

VOLUME: II-A PART 3
SUBMISSION TO BE MADE ON AWARD OF CONTRACT

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Submission to be Made on Award of Contract

2.1 Introduction

This Part sets out the technical requirements that are general to the Contract.

2.2 Technical Standards and Regulations

Except where otherwise specified in the bid document plant, materials and workmanship shall comply with the requirements of the relevant Indian Standards (hereinafter referred to as IS) issued by the Bureau of Indian Standards (BIS). Other equivalent National or International Standard Specifications such as those issued by the International Organisation for Standardisation (ISO) or the International Electro technical Commission (IEC) may be substituted by the Contractor (so as long as they are more stringent than the equivalent IS) at the sole discretion of the Engineer or as may have been agreed in the Contract. All standards used shall be the current and latest version.

All works shall comply with all relevant statutory regulations and standards current at date of bids, unless otherwise indicated within the Employer's Requirements. Electrical installations shall, where relevant, be in accordance with the Indian Standards Code of Practice for Electrical Wiring Installations IS 732.

All materials, plant and equipment shall be new and all materials and workmanship not fully specified herein or covered by an approved standard shall be of such kind as is used in first class work and suitable to the climate in the project area.

Indian Standard Specification (I.S.) issued by the Bureau of Indian Standards, (earlier known as Indian Standards Institution), Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002, or to any other equivalent Standard it shall be to the latest revision of that Standard at the Tender opening date.

All details, materials and equipment supplied and workmanship performed shall comply with these Standards. If the Bidder offers equipment to other Standards, the equipment/material should be equal or superior to those specified and shall be subject to approval by the Engineer and full details of the difference shall be supplied by the Contractor. In the event of conflict between this Specification and the Codes for equipment, the most stringent provision shall govern, except as otherwise approved by the Employer.

2.3 Precedence of Employer's Requirements

The requirements specified in the Particular Requirements parts, shall be in addition to those specified in the General Requirements parts. In case of conflict between the parts, the requirements of the Particular Requirements parts shall take precedence.

2.4 Units of Measurement

All designs, drawings, specifications and manuals shall use SI units and all measurements, dimensions and performance data shall be quoted in those units.

2.5 Programme

In accordance to Conditions of Contract, the Contractor shall submit within in the stipulated time detailed contract programme for approval, which shall include details of all temporary and permanent works, construction procedures and methodologies.

In addition to the requirements set down in the Conditions of Contract the programme shall include the following details:

- (a) Contractor's organisational family tree for the Contract including details of all site supervisors and their responsibilities;
- (b) A statement giving the numbers and categories of supervisory and technical staff and skilled and unskilled labour to be employed on the Works;
- (c) A list and type details of major constructional plant (including vehicles) which the Contractor proposes to employ on the Works, including programmed dates for order and delivery;
- (d) Details of the Contractor's methods of working for all operations;
- (e) A statement giving the proposals for location or locations and sizes of offices, workshops and stores at the Site;
- (f) A complete resource allocation showing the number of units and allotted times for each unit of constructional plant, materials and labour allocated to each part of the Works;

The programme shall be co-ordinated to take into account the requirements of climatic, groundwater and other conditions to provide for the completion of the Works in accordance with the Contract.

The programme shall be prepared using MS Project software and shall be submitted in both electronic softcopy and paper hardcopy form.

2.6 Contract Management

The Contractor shall be responsible for administration of the Contract from award of Contract through design, manufacture, manufacturer's works testing, and delivery of Plant to Site, installation, testing and performance testing to final take over. For this purpose he shall nominate a Contractor's Representative in accordance with the General Conditions of Contract who shall be fully responsible for and undertake this administration.

Specific responsibilities of the Contractor's Representative shall be:

- (a) The sole representation on behalf of the Contractor in all discussion, correspondence and matters relating to the Works.

- (b) The co-ordination and monitoring of Contract progress, which shall include the preparation of the Contract programme, monitoring of progress and submission of monthly progress reports. At the discretion of the Engineer, regular meetings shall be called at which the Contractor's Representative shall give a full account of the Contract progress and programme.
- (c) The co-ordination and checking of designs, drawings and submissions. The Contractor's Representative shall be responsible for co-ordinating the design, technical information and data between sub-contractors. All calculations, drawings and information submitted to the Engineer shall be checked by the Contractor's Representative and certified as having been checked before submission.
- (d) Contract communication between the Engineer and the Contractor. The Contractor's Representative shall attend all meetings involving the Contractor and the Engineer.
- (e) The co-ordination and programming of manufacturer's works tests and the submission of test certificates.
- (f) The co-ordination and programming of Plant delivery.
- (g) The co-ordination and programming of the installation of Plant on the Site, site tests and take over trials. The Contractor's Representative, although not necessarily based at the Site, shall be responsible for the various sub-contractors. At the discretion of the Engineer regular site meetings will be held during which the Contractor's Representative shall give full account of site progress and programme.
- (h) The Contractor's Representative shall also be responsible for producing in advance of the work being undertaken, detailed method statements of any work, which involves or affects the performance of existing equipment, processes, or disruption to existing water supplies.
- (i) The co-ordination and preparation and submission of As-Built Drawings and Operation and Maintenance Manuals.
- (j) Soft copies of all submissions should be in editable form.
- (k) The preparation and co-ordination of training of Employer's Personnel.
- (l) The submission of applications for payment.

2.7 Meetings

From time to time the Engineer will call meetings in his office or at the Contractor's office, or at the Site, as he deems necessary, to discuss progress and any technical points requiring settlement.

The Contractor's Representative or responsible representative shall attend such meetings.

The Contractor shall prepare and submit to the Engineer a daily activity report summarising the main activities undertaken each day

2.8 Site Photographs

In accordance with the requirements of the Conditions of Contract the Contractor shall supply negatives of photographs and unmounted positive colour prints not less than 250mm x 200mm of such portions of the Works, in progress and completed, as may be directed by the Engineer and specified herein. Contractor shall submit digital photographs in electronic

format on any standard digital media such as memory card or CD for every fortnightly. No prints of these soft copies shall be supplied to any other person without the written permission of the Engineer.

The photographs shall be of following categories:

- progress photographs
- record photographs
- Video (CD)

All categories of photographs shall be properly referenced to the approval of the Engineer, and on the back of each print shall be recorded the date and time of the photograph, the direction in which the camera was facing, an identifying description of the subject and the reference.

The taking of photographs of the Works by the Contractor for any other purpose whether for use in India or in any other country shall not be carried out without written approval from the Engineer-In-Charge.

2.9 Setting Out of the Works

The Contractor shall set out the Works, and carry out the Contractor's quality control procedures verifying the accuracy and precision of the setting out for each item of the works. The Contractor shall notify the Engineer sufficiently in advance of the setting out to enable the Employers Representative to observe the accuracy and precision of the laying out. The observations of the Engineer shall not relieve the Contractor of the responsibility under the Contract for the accuracy and precision of the setting out.

2.10 Engineer's Requirements

The Contractor shall provide the following for use by Engineer at the each proposed plant sites covered under the contract. These items are to be maintained by the Contractor in proper, safe, and clean working condition throughout the construction period and shall be returned to the Employer after completion of works.

No separate payment shall be made for the items covered here.

2.10.1 Office Facilities

A separate office for the sole use of the Engineer, his staff and Consultant shall be provided by the Contractor at STP site. The Contractor shall provide, erect, furnish, clean, maintain and subsequently transfer the office and associated furniture/items to the Employer after the completion of works. The carpet area of the office shall not be less than 50 Sq. Meter.

The walls shall be of 230mm thick brick masonry, plastered and with oil bound distemper on the inner face and snowcem on the outer face. RCC roofing at 3 metre from floor, painted with oil bound distemper shall be provided. The doors shall be of first quality wood and steel windows of approved quality shall be provided. The flooring for the office building shall be

minimum 2.5mm thick Vinyl over PCC base. Before commencing the construction of the office, the Contractor shall submit to the Engineer for his approval a drawing of the proposed building with all architectural and finishing details fully shown. The location of the office shall be as directed by the Engineer.

The Contractor shall furnish the rooms as detailed in Volume III, Price schedule.

2.10.2 Assistance to the Engineer

The Contractor shall provide all necessary assistance to the Engineer and his staff in carrying out their duties of checking, inspecting, and measuring the Works. The Contractor shall provide, at no additional cost, chainmen, staffmen, office attendants, and labourers as may be needed from time to time by the Engineer.

The Contractor shall provide for the Engineer and his staff, consultants and their staff and visitors such protective clothing, safety helmets and rubber boots of suitable sizes, hand lamps and the like as may be reasonably required by them. These articles shall remain the property of the Contractor. No extra payment shall be made on this account

2.11 Erection of Plant

Erection of Plant shall be phased in such a manner as not to obstruct the work being done by other contractors.

Before commencing any erection work, the Contractor shall check the dimensions of structures where the various items of Plant are to be installed and shall bring any deviations from the required positions, lines or dimensions to the notice of the Engineer.

Plant shall be erected in a neat and workmanlike manner on the foundations and at the locations shown on the Approved Drawings. Unless otherwise directed by the Engineer, the Contractor shall adhere strictly to the aforesaid drawings.

The Contractor shall be responsible for setting up and erecting the Plant to the line and level required and shall ensure that all Plant is securely held and remains in correct alignment before, during and after grouting-in. This responsibility shall not be passed to any other contractor.

Any damage caused by the Contractor during the course of erection to new or existing plant or building or any part thereto, the Contractor shall at his own cost, make good, repair or replace the damage, promptly and effectively as approved by the Engineer and to the Engineer's satisfaction.

2.12 Site Labour and Supervision

The Contractor shall provide all the skilled and unskilled labour required, and all necessary tools and equipment, to erect, test and commission the Works within the period agreed in the

programme. The Contractor shall not remove any supervisory staff or skilled labour from the Site without the Engineer's prior approval.

2.13 Sub-letting

The Contractor shall not sub-let the whole of the Works. Where any design or manufacture is sub-let, the Contractor shall not be relieved of his obligation under the Contract. The Contractor shall be responsible for the acts, defaults and neglect acts in manufacture or design of any sub-contractor, as if they were his own.

Where the Engineer has consented to supply of Plant or execution of work by manufacturers or sub-contractors proposed by the Contractor, such manufacturers or sub-contractors shall not be changed without the prior approval in writing of the Engineer. A copy of every sub-order shall be sent to the Engineer at the time the order is placed each clearly marked with the title of the Contract and the Contract number.

2.14 Temporary Works

Not less than 7 days before commencing any portion of the Works, the Contractor shall submit to the Engineer for his approval comprehensive drawings and calculations for all Temporary Works which the Contractor proposes for the construction of that part of the Works.

Notwithstanding approval by the Engineer of any design for the Temporary Works, the Contractor shall be entirely responsible for their safety, efficiency, security and maintenance and for all obligations and risks in regard to such Temporary Works specified or implied in the Contract.

2.15 Languages

All drawings, instructions, signs, notices, name-plates, etc. for use in the design, construction, operation and maintenance of the Works shall be in English.

All site sign boards and warning signs shall be in Hindi and English Languages.

2.16 Drawings and Information to be provided

2.16.1 General

The drawings that will be prepared and issued for this Contract shall be classified as follows and where relevant shall be to a scale which is suitable for the representation of those details illustrated.

The term Drawing shall be deemed to include all drawings, schedules, lists, software documentation, descriptive text and calculations necessary for the design, construction, operation and maintenance of the Works and referred to in this clause.

Drawings and all other submittals required by this contract shall be submitted in editable electronic softcopy format on CD(s) or DVD(s) as well as in hardcopy paper format.

The softcopy format for various items shall be as follows:

- Drawings: AutoCAD version 2008
- Text Documents: Microsoft Word version 2003 or 2007
- All programmes and schedules related to the project: Microsoft Project version 2003 or 2007
- Spreadsheets, calculations, tables, technical schedules, prices schedules, and other numerical data: Microsoft Excel version 2003 or 2007
- Databases: Microsoft Access version 2003 or 2007
- All other required information not included in the above: Adobe Portable Document Format (PDF) version 7.x

The hardcopy format/sizes for various items shall be as follows:

- Drawings: Standard A1 size paper. The scale for each drawing shall be selected such that the information is presented without any clutter or ambiguity and is clearly and easily legible without the use of magnifying aids other than a reader's normal eye-glasses.
- All other information: Standard A4 or A3 paper size, except for any pre-printed standard information such as brochures or catalogue information, which may be submitted in the original size and format.

2.16.2 Drawing Format and Numbering

All drawings shall be prepared using an identical title block format. This shall be approved by the Engineer and shall identify the project, drawing title, the Employer, the Contractor, Sub-contractor, if applicable, and the Engineer.

A formalised drawing numbering system shall be adopted with digits of each number, referencing location, revision, drawing type and size. The numbering format and allocation of drawing number blocks shall be approved by the Engineer.

The Contractor shall provide a sequential numbering system for all Construction Documents. The drawing number shall not be repeated or duplicated.

All drawings shall be submitted to a formalised checking procedure prior to submission. Drawings not so checked will not be approved.

2.16.3 Bidder's Drawings

The Bid Drawings are those issued to Bidders either with the Bidding Documents for the purpose of illustrating and clarifying the Works described in the Employer's Requirements or later during the bidding period as part of an Addendum to the Contract Documents.

Such drawings shall be deemed to have been issued for the guidance of Bidders and shall, for the purpose of executing the Works, be superseded by the Construction Documents.

2.16.4 Bid Drawings and Details

The Bid drawings are those furnished by a Bidder with his Bid for the purpose of illustrating and clarifying his proposals.

The following drawings, details and specific information pertaining to the entire STP package shall be furnished by the Bidder for each STP in the technical envelope in addition to other information mentioned elsewhere in the bid. The lists provided below shall not be considered comprehensive. The bidder shall be responsible for including any and all drawings and information for any and all works that may be necessary for full and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

General and Process

- (i) Narrative Description of the Works
- (ii) Plant Operation and Control Philosophy
- (iii) Sizing and Design Calculations covering all Major Unit Processes and components of the Works
- (iv) List of all structures (basins, tanks, channels, buildings, etc.) including dimensions and freeboards
- (v) Complete Equipment List
- (vi) All Equipment Catalogues and selection chart (with all relevant manufacturers' documentation).
- (vii) Major Piping Schedule to include service (process stream), installation type (e.g., buried, exposed, submerged, etc.), size, material, coating, lining, joint type(s), gauge/thickness, pressure rating, testing protocol, design standards
- (viii) Major Valve Schedule to include service (process stream), installation type (e.g., buried, exposed, submerged, etc.), size, type, material, joint type(s), pressure rating, differential pressure rating, testing protocol, design standards, operator/actuator type, and whether Open/Close or Modulating
- (ix) Major Gate Schedule to include service (process stream), installation type (e.g., buried, exposed, submerged, etc.) size, type, differential head, seating or unseating, testing protocol, design standards, operator/actuator type, and whether Open/Close or Modulating
- (x) Plant Layout.
- (xi) Hydraulic Profile.
- (xii) Process Flow Diagram.
- (xiii) Piping and Instrumentation Diagrams (P&IDs)
- (xiv) Electrical Load List & Power Consumption Chart.
- (xv) List of Chemical Consumption on Daily/ Monthly Basis.

Mechanical

- (i) To-scale dimensional layout and/or installation drawings minimum for the following Equipment :
 - Major gates
 - Fine Screens
 - Grit removal equipment
 - Fine Bubble Diffusers
 - Process Air Blowers
 - Secondary Clarifiers
 - Return activated sludge pump sets
 - Gravity Sludge Thickeners
 - Thickened sludge pump sets
 - Sludge Dewatering Centrifuges
 - Chlorination system
 - Plant Water Pumps
 - Plant Drain Pumps
- (ii) Graphs for all major pumps and blowers (including but not limited to Return Activated Sludge Pumps, Thickened Sludge Pumps, Centrifuge Feed Pumps, Process Air Blowers)
 - Pump Performance Curves : Q vs H, speed, P, Efficiency, and NPSH
 - ISO-efficiency curves of the pump model proposed

Electrical

- (i). Equipment layout
- (ii). Earthing layout
- (iii). Cable routing layout
- (iv). Lighting and power layout
- (v). Electrical Load List
- (vi). Electrical Single Line Diagram of STP
- (vii). Sizing Calculations for Transformers and DG Sets
- (viii). Specific Energy Consumption
- (ix). Technical Schedules for Electrical Works duly filled in
- (x). Instrumentation SCADA
- (xi). Construction schedule

Instrumentation, Control & Automation

- (i) P&IDs for the complete process indicating all the local & remote /panel mounted measurements & controls, alarm & interlocking functions, using ISA symbols.
- (ii) Consolidated instrument list (Instrument Index) indicating description, application, location, type, quantity, accuracy, process parameters, measuring ranges, etc.
- (iii) Tentative instrumentation power (UPS & Non UPS) & air requirements, as applicable.

- (iv) Automation system configuration diagram along with a write up explaining the system functions, redundancy features, interfacing with other systems, etc.
- (v) Broad bill of materials for the Instrumentation & Automation equipment & peripherals.
- (vi) Tentative I/O list.
- (vii) Control Room Layout indicating disposition of various panels, cabinets, consoles, etc. with dimensional details (approx). Heat load in the control room shall be furnished.
- (viii) List of spares and consumables with details and quantities.

2.16.5 Details of Drawings and Calculations to be submitted by the Contractor for Approval

Drawings / Calculations for approval shall be submitted by the Contractor after award of the contract in two Phases.

The first phase shall be the Preliminary Drawings / Designs. Drawings / Designs submitted during this phase shall be of sufficient detail for the Employer and Engineer to understand in outline the Contractor's proposals for the design and construction of the Works. The lists provided below shall not be considered comprehensive. The bidder shall be responsible for including any and all drawings and information for any and all works that may be necessary for full and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

The Preliminary Drawings / Designs for each STP shall comprise:

- Detailed Description of the proposed Sewage Treatment Plant and Treatment Process offered (including Raw and Treated Sewage Quality).
- Detailed Plant Operation and Control Philosophy;
- Detailed Process Design Calculations / Mass Balance Calculations covering all Units/ Equipment.
- Detailed List of Units including Unit Dimensions/ Free Boards.
- Detailed Equipment List
- Major Equipment /Instrument Specifications (with supporting Brochures).
- Major Piping Schedule to include size, material, coating, lining, gauges/thickness, and pressure rating
- Major Valve Schedule to include size, type, material, pressure rating, operator/actuator type, and whether Open/Close or Modulating
- Gate Schedule to include size, type, differential head, seating or unseating, operator/actuator type, and whether Open/Close or Modulating
- Detailed Plant Layout (including Pipe Sizes/ Pipe Routing/ Channel Size/ Channel Routing/ Site Roads/ Site Drainage)
- Detailed Hydraulic Profile including Hydraulic Calculations;
- Detailed Process Flow Diagram (inclusive of Mass Balance)
- Process and Instrumentation Diagram (P&ID) & SCADA.
- Detailed Electrical Load List for STPs, prepared based on approved Equipment list from process and Mechanical

- Transformer sizing calculation for STPs, based on approved Electrical load list
- D.G sizing calculation for STPs based on approved Electrical load list
- Detailed Chemical Consumption Calculations (Daily/ Monthly Basis).

The second phase shall be the Detailed Engineering Design phase and shall comprise the submission of the Detailed Mechanical/ Electrical/ Instrumentation/ SCADA/ Structural/ Civil Construction Drawings and Calculations. These shall be submitted after the approval of the Preliminary Drawings. The lists provided below shall not be considered comprehensive. The bidder shall be responsible for including any and all drawings and information for any and all works that may be necessary for full and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

The Construction Documents shall be used for the construction of the Works and shall comprise:

Civil

Site layouts for each STP providing information on levels and detailing the location of:

- General arrangements and main sections of all plant areas;
- Plans, elevations and main sections of all structures and buildings;
- Buildings
- Storage tanks;
- Process plants;
- Transformer enclosures
- Roadways;
- Drainage (plant drainage, sanitation and storm water drainage);
- Buried pipelines;
- Cable routes for direct in ground and ducted systems;

Detail drawings of:

- Cable and pipework chambers;
- Buried pipework;
- Pipework connections;
- Contract interface;
- Reinforcement drawings;
- Bar bending schedules.

Calculations for:

- Detailed Structural Design calculation of all the units/ Structures;

Hydraulic

- Detailed hydraulic profile;
- Detailed hydraulic calculations

Process**Drawings:**

- process flow diagram;
- comprehensive P&ID s including details of:
 - pipeline sizes and materials;
 - valve size and type;
 - Equipment detail
 - instrumentation;
 - Identification of controlling PLC.

Calculations for:

- Detailed Process Design Calculations / Mass Balance Calculations covering all Units/ Equipment.
- Detailed List of Units including Unit Dimensions/ Free Boards.
- Detailed Equipment List
- Major Equipment /Instrument Specifications (with supporting Brochures).
- Major Piping Schedule to include size, material, coating, lining, gauges/thickness, and pressure rating
- Major Valve Schedule to include size, type, material, pressure rating, operator/actuator type, and whether Open/Close or Modulating
- Gate Schedule to include size, type, differential head, seating or unseating, operator/actuator type, and whether Open/Close or Modulating
- Detailed Process Flow Diagram (inclusive of Mass Balance)
- Detailed Chemical Consumption Calculations (Daily/ Monthly Basis).

Mechanical**Drawings:**

Outline dimensional drawing & Cross section Drawing (with Bill of Quantity and Material of construction) for the following items for each STP but not limited to:

1.	Fine screens
2.	Belt Conveyor for screenings
3.	Sluice valve – motorised
4.	Sluice valve – manually operated
5.	Non-Return valves
6.	Knife Gate Valves
7.	Dismantling joints
8.	H.O.T & E.O.T Cranes
9.	Sluice gate – Manual & Motorised
10.	Dewatering Pumpset
11.	Grit removal equipment
12.	Fine Bubble Diffused Aerators along with Grid

13.	Process Air Blowers
14.	Secondary Clarifier
15.	Return activated sludge Pumpset
16.	Chlorination system
17.	Chlorination system
18.	Plant Drain Pumps
19.	Plant Water Pumps
20.	Sludge Dewatering Centrifuges
21.	Gravity Sludge Thickeners
22.	Thickened sludge pump sets
23.	Sludge conveyor system & Hopper
24.	Sludge Dewatering Centrifuge Feed Pumps
<p>Graphs for all major pumps and blowers (including but not limited to Return Activated Sludge Pumps, Thickened Sludge Pumps, Centrifuge Feed Pumps, Process Air Blowers):</p> <ul style="list-style-type: none"> • Pump Performance Curves : Q vs H, speed, P, Efficiency, and NPSH • Iso-efficiency curves of the pump model proposed 	
	Motor Curve
(i)	Starting Current vs time
(ii)	Characteristics

Electrical

Drawings

Single Line Diagram of Complete Electrical System for STP based on the equipments finalized by Mechanical and Process.

- (1) Electrical Substation Layout of STP showing Panel locations, Transformer locations and Trench Layout.
- (2) 11kV Switchgears
 - (a) Dimensional Drawing showing overall dimensions, plan, elevation and cable entry details.
 - (b) Complete assembly drawings of the Switchgear showing plan, elevation and typical sectional views, details of busbars and location of cable end boxes and control cable terminal blocks for external wiring connections, etc.
 - (c) Foundation plan showing the location of channel sills, anchor bolts and anchors, floor plans and openings.
 - (d) Schematic power and control wiring diagrams along with control & interlock details, complete bill of materials indicating make, type, rating, setting etc of Circuit breakers, relays, contactors, current transformers, potential transformers, instruments, meters, annunciations etc .
- (3) Outdoor pole Structure
 - (a) Detail designs and Structural/ fabrication Drawings showing member sizes and their fixing details, foundation details, etc.

- (b) General arrangement drawing shall indicate the overall dimensions, net weights, mounting and fixing details of insulators, lightning arrestors, disconnector, drop-out fuses, etc.

(4) Diesel Generator Set

- (c) GA Drawing showing overall dimensions ,plan, elevation, sectional views, mounting arrangement, layout, make, type, rating etc of diesel engine, Alternator, Control panel, battery, battery charger etc.
- (d) Single Line & Schematic diagrams showing details of Power & Control, Change over, AMF details, Synchronising details, interlocks, protections annunciations, battery, battery charger etc with make, type, rating, setting etc of various equipment, components etc.
- (e) Foundation plan showing the location of channel sills, foundation, anchor bolts and anchors, floor plans and openings.
- (f) Exhaust system with piping layout
- (g) Day oil tank sizing with mounting arrangement details
- (h) Fuel bulk storage tank sizing with mounting arrangement details
- (i) Fuel supply system with pipe arrangement.

(5) Transformers

- (a) General arrangement drawing of the transformer, showing plan, front elevation and side elevation complete with all accessories and fittings, detailed dimensions, net weights, quantity of oil, clearances between HV terminals, between LV terminals, between HV and LV terminals, between HV & LV terminals and ground etc.
- (b) Rating, diagram and terminal marking, complete with polarity and vector group.
- (c) Control wiring diagram for marshalling box.
- (d) Foundation drawing with position of foundation bolts and depth.

(6) L.T Panels, Distribution Boards, Power Control Centres, Power Motor Control Centres, Motor Control Centres etc.

- (a) Dimensional Drawing showing overall dimensions, plan, elevation and cable entry details.
- (b) Complete assembly drawings of the switchboard/distribution board / MCC showing plan, elevation and typical sectional views ,details of busbars and location of power & control cable terminal blocks for external wiring connections, etc.
- (c) Foundation plan showing the location of channel sills, anchor bolts and anchors, floor plans and openings.
- (d) Schematic power and control wiring diagrams along with control & interlock details, complete bill of materials indicating make, type, rating, setting etc of Circuit breakers, relays, contactors, current transformers, potential transformers, instruments, meters, annunciations etc .

- (e) Feeder Operation and Interlock logic.
- (7) L.T Capacitor bank with Automatic Power Factor Correction Relay
 - (a) Fully dimensioned general arrangement drawings of capacitor and capacitor control panel with elevation, side view, sectional view and foundation details.
 - (b) Justification for number of steps for switching.
 - (c) Complete schematic and wiring diagrams for capacitor control panel.
- (8) Variable Frequency Drives
 - (a) Dimensional details with mounting arrangement.
 - (b) Schematic power and control wiring diagrams along with control & interlock details, complete bill of materials indicating make, type, rating, setting etc of Circuit breakers, relays, contactors, current transformers, potential transformers, instruments, meters, annunciations etc .
 - (c) Specific details of converter, inverter and harmonic control units.
- (9) Battery and Battery Charger with D.C. Distribution board
 - (a) Dimensioned general arrangement drawings
 - (b) Fully dimensioned general arrangement drawings of battery and battery charger with elevation, side view, sectional view and foundation details
 - (c) Complete schematic and wiring diagrams
- (10) Cabling System
 - (a) Make and type of HT& LT Power and Control Cables.
 - (b) Details of Installation of Cables in Trenches, on cable trays, directly buried Etc at all locations inside the plant.
 - (c) Cable routing plan and section inside the plant.
 - (d) 11kV Cable termination and mounting Kit Layout drawing.
- (11) Lighting system
 - (a) Make, type, rating etc of various fixtures, receptacles, switches etc in various premises.
 - (b) Make, type, rating etc of various fixtures, lighting poles etc for street lighting and flood lighting.
 - (c) Detailed Room wise Lighting Layout with Type of fixture details and Circuit diagram showing phase wise load distribution and interconnection between switches, fixtures, Lighting panel, receptacles etc.
 - (d) Internal road Lighting and Area lighting layout with location of poles, details of fixtures and mounting.

(e) Street Light pole details with Foundation details.

(12) Earthing System

- (a) Details such as material, sizes, etc. of the earth conductor and electrode pits.
- (b) Earthing layout drawing showing routing of main grid inside the plant with details of interconnection of equipment earthing to the grid and earth pits.

(13) Electrical Equipment and Panel Layout for STP.

Schedules

- (1) Cable schedules & bill of quantities
- (2) Electrical Load and Power consumption schedule
- (3) Junction box schedule
- (4) Protection relay setting schedule.

Calculations

- (1) Specific Energy Consumption Calculations.
- (2) Bus bar sizing calculation for 11 KV Switchgears, 415 V Switchgears etc.
- (3) Co-ordinated protection study.
- (4) Fault level and Voltage Dip Calculations.
- (5) Sizing of Capacitor banks.
- (6) Non Segregated Bus Duct
 - (a) Sizing of the bus bars vis-à-vis thermal capability to withstand rated Continuous current and one second short time current.
 - (b) Spacing of the insulators vis-à-vis mechanical strength to withstand forces due to momentary short circuit current.
 - (c) Heat loss and temperature rise calculations for conductor and enclosure. All formulae and other information from which the heat losses have been derived shall be enlisted.
- (7) HT and LT Cable sizing.
- (8) Earthing sizing calculation
- (9) Room wise Lighting Calculation as per Lux level given in the specification.
- (10) Building Lightning Protection and Earthing Sizing Calculation.

Control and Instrumentation

Drawings:

- power supply distribution single line and schematics diagrams (see note 1) for each control panel;
- internal and external (see note 2) general arrangement for each control panel (dimensional);
- Control panel wiring diagram, , relay logic diagram along with terminal block details;

- System configuration and layout diagram along with bill of material, program listings, block logic diagram and control logic write up for PLC;
- UPS and battery sizing calculations;
- control and instrumentation loop drawings (see note 3);
- instrument installation detail drawing (hook up, see note 4);
- cable block diagrams;
- cable routing/installation drawings;
- foundation and fixing details and trenches drawings;
- Mimic general arrangement (full colour copies shall be provided).

Schedules:

- cable schedule;
- cable interconnection schedule;
- control and instrumentation load schedule for each control panel;
- I/O schedule;
- junction box schedule;
- instrument schedule with tag nos;
- instrumentation, process control set point schedule;
- instrument data sheets;

Documentation:

- functional design specification (FDS)(see note 5);
- factory acceptance test document (FAT);
- site acceptance test document (SAT).

Notes:

1. Schematic drawings shall include a comprehensive schedule of the components used in each switchboard, MCC and control panel including details of the type, manufacturer and rating of each component.
2. The external arrangement of each switchboard, MCC and control panel shall show the arrangement of all components including details of panel section, switch and instrument labels.
3. Control and instrumentation loop drawings shall show on a single drawing the complete circuit associated with an instrument or device including details and location of power supplies, cabling and terminations.
4. Hook up drawings shall detail how an instrument or device is installed.
5. See details later for requirements of the FDS.

Electrical control schematics, loop diagrams and schedules shall where practical be A3 size drawings; all other drawings shall be A1 size.

Mechanical Building Services

Drawings:

- single line schematics for waste water system and drainage systems;
- general arrangement drawings showing the location of each mechanical building service plant item;
- general arrangement of ventilation systems;
- Fixing details.

Schedule:

- plant data sheets with Equipment GA dimensional drawing, Foundation detail, Calculation and Manufacturer's Quality Assurance Plan;
- pipeline schedules;
- Valve schedules.

Calculations for:

- System & Equipment sizing.

The Engineer reserves the right to ask for additional Equipment/system information apart from the above to ascertain good system design and proper selection of Equipment.

2.17 Operating and Maintenance Manuals

2.17.1 General

2.18 Submission of Documents and Drawings

The Contractor shall supply to the Engineer 5 (five) copies each of the drawings and design calculations for the process and sizing of all components of the System including architectural, structural, mechanical, electrical and instrumentation equipment, supported by flow diagrams and general arrangement drawings for approval.

The Engineer may require the Contractor to submit for approval additional drawings if they are necessary to enable him to satisfy himself that the items are well designed, that they comply with the Employer's Requirements and that they are suitable for their intended purpose. These drawings shall form the agreed basis for the execution of the Works. If an approved drawing is revised, revised copies shall be submitted for approval as above and no such revised drawing shall be used for the purposes of the Contract until it has been approved in place of the earlier issue of the drawing.

The Employer shall arrange to send observations if necessary within 28 (twenty eight) calendar days of submission of the design and drawings for modifications to the Contractor. The Contractor shall incorporate all necessary comments of the Engineer in the above design and drawings, if any, and shall re-submit further 5 (five) copies each of the revised designs and drawings within 10 (ten) days for the final approval of the Engineer. The Contractor shall thereafter submit 8 (eight) copies each of the approved designs and 8 (eight) copies each of the approved drawings together with one copy each of the

reproducible tracings. The Engineer will return 2 (two) approved copies to the Contractor and retain 6 (six) for the Engineer's office and field use.

If the submissions require more than one round of revision on account of incomplete compliance from Contractor, the delay will be on account of the Contractor. If new observations are given by the Engineer, the Contractor will be entitled to take an additional 10 (ten) days period for compliance.

The Engineer will signify his approval or disapproval of the Preliminary Phase Drawings / Construction Documents within 28 (twenty eight) calendar days of each submission.

The structural designs shall be submitted along with STAAD files (input and output).

The Construction Documents are certified Drawings submitted by the Contractor to the Employer or Engineer during the course of the Contract for approval. Construction Documents shall be submitted in accordance with the timetable set down in the Work Programme.

Approval of drawings by the Engineer shall not be held to relieve the Contractor of his responsibilities under the Contract.

The construction drawings shall be submitted in A3 / A1 sized drawing papers and to readable scale.

The Engineer will not permit construction to start on a part or section of the Works unless Construction Documents for that part or section have been approved.

Draft copies of the O & M Manuals shall be submitted to the Engineer for his approval at least 56 (fifty six) calendar days prior to the commencement of Tests on Completion.

The Engineer will signify his approval or disapproval of the O & M Manuals within 28 (twenty eight) calendar days of submission.

Draft As-Built Drawings shall be submitted 56 calendar days prior to the commencement of Tests on Completion.

The Engineer will signify his approval or disapproval of the As-Built Drawings within 28 (twenty eight) calendar days of submission.

To remove doubt the submission dates referred to above shall be the dates on which the drawings and documents are received by the Engineer.

2.19 Notice of Operations

The Contractor shall give full and complete written notice of all important operations to the Engineer sufficiently in advance to enable the Engineer to make such arrangements as the

Engineer may consider necessary for inspection and for any other purpose. The Contractor shall not start any important operation without the written approval of the Engineer.

2.20 Protection of Existing Installations

The Contractor shall apply to the Engineer in writing at least 28 days before starting any work that involves interference with existing structures, equipment, etc. The Contractor shall not execute such work until he has received permission to proceed, in writing from the Engineer.

The Contractor shall ensure that no earth, debris or rock is deposited on public or private roads or rights of way as a result of the Works and all vehicles leaving the Site shall be cleaned accordingly.

2.21 Protection of Existing Public and Private Services

The Contractor shall notify all public authorities, utility companies and private owners of proposed works that will affect them not less than two weeks before commencing the works.

The Contractor shall adequately protect, uphold, maintain and prevent damage to all services and shall not interfere with their operation without the prior consent of the public authorities, utility companies, private owners, or the Engineer as appropriate.

If any damage to services results from the execution of the Works, the Contractor shall immediately:

- (a) Notify the Engineer and appropriate public authority, utility company or private owner.
 - (b) Make arrangements for the damage to be made good without delay to the satisfaction of the public authorities, utility company or private owner as appropriate.
- The Contractor shall be liable for all costs for making good such damage.

The Engineer may issue instructions or make other such arrangements as he deems necessary, to repair rapidly any essential services damaged during the execution of the Contract. Such arrangements shall not affect any liability to pay for making good the damage.

2.22 Reinstatement and Compensation for Damage to Persons or Property

The Contractor shall reinstate all properties whether public or private which are damaged in consequence of the construction and maintenance of the Works to a condition as specified and at least equal to that obtaining before his first entry on them.

If in the opinion of the Engineer the Contractor shall have failed to take reasonable and prompt action to discharge his obligations in the matter of reinstatement, the Engineer will inform the Contractor in writing of his opinion, in which circumstances the Employer reserves the right to employ others to do the necessary work of reinstatement and to deduct the cost

thereof as certified by the Engineer from any money due or which shall become due from the Employer to the Contractor.

The Contractor shall refer to the Employer without delay all claims, which may be considered to fall within the exceptions listed in the Conditions of Contract.

2.23 Packing and Protection

Before any Plant is despatched from a manufacturer's factory it shall be adequately protected and packed to ensure that it will arrive on the Site in an undamaged condition. The methods employed for protection and packing must be suitable for withstanding the conditions which may be experienced during shipment, delivery to the Site and prolonged periods of storage in the open, whether the items are shipped in packing cases, crates or only partially protected according to their nature.

Bright parts and bearing surfaces shall be protected from corrosion by applying a rust preventive lacquer, high melting point grease or similar temporary protection. A sufficient quantity of solvent shall be supplied with the plant to enable this coating to be removed on the Site.

All machined flanges and other mating surfaces shall be protected by means of wood templates. The bolts for securing these templates shall not be reused in the final installation.

No one crate or package shall contain items of Plant intended for incorporation in more than one part of the Works.

All items of Plant shall be clearly marked for identification against the packing list, which shall be placed in a waterproof envelope inside every packing case or crate.

Every packing case and crate shall be indelibly marked to show its weight, serial number, top and bottom, shipping marks and handling instructions or sling marks.

Electrical Plant shall be enclosed in sealed airtight packages with dehydrating material, before being placed in packing cases on shock-absorbent material and secured by means of battens.

2.24 Quality Assurance

2.24.1 Policy

In accordance with Conditions of Contract the Contractor shall apply the formal requirements of Quality Assurance to the design, supply, construction and maintenance of the Works. This shall be achieved through the implementation of a Quality System compliant with the requirements of BS 5750 or an equivalent International Standard.

Positive commitment to Quality Assurance shall be expressed in a formal policy statement given in the Contractor's Quality Manual.

2.24.2 Objectives

It shall be the stated aim of the Contractor to achieve and demonstrate the achievement of quality as expressed by 'due care and diligence' of the design, supply, construction and maintenance of the Works as defined by the Employer's Requirements.

The criteria to define 'due care and diligence' shall be explained in the Contractor's Quality Plan and shall embody all of the design, supply, construction and maintenance requirements of the Works.

2.24.3 Quality System

The Quality System shall be fully integrated for all of the Works.

This system will be defined by the organisational structure, responsibilities, activities, resources, and events that together demonstrate the capability of the Contractor to meet the stated quality requirements.

The Contractor shall ensure that all sub-contractors and sub-consultants establish quality systems and shall supply to the Employer such evidence as is necessary to demonstrate the effective implementation of a quality system in each sub-contractor or sub-consultant organisation.

The Quality System of the Contractor and of his sub-contractor and sub-consultants will be subject to periodic audits undertaken by the Engineer. The Engineer will give two weeks' notice of such audits that will involve a full assessment of the performance and efficiency of the Quality System and will include review of the feedback and records derived from the Contractor's monitoring and internal reviews.

On a day-to-day basis the Contractor shall afford reasonable availability of staff and documentation for the Engineer to assess the implementation of the Quality System. The Contractor shall ensure that all relevant personnel and documentation are available for such audits.

2.24.4 Quality Plan

The implementation of the Quality System shall be through the establishment of a comprehensive Quality Plan issued to and approved by the Engineer.

The documented procedures shall include but not be limited to:

- Management Procedures;
- Design;
- Supply/Procurement;

- Construction;
- Putting to work/Commissioning/Reliability Trial/Performance Test;
- Operator Training and Maintenance;
- Interface Control;
- Quality Performance, Monitoring and Review.

There shall be procedures to control transmission of information across all interfaces both internally (that is, within the Contractor's Quality System) and externally. Those of the latter shall include all Statutory Bodies, Authorities and the Engineer.

Formal assessment of any non-compliance with the Quality Plan shall be achieved through periodic reviews undertaken by a team appointed by the Contractor. All deficiencies shall be recorded and appropriate corrective measures shall be assessed, within an appropriate timescale, through subsequent formal reviews undertaken by the Contractor.

2.24.5 Quality Feedback

The system shall include for the reporting back, recording and incorporation into the system of deficiencies and remedial measures to correct them noted during the control of the project.

2.25 Environmental Protection

The Contractor shall minimize, as far as is practically possible, the effects of all his and his Subcontractors' activities upon the environment and shall implement and monitor measures to prevent:

- (a) Contamination of surfaces, ground, groundwater, surface water and rivers,
- (b) Emissions to air, including smells, gases, smoke, and dust.
- (c) Unsanitary or unsafe storage or discharge to drain, sewer and surface waters,
- (d) Unsanitary or unsafe storage or discharge of solid wastes,
- (e) Noise,
- (f) Visual intrusion, and
- (g) Excessive energy and water consumption.

These requirements shall be met through the constant and careful attention of the Contractor's management of all Site and off-site activities, and by instruction to all staff and labour in these matters.

The Contractor shall appoint an Environmental Control Manager for the Works, who shall be responsible for preparing an Environmental Management Plan and ensuring its implementation by the Contractor after obtaining approval of the Engineer.

Implementation shall include for monitoring and reporting on the results of the above measures. Monitoring reports shall be in writing and submitted on a monthly basis as part of

the monthly report referred to above. The report shall include a listing and summary of daily monitoring results on all aspects listed above.

All potentially affected areas of the Site, other areas used for or affected by the works and all adjacent or affected waterways shall be monitored and, where instructed by the Engineer, tested.

The Environmental Management Plan (EMP) shall identify the potential environmental impacts from the various construction and operations and maintenance activities to be undertaken in the Contract and set out in detail the approach he will adopt in mitigating these environmental impacts to ensure that the residual impacts are minor and confined to a short period.

The EMP shall consider but not be limited to the following:

- The methods of materials delivery, storage, usage and disposal; equipment usage; and site activities to ensure they have minimal impact on the environment,
- Only environmentally safe products and practices shall be adopted in performing his works, and
- The Contractor shall comply with all of the statutes regarding environmental effects.

The EMP shall provide separate descriptions of its proposals for minimizing any adverse environmental impacts/effects during the construction phase and the subsequent operations and maintenance phase.

The EMP shall be provided in draft form within 28 days from the Notice to Commence, and shall be updated from time to time by the Contractor as agreed or required by the Engineer to ensure the objectives of environmental protection are fully met.

2.26 Safety

The Contractor shall prepare a Safety Plan and submit the same to the Engineer for approval within 28 days of receiving the Notice to Commence.

The Safety Plan shall be followed at all times by the Contractor and shall contain adequate control measures, in accordance with the relevant protection of property and local laws and regulations as well as internationally accepted good practice, for the prevention of accidents, fires and public nuisance.

The Safety Plan shall be implemented properly and diligently throughout the execution of the Works and during the operations and maintenance period.

The Contractor's Safety Plan shall make safety provision for, among other things:

Deep excavations and collapsing sides in trench excavations,
Scaffolds and overhead working,
Working in confined spaces,
Working in water,
Contractor's Equipment, especially cranes,
Hand held power tools,
Electrical equipment,
Hazardous chemicals, gases and fuels,
The use of protective clothing, and
The provision of first aid facilities.

The Safety Plan shall be developed to ensure zero fatal accidents and zero hazardous incidents/occurrences in all construction works. The Safety Plan shall include descriptions of the company's standard policies and procedures regarding its site organization and procedures, methods and frequency of conducting safety audits at the Site(s), record keeping and reporting, providing safety training for its personnel (including subcontractors), issue and mandatory use of safety equipment, and details of the qualifications and experience of the Bidder's proposed safety officers to be deployed at the Site(s). The Contractor shall provide separate descriptions in its Safety Plan covering the construction phase and the subsequent operations and maintenance phase.

The Contractor shall appoint a Full Time Safety Manager for the Works having experience in this field, who shall be responsible for implementing the Safety Plan. He shall be supported by at least two safety officers who are qualified for such safety works.

The Contractor shall ensure that his staff and labour and his Subcontractors are all fully trained in and aware of good and safe working practices.

The Contractor shall ensure that all precautions are taken to safeguard the general public and construction/operating staff from any danger.

All temporary and partially completed works shall be protected by way of barriers, lights, notices and the like.

All excavations and the like are to be protected by barriers at all times and adequately illuminated at night.

Warning and diversion signs concerning roadwork shall be suitably placed to give motorists ample warning. During the movement of heavy vehicles across roads or onto roads, men, bearing red flags, shall be in attendance to warn other road users and to generally control traffic in a safe manner.

The Safety Plan shall also consider requirements for warning and protection for other risks including overhead and underground cables, pipes or obstructions, or voids, openings, pits and trenches. The Contractor shall ensure that all appropriate measures are implemented.

The Safety Plan shall include a policy statement signed by the CEO or equivalent authority of the Organization declaring that safety and loss prevention shall be given the highest practicable priority in all aspects of the Contract. The Safety Plan shall be updated as necessary to cover the activities to be undertaken for operations and maintenance.

-----End-----