

DEPARTMENT of INFRASTRUCTURE, ENERGY and RESOURCES, TASMANIA

BRIDGEWORKS SPECIFICATION

B22 - ERECTION OF STRUCTURAL STEELWORK

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B22.1 SCOPE

This Specification sets out the requirements for the handling, storage, assembly and erection of steelwork and the installation of bolts.

B22.2 REFERENCES

The following Australian Standards and codes are referred to in this Specification.

A.S. 1111	ISO metric hexagon bolts
A.S. 1112	ISO metric hexagon nuts
A.S. 1252	High strength steel bolts for structural engineering
A.S. 1554	Structural steel welding
A.S. 4100	Steel structures

B22.3 ASSEMBLY AND ERECTION OF STEELWORK

B22.3.1 Methods of Erection

The Contract Management Plan shall include details of the proposed method of erection of the steelwork, including falsework, together with the type and size of the erection equipment to be used. The falsework shall be professionally designed and constructed for the loads that will come upon it and shall be adequately maintained while in use. Detailed drawings and calculations shall be submitted at least two weeks prior to the commencement of any erection. The design calculations and drawings shall be certified by an Engineer experienced in structural design and who has qualifications admitting to corporate membership of the Institution of Engineers, Australia.

Erection shall not commence until receipt of the Superintendent's written acceptance.

B22.3.2 Handling and Storage

At all times structural steelwork shall be handled and stored such that the material and parts are kept clean and free from damage. Steelwork to be stored shall be placed on supports above the ground. Girders shall be placed upright and shored. Long members shall be adequately supported at points sufficiently close together to prevent damage from deflection.

B22.3.3 Unloading Steelwork

The unloading, handling and storage of the steelwork shall be conducted so that the material is kept clean and is not damaged.

All small articles, such as bolts, gussets, etc, shall be sorted and stored above ground out of the weather. Any damage, including bending, of steelwork or protective coating shall be subject to a non-conformance report and shall be either repaired or the member replaced. All costs of this work shall be borne by the Contractor.

B22.3.4 Straightening Bent Material

Straightening shall be done by methods that will not damage the material or member.

Sharp kinks and bends shall be cause for rejection. Where hot bending is submitted as a method the material shall be bent by methods with the temperature not to exceed 650°C and, after bending, allowed to cool slowly in air to ambient temperature. While cooling, the work shall be protected from draughts or other rapid movement of air.

B22.3.5 Position of Bearings

To allow for the change in length of steelwork under dead load and temperature variations, the Contractor shall position the bearings accurately so that the horizontal distance between the centres of base plates at a temperature of 15°C shall be as shown on the Drawings or as the Superintendent may direct in writing.

Measurements shall be made with a certified steel tape or band and the Contractor shall ensure that the proper corrections are made when measurements are carried out at other than the temperature and tension for which the tape or band is calibrated.

B22.3.6 Propped Construction

If required by the Drawings, or specified elsewhere, the girders shall be supported to prevent vertical deflection at the points of propping during placing, setting and curing of the concrete deck.

Foundations for the prop supports shall be such that no appreciable settlement will occur under the loads carried during the construction of the deck, or the extent of settlement shall be ascertained with accuracy and due allowance shall be made for such settlement by raising the girders at the propping points by an appropriate amount.

The design of the supports for the girders shall make allowance for elastic shortening of the supports and bedding in of contact surfaces under the construction loads. Care shall be taken against excessive lifting of the girders by the supports and, if necessary, arrangements shall be made to prevent the lifting of the girders from the bearings.

The supports shall not be removed or lowered until the concrete in the deck has reached its specified 28 day strength, unless the removal is approved in writing by the Superintendent on the advice of the designer.

The Contractor shall submit details of his proposed method of propping the girders in the Contract Management Plan.

B22.3.7 Erection Procedures

The steelwork shall be erected plumb and true to line and level. As erection progresses adequate temporary supports shall be provided where necessary, to ensure that the structure is not overstressed during erection.

The correction of misfits involving minor amounts of reaming, cutting and grinding will be considered part of the erection and no additional payment will be made on this account.

Any error in the shop fabrication or deformation resulting from handling and transportation, which prevents the proper assembly and fitting up of the parts by the moderate use of drift pins, reaming cutting and grinding, shall be the subject of a non-conformance report.

Field cutting shall only be done to an approved procedure and shall be the subject of a non-conformance report

All field cutting shall be done in a neat and workmanlike manner, and the cut surface shall have striations and burrs removed by grinding.

All field welding shall be done in accordance with the requirements of this Specification.

Installation of bolts and bolted connections shall be in accordance with this Specification.

The Contractor shall be fully responsible for the erection of the steelwork in strict accordance with the Drawings and this Specification. Acceptance of any completed work or methods by the Superintendent shall not relieve the contractor of his responsibility. Work which has not been completed in accordance with the Specification, or which the Superintendent considers is defective, shall be completed or corrected within the limits assigned by the Superintendent at the Contractor's cost.

B22.3.8 Preparation of Contact Surfaces

The surface of steelwork that will be in contact after bolting shall be cleaned free of oil, dirt, burrs or any coating or defects that would prevent satisfactory seating of parts.

Zinc-rich primers shall not be removed from contact surfaces.

B22.3.9 Drifts

Parallel drifts may be used to bring the various members into alignment and the parts may be held temporarily by service bolts. Excessive hammering which would injure or distort the material shall not be permitted.

The diameter of any parallel drift shall not exceed the diameter of the hole in which it is to be used. The length of the parallel section shall not be less than the total thickness of metal through which the drift is to pass, plus one diameter of the drift. Both ends of the drift to a length equal to one and one-half times the diameter of the parallel portion shall be tapered to an end diameter one-half of the parallel portion.

B22.3.10 Service Bolts

High strength steel bolts may be used for service bolts, provided the bolts are placed in their final positions and are not tightened to more than 'snug-tight' as specified herein, and provided the bolts will not be damaged in the course of the assembly of the steelwork.

B22.3.11 Field Welding

Except where shown on the Drawings, no field welding shall be carried out without the approval of the Superintendent. All site welding shall be done in accordance with Category SP of AS 1554.

Field welding shall be carried out in the presence of the Superintendent or his representative.

The Contractor shall give seven days notice of his intention to proceed with any field welding.

Inspection of completed field welds will be carried out in accordance with the requirements of this Specification.

B22.4 INSTALLATION OF BOLTS**B22.4.1 General**

Bolted connections shall only be used where specified. The type of bolt used shall be as specified. Bolted parts shall have effective contact without the interposition of gaskets or other flexible materials. Where bearing faces of bolted parts are not parallel, tapered washers shall be used to compensate for the lack of parallelism. The angle between the axis of the bolt and the surface under the bolt head or nut shall be 90 ± 3 degrees. Tapered washers shall be placed under the non-rotating component where possible.

The parts of an assembly shall be pinned and firmly drawn together with temporary bolts and erection pins before reaming or permanent bolting is commenced. Steel packing shall be provided where necessary to ensure that the surfaces are in effective contact. All packing shall have a surface condition similar to that of the adjacent material. Drifting during assembly shall not enlarge the holes or distort the metal. Holes which do not match shall be reamed or drilled, and if necessary bolts of larger diameter shall be used.

The holes in the parts to be joined shall be sufficiently aligned to permit bolts to be positioned without damage. Bolts and nuts shall always be tightened in accordance with any specified sequence. Where the sequence is not shown on Drawings nor specified, a staggered pattern shall be adopted with tightening proceeding from the centre of the joint outwards.

B22.4.2 Commercial Bolts

Commercial bolts shall be in accordance with AS 1111. Bolts shall be assembled with washers under the heads and nuts. Bolts shall be of such a length that they will extend entirely through the nuts, but not more than 12 mm beyond them. The shank shall be threaded to such a length that not less than one thread shall be beyond the grip length. Bolt heads and nuts shall be tightened with a suitable wrench and where specified the nut shall be effectively locked.

B22.4.3 High Strength Bolts

Each bolt and nut shall be assembled with at least one round or tapered washer conforming to AS 1252. One washer shall be placed under the nut or the head of the bolt, whichever is to be rotated during the tightening operation. One washer may also be placed at the other end of the bolt.

The rotated bolt head or nut shall be tightened against a surface square to the axis of the bolt and where necessary a suitable tapered washer shall be used to ensure that this is achieved.

Unless otherwise indicated all bolts shall be tightened in accordance with (i) and (ii) below. In the completed connection all bolts shall have at least the minimum tension as specified in the table below.

Bearing bolts, where shown on the Drawings, shall be installed with snug tightening only.

(i) Snug Tightness

Following the placing of the bolts, the joint shall be brought to the 'snug tight' condition, to ensure that all parts of the joint are brought into effective contact and bolt heads and nuts are properly seated. 'Snug-tight' is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using a standard podger spanner.

After the joint is satisfactorily assembled and 'snug tight', suitable location marks shall be established so that further rotation of the nut relative to the shank of the bolt may be measured.

The method of marking shall consist of punch marks, paint or crayon lines, placed in a manner which will eliminate the effects of accidental movement of the non-rotating component in measuring the final rotation between the shank and the nut of the bolt.

Any bolts which have failed to reach the minimum shank tension specified in the table below shall be further tightened or replaced by new bolts supplied by the Contractor at his cost. After a satisfactory final inspection, all bolts in the completed joints shall be suitably marked.

NOMINAL DIAMETER OF BOLT	MINIMUM BOLT TENSION
M 16	90 kN
M 20	145 kN
M 24	205 kN
M 30	325 kN
M 36	475 kN

(ii) Final Tightening

The bolts shall be finally tightened by further turning from the 'snug-tight' position by either half or three quarters of a turn as set out below. This rotation shall be the nut relative to the bolt, regardless of which is being turned.

NUT ROTATION FROM THE SNUG-TIGHT CONDITION

NOMINAL BOLT DIAMETER	LENGTH OF BOLTS (mm)	
	NUT ROTATION (½ turn)	NUT ROTATION (¾ turn)
M 16	Up to 120	Over 120 up to 240
M 20	Up to 120	Over 120 up to 240
M 24	Up to 160	Over 160 up to 350
M 30	Up to 160	Over 160 up to 350
M 36	Up to 160	Over 160 up to 350

Tolerances on the rotation shall be one-sixth of a turn (60°) over, nil under.

During final tightening the non-rotating component shall be held to prevent rotation. Bolts may be tightened by hand or by mechanically operated wrenches. Once fully tightened, bolts shall not be released and re-tightened in either the original position or elsewhere.

(iii) Final Inspection

The completed joint will be inspected by the Superintendent and the bolts may be checked by mechanical wrench or hand torque wrench for compliance with this specification. The Contractor's equipment used for tightening of the bolts, shall be made available for the purpose of inspection as and when directed by the Superintendent. The checking wrench shall be calibrated in accordance with provisions of AS 4100, to give a bolt tension equivalent to 1.05 times the minimum bolt tension specified above.

B22.5 PAYMENT

The rate in the Bill of Quantities relating to the erection of structural steelwork shall include full payment for providing all traffic management, labour, materials, tools, equipment and any other work incidental to the erection of the steelwork superstructure.

Payment for these Items shall include, where applicable, jigs, cleaning, falsework, erecting / installation, bracing, field welds and fitting up bolts.

All materials, tools and equipment supplied by the Contractor which do not form part of the permanent works shall remain the property of the Contractor unless specified otherwise.

B22.6 HOLDPOINTS

The following holdpoints have been identified in this Specification:

- Acceptance of erection procedures by the Superintendent (B22.3.1)
- Notice of intention to carry out field welding (B22.3.11)

B22.7 INFORMATION TO BE INCLUDED IN CONTRACT MANAGEMENT PLAN

The following information to be included in the Contract Management Plan has been identified in this Specification:

- Procedure for the erection of steelwork (B22.3.1)
- Certification of steel tape (B22.3.5)
- Procedure for propping girders (B22.3.6)