



ABU DHABI SEWERAGE SERVICES COMPANY (ADSSC)

GENERAL SPECIFICATION FOR MECHANICAL WORKS

DIVISION 15 MECHANICAL

SECTION 15003 PLANT MANUFACTURING

ADSSC/GSMW	Division 15	Section 15003	Plant Manufacturing	Rev: 01	April 2008	Page 1 of 11
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1. PLANT SUPPORT STEELWORK

1.1 DESIGN

- a) Structural steelwork design, fabrication and erection to be in accordance with BS 5950; and loads to be determined in accordance with BS 6399: Parts 1, 2 & 3.
- b) Metalwork is to be designed in accordance with "Factory Stairways, Ladders and Handrails (including Access Platforms and Ramps)" published by EEMUA. Access openings in flooring shall be designed with hinged lock back facility.
- c) This Specification shall be read in conjunction with Section 15001: General M and E Requirements.

1.2 FABRICATION

- a) Fabrication tolerances shall be:
 - i. Maximum difference in squareness: 3mm on diagonals
 - ii. Maximum variation from plumb: 6mm per story, non-cumulative
 - iii. Maximum offset from true Alignment: 6mm
 - iv. Maximum out-of-position: 6mm
 - v. Maximum offset between faces: 1.5mm
 - vi. Maximum misalignment of adjacent members: 1.5mm
 - vii. Maximum bow: 3mm in 1.2m
 - viii. Maximum deviation from plane: 1.5mm in 1.2m.

1.3 ERECTION LOADINGS & BRACING

- a) During erection, allowance shall be made for erection loads, and for sufficient temporary bracing to maintain the structure safe, plumb, and in true alignment until completion of erection and installation of any permanent bracing.
- b) High strength grip bolts which have been slackened after tensioning shall not be re-used.

1.4 CUTTING

- a) Cutting of steel plates and sections may be by shearing, cropping, sawing or machine flame.
- b) Hand cutting of steel up to 10 mm thick may be permitted subject to the approval of ADSSC. All cut edges shall be dressed to a neat smooth finish.

- c) Structural members shall not be field cut without approval of ADSSC.
- d) Punching of holes for High Strength Friction Grip bolts shall not be permitted. Such holes shall be drilled and burrs shall be removed.
- e) Members with threaded fasteners shall be torqued to the required resistance.

1.5 ANCHORING

- a) Column bases and joint surfaces in contact with other steelwork or acting as sole plates shall be machined over the contact area.
- b) The Contractor shall be responsible for co-ordinating placement of anchors in concrete construction for securing bearing plates.
- c) The Contractor shall supply components required for anchorage of fabricated structures. Such components shall be made of the same material and finish as the main structure, except where specifically called for in the particular specification.
- d) Aluminium products shall not be embedded into cementitious materials due to inevitable corrosion.
- e) Steel items required to be cast into concrete or embedded in masonry shall be supplied with setting templates to appropriate sections.

1.6 PROTECTION FROM CORROSION

- a) Unless otherwise stated, finished steelwork shall be hot dipped galvanized in accordance with BSEN ISO 1461. The steel shall first be degreased and then hot dip galvanised in a bath sufficiently large to permit complete coating by single dipping. Fabrication details shall be such as to facilitate galvanising and in particular sealed hollow spaces and zinc traps shall be avoided. All nuts and bolts shall also be galvanised.
- b) Structural steel members not subjected to galvanising shall be shop primed. Surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted, shall not be primed.
- d) Preparation techniques required for steel surfaces shall be as per the Section 15004 : Corrosion Protection.

2. HANDRAILS, LADDERS, BALUSTERS & FLOORING

2.1 HANDRAILS

2.1.1 GENERAL

- a) Except as otherwise stated in BS 6180, all handrails and balusters shall be designed by the Contractor following the recommendations of BS 5395 : Part 3.
- b) Toe plates shall be 150mm deep x 5mm thick manufactured from the same material as main handrails material stiffened as necessary to prevent bowing and buckling. Toe plates shall be fixed to all handrail systems. Handrails shall not be attached to toe plates.
- c) Handrailing shall be of the two-rail type. All handrails shall be flush jointed and secured against lateral and rotational movement.
- d) Balusters shall be regularly spaced at approximately 1500mm centres. Balusters for steel and stainless steel shall be of the ball type.
- e) Infill panels to handrailing shall be provided where access to the public is permitted or at high level. Further reference can be found in BS 5395.
- f) Handrails shall be constructed from either:
 - i. Hot-dip galvanized mild steel sections to BS 1387 and BS 4360 Grade 43A
 - ii. Stainless standard steel sections grade 316[S16]
 - iii. Extruded Aluminum sections BS 1615 [ASTM B221M and B483M] [DIN 4113]
 - iv. GRP (mandatory when in contact with sewage or sewage gases)
- g) The handrailing shall be designed to withstand 740 Newtons per meter run, with the deflection of the rails not exceeding 0.8% of their span between standards and the standards 0.8% of their height.
- h) The mounting flanges shall be drilled for not less than three bolts with two bolts on a line parallel to and on the walkway side of the handrailing.
- i) Handrails, ladders, Balusters and flooring shall comply with standard drawings SD 810.

2.2 GRP HANDRAILING

- a) Glass Reinforced Plastic (GRP) handrailing shall be used in all areas in contact with sewage or sewage gas. The handrailing shall be 1000mm high and be provided with an intermediate rail 500mm high. Standards shall be set at not more than 1.50m centers. The handrailing and fixings shall be designed to withstand a horizontal force at handrail level of 740N/m run. The deflection of rails shall not exceed 0.8% of their span between standards and the deflection of standards shall not exceed 0.8% of their height.
- b) GRP handrailing shall be formed from a laminate of chopped strand mat of the ECR type. The resin in the resin rich surface shall be vinyl ester resin.
- c) Resins shall contain UV inhibitors if exposed to sunlight
- d) GRP handrailing shall be in prefabricated lengths complete with fittings. The Contractor shall ensure that unless otherwise specified, all handrailing shall be of uniform appearance and manufacture.
- e) Fixing used for anchoring GRP handrailing shall be approved grade 316L stainless steel anchors. All fixing holes shall be grouted epoxy mortar and the exposed fixing material sealed with coal tar epoxy or GRP coating as appropriate.
- f) Horizontal mounting flanges shall be drilled for not less than three bolts with two bolts on a line parallel to and on the walkway side of the handrailing. Vertical mounting flanges shall be drilled for not less than two bolts the line through the bolts being vertical. Fittings shall be screwed or secured with grub screws.

2.3 METAL STAIRWAYS

- a) Stairways shall be in accordance with BS 449 and BS 4592.
- b) Treads are to be open mesh fixed to the stringers, and not direct to the concrete.

2.4 LADDERS

2.4.1 GENERAL

- a) Unless otherwise stated, ladders shall be fabricated from GRP.
- b) An intermediate landing shall be provided where the rise exceeds 6.00m.
- b) Each rung shall be able to withstand a point load of 5000N when applied at the center of the rung and when applied close to one end.
- c) When supported horizontally over a span of 1.00m with the climbing face uppermost and with a load of 1000N applied at the center of the span the ladder shall not deflect more than 15mm at the point of application of the load and shall show no permanent deflection after removal of the load. Each ladder fixing shall be capable of withstanding shear and pull-out loads of 5000N.
- d) Safety cages shall be provided on ladders where Drawings indicated on the standard specification or where the distance between landings exceeds 4.50m. These shall be constructed of three flat vertical members supported by flat hoops with a diameter of 750mm. The hoops shall be at a maximum of 700mm centers and the first hoop shall be 2.40m above ground or platform level.
- e) Each hoop shall be able to withstand both a tangential point load of 740N and a vertical point load of 1200N applied at any point on the hoop. The maximum allowable deflection at the point of application of the load shall not exceed 25mm and there shall be no permanent deflection of the hoops after removal of the load.

2.4.2 GRP LADDERS

- a) GRP Grab Handles shall be positioned centrally at 400mm apart over the ladder and as directed by ADSSC
- b) The ladder shall be constructed from structural quality fiberglass shapes formed from a laminate of 'ECR' type chopped strand mat and vinylester resin throughout. Hardwood stiffeners are to be provided inside both the rungs and the rails as a former, and shall be fully covered with the laminate.
- c) The surface shall have a mould face in one side and a finish of tissue and final resin flow coat on the other and the wall thickness of the laminate shall not be less than 5mm at any point. There shall be no sharp edges.

- d) The support fixing brackets shall be GRP continuously moulded with the main lamination and they shall be spaced not more than 500mm apart (every 2 steps/rungs). The support brackets shall be put through the liner wall, and shall be designed to be totally encapsulated by concrete. They shall be laminated to the outside of the liner.
- e) The Rungs shall be 250mm apart with upper face finished with a non-slip surface.
- f) The structural components shall possess Class I fire retardance, with an ASTM E84 flame spread rating of 25 maximum.
- g) The internal liner to ladder lamination shall be of 'ECR' type CSM and vinylester resin only. No nuts and bolts are allowed.
- h) There shall be no pigmentation of the resin. Resins shall contain UV inhibitors if exposed to sunlight
- i) GRP ladders and cages shall have the same overall dimensions and design criteria as in the standard drawings in this specification.
- j) GRP grab handles shall be constructed from 20mm diameter mild steel bar coated after bending with resin rich GRP laminate. Handles shall have a 150mm x 150mm square opening when in their final position.
- k) GRP ladders shall be mechanically bonded into the concrete structure by means of suitable lugs or concrete anchors and also is bonded to the internal GRP lining of wet wells. The bonding lugs shall have a roughened surface to provide adequate bond with concrete and shall project a minimum of 100 mm into the concrete.

2.4.3 MILD STEEL LADDERS

- a) Galvanized mild steel ladders shall only be permitted where specified.
- b) Ladders over 3.00m long shall have additional intermediate stays at a minimum center to centre 2.50m.

2.4.4 ALUMINIUM ALLOY ACCESS AND CAT LADDERS

- a) Aluminum alloy access ladders and cat ladders shall only be permitted where specified and shall be 400mm wide with rungs spaced at 250mm centers.

- b) Stiles shall be of rectangular tube section with 25mm diameter non-slip double serrated tube section rungs.
- c) Rungs shall be fixed through stiles with approved pattern clip rivets.
- d) Curved stile returns on cat ladders shall be in aluminum sections socketed into hollow stile risers.
- e) Ladder feet shall be properly dowelled into floors and stiles shall be fitted with fixing lugs for building in at a maximum of 500mm centers. All fixings shall be stainless steel.
- f) Extruded aluminium sections shall be anodized to BS EN 12373-1 Grade AA25 with natural silver finish.
- g) Contact between dissimilar materials shall be prevented by the use of suitable washers' bushes and bedding pads so as to avoid anodic reactions.

2.4.5 TESTING OF LADDERS

After installation each ladder shall be subjected to a loading test. Ladders with five rungs or less shall be loaded with 150kg on each rung. Ladders with more than five rungs shall have five of their rungs loaded with 150kgs. The loads shall remain in place for 24 hours after which the ladder shall be inspected for defects.

2.2.6 STEP IRONS

- a) Step Irons shall be galvanized malleable cast iron and shall comply with BS 1247 and be of the general purpose or precast concrete manhole pattern as applicable. Flooring
- b) Open Bar Grating shall be of the non-slip rectangular mesh type to BS 4592. Fixing to frames is by purpose made cleats.
- c) Industrial open type metal flooring panels shall be manufactured so that when fitted the load bearing bars and transverse bars are aligned with adjacent panels where possible.
- d) Chequer Plate Flooring shall be of the non-slip type, not less than 10mm thick excluding the raised pattern. Fixing to frames is to be by way of countersunk stainless set screws.

- e) Gratings and Plate Flooring shall be suitable for lifting by one man with cutouts to permit removal without disturbing any of the installed electrical or mechanical plant. Panels shall be sized to provide clear access to the openings and trenches.
- f) Toe plates are to be provided around all cutouts.
- g) Grating and Flooring shall be set flush with surrounding surfaces and supported using frames and traverse bars fixed to the walls/structures.

END OF SECTION