

WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION E-00-02

SITE INSTALLATION AND COMMISSION FOR ELECTRICAL

AND FIRE SERVICES WORK

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1. GENERAL

All work executed by the Contractor shall comply with the terms and conditions stated in the Special Conditions of Contract (SCC) and Particular Specification which include:

- Sub-contracting
- Qualified Tradesmen and Intermediate Tradesmen
- Independent Checking of the Design, Erection, Use and Removal of Temporary Works
- Assessment of Liquidated Damages
- Computer-Aided Drafting Drawings
- Management of Sub-contractors
- Progress Reports and Meetings
- Environmental Mitigation Measures
- Site Safety
- Waste Management
- Works Tests and Inspection
- Packaging & Protection for Shipment and Storage
- Inspection of Plant, Materials and Workmanship at Site
- Plant Commissioning and Performance Testing
- Other Requirements as Specified.

2. CIVIL WORK FOR PLANT ERECTION

2.1 Provision of Structural Details and Built-in Parts

The Contractor shall submit within the time specified for the approval of the Engineer full details of all concrete and support structures required for the Plant and associated ancillaries, including the loadings (horizontal, vertical and bending moment) at each point of support on the concrete sub-structure. Full building details shall also be submitted of all thrust blocks, holes, ducts, chases, openings, recesses, rebates, plinths, drains, built-in parts and the like to enable the civil contractor to proceed with the design and construction of the plant foundations and other civil work.

The Contractor shall include details of the location and loading of metallic supports and anchors to be attached to building columns or beams in order that the necessary

foundation provisions can be made.

The Contractor shall supply all necessary parts of the Plant to be "built-in" to the concrete work and shall be responsible for checking the alignment of built-in parts both before and after concrete is placed. The Contractor shall ensure that all parts to be built-in are delivered to the Site at the appropriate time to suit the civil contractor's construction programme.

2.2 Foundation Work

The Contractor shall supply all holding-down, alignment and levelling bolts complete with anchorages, nuts, washers and packings required to attach the Plant to its foundations, and all bedplates, frames and other structural parts necessary to spread the loads transmitted by the Plant to concrete foundations without exceeding the design stresses.

2.3 Setting Out and Grouting

The Contractor shall be responsible for checking all civil work provided for the Plant, such as plinths, openings, etc., and shall immediately bring to the attention of the Engineer any defects, deficiencies, levelling, dimensional errors or other factors which affect the proper installation of the equipment.

Before grouting in of equipment is carried out the Contractor shall give the Engineer the option of inspecting the equipment and shall obtain the Engineer's approval for the correct setting-out, level and alignment of each item of the Plant.

All grouting work shall be carried out by the Contractor unless otherwise specified. The Contractor shall be responsible for ensuring that such grouting is satisfactorily carried out and shall check the setting-out, level and alignment of each item of the Plant after the grout has been placed but before it has set. A similar check shall be carried out after the grout has set.

3. PIPEWORK INSTALLATION

3.1 General

Subject to particular requirements specified elsewhere for cross-overs, parts of the pipeline which cross open ground above ground level shall be laid over concrete piers or supported by pipe hangers and the exposed pipes shall be painted or otherwise protected as directed by the Engineer.

Necessary supports, hangers, saddles, slings, structural steelwork, fixing and foundation bolts shall be supplied and fixed to support the pipework and its associated equipment in an approved manner.

No water pipes shall be installed in the electrical plant rooms.

Floor collars or wall boxes shall be supplied and fixed at all points where pipes pass through floors or walls, together with all fittings and, for external walls and floors, weatherproofing. The floors, walls and roof will be made good under another contract.

No drilling, welding or fixings of any kind may be made to any structural components or other contractor's work without the consent of the Engineer or his duly authorised representative.

3.2 Instrument Tubing

For low pressure applications, tubing shall be in compression-jointed PVC covered, heavy-gauge seamless copper of soft-annealed type. Fittings shall be chosen to be compatible with the application and service conditions called for.

Tubing shall be neatly run and shall be cleated to walls or cable trays. Routes shall not obstruct traffic through the process plant, nor interfere with the accessibility for the removal of equipment. They shall be routed away from hot environments, places with potential fire hazard or likely to be subjected mechanical abuse or vibration. Where necessary, the pipe run shall slope upwards or downwards, with drain or vent facilities at the lowest or highest points respectively.

4. EQUIPMENT INSTALLATION

Equipment and instruments shall be installed in accordance with the recommendation or instruction of the manufacturer. Wall-mounted panel shall be at least 10 mm clear from the wall.

Switchboard, control panels, floor-mounted panels and equipment shall be properly secured. Normally, four fixing bolts at corners of each panel shall be considered as the minimum. High voltage switchboard shall be mounted on unistrut channels embedded in the concrete floor. Marshalling boxes shall not be installed inside cable trenches.

High voltage motors shall be dried out on site prior to high voltage testing and energisation.

All mounting brackets, supporting steelwork etc. shall be supplied and installed by the Contractor. Steelwork shall be of adequate strength with suitable surface treatment for the prevailing conditions on site. Fabricated steelwork shall preferably be hot-dip galvanised.

Equipment labels shall be properly fixed or stencilled on the equipment to give a clear identification prior to cable termination particularly where a number of identical items are installed. "Danger", "Busbar Alive" and other warning labels shall be fixed prior to commissioning. Touch-up point shall be applied to scratched or bare metal surfaces.

5. CABLING INSTALLATION

5.1 Cable Installation

Cable trench shall be provided at ground level or basement for cable installation as far as practicable. Power cables of diameter 45 mm or above shall run at the bottom of the trench and small power or control cables shall run along side walls on cable trays. At other floors, cables shall run in cable gallery or under floor slab on trays supported by mounting racks or hangers. Cables for control boards in control room shall preferably run in raised floor.

Cable shall not be mounted on wall direct, cable trays shall be used and cables must run neatly in horizontal and vertical directions only. Cables connected to a group of wall-mounted electrical equipment shall follow one common vertical route in cable tray and then be diverted horizontally to the respective equipment in a neat and systematic manner.

Cables to floor standing equipment shall be properly supported by trays or unistrut channels. Fixing of the cable trays or channels on detachable parts of other equipment such as pipework shall not be permitted. The cable routing shall cause minimum obstruction to other plant.

5.2 Cable Tray Installation

Cable trays shall be mounted on channels. A minimum clearance space of 20 mm shall be allowed between cable tray and mounting wall. Cable trays supported at high levels shall have fabricated steel angle frames of robust construction and fixed onto the ceiling by expansion bolts. This method of installation and materials used shall have prior approval in writing. Cable trays shall have supports at spacing not more than 1200 mm.

Cable tray accessories shall be the standard range of products of the cable tray manufacturer for compatibility. Standard bends, tees, and reducers shall be used for trays jointing.

Cable trays shall be cut along a line of plain metal, not through the perforation. The burr on the cut edge shall be removed and the edge shall be treated with a compatible paint immediately after cutting. Holes in cable tray for the passage of cables shall be provided with rubber grommets, else bushed or lined.

5.3 Cable Laying Practice

Cables shall be unrolled from the drums in such a manner to avoid loops or kinks and care shall be taken when laying to avoid damage to the outer sheath caused by drawing over sharp obstacles. etc. Cable rollers shall be used whenever necessary.

The use of straight-through and tee joints boxes is prohibited unless approved

otherwise.

Cables in draw pits shall be gently snaked to avoid tension in the cable.

Draw wires shall be installed inside the cable duct to facilitate the drawing of cables. On pulling of cable inside the duct, pulling attachment shall be made to the cores, insulation, inner and outer sheath and not to the wire armour only. Cable ends shall be kept dry throughout all phases of handling, laying and jointing and every care must be taken to prevent the ingress of moisture.

Cablings through wall or floor opening shall have the through hole covered in sleeve or bushing to avoid any sharp edges damaging the cable. Cables through wall or floor inside a building shall be arranged to be sealed with fire resisting material of appropriate fire resistant rating equivalent to that of the enclosure after installation.

5.4 Cable Cleating

Power and control cables shall be cleated separately. Where die-cast cleats are not used, PVC coated brass strip shaped to the form of cables shall be used for cleating at a spacing to IEE Wiring Regulations. If the strip length exceeds 150 mm, intermediate fixing shall be provided such that the spacing between screws shall be within 150 mm. Cables shall be stacked in a single tier on tray.

Cables of 45 mm diameter and above shall be cleated individually with die-cast aluminium cleats with the separation between cables not less than 50 mm. Single core cables shall be cleated in trefoil die-cast cleats.

For mounting die-cast cleats of power cables on trench floor, channels shall be placed at intervals not exceeding 1000 mm across the trench, with the ends at least 25 mm from trench sides to avoid trapping of water between channels.

5.5 Cable Marshalling

Marshalling box may be used for termination of small cables for instrumentation and control purposes only. Supply to small electrical equipment from the individual HBC fuse/MCB shall not be routed through the marshalling or jointing box. Also, cables for emergency shutdown of plant and equipment shall not route through any marshalling box.

Cables termination in junction boxes or marshalling boxes shall have bottom entry and exit. The box shall be sized generously to permit adequate room for cable termination. For PVC cable, metallic conduit shall be used to enclose cables for mechanical protection.

5.6 Cable Termination

For XLPE and PVC insulated cables, brass mechanical glands and copper compression type lugs shall be used for termination. For PILC cables, wiping glands and solder type cable sockets shall be used for termination.

Terminations for PVC insulated power cables of 185 mm² and above, and PILC cables of any size shall be carried out with heat shrinkable terminations. Earthing of the single core cable sheath or armour shall be at the source end only and insulated gland shall be used at the power receiving end.

For power supply cables, the number of cable core shall match the exact requirement e.g. 4-core cable not to be used for 3-wire motor supply. For multi-core control cables, spare cores shall be terminated and properly ferruled. 20% spare cores shall be provided for control cable of 12-core or above.

Control cables terminated inside a panel shall be looped before termination to permit a change of terminated position that may be required later on. Cables terminated within a marshalling cubicle shall be similarly looped.

Cables for instrument signal shall be suitably screened and earthed at the receiving end only. Telephone cable cores for speak circuits shall be screened from other circuits.

Where cables are cut and laid, but there is a time lag before the cable is terminated, the Contractor shall seal up the ends with appropriate sealing end cap.

5.7 Cable Identification

Each and every cable shall be permanently identified by its cable number as shown on the cable schedule at each end, entry and exit points of buried ducts, exits from buildings and all such positions required to identify and trace the route of any cable. Cable tags for indoor use shall be manufactured from white rigid PVC material with engraved characters filled black. Identification for outdoor cables shall be 3mm stainless steel plate with engraved lettering fixed near termination.

All cores of power cables shall be identified with phase colours for three phase systems and red and black for single phase.

Control cables shall have individual cores identified by means of suitable permanent ferrules at both ends in accordance with the approved termination schedules. Core identification ferrules shall bear the same numbering as the terminal to which the core is connected. Where this number is different from the number at the other end of the core then that different number shall also be included as a double ferrule.

Concrete cable markers shall be provided at the ground surface on top of the directly laid cables along the route and at locations of bends and joints.

6. EARTHING

Plate electrodes where used shall be installed by the Contractor prior to backfilling of soil around the building. This part of the work may have to be carried out before

commencement of the erection period subject to one week advance notice from the Engineer's Representative.

Buried earth conductors shall be at least 900 mm from the ground surface. Exposed earth conductors shall be fixed on the building structures or trench wall by means of brass clamps, suitably spaced, and neatly run vertically, horizontally or parallel to adjacent walls, ceilings, beams etc.

Markers shall be provided at the ground surface on top of the buried earth plates.

Test links shall be provided in cable trenches such that they are easily accessible for routine inspection and testing.

All joints shall be by means of bracing or "thermal weld". The joints shall be covered with green PVC sleeves after inspection and testing.

All exposed metallic parts of steel platform, pipes, equipment casing, cable boxes etc. shall be connected to the adjacent earth network to conform with the I.E.E. Wiring Regulations. Earth conductors shall be connected to the equipment at the stud terminals designed for the purpose. Prior to testing of an item of the Plant, the station earth network shall be completed and the item under test shall be properly connected to the earth network.