

रजिस्ट्र. पोस्ट द्वारा

फोन: 25273351-54, 25275795-98, 25272728
फैक्स: (080) 25269611, 25270670, 25260862
सभी पत्राचार निदेशक, एनएएल के नाम पर
ही लिखे जाएं, किसी अधिकारी के नाम पर नहीं



राष्ट्रीय वांतरिक्ष प्रयोगशालाएँ
कोडिहल्ली, एयरपोर्ट रोड, बेंगलूर -560 017, भारत
National Aerospace Laboratories

KODIHALLI, AIRPORT ROAD, BANGALORE - 560 017, INDIA

By Registered Post

Phone : 25273351-54, 25275795-98, 25272728

Fax : (080) 25269611, 25270670, 25260862

All communications to be addressed to the

Director, NAL and not

in the name of any officer.

क्रय आदेश / PURCHASE ORDER

OUR TIN No. IS : 29750311018.

PURCHASE ORDER No.:180/SED/10/286/08

NO: NAL/PUR/SED/10/286/08

June 8, 2009

M/s. Vacuum Techniques Pvt. Ltd.
No.2/13, 1st stage, 1st phase.
Peenya Industrial Area,
Bangalore-560 058

Ref: Your quotation No:VT/I/NAL/E-8560/C-018/09-10, Dt: 14/05/2009

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Dear Sirs,

Please arrange to supply within 5 months, the articles noted below on the terms and conditions stated on the reverse:

Sl.No.	Description of Materials	Qty	Unit	Rate	Amount
1.	ICP PECVD System along with spares. [As per specification & terms & conditions enclosed]	1	No.	29,00,000.00	29,00,000.00
TOTAL					29,00,000.00

Please Note:

- PAYMENT:** 80% OF ORDER VALUE + 100% TAXES AFTER PRE-DISPATCH INSPECTION & DELIVERY OF MATERIAL IN GOOD CONDITION AT NAL & BALANCE 20% AGAINST INSTALLATION & ACCEPTANCE AGAINST 10% PBG VALID UPTO 2 MONTHS BEYOND WARRANTY PERIOD *
- TAX:** VAT @ 12.5% EXTRA.
- ED:** AS PER GOVT. OF INDIA NOTIFICATION NO.10/97-CENTRAL EXCISE DT 1/3/97, NAL IS EXEMPTED FROM PAYMENT OF CENTRAL EXCISE DUTY. THE EXEMPTION CERTIFICATE DULY ISSUED BY SR.CONTROLLER OF ADMINISTRATION IS ENCLOSED HERewith.
- CONCESSIONAL CUSTOM DUTY CERTIFICATE** WILL BE ISSUED FOR IMPORTED ITEMS. THE CD SHALL BE REIMBURSED AT ACTUALS AGAINST SUPPORTING VOUCHERS i.e, COPY OF CHALLAN & BILL OF ENTRY.
- DELIVERY:** TO NAL STORES.
- WARRANTY:** 12 MONTHS FROM THE DATE OF ACCEPTANCE OF THE MATERIAL.
- YOU MAY APPROACH THE DIRECTOR OF THE LAB, WITHIN A PERIOD OF 30 DAYS, IN THE EVENT OF ANY DELAY IN TAKING DECISION, DIFFICULTY IN MAKING PAYMENT ETC., ALONGWITH RELEVANT DOCUMENTS TO SUBSTANTIATE YOUR CASE.**
- ALL OTHER TERMS & CONDITIONS TO THE EXTENT NOT SUPERSEDED IN THIS PURCHASE ORDER SHALL BE GOVERNED BY THE PROVISIONS OF THE BIDDING DOCUMENTS.**

PR No.: SED/1531, DT: 5-01-2009

PJ No.: U-1-114, P9090101

P99103, GAP 04-09

CC: DR. C. ANANDAN, SED
STORES/MASTER COPY

Yours faithfully

(R. K. RAO)

CONTROLLER OF STORES & PURCHASE

Spare 1

निबंधन व शर्तें

1. आदेश को दरों के अन्य निबंधन एवं शर्तों की पुष्टि सहित 21 दिनों के अंतर्गत वापसी डाक से भेजें।
2. आदेश की संख्या एवं तारीख और सामान की क्रम संख्या बिल में दर्शाएं तथा अपने मूल कोटेशन के साथ दरों की जांच करें। कीमत एवं विनिर्देशों में अंतर स्वीकार्य नहीं होगा।
3. भुगतान के लिए टंकित/लिखित बिल (दो प्रतियों में) रसीदी टिकट लगाकर सूची सहित प्रस्तुत किया जाए।
4. यदि आपकी दर एफओआर प्रेषण स्टेशन से संबंधित हो तो मालभाड़ा सहित सामान के कुल कीमत पर बीमा करवाएं और सहायक वाउचरों सहित अपने बिल द्वारा दावा करें।
5. कोटेशन में नहीं बताए गए प्रमारों का भुगतान नहीं किया जाएगा। यदि आवश्यक हो, बिल में वैट-टिन संख्या लिखी जाए। नोट किया जाए कि यह प्रयोगशाला केन्द्रीय विक्री कर रियायती फार्म-‘सी’ या ‘डी’ जारी नहीं कर सकता।
बहरहाल, कुछ राज्य मुंबई (महाराष्ट्र), दिल्ली, मणिपुर द्वारा वैज्ञानिक उपकरण आदि की खरीद पर अनुसंधान संस्थानों को ग्राह्य केन्द्रीय विक्री कर की रियायत, इस प्रयोगशाला पर भी लागू होगी।
6. कोटेशन के साथ प्रेषित मुद्रित शर्तें हम पर बाध्य नहीं होंगी।
7. इस प्रयोगशाला को अधिसूचना से 10/97 दिनांक 01/03/2007 एवं सीमाशुल्क 51/96 दिनांक 23/07/96 द्वारा रियायती दर में छूट दी गयी है।
8. मुनिसिपल कार्पोरेशन की सीमा के भीतर चुकायी चुंगी का दावा स्वीकार्य नहीं होगा।
9. सामान सही स्थिति में प्राप्त होने पर ही भारतीय स्टेट बैंक, बेंगलूर के आदाता चेक द्वारा बिल का भुगतान किया जाएगा।
10. क्षतिग्रस्त और अननुमोदित सामान आपकी लागत एवं जोखिम पर वापस कर दिया जाएगा। इसमें संबंधित प्रासंगिक व्यय किसी भी बिल के माध्यम से वसूल किया जा सकता है।
11. अंतिम तिथि के बाद प्राप्त सामान अस्वीकृत किया जा सकता है।
12. इस आदेश के पालन में डेलिवरी के समय का ध्यान रखें, अन्यथा परिनिर्धारित नुकसान के रूप में, प्रति हफ्ते एक प्रतिशत, अधिकतम आपूर्ति आदेश के कुल कीमत पर दस प्रतिशत तक का दावा करने का अधिकार निदेशक, एनएएल के पास है।
13. सभी कार्यदिवसों में 4:00 बजे से पहले हमारे भंडार में सामान की आपूर्ति की जा सकती है। कहीं भी संस्थापन की आवश्यकता हो तो, आपूर्तिकार द्वारा बीमा मुक्त समय के अंतर्गत, किया जाए ताकि दावे प्रस्तुत किये जा सकते हैं। उपस्कर के संस्थापन विफल हो गया तो उपरोक्त में बनाये गये वही दर जुर्माना देना होगा।
14. आदेश बेंगलूर क्षेत्राधिकार के अंतर्गत है।

Terms & Conditions

1. The order should be acknowledged by return post confirming the rates and all other terms and conditions embodied, within 21 days.
2. The number and date of this Order and serial number of the article overleaf must be quoted in the bill and the rates must be checked with your original quotation. No variation in price and specifications will be accepted.
3. For payment, the bill should be prepared in ink or typed, pre-receipted and submitted in duplicate along with packing list.
4. In case your rate is F.O.R dispatching station the goods are required to be insured for full value including freight charges and claim the same in your bill with supporting vouchers.
5. Charges not mentioned in the quotation shall not be paid. VAT-TIN number should be mentioned in the bill wherever applicable. It may be noted that this Laboratory is NOT eligible to issue Central sales Tax concessional Form 'C' or 'D'. This laboratory is, however eligible to issue Central Sales Tax as applicable to Scientific and Educational Institution on all purchases of Scientific Equipment from Bombay (Maharashtra State), Delhi and Manipur.
6. Printed conditions, if any, sent along with your quotation shall not be binding on us.
7. This laboratory is exempted from Excise Duty vide notification No.10/97 dtd 01/03/2007 & Customs duty vide 51/96 dtd 23/07/96 at a concessional rate is leviable.
8. No claim on account of payment of Octroi duty within the limit of the Municipal Corporation shall be accepted.
9. Payment of your bill will be made on receipt of the articles in good condition, by crossed account payee cheque on the State Bank of India, Bangalore.
10. All damaged or/and unapproved good shall be returned at your cost and risk and the incidental expenses, incurred thereon shall be recovered from any of your bills.
11. Supplies received after the due date are liable to be rejected.
12. As time is the essence of this order, the date of delivery should be strictly adhered to, otherwise the Director reserves the right to claim liquidated damages at 1/2 percent per week subject to maximum of 10 percent of the total value of supply order.
13. The items can be delivered in our stores before 4 P.M on all working days. Wherever, installation is required to be done, the same should be done by the supplier within the free time of insurance so that claims if any can be lodged. Failure to install the equipment will attract the same rate of penalty as mentioned at 12 above.
14. ORDER SUBJECT TO BANGALORE JURISDICTION ONLY.

SPECIFICATIONS FOR INDUCTIVELY COUPLED PLASMA PECVD SYSTEM

The Inductively coupled PECVD system has to be fabricated, tested, inspected, supplied and installed as per specifications and details provided below.

The system should essentially consist of :

- Semi circular type high vacuum chamber with front opening door and having number of ports for connecting different facilities.
- High vacuum pumping system with turbo molecular pump with controller, backing rotary pump, valves, SS plumbing line, vacuum measuring gauges, manual throttle valve for controlling the process pressure etc.
- Gas handling system with manifold, valves, SS pipeline, 4 channel mass flow controller with display unit . Capacitance manometer (Baratron type) with power supply and display unit for measurement of process pressure.
- 500 Watt , 13.56 MHz, RF power supply with water cooled RF feedthrough as per our specifications.
- Control console with safety interlocks for smooth operation of the system.
- Set of spares and mounting stand for the total system.

Brief description of the main components are given below:

HIGH VACUUM CHAMBER

The vacuum chamber of the proposed Inductively Coupled PECVD system has to be rectangular type measuring 600x500x400 mm (hwxwd) with rectangular door and a semi-circular body at the back. Material of construction has to be SS304. The type and number of ports given below are the minimum and minor modifications may be made with consultation with out major changes in the basic design.

The top plate should have an ISO250KF flange and cover plate for the flange to have a water cooled RF feed through and 4 no. one inch feed throughs. The bottom and the back side of the chamber to have ISO 160KF flanges for mounting the turbo or other pumping system. Two number ISO 250 bolt-on flanges are to be provided on both the sides.

In addition to these flanges other ports on the main chamber have to be provided for view ports, general vacuum measurement, process gas inlet and process pressure measurement and other feed throughs. A complete drawing of the system has to be provided.

The cover plate for the bottom 160 ISO KF flange should have provision for 5 number feed throughs with one electrically isolated for biasing the substrates. The door should have three number 2inch view ports mounted on it. A two layer removable shield has to be provided in side the chamber.

The design and fabrication of the chamber has to be as per ASME code sec VIII and the weldings have to be done by TIG argon arc welding following ASME code Sec IX . All the weld joints have to be leak tested by Helium Mass Spectrometer Leak Detector to an

individual leak rate of 1×10^{-9} std cc/sec and finally the chamber should be buffed and polished to bright finish.

HIGH VACUUM PUMPING SYSTEM

The chamber should be evacuated to a base pressure better than 10^{-6} mbar by a combination of Varian / Pfeiffer Turbo molecular pump of atleast 500 lit/sec. with appropriate controller, vent valve, inlet shield etc., and backing rotary vacuum pump of capacity 585 lit/min (35m³/hr) 20.5 CFM). Necessary valves, SS pipelines and vacuum measuring gauges should be provided. The turbo pump should be capable of pumping at low backing pressure, typically from 10^{-1} mbar. The system should have two low vacuum gauges and a high vacuum gauge to measure high vacuum better than 10^{-6} mBar. The digital gauge controllers for the gauges and the gauges themselves should be calibrated against national standards.

A 6" size electro-pneumatically operated gate valve has to be used as high vacuum valve above the turbo pump and the 2" backing / roughing valves used should be butterfly type. A manually operated throttle valve has to be fixed above the high vacuum valve to control the pumping speed during CVD process.

GAS HANDLING SYSTEM

The gas handling system should consist of a SS manifold for mixing the gases. Manifold should have 4 numbers of inlet and one number of outlet which is connected to the chamber. 4 nos. of mass flow controllers with display cum control unit have to be provided in the gas handling system and the MFC's have to be procured from MKS Instruments. The MFC's have to be calibrated for Methane (0-50 sccm), Nitrogen (0-50 sccm), Hydrogen (0-100 sccm) and Argon (0-100 sccm). The MFCs should have solenoid operated isolation valves on both sides. The gas mixture from the gas manifold should enter the vacuum chamber and deliver the gases at the appropriate location uniformly with a ring shaped showerhead type gas feeding arrangement.

PROCESS PRESSURE MEASUREMENT

Process pressure measurement has to be done by an MKS make baratron capacitance manometer calibrated for reading 0.1mbar pressure with appropriate readout device and connecting cables.

RF POWER SUPPLY

The Huttinger make RF power supply operating at 13.56MHz frequency should have an output power of atleast 500W with auto matching network for inductive coupling with optical fiber control of matching network. Availability of pulse mode power operation is desirable. Digital display of forward and reflected power, RF voltage, self-bias and matching network settings and other important operating parameters should be readable through a front panel display.

CONTROL PANEL

All the electrical and electronic instrument should be mounted on a separate movable standard 19" instrument rack. It should house all the electrical switch gear and operating switches and monitoring devices. Vacuum measuring gauge, RF power supply,

Mass Flow controller, Turbo controller, etc all have to be mounted in the control panel. A mimic diagram with active display should be provided to know the status of the system and process cycle. All the safety interlocks for the smooth operation of the system should be provided in the control panel. The control panel should be a self standing unit and separate from the main process system and a connecting cable should integrate them.

SAFETY INTERLOCKS

Standard safety interlocks for high vacuum system should be provided for the smooth operation of the system. Vacuum system / cycling and process should be interlocked for safety of the instrument and the personnel using. All the major electrical circuit should be provided with contactor / circuit breaker with fuses . The RF feedthrough should be checked for the leakage and impedance and the instrument should be effectively grounded.

SPARES

Following spares are provided with the system

- | | |
|------------------------|-------------|
| 1) 'O' ring and gasket | : 1 Set |
| 2) Fuses | : 1 Set |
| 3) Indication lamps | : 1 Set |
| 4) Rotary pump oil | : 20 litres |
| 5) Pirani gauge head | : 2 Nos. |
| 6) Penning gauge head | : 1 No. |
| 7) Swagelok coupling | : 2 Nos. |
| 8) Solenoid valve | : 2 Nos. |

9) A set of fuses and essential spares for turbo and rotary pumps, RF power supply and gas handling system to be provided.

FABRICATION AND DRAWING

The system has to be fabricated from SS 304L material and the vacuum chamber should be electropolished and leak tested. All the SS material should be tested for chemical composition. All the weldings should be done by TIG argon arc welding following ASME code Sec IX. All welded joints should be tested by NDT. All the welded joints should be leak tested by Helium Mass Spectrometer Leak detector to an individual leak rate of 1×10^{-9} std cc/sec.

A compact mounting stand fabricated from MS material (neatly painted) should be provided to mount the process chamber at convenient height.

Detailed fabrication drawing has to be made and submitted for our approval. Only after our approval, the fabrication process should start.

PRE-DESPATCH INSPECTION

The total system has to be offered for checking at various stages for conformity to the tendered specifications and finally before dispatch for our inspection at your works at Bangalore. Only after our inspection and acceptance, the items should be shipped to our site.

INSTALLATION

The supplied items must be installed at our site by your factory trained engineers on free of cost. However the utilities will be provided by us.

INSTRUCTION MANUAL

The supplied item must accompany instruction manual containing all drawings , electrical and electronic circuit diagram, operation and maintenance manual etc.,

FINAL ACCEPTANCE AT NAL

After the installation and commissioning at NAL, you should demonstrate the system performance as per tendered specifications.