

SECTIONS – 3000

STRUCTURAL STEEL WORKS

1.0 SCOPE

The work under this section of the Specifications consists of furnishing all material, labour, plant, equipment and appliances, fabricating, erecting, installing, testing, painting and all other items incidental to Structural steel work for a complete job as shown on the drawings, specified herein and/or as directed by the Engineer.

2.0 APPLICABLE CODES AND STANDARDS

Latest edition of the following codes and standards are applicable to the work of this section:

AISC	Specifications for the design, fabrication and erection of structural steel for buildings.
ANSI / AISC 360	Specification for Structural Steel Buildings.
AISC 303	Code of Standard Practice, for Steel Buildings and Bridges.
AISC	Specifications for structural joints using ASTM A325 or A490 bolts.
AISC	Guide to shop painting of Structural Steel.
ASTM A6	Standard specifications for general requirements for rolled structural steel bars, plates, shapes and sheet piling.
ASTM A36	Standard Specification for Carbon Structural Steel.
ASTM A53	Standard Specification for Pipe, Steel, Black & Hot Dipped, Zinc Coated, Welded and Seamless
ASTM A307	Standard Specification for Carbon steel bolts and studs, 60000 PSI tensile strength. Carbon steel externally and internally threaded Standard fasteners.
ASTM A325	Standard Specification for Structural bolts, Steel, Head treated. 120/105 kg minimum tensile strength (galvanized).
ASTM A653	Specifications for steel sheet zinc coated (galvanized) or zinc iron alloy coated by the hot dipped process.
ASTM A490	Standard Specification for heat treated steel structural bolts, 150 kg minimum tensile strength.
ASTM A354	Standard Specification for quenched and tempered alloy Steel bolts, studs and other externally threaded fasteners.
ASTM A501	Standard Specification for Hot formed welded and seamless carbon steel structural tubing.

ANSI / NAAMM MBG 531	Metal Bar Grating
ASTM A563	Standard Specification for Carbon and alloy steel nuts.
ASTM A572	Standard Specification for High - Strength Low - Alloy Columbium – Vanadium Structural Steel
ASTM E109	Dry powder magnetic particle inspection.
ASTM A653	Standard Specification for sheet steel, Zinc coated (Galvanized) or zinc alloy coated (Galvanized) by hot dip process.
AWS D1.1	Specifications for welding of steel structures.
ASCE/SE-1	Minimum Design Load for Buildings and other Structures.
ANSI/AISC 358	Prequalified Connections for Special and Intermediate Moment Frames In Seismic Applications.
ANSI B 18.2.2.1	Plain Washers.
AISI	American Iron and Steel Institute (Relevant Standards)
SSPC – SP6	Steel structures painting council – surface preparation specifications.
NACE	For Corrosion Control

3.0 MATERIALS

Except otherwise stated on the drawings, the material specifications shall conform to the following standards. Wherever necessary the Contractor may use equivalent alternative material subject to approval of the Engineer.

3.1 Structural Steel

- Structural steel shall conform to the requirements of ASTM A-36, or ASTM A-572.
- Steel pipes shall conform to the requirements of ASTM A 53 Class B, ASTM A501 or shall be made of plates spirally welded.
- All material shall be supplied chirpy V-Notch testing in accordance with ASTM A6, Supplementary Requirement S5.
- Grating shall conform to ANSI / NAAMM MBG 531.

3.2 Welding

Welding electrodes shall match the base metal and shall conform to the requirements of AWS D1.1 specifications.

3.3 High Strength Bolts

All shop connections, except as noted herein or on the drawings, shall be made with High Strength Bolts in friction type connections, or by welding.

High strength bolts, heavy hexagonal nuts and hardened washers shall conform to the requirements of ASTM A325. All field connections, except noted, shall be made with high strength bolts in friction type connection.

3.4 Washers

Washers shall conform to the requirements of ANSI B18.2.2.1 and shall be of structural grade steel appropriate for the type of bolts for which they are used. For oversized holes, the washers shall be large enough to cover the entire hole by at least 6mm or as directed by the Engineer.

3.5 Studs

Steel Studs Shear Connectors shall conform to the requirements of Structural Welding Code-Steel, AWS D1.1.

3.6 Paints

3.6.1 All material shall be acceptable, proven first grade products and shall meet or exceed the minimum standards of specified manufacturers like Jotun, SIPCO, PATSA and ICI paints.

During painting works an approved Quality Control inspector or a technical representative shall be provided by the manufacturer to oversee the painting and coating application. The Quality Control Inspector shall be liable to confirm in writing to the Consultant / Architect of the correct use of their product and the DFT by approved Thickness Gauge Meter, on job site as per Specification.

3.6.2 High solid, aliphatic polyurethane Topcoat by JOTUN or equivalent.

3.6.3 Anti-corrosive Surface tolerant epoxy primer by JOTUN or equivalent.

3.7 Copper Slag Abrasive

Copper Slag abrasive Omgritor equivalent

4.0 CONNECTIONS

All connections shall be designed and detailed for 75% of the effective capacity of the member. A minimum of two bolts or equivalent welding shall be used per connection.

Shop connection may be welded or bolted. Field connections shall be bolted unless noted otherwise on design drawings or approved by the Engineer.

5.0 ALLOWABLE STRESSES

Allowable design stresses for structural steel members and their connections, including temporary bracings and shorings shall be in accordance with AISC Specifications.

6.0 SHOP DRAWINGS

- 6.1 Shop drawings shall be submitted by the Contractor, for structural steel works, for acceptance in accordance with the requirements or the Contract Documents.
 - 6.2 Shop drawings furnished for this section shall conform to the best standards of the construction industry. Shop drawings shall be prepared by and under the supervision of competent engineering personnel. Prior to submittal, the Contractor shall check each shop drawing for compliance with the requirements of the Contract Documents.
 - 6.3 Shop drawings shall include plans, elevations, sections and complete details to describe clearly, at an ample scale, all work to be provided. Drawings shall be accurately dimensioned and shall be noted clearly.
 - 6.4 All connections shall be designed and detailed as, per sub-section 4 above, by the Contractor on the shop drawings. Design calculations for connections shall be made as per AISC specifications and shall be submitted along with the shop drawings after checking and signing by the Contractor for approval of the Engineer.
 - 6.5 The shop drawings shall include
 - (i) An erection scheme, in suitable size, having the following information:
 - Location of erection elements in respect of axis and Marks as well as picking points of these elements with respect to each other or with the existing steel or reinforced concrete structures.
 - Joints showing erection welding sizes and lengths, bolts diameter and numbers.
 - Chart showing list of assembling marks having columns such as Mark, Description, Quantity, Weight of each Mark, total weight and Remarks with grand total in the end.
 - Chart showing List of Erection Bolts, Nuts and Washers in tabulated form, detailing information such as size, quantity, weight and their grand totals.
 - Quality of materials.
 - Quality and type of welding electrodes.
 - Measures to be adopted against unscrewing of bolts.
 - Painting instructions.
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- Erection sequence.
 - References to relevant drawings.
 - Except in special cases all scheme drawings shall be made in single fairly thick lines.
 - The recommended scale of erection scheme is 1:50, 1:100, 1:200, for joints 1:5, 1:10 or 1:20.
- (ii) Fabrication drawings in suitable size shall contain the following information:
- Each Shop Assembly (Mark) shall be drawn separately showing necessary lines, elevations, sections with reference to axis, center lines, location of holes, cleats, plates, lugs etc. fully dimensioned with part numbers.
 - Bolts and holes sizes.
 - Welding symbols and welded joints requirements, in accordance with AISC manual of steel construction and AWS specifications.
 - Geometrical Setting out dimensions necessary for the assembly of an element. Location and details of joints as calculated by the Contractor.
 - Instruction for welding, dimensions of weld, edge preparations methods of welding, and methods for control of distortions.
 - List of symbols for bolts and holes used.
 - List of symbols for welds used.
 - Edge distance (general).
 - Welding sizes and lengths (general).
 - Standards and quality of materials.
 - Type and quality of welding electrodes.
 - Tests for welding.
 - Reference to related erection scheme drawings.
 - Reference to design and working drawings.
 - Parts list.
 - Instructions for surface preparation, painting, primer and finish coats.
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- Recommended scales for fabrication drawings are preferably 1:10 or 1:20, and for joints and details 1:1, 1:2, or 1:5.

7.0 FABRICATION

The Contractor shall notify the Engineer about any problems or doubts/errors, if any, in the drawings for clarifications/rectification well in time to prevent any fabrication errors. Fabrication shall not be commenced until approval has been obtained from the Engineer.

7.1 Straightening of Material

Rolled material, before being worked upon shall be straightened within tolerances as per ASTM specifications A6. Straightening necessarily shall be done by mechanical means or by the application of a limited amount of localized heat. The temperature of heated areas, as measured by approved methods, shall not exceed 1200 ° F.

7.2 Cutting

As far as practicable cutting shall be done by shearing. Oxygen cutting shall be done where shear cutting is not practicable and shall preferably be done by Machine. All edges shall be free from notches or burs. If necessary, the same shall be removed by grinding.

7.3 Holes Punching/Drilling

Holes shall be punched where thickness of the material is not greater than the diameter of bolt + 3mm. Where thickness of the material is greater, the holes shall either be drilled or sub-punched and reamed to size. Die for all sub-punched holes and drill for all sub-drilled holes shall be at least 2mm smaller than the nominal diameter of the rivet or bolt.

7.4 Welding

7.4.1 All execution and inspection of welding shall be done in accordance with the provisions of the American Welding Society Specifications. No welding for piping/electrical supports shall be made transversely to any tension flanges or beams or columns.

7.4.2 Maximum and minimum size and lengths of fillet welds shall be in accordance with AISC specifications, or as mentioned on drawing.

7.4.3 Surface to be welded shall be free from loose scale, slag, rust, grease, paint or any other foreign matter.

7.4.4 Butt welds shall be full penetration welds, unless otherwise specified and permitted.

7.4.5 Avoid the use of temporary welded attachments during fabrication as much as possible. After fabrication is completed, remove flush with the base material without encroaching on the minimum required base material thickness. After the surface has been restored, examine all areas from which temporary

attachments have been removed by the same methods required for permanent fillet welds.

- 7.4.6 Do not begin structural welding until joint elements are tacked in intimate contact and adjusted to dimensions shown with allowance for any weld shrinkage that is expected. Weld heavy sections and those having a high degree of restraint with low hydrogen type electrodes. No member shall be spliced without approval.
- 7.4.7 For notch-toughness specified material, all weld metal, processes and preheat requirements shall be compatible to assure notch-tough composite weld metal.
- 7.4.8 Shop splices of webs and flanges in built-up girder shall be made before the webs and flanges are joined to each other.

7.5 Tolerances

Tolerances for Structural Steel shall be as per AISC Specifications unless noted otherwise.

8.0 WELDER QUALIFICATIONS

- 8.1 All welders contracted to perform work shall be required to show written evidence that they have been properly tested in compliance with the approved welding procedures.
- 8.2 Welders shall have been qualified in the proposed procedure by an established laboratory acceptable to the Engineer within the preceding 90 days.
- 8.3 All welders shall be qualified for the type of weldment, grade of steel, thickness of steel, welding process and welding position that they are employed to weld. Welders and welding operators that have not been performance qualified, for all material and thickness ranges used on the job, shall be restricted to welding only that portion of the work for which they are qualified.
- 8.4 Engineer reserves the right to have welders or welding operators prequalified or removed from the job as he deems necessary during the progress of work. Engineer's decision regarding the qualifications of any welder shall be final.

9.0 WELDERS IDENTIFICATION

- 9.1 Each welder shall be assigned a unique identifying number or symbol that he shall use to identify all welding resulting from his skills.
 - 9.2 Stenciled markings shall be applied within 40mm of the weld using low stress concentration dies. Written symbols are also acceptable.
 - 9.3 A record shall be kept of these symbols by the Contractor. The records shall show welder's name, symbol assigned, procedures to which
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qualified, employment and test dates. This record shall be available to the Engineer's Representative at all times.

10.0 TEST ASSEMBLY

- 10.1 Fabricated components such as Beams, Girders, Bracing, as and where required by planning, shall be test assembled in the shop prior to transportation to site.
- 10.2 Test assembly work and procedure should be planned during fabrication process.
- 10.3 Each test assembly shall be got inspected from the Engineer's Representative and shall be dismantled only after his approval in writing.

11.0 SURFACE PREPARATION / PAINTING

11.1 Surface Preparation

- These Specifications and NACE standard RP-01 shall govern the procedures and materials required for surface preparation and coating of the specified structures.
 - All fabrication and assembly of a particular section shall be completed before surface preparation begins.
 - All blast cleaning on metal surface should be carried out by Copper Slag abrasive and grit should not be recycled to avoid contamination of surface in accordance with the SSPC specification required for that particular area. Blasting anchor profiles shall be consistent with manufacturer's recommendations.
 - All blasting should be scheduled in a manner which enables paint to be applied in accordance with the manufacturer's recommendations and on the same day as blasting Occurs.
 - All welded area and appurtenances shall be given special attention for removal of welding flux in crevices. Welding splatters, slivers, laminations and under laying mill scale exposed during blasting shall removed or repaired. Bolt holes shall be drilled and de-burred prior to blasting. Sharp edges shall be ground or filed to provide a visible radius.
 - The abrasives used for blasting will be sized to give the specified anchor profile as determined by this specification. A mesh size will be used as prescribed for thickness of paint to be applied. The maximum particle size shall be no larger than that passing a 16 mesh screen.
 - No acid washes or other cleaning solutions or solvents may be used on metal surfaces after being blasted. This includes any inhibitive washes intended to prevent rusting.
 - All oil and/or grease contamination shall be removed by water based degreaser before starting to blast like glo-flo heavy duty degreaser or equivalent.
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- No intermediate or finish coating shall be applied prior to fabrication without prior approval from Engineer.
- Blasting shall be done in an area removed from painting operations and freshly coated surfaces to prevent contamination. Contaminated coatings shall be re-blasted by Contractor to bare metal and reapplied.
- After blasting Contractor shall thoroughly clean all blast grit and dust from both internal and external surfaces, including removal from crevices, recesses etc.

11.2 Coating Application

- Coating application will be done according to paint manufacturer's recommendations included with the materials and will be subject to inspection by Engineer.
 - The blast-cleaned surfaces shall be coated with primer during the same day as blasted and at least one hour prior to sundown of the day, and also before any rusting occurs. A minimum of 150mm (6 inches) around edges of sand blasted area will be left un-primed unless adjoining a coated surface. Any steel/metal that is not primed and is wet by rain or moisture shall be re-blasted prior to application of primer.
 - All coating shall be allowed to dry thoroughly, but not less than the manufacturer's specified time, prior to application of a succeeding coat.
 - The surface shall be clean, dry and free from dust before application of any coat of paint.
 - All coating materials furnished by Contractor shall be furnished in unopened, clearly identifiable containers. Mixing of different coatings shall not be permitted. Containers shall remain closed until required for use. No paint shall be used that has expired its shelf life.
 - All coating film thickness shall be as specified and shall be checked by the Engineer or his Representative.
 - Damage to intermediate coats, prior to application of the next coat, shall be repaired by Contractor to provide the coating sequence and film thickness as specified.
 - After the prime coat has been applied to all hard-to-spray areas, such as corners. Edges and welds, may be brush painted with the same paint and film thickness.
 - The finished job shall not contain sags, runs, wrinkles, spots, blister or other application flaws.
 - Holidays in the final coat at edges, corners, welds and inaccessible areas may be protected by spraying or hand brushing an additional layer of topcoat provided excessive build up does not occur.
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- All components shall be thoroughly stirred before, during and after mixing. The mixed coatings shall be continuously stirred by mechanical spray pot agitators or other approved means. The volume to be mixed shall be accurately measured. All mixing shall be done in clean containers, free from traces of grease, other type paints, or other contaminants. All containers shall be kept covered to prevent contamination by dust, dirt or rain.
- Coating may be brushed on all areas, which cannot be properly spray coated using brushes of style and quality that will enable proper application of materials.
- Paint shall be worked into all crevices and corners, and all runs or sags shall be brushed out in order to insure no air pockets, solvent bubbles, voids, or areas of excessive build up.

11.3 Repair of Damaged Area (Touch-UP)

- All external surfaces where coating is damaged during fabrication, transportation and erection shall be repaired as follows:
- Top coat damaged, but base coat undamaged, will be repaired by removing damaged coating with sand paper or other means acceptable to the Engineer (wire brushing will not be acceptable) and applying top coat as specified.
- Coating damaged to base metal where blasting is not approved shall be mechanically cleaned as specified in other Section and applying a three coats system as specified in relevant sections.
- Care will be taken to avoid damaging the coatings surrounding repaired areas and to assure complete tie-in of the coating with surrounding areas.
- Remove damaged areas by spot blast and feather into surrounding coating with sandpaper. Clean all loose materials from surface.
- Contractor shall repair the coating on all damaged areas prior to final acceptance of the Engineer.

11.4 Galvanizing (Zinc Coating)

Galvanizing, wherever specified, shall be applied in a manner and of a thickness and quality conforming to the requirements of ASTM A123 standard specifications for zinc (Hot dipped galvanized) coating on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips.

Components shall be galvanized i.e. zinc coated after complete fabrication i.e. welding, drilling etc. the process shall consist of removal of rust and mill scale by pickling in hydrochloric acid or sulphuric acid followed by water wash and prefluxing in tanks containing zinc ammonium chloride and then fluxing with ammonium chloride. The

fluxed components shall then be passed through a drying oven prior to immersion in a bath of virtually pure molten zinc.

12.0 PAINT AND COATING SYSTEMS FOR STEEL GATE AND STEEL METAL WORKS

The paints and coating systems have been specified hereunder for steel/ metal works like pipe support, angle iron support in trenches, manufactured by Jotun paint or equivalent as approved by the Engineer and all such surfaces as shown on the Drawings and/or as directed by the Engineer. All paint applications to be carried out by airless spray.

12.1 Exterior Paint System for Steel Structures

12.1.1 Surface Preparation

Abrasive blasting to Near White with copper slag in accordance with SSPC-SP10 and SSPC-AB1 to provide 40 to 60 microns anchor profile.

12.1.2 Paint System

1st Coat: Surface tolerant epoxy mastic to be applied at 250 microns DFT. JOTAMASTIC 87 or equivalent.

2nd Coat: Two components polyurethane to be applied at 60 microns DFT. HARDTOP XP AS or equivalent.

13.0 INSPECTION AND TESTS

13.1 Manufacturer's Test Certificate for all material used shall be furnished by the Contractor for Engineer's scrutiny and approval.

13.2 Rolling tolerance of all shapes and profile according to AISC shall be in accordance with the provisions of ASTM A6 specifications. These shall be checked by the Contractor before commencing work and shall be rejected if found not within limits.

13.3 Materials shall be tested for conformance with the specified standards at an approved testing laboratory as and when directed by the Engineer.

13.4 Contract surfaces of connections using high strength bolts in friction type connections shall be got inspected and approved from the Engineer before bolting.

13.5 All bolted connections shall be got inspected and approved from the Engineer for types, size, number of bolts and installation including tightening.

13.6 Inspection and Testing - Welding

13.6.1 General

Welding shall be inspected and tested by an approved testing laboratory during fabrication and erection of structural steel as follows:

The testing laboratory shall be responsible for conducting and interpreting the tests. It shall state in each report whether or not the test specimens conform to all requirements of the Contract Document and shall specifically note any deviations therefrom.

Certify all welders and make 100 percent visual inspections and tests as follows:

- Record types and locations of all defects found in the welding work.
- The measures required and performed to correct such defects.

In addition to the requirements of AWS D 1.1, paragraph 8.15, each weld shall be visually free of slag, inclusions and porosity.

In addition to visual inspection of all welds magnetic particle, ultra-sonic and radiographic inspection shall be made of all welds as specified below. Magnetic particle tests shall be made on the root pass and finished weld.

The method of magnetic particle test shall be in accordance with ASTM E109. Any type of crack or zone of in-complete fusion or penetration shall not be acceptable.

Radiographic testing technique and standards of acceptance shall be in accordance with AWS D 1.1.

Ultra-sonic testing shall be performed in accordance with AWS D 1.1.

Welding inspection and test report showing evidence of the quality of welding shall be submitted by the Contractor. For each section of weld inspected and tested, furnish a report which clearly identifies the work, the welder's identification, the areas of inspections and test, the acceptability of the welds, and signature of the inspector or laboratory incharge. Each report shall be completed at the time of inspection or test. For radiographic examination, furnish a complete set of radiographs in addition to the reports. All inspection and testing shall be carried out in presence of the Engineer or his representative.

13.6.2 Test Methods

Use the following test methods as specified. The following list is in descending order. When a particular test method is specified for a joint and the method is impractical to use, use the next highest method practicable. The alternative method will be subject to approval, NDT procedures and techniques shall be in accordance with AWS D 1.1, section 6.7.

- a) Radiographic Method: In addition to the requirements of AWS D 1.1, comply with ASTM E94.
 - b) Ultrasonic method.
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- c) Magnetic particle method.
- d) Liquid Penetration Method: Visible-dye, solvent removable method only.

13.6.3 Members Designated for Tests

- a) Built – up Members:

Examine 100 percent of flange-to-flange and web-to-web welding by the radiographic method. For all web-to-flange and pipe column seam welding, examine ten percent of each welder's work as follows:

- Full penetration groove welds by the ultrasonic.
- fillet welds and partial penetration groove welds by the magnetic particle method.

- b) Moment Connection Joints:

- Examine 100 percent of all flange-to-flange and web-to-web welding as follows:

Full penetration groove welds by the ultrasonic method or other method as designated by the Engineer.

Fillet welds and partial penetration groove welds by the magnetic particle method.

- For all web-to-flange welding, examine ten percent of each welder's work as follows:

Full penetration groove welds by the ultrasonic method or radiographic method as approved by the Engineer.

Fillet welds and partial penetration groove welds by the magnetic particle method.

- c) Column Base Plates.

Examine 100% of all welding for connection of base plate to column.

- d) Bracing Connections: Examine 100 percent of all welding for connection of diagonal bracing as follows:

- Groove welds by the ultrasonic method.
- Fillet welds by the magnetic particle method.

13.6.4 Requirement for ten percent Examination

- a) Examine a 300mm section of weld in each 3m increment of each welder's work as directed by the Engineer. If the
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examination meets the acceptance standards of AWS D 1.1, the 3m of weld represented will be accepted.

- b) if the examination fails to meet the acceptance standards, examine two additional 300mm sections in the 3m increment as directed by the Engineer. If both of these examinations meet the acceptance standards, the 3m of weld represented will be accepted. Repair the defects detected in the first examination and re-examine.
- c) If one or both of the examinations fails to meet the acceptance standards, examine the remaining weld of the 3m increment. Repair the areas that do not meet the acceptance standards and re-examine.

13.6.5 Repair and Re-Testing of Welds

Repair defective welds in accordance with AWS D 1.1, or replace the weld, and Re-test repaired and replaced welds by the same method and acceptance standard used to examine the original weld. In addition, when defective welds are found, the testing laboratory shall determine the cause of the defective welding and institute immediate corrective action.

All defective welding shall be repaired or replaced at the Contractor's expense.

13.7 Rejection

Neither the fact that the materials have been tested nor that the manufacturers test certificates have been furnished shall affect the liberty of the Engineer to reject material found not according to these specifications.

Materials or workmanship not in conformance with the provisions of these specifications shall be rejected at any time, after delivery or during the progress of the work or the completion and erection at site.

14.0 ERECTION

14.1 Bracing

All steel structures shall be carried up true and plumb within the limits defined in the AISC code of standard practice and temporary bracing shall be introduced wherever necessary to take care of all construction loads to which the structure may be subjected including the equipment and the operation of the same. Such bracing shall be left in place as long as required for safety.

Wherever piles of materials, erection equipment and other loads are carried during erection, proper provision shall be made by the Contractor to take care of the stresses resulting from such loads.

14.2 Alignment

No permanent bolting or welding shall be done at site during erection until as much of the structure as will be stiffened thereby has been properly aligned and approved by the Engineer.

14.3 Joints Using High Strength Bolts

All structural joints using high strength bolts shall be executed and inspected in accordance with "AISC Specification for structural joints using ASTM A325 or A490 bolts". High strength bolts and nuts, loosened after tightening, shall be discarded and replaced with unused bolts and nuts.

15.0 MEASUREMENT AND PAYMENT

15.1 Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost there of shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

15.1.1 Nuts, bolts, screws, washers, weld metal and welding rods.

15.1.2 Testing of materials and welds, and repair of defects.

15.1.3 Surface preparation including cleaning with blasting.

15.1.4 All Painting works.

15.1.5 Galvanizing

15.1.6 Fabrication

15.1.7 Erection

15.1.8 Hardware and fixing accessories etc.

15.1.9 All embedded parts unless otherwise specified in the Bill of Quantities

15.2 Structural Steel Works

15.2.1 Measurement

Measurement of acceptably completed works of structural steel will be made on the basis of weight in tonnes (1000 kg), according to approved shop drawings, after verification at site to the satisfaction of the Engineer that the items fabricated, supplied and erected in position conform with the contract and approved shop drawings.

15.2.2 Payment

Payment will be made for acceptable measured quantity of structural steel works on the basis of unit rate per tonne quoted

in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

15.3 Steel Gates

15.3.1 Measurement

Measurement of acceptably completed Works of steel gates will be made on the basis of weight in kilogram of gates, according to approved shop drawings, after verification at site to the satisfaction of the Engineer that the items fabricated, supplied and erected in position conform with the Contract and approved shop drawing.

15.3.2 Payment

Payment will be made for acceptable measured quantity of steel gates on the basis of unit rate per kilogram quoted in the respective item of the Bill of Quantities and shall constitute full compensation for all the Works related to the item.

15.4 Stair case hand railing

15.4.1 Measurement

Measurement of acceptably completed Works of stair case hand railing will be made on the basis of running foot / meter, according to approved shop drawings, after verification at site to the satisfaction of the Engineer that the items fabricated, supplied and erected in position conform with the Contract and approved shop drawing.

15.4.2 Payment

Payment will be made for acceptable measured quantity of stair case on the basis of unit rate per running foot / meter quoted in the respective item of the Bill of Quantities and shall constitute full compensation for all the Works related to the item.

*** End of Section 3000 ***
