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STRUCTURAL SERVICES DESIGN & CONSTRUCTION STRUCTURAL STEELWORK PERFORMANCE SPECIFICATION

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1. GENERAL

1.1 Contract Documents

The "General Conditions of Contract", "Special Conditions of Contract" and the "Preliminaries" clauses shall form an integral part of this specification.

This section of the specification shall be read in conjunction with all other sections as the requirements may be interrelated.

In the event of discrepancies between the documents, the following order of precedence shall apply:

- Drawings
- This Specification
- General Standards

1.2 Scope

The work shall consist of the supply and fabrication of all the steelwork shown on the drawings and includes surface treatment, storage, delivery to the site, steel to steel connections and their fastenings, miscellaneous attachments and anchor bolts.

The work shall consist of the erection of all the steelwork shown on the drawings and includes offloading, erection, field welding, high strength bolting, making steel to steel connections, connection to anchor bolts, permanent grouting and repairs to surface treatment.

The work shall be carried out in strict accordance with the Engineer's drawings and this Specification and in conjunction with the Architect's drawings and other relevant plans and details. Allow for the drillings and cleats indicated on the drawings and as necessary to support and connect the architectural finishes. As the work proceeds refer to the Architect's drawings and other relevant documents for specific details and locations.

1.3 Standards

Structural steelwork shall conform with the current relevant standards of Standards Australia and to the requirements of the statutory authorities.

Relevant publications of particular importance are as follows:

Workmanship

AS 1418	SAA Crane Code
AS/NZS 4600	Cold Formed Steel Structures Code
AS/NZS 1554	SAA Structural Steel Welding Code
AS 1657	SAA Code for Fixed Platforms Walkways, Stairways and Ladders
AS 1674	Safety in Welding and Allied Processes
AS 1796	SAA Welder Certification Code
AS 2214	SAA Structural Steel Welding Supervisors Certification Code
AS 2327	SAA Composite Construction Code
AS 3990	Steelwork for Engineering Applications
AS 4100	Steel Structures

Steel

AS 1163	Structural Steel Hollow Sections
AS/NZS 3678	Hot-Rolled Structural Steel Plates, Floor Plates and Slabs
AS/NZS 3679	Hot-Rolled Structural Steel Bars and Sections

Steel Bolts

AS/NZS 1110	ISO Metric Hexagon Precision Bolts and Screws
AS/NZS 1111	ISO Metric Hexagon Commercial Bolts and Screws
AS/NZS 1112	ISO Metric Hexagon Nuts Including Thin Nuts, Slotted Nuts and Castle Nuts,
AS 1237	Flat Metal Washers for General Engineering Purposes
AS 1252	High Strength Steel Bolts with Associated Nuts and Washers for Structural Engineering
AS 1275	Metric Screw Threads for Fasteners
AS/NZS 1559	Fasteners – Bolts, Nuts and Washers for Tower Construction

Welding

AS 1101.3	Welding and Non-Destructive Examination
AS/NZS 1553	Covered Electrodes for Welding, Parts 1 and 2
AS 1858	Electrodes and Fluxes for Submerged – Arc Welding, Parts 1 and 2
AS 2812	Welding, Brazing and Cutting of Metals – Glossary of Terms

Cold Formed Light Gauge Sections

AS 1397	Steel Sheet and Strip-Hot-Dipped Zinc-Coated or Aluminium/Zinc-Coated
AS/NZS 1594	Hot-Rolled Steel Flat Products
AS 1595	Cold-rolled Unalloyed Low Carbon Steel Sheet and Strip

Surface Treatment

AS 1627	Metal Finishing – Preparation and Pre-treatment of Surfaces
AS/NZS 2312	Guide to The Protection of Iron and Steel Against Exterior Atmospheric Corrosions

Protective Coatings

AS 1214	Hot-dip Galvanised Coatings on Threaded Fasteners (ISO Metric Coarse Thread Series)
AS/NZS 4680	Hot-Dipped Galvanised Coatings on Ferrous Articles
AS 2105	Inorganic Zinc Silicate Paint
AS/NZS 3750.9	Zinc-rich Organic Priming Paint
AS 3887	Paints for Steel Structures – Coal Tar Epoxy (two pack)

Testing

AS 1171	Methods for Magnetic Particle Testing of Ferromagnetic Products and Components
AS 1391	Methods for Tensile Testing of Metals
AS 1544	Methods for Impact Tests on Metals, Parts 1 to 5
AS 1710	Non-Destructive Testing of Carbon and Low Alloy Steel Plate – Test Methods and Quality Classification
AS 1815	Method for Rockwell Hardness Test
AS 2062	Methods for Non-Destructive Penetrant Testing of Products and Components
AS 2177	Radiography of Welded Butt Joints in Metal
AS 2207	Methods for the Ultrasonic Testing of Fusion Welded Joints in Steels

Other Publications

Control of Lamellar Tearing:	AWRA Technical Note 6
Commentary on the Structural Steel Welding Code:	AWRA-AISC-AWI, Technical Note II
	SAA MAI SAA Manual on Steel Structures
Design Capacity Tables for Structural Steel:	AISC
Standardised Structural Connections:	AISC
SAA/SNZ HB 62.1 and HB62.2	Codes of Practice for Safe Erection of Building Steelwork

The standards designated may be substituted by an equivalent standard of practice only where agreed to by the Managing Contractor.

1.4 Shop Drawings

The Contractor shall supply shop drawings of the structural steelwork for review and shall obtain an accepted copy before commencing fabrication.

The drawings shall show, in standard engineering drawing manner, clear and complete details of each assembly, component and connection in the work, together with information relevant to their fabrication, surface treatment and erection. The weight of each component and fittings shall be included on the material list.

The Contractor shall verify that all members can be erected properly and, should this require variations to the Engineer's drawings, they shall be referred to the Managing Contractor.

The Engineer's acceptance of the shop drawings is based upon a review of the member sizes, structural sufficiency and surface treatment only, (not dimensions, erection sequence, etc.) and acceptance indicates the opinion that the Contractor's interpretation of the contract requirements is generally satisfactory. Such acceptance shall not relieve the Contractor of its contractual obligations nor of its responsibility of ensuring that the works are complete, accurate and correct.

Shop drawings shall be issued progressively to the Managing Contractor.

The Contractor shall allow a period of four working days for the review of shop detail drawings, or to an agreed program should a large number of drawings be involved.

For each drawing supply two copies in the form of prints on paper, one of these copies shall be returned, stamped if accepted or marked with queries where necessary.

Where amendments to the drawings are necessary, the amendments shall be promptly made and two amended copies shall again be submitted for acceptance. One copy shall be returned as described above.

1.5 Samples

Submit the samples listed in the Special Finishes Schedule.

1.6 Inspections

All steel, materials and procedures shall be subject to inspection by the Managing Contractor or his representative during fabrication and erection, and their acceptance or rejection shall be final.

Give sufficient notice so that inspection may be made at the following stages:

- Completion of erection prior to encasing or field painting or fixing cladding.
- Anchor bolts in position prior to casting in.
- Column bases prior to grouting.
- Commencement of encasing.

1.7 Weld Testing

Carry out non-destructive weld testing by an approved independent inspector whose qualifications comply with the requirements of AS/NZS 1554 Part 1. Provide the name of the inspector and the company, the inspector's experience and the method of reporting for approval prior to the commencement of fabrication.

The extent of non-destructive testing shall comply with Schedule 6.3. The type of non-destructive test shall be determined by the inspector on the basis of appropriateness for each instance.

Welds noted on the drawings to be tested shall form part of the required test program.

Provide a copy of all test reports to the Managing Contractor immediately.

Pay all costs and expenses associated with non-destructive weld testing.

Remove and re-weld faulty joints to the degree specified and re-test these welds at no additional cost.

Carry out additional non-destructive testing in accordance with the relevant Australian Standard or, where no relevant standard exists, to the relevant British Standard. Pay costs associated with such additional non-destructive testing where the work fails to meet the requirements of the specification.

1.8 Marking

Every separate member shall be plainly and permanently marked to show position and direction as necessary for easy identification and correct placement. Where a member designation system is shown on the drawings this shall be used as the means of identification. Exposed, unpainted steel shall be marked with tags.

1.8.1 Cleats and Bolts

Loose pieces for connections shall be attached to their respective members by wiring. Bolts, where not in holes, shall be metal tagged, each type and size in a separate container. Connections which are to be made by tensioned high strength bolts shall be given a 75mm wide distinctive flash of colour clear of holes for easy identification.

1.8.2 Welds

The extent and size of all fillet welds which are to be made in the field shall be clearly marked. Where welds are to be made between dissimilar steels they shall be given a distinctive flash of colour.

1.9 Handling and Storage

1.9.1 Handling

The fabricator shall deliver steelwork to site at the times required in the Contractor's schedule and to locations as determined to suit the erection program. The steelwork shall be handled and stored in a manner that will not overstress or deform.

1.9.2 Storage

Members shall be stored above the ground surface so as to avoid contamination. Bolts, nuts and washers shall be supplied in grit-free containers and stored in watertight premises. Burred, damaged, corroded or otherwise unserviceable bolts shall not be used.

1.9.3 Defects

Should any member be defective or distorted, the Contractor shall notify the Managing Contractor in writing before erection. If such defects or damage cannot be satisfactorily corrected in the field, the defective material shall be returned to the shop for re-working or replacement by new, as the Managing Contractor may direct. The Contractor will be responsible for all expenses incurred.

1.10 Substitution

Application shall be made in writing to the Managing Contractor for the use of a substitute section where the section called for in the Contract Documents is unavailable. Do not proceed with the substitution until written consent has been received.

Pay all costs associated with the substitution. The Managing Contractor reserves the right to disallow claims for additional time incurred due to substitution.

1.11 Design Changes

Be liable for the professional fees of the consultant team where additional design and/or inspections are required for:

- rectification of construction errors;
- non-compliance with Contract Documents; and
- requests by the Contractor to vary the documented design for whatever reason.

1.12 Coordination

Coordinate the work of the structural steel sub-contractor and the work of following trades. Coordinate the on-site activities of the structural steel sub-contractor including but not limited to working areas, scaffold, craneage, program, power and safety and allow for temporary bracing as required to erect the steelwork in accordance with the construction program.

2.1 Steel Type and Grade

Unless otherwise shown on the drawings, all steel shall be as follows:

- Structural steelwork shall comply with AS 4100, AS/NZS 3678 Grade 250, AS/NZS 3679 Grade 300 and AS 1163 Structural Steel Hollow Sections Grade 350 or 450.
- Cold formed steelwork shall comply with AS/NZS 4 and AS 1397-G450-Z350 (450 MPa minimum yield stress, 350g/sq m minimum average coating thickness).
- Manufacturer's test certificates stating chemical analysis and mechanical tests for every batch of steel shall be available for inspection.

Steel failing to meet the test requirements may be rejected.

2.2 Greenstar Requirements for Structural Steel Credit 20.1

All structural must be sourced from a Responsible Steel Maker; and all reinforcing bar and mesh used must be produced using energy-reducing processed in its manufacture (measured by average mass by steel maker annually). For a steel manufacturer or a steel maker to be considered a responsible source of steel, they must show that they comply with both of the following initiatives:

- The steel making facilities where the structural and/or reinforcing steel for the project is sourced have a currently valid and certified ISO 14001 Environmental Management System (EMS) in place. Valid ISO 14001 Environmental Management System (EMS) certificates must be provided from the steel making facilities where the structural and/or reinforcing steels in the project were produced.

2.3 Bolts in General

2.3.1 General

Bolts in bearing shall be of such lengths that the threaded portion may be within the thickness of the parts joined unless noted otherwise on the drawings. At least one washer shall be placed under the bolt head or nut, whichever is to be rotated. Taper washers shall be used where the part under the bolt head or nut is not perpendicular to the centreline of the bolt. All bolts, nuts and washers used for bolting galvanised members shall be galvanised. The threaded portion of each bolt shall project beyond the nut by at least one full thread.

Hardened washers shall be installed under both the bolt head and nut for any slotted and oversize holes.

2.3.2 Assembly

Drifting done during assembly shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the bolts shall be reamed. Poor matching of holes shall be cause for rejection. Alignment is to be maintained with drift pins until sufficient bolts have been tightened. Driving of bolts is not permitted.

Nuts and bolts shall always be tightened in a staggered pattern and where there are more than four in any one joint, they shall be tightened from the centre of the joint outwards. High strength tensioned bolts, nuts and washers may be used temporarily to facilitate assembly during erection; if so used they shall not be finally tightened except in their correct sequence in the complete joint. Nuts or bolts subject to vibration or vertical bolts in tension shall be effectively locked in position.

2.4 Commercial Grade Mild Steel Bolts

Commercial grade bolts shall be grade 4.6 complying with AS/NZS 1111 and fitted with the appropriate washer(s).

Bolts referred to as 4.6/S shall be tightened using a standard wrench or pneumatic impact wrench to achieve a 'snug tight' condition to AS 4100.

2.5 High Strength Grade Steel Bolts

2.5.1 General

High strength grade steel bolts shall be grade 8.8 complying with AS 1252 and fitted with the appropriate washer(s). Bolts referred to as 8.8/S shall be tightened using a standard wrench or pneumatic impact wrench to achieve a 'snug tight' condition to AS 4100. Bolts referred to as 8.8/TF or 8.8/TB shall be fully tensioned in a controlled manner in accordance with AS 4100.

2.5.2 Tensioned Bolts

Special attention is drawn to High Strength Fully Tensioned bolt connections where tensioning is not carried out immediately. These bolts shall be inspected for weathering or corrosion and relubricated if necessary with an approved lubricant prior to commencement of tightening.

2.5.3 Coronet Load Indicators

8.8/TB and 8.8/TF bolted joints shall be tightened by use of the Direct-Tension Method (refer AS 4100) using Coronet Load Indicator washers, unless written agreement otherwise is obtained from the Managing Contractor. It is essential that the correct diameter Coronet Load Indicator be used with each bolt diameter.

Load indicator washers shall be placed on the bolt with protrusions bearing against the underside of the bolt head. In locations where the head is to be rotated in tightening, the load indicator shall be placed at the nut end of the bolt assembly with the protrusions bearing against a hardened flat washer to AS 1252. The protrusions must always bear against the bolt head or a nut face washer and not the structural member.

Important: A nut should not be slackened after full tensioning. If it is necessary to slacken a nut, the bolt and load indicator shall be rejected, and a new bolt and load indicator used.

2.5.4 Surface Finish

At the time of assembly, the surfaces in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs, and other defects which would prevent solid seating of the parts or would interfere with the development of friction between them. (Tight mill scale and inorganic zinc silicate paint are not detrimental). No gasket or other flexible material shall be placed between the plies in a friction grip bolted connection.

2.6 Welded Shear Stud Connectors

2.6.1 Studs

Welded shear stud connectors shall comply with AS 1554, Part 2 and AS 2327. Studs shall be made from cold-drawn bar stock complying with AS 1443, Grades 1010 to 1020, inclusive, either semi-killed or fully-killed, with a minimum tensile strength after manufacture of 410 MPa.

Shear studs shall be tested in accordance with AS 1554 Part 2. All test results shall be submitted to the Managing Contractor for acceptance with respect to compliance with the design intent.

2.7 Purlins

Purlins (including proprietary purlins with acoustic/ceiling systems) systems shall be supplied complete with all bridging pieces, sag rods or struts, brackets and bolts and the like sufficient to complete the works.

Purlins and associated bridging and brackets, etc, shall be manufactured from hot dip galvanised steel strip. Bolts shall be hot dip galvanised high strength purlin bolts as supplied by the purlin manufacturer.

Contractor to allow for steel detailing through any ceiling system for fly bracing as per locations noted on the documentation.

3.1 Fabrication

3.1.1 Fabrication

Fabrication shall comply with AS 4100. Do not commence fabrication until permission to use the relevant shop drawings has been received. Provide structural members in single lengths unless otherwise required or approved.

3.1.2 Camber

Any required camber on beams shall be as documented on the Structural Engineer's drawings and shall have a tolerance of $\pm 5\text{mm}$. If beams have a natural camber within the straightness tolerance, fabricate and erect them with the camber up.

3.1.3 Connections

Connections and joints shall be as detailed, or in the absence of specific details, they shall be of a type and proportion to suit the location and/or reaction shown thereon. The connections shall be of a type shown in the AISC Manual for Standardised Structural Connections. Variations from drawings and additional details proposed by the Contractor are to be submitted for inspection prior to fabrication. No extra will be allowed for variation to details or additional details except when authorised in writing by the Managing Contractor.

3.1.4 Cleats

Do not locate cleats other than as shown on the Shop Drawings without prior permission. Remove temporary connections on completion and restore the permanent surface.

3.2 Welding

3.2.1 General

Weld size and category shall be as noted on the drawings. All welding shall comply with AS/NZS 1554 and AS 4100. Do not commence fabrication until welding procedures have been accepted.

Other than the site welds indicated on the shop drawings, do not weld on site without prior approval. Wherever possible locate site welds in positions for down hand welding.

3.2.2 Qualifications

Before commencing fabrication submit details of proposed welding procedures, using the form in Appendix E of AS/NZS 1554.1. Welding shall be carried out under the immediate and continuous supervision of a supervisor employed by the Fabricator. This person shall have qualifications as described in AS/NZS 1554.1 Section 4.11 and these qualifications shall be submitted to the Managing Contractor on request.

3.2.3 Butt Welds

All butt welds, except when produced with the aid of backing material, shall have the root or initial layer gouged or chipped out on the back side before welding is started from that side.

Butt welds made with the use of a backing strip shall have the weld metal fused with the backing strip. Ends of butts shall have the start and stop zones removed by the use of run on and run off plates. Such plates shall be removed after use.

3.2.4 Testing

Where NDT is specified for individual welds on the drawings it shall mean Non-Destructive Test by either radiographic or ultrasonic means. The weld examination shall be performed by an independent testing authority, the test reports shall be submitted to the Managing Contractor.

3.2.5 Repairs

After repairing a faulty weld revealed by non-destructive examination repeat the specified examination and furnish the testing authority's report.

3.3 Bolt Holes

Bolt holes shall comply with Section 14 of AS 4100. Slotted holes shall be 'short slotted holes' as defined in that section unless a 'long slotted hole' is specifically detailed on the drawings.

4 ERECTION

4.1 Erection

4.1.1 General

Erection of structural steel shall be in accordance with AS 4100. Before leaving the shop, members to be connected on site shall be pre-assembled to ensure alignment is within the specified tolerance. Lack of tolerance shall be corrected before members are despatched to site.

4.1.2 Site Conditions

The Contractor shall check that the structure/foundations onto which steel is to be placed are at the correct levels to receive baseplates and/or other fixings, and verify the correctness for location and/or level of all anchor bolts set in the bases, and immediately notify the Managing Contractor of any inaccuracies. The Contractor will be responsible for the accurate bearing of the steel on the foundations, for correct location, shimming to levels and placement of all members.

After shimming to levels, test the steelwork for verticality in both directions and tighten holding down bolts. Carry out steelwork erection in a sequence and with sufficient bracing which will allow steelwork to be maintained vertical and stable in both directions throughout the frame.

The frame shall be erected in sections. Each section shall be plumbed and secured before erection of the next section commences.

4.2 Anchor Bolts

Provide all cast-in plates, anchor bolts and positioning cages necessary for erection of steelwork.

Anchor bolts shall be of the diameter shown on the drawings, and shall be provided with hexagonal nuts with a square washer at the head of bolts and a round washer under the nut. Inserts and bolts shall be set accurately in the concrete forms and shall be rigidly held during concreting operations. The length of anchor bolts and the elevation at which they are set shall be such that two full threads project above the nut when fully tightened. Anchor bolts shall be tied together into a cage and held with round bar ligatures at not more than 300mm centres.

4.3 Temporary Bracing

Particular attention is drawn to the necessity of providing and installing, and afterwards removing if necessary, sufficient temporary bracing to keep the structure plumb and in true alignment until other structural units provide the necessary permanent bracing.

It is the responsibility of the Fabricator to ensure that this bracing is adequate for construction purposes. Obtain the advice of a practising structural engineer on the requirements for and design of any erection bracing required. The Fabricator shall submit drawings of the temporary bracing for acceptance by the Managing Contractor before any erection commences.

Bracing shall not be used to force the structural frame into its correct plumbed position. Bracing shall be tightened only after the frame has been squared and plumbed or if inserted at an earlier time shall be loosened to permit plumbing to be done.

4.4 Alignment

4.4.1 Surveys

Tolerances shall be in accordance with AS 4100 except as noted otherwise in this specification. The position of the heads of the various columns, beams and anchor bolts shall be checked by surveys working from permanent marks outside the building. Surveys shall be made by a Licensed Surveyor (appointed and paid for by the Contractor's fabricator) and results reported to the Managing Contractor immediately. Final surveys shall be made on frames in which the temporary bracing has been released or removed.

4.4.2 Misalignments

During erection steel members shall not be cut, burnt, welded or drilled without approval. Drifting may only be used for bringing parts into position, not to match unfair holes, or enlarge holes, or distort metal. Any holes not matching properly shall be reamed or drilled out, and larger bolts inserted. The structure shall not be distorted in any way in order to match up misaligned holes. Holes for bolts shall not be formed by any burning process.

4.5 Grouting of Base Plates

Surfaces to be grouted shall be clean and all loose material shall be blown clear using high pressure air hoses. Prior to grouting and after shimming to levels, the steelwork members and base plate shall be correctly aligned in both directions and firmly held in position by temporary braces and holding down bolts shall be tightened.

Bases of all steel columns shall be grouted using a proprietary pre-mixed, non-shrink cementitious grout having a minimum 28 days compressive strength of 40 MPa unless noted otherwise on the drawings. Grout shall be mixed and introduced into the grout cavity in a liquid flowable state strictly in accordance with the manufacturer's instructions. Provide all necessary holes and header tubes to ensure the complete filling of the grout spaces.

Adequate supplies of the liquid grout shall be kept on site to allow the base plate to be grouted in one operation.

All grout shall be tested by an approved NATA laboratory for compressive strength at 28 days in accordance with AS 1012 and AS 2073 at the rate of 3 cubes per mixer batch. Full allowance shall be made by the Contractor for all costs associated with these tests and for submission of the results to the Managing Contractor.

For small, easily accessible base plates, grout may be introduced by dry packing. In such instances, moist 3 to 1 sand-cement grout shall be rammed under the base plates such that the void is completely filled and the grout shall be struck off neatly around the perimeter at 45° to the underside of the base plate.

4.6 Concrete Encasement

All steelwork which is to be encased shall have a minimum of 50mm concrete cover measured from the outer faces of the steelwork. Maintain the steelwork free of loose rust and mill scale. Steel surfaces to be cleaned to AS 1627 Class 1 before encasing operation.

Concrete for encasing steel shall have a minimum compressive strength of 20 MPa at 28 days, unless noted otherwise. Reinforcing shall be as detailed on the drawings.

4.6.1 Cutting

Panels shall be supplied to required lengths so site cutting can be kept to a minimum. Where necessary, panels can be cut using a power saw with an abrasive disc or a metal cutting friction blade. Where holes are to be cut for pipes, etc., the use of a hole saw is recommended.

4.6.2 Fixing

Panels should be accurately aligned, sides fully lapped and the gap between abutting ends kept to a minimum. Provision should be made so that all panels have full end and intermediate bearing support on the building framework. Panels fixed to structural steelwork should be fixed by one weld per panel per support, unless otherwise noted, to meet special wind or shear load requirements. Welds are to be located adjacent to the female side lap flange and are to be formed by burning through the pan and forming a 12mm diameter puddle. Alternatively, 4mm minimum diameter power actuated drive pins may be used to fix panels. Shear connectors welded through the panels will provide adequate fixings where they occur.

Fixing panels to masonry supports may not be necessary if concrete is placed immediately after panels are laid. If fixing is required to prevent movement due to wind or for safety reasons during placement of concrete, the panels should be secured to the temporary timber bearers by nailing.

4.6.3 Propping

During concreting, one or two lines of temporary props may be required in accordance with the manufacturer's recommendations or as nominated on the drawings. Propping shall consist of substantial timber or steel bearers supported by a line of props, adjusted to prevent settlement of the working levels during the concrete placement and curing. Propping shall be designed to support the weight of wet concrete and construction loads.

Propping shall not be removed until the concrete has reached sufficient strength to support superimposed loads.

4.6.4 Soffit Attachments

For soffit attachments, the pan can be punched or drilled and a suitable "pigtail" suspension rod inserted. Alternatively, soffit attachments can be made by means of proprietary clips which engage into rib slots, or selected eyelet type drive pins power fixed to the underside of the slab.

4.6.5 Side Lap Joints

Side lap joints shall be fastened in accordance with the steel formwork manufacturer's recommendations.

4.7 Welded Shear Stud Connectors

For metal deck construction, studs shall be field welded to the structural members after the steel framing and metal deck are in place. The deck shall be installed so that the bottom of the rib is in continuous contact with the top of the beam flange. All shear stud connectors shall be installed in the size, quantity and location as shown on the structural engineer's drawings.

The area on the beam to which the stud is to be welded directly shall be free of loose mill scale and heavy rust which adversely affect the stud welding. In addition, where studs are to be welded to the top flange of steel beams through profiled metal deck sheeting, the top flange shall not be painted, and shall be free of dirt and debris prior to laying the metal deck. Any water in the deck's valley shall be released so that it does not become entrapped between the deck and the beam.

No reinforcing steel or other materials and equipment which will cause deflection of the metal deck or interfere with the stud installation shall be placed on a floor until the studs are installed. Welding through two thicknesses of hot dipped galvanised sheeting at lap joints is not permitted.

Make available on site a 2.5 kg (long handled) sledge hammer for random testing of welded studs on site by the Managing Contractor.

5 FINISHES

5.1 Surface Preparation

Prepare the steelwork by methods complying with AS 1627, to produce surfaces required by this clause, and by the coating systems shown on the Drawings or listed in the Steelwork Coatings Schedule.

Steelwork without surface treatment shall be free of all loose mill scale, loose rust, dirt, oil, grease, globules of weld metal and other foreign matter.

No treatment other than that mentioned above shall be needed for steelwork encased in concrete or steelwork to be coated with sprayed fireproofing.

Those parts to be field welded and contact surfaces in friction type joints, shall be kept clear of specified finish except that inorganic zinc silicate coatings on contact surfaces of friction type joints will be acceptable.

5.2 Priming

5.2.1 Priming (Definition)

The first coat of the specified paint system (including both decorative and protective coating systems). Refer also to Clause 5.03 for further priming requirements if no paint coating is to be applied after priming.

5.2.2 Application

Apply the specified priming after fabrication and before delivery to site. Do not prime contact surfaces of friction type joints except as allowed under Clause 5.01 and those parts to be field welded. After erection, repair damaged priming and complete the coverage to unprimed surfaces such as bolts, nuts, field welds, and the like.

Prime steel surfaces as soon as possible after surface preparation and in any case within 4 hours for shop work and 2 hours for field work. If surfaces are tarnished repeat the surface preparation before priming.

Where members are part concrete encased extend the priming 25mm into the surface to be encased.

5.3 Painting

Painting shall be applied to primed surfaces where specified.

5.3.1 Application

Apply the paint coating systems (including both decorative and protective coatings) shown on the drawings or listed in the Steelwork Coatings Schedule and the Architectural specification.

5.3.2 Access

Where surfaces will be in contact or near contact after fabrication or erection (including backs of double angles) apply specified finish and allow it to dry before assembly or treat the area by immersion after fabrication.

5.3.3 Handling

Do not handle or transport steel members until the paintwork is dry. Protect the paintwork from damage during transport and handling.

5.3.4 Site Painting

Before site painting clean the steelwork to remove any foreign matter or contamination of the primed surface.

5.4 Galvanising

5.4.1 Galvanising

Galvanising of structural sections shall be in accordance with AS/NZS 4680, the galvanising of threaded fasteners shall be in accordance with AS 1214.

5.4.2 Preparation

Prior to galvanising, the surfaces shall be cleaned of all dirt, weld spatter, grease, slag, oil, paint or other deleterious materials. The steelwork shall be pre-cleaned in accordance with AS 1627 Part 1, followed by acid pickling, in accordance with the requirements of AS 1627 Part 5. Surface contaminant and coatings, which cannot be removed by the normal chemical cleaning process in the galvanising operation, shall be removed by abrasive blast cleaning to produce a Class 2.5 finish in accordance with the requirements of AS 1627 Part 4.

5.4.3 Composition

The composition of the zinc in the galvanising bath shall not be less than 98% zinc. The mass of the galvanised coating other than on nut and bolt thread surfaces shall be:

- Average 600g/m²
- Minimum 550g/m²

The galvanised coating shall be continuous, adherent, smooth and free from lumps, blisters, gritty areas, uncoated spots, acids and black spots, dross, flux and other imperfections.

5.4.4 Handling

All articles to be galvanised shall be handled in such a manner as to avoid any mechanical damage and to minimise distortion. Galvanised components shall be transported and stored under dry, well ventilated conditions to prevent the formation of wet storage staining.

5.4.5 Repairs

Small areas of galvanised coating damaged by welding, cutting or by rough treatment during transit and erection may be renovated, subject to agreement, either by the use of low-melting-point zinc alloy repair rods or powders made specifically for this purpose, or by the application of at least two coats of good quality zinc-rich paint. (AS/NZS 3750.9 Paints for Steel Structures: Organic Zinc-Rich Primer). Sufficient material should be applied to provide a zinc coating at least equal in thickness to the galvanised layer. Both methods require adequate surface preparation prior to application.

The maximum size of the areas for which such repairs are acceptable will depend, to some extent, on the article and the application but for general guidance an area of 40cm² is suggested as being acceptable.

If required by the Managing Contractor, a certificate shall be provided stating that the galvanising complies with the requirements of AS/NZS 4680.

6 SCHEDULES

6.1 Materials Schedule

Steel Type	Grade (UNO on Drawings)
Hot rolled structural bars and Sections to AS/NZS 3679	300 MPa
Welded beams and welded columns (designated "WB" and "WC") to AS/NZS 3679.2	300 MPa
Hot rolled plates, floor plates and slabs to AS/NZS 3678	250 MPa
Hollow sections to AS 1163	450 MPa
Cold formed Steelwork to AS 1397	450 MPa
Grout	
Type: Pre-mixed non-shrink grout Minimum compressive strength	40 MPa
Bolts	High strength/Commercial Grade/Galvanised

6.2 Special Finishes Schedule

Where any part of the work is specified to have a finish defined as a "Special Finish" on the drawings and/or listed below, the finish shall comply with an approved sample or samples. Except where samples are provided by the Principal, prepare and submit a sample or samples for acceptance.

Sizes of samples shall not be less than:

- Surface finish samples 0.1m²
- Weld samples 300mm min of weld

6.3 Weld Testing Schedule

Class of Weld	Type of Test	Extent of Testing
All	Visual	To Table 6.2 of AS/NZS 1554 Part 1
GP (General Purpose)	Ultrasonic or radiographic	10% of welds
SP (Structural Purpose)	Ultrasonic or radiographic	20% of welds

Other means of non-destructive testing:

- GP Not required
- SP At the discretion of the tester

6.4 Steelwork Coating Schedule

Identification of Steel Surface	Surface Preparation Method to AS 1627	Surface Preparation Coating
Generally, members within the air seal of the building	Power tool or blast clean Class 1	Zinc phosphate 75µm DFT
Members external of the air seal of the building	Blast clean to AS 1627.4 Class 2.5	Hot-dip galvanised