OMAN WASTEWATER SERVICES COMPANY S.A.O.C

الشركة العمانية لخدمات الصرف الصحي ش.م.ع.م

OMAN WASTEWATER SERVICES COMPANY

TECHNICAL STANDARD SPECIFICATION

CIVIL WORKS

SECTION 06 METALWORKS

SECTION 6 TABLE OF CONTENT

Section # 06 Structural Steel and Metalwork

1. METALWORK

1.1 General

All materials shall be free from oil, grease, dirt scale, rust damage or defects. All welding, brazing or hot forging shall be carried out by approved process.

1.2 Mild Steel

Unless otherwise specified mild steel shall comply with BS 4360 Grade 1.
Unless otherwise specified all mild steel is to be primed before delivery with an approved primer.

1.3 Galvanization

The surfaces of all steel described as galvanized are to be thoroughly and evenly coated to a thickness of 88 Microns or equivalent to 610 grams per square meter and shall be free from pin holes, lumps of surface galvanizing materials and all other defects in accordance with BS 729.

All damaged galvanized surfaces and all edges exposed by cutting or drilling after galvanizing shall be treated with two coats of zinc paint sprayed on in accordance with BS 2569. Ends of metal sections not exceeding 100 mm sq. exposed by cutting after galvanization shall be treated with two coats of zinc paint sprayed on in accordance with BS 2569.

Where site galvanizing is necessary this shall be carried out by using paint to the Engineer's satisfaction.

1.4 Workmanship

The Contractor shall Prepare and submit shop drawings where required and obtain the Engineer's approval before proceeding with the fabrication and work. The Contractor shall check site dimensions and fabricate work to the "Approved" shop Drawings.

Shop drawings shall show in detail the various portions of the work, types of materials size of members and methods of securing same together and to the work of other trades.

The Contractor shall coordinate with other trades in obtaining the exact site dimensions and the contractor will be held responsible for the accurate execution of the parts of the work specified. All fastenings shall be concealed where possible. The approved shop drawings shall be followed exactly.

Unless otherwise specified in these descriptions, fabrication of metalwork shall conform to the following:

a) All work shall be finished straight smooth and free from all defects and imperfections and shall be to the size shown on the drawings.

b) All steel items shall be thoroughly wire brushed cleaned and given one coat primer, before delivery to the site.

c) All parts, which are inaccessible after assembly or erection, shall receive two coats of primer before assembly takes place.

d) All metalwork shall be rigidly fixed in place as shown on the drawings, using appropriate sizes of bolt, hold fast anchor bolts and locks.

e) Cutting of steel parts shall be done using hacksaws. No gas burning shall be allowed. All cut parts and sections shall be ground even and filed smooth with rounded edges.

f) All welding materials plant equipment procedures and types of welds shall conform to BS 693 or BS 1856. "General Requirements for Oxy-acetylene / metal arc / welding of mild steel".

Welding of steelwork shall be carried out by skilled Welders using one of the following methods

a) Gas welding to BS 693 for mild steel.
b) Metal arc welding to BS 5135 for mild steel.
c) Projection welding to BS 2630.
d) Seam welding to BS 2937 for mild steel sheets.
e) Stainless Steel BS 3014.

Where practical all welding shall be carried out prior to the galvanizing process.
Welds shall be finely ground down, filed or spun to a smooth finish prior to the work being released for finishing.

1.5 Finishing

All ferrous metal work is to be shop primed or galvanized before delivery to site. Those portions of items which are to be embedded in concrete or masonry and surfaces and edges which are to be site welded, unless galvanized are to remain unprimed.
Remove scale rust and other deleterious materials before the stop coat of paint is applied. Immediately after surface preparation, brush or spray on metal primer paint applied in accordance with the manufacturer's instructions at a rate sufficient to provide a uniform dry film thickness of 0.05 mm for each coat. Use painting methods, which will result in full coverage of joints, corners, edges and all exposed surfaces.

1.6 Storage and Handling

All items described under this section shall be handled delivered and stored in a manner that will avoid damage rust or deformation. Items shall be stored off ground and shall be entirely covered with weatherproof coverings in a storage area.
Items, which become rusted or damaged because of non-compliance with these conditions, will be subject to rejection and such items shall be replaced without additional cost to the Employer.

1.7 Installation

The Contractor shall provide anchorage devices and fasteners where necessary for securing to finished work including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, rag bolts and wood screws and other connectors as necessary.

All non-ferrous items in contract with dissimilar metals, concrete, masonry and mortar shall be thoroughly insulated with approved zinc-chromatic coating or plastic membrane on contact surfaces before installation.

The Contractor shall cut drill and fit as necessary for installation. Set the work accurately in location alignment and elevation plumb level and true. Provide temporary bracing or anchors in framework for items, which are to be cast or built into concrete, masonry or similar construction. Form tight joints with exposed connections accurately fitted together. The Contractor shall not cut or abrade members with finishes, which cannot be completely restored on site. Where cutting, welding and grinding are required for fitting and jointing of the work, the Contractor shall restore finishes to eliminate any evidence of such corrective work.

The Contractor shall carry out all welds and carefully make good on completion.

1.8 Water Bars, Brass Strips

Water bars where required shall be formed from 10 x 4-mm brass flat.
Brass "T" pieces 6 mm x 75 mm x 75 mm are to be used at junctions of differing floor coverings and as shown on the drawings. Alternatively brass systems may be used.
Expansion joints should be formed using brass expansion joints of appropriate size.

1.9 Gate Doors and Grilles

Gates, doors and adjacent grilles on boundary wall shall be constructed with mild steel hollow sections, squares, channels and flats, as indicated on the drawings.
All joints to be welded and filed properly.
All mild steelwork should be protected and painted in accordance with the painting specification.
Locking arrangements and bolt stops should be provided for the gate doors.

1.10 Car Parking Cover

Steel supports and fixings for a timber structure are to be as detailed on the drawings protected and painted in accordance with relevant specification clauses.

1.11 Roof Drains

Roof drains shall be fixed in accordance with manufacturer's instruction and waterproofed to the approved detail.

1.12 Steel Handrails

Tubular steel handrails shall comply with BS 1775, BS 729.
Standard tube and fittings are to be manufactured to withstand heavy-duty loadings associated with high-density pedestrian traffic and escape routes.
Stainless steel handrail shall comply with item G.2.3 and BS 4592.

1.13 Open Grid Flooring

Open grid flooring shall comply with BS 4592.

All proprietary fixings, support members and mountings shall be supplied by the manufacturer.

1.14 Roof Purlins

Steel for roof purlins and rails shall comply with BS 2989 type Z.28, Class C and BS 449: Part 2:1969 addendum no. 1 PD 4064.

Purlins shall be cold rolled, jointed and fixed strictly in accordance with manufacturer's instructions.

1.15 Roof Cladding

Profiled pr corrugated roof sheeting shall comply with BS 6427: 1976, BS CP 143, BS 4868:1972.

Profiled roof cladding shall be aluminum single skin panels. Colour shall be to the Engineer's approval.
Proprietary colour matched ridge pieces, flashing and end closures shall be fixed strictly in accordance with manufacturer's instructions.

Fixing of profiled roof cladding shall be concealed using proprietary water seals and fasteners. Side and end laps are to be not less than 150 mm and 130 mm respectively and strictly to manufacturer's instructions.

1.16 Aluminum Balustrades

Cast or wrought aluminum shall be fabricated from LM-6 quality aluminum and shall comply with BS 1490, and BS 6496.

The Contractor shall submit fully detailed shop drawings of all decorative aluminum work for Engineer's approval.

Coatings and finishes shall be approved by the Engineer.

1.17 Aluminum Flashing

Aluminum sheet and strip shall comply with BS 1470, work to be dressed in-situ shall be in annealed condition (O) and that to be pre-formed shall be half hard condition (H4).
Standard aluminum flashings sections for flat roofs shall be prefabricated to the profiles shown on the drawings.

Shop welding shall be MIG to BS 3571; Part 1 or TIG to BS 3019: Part 1.
Extrusions for eaves trim drip etc. shall comply with BS 1474; allow HE 30 TF.

2. Structural Steel

2.1 Drawings

The contractor shall prepare and submit all necessary working shop drawings to the Engineer before proceeding with the fabrication and erection. The Contractor shall check site dimensions and fabricate work to the "Approved" shop Drawings.

.

2.2 Dimensions

The contractor shall make his own survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the steelworks. The Contractor shall be responsible for every piece being made to the correct form and size notwithstanding any inspection of any of the contractor's work shop drawings by the Engineer.

2.3Inspection

The contractor shall inform the Engineer of the date on which fabrication will commence, shall keep the Engineer informed of the fabrication Programme and shall permit the Engineer or his representative full access to the work, at reasonable hours, for the purpose of inspecting the steelwork at any stage in its manufacture. The contractor must clearly understand that any material not complying with this specification shall, upon inspection, whether at his work, the site, or erected in position, be rejected and it shall promptly be made to comply or be replaced to the entire satisfaction of the Engineer.

2.4 Steel Quality Identification

Each steel section piece obtained from the rolling mill supplier shall be marked as required by clause 33 of BS 4360 including the special quality identification mark required by appendix D of BS 4360. The contractor shall arrange for the Engineer to be supplied with the manufacturer's certificate and test sheets including chemical composition as required by clause 34 of BS 4360 in respect of all sections and plates to be used in the works.

2.5 Materials

All structural hollow sections shall comply with BS 4360 grade 43C and BS 1775. All other steelwork shall comply with BS 4360 grade 43A.

2.6 Section and Rolling Tolerances

Universal columns, universal beam, joints and channel sections shall comply with BS 4 Part 1. Structural hollow sections shall comply with BS 4848 Part 2. Angle sections shall comply with BS 4848 Part 4. Plates and other sections shall comply with BS 4360. Sections used in the fabrication of members shall be cut from one piece of material.

2.7 Welding and Bolting

Welding is to be by the metallic arc process, using electrodes complying with the requirement of BS 639. The whole of the work is to be in accordance with the requirement of BS 449 and BS 5135.

All Welders employed to perform welding operations in the work shall be proved to be competent welders to the satisfaction of the Engineer, either at the option of the Engineer, by the production of appropriate trade certificates or by the performance of welding tests.

Any steelwork to be site welded shall be cleaned back to bare metal to the satisfaction of the Engineer in the area to be affected by the weld and subsequently repainted in accordance with this specification.

Before fabrication is begun the contractor shall submit in writing to the Engineer full details of the proposed welding procedures which process the Contractor will adopt for each type of weld in the work.

Ordinary bolts shall conform to BS 3692 or Bs 4190 for hexagonal head bolts, or BS 4933 for countersunk or cup, head bolts. Nuts shall be of at least the strength grade appropriate to the grade of bolt or other threaded element with which they are used. Plain and taper washers shall comply with the requirements of BS 3410 or BS 4320 as appropriate.

High strength friction grip bolts and associated nuts and hardened washers shall comply with BS 4395.

An approved load indicating bolt or a load indicating washer shall be used in all high strength friction grip bolt assemblies.

Holes for friction grip fasteners, the contact surfaces and the use of friction grip bolts shall be in accordance with BS 4604.

2.8 Testing

The Engineer may select samples from the work at any stage of its completion for the purpose of testing for chemical analysis, for impact tests or for any other testing that the Engineer may require. The contractor shall allow in his pricing for taking samples for the purpose of such testing and for welding back the appropriate equivalent material but should not include for the cost of the tests which will be carried out by an independent tester.

Where butt welds occur in any portion of the work which will be subjected to tensile stress in the completed work the contractor shall arrange and pay for radiographic tests to be made of all such butt welds by an approved independent tester. The radiographs shall be readily identifiable with the weld it is related to and shall be submitted to the Engineer for examination and retention.

Where butt welds occur in any portion of the work which will be subjected to compressive stress in the completed work the contractor shall arrange and pay for radiographic tests as described above for 10% of such weldments and the Engineer shall direct which joints shall be so tested.

The Contractor should note that in additions to the testing described above the Engineer may require further testing of weldments or any of the materials used to be carried out by an independent tester, either in his works or on the site. The contractor shall make due allowance in his fabrication and erection Programme for this item but shall not allow in his tender for the cost of such additional testing.

2.9 Workmanship

Notwithstanding any other clause contained in this specification the standard of materials and workmanship shall be in no way inferior to the recommendations contained in BS 449.

Except as noted below, abutting surfaces depending on contact for the transmission of compressive loads or forces shall be machined (together with gussets where present already welded on) so that the whole areas of the abutting surfaces is in direct contact. Faces, which are to be grouted directly to a foundation, need not be dressed.

Caps bases and end plates shall be fixed to the member concerned prior to erection. Unless indicated otherwise on the drawings such caps, bases and plates shall be truly at right angles to the member axis.

The ends of all beams shall be accurately cold sawn. End cleats must not project more than 2.0mm beyond the end of the beam.

The welding procedures shall be arranged to avoid distortion of the completed member. Work that is deformed by shrinkage after welding will be rejected and is to be made good at the contractor's expense.

Sheared edges of gussets or other members are to be straightened and dressed where necessary.

Shop connections shall be either welded or bolted unless indicated specifically on the drawings otherwise.

Site connections shall be bolted or welded as indicated on the drawings.
All holes shall be drilled to template, through all thicknesses in one operation, where possible, and all burs removed. The diameter of the hole must not exceed the diameter of the bolt for which it is drilled by more than 2.0mm.

All bolt shanks are to be solid with heads and lengths sufficient to allow not less than two clear threads projection beyond the nuts after tightening. The length of the unscrewed shank or barrel shall be at least equal to the thickness of the members to be connected.

2.10 Erection

2.10.1 Submittals

The Contractor shall submit to the Engineer The proposed erection sequence and procedure for comment prior to the erection of any steelwork.

2.10.2 Delivery, Storage and Handling

Fabrication parts shall be handled and stacked in such a manner that permanent damage is not caused to the components. Means shall be provided to minimize damage to the protective treatment on the steelwork and any damage, which does occur, shall be made good.
All work shall be protected from damage in transit. Particular care shall be taken to stiffen free ends, prevent permanent distortion, and adequately protect surfaces. All bolt, nuts, washers, screws, small plates and small articles generally shall be suitably packed and identified. In addition, when steelwork is to be transported by sea, special care should be taken to protect all work from damage, contamination and corrosion during transit.
The Contractor shall submit his proposals for protection, handling and storage of steelwork for shipping to the Engineer prior to dispatch.

2.10.3 Erection of Structural Steelwork

Erection of the steelwork shall be carried out in accordance with the recommendations in BS 5531 "Code of Practice for Safety in Erecting Structural Frames".

The steelwork shall be securely bolted or fastened in order to ensure that it can adequately withstand all loadings liable to be encountered during erection, including, where necessary, those from erection plant and its operation.

Any temporary bracing shall be left in position until time as erection is sufficiently advanced as to allow its safe removal.

All connections for temporary bracing, bolts, members, etc, to be provided for erection purposes shall be made in such a manner as not to weaken the permanent structure or to impair serviceability.

All plant used by the contractor shall be sufficient for the purposes of erecting the steelwork.

Details of the weight and location of any lifting, erection or other machinery shall be submitted to the Engineer for comment prior to such machinery being brought onto site.

The contractor shall be entirely responsible for the stability of the structure during erection and shall arrange that sufficient tack bolts are used to ensure that the work will remain rigid until final bolting is completed. The contractor shall supply and fix, without extra charge, any temporary bracing which may be necessary. Final bolting is to follow on as soon as possible in order to keep the amount of tack-bolted work to a minimum.

Fabrication shall be such that all parts can be accurately assembled and erected. Drift pins shall be employed only to align such parts and must not distort the work.

Alignment of each part of the structure shall be carried out as soon as possible after it has been erected. Permanent connections shall not be made between members until sufficient of the structure has been aligned, leveled, plumbed and temporarily connected to ensure that members will not be displaced during subsequent erection or alignment of the remainder of the structure.

When the steelwork has been finally leveled and plumbed the space under all base or bearing plates shall be thoroughly cleaned, dampened and then grouted, as described under the section of the specification entitled “concrete Work”.

2.11 Site Welding:

The site welding procedure proposed by the contractor shall be submitted to the Engineer for comment before work proceeds on site.
Attention is drawn to the requirements above in connection with the recommendations for site welding and cutting given in section 24 of BS 5531.

2.12 Surface Treatment

a) After fabrication all items of steelwork shall be cleaned such that it is free from grease and other deleterious matter.

b) After cleaning, all items of steelwork, including bolted interfaces, shall be blast cleaned at works to "2nd quality" finish as defined in BS 4232. The maximum profile height of the blasted surface shall not exceed 50 microns.

c) All surface defects, including cracks, surface laminations and pitting shall be removed as laid own in BS 4360. All fins at saw cuts, burrs, sharp edges, weld spatter, slag, flux and extraneous weld metal shall be similarly removed. Where extensive grinding has been necessary the dressed area shall be re-blasted to provide the surface specified.

d) After blasting, the substrate shall be vacuum cleaned to remove all, spent shot, grit, dust or other debris. The substrate shall also be free from moisture, oil or any other deleterious material.

e) Immediately after blast cleaning is complete, and in any case within four hours the steelwork shall be protected by the application overall of one coat of a 2 pack epoxy zinc phosphate primer or otherwise specified in the Contract Documents.

f) Any areas of steel to be site welded or contact surfaces in friction grip bolted assemblies shall be carefully masked off from the priming coats.

g) Care should be taken when storing, transporting and erecting the primed steelwork to protect the painting and to minimize mechanical damage.

h) After erection, site bolts and any damaged areas shall be made good by the Contractor by thorough hand cleaning down to bare metal and degreasing. These areas shall then be stripe painted with two coats of red lead primer.

i) Paint coatings shall not be applied in adverse ambient conditions which are contrary to the recommendations of BS 5493: 1977.

j) The complete paint system shall be purchased from one paint supplier upon his recommendation that each part of the system is compatible with the remainder

and that the complete paint system is satisfactorily resistant to the environment envisaged for the structure.

k) Thinners shall only be used strictly as and when recommended by the paint supplier.

l) The paint system to be employed shall comprise the coatings, each of a different colour, as listed in the following sub-clauses and each coating shall be applied in strict accordance with the manufacturer's printed recommendations.

2.13 Shop Painting

All steelwork shall be shop painted with one coat of a 2 pack epoxy zinc phosphate primer as specified in the Contract Documents.

2.14 Site Painting

All steelwork shall be site painted as follows

Touch up and make good damaged priming, undercoat, and travel coat as defined above.

b) Apply chlorinated rubber finish coat (DFT = 100 microns).

The nominal dry film thickness of the completed system shall be not less than 270 microns.

The contractor may submit alternative proposals for the surface treatment and protection provided that the alternative will achieve a protective coating of a durability not less than that which would be provided by the painting specified above. The specified painting systems classified in BS 5493: 1977 as system reference SL2 and this British Standard will be referred to in the assessment of any alternative proposal.

2.15 Galvanizing

The surface of all steel described as galvanized are to be thoroughly and evenly coated to a normal thickness of 180 microns in accordance with BS 729 and shall be free from pinholes, lumps of surface galvanizing and all other defects.

All damaged galvanized surfaces and all edges exposed by cutting after galvanizing shall be treated with two coats of zinc rich paint sprayed in accordance with BS 2569. Ends of metal sections not exceeding 100mm2 in area exposed by cutting after galvanizing shall

be treated with two coats of zinc rich paintbrush applied in accordance with BS 2569. Sufficient material shall be applied in the two coatings to provide a zinc coating at least equal in thickness to the galvanized layer.

2.16 Unpainted Steelwork

Steel to be encased in concrete shall be dispatched from works unpainted, but mill scale and loose rust shall be removed prior to delivery to site. After erection, the steel shall be free from any contamination of dirt, oil or grease.