

**Technical Specification**

**Transport and Main Roads Specifications  
MRTS78A Fabrication of Structural Stainless Steelwork**

**November 2020**

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## 1 Introduction

This Technical Specification applies to the fabrication of structural stainless steel components for bridges, gantries, roadside furniture, pose and other structures.

For steel fabrication refer to MRTS78 *Fabrication of Structural Steelwork*.

For aluminium refer to MRTS79 *Fabrication of Aluminium Components*.

The aim of this Technical Specification is to produce fabricated stainless steel which conforms to the specified Engineering Drawings and to ensure the required durability. It describes the materials, supply, welding, finishing and assembly of stainless steel components. This Technical Specification is meant for the management of steelwork which is fabricated within a designated workshop using the following process and the supply of non-welded components.

- Gas Tungsten Arc Welding (GTAW), and/or
- Gas Metal Arc Welding (GMAW).

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

The use of commentary text, such as this, is covered by Clause 16 of MRTS01 *Introduction to Technical Specifications*.

### 1.1 Registered suppliers

The requirements for the fabrication of stainless steel components include the use of registered suppliers. For information regarding these suppliers refer to the department's website, <https://www.tmr.qld.gov.au/business-industry/Business-with-us/Approved-products-and-suppliers>, or email [TMRStructuralMaterials@tmr.qld.gov.au](mailto:TMRStructuralMaterials@tmr.qld.gov.au).

Note the differing submission requirements throughout this Technical Specification. Some approvals (for example, suitability of the welding supervisor) are wholly dealt with through the registration process, some submissions (for example, welding procedures) can be assessed by Structures Construction Materials but signed by the Administrator after receipt of a report or similar, and others (for example, niche project specific requirements) are assessed by the Administrator.

## 2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*.

In addition, terms listed in Table 2 are applicable to this Technical Specification.

**Table 2 – Definition of terms**

Term	Definition
Approved	Approved by the Administrator (this may be on the advice from Structures Construction Materials unit).
ASTM	American Society for Testing and Materials.
ATIC	Australian Technical Infrastructure Committee.
business days	Monday to Friday and excluding public holidays.
designer	The Registered Professional Engineer of Queensland (RPEQ) responsible for the design of the component.
Design Criteria	Departmental requirements for design details and methodology, found in different documents depending on application. In this document this refers to <i>Design Criteria for Bridges and Other Structures</i>
Engineering Drawings	RPEQ certified drawings as detailed in the Project / Contract drawings.
Fabricator	The supplier of the welded stainless steel components.
fasteners	Bolts, nuts and/or washers. These may be as an assembly or as individual components.
NDE	Non-destructive examination.
NDT	Non-destructive testing.
PQR	Procedure Qualification Record.
registered supplier	Prequalified supplier in accordance with departmental registration schemes. In this document this refers to: <i>Registration Scheme – Suppliers and Products for Bridges and Other Structures.</i> Registration for certain suppliers is a prerequisite for Administrator approval, not a substitute.
Registration Scheme	The process through which fabricators are assessed as competent to carry out stainless steel fabrication.
Robot Welder	The welding process that uses both a robot welding machine and a qualified operator.
SCM	Structures Construction Materials unit.
WPS	Welding Procedure Specification.
WTIA	Welding Technology Institute of Australia, now known as Weld Australia (WA).

### 3 Referenced documents

Table 3 lists documents referenced in this Technical Specification. The latest revision of the documents shall be used, dates are included when specific clauses have been reference.

**Table 3 – Reference documents**

Reference	Title
AS 4100	<i>Steel Structures</i>
AS/NZS 1167.2	<i>Welding and Brazing – Filler Metals – Filler Metal for Welding</i>
AS/NZS 1554.1	<i>Structural Steel Welding, Part 1: Welding of Steel Structures</i>

<b>Reference</b>	<b>Title</b>
AS/NZS 1554.6	<i>Structural Steel Welding – Welding Stainless Steels for Structural Purposes</i>
AS/NZS 4854	<i>Welding Consumables – Covered Electrodes for Manual Metal Arc Welding of Stainless and Heat-Resisting Steels - Classification</i>
AS/NZS ISO 9606.1	<i>Qualification testing of welders – Fusion welding, Part 1: Steels</i>
ASTM A240 / A240M	<i>Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications</i>
ASTM A276 / A276M	<i>Standard Specification for Stainless Steel Bars and Shapes</i>
ASTM A312 / A312M	<i>Standard Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes</i>
ASTM A380 / A380M	<i>Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems</i>
ASTM A554	<i>Standard Specification for Welded Stainless Steel Mechanical Tubing</i>
ASTM A789/789M	<i>Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service</i>
ISO 3506-1	<i>Mechanical Properties of Corrosion-Resistant Stainless Steel Fasteners</i>
ISO 3506-2	<i>Mechanical Properties of Corrosion-Resistant Stainless Steel Fasteners</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS78	<i>Fabrication of Structural Steelwork</i>
MRTS79	<i>Fabrication of Aluminium Components</i>
WTIA Technical Note 16	<i>Welding Stainless Steel</i>
-	<i>Registration Scheme: Suppliers and Products for Bridges and Other Structures</i>

#### **4 Standard test methods**

The standard test methods referenced in the applicable materials standards shall be used in this Technical Specification.

Further details of test numbers and test descriptions are given in Clause 4 of MRTS01 *Introduction to Technical Specifications*.

All tests for the purpose of compliance including sampling shall be performed and reported by a National Association of Testing Authorities (NATA) accredited laboratory, whose scope of accreditation encompasses the test method used.

#### **5 Quality system requirements**

##### **5.1 Hold Points, Witness Points and Milestones**

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points and Milestones applicable to this Technical Specification are summarised in Table 5.1. There are no Witness Points defined.

**Table 5.1 – Hold Points, Witness Points and Milestones**

Clause	Hold Point	Witness Point	Milestone
7	1. Approval of fabricator and design approval (where applicable)		Submission of fabricator's registration certificate and design approval (10 business days)
8.2	2. Approval of welding documentation		Submission of welding documentation (5 business days)
9.2.1	3. Approval of material test certificates		Submission of material test certificates (3 business days)
9.3.2	4. Approval of fastener material test certificates		Submission of fastener material test certificates (3 business days)
10.5.4	5. Approval of butt weld preparation		Inspection notification – butt weld preparation (3 business days)
10.5.5.2 10.5.6	6. Inspection of completed product		Inspection notification – completed weld (3 business days)
10.5.6	7. Inspection of overseas fabrication in Australia 8. Submission and review of non-destructive examination reports		Inspection notification – completed weld (3 business days)
10.5.7	9. Submission and review of weld maps		

## 5.2 Conformance requirements

The conformance requirements which apply to lots of work covered by this Technical Specification are summarised in Table 5.2.

**Table 5.2 – Conformance requirements**

Clause	Conformance requirements
10	Tolerances
10.5	Welding
11	Coatings

## 6 Conditions for fabrication of stainless steel components

### 6.1 General

All stainless steel components shall be fabricated in accordance with the details shown on the Engineering Drawings and in accordance with this Technical Specification.



## 6.2 *Manufacture by registered suppliers*

Stainless steel components shall be manufactured only by a registered supplier. Registered suppliers shall comply with the *Registration Scheme: Suppliers and Products for Bridges and Other Structures*.

The Registration Scheme also covers fabricators who are located outside Australia. Other requirements are specified within this Technical Specification.

## 6.3 *New stainless steel products*

Alternate or innovative product designs which do not comply with the department's Standard Drawings or the Engineering Drawings shall not be used without prior approval from the department. Alternative product designs shall comply with the Design Criteria, this Technical Specification and other relevant Technical Specifications. Supply of product to alternative designs shall not occur without prior approval of the Administrator.

Alternative product designs for products covered by Standard Drawings or other innovative products shall be submitted to the relevant section of the department's Engineering and Technology Branch for consideration and approval by the relevant Deputy Chief Engineer. All product details, including welding details, shall be provided.

Where innovative products are proposed, it should be noted that the department has a strategy document on engineering innovation.

Note that approval of an alternate or proprietary design by Engineering and Technology Branch, and the approval to supply an alternative product by the Administrator are separate processes. The former is, however, a prerequisite of the latter.

With respect to intellectual property, the department has and always will respect manufacturers' intellectual property. However, it is considered necessary for all details of the product purchased by the department to be provided. These details shall not be provided to any third party.

Note: Any confidentiality document or formal agreement required would need to be negotiated between Transport and Main Roads' Legal Services and the manufacturer.

## 7 **Prior to commencing fabrication**

No fewer than 10 business days **Milestone** prior to the start of fabrication, the Contractor shall supply to the Administrator a copy of the nominated Fabricator's registration certificate and any design approvals for proprietary products where applicable. **Hold Point 1**

## 8 **Welding**

### 8.1 *General*

As a minimum, welding carried out under this Technical Specification shall be Category 2, Class B and Surface Condition II in accordance with AS/NZS 1554.6.

Welding consumables shall be compatible with the parent material and shall have a classification and designation in accordance with the provisions of AS/NZS 1167.2 and/or AS/NZS 4854.

## **8.2 Welding documentation**

No fewer than five business days prior to the start of fabrication, the Contractor shall supply the following to the Administrator: **Milestone**

- a) a copy of the Welding Procedure Specification (WPS)
- b) the corresponding Procedure Qualification Record (PQR)
- c) macro test results for the welding staff for each submitted WPS, refer to Clause 10.5.3
- d) welding wire batch certificate, and
- e) a draft weld map (refer to Clause 10.5.7) to show where the WPS will be used.

The WPS shall be in accordance with AS/NZS 1554.6. The macro test reports shall be NATA-endorsed.

The WPS shall reflect the connection to be welded shown on the Engineering Drawings.

Welding shall not be carried out until the above documentation has been approved by the Administrator. **Hold Point 2**

AS/NZS 1554.6, Appendix C and AS/NZS 1554.1, Appendix C show typical forms for welding procedures. The WPS outlines the way the welded joint needs to be prepared, the welding parameters and the run sequence for the placement of the welds.

Transport and Main Roads – Structures Construction Materials (SCM) unit can assist with the review of this documentation if the Administrator is unsure of the technical requirements. A copy of the Engineering Drawings is required to undertake this review.

## **9 Materials**

### **9.1 General**

All stainless steel shall be Grade 316 (UNS S31600) or Grade 316L (UNS S31603). When specified on the Engineering Drawings, duplex stainless steel shall be Grade 2205. Material manufactured to other standards will be accepted provided the material also complies with the appropriate American Society of Testing and Materials (ASTM) Standards.

### **9.2 Stainless steel sections**

#### **9.2.1 Material test certificates**

No fewer than three business days prior to the start of fabrication, the Contractor shall supply a copy of the material test certificate for the material used in the fabrication. **Milestone**

This clause requires the Fabricator to supply the Administrator with the material test certificates for all material used in fabrications of the stainless steelwork. This requirement was introduced as the Transport and Main Roads Structures section found some stainless steel merchants were sourcing materials which did not comply with the requirements of the relevant standards.

Fabrication shall not commence until the Administrator has reviewed and approved the following **Hold Point 3**:

- a) a conforming material test certificate, and/or
- b) material testing results as appropriate, and
- c) a location map showing where the material can be found on the Engineering Drawings.

The material test certificate shall show the full chemical composition and the mechanical properties of the material, including yield, tensile and elongation results.

Third-party certification can be undertaken by an independent party for product conformity assessment. The certifying body shall be acceptable to the department. The certification will be carried out on the manufacturer of the raw material.

Material test or testing certificates are still required to prove traceability.

The submission of the material test certificates was introduced as it was found that some merchants were sourcing material which did not comply with the relevant Australian Standards.

The following are examples of the documents which could be submitted:

Option 1	Option 2
Conforming material test certificate	Material testing results
A location map showing material location	A location map showing material location

Transport and Main Roads – Structures Construction Materials unit can assist with the review of this documentation if the Administrator is unsure of the technical requirements. A copy of the Engineering Drawings is required to undertake this review.

If material test certificates are not available, sample testing shall comply with the requirements of Clause 9.2.1.1.

If the material specified on the Engineering Drawings is not available, it shall be raised with the designer or their nominated representative to be resolved prior to the commencement of fabrication.

#### 9.2.1.1 Sample testing

If testing is needed, then the following sampling conditions must be completed:

- a minimum of one test per size and grade, or
- 2% of the material of the same size and grade.

The sample tests shall be in accordance with the appropriate Australian Standard, stating the full chemical composition and mechanical test results, including yield, tensile and elongation tests. The results shall be NATA-endorsed. The sample tests shall be at no expense to the Principal.

### 9.2.2 Relevant Australian Standards

The grade and applicable ASTM Standards for stainless steel and/or the manufacturer's part number for fittings shall be as shown in the Engineering Drawings.

- ASTM A240/A240M *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications*
- ASTM A276/A276M *Standard Specification for Stainless Steel Bars and Shapes*
- ASTM A312/A312M *Standard Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes*
- ASTM A554 *Standard Specification for Welded Stainless Steel Mechanical Tubing*
- ASTM A789/789M *Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service*

The ASTM Standards noted above are the most commonly used for the supply of stainless steel. Other ASTM Standards may be used in the fabrication of the product if these are noted on Engineering Drawings.

### 9.2.3 Traceability of material

The Fabricator shall ensure there is traceability between the material test certificates and the material being used in the product. The Contractor shall demonstrate the method of traceability to the satisfaction of the Administrator.

If traceability cannot be established, then the material shall be tested by a NATA laboratory accredited for the appropriate testing. The results shall show the full chemical composition and the mechanical testing results, including yield, tensile and elongation tests. The sampling rate and number of tests shall be in accordance with Clause 9.2.1.1.


Traceability is deemed acceptable if there is a link between the approved material test certificate and the material being used for fabrication.

Figure 9.2.3(a) shows the heat number on a stainless steel plate. This number can also be found on the corresponding material test certificate, refer to Figure 9.2.3(b). The cross check between the material test certificate and the material is important to ensure the material being fabricated complies with the relevant Standards noted either in this Technical Specification or on the Engineering Drawings.

Figure 9.2.3(a) – Heat number on material



Figure 9.2.3(b) – Material test certificate

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004 Inspection Certificate 3.1 / EN 10204:2004 Abnahmescheinprüfung 3.1 / EN 10204:2004		Numéro de document Rev 00 Document number Beschreibungsnummer 2017-126386		Page 001 Sheet 003 Seite	 <b>ArcelorMittal</b>		
Client - Purchaser - Besteller							
Référéncie client - Purchase order - Kaufauftrag							
Projet - Project Industeel Belgium Site : Rue de Châtelet 266 6030 Marchienne-au-Pont							
ISO 9001 (Cert ES081397, Valid 14/09/2018) - MAQ REV 12 du 02/05/2012 ISO 9001 (Cert ES081397, Valid 14/09/2018) - QAM REV 12 of 02/05/2012							
Produit - Product - Erzeugnis			Plate(s)				
Commande / Poste - Internal order - Werksbestellung			1071752 / 000030				
Bordereau de livraison - Delivery note - Lieferungsdocument			80318353				
<b>#010 - PRODUITS LIVRES - DELIVERED PRODUCTS - GELIEFERTEN GEGENSTÄNDE</b>							
Nuance - Grade - Werkstoff		UNS S31803 PREN 35		Selon norme - According to - Entsprechend			
		UNS S31803 PREN 35		ASTM A 240/M ED.2016			
		UNS S32205 (2205)		ASME IIA ED.2015 SA 240/M			
		UNS S32205 (2205)		ASME IIA ED.2015 SA 240/M			
		UNS S32205 (2205)		ASTM A 240/M ED.2016			
Epaisseur - Thickness - Dicke		16.00 mm		Largeur - Width - Breite			
				2,000 mm			
				Longueur - Length - Länge			
				9,144 mm			
Specification - Specification - Spezifikation							
Etat thermique de livraison - Heat treatment state of delivery - Wärmebehandlung Lieferzustand							
Hypertrempe eau (1100 °C - 2 min/mm) - Solution annealed and water quenched - Wasser abgeschreckt							
Procédé d'élaboration - Melting process - Erschmelzungsart							
Electric-arc furnace - VOD - Finish n°1 - 1D - HRAP							
Nbre Nbr Stk	N° produit Product Erzeugnis	N° de coulée Ladé nr. Schmelze nr.	N° de lot de contrôle Inspection lot nr. Profilos nr.	Nbre Nbr Stk	N° produit Product Erzeugnis	N° de coulée Ladé nr. Schmelze nr.	N° de lot de contrôle Inspection lot nr. Profilos nr.
01	862269001	21941	862269 5001	01	862269002	21941	862269 5001
Total - Total - Gesamtzahl		002					
The radiation level from the steel plates is less than 100 becquerels/gram (Bq/gram) or 0.5 microsieverts per hour (µSV/hr).							
							
Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande. We hereby certify that the above mentioned products are complying with the order requirements. Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellschriften entsprechen.							
							MONIQUE BORGNIET 02/11/2017 Gestionnaire Commande Mill inspector Werksbeauftragte 

### 9.3 Fasteners

#### 9.3.1 General

Bolts shall be stainless steel designation A4-70, nuts shall be designation A2-70, and washers shall be Grade 316 (UNS S31600), unless noted otherwise on the Engineering Drawings.

For easy reference, stainless steel bolts designated as A4-70 are approximately equivalent to Grade 316 (UNS S31600) and stainless steel nuts designated as A2-70 are Grade 304 (UNS S30400).

Bolts and nuts shall have ISO coarse pitch metric rolled thread.

All fasteners (bolts, nuts and washers) shall be either electro-polished or passivated in accordance with ASTM A380 / ASTM A380.

#### 9.3.2 Fastener documentation

No fewer than three business days prior to the start of fabrication, the Contractor shall supply a copy of the material test certificates for the fasteners. **Milestone**

Assembly or installation shall not commence until the Administrator has reviewed and approved the material test certificates for the fasteners. **Hold Point 4**

The material test certificate shall show the full chemical composition and mechanical properties of the material, including yield, tensile and elongation results.

#### 9.3.3 Relevant Standards

Bolts and nuts shall comply with the requirements of the following Standards:

- ISO 3506-1 *Fasteners – Mechanical properties of corrosion-resistant stainless steel fasteners*
- ISO 3506-2 *Fasteners – Mechanical properties of corrosion-resistant stainless steel fasteners.*

#### 9.3.4 Traceability of material

The Fabricator shall ensure there is traceability between the material test certificates and the fasteners being used in the product. The Contractor shall demonstrate the method of traceability to the satisfaction of the Administrator.

## 10 Fabrication

### 10.1 General

All stainless steel components shall be fabricated in accordance with AS/NZS 4100 and AS/NZS 1554.6.

The WTIA Technical Note 16 *Welding Stainless Steel* has useful information about the fabrication of stainless steel.

## **10.2 Handling and storage of stainless steel components**

All stainless steel fabrication shall be undertaken in a separate building to carbon steel unless approved by the Administrator. The assessment of the workshop suitability is carried out during the Fabricator registration process.

Stainless steel material shall not be stored in contact with carbon steel. Stainless steel shall be stored in an area which is free from contaminants such as oil, grease or water and including the potential for condensation.

Stainless steel material shall be wrapped or otherwise protected during transport to avoid contamination. If an adhesive plastic film is used all traces of adhesive shall be removed from the steel with a suitable solvent.

Marking of stainless steel shall not be undertaken with a sharp object or a lead pencil.

Web slings shall be used in lifting stainless steel components and not chains.

It is important that stainless steel and carbon steel are stored and fabricated in separate locations. Also, the tools used for carbon steel fabrication are not to be used for stainless steel fabrication. This is to avoid rusting and instigation of corrosion of the stainless steel.

## **10.3 Section processing**

### **10.3.1 Cutting and edge preparation of stainless steel sections**

All material shall be cut to the required length and prepared as outlined by Clause 5.4 of AS/NZS 1554.6.

Tools used to fabricate or assemble stainless steel components shall be dedicated tools for stainless steel work. Tools previously used on carbon steel shall not be used for stainless steel work.

Grinding, cutting and welding shall not be carried out over open bundles of stainless steel components.

Edges to be welded shall not be sheared.

All butt weld preparation shall be prepared by machining, grinding or plasma cutting followed by grinding. All cutting shall be generally as smooth and regular as that produced by edge planing and the edge shall be left free of slag.

All re-entrant corners shall have a radius of 40 mm. The cut edge shall transition smoothly into the radius of the re-entrant corner.

No rough edges shall be allowed to remain, and uneven outer edges shall be dressed off to a true line.

### **10.3.2 Holes**

All holes shall be finished accurately to size and in the position shown on the drawings. All holes shall be cleaned of all burrs and rough edges.

The axis of the holes shall be at right angles to the surface through which they pass, except where otherwise shown on the drawings.

All holes in material with a thickness greater than 10 mm shall be drilled.

Punching of holes in material having a thickness greater than 10 mm will not be permitted.

### 10.3.3 Bending of plate or sheet

Prior to processing all bending equipment shall be cleaned of any potential contamination.

Prior to bending, any rags present on sheared edges shall be removed by grinding or filing to prevent the possibility of plate splitting on the outside corner.

Bending of stainless steel plate shall be carried out in a press to produce clean straight bends with no distortion in the adjacent flat surfaces.

### 10.3.4 Rolling of plate or sheet

Prior to processing all rolling equipment shall be cleaned of any potential contamination.

Prior to rolling any rough edges shall be smoothed by grinding to reduce the chance of the material cracking or splitting.

The surfaces of the rollers shall be clean so that the plate will not be scratched or pick up contaminants.

### 10.3.5 Cover Plates

Stainless steel cover plates made from material of thickness 9 mm and below shall be fabricated from stainless steel with a Class 2B mill finish.

Stainless steel cover plates made from material of thickness 10 mm and above shall be fabricated from stainless steel with a HRAP (Hot Rolled, Annealed and Pickled) finish.

Welding undertaken on cover plates shall comply with the welding requirements in Clause 10.5.

## 10.4 Tolerances

### 10.4.1 General

Tolerances shall comply with the requirements of AS 4100 or in the Clauses 10.4.2 or 10.4.3, as applicable.

### 10.4.2 Bridge traffic barrier and balustrade

The tolerances listed in Table 10.4.2 shall apply to stainless steel bridge traffic barriers and balustrade.

**Table 10.4.2 – Tolerances for bridge traffic barrier and balustrade**

Location	Tolerance
Length of rails and balustrade	±2 mm
Height of posts	±2 mm
Centre of holes	±2 mm
Finished height of balustrade	±2 mm
Plan Dimension	±3 mm
Bow in rail and balustrade	1 mm / m

### 10.4.3 Components other than bridge barrier

Unless specified otherwise on the Engineering Drawings the fabrication tolerances shall be ±2 mm.



## **10.5 Welding**

### **10.5.1 General**

Welding shall be carried out in accordance with AS/NZS 1554.6 except as amended by Clauses 10.5.2, 10.5.3, 10.5.5, 10.5.6 and 10.5.7 of this Technical Specification.

Where welding is undertaken outside Australia, all the clauses shall be complied with unless modified with the relevant additional clauses in this Technical Specification.

Welding carried out under this Technical Specification shall be Category 2, Class B and Surface Condition II in accordance with AS/NZS 1554.6.

#### **10.5.1.1 Administrator supervision for fabrication outside Australia**

All fabrication shall be overseen by the Administrator or their representative who conforms to the following requirements (at the Contractor's expense):

- Clause 4.12.1 (a) to (d) of AS/NZS 1554.6
- has a culturally different background to the country where the fabrication is being undertaken.

### **10.5.2 Welding supervisor**

All work shall be carried out under the supervision of a welding supervisor who conforms to at least one of the requirements of Clause 4.12.1 (a) to (e) of AS/NZS 1554.6.

The nominated welding supervisor shall be available to the welding personnel in the workshop or factory office during all welding processes, including tack welding.

The welding supervisor's qualifications and competency shall be assessed through the Registration Scheme.

The welding supervisor is responsible for the daily supervision of fabrication.

The inspections undertaken by the Administrator does not mitigate the responsibility of the welding supervisor.

#### **10.5.2.1 Welding supervision for fabrication outside Australia**

All work shall be carried out under the supervision of a welding supervisor who conforms to one of the requirements of Clause 4.12.1 (a) of AS/NZS 1554.6.

### **10.5.3 Welding personnel**

All welding personnel shall comply with the initial welder qualification requirements of Clause 4.12.2.3 of AS/NZS 1554.6.

After the initial qualification, all welding personnel shall undertake a macro test on a 12-monthly basis. The macros shall be for each welding procedure specification used on Transport and Main Roads projects.

Welder qualification to AS/NZS ISO 9606.1 is not acceptable.

Welding personnel nominated to carry out welding for Transport and Main Roads shall be assessed and approved under the Registration Scheme.

Transport and Main Roads reserves the right to withdraw a welder's approval if the welding is below the minimum requirements outlined in AS/NZS 1554.6.

All welding personnel require a minimum trade qualification as outlined by the Registration Scheme.

#### 10.5.3.1 Welding personnel (robot welder)

All welding undertaken by a robot welder and the associated operator shall comply with the initial welder qualification requirements of Clause 4.12.2.3 of AS/NZS 1554.6.

After initial qualification the robot welder shall undertake a macro test on a 12-monthly basis. The macros shall be for each WPS used on Transport and Main Roads projects.

Individual operators of the robot welder shall undertake the qualifications detailed above.

Transport and Main Roads reserves the right to withdraw approval of the robot welder if the welding is below the minimum requirements outlined in AS/NZS 1554.6.

#### 10.5.4 Butt welding preparation

No fewer than three business days **Milestone** prior to welding commencing on any butt welded connection, the Contractor shall notify the Administrator that the joint is ready for inspection. The Administrator shall ensure the butt weld preparation has been assembled in accordance with the approved WPS, including bevel angle and root gap. **Hold Point 5**

If the joint does not comply with the details on the WPS, the Fabricator shall either:

- a) modify the aluminium so the joint complies with the WPS, or
- b) develop and test a PQR with the new joint details, then qualify the necessary welding staff to the subsequent WPS in accordance with Clause 10.5.3.

This clause was added to the Technical Specification as some fabricators had not prepared the butt weld joint in accordance with the Engineering Drawings and WPS requirements. Some fabricators did not understand the welding symbols or thought the joint was over designed and did not require the weld specified. This problem has been greatly reduced with the inclusion of this point and the implementation of the Registered Suppliers List.

**Figure 10.5.4(a) – Bevel angle on a butt weld preparation**



The preparation of this type of joint is critical in guaranteeing the weld has its intended purpose. This may be due to the strength of the connection or to prevent crevice corrosion. Both the bevel angle (Figure 10.5.4(a)) and the root gap (Figure 10.5.4(b)) are important to getting the correct weld. The WPS should specify both factors.

**Figure 10.5.4(b) – Bevel angle on a butt weld preparation**



This Hold Point may take place at several stages during the fabrication process.

Transport and Main Roads – SCM unit can assist with this inspection if the Administrator is unsure of the technical requirements. A copy of the Engineering Drawings and the WPS are required to undertake this inspection.

## 10.5.5 Completed welds

### 10.5.5.1 Quality of welds

Permissible levels of imperfection in fillet and butt welds shall conform to Table 6.3.2 of AS/NZS 1554.6.

### 10.5.5.2 Inspection of welding

No fewer than three business days **Milestone** prior to items being sent for protective coating, the Contractor shall notify the Administrator that the completed welds are ready for inspection.

The Fabricator shall ensure the welded items are positioned so they can be inspected; that is, stacking of items that restricts visibility of completed welds is not permitted. All welds shall pass a visual inspection by the Administrator prior to coating. **Hold Point 6**

Additional testing, that is, non-destructive examination, shall be either outlined on the Engineering Drawings or at the request of the Administrator.

Any minor welding defects identified shall be repaired prior to the application of the protective coating. Any suspected major welding defects shall be tested with a suitable non-destructive test.

The inspection in this clause is to ensure the welds are the correct size and free from visible welding defects.

This Hold Point may take place at several stages during the fabrication process.

Transport and Main Roads – Structures Construction Materials unit can assist with this inspection if the Administrator is unsure of the technical requirements. A copy of the Engineering Drawings is required to undertake this inspection

**Figure 10.5.5.2(a) – Fillet weld leg length**



The weld fillet gauge verifies the weld leg length is the correct size. Figure 10.5.5.2(a) shows the leg length on the vertical face is 8 mm (7.9 mm).

**Figure 10.5.5.2(b) – Fillet weld throat thickness**



The weld fillet gauge also verifies the weld throat thickness is the correct size. Figure 10.5.5.2(b) shows the throat thickness is compliant with the requirements of an 8 mm (7.9 mm) fillet weld.

A potential defect with stainless steel is lack of fusion. The use of dye penetrant testing can identify areas which have lack of fusion.

**Figure 10.5.5.2(c) – Dye penetrant testing on a post**



### 10.5.6 Inspection of welding for fabrication outside Australia

No fewer than three working days **Milestone** prior to items being transported to Australia, the Contractor shall notify the Administrator that the completed welds are ready for inspection.

The Fabricator shall ensure welded items are positioned so they can be inspected; that is, stacking of items that restricts the visibility of completed welds is not permitted. All welds shall pass a visual inspection by the Administrator prior to coating. **Hold Point 6**

Any minor welding defects identified by the Inspector shall be repaired prior to the application of the protective coating. Any suspected major welding defects shall be tested with a suitable non-destructive test.

All fabricated products shall also be inspected by the Administrator in Australia at a location nominated by the Administrator prior to the application of the protective coating. **Hold Point 7**

All welding shall have the following non-destructive examination undertaken:

- minimum 50% of all butt welds shall be ultrasonically tested, and
- minimum 50% of all fillet welds dye penetrant tested.

If any welds are found to be non-compliant, then 100% of all welds shall be tested.

Transport and Main Roads reserves the right to increase the minimum level of non-destructive examination.

Non-destructive examination shall be carried out by a suitably qualified person. The examination report shall be NATA-endorsed.

Any welding defects found either during the inspection or testing shall be repaired by a Transport and Main Roads registered Fabricator prior to the application of the protective coating.

The Contractor shall submit the non-destructive examination reports for review. **Hold Point 8**

The requirement to inspect all welded products in Australia prior to protective coating is to ensure the non-destructive examination (visual and ultrasonic) can be successfully carried out. Any defects can then be easily repaired.

#### 10.5.7 Weld maps

Once the welding has been completed, the Fabricator shall provide a weld map outlining the welding undertaken in the manufacture of the stainless steel components. The weld map shall outline, for each connection, the following:

- WPS number used
- welder's initials (or welder ID) and date welded, and
- nominated welding supervisor's initials (or welder ID) and date inspected.

The weld maps shall be submitted to the Administrator for approval prior to the stainless steel product being released for protective coating. **Hold Point 9**

A table or legend shall be made available if requested to identify the welder's full name and corresponding initials or welder ID.

It is important to record which staff member welded a joint and which staff member checked that joint, as a part of the conformance documentation.

This Hold Point may take place at several stages during the fabrication process, depending on the method the Fabricator uses. The weld map template is reviewed during the supplier audit process.

Transport and Main Roads – SCM unit can assist with the review of this documentation if the Administrator is unsure of the technical requirements. A copy of the weld map, WPS and macro test results are required to undertake this review.

## **11 Protective coating**

### **11.1 *Stainless steel products***

All fabricated stainless steel products shall be pickled and passivated in accordance with the requirements of ASTM A380/A380M. The pickling and passivation process shall be carried out once the fabrication is complete.

The use of mechanical methods is not the preferred means of descaling.

All pickled and passivated stainless steel components shall be subject to the following special conditions:

- a) no repairs to the coating shall be made, and
- b) the use of power-operated sanding tools or grinders shall not be permitted.

The passivation process increases corrosion resistance.

