INSTITUTE FOR PLASMA RESEARCH

An Aided institute of department of Atomic Energy, Govt. of India)
Near Indira Bridge, Bhat. DIST.GANDHINAGAR - 382 428 (INDIA)
PHONE :(079-2396 2000),FAX :91-079-23962277
Web : www.ipr.res.in

MINOR FABRICATION WORKS
ENQUIRY

Office Copy

ENQUIRY NO :IPR/MFW/20-21/80
Date : 07-10-2020
Due Date : 04-11-2020 13:00 IST
Extended Due Date : 18-11-2020

Please send your offer in sealed envelope specifying Inquiry No, Date & Due Date, ALONG WITH your credentials for he following items:

Important Note:

Please note that e-mail quotations are not acceptable however you may send your queries (if any) to **rkumar@ipr.res.in**

Please Ensure that your sealed quotation reaches this office not later than above mentioned due date and time.

Kindly go through the following document properly before Quoting which are available on the IPR web portal i.e., http://www.ipr.res.in/documents/tenders.html/ attached here with.

1. Technical specification as enclosed.
2. Instruction to the bidders & terms and Condition (refer Form NO:**IPR-MFW-01-V1**)
3. Bidding format(refer Biddingformat MFW-Bid.pdf)

GST fro Goods and Services (IGST/CGST/SGST TAX BENEFITS): PLEASE REFER clause no:8 of Form No:**IPR-MFW-01-V1**

QUOTATION SHOULD BE ADDRESSED TO **RAJESH KUMAR** ONLY.

Sr.No.	Description	Quantity	Rate
1	Fabrication and installation of exhaust (off-gas) system for NF3	1	No.

Free Issue Material

Sr.No.	Description	Quantity	Unit	Value

Note : Please quote with complete technical details (Technical Compliance sheet and product data sheet)

Encl:As per attachment

Sd/- Rajesh K
5-11-20

RAJESH KUMAR
Scientific Officer-G

प्लाज़्मा अनुसंधान संस्थान
(भाट, इन्दीरा पल के पास, गांधीनगर382428 - , गजरात) भारत
Institute for Plasma Research
Bhat, Near Indira Bridge, Gandhinagar – 382428, Gujarat (INDIA)
Phone: +91-79-23962000 Fax: +91-79-23962277 Website: www.ipr.res.in

Form No: IPR-MFW-01.V1

INSTRUCTIONS TO BIDDERS AND TERMS AND CONDITIONS

1. The Quotation and any order resulting from this enquiry shall be governed by our Conditions of Work Order and Contractor quoting this enquiry shall be deemed to have read and understood the same completely.
2. Where counter terms and conditions have been offered by the Tenderer, the same shall not be deemed to have been accepted by IPR unless our specific written acceptance thereof is obtained.
3. **Quotation:** Quotation should be submitted in the prescribed QUOTATION FORMAT attached with this Enquiry and the same should be submitted in a sealed envelope super-scribing the same with our enquiry No., date, due date and brief description of item on or before the due date. Late/delayed/incomplete/unsigned quotations will not be considered. Envelopes received without Enquiry number, date, due date and brief description of item may be rejected. The quoted prices should be firm for a period of 90 days from due date for placing order. IPR is not bound to accept lowest rate/s. IPR reserves the right to place on one or more parties. The scope of supply includes insurance by the Contractor.
4. **Specifications:** Goods should be offered strictly confirming to our specifications/drawings. Deviation, if any, should be clearly indicated by the contractor in their quotation. The Tenderer should also indicate the Make/Type number of the goods offered and catalogues, technical literature and samples, wherever necessary should accompany the quotation. Clarification/s on drawings should be obtained before submitting quotation.
5. **Terms of Prices:** Quotation should be submitted on door delivery basis without extra charge wherever possible. For quotations on Ex-Works, Ex-godown basis the approximate packing and forwarding charges should be indicated by the contractor. In the case of local contractors, the goods are to be delivered at our stores free of charge.

5.1 In respect of tenders on Ex-works basis, in case the tenderer has not mentioned in the offer packing, forwarding and transportation charges for safe delivery up to Purchaser's site, 2% of the price quoted towards packing (in respect of both local and outstation firms), 1% of the basic price quoted towards safe delivery charges in respect of local tenderer and 3% of the basic price quoted towards safe delivery charges in respect of outstation firm will be added for comparison of offers on safe door delivery at Purchaser's site.

5.2 Prices are required to be quoted according to the units indicated in the tender form/Enquiry. When Quotations are given in terms of units other than those specified in the tender form, relationship between the two sets of units must be furnished

6. Tender should be free from Correction and Erasures. Corrections, if any, must be attested. All amounts shall be indicated both in words as well as in figures. Where there is difference between amounts quoted in words and figures, amount quoted in words shall prevail. Unsigned quotations will summarily be rejected. If there is a discrepancy between the unit price and total price, unit price shall prevail.
7. IPR shall be under no obligation to accept the lowest or any tender and reserves the right of acceptance of the whole or any part of the tender or portion of the quantity offered and the tenderers shall supply the same at the rate quoted.
8. **Goods & Services Tax (GST):** The details of Taxes/GST and other levies legally applicable and intended to be claimed should be clearly indicated in the tender. Where this is not done, no claim on these accounts would be admissible later.

   a) GST for Goods (IGST/CGST/SGST TAX BENEFITS):

   IPR is entitled to avail tax benefit as per the following notifications issued by Ministry of Finance, Department of Revenue, Government of India:

   (1) No: 47/2017-INTEGRATED TAX (RATE) DATED 14/11/17 for IGST
   (2) No: 45/2017-CENTRAL TAX (RATE) DATED 14/11/17 for CGST

   And,

   IPR is entitled to avail tax benefit as per the following notifications issued by Finance Department, Government of Gujarat:

   (1) No. 45/2017-STATE TAX (RATE) DATED 15/11/17 for SGST

   As per above notifications IPR will bear only 5% IGST for procurement of goods from outside Gujarat & 2.5% CGST and 2.5% SGST (total 5%) for procurement of goods within Gujarat. Vendors are required to charge tax as per these notifications while quoting/supplying the goods. Deviations, (if any) should be clearly mentioned in the quotation/offer.

   Please specify the HSN codes while quoting.

   b) GST for Services:

   As applicable. **Specify the SAC codes wherever services are involved**.

9. **Delivery Date:** Delivery period is essence of the Contract. Contractor must indicate the firm delivery date by which the goods will be dispatched or delivered by them from the date of our order. Delivery period shall be clearly indicated against each item separately.
10. **Price/ Purchase Preference:** Purchase/Price preference to industries will be given as per the policy of the Government of India in force at the time of evaluation provided their offer is in compliance with the conditions of the policy.

11. **Liquidated Damages:** The successful Vendor/Bidder should pay liquidated damages @ ½% (half percent) of the total work order value for the delay of each week in the scheduled date of completion of the work envisaged in the Work Order subject to a maximum of 5% (Five percent) of the total Work Order value.
12. **Inspection**: Goods on its arrival at IPR will be inspected by Stores, and his decision in the matter will be final. However, where the items are required to be inspected at the Contractors Premises, Contractor has to give advance notice regarding readiness of the Goods to enable us to depute our representative for inspection.
13. **Payment**: Payment will be arranged for accepted goods only within 30 days from the date of receipt of goods at IPR and bills in our accounts section, completed in all respects.
14. No correspondence will be entertained within 30 days from the date of receipt of good and bills, whichever is later.
15. **Guarantee**: The Stores offered should be guaranteed for a minimum period of twelve months, from that date of acceptance, against defective Goods, design, workmanship, operation or manufacture. For defects noticed and communicated during the Guarantee period, replacement/rectification should be arranged free of cost within a reasonable period of such notifications. In case where our specifications call for a guarantee period more than 12 months specifically, then such a period shall apply.
16. **Performance Bank Guarantee**: If demanded by IPR, the successful bidder will have to furnish Performance Bank Guarantee for 10% of the order value (basic price) from a Nationalized/Scheduled Bank/State Bank of India, valid throughout the Guarantee/Warranty period. The scheduled banks approved by IPR are Axis Bank, HDFC Bank, ICICI Bank and IDBI Bank. Bank Guarantees submitted other than from banks approved by IPR will not be accepted.
17. **Security Deposit:** If demanded the successful Bidder will have to furnish to the Purchaser an interest free security deposit for 10% (Ten percent) of the order value in the form of Bank Guarantee of an equivalent amount from a nationalized/ scheduled Bank/State Bank of India within 15 days from the date of work order and the said Guarantee should be valid till the goods are accepted by IPR. The scheduled banks approved by IPR are Axis Bank, HDFC Bank, ICICI Bank and IDBI Bank. Bank Guarantees submitted other than from banks approved by IPR will not be accepted. The Security deposit shall be forfeited in case the selected Bidder does not start the work within the time limit specified or fail to complete the work within the stipulated delivery period or fail to comply with any of the terms and conditions in the work order. On successful completion of scope of work and its acceptance by IPR, Contractor should send a letter requesting return of the original BG.
18. The Contractor shall at all times indemnify the purchase against all claims which may be made in respect of the stores for infringement of any right protected by Patent Registration of design or Trade Mark and shall take all risk of accidents or damage, which may cause failure of supply from whatever cause arising and the entire responsibility for sufficiency of all means used by him for the fulfilment of the contract.
19. **Free Issue Material (FIM):** Successful tenderer will have to arrange insurance showing beneficiary as “Institute for Plasma Research” at their risk and cost towards adequate security for the materials/property provided/issued by the Purchaser as Free Issue Material for the due execution of the contract.
20. The Director, IPR reserves the right to accept or reject any quotations fully or partly or to cancel the enquiry without assigning any reason.
21. **Jurisdiction**: The contract shall be governed by the Laws of India for the time being in force. The Courts of Gandhinagar only shall have jurisdiction to deal with and decide any legal or dispute arising out of this Contract.

(This need to be printed in Bidders letter head)

1. Please quote with complete technical details along with technical compliance sheet.
2. Quotation should be submitted in the format given below, else IPR shall not consider the offer by the vendor.

NAME OF PARTY : _____

ENQUIRY NO: _____

QUOTATION No. & DATE : _____

Currency of Quotation: **Indian Rupees**

Sr. No.	Item Description	HSN/SAC Code	Quantity	Unit Rate (Basic)	Packaging & forwarding (P&F)	Applicable GST	Rate (incl P&F and GST)	Total Value
			a	b	c	d	e = b + c + d	f = a * e
1								
2								
3								
4								
5								
6								

Sr. No.	Particular	Remarks
I.	Ex-works / FOR Destination	
II.	Freight	
III.	Insurance	
IV.	Delivery Period	
V.	Payment (IPR terms will apply)	
VI.	Guarantee / Warrantee	
VII.	Validity Period	
VIII.	Discount (if any)	
IX.	Remarks	

Place: Authority Signatory

Date: Company Seal

Note:

1. **Bidder should submit the copy of GSTIN / ARN Certificate along with the offer**
2. **Bidder should specify the SUPPLY and SERVICE rates/ charges separately wherever applicable**

Fabrication and installation of exhaust (off-gas) system for NF3

1) Introduction:

Nitrogen Trifluoride (NF_3) gas is used as reactive gas in the plasma etching experiment of the silicon and silicon oxide samples. Gas density of NF_3 is higher than air. NF_3 has been identified as a potential significant long-lived "greenhouse" gas. Threshold Limit Value (TLV) of NF_3 is 10 ppm.

The exhaust gas from etching chamber will contain small amount of SiF_4, F_2 along with NF_3 gas. SiF_4 is also toxic in nature. Exhaust gas temperature will most likely be room temperature. Exhaust gas needed to be treated before release it in to the atmosphere.

The abatement strategy for off-gases is as follow:

$$2NF_3 + 2AlCl_3 \xrightarrow{70^0 C} N_2 + 3Cl_2 + 2AlF_3$$

A packed bed of anhydrous $AlCl_3$ is required to convert NF_3 into N_2. The reaction produces poisonous Cl_2 gas. Cl_2, SiF_4 and F_2 can be scrubbed out by aqueous calcium hydroxide. SiF_4 will first react with water of calcium hydroxide slurry.

$$3SiF_4 + 2H_2O \rightarrow 2H_2SiF_6 + SiO_2$$

Neutralization of fluosilicic acid with alkali metal bases produces the corresponding alkali metal fluorosilicate salts.

$$H_2SiF_6 + Ca(OH)_2 \rightarrow CaSiF_6 + 2H_2O$$

With excess base, the fluorosilicate undergoes hydrolysis.

$$CaSiF_6 + 2Ca(OH)_2 \rightarrow 3CaF_2 + SiO_2 + 2H_2O$$

$$2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + H_2O$$

$$2Ca(OH)_2 + 2F_2 \rightarrow 2CaF_2 + O_2 + H_2O$$

The scope of this work comprises of Supply, installation, commissioning, testing and final acceptance of packed bed column/ reactor, Agitator tank (scrubber), exhaust blower and stack for height release along with the associated piping, resistive heating system and instrumentation.

2) Scope of the work

- The scope of this work comprises of Procurement of material, fabrication, inspection, supply, installation, commissioning, testing and final acceptance of off-gas system for the NF_3 plasma etching system, which included packed bed column/ reactor, agitator tank (scrubber), exhaust blower and stack for height release along with the associated

piping, resistive heating on packed bed column/ reactor, instrumentation, valves etc. at IPR premises, Gandhinagar.

- These equipment shall be used in a chemical process whose details are given in introduction.
- These equipment shall confirm, in all aspects to high standards of engineering practice and be capable of performing trouble free operation up to vendor's guarantee in a manner acceptable to purchaser.
- In the event of any conflict between or within the various sections of this specification or in case of any doubt, vendor is supposed to clarify the same before the quotation is submitted. In case the vendor failed to clarify the same interpretation of the purchaser shall be final and binding to both the parties.
- Expenditure incurred in all the steps of scope of supply shall be borne by the vendor.
- General assembly drawings of equipment are supplied to the vendors. Vendor shall prepare detailed fabrication drawings wherever required giving all dimensions and tolerances based on the assembly requirements along with all components list. These drawings (hard copy/ soft copy) shall be submitted to IPR for approval.
- Resistive heater for packed bed column/ reactor and instrumentations are indicated in supplied process and instrumentation diagram. A small instrumentation panel comprising off controllers, indicators, variable frequency drive, start – stop switches, alarms and trips has to be fabricated and installed. Fabrication drawing and line diagram of panel shall be submitted to IPR for approval.
- Any modification suggestions from the vendor's end will be discussed with IPR and acceptance may be provided, if found suitable.

3) Location of Supply & Installation:

RF-Plasma Application Division,
Institute for plasma research,
Gandhiangar - 382428, Gujarat

4) Fabrication:

- Prior to fabrication, all the materials shall be checked and confirmed to be of the required quality for the intended purpose.
- Welders: All welding jobs shall be carried out by code qualified welder. This will be reviewed by purchaser from time to time during fabrication.
- Stamp transfer for each and every part is must.
- Any nozzle hole in shell to nozzle welding be of full penetration type and its reinforcement pad shall not be on any longitudinal or circumference-weld of the shell.
- In general number of weld joints on the equipment shall be as low as possible.
- In case of any hot forming in due course of fabrication complete care shall be taken so that physical & chemical properties of the material are not changed.
- No production weld shall be taken unless purchaser has qualified the welding operator & welding procedure. Procedure adopted in the entire production weld shall be recorded.

- All the welding shall be GTAW type.
- Weld defect shall be removed by suitable mechanical means. No peening will be allowed. If any repair is required vendor shall take prior written approval of the repair from the purchaser.
- Equipment shall be neatly finished in a good workmanship manner. All exposed metal surfaces shall be smooth and free from burrs and sharp corners.
- Before the equipment is closed, it shall carefully be checked to be sure that all extraneous matter such as rags, tools, rubbish, foreign matter, loose scale, dirt and weld rod stub etc. have been removed and the surfaces are pickled and dried. All the opening shall be closed with stainless steel blind flanges or stainless steel threaded caps as the case may be. PCD, OD, thickness and all other dimensions of these blind flanges shall be same as their companion flanges. Caps shall be provided of such a shape that a standard spanner can tighten them.
- Residual stress shall be kept to a minimum to ensure dimensional stability and minimum stress corrosion. Excessive force shall not be used to achieve a fit. Welding and fitting shall be performed in such a manner as to control and minimize distortion and locked in stress.
- Any raised face or a face, which is used as a sealed joint by using gaskets, shall have serration in concentric style. This holds true for even SORF flanges.
- Bolt-holes of all nozzle-flanges shall be straddled to the principal central line of the equipment.
- The nozzle orientation and its vertical location are temporary and it shall be finalized during final approval of fabrication drawings.

5) **Test Laboratories:** All the tests and inspections shall be carried out in reputed and renowned test laboratories only, approved by IPR. Vendor has to take written approval from purchaser in this regard.

6) **Inspection & Testing:**

- All the material including welding rod, which is supposed to be used in the fabrication, shall be approved and stamped by an authorized inspector from purchaser only after sample taken by the inspector is tested and cleared by test lab approved by purchaser.
- At least six elements (C, Cr, Ni, Mn, Mo, Si, and Ti) for SS 304L/ (Ni, Cu, Fe, Mn, Si, C) for Monel 400 in the chemical composition test mentioned in the ASTM codes shall be done in the lab for approval and stamp transfer.
- DP test after every pass of the welding is must.
- Hydrotest of the equipment shall be carried out at 1.5 times of the design pressure.
- In the event of equipment or any part thereof fails to meet the examination or test requirements specified herein the vendor shall notify the purchaser in writing. The vendor shall obtain written permission from purchaser before repair and subsequent use of the part.
- Calibration Test Certificate of the measuring instruments from approved labs should be produced during inspection of equipment.

7) Guarantee:

- The vendor shall guarantee that the equipment for a period of eighteen months (18 months) after the completion of all delivery or twelve (12) months from the date of commissioning, whichever is earlier.
- If within the guarantee period stipulated above, the equipment and materials mentioned in the scope of supply or any part of the same are found defective because of bad materials, improper fabrication or any mistake in the operations carried out by the vendor in completion of the scope of supply, then the vendor at his own expense either repair them preferably on the site or transport them to their workshop and repair/ replace them to be delivered at site again. The decision of repair and replacement will be taken in consideration with the function, end use and life of that equipment.

8) Completion period: The completion period for the total work shall be 2 months from the date of placing order.

9) Rights and Privileges of Purchaser:

- Authorized inspector/person shall be permitted free access to vendor's or his sub-vendor's workshop/ stores (if any) at all the working hours for the purpose of inspecting work at all stages of progress.
- Authorized Inspector reserves the right to call for certificate of origin and test certificates of all raw materials in addition to the calibration certificate of the instruments being used.
- The authorized inspector shall have a right to conduct any additional examination, inspection or testing, he feels is necessary.
- Vendor shall keep a set of latest prints of the approved drawings available and a copy of this technical specification, in the shop floor for the reference of authorizes inspector during inspection.

10) Documentation:

Two copy of following documents shall be handed over by the vendor to the purchaser at the time of delivery of these equipments:

- As build drawings
- Test certificates from labs
- Inspection reports of authorized inspector
- Reports of all the test certificates
- Weight of every equipment
- Quality compliance Record
- Any other relevant documents
- Instrumentation line diagram

11) Packing, Transportation & Delivery:

- The equipment shall be packed in such a manner as to provide maximum protection against physical damage.

- Details of packing procedure and packing are subject to purchaser's approval.
- All packing cases and packing material shall become the property of the Purchaser, after delivery.
- Vendor shall be responsible for any damage to the equipment during transit due to improper and inadequate packing.
- All equipment shall be protected for the entire period of dispatch, storage (in transit delay) and erection; against corrosion, sun-light, rain, high temperature, humid atmosphere, rough handing in transportation and storage in the open.
- No material shall be dispatched without prior written consent of purchaser or his representative.

12) Packing, Transportation & Delivery:

- The equipment shall be packed in such a manner as to provide maximum protection against physical damage.
- Vendor shall be responsible for any damage to the equipment during transit due to improper and inadequate packing.
- All equipment shall be protected for the entire period of dispatch, storage (in transit delay) and erection; against corrosion, sun-light, rain, high temperature, humid atmosphere, rough handing in transportation and storage in the open.
- No material shall be dispatched without prior written consent of purchaser or his representative.

13) Other Conditions to the Party:

- The work under this specification is sophisticated in nature requiring best quality precision workmanship, engineering and construction management. The contractor shall deploy adequate skilled and unskilled personnel so as to complete the work up to the satisfaction of the purchaser. Contractor should depute one qualified and experienced supervisor at site to interact with purchaser.
- The contractor shall arrange consumables and other materials, tools, tackles and testing instruments.
- The contractor shall get approved all materials before procurement.
- The contractor shall get approved all drawings prepared before fabrication.
- The contractor having adequate experience in execution of this type of job will only be considered. The list of previously executed works in recent past shall be enclosed with details.
- The contractor shall be responsible to complete the work within the stipulated time and satisfactorily in accordance with the drawings and specifications issued.
- The contractor shall be responsible for taking all safety precautions during the work and leaving the site safe at all times and at the end of each working day. The contractor shall adhere to all the safety precautions necessary at site.
- The contractor shall strictly follow the specification of the materials given along with the schedule of quantities for purchase. In case of any deviation, if any, shall be notified to

the department before placing any order for purchase. The purchaser may be involved in stage/final inspection of materials to be supplied.

- The contractor shall be fully responsible for safe transportation and handling of materials, equipment, and consumables from place of delivery to the erection site and complete the erection work.
- It is responsibility of contractor to keep working area clean during execution of the work and clear site after completion of the work.
- The contractor shall arrange for necessary crane / tractor, slings / tools and labor / including operators for loading and unloading of the material issued to him at site.

14) Securities and Safety Procedure:

- Party has to take all the necessary safety precautions during the work. He will be responsible for any accidents and damages due to negligence during installation work.
- Party will be allowed to work only on working days (Mondays to Friday) between 1000 to 1800 hrs. Working on holidays may be permitted only under urgent situations.

15) Process and instrumentation diagram for the off- gas handling system for the NF_3 plasma etching system

Process and instrumentation diagram for the off-gas handling system is shown in the Figure 1. From the outlet of the etching chamber exhaust gas will be passed through the vacuum pumping system. Exhaust from the vacuum pump will contain the NF_3, SiF_4 and F_2 etc. which needed to be treated before releasing in the atmosphere. From the vacuum pump exhaust gas will first pass through the packed bad column of $AlCl_3$ powder. After the Packed bed column it will pass through the agitator tank and after that it will pass through the blower to the atmosphere through stack. Design detail and the fabrication drawing for the packed bed column and the Agitator tank is attached herewith. Also a blower has been recommended after scrubber to reduce the pressure load at discharge side of vacuum pump. It will also maintain slight below atmospheric pressure in off-gas equipment and lines and thus any leakage from system to outside environment can be avoided.

Off-gas system is subdivided in to packed bed column/ reactor, agitator tank (scrubber), exhaust blower and stack. Description of the above components is given bellow.

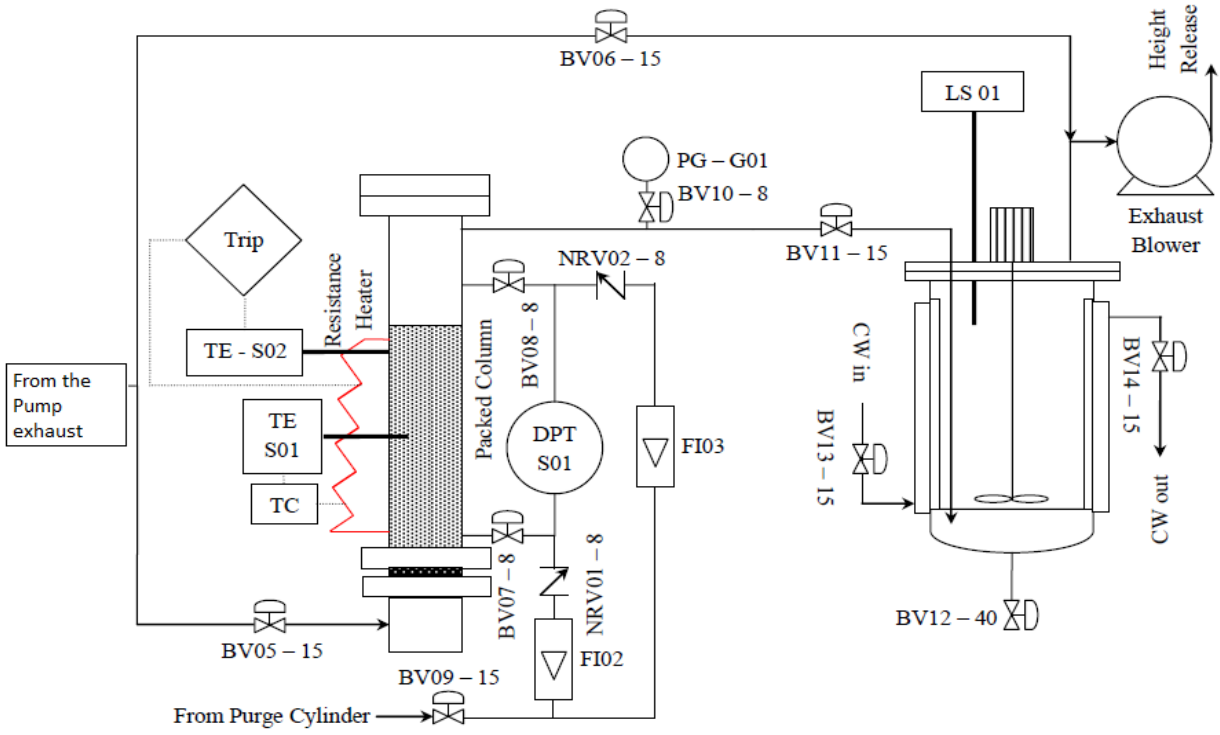

Figure 1: P&ID for the off-gas system for the NF_3 plasma etching system

[A] Packed bed column:

- Inner diameter of packed bed column (di) = 52.48 mm (50 NB Sch. 40 pipe). It will be filled with approx. 1.61 kg of $AlCl_3$ powder.
- As per the P&ID, a resistance heater (capacity ~ 1.2 kW) will be fixed on the packed bed column to maintain the temperature at 70 °C. Vendor also has to provide the system (PID controller or equivalent) to measure and maintain the temperature in the packed bed. Provisions for measuring and indication of column surface temperature, manual input of set points for high surface temperature alarm and heater trip have to be incorporated. Temperature controller, indications and heater start-stop switch shall be placed in the instrumentation panel. The column shall be wrapped with suitable thermal insulation to minimize the heat loss.
- Vendor also has to provide the differential pressure sensor to measure the pressure drop across the packed bed. Pressure drop indication shall be placed in the instrumentation panel. Vendor also has to provide the purge gas system to purge (~ 0.4 LPM N_2) the packed bed assembly as shown in the P&ID.
- At the bottom of the packed bed distributor plate will be placed. Distributor plate orifice details: 26 No. φ 0.4 mm holes on 9 mm square pitch. If difficulty is faced for manufacturing of perforated gas distributor plate, a porous plate of Monel 400 (sintered metal plate)/ ceramic can be used as gas distributor.
- Material of construction for the packed bed is Monel 400.
- Vendor also has to make necessary arrangement to replace the $AlCl_3$ powder bed after some operation.
- Fabrication drawing of the packed bed column is shown in the Annexure – 1.

[B] Agitator Tank (scrubber) Design:

- Tank ID (D_t) = 303.18 mm (300 NB Sch. 40 pipe, OD – 323.8 mm, thickness = 10.31 mm)
- MOC of all parts is SS 304 L.
- All wetted parts shall be coated with 1.5 mm (min.) thick Teflon
- MOC of gasket is Teflon (3 mm thick, minimum)
- Torispherical tank bottom according to DIN 28011:
- Do = Outside diameter = 323.8 mm, Di = Inside diameter = 311.8 mm, t = Wall thickness = 6 mm, SF = Straight flange height = 21 ~ 25 mm, CR = Crown radius = D0 = 323.8 mm, KR = Knuckle radius = 32.38 mm, DH = Dished height = 60 mm
- Agitator: Rushton Turbine
- Turbine diameter (Da) = 121 mm
- Height of the liquid (H) = 333.5 mm
- Baffle thickness (J) = 25 mm
- Height of turbine above vessel floor (E) = 101 mm
- Turbine width (W) = 25 mm
- Length of turbine blade (L) = 31 mm
- RPM ≈ 475 rpm
- 0.25 hp 1440 rpm motor with variable speed controller (VFD) should be provided.
- Vendor also has to provide the level transmitter to measure the liquid level in the tank. Level indication, VFD and motor start-stop switch shall be placed in the instrumentation panel.

Fabrication drawing for the agitator tank is shown in the Annexure -1.

[C] Support structure and piping:

- Vendor has to provide the support structure for the packed bed column and agitator tank and blower. Specification of the blower shall be fixed considering total pressure drop of off-gas system (~ 0.1 bar) as well as total off-gas flow (~ 5 LPM).
- Vendor also has to provide the drawing for the connecting piping between the vacuum pump, packed bed, agitator tank and blower along with all the valves shown in the P&ID. Stainless steel 316 l, size 15 (NB) Sch. 40 pipe shall be used for the interconnecting pipe except the connecting line between packed bed and agitator tank.
- Monel 400, size 15 (NB) Sch. 40 pipe shall be used for the connecting line between packed bed and agitator tank. Pressure tap and compound gauge (-0.5 to +0.5 bar (g)) shall be provided in this line.
- Vendor has to supply the fabrication drawing for the support structure for the packed bed column, agitator tank and exhaust blower as well as piping.

16) Important points for the vendor/ contractor.

- Offers must provide pricing on all items within a sub system and/or all sub systems.
- The vendor(s)/contractor(s) must provide complete system installation and conduct operational testing.
- The vendor(s)/contractor(s) must be familiar with all safety requirements and must have enough experience to setup such facilities.

17) Pre-dispatch Inspection at Vendor's Site:

- Pre-dispatch inspection will be done by IPR representative before supply of materials.
- Pre-dispatch inspection of packed bed column, agitator tank and blower assembly along with support structure and instrumentation for workmanship and overall quality of materials.
- After dispatch clearance only, vendor should supply materials as per work order.

18) Supply and Installation:

- Vendor should supply all sub-parts /sub-systems / materials / equipment related to this work order in single delivery at IPR, Gandhinagar site.
- Installation should be done at IPR, Gandhinagar site. Vendor may visit the site and do the planning for the scope of work before installation.
- Vendor should come with adequate trained and qualified manpower along with all the equipment, tools and safety related Personal Protective Equipment (PPE) and other necessary items to complete this task.

19) Testing and Final Acceptance:

Before final acceptance at IPR premises

- All items/parts and piping work asked in purchase order will be checked.
- Operation testing: operation testing will be checked for performance of packed bed, agitator tank and blower along with the all the necessary equipment at the IPR site.

Annexure-1

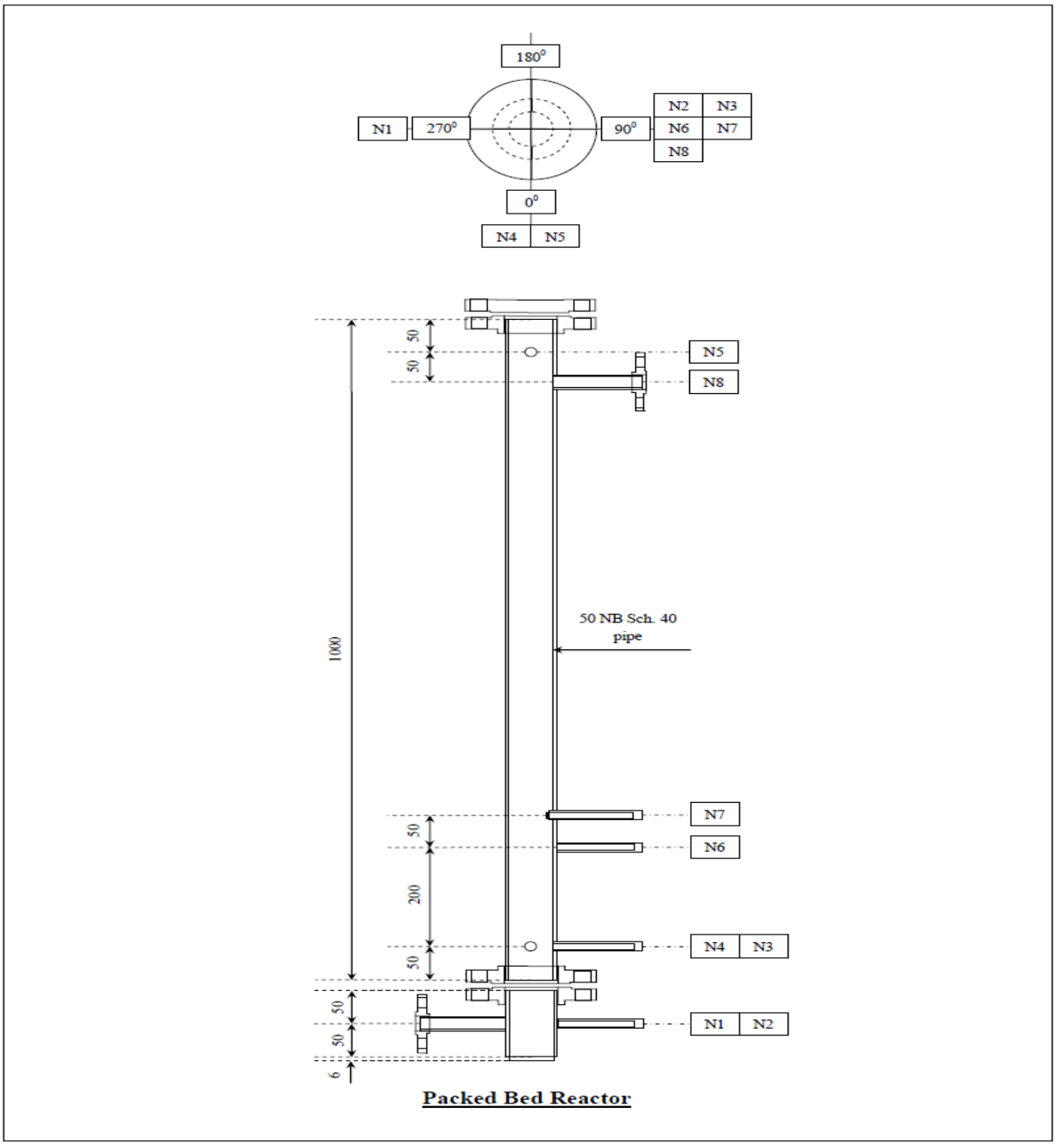

Figure 2: Packed bed Column

Mark	Service	Qty. (No.)	Size (NB)	Sch.	End connection/ Flange (ANSI B 16.5)		Nozzle orientation (Degree)	Length
					Type	Rating		
N1	Gas inlet	1	15	40	SORF	150#	270	100
N2	Dist. Diff. Pr. (H)	1	8	40	NPT (M)		90	100
N3	Dist. Diff. Pr. (L)	1	8	40	NPT (M)		90	100
N4	Bed Diff. Pr. (H)	1	8	40	NPT (M)		0	100
N5	Bed Diff. Pr. (L)	1	8	40	NPT (M)		0	100
N6	Temp. Measurement (S)	1	8	40	NPT (M)		90	100
N7	Thermowell (B)	1	8	40	NPT (M)		90	100
N8	Gas Outlet	1	15	40	SORF	150#	90	100

1. All dimensions are in mm
2. MOC of all parts is Monel 400

Title: Packed Bed Reactor

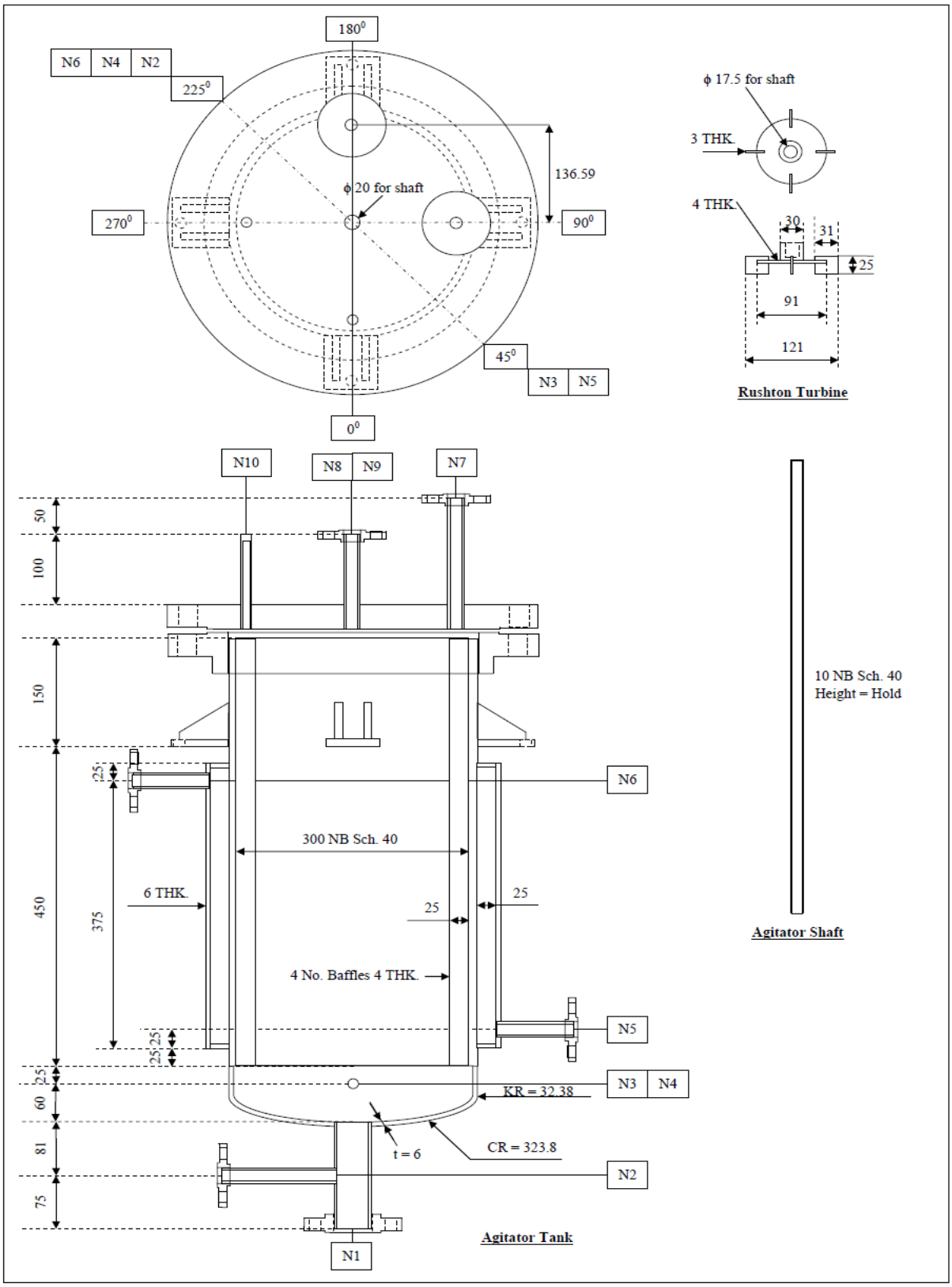

Figure 3: Agitator Tank

Mark	Service	Qty. (No.)	Size (NB)	Sch.	End connection/ Flange (ANSI B 16.5)		Nozzle orientation (Degree)	Length
					Type	Rating		
N1	Drain	1	40	40	SORF	150#	----	150
N2	Gas inlet	1	15	40	SORF	150#	225	150
N3	Thermowell	1	8	40	NPT (M)		45	100
N4	Liquid sampling	1	8	40	NPT (M)		225	100
N5	CW inlet	1	15	40	SORF	150#	45	100
N6	CW outlet	1	15	40	SORF	150#	225	100
N7	Gas vent	1	15	40	SORF	150#	90	100
N8	Level switch	1	15	40	SORF	150#	180	100
N9	Spare	1	8	40	NPT (M)		90	100
N10	Spare	1	8	40	NPT (M)		270	100

1. All dimensions are in mm
2. MOC of all parts is SS 304 L.
3. All wetted parts shall be coated with 1.5 mm (min.) thick Teflon
4. MOC of gasket is Teflon (3 mm thick, minimum)

Title: Agitator Tank

Scale 1:5