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NFL
नंगल इकाई
NANGAL UNIT

**ANNEXURE-I**

## TECHNICAL SPECIFICATION:

Complete Process & Mechanical Design, Engineering, manufacturing, supply, commissioning of Urea Synthesis Reactor including High efficiency Trays and bought out components, hydro test, commissioning and two years mandatory spares, bolt tensioning device, special tools /tackles, delivery/unloading at NFL Nangal site.

## TECHNICAL SPECIFICATION:

This annexure comprises of following documents for reference:

| Sr. No | Title | Document No. |
|---|---|---|
| 1. | Data sheets of existing reactor | Data sheet NO-:OP-3090 |
| 2. | Reference Drawing of Exiting Reactor | NG-928, NG-238, NG18401, NG 559, NG 1538 |

**Notes:**

1) Similar One to one equipment shall be supplied, for the replacement of the existing urea reactor of Urea Plant at N.F.L. Nangal unit on existing foundation.
2) In order to minimize piping modifications, the location and orientation of the inlets and outlet nozzle shall be maintained as per existing urea reactor.
3) The new urea reactor will be installed on the foundation of the existing urea reactor. In order to minimize foundation modifications, sizing, location and orientation of the foundation plates, platform & structure shall be maintained to match with the existing urea reactor.
4) All critical dimensions like nozzles orientation, height, weight of the urea reactor, fitment of flanged joints, location and size of the foundation bolts shall be governed by existing urea reactor dimensions, such that no modifications are needed in piping, foundation, existing stair-case and various mountings. Hence complete one to one interchangeability with the existing reactor to be ensured and certificate to this effect will be issued by the manufacturer.
5) MOC of Liner, High efficiency trays and other internals for supplied reactor shall be SA 240 GR 310MoLN (UNS-S31050)/Safurex/ DP28W.
6) Reactor supplied with Liner Thickness less than 6 mm will be rejected.
7) Party shall guarantee steam saving over the GTR steam consumption in Urea Plant (Steam consumption to be measured at 33 ATA steam battery limit (FR-07)). Specific steam consumption at Urea plant is 1.011 MT/MT of Urea (excluding hydrolyser steam consumption) as per GTR report for revamped urea plant (2001). During evaluation of bids, the offer will be loaded for steam consumption as per annexure-IX.

## Bidder's scope of supply shall be as follows and price shall include the following:

### 1.0 SCOPE

This requisition covers the requirements for Process design, Mechanical design, Engineering, Materials, Fabrication, Inspection, Testing, Packing and Supply & commissioning of Urea Reactor along with accessories & spares as per applicable codes and standards for National Fertilizers Limited, Nangal unit.

### 1.1. Items to be supplied

The equipment listed below shall be supplied in accordance with the requirements specified in this requisition and the related documents as described in references:

| Sr. No | Item Tag No. | Equipment Name | Required Quantity (In No.) |
|---|---|---|---|
| 1. | 10-R-1/N | Complete Process & Mechanical Design, Engineering, manufacturing, supply, commissioning of Urea Synthesis Reactor including High efficiency Trays and bought out components, fabrication including assembly/ sub assembly at shop, NDT, inspection, testing at manufacturer's works, hydro test, commissioning and two years mandatory spares, bolt tensioning device, special tools /tackles, delivery/unloading at NFL Nangal site along with followings:<br>a) Technical specification of Reactor is as per Annexure I<br>b) Scope of supply of complete reactor is as per Annexure II<br>c) Inspection/Testing during construction, fabrication erection plan and TPIA scope is as per Annexure III<br>d) Drawing and documentation of complete supply & commissioning shall be as per Annexure IV.<br>e) General Information (General Technical requirement, inspection, commissioning and two years mandatory spares, G/W, process performance Guarantee, packing etc.) as per Annexure V.<br>f) Technical data of existing Urea Reactor shall be as per Annexure VI<br>g) Design basis shall be as per Annexure VII<br>h) Process performance Guarantee shall be as per Annexure VIII<br>i) Evaluation and comparison of bids & price reduction clause shall be as per Annexure IX<br>j) Performa of Quoting Rates as per Annexure X | 01 |

### 2.0 SCOPE OF SUPPLY:

2.1 Complete process design.

2.2 Complete Mechanical design.

2.3 Design code for fabrication of the reactor will be ASME: Section -VIII Div-2(latest version) or equivalent applicable IS Standard.

2.4 Vendor can quote in equivalent applicable IS code/standard against foreign code/standard specified elsewhere in tender.

2.5 Detailed engineering including preparation of fabrication drawings.

2.6 Procurement of raw material. Fabrication, stage wise inspection, testing, seaworthy packing, forwarding, transportation and guarantee of the reactor as per applicable codes and standards.

2.7 Pickling of all S.S. surface.

2.8 Bidder shall supply and install high efficiency trays etc. at party's workshop.

2.9 Supply of commissioning spares, two year mandatory spares and tool & tackles requirement (as per annexure-V).

2.10 Design and supply of earthing lugs, lugs for platform, ladders and piping support, lugs for fire protection, lifting and tailing lugs for equipment and manhole cover, Insulation supports, riser pipes & nozzles etc., along with the supply of equipment.

2.11 Vacuum based efficient leak detection system with alarm in control room shall be provided.

2.12 Thermo well at top and bottom with thermocouples and TI (Thermo indication) point for shell temperature along with its thermocouples as per process licensor design.

2.13 Application of primer and protection of all external surfaces. (As per Annexure-V)

2.14 Design and supply of transportation saddles and extension pieces for multi modal transportation.

2.15 Supply of companion flanges, gaskets, bolting with spares, Protection sleeves/Caps for studs, Lifting lugs, foundation bolts and nuts, davit for top manhole cover.

2.16 Submission of monthly progress report, bar charts, planning and scheduling of all activities for completion of entire job.

2.17 Supply of installation, erection plan and transportation procedures.

2.18 Performance (Process and Mechanical design) guarantee as per Annexure VIII.

2.19 Hydraulic Bolt Tensioner shall be supplied.

2.20 Compliance to all statutory requirements.

2.21 Any other requirements specified in N.I.T. or required for safe & smooth operation of Equipment.

2.22 Commissioning Spares

2.23 Two years mandatory spares.

2.24 Filler wires and Electrodes.

2.25 One sample of Liner (Approx. one square meter area) for N.D.T. instrument calibration.

2.26 Installation and Erection of Urea Reactor shall be in NFL scope. However, Transportation upto NFL Nangal Site, unloading at NFL Nangal Site, Commissioning and Startup supervision shall be in party scope.

2.27 List of Commissioning Spares, special tools & tackles and operating spare to be enclosed and cost included in base price.

2.28 Vendor shall provide sea worthy packing and pressurized dry N2 filling for equipment with N2 cylinders, valves and reducers and pressure gauges to maintain the nitrogen pressure during transportation.

After completion of all testing and inspection, the inside of complete equipment shall be thoroughly drained and dried out. Equipment shall be completely dried by passing air for sufficient time until no further increase in relative humidity of outgoing air is observed. After drying, the equipment shall be purged and filled with dry N2 at suitable pressure. The equipment shall be provided with pressure gauge to monitor N2 pressure and ½'' non-return valve. All threaded holes other than telltale holes for testing shall be suitably protected with steel bar plugs. All nozzles not provided with blind flange shall be provided with steel covers, temporary gaskets and bolts. All external surfaces shall be properly protected/covered.

Annexure-III

## Inspection & Testing:

1) Inspection and testing of the reactor shall be conducted in accordance with process licensor standard and specifications referred in the enquiry.
2) **SCOPE OF PROCESS LICENSOR:** Item shall be supplied under the basic engineering design and Inspection of Process Licensor for urea fluid/process parts as per scope given hereunder:

**2.01) During the construction of the Urea Reactor:**

- Review of drawings executed by Process Licensor. Process Licensor will verify the compliance "from the process standpoint as well as Mechanical " with Process Licensor's prescriptions of the following aspects:
  - general arrangement
  -material in contact with process fluid
  -lay-out of internals and weep-holes/vent tube/vent holes
  - Inside layers(shell +Liner) connections
- Review of welding book (WPS and PQR) documents and other fabrication and inspection documents executed, including verification the compliance and Process Licensor's prescriptions. Review of Quality Control Plan, N.D.E. procedures, Fabrication Sequence Plan. Inspection and tests shall be attended by Process Licensor at the place fabrication to the extent that to verify that the reactor procured by NFL are in compliance with the Process Licensor's process requirement.

**2.02) inspections (As per process licensor standard):**

- Material testing as per applicable codes and standards
- Radiography and other NDT Tests
- Hydrostatic test .
- Pnumatic test.
- Helium test on Liner welding (lining welds).
- D.P.I. of S.S. welds and surfaces.
- Any other test required by the applicable codes and standards as per the process licenser e.g. corrosion resistance , mechanical strength of the liner material.
- Examination of manufacturer tests book.

3) The equipment shall be manufactured under Third Party Inspection of M/s Lloyd's / BV/TUV/PDIL/EIL. The equipment is to be inspected by third party at all stages of manufacturing starting from the material identification up to final completion at bidder's shop as per agreed Quality Assurance Plan. It shall be the responsibility of the vendor to arrange the third-party inspection agency.
4) It shall be the responsibility of the vendor to make available the drawings, design calculations and other documents to the inspector. All bought out items shall be procured under third party inspection as applicable.
5) It shall be the responsibility of the Vendor to take all necessary statutory approvals during the manufacturing and testing at manufacturer's works.

6) Final QAP prepared shall be submitted and approved by the Process Licensor, TPI and NFL prior to manufacture.

7) Weld procedure shall be qualified for Liner and shell joints. Mock-up test shall be carried out to establish all the requirements to the satisfaction of Process Licensor.

8) Chloride content in water used for hydrostatic testing shall be as per process licensor norms for CS and low alloy steel equipment. Duration of test shall be as per applicable codes & standards. Test medium/water shall be tested for the chlorine contents before filling the equipment. The temperature of test water shall comply with requirement of Fabrication code.

9) The following NDT requirements are mandatory in addition to codes, standards and specifications of the NIT:

i) Ultrasonic (UT) examination.

ii) UT examination of FPW of nozzle attachments.

iii) UT examination of all forgings.

iv) MP/DPT examination of :

a) All edges of plates and opening in shell having all sizes.

b) Root and final layer of all butt welds.

c) All weld surfaces after PWHT

d) All forgings after machining

e) All fillet and butt weld after hydro testing

f) Each pass of Liner, cleats and TSR joint

g) Knuckle surfaces of dish ends.

10) All nozzles, if fabricated from plates, shall be 100% radiographed.

11) Weld and heat affected zone of all pressure welds shall be tested for hardness after heat treatment. Hardness value shall be as per standard.

12) All nozzle reinforcing pads wherever applicable shall be tested pneumatically at 0.5 Kg/cm2g pressure with soap solution on attachment welds. Vent holes shall be plugged with non-hardening mastic to prevent ingress of water.

13) Hydrostatic Test of Complete Equipment.

14) Pre-dispatch inspection is required for the witness of hydraulic test by NFL. Party will dispatch material after inspection clearance.

15) Vendor shall send copies of correspondence with TPIA regarding the inspection and shall furnish the monthly progress report to NFL.

16) **SCOPE OF TPIA:** The third Party Inspection Agency shall be responsible for ascertaining and confirming in writing that the completed equipment meets the requirements of approved drawings / specifications by issuing final acceptance certificate. Scope of third party inspection shall include but not limited to:

**A) For Raw Material.**

i) Approval of Inspection Program.

ii) Verification of Heat Treatment Records

iii) Verification of NDT records / certificates e.g. RT / UT / MP / PT / hardness, etc.

iv) Verification of Material Test Certificates for Mechanical and Chemical Properties and material identification.

v) Verification of hydraulic tests of Reactor.

vi) Checking of dimensions for conformity for bought out items.
vii) Witness of Stamping of materials and marking transfer.
viii) Witness of mechanical tests of pressure retaining parts.
ix) Witness of NDT of pressure retaining parts.
x) Visual Inspection.

**B) For Fabrication of Urea Reactor:**

i) Approval of Inspection Program.
ii) Approval of Manufacturer's Drawings and Design Calculations. These shall be submitted for approval to NFL also.
iii) Approval of Heat Treatment Procedures
iv) Approval of Welding Procedures Specifications and PQR.
v) Approval of NDT Procedures
vi) Review of test procedure for Chemical, Mechanical and Hydro test.
vii) Verification of WPS & PQR records.
viii) Verification of Heat Treatment Records
ix) Verification of NDT records / certificates e.g. RT / UT / MP / PT / hardness, etc.
x) Verification of Material Test Certificates for Mechanical and Chemical Properties and material identification.
xi) Verification of Conformity between actual material supplied and material / mill certificates (for material used in pressure retaining parts including bolts and nuts) and construction code & specification.
xii) Witness / Approval of Edge Preparation and fit-up.
xiii) Witness of Radiographic examination.
xiv) Visual Inspection.
xv) Witness and approval of ultrasonic examination, MPT after PWHT, MPT after hydrostatic test, LPT after hydrostatic test.
xvi) Verification of hardness tests of welds.
xvii) Approval of Inner and outside surface of welds
xviii) Checking of Liners and shell segment joints.
xix) Witness and verification of DPT of Liners and shell segment joints.
xx) Approval of Dimensions including nozzle orientations.
xxi) Approval of Surface preparation and cleaning.
xxii) Witness and approval of Pneumatic and Hydrostatic test of complete equipment Liner and shell segments including circumferential measurement.
xxiii) Issue of release Note.

19. NFL, at any stage, may send its representative for inspection at vendor's shop.
20. Vendor shall provide all assistance for such inspections and NFL shall have free access for such inspections at vendors shop.
21. **In addition to TPIA scope, NFL's scope of inspection shall be as below:**

i) Approval of Quality Assurance Plan.
ii) Manufacturer's drawings shall be approved by Process Licensor & drawing may be submitted to NFL.
iii) Witness of some stages of fabrication.

iv) Witness of Liner and shell leak test.

v) Witness of hydrostatic tests of complete equipment. Party will dispatch material after inspection clearance from NFL.

**22. Following Test Certificates, duly certified by Third Party Inspection Agency are to be submitted:**

i) All the Material test certificates for physical, mechanical and chemical properties, metallographic examination, heat treatment records, pressure testing certificates, all NDT reports, etc. duly certified by the above inspection agency, of each part as per applicable standards, are to be submitted.

ii) WPS, PQR and Design calculations.

iii) Hydraulic Test Certificate of Complete Equipment.

iv) Dimensional Check report

v) Inspection release note from third party inspection agency is to be submitted before final dispatch of equipment

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**ANNEXURE-IV**

## The following drawings/documents shall be furnished by the bidder.

1. Process data sheet for new reactor.
2. Mechanical design calculations including wind & seismic analysis of equipment.
3. General arrangement drawing indicating design data, fabricated equipment weight, general notes, nozzle schedule, detail of shell and liner, heads, supporting arrangement, details of high efficiency trays, main weld seams, nozzle orientation plan, cutting layout etc.
4. Shell and liner details
5. Detail of nozzles.
6. Details of gaskets
7. Detail of anchor bolt/supports
8. List of spare parts with details
9. Details of bought out items with the name of supplier.
10. Manufacturer's data report
11. Reactor detailed drawings and parts list
12. Procedure for pickling & passivation (for ss items only)
13. Inspection and testing plan
14. Welding procedures and qualification test reports
15. Destructive and non-destructive test reports
16. Material test certificates
17. Weep hole test reports.
18. All the test certificates required as per applicable codes and standard including metallographic examination, ferrite test report for all the bought-out liner material.
19. Radiographic examination reports with films.
20. Heat treatment procedure and time temperature charts code certificates (including inspection certificate, hydrostatic test certificate, local code requirements, rubbing of code stamp and name plate etc.)
21. Packing and forwarding instructions
22. Erection & installation procedure
23. Design and detail of testing accessories.
24. Transportation & Storage procedure.

**Notes:**

1. All technical documents shall be in English language and in Metric (SI) system.
2. The supply of documentation shall include all the technical documentation needed for the design, fabrication, examination, acceptance, transport, site storage, erection plan, commissioning, chemical cleaning, start-up, operation, maintenance and repair of all parts included in this purchase order.
3. Detailed fabrication drawings shall be prepared by vendor clearly indicating all design data, nozzle data, details of all parts with tolerances, all welding joints details and detailed bill of materials etc. Location of weld seams, construction notes, welding processes, detailed

specification of electrodes including NDT tests etc. as applicable shall be clearly indicated in the drawing. Fabrication drawing shall also indicate Empty Weight, operating weight & hydro test weight of the equipment. Drawing submitted for approval must be complete in all respects and thoroughly checked and approved by vendor's competent authority before submitting to NFL/Third Party Inspection Agency.

4. Drawings may be drawn in AUTOCAD to scale. Manual drawing shall not be accepted.
5. All documents / drawings shall be in English language and in Metric system. Further the following documentation shall be submitted by Bidder for review & approval as per NFL's requirement besides other documentation listed elsewhere.
6. 4 sets of hard copies of GA drawing, design calculation, procedures, etc with soft copies (pdf format) to NFL for review.
7. 8 sets of hard copies of all final documents such as design calculations, fabrication drawings, test certificates, material test reports, repair procedure along with the reproducible copy. The final documents shall also be submitted in soft copy in pdf format. Hard copies etc. shall be properly arranged, indexed and bound in one folder and submitted to N.F.L.

ANNEXURE-V

**General Information (General Technical requirement, inspection, commissioning and two years mandatory spares, G/W, process performance Guarantee, packing etc.):**

**1. SCOPE**

Process licensor to furnish the detailed process data sheet and design the Urea Reactor on basis of the following process data:

| S. No | Operating Parameter | Value |
|---|---|---|
| 1 | Normal operating pressure | 220 [bar] |
| 2 | Normal operating temperature | 188-198 [°C] |
| 3 | CO2 conversion | 53-55 [mol/mol] |
| 4 | Design temperature | 200 [°C] |
| 5 | Design pressure | 235.36 [bar] |
| 6 | Cylindrical volume | 50 [m3] |
| 7 | Internal diameter | 1376 [mm] |
| 8 | Total length | 33350[mm] |
| 9 | Cylindrical length between tangent lines | 32260 [mm] |
| 10 | Net weight (Empty) | 145 Ton |
| 11 | Net weight (Filled) | 195 Ton |

**2. GENERAL**

2.1. The new urea reactor will be installed in place of the existing one. In order to minimize piping and modifications, the location of the nozzles shall be maintained as per existing Urea Reactor.

2.2. The new Urea Reactor will be installed on the foundation of the existing Reactor and the weight of new supplied Urea reactor shall not exceed the existing weight of Urea Reactor i.e. 145 Ton.

2.3. The Units of measurement applied for the project will basically comply with SI.

2.4. Vendor shall be responsible for complete design/analysis of equipment and its components (either pressure or non-pressure parts) including internals, to meet the design codes and design requirements indicated in the documentation listed in requisition and guarantee the equipment stability.

2.5. All standard sourcing of raw material / Bought out items is restricted from authorized vendors of the process licensor.

2.6. All welded externals shall be supplied by vendor in accordance with the details furnished by Licensor.

2.7. Lifting and retention lugs shall be adequate for lifting the equipment including external insulation and accessories, which will be assembled before equipment's erection. The Supplier shall be responsible for the detailed design and fabrication of the lifting supports for equipment erection and their parts. The Supplier shall design

the equipment for handling and erection loads with a minimum overload dynamic coefficient of 1.5.

2.8. Equipment local load analysis shall be carried out for all process nozzles on shell as considering external piping loads. Loads on nozzles shall be as per applicable Process Licensor's specifications.

2.9. All Carbon Steel outer surfaces shall be blast cleaned and apply two coats of inorganic Zinc Rich primer having 25 micron thickness of each coat. Painting of skirt with one coat 25 micron inorganic zinc rich primer and two coats 25 mm micron of epoxy paint.

2.10. All process side Nozzles are to be supplied with companion flanges along with spool piece along with threaded Nozzles, MOC of Spool piece and gasket shall be compatible to Carbamate services. Pickling of all SS surfaces

2.11. All man ways shall be provided complete with blind flange, bolting and gaskets.

2.12. All gaskets shall be with asbestos-free compound.

2.13. Site Data (Wind and Seismic Design)

2.13.1 WIND LOAD REQUIREMENTS

Design of equipment including anchor bolt shall be carried out considering Wind Load as per Indian Code IS-875 (latest edition).

2.13.2 SEISMIC REQUIREMENTS:

The plant structures must be designed for design basis earthquake (DBE) as per the design spectra given in IS: 1893 (Part-IV)-2205

2.14. Bracket/Saddle support shall be of MOC same as shell base metal.

2.15. Equipment support shall have total corrosion allowance as per applicable code.

2.16. For Equipment supports, the Unity stress check shall have at least 10 % margin.

2.17. Sizing of anchor bolts shall be done by Supplier.

2.18. Vendor shall conclude and submit anchor bolts calculation report with foundation loads table within 6 weeks from placement of LOI. Maximum Permissible stresses in mild steel bolts (anchor bolts) shall be as per IS: 1367-1967.

2.19. Foundation loading and foundation load plan shall be provided by vendor for erection condition, hydrotest condition, operating conditions etc. Vendor shall confirm the adequacy of existing foundation. Furnished load shall also take into account seismic and wind condition along with factor of safety as per standard engineering practice. All the necessary loads and moments on the foundation shall be calculated and furnished.

2.20. Gaskets used for hydro testing of equipment shall be of the same specification as service gaskets. Gaskets used for hydrotest shall be used for actual hook up.

2.21. Design and supply of transportation saddles and extension pieces for multi modal transportation of equipment up to site is in scope of vendor. Additionally design and supply of stools required for unloading of equipment from trailer is also in vendor's scope of supply. Transportation saddles including extension pieces and stools shall not be returned back and the same shall be included in base price.

Vendor shall include in the supply transportation saddles for equipment. For marine transportation number and size of the temporary saddles shall be define by vendor. While transporting completed equipment; fabricator shall provide suitable type and no. of supports so that no deformation of any part of the equipment takes place.

Finalization of numbers and dimensions of transportation saddle shall be based on reconciliation with transportation agency being mobilized at the time of execution for both the locations i.e. at vendor's works and site. Accordingly, dimensions of extension pieces and stools shall be finalized. Equipment vendor to consider the same and include the same in base price.

2.22. Vendor shall exercise utmost care during loading/unloading of equipment so that no damage to any part of the equipment occurs.

2.23. Vendor shall ensure packing shall be as per process licensor's standard.

2.24. Torque values required for tightening of bolts shall be specified in vendor drawing/documents by vendor. All stud bolts shall be of increased length and suitable for tightening with hydraulic bolt tensioner. Studs shall be longer than normal by minimum 1 nut diameter.

2.25. Vendor shall furnish detailed procedure for transportation, storage, installation & erection of equipment.

2.26. No welding is permitted after post weld heat treatment. Add this note on equipment fabrication drawings. The equipment shall be clearly marked "POSTWELD HEAT TREATED. DO NOT BURN, WELD OR HAMMER".

2.27. All welded internals shall have continuous full penetration welds.

2.28. The Minimum Design Metal Temp (MDMT) shall be indicated on vendor's drawings.

2.29. **BOLT TENSIONER**

Vendor to supply hydraulic bolt tensioners with attachments of different sizes required for Urea Reactor. Fabrication drawings must include a table for each size of bolts indicating load required by bolt tensioner. Bolt torque calculations shall be submitted to NFL for information.

## 3. INSPECTION

All materials including those used for internals shall be procured with stage-wise inspection.

Stage wise and final inspection of equipment including all components and internals shall be carried out by third party inspection agency. All costs towards TPI inspection shall be borne by vendor and Quoted price shall include the same.

Acceptable third-party inspection agencies are LRIS/BV/TUV/PDIL/EIL.

Vendor shall allow and provide the process licensor all the facilities required for the inspection job.

## 4 SPARES

Vendor shall supply following as erection, commissioning and maintenance spares in addition to the installed fastener and gaskets. Cost of commissioning spares (as per 4.1) shall be included in the base price. Party is required to quote separately for two years Mandatory spares (as per 4.2) and commissioning/startup supervision charges (as per 4.3)

4.1 Spare parts for commissioning

- 200%gaskets for nozzles
- 10% bolts and nuts for nozzles
- 200% of manhole cover gasket

- One sample of Liner (Approx. one square meter area) for N.D.T. instrument calibration.

4.2 Two year mandatory spare.

- 400% service gaskets for nozzles
- 2 sets of bolts and nuts for nozzles and internals
- 200% of man hole gaskets
- 20kg of Weld consumable i.e. (10kg 2.4mm filler wire + 10kg 3.2 mm welding rod)
- One number thermocouple of each type used for Top, Bottom & Shell temperature indication shall be included in the scope of supply.
- One number thermo-well of each type used for Top, Bottom & Shell thermocouple shall be included in the scope of supply.

4.3 Bidder may be asked to quote separately as per Annexure X for

a) Lump-sum Price for Urea reactor,
b) Fright Charges at NFL Nangal basis
c) Two Year mandatory Spare Charges
d) Commissioning and Startup Supervision Charges.

## 5. DATA REQUIREMENT

5.1 All correspondence and documentation shall be in English.

5.2 NFL review of Process Licensor's drawings and documents must not be considered as a check and shall not relieve the Process Licensor of his responsibilities to supply equipment as per requisition. Process Licensor shall remain responsible for conflicts between his drawings/documents and NFL queries.

5.3 All vendor's drawings submitted to NFL shall be based on purchase requisition and shall bear reference number and revision of the corresponding NFL drawings. In addition, it shall indicate item number, client's name, project name, vendor's name, purchase order number, purchase requisition number, drawing number, revision number etc. all in the lower right hand corner. All revisions shall be clearly marked by encircling with revision marks.

5.4 Submission of required drawings/documents shall be the responsibility of vendor. In the event of vendor's failure to meet this requirement, the supply of equipment shall be considered as incomplete.

5.5 Vendor shall submit list of those drawings (Document control index), which are to be submitted for review to NFL along with the submission dates for each drawing within 30 days of placement of PO. A soft copy of this index shall also be provided in the format provided. Vendor shall strictly adhere to this drawing submission schedule. Updated vendor drawing / document submission schedule shall be forwarded along with each submission. This shall be submitted in soft copy also.

## 6. GUARANTEE / WARRANTY:

Vendor shall guarantee Process design, mechanical design, material workmanship and mechanical performance of the equipment including internals supplied by them.

Vendor shall upon notice from purchaser make good at his own expense all defects found during the guarantee period expeditiously. Vendor shall also warrantee and guarantee all work, materials and equipment furnished by any subcontractor and which is incorporated in equipment.

**A. <u>Workmanship Guarantees / Warranty:</u>**

Bidder shall guarantee / warranty the equipment against faulty design, improper material of construction and poor workmanship for a period of 24 months from the date of supply or 12 months from the date of commissioning, whichever is earlier. Approval by Owner/TPI for design calculations, drawings & other documents will not in any way absolve the Bidder from his responsibility. Should any repair or replacement be necessary owing to any type of failure on account of design material and workmanship of the item, Bidder shall in view of this guarantee be bound to replace the same either in part or whole without any commercial implications to Owner. Repaired or replaced part shall also be covered by same guarantee as in case of main supply

**B. <u>Process Performance Guarantees:</u>**

Bidder shall also guarantee the equipment for process performance as per process parameters indicated in the process data sheet (to be submitted by process licenser) for a period of 24 months from the date of supply or 12 months from the date of commissioning, whichever is earlier. Detailed Process performance Guarantee as per Annexure-VIII.

**7. ACCESSORIES**

Special tools and tackles required for maintenance of this equipment shall be supplied by the vendor.

**8. Miscellaneous:**

i. No deviation is allowed from the details given in the applicable standards and specifications mentioned without prior approval of 'NFL/Process Licensor.

ii. Vendor shall clearly mention the deviations separately with their bid.

iii. In case vendor requires any other information/drawing for reference, the same shall be furnished as available.

**9. Packing**

It is included in the scope of supply that the goods are delivered carefully and properly packed and marked in order to protect them from moisture, rain, rust and corrosion so as to withstand numerous handlings during sea voyage and inland transportation and to ensure their safe arrival and storage at the plant site during the full guaranty period without any risk of rusting, corrosion or damage due to humid and hot climate. Storage in open area is to be foreseen.

Instructions for the correct handling and the required surveillance and service must be clearly stated in the documentation for the unit. Furthermore, the instructions shall be attached to the equipment in a way which ensures full legibility throughout the shipping and storage period.

Annexure-VI

## Detail of Existing Urea reactor

### 1.1 BACKGROUND

NATIONAL FERTILIZERS LIMITED (A Govt. Of India undertaking) herein referred to as NFL, is a company incorporated in India under Companies Act, 1956, having it's registered office at SCOPE COMPLEX CORE-III, 7, Institutional area, Lodhi road New Delhi-110 003 and Corporate office at A-11, Sector –24, Dist- Gautam Budhnagar, NOIDA-201301, UP and production units at Nangal, Bhatinda (in the state of Punjab), Panipat (in the state of Haryana) and Vijaypur (in the state of Madhya Pradesh).

NFL Nangal plant is located at Nangal in the District Ropar the state Punjab. About 350 Kilometers from Delhi. Site is well connected by B.G. Railway line and road to all parts of India. There is Ammonia and Urea Plants. Urea Plant commissioned in 1978 along with related bagging & offsite facilities. This plant was originally designed by M/s. Mont Edison for the 1000 MTPD of urea. Later on, the capacity was enhanced to 1450 MTPD of urea in 2001 by M/s. Casale installing additional urea reactor R-2N.

### 1.2 OBJECTIVE:

The Urea Reactor R-1N was designed by M/s Mont Edison and manufactured by M/s. Reinsthal and commissioned in the year 1978. Presently the Urea Reactors have undergone thinning of the liner and seem to have outlived their life. Based on their condition, NFL has decided to replace it. The Urea Reactor will be replaced on one to one basis, all nozzles, associated auxiliaries, piping, foundation and structure shall remain the same.

So, a NIT has been raised for Process design, Mechanical design, Engineering, Materials, Fabrication, Inspection, Testing, Packing and Supply of Urea Reactor along with accessories & spares as per applicable codes and standards for National Fertilizers Limited, Nangal.

**Technical detail of the plant and equipment is as follows-**

- **Reactor 10-R-1/N (Urea reactor)**

**Multilayer Urea Reactor with outer jacket**

| S.No | Design Parameter | Design Value |
|---|---|---|
| 1 | Cylindrical volume | 50 [m3] |
| 2 | Internal diameter | 1376 [mm] |
| 3 | Total length | 33350[mm] |
| 4 | Cylindrical length between tangent lines | 32260 [mm] |
| 5 | Net weight Empty) | 145Te |
| 6 | Net weight (Filled) | 195Te |
| 7 | Material of liner | SS 316L UG |
| 8 | No of Trays | 14 No High efficiency Casale Tray |
| 9 | Liner thickness | 12 [mm] |
| 10 | Design temperature | 200 [°C] |
| 11 | Design pressure | 235.36 [bar] |

**Operating Parameter**

| S.No | Operating Parameter | Value |
|---|---|---|
| 1 | Normal operating pressure | 220 [bar] |
| 2 | Normal operating temperature | 188-198 [°C] |
| 3 | CO2 conversion | 53-55 [mol/mol] |

**DESIGN BASIS**

**Introduction:**

This documentation describes the conditions at the plant site and defines the design basis for the replacement of existing Urea synthesis reactor of Nangal Fertilizer Complex of National Fertilizers Limited. The design basis is valid for the replacement of existing Urea reactor of Urea plant having capacity of 1450 MTPD of Urea.

**1.0 Raw materials:**

1.1 Process feed

For design of urea reactor the Battery limit conditions for Ammonia and carbon di-oxide shall be as given below:

**Physical condition:**

| S. No. | Service | Physical condition |
|---|---|---|
| 1 | Ammonia | Liquid |
| 2 | CO2 | Gas |

**Specification sheets:**

| | | |
|---|---|---|
| **Ammonia** | NH3 | 99.5% by weight |
| | Oil | 10 ppm max |
| | Water | 0.5% by weight. |
| **Carbon Di-oxide** | CO2 | 99.00% Wt |
| | H2O,inerts | 1% by weight |

**2.0 Utilities:**

**2.1 Instrument Air:**

| | | | |
|---|---|---|---|
| **Utilities-Instrument Air** | **Parameters** | **Normal** | **Design** |
| | Pressure Kg/Cm²g | **6.5** | **10** |
| | Temperature °C | **Ambient** | **120** |
| | Dew point at atm pressure $^{0}$ C | **-40** | |
| | Quality | **free from Dust, water drops, oil** | |
| | New instrument lines to be made in SS 304 | | |

**3.0 Site conditions:**

**3.1 Site Location**

| | |
|---|---|
| Country India | State Punjab |
| District Roopnagar (Ropar) | Place Nangal |
| Longitude 31023"7.0656" N | Latitude 76022"29.6148" E |
| Country India | State Punjab |
| District Roopnagar (Ropar) | Place Nangal |
| Longitude 31023"7.0656" N | Latitude 76022"29.6148" E |

**3.2 Weather Conditions:**

| | |
|---|---|
| Mid October to March | 36.7 0C at humidity: 90% (max) and<br>11.1 0C at humidity: 92% (min) |
| April to Mid June | 46.7 0C at humidity: 69% (max) and<br>16.7 0C at humidity: 87% (min) |
| Mid June to Mid October | 40.0 0C at humidity: 84% (max) and<br>26.7 0C at humidity: 84% (min) |

**3.3 Ambient conditions: Atmospheric Pressure, mbar**

| | |
|---|---|
| Maximum | 735 Torr |
| Minimum | 720 Torr |
| Design | 725 Torr |

**3.4 Rainfall, mm**

| | |
|---|---|
| Annual Rainfall | 1448 mm |
| Maximum Rainfall in 24 hrs | 114 mm |
| Design Rainfall Intensity | 94 mm on 01.09.2016 |

**3.5 Temperature, °C**

| | |
|---|---|
| max °C | **48** |
| min °C | **1** |
| Winter % relative | Min 42% |
| Summer % relative | Max 100% |

**3.6 EARTH QUAKE:**

The plant structures must be designed for design basis earthquake (DBE) as per the design spectra given in IS: 1893 (Part-IV)-2205.

**Process Performance Guarantee:**

Process performance guarantee figures to be submit by process Licensor / Bidder along with their offer. Party may record existing operating & process data before shut down of plant when reactor replacement is scheduled.

Performance Test Run to be conducted at the timing when plant is put into stable operation mode after the installation of the new urea reactor.

**Method of Performance Test Run:**

The duration of Performance Test Run shall be maximum 05 Days for determining the performance at 1650 MTPD. All data shall be averaged over continuous period of 72 Hrs to demonstrate that steam consumption at new urea reactor meet the guarantee figure at 1650 MTPD Urea production.

During the Performance Test Run, Urea plant shall be operated steadily and continuously by NFL with the same operation condition as the existing plant performance evaluation.

NFL shall provide qualified superintends, operating, maintenance and laboratory personnel for performance Test Run in sufficient numbers in accordance with the Bidder's instruction and supervision.

Performance guarantee is considered as fulfilled, if during Performance Test Run Performance figure would be equal to or better than guarantee figure on average basis.

**Procedure of Performance Test Run:**

Such detailed procedures during the performance test run as the operating data to be recorded and the manner by which the operating data shall be collected during the Performance Test Run including all correction of error and tolerances of measurements shall be specified and proposed by bidder to NFL and shall be mutually discussed and agreed upon between NFL & Bidder. Bidder shall submit detailed PGTR procedure.

## EVALUATION AND COMPARISION OF BIDS & PRICE REDUCTION CLAUSE

### 1) EVALUATION AND COMPARISION OF BIDS

- **Operating Cost:** Loading shall be done to take care of the performance and productivity of the process and equipment offered. In case the Saving of the steam are different for different bidders, extra operating cost over the maximum quoted steam saving shall be calculated as given below:

  Extra Operating Cost over maximum quoted steam saving =
  Difference in Steam saving x unit cost of utility x 7920X 0.95 x 6.16xN

  Where: 7920 = operating Hours / year
  0.95 = Availability Factor
  6.16 =The discount factor at an interest rate of PLR (presently 14.15% p.a) on Yearly basis for the period of 15 years.
  N=Number of years (15 years).

**The unit cost of utilities will be follows:**

The Unit cost of utilities for loading shall be as follows:

| Utilities | Cost |
|---|---|
| 33 ATA steam | Rs. 4697 per MT |

- Evaluation of the bid shall be on the basis of overall costs and shall comprise of following:
  a. Total quoted price as per Annexure X
  b. Loading on account of extra Operating Cost as above.

### 2) DAMAGES/ PRICE REDUCTION CLAUSE

2.1) If for reasons not attributable to the Owner or due to conditions constituting Force Majeure as defined in this Contract, the Work is not completed in accordance with the provisions hereof, within and in accordance with the Time Schedule / time for Completion as indicated in the terms and conditions of the contract, it is agreed that the Owner shall be entitled to recover and / or the Contractor shall pay to the Owner, without prejudice to any other right are remedy available to the Owner, the following amount as mutually agreed compensation;

2.1.1) A sum equivalent to 0.5% of the total Contract value for every complete week or part thereof, for delay in supply of urea reactor as defined in technical ITB subject to a maximum 5% of total PO value. There will be no LD on supply of Mandatory spares.

2.1.2) GST will be applicable on the liquidity damages/ penalty recovered by M/s. NFL.

2.2 In the event that the consumption figures exceed the figures guaranteed by the Contractor, it is agreed that the Owner shall be entitled to recover and /or the Contractor shall pay to the Owner, without prejudice to any other right or remedy available to the owner, the following amount as mutually agreed compensation.

For every 01 Tons/ hr part there of increase Steam consumption in the Urea plant than the guaranteed figure as mentioned in the contract, there will be penalty @ 0.5% of the total contract value subject to maximum **2.5% of total contract value**, under this head. If the steam consumption is more than 05 Te / hr over the guaranteed figure, the vendor shall make good the equipment as required at no cost to the NFL.