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KARACHI WATER & SEWERAGE BOARD

Package # 02

**CONSTRUCTION OF NEW 65 MGD PUMP HOUSE
(EQUIPPED WITH M&E PUMPING MACHINERIES)
AT GHARO**

**UNDER ADDITIONAL 65 MGD WATER SUPPLY SCHEME
FROM HALEJI TO PIPRI KARACHI**

**EPC/TURNKEY CONTRACT
ON LUMP SUM FIXED PRICE BASIS**

**BIDDING DOCUMENT STAGE-I
(VOLUME-II)**

SPECIFICATION –TECHNICAL PROVISION

**EMPLOYER’S REQUIREMENTS
FOR
CIVIL, MECHANICAL & ELECTRICAL WORKS**

JANUARY 2018



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In Association With



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EMPLOYER'S REQUIREMENT FOR MECHANICAL & ELECTRICAL WORKS

CHAPTER 01 GENERAL REQUIREMENTS

CHAPTER 1

GENERAL REQUIREMENTS

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CHAPTER 1

GENERAL REQUIREMENTS

1.1. General

Volume-II of the Tender Documents contains Employer general requirements and Minimum standards of design, materials & workmanship of the work with respect to all Mechanical, Electrical and Civil Works of the Pump House to be constructed on EPC/Turnkey basis. In case of any conflict between provisions of Chapters 1, 2, 3, 4, 5, and 6, the later shall take precedence.

Chapter 1 of this Volume includes some of the general responsibilities for execution of the Work, which are in addition to the requirements provided in the Conditions of Contract, Volume-I.

1.2. Background and Project Objectives

a) Background

Population of over 20 million having a vibrant, economical and Commercial hub of Pakistan including

At the time of Independence in 1947 the population of Karachi was 300,000 persons and no significant water scheme existed at that time except the followings:

- 1) Few tube wells were dug on the bank of Lyari River called Mitha-dur in the year 1838. At that time population was 14,000 persons. After 45 years the population grew to 75,000.
- 2) In the year 1883 some wells were constructed & commissioned at Dumlottee near Malir River and 5 MGD capacity Conduit, with a length of 25 miles, was constructed for water supply.
- 3) In 1923 the 5 MGD capacity Conduit was increased to 20 MGD by digging few more tube-wells at Dumlottee. Additionally 2 numbers of 6 MGD reservoirs (Temple & Currie) were constructed along with laying of 15 MGD gravity conduit
- 4) The population of Karachi reached a figure of 250,000 in 1941 and water demand increased to 20 MGD. Hence water supply scheme was planned in two phases. In phase-1, Haleji Scheme with a total capacity 10 MGD was executed by Municipal Committee in 1943 and Second phase of 10 MGD Haleji water Scheme was implemented in 1953.

This organization was established in 1957 which implemented a number of development schemes for the city. The city itself underwent a series of administrative reforms. The major structural reforms were as under:

In 1962 KDA completed Greater Karachi Bulk water Supply scheme having a capacity of 70 MGD in Phase-I. In 1971 Phase-II was completed with a capacity of 70 MGD and In 1976 Phase-III was completed with a capacity of 70 MGD.

Construction of New 65 MGD Pump House(Equipped with M&E Pumping Machineries)
at Gharo, Karachi. Package # 2

In 1981 Karachi water Management Board was established and the major schemes were executed during their period were as under:

- (i) Hub Water Supply Scheme was implemented in 1982 which had the conveyance capacity of 89 MGD under Phase-I

KW&SB was established in 1983. Some of the major schemes implemented by KW&SB are as follows:

Phase-II of Hub water supply scheme was implemented in 2006 which had the capacity of 11 MGD.

1. In 1988, Greater Karachi Bulk water Scheme, Phase-IV with capacity 28 MGD (First Stage by KDA) was implemented.
2. In 1998, Greater Karachi Bulk Water Scheme, Phase-IV Stage-II was implemented with 42 MGD (balance conveyance).
3. In 1999, K-II Water Supply Scheme, with a total capacity of 100 MGD was constructed.
4. In 1999, Army Water Supply Scheme, having a total capacity 40 MGD was implemented.
5. In 2006 K-III Water Supply Scheme, with a gross capacity of 100 MGD was completed and made functional

Water supply to Karachi from Indus River source is drawn through Kinjhar lake through Kinjhar Gujjo Canal. The designed capacity of 30 Km long canal which supply water to Karachi is 648 MGD. From Gujjo canal water is transmitted to different pumping station and filter plants for Karachi through a system of Canals and conduits. Different quantities of Bulk Water Supply to Karachi from different systems are given below:

1. Haleji Scheme	30 MGD
2. Greater Karachi Bulk water Supply Scheme Stages I to IV	280 MGD
3. K-II Scheme	100 MGD
4. Additional Water Supply from GK BWS System.	40 MGD
5. Pakistan Steel	26 MGD
6. Port Qasim Authority	7.5 MGD
7. K-III Scheme	<u>100 MGD</u>

Total Present width-drawl 583.5 MGD

Balance Supply Capacity available from Kinjhar Gujjo Canal

$$648-583.5 = 64.5 \text{ MGD Say } 65 \text{ MGD}$$

The present scheme is proposed to utilize the available capacity of 65MGD from Kinjhar Gujjo Canal to supply this quantity of water to water deficit areas of Karachi.

As per existing topography this water from the canal can be transmitted by gravity up to Gharo pumping station. A new pumping station is proposed adjacent to existing Gharo pumping station from where this water will be pumped to Forebay of KW & SB. From this high point 5 MGD water will be transmitted to Existing Haleji Conduit and remaining 60 MGD water will gravitate along this alignment of existing Greater Karachi Bulk Water Supply Scheme conduit to Pipri Filter plant. At Pipri Filter Plant, 15 MGD water will be transmitted to K-II & K-III respectively and the balance water will be pumped to Pipri Filter plant by constructing a pump house. Transmission mains have been proposed to be constructed for supply of water from this filter plant to different deficit areas of Karachi under a separate project Part II.

b) Project Objectives

The objectives of the EPC/Turnkey Contract is the provision of a high lift Pumping Station of 295,500 m³/day (65 MGD) capacity at Gharo Pumping Station. To provide additional 65 MGD water to deficit area of Karachi.

The EPC/Turnkey work includes design and construction of all Civil Works, Procurement, Installation, Erection, Testing and Commissioning of all Electrical and Mechanical Works, equipment and service and ancillary maintenance training of operatives all as detailed in the Tender documents.

The pump house will comprise of:

- (1) All civil works of the sump and pump house including inlet works, screen channels and chambers etc.
- (2) Sump model test.
- (3) Manual and automatic bar screens.
- (4) Mechanically operated band screens
- (5) High lift pumping sets
- (6) Transformers
- (7) HV and LV panels
- (8) PLC/SCADA system for auto control, monitoring and data processing
- (9) Suction and discharge pipework and delivery manifold including valves and flow meter in each pump.
- (10) Surge control system
- (11) Flow meter
- (12) Internal and external illumination including emergency lighting
- (13) Overhead gantry crane
- (14) Exhaust fans
- (15) Any other work to complete the project objective
- (16) Outer development including landscaping
- (17) Penstocks
- (18) Level sensors
- (19) HT/LT power cables

2.3. Works to be executed on “EPC/Turnkey” basis

The Contract is for the engineering designs, supply and execution of civil,

Construction of New 65 MGD Pump House(Equipped with M&E Pumping Machineries)
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mechanical and electrical works of the pumping station on “EPC/Turnkey
(Engineering, Procurement and Construction)” basis as stated in the Contract.

The electrical and mechanical works include complete designs, manufacture of plant and equipment testing at manufacture's works, painting and full tropicalization, packing, freight and port handling including making all arrangements for clearance of imported goods, preparation of bill of entries and all other documents for port clearance, issue of import permits etc. and assessment of duty and taxes. The Contract also includes payment of wharfage, demurrage, octroi, clearance charges, toll and all local/government duties, taxes and charges, insurance costs, taking charge at the port of delivery or at local manufacturer's/supplier's works, loading, transportation, handling at various stages, unloading, safe storage, erection, testing, site painting, commissioning, testing and operation complete in all respects of the plant and machinery for providing a pumping station of the highest possible operative standard as per Contract Specification including all other items not specifically mentioned but are necessary for the satisfactory performance of the Work.

The Contract includes all costs related to the execution of the Work including provision of all skilled and unskilled labour, supervision, training of Employer's operation and maintenance personnel. Production of drawings and O&M manuals as required under the Contract.

1.4. Units of Measurement

All designs, drawings, specifications and manuals shall use SI (Kg m s) units and all measurements, dimensions and performance data shall be quoted in these units.

1.5. Language of Usage

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

Warning signs shall be in Urdu, English and Sindhi

1.6. Operational Capacity of Pumping Stations

The new Pumping Works shall operate on a 24 hours basis with staff superintendence during 24 hours per day for 7 days per week. It shall be capable of operating at rates between 25% and 100% of design flow.

1.7. Plant Design

The whole of the Plant and machinery shall be designed and constructed to the high level/latest standards of International water works practice.

A manufacturer's standard design may be used for a Plant item where such a design is not available and it is equal to and compatible with that required by the Specifications.

The Plant shall be new, of sound workmanship and robust design, and of a grade and quality suitable for the duty concerned and for the climatic conditions at Site.

The Plant shall be designed to provide adequate protection against the attack of vermin and dust and to minimize fire risk and consequential damage.

All parts which can be worn or damaged by dust shall be totally enclosed in dust proof housings.

All equipment's shall operate without excessive vibration and with minimum of noise.

All similar items of the Plant and their components together with spare parts shall be made from the same material and shall be fully interchangeable.

1.8. Regulations and Standard Specifications

Except where otherwise specified all materials and workmanship shall comply with current international standards provided that these standards are not less stringent than the equivalent British Standards or Codes of Practice or provided that they comply with the requirements of the International Organization for Standardization (ISO) or the International Electro-technical Commission (IEC), as appropriate.

For the purpose of inspection or testing, the Contractor shall make available to the Employer copies of relevant standards.

The electrical installation shall comply with all relevant statutory regulations and standards at the current date of Tender, unless, otherwise indicated within this Specification. Electrical installations shall where relevant be in accordance with the IEE Regulation for Electrical Installations, latest edition.

1.9. Project Management

The Contractor shall be responsible for administration of the Project from award of Contract through design, manufacture, works testing, delivery of plant to the site, installation, testing and commissioning to final taking-over. For this purpose he shall nominate a Project Manager (PM) who shall be fully responsible for and undertake the administration.

The PM shall be a manager having BE Degree with not less than 20 years of experience of construction management at least 5 years of which is in a management position on works of a similar nature and complexity as required for this project.

Specific responsibilities of the PM shall be:

- a. Representation on behalf of the Contractor or the Consortium of Contractors in all discussions and matters relating to Work.
- b. Coordination and monitoring Contract progress and submitting monthly progress reports.

- c. Attending periodical and/or monthly meetings called by the Employer and giving full account of the Contract progress, program of Work and Site related problems
- d. Coordination and programming of all building works, installation of plant, site tests and takeover trials including coordination of various sub-contractors employed by the contractors. (if any)
- e. Preparation of training programs of Employer's personnel and coordination of their training activities.

1.10. Water for Testing and Commissioning of Plant

Water for testing and commissioning will be made available by the Employer at the commencement of the Work free of cost to the Contractor. The Contractor shall make his own arrangements for transporting the water to the civil construction Sites and other requirements at his own cost. The Contractor shall give a minimum of 30 days' notice in writing to the Employer of when water is required for tests and commissioning.

1.11. Permanent Power Supply

The Employer will provide permanent Electric supply at KESC substation as determined by the Contractor in his EPC/Turnkey Design. The Contractor shall derive power from this substation at 11kV, 3 phase, 50Hz. The electric supply will be available to the Contractor free of cost for tests and commissioning.

The Contractor shall extend his connections to all switch boards at site as provided in the Specification for servicing all sections of the Plant including building services to be provided by him under the civil works of the Contract.

1.12. Drawings

a. General

All drawings submitted by the Contractor to the Employer for consent shall be on ISO standard size sheets with a maximum size of A1 unless otherwise agreed. Every drawing shall have a title box in the bottom right corner showing:-

- (1) Employer's Name
- (2) Title of Scheme
- (3) Title of Contract
- (4) Contractor's Name
- (5) Title of Work Location
- (6) Title of Drawing
- (7) Drawing Number
- (8) Date
- (9) Designer,

Drawn by_____ Checked by_____

(10) Signature and Stamp of Contractor to the effect that the drawing, whether his own or from any other source has been checked by him before submission to the Employer/ employee representative.

Each drawing shall also have a separate revision box with space for revisions and including revision number, revision date, revision description and revision check.

Drawings shall be drawn to specified scales or to such scales as are appropriate for clearly detailing and conveying the Contractor's proposals. Scales shall generally be 1:2, 1:5, 1:10 or multiples of 10 thereof. The appropriate measuring scales used shall be shown on the drawings.

Drawings shall include cross references where appropriate and key information such as vital levels and dimensions. All plans shall show the 'north' direction.

All drawings submitted by the Contractor shall use the English language and SI units.

Where drawings shall be revised, the revision letter or number shall be incorporated in the title block and the revision shall be clearly indicated on the drawing with the revision letter or number shown in an adjacent triangle.

Original drawings shall be drawn in ink. Prints of drawings shall show dark and fade-proof line work on a light and non-darkening background. Prints shall be on durable paper of good quality and 80 gm/m² minimum weight. Reproducible shall be on 75 micron durable plastic film. CAD drawings shall be on DVDs in the latest version of AutoCAD format. Four sets of drawings and documents shall also be supplied in softcopies, DVD ROM.

The drawings comprise of:-

a. Conceptual Drawings

These are drawings issued to the Contractor with the Tender Documents for the purpose of preparing a tender. Such drawings shall be deemed to have been issued for the guidance of the Tenders and shall be referred to for the interpretation of the Contract only where the drawings supplied by the Contractor at the time of tendering and incorporated in the Contract are insufficient.

b. Tender Drawings

The Tender Drawings of all Civil, Mechanical and Electrical Works are to be supplied by the Contractor for the purpose of illustrating his Tender, mainly:

(1) A layout of the whole scheme, in appropriate scale.

- (2) Drawings and technical details of the plant in sufficient detail to illustrate that the several items of the plant are suitable for their intended purpose.

Where Contractors tender proposals are given, Tender Drawings showing features not in compliance with the Specifications, and where such features are not listed in the Contract then the requirements of the Conceptual Drawings will be taken as the basis of the Contract.

c. Approved Drawings

Within 2 months of the Commencement Date, the Contractor shall submit to the Employer, four copies of detailed drawings of all civil, electrical and mechanical works, for approval, as detailed below.

Structural detailed Drawings and Computations.

The Pump Station building and its components shall be designed to be earthquake resistant.

The drawings shall show sufficient detail and structural design of the associated civil structure, including dimensions of foundations, the detailed dimensions of channels and sizes of openings in walls etc. Detailed computation sheets for structural design shall also be submitted with the Drawings.

Manufacturing of the Plant shall not begin, nor shall erection of the Plant commence, until the appropriate Approved Drawings are available. The Plant shall be manufactured and erected in accordance with the Approved and Conceptual Drawings.

The approval by the Employer shall constitute only general approval of overall layout of Civil, Mechanical and Electrical works, nevertheless the main responsibility of proper and adequate design and functioning of the entire system of the pumping station shall rest with the contractor.

The Approved Drawings shall include but may not be limited to:

- (1) General arrangement drawings to illustrate the position of the Plant in relation to the appropriate part of the Work in sufficient detail to show all the principal dimensions, methods of support and other relevant information.
- (2) Drawings of the Plant in sufficient details for the Employer to satisfy himself that jointly and severally the items of the plant are suitable for their intended purpose.
- (3) Sectional drawings of each major item of the Plant including general arrangement of electrical panels with foundation and cable access details.
- (4) Diagrammatic outline and detail drawings of all services to, from and between the several items of the Plant, including water supplies, pipe work, work, connections and fittings, electrical single line and schematic diagrams, cable schedules and site cable layout.

- (5) Requirements for incoming supplies, services and details of interface connections in respect of the Plant, particularly where such connections are at the limit of the Contract.
- (6) Drawings of the Plant and data in sufficient detail as may be reasonably required by the Employer to satisfy himself as to the stability. Durability and safety of the works and for ascertaining inspection of the Plant during construction that it is in conformity with the Contract.
- (7) Installation drawings giving complete dimensions of pedestals, cuts, chases, bolt holes, ducts and other provisions to be made in the civil structures and on Site during the fixing of the Plant.

d. Employer's Drawings

The drawings issued from time to time by the Employer.

e. As-Built or Record Drawings

The Contractor shall provide As Built or Record Drawings to show the whole of the civil works as constructed and the Plant as installed. They shall be in the form of six (06) sets of full (as drawn) reproducible plus one set of drawings in an electronic format using AUTO-CAD latest version or civil 3D or approved similar. They shall include all such drawings, diagrams and schedules as are necessary for a complete understanding of the work including details of any 'bought-in' items and any items shown as 'blocks' on the main drawings. Information given on Record Drawings shall include tolerances, clearances, Loadings, finishes, materials and ratings. The Contractor shall ensure that the consented to Drawings are marked up to show the condition of the civil Works as constructed and the Plant as installed and two copies of such marked up prints shall be submitted to the Employer for consent prior to the preparation of Record Drawings and to the start of tests before completion.

Record Drawings shall include but not limited to –

- 1) Process and instrumentation (P&I) diagrams showing in symbolic form the plant and systems for measurement, control and automation Including interface between control panels and separate installations etc.
- 2) General arrangement of drawings and sectional views, fully dimensioned and showing in detail all items of plant and ancillary equipment to be provided under the Contract.
- 3) Dimensional assembly and erection drawings of each item of Plant.
- 4) Foundation drawing showing foundation requirement for Plant and loads thereon. This shall include all holes, chases and other requirements to building structure required for the installation of the Plant.
- 5) Working drawings of all engineering systems requiring electrical and /or mechanical connections. Showing the units of equipment in the proposed position for installation and the details of attachment and connections

required, with locations referred to each other and to the structure.

- 6) Diagrams of connections for each type of electrical equipment together with a comprehensive wiring diagram showing all connections between the various items of the equipment and the safety devices (the terminal lettering shall correspond to the terminal marking to be used on the equipment).
- 7) Surge valves, control valves, protection from water hammers, and failure of one pump or all the pumps. Power failures and equipment protection devices.
- 8) Working drawings for protection and air-conditioning systems and for water supply, drainage, waste water and firefighting systems.
- 9) Plans of conduits, station pipe work and valves indicating manual and remote control devices.
- 10) Fabrication drawings for station metal work, including platforms, floor plates and frames, hand railings etc.
- 11) Diagrams showing flow paths and circuits and piezometric levels corresponding to average and maximum flow rates accompanied by proof of computations.
- 12) Complete and detailed schedules listing all items of plant and ancillary equipment to be supplied by the Contractor.
- 13) Civil works drawings (liaison, markup and correction to the civil contractor design as necessary to facilitate the integration of the M & E and civil systems).
- 14) Any additional drawings required to cover other elements not listed above.

All items of electrical equipment constituting an operating system and any mechanical units involved therein or necessary for the functioning of such system shall be submitted to the Employer concurrently and shall include clear diagrams showing circuit functioning and necessary details for field erection.

1.13. Bid submissions

1.13.1 Design brief

a) General

Clause 7.1 of Material & Workmanship defines the scope of work. The Employer requires that each bidder be prepared to define in detail, the elements of his offer during the tendering process. This shall be done through a design brief covering all elements to be designed by Contractor. Through this brief the contractor shall provide evidence that consideration has been given to all other items. The design brief is to be supported by drawings and are intended to represent the type and quality of information required to evaluate the bids and to highlight;

- (1) Design parameters and methodology

(2) Design criteria of the project and its components parts.

1.13.2 Construction Specifications

All designs, equipment materials and construction methodology not completely detailed in referenced or proposed documents or design criteria shall conform to acceptable industrial practice. During the evaluation period, the Employer may request to submit Construction Specifications for the purpose of clarifying and defining the bid. The format of the Specifications shall be as follows:

- a. General
- b. Detail Description
- c. Related Works
- d. Reference Specifications
- e. Submittals
- f. Design Requirements

1.13.3 Contractor staff qualification

All staff must be proficient in the English language.

The Project Manager, Project Design Manager and Project Design Engineer should be graduates of recognized colleges/University.

The Bidders shall submit with their Bids the name of the nominees for each of the designated positions together with detailed resumes of their experience and qualifications.

1.14. Detailed design submission

1.14.1 Design Programme

The Contractor shall submit to the Employer a Design Programme showing the order and procedure in which he proposes to carry out the Design and Engineering services with a schedule of submission of design documents and drawings for completing the Works within 28 days after the “Notice to Commence”, and also to match with the Work Programme (Sub-Clause 8.3 of the Conditions of Contract). Such Design Programme shall be subject to review and revision by the Contractor in Consultation with the Employer in order to achieve completion of the Works within the time for completion.

The number of copies of the report and other documents to be submitted to the Employer by the Contractor is specified in Sub-Clause 2.8.

1.14.2 Detailed design submission

The Contractor shall carry out structural analysis of the structures and its foundations to confirm the stability under site specific seismic loads.

Detailed reinforcement drawings and bar bending schedules shall be prepared for all concrete structures. Where the structural design for earthquake loading relies in ductile behavior of structural elements then anchorage, splicing of bars and shear provision shall comply with current

earthquake detailing practice.

The design works shall cover determining the hydraulic conditions relevant for long term operational efficiency and safety in the approach to through all water conveyance elements (No additional payments shall be made for any change modification at any stage for the construction of pumping station).

Within 2 (two) months of commencement date and prior to beginning any construction work, the Contractor shall submit to Employer for consent a Detailed Project Report (DPR). The DPR shall define all finished structural dimensions and / or performance characteristic of all elements of the project except those dependent on subsurface geotechnical conditions. Geotechnical investigation report is enclosed. The bidder however shall ensure that the estimates are based on the Contractor's own confirmatory investigations and / or interpretations. The results and interpretations of the geotechnical investigations shall be presented in the DPR.

The DPR should include at least the following:

- a. The result and interpretations of the geotechnical investigations (including construction materials.)
- b. The results and interpretations of the hydrological investigations.
- c. The results and interpretations of topographic surveys.
- d. The geotechnical, hydraulic and structural design including design standards, criteria and calculations.
- e. Drawings to a detail sufficient to show all significant structural and plant features.
- f. Justifications supported by calculations and drawings.
- g. Details of specifications to be adopted.
- h. Quality Control plan for construction stage.

1.14.3 Drawings & documents

The contractor shall provide copies of all standard mentioned in this document. Furthermore all standards referred to in the design documents submitted by the EPC contractor shall also be provided to the employer. All standards copies shall be provided. As a part of the Design Documentation, the Contractor shall provide a complete and clear set of stability check calculations, specifications and drawings of all construction works, service utilities, and materials as well as of his temporary works design.

The Contractor shall successively submit structural design, documents and drawings for the review, comment and consent of the Employers in accordance with the schedule of submission of design documents and drawings in the Contractor's Work Programme as stipulated in above. The Employer shall give his consent / Comments on all design and drawings referred to him within 15 days for submissions prepared by the Contractor and submitted to the Employer at Site, and 28 days of the date of receipt in the Employer main design office for submissions prepared by the Contractor and reviewed by the Employer from the main design offices.

1.14.4 Submission of Drawings

The details of drawings / documents which will be submitted for the Employer

review and consent or for information are as below:

- a. Detailed technical specifications wherever necessary.
- b. General arrangement and layout drawings.
- c. Concrete outline drawings.
- d. Assembly drawings.
- e. Foundation design and treatment drawings.
- f. General reinforcement arrangement for structures.

The drawings in the following category will be submitted only for information and record of the Employer:

- a. Detailed Reinforcement drawings.
- b. Design Calculations.
- c. Sub-assembly Drawings.

In case of consent of a submission of drawings / documents by the Employer, one set of drawings / documents will be returned to the Contractor within the stipulated review period, marked "Consented".

In case the drawings / documents are accepted in principal, but minor comments are made, the drawings / documents will be marked "consented with comments" and the comments shall be explained in a covering letter and / or clearly marked in the drawings / documents, which will be returned to the Contractor within the stipulated review period. Further design construction shall proceed, considering the comments. Amended drawings / documents will be submitted after completion of the works.

In case of substantial disagreement with the drawings / documents, these will be marked "returned for review" and will be returned to the Contractor within the stipulated review period with the reasons for disagreement spelt out in detail in the covering letter. Technical discussions shall, if required, be held thereafter without delay to address the concerns of the Employer. The drawings / documents will be reviewed, appropriately revised and resubmitted for information with the response, explanation or action to the comments of the Employer.

1.14.5 Approved drawings

In case consent or comments of the Employer have not been communicated within the stipulated review period then the drawings shall be deemed to have been consented to and the Contractor can then act on them and shall inform the Employer accordingly.

The Contractor shall furnish to the Employer the following number of copies of approved drawings, reports and other technical documents:

- a. One transparent copy and 3 paper copies of drawings, which are submitted for information only.
- b. One transparent copy, three paper copies A1 size and three paper copies of minimum A-3 size of drawings, which are submitted for consent. One paper copy shall be returned to the Contractor with consent or comments.
- c. Consent drawings in sets of two transparent copies and ten paper copies of minimum A-3 size.
- d. As-built drawings in sets of one transparent copy, and ten paper copies of

minimum A-3 size.

- e. Report and other documents in five copies and approved manual in ten copies for Employer's reference and records.
- f. Progress reports in five copies.

1.14.6 Amendment / revision of drawings

No comment, amendment or revision to a report or design or its redesign made or requested by the Employer which is for reasons caused by an error or mistake by the Contractor or is deemed necessary for the proper fulfillment of the Scope of the Works defined in the Contract shall not be grounds for additional time or payment. Any request of the Employer that can be shown to be a requirement outside of the scope of the Works of the Contractor shall be notified as such by the Contractor and the Employer will decide whether such additional work will be required. If outside the scope of the works and required by the Owner this shall imply that such additional works shall constitute a Variation.

1.14.7 Defect

If either the Contractor or the Employer become aware of an error or defect of a technical nature in a document which was prepared for use in executing the Works, which has any effect on the execution of the Works and needs to be clarified, prompt notice shall be given to the other party of such error or defect, if errors are found in the documents produced by the Contractor, the documents and the Works shall be corrected at the Contractor's cost, notwithstanding any consent by the Employer.

The Contractor is responsible to liaise and co-ordinate his design with that of the different disciplines and subcontractors / suppliers, including incorporating the interface requirements,

1.14.8 Consent or approval

Consent or approval of the Employer to any or all of Contractor's documents, programme, schedules, designs and drawings etc. shall not relieve the Contractor of design and construction responsibilities / liability or obligations to complete and commission the Works as per provisions of the Contract.

1.15. Transport for the Employer

The Contractor shall provide new approved vehicles as listed in the Schedule of Prices, for the use of the Employer and his staff.

Vehicles shall be equipped with spare water and fuel containers, roof rack and be suitable for tropical use. Kerb weight and tyre pressures shall be stated on each vehicle and the vehicles shall conform in all respects to the regulations of the appropriator registration authority.

The Contractor shall provide competent drivers with monthly remuneration to the approval of the Employer for the vehicles used on site. The Contractor shall provide all fuel, lubricants, etc and shall license, insure (as detailed below), service and maintain the vehicles in a roadworthy state. The Contractor shall be

obliged to have ready access to spare parts appropriate to the number, type and duty of the vehicles supplied. If in the opinion of the Employer the Contractor should default in this respect and deprive the Employer of use of vehicle(s) made unserviceable by normal use in the conditions and demands of the Site, the Contractor shall provide suitable alternative transport to the approval of the Employer. If the Contractor fails to provide this service the Employer shall be entitled to withhold the issue of a Payment Certificate until the service is resumed.

Insurance for vehicles must be comprehensive and include:

- a. Cover for the Employer and his staff driving the vehicle;
- b. Usage on the business of the Employer and his staff and for social document and pleasure purposes; and
- c. Liability to third parties (including passengers whether the Employer, his staff or others) for an unlimited indemnity in respect of death or personal injury and for the maximum indemnity reasonably obtainable in respect of loss, destruction or damage to property.

The vehicles shall be handed over to the Employer at the end of the Defects Liability Period or earlier if ordered by the Employer and transferred in the name of the Employer.

For a site movement of Employer Supervision staff, for inspection of Contractor's works or in connection with the works, the Contractor shall make available suitable transport as required. No direct payment shall be made for this and the cost thereof is deemed to be included in the contract price.

1.16. Telephones

The Contractor shall provide following communication facilities for the sole use of the Employer and his staff. Four (4) sets of Smart cell phones with all accessories as approved and a landline with Fax & Internet connections.

The Contract Price shall be deemed to have included cost of Rupees Sixteen thousand (Rs.16,000/-) per month pertaining to telephone uses in shape of Prepaid Mobile Cards.

1.17. Health and Safety

The Contractor shall provide for the health and safety of its employers, any employees of Employer and any other persons who are at any time directly or indirectly effected by the performance of the Work by an application of a suitable or acceptable health and safety policy that ensures attention to the safety of work sites, to safe methods of working, to the suitability of personnel by training or placement and by adequate supervision.

The Contractor shall be under an obligation to take all reasonable safety measures in relation to the type of services undertaken along with all personnel assigned to the Work and perform the Work in such a way as to comply at all times with its obligation and duties under laws, regulation, rules, order and other enactments in force from time to time relating to health and safety matters,

including the Employer's safety requirements.

The Contractor shall in addition observe and follow all guides, codes and recommendations issued or made by the government, professional or trade organization or other official or responsible organization relating to health and safety at work as applicable to the project.

1.18. Operation and Maintenance Manuals

The Contractor shall compile installation, operating, preventive maintenance, removal, testing and overhauling manuals for the whole of the Work. The Manuals shall be divided into (a) Maintenance Manuals sub-divided into mechanical, electrical and instrumentation, and (b) Operating manuals divided into locations.

It is emphasized that a collection of standard pamphlets of a general nature unaccompanied by drawings and descriptive matter relating to items of Plant as installed, will not be acceptable. In particular information supplied by subcontractors and manufacturers employed by the Contractor shall be coordinated into the comprehensive manual. Cross-referencing of descriptive matter, drawings and spare part lists must be complete.

The Operation and Maintenance Manuals shall describe the installation as a whole and shall give a step by step procedure for any operation likely to be carried out during the life of each item of Plant, including its erection, commissioning, testing, operation, maintenance, dismantling and repair. Manuals shall identify and cover aspects liable to affect other installations and shall include all health and safety precautions to be taken.

Maintenance instructions shall include data showing lubrication, checking, testing and replacement procedures to be carried out at daily, weekly, monthly and longer intervals to ensure trouble-free operation. Where applicable, fault location charts shall be included to facilitate tracing of the cause of malfunction or breakdown.

A separate section of the Manuals shall be devoted to each size and type of equipment and its operation and shall include all relevant pamphlets, and a list of parts with the procedure for ordering spares. The detailed sections of the Manuals, if necessary, shall contain further maintenance instructions and fault location charts. Subject to the foregoing, the Manuals shall generally comply with the recommendations of BS 4884 Parts 1 and 2 (Technical Manuals - Content and Presentation).

The Contractor may ensure that, as minimum following items are included in the Operation and maintenance Manuals:

- a. All health and safety instructions for chemicals and any precautionary measures necessary for ensuring health and safety and avoidance of mishaps.
- b. General description of the scope, purpose and manner of working of each system or apparatus forming part of the Work.
- c. Schedule of equipment supplied giving manufacturers name, address, fax number and appropriate Make/Model No /Cat No description of unit and component parts identified on drawings giving ordering reference numbers.

- d. Maintenance procedures for regular maintenance and preventive maintenance including frequencies of routine operations, guide to trouble shooting, fault finding charts, procedures for disassembly, repair and reassembly, procedures for removal of transport screws and/or clamps and procedures for alignment, adjustment and checking.
- e. Schedules of spare parts, tools and lubricants supplied.
- f. Schedules of consumable supplies, packings, together with lubricant application.
- g. Schedule of changeover frequencies for duty/standby equipment.
- h. Sectional arrangement drawing of major items of equipment with comprehensive instructions for dismantling, cleaning, servicing & replacement of component parts, reassembly including recommended clearances and tolerances
- i. Plant layout drawings showing the "As installed" installation.
- j. Process and instrumentation drawings of the "As installed" processes.
- k. General arrangement and schematic diagrams of the "As installed" control panels.
- l. "As wired" diagrams of all electrical connections between the control panel and installed loads, circuit directories of panel boards and "As installed" color coded wiring diagrams. Cable schedules and connection/termination data for all equipment installations.
- m. Operating procedures including step by step instructions for pre-start, starting up including startup following emergency shutdown, normal operation and normal and emergency shutting down of the Plant.
- n. Test certificates and performance curves for both works and site tests of motors, pumps, screens, electrical switchboard, transformer, instrumentation, valves and lifting equipment, site tests of pipework, cabling and electrical installations, earthing, lightning protection and other items where appropriate.
- o. Records of lightning protection system installation to BS 6654, section 5.
- p. Complete software documentation for each programmable piece of equipment. The material to be provided shall include all of the manufacturer's standard published reference materials and user's guides.
- q. Instrumentation, control and automation equipment, operating instructions for normal procedures in a step by step format including flow charts, control operations, requests for display or printing of data, performance monitoring, response to alarms or failures, changing of operation parameters, and manual data entry.
- r. Description of the plant control philosophy.

- s. Schedule of alarms, their initiation and action to be taken.
- t. Procedures for calibration of instruments etc.
- u. Firefighting procedures and drills.

All drawings incorporated in the manuals shall be presented in such a way that they can easily be referred to whilst reading the associated description in the text copies of all software & shall be provided on DVD.

The Manuals shall be in the English language and each volume shall be numbered in sequence. Pages shall be of A4 size to 150-216 or folded to that size and placed in a loose leaf four ring hard cover binder.

The cover of each volume shall have inscribed on it, the names of the Employer, project and subject matter. A content page shall be included in each volume and index tab pages shall be provided to permit quick reference.

Any additions, alterations or deletions which may be required by the Employer or following the experience gained during the running and maintenance period shall be incorporated in the Manuals without any extra cost to the Employer.

1.19. Commissioning and Reliability Trials

Following completion of erection of the plant and after each item of the plant has been retested on the site and found to be in working order, water and electricity having been provided as and when available, the Contractor shall for a minimum of 30 consecutive days himself operate the plant and undertake such adjustments / repairs as are necessary to make it fully operational and compliant with the requirements of the Specifications. The completeness and compliant operation shall be demonstrated to the Employer in conjunction with instructions given in the operation and maintenance manuals. This shall also include such tests and simulations of operating fault conditions as are required to prove the satisfactory operation of all automatic and emergency control systems.

Six final copies shall be submitted not later than three months before the due date for final taking over of the Work.

The Contractor shall operate the plant over its complete operational range and shall prove its safe and satisfactory operation during normal and abnormal operating situations likely to be encountered, and also in various modes of combinations with other pumps operating in parallel.

Should the Plant not achieve satisfactory, constant and continuous output or requires specialist services of the Contractor during the initial commissioning it will be deemed not to have achieved an acceptable level of reliability and it would require the 30 days period to be restarted.

After satisfactory completion of the initial running period of 30 days as certified by the Employer, the reliability trial period of 3 months shall commence. The contractor shall continue to operate and maintain the plant to the satisfaction of the Employer.

All consumables, spare parts, replacement components and labour shall be

provided by the contractor at his own cost during the initial commissioning and reliability trial period. The cost of power and water required shall however, be borne by the Employer.

1.20. Inspection and Tests

The Contractor shall be responsible for ensuring that all inspections and tests in connection with quality control or otherwise are properly carried out whether on the Site or elsewhere and that, where necessary, the appropriate remedial measures are taken.

The Employer may require to inspect work being prepared and to witness tests at supplier's premises. The Contractor shall give the Employer adequate notice of the program of Work and testing at supplier's premises to enable the Employer to arrange such inspections.

The Contractor shall ensure that access to supplier's premises is available to the Employer and his representatives throughout the Contract period. The Contractor shall at no additional cost provide all facilities and equipment necessary to carry out inspection by the Employers Representative.

Satisfactory testing and inspection of manufactured items or materials before these are delivered to the Site shall not relieve the Contractor of his responsibility to ensure that manufactured items and materials used in the works comply with the Contract and meet its objective when they are incorporated in the Work. Manufactured items and materials delivered to the Site shall be inspected on arrival and any defects shall be notified to the Employer's Representative. The Contractor shall obtain the consent of the Employer for his proposals for rectification of the defects, either at Site or at the manufacturer's premises or for replacement of the goods.

Inspections or tests carried out by or on behalf of the Employer shall not relieve the Contractor of his responsibilities in connection with quality control on every aspect of the Work.

Records of on-site testing and inspection shall be kept on approved format. Test results shall be certified by the appropriate responsible member of the Contractor's staff. All test certificates and inspection records (including any from suppliers or other outside testing agencies) shall be clearly identified with the appropriate part of the Work to which they refer.

Test results shall be summarized in tabular form or graphically or both in a way which best illustrates the trends, specific results and specification requirements. Where the tests show that the specified requirements were not achieved, the report shall describe the action which was taken.

The Contractor shall keep detailed and up-to-date inventories in an approved form of goods and materials subject to quality control which are on order, delivered, found faulty, and lost during the work or to is surplus to requirements.

1.21. Warranty Period

During the warranty period of 12 months (Defect Liability Period) the Contractor's

responsibilities shall include, at no additional cost in the Contract, but not limited to:

- a. Providing skilled maintenance staff in each discipline for the whole of the maintenance warranty period.
- b. Monitoring the performance of the whole of the Works.
- c. Investigating faults in similar equipment under similar conditions.
- d. Rectifying faults.

1.22. Plant Delivery and Handling

1.22.1 Protection and packing for dispatch

Before dispatch from the place of manufacture, the equipment shall be adequately protected by painting or by other approved means against corrosion and accidental damage for the whole period of transit, storage and erection. The Contractor shall be responsible for the equipment being so packed and/or protected as to ensure that it reaches the site intact and undamaged. All equipments as necessary shall be packed in first quality containers or packing, no second-hand timber shall be used. The equipment shall be packed to withstand rough handling in transit and all packages shall be suitable for several stages of handling via sea or air freight, inland transport and movement on Site and for storage including possible delays in delivery.

Precautions are to be taken to protect shafts and journals where they rest on wooden or other supports likely to contain moisture. At such points impregnated wrapping with anti-rust composition or vapour phase inhibitors are to be used of sufficient strength to resist chaffing and indentation due to movement which is likely to occur in transit.

Lids and internal cross battens of all packing cases are to be fixed by screws and not nail.

Hoop metal bindings of cases are to be sealed where ends meet, and if not of rustless material, are to be painted

Contents of such cases are to be bolted securely or fastened in position with struts or cross battens and not with wood chocks, unless they be fastened firmly in place. All struts or cross battens are preferably to be supported by cleats fixed to the case above and below to form ledges on which the batten may rest. Cases are to be opened after packing, to prove that there is no movement of contents.

Where parts are required to be bolted to the sides of the cases, large washers are to be used to distribute the pressure and the timber is to be strengthened by means of a pad.

Waterproof paper and felt linings are to overlap to at least 12mm and the seams secured together in an approved manner, but the enclosure is to be provided with screened openings to obtain ventilation.

The flanges of pipe, sluice valves and fittings shall have their open ends protected

by adhesive tape or jointing and then protected by wooden discs secured by means of service bolts (which shall not be used on Site) or by other approved means. The sleeves and flanges of flexible couplings shall be bundled by wire. Cases containing rubber rings, bolts and other small items shall not normally weigh more than 500 Kg.

All relays, instruments, and similar equipment shall be shipped with transport screws and/or clamps, clearly marked and painted red, to prevent movement of moving parts.

Structural steel work, pipes, sluice valves, uncased fittings and metalwork shall be similarly marked. When the dispatch marks cannot be applied satisfactorily to any item they shall be stamped on a metal label attached to the item or part by means of a piece of wire passing through holes at either end of the label and secured so that it lies flat with the item.

Indoor items such as electric motors, switch and control gear, instruments and panels, machine components are to be 'cocooned' In aluminium or polyethylene sheeting, sealed at the joints and the enclosures provided internally with an approved desiccator.

All items of equipment shall be clearly marked for identification against the packing list.

All cases, packages etc, shall be clearly marked on the outside with a waterproof material to show the weight, where the weight is bearing and where the slings should be attached.

Cases shall bear the Contractor's name and the name of the Employer and the particular Site. These shall be marked in legible letters, and all markings shall be in red or black paint.

Each crate or package is to contain a packing list in a waterproof envelop and three copies are to be forwarded to the Employer prior to dispatch. All items or material are to be clearly marked for ready identification against the packing list. The Contractor shall be deemed to include in the Contract Price all materials and packing cases necessary for the safe conveyance and delivery of the equipment.

The Employer may require to inspect and approve the packing before the items are dispatched but the Contractor is to be entirely responsible for ensuring that the packing is suitable for transit and such inspection will not exonerate the Contractor for any loss or damage due to faulty packing.

The Contractor shall ensure that during all handling operations adequate care is taken for all uncrated fittings. Nylon slings and timber packing shall be used to ensure that surface finishes of uncrated items are not damaged.

The Contractor shall send advice of dispatch to the Employer, this information is received not less than two weeks before the anticipated delivery of the goods.

1.22.2 Safekeeping and Storage

The Contractor shall be entirely responsible for the security and maintenance of

equipment during all periods of storage.

Should it be necessary to place the equipment into on-site store, the Contractor shall be responsible for inspecting all equipment after shipment and prior to storage and he shall arrange for any damaged equipment to be rectified prior to delivery to the Site.

The Contractor shall remove the equipment from off-Site storage or the place of manufacture as the case may be and ship or remove from on-site storage and delivery to the final point of installation

The off-Site and on-Site storage arrangements shall comply with the following minimum requirements.

Category-A: Electrical and instrumentation equipment covered in air Conditioned dust and vermin proof area.

Category-B: Rotating mechanical equipment -covered area.

Category-C: Pipes, valves, steelwork, etc - security sheeting on open hard standing area.

The Contractor shall be responsible for the operation, safe keeping and maintenance of the equipment on Site during and after erection upto the final taking over of the Works.

1.23. Unloading, erection and running of equipment

The Contractor shall at his own expense provide all equipment, tools, meters, gauges, temporary accommodation, all skilled and unskilled labour for the erection of the whole of the equipment and apparatus so that it can be installed completely and left in good working order.

Erection shall include unpacking of plant either on Site or in the on-Site storage for examining damages or defects, notifying such damages and defects to the Employer and taking action, for their repair or replacement with the approval of the Employer. The cost of such repairs or replacements shall be borne by the Contractor.

The Contractor shall provide the services of adequate numbers of competent skilled and experienced erection engineers, for mechanical and for electrical works, trained at the manufacturer's works on the various components of the plant being supplied. The Contractor shall submit the Curriculum Vitae of his erection engineers and senior supervisory staff for the approval of the Employer.

Any special erecting tackle required shall be provided by the Contractor and be left at site after the completion of the Contract.

The Contractor shall provide adequate protection for the equipment from the time it is delivered to Site until the final taking over of the Works.

When loading, unloading or erection of equipment is undertaken adjacent to structures using a mobile or static crane, the Contractor shall ensure that the maximum superimposed load exerted by such lifting shall not exceed by half of the bearing capacity of the standing surface or 100N/m² on the standing surface whichever is more.

The Contractor shall be responsible for the installation, maintenance, operation and subsequent removal of temporary supplies of electricity, gas and water etc, to all offices and stores used by the Contractor together with that required in connection with the installation of the Work.

The Contractor shall at his own expense during progress of the work and on completion of erection and site tests, remove from the Site all surplus materials supplied by him, including rubbish and shall ensure that the Site is left tidy to the satisfaction of the Employer.

1.24. Equipment spare parts

The Tenderer shall provide such spare parts for the equipment which he considers would be kept in stock to cover replacements over a period of 3 years after final taking over of the Work. The spares Parts shall be packed and sealed in individual boxes to preserve the parts against damage and corrosion over long storage periods. Each package shall be clearly identified as to its contents in English.

The Employer will ask the contractor to provide priced lists of recommended spare parts for all of the equipment which would be needed and shall be evaluated by the Employer. After approval of the prices list the Contractor will proceed with their procurement and supply to the Site.

1.25. Special tools and testing equipment

The Contractor shall supply a complete set of special tools and test equipment necessary for maintenance or testing of any part of the Plant to be carried out during the life of the Plant, whether of an electrical, mechanical or any other nature. The Contractor shall include a price list of all special tools and test equipment in his tender.

The tools and test equipment shall not be used for the erection of the Plant and shall be handed over in a new and unused condition expecting that the Employer may call upon the Contractor to prove their effectiveness.

The tools and test equipment shall be boxed separately, in suitable containers marked or labeled with their contents. All cases, containers or other packages shall be designed to facilitate opening and subsequent repacking.

When specified, tools and test equipment for internally sited plant shall be mounted in suitable cabinets with lockable doors. Racks or clips shall be provided for individual items with outline markings and labels showing which tools or equipment are missing. The cabinet shall be wall mounted with best quality finish and appearance.

The employee will ask the Contractor to supply price lists of all tools and equipment which would be evaluated by the Employer. After approval of the price lists the Contractor will proceed with their procurement and supply to the Site.

1.26. After – Sales Service

The Contractor shall provide full details in the Schedule of Guarantees and proof of particulars of facilities which he will provide for “After-sale service” in the supply or replacement of components / spare parts and skilled maintenance services at Site at any time in future covering all plant and equipment incorporated in the Work.

1.27. Cleaning of Plant

At all stages of manufacture and construction, the Contractor shall ensure that all components which will come into contact with water which is to be used as potable water, are kept in a clean and wholesome state. During storage in the Contractor's works and at Site all reasonable measures shall be taken to exclude vermin, debris and dirty water. After completion of erection and before commissioning, the pumps and pipe work shall be flushed with clean-water to remove any debris or foreign matter.