Rehabilitation of water production station in Daychounieh Water Treatment Plant & Pumping Station

TECHNICAL SPECIFICATIONS DOCUMENTS

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March 2015

UN HABITAT
FOR A BETTER URBAN FUTURE

Rehabilitation of water production station in Daychounieh Water Treatment Plant & Pumping Station

Section I -

TECHNICAL SPECIFICATIONS DOCUMENTS
General Specifications

March 2015

Technical Specifications

Section –I- General Specifications

1. Definitions:

- Architect and Engineer: also referred to as Design Architect or Engineer means the individual or organization who furnished the design, which includes but not limited to the construction drawings and technical specifications.

- The “project implementer” means UN Habitat.

- The “Funding Agency” means the organization, entity, or persons who have entered into a contract or agreement with UN Habitat to achieve a development objective. UN Habitat is responsible to manage the funding provided by the Funding Agency. The Funding Agency is UNICEF.

- The “Supervising engineer”, or Engineer’s representative, means the person whose services have been engaged by UN Habitat to technically monitor and administer the subcontract as provided therein, as will be notified in writing to the contractor or stated in the Contract Data of the subcontract.

- The “Owner” means the individual or organization that will own, use and be responsible for operations and maintenance of the completed work, Beirut & Mount Lebanon Water Establishment (BMLWE).

- The “contractor” means the person or corporate body whose bid to carry out the work has been accepted by the project implementer who in this case is UN Habitat.

2. Location:

Project will take place in Daychounieh WTP & PS (*Southern suburbs of Beirut)* and covers the supply of one axial vertical electric motor 500 HP and the rehabilitation of two axial vertical pumps.

3. General requirements: Prior to any work;

Contractor must obtain written approval from BMLWE, and supervising engineer.

Approval must include proposed time table schedule submitted by Contractor, and approved by UN Habitat Engineers.

Contractor responsibilities include:

- Inspection of site to assess the pumping station and all axial vertical units that need to be overhauled and put in service,

4. Sign boards and visibility panels:

Contractor must provide visibility signs (sign boards) approved by the UN Habitat & BMLWE.

5. Method Statements and time table schedule:

The Contractor shall provide in a reasonably timely manner a method statement to the Supervising engineer (Consultant) for any part of works upon request from the supervisor.

The Contractor shall also provide a detailed time table schedule on MS project or Primavera software, indicating all the phases of the project, starting and ending dates and specific key times for any particular job and major milestones to be achieved all along implementation period.

All schedules shall be in the English language and any system of dimensions (English or metric) shown shall be consistent with that used in the subcontract.

An update of the schedule shall be provided, schedule of deliverables, showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

The contractor shall submit to the supervisor representative for approval an update schedule.

The supervisor approval of the schedule shall not alter the contractor's obligation to perform within the period of performance. The contractor may revise the schedule and submit it to the engineer again at any time. A revised schedule shall show the effect of change orders, where applicable.

6. Safeguards to existing pipes, cables, structures:

It shall be the Contractor's responsibility to safeguard by means of temporary or permanent supports or otherwise all existing installations, pumps cables, panels or other things which would be liable to suffer damage if such precautionary measures were not taken.

7. Record drawings:

Where the Contractor executes work under the contract, including locations where the Contractor undertakes repair or rehabilitations work, the Contractor shall record the location and nature of all existing installations and their associated services.

Where instructed by the Supervisor for the purpose of producing record drawings, the Contractor shall undertake such surveys and investigations to determine the location of existing services. Such surveys and investigations shall be additional to those surveys and investigations undertaken by the Contractor for the purpose of determining the location of services prior to excavation.

The Contractor shall where necessary utilize appropriate equipment and where instructed by the supervisor excavate trial pits to confirm the location and determine the size and nature of the buried services.

For sites where the Contractor undertakes permanent works the record drawings shall be submitted to the engineer for approval, as part of the as built drawings. In the case of repairs and rehabilitation the record drawings shall be submitted for approval within a period of 15 days following execution of the work.

8. Project Management:

The Contractor shall provide within his site organization a project management section to recommend and be directly responsible to the Contractor's Project Manager. The duties of the section shall include the following:

a) Planning and program preparation particularly in relation to the requirements of the Employer and the public authorities, and the requirements to maintain water supply service where careful detailed arrangements have to be made and adhered to.

b) Planning the execution of the works in a manner which minimizes disruption to the water supply system and will permit the efficient and effective commissioning of the water supply system and their respective components.

c) Ensuring that adequate potable water supplies are maintained to all consumers, and that no contamination to those pipes might result from his ongoing works.

d) Continuous surveillance of progress and anticipation of factors likely to affect the timely performance of the contract.

e) Making proposal for modification to forward planning and to the program at an early stage in the light of factors resulting from (d) above.

f) Continuous appraisal of the Contractor's methods and routines particularly as to their effectiveness relating to speed of execution and to their effect on the community and property.

g) Forward planning for resource requirements taking due account of possible shortages and delays in the arrival on site of materials, equipment, plant and personal and their mobilization for effective usage.

h) Acquisition and process of up-to-date information for progress with the engineer. The preparation of monthly progress reports including an update of the detailed program and cash flow forecast which shall include progress pictures as directed by the Engineer.

9. Required standards:

Works covering the rehabilitation of pumps and supply of axial vertical electric motor must conform to the technical specifications described later on in the tender documents.

Any reference to codes, specifications or standard means the latest edition or revision of above referenced codes or standard.

Any work shall be manufactured (constructed), tested and installed in conformance to international standards, or regulations applicable to such work.

The approval of "Supervisor" is a must prior to any work.

Any alternative proposal on required standards covering specifications, drawings and bill of quantities, must be approved by "Supervisor".

Proposed standards and codes governing this contract cover pumping units and all related accessories, hydraulic works, steel works, electrical works (cables & panels)

10. Silence of specifications:

The apparent silence of the specifications as to any detail, shall be considered as meaning "that only the best general practice" is to be used.

In such case “Supervisor” will make the necessary and relevant interpretations covering such works.

11. Correspondence and records:

All correspondence between Contractor and “Supervisor” shall be made in English.

All records, sheets, drawings and documents shall be in English language.

12. Units:

The international system of metric units shall be used throughout this contract.

13. Intent of the contract:

The contract determines and specifies all the work conditions for the construction and completion of the desired work.

Intent of contract is also the description of the work procedures in every detail enlisting all items related to:

- The responsibilities and duties of the Contractor to furnish all the supplies, such as: labors material, equipment, transportation in accordance with the plans, specifications and terms of the contract documents.

- Submittal of shop drawings, (plans & sections) will be approved or returned for modifications within 8 days of submittal.

14. Terms in the contract:

Expressions Like:

- Contractor refers to the entity responsible for implementing the works.

- “As shown”, “as indicate”, “as detailed” as terms of the same connotation, imply that the work should be done according to the drawings and the related specifications.

- “As approved”, “as directed”, “as required”, “as accepted” should mean and understood that the approval, direction, requirement, permission, authorization, review or acceptance of the “Supervisor” is intended.

- “Provide”, that be understood to mean “complete in place”, “that is”, “furnish and install”.

- “Equal” or “equivalent” means that material or equipment will be acceptable when composed of parts or equal quality, or equal workmanship and finish, designed and constructed to perform or accomplish the desired result as efficiently as the named brand, pattern, grade, class or model.

15. Quality control:

Contractor is responsible for his own quality control and shall provide competent personal for supervising his works, taking and preparing samples and for carrying out all necessary required tasks including asphalt cutting pipes welding, concrete construction & casting, trench backfilling, installation of valves road reinstatement and carrying out all necessary tests during work implementation.

16. Reporting:

Contractor in coordination with “Supervisor” will prepare and submit a detailed measurement of works that are completed within the month frame.

Measurements are according to B.O.Q items and the contract is lump sum. The contractor shall price all items after inspecting them.

All materials that must be brought on site must be supplied in suitable containers and in appropriate batch sizes for the work to be undertaken.

Information to be provided:

- Storage instructions.
- The manufacturer’s name.
- Shelf life and dates of manufacture.
- Material identification.
- Batch reference number.
- Net weight.
- Mixing instructions.
- Any warnings or precautions concerning the contents and their safe use;

Add to this that Contractor shall supply with each consignment of proprietary material delivered to the site, certificate furnished by the manufacturer including:

- The manufacturer’s name and address;
- Material identification;
- Batch reference numbers, size of each batch and the number of containers in the consignment;
- Date of manufacture;

17. Refusal of delivered materials:

In case delivered articles or materials are found unsound or of poor quality, such items will not be used and must be removed from site, and replaced by materials pre-inspected and approved by “Supervisor”.

18. Quality of supplied materials and of workmanship:

The materials and work man ship shall be the best of their respective kinds to the approval of the “Supervisor”.

The words “to the approval of Supervisor” shall be deemed to be included in the description of all materials and workmanship for the due execution of works.

19. Approval on materials:

All proposed and supplied sources of materials, construction requirements and proposed standards should be deemed to the “Supervisor’s” approval, the “Supervisor’s” has to approve and agree upon any standard or method of manufacture or specification whether to maintain or change these items.

In other words, nothing related to the constructions or works, or the choice of standard materials in terms of quality (and liability or validity) should be carried out or obtained without the ultimate approval of the “Supervisor”.

Samples of materials shall be submitted to the “Supervisor” for approval, materials supplied must confirm to the quality of the samples that have been approved by the “Supervisor”.

20. Work on private lands:

All works are located within the BMLWE owned WTP & PS and there is no need to obtain clearance from private owners unless specified otherwise.

In any case, and unless clearance is given by Beirut & Mount Lebanon Water Establishment, contractor shall not disrupt any private or public access way without providing alternative arrangements, in such case property access affected by the works must be maintained, trench crossings must be provided via special road plates.

21. Damages to utility properties:

Any damage occurring in the course or progress of work that is adjacent to telegraph, telephone and power agencies or companies or even adjacent to neighboring property, shall be rearranged on Contractor's expenses in cooperation with the owners of any underground or overhead utility lines.

The damage resulting in terms of considerable expense or inconvenience shall be managed before the continuation of work.

22. Access road to site:

Beside main access road any other work requesting access to specific location on site must be implemented and achieved by Contractor himself.

The employer does not guarantee availability of any temporary or existing road inside site premises, and will not entertain any claim in respect of the non-suitability or availability of any such road for continuous use during the contract period.

At the end of works, all temporary roads must be closed, and Contractor must restore landscape to its original form or as indicated by "Supervisor".

23. Site limits premises:

Once boundaries and site limits have been established; (during handing over of site to Contractor) existing boundaries (fences, wire mesh, walls, sidewalks….) will not be modified unless approved by "Supervisor".

24. Starting out of works – Submittal of shop drawings:

Upon receiving clearance to start works, Contractor will submit to the "Supervisor's" approval, detailed drawings and data sheets required to start works.

Coordination will be made between "Supervisor" and Contractor, so as to agree on basic information supplementary to that shown on submitted drawings like base lines, borders, center lines in order to locate exact level of pipes and their relative slopes.

Supplementary information will be submitted on draft drawings, sketches or in writing.

The Contractor shall submit to the "Supervisor" shop drawings that shall satisfactorily establish actual details of manufactured or fabricated items and of works to be executed.

Shop drawings shall clarify and amplify the design drawings and other design requirements and shall, incorporate minor changes in design or construction as may be necessary to suit the requirements of the work.

By submitting shop drawings, the Contractor thereby admits that he has determined and verified all dimensions in relations to existing works, as well as with regards to future works on site.

Accuracy of information submitted by Contractor is under his strict responsibility and any discrepancies, errors or omissions in supplied drawings must be corrected and then re-approved by “Supervisor”.

The Contractor shall submit final as-built record drawings to the “Supervisor” for his review by the specified date.

After review and approval by the “Supervisor” of the final as-built drawings, the Contractor shall within 7 days thereof, produce a final set of “as-built drawings” and submit to the “Supervisor”, one computerized disk copy and 2 printed copies.

In case there are no changes with proposed design drawings, the contractor must obtain the approval of “Supervisor” prior to commence works.

25. Levels, dimensions, benchmarks and level datum:

All construction drawings must be referred to the institute of national height datum. The contractor must obtain the location of permanent bench marks.

In the event that benchmarks do not exist, site datum must be approved by “Supervisor”.

Upon commencement of construction work, steel datum pegs shall be erected in locations approved by “Supervisor”.

All levels used in the construction shall be referred to these steel pegs.

Accuracy of established datum shall be regularly checked during the construction process.

Benchmarks in the area that appear on the drawings shall be established by Contractor.

The Contractor shall provide one sign board mounted on suitable steel frame, in positions and heights indicated by “Supervisor”.

Wherever necessary, safety barriers must be installed to protect pedestrians and people working on site as well as visitors.

26. Miscellaneous works on site:

i. While working on site, Contractor must keep the site as clean as possible by removing wastes, debris and other materials to approved dumping locations.
At the end of works, Contractor shall clean the site to restore it to its initial condition, to the exception of works he has completed.

ii. On all occasions works shall be properly flagged.
Site must be lighted at sunset and whenever visibility is found poor.

27. Insurance:

Contractor must insure his staff and materials against incident and theft, and must also insure his site against any incident that might occur to pedestrians and vehicles and against any third party claim with regard to his work on site.

Insurance must cover the whole period of works on site.

28. Site demobilization:

Upon completion of works and after getting the approval of “Supervisor”, Contractor will start dismantling of stores, work shops, offices and will proceed to the removal of all equipment from site.

Contractor must clean the site and remove all remaining debris, materials in excess, temporary structures.

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Water Treatment Plant & Pumping Station
Beirut & Mount Lebanon Water Establishment

TECHNICAL SPECIFICATIONS DOCUMENTS

Section II

Particular Specifications for pumps rehabilitation and electric motors supply

March 2015

Section-II- Particular Specifications for pumps rehabilitation and electric motors supply

1. Introduction

UN Habitat is implementing the rehabilitation of Daychounieh WTP & PS, the major water supply source for the southern suburbs of Beirut. Project will cover the supply of one axial vertical electric motor 500 HP and the rehabilitation of two axial vertical pumps.

Conditions on site

Before carrying out works, the sites shall be inspected by the Contractor in conjunction with the "supervisor" to establish its general condition that shall be agreed and recorded in writing, and where in the opinion of the Supervisor it is deemed necessary, by means of photography.

Details records shall include the location of all boundary and survey beacons, the conditions of buildings, surfaces, terracing (if any), ditches, watercourses, roads, tracks, fences and other information relating to the site and elsewhere which may be affected by the works.

2. General requirements & guidelines:

a. Site Mobilization:

Mobilization of site covers all preliminary works necessary to start works on the ground.

Contractor is requested to submit a Construction Planning Program (C.P.P) with a time table schedule sheet, C.P.P must describe every task and its correlation with any other job.

Submitted time table must also cover ordering and delivering of materials and consumables.

Contractor's time table schedule sheet will be used as the basis for progress reports during construction phase (weekly & monthly).

b. Mobilization of equipment:

All equipment and machinery needed to implement works must be brought on site prior to the startup of works.

Contractor must provide equipment in good conditions recently maintained and tested.

All consumables needed for machinery and equipment operation must also be brought on site and properly stored in a safe way and to the approval of the “Supervisor”.

Fine tuning of various machinery’s engines must be implemented prior to work on site to prevent pollution during operation.

c. Operation and maintenance manuals:

The “Supervisor” will control and supervise, and eventually approve any set of instructions, after the Contractor has submitted draft copies of the operation and maintenance manuals. On the other hand, the Contractor shall abide and conform to any amendments on additions necessary and indispensable dictated by the “Supervisor” in the production of the final manuals. Each installation requires a provision of a separate set of instructions.

The Contractor shall confine his work to verify that all the instructions are being followed step by step till the completion of each section or part of the works respectively.

Any modifications of the original or initial manuals shall be incorporated in the final version.

Operation & maintenance should be supplied in a written form in both English and Arab languages. All parts and equipment listings are to be described and listed in English.

The draft operation and maintenance manuals must be on site during tests and this to verify that operations comply with instructions.

Any modifications found necessary will be incorporated in the final operation and maintenance version.

3. Submittals:

The Contractor shall order materials to suit the construction program and shall plan his necessary submittals to the “Supervisor” in accordance with the required specifications in a timely manner to suit the ordering, delivery and construction timing requirements. The Contractor shall submit as a minimum the following documents for review and approval by the “Supervisor”:

a. Materials, product data and equipment specifications & catalogues:

All specifications, diagrams, samples, drawings and such other data shall be provided by the Contractor, in a format to be agreed upon with the “Supervisor”, which may be required to demonstrate compliance with the specification.

This shall include but not limited to the following information:

- Originals of catalogues and Supervising data sheets for manufactured items; each item and option to be provided shall be clearly marked and each item not be provided shall be deleted.
- Literature to show that products provided meet the requirements for material, construction, operation, and testing.
- Information on the following items as a minimum: pipes; pipe jointing systems, manhole covers and all other hydraulic accessories.
- Manufacturer's installation instructions for all items.
- Certified reports for all tests and inspections designated herein, showing full compliance with referenced standards.
- Maintenance requirements and procedures.
- Period of guarantee for products.

b. Shop drawings

The Contractor shall prepare shop drawings based on project design plans and section including but not limited to the following information:

- Drawings (plans & sections) for submersible pumpsets that will be installed inside deep wells
- Equipment and material to be supplied including all information related to brand, class, grade, , pressure rating, dimension, location and identification number of each item pumps, pipes hydraulic accessories and pipe fitting to be furnished and installed.
- Procedures for installations.
- All other miscellaneous details required to complete the whole installation process

The review and approval of shop drawings by the "Supervisor" shall not relieve the Contractor from any of his responsibilities under the contract for successful completion of the work.

c. Manufacturer's certifications:

In case decided by the client, Contractor must submit a certification mark scheme issued by an independent third party testing organization to the satisfaction of "Supervisor" stating that production has been carried out under a standard system for supervision, control and testing, applied during manufacture, in accordance with ISO or an equal procedure.

In any case, Contractor will have to submit a certificate of origin and production date of material that must not exceed 18 months.

d. Manufacturer Recommendations:

The Contractor shall submit issued by the manufacturer's recommendations for installation and commissioning of all pumping equipment and their related accessories.

Recommendations shall include testing methods, storage requirements and maintenance and operational data.

The Contractor shall have a copy of the manufacturer's instructions available on site at all times while works are in progress and shall

strictly follow these instructions unless otherwise authorized to deviate by the “Supervisor”.

e. Installation and testing:

The Contractor shall submit his proposed work method statement prior to commencing work.

The statement shall detail proposed sequence of work, hold points, testing frequency and document control.

f. As-built drawings:

The Contractor shall maintain one set of contract drawings for the sole purpose of recording accurate changes made as the work progresses *(“As-Built” conditions of the water project).*

All changes previously agreed upon with the “Supervisor” and all completed work shall be recorded on these drawings.

The Contractor shall prepare as-built drawings clearly showing all shapes and dimensions of all works as executed. All pumps, pipes valves locations shall be identified and recorded. The Contractor shall submit as-built drawings for all installations.

4. Material Storage and Handling:

a. Transportation and handling:

All materials shall be delivered in the manufacturers' original protective packaging and shall be inspected by “Supervisor” upon delivery on site.

Any products, which are damaged and are not in accordance with specifications shall be immediately removed from the site and replaced on Contractor’s expenses.

The Contractor must inspect the shipments to assure that products comply with requirements, and that delivered quantities are correct and undamaged.

All products shall be handled and stored in accordance with manufacturer’s printed recommendations.

The manufacturer must package products for shipment in a manner suitable for safe transport by commercial carrier. When delivered, a receiving inspection shall be performed, and any shipping damage must be reported to the manufacturer, contractor being obliged to replace damaged materials immediately

It is the responsibility of the Contractor to safety transport pumpsets, control panels and all hydraulic accessories to site and proceed for proper stockpiling.

b. Storage and handling:

The Contractor shall store and protect products in accordance with manufacturers' instructions, with seals and labels intact and legible.

The Contractor shall cover products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.

The Contractor shall arrange storage of products to permit access for inspection and shall periodically inspect products to ensure that the products are undamaged and are maintained under specified conditions.

c. Materials to be supplied by Contractor:

All materials that must be provided by the Contractor, unless otherwise specified, shall include but not limited to axial vertical electric motor, PT100 monitoring device, and spare parts for existing pumps rehabilitation.

All materials and equipments supplied locally by the Contractor shall be of the best quality in their class and of the respective kinds as described in the contract and in accordance with the “Supervisor’s” instructions and to the satisfaction of the “Supervisor”. They shall be inspected from time to time at the site during the progress of the work.

Any materials arriving on site found unsuitable shall be rejected. The Contractor shall replace the rejected material at his own expense.

5. Technical specifications for axial vertical electric motor:

This section covers the specifications related to new 500 HP Electric motor

a. Axial vertical electric motor Unit

The electric motor shall be axial vertical hollow shaft similar to existing units and rating 500 HP

The motors shall be totally enclosed squirrel-cage, fan-cooled, induction type, class F insulation with weather protection according to WP II

- Power supply 3 phase, 380v, 50HZ.
- Synchronous speed 1,500 max r.p.m.
- Rating power 500 HP

Motor winding shall incorporate thermal switches as to safeguard against overheating.
The thermal switches shall be connected in the control circuit of the starter.

Motors shall be weatherproof with screens suitable for outdoor use.

The motor windings shall be insulated, and motors shall operate continuously at rate voltage and frequency with a temperature rise not to exceed 40 ^{o}C above ambient when operating at 115 percent of the rate power. The motors shall be rated for a minimum of 20% above pumpset nominal power and shall be capable to drive the pump without over- loading through the full operating range of the pump from maximum capacity to shut off head. The motors shall have a full-load power factor of not less than 75 percent. The locked rotor torque shall be not less than 100 percent of full-load torque. The breakdown torque shall be not less than 200 percent of full-load torque. All motor bearings shall be of the antifriction type suited for a 10-year minimum life.

Drawings & Data

Complete fabrication, assembly and installation Drawings, together with detailed Specifications and data covering materials used, parts, devices and other accessories forming a part of the equipment furnished, shall be submitted with the tender. The data and

Specifications for each unit shall include, but shall not be limited to, the following:

Motor:

- Name of Manufacturer; Type and Model;
- Type of Bearings and Lubrication; Rated Size of Motor, hp;
- Net Weight of Motor;
- Temperature Rating;
- Full Load rotating Speed;
- Efficiency and Power Factor at Full Load, 3\4 Load and 1\2 Load; Locked Rotor Current;
- Rated Current and Voltage;
- Sectional Drawings and Dimensions; Operation and Maintenance Manuals; Spare Parts Manual.

b. Cables for electric motor

Proposed cables for electric motor shall be those already in use for existing motor unit.

Control cables for PT 100 sensors shall be 4x2.5 mm^2 NYM for 300/500 V as per IEC 227.
Control cables for piezo-resistive water level sensor shall be 4x1.5m^2 with polyurethane molded and vented with Kevlar, the level transmitter cables shall be delivered with the transmitter device with no junction on the whole length .

c. Digital indicators for PT100 Thermo-probes

Contractor to supply and install inside control panel of digital indicators for piezo-resistive sensors.

Digital indicators must be housed in a polycarbonate gasket IP65 protected (from the front).

Indicator to be with minimum 5 digits LED lights.

Indicator measuring input 4-20 mA/0-10V DC

d. Pump Disassembly

Major maintenance beyond lubrication, adjustment of impeller or wear ring clearance, and replacement or adjustment of the packing will require disassembly of the pump.
The following are step-by-step instructions and are essentially the reverse of the installation procedure and contractor should abide to these instructions.

Driver Removal Vertical Hollow Shaft (VHS) Driver

- Stop the pump and lock out the power to the driver.
- Close the discharge valve.
- Disconnect the electrical cables from the driver.
- Remove the driver cover and adjusting nut lockscrew.
- Lower the shaft until the impeller rests on the bowl seat.
- Remove the adjusting nut and gib key.
- Disconnect the shaft coupling under the driver and remove the top shaft.
- Remove the cap screws holding driver to discharge head.
- Lift the driver from the head and set aside.

Discharge Head Removal

- Remove and disassemble the pump head, the column, packing box and shafting according to the following procedure which is essentially the reverse of the installation procedure.
- Remove the packing gland bolts, glands, water slinger and packing
- Loosen and remove all the discharge piping flange bolts.
- Remove the packing box bolts and remove the packing box from the head and shaft to a work area for inspection & cleaning.
- The packing box bearing is an interference fit in the packing box. The removal of this bearing will require the use of a mechanical press the bearing maybe removed by machining or other similar methods. Use care when removing bearings to not damage bores or hubs.
- Lift entire unit with the lifting lugs and install a column clamp just below the upper column flange leaving room to remove the flange bolting.
- Lower unit so that the column clamp rests on adequate supports.
- Remove the bolts holding the column to the discharge head.
- Lift the discharge head off the unit and set aside.

Column Removal Flanged Column

- Install eyebolts of sufficient size in the column flange holes and lift the unit and reposition the clamp below the next column flange.
- Use column and shaft clamps (or other acceptable method) to safely support and lift this assembly.\
- Unbolt column flange and lift column enough to loosen the shaft coupling. When all components are loose, carefully lift this assembly from the pump unit. With soft skid boards under the column to protect the flange, slowly lower the column and shaft assembly onto the floor and move to a convenient work area.
- Repeat above steps A until all column and shaft sections have been removed from the unit.
- Remove the bearing retainer assembly for inspection and cleaning.
- Remove shaft section from column pipe.
- Remove couplings from shafts and inspect for wear or damage.
- Inspect bearings and retainers for damage.
- If the top and intermediate drive shaft sleeves show wear or damage remove the sleeve by heating to break the Loctite bond
- *Refer to Pump Bowl Disassembly for detailed6- Pipe works (for discharge headers):*

Pump Bowl Disassembly

- For disassembly of the pump bowls, contractor must proceed in accordance with steps listed below.
- Select a clean area for work. Refer to assembly drawing and parts list for part identification.(if available)
- For flanged bowls place the bowl assembly in a horizontal position, blocked to prevent rolling.
- Measure and record the axial end play of the shaft. This must be checked on reassembly of the bowls.
- Remove the shaft coupling
- Remove the cap screws holding the top intermediate bowl and discharge case or water lube adapter (and remove from the pump shaft and set aside for inspection
- Remove the impeller and collets from the pump shaft for this, pull the shaft upwards until the impeller is in its highest position. Using a collet driver drive the impeller off the collet.
- If impellers are to be reused, they should be marked so that they are re-installed in the same bowl position.
- Remove the cap screws holding the next intermediate bowl
- Remove the intermediate bowl from the pump shaft and set aside for inspection.
- Repeat steps above until all bowls and impellers have been removed.
- Remove the shaft from the suction bell or suction case.

- Measure and record the location of the sand collar
- Remove the sand collar only if it is damaged and replacement is required.
- Replace existing rings.

Any parts showing signs of excessive wear or damage should be replaced with genuine pump parts.

- A. Inspect the shafting at each bearing location for damage or excessive wear and replace shaft if not salvageable and if instructed by supervisor
- Inspect all line shaft bearings, packing box bushing,and all bowl bearings for wear and excessive clearance. If the diametrical bearing clearance exceeds the limits, the bearings must be replaced.
- Inspect the bowl wear ring for wear and excessive clearance and proceed fr repaceent or reparation as if instructed by supervisor
- Inspect the shaft sleeves for wear and eplace as necessary.

Packing Replacement

The replacement procedure for Packing Replacement should be as follows:

- Stop the pump
- Unbolt and remove the gland.
- Use a flexible packing tool with a hook attachment for removal of the packing.
- Clean the packing box and shaft sleeve.
- Inspect the shaft sleeve for wear or rough finish and replace the sleeve with a genuine pump sleeve if necessary

- Supply and install of new genuine packing element
- Reinstall the gland and tighten the gland nuts finger tight. After the pump has been started adjust the glands so that there is a steady stream, approximately 1/8" diameter, from the packing box.
- Reassemble and test
- Proceed for calibration and adjustment.

e. Pump Bowl Assembly

Prior to the start of reassembling the pump bowl the following is to be done:

- Apply grease to the bowl registers to improve assembly alignment.
- Clean all components before starting the assembly. Do not apply any petroleum based
  solvents to neoprene bearings
- Install bearings in their respective bowls if they have been removed.
- If they have not been replaced, they should be thoroughly cleaned and lubricated with a thin film of grease
- Install new wear rings, if they are to be replaced, in all bowls.
- Remove the pipe plug from the suction bell and remove old grease. Apply a thin film of multi-purpose grease to the shaft and the suction bowl bearing.
- Lay out the parts in the order in which they will be assembled.
- Reused impellers are to be re-installed in the same bowl in which it was originally installed and the bowl is to be reinstalled in its initial position.
- Install shaft sleeves as required according to the following procedure:
- Refer to the previously recorded sleeve locations and scribe or mark shaft accordingly.
- Thoroughly clean the sleeve and shaft in the sleeve area using a cleaner as recommended by supervisor
- Apply a coat of Loctite 609 or similar approved on the shaft in the correct sleeve location area.
- Slide the sleeve over the shaft, rotating it several times while at the same time moving the sleeve axially on the shaft.
- Proceed with the assembly of the pump bowl as follows:
- Put the suction bell in a horizontal position and block from rolling. Insert the pump shaft into the bearing as far as it will go.
- Insert a shaft locating tool through the pipe tap in the suction bell and fasten to the pump shaft. Tighten securely.
- Install the sand collar if it has been removed and secure with setscrews.
- Install the first impeller over the pump shaft and into position in the suction bell seat. The impeller should rotate freely in the bowl. If it binds, remove and determine the cause.
- Open a lock collets slightly and slide over the pump shaft and into the impeller. Using a collet driver drive the lock collet into place in the impeller bore.
- Install the intermediate bowl and tighten capscrews.
- Repeat steps above to install all additional stages until all pump bowls have been reassembled.
- Install the top intermediate bowl and discharge case or water lube adapter over the pump shaft and bolt in place with cap screws and nuts.
- Remove the shaft locating tool holding the pump shaft in place. Check the bowl endplay.
- Pack the cavity with grease and replace the pipe plug in the suction bell
- (case) hub.
- Install the coupling on the pump shaft.

f. New impellers

The new impellers should be identical to existing one with bronze or stainless steel material unless otherwise specified

New impellers should be assembled as mentioned previously and the whole system must be re-calibrated against vibration

9- Painting (where applicable)

All painting (internal and external surfaces) shall be applied in conformity with the manufacturer's recommendations.

All interior paints for control & chlorination room will be covered by a washable Latex – Based paints.
Paints shall be washable, of a perfect solidity and shall allow a flawless application.

Surfaces that must be painted shall first be cleaned, and sand papered before the application of the first coat of sealer.

A second sanding shall be followed by the application of a primer coat.

Finally two (2) paint coats shall be applied in conformity with the colors and samples approved by the engineer.

For exterior surfaces a plastic paint ready to use under the form of a unctuous thixotropic paste will be used; it shall be composed of vinyl-maleate resins or water, the painting must adhere perfectly and be totally waterproof and offering a perfect resistance to chemical agents, heat and fire.

Before any commencement of application of the paint, contractor must make sure that all surfaces are clean, without grease and dustless.

The contractor shall apply a primer coat (undercoat) acting as a surface regulator and then will apply two coats using an alxeolroll.

Application must be in thick layer and must be starting from down toward upper zones.

The product must be applied in important quantities but not spread.

10-Tiling (where applicable)

Tiling will be used for floors and walls as instructed by the supervising engineer.

The contractor must take all necessary measures to ensure complete protection for tiling works and this until the taking over.

Cement mortar for wall tiles and skirting's shall be composed from one part of Portland cement and three parts of sand (Volumetric dosage)

Cement used must conform to B.S.12 and sand must be clean free from dint, clay particles and other impurities.

For wall tiling contractor must use a white ceramic enameled tiles 20cmx20cm, and skirting 10x20cm.
Ceramic tiles must be of a first grade quality and have to be resistant to acids, bases, grease and hydrocarbons.

They must be tested under a 400kg/cm^2 load during manufacture.

For floor tiling, contractor must use concrete tiles not less than 3 cm, or cement mosaic tiles 20x20cm.
Mosaic tiles shall be of local manufacture and shall consist of two layers:

a. A wearing layer of 7 mm minimum thickness
b. A base layer constituted of a mixture of sand and cement proportioned at 350 Kg of cement (7 bags) for 1 m^3 of sand.

The minimum thickness of the tiles shall be 200 mm, and must be highly resistant to abrasion.