Technical Specification

Transport and Main Roads Specifications
MRTS71 Reinforcing Steel

July 2017
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1 Introduction

This Technical Specification applies to the supply, fabrication and placement of all types of low carbon steel reinforcement used in concrete road, marine and bridge structures, and all other incidental concrete construction.

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 requirements for supply, fabrication and placing of all types of low carbon steel reinforcement used in concrete road and bridge structures and other incidental concrete construction includes the use of suppliers and products for the items listed in Table 1 that are registered by Transport and Main Roads.

Table 1 – Items requiring use of registered suppliers and products

<table>
<thead>
<tr>
<th>Clause</th>
<th>Category of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Supply and processing of steel reinforcement</td>
</tr>
<tr>
<td>10</td>
<td>Bar chairs (Refer MRTS70 Concrete)</td>
</tr>
<tr>
<td>11.3</td>
<td>Mechanical reinforcing bar splices</td>
</tr>
</tbody>
</table>

For information regarding approved suppliers and products for the above items refer to https://www.tmr.qld.gov.au/business-industry/Business-with-us/Approved-products-and-suppliers or:
Department of Transport and Main Roads
Bridge Construction Maintenance and Asset Management
GPO Box 1412
Brisbane Qld 4001.

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACRS</td>
<td>Australasian Certification Authority for Reinforcing and Structural Steels.</td>
</tr>
<tr>
<td>Designer</td>
<td>RPEQ Certified Engineer responsible for the design of the reinforcement cage or structure.</td>
</tr>
<tr>
<td>Fabrication</td>
<td>The process of assembling reinforcement or a reinforcing cage, such work may include tying, bending, welding and cutting of reinforcement.</td>
</tr>
<tr>
<td>Large Cages</td>
<td>Any reinforcing cage not meeting the requirements of a small cage.</td>
</tr>
</tbody>
</table>
Term | Definition
--- | ---
Processing | Any process which significantly changes the shape and properties of the reinforcing steel. Processing may include cold-rolling, cold-drawing, de-coiling and straightening (including assembly into spiral cages), and automatic electric-resistance welding (adapted from AS/NZS 4671 (2001). Clause 3.20). The cutting and bending of reinforcing bars, and the production of pipe cages to MRTS25 *Manufacture of Precast Concrete Pipes*, is not considered to be processing.
Small Cages | A small reinforcing cage is one which meets the following requirements; an overall length of not greater than 4.0 m in any direction, or an overall weight not greater than 500 kg.

3 **Referenced documents**

Table 3 lists documents referenced in this Technical Specification.

*Table 3 – Referenced documents*

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 5100.5</td>
<td><em>Bridge design Part 5: Concrete</em></td>
</tr>
<tr>
<td>AS/NZS 14341</td>
<td><em>Welding consumables – Wire electrodes and weld deposits for gas shielded metal arc welding of non-alloy and fine grain steels</em></td>
</tr>
<tr>
<td>AS/NZS 16834</td>
<td><em>Welding consumables – Wire electrodes, wires, rods and deposits for gas shielded arc welding of high strength steels - Classification</em></td>
</tr>
<tr>
<td>AS/NZS 4680</td>
<td><em>Hot-dip galvanized (zinc) coatings on fabricated ferrous articles.</em></td>
</tr>
<tr>
<td>AS/NZS 4855</td>
<td><em>Welding consumables – Covered electrodes for manual metal arc welding of non-alloy and fine grain steels - Classification</em></td>
</tr>
<tr>
<td>AS/NZS ISO 17632</td>
<td><em>Welding consumables – Tubular cored electrodes for gas shielded and non - gas shielded metal arc welding of non - alloy and fine grain steels – Classification.</em></td>
</tr>
<tr>
<td>AS/NZS ISO 18276</td>
<td><em>Welding consumables – Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of high strength steels – Classification.</em></td>
</tr>
<tr>
<td>AS/NZS ISO 9001</td>
<td><em>Quality management systems - Requirements</em></td>
</tr>
<tr>
<td>MRTS01</td>
<td><em>Introduction to Technical Specifications</em></td>
</tr>
<tr>
<td>MRTS25</td>
<td><em>Manufacture of Precast Concrete Pipes</em></td>
</tr>
<tr>
<td>MRTS50</td>
<td><em>Specific Quality System Requirements</em></td>
</tr>
<tr>
<td>MRTS63</td>
<td><em>Cast-in-place Piles</em></td>
</tr>
<tr>
<td>MRTS70</td>
<td><em>Concrete</em></td>
</tr>
<tr>
<td>SMP-RS01 (BCM-P-014)</td>
<td><em>Registration Procedure: Approved Suppliers of Reinforcing Steel</em></td>
</tr>
</tbody>
</table>
Other elements of the MRTS suite are referenced within this Technical Specification but are not listed here.

3.1 Standard Drawings

Table 3.1 lists Standard Drawings referenced in this Technical Specification.

<table>
<thead>
<tr>
<th>Standard Drawing Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1043</td>
<td>Reinforcing Steel – Standard Bar Shapes</td>
</tr>
<tr>
<td>1044</td>
<td>Reinforcing Steel – Standard Hook, Lap and Bend Details and General Steel Reinforcement Information</td>
</tr>
</tbody>
</table>

4 Standard test methods

The standard test methods stated in Table 4 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.

<table>
<thead>
<tr>
<th>Property to be Tested</th>
<th>Method No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slip in mechanical bar couplers</td>
<td>ISO 15835-2 Clause 5.4</td>
</tr>
<tr>
<td>Tensile strength of mechanical bar couplers</td>
<td>ISO 15835-2 Clause 5.3</td>
</tr>
</tbody>
</table>

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, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

For Department of Transport and Main Roads registered precasters only, Hold Point 3 shall be a mandatory Hold Point in the supplier's Quality Management System and a Witness Point for the Administrator.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Hold Point</th>
<th>Witness Point</th>
<th>Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>1. Acceptance of Supplier</td>
<td></td>
<td>Submission of proposed supplier of steel reinforcement (three days).</td>
</tr>
<tr>
<td>8.2</td>
<td>2. Hot Bending</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3. Inspection of steel reinforcement before placement of concrete (precasters exempt)</td>
<td>1. As per Hold Point (precasters only)</td>
<td></td>
</tr>
<tr>
<td>Clause</td>
<td>Hold Point</td>
<td>Witness Point</td>
<td>Milestone</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>---------------</td>
<td>-----------</td>
</tr>
<tr>
<td>11.3</td>
<td>4. Alternative mechanical reinforcing bar splices</td>
<td>2. Installation of mechanical reinforcing bar splices</td>
<td></td>
</tr>
<tr>
<td>11.3.2</td>
<td>5. Substitution of different size, grade or ductility class of steel reinforcement</td>
<td></td>
<td>Application for substitution of reinforcement (three weeks)</td>
</tr>
<tr>
<td>13</td>
<td>6. Welding procedure specification sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.2</td>
<td>7. Inspection of splice welds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.5</td>
<td>8. Certification of lifting design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.1</td>
<td>9. Inspection of imported cages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.3</td>
<td>10. Submission of conductivity results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6 Materials</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Steel reinforcement shall be supplied from an approved source according to Clause 6.1. Reinforcing materials, and associated test certificates shall comply with Clause 6.2.

6.1 Supply of Steel Reinforcement

Steel reinforcement shall be manufactured, processed and supplied in accordance with this clause.

At least three days before steel reinforcement is supplied, the Contractor shall submit to the Administrator the identity and address of the proposed supplier and evidence of conformance with Clause 6.1.1 or Clause 6.1.2. **Milestone**

Steel reinforcement shall not be delivered to the Site until written acceptance of the proposed supplier and processor has been obtained from the Administrator. **Hold Point 1**

6.1.1 Supply of Steel Reinforcement – processed or unprocessed coil, bar or mesh

Steel reinforcement manufacture and processing shall be certified by an independent product certification body for steel reinforcement such as ACRS or equivalent Transport and Main Roads approved product certification body. Reinforcement shall be supplied by one of the department's registered suppliers (Refer Clause 1).

Where a fabricator of reinforcement cages, including precast concrete suppliers, cannot gain independent certification, for reasons other than product compliance, registration may be granted in accordance with Clause 6.1.2.
6.1.2 Processing of reinforcing steel (without third party product certification)

The department’s registration may be granted without third party product certification subject to:

   a) certification to AS/NZS ISO 9001 by JAS/ANZ accredited certifier
   b) supply of unprocessed reinforcement in accordance with Clause 6.1.1, and
   c) regular testing of product to demonstrate conformance.

Testing shall be conducted in accordance with AS/NZS 4671.

It is intended that this provision be removed in subsequent versions of this Technical Specification. Sampling frequencies for de-coiled products are found in AS/NZS 4671 Appendix B3 (b). Full details of the requirements for registration can be found in SMP-RS01.

6.2 Steel Reinforcement Materials

Steel reinforcement materials shall comply with all sections of this clause.

6.2.1 General

Steel reinforcement materials shall comply with AS/NZS 4671 and AS 5100.5.

Where shown in the Drawings, steel reinforcement shall be galvanized to AS/NZS 4680. Galvanized reinforcing bars shall be passivated in a 0.2% sodium dichromate solution applied by the galvaniser.

6.2.2 Test Certificates

If requested, the Contractor shall supply to the Administrator copies of the manufacturer’s test certificates identifiable with the reinforcement supplied or provide documentary evidence that all products meet the requirements of AS/NZS 4671 and that the supplier has a system in place to prevent non-conforming material from being supplied.

Where such certificates or documentary evidence cannot be supplied, the Contractor shall arrange testing of reinforcement to demonstrate conformance to AS/NZS 4761. In this case, reinforcement shall be tested as required in Table 7 of AS/NZS 4671 at a rate of one bar length for each 5 tonnes of reinforcement or part thereof for each size, grade and ductility class of reinforcing bar used, with a minimum of 2 bar lengths per size, grade and ductility class. Test results shall be made available to the Administrator.

ACRS certification is normally acceptable as demonstration of conformity in lieu of supplier test certificates unless there is a specific technical requirement or a particular concern that receipt of test certificates or additional testing would address.

6.2.3 Ductility Class L Reinforcement

Ductility Class L Reinforcement shall only be used where it is shown on the certified engineering drawings. Class L Reinforcement shall not be substituted for Class N reinforcement without written approval from the Designer.

The substitution shall also be presented to the Administrator for approval in accordance with Clause 13.
7 Protection

Steel reinforcement shall be protected from damage and surface contamination, that affects the bond between reinforcement and concrete, at all times. During storage it shall be stacked in racks, or on timber or other suitable material above ground and shall be kept clean of any contamination. The stacking method shall ensure that the reinforcement is not bent, kinked, or damaged.

The surface condition of reinforcement shall comply with Clause 9.

8 Bending

8.1 Bending General

Steel reinforcing bar shall be free of kinks or other unwanted deformations, and shall be cut to length, and bent in accordance with the Drawings. Welded reinforcing mesh shipped in rolls shall be straightened into flat sheets before use.

Steel reinforcing bar shall be cold bent by the application of a consistent force around a circular pin.

All bends shall be made in accordance with the shapes and dimensions shown on Standard Drawing Numbers 1043 and 1044, unless otherwise shown on the Drawings.

If a reinforcing bar has been bent and subsequently re-bent in the reverse direction or straightened, it shall not be bent again within 20 bar diameters of the previous bend.

After cutting and bending, bars shall be bundled or stored in a manner which permits clear identification of the bending schedule mark.

8.2 Hot Bending

Where specifically authorised by the Administrator, Hold Point 2 steel reinforcing bars may be bent hot on the site provided that:

a) the steel is heated uniformly through and beyond the portion to be bent (5 bar diameters is suitable for a 90° bend)

b) the temperature does not exceed 450°C

c) suitable temperature indicating crayons or equivalent are used to determine the temperature, and

d) the bar is not cooled by quenching, compressed air blast or any other accelerated method.

If the temperature of the bar exceeds 450°C, the bar shall be rejected Nonconformance.

Class L reinforcement or mesh shall not be heated or hot bent.

8.3 Bending Tolerances

Steel reinforcing bar and welded reinforcing mesh shall be fabricated to the shape and dimensions shown in the Drawings and within the following tolerances:

a) on any overall dimension for bars and mesh except where used as a fitment:

- Length up to 600 mm - 25 mm, + 0 mm
- Length over 600 mm - 40 mm, + 0 mm
b) on any overall dimension of bars or mesh used as a fitment:

- For deformed bars and mesh -15 mm, + 0 mm
- For plain round bars and wire -10 mm, + 0 mm

\( c \) for all precast / prestressed concrete -5 mm, + 5 mm

\( d \) on the overall offset dimension of a cranked column bar -0 mm, +10 mm

e) for the sawn or machined end of a straight bar intended for use as an end-bearing splice, the angular deviation from square measured in relation to the end 300 mm of the bar shall be within 2°

f) for situations requiring tolerances tighter than those outlined above the contractor shall specify the required tolerance limits when sourcing the reinforcement, and

g) in all cases the required cover to formwork and other surfaces shall be maintained.

Note that to maintain cover to reinforcement requirements tighter tolerances may be required in some applications.

9 Surface condition of steel reinforcement

The surface condition of steel reinforcement shall comply with the following requirements:

a) At the time concrete is placed, steel reinforcement shall be free from mud, oil, grease, paint, other non-metallic coatings, and loose rust which would reduce the bond between the concrete and the steel reinforcement.

b) Nevertheless, a deformed bar or welded reinforcing mesh complying with AS/NZS 4671 and having mill scale or rust or both shall be deemed to comply with this Standard if, for a specimen which has been wire-brushed by hand:

i. the dimensions of the cross-section, including height of deformations, and

ii. the mass per unit length

are not less than the dimensions and mass required by the Australian Standard.

c) Any steel reinforcement projecting from a previous concreting operation shall be cleaned free of adhering concrete or slurry prior to any further embedment.

d) Any steel reinforcement installed within 1 km of the coastline shall be thoroughly washed with a high pressure potable water jet immediately prior to pouring concrete to remove any salts deposited during storage and placement.

e) Steel reinforcing which has been accidently submerged by tidal or flood waters shall be cleaned with a high pressure potable water jet prior to pouring concrete.

f) With the exception of cast-in-place piles (refer MRTS63), construction or placement of reinforcing cages in tidal water, or submerged in standing fresh or salt water shall not be permitted.
For the purpose of sub-clause (a), loose rust includes flakes and pits. Rust that leaves a strain when rubbed with a thumb, but does not flake off is acceptable.

The aim of sub-clause (c) is to ensure sufficient mechanical integrity, including the concrete-reinforcement bonding. At a minimum deformations in the bar should be clearly visible.

10 Placing and fixing

Steel reinforcement shall be placed in position as shown in the Drawings. Where the bars are to be tied together, the reinforcement shall be tied by wiring at each intersection, using annealed wire not less than 1.25 mm in diameter. Where the bar spacing is 300 mm or less, alternate intersections only need to be tied. Fixing by locational tack welding is to be in accordance with Clause 14.4. Plastic ties or clips are not permitted.

Clearance from forms shall be maintained by use of registered bar chairs (refer to MRTS70). The shape of the chair shall be such that the minimum obstruction is offered to the formation of the homogenous concrete both within and around the chair. Some bar chairs are suitable for soffit use only and these shall not be used against side forms.

Steel spacers can be used for internal spacing of individual reinforcing mats where the spacer does not intrude on the cover zone in any way.

The system of fixing shall be such as to form a rigid cage which maintains dimensional tolerances under all applied loads applied before and during the placement of concrete. All steel reinforcement in position shall be inspected and approved before placement of concrete commences. Hold Point 3

As per Clause 5 this Hold Point 3 is a Witness Point 1 in reference to precasters, but must be considered as a Hold Point (for internal sign off) in the precaster's inspection and test plan.

11 Splicing of reinforcement

11.1 General

Splicing of steel reinforcing bar shall occur only in the locations shown in the Drawings, unless otherwise approved by the Administrator. Where practical, splices in steel reinforcing bar shall be staggered. Where splices cannot be staggered, the splices lap length shall be increased by 1.3 times the standard lap length.

Where an unscheduled splice occurs or where the length is not shown in the drawings, the length of the lap splice shall be as shown on Standard Drawing Number 1044. All steel reinforcement shall be spliced in such a manner as to maintain specified clear cover to the surface of the concrete.

Welded reinforcing mesh shall be lap spliced only. Splicing of welded reinforcing mesh shall be achieved so that the two outermost transverse bars of one sheet of mesh overlap the two outermost transverse bars of the sheet being lapped.

Locational tack welding of spliced bar shall comply with Clause 14.4.
11.2 **Splice welding**

Splicing by welding shall be permitted using the procedures described in Clause 14.5.

11.3 **Mechanical reinforcing bar splices**

Mechanical reinforcing bar splices shall be registered proprietary products used for splicing steel reinforcing bar (refer Clause 1).

Mechanical reinforcing bar splices shall be of either of the following types:

a) mechanically gripped to the end of a steel reinforcing bar by swaging or clamping with screws, and

b) connected to a steel reinforcing bar with a thread.

Mechanical reinforcing bar splices shall connect two reinforcing bars on a single axis.

Mechanical reinforcing bar splices permitted for use are to be listed in Clause 1 of Annexure MRTS71.1. Alternative registered mechanical reinforcing bar splices shall not be used without prior approval of the Administrator. **Hold Point 4**

Each coupler shall be legibly and durably marked (for example, hard stamped) with the identification of the manufacturer, the nominal bar size for which it is intended, and a batch mark for traceability purposes. Each coupler shall be traceable back to its production data.

The reinforcing coupler types listed further restrict the definition in ISO 15835 to exclude, for example, the use of adhesives to bond the joint together.

11.3.1 **Coupler properties**

The mechanical reinforcing bar splice shall be tested in accordance with ISO 15835-2, or approved equivalent, and exhibit:

a) a tensile strength of not less than 1.08 times the nominal specified yield stress of the weaker bar at the splice, and

b) a total slip of no more than 0.10 mm.

The ductility of the spliced bars shall conform to the requirements of ISO 15835-1 Clause 5.2.3.

Testing for compliance shall be undertaken at a NATA-accredited laboratory.

11.3.2 **Installation and use**

Mechanical reinforcing bar splices shall be installed where shown on the Drawings. Prior to attaching bars with a mechanical reinforcing bar splice, all bar ends shall be thoroughly cleaned. Bars shall be completely engaged and the joint assembled and tightened or locked in accordance with the manufacturer’s instructions. **Witness Point 2**

Unless supplied with a threaded coupling bar installed, the mechanical reinforcing bar splice shall be fitted with a plastic plug to protect the thread.

As constructed drawings shall be marked up to show the type used and the location of the mechanical reinforcing bar splice.
12 Tolerance on position of steel reinforcement

The deviation from the specified position of steel reinforcement shall not exceed the following stated tolerances. A positive value indicates the amount of cover increases, and a negative value indicates the amount the cover decreases.

a) for positions controlled by cover:
   • in girders, beams, slabs, and deck and kerb units - 5 mm, +10 mm
   • in slabs, columns and walls - 5 mm, +10 mm
   • in slabs-on-ground including footings of walls and culverts - 10 mm, +20 mm
   • in footings cast in the ground where the depth of the footing is 500 mm or more - 10 mm, +40 mm

b) for positions not controlled by cover:
   • the location of steel reinforcement on a profile ±10 mm
   • the position of the ends of steel reinforcement along the line of the bar ±50 mm
   • the spacing of bars in walls and slabs, and of fitments, the greater of:
     i. 10% of the specified spacing, and
     ii. 15 mm.

13 Substitutions

Substitution of different sizes, grades or ductility class of steel reinforcement to that shown on the drawings shall not be made unless approved in writing by the Designer and the Administrator. The application shall be forwarded at least three weeks prior to the date on which the steel reinforcement is required to be placed.

Substitution shall be permitted only if the structure is not adversely affected by the change. Substitution shall not proceed until the Administrator has approved the change. Hold Point 5 No additional payment shall be made on account of any approved substitution.

14 Welding

14.1 General

Where reinforcement is to be welded, the welding shall be conducted in accordance with the provisions of AS/NZS 1554.3 and the following requirements.

Welding adjacent to or above any prestressing bar or strand (stressed or unstressed) shall not be permitted without special precautions to protect all prestressing from welding spatter. Protection arrangements shall be approved by the Administrator.

With the exception of locational tack welding on small reinforcing cages reinforcing mesh shall not be welded.

Clause 14 Welding does not apply to fabrication of mesh certified by ACRS.

Where AS/NZS 1554.3 refer to ‘principal’, this shall be understood as the Administrator.
14.2 **Welding Procedures Sheets**

No welding shall be carried out until a Welding Procedure Specification (WPS) Sheet, in accordance with Section 4 of AS/NZS 1554.3, has been completed and a copy submitted to the Administrator. Welding shall not be carried out until the appropriate Welding Procedure Specification Sheet has been approved by the Administrator.

Hold Point 6

This requirement applies to tack welding.

14.2.1 **Welding consumables**

Welding consumables shall be compatible with the parent metal and shall be classified and identified in accordance with the provisions of the appropriate Australian Standards. When welding consumables are specified on the Certified Engineering Drawings, the welding consumables on the Drawings take precedence.

Table 3 contains a list of appropriate standards.

14.3 **Welding supervisor**

All work shall be carried out under the supervision of a welding supervisor who shall conform to at least one of the following requirements in:

a) Clause 4.12.1 of AS/NZS 1554.3.

14.4 **Locational tack welding of reinforcement**

Locational tack welding shall comply with AS/NZS 1554.3 Clause 3.3 and shall:

a) not substantially reduce the cross-section of the steel reinforcing bar nor adversely affect its strength

b) have a throat thickness not less than 4 mm, and

c) have a length not less than the diameter of the smaller bar.

Non-hydrogen controlled consumables may be used provided yearly qualification tests in accordance with AS/NZS 1554.3 have been completed and their use is not excluded by the drawing notes or other Technical Specification requirements.

Not more than one-third of the main steel reinforcing bars at any cross section shall be tack welded.

14.4.1 **Welding staff – tack welding**

All welders shall satisfy Clause 4.12.2.1 of AS/NZS 1554.3.

The remainder of Clause 4.12.2 of AS/NZS 1554.3 does not apply to the qualification of welders for location tack welding.
14.5 Splice welding

Splicing of steel reinforcing bar by welding shall comply with AS/NZS 1554.3 and be permitted only where shown in the RPEQ certified 'for construction' drawings or where approved by the Administrator.

Splices shall be made by direct butt or double-lap welds. Butt welds shall be qualified complete penetration butt joints in accordance with AS/NZS 1554.3.

Splice welding shall not be carried out within a distance equal to two bar diameters of any portion of a bar which has been or will be bent.

Splice welding is not permitted for Class L reinforcement.

Placement of the reinforcement within the concrete formwork shall not proceed until the Administrator has inspected and approved all splice welds. **Hold Point 7**

14.5.1 Welding staff – splice welding

All welders shall satisfy Clause 4.12.2 of AS/NZS 1554.3 and be requalified on a twelve monthly basis.

All qualification testing shall be conducted by a laboratory accredited by NATA for the tests.

Clause 4.12.2.1 of AS/NZS 1554.3 sets down requirements for evidence and particulars to be submitted and the consequences for non-conforming welding.

15 Prefabrication of reinforcing cages

Reinforcing cages fabricated or assembled out of position and subsequently lifted into position shall comply with the requirements of this Technical Specification and the following additional requirements.

15.1 Provision for lifting of cages

All reinforcing cages which are required to be lifted or transported into position, shall have dedicated lifting points incorporated into the cage to permit such lifting. Lifting points shall be clearly identifiable on all cages.

Lifting points not subject to design stresses shall be welded in accordance with AS/NZS 1554.3 Clause 3.3.

For large cages, an RPEQ engineer certified drawing which clearly shows the location and capacity of all lifting points and the location of all welding to ensure the reinforcing cage remains rigid during lifting and handling must be submitted to the Administrator prior to the lifting of the reinforcing cage. **Hold Point 8**

All components of lifting forces should be considered.
15.2 **Labelling cages**

All reinforcing cages shall be identified with the following information, either by tagging or a combination of labels, schedules and drawings:

- a) fabricator’s name
- b) date of manufacture
- c) drawing reference
- d) mass of cage, and
- e) for large cages, colour and location of dedicated lifting points.

For cages fabricated on site this information need not be written out on every cage. A visual inspection with accompanying documentation should be able to discern the above information.

15.3 **Inspection of cages fabricated outside of Australia**

All cages fabricated outside of Australia shall be visually inspected by the Administrator in Australia at a location suitable to the department prior to placing all steel reinforcement in position. **Hold Point 9**

The supplier shall be responsible for covering all costs involved.

16 **Electrical conductivity**

If electrical conductivity is specified in the drawings, it shall be demonstrated to the satisfaction of the Administrator by means of test results prior to placement of concrete. **Hold Point 10**

17 **Supplementary requirements**

The requirements of MRTS71 Reinforcing Steel are varied by the Supplementary requirements given in Clause 2 of Annexure MRTS71.1.