VOLUME - II, PART - 2

SECTION – 1

GENERAL TECHNICAL SPECIFICATION

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VOLUME – II

SECTION 1

GENERAL TECHNICAL SPECIFICATION

1.0 GENERAL PLANT DESCRIPTION

1.1 Intent of specification

GIPCL requires a 2 x 0.5 MLD Desalination plant to supply clear water to 2375MW RE Park at great ran of Kutch area, in the State of Gujarat.

The scope of this Tender Specification is for a 2 x 0.5 MLD Desalination plant project for 2375 MW RE Park with four Nos Borewell, raw water conveyance to desalination plant, desalination plant system, treated water supply till termination point, reject water supply till termination point, neutralization reject system including all mechanical, electrical, controls & instrumentation as specified herein covers the following:

(i) Four (4) no's borewell with submersible pump and conveyance piping till desalination plant
(ii) Pond water clarification system and conveyance piping till desalination plant
(iii) Desalination plant (2 x 0.5 MLD capacity)
(iv) Treated water supply till terminal point
(v) Neutralization reject system
(vi) Reject water system till termination point
(vii) Plant & Piping Layout
(viii) Design of equipment, piping and tank capacities
(ix) Engineering works for all items of desalination package
(x) Procurement and Manufacture of all items of Desalination plant package
(xi) Carrying out Inspection & Testing at Manufacturer's works
(xii) Supply, Packing & forwarding, transport and delivery to site
(xiii) Installation & construction activities at Site including Basic design and further detailed engineering and design of civil works construction
(xiv) Pre-commissioning works at site (Pre-commissioning works shall be carried in the presence of client Engineer/PMC Engineer.)
(xv) Testing and commissioning work at site
(xvi) Performance testing & Guarantee testing.
(xvii) Successful Bidder to provide comprehensive Operation and Maintenance of complete Desalination plant for a period of Three (3) years.
(xviii) Storage Tanks

This technical specification is intended to specify the minimum requirement for the Desalination plant and its accessories. The design, manufacture, supply, inspection, testing, cleaning, painting, and systems covered herein shall conform to the latest edition of international codes and standards. Best engineering practices shall be followed wherever the relevant standards are not available.

The scope of the package for the Desalination plant shall include associated mechanical, electrical, controls & instrumentation and Civil works as specified herein. Bidder's scope of works shall cover design, engineering, procurement, manufacture, inspection and testing at manufacturer's works, supply, packing & forwarding, insurances, transportation to site, erection, pre-commissioning, testing, commissioning, performance testing, Guarantee testing of all equipment related to Desalination plant and associated accessories which are deemed to be part of the package.

The groundwater shall be drawn from the four borewells within the RE Park and shall be desalinated in the RO desalination plant located at the identified plot within the park to achieve the specified water quality parameters for Solar PV module cleaning purposes and domestic use.

Rainwater during southwest monsoon will be collected in pond -2 located within RE park. It shall be utilised till availability of water for RO desalination plant. Rainwater collected in the pond has low TDS compared to ground water extracted through bore-wells and Pond water parameter is given in section 2.

The product water from the desalination plant shall be pumped to the designated termination point.

The brine/reject water and neutralised water from the desalination plant shall be pumped to the designated termination point.

The supplied equipment's by the Bidder shall be new and unused.

The detailed scope of supply and services are indicated in this section as well as in the following sections of Volume II.

Section 2.0	Detailed Technical Specification – Process and Mechanical
Section 3.0	Detailed Technical Specification – Electrical
Section 4.0	Detailed Technical Specification – Control & Instrumentation

Section 5.0	Technical Schedules
Section 6.0	Quality Assurance Plan
Section 7.0	Standard specification for shop and field painting
Section 8.0	General specification for 3 years operation and maintenance

This section explains General scope of supply & services, General plant design & layout requirements, Quality & testing requirements, Spare parts and Documentation requirements.

1.2 Major Equipment and systems

The Desalination plant system package for the proposed 2 x 0.5 (1-one) MLD capacity Desalination plant system shall include, but not be limited to the following:

1.2.1 Mechanical

The scope of supply and services as per the scope matrix provided in Annexure 1.1.

1.2.2 Electrical

The Scope shall include design, engineering, supply, installation, testing and commissioning of the following electrical equipment complete with all accessories and meeting all statutory requirements. The following items shall include but shall not be limited to:

1. 415V Motor Control Centers for 2 x 0.5 MLD Desalination plant.
2. Cabling from 415V Motor control center to various Motors complete with cable trays, supports, conduits, glands, lugs straight through and termination kits etc.
3. Cabling from PSS 1 to Desal plant complete with precast cable trench, cable trays, supports, conduits, glands, lugs straight through and termination kits etc.
4. Cabling from PSS-I to Borewell 2 & 3, PSS-2 to Borewell 1& 4 will be in bidder scope including precast cable trench, cable trays, supports, conduits, glands, lugs straight through and termination kits etc.
5. Local Push Button Station for supplied equipment.
6. LV Motors for all rotating mechanical equipment supplied under Bidder scope.
7. Junction Boxes as required for supplied equipment.
8. 230V AC UPS, Battery bank & UPSDB
9. LT Power cables and control cables for all the equipment
10. Cabling system completes with cable trays, supports, conduits, glands, lugs, ferrules, clamps, straight-through and termination kits, etc., for all the cables.

11. Fire stop sealing system for cable penetrations. Fireproof painting for power cables up to 1 meter from Termination at both end (Power source and Equipment).
12. Illumination system (Indoor & outdoor) completes with lighting distribution boards, lighting panels, lighting transformers if required, lighting poles, receptacles, fans, conduits, wires, switch boxes etc.
13. Complete earthing system including buried (below ground and connection to existing earth-mat) earthing. Equipment earthing (above ground Earthing). Lightning protection system
14. Electronic earthing system with earth pits
15. Lightning protection system as required.
16. Fire sealing system for cable penetrations on the walls/floors.
17. Safety equipment such as Rubber mats, First aid box, Danger plate, etc.
18. Complete Electrical Installation work
19. Interfacing of electrical equipment with proposed Desalination plant PLC. If applicable.
20. Bidder to provide the Mandatory spares.
21. Special Tools and tackles for erection & maintenance
22. Any other electrical system as required to complete the project shall be included.
23. Bidder shall refer to Single line diagram (SLD) for further details in volume II, Part - 2, Section -3 (Detailed Technical Specification- Electrical).

1.2.3 Control & Instrumentation System

The Scope shall include design, engineering, supply, installation, testing and commissioning of the following electrical equipment complete with all accessories and meeting all statutory requirements. The following items shall include but shall not be limited to:

1. PLC based control system with SCADA & Historian system including data logging and retrieval and printing, Operator cum engineering station with 32-inch LED monitor, required software's and necessary License, control desk and the chairs further monitoring from PSS-1 HPCMS system monitoring integration shall be in bidder scope.
2. Additionally, complete one number of Engineering station software's and necessary License for the engineering station shall be provided by the bidder.
3. Auxiliary power supply & UPS system with complete distribution for I&C equipment
4. All field Instruments and sensors including pipe/line mounted items and accessories

5. within battery limits and the power supply shall be provided by UPS. However, bidder is to ensure minimum voltage drop (1.5%) at the instrument end with universal power supply of 110V AC to 230 V AC.
6. All final control elements like control valves and actuators etc. within battery limits
7. All junction boxes, local panels, pneumatic and process hook up hardware and other erection materials and accessories including earthing system (separate electronic and frame earth) along with cables.
8. Necessary Ultrasonic/Magnetic flow metering station with totalizer at each borewell water supply pumps, Product water distribution at main discharge lines and at every distribution tapping including future provision required during detail engineering and with the necessary communication system including UPS power supply to the respective flow meter and totalizer arrangement and the Desalination PLC shall be in the bidder scope.
9. From Each Totalizer flow(m3/h), daily totalizer and cumulative totalizer to the SCADA system including daily automatic report generation in excel format.
10. Cable trays, conduits, supports and stanchions for all instruments within the battery limit.
11. Complete Instrumentation, control, compensating, special cables, prefabricated cable, fiber optic cable etc.,
12. MODBUS TCP/IP Communication through redundant FO link shall be established between Desalination and existing GIPCL HPCMS SCADA system for monitoring. For this purpose, redundant armored single-mode fiber optic link with spare cores shall be provided & laid between Desalination and existing GIPCL HPCMS SCADA system.
13. All necessary field instruments - Transmitters, gauges, final control elements like on-off valves, control valves, motorized valves, etc. along with junction boxes with canopy, erection hardware, instrumentation cables, control cables, special cables, fiber optic cables, patch-chord cable (bidder ensure that patch chord connector shall be same type) and other accessories as required for proposed project.
14. Start up and commissioning spares.
15. Mandatory spares.
16. Special Tools and tackles for erection & maintenance
17. All other I&C items, works and services detailed elsewhere in the specification

18. Any other control & instrumentation system as mentioned in Section 4 of this specification & as required to complete the project shall be included in bidder scope.

1.2.4 Scope of Supply and Services

The scope of supply and services as per the scope matrix provided in Annexure 1.1.

1.2.5 Civil

The scope of supply and services as per the scope matrix provided in Volume II - Part 1.

2.0 LIMITS OF SUPPLY/ TERMINAL POINT (TP)

2.1 Mechanical

Sl. No.	Description	Terminal Point	Remarks
1	Supply of Borewell water	Construction of Borewell and supply of Borewell water to Desal plant, with required air release valves and isolation valves.	
2	Supply of RO water	At the termination point. * 7 nos outlets of Gravity pipeline from RO tank.	* Each pipe of required size, with isolation valve, NRV & blanking with blind flange arrangement for each outlet
3	All drain lines	At the inlet of reject water sump and further disposal till termination point	
4	Disposal of Reject water	At the termination point.	With isolation valve & blanking with blind flange arrangement
5	Instrument Air	Not envisaged.	If Instrument Air is envisaged by the bidder and same IA system shall be supplied by bidder.
6	Process Piping	As per S. No 1, 2 & 3	Complete piping, valves and support in bidder's scope.
7	Vents	Shall be terminated to safe location	Complete piping, valves and support in bidder's scope.

Sl. No.	Description	Terminal Point	Remarks
8	Service water from RO supply pump header.	Further distribution to internal requirements by Desalination Bidder.	Bidders' responsibility.
9	Service Air required)	Not envisaged.	If Service Air is envisaged by the bidder and same SA system shall be supplied by bidder.
10	N-Pit Reject	Disposal of N-Pit reject till designated location	With isolation valve & blanking arrangement

Pond Water Clarification Plant:

Sl. No.	Description	Terminal Point	Remarks
1	Raw Water	from Pond	
2	Clarified Water	At Raw Water Storage tank	
3	Clarifier Sludge / DMF backwash	At Reject sump	

Counter flanges required fasteners and gaskets for terminal flange connections shall be supplied by the Bidder.

2.2 Electrical

Sl. No.	Description	Terminal Points
1.	LT Power supply	Incoming power supply feeders at PSS-1/2 for MCC/BW motor will be provided by GIPCL. Power supply from feeders to MCC/BW/High Pressure pumps will be Bidders scope including precast cable trench from PSS1 to Desalination plant
2.	Earthing	By the Bidder within his battery limits.

2.3 Instrumentation and control

Sl. No.	Description	Terminal Points
1.	Cables	No terminal points. Complete supply by the Bidder within tolerance limits.

Sl. No.	Description	Terminal Points
2.	Field Instruments / Final Control elements / Erection hardware	No terminal point. Complete supply by the Bidder within his battery limits.
3.	Power supply	No terminal point. Complete supply by the Bidder within its battery limits and for purchaser use as per the specification requirement.
4.	Instrument air	Not envisaged. (if it is envisaged during detailed engineering bidder shall supply the complete Instrument Air (IA) for successful commissioning of the project.
5.	Soft link communication with purchaser SCADA	The Desalination plant PLC control system shall be connected to a dual redundant high-speed fibre optic data highway and interface with the purchaser's common SCADA through located in the main plant's PSS-1 control room. The Bidder shall provide the supply of redundant single-mode Fiber optic cable (SMFO) from the Desalination plant to the Existing SCADA LIU panel and the connection through Modbus TCP/IP. The Bidder shall also provide the Redundant Light Interface Unit (LIU), Redundant Hardware fire wall, Redundant media converter, and Redundant patch cord etc. at the Bidder's end.
6.	Master clock signal interface	The Desalination PLC shall be time-synchronized through the master clock system using the NTP (SMFO) protocol. The redundant SMFO cable from the Desalination plant PLC & SCADA to the purchaser's Master Clock System panel. The Bidder shall also provide the Redundant Light Interface Unit (LIU), Redundant media converter, and Redundant patch cord at the Bidder's end.
7.	UPS power & supply feeder	Complete Parallel (2 X 100%) redundant UPS & ACDB, power distribution for desalination plant and up to all borewell pumps and at pond pumps for the project including the incoming and outgoing cables for UPS and its DB.

2.4 Civil

Construction of any nature of civil works/tanks/foundations/drains is in the bidder's scope. The required puddle flanges, insert plates, angles, and bolts which shall be

supplied and inserted in the concrete shall be in the Bidder scope. Complete engineering and providing GFC drawings as required for construction are in the bidder's scope.

Bidder shall consider providing GFS tanks for storage tanks having holding capacity lesser not less than as per the process requirement. Necessary fabrication drawings, quality procedures, steel plates including wastages shall be provided by bidder to site. Further fabrication of larger tanks as per the provided quality procedures shall be executed by the bidder at site. Responsibilities and guarantees on fabricated items lies with the bidder. Refer Volume II - Part 1 for further details.

3.0 EXCLUSIONS

3.1 Mechanical

NIL

3.2 Civil

NIL

3.3 Electrical

NIL

3.4 Control & Instrumentation

NIL

4.0 PROVISIONS BY THE OWNER

The following activities shall be the responsibility of the Owner:

- Land within the property line limits as indicated in the plot plan
- Incoming power supply feeder to PSS1 & 2

5.0 PLANT LAYOUT AND DESIGN

Bidder shall be responsible for the satisfactory arrangement and layout of borewell & raw water piping, Pond Water Clarification system with pump, Desal plant, tank, equipment & Piping layout, reject water till designated termination point & treated water system layout covered in this package specification.

Plant layouts included with the tender documents are intended to guide the Bidder. The Bidder may offer alternative arrangements to suit the requirements of the equipment and plant facilities being offered or alternative arrangements that will provide a more practical or safer design.

However, the plant layout and design shall satisfy the following requirements:

a) The Bidder shall produce a coherent and co-ordinated design for the plant. All equipment shall be finished in the same colour regardless of manufacturer except

when specified otherwise or as agreed by the Owner/Owner's Engineer.

b) The design shall be considered in such a way that every equipment shall be accessed easily for carrying maintenance activities.

6.0 GENERAL PLANT DESIGN REQUIREMENTS

6.1 General

The design of the Desalination plant package and associated auxiliaries shall generally conform to the following requirements.

The Desalination plant system Equipment shall be constructed considering prudent engineering practices and optimal utilization of resources. These shall be complete and include all the equipment and systems necessary to ensure high level of reliability, availability, efficiency, safety and maintainability over their lifetime. It is also necessary to consider various precautions to safeguard the operating and maintenance personnel.

The Desalination plant system equipment shall be suitable for full range of ambient and other environmental conditions as prevailing at the site. The design of the desal plant shall ensure that the plant can, in the state of normal operation, adapt itself to load, frequency, power factor, and ambient variations within the allowable range of design.

The plant will be commissioned with a capacity of 0.5 MLD as the priority, utilizing one borehole for water supply. It will produce 0.25 MLD of RO water initially and will reach a final capacity of 0.5 MLD using a VFD drive system to provide clean water for the RE Park.

The life span to be considered for the design of equipment and component selection shall be minimum 25 years.

The various parts or components or assemblies of equipment and systems shall be of proven materials with well-established physical and chemical properties appropriate to the service and atmospheric/ environment of the site/ location of the plant as intended. It is required that the equipment shall be of a rustproof, moisture-proof and waterproof type to ensure continuous trouble-free operation.

All materials, components and equipment shall be tested at all stages of procurement, manufacturing, erection, and commissioning as per the comprehensive Quality Assurance Programme to be agreed mutually between the Owner and the equipment supplier.
In the design of the Desalination plant and selection of equipment, the specific requirements of this project and likely occurrences of abnormal operating conditions must be taken into consideration to ensure that the desal plant can, under these circumstances, operate continuously, safely and with high efficiency. The selection of

materials shall be suited to local environment site conditions.
The equipment must operate without vibrations that may affect its operation, that of other machinery or of civil works under every condition.

Corresponding parts throughout shall be made to gauge and be interchangeable wherever possible. In case required, the supplier shall provide the necessary references for all kinds of equipment along with technical specifications, drawing of parts, manuals as per requirement.

All equipment performing same duties shall be of the same type and manufacture to limit the stock of spare parts required and maintain uniformity of plant and equipment to be installed.

The equipment should be adequately protected against environmental elements, such as humidity, dust, corrosive, chemical environment at site etc., and the influences that other equipment may have, such as heat radiation, induced vibrations, etc. The supply shall include protective cabinets for parts exposed to the open air or sensitive parts requiring such protection.

The Bidder shall provide a complete, state-of-the-art instrumentation and control (I&C) scope for the 2 × 0.5 MLD desalination plant, fully engineered, supplied, installed, integrated, configured, calibrated, tested, commissioned, and handed over on a turnkey basis, such that no additional items or services are required for safe, reliable, and compliant operation; this includes field instruments (pressure, flow, level, temperature, conductivity/TDS, pH/ORP, turbidity/SDI, salinity, differential pressure across filters/membranes), analyzers, control valves/positioners, actuators, local control stations, junction boxes, marshalling, cabling and terminations, industrial networks, panels (MCC/PCC interfaces, PLC & Scada, I/O, UPS-backed control power), a redundant PLC/SCADA with historian, alarm and event management, interlocks, permissive, trips, cybersecurity hardening, time synchronization, user licenses, reports, data export, and remote access as approved; complete pre-commissioning (loop checks, instrument calibration with traceable certificates, valve stroking, FAT/SAT), commissioning (dry/wet), performance tuning (PID/sequences), fail-safe design, safety instrumented functions as specified, spares, special tools, O&M manuals, as-built documentation (P&IDs/sequences, IO lists, cause-and-effect, alarm rationalization, instrument index, loop drawings), training, warranty support, and all updates/upgrades released by OEMs during project and commissioning phases; the Bidder is responsible for integration with electromechanical systems (intake, pretreatment, RO trains, CIP, flushing, backwash, chemical dosing, product/Reject handling, storage, transfer), utility systems (instrument air, power), communication with Owner systems if required, meeting all applicable

codes/standards, and achieving guaranteed performance and availability, with any commission—whether or not explicitly mentioned—deemed included in the Bidder's scope for a complete and fully functional plant.

Stand-by auxiliaries shall be designed for auto start up, on failure of running auxiliaries with minimum time delay and without runback on unit load.

6.2 Standards and Codes of Practice

The equipment's to be furnished under this specification shall be in accordance with the applicable section of the latest version of the relevant IS/IEC standards including amendments, if any, except where modified and / or supplemented by this specification. The following codes and standards are as applicable to the design, manufacture and testing of the equipment covered by this specification:

ANSI	:	American National Standard Institute
API - 598	:	Testing code for Gate valves
API – 609 (up to 24")/BS 5155/ISO-5752 (Above 24")	:	Design code for Butterfly valves
API 610	:	Design Code Centrifugal pumps for chemical services
API 675	:	Design code for positive metering pumps
API-600/API-6D/API 602/IS 778/BS:5150/BS:5163/BS 1414/IS:14846	:	Design code for Gate valves
ASME Section VIII Div I	:	Boiler and pressure vessel code
ASME Section X	:	Design code for FRP vessels
ASTM	:	American Society of Testing and Materials
ASTM D1998	:	Standard specification for polyethylene upright storage tanks.
ASTM D3299	:	Standard Specification for Filament wound Glass fiber reinforced Thermostat resin chemical resistant tanks.
ASTM-I-165-65	:	Standards Methods for Liquid Penetration Inspection.
AWWA	:	American Water Works Association
BS – 6755 Part -1/API-598	:	Testing code for Check valves
BS- 5156	:	Design code for Diaphragm valves
BS -6755 PART 1	:	Testing code for Globe valves

BS- 6755-part 1	:	Testing code for Diaphragm valves
BS: 4994	:	Specification for design and construction of vessels and tanks in reinforced plastics
BS: 5500	:	Code for design fabrication and erection of cylindrical welded storage tanks
BS:2594	:	Specification for carbon steel welded horizontal cylindrical storage tanks.
BS-1868/API-594	:	Design code for Swing check valves
BS-5352/BS - 1873	:	Design code for Globe valves
BS-6755 PART 1/API-598	:	Testing code for butterfly valves
HIS	:	Hydraulic institute standards
ISO	:	International Organization for Standardization
ISO 1940	:	Dynamic balancing
ISO 2548	:	Acceptance tests for centrifugal, mixed flow and axial pumps
ISO 2858	:	Design Standard for Horizontal End suction pumps
OSHA	:	Occupational Safety and Health administration

6.3 Plant Operational Requirements

i) The unit shall give Guaranteed quantity and quality of water under the following conditions:
   - Maximum and Minimum water temperatures

ii) The design shall cover adequate provision for quick start-up and loading of the unit to full load at a fast rate.

iii) The design condition shall be validated based on the most likely occurrence.

iv) In case of any difference from the base level, the bidder shall consider the most stringent condition for design conditions.

v) Equipment and accessories should be designed to cater to the above operating conditions with adequate margin as per standard practice prevailing

vi) Mode of Operation
The plant shall be designed for an availability of more than 95%.

6.4 Vibration

Vibration shall be reduced to the minimum as far as possible to well within the limit of the standard where it cannot be eliminated. Amplitude and frequency limitations in the design and supporting structure shall be considered.

Special care shall be taken to avoid operating equipment making resonance with foundations, packing, duct, platform, piping or other components.
Unless otherwise stated or agreed by the Owner each rotating machine must comply with the requirements for designation as 'good' stipulated by ISO /ASME std for the respective group of machinery. If the vibration is higher than stipulated as 'satisfactory' the Owner has the right to reject the corresponding equipment, subject to the conditions specified elsewhere.

6.5 Noise levels

The Desalination plant Vendor shall take all necessary measures for noise attenuation to meet the specified noise levels. Noise pollution shall meet the World Bank Group norms and requirements. All equipment shall be specified for a design to run without undue vibration and with the least amount of noise.
Further Noise level at the Station boundary shall not exceed the Ambient Air Quality Standard in respect of noise as notified by latest world bank norms and any other stipulation by Government of Gujarat, India.

General requirements of noise control:

At 1.5 m from the floor or the platform of equipment, if in operation, the level of noise shall be less than 85 dB(A) or less at 1.00 m from the shell of equipment.

Equipment/ machines shall be provided with acoustic enclosures, wherever required so as not to exceed the permissible noise limits.

6.6 Units of Measurement

For all the technical tables and diagrams, calculation results, drawings, test data and scales adopted in the design and provided for the plant, the standard international unit system (SI) as per International Standardization Organization (ISO) shall be uniformly employed.

SI system shall be employed for all the first-class plant layout and arrangement drawings of equipment made especially for the project. In spite of the employment of British Standard in the layout or drawings and single item standard drawings made with other measuring units, the principal dimensions and demarcation points on these drawings shall also be converted into SI system to be directly marked onto them.

6.7 Painting, Insulation, Anti-dewing

Anti-corrosive coatings and painting shall be carried out as a pre-treatment to all equipment and parts. The paint system used should coordinate with the painted objects and surrounding conditions of project.

Anti-corrosive coatings and painting shall comply with ISO 12944 classification C5 (Durability – Very High) for all equipment and structural steel which are inside the plant boundary.
In multi-layer painting system, different painting layers should be selected to make the painting coordinate. If multi-layer painting system is used, various painting layers should have distinct colours so that the later layer can be distinguished from the former one.

After the equipment or apparatus finished preliminary or full painting, it can be supplied to field. After the installation is finished, ground coat must be painted.

Entire painting procedure should be supplied to repair the injures of painting coat after the equipment is delivered to field.

Colour strip indication system should be used for pipes. These strips should be painted on the joint of pipes, entrance, valves of pipe. This pipe without outside protection layer should be marked by some colour in whole length. The principal colour of field equipment should be determined by the Owner and Bidder during execution stage.
Cathodic protection shall be considered for corrosive system / equipment.

The specified requirements shall be applied to the whole equipment and facilities of the project Contract.

7.0 LANGUAGE TO BE USED

English shall be used as the general Contract language. English translations shall be provided for any code and standards in any other language.

Nameplates of equipment and instrument scale, etc. shall be marked in English as required for start-up, testing and training etc.

Documents for training shall be provided in English.

8.0 QUALITY ASSURANCE, SHOP INSPECTION AND TESTING

8.1 General

This section contains general requirements for inspection of material, parts, equipment

and workmanship of the plant during manufacture, assembling to demonstrate compliance with specification, codes and standards to ensure overall reliability of plant operation and performance.

The Owner and/or authorized Representatives shall, at any time, be allowed free and ready access to the Bidder's premises and those of his suppliers as well as to the site installation and the Bidder must make the plant items available for the purpose of inspecting the specified equipment components and obtaining information as to the progress of the work. Failure on the part of the Owner, at this or any other time, to discover or reject materials or work which do not meet specified requirements shall not be deemed an acceptance thereof nor a waiver of defects therein.

The approval of the Owner shall not prejudice the right to reject equipment if it does not give complete satisfaction in service.

8.2 Scope

Materials, components and equipment covered under this specification shall be tested at all stages of procurement, manufacturing, erection, and commissioning as per a comprehensive quality assurance programme. The requirements of minimum quality plans to be followed by the Bidder concerning various equipment are specified in the detailed technical specifications. The Bidder shall draw his quality plans in line with these requirements and his standard practices and implement such programme after approval by the Owner.

The manufacturing quality plan shall detail out, for all the components and equipment, various tests/inspections to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Bidder's quality control organization, the relevant reference document and standards, acceptance norms and inspection documents raised etc. during all stages of material procurement, manufacture, assembly and final testing/performance testing.

The Bidder has primary responsibility for ensuring the quality of items of equipment supplied under the contract and remains accountable when manufacture is subcontracted. It is therefore a requirement of the specification that work is only subcontracted to companies with effective quality control organizations and that the Bidder monitors the performance of these by the attendance at tests of experienced inspectors employed by the Bidder.

The Bidder shall, at the appropriate time, prove that his material and/or equipment comply with all the requirements of this Section, such proof being the successful completion of tests and inspections. Routine test and type test certificates shall be

submitted for each item of equipment, wherever applicable.

Materials, components and equipment supplied under the contract shall be subject to inspection by the Owner, and his representative. The inspection and tests shall include but shall not be limited to the requirements of this section of the specification. Further requirements to be applied are specified in the detailed specification.

The Bidder along with the quality plan, shall also furnish copies of the reference documents/plant standards/acceptance norms/test and inspection procedure etc. referred by the Vendor in quality plans. These quality plans and reference documents/standards etc. will be subject to the Owner's approval and will form a part of the contract. In these approved quality plans, the Owner shall identify customer hold points (CHP), indicating tests/checks that shall be carried out in the presence of the Owner's engineer or authorized representative, and beyond which work will not proceed without the consent of the Owner's Engineer/authorized representative in writing.

No materials/equipment shall be dispatched from the manufacturer's works before the same is either accepted after pre-dispatch final inspection including verification of records of all previous tests/inspections by the Owner's Engineer /authorized representatives, or such pre-dispatch final inspection is waived by the Owner and dispatch is authorized after review of test reports.

Materials used or supplied shall be accompanied by valid and approved material certificates and test and inspection reports duly approved by the Owner. These certificates and reports shall indicate the acceptable identification number of the material they proposed to certify. The material certified shall also have the identification details stamped on it.

Material used for equipment construction including castings and forgings etc. shall be of tested quality as per relevant codes/standards. Details of results of the test conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedures recommended and followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

Welding shall be carried out as per the welding procedure drawn and qualified by requirements of ASME Section IX. Welding procedures shall be submitted to the Owner for approval before carrying out the qualification test in the presence of the Owner's representative.

Welders/welding operators employed on any part of the contract either in the Supplier's

works or at the site or elsewhere shall be qualified as per ASME Section-IX.

Test results of qualification tests and specimen testing shall be furnished to the Owner for approval. However, wherever required by the Owner, tests shall be conducted in presence of Owner's Engineer/ authorized representative. The heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

The sub-Vendors proposed by the Bidder for procurement of major bought out items including castings, forgings, pumps, heat exchangers, semi-finished and finished components/equipment - (list of which shall be drawn up by the Bidder along with his offer and finalized with the Owner) shall be subject to Owner's approval.

The type and extent of inspection of items shall be in accordance with the relevant International and other standards approved by the Owner, supplemented or amended by the requirements of this section of the specification or as specified elsewhere in the Specification.

Material supplied to site shall be stored with OEM guidelines and in accordance with the storage class.

8.3 Inspection Program and Test Notifications

Before manufacture commences and not later than 45 days after award of contract, the Bidder shall submit an outline of his proposed inspection program, which shall include all major stages during manufacturing. The inspection and test program shall include for the various items the designation No., name of equipment, part of equipment, the kind of test, test standard, company which carries out the test, place, date and witnesses by the Bidder, third party or Owner's Representative.

The Owner will return a copy of the Bidder's proposed inspection program indicating those inspection stages for which notification is required. Notification shall be by Fax /Post or email in a format to be agreed upon and shall be sent before the intended test by 'General Conditions of Contract'. If the Owner intends to be represented at the test, he will provide at least 48 hours' notice and if his representative does not attend on the notified date, the test may proceed unless an alternative date has been requested by the Owner.

8.4 Test Certificate Documentation

The results of all tests shall be certified by the manufacturer, Bidder or independent agency as appropriate.

Document files containing material certificates, welding procedures, test reports etc. shall be compiled for each item of the plant and shall be suitably identified (including

equipment classification reference) and bound.

Three copies of each document file containing inspection reports and certificates of site erection testing activities of a particular item of plant or system shall be supplied to the Owner before commissioning.

Copies of the performance and acceptance test reports shall be prepared and distributed as specified in Clause 'Performance and acceptance test data and reports' of this Section. All documentation required by ASME/HEI shall also be prepared and submitted.

8.5 Codes and Standards

8.5.1 General

The type and extent of inspection shall generally be by that specified in the standard used for the design and construction of the item of equipment supplemented or amended by the requirements of this section of the specification. The Bidder should provide a copy of relevant codes and standards to the Owner if required by the Owner.

8.5.2 Reference to Codes and Standards

Reference to special codes and standards, where designated either directly or as "relevant", is intended to provide a measure of performance, safety, in-shop and on-site testing, and methods of construction and/or installation which must be equalled or exceeded to be considered acceptable for use under this specification. If more than a single degree of quality or accuracy is permitted within the scope of code or standard, the highest quality shall be applicable and the degree of accuracy commensurate with the intended function shall be selected, but with the understanding that the final decision will be made by the Owner.

In all instances, the finally accepted applicable code or standard shall be the version last published.

8.5.3 Alternative Standards

Where no appropriate standard is available, tests shall be conducted per the manufacturer's standard practice, subject to the Owner's approval.

In such cases, the Bidder shall submit to the Owner, complete data and a suggested procedure for the testing to be performed. Commencement of manufacture before receipt of the Owner's approval shall be at the Bidder's risk.

If the proposed procedures are accepted, the Bidder shall provide the Owner with four additional copies in English before any test is performed.

8.5.4 Derating Standards

The Bidder's attention is drawn to the climatic conditions in the site area. For every equipment Bidder must mention the derating factor. Derating factors shall apply by the

relevant and approved standards if not specified in the contract documents.

8.6 Services before and During Inspection and Testing

By and in addition to specified standards the Bidder shall submit procedures for material testing, manufacture, quality control and performance testing right from the procurement phase of raw materials to the finished product. Manufacture commenced before receipt of the Owner's approval of material specifications and testing procedures shall be at the Bidder's risk.

No inspection shall be valid unless the Bidder and manufacturer have relevant approved drawings and procedures for the item to be tested. The Bidder on request shall supply the Owner's representative with a copy of drawings and procedures at the time of the test.
All instruments and apparatus required for the inspection or used for the performance of tests shall be subject to the approval of the Owner at his discretion and shall be calibrated to an agreed standard in approved laboratories. The cost of making such calibrations shall be borne by the Bidder in all cases.

If the Bidder wishes to apply for a concession in respect of a departure from an approved procedure or standard, this shall be made in writing with full information substantiating the technical acceptability of the proposed change. The Owner's decision shall be final. Concessions granted shall not absolve the Bidder from any of his responsibilities under the Contract.

8.7 Testing During Manufacturing

The minimum testing requirement for mechanical, electrical and C&I items to be conducted at manufacturer’s works are specified under respective sections.

9.0 EQUIPMENT ERECTION, SITE TESTING, COMMISSIONING AND RELIABILITY TEST

This section generally covers the standards, scope of works, documentation, scope of installation, testing, and commissioning of various requirements to be adhered to during the execution of the mechanical, electrical &instrumentation works.

Works shall be performed according to this technical specification and various other drawings and schedules submitted and approved by the Owner during the execution and the instructions from the Engineer-in-charge or his authorized representatives during the progress of the work. All consumables required for the job shall be ensured by the Bidder. All necessary equipment & instruments required to carry out the works, and recalibration of the instruments required during loop checking and commissioning shall be done by the Bidder.

Field quality plans shall be submitted and shall detail all the equipment, quality practices,

procedures, etc. to be followed by the Bidder's site quality control organization during various stages of site activities including receipt of materials/equipment at the site, preservation and storage, pre-assembly, erection, pre-commissioning and commissioning. The Bidder shall provide all necessary means for the execution of inspection and testing, according to the requirements.

9.1 Electrical equipment

The Bidder shall specify the list of tests and measurements that need to be performed during erection and pre-commissioning (as appropriate) by agreed standards. The same shall be performed by the Bidder.

9.1.1 Control and Instrumentation Equipment.

Site-related tests for Control & Instrumentation equipment and Calibration tests of instrumentation loop checking, functional testing of control equipment, interlocks, protection inputs, etc. are covered under Volume II, Section 4 Detail Technical Specification for Control & Instrumentation.

9.2 Test at Site

9.2.1 General

For the respective components or equipment, the Bidder shall give to the Owner prior notice of the date after which he will be ready for tests on completion. The Bidder shall provide the Owner with the test procedures and protocols for such components or equipment to be tested.

If any portion of the Work fails to pass the tests, tests of the said portion shall, if required by the Owner, be repeated within a reasonable time under the same terms and conditions. All justifiable expenses incurred by the Owner/Owner's Engineer, because of repeating the tests, shall be borne by the Bidder.

9.2.2 Bidder's Responsibilities

The Bidder shall be responsible for the operation of the Plant during the period of testing, commissioning, initial startup, trial operation, reliability test run, and performance test leading up to Provisional Acceptance.

During these periods, the Bidder will delegate the operation supervisory personnel and will furnish the test instruments including calibration devices, etc., required to prepare for and conduct the various tests.

The instruments and test devices, necessary to conduct the test, shall be supplied, installed, and dismantled by the Bidder after completion of the test.

9.2.3 Summary of Required Tests and Time Schedule

The following requirements are related to the Desalination plant equipment.

a)	Pre-commissioning checks and commissioning procedure as mutually agreed upon by the Owner and Bidder.	
b)	Trial Run	Duration: 24 hours
c)	Initial Operation	Duration: 3 days Earliest 24 hours after completion of Trial Run
d)	Reliability Test Run	Duration: 3 days Earliest 24 hours after completion of Initial Operation
e)	Performance Test	After the Reliability Test Run according to approved procedures

9.2.4 Pre-commissioning Checks and Commissioning Procedure

9.2.4.1 General

At least two months before commencing the commissioning of any plant or equipment, the Bidder shall submit for approval fully comprehensive schedules of pre-commissioning checks and commissioning procedures as applicable to each item of the plant and equipment provided.

The Bidder shall provide at Site the necessary certified standard instruments and gauges and any other equipment necessary for checking the installation as and when required and shall operate the plant and carry out the tests to the satisfaction of the Owner.
When the commissioning of each section of the Works is completed and before the Reliability Run is commenced, the Bidder shall carry out such preliminary tests as are necessary to establish that the plant is functioning correctly and efficiently and shall make any adjustments required.

Within one month of the completion of the commissioning tests, the Bidder shall submit a comprehensive commissioning report with a complete set of signed checked sheets and procedures.

9.2.4.2 Minimum Scope of Commissioning Checks, Functional and Preliminary Tests

a) Mechanical systems

- Raw material Identification through Approved Drawings and Datasheets
- Properties as per relevant codes
- Alignments and dimensions.

- Visual checks
- Hydrostatic pressure test
- Water leakage test of all tanks
- To ensure the accuracy of Calibration certificates
- Manufacturer certificate of all bought-out items supplied at site.
- Inspection reports of equipment
- Testing of the water treatment system and demonstration that the unit is leakage-free.

b) Electrical Equipment

- Visual inspection.
- Megger test for all equipment supplied for this Package.
- Monitoring of status/values (local and/or remote) of devices as per this specification requirements.
- Functional tests for all equipment supplied for this Project especially operation and monitoring from Plant DCS, as applicable.
- Measurement of motor starting and operating current.
- Calibration of energy meters.
- Vibration of motors.
- Polarity, ratio, secondary winding resistance, knee point voltage checks of all CTs by primary injection.
- Check of circuits by continuity check method.
- Check of interlocks for switchgear operations locally and in DCS, as applicable.
- Functional test of relays, disturbance recorder, fault locator by primary and secondary injection as appropriate for respective protection schemes.

c) Station Supply Systems

- Checking of auxiliary electrical power systems

d) I&C System

- The following shall be performed by the Bidder under the supervision of the consultant & Owner/Engineer in charge.
- All the instruments shall be calibrated for the entire range of the instrument for which it is designed. Calibration shall include repeatability test. After first commissioning, the instruments shall be tested for calibration again to check whether the instrument maintains its zero and maximum range.
- All switches shall be tested for the actuation of both normally open and normally closed contacts at the given set points and also for the fixed/differential settings.
- All the float-operated level switches shall be tested for the movement of the float

and linkages to make or break the switch contacts by filling up with water before installation. For such tests, the necessary testing setup required shall be arranged by the Bidder. All the conductivity-type probes and switches shall be tested for performance before installation.

- Hydrotest shall be performed for all other impulse lines/sampling lines. Necessary equipment such as hydro test pumps and temporary piping to the required point, fill pump, etc., materials such as temporary gaskets miscellaneous fasteners etc. tools, and tackles including test pressure gauges etc. are to be provided by the Bidder.
- All control valves connected to the control system (loops) supplied by the Bidder shall be calibrated.
- For all electrical actuators of valves, functioning, setting and performance of limit switches/torque switches at various positions shall be checked before and after installation of the actuators.
- Electric actuators for control valves shall be calibrated at site.
- All Instrumentation & Control instrumentation shall be calibrated with NABL accredit laboratories; bidder shall provide all type calibration instruments for calibration of all desalination plant instruments.

9.2.5 Commissioning Requirements for I & C System

- All the items supplied and stored by the Bidder shall be commissioned.
- Before taking the instruments in service, all impulse lines, sampling lines and air supply lines shall be blown as many times as required with the establishment of adequate line pressure and temperature conditions to keep the lines thoroughly clean.
- Blow out of these lines and commissioning of the instruments may have to be repeated many times till the unit takes full load and in continuous operation.
- On-line (i.e., without removing control valves from the pipe) calibration of the positioners and stroking of control valves/control dampers and connected to the control systems (loops) shall be carried out during control system tuning.

9.2.6 Other Specific Commissioning Tests

In addition to the tests specified, the following tests shall be performed: -

- Noise Emission

  The Bidder shall perform the test to demonstrate that the noise emission requirements specified in the Project Requirements are met. The test shall be performed under the steady-state conditions. The test procedures including measurement points shall be mutually agreed between the Owner and the Bidder.

The Bidder shall measure the background noise levels (dB (A)) of the measurement points on the power station battery limit before the test

9.3 Initial Operation

a. Bidder shall carry out the continuous initial operation after having satisfactorily completed all preliminary and functional tests on the various plant components or systems and the trial run of the integrated plant, and after the relevant test protocols have been complied.
b. Bidder shall submit a detailed programme for the initial operation of the integrated plant in advance. This programme shall be within the permissible parameters, and include the demonstration of all operating conditions and operating capabilities such as low-load and maximum continuous load operation, isolated operation, load rejection, automatic start of stand-by units, etc.
c. During the initial operation period the Plant shall be operated and tested by the Bidder as per the approved programme with the assistance of the Owner's staff under the Bidder's supervision and responsibility.
d. Within the continuous initial operation, no shutdowns are permitted except those requested by the Owner or occurred beyond the Bidder's responsibility.
e. Bidder shall undertake the uninterrupted Reliability Test Run after completing the initial operation.

The Bidder shall furnish comprehensive performance reports on the initial operation to the Owner before proceeding to the next stage.

9.4 Reliability Test Run

The reliability test runs of the Desalination plant, and its auxiliaries or other equipment/installation shall last for 3 days.

Reliability Test Run shall be carried out together with the total plant.

During this period the Desalination plant unit and its respective auxiliary equipment shall be operated continuously and under the prevailing power requirements of the network. During this period no tests on components and systems shall be performed. No shutdowns are permitted during the reliability test run, except if occurred owing to causes beyond the Bidder's responsibility, the latter fact to be proven by the Bidder. If the reliability test run must be interrupted owing to reasons for which the Bidder is responsible, it shall be restarted from the very beginning after the cause of the interruption has been removed by the Bidder to the satisfaction of the Owner.

During the reliability test run the Bidder shall operate the plant in the presence of the Owner's staff and operate the plant in compliance with the operating philosophy and requirements of the grid.

The Bidder shall furnish comprehensive performance reports on the reliability test run to the Owner before proceeding to the next stage.

10.0 PLANT PERFORMANCE TEST AND GUARANTEES

10.1 General

After successful completion of the Reliability Test Run, a performance test shall be executed for the plant, the auxiliary and ancillary plants for which performance is guaranteed, provided that the plant is made ready for performance test by the Bidders of relevant packages and such readiness is certified by the Owner.

The performance tests shall be designed to demonstrate that the plant together with common auxiliaries comply with the performance guarantees.

The tests shall be conducted as per the agreed Performance Test Code.

The performance test shall be considered completed on the date by which the Bidder has removed all test instrumentation and returned the plant and equipment to its pre-performance test condition such that it can be used by the Owner for commercial operation.

The Bidder shall furnish comprehensive performance reports to the Owner before proceeding to the next stage.

10.2 Schedule for performance and acceptance test, test procedures

The Bidder shall give to the Owner, advance notice in writing of the date after which he will be ready to make the tests at the Site.
All test procedures shall be submitted for acceptance by the owner well in advance before the commencement of Performance and acceptance tests.

The test program shall be a written detailed description of the individual steps of test procedures, covering all functions of the respective plant components and systems as well as works to be performed.

The procedure for acceptance tests shall include the following for such test or group of tests:

- Time duration of each test at each load.
- The number of tests runs at each load.
- The sequence of tests to be conducted.
- A list of instruments that will be used for each test.
- The list shall designate which instruments are:

- Special test instruments
- Certified paper for the test instruments
- To be calibrated before and after each test
- Check instruments
- Station instruments

- Schematic diagrams showing all test points and cross-references to the instrument list shall also be included.
- Formulae, calculations, conversion factors, curves, correction curves, etc., to be used in the conducting of the tests and the calculations of the test results.
- Sample test reports or data sheets and all specific result sheets forms that will be used for the tests.
- Written procedure and description of conducting the tests.
- Test data to be recorded by the Bidder and the Owner.
- Contractual correction factor curves to be submitted as a part of the test procedure. Such curves will be used, if necessary, for variations in test conditions from the normal stipulated conditions. The correction curves shall cover the complete ranges of variation that may be encountered.

10.3 Test Instruments

Before despatch to Site instruments must be tested by a competent authority for accuracy of calibration. Test certificates must be issued confirming the desired accuracy and that the last test has been carried out within 6 (six) months before the execution of the performance test. Instruments with certificates older than six (6) months will not be accepted.

10.4 Station Instruments

Station instruments used for performance tests must be calibrated at the Site in the presence of the Owner.

Schematic diagrams showing all test points and cross-references to the test instrument list shall also be included.

10.5 Test Data and Report

10.5.1 Records

During each test run the measured values will be recorded jointly by the Bidder and Owner. After completion of the test runs the data sheets will be jointly initiated and two copies distributed to each party and the Owner.

10.5.2 Evaluation of Test Results

As soon as possible but not later than five days of the completion of a test the Bidder shall supply the Owner a test report containing a complete evaluation of the results together with the detailed description of the evaluation procedure.

The Final test reports are to be handed over prior to Provisional Acceptance.

10.5.3 Content of Final Test Reports

All final test reports for all acceptance tests are to be prepared by the Bidder and shall be submitted to the Owner within two weeks after the tests were completed. These reports shall mainly contain:

- General statements about the kind of tests
- Technical data of the tested equipment
- Description of the test method used
- Description of the evaluation method
- Comparison with the guaranteed values
- Summary and conclusion

10.6 Owner's Right regarding Postponement / Rescheduling

The Owner reserves the right to reschedule tests due to system load requirements or for any other valid reasons. In the case of "Force Majeure", the performance tests shall be completed within two months after the successful completion of the reliability test run.

10.7 Codes

The various codes, standards and Owner recommendations as specified in the Contract Documents will be regarded as the source of reference for definitions, methods of measurements and required procedures.

10.8 Provisional Acceptance / Taking Over

a. As soon as the Works have been completed by the Contract (except in minor respects that do not affect their use for the purpose for which they are intended) and save for the obligation of the Bidder under the Conditions of Contract and have passed the tests of completion and have satisfied the requirements of the reliability test run and have passed the performance test at Site, and have complied with all requirements as per Para (b) below, the Owner shall provisionally accept the Works.

b. On satisfactory completion of the tests mentioned above and if no major deviations, in the opinion of the Owner, in operating parameters and/or defects in supervisory and protection circuits are observed, if only some minor work in the opinion of the Owner is outstanding or minor defects are to be remedied, and the following

requirements have been met:

- having handed over the complete set of approved as-built drawings.
- having handed over the final performance test report including all functional test reports.
- having handed over preliminary O&M manuals.
- having trained Owner's personnel for operation and maintenance.
- having handed over the contractual spare parts and consumables as well as all the specified and required maintenance tools.
- having handed over an approved itemised spare parts list with prices.
- having submitted a schedule for remedy of minor outstanding work and minor defects.
- The plant is ready for a safe and undisturbed commercial operation.

10.9 Acceptance & Interim operation

After the reliability test run and performance test have been performed, and if the equipment supplied by the Bidder is found to meet the contractual guarantees and any other specified requirements, and if the Works have been completed as called for herein, the Owner's acceptance (Taking Over) will be forthcoming. This acceptance shall, however, not relieve the Bidder of his responsibilities during the Guarantee Period.

Should the equipment furnished by the Bidder fail to operate as laid down in the Contract or in case of failure to meet any of its guarantees, the Owner shall have the right to operate the equipment, using the Bidder's operation supervisory personnel, until such defects have been remedied by the Bidder and guarantees are met. In the event that defects necessitate rejection of the equipment or any part thereof, the Owner shall have the right to operate the equipment until such time new equipment is provided to replace the rejected equipment. Such operation shall not be deemed as an acceptance of any equipment or part thereof.

10.10 Functional Guarantees

Functional Guarantees fall under the following categories (Refer, Part-II, Section-5, Schedule-1 for Functional Guarantees)

A. Performance Guarantees under Penalty.

Reject the equipment/system/plant and recover from the Bidder the payments already made, if the level of tested Functional Guarantees is beyond the acceptable shortfall limits as per Volume II, Section - 5, Schedule - 1.

(or)

Accept the equipment/system/plant with penalty as per Volume II, Section 5, Schedule 1. If the level of tested Functional Guarantees is within the acceptable

shortfall limits. The penalty for shortfall in performance shall be levied separately for each unit. The penalty values and acceptable shortfall limits are applicable on per per-unit basis. The penalty shall be pro-rated for the fractional parts of the deficiencies.

B. Performance Guarantee under Rejection

Reject the equipment/system and recover from the Bidder the payments already made. Conformance to the performance requirements under Category is mandatory.

C. Performance Guarantee under Compulsory Correction

Reject the equipment /system and recover from the Bidder the payments already made.

(or)

Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Owner. Such damages shall, however, be limited to the cost of replacement of the equipment(s) / system(s), replacement of which shall remove the deficiency to achieve the guaranteed performance.

10.11 Specific Power Consumption of the plant

Refer, to Volume-II, Section-5, Schedule-1 for guaranteed specific power consumption.

The Bidder must guarantee the power consumption and losses of all auxiliaries and ancillary plant equipment that is required for the operation of the power generation unit at rated output (100% load).

The Bidder shall list the specific/ auxiliary power consumption and/or losses separately for each equipment item or system and provide correction curves for variation in ambient conditions.

10.12 Consumables

Bidders shall specify the major consumables (such as chemicals for Desalination plants, etc.) and their consumption along with the material grade. The bidder will be required to guarantee the consumption specified. The selection of chemicals shall be such that the plant is operated at the optimum dosage of chemicals. The selection of chemicals shall be based on ready availability in the local/international market. All the consumables including chemicals required till the project is handed over to the end user is in the Desalination plant bidder's scope of supply.

10.13 Vibrations

Bidder shall guarantee that the vibration levels as stipulated elsewhere in this specification will not be exceeded under any operating condition.

10.14 Plant Availability Guarantee

Bidder shall guarantee the availability of the plant to be demonstrated during the Warranty period. The availability shall be minimum 95%. Planned and forced outages as well as capacity deratings done due to plant problems shall be considered. Outages and deratings due to dispatch conditions will not be considered in availability calculations (i.e. it will be considered that the plant is fully available during such dispatch conditions).

10.15 Other Guarantees

Other guarantees as required have been indicated in the respective technical specifications.

11.0 CLEANING, PROTECTIVE COATING AND PAINTING

11.1 General

This section covers the general requirements related to the cleaning protective coating and painting of equipment, components and systems. The components and/or equipment shall be mechanically and /or chemically cleaned during the following stages of the Contract.

- Cleaning in workshop
- Cleaning before painting and/or corrosion protection (application of prime coat)

Cleaning of fabricated component items shall be carried out after fabrication and final heat treatment or welding at the manufacturer's works or at the site, as appropriate.
For cleaning in the workshop and before painting mechanical cleaning as opposed to alternative chemical cleaning is the preferred method for work cleaning except where this is precluded by design or access considerations.
Machined surfaces shall be protected during the cleaning operations.

In the event of the surfaces not being cleaned to the Owner's satisfaction, such parts of the cleaning procedures or agreed alternatives as are deemed necessary to overcome the deficiencies shall be carried out at the supplier's sole expense.

For reclining small areas, hand cleaning by wire brushing may be permitted. Wire brushes used on austenitic steel bristles.
Austenitic stainless steels, copper and aluminium alloys, cast iron, bimetallic and metallic/plastic items, and components fabricated by spot welding or riveting shall not be chemically cleaned. All weld areas shall be suitably stress relieved before chemical cleaning.
The paint manufacturer's instruction shall be followed as far as practicable at all times. Particular attention shall be paid to the following:

a) Proper storage to avoid exposure as well as extremes of temperature.
b) Surface preparation prior to painting.
c) Mixing and thinning
d) Application of paints and the recommended limit on time intervals between coats.
e) Shelf life for storage.

Any painting work (including surface preparation) on piping or equipment shall be commenced only after the system tests have been completed and clearance for taking up painting work is given by the Engineer, who may, however, at his discretion authorise in writing, the taking up of surface preparation or painting work in any specific location, even before completion of system test.

11.2 Equipment

All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipment, scaffolding materials, shot/sand blasting equipment & air compressors etc. shall be arranged by the Bidder at the site in sufficient quantity at his own cost. He shall arrange at his own cost, for suitable paint thickness measuring instruments like Elco meters acceptable to the Engineer (with calibration facilities).

Mechanical mixing shall be used for paint mixing operations in case of two pack systems except that the Engineer may allow the hand mixing of small quantities at his discretion.

All the surface preparation, protective coating, and painting of steel, structures; and equipment shall be suitable for prevailing site conditions. The bidder shall submit the surface preparation, Protective coating and paint specification for the Owner's approval.

11.3 Mechanical Cleaning at Manufacturer's Works

Mechanical cleaning shall preferably be carried out by abrasive blasting. The Owner is prepared to consider alternative methods provided they achieve the necessary surface condition.

11.3.1 Surface condition:

The Metal surfaces shall be clean and free of mill scale, rust, dirt, grease and any other deleterious matter. Where metal surfaces are to be painted the surface profiles shall conform with the painting specification requirements. Where this does not apply surfaces shall have a surface texture not coarser than Grade 80 abrasive paper.

11.3.2 Abrasives:

Abrasives containing silica, silicates or slag residues shall not be used for water/steam side surfaces of the plant except for cleaning sand castings, where hydro blasting with sand

may be used. For austenitic materials only, abrasives containing 98% or more of alumina, Al2 O3, shall be used.

Removal of abrasive and debris: - After cleaning, abrasive and debris shall be thoroughly removed from components.

Alternative Chemical Cleaning at Manufacturer's Works.

The procedure shall comprise Pre-treatment and acid treatment.

To achieve cleanliness equivalent to that specified for mechanical cleaning. The procedure to be adopted must meet with the Owner's approval.

11.4 Protection at Manufacturer's Works

As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

All water, air and steam side surfaces shall be protected by the application of approved water-soluble corrosion inhibitors, or vapour phase inhibitors that can be subsequently removed by site water washing or steam blowing.

The rate of application of volatile corrosion inhibitors shall be at least 10 grams per square metre or 35 grams per cubic metre, whichever is the greater, except for pipes up to 300 mm diameter for which the minimum application rates shall be 5 grams per square metre.

Immediately after the protective treatment has been applied all vessels and pipes shall be suitably sealed off by discs or caps or approved alternatives to prevent ingress from the surrounds. Cylindrical plugs shall not be driven into the ends of pipes. These protective covers shall not be removed until immediately before final connection is made to the associated equipment.

11.5 Weather Conditions

Painting shall be done only when the surface temperature is above 5°C. Surface temperature must be at least 3°C above dew point to ensure that condensation does not occur on the surface.

Reasonable protection against precipitation, corrosive fumes and vapours shall be exercised for the painting of outdoor parts.

Precautions shall also be taken against solar radiation to ensure that the specified dry film thickness of priming or finish coats is obtained.

Any prime coat exposed to excess humidity, rain, dust etc., before drying, shall be permitted to dry and the damaged area of primer shall be removed and the surface prepared and primed again.

Sheltered or unventilated horizontal surfaces on which dew may collect require more protection, and to achieve this an additional topcoat of paint shall be applied.

11.6 Surface Preparation

In preparing any surface to be coated, all loose paint, dirt, grease, rust, scale, weld slag or spatter or any other extraneous material shall be removed and defects repaired, so as to obtain a clean, dry, even surface to receive the priming or finishing coat (s) as called for in the painting schedules. Sharp edges should be rounded, especially when tank linings have to be applied.

All machined surfaces, including flange faces, shall be suitably covered to prevent damage during surface preparation.

All surfaces should be blast-cleaned whenever possible.

Surface preparation methods

Bare steel surfaces should be prepared by one of the methods described below in order of preference and under Swedish Standard SIS 05 59 00 or Steel Structures Painting Council, SSPC, Vis 1, or DIN 55928, section 4.

a) White metal blast cleaning: Sa 3 or SSPC - SP 5

Sa 3 Blast cleaning to bare metal. Mill scale, rust and foreign matter must be removed completely. Subsequently, the surface is cleaned with vacuum cleaner, clean dry compressed air or a clean brush. It must then have a uniform metallic colour and correspond in appearance to the prints designated Sa 3.

b) Near white metal blast cleaning: Sa 2 1/2 or SSPC - SP 10

Sa 2 1/2. Very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight imperfections in the form of spots or stripes. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It must then correspond in appearance to the prints designated sa 2 1/2.

Mechanical cleaning should only be used when procedures (a) and (b) are not practicable.

c) Commercial Blast Cleaning: Sa 2

Sa 2 Blast cleaning until at least two-thirds of each element of the surface area is free of all visible residues. This method of Blasing is suitable for the steel required to be painted with conventional paints for exposure to a mildly corrosive atmosphere for the longer life of the paint systems.

d) Near white metal blast cleaning P Sa 2 1/2 DIN 55928

Very thorough blast cleaning & very adhesive coatings remain. From all other surface mill scale and rust are to be removed to such an extent that the only traces remaining are slight imperfections in the form of spots or stripes. The adhesivity of residual coatings in the transition zone must be tested even after the application of the primer.

e) Very thorough mechanical scraping and wire brushing: St 3

St 3 very thorough scraping and wire-brushing - machine brushing - grinding - etc. are to be preferred. Surface preparation as for st 2. But much more thoroughly. After the removal of dust, the surface must have a pronounced metallic sheen and correspond to the prints designated St. 3.

f) Thorough scraping and wire brushing: St 2

St 2 Thorough scraping and wire-brushing - machine brushing - grinding - etc. The treatment shall remove loose mill scale, rust and foreign matter. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It should then have a faint metallic sheen. The appearance must correspond to the prints designated St 2.

Steel structures to be blast cleaned must be free of pitting and other severely corroded places under B.S. 4232 and SIS 055900.

The abrasives used for blast-cleaning shall be graded flint, grit, shot or silica sand and shall be such that they will produce an average keying profile on the blast-cleaned surface of not more than 40 microns.

After blast-cleaning, all accumulated grit, sand, dust, etc., must be removed leaving the surface clean, dry and free of mill scale, rust grease and other foreign matter.

In the event of rusting after completion of the surface preparation, the surface must be cleaned again in the manner specified.

Oil, grease, soil, cement, salts, acids or other corrosive chemicals shall be cleaned from steel surfaces, using solvents, emulsions or cleaning compounds. The final wiping shall be with clean solvent and clean rags or brushes. There shall be no detrimental residue left on the surface.

Primed areas that suffer damage must be spot blasted on site to a degree of cleanliness Sa 2 1/2 before touching up.

Protective coating must be applied as quickly as possible after the completion of surface preparation no matter what cleaning method has been used.

No blast-cleaned surface shall be allowed to remain uncoated overnight.

Steelwork protected by shop primer after arrival on site must be cleaned of salt, sand, oil etc. before the first coat of paint is applied on site. Shop primer damaged during transport must be rectified by blast-cleaning and coating before application of the site coats.

Wood surfaces shall be sanded clean. All nail holes shall be puttied and sanded before priming.

Concrete: If a protective coating is required, concrete shall be allowed to cure before painting.

11.7 Rub Down and Touch up of Primer.

The shop-coated surfaces shall be rubbed down thoroughly with emery paper to remove all dust, rust and other foreign matters, washed, degreased, then cleaned with warm fresh water and air dried. The portions, from where the shop coat has peeled off, shall be touched up and allowed to dry before applying a coat of primer. The compatibility between the shop coat and field primer should be ascertained by the paint manufacturer. In case degreasing with white spirit is not effective, the surface should be finally wiped clean with aromatic solvents like xylol or light naphtha.

11.8 Application

Health and safety of work

The supplier must check all painting work to be carried out according to the specification of the paint supplier further to all relevant prescriptions and regulations concerning the health and safety of work.

The paint supplier must present a written specification including at least the flash point of the paints, ventilation requirements, handling precautions such as inhalation, eye and skin protection, and first aid procedure, storage requirements, spill or leak procedure, fire precaution, waste disposal.

11.9 Safety Requirements

Protection of the blast cleaner operator's eyes and respiratory system should be given

prime consideration in any open blast cleaning operation. Air fed helmets, respiratory filters, air-conditioned hoods etc. should be provided in sufficient number to the blast cleaning operators to avoid the harmful effect of blast cleaning abrasives. Also, an automatic shut-off device which will shut-off the air supply to the blasting machine should be installed which will prevent the dangerous whipping of an operating blast hose if an operator becomes disabled.

Bidder shall take all safety precautions and shall follow all the safety requirement as imposed by the Owner during execution of work.

11.10 Dry Film Thickness (DFT)

To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats shall not be of the same colour. Suppliers' recommendations regarding the hardening time of epoxy paints must be followed. Particular attention must be paid to full film thickness at the edges. The minimum total dry film thickness of the paint systems shall be as per painting specification.

11.11 Protective Coatings and Paint Systems

The type and number of protective coats for any item requiring painting are to be furnished by the Bidder as per the paint manufacturer's recommendation for Owner's approval.

11.12 Colour Code for Piping

The colour code scheme is intended for identification of the individual group of the pipeline. The system of colour coding consists of a ground colour and colour bands superimposed on it. The colour coding for the identification of pipelines should comply with the standard and shall submit for Owner's approval.

11.13 Galvanizing

All galvanising shall be carried out by the hot dip process (and unless otherwise specified shall conform in all respects with BS EN ISO 1461 and BS EN 10143 or equivalent international standard).

Attention shall be paid to the detail design of structural members (in accordance with BS4479 or equivalent international standard). Adequate provision for filling, venting and draining shall be made for assemblies fabricated from hollow sections. Vent holes shall be suitably plugged after galvanising.

All surface defects in the steel including cracks, surface laminations, lumps and folds shall be removed (by BS 7668 or equivalent international standard). All drilling, cutting,

welding, forming and final fabrications of unit members and assemblies shall be completed before the structures are galvanised. The surface of the steelwork to be galvanised shall be free from welding slag, paint, oil grease and similar contaminants.

Galvanizing of structures shall conform to IS:4759. The min. thickness of galvanizing shall be 126 microns at any point of the galvanized structure. Galvanization shall be measured with elcometer or the material can be sent for testing to laboratory as and when required. No averaging is allowed for measuring the thickness of galvanization. All side shall be galvanization with same specification and shall be maintained for any hollow components of structures. Galvanization shall be considering the high saline zone C5 (Durability – Very High) as per ISO 12944. On removal from the galvanising bath, the resultant coating shall be smooth, continuous, and free from gross surface imperfections such as bare spots, lumps, blisters and inclusions of flux, ash or dross.

Galvanised contact surfaces to be joined by high-strength friction grip bolts shall be roughened before assembly so that the required slip factor is achieved. Care shall be taken to ensure that the roughening is confined to the net area of the mating surfaces.

Cable trays shall be ladder / perforated type as specified, prefabricated, made out of hot / cold rolled mild steel sheets, complete with matching fittings, accessories and hardware as required. All the items (including hardware) shall be hot dip galvanized. Thickness of galvanizing shall be not less than 126 microns i.e. zinc deposition for galvanization shall be 910 gm/sq.m.

Bolts, nuts and washers, excluding general grade high strength friction grip bolts, shall be hot dip galvanised and subsequently centrifuged (according to BS EN ISO 1461 or equivalent international standard). Nuts shall be retaped after galvanised and the threads oiled to permit the nuts to be finger-turned on the bolt for the full depth of the nut. No lubricants, applied to the projecting threads of a galvanised high-strength friction-grip bolt after the bolt has been inserted through the steelwork, shall be allowed to meet the mating surfaces.

During offloading and erection, the use of nylon slings shall be used. Galvanised work, which is to be stored in works or on-site shall be stacked to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanised coating damaged in any way shall be restored by cleaning the area of any weld slag and thoroughly wire brushing to give a clean surface followed by the application of two coats of zinc rich-paint, or the application of a low melting point zinc alloy repair rod or power to the damaged area, which is heated to 300oC.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc rich paint.

Connections between galvanised surfaces and copper, copper alloy or aluminium surfaces shall be protected by suitable inert tape wrapping to the Owner's Representative's approval.

11.14 Sprayed Metal Coatings

Corrosion protection may be also achieved by spraying suitable metals such as zinc and/or aluminium on the surfaces of structures. For special cases, tin, copper, and lead can be used as well. Methods of surface preparation must conform to relevant IS standards. A proper treatment of the surface followed by an immediate spraying is to be applied to ensure the adhesion of the sprayed metal. The surface must be clean, free of impurities, rust, and mill scale and rough enough to have binding properties to ensure good articulation with the sprayed layer. Suitable roughness can be achieved by blast cleaning acc. to BS 4232. Welds are to be cleaned and prepared with special care. All surfaces to be treated must be dry and accessible.

Application of coatings, requirements for thickness, adhesion, composition of coating metals and subsequent treatment shall conform to relevant IS standards.

Testing of the spray-coated layer is to be carried out by relevant IS standards.

The Bidder must specify the type, composition and thickness of the sprayed metal and the sealing coating acc. to relevant IS standards including the corresponding warranties and tests if sprayed metal coating will be applied.

11.15 Inspection and Testing

All painting materials including primers and thinners brought to site by the Bidder for application shall be procured directly from manufacturer as per specifications and shall be accompanied by the manufacturer's test certificates. Paint formulations without certificates are not acceptable.

Engineer at his discretion, may call for tests for paint formulations. Bidder shall arrange to have such tests performed including batch-wise test of wet paints for physical & chemical analysis. All costs thereof shall be borne by the Bidder.

The paints shall be tested as per International Standard and approved by the Owner.

The painting work shall always be subject to inspection by the Engineer. Following stage-wise inspection shall be performed and Bidder shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection are as follows:

a) Surface Preparation

b) Primer application
c) Each coat of paint

Any defect noticed during the various stages of inspection shall be rectified by the Bidder to the satisfaction of the Engineer before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, Bidder shall be responsible for making good any defects found during the final inspection/guarantee period/defect liability period as defined in the general condition of the contract. Dry film thickness (DFT) shall be checked and recorded after the application of each coat and an extra coat of paint should be applied to make up the DFT specified without any extra cost to Owner-steam blasting,

11.16 Guarantee

The Bidder shall guarantee that the chemical and physical properties of paint materials used are by the specifications contained herein/to be provided during the execution of work.

The Bidder shall produce test reports from the manufacturer regarding the quality of the batch of paint supplied. The Engineer shall have the right to test wet samples of paint at random for quality of the same. Batch test reports of the manufacturers for each batch of paints supplied shall be made available by the Bidder.

12.0 Spare Parts, Wear and Tear Parts

Spares for the total plant shall be divided into three categories namely:

a) Start-up and Commissioning Spares
b) Operation & Maintenance (O & M) Spares
c) Mandatory spares

12.1 Start-up and Commissioning Spares

Start-up and Commissioning spares are those that would be required during plant or equipment testing, start-up and commissioning. All spares used until the plant is finally handed over by the Bidder to the Owner come under this category. All start-up and commissioning spares as required shall be provided by the Bidder without any additional cost to the Owner. The list and details of start-up and commissioning spares shall be furnished by Bidder before the award of the Contract.

Bidder shall be responsible for the ready and timely availability of all the start-up and commissioning spares as required during various stages of testing, cleaning and commissioning up to handing over of each system of the plant.

12.2 Operation and maintenance spares

The Bidder shall provide, based on his own experience of the performance of his equipment, in the form of a schedule given in bid documents, the complete list of operation and maintenance spares for Three (3) years of operation of the equipment covered under the proposal. In the list of operation and maintenance spare parts, the Bidder shall identify the unit-wise population of each of the items recommended and the anticipated normal life of the spares.

The spare parts must be able to replace the original part completely and have the same technical specifications in quality, material, inspection and mechanical aspects.

Bidders shall supply all measurement testing data of any spare part supplied, if applicable.

All spare parts supplied shall be packed and stored for 5-year preservation based on the local climatic conditions. Small spare parts shall be packed and sealed in transparent plastic bags and drying agents will be used if necessary. Every spare part shall have operation instructions and design marks of the factory when it is supplied.

When multiple spare parts are packed in one packing box or container, the general indication to the spare parts outside the packing boxes or containers shall include a detailed list. All packing boxes, containers, and other such tanks shall be marked properly and numbered clearly. All electrical equipment including switches, fuse connection easy melting and other similar apparatus shall be protected and insulated.

The identification of all spare parts shall be in the English language.

Spare parts shall be supplied 1 month before the start of the Trial run.

Bidder's operation and maintenance spares required spare part list shall be confirmed during detail design.
Bidder shall identify in the spare parts list, the items having a delivery time of more than 3 months.

12.3 Mandatory spares

The Bidder shall indicate and include in his scope of supply all mandatory spares. Mandatory spares are those considered necessary by the Owner for normal plant operation.
The Mandatory spares ordered by the Owner shall be delivered at the site at least 1 month before the Trial run.

13.0 Tools, Tackles & Equipment

Maintenance and repair tools including all special tools and tackles required unit for the operation, maintenance, inspection and repair of the individual main equipment and auxiliary equipment shall be supplied by the Bidders in sufficient quantity to equip the shift personnel, maintenance personnel and workshop craftsman for commissioning, testing, calibration, modification and maintenance of the unit. A list of such special tools, tackles and equipment shall be reviewed and approved by owner during detail engineering

The special tools and equipment for maintenance and repair shall be delivered by the Bidder in lockable steel boxes and they shall be marked in an approved manner for identification purposes, and a corresponding tool chart shall be supplied with the steel boxes.

The following tools and appliances shall be supplied under this Contract for use by the Owner:

a) Two sets of special tools and gauges are required for the maintenance of the Plant.
b) One set of special lifting and handling tackles/appliances required for the maintenance of the Plant.

The tools, tackles and appliances supplied in general, shall not be used for erection purposes by the Bidder and shall be handed over in brand new condition. Damaged tools, tackles, and appliances shall be replaced before handing over.

The exception to this is the special lifting gear which may be used provided that when it is handed over to the Owner it has not been subjected to more than normal wear and is still fully suitable for its intended use.

Each set of tools, gauges and appliances under category (a) above shall be suitably arranged in fitted boxes of mild steel construction, the number of boxes being determined by the layout of the plant and equipment.

If the weight of any box and its contents should be such that it cannot conveniently be carried, it shall be supported on steerable rubber-tyre wheels.

Each cabinet and box shall be painted, fitted with a lock and marked in white letters with the name of the item of equipment for which the tools and appliances contained are intended.

Suitable storage racks shall be provided for all portable lifting tackle supplied under this contract.

Suitable lifting lugs, ears or ring bolts, or tapped holes for lifting rings shall be provided on all equipment items where the weight exceeds 15 kg.

All lifting tackle shall be stamped with a unique identification number and safe working load. A test certificate from an approved Authority shall be supplied for each item of lifting tackle.
The Bidder shall provide a schedule of all lifting tackle and tools and appliances being supplied, for the approval of the Owner's Engineer.

The Bidder shall provide all runway beams, trolleys, mobile ladders, forklifts, collapsible maintenance platforms, lifting blocks, special slings etc. necessary for the safe and efficient handling and maintenance of the works. Particular attention shall be paid to the handling of equipment located at higher elevations.

The tools and appliances with the appropriate storage racks, cabinets and boxes shall be handed over to the Owner at the time of Taking Over of the complete Plant.

14.0 CONSUMABLES

14.1 Lubricants and greases

All lubricants proposed for the Plant operation shall be suitable for all operating and environmental conditions that will be met on-site.
All oils and greases shall where possible be readily available in the country of installation.

The number of oils and greases shall be kept to a minimum. For each type and grade of lubricant recommended the Bidder shall list at least three equivalent lubricants manufactured by alternative companies.

On non-availability of any imported oil equivalent in the indigenous product EPC Bidder is to be arranged.

In case of imported oils, lubricants and other consumables, the Bidder shall indicate the indigenous equivalents to enable the Owner to arrange subsequent fills. Preference should be given to Indigenous oils and lubricants during the first filling itself. Short shelf-life items if any may be supplied in a phased manner keeping given their actual use.

The Bidder shall supply lubricants for the Plant till handover and shall provide at the plant handing over Certificate sufficient lubricants and greases necessary for the efficient operation and maintenance of the Plant at full load 24 hours per day for a period as specified under the scope of supply.

All the consumables including chemicals required till the project is handed over to

the end user are in the Desalination plant bidder's scope of supply.

15.0 APPROVED SUB-VENDOR / MAKES

The make of all the equipment/ instruments under this specification shall be subject to the Owner's approval, other than the Venders listed in Annexure 1.3. Bidder shall furnish a list of makes/sub-vendors/sub-bidders along with his bid. The owner reserves the right to accept/ reject any make or sub-vendor or add new makes/ sub-Vendors for the project, after the award of the contract. Approval, rejection or addition of makes shall not have any cost implication to the Owner after the award of the contract.

16.0 DOCUMENTATION

16.1 Format of Documentation

All engineering documents and drawings shall be of international "A" series sizes, that is, A0, A1, A2, A3 and A4.

A hard disk containing all the drawings in Auto CAD shall also be supplied in addition to hard copies. Soft copies of all documents shall be supplied in a Hard Disk in PDF format.

Grouped documents shall be provided by size A4, with the inclusion of bigger size drawings which, however, must be folded as Size A4.

16.2 Numbering and Identification of Documents

All the drawings shall be identified through a common way of numbering by the requirement of contracting. The numbering system of drawings and documents proposed by the Bidder shall follow the plant identification system and be agreed with the Owner. Apart from this, some drawings may also be numbered in the way that the Bidder or sub bidders are used to do. But there shall be a common title block on all published drawings which include the following contents:

- Owner
- Owner's Engineer
- Project
- Bidder
- System
- Drawing No.
- Sheet No
- Revision No.

The measuring units and dimensions marked on the project engineering drawings shall be of SI system conforming to ISO 1000.
English words shall be used as descriptions on drawings.

In case dimensions are not marked in conformity with the scale of drawings and any dimension on the drawing does not conform to those dimensions and sizes measured through a certain scale, the actual marked dimensions shall be applicable.

For revision of drawings, the revised part shall be clearly shown on the drawing. For revision of documents that have been grouped, a brief description shall be a perpendicular line with the margin of the revised copy closely following it.

16.3 Provision for Documents

The owner can examine those drawings as and when required at Bidder workplace.

Generally, copies of drawings or documents containing trade secrets and drawings with a patented nature need not be provided.

However, to know whether the Bidder has performed its obligations, the Owner has the right to examine those drawings within the Bidder's working scope.

The Bidder shall meet the Owner's reasonable demands to file and do the following to satisfy the Owner:

- Bidder will work according to the requirements specified in the contract.
- Bidder's work has been arranged properly and developed according to the plan.
- The quality control system is reliable.
- After receiving all documents necessary for Desalination plant operation and maintenance, Bidder shall supply equipment and systems.
- Having received all necessary documents for WRP Bidder to perform its legal obligations or other relevant responsibilities.

16.4 Owner's Responsibilities

The Owner agrees that the Contract will be concluded by the Desalination plant package & EPC method of building the project. The Desalination plant package Bidder must ensure that design standards and conditions meet the requirements, and that the Desalination plant system shall operate safely and reliably and with high efficiency, having the same performance as stipulated and guaranteed.

The Owner will examine, check and approve the drawings and documents to ensure all these drawings and documents meet the demands and duties written in the documents. The Bidder shall have an active and cooperative working relationship with the Owner. If there is a disagreement over an issue, the Owner and Bidder shall work together to reach some conclusion through mutual consultations.

If drawings and documents have been supplied to the Owner, the Bidder may not delay further design, waiting for the Owner's opinion. The Owner will arrange the time for submitting opinions and examination results for delivered documents. If the Owner finds that the Bidder cannot meet the contract requirements, the Bidder has to modify the design and drawings to meet the Contract demand.

17.0 PLANT AND EQUIPMENT IDENTIFICATION, LABELLING

17.1 Plant and Equipment Identification

The Bidder shall propose and apply a common identification system preferably KKS numbering for the whole plant equipment, facilities and systems showing the name and number of each item and its respective drawing number etc. to fully identify the plant. The structure of the designations shall be developed in such a way that the symbols used can be handled by electronic data processing equipment. The identification system must be used by all sub bidders, Vendors, etc., and shall be a proven system for Desal plant application. Each item of the plant shall be separately designed with a reference number, which shall be used consistently on the drawings, in the documents and on the catalogues as well as on the equipment items themselves.

17.2 Labelling

Name plates which are to be firmly fixed on all the equipment, buildings and structures shall be provided. For equipment of small size, these are to be fixed on the piping or structure adjacent to the equipment. The contents of the nameplate are to include the designation and principal parameters of the equipment.

The nameplate within the field shall be made of a high temperature - resistant metallic sheets, with a designation permanently engraved on them. Indoor-installed equipment (e.g., panels, cabinets, switchgear, etc.) shall also be labelled by an appropriate name plate.

The form, size, base colour and colour of contents of the name plates and prompting plates will be agreed between the Bidder and the Owner. It shall be possible for these to be readily seen by the operator. The designation of warning tags shall be different from that of other tags.

18.0 CONTRACT DRAWINGS, DOCUMENTS FOR APPROVAL

18.1 General

The Owner reserves the right to ask the Bidder to submit copies of drawings and other documents for approval to his Head Office or to the Office of his Representatives. If the Owner or his Representatives are satisfied with the drawing, one copy will be returned to the Bidder marked with an 'Approved' stamp. If the Owner or his Representatives are not

satisfied with the drawing, one copy stamped 'Reviewed and Returned with Comments' will be returned to the Bidder with comments marked thereon and the drawing shall be revised and re-submitted for approval.

The purpose of having drawings checked and approved by the Owner is to assist the Bidder in interpreting the Technical Specification to eliminate mistakes in the equipment or material shipped to the site of the work. The formal approval given to the Bidder is to be considered as in conformity with this purpose and no manner shall be construed to release the Bidder from any liability or responsibility for proper design, fabrication or compliance with the Contract Documents.

Equipment drawings shall indicate the general arrangement of the equipment to be furnished, give principal dimensions, and show sufficient details required for a complete Desalination plant.

While submitting drawings for approval, including any prepared by a Sub-Bidder, the Bidder shall certify that he has fully examined such drawings and that they comply with the requirements of the Contract.

If any item, equipment or work shown in the drawings does not completely comply with the requirements of the Specification or any other requirement of the Contract Document, the Bidder is obliged to inform the Owner and his Representatives of the differences giving full explanations and reasons for such changes.

For this Clause, the term "drawing" shall include design calculations, equipment specifications, diagrams, schedules, performance curves etc.

Approval of a drawing by the Owner or his Representatives will imply that:

a) Arrangement and layout drawings and key diagrams have been examined and appear to be by the basic design concept of the project and meet the requirements of the Specification.
b) Other drawings of components and equipment have only been examined for compatibility of the items and equipment with the Specification and with respect of interconnection with other items and equipment.
c) Any approval given by the Owner, or his Representatives shall in no way relieve the bidder of his responsibility under the Contract.

The Owner will not normally require receiving copies of detailed manufacturing drawings, but the Bidder shall make these available if requested to do so. However, for major tanks, structure and piping, necessary fabrication drawings shall be provided by the EPC Bidder.

The Bidder shall ensure that drawings are submitted in due time to permit amendments

to be made, and the drawings re-submitted for approval without delaying the scheduled deliveries or the guaranteed competition dates according to the Contract. Execution of work shall be taken up after the drawings are cleared by the Owner.

If, during the Contract period, the Bidder is required to modify the size of any buildings, foundations etc. from that shown on his Tender drawings to accommodate the finally approved arrangement of the Work (with due allowance for access, laydown, maintenance etc), then such modification shall be deemed to be included in the scope of the Contract.

Requirements about the format of drawings and documents, the provision for documents and the Owner's responsibilities about documentation are specified in relevant section of this Part.

The Bidder shall be responsible for any discrepancies, errors or omissions in the drawings and other particulars supplied by him, whether such drawings and particulars have been approved by the Owner and his Representatives or not.

18.2 Documentation by Bidder

The drawings to be submitted by the Bidder for approval shall cover the complete Scope of Contract work as defined by the Contract Specification and shall generally include, but not be limited to, the following:

18.2.1 Drawings & Documents to be submitted along with the proposal.

18.2.1.1 General

The Bidder shall prepare all necessary layouts, assembly, and detailed drawings giving complete information to enable the Owner/Owner's Engineer to properly consider, review and approve the design of the Work.

The Bidder shall commence his work immediately after the Commencement Date of the Contract, by giving priority to the drawings necessary for civil work, foundations, etc., to prevent any delays in the construction of civil work.

18.2.1.2 Submission of Drawings

The Bidder shall provide for the contractual scope of work all necessary drawings including, but not limited to the following:

a) Drawing List

The Bidder shall submit during the kick-off meeting a comprehensive master drawing list along with scheduled submission dates, which shall contain all the drawings and documents to be submitted.

b) Arrangement Drawings

All arrangement drawings shall be drawn according to scale. The general arrangement drawings shall show the physical arrangement of equipment units (machines, apparatus, piping, appliance, electrical equipment, instruments and control, cables etc.), and civil construction (room, channels, foundations, etc.) to agreed coordinates and boundaries.

The arrangement or layout drawings of mechanical, electrical, instrumentation and control equipment shall indicate the location of all plant and equipment.

c) Loading Data

Civil loading data along with GA drawings etc. required for the designing of the civil foundations & structures (civil/Steel) and electrical load data shall be submitted within 15 days after award.

d) Dimensional Drawings

The dimensions and outline drawings shall show all elements and main dimensions, loadings etc. of the individual components, where necessary with plan, section, side and top views, access, assembly and maintenance areas, required crane and hoist facilities, basic dimension of required building. Such dimensions, limited to the major ones, shall be shown in the arrangement drawings, allowing exact locations to be defined.

e) Installation Drawings

The Bidder shall provide the installation drawings for the entire scope of work, which shall show detailed information on the disposition of all the various items. They shall be based on dimensioned drawings and plans of equipment and building, plot plans etc. Bidder shall also provide schematics, layout and wiring diagrams as well as block diagrams as appropriate.

f) Electrical Diagrams, Logic Diagrams etc.

The bidder shall also provide cable schedules and cable block diagrams for all power, control, instrumentation and data cables. PLC ladder logic and function logic shall be provided with functional descriptions wherever applicable. The instrumentation loop diagram for DCIS shall also be provided with a database about the termination points wherever applicable. Typical Control Schemes for LV Switchboards wherever applicable.

g) Process Diagrams

The process or Piping and Instrument (P & I) Diagrams shall show the piping

including type, dimensions, fittings, flanges etc., and the flow directions. They shall also show the process data, the control functions and the instrumentation together with a listed explanation of used symbols.

h) Underground Service Drawings

The Bidder shall provide drawings showing all underground services. This includes all cables, earthing systems, piping, vessels, tanks, draining, water lines, etc.

i) Specifications Information

The Bidder shall provide basic lists and/+ or schedules regarding materials, pump lists, motor lists, cable lists, instrument loop diagram, measurement and control devices, types of pipes used etc., as well as any and all other information specified or listed in the technical specifications.

j) Design Calculations

The Bidder shall provide equipment design, system engineering calculations, all the code calculations for pressure parts and non-pressure parts design, tanks sizing and design, system engineering such as pump capacity, electrical utility data sheets, switchboard/switchgear sizing, cable sizing, voltage drop, motor run up calculation, protection relay settings, etc., for the Owner/Owner's Engineer review and information.

k) Terminal Points

The Bidder shall provide separate drawings showing all terminating points. These drawings shall indicate the co-ordinates of the terminating points as well as detail data such as flange dimensions, pipe forces, support loadings, cable connections, junction box, marshalling panel, spare conductors etc., thermodynamic data, electrical data, control data, etc., to completely describe all contractual terminal points.

18.2.1.3 Submittal of Program of Work

A 'Bidder's Program of Work', in the form of a CPM network, plans, bar charts and time schedules, detailed as directed by the Owner/Owner's Engineer and containing the results of the contract clarification before contract signing shall be submitted by the Bidder.

The "Bidder's Programme of Work,' shall include information relating to the scheduled activities, including the following:

- Design work in the office.
- Order dates, time and mode of delivery of subcontracted materials and equipment.
- Earliest/latest start and earliest/latest end dates for all contract activities.
- Period and place of fabrication.
- Dates of workshop and factory acceptance tests (FATs).
- Final date for delivery ex-factory.

- Transport to Site.
- Individual functional and preliminary tests of all components.
- Site acceptance tests.
- Training of Owner's personnel.
- Performance tests, defects liability periods.
- Commissioning, trial operation and reliability run.
- Interdependence with work by other sub-bidders/Owners.

From time to time and by the progress of work, the detailed programme shall be updated, and the overall activities shall be detailed. The variance between actual and expected progress of work shall be analysed and presented to the Owner/Owner's Engineer.

18.2.1.4 Drawings

Drawings shall be of computer-aided design using the latest version of AUTOCAD and PROS. Drawings shall be submitted via e-mail in the order in which they are required for adequate progress of work. The Owner/Owner's Engineer's approval of the Bidder's drawings shall not relieve the Bidder from his responsibility for errors or omissions that may exist, even though work is done by such approved drawings.

18.2.1.5 Drawings/ Documents to Be Submitted with the Proposal

The Bidder shall submit the following along with the Bid: -

S No.	Drawing / Document
1.	Bid drawings – Equipment GA, Layout,
2.	Scope & Terminal points
3.	Technical write-up for the system
4.	Technical Data Sheet for Mechanical, Electrical & Instrumentation items and filled in data sheets as per Section 5
5.	Comprehensive overview of the desalination plant system included in this package. This should encompass the following aspects: raw water parameters, pond water system parameters for the auto self-cleaning filter outlet, ultrafiltration outlet parameters, reverse osmosis (RO) outlet parameters, reject water parameter & quantity, N-pit reject parameter & quantity. Additionally, include the materials and manufacturers considered in the bid for the entire system.
6.	P&IDs for complete system indicating the scope of works with terminal points
7.	Process design calculations with catalogues and equipment sizing calculations
8.	PLC & SCADA configuration / Control system configuration drawing, I/O count.
9.	Quality Assurance Program
10.	Utility Requirement

S No.	Drawing / Document
11.	Control philosophy/operation philosophy / Design philosophy /Redundancy philosophy for Desalination plant system
12.	Codes and applicable standards followed for the project
13.	List of all maintenance tools, tackles and accessories required for maintenance of the offered equipment including bought out components.
14.	Catalogues
15.	Experience list
16.	Clause wise confirmation/deviation list concerning Mechanical/ Electrical and C&I requirements specified in sections
17.	Details of Fixed and Variable cost component for O&M Period

18.2.1.6 Drawings/ Documents to Be Submitted for Review / Approval by Owner / Owner's Engineer After the Award of Contract

NOTE:

- All the drawings shall be furnished in both soft and hard copies (2 sets of hard copies)
- All Engineering documents shall be provided in the format given by the Owner / Owner's Engineer after the award of the contract
- The format and point details for logs and process mimics shall be approved during the takeover of the system
- Legend: A – Approval, I – Information

Sl. No.	Drawing / Document	Category
A	**Mechanical**	
1.	Drawing / Document submission schedule	A
2.	Master drawing list	A
3.	Desalination plant and Equipment layout	A
4.	Process design calculations with catalogues and equipment sizing calculations along with all membrane projections, curves etc.	A
5.	Electrical Load List segregating Power (Motor - continuous, stand by, Intermittent, Power factor, efficiency, Load factor; Space heater)	A
6.	Equipment Load & Foundation Details	I
7.	Sizing calculation of auxiliaries	A

Sl. No.	Drawing / Document	Category
8.	GA of Desalination plant & Auxiliaries	A
9.	Process flow diagram	A
10.	Hydraulic flow diagram	A
11.	Process & Instrumentation Diagram (PID) indicating primary sensors and secondary instruments, destination reference (alarm, control etc.) for the plant.	A
12.	Technical Datasheets	A
13.	3D model	A
14.	Quality Assurance Plan	A
15.	Test Procedures	A
16.	Interconnecting Piping drawings/diagrams	I
17.	Layout for Borewell to desalination plant main conveyance (for each borewell)	A
18.	Layout for Pond water to desalination plant main conveyance, clarification plant	A
19.	Layout for Desalination plant to reject water discharge terminal point	A
20.	Layout for desalination plant to reject water discharge terminal point	A
21.	N Pit reject system	A
22.	Test certificates and Test procedures	A
23.	Erection & Commissioning Manual	I
24.	Operation & Maintenance Manual	I
B	**Electrical**	
1	Single line diagram	A
2	Technical data sheet	A
3	Control and metering philosophy for electrical system	A
4	Logic diagrams for various switchgear	A
C	**Control & Instrumentation**	
1.	Master Document list and drawing along with submission schedule	A
2.	System Configuration / Architecture drawing	A
3.	Functional design specification (FDS) for PLC	A
4.	PLC datasheets & Catalogue, Datasheet of PC/Server, Datasheet of Networking components	A
5.	IO List / Assignment	A
6.	All PLC Panel OGA, IGA & Wiring drawings, Bill of Material	A

Sl. No.	Drawing / Document	Category
	for the complete PLC system & Consoles / Desk GA drawings and wiring drawing	
7.	Power Distribution drawing for UPS & NON-UPS	A
8.	OGA/IGA Drawing of Peripherals (Networking cabinets)	A
9.	Datasheet of FO cable	A
10.	List of IP Address	I
11.	Graphic displays	A
12.	Controller and BUS loading details	I
13.	Loop schematics with detailed write-up & Logic diagrams	A
14.	Hardwired Input / Output list	A
15.	Soft link input/output list	I
16.	Instrument list	I
17.	Instrument datasheet & catalogue	A
18.	Control valve datasheet and catalogue	A
19.	UPS / Power Consumption Load List & Summary	I
20.	Control room layout	A
21.	Cable tray Layout & Junction box layout, Instrument Hookup drawing	A
22.	Earthing / Grounding Scheme	I
23.	Cable schedule	I
24.	Cable interconnection schedule	A
25.	Junction box GA & Instrument Hookup Drawings with BOQ	A
26.	Pre-FAT report	A
27.	MTBF & MTTR calculation details, system availability details	I
28.	Factory Acceptance Test Procedure (FAT)	A
29.	Site Acceptance Test Procedure (SAT)	A
30.	MQAP of the control system, Hardware, etc.	A
31.	Erection BOM & BOQ with complete dimensional details, weights, instructions, Instrument HOOKUP DRAWINGS etc.	A
32.	Factory Acceptance Test (FAT) procedure / Availability test procedure /PG test procedure for all C & I equipment.	A
33.	QAP for all equipment	A
34.	As-Built drawings	I
35.	O&M Manual for complete PLC system & Instruments, etc.	I
36.	Mandatory Spares	A
D	**CIVIL**	
1.	GA drawings for larger tanks along with Mechanical quality	A

Sl. No.	Drawing / Document	Category
	procedures	
2.	Quantity of plates (including waste) required for fabrication of larger tanks	I
3.	Load Details for various equipment placed on civil foundations	A
4.	Details of Puddle flanges & insert plates	I
5.	Fabrication drawing	I
E	**GENERAL**	
1	L2 Schedule	A

Review of Drawings

a) The Owner/Owner's Engineer will review documents and drawings as submitted, make such changes as required to assist the overall job coordination and assure conformance to the Technical Specifications, and return the comments to the Bidder as soon as possible marked with Owner/Owner's Engineer's comments and/or approval. The purpose of having drawings checked and approved by the Owner/Owner's Engineer is to assist the Bidder in interpreting the Technical Specifications to eliminate mistakes in the equipment or material shipped to the site of the work. The formal approval given to the Bidder is to be construed as in performance with this purpose and in no manner shall be construed to relieve the Bidder from any liability or responsibility for proper design, fabrication or compliance with the Contract Documents/specifications.

b) All Bidder's drawings, which are found to be incorrect during the construction period, which require changes due to field conditions, shall be corrected by the Bidder upon approval by the Owner/Owner's Engineer to an "as built" condition to reflect any necessary changes. The Bidder shall submit such "as built" drawings to the Owner/Owner's Engineer and the Owner/Owner's Engineer shall review and approve all such drawings before final payment is made to the Bidder. "Approved with comments (with code 2)", authorizes the Bidder to proceed with the fabrication, provided the Bidder agrees to all the Owner/Owner's Engineer's comments prior to start of fabrication. The document shall be resubmitted duly incorporating all the comments for final approval of the Owner/Owner's Engineer.

c) To facilitate the later processing of information between the Bidder and the Owner, the marking of parts for packing, final location, erection and testing shall follow a uniform system.

The classification system to be applied shall be the KKS system (ISO proposal) published by VGB

18.3 Manuals

18.3.1 General

The Bidder shall provide final sets as well as preliminary sets of operation and maintenance manuals containing all information and instructions for operation and maintenance of all station equipment and accessories furnished by him or through him in such number or copies as required by the Owner. All final manuals shall be provided in binders and be delivered in one shipment.

The information and instructions shall be in English language and lucid in description. For operation and maintenance manuals separate books shall be provided.

18.3.2 Operation Manual

The Operation Manual shall include one section that describes the equipment and functions, followed by one section that represents all important operational procedures in a compressed short form easy to understand and to follow as well as a section in which all operational procedures, test procedures, failure detection, etc. will be explained in detail.
An extensive trouble-shooting list shall be included.

Definition of technical terms used shall be included as well as a complete list of all items installed together with the Plant Component Identification Number.

18.3.3 Maintenance Manual

The Maintenance Manual shall include the manufacturer's descriptive material of all items supplied by him or his sub-bidders.
This manual is divided into eight sections:

1) Preventive maintenance, indicating the inspection required at regular intervals, the inspection procedure, the routine cleaning and lubricating operations, the regular safety checks and similar steps.
2) Repair and adjustment, describing the inspections, fitting and dismantling of parts, and fault tracing.
3) Spare parts list, containing all the necessary data for ordering spare parts, covering all equipment.
4) Tools list, containing all necessary data for identification of tools to be delivered under the present Contract.
5) List of suppliers and alternative suppliers and addresses.
6) All arrangement drawings, assemblies and sections indicating the part number/part quantity/technical specifications, schematic drawings, etc.
7) The Bidder will provide all necessary and special information for overhaul and repair work.
8) All additional special information for overhauls and repair work, not mentioned above, but essential for appropriate performance.

Shop drawings shall be provided as reference and understanding of the principles necessary for maintenance and repair.

Final manuals shall be provided complete with all necessary illustrative drawings provided in number as required by the Owner. Instrument calibration and procedure and test sheet shall be provided. Protection relays testing procedure and calibration test sheet shall also be included.

18.3.4 General Requirements for Operation & Maintenance Manuals

Operation and maintenance instructions will be given in a coordinated way. The Bidder shall provide the standard manuals and shall follow as far as possible the requirements as indicated below:

- Complete sectional drawings.
- Complete detailed drawings for every assembly
- All relevant isometric and control sections.
- Assembly procedure drawings including all clearances of bearings, moving blades, stationary blades, gears, etc. and other optional precision limits as erected.
- Clearances and alignment details
- Systems details and controls.
- Fluid capacities for both overhaul servicing and maintenance.
- Sub Bidder detailed drawings.
- Test and repair instructions.

19.0 TRAINING REQUIREMENTS

19.1 Training requirements

19.1.1 General

This section of the specification defines the specific services to be provided by the Bidder in addition to any other services defined in other parts of the Tender Document.

19.2 Training programme

The objective of the Training Programme is to train the Owner's operating and maintenance personnel in the operation and maintenance of plant and equipment furnished under this Contract.

The Training programme shall include instruction at the manufacturer's works and at the site. The Bidder shall submit for the approval of the Owner/Owner's Engineer a detailed training programme after the Award of Contract. The training programme shall describe in detail both the training at the manufacturers' works and the training on-site.

ANNEXURE - 1.1

SCOPE MATRIC FOR DESALINATION PLANT

Refer Scope matrix below for the entire scope of work for the Desalination plant.

Note: Bidder/Vendor is Desalination plant **Bidder**

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
I	**Mechanical**						
1.	**Borewell pumping system**						
A.	Four nos Borewells and Borewell pumps (3W+1S) including delivery connections up to raw water tanks, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance. Borewells also by bidder.	Bidder	Bidder	Bidder	Bidder	Bidder	Arrangement shall be provided for assembly and dismantling of pump along with piping and strainer.
B.	Raw water tanks (2 Nos) including ladders, walkways/platforms, manholes, instruments, foundation bolts, cathodic protection	Bidder	Bidder	Bidder	Bidder	Bidder	
2.	**Pond Water Clarification Plant**						
A.	**Pond Water Transfer pumps**	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	Two (2) x 100% (1W+1S) Pond Water Transfer Pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
	All interconnecting piping, valves, fittings and pipe supports & accessories within and between the equipment/skid.	Bidder	Bidder	Bidder	Bidder	Bidder	
B.	**High-Rate Solid Contact Clarifier**						
	One (1) x 100% 1W, High-Rate Solid contact clarifier, with telescopic sludge bleed arrangement	Bidder	Bidder	Bidder	Bidder	Bidder	
	Two (2) no's (2 x 100%) Dosing pumps for each chemical in Clarifications Process-Coagulant / Flocculant - including	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	suction/delivery connections, individual suction strainers, individual pressure gauges, Valves, NRVs, pulsation dampeners, calibration pot, and fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.						
	One (1) no dosing tank for chemicals dosed at market concentration / Two (2) no's (2 x 100%) dosing tanks for chemicals requiring dilution or dissolution for Clarification process - including instruments, level gauges, level switches, hinged covers for chemical filling, Eye wash cum Safety Showers, access platforms with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
	One (1) no Inlet Chamber/stilling Chamber for HRSCC feed	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
C.	**Dual Media Filter Feed Pumps**						
	Two (2) x 100% (1W+1S) Dual Media Filter Feed Pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
	Two (2) x 100% (1W+1S) Dual Media Filter Blowers - including suction/delivery connections, Silencers, Flexible bellows, suitable base frame, initial fill of lubricants, Valves, NRVs, acoustic hood if required, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	All interconnecting piping, valves, fittings and pipe supports & accessories within and between the equipment/skid.	Bidder	Bidder	Bidder	Bidder	Bidder	
D.	**Dual Media Filters**						
	Two (2) x 100% (1W+1S) Dual Media Filters - including Dual Media - Anthracite and Sand and supporting media, Strainer plates and Strainer nozzles, Davit type Manholes, Sight glasses, frontal piping, media traps and Auto valves and provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
E.	**Sludge Transfer pumps**						
	Two (2) x 100% (1W+1S) Sludge Transfer Pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
	All interconnecting piping, valves, fittings and pipe supports & accessories within and between the equipment/skid.	Bidder	Bidder	Bidder	Bidder	Bidder	
F.	**Filtered Water tank**						
	Filtered water tank - 1 no. - including instruments, level gauges, level transmitters, access platforms, ladders, side manhole, top manhole, foundation bolts with all required	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	accessories complete in all respects for plant commissioning, operation and maintenance.						
G.	**Filtered Water Pumps**						
	Two (2) x 100% (1W+1S) Filtered Water Pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
	All interconnecting piping, valves, fittings and pipe supports & accessories within and between the equipment/skid.	Bidder	Bidder	Bidder	Bidder	Bidder	
3.	**ASCF & ULTRAFILTRATION SYSTEM**	Bidder	Bidder	Bidder	Bidder	Bidder	
A	Four (4) no's (2 x 100% for each 0.5 MLD stream) - UF	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	Feed pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.						
B	Four (4) no's (2 x 100% for each 0.5 MLD stream) Auto Self-cleaning filters - including provisions for auto cleaning based on differential pressure across the filters, maintenance access of filters with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
C	Two (2) no's (2 x 50% UF Skids) - including required valves, NRVs, instruments, suitable headers, sampling valves, UF Membranes, supports, and fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
D	Two (2) no's (2 x 100%) UF Backwash pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
E	Two (2) no's (2 x 100%) Dosing pumps for each chemical in UF CEB - including suction/delivery connections, individual suction strainers, individual pressure gauges, Valves, NRVs, pulsation dampeners, calibration pot, and fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
F	One (1) no dosing tank for chemicals dosed at market concentration / Two (2) no's (2 x 100%) dosing tanks for chemicals requiring dilution or dissolution for UF CEB - including instruments, level gauges, level switches, hinged	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	covers for chemical filling, access platforms with all required accessories complete in all respects for plant commissioning, operation and maintenance.						
G	One number of UF/RO CIP Tank with agitator - including instruments, level gauges, level transmitters, hinged covers for chemical filling, access platforms and ladders with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
H	Two (2) (1W + 1S) UF CIP transfer Pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
I	One (1) no of UF basket filters (100 microns) suitable for chemical cleaning including Housing and filter mesh with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
J	One (1) no of RO Micron cartridge filters (5 microns) suitable for chemical cleaning including Housing and filter cartridges with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
4.	**RO SYSTEM**						
A	Four (4) no's (2 x 100% for each 0.5 MLD stream) of RO Feed pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, fittings with all	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	required accessories complete in all respect for plant commissioning, operation and maintenance.						
B	Four (4) no's (2 x 100% for each 0.5 MLD stream) of Micron cartridge Filters - including Housing and filter cartridges with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
C	Four (4) no's (2 x 100% for each 0.5 MLD stream) RO High-Pressure pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, Motor, VFD, fittings with all required accessories complete in all respect for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
D	Two (2) x 0.5 MLD (2W) of RO Skids - including required Reject valves, NRVs, provision for instruments, suitable headers, sampling valves, RO Membranes, supports, fittings with all required accessories complete in all	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	respect for plant commissioning, operation and maintenance.						
E	Two (2) no ERD - including suction/delivery connections, provision for associated instruments, fittings with all required accessories complete in all respect for plant commissioning, operation and maintenance	Bidder	Bidder	Bidder	Bidder	Bidder	
F	Two (2) (1W + 1S) Antiscalant Dosing Tank for RO - including instruments, level gauges, level switches, hinged covers for chemical filling, access platforms with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
G	Two (2) nos. (2 x 100%) Antiscalant Dosing pumps for RO - including suction/delivery connections, individual suction strainers, individual pressure gauges, Valves, NRVs, pulsation dampeners, calibration pot, and fittings, auto stroke with all required accessories complete in all	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	respects for plant commissioning, operation and maintenance.						
H	One (1) (1W) Hcl Dosing Tank for RO - including instruments, level gauges, level switches, hinged covers for chemical filling, access platforms, fumes absorber with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
I	Two (2) nos. (2 x 100%) HCl Dosing pumps for RO- including suction/delivery connections, individual suction strainers, individual pressure gauges, Valves, NRVs, pulsation dampeners, calibration pot, and fittings, auto stroke with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
J	Two (2) (1W + 1S) SMBS/SBS Dosing Tank for RO - including instruments, level gauges, level switches, hinged covers for chemical filling, access platforms with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
K	Two (2) nos. (2 x 100%) SMBS/SBS Dosing pumps for RO- including suction/delivery connections, individual suction strainers, individual pressure gauges, Valves, NRVs, pulsation dampeners, calibration pot, and fittings, auto stroke with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
5.	**RO Product water transfer Pumps**	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
A	Three (3) x 50% (2W+1S) RO Product water Transfer pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, VFD, fittings with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
B	All interconnecting piping, valves, fittings and pipe supports & accessories within and between the equipment/skid.	Bidder	Bidder	Bidder	Bidder	Bidder	
6.	**RO Reject water transfer Pumps**	Bidder	Bidder	Bidder	Bidder	Bidder	
A	Two (2) x 100% (1W+1S) RO Reject water Transfer pumps - including suction/delivery connections, suitable base frame, initial fill of lubricants, Valves, NRVs, provision for associated instruments, VFD, fittings with all required accessories complete in all respects for plant	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	commissioning, operation and maintenance.						
B	All interconnecting piping, valves, fittings and pipe supports & accessories within and between the equipment/skid.	Bidder	Bidder	Bidder	Bidder	Bidder	
7.	**Storage tanks**						
A.	**Raw water storage tank - 2 no's** - including instruments, level gauges, level transmitters, access platforms, ladders, side manhole, top manhole, foundation bolts with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
B.	**UF water tank - 1 no.** - including instruments, level gauges, level transmitters, access platforms, ladders, side manhole, top manhole, foundation bolts with all required accessories complete in all respects for plant	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	commissioning, operation and maintenance.						
C.	**RO water storage tank - 2 no's** - including instruments, level gauges, level transmitters, access platforms, ladders, side manhole, top manhole, foundation bolts with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
D.	**Reject Water Sump -** including instruments, level gauges, level transmitters, access platforms, ladders,	Bidder	Bidder	Bidder	Bidder	Bidder	
E.	**CIP tank - 1 no.** - including instruments, level gauges, level transmitters, access platforms, ladders, side manhole, top manhole, foundation bolts, chemical filling hinged covers with all required accessories complete in all respects for plant commissioning, operation and maintenance. (Vendor can consider separate CIP tanks for UF and RO if required)	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
8.	**Piping, Valves, Fittings Supports etc.**	Bidder	Bidder	Bidder	Bidder	Bidder	
9.	**Neutralization pit and pumping system**	Bidder	Bidder	Bidder	Bidder	Bidder	
	Neutralization pit including dewatering pump, instruments, level gauges, level transmitters, access platforms, ladders, side manhole, top manhole, foundation bolts with all required accessories complete in all respects for plant commissioning, operation and maintenance.	Bidder	Bidder	Bidder	Bidder	Bidder	
10.	**EOT crane and Hoist**	Bidder	Bidder	Bidder	Bidder	Bidder	
11.	**HVAC system**	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
12.	**Fire Protection and detection system**	Bidder	Bidder	Bidder	Bidder	Bidder	
13.	**Chemical Laboratory Equipment**	Bidder	Bidder	Bidder	Bidder	Bidder	
14.	**Common and miscellaneous items**						
A.	For all equipment/vessels: Anchoring base plates and vessel supports as required.	Bidder	Bidder	Bidder	Bidder	Bidder	
B.	Vent and drain connections with necessary isolation valves	Bidder	Bidder	Bidder	Bidder	Bidder	
C.	Lifting lugs is required for the installation and maintenance of all units.	Bidder	Bidder	Bidder	Bidder	Bidder	
D.	Safety Valves, sight glass and grounding lugs as required	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
E.	Necessary ladder/ platform to access vessel top (for access for valves, Instruments, re-filling filter/resin media, maintenance, etc.)	Bidder	Bidder	Bidder	Bidder	Bidder	
F.	Shop primer & Finish coating for all items. (C5 (Durability – very high) as per ISO 12944) Refer PAINT SYSTEM FOR HIGHLY CORROSIVE AREAS	Bidder	Bidder	Bidder	Bidder	Bidder	
G.	Touch-up paint is required for site touch-up.	Bidder	Bidder	Bidder	Bidder	Bidder	
H.	Standard tools skit, Special tools and tackles as required for the operation, assembly and maintenance of the system.	Bidder	Bidder	Bidder	Bidder	Bidder	
I.	Initial fill of lubricants and resins & filter media wherever required.	Bidder	Bidder	Bidder	Bidder	Bidder	
J.	Start-up and Commissioning Spares	Bidder	Bidder	Bidder	Bidder	Bidder	
K.	Mandatory Spares	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
L.	All mechanical connections between equipment and systems within the scope of the supply	Bidder	Bidder	Bidder	Bidder	Bidder	
M.	All necessary pipe fittings, drains/isolation valves, strainers, expansion bellows, relief valves etc.	Bidder	Bidder	Bidder	Bidder	Bidder	
N.	Design, fabrication & installation shall be as per ASME/HEI standards wherever applicable.	Bidder	Bidder	Bidder	Bidder	Bidder	
O.	Eyewash cum Safety Shower - 4 No minimum, at chemical handling/critical areas. (Inlet connection - Service water at 2 bar)	Bidder	Bidder	Bidder	Bidder	Bidder	
P.	Supply of consumable materials	Bidder	Bidder	Bidder	Bidder	-	
Q.	Bidder shall guarantee the long-term availability of spares to the owner for the full life of the equipment covered under the contract	Bidder	Bidder	Bidder	Bidder	-	
II	**Electrical**						

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
1.	400V PMCC, Motor Control Centres, Distribution Boards, Local starters and Local Push Button Stations.	Bidder	Bidder	Bidder	Bidder	Bidder	
2.	HT Motors and LT Motor	Bidder	Bidder	Bidder	Bidder	Bidder	
3.	Electric actuators	Bidder	Bidder	Bidder	Bidder	Bidder	
4.	VFD Drives and panels (As applicable)	Bidder	Bidder	Bidder	Bidder	Bidder	
5.	220V DC Battery, Charger & DCDB	Bidder	Bidder	Bidder	Bidder	Bidder	
6.	2x100% 230V AC UPS, 2x100% Ni-cd Battery, 60miniutes back-up time, charger, Battery Health Monitoring system & Redundant ACDB	Bidder	Bidder	Bidder	Bidder	Bidder	
7.	HT & LT Power cables and control cables	Bidder	Bidder	Bidder	Bidder	Bidder	
8.	Flexible trailing cables as applicable	Bidder	Bidder	Bidder	Bidder	Bidder	
9.	Cabling system complete with cable trays, supports, conduits, glands, lugs etc. for all the cables of	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	the Desalination plant system.						
10.	Fire sealing system for cable penetrations in the walls/floors.	Bidder	Bidder	Bidder	Bidder	Bidder	
11.	Above-ground earthing of all the buildings, structures & electrical equipment/systems	Bidder	Bidder	Bidder	Bidder	Bidder	
12.	An electronic earthing system with earth pits	Bidder	Bidder	Bidder	Bidder	Bidder	
13.	Safety equipment such as Rubber mats, First aid box, Danger plate, Sand buckets etc.	Bidder	Bidder	Bidder	Bidder	Bidder	
14.	Engineering of complete Electrical system including preparation of required sizing calculations, layouts, scheme diagrams, cable schedules, Interconnection schedules, relay setting calculations etc.	Bidder	Bidder	Bidder	Bidder	-	
15.	Basic engineering of the complete Electrical system including Electrical load list, LT Transformer sizing, 400 V PCC/MCC, HT/LT/Control cables etc. cable sizing	Bidder	Bidder	Bidder	Bidder		

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	calculation, Cable schedule, cable layout & Interconnection diagram shall be provided for all the cables of Desalination plant system.						
16.	Special tools & tackles are required for the maintenance of equipment. A list of special tools and tackles shall be provided by Bidder.	Bidder	Bidder	Bidder	Bidder		
17.	First, fill of consumables/chemicals	Bidder	Bidder	Bidder	Bidder		
18.	Spare parts required for successful commissioning	Bidder	Bidder	Bidder	Bidder		
19.	Mandatory spares	Bidder	Bidder	Bidder	Bidder		
20.	Any other electrical equipment and accessories required to complete the system	Bidder	Bidder	Bidder	Bidder		
III	**Control & Instrumentation System**						
1.	Design, engineering, procurement, supply, calibration, supervision of installation, testing and commissioning of all local and remote instruments, Analyzers, Pneumatic	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	control valves, MOVs with integral actuators, PLC-based control system, Operator workstation/Engineering station, Redundant UPS & Batteries, Battery charger, Battery Health Monitoring system, Junction Box, Local Instrument enclosure, Control desk, operator chair, printer table, power, control, Instrumentation Cables, Communication cables, special cables, Fiber optical cables, CAT6 cables, earthing cables, Cable tray, conduits, pneumatic tubing and process piping, Erection hardware, Cable glands, Structure and supports, earthing, including performance test instruments and other facilities necessary to ensure the completeness of the Desalination plant and to meet the specification requirements is in Bidder scope.						
2.	The complete operation, monitoring and control of the Desalination plant including Pre-treatment, RO, shall be performed from the dedicated redundant PLC-based control system located in the Desalination control room	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	with provision for the expansion of PLC to monitor the custody flow meters for the water consumption in each plot with GSM/IIoT based or wireless transmitters in future.						
3.	Supply of redundant PLC-based control system with Processor, Non-Redundant I/O modules, redundant communication modules, redundant power supply modules, redundant ethernet switches, relays, marshalling cabinets, LIU, media converters, protocol converters, patch cords, communication cables, etc. Hot redundant controllers shall be provided for Desalination plant PLC. However, the final number of controllers shall be determined based on the I/O handling capacity, controller loading, and other technical specification requirements.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
4.	The Desalination plant control room shall be provided with one number of OEWS (32" LED monitor), The operation of Pretreatment, and RO shall be fully automatic (sequentially). Additionally, complete one number of Engineering station software's and necessary License for the engineering station shall be provided by the bidder.	Bidder	Bidder	Bidder	Bidder	Bidder	
5.	Supply of Operator/engineering control desk, Operator chair and printer table for the Bidder supplied control system and facilities.	Bidder	Bidder	Bidder	Bidder	Bidder	
6.	Supply of redundant UPS & Battery with 60 minutes of Back-up time for the complete control system and instrumentation with sufficient capacity is in Bidder's scope including the power supply requirement for the purchaser system.	Bidder	Bidder	Bidder	Bidder	Bidder	
7.	Supply of One (1) No. of Control desk with chairs for the purchaser-supplied PLC Operator cum Engineering station in the Desalination plant control room.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
8.	The Desalination plant PLC-based control system shall be connected to a dual redundant high-speed fibre optic data highway and interface with the purchaser's common SCADA located in the main plant's CCR (Centre Control Room) via MODBUS TCP/IP protocol for centralized monitoring. The Bidder shall supply redundant single-mode Fiber optic cable (SMFO) from the Desalination plant PLC to the SCADA. The Bidder shall also provide the Light Interface Unit (LIU), media converter, and patch cord at both ends. Bidirectional communication link through FO link shall be established between desalination and existing GIPCL PSS-2 & PSS-1 for controlling the borewell motor feeders in the PSS-2 and from PSS-1 in bidder scope. PSS-1 TO PSS-2 there is an existing FO cable available for the bidirectional communication. the spare cores shall be	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	utilized from PSS-1 to establish the communication from the Desalination to PSS-2 via PSS-1. The FO cable termination, splicing, any converters, Switched and all accessories required for the communication shall be in the bidder scope.						
9.	The Desalination plant PLC shall be time-synchronized through the master clock system using the NTP (SMFO) protocol. The redundant SMFO cable from the Desalination plant PLC to the purchaser's Master Clock System panel is in the central control room of the GIPLC Main plant. The Bidder shall also provide the Light Interface Unit (LIU), media converter, and patch cord at both ends.	Bidder	Bidder	Bidder	Bidder	Bidder	
10.	Soft link interface with UPS, Battery charger, BHMS, Switchgear IEC 61850, etc. shall be provided with Desalination Plant PLC. Bidder to consider necessary Software and hardware in the respective	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	systems/equipment.						
11.	The supply of all field instruments within the battery limit, as per the approved P&ID (Piping and Instrumentation Diagram), operation and control philosophy, protection, control, interlock, and monitoring schemes, etc. as approved during the detail engineering stage, shall be included in the Bidder's scope.	Bidder	Bidder	Bidder	Bidder	Bidder	
12.	The supply of all Analysers within the battery limit, as per the approved P&ID (Piping and Instrumentation Diagram), operation and control philosophy, protection, control, interlock, and monitoring schemes, etc. as approved during the detail engineering stage, shall be in the Bidder's scope.	Bidder	Bidder	Bidder	Bidder	Bidder	
13.	The supply of all Pneumatic On/OFF, control valves within the battery limit, as per the approved P&ID (Piping and Instrumentation Diagram), operation and control	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	philosophy, protection, control, interlock, and monitoring schemes, etc. as approved during the detail engineering stage, shall be included in the Bidder's scope. Instrument air if required shall be provided by the bidder with necessary compressor and receiver with dryer.						
14.	The supply of all Motorized operated valves with integral actuators within the battery limit, as per the approved P&ID (Piping and Instrumentation Diagram), operation and control philosophy, protection, control, interlock, and monitoring schemes, etc. as approved during the detail engineering stage, shall be included in the Bidder's scope.	Bidder	Bidder	Bidder	Bidder	Bidder	
15.	Necessary Ultrasonic flow metering station with totalizer at the borewell water supply, Product water distribution at main discharge line and at every distribution tapping ant each plot with the necessary communication to the Desalination PLC shall be in the bidder scope.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
16.	Supply of Junction box and local instrument enclosure for all the field instruments supplied by the Bidder.	Bidder	Bidder	Bidder	Bidder	Bidder	
17.	Supply of complete Power, control, Instrumentation, special, communication Cable between all the field instruments, Analysers, Valves, MCC, Switchgear, Local control panels, JB, PLC, Switchgear to RIO, Switchgear to PLC etc is in Bidder cope.	Bidder	Bidder	Bidder	Bidder	Bidder	
18.	Supply of erection hardware, tubes and fittings, cable glands, pneumatic and process hook up hardware, Cable tray, conduits, cable ties, structure and structure support.	Bidder	Bidder	Bidder	Bidder	Bidder	
19.	Supply of Electrical and Electronic earth pit and earthing cables as required for the complete system is in Bidder scope.	Bidder	Bidder	Bidder	Bidder	Bidder	
20.	Supply of necessary instruments for performance testing.	Bidder	Bidder	Bidder	Bidder	Bidder	
21.	Supply of mandatory spares	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
22.	Supply of any other control & instrumentation items as required for the completeness of the system but not specifically indicated above shall also be in Bidder's scope.	Bidder	Bidder	Bidder	Bidder	Bidder	
IV	**Miscellaneous items** Common equipment services (to be included in the corresponding supply item).						
1.	Noise prevention measures as required.	Bidder	Bidder	Bidder	Bidder	Bidder	
2.	Complete lifting devices and equipment such as cranes and hoists as per the requirement & as per the specifications mentioned.	Bidder	Bidder	Bidder	Bidder	Bidder	
3.	Painting including corrosive protection and prevention measures	Bidder	Bidder	Bidder	Bidder	Bidder	
4.	Complete detailed labelling of installations	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
5.	Couplings and coupling guards	Bidder	Bidder	Bidder	Bidder	Bidder	
6.	Venting and draining equipment	Bidder	Bidder	Bidder	Bidder	Bidder	
7.	Piping, fittings, safety devices, fasteners, supports etc	Bidder	Bidder	Bidder	Bidder	Bidder	Drain of any system shall extended to nearest drain trench.
8.	Base frames, base plates, anchor bolts, supports, covers etc	Bidder	Bidder	Bidder	Bidder	Bidder	
9.	All termination points of treated water, reject water and N-pit disposal with Individual isolation valve & blanking arrangement	Bidder	Bidder	Bidder	Bidder	Bidder	
V	**Scope of services**						

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
1.	Design of foundation works for tanks & equipment	Bidder	Bidder	Bidder	Bidder	Bidder	Detailed design of concrete works shall be done by the Bidder.
2.	Performance testing of the Desalination plant.	Bidder	Bidder	Bidder	Bidder	Bidder	
3.	3D modelling for all the equipment	Bidder	Bidder	Bidder	-	-	
4.	Training of the Owner's operating personnel, in the operation and maintenance of the equipment/system offered.	Bidder	Bidder	Bidder	-	-	
5.	Seaworthy packing and transportation up to Indian port from Ex-works with Transit insurance.	Bidder	Bidder	Bidder	-	-	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
6.	Unloading from carriers, receiving, site storage and handling, inspection, site facilities and transportation to the erection site.	Bidder	Bidder	Bidder	-	-	
7.	Co-ordination with other agencies including with the Owner at the plant interconnections (interfaces)	Bidder	Bidder	Bidder	-	-	
8.	Coordination with DCS vendor or hardwired and soft link interface. (If applicable)	Bidder	Bidder	Bidder	Bidder	Bidder	
9.	Supervision Carry out commissioning, testing, trial operation, reliability run, and performance guarantee test of the systems / equipment works specified and handed over the Desalination plant package to the Owner's requirements and approval and in compliance with the requirements of this specification.	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
10.	Provision of documents required and specified including AS BUILT drawings.	Bidder	Bidder	Bidder	-	-	
11.	Training services for the Owner's operation and maintenance Personnel.	Bidder	Bidder	Bidder	-	-	
12.	Any other supplies and services in connection with or related to the works so far as the necessity for providing the same is specified in or reasonably to be inferred from the contract and/or required for the completion of this package	Bidder	Bidder	Bidder	-	-	
13.	The Bidder shall accept full responsibility for the completeness and the faultless working of the equipment and the Desalination plant. These shall be executed based on proven design principles and under the state of the art	Bidder	Bidder	Bidder	Bidder	Bidder	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	in such a manner that the purpose to be served by the plant is fulfilled in every respect and a maximum of operational dependability and efficiency are assured. Standardization of equipment, materials etc. as well as of buildings shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of assembling and dismantling of all parts of the plant.						
14.	Satisfactory conclusion of the Contract By accepting the Contract, the Bidder shall be deemed to accept the obligation of supplying everything necessary for the purpose mentioned above, regardless of any omission in the specification or on the drawings. More detailed scope of supply and service is described under this section and the relevant chapter of the detailed technical specification.	Bidder	Bidder	Bidder	Bidder	Bidder	
15.	Scope of Engineering Services The engineering services of the Contract refer to the	Bidder	Bidder	Bidder	-	-	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
	complete basic and detail engineering of all equipment and systems, providing engineering drawings, data, instruction manuals, as built drawings and other information for the Owner's review, approval and records. All documents shall be submitted by the Bidder to obtain the required permits to commence the works and operate the Plant, including but not limited to: ▪ Clarifications with authorities ▪ Participation in clarification meetings						
16.	Quality assurance of all work executed at the site.	Bidder	Bidder	Bidder	Bidder	Bidder	
17.	Preparation and submission of drawings in soft and hard form/documents for approval/information to the Owner / Engineer as per the drawings/document's submission schedule.	Bidder	Bidder	Bidder	-	-	
18.	Preparation of all necessary drawings/data/documents for obtaining necessary Approval of statutory authority and obtaining necessary approval on behalf of the Owner.	Bidder	Bidder	Bidder	-	-	

Sl. No.	Description	Engineering	Supply	Engineering Coordination	Supervision of erection, testing and commissioning	Erection, testing and Commissioning	Remarks
19.	Instruction manuals for installation, start-up, maintenance and operation of all the equipment, supplied by the Bidder as per the distribution schedule.	Bidder	Bidder	Bidder	-	-	
20.	Warranty support for all items supplied	Bidder	Bidder	Bidder	-	-	
21.	Submission of weekly progress report.	Bidder	Bidder	Bidder	-	-	

ANNEXURE - 1.2

MANDATORY SPARES

GENERAL

i) Quantity of mandatory spares specified in this section are on a unit basis

ii) One set means the quantity used in one unit unless specifically indicated otherwise.

iii) Wherever quantities are specified in percentage, the minimum quantity to be supplied shall be rounded off to the next integer unless mentioned otherwise.

A. MECHANICAL

DESALINATION PLANT & Auxiliaries	Qty
Horizontal Centrifugal Pumps	(for each type & model)
Centrifugal Pumps (for each type & model)	
Impeller with nuts & other accessories	1 Set
Wearing rings (Impeller & Casing; as applicable)	1 Set
Shaft with key	1 Set
Shaft Sleeves	1 Set
Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards as applicable.	1 Set
Bearings (Drive End and Non-drive end)	1 Set
Gland, Packing & Gland Assembly for each type or Mechanical Seal as applicable	1 Set
Gaskets & O Ring	1 Set
Vertical Centrifugal Pumps (for each type & model)	
Impeller with nuts & washers	1 Set
Bearings for Line, Head and Impeller shafts	1 Set
Thrust Bearings of pump & drive	1 Set
Wearing rings – Impeller	1 Set
Wearing rings – Casing	1 Set
Gland, packing & gland assembly	1 Set
Impeller Shaft with key, line shaft and head shaft with key	1 Set
Shaft Sleeves	1 Set
Stuffing box	1 Set

Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1 Set
All Gaskets & O rings	1 Set
Motor Bearings	1 Set
Line Shaft Couplings (if applicable)	1 Set
Borewell Pumps, Pond water and clarified pumps	
Complete set of pumps	1 No.
Impeller with nuts & washers	1 Set
Bearings (both pump & motor)	1 Set
All Gaskets & O rings	1 Set
Mechanical seal	1 Set
Shaft with key	1 No
High Pressure Pump (For each type and Model)	
Mechanical Seal (Complete Set)	1 set
Bearing Set	1 set
Gasket & O-ring Kit	1 set
Wear Rings / Casing Rings	1 set
Coupling Element / Rubber Spider / Spacer	1 set
Shaft Sleeve	1 set
Shaft with keys	1 set
All pumps other than above mention pumps (For Each size and Model)	
Mechanical Seal (Complete Set)	1 set
Bearing Set	1 set
Gasket & O-ring Kit	1 set
Wear Rings / Casing Rings	1 set
Coupling Element / Rubber Spider / Spacer	1 set
Shaft Sleeve	1 set
Shaft with keys	1 set
High-Rate Solid Contact Clarifier	1 set
Coupling element / spider / flexible joint	1 set
Center mechanism bearing set	1 set
Shaft seal and gland packing set	1 set

Scraper arm assembly / rake arm	1 set
Scraper blades (HDPE / SS / rubber)	1 set
Rake arm pin & bush set	1 set
Rake lifting mechanism components (where provided) Hydraulic cylinder seals, bush kit, and pins	1 set
Dual Media Filter	
Filter Media Set (Sand + Anthracite + Gravel):	One complete set (10–15% of total charge)
Underdrain Nozzles / Strainers	5% of total quantity
Top Diffuser / Distributor Assembly	1 set (if applicable)
Air Scour Nozzle / Header (if provided)	1 set
Vent, Drain, and Sample Valve Assembly	1 set
Flow Distributor Pipe / Header	1 set
PIPING / FITTINGS & VALVES	
Pipes	5% of the total straight length for each size and material grade of pipe
Gaskets	100% total requirement of gaskets
Fasteners (Flanges, Unions, etc.,) and fittings	10% of the total requirement of fasteners
Hangers and supports	5% spare spring box assembly for each type and rating of spring provided
Pipe clamps	20% spare pipe clamp/attachment for each size & category.
Valves	
Manual valve (For each type of valve category)	5% or min 1 no of each type, rating & size
Auto valve with Actuator (For each type of valve category)	5% or min 1 no of each type, rating & size
Valve Internals	
Bonnet/cover gaskets	5% or min 1 no of each type, rating & size
Gland packings	1 set per valve/speciality for each size and type.
Valve stems for size 50 mm NPS and smaller	2 sets for each size and type of valve.

Valve stems for sizes 65 mm NPS and larger	1 set for each size and type of valve
Disc or disc seat, as applicable, for gate, globe and safety valves and disc with hinge pin for check valves	1 set for each size and type of valve
Body seat ring for gate, globe and check valves	1 set for each size and type of valve
Yoke bushing for gate and globe valves	1 set for each size and type of valve
Trap disc and seat	1 set for each size and type of valve
Bucket, lever and guide pin for bucket traps	1 set for each size and type of valve
SS screen for traps with integral strainers	1 set for each size and type of valve
Control units for expansion joints	1 set for each size and type of valve
Air Blower (for each type and model)	
V-Belts	1 Set
Filter element	2 set
Seal	1 set
Lubricants and seal	1 lot (including initial fill)
Resin Exchanger	
Strainers for collector, distributor & nozzles	10% for MB units
Ejector	1 set for Acid & Alkali injection
Sight Glass (toughened)	1 No
UF system	
Victaulic coupling	3 No per skid for each size
Interconnector 'O" rings	10% of total quantity
Dosing system	
Diaphragm	1 No for each type
Complete suction & delivery fittings	1 No for each type
RO system	
Membrane 'O' rings	2 No for each skid
Interconnector 'O" rings	10 No for each skid
Victaulic coupling	3 No per skid for each size
General for all equipment	
Gaskets	3 No per skid for each size and type
Desiccants, if required (to remove moisture)	As required
Filters	1 set for Each type and size of the Filter
Piping and Valves	
Gland packing and gasket for valve (each rating, size, kind)	100% each

Size, kind of Valve over 25 mm Dia.	1 set for each type and size valve
Size, kind of Valve up to 25 mm Dia.	2 sets for each type and size valve
Pipe and fitting (each size and material)	5% of total length
EOT Crane	
Electric motor of each type	1 set
Electro-Hydraulic Thrustor Brake of each type	2 set
DC Disk Brake of each type	2set
Control Panel assembly	1 set
Lubricants	1 set
Master Controller	1 set
Travelling cable for one Crane	1 set
Pendent Controller cable for one Crane	1 set
Transmitter and Receiver of radio remote control system.	1 set
Busbar Connection Assembly	1 set
Busbar Tapping Assembly	1 set
Aux. relays, Overload relays, Auxiliary Contactors, SPP, Push Buttons, Limit Switches, Control Switches, Indicating Lamps, LED Cubical illumination Lamp, Annunciator, Control MCB, Control Fuses with carrier base and links, Timers, Power and Control Terminal Blocks etc. of each type & rating	1 set
Beacon LED Lamp, Glass LED Busbar Crane DSL Indicator Lamp	1 set
Bearings (Each Type and Size)	1 Set
Gearbox	1 Set
Coupling (Each type and size)	1 Set
Mechanical Seals	1 Set
Electrical	
HV/LV Motors (Qty indicated shall be for each rating motor)	
Type of Bearings	1 set each
RTD's	1 set
Thermocouples	1 set

Indicators, recorder and meter, digital display unit, Push Buttons, lamp, and switch installed in the panels.	10% for each type / Model or minimum of 2 Nos. (Whichever is more)
MCB, MCCB	10% for each type, model and rating or minimum1 No. (Whichever is more)
Fuses	30% of installed Qty / each type / each rating.
Terminal Blocks	10% for each type, size or minimum 10 Nos (Whichever is more)
Control & Instrumentation	
Field instruments	
For skid mounted instruments	10% of total number of instruments for each Type, Make, Model and range or minimum of 1No. (Whichever is more)
Bearing metal temperature RTDs	10% of total number of instruments for each Type, Make, Model and range or minimum of 2Nos. (Whichever is more)
Thermowells	10% of total number of instruments for each Type, Make, Model and range or minimum of 1No. (Whichever is more)
Electronic Transmitters (For Pressure, DP, Temperature, Flow, Level, Position)	10% of total number of instruments for each Type, Make, Model and range or minimum of 2Nos. (Whichever is more)
Temperature Switch, Differential pressure Switch, Pressure switch, Flow switch, Level Switch	10% of total number of instruments for each Type, Make, Model and range or minimum of 2Nos. (Whichever is more)
Temperature gauges, pressure gauges, differential Pressure gauges, flow gauges	10% of total number of instruments for each Type, Make, Model and range or minimum of 2Nos. (Whichever is more)
Flow elements	10% of total number of instruments for each Type, Make, Model and range or minimum of 2Nos. (Whichever is more)
All type of Rota meters & Sight Flow Indicator.	10% of total number of instruments for each Type, Make, Model and range or minimum of 1No. (Whichever is more)
Level Gauges	10% of total number of instruments for

	each Type, Make, Model and range or minimum of 1No. (Whichever is more)
Any other instruments not indicated above, but in the final approved P&ID.	10% of total number of instruments for each Type, Make, Model and range or minimum of 1No. (Whichever is more)
Analyzer	
pH /Conductivity/turbidity Analyzer	
Flow Through type cell and electrode	1 no. of each type
Electronic Transmitter unit without sensor	1 no. of each type
Prefabricated cable with connector	1 Set
Residual Chlorine Analyzer	
Sensor	1 no. of each type
Transmitter	1 no. of each type
Prefabricated cable with connector	1 Set
All chemical Reagents for 12-month operation (Supply to be staggered as per the shelf life)	1 Set
Silica Analyser	
Main PCB Assembly	1 no. of each type
Power supply cards (if applicable)	1 no. of each type
Rubber Tubes and capillary Tubes	1 set
Prefabricated cable with connector	1 set
Solenoid valves	1 set
All chemical Reagents for 12-month operation (Supply to be staggered as per the shelf life)	1 set
Sodium Analyzer	
Main PCB Assembly	1 no. of each type
Power supply cards (if applicable)	1 no. of each type
Rubber Tubes and capillary Tubes	1 set
Prefabricated cable with connector	1 set
Solenoid valves	1 set
All chemical Reagents for 12-month operation (Supply to be staggered as per the shelf life)	1 set
Any other Analyzer (As applicable)	
Main PCB Assembly	1 no. of each type
Power supply cards	1 no. of each type

Rubber Tubes and capillary Tubes	1 set
Prefabricated cable with connector	1 set
Solenoid valves	1 set
All chemical Reagents for 12-month operation (Supply to be staggered as per the shelf life)	
Erection Hardware	
Instrument valves, manifolds, etc.	5 nos. of each type, rating and size
Impulse piping & tubing	5 nos. of standard length of each size, rating & material
Fittings	10 nos. of each type, rating, material and size
Instrument Flange	10 nos. of each type, rating, material and size
Instrument Gaskets	10 nos. of each type, rating, material and size
Air Header	2 nos. of each type, rating, material and size
Control valves, Pneumatic On/off Valve.	
One complete Set of Pneumatic actuator assembly.	10% or minimum 1 Set of each type, model, rating, and size (whichever is more).
Stem packing	One set for each control valve
Diaphragms	2 Nos for each control valve
O rings, gaskets, seals	One set for each control valve
Limit switches	10% of total control valves / each type / Model
Positioner	10% of total control valves / each type / Model
Position transmitters	10% of total control valves / each type / Model

Valve trims (such as plug, stem, seat ring / cage, guide bushing, stem lock pin, packing retaining ring, etc)	One set for each type / model of control valve.
Pilot relay	10% or minimum 1 No. of each type, model, rating, and size (whichever is more).
Feedback linkages	10% or minimum 1 No. of each type, model, rating, and size (whichever is more).
Solenoid valve	20% of Solenoid valve or min 2 no. of each type for total qty. of control valves whichever is more.
I to P converters	10% of total control valves / each type / Model.
Air lock relay	10% or minimum 2 Nos. of each type / Model (whichever is more)
Air filter regulator	10% or minimum 2 Nos. of each type/Model (whichever is more)
Volume booster	10% or minimum 2 Nos. of each type / Model (whichever is more)
Solenoid valve / coils	10% or minimum 2 Nos of each rating / type / Model (whichever is higher)
Erection Hardware	
Manifold 2-way, 3-way, 5-way valve manifolds	10% of each type, rating, size installed.
Fittings	10% of each type, rating, size installed.
Condensate pots	10% of each type, rating, size installed.
Local Control panels	
Power supply Modules	10% for each type / Model or minimum of 2 Nos. (Whichever is more)

Indicators, recorder and meter, digital display unit, Push Buttons, lamp, and switch installed in the panels.	10% for each type / Model or minimum of 2 Nos. (Whichever is more)
MCB, MCCB	10% for each type, model and rating or minimum1 No. (Whichever is more)
Fuses	30% of installed Qty / each type / each rating.
Terminal Blocks	10% for each type, size or minimum 10 Nos (Whichever is more)
Microprocessor based control system	
Complete set including integral microprocessor-based control system along with system & application software and special cables.	10% or 1 set of each type/model whichever is more
PLC Items	
Multifunction Processor Unit / Controller Unit/ CPU	10% of total nos. used in the system or minimum 1(One) no. whichever is more.
Binary Input Module	10% of total nos. used in the system or minimum 2(Two)nos. whichever is more.
Analog Input Module (4 to 20mA input type)	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.
Analog Input Module (RTD input type)	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.
Analog Output Module (4 to 20mA output type)	10% of total nos. used in the system or minimum 2 (Two) nos. whichever is more.
Binary Output (contact) Module	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.
Binary Output (Voltage) Module	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.
Interposing Relays	10% of total nos. used in the system or a minimum 20(twenty) nos. whichever is

	more.
Output Relay modules/ Relay Board & Auxiliary Relay	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.
Power Supply Units	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type and rating.
MCB (Miniature circuit breaker) / MCCB	10% of total nos. used in the system or minimum 10(ten) nos. whichever is more for each type and rating.
Racks for housing I/O & Processor Modules	1(One) no. each type used in the system
Network communication cable with end connectors	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more for each type.
I/O Connector with prefab cable	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more for each type.
Communication Processor / Card	10% of total nos. used in the system or a minimum 2(Two) nos. whichever is more for each type.
Network Interface card	10% of total nos. used in the system or a minimum 2(Two) nos. whichever is more for each type.
Any other system specific Module/Cards used in the system but not mentioned in this list	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and model.
Signal Isolator Module/Card	10% of total nos. used in the system or minimum of 4(four) nos. whichever is more.
Network Switch	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.
LIU unit	10% of total nos. used for each type and model in the system or minimum 2(two) no. whichever is more.
Media convertor	10% of total nos. used for each type

	and model in the system or minimum 2(two) no. whichever is more.
Protocol convertor	10% of total nos. used for each type and model in the system or minimum 2(two) no. whichever is more.
Transceiver (Optical to UTP converter)	10% of total nos. used for each type and model in the system or minimum 2(two) nos. whichever is more.
Fibre-optic Patch Cords	10% of total nos. used for each type and model in the system or minimum 2(two) nos. whichever is more.
Data Bus cable	1 no. of full-length cable
Miniature Circuit Breaker (MCB)	10 nos. of each type and rating
Terminal Blocks	20% of total quantity but minimum 10 nos. of each type and model
Cabinet Cooling Fans	1 nos. of each type / rating
Memory Module/ EEPROM Chip	10% of total nos. used in the system or minimum 1 (One) no. whichever is more.
Battery for RAM Backup	2 (two) nos.
Fuse: Card mounted type, PCB mounted type, Rack Power supply etc.	Each type of fuse, 25% of total nos. used in the system or minimum 25 nos. whichever is more.

Notes:

1. The quantity of spares to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and if the % arrived is 5.1 the quantity to be supplied shall be 6.

2. Wherever all LOT or SET is mentioned, successful bidder shall provide detail description and specifications of each item, make, unit, quantity etc. during detail engineering stage. OEM part Number / drawing etc shall be provided for ordering of the parts by owner in future. Interchangeability certificate shall be provided for each spare items.

ANNEXURE - 1.3

LIST OF VENDORS

A. PROCESS AND MECHANICAL EQUIPMENT

S. No	EQUIPMENT / SYSTEM	VENDOR
1.	HIGH PRESSURE PUMPS	1. SULZER 2. KSB 3. FLOW SERVE CORPORATION 4. LOWARA 5. RUHRPUMPEN 6. TORISHIMA PUMP 7. GRUNDFOS
2.	ENERGY RECOVERY DEVICE	1. FLOW SERVE CORPORATION 2. ENERGY RECOVERY INC. 3. KSB AG 4. CALDER
3.	RO PRESSURE VESSELS	1. BEKAERT (PROTEC) 2. PENTAIR PLC (CODE LINE)
4.	RO MEMBRANES	1. DOW FILMTEC 2. HYDRANAUTICS 3. LANXESS AG 4. TORAY INDUSTRIES INC.
5.	CATRIDGE FILTERS	1. PARKER HANNIFIN CORPORATION 2. PALL CORPORATION
6.	SELF CLEANING FILTERS	1. AMIAD 2. STF 3. FILTRO 4. TAPROGGE Gmbh 5. AZUD
7.	ULTRAFILTERATION	1. X FLOW (PENTAIR) 2. INGE AG 3. DOW 4. HYFLUX
8.	TRANSFER PUMPS (CENTRIFUGAL)	1. SULZER 2. KSB 3. GRUNDFOS

		4. JOHNSON(SPX) 5. KIRLOSKAR 6. LOWARA
9.	TRANSFER PUMPS (VERTICAL)	1. GRUNDFOS 2. SULZER 3. LOWARA 4. ANDRITZ
10.	DOSING PUMPS	1. MILTON ROY/ ASIA LMI 2. SECO 3. GRUNDFOS 4. PROMINENT
11.	AGITATORS	1. REMI 2. CEACONS 3. ALFA LAVAL
12.	POSITIVE DISPLACEMENT PUMPS (SCREW PUMPS)	1. TUSACHO 2. ROTO 3. HYDROPROKAV 4. UT Pumps
13.	PRESSURE TUBE	CODE LINE or Equivalent
14.	FRP TANK	1. EPP COMPOSITES PVT LTD. 2. CHEMICAL PROCESS EQUIPMENT PVT LTD. 3. SHRIRAM SEPL COMPOSITES PVT LTD 4. SUMIT ENTERPRISE
15.	GLASSED FUSED STEEL TANK	1. PERMASTORE 2. OMERASTORE 3. SCHUMANN 4. SD ENVIRO ENGINEERS 5. JOEMILLARS STORAGE TANK 6. COEP ENVIRO SOLUTIONS PVT LTD 7. SHUBHAM TANKS AND LINER 8. ROSTFREI STEELS STORAGE TANK 9. NOVARIUS GLOBAL (INDIA) PRIVATE LIMITED
16.	AIR CONDITIOING	1. BLUE STAR 2. HITACHI 3. VOLTAS 4. O-GENERAL

		5. MITSHUBISHI HEAVY INDUSTRIES 6. CARRIER 7. SAMSUNG
17.	EXHAUST VENTILATION	1. GEC 2. ALMOND 3. KHAITAN
18.	FIRE EXTINGUISHERS	1. SAFEX 2. MINIMAX 3. KANEX 4. ZENITH 5. CEASE FIRE 6. KANADIA FYR FYTER 7. UNITED FIRE EQUIPMENTS 8. INTIME FIRE APPLIANCES
19.	CRANE & HOIST	1. HERCULES 2. ELECTROMECH 3. EDDY CRANES 4. CONSOLIDATED HOIST 5. ANUPAM INDUSTRIES LIMITED 6. REVA 7. SKYLINE MILLARS LIMITED 8. UNICORN CRANE
20.	STRUCTURAL STEEL	1. SAIL 2. RINL 3. TATA 4. JSW 5. JSPL 6. ESSAR

B. PIPES, VALVES & FITTINGS

SR. NO.	EQUIPMENT / SYSTEM	VENDOR
1.	CPVC/UPVA PIPES	3. ASTRAL 4. GEORGE FISCHER 5. SUPREME
2.	GRP PIPING	1. EPP

SR. NO.	EQUIPMENT / SYSTEM	VENDOR
		2. PROTESA 3. AMIANTIT
3.	VALVES	1. L&T (AUDCO) 2. KSB 3. KITZ CORPORATION 4. FLOWSERVE 5. CRANE 6. GENERAL VALVE 7. INTERVALVE
4.	MILD STEEL PIPES	1. SAIL 2. TATA 3. WELLSPUN 4. JINDAL
5.	HDPE PIPES & FITTINGS	1. JAIN IRRIGATION SYSTEMS LTD, 2. DURALINE 3. TIME PLAST 4. TIRUPATI 5. CREATOR POLY EXTRUSIONS LLP

C. ELECTRICAL EQUIPMENT

SR. NO.	EQUIPMENT / SYSTEM	VENDOR
1	MOTORS	1. ABB 2. ALSTOM 3. BHEL 4. SIEMENS
2.	SWITCH SOCKET OUTLETS / POWER RECEPTACLES	1. AJMERA 2. ANCHOR 3. BAJAJ 4. BCH 5. BEST & CROMPTON 6. C&S 7. CGL 8. CONTROL DEVICE 9. DYNAMIC CONTROLS

SR. NO.	EQUIPMENT / SYSTEM	VENDOR
		10. ELLORA 11. ESSEN 12. HAVELS 13. INDO ASAIN 14. LEGRAND 15. MDS 16. SCHNEIDER 17. SIEMENS
3.	POWER CONTACTORS	1. ABB 2. C&S 3. L&T 4. SCHNEIDER 5. SIEMENS
4.	RELAYS (CONVENTIONAL)	1. ABB 2. ALSTOM 3. BCH 4. C&S 5. GEC 6. JYOTI RE-300 7. L&T 8. SCHNEIDER 9. SIEMENS
5.	MCCB	1. ABB 2. C&S 3. CGL 4. L&T 5. MERLIN GERIN 6. SCHNEIDER 7. SIEMENS
7.	CABLE GLANDS	1. EXPROTECTA 2. COMET 3. FLEXPRO 4. STAHL 5. FLAMEPROOF CONTROL GEARS

SR. NO.	EQUIPMENT / SYSTEM	VENDOR
		6. BRACO 7. COSMOS 8. JAINSON
8.	CABLE LUGS	1. BRACO 2. COMET 3. COSMOS 4. DOWELLS 5. JAINSON 6. LOTUS
9.	HRC FUSES	1. ABB 2. ALSTOM 3. BUSMAN 4. C&S 5. COOPER BUSSMANN 6. GE POWER 7. L&T 8. SCHNEIDER 9. SIEMENS
10.	INDICATION LAMPS (LED)	1. ABB 2. AUTOMATIC ELECTRONIC LTD. 3. CROMPTON 4. L&T 5. SIEMENS 6. TEKNIC 7. TELEMACANIQUE 6. VAISHNO

D. CONTROL & INSTRUMENTATION

SL.NO	DESCRIPTION	APPROVED VENDOR
1.	PLC	1. ABB 2. GE 3. HONEYELL 4. SCHNEIDER 5. SIEMENS

		6. ROCKWELL
2.	OPERATING STATIONS / WORK STATIONS / LAPTOP	1. HP 2. LENEVO 3. DELL 4. COMPAQ
3.	SERVERS	1. HP 2. LENEVO 3. DELL 4. COMPAQ
4.	LED TV	1. LG 2. PANASONIC 3. PHILIPS 4. SAMSUNG 5. SONY 6. TOSHIBA
5.	MANAGED INDUSTRIAL GRADE ETHERNET SWITCHES	1. CISCO 2. HIRSCHMANN 3. HUAWEI 4. MOXA 5. RUGGEDCOM 6. DLINK 7. ENTERASYS 8. NETGEAR 9. 3COM 10. AVAYA
6.	OPTICAL LINK MODULE (OLM) / LIGHT INTERFACING UNIT (LIU)	1. CISCO 2. MTL
7.	INDUSTRIAL GRADE FIREWALL	1. CISCO 2. HIRSCHMANN 3. MOXA
8.	INTERPOSING RELAYS	1. JYOTI 2. OEN 3. OMRON 4. PARAMOUNT 5. PHOENIX 6. SCHNEIDER

		7. SIEMENS
9.	RADIO MODEM	1. D LINK 2. LOTUS 3. MOTOROLA 4. SIEMENS
10.	CONSOLE DESK / CONTROL	1. PYROTECH WORKSPACE 2. COSMOS 3. GODREJ 4. FEATHERLITE
11.	CABINETS	1. RITTAL 2. HOFFMAN 3. PYROTECH
12.	LOCAL CONTROL PANEL	1. INDUSTRIAL CONTROLS & APPLIANCES PVT. LTD. 2. STAHL 3. J & H 4. PYROTECH ELECTRONICS PVT. LTD. 5. RITTAL 6. ELMECH 7. ELECTRONIC CORPORATION OF INDIA LTD. 8. ADARSH CONTROL 9. L&T 10. SCHNEIDER 11. SIEMENS
13.	INSTRUMENT CABLES (SIGNAL, CONTROL)	1. UNIVERSAL CABLES LTD 2. CMI PVT LTD. 3. ASSOCIATED CABLES PVT LTD 4. ASSOCIATED FLEXIBLES & WIRES (P) LTD 5. BROOKS CABLE WORKS. 6. CORDS CABLES 7. THERMO CABLES 8. DELTON CABLES 9. KEI INDUSTRIES 10. RADIANT CABLES PVT LTD 11. ASIAN CABLES &INST LTD 12. GEMS CABLE 13. INCAB 14. PARAMOUNT CABLES

		15. POLYCAB
14.	FIBRE OPTIC CABLE	1. AKSH FIBRE 2. BIRLA ERICSSION 3. DIGILINK 4. D-LINK 5. FINOLEX 6. RPG CABLES 7. HFCL 8. MOLEX 9. POLYCAB 10. R&M SWISS 11. REWA 12. SCHNEIDER 13. UNIFLEX CABLES INDIA
15.	JUNCTION BOX	1. EXPROTECTA 2. GOVAN INDUSTRIES PVT LTD. 3. COMET BRASS PRODUCT 4. FLAMEPACK 5. FLEXPRO 6. FLAMEPROOF CONTROL GEARS 7. BALIGA LIGHTING EQUIPMENT PVT LTD 8. ADARSH CONTROL 9. CHEMIN 10. ELECTROMECHANICAL 11. HENSEL 12. JASPER 13. PYROTECH 14. RITTAL
16.	TERMINAL BLOCKS	1. CONNECTWELL 2. ELMEX 3. PHOENIK 4. WAGO 5. WIED MULER
17.	AC TO DC CONVERTER	1. COSEL 2. PHOENIX 3. SEIMENS 4. WIED MULAR

18.	RELAYS (CONVENTIONAL)	1. ABB 2. ALSTOM 3. BCH 4. C&S 5. EASUN REYROLLE 6. GEC 7. JYOTI RE-300 8. L&T 9. SCHNEIDER 10. SIEMENS
19.	HRC FUSES	1. ABB 2. ALSTOM 3. BUSMAN 4. C&S 5. COOPER BUSSMANN 6. ENGLISH ELECTRIC 7. GEC 8. GE POWER 9. L&T 10. SCHNEIDER 11. SIEMENS 12. STANDARD
20.	INDICATION LAMPS (LED)	1. ABB 2. ALSTOM 3. AUTOMATIC ELECTRONIC LTD. 4. BCH 5. BINAY 6. CROMPTON 7. ESSEN 8. L&T 9. SIEMENS 10. TEKNIC 11. TELEMACANIQUE 12. VAISHNO
21.	MCB	1. ABB 2. ALSTOM 3. C&S

		4. CGL 5. GEC 6. GEPC 7. INDO ASAIN 8. INDO KOPP 9. L&T 10. MDS 11. MERLIN GERIN 12. S&S 13. SCHNEIDER 14. SIEMENS 15. STANDARD 16. TELEMECANIQUE 17. VERSATRP
22.	SEMICONDUCTOR FUSE	1. ABB 2. BUSMANN 3. C&S 4. COOPER BUSSMANN 5. ENGLISH ELECTRIC 6. GE 7. GE POWER 8. L&T 9. SCHNEIDER 10. SIEMENS
23.	SWITCH SOCKET OUTLETS / POWER RECEPTACLES	1. AJMERA 2. ANCHOR 3. BAJAJ 4. BCH 5. BEST & CROMPTON 6. C&S 7. CGL 8. CONTROL DEVICE 9. DYNAMIC CONTROLS 10. ELLORA 11. ESSEN 12. HAVELS 13. INDO ASAIN

		14. LEGRAND 15. MDS 16. SCHNEIDER 17. SIEMENS 18. STANDARD
24.	DIGITAL INDICATORS	1. MASIBUS 2. PYROTECH
25.	GRAPHIC INTERFACE UNIT	1. ROCKWELL AUTOMATION 2. DIGITAL INSTRUMENTS AND CONTROL SYSTEM (PROFACE) 3. SCHNEIDER ELECTRIC
26.	TEMPERATURE TRANSMITTER	1. ABB 2. EMERSON (ROSEMOUNT) 3. HONEYWELL 4. SIEMENS 5. E&H 6. FORBES MARSHALL 7. FUJI ELECTRIC 8. YOKOGAWA
27.	SMART POSITIONER	1. ABB 2. EMERSON (FISHER ROSEMOUNT) 3. IL 4. MIL 5. SIEMENS 6. YOKOGAWA 7. DRESSER
28.	TEMPERATURE GAUGES (GAS FILLED AND BIMETALLIC)	1. WIKA 2. ASHCROFT 3. BUDENBERG 4. A N INSTRUMENTS 5. FORBES MARSHALL 6. THERMO ELECTRIC 7. GOA THERMOSTATIC INSTRUMENTS PVT. LTD. 8. GENERAL INSTRUMENTS CONSORTIUM 9. WAAREE INSTRUMENTS PVT LTD 10. THERMO- COUPLE PRODUCTS CO. 11. PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.

		12. MARSH BELLOFRAM 13. RADIX
29.	THERMOWELL	1. TEMPSENS 2. TEMPTECH 3. TOSHNIWAL INDUSTRIES PVT. LTD 4. DETRIVE INSTRUMENTATION & ELECTRONICS LTD. 5. BAUMER TECHNOLOGIES INDIA PVT. LTD. 6. E&H 7. GOA INSTRUMENTS INDUSTRIES PVT.LTD 8. PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD. 9. TECHNO INSTRUMENTS 10. THERMAL INSTRUMENT INDIA PVT. LTD. 11. TM TECHNOMATIC 12. GENERAL INSTRUMENTS 13. WIKA 14. MARSH BELLOFRAM
30.	THERMOCOUPLE	1. TEMPSENS 2. TEMPTECH 3. TOSHNIWAL INDUSTRIES PVT. LTD 4. DETRIVE INSTRUMENTATION & ELECTRONICS LTD. 5. BAUMER TECHNOLOGIES INDIA PVT. LTD. 6. GOA INSTRUMENTS INDUSTRIES PVT.LTD., 7. PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD. 8. TECHNO INSTRUMENTS 9. THERMAL INSTRUMENT INDIA PVT. LTD. 10. TM TECNOMATIC SPA 11. WIKA 12. GENERAL INSTRUMENTS
31.	RTD	1. TEMPSENS 2. TEMPTECH 3. TOSHNIWAL INDUSTRIES PVT. LTD 4. DETRIVE INSTRUMENTATION & ELECTRONICS LTD. 5. THERMO ELECTRIC 6. PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD. 7. OKAZAKI 8. GENERAL INSTRUMENTS

		9. MARKETING SERVICES INTERNATIONAL 10. EMERSON 11. THERMO- COUPLE PRODUCTS CO. 12. WIKA 13. DAILY THERMETRICS CORPORATION, USA 14. TM TECHNOMATIC 15. RADIX
32.	PRESSURE GAUGE	1. WIKA 2. ASHCROFT 3. BUDENBERG 4. FORBES MARSHALL 5. GLUCK (I) MANUFACTURING CO 6. H GURU 7. AN INSTRUMENTS 8. GAUGE BOURDON INDIA PVT. LTD. 9. GENERAL INSTRUMENTS CONSORTIUM 10. BAUMER TECHNOLOGIES INDIA PVT. LTD. 11. MANOMETER INDIA 12. PYROELECTRIC 13. BLISS ANAND(BADOTHERM) 14. SWAGELOK INDIA 15. WAAREE INSTRUMENTS PVT LTD 16. NAGANO KEIKI SEISAKUSHO LTD 17. RADIX
33.	DRAFT GAUGE	1. BADOTHERM PROCESS INSTRUMENTS BV 2. DWYER INSTRUMENTATION 3. SWITZER INSTRUMENTS LTD. 4. WIKA ALEXANDER WIEGAND & CO. GMBH 5. GENERAL INSTRUMENTS CONSORTIUM 6. ODIN
34.	DIFFERENTIAL PRESSURE GAUGE	1. SWITZER INSTRUMENTS 2. PYROELECTRIC 3. SALVIN PROCESS 4. WIKA 5. RADIX 6. GENERAL INSTRUMENTS CONSORTIUM 7. NAGNO

35.	FLOW ORIFICE ASSEMBLY	1. MICRO-PRECISION 2. INSTRUMENTATION LIMITED. 3. UNI-CONTROL 4. STARMECH 5. GENERAL INSTRUMENTS CONSORTIUM 6. EUREKA INDL EQUIP (P) LTD 7. CHEMTROLSSAMIL 8. BALIGA LIGHTING (INSTDIV) 9. WIKA 10. TM TECHNOMATIC
36.	VENTURI FLOW / FLOW NOZZLES	1. MICRO PRECISION 2. INSTRUMENTATION LTD. 3. GENERAL INSTRUMENTS CONSORTIUM 4. CHEMTROLS SAMIL INDIA PVT LTD 5. BALIGA LIGHTING (INST DIV) 6. EMERSON 7. WIKA 8. HYDROPNEUMATIC
37.	LEVEL GAUGE (TRANSPARENT & REFLEX, TUBULAR / FLOAT & BOARD TYPE)	1. CHEMTROLS 2. MOBREY 3. FORBES-MARSHALL 4. SOLATRON 5. HI-TECH (LEVELSTAT) 6. LEVCON 7. UNIKLINGER CHENNAI 8. WIKA 9. PRATOLINA INSTRUMENTS PVT LTD 10. D.K.INSTRUMENTS 11. MAGNETROL 12. PUNE TECHTROL 13. V-AUTOMAT
38.	LEVEL GAUGE - MAGNETIC	1. FORBES MARSHAL 2. BLISS ANAND 3. MAGNETROL 4. KUBLERSTEUR 5. HEINRICH

		6. GENERAL INSTRUMENTS 7. CHEMTROLS SAMIL (INDIA) PVT LTD
39.	SIGHT FLOW INDICATOR / ROTAMETER	1. EUREKA 2. FLOWSTAR ENGINEERING 3. IEPL 4. SAMIL CHEMTROL 5. SCIENTIFIC DEVICES 6. ABB 7. EIPL 8. BROOKS 9. FITZER 10. GAUGES BOURDON 11. GAUGES BOURDON 12. KHRONE 13. PLACKA INSTRUMENTS & CONTROLS 14. SUBKLEW
40.	SMART TRANSMITTER (PRESSURE, LEVEL, FLOW, DP)	1. EMERSON 2. HONEYWELL 3. YOKOGAWA 4. SIEMENS 5. E&H 6. SBEM 7. VEGA 8. FORBES MARSHALL 9. FUJI ELECTRIC 10. ABB
41.	ULTRASONIC FLOW METER	1. FORBES MARSHALL 2. YOKOGAWA 3. FUJI 4. E & H 5. GE 6. SIEMENS 7. SICK 8. ABB 9. EMERSON 10. HONEYWELL 11. KHRONE

		12. SBEM 13. TOSHNIWAL
42.	ELECTROMAGNETIC FLOW METER	1. YOKOGAWA 2. ABB 3. E & H 4. FORBES MARSHALL 5. EMERSON 6. ROSEMOUNT 7. SIEMENS 8. BURKET (GERMANY)
43.	MASS FLOW METER (CORIOLIS PRINCIPLE)	1. ABB 2. E & H 3. EMERSON 4. KHRONE 5. SIEMENS 6. YOKOGAWA
44.	LEVEL TRANSMITTER (ULTRASONIC TYPE)	1. E & H 2. FORBES-MARSHALL 3. SIEMENS 4. EMERSON 5. WIKA 6. VEGA 7. EIP 8. GIC 9. HONEYWELL 10. HAWK 11. ABB
45.	LEVEL TRANSMITTER (DISPLACER TYPE)	1. EMERSON 2. ECKARD 3. MASONIELAN 4. D K INSTRUMENT 5. DRESSER 6. LEVCON 7. MAGNETROL 8. PUNE TECHTROL 9. SBEM 10. V AUTOMAT

		11. E&H
46.	LEVEL TRANSMITTER (RADAR TYPE)	1. E & H 2. EMERSON 3. HONEYWELL 4. FORBES-MARSHALL 5. SIEMENS 6. WIKA 7. VEGA 8. EIP 9. GIC 10. HAWK 11. ABB
47.	LEVEL TRANSMITTERS (ACOUSTIC TYPE–3D)	1. EIP ENVIRO 2. E&H 3. EMERSON 4. HAWK 5. KHRONE 6. SBEM 7. SIEMENS 8. YOKOGAWA
48.	OXYGEN ANALYZER	1. SERVOMAX 2. EMERSON 3. ABB 4. YOKOGAWA 5. AMETEK
49.	RESIDUAL CHLORINE ANALYZER	1. EMERSON 2. HACH
50.	OIL IN WATER ANALYZER	1. EMERSON 2. HACH 3. HONEYWELL 4. GUIDED WAVE
51.	PH & CONDUCTIVITY ANALYZER	1. EMERSON 2. YOKOGAWA 3. DKK CORPORATION 4. FORBES MARSHALL
52.	SILICA ANALYZER	1. HACH

		2. EMERSON 3. YOKOGAWA 4. POLYMETRON 5. SERES
53.	TOTAL ORGANIC CARBON ANALYZER	1. EMERSON 2. HACH 3. HONEYWELL 4. GUIDED WAVE
54.	CONTROL VALVES / SHUTDOWN VALVES (GLOBE, BALL, BUTTERFLY, PLUG, ECCENTRIC PLUG) WITH PNEUMATIC ACTUATOR	1. EMERSON 2. INSTRUMENTATION LIMITED 3. MASONELIAN 4. VALFLO 5. SAMSON CONTROLS 6. FORBES MARSHALL 7. MIL CONTROLS LTD 8. GE 9. SEVERN GLOCON 10. FLOW SERVE 11. COPES VULCAN
55.	SOLENOID VALVE	1. MAC 2. ROTEX 3. SCHRADER-SCHOVILL 4. ASCO 5. SMC 6. NUCON 7. U.V. INT'L - JEFFERSON 8. CAMOZZI 9. HERION 10. DANFOSS 11. BURKET (GERMANY) 12. SMC PNEUMATICS 13. VELJAN 14. AVCON
56.	PRESSURE & DIFFERENTIAL PRESSURE SWITCH, TEMPERATURE SWITCH	1. CELLA 2. DRESSOR (ASHCROFT) 3. GENERAL INSTRUMENTS CONSORTIUM 4. GOA THERMOSTATIC

		5. GEORGEION 6. INDFOSS 7. SOR 8. SWITZER 9. TRAFAG 10. ASHCROFT 11. BARKSDALE 12. BAUMER 13. HONEYWELL 14. WIKA 15. WAREE 16. SMC
57.	LEVEL SWITCH (FLOAT, DISPLACER TYPE)	1. CHEMTROLS 2. D K INSTRUMENT 3. LEVCON 4. MAGNETROL 5. PUNE TECHTROL 6. SBEM 7. TECHTROL 8. V AUTOMAT 9. ABB 10. EMERSON 11. ENDRESS & HOUSER 12. FLOW STAR 13. LEVELSTATE 14. ROSEMOUNT 15. SIEMENS
58.	LEVEL SWITCH (RF, CAPACITANCE, CONDUCTIVITY TYPE)	1. E&H 2. EIP ENVIRO 3. ENDRESS & HOUSER 4. HI-TECH INSTRUMENTS 5. LEVELSTATE 6. NIVO CONTROL 7. SBEM 8. YARWAY 9. ABB 10. D K INSTRUMENT

		11. EMERSON 12. MAGNETROL 13. SIEMENS 14. PUNE TECHTROL 15. V AUTOMAT 16. VEGA
59.	FLOW SWITCH	1. D K INSTRUMENT 2. E & H 3. FLOWSTER 4. LEVCON INSTRUMENTS 5. SWITZER 6. KHRONE 7. INDFOSS 8. PUNE TECHTROL 9. V AUTOMAT 10. MAGNETROL 11. WIKA
60.	AIR FILTER REGULATOR / AIR LOCK RELAY	1. SHAVO-NORGEN 2. MARSH-BELLOFRAM 3. PLAKA 4. SCHRADEL-SCHOVILL 5. ONEXIS AUTOMATIONS(FAIRCHILD) 6. DIVYA CONTROLS 7. FISHER SANMAR 8. MARSH BELLOFRAM 9. ROTEX 10. SMC PNEUMATICS 11. CAMOZZI

61.	I/P CONVERTERS	1. ABB 2. BELL CONTROLS 3. DRESSER MASONEILAN 4. DRESSER MASONEILAN 5. FAIR CHILD 6. FISHER 7. HONEYWELL 8. SIEMENS 9. YOKOGAWA 10. FESTO 11. MTL 12. ROSEMOUNT 13. SMC PNEUMATICS
62.	TUBE FITTINGS & INSTRUMENT ISOLATION VALVES	1. SWAGELOK 2. HOKE 3. PARKER 4. DKLOK 5. ASTEC 6. COMFIT
63.	INSTRUMENT VALVE MANIFOLDS	1. SWAGELOK 2. EMERSON 3. HILOK 4. HOKE 5. PARKER 6. HEX VALVE, USA 7. SMC 8. ASTEC
64.	SS TUBES	1. SANDVIK 2. HILOK 3. RATNAMANI METALS 4. CHOKSI TUBE CO.LTD. (CTCL) 5. HOKE 6. PARKER
65.	COPPER TUBES	1. EXPROTECTA 2. CHAMP INSTRUMENT & ENGINEERS 3. HOKE 4. SANDVIK

1. Note: The final make selected out of the recommended makes listed above shall be subject to the Owner's approval during detailed Engineering.
2. Wherever the make is not specified for any other items, the contractor shall submit credential for vendors for relevant items / equipment, out of which Owner shall decide acceptance of vendor based on review of credentials. This shall have no price implication. Owner reserves the right to reject the proposed vendor without assigning any reason.
3. Bidder may suggest /request for approval of Additional vendor with credentials and details for review and approval of Owner. Owner may consider the request in case proposed additional vendor is reputed and meeting the tender specification requirements. Owner reserves the right to reject the proposed vendor without assigning any reason.

ANNEXURE - 1.4

LIST OF MAJOR STORAGE TANKS FOR DESALINATION PLANT PACKAGE

S. No	Description of the Tank	Qty	MOC	Holding Volume of each tank, KL	Dimensions of each Tank
1	Raw Water Storage Tank ##	2 No	GFS (Glass fused steel)	500	Dia.9.0 m x 9.0 m Ht
2	RO water Storage Tank ##	2 No	GFS	500	Dia.9.0 m x 9.0 m Ht
3	UF Water Tank ##	1 No	GFS	200	Dia.9.0 m x 4.5 m Ht
4	ASCF & UF Back wash and Reject Sump with 3 mm Epoxy screeding #	1 No	RCC	150	8 m x 8 m x 3.5 m
5	Neutralization pit with 3 mm Epoxy screeding #	1 No	RCC	10	
6	CIP Tank ##	1 No	FRP	20	Dia.3.0 m x 4.0 m Ht

Legends:

FB - Free Board

LD - Liquid Depth

TH - Total Height

RCC - Reinforced Cement Concrete

MSEP - Mild Steel Epoxy Painted

HOS - Height on Straight

Notes:

- Underground and closed

- Above-ground tanks

- The size of the Chemical House room is considered for storing 15 days of operational requirement.

Note:

The Volume of Storage tanks shown above is the minimum requirement.