 7.3 B	0% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2P steel	Fillet	7.4.1	Supervisor 100% scan Inspector 100% Inspected	10% MPI
	AS 4037 Table 7.3 B	5% RT T<10 Rt 5% T>10 RT/UT + MT 5% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2P steel	Butt	7.4.1	Supervisor 100% scan Inspector 100% Inspected	10% RT
	AS 4037 Table 7.3 A	Visual 100% RT 10% (<10mm) RT/UT 10% + MT (10-32mm)	Class 2P steel	Longitudinal Butt	7.4.1	Supervisor 100% scan Inspector 100% 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 + MT 5% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2P steel	Circumferential corner / Butt. Joint type C1	N/A	-	-
	AS 4037 Table 7.3 C	5% RT T<20mm MPI/DPI 0% T 20-32mm MPI/DPI 5% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2P steel	Circumferential Butt and fillet. Joint type C2-5	N/A	-	-
	AS 4037 Table 7.3 D	Throat < 15mm MPI/DPI 0% Throat >15mm MPI/DPI 5%	Class 2P steel	Branch Joint Type D1-6	7.4.1	Supervisor 100% scan Inspector 100% Inspected	100% MPI - branch / pipe No NDE - pipe / branch / comp plate 100% MPI - branch / comp plate fillet
AS 4041	AS 4037 Table 7.3 B	0% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2 piping Group K - 316	Fillet	7.5.2	Supervisor 100% scan Inspector 100% scan and 20% Inspected	10% DPI
	AS 4037 Table 7.3 B	5% RT T<10 Rt 5% T>10 RT/UT + MT 5% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2 piping Group K - 316	Butt	7.5.2	Supervisor 100% scan Inspector 100% scan and 20% 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) Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2 piping Group K - 316	Longitudinal Butt	7.4.2	Supervisor 100% scan Inspector 100% scan and 20% Inspected	10% RT
	AS 4037 Table 7.3 D	Visual 100% RT 10% (<10mm) RT/UT 10% + MT (10-32mm) Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2 piping Group K - 316	Branch Joint Type D1-6	7.4.2	Supervisor 100% scan Inspector 100% scan and 20% Inspected	100% DPI - branch / pipe No NDE - pipe / branch / comp plate 100% DPI - branch / comp plate fillet

Australian Standard	Clause	Minimum Recommended extent of inspection	Structure Class	Weld Joint Type	TS 0420 Clause	TS 0420 Visual examination Requirement	TS 0420 NDT Requirement
AS 4041	AS 4041 Table 1.5	Visual 100% MPI or DPI 0% RT or UE 0%	Class 3	Regional (Unless project specified)	7.4.3	Supervisor 100% scan Inspector 100% Inspected	10% MPI
	AS 4037 Table 7.3 B	0% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2P steel	Closing collars	7.4.4	Supervisor 100% scan Inspector 100% Inspected	10% MPI
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	Patch Metro / pump station	7.4.5	Supervisor 100% Inspected	10% MPI
	AS 1554.1 Table 7.4	Visual Scanning 100% Visual examination 0 to 50% RT/UT 0 to 10%	Class SP Structural Steel	Patch Regional	7.4.5	Supervisor 100% Inspected	Nil
	AS 1554.1 Table 7.4	Visual Scanning 100% Visual examination 0 to 50% RT/UT 0 to 10%	Class SP Structural Steel	Fillet	7.5.1	Supervisor 100% scan Inspector scan and 50% 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	7.5.1	Supervisor 100% scan Inspector scan and 50% 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	N/A	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	7.5.2	Supervisor 100% scan Inspector 100% scan and 20% 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	7.5.2	Supervisor 100% scan Inspector 100% scan and 20% 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 UE CF2 – Visual CF3 – Visual	Class B Aluminium	Fillet	7.5.3	Supervisor 100% scan Inspector 100% scan and 50% Inspected	10% DPI
		CF1 - Cat B 2 to 5% RT or UE CF2 – Visual CF3 – Visual	Class B Aluminium	Butt	7.5.3	Supervisor 100% scan Inspector 100% scan and 50% 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	Butt	7.5.4	Supervisor 100% scan Inspector 100% scan and 50% Inspected	10% MPI
				Splice	7.5.4	Supervisor 100% scan Inspector 100% scan and 50% Inspected	10% MPI

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	<p>Weld Information Collated</p> <p>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.</p> <p>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</p>	SA Water Project Manager
2	<p>Weld Documentation submitted via Request for Engineering Engagement (RFEE) system</p> <p>The weld procedure review request is to be submitted via the RFEE system. Details of this form are provided below for reference.</p> <p>Weld procedure reviews will only to be actioned if received as a RFEE, and after steps 3 – 5 have been completed.</p> <p>Please note:</p> <ol style="list-style-type: none"> Weld procedures will not proceed without a work order number being provided. Review timeframes specified in TS 0420 <u>commence from the receipt of current and complete information</u>. This review timeframe is reset when information is incomplete. 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	<p>RFEE Assigned</p> <p>RFEE assigned to the SA Water Materials Engineer.</p>	SA Water Manager Engineering Quality and Innovation
4	<p>Submission Check</p> <p>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.</p> <p>Where <u>any document/s</u> 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.</p>	SA Water Materials Engineer
5	<p>Submission Review</p> <p>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:</p> <ul style="list-style-type: none"> The Weld Procedure Specifications are provided (WPS). 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. 	SA Water Materials Engineer

	Where <u>any document/s</u> 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.	
Step	Step Description	Responsibility
6	<p>Weld Procedure Specification (WPS) Acceptance Check</p> <p>A check of the WPS is conducted to determine if submitted documentation has been assessed and accepted previously.</p> <p>If a WPS has not been assessed and accepted previously, a detail review is conducted.</p>	SA Water Materials Engineer
7	<p>Weld Procedure Specification Review</p> <p>Where a WPS has not been assessed and accepted previously, a detailed review of WPS is undertaken.</p> <p>This is required before other related documents can be reviewed.</p>	SA Water Materials Engineer
8	<p>Personnel and ITP Review</p> <p>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.</p> <p>A check of Welder Qualification and Supervisor/Inspector to be used is also undertaken.</p>	SA Water Materials Engineer
9	<p>Review Letter Prepared</p> <p>A response letter is prepared, detailing either acceptance or rejection of submitted documentation.</p> <p>Where documentation is rejected, areas for improvement/correction will be provided.</p>	SA Water Materials Engineer
10	<p>Response Provided</p> <p>Review letter prepared in Step 9 is issued to the SA Water Project Manager for distribution to the contractor and fabricator.</p> <p>RFEE also closed if compliant to TS 0420.</p>	SA Water Materials Engineer
11	<p>Fabricator Documents Updated</p> <p>Where any original submission is rejected, citing corrective actions, updated weld documentation will be required to address these.</p>	SA Water Project Manager
12	<p>Documents Resubmitted</p> <p>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</p> <p>Please note:</p> <ul style="list-style-type: none"> This review will commence upon <u>receipt of all documents</u> for which corrections have been identified in Step 11. 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

C1 Request for Engineering Engagement form

Details of the RFEF form required for weld procedure reviews is provided below for reference.

This is available on the engineering business home page

[Engineering - AquaNet \(sawater.sa.gov.au\)](http://sawater.sa.gov.au).

Request for Engineering Engagement

Is this request for capital work? *

No▼

Select 'No' if you are entering a request for -
Safety in Design, Engineering Solutions, Technical Standards Dispensation Request, Technical Standards Recommendation for Improvement, Weld Reviews, Quality and Innovation, Water or Wastewater

Engagement Type *

Weld Review▼

Framework Allocation

Please Select▼

Required Documents for Weld Reviews *

PQR NDT ITP WPS Material Certificate Weld Procedure Document Mechanical Test Results

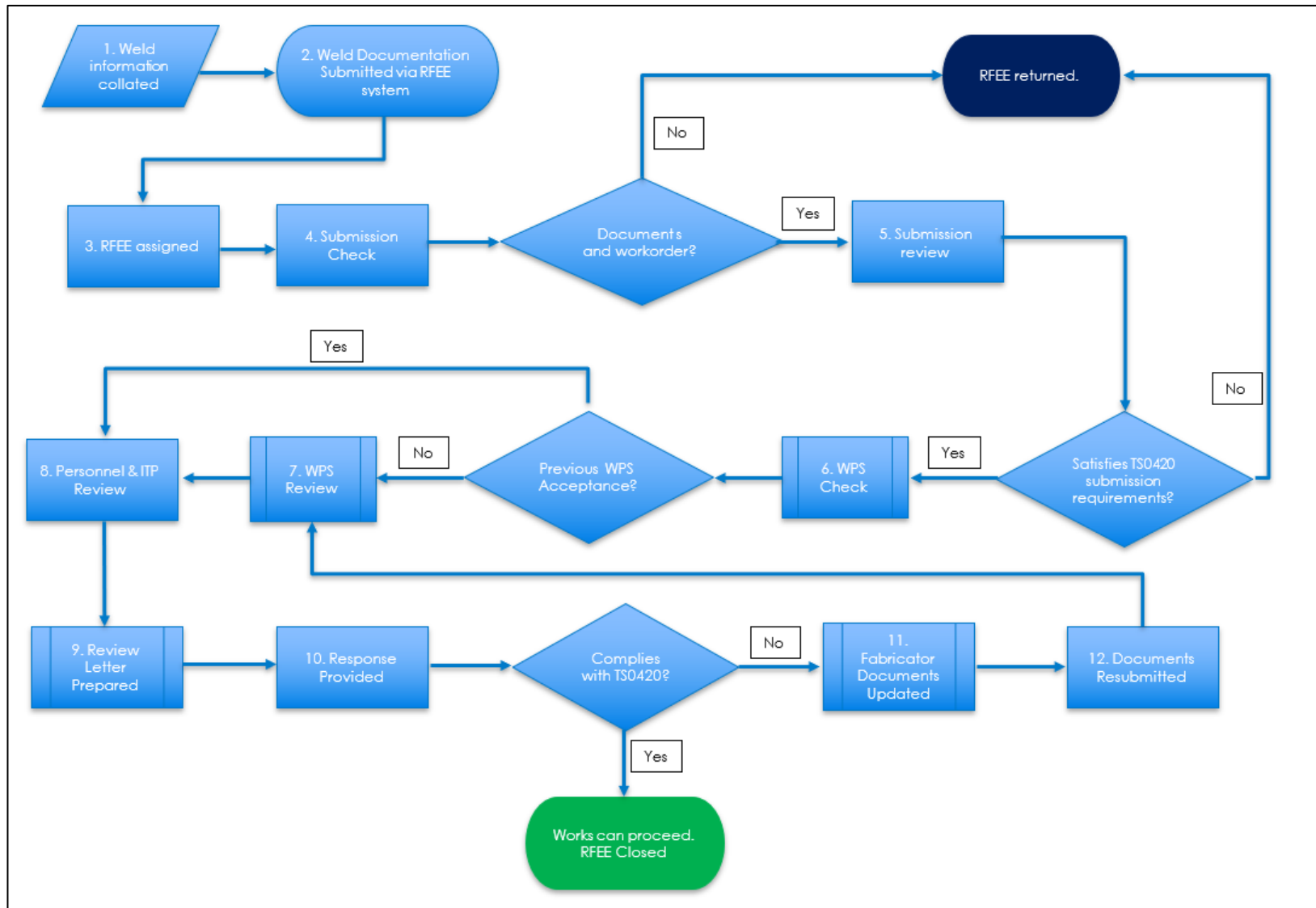
Weld Qualification Record Weld Supervisor Qualifications

Title *

Max 32 Characters

Work Order Number *

C2 Weld Review Process Flowchart



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	Prime Contractor (MFP)	Pre-commencement	Issued for Construction drawings	Contract	Drawings	H			
1.2	Prime Contractor (MFP) Review all documentation meets the requirement of TS 0420	Prime Contractor (MFP)	Minimum 15 days prior to commencement	Review against TS 0420	In accordance with AS4458 Clause 4.4 Confirm acceptable as per all relevant documentation including: <ul style="list-style-type: none"> • Purchase Orders • Drawings 	Submission to SA Water	R	S		
1.3	Submission of ITP, welders, supervisors and inspectors for approval	Welding Contractor Supervisor	Minimum 15 days prior to commencement	MDR	Documents submitted as per TS 0420 Clause 3, and Clause 7	Document submissions	S		H	
1.4	Welding Procedures	Welding Contractor Supervisor	Minimum 15 days prior to commencement	Document	As per TS-0420, in accordance with AS 4041 Section 5 AS/NZS 3992 Section 2 and 3 and with detailed design drawings	Welding procedure Specification and Procedure Qualification Records	R	S		
1.5	Qualified Welding Supervisor	Welding Contractor Supervisor	Minimum 15 days prior to commencement	Certificates	TS 0420 Clause 6.1	Qualification Certificates	R	S		
1.6	Welding Personnel qualified to procedures	Welding Contractor Supervisor	Minimum 15 days prior to works 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	Prime Contractor (MFP)	Pre-commencement	Verify	TS 0420 Clause 6.1	Certificates	A	S		
1.8	Welding Inspector	Prime Contractor (MFP)	Pre-commencement	Verify	TS 0420 Clause 6.2	Certificates	A			
1.9	Welding NDT Contractor	Prime Contractor (MFP)	Pre-commencement	Verify	TS 0420 Clause 6.3	NATA Certificates	A			

Item	Inspection / Test Activity	Responsibility	Frequency	Inspection / Test Method	Acceptance Criteria	Record	Contractor	Subcontractor	SA Water	Sign & Date
1.10	Approval submitted welding documentation	SAW 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	TS0420	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 Clause 8.9	Weld map and weld traceability records	M	S		
3.2	Visual scanning and inspection of welding during fabrication	Welding Supervisor	TS 0420 Clause 7	Visual AS 3978:2003 AS 4037:1999 – Clause 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 – Clause 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 – Clause 3.2	TS 0420 Clause 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 Clause 9	Formal Inspection Report	T	R	H	
4.3	Non-Destructive testing - Magnetic particle test	NDT Contractor	TS 0420 clause 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 clause 7	AS 2062:2017	Aluminium /Stainless steel fillets	NATA endorsed inspection report	T	R		
4.5	Non-Destructive testing - Radiographic	NDT Contractor	TS 0420 clause 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		

Item	Inspection / Test Activity	Responsibility	Frequency	Inspection / Test Method	Acceptance Criteria	Record	Contractor	Subcontractor	SA Water	Sign & Date
4.6	Non-Destructive testing - Ultrasonic	NDT Contractor	TS 0420 clause 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	Contractors Supervisor	100%	AS 4037:1999 – Section 17	In accordance with: AS 4037Section 17 TS 0420 Clause 8.6and D5	TS 0420 A6 Pressure Test Record	W	T	H	
4.9	Pre-delivery surface and edge preparation	Contractors Supervisor	100%	AS 4458:1997 – Clause 21.3	In accordance with Contract	Inspection and Test Plan	W	T		
4.10	Loading check before transport	Contractor Supervisor	100%	AS 4458:1997 Section 21.3	In accordance with Contract	Inspection and Test Plan	W	T		
4.11	Final Inspection	Prime Contractor (MFP)	100%	Visual Check and Review	In accordance with Contract	Inspection and Test Plan	H	S		
4.12	Prepare Manufacturers Data Report (MDR)	Contractor 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	Prime Contractor (MFP)	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 Specifications.

Print Name:

Position:


Signature:

Date:

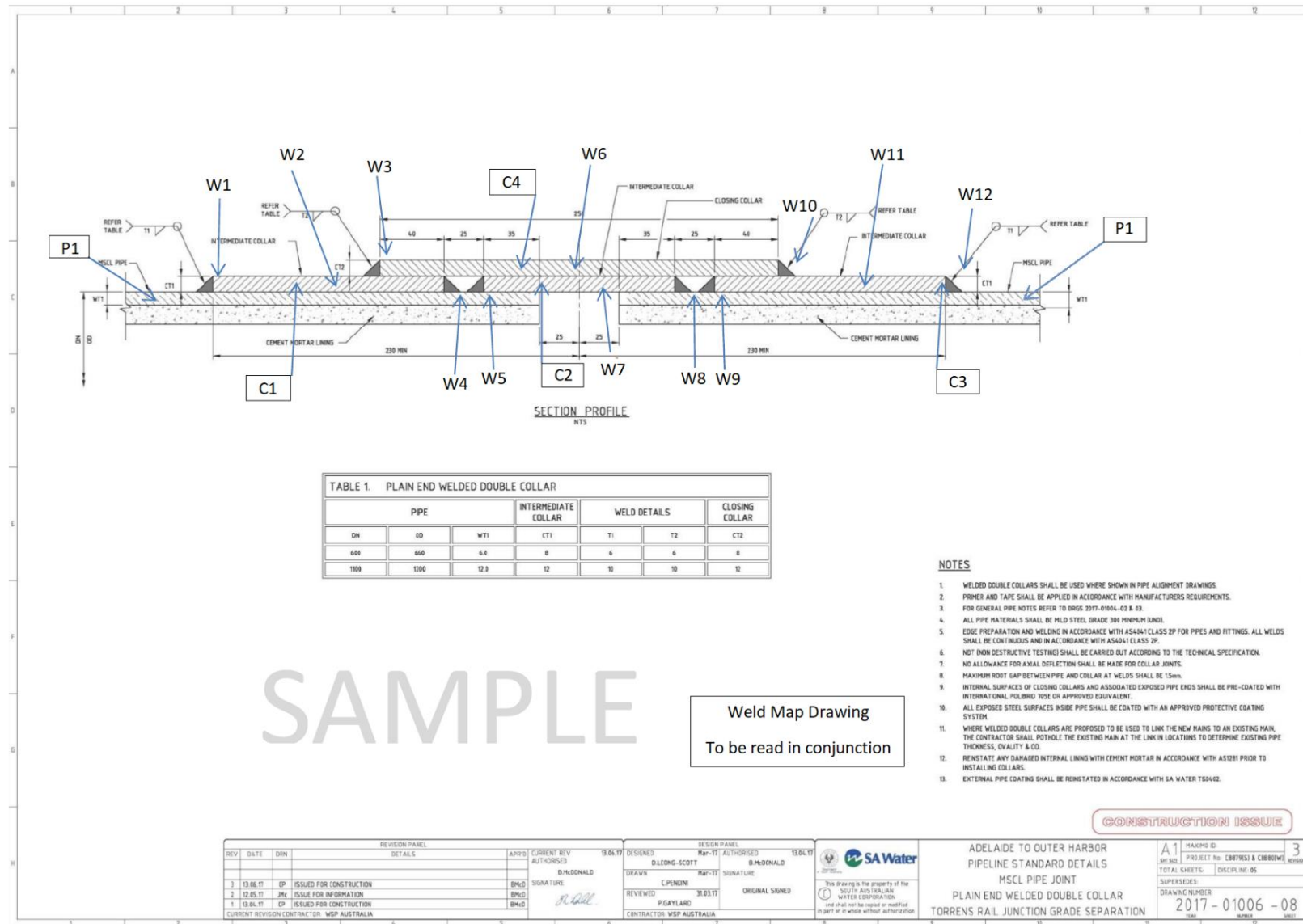
Notes:**Legend**

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	Contractor
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
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




SAMPLE

Weld Map Drawing
To be read in conjunction


CONSTRUCTION ISSUE

REVISION PANEL REV DATE DIN DETAILS 3 19.06.17 OP ISSUED FOR CONSTRUCTION 2 12.05.17 JK ISSUE FOR INFORMATION 1 19.06.17 CP ISSUED FOR CONSTRUCTION CURRENT REVISION CONTRACTOR: WSP AUSTRALIA		DESIGN PANEL DESIGNED: D.LONG-SCOTT DRAWN: C.PENDIN REVIEWED: P.GAYLARD CONTRACTOR: WSP AUSTRALIA		DESIGN PANEL AUTHORIZED: B.MCDONALD ORIGINAL SIGNED: [Signature] SA Water logo and text: "This drawing is the property of the SA Water Corporation and shall not be copied or modified in part or in whole without authorization."		ADELAIDE TO OUTER HARBOR PIPELINE STANDARD DETAILS MSCL PIPE JOINT PLAIN END WELDED DOUBLE COLLAR TORRENS RAIL JUNCTION GRADE SEPARATION		A1 MAXIMO ID: 3 PROJECT No: C087951 & C088046 TOTAL SHEETS: 10 DISCIPLINE: 05 SUPERSEDES: DRAWING NUMBER: 2017-01006-08 DATE: 19.06.17	
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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 ϕ 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 Pressure Test Record Sample Form

		Pressure Test Record (PTR)	
Project:	Client:		
Description:	Area:		
Marking Plan(s) Ref:	Wp:		
Report Raised by:	Date Raised:		
Test Circuit Section:	Specification No.		
Reference Drg/P&IDs:			
Line Numbers	ISO Number		
Design pressure	Service Pressure:		
Test Pressure: KPa	Test Medium Water		
Ambient Temp: °C	Test Duration:		
All NDE completed and compliant			
Was there any deformation of the line during the test?			
Was there any evidence of the leakage during the test?			
Pressure Gauge Serial Number	Pressure Range	Calibration Certificate Number	
Tested:	Verified (QC):	Reviewed by Client:	
Date:	Date:	Date:	
Comments	Attachments (Completion and Special Test Reports)		

D6 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	
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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	
		C/DNC	
		C/DNC	
Test Verification		SAW Representative	Contractor
Name			
Date			
Signature			
Reference			

D7 Manufacturers Data Report Sample Index

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NDT % of Production Welds	
NDT % of Welders Production Welds	
Key: NR=Not Required	