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FABRICATION OF ALUMINIUM STRUCTURAL MEMBERS

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IC-DC-B245

VERSION FOR:
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June 2011

ROADS AND MARITIME SERVICES
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FOREWORD

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BASE SPECIFICATION

This document is based on Specification RMS B245 Edition 3 Revision 1.
RMS SPECIFICATION D&C B245

FABRICATION OF ALUMINIUM STRUCTURAL MEMBERS

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for the supply of materials, preparation of materials, assembly, welding, testing, inspection, packing, handling and delivery to the bridge site of aluminium girders, columns and other structural members and assemblies from plates and wrought, drawn and/or extruded sections.

This part does not apply to the fabrication of aluminium railings, lamp standards, expansion joints, protection angles, or bearings.

1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.2.1 (Not Used)

1.2.2 (Not Used)

1.2.3 Schedules of HOLD POINTS, WITNESS POINTS, Processes Requiring Validation and Identified Records

The schedules in Annexure B245/C list the HOLD POINTS and WITNESS POINTS that must be observed. Refer to Specification RMS D&C Q6 for the definitions of HOLD POINTS and WITNESS POINTS.

The processes listed in Annexure B245/C are processes requiring validation in accordance with AS/NZS ISO 9001 Clause 7.5.2 (refer to RMS D&C Q6 Clause 7.5.2).

The records listed in Annexure B245/C are Identified Records for the purposes of RMS D&C Q6 Annexure Q/E.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure B245/D and must be implemented.

Supply, as part of your PROJECT QUALITY PLAN, procedures for assembly and fabrication, welding, transport and protective treatment which must include, but not be limited to, the following:

(a) Assembly procedures, including dimensional control and details of manufacturing jigs;
(b) Cutting and edge preparation procedures;
(c) Procedures for cambering, curving, bending and straightening;
(d) Procedures for trial assembly;
(e) Welding procedures;
(f) Procedures and welding sequence for control of distortion;
(g) Qualification of welds;
(h) Qualification and identification of welders;
(i) Qualification of welding supervisors;
(j) System of identification of welders with work;
(k) Procedures for inspection of welds including:
   (i) Programme for weld inspection,
   (ii) Methods of reporting results of weld inspection,
   (iii) Procedures for correction of faulty welds;
(l) Procedures for transport, handling and storage, including measures to prevent distortion and
damage to the aluminium work and its protective coating;
(m) (When Specification RMS D&C B261 “Erection of Structural Aluminium” is included in the
deed) The procedures required under Annexure B261/D of RMS D&C B261.

1.2.5 Referenced Documents

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For
convenience, the full titles are given in Annexure B245/M.

1.3 DEFINITIONS

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

1.4 PROVISION FOR AUDITING

When required for the purpose of auditing, lay out and arrange the individual members or units so that
identification marks on each may be readily distinguished and each member or unit is accessible. Assist by turning the members or parts to permit examination on all sides.

2 INFORMATION TO BE SUPPLIED BY THE CONTRACTOR

2.1 FABRICATION PROGRAMME

Submit a programme showing the proposed sequence of operations for all members and/or parts,
which must be identified by name and mark, at least seven (7) working days before any fabrication
work commences.

2.2 SHOP DRAWINGS

Prepare shop drawings for the fabrication of all members.

The details shown on the shop drawings must be consistent with the Design Documentation drawings
and must comply with the following:
(a) The marking plan must show the locations, as appropriate, of Abutment A and B, Upstream and Downstream, span numbers, Pier numbers and North orientation;

(b) Shop drawings must conform to AS 1100 as appropriate;

(c) Welding and cutting definitions must conform to AS 2812;

(d) Welding symbols must conform to AS 1101.3;

(e) Complete information regarding the location, type, size and extent of all welds must be clearly shown;

(f) Full details of weld category and level of quality assurance in accordance with Clause 1.6 and Appendix B of AS/NZS 1665;

(g) Each member must be clearly identified with the identification marks shown on the Design Documentation drawings. Each type of component must be further identified to readily distinguish it from all other types;

(h) For assemblies, all associated bolting, accessories and/or joining details must be shown on the shop drawings.

Submit to the Project Verifier four (4) copies of the shop drawings, certified by you as complying with the above requirements, at least five (5) working days before fabrication commences.

You are responsible for the correctness of the shop drawings. Submit to the RMS Representative two (2) copies of the work-as-executed shop drawings within four (4) weeks of the completion of fabrication and erection of the aluminium members.

3 MATERIALS

3.1 GENERAL

Unless noted otherwise on the Design Documentation drawings or in the Specification, materials used in the Project Works must comply with the following standards:

(a) structural aluminium sheet and plates must comply with AS/NZS 1734;

(b) structural aluminium drawn wire, rod, bar and strip must comply with AS/NZS 1865;

(c) structural aluminium extruded rod, bar, solid and hollow shapes must comply with AS/NZS 1866;

(d) structural aluminium drawn tube must comply with AS/NZS 1867 unless noted otherwise on the Design Documentation drawings or in the Specification.

All grinding of surface defects must produce a surface roughness similar to the finish on surrounding areas.

Any significant surface defect areas corrected by grinding must not be located on the outside (visible) surface of outside members.

Weld repairs to materials are not permitted.
3.2 TESTING OF MATERIALS

The test certificates must be related to the aluminium by trade marks and heat number which must be legibly marked on each piece.

<table>
<thead>
<tr>
<th>HOLD POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Held: Fabrication of Aluminium Structural Members.</td>
</tr>
<tr>
<td>Submission Details: Test certificates from a laboratory with appropriate NATA registration, indicating compliance of all materials with the relevant standards.</td>
</tr>
<tr>
<td>Release of Hold Point: The Nominated Authority will consider the submitted documents prior to authorising the release of the Hold Point.</td>
</tr>
</tbody>
</table>

3.3 IDENTIFICATION OF MATERIALS

Establish and maintain a comprehensive system of identification records.

3.4 PRECUTTING OF ALUMINIUM BY MERCHANTS AND SUPPLIERS

Any cutting or shaping of aluminium plates and sections after the aluminium has left the aluminium mill is regarded as fabrication work and must be carried out in accordance with the requirements of this Specification.

3.5 STORAGE OF MATERIALS

Store all aluminium, whether fabricated or not, in such a manner that it is maintained in its original condition, will not be bent or damaged and will be adequately protected against corrosion.

Provide protection against any contamination from materials which can cause weld porosity such as water or hydrocarbons, e.g. oil or grease. Prevent water from collecting between individual sheets or plates.

Generally, storage in a dry area with an even temperature, with sheets separated with an allowance made for air flow between them, covered with sheet plastic, at least 200 mm above the ground on platforms, slabs, or other supports will be satisfactory.

4 FABRICATION

4.1 COMMENCEMENT OF FABRICATION

Give five (5) working days notice in writing before commencing fabrication work, and allow for this notice in your fabrication programme.

4.2 TOLERANCES

Fit all pieces together correctly on assembly in the Project Works. Curving, bending or shaping must be even and true to the Design Documentation drawings.
Where tolerances are not specified, the absolute tolerance must be ± 2 mm.

Measure member dimensions and camber for conformity when all fabrication, welding and heating operations are completed and the member has cooled to a uniform temperature.

4.3. STRAIGHTENING

Before any marking out or other work is done, make all plates flat and all bars and sections straight and free from twist so that, when assembled, adjacent surfaces will be in close contact throughout. The methods adopted for the above work must be such that the material is not damaged.

4.4 BENDING

The bending and forming of plates or sections must conform to the manufacturer’s recommendations and/or the relevant Australian Standard.

4.5 PLATES AND FLATS

Finish stripped plates square, straight and plane without burrs or imperfections.

Mark plates before cutting so that the cut pieces are identifiable at all times.

4.6 CUTTING AND EDGE TREATMENT

4.6.1 General

Aluminium work may be cut by plasma-arc cutting, sawing, routing, planing, grinding or shearing unless specified otherwise below. Flame cutting must not be used.

Surfaces produced by cutting must be representative of good workmanship, finished square (unless a bevelled edge is called for), true to the required dimensions and free from defects such as excessive roughness, which would impair the service performance or seriously interfere with subsequent fabrication and protective treatment.

Do not use shearing for main plates, reinforcing plates, main gussets, splice plates, diaphragms, main members and bracing. Remove distortions caused by shearing.

Do not use grinding on surfaces prepared for welding.

Round the re-entrant corners smoothly to a radius of not less than 3 mm.

Unless shown otherwise on the Design Documentation drawings, round all corners on exposed edges to remove sharp edges, except where such edges must subsequently be welded. Rolled and extruded edges need not be rounded provided that the corners are not sharp.

Carry out plasma-arc cutting wherever possible by machines which are mechanically guided and moved at uniform speed. Use hand cutting only for secondary cuts, hole preparation, repairs and other work where machine cutting is not possible.

Any cut surface to be incorporated in a weld must comply with AS/NZS 1665.
4.6.2 Repairs

Cut surfaces may be planed or ground to obtain the specified surface roughness. Grinding marks must be parallel to the direction of the cut.

Do not use grinding on surfaces which will be subsequently welded.

5 HOLES FOR BOLTING

5.1 GENERAL

The diameters of holes for bolting must be not more than 2 mm larger than the diameters of the bolts shown on the Design Documentation drawings unless specified otherwise.

Holes may be either drilled full-size or reamed to full-size after sub-drilling or sub-punching.

5.2 SUB-PUNCHED AND SUB-DRILLED HOLES

Sub-punched and sub-drilled holes for bolts must be smaller in diameter than the nominal diameter of bolts by 3 mm.

For sub-punched holes, the diameter of the die must not exceed the diameter of the punch by more than 1 mm. Holes must be clean cut, without torn or ragged edges.

Do not use sub-punched holes where the diameter of the hole is less than the thickness of the material.

5.3 REAMED OR DRILLED HOLES

Reamed or drilled holes must be cylindrical and perpendicular to the face of the member unless shown otherwise on the Design Documentation drawings. Carry out reaming and drilling by mechanical means.

Connecting parts must be assembled and held securely while being reamed or drilled and must be match-marked before separating the parts.

Remove all burrs. If necessary, take assembled parts apart for removal of burrs caused by drilling and reaming.

5.4 HOLES FOR FIELD CONNECTIONS

Holes for field connections of members may be reamed or drilled with the members assembled in the shop in their correct relative position.

If this procedure is adopted, assemble all adjoining main members in an assembly before reaming or drilling is commenced. Matchmark all joints and associated splice plates so drilled before the structure is dismantled.
Alternatively, these connections may be sub-punched or sub-drilled and reamed or drilled from the solid to a hardened steel template not less than 25 mm thick, and all corresponding holes in the members to which they connect must be reamed or drilled to the same template.

5.5 ALIGNMENT

All matching holes in any contiguous group must register with each other so that a gauge or drift 2 mm less in diameter than the holes must pass freely through the assembled contact faces at right angles to them.

You are responsible for the accuracy of all holes regardless of variations in dimensions of rolled sections or tolerances allowed in fabrication.

6 WELDING

6.1 GENERAL

Identify welding as a PROCESS REQUIRING VALIDATION in accordance with RMS D&C Q6.

All welding must conform to AS/NZS 1665 and to the additional requirements given below.

Remove all weld spatter from the surface of the weld and the parent metal.

Welding must be Category B with no undercut unless otherwise specified.

6.2 WELDING CONSUMABLES

Welding consumables must conform to AS/NZS ISO 18273 for rods or AS/NZS 1865 for continuous wire. Testing of welding consumables must comply with AS/NZS 1665.

Welding consumables must be selected in accordance with Annex ZB of AS/NZS ISO 18273 and must only be used in accordance with the manufacturer's recommendations and AS/NZS 1665.

Obtain certification, by a recognised authority complying with the requirements of AS/NZS 1665, that the classification and grade of the welding consumables are suitable for welding the aluminium type nominated in the welding procedures.

6.3 QUALIFICATION OF WELDING PROCEDURES

Each welding procedure must be qualified by way of test pieces and/or assemblies in accordance with AS/NZS 1665.

WITNESS POINT

Process to be Witnessed: Welding and testing of each test piece and/or assembly.

Submission Details: At least three (3) working days notification to the Nominated Authority of the time and place where the welding and testing of the test pieces and/or assemblies will be carried out.
Obtain test and/or Inspection Certificates from a laboratory with appropriate NATA registration, with all relevant results shown and a statement that the results comply with AS/NZS 1665. The testing operator must have the relevant AINDT certification for the test carried out.

### 6.4 QUALIFICATION OF WELDING SUPERVISOR

The welding must be supervised by a Welding Supervisor who satisfies the requirements of AS/NZS 1665 Clause 4.5.2.

### 6.5 QUALIFICATION OF WELDERS

All welders must demonstrate their competence by welding a test piece qualified by testing in accordance with AS/NZS 1665 Clause 4.5.3.

Any welder who during fabrication, repeatedly produces nonconforming welds must be required to be re-tested. Failure of the re-test must preclude such welder from further similar welding on the Project Works until the welder develops the required proven ability to produce sound welds.

### 7 INSPECTION OF WELDS

#### 7.1 GENERAL

Identify welding inspection as a **PROCESS REQUIRING VALIDATION** in accordance with RMS D&C Q6.

Carry out inspection of welds in accordance with the methods nominated in AS/NZS 1665.

All welding inspection must be supervised by a qualified welding supervisor who must have at least the requirements of a WTIA certificate. All welding inspection must be carried out by a qualified welding inspector who must hold a WTIA Welding Inspectors Certificate.

Carry out weld inspections, to be covered by test certificates, when all adjacent welds are completed and are sufficiently cool to ensure that no further defects arise after inspection.

#### 7.2 NONCONFORMING WELDS

When a nonconforming weld is detected following inspection, inspect the remaining area of the member which has not been similarly inspected (and is represented by the inspected weld) to the extent specified in AS/NZS 1665. Additionally, inspect the welds adjacent to the nonconforming weld for a distance of 300 mm.

Re-inspect all weld repairs for conformity.

### 8 SHOP ASSEMBLY

At the earliest possible stage during fabrication, or as indicated on the Design Documentation drawings or in the Specification, shop assemble each different combination of members and panels to check the fit of the components and verify the suitability of the templates used in fabrication.
Supply certification of satisfactory shop assembly.

9   CERTIFICATION OF FABRICATION

Provide the Project Verifier with certification that each item fabricated conforms to the requirements of the Design Documentation drawings and the Specification.

10   MARKING, PACKING AND HANDLING

Mark each part with durable distinguishing marks. Use paint of different colours to distinguish similar parts.

Supply two copies of drawings showing these markings to the Project Verifier when the aluminium work is despatched.

Take special care in the packing and methods of support and lifting during handling of all structural aluminium work to prevent distortion or damage to the aluminium work and its protective coating.

11   TRANSPORT TO THE CONSTRUCTION SITE

During transport of any part of the work, there must be no distortion or damage to the aluminium work and its protective coating.
ANNEXURES B245/A TO B245/B – (NOT USED)

ANNEXURE B245/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS, PROCESSES REQUIRING VALIDATION AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS

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<thead>
<tr>
<th>Clause</th>
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<th>Description</th>
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<tr>
<td>3.2</td>
<td>Hold</td>
<td>Submission of test certificates for materials</td>
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<tr>
<td>6.3</td>
<td>Witness</td>
<td>Welding and testing of test pieces and/or assemblies</td>
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</tbody>
</table>

C2 SCHEDULE OF PROCESSES REQUIRING VALIDATION

The processes listed below are Processes Requiring Validation in accordance with AS/NZS ISO 9001 Clause 7.5.2 (refer to RMS D&C Q6 Clause 7.5.2).

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
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<tbody>
<tr>
<td>6.1</td>
<td>All welding</td>
</tr>
<tr>
<td>7.1</td>
<td>All welding inspection</td>
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</table>

C3 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of RMS D&C Q6 Annexure Q/E.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of Identified Record</th>
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</thead>
<tbody>
<tr>
<td>2.2</td>
<td>Work-as-executed shop drawings</td>
</tr>
<tr>
<td>3.2</td>
<td>Test certificates indicating compliance of all materials with the relevant standards</td>
</tr>
<tr>
<td>8</td>
<td>Certification of satisfactory shop assembly</td>
</tr>
<tr>
<td>9</td>
<td>Certification that each item fabricated conforms to the requirements of the Design Documentation drawings and the Specification</td>
</tr>
</tbody>
</table>
ANNEXURE B245/D – PLANNING DOCUMENTS

Refer to Clause 1.3.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the deed must be reviewed to determine additional documentation requirements.

The information to be submitted as part of the PROJECT QUALITY PLAN must include, but is not limited to, the following:

(a) Procedures for assembly and fabrication, welding, transport and protective treatment (Clause 1.3);
(b) Shop Drawings (Clause 2.2);
(c) Details of method of storage of materials (Clause 3.5);
(d) Nominated welding supervisor together with evidence of compliance with the requirements of AS/NZS 1665 Clause 4.5.2 (Clause 6.4);
(e) Nominated welders together with evidence of compliance with the requirements of AS/NZS 1665 Clause 4.5.3 (Clause 6.5);
(f) Details of method of packing and handling (Clause 10);
(g) Details of method of transportation (Clause 11).
ANNEXURES B245/E TO B245/L – (NOT USED)

ANNEXURE B245/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.5.

RMS Specifications

RMS D&C Q6 Quality Management System (Type 6)
RMS D&C B261 Erection of Structural Aluminium

Australian Standards

AS 1100 Technical drawing (Parts as appropriate)
AS 1101.3 Graphical symbols for general engineering – Welding and non-destructive examination
AS/NZS 1665 Welding of aluminium structures
AS/NZS 1734 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate
AS/NZS 1865 Aluminium and aluminium alloys – Drawn wire, rod, bar and strip
AS/NZS 1866 Aluminium and aluminium alloy – Extruded rod, bar solid and hollow shapes
AS/NZS 1867 Aluminium and aluminium alloy – Drawn tubes
AS 2812 Welding, brazing and cutting of metals – Glossary of terms
AS/NZS ISO 9001 Quality management systems - Requirements
AS/NZS ISO 18273 Welding consumables – Wire electrodes, wires and rods for welding of aluminium and aluminium alloys – Classification