



Ergon Energy Corporation Limited

Specification for the Fabrication of Steel Structures

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1. Purpose and Scope

This specification covers the supply of materials, including fasteners and accessories, fabrication, galvanising and testing of components for steel structures. All costs related to this section shall be deemed to be included in the Schedule of Rates for Structure Supply and Delivery.

2. References

2.1 Ergon Energy controlled documents

Nil

2.2 Other sources

AS 4100 – Steel Structures

AS 3678 – Structural steel – Hot-rolled plates, floorplates and slabs

AS 3679.1 – Structural steel – Hot-rolled bars and sections

AS 1111 – ISO metric hexagon bolts and screws – Product grade C

AS 1559 – Hot-dip galvanised steel bolts with associated nuts and washers for tower construction

AS 1110 - ISO metric hexagon bolts and screws – Product grades A and B

AS 1112 - ISO metric hexagon nuts

AS 1214 – Hot-dip galvanised coatings on threaded fasteners (ISO metric coarse thread series)

AS/NZS 1252 – High strength steel bolts with associated nuts and washers for structural engineering

AS/NZS 1554 – Structural steel welding

AS/NZS 4680 - Hot-dip galvanised (zinc) coatings on fabricated ferrous articles

3. Definitions, Acronyms, and Abbreviations

3.1 Acronyms and Abbreviations

The following acronyms appear in this standard:

AS	Australian Standard
AS/NZS	Australian/New Zealand Standard
ILAC	International Laboratory Accreditation Co-operation

4. Security

Nil

5. Safety, Environmental and Ergonomic Considerations

As per Ergon Energy's Safety, Environmental & Ergonomic Policies.

6. General

All fabricated units shall be supplied in pieces to be bolt assembled and shall be based on the principles contained in AS 4100.

All components shall be fabricated using jigs and machines such that close tolerances are maintained and burred and sharp edges, weld spatter, weld slag and galvanising slag are avoided.

7. Materials and Standards

All poles shall be fabricated from mild steel or high tensile steel manufactured by an approved process. Both mild steel and high tensile steel shall be to Grades 250 (or 300), 350 and 450 in accordance with AS 3678 and AS 3679. The steel shall be in all cases free from blisters, scale, laminations or any other defects.

Grade 350 material shall be clearly identified at all stages of storage and fabrication by colour coding and labels.

Where structures are designed in accordance with AS4100 or AS4600, and imported steel is used, the supplier shall obtain test certificates from the mill, certifying that the steel used complies with all the requirements of the relevant standard (from the list below). The test certificates shall be verified by an independent laboratory accredited by ILAC.

Bolts shall be supplied in accordance with AS 1111 for grade 4.6, AS 1559 for grade 5.8 and AS 1110 for grade 8.8 bolts. They shall be fitted with heavy duty galvanised spring washers.

The latest editions of the following Australian Standards shall apply to the fabrication, galvanising, repair and alteration, where applicable, of all steelwork:

AS 1110	ISO Metric Hexagon Bolts and Screws – Product Grades A & B
AS 1111	ISO Metric Hexagon Bolts & Screws – Product Grade C
AS 1112	ISO Metric Hexagon Nuts
AS 1214	Hot-dip galvanised coatings on threaded fasteners (ISO metric coarse thread series)
AS 1252	High Strength Steel Bolts with Associated Nuts and Washers for Structural Engineering
AS 1554	Structural Steel Welding
AS 1559	Hot-dip galvanised steel bolts with associated nuts and washers for tower construction
AS 3678	Structural steel – Hot-rolled plates, floorplates and slabs
AS 3679.1	Structural steel – Hot-rolled bars and sections
AS 4100	Steel Structures
AS/NZ 4680	Hot Dipped Galvanised (zinc) Coatings on Fabricated Ferrous Articles

8. Fabrication

8.1 Cutting, Drilling, Deformation and Punching of Members

All members shall be carefully cut and holes accurately located so that when members are in position the holes will be truly opposite each other before being bolted.

Holes in material having a thickness exceeding 15 mm or exceeding the diameter of the holes shall be drilled, other holes may be punched.

The diameter of the hole, measured before galvanising, shall not exceed that of the bolt by more than 2.0 mm except where otherwise specified. In addition, the diameter of the die used in the punching machine shall exceed the diameter of the punch by the minimum practical amount so as to avoid excessive hole taper and consequent heavy bearing stress on the bolt shank. In no case shall the punch die exceed the punch diameter by more than 12.5%.

Deforming of members by swaging, or by opening or closing angle legs shall only be permitted where this detail has no detrimental effect on the performance of the structural element.

All plates up to 12 mm in thickness may be bent cold. Plates greater than 12 mm may be bent cold provided the angle of set does not exceed 15°.

8.2 Erection Marks

Before galvanising all members shall be stamped with an alphanumeric mark number to identify the member. This marking shall be carried out in such a manner as to enable it to be clearly read after galvanising.

8.3 Repairs

Repair of out of tolerance fabricated members or where members do not comply with this Specification or AS 4100 shall only be permitted if in the opinion of the Superintendent

- the member, after such repairs, is equivalent in terms of strength, corrosion resistance and appearance to that which it would have been if fabricated as new in accordance with the Specification, and
- the repaired member does not impair the Principal's maintenance procedures.

9. Welding

9.1 Welding Personnel

All welding shall be carried out by qualified welders experienced in the type of work covered by this Specification and under the supervision of the Contractor's Welding Supervisors satisfying the requirements of AS 1554 Part 1.

The Superintendent reserves the right to request welder qualification tests at any time or withdraw approval of any welder whose work, in the opinion of the Superintendent, is unsatisfactory. All costs of welder qualification tests and re-tests shall be at the Contractor's expense.

9.2 Welding and Welding Procedures

Welding procedure shall be in accordance with AS 1554 Part 1.

The Contractor shall if requested submit to the Superintendent for approval at least 14 days prior to the commencement of welding, full details of the position, edge preparation, welding procedure and welding consumables which he proposes to use for any welds to be adopted.

The Superintendent reserves the right to withdraw approval of any welding procedure which, in the opinion of the Superintendent, does not provide satisfactory welds in practice. The Contractor shall submit alternative welding procedures for approval. All costs of delays and testing shall be at the Contractor's expense.

The Contractor shall carry out all welding in accordance with Section 14.3.4 of AS 4100 and AS 1554 Part 1. All welds shall be continuous unless otherwise shown on the drawings.

Butt welds shall be full section, complete penetration welds unless otherwise shown on the drawings. All welds shall be of a configuration which allows full coverage by radiography and/or ultrasonic testing. Where joints are welded from both sides, the second side to be welded shall be chipped, ground or flame or arc gouged to sound metal and of a shape which will ensure proper fusion and penetration.

The Contractor shall use a suitable welding sequence on seam welds to minimise heat inputs and shall take suitable measures to keep torsional and other distortions of welded box section members and other steelwork within specified limits.

The Contractor shall not butt weld members to produce longer lengths except where specified on the drawings or approved by the Superintendent.

Repair of welds shall be carried out in accordance with Section 5.8 of AS 1554 Part 1.

9.3 Finishing

The surface of all welds shall be smooth and free from sharp contour changes.

The Contractor shall remove all burrs and sharp edges from all steelwork before galvanising.

Welded end plates and contacting surfaces of parts to be bolted shall be free from distortion which would prevent the connecting faces from being in full contact when bolted.

10. Galvanising

All ferrous items shall be hot dip galvanised in accordance with AS/NZS 4680 after all fabrication is completed. Bolts and nuts shall be hot dip galvanised in accordance with AS 1214.

The zinc coating shall be adherent, smooth, continuous and thorough, free from lumps, blisters, gritty areas, uncoated spots, acid and black spots, dross and flux or other defects. The members shall not be supported whilst in the galvanising process through the conductor and earthwire fitting attachment holes.

Particular care shall be taken in the handling and storage of galvanised steelwork to minimise damage and avoid the occurrence of "white rust". Reference should be made to the provisions of Appendix F of AS/NZS 4680.

Galvanised sections shall be passivated in a 0.2% sodium dichromate solution or its equivalent applied by the galvaniser.

After hot-dip galvanising, the maximum allowable bow in any of the main members shall not exceed 1 in 500 measured in any plane. Approved steel gauges of the stub type or other gauges approved by the Superintendent shall be provided by the Contractor to the extent required by the Superintendent to enable him to carry out any checking of members considered necessary.

Grinding for removal of excess zinc shall not be carried out unless approval is granted by the Superintendent.

The "extent of repairable damaged or uncoated areas", Clause 8.1 of AS/NZS 4680 shall not apply. Objects where the total damaged or uncoated area exceeds 100 mm² shall be regalvanised (equivalent to 10mm by 10mm).

11. Tests and Inspections at Contractor's Works

11.1 Inspection

The Contractor shall be responsible for quality control and inspection of all materials and processes of fabrication and galvanising to ensure that the materials and workmanship comply with the requirements of the relevant Australian Standards and this Specification. However, the Superintendent may independently inspect and test materials, fabrication and galvanising.

The Contractor shall give the Superintendent two weeks advance notice in writing of fabrication and testing and furnish the Superintendent with all test certificates for materials and fabrication processes.

The Contractor shall carry out any reasonable tests required by the Superintendent but not specifically nominated in the Australian Standards or this Specification, such tests being at the Principal's expense except where results show defective materials or workmanship.

The Contractor shall repair or replace to the satisfaction of the Superintendent materials and workmanship which do not comply with the Specification.

11.2 Material Tests

All steelwork and material provided under this Specification shall be subject to such tests and inspections as are usual in the best practice and as may be necessary in the opinion of the Superintendent, to determine whether they comply in all respects with this Specification and to provide their safety and suitability for the use to which they will be applied. These tests shall include but not be limited to mill test certificates of steel production, compliance and test certificates of bolts; and ductility tests for spring washers.

Samples selected at random by the Superintendent or his duly authorised representative may be taken from this material after it has been allocated for fabrication of specific structure members and suitably identified. The samples shall then be subject to check tests. Should any specimen so tested fail to meet the requirements, the procedure set out under Clause "Additional Tests" in the Australian Standard Specifications shall be carried out.

Failure of the check tests, unless stated otherwise shall result in rejection of the steel. The Contractor shall give every assistance to the Superintendent's representative to enable a check to be made of the accuracy of all instruments used during the tests either by the production of a recently certified calibration report for the instruments or by actual calibration of the instruments against accepted standard equipment.

The Contractor shall bear the costs of all tests and members used for the tests.

11.3 Galvanising Tests

One steel structural member shall be withdrawn from each batch after galvanising and test specimens shall be taken there from and submitted to testing for quality and weight of coating.

The selected structural member shall be suitably marked for identification with the batch it represents and should the specimens taken from it fail their tests, an additional structural member or members sufficient to provide twice the original number of specimens shall be selected. Should the second series of tests fail, the batch represented shall be rejected.

In the event of rejection a batch may be stripped and regalvanised once only.

The tests shall be made in accordance with the appropriate Standards previously listed in this Specification for quality and for weight of coating by stripping. The Contractor shall bear the cost of all tests and members used for the galvanising tests.

11.4 Welding Tests

All welds shall be Categorised SP or GP as defined in AS 1554 Part 1.

Tests shall be carried out on 5% of Category SP welded joints using ultrasonic, x-ray or (if approved by the Superintendent) other methods. The Contractor shall bear all of the costs of the tests required by this sub-clause.

11.5 Delivery and Unloading

The Contractor shall deliver the steelwork including all necessary accessories, such as bolts, nuts, washers and timber packing to the Site.

The Contractor shall be responsible for the steelwork at all times during transport, loading and unloading and shall take appropriate measures to prevent loss of, or damage to the steelwork or galvanising.

The Contractor shall lift all galvanised steelwork using bow shackles attached to suitable lifting lugs or by approved slings. Under no circumstances will lifting of galvanised steelwork by unprotected chains placed around the galvanising be permitted.

All small, loose items which cannot be adequately stored on timber packing shall be placed in sealed durable containers.