


ESP-001-2A Rev.00		<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> Technical specification for Pre-bid Tie-up	Std. / Doc. Number	
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## TECHNICAL SPECIFICATION

FOR

**PRE-BID TIE-UP**

WITH

**ZLD SYSTEM SUPPLIER**

FOR

**RWTP, RO-DMP, CPU & ZLD PLANT TENDER**


OF

**M/s IOCL**

AT

**Panipat Refinery, Haryana (India)**

<b>Revisions:</b> Refer to record of revisions	<b>Prepared by :</b>	<b>Checked by :</b>	<b>Approved by :</b>	<b>Date :</b>
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## 1.0 INTRODUCTION

Indian Oil Corporation Ltd (IOCL) is planning to construct a new Raw Water Treatment Plant (RWTP), Reverse Osmosis - Mixed Bed based Demineralization Plant (RODMP), Condensate Polishing Unit (CPU), Zero Liquid Discharge Plant (ZLDP) and Condensate Polishing Unit-PNCP Area as part of Panipat Refinery Expansion Project (P-25).

M/s EIL as PMC for the project, has invited bids for RWTP, RO-DMP, CPU & ZLD Plant Package.

This specification is issued for placement of order for Pre-Bid Tie-up with with the Evaporator and Dryer Units (ZLD Plant) Supplier.

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

As per Tender requirement by M/s IOCL, turnkey contractor (here BHEL) shall submit a “Memorandum of Understanding (MoU)” with qualified ZLDS along with BHEL’s Techno-commercial bid for evaluation by IOCL.


### 1.1. 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 IOCL. BHEL will place an order on selected “ZLD System Supplier (ZLDS)”, in case BHEL adjudged as successful EPC Bidder and awarded the “Project” by IOCL. This “AGREEMENT” should be valid up to the completion period of BHEL for the plant as per contractual agreement with M/s IOCL.

The intent of this specification is to elaborate the scope of “ZLDS” for the proposed 3chains of each chain rated for 30 m3/hr 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, training, pre-commissioning, commissioning, trial runs of 30 Days operation, sustained load test after commissioning and performance guarantee test run for 72hrs and Two Years O&M. 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, **who has to** Design, Engineer, Manufacture, Assemble, Inspect, Test and Deliver properly packed and painted Zero Liquid Discharge Plantconsisting of Multi-Effect Evaporator Unit and Dryer Unit (Agitated Thin Film Dryer/ Pusher Centrifuge) system with all accessories and **Erect, Commission, Operate & Maintain for 2-Years and depute Manpower for O&M Period** as specified in the IOCL’s Tender Specification and BHEL’s Enquiry Documents.

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## 2.0 SPECIAL NOTES TO BIDDERS:

### LEGEND

IOCL	Indian Oil Corporation Ltd
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, BHEL
<b>ZLDS / Bidder</b>	<b>Qualified ZLD System Supplier</b>

**‘Contractor’ mentioned anywhere in IOCL’s Tender Document in context of ZLD Plant / Equipment shall be treated as ‘ZLDS’**

**2.1.1. This specification shall be read in conjunction with its enclosures and Techno-commercial Specifications, Amendments, corrigenda, Pre-Bid Replies, clarifications etc issued by IOCL/EIL regarding the subject tender.**

**The same are available at**

**[https://iocletenders.nic.in/nicgep/app?component=%24DirectLink\\_0&page=FrontEndAdvancedSearchResult&service=direct&session=T&sp=SxhKnCK8OvBV4pOeKEwMwxg%3D%3D](https://iocletenders.nic.in/nicgep/app?component=%24DirectLink_0&page=FrontEndAdvancedSearchResult&service=direct&session=T&sp=SxhKnCK8OvBV4pOeKEwMwxg%3D%3D)**

**[www.iocltenders.nic.in](http://www.iocltenders.nic.in) --- → IOCL’s tender id : 2022\_REFHQ\_146435\_2**


**For the ease of Bidder, important IOCL’s Technical documents are enclosed along with this enquiry, only for ready reference, but Bidder is responsible for accessing the above link to download and comply with all the requirements of the IOCL’s Tender.**

***The Techno-Commercial conditions of IOCL’s above tender are binding on ZLDS supplier on back-to-back basis, without any deviation / exception.***

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.

- Bidders shall comply with various requirements of this specification. Bidders can bring out only those deviations, which are impractical to meet, for BHEL review.
- 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.

**2.1.2. 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**

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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.

- 2.1.3. 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.
- 2.1.4. 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.
- 2.1.5. 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.
- 2.1.6. 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**

The Bidder should have carried out Design & Engineering including procurement/supply, Installation /installation supervision and commissioning/commissioning supervision of at least one plant consisting of a Multi Effect Evaporator unit of 180 KLD Minimum Capacity and a Dryer Unit (consisting of Agitated Thin Film Dryer or Pusher Centrifuge) on his own.

ZLDS shall have experience in Design, Engineering, Supply, installation/installation supervision and Commissioning/Commissioning Supervision of the following:


- i) Multi Effect Evaporator Unit of Minimum Capacity of 180 KLD
- ii) Dryer Unit (Agitated Thin Film Dryer or Pusher Centrifuge).

#### **3.1. 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 12(Twelve) 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.

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### 3.2. Financial Criteria

- 3.2.1. 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 25 Crores** (Rupees Twenty Crores Only) or in equivalent foreign currency.
- 3.2.2. Audited financial statement have to be submitted for all the Three 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.
- 3.2.3. In case audited Financial statements have not been submitted any of Three years as indicated above, then the applicable audited statements submitted by bidders against the requisite three years, will be averaged for Three years i.e. total divided by Three.
- 3.2.4. ZLDS shall not be under Holiday List/ Negative List/ Suspension List/ Banning List of IOCL, 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 IOCL 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 IOCL based on the information submitted with the bid. If certified internally by IOCL 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 IOCL'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 IOCL's Tender Specification.

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

- 7.1. For deliverables in the scope of ZLDS in Post-Order Stage, refer IOCL's Tender Specification.
- 7.2. 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.
- 7.3. 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.
- 7.4. The detailed list of deliverables during the Pre-bid stage and during detailed engineering to be submitted along with offer
- 7.5. The deliverables of ZLDS shall be submitted to BHEL only, unless instructed otherwise.
- 7.6. 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:**

Back-to-Back as per IOCL's Tender Specification.


## **9.0 Penalty Clause**

Back-to-Back as per IOCL's Tender Specification

## **10.0 PERFORMANCE GUARANTEE**

- 10.1. ZLDS shall provide a list of laboratory test procedures and frequencies thereof required for validating Performance Guarantees.
- 10.2. 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.
- 10.3. 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.
- 10.4. ZLDS shall note and comply to the applicable clauses in GCC/SCC of BHEL's NIT and IOCL's Tender Specification.




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## **11.0 OTHER INSTRUCTIONS**

- 11.1. 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.
- 11.2. ZLDS shall familiarize fully with the standard/ procedures/ practice of BHEL/OWNER, to avoid any dispute at later date and after order placement.
- 11.3. 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.
- 11.4. 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.
- 11.5. 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.
- 11.6. 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.
- 11.7. 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.
- 11.8. 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.
- 11.9. 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.
- 11.10. ZLDS shall comply with the laws and regulations of the country, the state and territories concerned, during the progress of the work.
- 11.11. ZLDS shall submit progress report on the status of the work entrusted to them periodically and as mutually agreed upon.
- 11.12. ZLDS shall ensure optimal & economic design while executing the work, but without sacrificing the customer specification requirements/ Statutory regulations/ code provisions/ safety aspects.



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### **TECHNICAL SPECIFICATION OF ZERO LIQUID DISCHARGE PLANT**

<b>Capacity</b>	<b>3 x 30 m<sup>3</sup>/hr (2 working + 1 standby)</b>
Treatment Configuration	ZLD Feed Tank & Pump - Lime Soda Clarifier – Evaporator Sump & Pump – Evaporator Unit – Dryer Unit (ATFD/Pusher Centrifuge

The Zero Liquid Discharge Plant (ZLDP), of capacity 60 m<sup>3</sup>/hr, shall be a part of RODMP and shall process the reject/waste stream from the RODM Plant to generate condensate water that shall be utilized as feed to the RODM plant.

#### **12.0. DETAILED SCOPE OF SUPPLY/WORK**


**12.1.** The scope of work shall include Project Management; Residual Process Design & Detailed Engineering; Procurement; Fabrication; Inspection; Supply; Manufacture; Transportation of all equipment/materials to the work site& Storage at site; assembly, erection & installation; Construction and Erection of Structural, Mechanical, Electrical, Instrumentation & Piping works; Acid /Alkali proof tiling; Painting; Testing; Pre-commissioning, trial run for 30 days before commissioning; commissioning; Training of IOCL's personnel; Performance guarantee test run for 72 hours continuous operation in presence of IOCL's & EIL's Representatives; Guaranteeing and handing over of the Zero Liquid Discharge Plant in the RODMP to the Client on lump sum turnkey basis as per design basis, equipment list, standards, P&IDs, data sheets, drawings, etc., all complete within Bidder's specified battery limits including supply of spares, chemicals & consumables. The bidder shall be required to obtain all statutory approvals for completion of his scope of work. Contractor's scope of work also includes Operation & Maintenance of ZLDP for a period of two (2) years after successful commissioning. Bidders shall quote price for Two (2) years O&M contract duration including required chemicals supply.

#### **12.2. PROCESS**

Process documents enclosed are the basic documents and are to be followed for execution of job leading to successful commissioning and performance guarantee test run of the Plant. During the course of execution, updating/modification to the process documents that would become necessary is to be carried out with the approval of EIL/IOCL. The resultant work arising out of this will also form the part of scope from detailed engineering to handing over of the plant with no cost implication to IOCL. The tender specifies the scheme (refer to the PFDs/SFDs and P&IDs attached in relevant sections in tender documents) & Bidder's scope of supply in subsequent sections of this document as minimum requirements. Bidder may include in his scope any additional requirements, if so warranted to meet process guarantees and for smooth safe and trouble-free operation of the plants. All equipment described in these specifications; datasheets & equipment list; as shown in the P&IDs& PFDs; as mentioned elsewhere in the tender document or as necessary for completeness but not listed above shall also be deemed to have been included in Contractor's scope. All works required to meet requirements given in design/process/operation requirements defined elsewhere in the bid document shall also be deemed to have been included in Contractor's scope.

#### **12.3. ENGINEERING**

The design basis, data sheets, drawings, standards, specification, codes to be followed for different types of works are brought out in the various engineering sections forming part of the tender document. Bidder shall carry out residual process design & detail engineering works for the plant and submit various drawings and documents for approval of EIL/IOCL before these are released for construction.

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3D modeling (in PDMS software as defined in the Piping specifications) for the ZLDP shall also be included in scope of work.

#### 12.4. SUPPLY OF EQUIPMENT

*Equipment for the plant shall be as per the Equipment List (Document No. B269-475-17-44-EL-1002 (Latest Revision – Rev 3) attached with this document. Bidder may include in his scope, any additional requirements/equipment, if so warranted by him, in order to meet the guarantees as specified in this specification. Only Equipment whose MOC is RCC, will be provided by Contractor (BHEL); All other equipment shall be supplied by Bidder.*

#### 12.5. SUPPLY OF CONSUMABLES, LUBRICANTS, AND CHEMICALS

*Supply of consumables, lubricants, and Chemicals (if any-(except HCl & NaOH)) required for 100% pre commissioning, Commissioning, PG Test and O&M period is in Bidder's scope only.*

#### 12.6. MAN POWER FOR ERECTION, COMMISSIONING AND OPERATION AND MAINTENANCE.

*Required man-power to be deputed to site, for Erection, Commissioning, O&M by ZLDS contractor in line with IOCL technical specification.*

#### 12.7. CONSTRUCTION

**Foundations and other civil works are by Contractor (i.e. BHEL), whereas all erection of structural works including materials (for ZLD System) are in ZLDS scope.**

#### 12.8. QUALITY ASSURANCE


These activities shall be carried out by the Bidder as specified elsewhere in the tender document.

#### 13.0. STATUTORY CLEARANCES

All the applicable safety codes, national laws and local regulations shall be followed by the successful bidder for the design, engineering, fabrication, erection, commissioning & handing over of the Plant / Equipment and necessary approvals shall be obtained from the concerned statutory authorities by the Bidder. Statutory bodies from which approvals may have to be taken include State Pollution Control Board, Chief Inspector of Boilers / IBR, Factory Inspectorate, Labour Authorities, Electrical Inspectorate and Chief Controller of Explosive, Directorate General of Mines and Safety requirements, etc. The Bidder shall ascertain requirement of approvals as applicable in such plants and initiation of action as required shall be in Bidder's scope.

#### 14.0. VENDOR LIST

For most of the systems/equipment, the approved vendor list of EIL is enclosed in the bid document, which shall be adhered to. While for other items, not listed in the approved vendor list, the suppliers who would be involved for design, engineering and supply of equipment and materials are to be proposed by the Bidder (for EIL/IOCL approval) during detailed engineering with the documentary evidence of having supplied similar equipment, systems and/or materials for similar applications with

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proven track record. Any change for new contractor/supplier after award of contract for supply will not be permitted. It will be necessary to purchase certain items as a system and not as individual equipment. These have to be identified and furnished during detailed engineering for approval of the EIL/ IOCL.

#### 15.0. WASTE DISPOSAL

All wastes generated like surplus earth after use/surplus construction materials to be disposed-off from time to time by the Bidder to the disposal locations as directed by the Engineer-in-Charge.

#### 16.0. DESCRIPENCIES / VARIATIONS IN SPECIFICATIONS / STANDARDS

Bidders may bring out variations, deviations, if any, in related data sheets, equipment list, drawings, specifications, standards, codes, scope and any other contractual clauses before submission of bids and seek clarifications. In case of any contradiction on specification brought out at the post award stage of job, decision of EIL/ IOCL shall be final & binding upon the Bidder without any time & cost implication.

#### 17.0. SUPPLY OF CONSUMABLES & CHEMICALS

Supply of all chemicals (**except HCl & NaOH**), spares and consumables required for the Operation and Maintenance of the plant during start-up, pre-commissioning, 30 days trial runs and up to successful commissioning shall be in the scope of supply of the LSTK contractor. HCl and NaOH shall be free issue supply by IOCL. Special chemicals required, if any, shall be clearly defined by the Bidder with respect to quality and quantity and the supply of the same shall also be in Bidder's scope. Minimum two nos. of manufacturers shall be specified by the bidder for these special chemicals. Unloading, handling and storage of all chemicals and consumables (including provision of necessary facilities) shall be done by the Bidder.

Also, Bidder's scope regarding supply of chemicals, spares, consumables and other requirements during the Two years operation duration shall be as per Specifications No. B269-472/475/476-17-44-SS-1003.

#### 18.0. SPARES & TOOLS


- **ERECTION & COMMISSIONING SPARES**

Bidder shall ensure adequate supply of all spares as required by him for successful erection & commission of the plants till handing over to the client. The lump sum price quoted shall be deemed to be inclusive of cost of such spares.

- **MANDATORY SPARES**

Bidder's scope regarding supply of mandatory spares shall be as per the specifications attached in the tender.

- **TWO YEARS RECOMMENDED SPARES**

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Two years normal operation spares required are to be identified by the bidder and shall be in the bidder's scope during the Two Years Operation and Maintenance Contract. These Spares as identified by the Bidder shall be over and above the minimum spares list as indicated in the Annexure-1 of the O&M Specifications document No. B269-472/475/476-17-44-SS-1003.

- **STORAGE OF SPARES**

All spare parts supplied by the bidder shall be properly wrapped, packaged and stored by the Bidder so that they will be preserved in original and new condition under the normal conditions of storage to be anticipated in India and shall be properly tagged and coded so that later identification as to intended equipment usage will be facilitated. They shall be packed separately clearly marked as 'spare parts'. Packing lists shall be furnished so that the parts can be handled without uncrating if desired.

- **SPECIAL TOOLS AND TACKLES**

Bidder shall ensure supply of all special tools and tackles for commissioning of the entire plants till handing over. The lump sum price quoted shall be deemed to be inclusive of cost of such tools and tackles.

## **20.0. MECHANICAL COMPLETION / PRE-COMMISSIONING / COMMISSIONING / GUARANTEE & TOLERANCES**

- **Mechanical Completion**

Mechanical completion of the Plant shall mean that all installations works of the Plant have been completed and hydrotested in accordance with approved construction drawings, approved specifications, applicable codes, accepted International good engineering practices and all the activities have been completed in a comprehensive manner by the Bidder.


- **Pre-Commissioning**

Pre-commissioning activities are defined as those activities which are required to be performed after completion / installation, inspection, hydro-testing, etc. of the Plant to make it ready for commissioning.

- **Commissioning**

The Plant shall be considered "Ready for Commissioning" when 30 days trial runs are over and all the facilities have been completed along with their auxiliaries and support facilities in every respect including charging of lubes, chemicals, filters media, preparation of solution, etc. as recommended by IOCL / EIL in standard format with all exceptions, if any, resolved.

Commissioning of the Plant shall mean taking the feed in the system, passing it through normal route and establishing the process control parameters. The Plant shall be considered to be commissioned successfully with instrumentation / control system, process, utilities & support system have been on uninterrupted stable operation for not less than 72 hours while producing treated water of desired quality. Whether the 72 hours operation has been successful or not shall be decided by IOCL/EIL based on observations recorded during 72 hours. The countdown for 72 hours operation shall start on after the system has been on stable operation with all controls and safety systems in normal operation for a period of not less than 48 hours.

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## 20.0. GUARANTEE

Bidder shall guarantee the following parameters:

- Hydraulic capacity of the Zero Liquid Discharge Plant
- Quality at the Multi Effect Evaporator Outlet
- Condensate Quality at the Outlet of the ZLDP
- Solids Quality at the ZLDP Outlet

## 21.0. TOLERANCES

The guaranteed figures are subject to the following tolerances for acceptance of the plant.

- i) Capacity measurement  $\pm 2\%$ .
- ii) Quality measurement as per accuracies guaranteed by the instrument supplier.

***In case of any variation over the tolerances given above, Bidder shall rectify the plant at his own cost within a time mutually agreed upon by the Contractor and IOCL/EIL to bring the plant performance in line with the guaranteed figures.***

## 22.0. PERFORMANCE AND GUARANTEES

- a) After the system has been stabilized by the Bidder during 30 days trial runs and plant is successfully commissioned, the Bidder shall conduct a performance guarantee test run for the ZLDP. The procedure for performance testing shall be submitted by the Bidder to the EIL/ IOCL for review & approval. The duration for the performance guarantee test run shall be 72 hours continuous operation of the plant.

***The performance guarantee test run for ZLDP as part of the RO-DMP shall be carried out at the design conditions (including design capacities & design feed water quality) as specified in the Process Design Basis (Doc. No.B269-475-17- 4-DB-1001).***

During the performance guarantee test runs, the following guarantee parameters shall be fulfilled (within the tolerances as specified) at design conditions as specified above.

### Hydraulic Capacity of the ZLD Plant:

Zero Liquid Discharge Plant Capacity : 30 m<sup>3</sup>/hr per chain


### Quality Parameters to be guaranteed under ZLD as specified below:

Water Quality at Evaporator Unit Outlet in ZLD Plant:

Component	Unit	Evaporator Outlet Water Quality
Total Dissolved Solids Content	%	30.0 (minimum)

Condensate Quality at ZLD Plant Outlet

Component	Unit	Condensate Water Quality
Total Dissolved Solids	ppm	< 300
Total Suspended Solids	ppm	< 1.0

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#### Dry Solids at ZLD Plant Outlet

Component	Unit	Discharge Limit
Moisture Content in Dry Solids	%	10.0 (maximum)

In case the designed feed quantity & quality is not available as specified in the tender document, the PGTR may be carried out (if so desired by M/s IOCL) for the actual conditions within the design conditions for the plant, while performing to the desired treated outlet quality as per the requirement of the tender.

- b) Any loss of consumable/material during pre-commissioning, trial runs, commissioning, etc. prior to handing over of plant to IOCL shall be made up by the bidder to the quantities specified in the design calculations as initial charge without any extra time & cost to IOCL.
- c) If on testing, any material or equipment or the unit does not meet the design, rated or guaranteed performance related there to, the Bidder shall forthwith, within the scope of work of Bidder and at no additional cost to IOCL, undertake such additional tests and / or operations as are necessary to identify the cause of such failure. Such tests and / or operations shall be conducted in conjunction with IOCL, if the plant as a whole fails to meet the guarantees.
- d) If as a result of such tests and / or operations it is determined that the design, rated and / or guaranteed outputs or capacities have not been met because of defect in any material(s) (including machines and equipment) supplied by the Bidder,  
the bidder shall forthwith in consultation with the Engineer-in charge take steps necessary to cause the defect to be identified and rectified, either by replacement of the defected material, machine or equipment or part thereof or by repair or replacement thereof at sole cost and expenses of Bidder.
- e) In the event that certain of the guaranteed performance have not been met, the bidder shall make suitable additions, deletions or modifications, if required after obtaining approval of IOCL/EIL to the process and the Plant to ensure the guaranteed results.

#### 23.0. PROJECT MANAGEMENT

Effective project management within time frame is also a part of the Bidder's scope. The system of organization & control; feedback & corrective measures; communication & project execution scheme to be submitted.


Planning, scheduling and monitoring is essential for timely completion of the project and effective project management system to be adopted as enumerated.

#### 24.0. BATTERY LIMIT CONDITIONS

Feed to the Zero Liquid Discharge Plant shall be from the RO Reject recovery Section of the RODM plant and shall be considered by the Bidder as per ZLD Process requirements.

The outgoing condensate stream shall be sent to the feed collection tank in the RODM Plant as per the process requirements.



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The following utilities shall be supplied at the Common RO-DMP/ZLD Battery Limit:

- Plant Air
- Instrument Air
- MP Steam
- MP BFW
- LP Steam
- Service Water
- Cooling Water
- Drinking Water
- Nitrogen
- Power
- Fire Water

## **25.0. SCOPE OF BIDDER'S WORK/ SUPPLY (ISBL)**

The Bidder's scope of supply of equipment as a minimum shall be as given in this specification, Process Design Basis, Equipment List, Process Datasheets, PFD, P&IDs, and as specified elsewhere in the Tender Document.

All works required inside the battery limit of the ZLDP for treatment including all associated facilities as per tender requirements shall be in bidder's scope of supply.

For all the equipment listed in tender or as required to make the plant complete in all respects to deliver the required quantity & quality of treated products, the Bidder has to supply piping, valves and fittings, instruments, electrical items, consumables, etc. and all other items as indicated in the equipment list, datasheets, P&IDs, PFDs etc., or as required to make the plant complete with respect to safe trouble free operation of the plant.

The proposed Zero Liquid Discharge Plant shall be designed for the conditions as specified in the Process Design Basis documents and as described in the subsequent sections of this specification and as described elsewhere in the Tender Document.

**A deaerator shall be provided before the Multi-effect Evaporator system.**

**The Dryer (ATFD or Pusher Centrifuge) units located at the elevated Technological Structure shall be able to provide for the bottom withdrawal of dried product (salts) into 3 Nos. Salt Storage Sheds. The discharge from each of the Dryer Units shall be conveyed to all Three Storage sheds through Chutes.**


**Bidder has to design the units in complete conformance with the Technical Specifications of the Evaporator and Dryer Unit as indicated in the process datasheets and elsewhere in the tender specifications.**

**The ZLDP shall be controlled from the Common Control Building which shall house the Substation and Control room along with associated facilities for the RODM, ZLDP and CPU Plants.**

The Control system for the ZLD shall be a PLC based Control System. All signals from the Zero Liquid Discharge Plant shall be routed to the Common Control Room with separate Operator consoles for Monitoring and Control.

**All Signals of the ZLDP shall also be repeated in the MCR of the Refinery for Monitoring. The detailed Instrumentation scope shall be as per the Instrumentation Specifications provided in the Tender.**



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**Power for the ZLDP shall be supplied from the Common Substation housed in the Control Building for the RODM, ZLDP and CPU Plants. All Motor Controls shall be located in the Common Substation. Detailed Electrical scope shall be as per the Electrical Specifications attached in the Tender Document.**

#### **Electrical Scope:**

- a) Owner/BHEL shall provide AC, 415V power at incomer of Bidder supplied MCC.
- b) All power & Control Cables from bidder supplied MCC to Bidder's loads are in Bidder scope.
- c) Cable trays from Substation to Bidder's battery limit is in BHEL Scope. **Cable trays will be free issued to contractor at site for installation of contractor battery limits.** Erection of Cable trays with in Bidder terminal point is in bidder scope Only. Cable trays BOQ to be furnished by contractor during detail engineering.. Structural supports for cable trays is contractor scope only with in contractor terminal points.
- d) Complete below ground earthing material is in BHEL scope. **Earthing material will be free issued to contractor at site for installation of contractor battery limits.** Erection of same for bidder supplied equipments with in Bidder terminal point is in bidder scope Only. Earthing material BOQ to be furnished by contractor during detail engineering. Approx.25Meter length to be consider by bidder form nearest earth raiser to Equipment for installation of earthing material.
- e) Redundant UPS power supply shall be provide at one point at bidder's supplied Bidder supplied PLC.
- f) Total illumination, PA/Telephone system, CCTV packages are excluded from Bidder scope.
- g) Bidder to consider all required items/Accessories to complete the package as per IOCL's technical specification.

#### **26.0. Treatment Philosophy**


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

- ZLD Feed Tank and Feed Transfer Pumps
- ZLD Pretreatment Section
- Deaerator
- Evaporator Section
- Dryer Section
- Products (distillate/condensate, concentrated liquor and reject vapors /emissions) Storage and Transfer Facilities
- Cleaning & Dosing Chemicals Handling &Dosing facilities
- Dried Salts handling and Storage Facilities.

The reject stream from the RO-IV system in the RODM plant shall be routed to the ZLD feed storage tanks.

Pre-treatment of the feed stream as required prior to the evaporators shall be provided in the pre-treatment section. Pre-treatment section shall include the following facilities:

- Treatment Facilities for Hardness and Silica reduction from the feed water and making it acceptable for processing in the Evaporator and Dryer units of the ZLDP shall be provided. Lime-Soda Ash Softening process as recommended by the Evaporator / Dryer Suppliers shall

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be provided and all associated facilities as required shall be considered in the scope of the bidder.


- Acid dosing for converting bicarbonates to carbonates before feeding to the Evaporators.
- Any effluent generated from the pre-treatment section of the ZLDP shall be suitably treated within the ZLDP and it must be ensured that NO Liquid Effluent is discharged outside the ZLD Package.
- The sludge generated from the clarifier in the ZLD Unit shall be dewatered through a centrifuge and the solids shall be sent for disposal.
- The Centrate from the Centrifuge shall be partly recycled back to lime soda clarifier and partly utilized for Lime solution preparation and shall return back to the Clarifier as Lime solution dosing
- Additive/Antiscalant dosing to prevent calcium salts depositing on the wall of the evaporator or Dryer / crystallizer units.
- Neutralization for pH correction shall be done if required with Caustic.
- The feed to the evaporator unit from the ZLD feed tank shall be through the Evaporator feed pumps.

### Evaporation Section

Feed at controlled rate (controlled by a flow control valve) shall pass through deaerator, pre-heaters, calandrias and vapor 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 vapor recompression (TVR) to the 1<sup>st</sup> 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 condensate recovery) falling film cum forced circulation evaporators with thermal vapor recompression (TVR) system are envisaged. The No. of Effects for the Multi-effect Evaporator Unit shall be confirmed by the Evaporator Supplier for achieving higher steam economy.** The feed shall be preheated in pre-heaters before going into the 1<sup>st</sup> effect. The circulating brine in the 1<sup>st</sup> 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 vapor separator. The vapors separate from the brine/slurry in the vapor separators. Mesh-pad droplet separators shall be provided to virtually eliminate droplet carry over with vapors leaving the vapor separators.

Vapors from the 1<sup>st</sup> effect vapor separator shall be discharged into the shell side of the 2<sup>nd</sup> effect heating element (where they condense) whereas a part of the vapors (depending upon the bidder's design) may be discharged into the suction of the TVR (The choice of the effect from where vapors for TVR are to be taken shall be made by the bidder on the basis of his optimized design).

The vapors from the 2<sup>nd</sup> effect vapor separator shall be discharged in to the 3<sup>rd</sup> effect heating element and so on. The type (falling film or forced circulation) for each effect shall be as per bidder's design.

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The type of evaporator shall be based on bidder's experience. The unit shall be designed for operation under vacuum. The necessary flash vessels, as require, shall be provided 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 vapors shall be condensed in a surface condenser or any other suitable system.

### **Dryer Section**

The concentrated feed shall then be passed through a Dryer Unit (ATFD or Pusher Centrifuge) so as to remove maximum quantity of salts from feed as a dry product discharge and same shall be disposed of as solids or crystals (having moisture content less than 10%) from the plant. The solids shall be discharged to a dumpster of adequate capacity for further disposal.

### **Cleaning Facilities for Vessels/Equipment**

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) for hot water washing, chemical/acid (HNO<sub>3</sub>) cleaning & high-pressure water jet cleaning shall be provided. Sufficient stand by equipment/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.

Cleaning and flushing arrangements of the equipment shall also be provided in case of power failure.

Effluents generated during the Cleaning cycles shall be collected in a drain sump and transferred back to the ZLD Feed tanks by pumping. No cleaning effluent shall be drained outside the ZLD package.


### **Products (salts/solids, distillate/condensate and reject vapors /emissions) handling, treatment & disposal facilities**

#### **Salts**

The salts/solids coming out of the plant shall have moisture content less than 10% and shall be suitable for its disposal in a secured landfill. The salts generated from the Dryer units shall be conveyed to the Salts storage sheds as detailed in the tender specifications. Necessary Facilities for the same shall be considered and provided by the Bidder as part of the scope. The Salts shall be suitable for packing in bags/drums for transferring to the landfill site.

#### **Emissions/Reject Vapor**

Liberation of polluting/hazardous/toxic gases, if any, shall be treated to suitable limits as per the applicable environmental regulations.

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### Condensate/Distillate

The distillate from the plant shall be condensed, stored and pumped for recycle in the UF Feed Tank in RODM Plant. The ZLD plant shall be provided with condensate collection tanks for the Evaporator and Dryer Units Individually. The condensate from both the condensate tanks shall be pumped to the UF Feed Tank in RODMP.

Adsorption or any other suitable system (if required) shall be provided to treat condensate / distillate to the acceptable limits as specified in the Design Basis document no. B269-475-17-44-DB-1001.

**The Multi-effect Evaporator and Dryer Units as part of the ZLD Plant shall be installed on a technological structure.**

The details of the Tech structure (including No. of Tiers) shall be developed by the Bidder based on the Multi-effect Evaporator and Dryer Unit requirements with adequate space to facilitate smooth operation and maintenance of the Units and the ***structure shall be provided by Bidder.***

***Bidder has to design the units in complete conformance with the Technical specifications of the Evaporator and Dryer Unit as indicated in the process datasheets and elsewhere in the tender specifications.***


### Minimum Instrumentation Requirements for ZLD Plant (Evaporator and Dryer Units)

The ZLD 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.

5 (FIVE) Years CPWMC (COMPREHENSIVE POST WARRANTY MAINTENANCE CONTRACT) to be executed after expiry of the defect liability period with supply of consumables for PACKAGE PLC, ANALYSERS shall be considered by Bidder as per JOB SPECIFICATIONS RWTP, RO-DM, CPU & ZLD PANIPAT REFINERY EXTENSION PROJECT Doc No: B269-475-16-51-SP-8701

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 Bidder. The plant shall have optimized number of instruments & controls, which shall include the following as a minimum 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 and BFW line.

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- Pressure Reduction and De-superheating System (PRDS) along with the required Flow Transmitter, Pressure and Temperature Transmitters and Control Valves. Pressure and Temperature Transmitters at the outlet line of de-superheated Steam from the PRDS shall also be provided.
- 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 Level Gauge.
- For Acid service, the level measurement instruments shall be a Non-Contact type SMART Radar type Level Transmitters. Level transmitter shall be used for local & control room level indication and for corresponding interlocks, tripping purposes (auto trip of pumps and agitators), etc. including low & high levels alarms in the control room.
- All the dosing pumps shall have in built pressure safety relief valves at their respective discharge lines.
- Flow control valve for level control in the Vapor separators and condensate collection vessels shall be provided on the feed flow to various effects.
- Pressure and Temperature control valves as required for the smooth operation and Control of the evaporator and Dryer units shall be provided.
- Temperature Transmitters for feed line, all vapor separators, and cooling water inlet & outlet. Temperature Transmitter (with local and Control room indication with high/low alarm) for measuring temperature for shell of 1steffect. Auto steam shut-off at high temperature shall be provided as per process requirements.
- Vacuum Pressure Transmitters (with local and Control room indication with high/low alarm) and vacuum gauge on all vapor separators.
- One Level Transmitter and one Level gauge on each vapor separator.
- 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 and Outlet line in the pre-treatment section of the ZLD Package shall be provided. All analyzers shall be provided with local and control room indication with high alarm. Analyzers shall be located in the Analyzer room in the Chemical House / RO Building.
- Additional instrumentation, Controllers and Analyzers as required for smooth, trouble free and safe operation of the plant and as per supplier's system design shall be provided.



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**Online Analyzer Requirements for ZLD Plant (Evaporator and Dryer Unit)**

- Conductivity Analyzer at ZLD Feed Tank outlet.
- pH, Silica, COD and Conductivity Analyzer at the Inlet Feed Line to Evaporator Unit (Downstream of the Pre-treatment section).
- pH and Conductivity analyzer at the Condensate outlet headers from the Evaporator and Dryer Units to UF Feed Tank.


All other analyzers as indicated elsewhere in the tender, P&IDs, Drawings, Document shall also be included in the Bidder's scope of work.

**GENERAL DESIGN & ENGINEERING REQUIREMENTS**

- Line Size Criteria to be based on following pipe/line velocities:
  - Pump Discharge: 2.0 m/sec (maximum)
  - Pump Suction: 1.2 m/sec (maximum)
  - Gravity Lines: 0.8 m/sec (maximum)
- Piping class shall be as given below for the indicated services. Corresponding material shall be as per EIL Piping Specifications.

Service	Piping Class
RO-IV Reject to ZLD Package	A71V/B71V
ZLD Feed Tank up to Pre-Treatment Section Outlet	A71V
Pre-Treatment Outlet to Evaporator Feed / Concentrated Liquor Lines and up to Dryer Unit Inlet	A71V (IH/IS)
Steam Condensate	A1A-IH
Vapor Lines in Evaporator / Dryer Unit	A1A-(IS/IH)
ZLD Package outlet to UF Feed Tank in RODM plant	A1K
Chemical Sludge	A9A
Dewatering Polyelectrolyte (DWPE)	A1K
Lime	A91S
Coagulant	A91S
Polymer	A91S
Morpholine	A1K
Antiscalant	A91S
Anti-foam	A91S
Cleaning Chemicals	A91S or Superior PMS
Nitrogen	A3A

For all incoming lines, same class of piping, as available at the Plant battery limit, shall be used up to their respective first unit. Material, for services not listed here, shall be subject to EIL's review and approval during engineering.

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**In case, different material & line size is specified in the tender drawings (Schematic Flow Diagram, PFDs, P&IDs, etc.), the material & line size specified in the drawings shall be provided as a minimum.**

**Other PMS for lines shall be as per the RODM specifications document no. B269-475-17-44-SS-1001**

Following types of valves shall be used for the Indicated Services:

Service	Valve Type
Effluent Lines/Treated water lines	Gate & Globe Valve/ Butterfly Valves
Conc. Hydrochloric Acid	Ball Valve
Caustic Solution Lines	Plug Valve (Lubricated)
Chemical Solution Lines	Ball Valves / Diaphragm Valves
Sampling Lines	Gate followed by Globe Valve

Other type of valves such as Check Valve (NRV), Control Valve etc. shall be provided, wherever required. Isolation valves shall be provided in each unit as per the valve specs. MOC of the valves shall be compatible with MOC of the pipe.

Spectacle blinds shall be provided downstream of all tank drain lines as well as at other main isolation places, wherever required.

Piping components and its type shall be provided, as appropriate, which shall be subject to EIL's review and approval during Detailed Engineering.

All Butterfly Valves shall be tight shut-off valves.

Valves shall be provided as per the P&IDs.

- For a full liquid system at the discharge of centrifugal pumps/blowers, the design pressure shall be as under.

$$P(\text{des}) = P(\text{max}) \text{ suction} + \text{DELTA } P(\text{max})$$

where,

$P(\text{max}) \text{ suction}$  = Maximum pressure at suction vessel bottom during suction system relieving conditions.

$\text{DELTA } P(\text{max})$  = Pump differential pressure at pump shutoff head with maximum operating density. If not known:

$\text{DELTA } P(\text{max}) = 1.2 \times \text{DELTA } H \times \text{Density}(\text{max})$ : constant speed pump

$\text{DELTA } P(\text{max}) = 1.1 \times 1.2 \times \text{DELTA } H \times \text{Density}(\text{max})$ : variable speed pump


$\text{DELTA } P(\text{max}) = 1.3 \times \text{DELTA } H \times \text{Density}(\text{max})$ : high head multistage pump

$\text{DELTA } P(\text{max}) = 1.3 \times 1.1 \times \text{Del } H \times \text{Density}(\text{max})$ : variable speed high head multistage Pump

Where, DELTA H is the pump head at rated condition

- For a full liquid system at the discharge of positive displacement pumps, the design pressure shall be the higher of:




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$$P(\text{des}) = P(\text{rated}) \text{ discharge} + 2 \text{ kg/cm}^2$$

$$P(\text{des}) = 1.1 \times P(\text{rated}) \text{ discharge}$$

- Vessels operating under vacuum shall be, in general, designed for an external pressure of 1.033 kg/cm<sup>2</sup>abs and full internal vacuum, unless otherwise specified.
- All the pumps which are to be located below FGL shall have a suitable pump house building having RCC construction below FGL and RCC lintel and brick masonry work above FGL. All pump pedestals shall have arrangement for collection of leakage and connection to the nearest drain. Edges of pump pedestals in pump house shall be kept in one line on pump motor side so as to render clear walkway. The clear distance between adjacent pump/blower pedestals shall be minimum 900 mm. Minimum clearance of 500 mm shall be provided around pumps / blowers / equipment pedestal for paving, etc. applicable guidelines shall be followed for the minimum clearances between the adjacent equipment/pumps/blowers etc.
- Common delivery header and suction header of pumps (and blowers) shall be provided with a blind flange on one end. Recirculation lines for the pumps shall be provided by the vendor as indicated in the tender PFDs / P&IDs and also shall be provided as per process requirements/ turndown requirements.
- All working & standby pumps (including warehouse/store standby) shall also be provided with the respective motors. All motor shall have running indication in control room. Motors of all pumps and blowers, if not housed under shed/room, shall be covered with canopy. Suction line/filter of blowers shall also be provided with canopy.
- Rated capacity of all the blowers shall be minimum 10% more than the normal process requirements. Also, head of all the pumps (except RO high pressure pumps) shall be minimum 10% more than the total calculated head (including static head and losses in pipes, fittings, instruments, etc.) based on normal process requirements. All sets of rotating equipment viz. pumps, blowers, compressors, etc shall be provided with at least one standby of same capacity as the operating equipment.
- Chemical dosing pumps shall be designed to cater for minimum to maximum hydraulic requirements. All chemical dosing pumps shall be provided with pressure safety valves and pulsation dampeners on individual pump discharge. All chemical handling pumps shall have permanent flushing connection (inlet and outlet).
- All pumps shall be flooded suction type, unless otherwise specified, fully primed under Low Liquid Level in the suction sump/ tank. Also, for all pumps with flooded suction, LWL in the tank/sump shall be above the top of pump casing.
- Access to the platform shall be by ladders. Access shall be by staircase if unit requires frequent attention of operating personnel. Approach & platform shall be provided wherever adjustable weir, instruments, measuring scale, etc. are kept. Adjoining units shall be connected with operating platform (with Hand-railing).
- Lifting Arrangement and all Necessary Facilities for Lifting of the Calandrias in the MEE and Other Maintenance in the MEE and ATFD Units shall be provided and considered in the bidder's scope of supply.
- Monorail and Section pulley block (Manually operated) shall be provided for all pump houses, blower sheds, etc., of adequate capacity (minimum 1.1 times the weight of heaviest equipment).

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Drop-out platform (minimum 1.5 m wide) shall be provided. Monorail shall be extended outside the Pump houses/sheds/ buildings to facilitate loading / unloading equipment directly on vehicle, for which ramp approach shall be given. Vehicular approaches shall be provided to units wherever required from maintenance / operation point of view.

- Vehicular approaches shall be provided to units wherever required from maintenance / operation point of view.
- Vehicular approach for the salts storage sheds with proper ramp / movement spaces.
- The Equipment Layout shall be prepared such that all units are accessible for routine maintenance/repair. It shall also facilitate convenience for regular monitoring of units by operating staff.
- Draining arrangement shall be provided for all units/equipment, as necessary.
- Sampling points shall be provided for each treatment section including adequate sampling points for measuring water quality at intermediate points and chemical solution concentration.
- All piping, instrumentation, electrical and other mechanical works as necessary are in Bidder’s scope.
- Sizes/specifications as given in various datasheets of the tender are minimum requirements, which are to be followed by the bidders as a minimum. Higher sizes, if process design demands, shall be provided by the bidders at no extra cost to IOCL. These are part of the detail engineering review/approval by EIL.
- Type and minimum size of manholes (for pressure vessels, tanks, covered sumps, underground sewer etc.) shall be as per EIL standards. All vessels with a bottom manhole shall have a clear height of 1.2 m below the manhole elevation.
- The specifications/requirements are bare minimum only. The vendor shall follow good engineering practices and incorporate maximum operational flexibility in the system.



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### FORMAT FOR CHEMICAL AND UTILITY CONSUMPTION FIGURES

All Utilities & Chemicals Consumption shall be listed by ZLDS which is envisaged to be used in ZLD Plant for Normal Operation as well as for start-up / shutdown requirements.

#### Maximum Consumption Figures for Utilities in ZLD Plant

Description of Utility	Unit	Hourly Rate (Max.)	Maximum Consumption Figure/ day (1 Day = 24 Hours)
Power	kW		
Service Water	m <sup>3</sup> /hr		
Drinking Water	m <sup>3</sup> /hr		
Plant Air	Nm <sup>3</sup> /hr		
Instrument Air	Nm <sup>3</sup> /hr		
Nitrogen	Nm <sup>3</sup> /hr		
MP BFW	Kg/hr		
MP Steam	Kg/hr		
LP Steam	Kg/hr		
Cooling Water	m <sup>3</sup> /hr		
Fire water	m <sup>3</sup> /hr		
Any Other			

#### Maximum Consumption Figures for Chemicals in ZLD Plant


Description of Chemical	Dosing Rate in ppm (Normal / Design)	Consumption in kg/d at Design Flow	Purity of Chemical	Solution Strength
Hydrochloric acid (HCl)				
Caustic (NaOH)				
Soda Ash				
Antiscalant				
Lime				
Anti Foam				
Nitric Acid				
Cleaning Chemicals				
Any Other Chemicals				

#### Notes:

MSDS for all the chemicals are to be provided by the Bidder.

Chlorine gas and H<sub>2</sub>SO<sub>4</sub> should not be used in the plant.

All Utilities & Chemicals Consumption shall be listed individually and separately for each Plant which are envisaged to be used in RWTP, RO-DMP, ZLDP & CPU for Normal Operation as well as for start-up / shutdown requirements.

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## LIST OF ENCLOSURES

All works as per following enclosures (IOCL's Tender Documents) are part of bidder's scope of work/supply:

Sl. No.	Document No.	Document Title
1.	B269-475-17-44-DB-1001	Process Design Basis
2.	B269-475-17-44-0101	Schematic Flow Diagram (2 Sheets)
3.	B269-475-17-44-1001	Equipment Layout
4.	B224-475-17-44-EL-1002	Equipment List
5.	B269-475-17-44-1144 to 1145	P&IDs
6.	B269-475-17-44-DS-2001 to 2022	Datasheets
7.	B269-472/475/476-17-44-VDR-1001	Vendor data requirement (Plot Plan & Water)
8.	B269-472/475/476-17-44-TC-1001	Technical compliance (Plot Plan & Water)
9.	B269-472/475/476-17-44-SS-1002	Pre-Commissioning, Commissioning and P.G. Test Guidelines
10.	B269-475-17-44-SS-1001	Scope of supply / works for ZLD
11.	B269-472/475/476-17-44-SS-1003	Operation & Maintenance
12.	B269-999-81-41-EDB-1001	Engineering Design Basis (Civil)
13.	B269-999-16-50-EDB-1001	Engineering Design Basis (Electrical)
14.	B269-999-16-43-EDB-1001	Engineering Design Basis (Piping)
15.	B269-999-16-42-EDB-1001	Engineering Design Basis Static & Machinery (Rotating Equipment)
16.	B269-475-16-50-SP-8701	Job Specification-Electrical
17.	B269-475-16-51-SP-8701	Job Specification-Instrumentation

\*In case any Enclosure missing/required date not available bidder to communicate to BHEL and obtain confirmation/required data.

**No deviations (technical / commercial) to the requirements as stated in IOCL's Tender Documents, BHEL's Enquiry Documents (Tech Spec, GCC, SCC, Price Bid Format, MOUs etc) will be accepted.**

**Any deviations / alternatives indicated as part of Bidder's Offer in any form will not be considered.**

**Bidder to furnish the signed, stamped copy of BHEL's Enquiry Documents (Technical Specification, important IOCL Tender Extract enclosures, GCC, SCC, Un-Priced Price Bid Format, MOU formats etc) as part of Technical Offer.**

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