TECHNICAL SPECIFICATION

FOR

PRE-BID TIE UP

WITH

ZLD SYSTEM SUPPLIER

FOR

WATER BLOCK PACKAGE TENDER

OF

M/s GAIL

AT

USAR, Maharashtra (India)

Revisions: Refer to record of revisions	**Prepared by :**	**Checked by :**	**Approved by :**	**Date :**
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1.0.0 INTRODUCTION

Gas Autority of India Limited (GAIL) Limited is the largest state-owned natural gas processing and distribution company and the Maharatna.

GAIL (India) Ltd is planning to set up a 500 KTPA Propane Dehydrogenation unit (PDH) integrated with Polypropylene unit (PPU) at the existing LPG recovery Plant at USAR. The feedstock propane shall be imported from JNPT port and a cryogenic terminal shall be set up at Uran for Propane storage. From Uran the Propane shall be pumped through a cross country pipeline to USAR for processing. GAIL has engaged EIL as EPCM Consultant for the above Project.

To meet GAIL's commitment sustainable development to maximize the reuse of treated effluent and reduce its fresh water consumption, GAIL-Usar plant is intended to recover the maximum water recovery from existing RO reject by installation of ZLD plant including filtration system, RO plant and multi effect evaporator.
This specification is issued for placement of order for supply, erection, construction, testing, commissioning, demonstration of performance guarantee test for the "Evaporator section and salt handling" plant complete with necessary electrics, instrumentation, automation and communication, etc. to complete the work in all respect.

BHEL intends to participate as a "Turnkey Contractor" in the above tender.

As per Tender requirement by M/s GAIL, turnkey contractor (here BHEL) shall submit a "Technology Tie-up Agreement" in prescribed format with qualified ZLDS along with BHEL's Techno-commercial bid for evaluation by GAIL.

1.1.0 INTENT OF SPECIFICATION:

BHEL is in the process of identifying "Qualified ZLD System Supplier (ZLDS)" to enter in to a Tie-up Agreement, which shall be part of BHEL's bid to GAIL. BHEL will place an order on selected "ZLD System Supplier (ZLDS)", in case BHEL adjudged as successful EPC Bidder and awarded the "Project" by GAIL. This "AGREEMENT" should be valid up to the completion period of BHEL for the plant as per contractual agreement with M/s GAIL.

The intent of this specification is to elaborate the scope of "ZLDS" for the proposed 7 m3/hr (168KLD) ZLD system for the ETP. The Prospective ZLDS will undertake that the ZLD technology shall conform to all technical specification requirements set forth in the tender attached and further agrees to abide by with the execution schedule.

In the event, BHEL is declared as successful EPC Bidder and awarded the "Project", the ZLDS shall be responsible for design, engineering, supply, erection, testing, pre-commissioning, commissioning, trial runs of 30Days operation, sustained load test after commissioning and performance guarantee test run for 72 hrs. continuous operation, guaranteeing and handing over, all on turnkey basis as required & complete in all respect and demonstration of guarantees, calibration, spares & maintenance tools etc. for ZLD system of the said project.

BHEL is looking for a prospective ZLD System Supplier (ZLDS) qualified as per the requirements specified in this Technical Specification.

This specification specifies the requirement of Design, Engineering, Manufacturing, Assembling, Inspection, Testing at manufacturer's works and Delivery of properly packed and painted Zero Liquid Discharge Plant consisting of Multi-Effect Evaporator Unit and Dryer Unit (Agitated Thin Film Dryer/ Pusher Centrifuge) system with all accessories as specified in the scope of work and as required for the safe and trouble-free operation of equipment to be installed at site.

2.0.0 SPECIAL NOTES TO BIDDERS:

LEGEND

GAIL	Gas Authority of India Limited.
BHEL	Bharat Heavy Electricals Limited
PE&SD	Project Engineering & Systems Division, Hyderabad, unit of BHEL
BQC	Bidder Qualification Criteria
PO	Purchase Order
LOI	Letter of Intent
Contractor	EPC Contractor
ZLDS	Qualified ZLD System Supplier

2.0.1 This specification shall read in conjunction with its enclosures. In case of any discrepancy arising between this specification & its enclosures, the most stringent of all shall be followed and shall over-ride others. Further, if a requirement in this specification or its enclosures, calls for decision of BHEL, it shall be bidder's sole responsibility to clearly bring out the same distinctively in his technical tender offer, to enable BHEL to furnish their decision. If such a requirement is not duly addressed by bidder during tender stage and same comes out during order execution stage, it shall be binding on the bidder to comply with the decision furnished by BHEL then, without any cost, delivery, or any other commercial implications.

a) Bidders shall comply with various requirements of this specification. Bidders can bring out only those deviations, which are impractical to meet, for BHEL review.
b) Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.

2.0.2 Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.

2.0.3 The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipment. These shall be executed on the basis of proven design principle and in accordance with the latest state of the art in such a manner that the purpose to be served by the equipment is fulfilled in every respect and a maximum of operational dependability and efficiency are assured. Standardization of equipment, materials etc. 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.

2.0.4 Bidder shall quote strictly as per the scope of supply and requirements of this specification. Unsolicited or Alternate offers from the bidders will not be entertained.

2.0.5 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid.
2.0.6 Incase Bidder is unable to offer due to any specific requirement of specification, Bidder shall bring out the same in their regret letter. Otherwise, it will be considered that non-participation by the bidder is attributable to reasons other than any specification requirements.

3.0 BIDDER QUALIFICATION CRITERIA

3.1 The Bidder shall have experience in Design & Engineering including Procurement / Supply, Installation / Installation supervision and Commissioning / Commissioning Supervision of a Zero Liquid Discharge Plant consisting of Multi-Effect Evaporator Unit and Dryer Unit (Agitated Thin Film Dryer/ Pusher Centrifuge) of minimum 100 KLD Capacity in any industry and having RO Reject as feed, during any of the last ten years ending on the last date of month immediately previous to the month in which the last date of submission of bids (in case of extended bid submission date, original bid submission date shall be considered) falls. The above Multiple Effect Evaporator (ZLD) Plant shall have been in satisfactory operation for at least one year as on date of bid submission.

The Unit(s) as referred at 3.1 above must have been commissioned within the last 10 years ending on last day of the month immediately previous to the month in which last date of bid submission falls (in case of extended bid submission date, original bid submission date shall be considered).
The units referred at 3.1 should also have been in operation for at least 1 (one) year after commissioning.

Copy of Detailed Letter of Acceptance (DLOA) / Work Order /relevant extract of work Order/ Contract Agreement along with Detailed scope of work and Completion / Acceptance Certificate reckoned from date of Acceptance / Commissioning of Plant. Further, a certificate in respect of minimum one year successful operation of the Plant issued by the Owner/End user shall also be submitted.

Financial Criteria

3.3.1 The average annual turnover of the ZLDS, in the preceding three (3) financial years as on the date of techno-commercial bid opening, should not be less than the **INR 3 Crores** (Rupees Three Crores Only) or in equivalent foreign currency.

3.3.2 Audited financial statement have to be submitted for all the five years as indicated against clause above. If financial statements are not required to be audited statutorily, then instead of audited financial statements, financial statements are required to be certified by chartered accountant. Published Annual Report available in the public domain shall also be acceptable.

3.3.3 In case audited Financial statements have not been submitted any of five years as indicated above, then the applicable audited statements submitted by bidders against the requisite three years, will be averaged for five years i.e. total divided by five.

3.3.4 ZLDS shall not be under Holiday List/ Negative List/ Suspension List/ Banning List of GAIL, EIL, BHEL.

4.0 DOCUMENTATION

4.1 Multiple Effect Evaporator (ZLD) system supplier to furnish the following documentary proof for meeting the above technical qualification criteria mentioned in Sl. no. 3.1:

a) Copy of relevant pages of work orders(s)/contract agreements(s)/contract documents(s) mentioning the scope of work for the reference item submitted for qualification.

b) Completion Certificates by Owner/ Owner's Consultant/Main Contractor for the reference item submitted for qualification.

c) Commissioning certificate of the plant issued by the Owner/Owner's Consultant/Main Contractor certifying that the supplied plant has been successfully commissioned.

d) Certificate(s)/communication from Owner(s)/Owner's Consultant/Main Contractor, for having completed 1 year of operation after commissioning of the reference Plant submitted for qualification. If the bidder is not able to submit the certificate(s)/communication from the Owner(s)/Owner's Consultant/Main Contractor, then following additional documents shall also be considered for proof of satisfactory operation for at least 1 (one) year after commissioning, along with the Bid.

- Certificate of Release of full & final Security Deposit (Bank Guarantee) by Client against the defect liability period.

OR

- Certificate of Completion of Performance Guarantee and Test run (PGTR) with completion date at least 1 year prior to bid submission.

OR

- For reference job of GAIL in support of successful operation of one year, if the bidder does not have certificate for successful operation of one year, then the qualification of the reference job order submitted by the bidder for the tender will be checked internally by GAIL based on the information submitted with the bid. If certified internally by GAIL that the submitted work order qualifies successfully for one year satisfactory operation, then same shall be acceptable.
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For establishing the Technical PQC credentials of Mechanical Completion, Commissioning, PGTR and one year successful Plant/unit operation post commissioning, a single certificate from the client mentioning all the details of Mechanical Completion, Commissioning, PGTR and one year successful operation since commissioning as well as executed work value will also be considered.

4.2 A job executed by a ZLDS for its own plant/ projects cannot be considered as experience for the purpose of meeting requirement of BQC of the Bidding Document. However, jobs executed for Subsidiary/ Fellow subsidiary /Holding company will be considered as experience for the purpose of meeting BQC subject to submission of tax paid invoice(s) duly certified by Statutory Auditor of the bidder towards payments of statutory tax in support of the job executed. Such bidders shall submit these documents over and above the other required documents under the various Clauses of BQC

5.0 TERMS OF CONTRACT

5.1 ZLDS shall extensively use latest design software including 3D Modeling with PDS/PDMS software.

5.2 BHEL may depute its Engineers to office/factory of ZLDS to expedite design, supplies of the ZLDS

5.3 After start of construction, ZLDS shall position at work site a field engineering team essentially consisting of General Civil, Piping & Structures initially and followed by Electrical and Instrumentation, who have been involved in carrying out the design at the design office in order to closely coordinate with site construction group to resolve any issues related to design/ construction and provide additional drawings/ documents as required.

5.4 ZLDS shall note and comply to the applicable clauses in GCC/SCC of BHEL' s NIT and GAIL's Tender Specification.

6.0 BID EVALUATION CRITERIA

6.1 The bidders are expected to meet the Bidder Qualification Criteria as detailed earlier in this specification (ref cl 3.0). The same shall be evaluated during technical bid scrutiny. The offers made by the bidders not meeting the BQC are liable for rejection.

6.2 The bid evaluation shall be on lowest value arrived among all the quoted bidders as per the data filled by bidders in Price Bid Format. Quotations submitted in partial will be summarily rejected. BHEL will not entertain any other expenses/ assumptions written separately elsewhere other than those specified in the price bid format.

6.3 The Price Factors shall be binding on the Bidders. No deviation shall be permitted.

6.4 Successful Bidder shall be awarded the LOI for Pre-Bid Tie-up. Subsequently PO for Zero Liquid Discharge Plant consisting of Multi-Effect Evaporator Unit and Dryer Unit (Agitated Thin Film Dryer/ Pusher Centrifuge) will be awarded to Successful bidder if BHEL bags the order as EPC contractor.

6.5 ZLDS shall note and comply to the applicable clauses in GCC/SCC of BHEL' s NIT and GAIL's Tender Specification.

7.0 DELIVERABLES TO BE SUBMITTED DURING PRE-BID AND POST BID STAGE

7.1 Deleted

7.2 For deliverables in the scope of ZLDS in Post-Order Stage, refer GAIL's Tender Specification.

7.3 In general, it is expected that the ZLDS shall maintain high standards of engineering, quality in deliverables submitted and accuracy in documentation submitted meeting the intended contractual requirements.

7.4 If the Bidder is in JV/corporation with the principal firm, all the drawings submitted by the bidder/ZLDS shall be vetted by the competent person in principal firm before submitting the deliverables to BHEL.

7.5 The detailed list of deliverables during the Pre-bid stage and during detailed engineering to be submitted along with offer

7.6 The deliverables of ZLDS shall be submitted to BHEL only, unless instructed otherwise.

7.7 BHEL will review the deliverables and furnish its observations, comments, if any to ZLDS for their incorporation and resubmission to BHEL.

ZLDS shall clarify, with all supporting details on any queries raised by BHEL on their deliverables

8.0 Delivery Schedule:

8.1 ZLDS shall note and comply to the applicable clauses in GCC/SCC of BHEL' s NIT and GAIL's Tender Specification.

8.2 Penalty Clause

8.3 ZLDS shall note and comply to the applicable clauses in GCC/SCC of BHEL' s NIT and GAIL's Tender Specification.

9.0 PERFORMANCE GUARANTEE

9.1 ZLDS shall provide a list of laboratory test procedures and frequencies thereof required for validating Performance Guarantees.

9.2 Performance tests shall be started when the operation of the UNIT is stabilized under design conditions. The UNIT shall be operated and controlled in accordance with procedures set up beforehand. One or more performance test shall be carried out for a maximum of 30days under the technical direction of OWNER/LICENSOR and/or their designated representatives after successfully commissioning the UNIT in accordance with the procedures and conditions detailed in the Bid documents. At the end of the performance test, an uninterrupted period of 72 hours shall be selected by OWNER and average results obtained during that period shall form the basis of comparison between the actual performance and the guaranteed performance.

9.3 ZLDS's liabilities on account of not meeting the above said Engineering Guarantees and Performance Guarantees (because of Engineering related issues), **shall be limited to 10% (Ten percent) of the ZLD Supply** value between BHEL and ZLDS, payment of which is reserved against issue of Commissioning and Performance Test Certificate by OWNER.

9.4 ZLDS shall note and comply to the applicable clauses in GCC/SCC of BHEL' s NIT and GAIL's Tender Specification.

10.0 OTHER INSTRUCTIONS

10.1 Since speedy completion of project is essential for a tight project schedule, it shall be responsibility of ZLDS to ensure timely delivery of all milestones.

10.2 ZLDS shall familiarize fully with the standard/ procedures/ practice of BHEL/OWNER, to avoid any dispute at later date and after order placement.

10.3 BHEL shall not pay any amount, other than the fee specifically agreed, towards any cost incurred by ZLDS by way of salaries to their employees (income and taxes), insurance of any nature, benefits/ bonus to the employees, etc. BHEL's liability is limited to the amount contracted for the services to be rendered under the scope of work defined.

10.4 ZLDS shall not commit any expenditure on behalf of BHEL without BHEL's consent in writing, during the execution of the work defined in the scope.

10.5 ZLDS shall bear all expenses/ fee penalties if it infringes on patents/ licenses of any persons/ organizations or in case of suits, court proceedings, damage claims etc., due to any reason whatsoever.

10.6 ZLDS shall ensure that it possesses the latest revisions of various national and international standards, codes of practices, statutory & environmental regulations etc. as applicable, for execution of the work. BHEL shall not provide any such documents to ZLDS. Engineers of ZLDS assigned for this project shall have familiarity on relevant documents as mentioned above for their use and applications.

10.7 ZLDS shall maintain at their own cost the personal accidents policy, life insurance and / or any such insurance required in respect of their personnel deputed to outstation visits for the given contract.

10.8 BHEL reserves the right to terminate or suspend the contract or withdraw part of the scope of the work at any stage of its execution, if it is found that ZLDS has not met its obligation for the performance / progress is not up to the expected standards and overall work is likely to suffer. In such an event, BHEL shall give 15 days' notice in writing. In such case all costs incurred accordingly by BHEL to complete any work forming part of the contract shall be recovered from ZLDS. In case of such premature termination of contract, BHEL reserves the right to claim damages from ZLDS including the initiation of judicial proceedings.

10.9 ZLDS shall keep all information/data/drawings etc. related to the work as confidential information and shall not divulge or use the information indirectly or directly in any way detrimental to the interest of BHEL. All drawings, documents, manuals, design calculations including all originals prepared or obtained during the work shall remain the property of BHEL and shall be handed over to BHEL on demand.

10.10 ZLDS shall comply with the laws and regulations of the country, the state and territories concerned, during the progress of the work.

10.11 ZLDS shall submit progress report on the status of the work entrusted to them periodically and as mutually agreed upon.

10.12 ZLDS shall ensure optimal & economic design while executing the work, but without sacrificing the customer specification requirements/ Statutory regulations/ code provisions/ safety aspects.

TECHNICAL SPECIFICATION OF ZERO LIQUID DISCHARGE PLANT

Capacity	**7 m^3/hr. (168 KLD)**
Plant Configuration	Lime Soda Softening Clarifier – Multi- Effect Evaporator Unit – ATFD/Pusher Centrifuge
Multi Effect Evaporator + ATFD/Pusher Centrifuge	2 Nos. (1 working + 1 stand by) x 7 m^3/hr. feed capacity

The Feed to the Zero Liquid Discharge Plant shall be the Reject Stream from the RO-III System in the RODM plant. The RO-III reject stream shall be stored in a ZLD Feed tank and then shall be pumped at a controlled rate to the ZLD Plant.

Reject Water from RO-III System : 5.8 m^3/hr. (Normal)
6.2 m^3/hr. (Max)

The Design Capacity of the ZLDP shall be 7.0 m^3/hr.

- **ZLD FEED WATER QUALITY**

The RO-III Reject Water from the RODM plant shall be the Feed to the ZLD Plant and the design feed quality shall be as indicated in the Table-9 below.

S. No.	Parameter	Unit	Design Value
1.	pH	-	7 - 8
2.	TSS	ppm	Nil
3.	TDS	ppm	~ 20000
4.	Total Hardness as $CaCO_3$	ppm	~ 10000
5.	Calcium as Ca	ppm	1950
6.	Magnesium as Mg	ppm	1200
7.	Sodium as Na	ppm	2600
8.	Alkalinity as HCO_3	ppm	2000
9.	Sulphate as SO_4	ppm	7185
10.	Chloride as Cl	ppm	4543
11.	Silica as SiO_2	ppm	350

Table-9: Feed Effluent Quality at ZLDP Inlet

Note-1: The Ionic break up in the Feed Quality may vary based on the ionic balanceof water.

➢ TREATED WATER REQUIREMENTS AND GUARANTEES

a) Water (Concentrate) Quality at Evaporator Unit Outlet in ZLD Plant

S. No.	Component	Unit	Evaporator Outlet Water Quality
1.	Total Dissolved Solids Content	%	30.0 (Minimum)

b) Condensate Quality at ZLD Plant Outlet

The Quality of Condensate / Distillate at the Outlet of the Zero Liquid Discharge Plant shall be as specified in the Table.

S. No.	Parameter	Unit	Specification
1.	Temperature	Deg C	40 (Max)
2.	pH	-	6.5 - 7.5 #
3.	Total Dissolved Solids (TDS)	ppm	< 200 #
4.	Total Suspended Solids (TSS)	ppm	< 1.0 #

The highlighted Parameters shall be considered as Guaranteed Parameters at the ZLDP Outlet.
The condensate / distillate from the plant shall be sent to Surplus permeate water storage tank for reuse as cooling water make-up along with the Surplus RO-I permeate and RO-III Permeate water.

c) Dry Solids at the ZLD Plant Outlet:

S. No.	Component	Unit	Discharge Limit
1.	Moisture Content in Dry Solids	%	10.0 (Max)

(The Salts out of the Drying Unit shall be suitable for filing and packing in bags/drums for transferring to the Secured landfill within the complex).

➢ EQUIPMENT DESIGN PHILOSOPHY

The Zero Liquid Discharge Plant shall be designed to operate continuously for minimum 120 hours between every Cleaning Cycle. The duration of the Cleaning Cycle of the complete ZLDP shall not be more than 16 hours (and maximum 24 hours between stabilized Operations of the Complete ZLDP Unit).

- **Hydraulic Turndown Requirement for All Plants : 50%**

➢ PROCESS DESCRIPTION OF THE ZERO LIQUID DISCHARGE PLANT

The Zero Liquid Discharge Plant shall consist of the following sections:

- ZLD Feed Storage & Pre-treatment section
- Multi Effect Evaporator Section
- Dryer Section
- Products (distillate/condensate, concentrated liquor and reject vapors/emissions) handling, Treatment & Disposal facilities
- Cleaning & Dosing Chemicals handling & dosing facilities

The reject stream from the RO-III system in the RODM plant shall be routed to the ZLD feed storage tank. The ZLD Feed tank, with storage capacity equivalent to ~ 24 hours of design feed flow shall homogenize the feed and then the same shall be pumped at a controlled rate for further Processing.

The ZLD feed storage tank shall also act as a buffer storage tank to provide for the storage of the feed during the Cleaning Cycle of the Evaporator and Dryer units of the ZLDP. Pre- treatment of the feed stream as required prior to the evaporator Unit shall be provided in the pre-treatment section. Pre-treatment section is to be finalized by the Vendor and shall include the following facilities in general:

- Pretreatment Facilities shall include Lime-Soda Ash Softening process for Hardness and Silica reduction from the Feed water and making it acceptable for processing in the Evaporator and Dryer units of the ZLDP. The Vendor can consider any other equivalent or additional process as recommended by the Evaporator / Dryer Suppliers and provide the same along with all associated facilities as required and shall be in the scope of the water block package contractor. Any effluent generated from the pre-treatment section of the ZLDP shall be suitably treated within the ZLDP or the Water Block Package and it must be ensured that **NO Liquid Effluent** is discharged outside the water block package.

  The pretreatment may also include
  - Acid dosing for converting bicarbonates to carbonates before feeding to the evaporators as recommended by the ZLD Unit supplier.
  - Additive/Anti-scalant dosing for Scale and Fouling Control in the Evaporator and Dryerunits as recommended by the ZLD Unit supplier.
  - Neutralization for pH correction shall be done if required with Caustic.

The Effluent after pre-treatment shall be routed to a ZLD feed Tank and from there it shall be pumped with flow control to the Multi Effect Evaporator unit.

➢ EVAPORATION SECTION

Feed at controlled rate (controlled by a flow control valve) shall pass through pre-heaters, calandrias and vapour separators of various effects. The evaporation takes place under vacuum, which shall be maintained mainly by vacuum system. Steam shall be supplied as a heating medium through thermal vapour recompression (TVR) to the 1st effect jacket. The concentrated product at the desired concentration shall continuously be taken out from the system.

Multiple effects (Minimum FOUR EFFECTS for good steam economy and maximum condensate recovery) falling film cum forced circulation evaporators with thermal vapour recompression (TVR) system are envisaged. The feed shall be preheated in pre-heaters before going into the 1st effect. The circulating brine in the 1st effect heating element shall be heated with steam from the discharge of the TVR, and which condenses on the shell side. The heated and concentrated brine slurry which is circulating in the tube side of the heating element shall be discharged from each heating element into its respective vapour separator. The vapours separate from the brine/slurry in the vapour separators. Mesh-pad droplet separators shall be provided to virtually eliminate droplet carry over with vapours leaving the vapour separators. Vapours from the 1st effect vapour separator shall be discharged into the shell side of the 2nd effect heating element (where they condense) whereas a part of the vapours (depending upon the bidder's design) maybe discharged into the suction of the TVR (The choice of the effect from where vapours for TVR are to be taken shall be made by the bidder on the basis of his optimized design).
The vapours from the 2nd effect vapour separator shall be discharged in to the 3rd effect heating element and so on. The type (falling film or forced circulation) for each effect shall be as per bidder's design.

The type of evaporator shall be based on bidder's / ZLD suppliers' experience. The unit shall be designed for operation under vacuum. The necessary flash vessels, as require, shall be provided so as to recover maximum heat from the feed purge and condensates and at the same time meet the temperature requirements of these streams at the battery limit of the Plant. The vapours shall be condensed in a surface condenser or any other suitable system.

The Condensate generated from the ZLD unit shall be collected and routed to theSurplus Permeate Water Storage tank.

- **DRYER SECTION**

The concentrated feed shall then be passed through a Dryer Unit with forced circulationtype or falling film type (ATFD) or Pusher Centrifuge for Drying of the slurry from the Multi Effect Evaporator to Solid Crystals / Salts (having moisture content less than 10%). The Condensate in case of AFTD shall be recovered and sent for use along with the condensate recovered from the Evaporator Unit. In Case Pusher Centrifuge is provided, the mother liquor after the Solid crystal / Salts separation shall be recycled back to the Evaporator unit for reprocessing. The Evaporator Unit Capacity shall be provided accordingly.

The solids shall be discharged to a dumpster for collection and disposal to the Secured landfill. At least three Dumpster units of adequate size/volume shall be provided. Disposal of all Solid Wastes including salts from ZLD Plant and all other solid waste and sludge(s) that is generated during pre-commissioning / commissioning of the Water block package plants to the designated areas like Secured Landfill, Hazardous waste storage facility shall be in the scope of the contractor.

- **STEAM STATION**

MP steam shall be made available at the Water Block Battery Limit at the Indicated conditions. The Pressure reduction and De-superheating facilities as required for the ZLDP package shall be in the scope of the Package vendor. For De-superheating requirements in PRDS, Polished condensate as available in the CPU section of the water Block shall be used.
The Consumption of steam shall be optimized to achieve the maximum steam economy from the Evaporator Package and Dryer Unit.

- **CONDENSATE RECOVERY AND TRANSFER**

The plant shall be provided with a collection tank & transfer pumps to collect and discharge the distillate/condensate from the ZLDP. Any additional treatment system envisaged to treat the Condensate/distillate to the Design quality shall be provided and shall be in the scope of the contractor.

- **CLEANING FACILITIES FOR VESSELS / EQUIPMENTS**

During normal operation of the plant, gradual deposition of carbonates, sulfates, silicates etc. due to super saturation may take place. To maintain and operate the system at desired efficiency, provisions as required and recommended by the Zero Liquid Discharge Plant suppliers for hot water washing, chemical/acid (HNO3) cleaning & high pressure water jet cleaning shall be provided. Sufficient stand by equipments / arrangements shall be provided so that down time for the plant for maintenance is minimized. The necessary tanks & pumps shall be provided for dosing of cleaning chemicals as per the ZLD Unit Supplier recommendations and shall be in the scope of the Water Block Package Contractor.
The ZLD unit drains shall be collected in a Drain Sump and shall be recycled back to the ZLD feed tank for reprocessing. This shall include equipment drains during the Cleaning cycles also.

- **TECHNOLOGICAL STRUCTURE(S):** The Multi-effect Evaporator and Dryer Units as part of the ZLD Plant shall be installed on a technological structure(S).

The details of the Tech structures (including No. of Tiers) shall be developed by the contractor based on the Multi-effect Evaporator and Dryer Unit requirements and suppliers' recommendations. The tech structure shall be provided with adequate space to facilitate smooth operation and maintenance of the Units. 3 nos. of dumpsters with Covers and suitable material of construction shall be provided by the Contractor for dry solids disposal from the ZLD plant.

The Dryer (ATFD / Pusher Centrifuge) unit shall also be located at the elevated Technological Structure and shall be able to provide for the bottom withdrawal of dried product (salts). The facility shall be developed to ensure withdrawal of the dried salts for disposal through Dumpsters and suitable ramp facilities shall be provided for access and movement at the withdrawal facility.

- **CHEMICALS HANDLING**

Chemical dosing facilities for acid, alkali and all other chemicals required for dosing in the ZLD plants shall be provided. Neutralization, Backwash and Chemical Cleaning waste and other Chemical Drains collection and transfer facilities, etc. shall be provided.

The following Chemicals are envisaged to be dosed in the ZLD Plants:

- Antiscalant / Additives for Evaporator and Dryer units in ZLDP
- Cleaning Chemicals in Evaporator and Dryer units in ZLDP
- Other Chemicals (as required)

➢ BATTERY LIMIT CONDITIONS

Stream at Water Block Battery Limit	Pressure, Kg/cm^{2}g				Temperature, ^{0}C			
	Min.	Nor.	Max.	Mech. Des	Min.	Nor.	Max.	Mech. Design
PROCESS LINES								
CTBD at RODM B/L	3.8	4	4.5	8	-	33	-	65
Boiler Blowdown	-	2.5	-	18.0	-	40	-	75
Treated Effluent fromETP	-	2.5	-	18.0	-	Amb	-	65
Treated Raw water	3.0	4.5	5.0	10.5	-	Amb	-	65
DM Water at Process & CPP B/L	9.5	-	-	-	-	Amb	-	65
Treated Water to CT	7.0	-	-	10.5	-	Amb	-	65
UTILITIES								
Plant Air	4.5	6.5	8	10	-	Amb	-	65
Instrument Air	4.5	6.5	7.5	10.5	-	Amb	-	65
Service water	3	4.5	5	10.5	-	Amb	-	65
Cooling Water Supply	-	5	-	10	-	33	-	65
Cooling water Return	-	-	-	10	-	-	45	65
Nitrogen	5	6.5	7	10.5	-	Amb	-	65
MP Steam	14	15	16	24	250	265	280	350
LP Steam	4	4.5	5.0	10	170	185	190	250

➢ INSTRUMENTATION AND CONTROL PHILOSOPHY
Zero Liquid Discharge Plant (Evaporator and Dryer Unit)

The plant will be supplied with the necessary instrumentation and interlocks to ensure that it remains in a stable condition and that corresponding measures are taken if, due to operator error or malfunction, the parameters should exceed a defined operating range. Manual intervention shall be provided as required. The instrument control philosophy for the Evaporation plant shall be as applicable for the smooth & trouble free operation of different section of the Evaporation plant as recommended by the System Supplier.

All the instruments as required to make the plant complete as per design/operation/control/ instrumentation philosophy or as required for safe, smooth & trouble free operation of the plant shall be provided by the contractor. The plant shall have optimized number of instruments & controls, which may include the following to facilitate safe operating of the plant:

- Suitable type flow measurement systems with local and control room indication along with recording and totalizing facilities (in Control Room) on feed inlet line, condensate/distillate line and cooling water make-up line.
- Flow Transmitter, Pressure and Temperature Transmitter and PI/TI on incoming MP steam line.
- Pressure Reduction and De-superheating System (PRDS) along with the required Flow Transmitter, Pressure and Temperature Transmitters and Control Valves and PI/TI on incoming MP steam line and Polished condensate line. Pressure, Flow and Temperature Transmitters along with Pressure Gauge and Temperature Gauge in the outlet line of Steam from the PRDS shall also be provided for control and operation of the PRDS system.
- Suitable type of flow measurement systems with local indication on all other incoming utility lines and all other outgoing lines
- Pressure Gauge on cooling water inlet & outlet line
- All the tanks shall be provided with two (2) Nos. level measurement instruments.Primary level measurement instrument shall be non contact Radar type. Secondary Level indication shall be a Magnetic Level Gauge.
- All the dosing pumps shall have in built pressure safety relief valves at their respective discharge lines.
- Flow control valve/actuator operated On-Off valves shall be provided on the feed flow to various effects if and as required as per process & operational requirements.
- Pressure and Temperature control valves as required for the smooth operation and Control of the evaporator and Dryer/pusher centrifuge units shall be provided.
- Gauge for feed line, all vapour separators, and cooling water inlet & outlet Temperature Transmitter (with local and Control room indication with high/low alarm) for measuring temperature for shell of 1st effect. Auto steam shut-off at high temperature shall be provided as per process requirements.
- Vacuum Transmitter (with local and Control room indication with high/low alarm) and vacuum gauge on all vapour separators
- Level gauge on all vapour separators
- Density control loop with density transmitter linked with feed rate and display (local and in control room) of concentrate density
- Online conductivity and TOC analyzers at common condensate header and online conductivity analyzer at inlet feed line. All analyzers shall be provided with local and control room indication with high alarm. Analyzers shall be located in the analyzer room in the RO shed.
- Other instrumentation, Control and/or analyzer as required for smooth, trouble free and safe operation of the plant and as per supplier's system design shall be provided.

➢ CONTROL PHILOSOPHY

The ZLD Plant shall be operated and controlled through a PLC based control system from the Common Control System of the Water Block Package in the O&U Control Room. Details of the control system shall be as per the Instrumentation design basis for the Project. The plants will also have a provision for manual operation.

The Instrumentation and Control Philosophy for the Plant shall be as applicable for smooth, safe & trouble free operation of Unit and shall be defined in detail in Process specifications. Similarly, on line analyzers as required shall be installed at appropriate locations for smooth, safe & trouble free operation of ZLDP which shall be defined in the Process specifications.

➢ SCOPE OF OPERATION:

Contractor shall operate the ZLDP, during SIX (6) MONTHS OPERATION CONTRACT duration, which shall start from the date of end of successful commissioning.
The Contractor's scope of work for SIX (6) Months Operation Contract for Water Block Package (ZLDP) shall include the following:

Operation of all the ISBL (inside battery limit) units of Water Block Package (ZLDP) for SIX (6) Months including the following as minimum:

- ZLD feed storage & Pre-treatment Section, Multi effect Evaporator Section, Dryer Section, Condensate Recovery Section and Steam Let Down (PRDS) Section Products of the Zero Liquid Discharge Plant.
- Intermediate storages & pumping, Sludge handling section, Chemicals handling section, Instrumentation, Electrical, Mechanical and all other works & associated facilities for ZLDP.

During the entire Operation contract period, the Contractor shall maintain the following on sustainable basis for Water Block Package (ZLDP):

- Guaranteed hydraulic capacity as per Scope of Work/Supply for the Water Block Package (ZLDP)
- Guaranteed quality of Condensate from ZLDP etc., all as per Scope of Work/Supply for the Water Block Package (ZLDP)
- Ensuring trouble free & efficient operation of units individually and the plant as a whole ZLDP in the Water Block Package.

The Operation Contract start from the date of end of successful commissioning. Bidders shall quote a lump-sum price for Six (6) Months Operation contract duration.

The Operations Contract can be extended for further six months after the end of the Six Month operations contract, if so desired by M/s GAIL and shall be binding on the contractor. Contractual conditions for the Extended Operations Contract Duration shall remain identical to the Six Months Operations Contract as per this Specification INCLUDING the price quoted by the Bidder for the Contract and no escalation shall be applicable.

All the Water Block Package Plants (ZLDP) & Equipment shall run continuously and Consistently for the production of DM water, Treated Water, Polished Condensate and Treatment of all incoming effluents, Solids/Salts for Disposal as per the Technical Specifications included in the Tender.

The Contractor shall have his own trained, experienced, competent operating & supervisory personnel round the clock responsible to carry out the Operation for Water Block Package.

The Operation contractor shall also provide assistance to GAIL in getting necessary approvals from statutory bodies like State pollution control board, CPCB, etc., as applicable.

Contractor's scope regarding supply of chemicals shall be as follows:

Chemicals for Water block Package (Ferric Chloride (FeCl3), Acid (HCl), Caustic (NaOH), Nutrient (Nitrogen source), Nutrient (Phosphorous source), De-oily poly electrolyte (DOPE), De-watering poly electrolyte(Bio), De-watering poly electrolyte (Oily), De-watering poly electrolyte (Chemical), Sodium Bicarbonate, Polyelectrolyte, Sodium Hypochlorite (NaOCl), Lime, Antiscalant for RO, Sodium Bisulphite, Morpholine, Soda Ash, Sodium carbonate (Na2CO3), Lime shall be procured and supplied by Contractor on cost reimbursable basis by GAIL. Contractor shall inform requirement to GAIL in advance before procuring the chemicals. GAIL shall certify the requirement & bills/invoices and make payments to the contractor towards cost of chemicals received at site.

Special chemicals for Water Block package (Cleaning Chemicals in Evaporator and Dryer units in ZLDP, Antiscalant / Special Additives for Evaporator and Dryer units in ZLDP, Chemicals for bioremediation package) shall be supplied by the contractor at his own cost during the Operations Contract Duration.

Any other chemicals (**not listed above**) if required shall also be procured & supplied by the contractor at his own cost. Cost of these chemicals shall not be reimbursed by GAIL to the Contractor.

The operation of Water Block Package shall involve round the clock manning of the entire facilities of Water Block Package for providing continuous operation, to produce treated water/effluent with specific quality and required quantity as per the designed parameters, without any unplanned shut down of the facilities.

- Operator: 1 No. (per Shift), Degree/Diploma holder in Chemical/ Environmental engineering with minimum 3 years of experience in operating a Zero Liquid Discharge Plant.

S. NO.	DATASHEET NO.	NOS.	EQUIPMENT TAG NO.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
1.	B378-125-17-44-DS-1101	1W	125-TT-1027	ZLD Feed Tank	Nominal Capacity: 207 m3 Size: 6.5 m Dia x 6.25 m Ht	CS Glass Flake VinylEster Lining
2.	B378-125-17-44-DS-1102	2 (1W+ 1S)	125-PA-1042 A/B	ZLD Feed Pump	7m3/hr, 20 m Diff. Head	C: SDSSI: SDSS
3.	B378-125-17-44-DS-1103	1W	125-CL-1002	Lime Soda Softening Clarifier	Capacity : 7 m3/hr Dia : 3.0 m, Ht 3.50 m	RCC With Epoxy Screed Lining
4.	B378-125-17-44-DS-1104	2 (1W+ 1S)	125-PA-1043 A/B	Lime Solution DosingPumps - ZLD	Capacity: 2000 LPH Head: 20 mLC	C: PP/PVDF, D:TEFLON
5.	B378-125-17-44-DS-1105	2(1W +1S)	125-PA-1044 A/B	Polyelectrolyte SolutionDosing Pumps - ZLD	Capacity: 20 LPH Head: 20 mL	C: PP/PVDF, D:TEFLON
6.	B378-125-17-44-DS-1106	2(1W+ 1S)	125-PA-1045 A/B	FeCl3 Solution Dosing Pumps - ZLD	Capacity: 20 LPH Head: 20 mLC	C: PP/PVDF, D:TEFLON
7.	B378-125-17-44-DS-1107	2W	125-TT-1028 A/B	Soda Ash Solution Dosing Tanks	Nominal Capacity: 4.2 m3 each Size: 1.75 m Dia x 1.75 m Ht	FRP
8.	B378-125-17-44-DS-1108	2W	125-TM-1011 A/B	Soda Ash Solution Dosing Tanks Agitators	Diameter: 300 mm	I:SS316 L S:SS431
9.	B378-125-17-44-DS-1109	2 (1W+1 S)	125-PA-1046 A/B	Soda Ash Solution Dosing Pumps -ZLD	Capacity: 1000 LPH Head: 20 mLC	C: PP/PVDF, D:TEFLON
10.	B378-125-17-44-DS-1110	1W	125-AU-1005	MEE Feed Tank	Nominal Capacity: 18.75 m3 Size: 3.0 m L x 2.5 m B x 2.5 m Ht	RCC Epoxy Screed Lining
11.	B378-125-17-44-DS-1111	2(1W+ 1S)	125-PA-1047 A/B	MEE Feed Pump	7m3/hr, 40 m Diff. Head	C: SDSS I: SDSS
12.	B378-125-17-44-DS-1112	1	125-LZ-1006	ZERO LIQUID DISCHARGE PACKAGE PLANT (Including all Associated Equipments, Heat Exchangers, Coolers, Condensate Collection and Transfer System, Waste Collection and recycle, Chemical Cleaning Systems etc)	168 KLD (7 m3/hr)	As Per Process Datasheet
13.	B378-125-17-44-DS-1113	1W	125-LZ-1007	De-superheater Package	MP to LP De-superheater 3.5 TPH	Package Supplier Std.
14.	B378-125-17-44-DS-1114	1W	125-AU-1006	ZLD Plant Drain Sump	Nominal Capacity: 18.75 m3 (DDE) Size: 3.0 m L x 2.5 m B x 2.5 m Ht	RCC Epoxy Screed Lining

15.	B378-125-17-44-DS-1115	2W	125-PA-1048 A/B	ZLD Plant Drain Transfer Pumps (Vertical Centrifugal)	7m3/hr, 40 m Diff. Head	C: SDSS I: SDSS
16.	B378-125-17-44-DS-1116	2W	125-TT-1029 A/B	Anti Foam Solution Dosing Tank	Nominal Capacity: 1.7 m3 each Size: 1.2 m Dia x 1.5 m Ht	FRP (Vinyl ester resin)
17.	B378-125-17-44-DS-1117	2W	125-PA-1049 A/B	Anti Foam Solution Dosing Pumps	Capacity: 50 LPH Head: 25 m	C : PP/PVDF, D : TEFLON
18.	-	-	-	Technological Structure for MEE / ZLD	12.0m [L] x 8.0m [W] x 14.0 m [H] (Minimum)	Structural Steel

NOTES:

1. ***W: Working; SB: Stand by: L: Length; B: Breadth/Width; H: Height; SWD: Side Water Depth; MWL: Minimum water level, D: Depth; DDE: During Detail Engineering; I: Impeller; S:Shaft; EP: Epoxy Painted; EL: Epoxy Lined; SDSS: Super Duplex Stainless Steel***

2. ***All other works including civil, mechanical, electrical, piping, instrumentation, construction, erection, testing, painting works, etc., shall be as per the tender requirements.***

3. ***The sizes specified in the equipment list and corresponding Process Datasheets are minimum requirements. Vendor to confirm the same during detailed engineering.***

4. ***Equipment list shall be updated during detail engineering based on UF and RO membrane supplier's recommendation.***

SCOPE OF WORK (SUPPLY & SERVICES) OF ZLDS:

The capacity of ZLD system: **7 m^3/hr**. The scope of work of ZLDS, indicating supply and services, is listed below:

a. Technology tie-up agreement during bid submission to M/s GAIL, by BHEL
   Enter into tie-up agreement with BHEL in the prescribed sample format attached with the specification.

b. Pre-Bid engineering services by ZLDS (during bid submission by BHEL, to GAIL):
   1. Support BHEL for Pre-bid engineering of the ZLD system by providing required inputs, data sheets, drawings etc. for "Tender Purpose" to submit along with BHEL bid.

   Detailed BOQ estimation and cost estimation for Civil is in the scope of BHEL.

   2. Support BHEL for Technical closure of bid with customer pertaining to ZLD system.

c. Scope of ZLDS during project execution:
   1. Design, engineering, manufacture, testing, supply, erection, commissioning of complete ZLD system consisting of following major equipment:
   2. Assist in obtaining the approvals of various engineering documents from customer during contract stage.
   3. Furnish required input details for the civil design of the ETP and ZLD system (detail BOQ, design and execution by BHEL)
   4. Establishing plant performance guarantees as per the tender specification.
   5. Visit of experts to meetings at intimated location and also at project site for support, if required.
   6. Supply E&C spares for ZLD equipment. It shall form part of the main equipment supply.

7. Supply of special tools and tackles of ZLD system. The scope of such tools shall form part of the main equipment supply and a separate list for the same shall be furnished along with bid.

A. SCOPE MATRIX BETWEEN ZLDS AND BHEL

Sl. No.	Description	Basic Engineering	Detail Engineering	Supply	Execution
1	ZLD system	ZLDS	ZLDS	ZLDS	ZLDS

1) **Basic Engineering:** means conceptual design, sizing criteria.
2) **Detail Engineering:** Procurement,
3) **Execution:** means erection, commissioning and establishing performance guarantee.

Note: The civil design and civil works are in the scope of BHEL. However, ZLDS shall provide all the necessary civil inputs.

B. TECHNICAL SPECIFICATION

1. Mechanical: The complete design, supply, erection, commissioning and establishing the performance parameters of all the equipment (as per the enclosed ZLD tender scheme) needed to treat the incoming effluent to ZLD to meet the guarantee parameters. If any equipment is required over and above the scheme, for meeting the outlet parameters, is to be considered by the Bidder. The scheme indicated is minimum.
2. Electricals: Complete electrical system consisting of motors, MCC panel, cables, cable trays, earthing, etc. for the ZLD are in the scope of Bidder. The detailed specification of these electrical are indicated in the attached GAIL tender document.
3. C&I: All the instruments, as detailed in the attached GAIL specification, PLC panel, instrument cables etc. are in the scope of Bidder only. The detailed specification is indicated in the attached GAIL tender document.

C. OPERATION AND CONTROL PHILOSOPHY:

The evaporator and crystallizer plant shall be operated, monitored and controlled through one central programmable logic controller (PLC) with complete automation to perform normal operation, sludge removal, valve operation etc. However, the total plant shall have provision of manual Intervention and operation of the same, locally or from remote. PLC based control system shall be provided to start, stop, monitor and control the plant from one central place. All the local push buttons required for the plant shall be housed near the plant. Temperature measurement for various as mentioned above shall be sensed by individual temperature indicating transmitter and displayed in the panel/monitor. Operator can read those temperatures automatically in sequence or manually at any of the above points randomly to operate the plant effectively.

2) An interlock sequence shall be provided for starting and stopping of the plant in predetermined correct sequence only and not otherwise due to any mistake in operation.

3) An alarm annunciator indicates tripping of any drive and also abnormal parameters if any in the plant. This will provide extra facility to monitor the plant from panel and operate the plant correctly in manual mode.

4) An automatic PID based level control loop shall be provided for evaporator to regulate product

flowing out from the evaporator. This ensures constant level in the system and avoids Fluctuations in performance of total plant. The loop consists of level sensor (indicating transmitter), PID controller (electronic type), I/P converter to convert electronic signal to pneumatic signal and pneumatic control valve.

5) An automatic PID pressure control loop at inlet of live steam line to ensure uniform steam supply at desired condition to the plant. This also ensures exact required temperature of 1st effect.

6) A control valve (or double solenoid valve) shall be provided which will control the flow to ensure the safe boiling temperature in calendria. These safe temperatures ensures no overheating of product at any stage, which otherwise may cause undesired fouling in the tubes.

An automatic PID feed flow control loop shall be provided in the feed line of the plant so that operator is able to control the feed rate to the plant. (Flow control valve shall be provided in HRSCC feed pump discharge).

8) With the PID control loop arrangement constant feed rate to the plant and constant supply of steam to the plant can be ensured.

9) All equipment and valve status (On/off/trip status or open/close) should be indicated. Necessary failure in operation/trip shall have visual and sound alarms.

10) The local push buttons with control boxes of individual pumps, equipment shall have selector switches with position of manual and automatic.

11) The remote selection facility at the HMI shall have the override over the local selector switch position in the local control boxes.

12) Preparation and dosing of chemical (Operation of pump from local control panel) shall be controlled manually.

13) All pumps shall work on level sensing.

14) In general operating pumps selected shall be rotated on a daily basis or after fixed time interval.

15) PLC shall have indications of all instrument/transmitter readings in HMI.

NOTE:

For detail Instrumentation and control system, refer Instrument design philosophy (section:5.4)

- Specification of equipment and design data are general in nature and may require changes based on specific selection and application. Tenderer is required to make their own judgment for proper selection of equipment in their offer or during detail engineering if LOA is placed on them. Tenderer is required to submit proper design calculation.
- Responsibility of selection of equipment rests entirely on the tenderer considering that tenderer is required to provide guarantee on the equipment selected, which will undergo performance testing at site during PG test.
- Where specification of all equipment required for completeness of the system is not specified herewith, tenderer is required to make selection of proper equipment based on their judgment.

I. Quality & Inspection

Quality Assurance Program

To ensure that the equipment and services under the scope of contract whether manufactured or assembled within the ZLDS's works or at his Sub-Vendor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, ZLDS shall adopt suitable quality assurance program to control such activities at all points, as necessary. Such program shall be outlined by the ZLDS and shall be finally accepted by the Owner / Authorized representative after discussions before the award of Contract. The QA program shall be generally in line with ISO-9002/IS-14001. A quality assurance program of the ZLDS shall generally cover the following:

System for shop manufacturing and site erection control including process controls, fabrication and assembly controls.

Quality Assurance Documents

The ZLDS shall submit required no. of copies of the following Quality Assurance documents

- Material test reports on components as specified by the specification and approved Quality Plans.
- The inspection plan with verification, inspection plan check points, verification sketches, if used and method used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
- Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- Non-destructive examination results, reports including radiography interpretation reports.
- Factory tests results for testing required as per applicable codes and standards referred in the specification and approved Quality Plans.
- Inspection reports duly signed by QA personnel of the customer and ZLDS for the agreed customer hold points.

The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The Owner reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of Technical data sheets.

Quality Plan:

ZLDS to furnish Quality Plan [Supply Quality plan] to BHEL along with offer in their standard format for general review by BHEL. During Detailed engineering, in addition to various tests indicated in this specification, Quality plan will be reviewed with respect to standard Inspection, standard Engineering practices, applicable standards, code etc. Accordingly, various tests required, stages of inspection and appropriate agencies for Inspection will be intimated. ZLDS to abide by the same.

1. Tests & Inspection:

The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with requirements of applicable codes and standards.

The particulars of the proposed tests and the procedures for the tests shall be submitted to the Purchaser/Consultant for approval before conducting the tests.

2. Test at Manufacturer's work (as applicable):
   Material Tests
   Other Tests
   Site Performance Test:
3. Inspection agency:
   BHEL/Third Party appointed by BHEL/Customer. The various inspection stages will be witnessed by individual agencies (or) Group of Agencies as per above, in line with approved quality plan.

II. PROTECTION FOR SHOP FABRICATED ITEMS:

a) All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or non-metallic protecting device. The parts which are likely to get rusted due to exposure to weather, should also be properly treated and protected in a suitable manner. All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall beforehand be treated and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scale, oxide and other coatings and prepared in the shop.

b) The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. The finished colors shall be as per manufacturer's standards.

c) Shop primer for all steel surfaces which will be exposed to operating temperature below 95°C shall be selected by the ZLDS after obtaining specific approval of the Purchaser regarding the quality of primer proposed to be applied.

d) All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Purchaser.

e) All material shall be delivered in a clean and usable condition. Openings shall be securely covered against entry of foreign material where appropriate.

III. PACKING AND TRANSPORTATION:

All equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. ZLDS shall follow necessary road safety rules and shall obtain permission from highway authorities for goods movement. However, these aspects shall be taken into consideration in the design of the packing for the system.

IV. NAME PLATES & TAG PLATES:

A. Components whose identity is important for operation and maintenance of the plant shall be provided with permanently attached tag bearing the Purchaser's coding together with relevant text clearly inscribed.

a) A corrosion-resistant nameplate shall be attached to each unit in a clearly visible, easily accessible location. The nameplate shall be stamped with the following information: **Manufacturer's name**

b) Manufacturer's model number
c) Manufacturer's serial number
d) Purchaser's equipment tag number (item No.)
e) Service name
f) Weight (kg)
g) Hydrostatic test pressure, Bar. (g)
h) Other design information of the flow media like flow rate, temperature, pressure etc.

B. Nameplates shall be 3 mm (0.12") thick engraved plate of sufficient rigidity with lettering of a minimum height of 4 mm (0.16"). The method of implementation and labelling will be informed for all components after award of contract.

C. Identification tags shall be provided and placed on all ZLDS furnished items. Tags shall be corrosion resistance, having a larger than diameter of 3 cm, and shall have black identification figures stamped thereon. Figure height shall be larger than 0.5 cm. Tags shall bear the component system designation symbol shown on the ZLDS's drawings.

V. SITE METEOROLOGICAL DATA

S.No.	Parameter	Unit	Min.	Nor.	Max.
	METEOROLOGICAL DATA FOR USAR				
1	Barometric pressure	hPa	990	1009.4	1018.5
2	Ambient temperature	C	tmin=9.4	tnor =31.1	tmax=40.5
3	Relative humidity at ambient temperature	%	30	80	100
4	Rainfall data				
4.1	for 1-hour period	mm		45	125
4.2	for 24-hours period	mm		168.4	517
4.3	Annual	mm	677.7	3104.8	4063.6
5	Wind data				
5.1	Wind velocity	Km/h	0	12.6	42.0

VI. VENDOR DOCUMENTATION:

1. At Pre-Bid Stage:

Following data to be furnished by ZLDS for civil engineering by BHEL:

a) Civil inputs (sizes of various process structures, foundation, building etc.)

Following documents/data to be furnished by ZLDS for **"Tender Purpose"** which shall be included with BHEL's bids to GAIL:

a) Overall Process Flow Diagram /P&IDs
b) Process write up
c) Control/ Operation/ Design Philosophy
d) Functional guarantees of the plant as per GAIL "Guarantee Schedule"
e) Data sheet for Process for Tender Purpose as per GAIL specification.
f) st of Spares (for items supplied by ZLDS)
g) Layout and area requirement.
h) Load list and power requirement.
i) Chemical list & consumption, unit rate and overall cost.
j) Yearly shutdown maintenance cost.
k) Steam requirement based on supply condition.
l) Dry solid production quantity, analysis, specific
m) gravity and volume, area requirement for 48 hrs
n) storage.
o) Operating cost estimate.
p) Time required for CIP.
q) Yearly down time.

2. During Project Execution:

Documents to be submitted by ZLDS after receipt of order:

Sl.No	DRG/DOC. NAME	Submission by
MECHANICAL		
M.01	P&ID of ZLD system	1 week from PO
M.02	System write-up (Including Control Philosophy)	1 week from PO
M.03	Design Basis and Sizing Criteria including Process Calculations	1 week from PO
M.04	Equipment Layout and list	2 weeks from PO
M.05	List of Terminal Points	2 weeks from PO
M.06	Individual equipment GA drg.	3 weeks from PO
M.07	Data sheet of complete equipment	3 weeks from PO
M.08	Overall Layout of ZLD system	2 weeks from PO
M.09	Painting Specification	4 weeks from PO
M.10	Piping layout	4 weeks from PO
ELECTRICAL		
E.01	Electrical Load List with normal and emergency power requirement	1 week from PO
E.02	GA and Datasheet of motors	2 weeks from PO
E.03	Cable datasheet	2 weeks from PO
E.04	Cable tray layout	3 weeks from PO
E.05	MCC panel GA and Wiring diagram	3 weeks from PO
E.06	Earthing details	3 weeks from PO
INSTRUMENTATION		
I.01	Instrument Index with BOQ, range, set points etc.,	2 weeks from PO
I.02	Instrument Hook up drawings	4 weeks from PO
I.03	Technical data sheet of Instruments	3 weeks from PO
I.04	PLC Configuration Diagram, GA & Wiring diagram	4 weeks from PO

Sl.No	DRG/DOC. NAME	Submission by
I.05	PLC I/O List	5 weeks from PO
I.06	PLC Logic Diagram	5 weeks from PO
I.07	PLC Control Room Layout	5 weeks from PO
I.08	PLC Power Supply AC Inputs requirement	5 weeks from PO
I.09	PLC interconnection diagrams	5 weeks from PO
CIVIL		
C.01	Civil input drawings for structures	4 weeks from PO
C.02	Civil input drawings for all building	4 weeks from PO
C.03	Civil input drawings for all Tanks, pits and chambers etc.	4 weeks from PO
MISCELLANEOUS		
MIS.01	Commissioning spares	5 weeks from PO
MIS.02	Recommended spares	5 weeks from PO
MIS.03	Consumable list (Chemicals, oil, grease etc.)	5 weeks from PO
MIS.04	O&M manual	5 weeks from PO
MIS.05	Performance Test Procedure	5 weeks from PO

Note: The date of first submission is indicated above. ZLDS shall submit all subsequent revision within 5 working days of comments. BHEL shall provide review/approval in 7 working days

3. The O&M manuals shall contain the following details as minimum in addition to those indicated in the above table: -
   - Identification details of the equipment like BHEL PO NO., Vendor's Sl. No., Vendors contact address with tel., fax details.
   - Description of the equipment.
   - Final Data sheets and Drawings of the equipment as per the list mentioned in this specification.
   - Recommended 2 years operational spares.
   - Test reports.

4. The erection documentation shall consist of
   - All drawings/documents,
   - All such drawings/documents, not submitted for review, but essential for erection/ commissioning, e.g. assembly drawings, etc.
   - Master document list
   - Site dispatchable B.O.M.

VII. Performance Guarantees

The guarantees shall form contract guarantees to be demonstrated through an approved performance test procedure (to be furnished by the Bidder, as per the tender) after the completion of the Plant. The schedule shall be finalized during the detail engineering stage.

VIII. Terminal/ Interface Points between ZLDS and BHEL.

Sl. No.	Equipment	Terminal Point
Mechanical		
1	Influent waste water	At RO reject sump. The ZLD feed pump is in the scope of the Bidder.
2	LP steam, return condensate, CW in and out	At one point near the battery limit. The pipe counter flanges along with stud nuts and gaskets at battery limit are in the scope of Bidder.
Electrical		
1	Power Supply 415 V	Incomer to MCC. The required cable glands and lugs are in the scope of the Bidder.
Control & Instrumentation		
1	Power supply to PLC	At one (1) point in PLC panel incomer. Further distribution to all associated equipment including HMI, Printer etc. shall be taken care by ZLDS.

IX. Information to be submitted along with offer

1.0 Filled in Annexures (Key Information, Recommended spares, special tools & tackles and Deviations)
2.0 Checklist
3.0 Unpriced price-bid format

ANNEXURE – I

KEY INFORMATION

1.	Name of the Bidding Company		
2.	Registered in (mention the name of the Country)		
3.	Name, designation, telex & telephone number and postal address of responsible officer of ZLDS to whom all reference shall be made for expeditious co-ordination		
4.	Name, designation, telex & telephone number and postal address of responsible officer of Indian Agent.		
5.	ZLDS's proposal number		
6.	ZLDS's proposal date		
7.	Validity of offer, counted from the date of opening of bid		
8.	Guaranteed completion period, counted from date of issuance of LOI/TOI		
9.	Confirm that Scope of supply and services are exactly as per specification requirement		Yes/No
10.	Confirm Technical Compliance with Specification		Yes/No
11.	Confirm that Guarantees are as per Job Specification		Yes/No
12.	Confirm that List of Recommended Spares has been furnished as per Annexure-II		Yes/No
13.	Confirm that List of Special Tools & Tackles has been furnished as per Annexure-III		Yes/No
14.	Confirm that deviations ,if applicable, have been furnished as per Annexure-IV		Yes/No

Signature of ZLDS's
Authorized representative .....

Date.....

ANNEXURE – II

LIST OF RECOMMENDED SPARE PARTS

ZLDS shall tabulate in the proforma below list of all spare parts as recommended by the respective manufacturer for regular, reliable operation. In case the ZLDS has to add any other relevant information, the same shall be indicated herein. Continuation sheets of like size and format may be used as per ZLDS's requirements.

Sl. No	Description	Quantity	Unit Price	Total Price	Delivery Period	Remarks

Signature of ZLDS's
Authorized representative .....

Date.....

ANNEXURE – III

LIST OF SPECIAL TOOLS AND TACKLES

ZLDS shall tabulate in the proforma below list of all tools and tackles as recommended by the respective manufacturer for regular, reliable operation. In case the ZLDS has to add any other relevant information, the same shall be indicated herein. Continuation sheets of like size and format may be used as per ZLDS's requirements.

Sl.No.	Description	Quantity	Remarks
a			
b			
c			
d			

Signature of ZLDS's
Authorized representative .....

Date.....

ANNEXURE – IV

DEVIATION FROM SPECIFICATION

If the proposal submitted has got any deviation from the technical stipulations in the bidding document, the ZLDS shall tabulate below the full particulars of such deviations and shall sign below. Additional sheets may be enclosed, if necessary. Deviation is to be furnished with mention of specific clause numbers. Technical and commercial deviations to scope of supply and services, shall be indicated separately. ZLDSs shall bring put only those deviations which are impractical to meet (or) not advisable

Sl.No.	CLAUSE NO.	DESCRIPTION AS PER SPECIFICATION	DEVIATION BY ZLDS

We confirm that all the deviations/exceptions to the Technical Specification PY51806, Job Specification and enclosures including reference documents attached are listed in this Annexure only. No other deviations or exceptions even if mentioned elsewhere shall be considered for any technical/ commercial evaluation or for ordering.

Signature of ZLDS's
Authorized representative.....

Date .....

1.0 CHECK LIST

ZLDS to note that Check List shall be completely filled and the data required in-line with Check List shall be submitted along with their Offer to enable Purchaser to evaluate the offer submitted.

S.No.	Description	Enclosed or [Yes/No]	Remarks/ Comments by ZLDS
1	**ZLDS to confirm compliance with** spec. and its annexure without any deviations.		
2	ZLDS has already raised pre-bid queries (if any) on Purchase specification.		
3	ZLDS Shall submit completely filled following Annexures enclosed with Technical Purchase Specification PY 51806 along with their offer **Annexure-I:** Key Information **Annexure-II:** List of Recommended Spare Parts **Annexure-III:** Special Tools and Tackles **Annexure-IV:** Deviation from specification		
4	ZLDS shall furnish the list of Erection and commissioning spares along with their offer.		
5	ZLDS to fill Deviation list (Refer Annexure-IV of PY 51806). Only those deviations indicated in this list will be considered during technical evaluation of offer. ZLDS to indicate the deviations which are impractical.		
6	All other requirements except the deviations brought out under deviation list, have been taken into consideration in the offer.		
7	ZLDS has submitted unpriced “Price bid format” with “Quoted” mentioned against price for each line item of Price Bid Format		

ATTACHMENTS

Sl. No.	Description	Drg. / Doc. No.	Rev. No.
1	Tender Scheme	Annexure 1	
2	Technical Spec Extract	Annexure-2	
3	Price Format	Anexure-3	
4	Corporate packing standard		

X. Material Code

Sl. No	Variant No.	Description	Material code
1.	00	Pre-bid Tie-up of ZLDS for GAIL-Usar.	PY9751806003

RECORD OF REVISIONS				
Rev. No.	**Date**	**Revision Details**	**Revised By**	**Approved By**
00	03.01.2021	First Issue	Ch. Pradeepa	K. Srinivas