भारत सरकार / GOVERNMENT OF INDIA
अंतरिक्ष विभाग / DEPARTMENT OF SPACE
विक्रम साराभाई अंतरिक्ष केंद्र / VIKRAM SARABHAI SPACE CENTRE
तिरुवनंतपुरम / THIRUVANANTHAPURAM - 695 022

विज्ञापन सं. वीएसएससी/पी/विज्ञापन/23/2009 दिनांक 08.03.2010

ADVT NO. VSSC/P/ADVT/23/2009 DATED: 08.03.2010

भारत के राष्ट्रपति के लिए तथा उनकी ओर से, निम्नलिखित कार्य के लिए, वरिष्ठ प्रधान, क्रय एवं भंडार, विक्रम साराभाई अंतरिक्ष केंद्र (वीएसएससी) मोहरबंद निविदाएं आमंत्रित करते हैं।

For and on behalf of the President of India, the Sr. Head Purchase & Stores, Vikram Sarabhai Space Centre (VSSC) invites Sealed Tenders for the following work.

सं NO.	निविदा सं. TENDER NO.	मद / ITEM	मात्रा (सं.) QTY. (Nos.)	निविदा शुल्क TENDER FEE
1	6082-09-6898	उच्च ताप सिंटरन भट्टी (एचटीएसएफ) **यह दो भागवाली निविदा है।** भाग-1 (तकनीकी तथा वाणिज्यिक बोली) भाग-2 (मूल्य बोली) High Temperature Sintering Furnace (HTSF) **THIS IS A TWO PART TENDER** Part-1[Technical & Commercial Bid] Part-2 [Price Bid]	01	रू./Rs. 225/-

निविदा फॉर्म जारी करने की अंतिम तिथि **Last Date for issue of Tender Forms**	**21.04.2010 16.00 बजे तक/up to 16.00 Hrs**
निविदा स्वीकृति की नियत तिथि **Due Date for Receipt of Tender**	**22.04.2010 16.00 बजे तक/up to 16.00 Hrs**
निविदा खोलने की तिथि **Tender Opening Date**	**23.04.2010 10.00 बजे/at 10.00 Hrs**

नोट / Note:

1. उक्त मद के संपूर्ण विवरण तथा विनिर्देशन एवं निविदा प्रस्तुत करने के संबंध में पालन किए जानेवाले सामान्य अनुदेश निविदा दस्तावेज़ों में दिए गए हैं।
   Full details and specifications of the item and general instructions to be followed regarding submission of tenders are indicated in the tender documents.
2. **इसरो वेब साइट www.isro.gov.in** में निविदा दस्तावेज़ उपलब्ध हैं। इच्छुक निविदाकार इस वेब साइट से अपनी इच्छानुसार निविदा दस्तावेज़ों को डाउनलोड करें और निविदा अधिसूचना में दिए गए विवरणों के अनुसार अपने प्रस्तावों को निर्धारित निविदा लागत के साथ (बैंक ड्राफ्ट के रूप में) प्रस्तुत करें।
   Tender documents are available on ISRO website **www.isro.gov.in**. Interested tenderers may, at their option download the tender documents from the website and submit their offers along with the prescribed tender cost [in the form of Bank Draft] as per details given in the tender notification.
3. निविदा दस्तावेज़ों को निम्नलिखित पते से भी प्राप्त किया जा सकता है:
   वरि.क्रय एवं भंडार अधिकारी, क्रय यूनिट-V, आरएफएफ क्षेत्र, वीएसएससी, इसरो डाकघर, तिरुवनंतपुरम - 695 022.
   Tender Documents can also be obtained from the following address:
   Sr.Purchase & Stores Officer, Purchase Unit - V, RFF Area, VSSC, ISRO Post, Thiruvananthapuram - 695 022
4. निविदा शुल्क का भुगतान **मात्र रेखित डिमांड ड्राफ्ट** के रूप में किया जाए। अन्य विधि का भुगतान स्वीकार्य नहीं है। **यह डिमांड ड्राफ्ट लेखा अधिकारी, यूनिट सं. V, वीएसएससी के नाम पर भारतीय स्टेट बैंक, तुंबा शाखा, तिरुवनंतपुरम - 695 022 पर देय होना चाहिए।**
   Tender Fee shall be paid in the form of CROSSED DEMAND DRAFT ONLY. Other mode of payment is not acceptable. **The Demand Draft should be in favour of: Accounts Officer, Unit No.V, VSSC payable at State Bank of India, Thumba Branch, Thiruvananthapuram - 695 022**
   [निविदा शुल्क अप्रतिदेय है।/ The tender fee is NON - REFUNDABLE]
5. निविदा दस्तावेज़ों के लिए अनुरोध करते समय लिफाफे पर "निविदा दस्तावेज़ों के लिए अनुरोध-निविदा सं.—— दिनांक————" का उल्लेख करें।
   While requesting for Tender Documents please indicate on the envelope as "Request for Tender Documents - Tender No..... dt....."
6. अपने प्रस्ताव को प्रस्तुत करते समय लिफाफे पर ऊपरी भाग में स्पष्ट रूप से निविदा सं. तथा नियत तिथि लिखी जाए तथा ऊपर की क्रम सं.3 के प्रेषिती को भेजा जाए।
   While submitting your offer, the envelope shall be clearly superscribed with Tender No. and Due Date and to be sent to the addressee at Sl. No. 3 above.
7. नियत तिथि / समय के बाद प्राप्त होनेवाली दर सूचियों पर विचार नहीं किया जाएगा।
   Quotations received after the Due Date / Time will not be considered.
8. डाक व्यवस्था के कारण, दस्तावेज़ प्राप्ति में होनेवाले किसी विलंब / अप्राप्ति के लिए वीएसएससी, तिरुवनंतपुरम उत्तरदायी नहीं है।
   VSSC, Trivandrum is not responsible for any postal delay / loss of documents in transit.
9. वरि.प्रधान, क्रय एवं भंडार, वीएसएससी, तिरुवनंतपुरम को यह अधिकार होगा कि वे कोई कारण बताए बिना किसी/या सभी निविदाओं को भागों में या पूर्णतः स्वीकार या अस्वीकार कर सकते हैं।
   Sr.Head Purchase & Stores, VSSC, Thiruvananthapuram reserves the right to accept or reject any / or all the tenders in part or full without assigning any reasons thereof.

(एम पी कृष्णन कुट्टी / MP Krishnan Kutty)
वरि.क्रय एवं भंडार अधिकारी, वीएसएससी/ Sr.Purchase & Stores Officer, VSSC

Annexure - 1

HIGH TEMPERATURE SINTERING FURNACE (HTSF)

SCOPE OF WORK

Design, Engineering, Fabrication, Supply, Installation, Testing, Commissioning, and Demonstration of High Temperature Sintering Furnace (HTSF), as per the Technical Specifications, Terms and Conditions given below.

INTENDED USES OF HTSF

The specified HTSF is intended to be used for the following applications:

1. Sintering of P/M components made out of Non-ferrous/Ferrous alloys (Cu, Ni, Ag, Mo, W, Fe etc) and ceramics ($MoSi_2$, SiC, Al_2O_3 etc).
2. Heat treatment of components made out of magnetic/super alloys (Fe, Ni and Co base), MA-ODS alloys, refractory alloys, stainless steels, copper alloys etc. with slow, fast and variable heating & cooling rates under Hydrogen, vacuum & inert atmosphere.

SPECIAL CONDITIONS

The offer should be of two parts :

(i) Technical bid & Commercial bid and

(ii) Price bid

1.0 MAJOR SPECIFICATIONS AT A GLANCE

1.1 Configuration : Front Loading, preferably Cylindrical, Horizontally Mounted furnace.

1.2 Usable Work Zone : 300mm (W)x 300 mm(H) x 600 mm(L). (Suppliers can quote for the nearest available higher size. However, 300mm (W)x 300 mm(H) x 600 mm(L) is the minimum size requirement)

1.3 Load weight maximum : 45 kg of Tungsten

1.4 Ultimate Vacuum level : better than $1x10^{-5}$ mbar within 45 minutes for clean, cold and empty chamber.

Operating Vacuum Level (range) : 1×10^{-2} mbar to 1×10^{-5} mbar

1.5 Heating element : Lanthanum doped Molybdenum wire mesh

1.6 Temperature, atmosphere & Holding time :

Maximum operating temperature : 1700°C
Normal operating temperature range : 400 °C -1600°C
Working atmosphere : Vacuum, Argon & Hydrogen.
Holding time at maximum operating temperature : 4 hrs.

1.7 Process Gases used : Hydrogen & Argon

DETAILED TECHNICAL SPECIFICATIONS

2.0 CHAMBER ASSEMBLY

2.1 Furnace chamber should be designed to operate in a Process Gas environment at normal working internal pressures of 2 to 10 PSIG. or in vacuum of $1x10^{-6}$ mbar. The adopted design code reference for fabrication of chamber & door along with all relevant details shall be indicated in the offer. Furnace outer shell & door temperature should not exceed 45°C during maximum operating temperature. The design of water cooling jacket shall assume that there is no hot spot above 45 ^{o}C on the vessel.

2.2 Chamber & door should be double-walled baffled, water-cooled with 304L grade stainless steel construction with electro polished finish for good vacuum pumping characteristics and aesthetic appearance. The chamber shall be supported and mounted horizontally on an enclosed structural support frame assembly for ease of loading and unloading of products by the operator. Front door shall be secured with suitable clamps or/and air-operated pneumatic wrench. This safety feature shall prevent accidental opening the door when in a hydrogen atmosphere.

2.3 The chamber should be constructed with a front door which allow easy access(180º swing) to the hot zone allowing the operator to reach the hot zone entirely during the loading of work piece.

2.4 Viewing sight glass on the front door shall be provided(optional). This viewpoint can also be used in conjunction with an optical pyrometer. Preferably a movable sight glass shield shall also be provided to prevent vapor deposition on sight glass.

2.5 Suitable ports should be provided for Control, over-temperature and survey thermocouples. Preferably extra blind port flange with six T/C connectors also should be provided for extra Thermocouples for monitoring the job.

2.6 All elastomer o-ring seals exposed to high vacuum / temperature should be Viton of single piece. They should be free from wrinkle or projection.

2.7 Chamber and pipelines shall be painted with good finish.

3.0 HOT ZONE

3.1 Usable Work Zone: 300mm (W) x 300 mm(H) x 600 mm(L). (Suppliers can quote for the nearest available higher size. However, 300mm (W)x 300 mm(H) x 600 mm(L) is the minimum size requirement)

3.2 Temperature uniformity on entire hot zone: ± 5^{0}C

3.3 Heating element, Temperature, atmosphere & Holding time :

Heating element : Lanthanum doped Molybdenum wire mesh

Maximum operating temperature : 1700°C

Normal operating temperature range : 400 ° C - 1600°C

(controlled and programmable)

Working atmosphere : vacuum, argon & Hydrogen.

Holding time at maximum operating temperature : 4 hrs.

3.4 No. of heating elements: The heaters shall be designed to achieve the correct heating rate and temperature uniformity (± 5 °C) with a charge of 45 kgs of Tungsten with sufficient de-rating. The heating elements have to be protected by accidental bump during loading of the work piece. Heating elements and hot zone should be procured from M/s Plansee or other reputed make.

3.5 The furnace shall have heating and cooling rates programmable and controllable.

Heating rate : Minimum 1 ºC/minute to maximum 20 ºC/minute (controlled and programmable)with full charge.

Cooling rate : Minimum 1 ºC/minute to natural cooling rate of the furnace(controlled and programmable).

3.6 The furnace shall have multiple-layer molybdenum refractory metal radiation shields completely surrounding the hot zone. The heating system shall be designed such that minimum distortion of the heating elements takes place during operation. The spacers placed between each panel shall ensure the correct clearance and avoid deformation leading to a mechanical contact between shields during operation. Suitable radiation cooled supports shall be provided for the shields.

3.7 Suitable pedestal base plate, preferably Lanthanum doped Molybdenum should be provided to support the work load of up to 45 kgs of Tungsten at the max. operating temperature.

3.8 Power feed-through shall be machined from solid copper. Power feed-through protection covers to be provided.

3.9 Continuous operation capability with Full charge at maximum working temperature shall be 4 Hrs.

3.10 Procedures & methods for calibration are to be provided.

3.11 Temperature Control /Recording/Data Logging:

3.11.1 One (1) Type 'C' (W-5% Rhenium/ W-26%Rhenium) control thermocouple (omega USA make), 1/8 inch diameter Tantalum sheathed along the entire length as required for primary temperature control.

Optional feature: The system shall have 2 primary control thermocouples inside the hot-zone, one primary and a second redundant one, which can be "switched-in" in case of primary thermocouple failure, to control the temperature.

3.11.2 one (1) Type 'C' (W-5% Rhenium / W-26%-Rhenium) over-temperature detection(preferably omega make), 1/8 inch diameter Tantalum sheathed along the entire length as required should be provided.

3.11.3 Two (2) Type 'C' (W-5% Rhenium / W-26%-Rhenium) Job thermocouples (M/s. omega, USA), 1/8 inch diameter Tantalum sheathed along the entire length as required.

3.11.4 Measuring accuracies for Temperature controllers should be within

± 0.5 % or better.

3.11.5 All thermocouples should be procured from M/s. omega, USA with calibration certificates and traceability to the National standards.

4.0 VACUUM SYSTEM

4.1 Furnace shall be provided with suitably sized rotary vacuum pump and Diffusion Pumping (Varian/Edwards/Pfeiffer/Leybold/Alcatel) system including appropriate vacuum valve, isolation valve, relief valve etc.

4.2 Pumping system of adequate capacity shall be provided to achieve ultimate vacuum level of better than $1x10^{-5}$ mbar in less than 45 minutes from start of pump down from atmosphere pressure. (Performed in a clean, empty, dry and at room temperature).

4.3 The total leak rate (system level) should be $\leq 1 \times 10^{-3}$ mbar lit/s and the individual level (joints, vacuum plumbing lines, feed through flanges, valves, various ports etc) leak rate should be $\leq 1 \times 10^{-8}$ m bar lit/s. Leak rate should be certified.

4.4 The capacitance gauge (Edwards/Pfeiffer/Leybold/Variant) should be incorporated for the vacuum level measurement in the chamber.

4.5 The pumping system should be operated using PLC with sequencing to ensure interlock and safe operation.

4.6 Stainless steel vacuum plumbing lines with metallic bellow adaptors to connect vacuum system with the furnace chamber should be used. The metallic SS bellows should be preferably of Mewaza (Switzerland) or Edwards/ Pfeiffer/Leybold make. All flanges and fittings should be as per ISO standards with Viton 'O' rings as seal. Design should ensure that the Viton 'O' rings are not exposed to high temperatures.

4.7 Provision of additional port (as per ISO standard) shall be given in the backing line for Helium leak test.

4.8 The pumping system (rotary pump) should contain an exhaust oil mist filter to avoid contamination. All pumps must be provided with proper oils/ fluids. Technical Details of pumps and its Motors should be indicated.

4.9 Required fittings, gate valves and gauges should be provided with schematic diagram, and they must be from reputed brands. Schematic diagram includes all the vacuum lines, Electro-pneumatic operated high vacuum valve, Electro-pneumatically operated roughing valve and Electro-pneumatically operated fore line valve, vacuum sensors, valves, and instruments needed for monitoring and operating the vacuum system.

4.10 Air manifold system should be used to operate pneumatic valves.

4.11 A vacuum relief valve (back to atmosphere) shall be provided for the purpose of releasing the pressure or to conveniently leak check the system.

4.12 Cold trap with Refrigeration Condensing Unit should be provided. Condensing unit shall be charged with a non-CFC refrigerant with an ozone depletion value of zero. A baffle temperature shall be -6°C to -9°C.

5.0 PROCESS GAS SYSTEMS

5.1 Purge gas is Argon (Total purity in VL.% - 99.9 (min)). Process gas is Hydrogen (Total purity in VL.% - 99.9(min)) or Argon or a mixture of both.

5.2 System should have one Static Backfill & Flowing Inert Gas System and one Combustible Gas Operation Safety System. Static Backfill control shall backfill the chamber with inert gas and maintain pressure at 1 psig. Flow control will backfill the chamber with inert gas to 1 psig flow through the chamber and exhaust to atmosphere. The system will maintain 1 psig throughout the furnace operation.

5.3 System shall have standard normal positive operating pressure of 2 to 10 PSIG. Inert gas system for Static Backfill shall include solenoid operated valve, compound gauge, 2 psig pressure relief valve, pump out valve and 1 psig pressure switch for automatic gas shutoff etc.

5.4 Combustible gas control (for use with hydrogen) system includes a burn off with dual igniter with flame detector, flash arrestor, pressure relief valve, filter, gas metering valve, air operated exhaust valve, compound gauge, pressure switches (for vacuum, 1 psig, 10 psig, 2 – 10 difference), solenoid operated valve, flow meter with integral flow control valve and pump out valve.

5.5 Party should specify clearly following operational details like i) Operating pressure of Hydrogen gas system , static back fill and flowing inert gas system. ii) safety relief pressure setting iii) over pressure setting iv) cut off gas supply pressure v) sequence of operations for purge, process gas (Hydrogen) and inert gas (Argon) system vi) and Auto, Semi-auto and Manual operations.

5.6 Manual shutoff valve shall be provided in inlet of process gas & purge gas lines to evacuate the pipelines. Supply connections shall be provided for Purge line, Process gas line and Inert gas line.

5.7 Before start of a Process gas (Hydrogen) cycle, the chamber has to be evacuated to 10^{-3} mbar (pre-determined level) and argon gas to be purged. The purpose of this pumping system is to quickly remove most of the air from the furnace chamber and fill the space with inert gas. Typical combustible gas operation (hydrogen) cycle consists of the following sequence:

Typical sequence of process gas cycle

Chamber evacuation to the pre-determined level.

Leak check integrity of chamber via rate of rise test.

If required, backfill with Argon gas and evacuate the chamber (if desired by operator)

Check the Vacuum status

Start hydrogen process "ON"

Ignition on and check the status.

Check the process gas and Purge gas pressure

Fast backfill of purge gas (Argon) to 1 Psig

Start hydrogen gas flow

Start heating cycle

Maintain the process gas pressure during heating and cooling

Cool down to room temperature

Timed purge after "switch off" the heating element and closure of hydrogen gas.

The above mentioned is only a suggested sequence based on our experience on similar system and party may quote their own process gas cycle conforming to NFPA/other international standards. Party should clearly specify the sequence of process gas operations with appropriate interlocks in Manual / semi-automatic / Automatic mode.

5.8 Atmosphere Control: Process gases shall be admitted to the chamber through programmed valves and flow meters. An interlock should be included which provides for automatic argon purge in the event of loss of Hydrogen or hydrogen pressure or hydrogen flow. Exhaust gas is routed through a check valve and gas

metering valve to control the flow of hydrogen.

5.9 Timed argon purge with adjustable timer shall be provided in the purge assure circuit, regardless of the program status whenever power or the program is interrupted. A normally open solenoid valve on the purge circuit shall be provided. It assures that the furnace is always under a constant flow of gas in the event of a power failure. This feature will purge the chamber of hydrogen so that the furnace chamber will have a safe atmosphere to be opened to.

5.10 All gas plumbing, fittings and components shall be made of Stainless Steel. All gas connections are high quality high-pressure swagelok fittings.

5.11 ELECTRIC BURN OFF IGNITOR

5.11.1 Process gas system should have Burn off column and flash arrestor.

5.11.2 An electric igniter made of silicon carbide maintains a positive ignition source at the gas exit. This includes an electronic sensor which signals an alarm to shut off hydrogen if the ignition source is lost.

5.11.3 System should have Two (2) igniters for primary and secondary ignition (in the event of primary igniter failure). The system is interlocked with a current sensor to test for acceptable igniter operation at the beginning of each run cycle. A test of igniter and pilot lamp shall be provided. An exhaust gas burn off column electronically ignites the waste gas. Ignition is called for automatically at all times that Hydrogen is called for, and the unit attempts re-ignition should the flame be inadvertently extinguished.

5.11.4 Combustion assembly shall be fitted where burn-off of effluent products is performed safely away from accidental contact by operator. All flow train components should be provided in the flow control panel for protection of the components and good appearance.

6.0 ELECTRICAL SYSTEM

6.1 The equipment should be designed to operate at 415 V, 50 Hz, 3 phase AC supply.

6.2 Furnace heaters should be powered through isolated step down transformer for low voltage operation (preferably < 36 V) and controlled by thyristers. Thyrister Controller System should be provided with proper protection and Semiconductor back up fuse. Heating power system should be three phase balanced to minimize harmonic disturbance.

6.3 Power control system should be equipped with a main contactor, current limiters, over current protection, slow starting circuits for preventing surges, etc.

6.4 A free standing standard industrial panel with full opening front doors should be provided to house all control instrumentation, PLC, push buttons, lights, alarms, motor starters, relays, and power meters etc. Panel should be dust protected and properly ventilated. All items should be properly mounted inside the control panel for easy inspection and maintenance. The control panel should be fully tropicalised (Max. Ambient temperature 45°C).

6.5 All the circuit diagrams and details should be provided.

7.0 CONTROL AND DATA ACQUISATION SYSTEM

7.1 The furnace should be controlled for it safe operation by a Programmable Logic Control of standard make like AB, Schneider, Siemens, Honeywell etc. All operations like vacuum system, inert gas purging, inert gas, process gas and heating system should be properly carried through PLC with necessary safety interlocks.

7.2 A programmable PID temperature controller of reputed make like (Yokogawa/ Eurotherm/Honeywell) should be provided for temperature control. The controller should be capable of programming different temperature cycles and store at least 16 programmes. A separate temperature controller should be provided for over temperature protection.

7.3 Control panel should be provided with phase indicators, meters for monitoring voltage & current to each heater circuits, MIMIC Diagram with indicators for operation of heater, pumps and valves etc. An emergency switch should be provided on control panel for emergency shut down of the furnace. An audio-visual alarm should be provided in the control panel to indicate any Warning, fault or failure in operating / safety systems.

7.4 The control and data logging system can be either PC based or HMI based. It should be equipped with relevant software like SCADA system for its trouble free operation. Control system should have the provision for Manual/ semi-automatic / Automatic operation of the Furnace. Party should clearly specify the operations in Manual / semi-automatic / Automatic mode. Preferably, PC based data acquisition shall be provided. The system should include latest industrial version PC with fastest memory, 19-inch TFT LCD color monitor, color laser printer etc.

7.5 Licensed copies of all software and programs should be provided with the equipment.

7.6 Any software developed for this system should be given to VSSC, and it will be VSSC property.

7.7 Provision should be available to upload and download the PLC software at site.

7.8 All the software used for the system should be supplied to VSSC in installable CD media.

8.0 WATER COOLING SYSTEM

8.1 Necessary water flow interlock should be provided in water circuits

8.2 Water manifolds shall be provided for supply and discharge.

8.3 Necessary manual valves and flow control valves shall be provided to enable proper water flow for each circuit.

8.4 A closed loop water-cooling system (Chilling plant) with a suitable heat exchanger shall be provided (optional) for cooling the furnace chamber. Maximum outside vessel temperature shall not exceed 45º C.

9.0 SAFETY

9.1 The party should take all steps to ensure completely safe operation of the furnace.

9.2 Most critical Interlocks must be hard-wired with link to PLC. All safety systems should be interfaced with PLC. Necessary safety interlocks like over temperature, water etc, Audible alarms, signal lamps, flow control valve, relief vale, process gas cut off valve etc should be provided to ensure safety of the equipment and personnel. Complete details of all safety features incorporated including interlocks, Audible alarms, warning, signal lamps etc., should be indicated in the offer.

9.3 A periodic safety audit procedure, maintenance procedures and Do's & Don'ts should be clearly indicated by the manufacturer to ensure safety of equipment and operating personnel.

9.4 Emergency stop button & Emergency operating procedures to be provided for

safe shutdown during in emergency condition.

9.5 SYSTEM CONFORMITY :The furnace system shall conform to international code or applicable code in India like "Electrical Standard for Industrial Machinery", "Standard for Industrial Furnaces using a special processing atmosphere", "Standard for Industrial Furnaces using vacuum as an atmosphere" etc., The adopted code reference along with all relevant details shall be indicated in the offer.

9.6 Electronics and electrical system should be conformed to the accepted international electrical standards and rules. The code reference along with all relevant details shall be indicated in the offer.

9.7 In the event of a power failure, the furnace system should go to safe mode configuration thereby protecting the hot zone and the workload from any type of damage.

9.8 Safety features in Hydrogen gas system:

9.8.1 Process gas system(Hydrogen gas) shall be designed as per NFPA requirements or applicable rules in India and Industrial Furnaces using a special processing atmosphere. All electrical components/ solenoid valves in hydrogen line should be explosion proof standard components and meet NFPA requirements or applicable rules in INDIA. Hydrogen gas system should be completely equipped with all the necessary controls to operate safely and efficiently.

9.8.2 System should have a spring-loaded secondary safety Relief port in the chamber to relieve excessive gas pressures, in the event of hydrogen ignition within the furnace .

9.8.3 Anytime the chamber pressure rises above the overpressure set point, the process gas or purge gas valve will close until the pressure falls below set point. The overpressure light will be energized to indicate the overpressure condition. Anytime the pressure remains overpressure for 2 (two) minutes or more the overpressure light will flash and the alarm will sound to alert the operator.

9.8.4 Due to the extremely flammable nature of hydrogen, it is important that all penetrations into the furnace should be protected against the accidental leak-in of air during operation.

9.8.5 The system should be safety interlocked for safe operation through all programmed operations. Some of the safety interlocks are:

Pre-operation: Power on, vacuum system isolation, chamber pressure & leak, pressure on all gas lines. Water flow, igniter on etc.,

During operation: Power on, chamber pressure between low and high limit, water flow, flame sensing, Misbehavior of any components/sub-system etc.

9.8.6 A test of the igniter should be provided. Visual Indication Of Gases: Pilot lights shall be provided to indicate which gases are flowing.

9.8.7 Timed purge should be incorporated in the purge system.

9.8.8 Provision should also exist for manual over-ride of control, if necessary.

9.8.9 In the event of power failure / in-sufficient flow/pressure of hydrogen gas, all valves to return to a safe configuration.

9.8.10 Party should provide two numbers of independent Hydrogen leak

detectors. Detector out put shall be connected to PLC. Incase the leak is detected, the system shall give alarm/ warning / fail safe mode.

9.8.11 It is the responsibility of the supplier to certify the installation for safe operation under hydrogen atmosphere.

10.0 GENERAL TERMS AND CONDITIONS

10.1 Documents to be submitted along with quotation :

10.1.1 Technical specifications : Technical specifications offered by the party with all the details in the required/specified technical specifications under sections 1 to 9 should be provided. **Quotation should consist of construction details with well-supported catalogues and leaflets along with make and model number of each component without which their offer will not be considered. Foot print of the system, dimension, weight, mobility and enclosure details to be provided.**

10.1.2 Specification compliance report : Party should enclose a compliance /deviation matrix with respect to each of the specification along with their offer for easy comparison without which the offer will not be considered.

10.1.3 QA plan: The proposed Quality assurance (QA) plan, by the party, for different stages of fabrication/testing, acceptance test procedures, details of operation of furnace (Vacuum, purge, backfill, inert gas and process gas) and details of controls etc should be provided.

10.1.4 Acceptance procedure : The proposed acceptance tests procedure (ATP), by the party, shall also be provided. The party should also provide all details like model number, make and specification of all the temperature/pressure controllers/sensors, thermocouples etc., and subsystems & accessories used in furnace.

10.1.5 Lay-out plan: The general arrangement of equipment layout details with drawings and the necessary building plan for accommodating equipments and auxiliaries shall be provided along with the offer.

10.1.6 Utilities required: The party shall clearly indicate the details of power, gas requirements and cooling water requirements to be provided by VSSC.

10.1.7 NOC: The vendor shall provide no objection certificate (NOC) from their respective Governments for the export of furnace to India (Vikram Sarabhai Space Centre(VSSC), Department of Space, Government of India).

10.1.8 Credentials : The suppliers should submit, along with their offer a list of customers in India/abroad , with full addresses where the furnaces having similar major specification supplied by them are operating. Parties are also requested to submit latest satisfactory performance certificate provided by the customers. A comparative statement of the technical specifications of the furnace indented versus the furnace being offered must be furnished by the bidders. **Since the item is required for sintering of high precision Powder Metallurgy components so, only companies having proven track record in the manufacturing of Hydrogen furnaces (min. five numbers of similar specifications) will be considered. The parties deviating above conditions are liable to be rejected.**

Note : All the documents should be in English.

10.2 Documents to be submitted after placement of purchase order (PO) :

10.2.1 Drawings and electrical details : The party should submit all the preliminary design drawings of furnace & its sub-systems, electrical details and details of

equipment layout plan for the building, equipment foundation details etc to be furnished within 3 months after the placement of order.

10.2.2 Mutually evolved Quality assurance (QA) plan during different stages of fabrication, integration and testing of the furnace and the Acceptance Tests Procedure (ATP) shall also be provided.

Note : All the documents should be in English.

10.3 Documents to be submitted along with Furnace :

10.3.1 All design documents conforming the specification/ fabrication drawings, test reports/ certificates, Calibration certificates, wherever necessary, should be provided including bought out items.

10.3.2 The methodology and means to monitor the health of the furnace at periodic intervals should be provided.

10.3.3 Procedures for calibration are to be provided.

10.3.4 Software: Any software developed for operation/maintenance the furnace should be supplied to VSSC in installable CD media with source code. Any Software used in the system should be given to VSSC with License. VSSC prefers to have the software to be developed in constant consultation with VSSC Engineers.

10.3.5 Operation, Maintenance, Testing & Calibration and Safety Manuals:

(a) Two sets of Operation, Maintenance, Testing & Calibration and Safety Manuals for the complete integrated system should be provided.

(b) Two sets of Manufacturer's Instruction Manuals for components manufactured by others should be provided.

(c) Two sets of assembly drawings should be included with the Furnace System.

10.3.6 Code Compliance : The Code compliance conformation of the Furnace System design must be mentioned and a certificate to be provided.

Note : All the documents should be in English.

10.4 INSPECTION

Pre-delivery inspection at the party's site :

10.4.1 The terms and conditions are on mutually agreeable basis.

10.4.2 Supplier shall submit all documents including test reports, and test certificates with respect to design, materials, fabrication, testing etc for pre-delivery inspection at manufacturer's site.

10.4.3 The equipment shall be assembled and satisfactory performance of all the systems shall be demonstrated as per the specifications and mutually evolved Accepted Test Procedures (ATP) at manufacturer's site.

10.4.4 The manufacturer should demonstrate the successful performance of the system initially at his work center for the maximum rated temperature, heating & cooling rates and furnace operation with 45 kg work load (Tungsten) and also after installation and commissioning at VSSC site.

10.5 INSTALLATION, COMMISSIONING AND ACCEPTANCE

The supplier (party) should undertake the full responsibility for :

10.5.1 The dispatch and unloading of the components at the installation site in VSSC, and successful installation, commissioning, testing and demonstration of the furnace at the site provided by VSSC.

10.5.2 The manufacturer should demonstrate the following performance of system at VSSC 's site after installation and commissioning for the final acceptance.

(a) The equipment shall be assembled and satisfactory performance of all the systems shall be demonstrated as per specifications and mutually evolved Accepted Test Procedures (ATP). All furnace operations and safety interlocks should be tested to assure proper functioning.

(b) ultimate Vac. Level : better than 1×10^{-5} mbar with in 45 minutes (clean, empty, dry and RT)

(c) Heating and cooling rates as per specification.

(d) Max. working temperature without charge : one cycle each in Vacuum, Inert gas, Process gas with Holding time of 4 Hrs.

(e) Max. working temperature with maximum charge : Two process cycles in Vacuum, Inert gas. Process gas. Holding time : 4 Hrs.

10.5.3 Utilities viz. Power (3-phase, 415V, 50Hz), required gas (Argon & Hydrogen gas) and water will be provided by VSSC.

10.5.4 Any software modification required within 1 year from installation should be supplied at free of cost.

10.6 GUARANTEE/WARRANTY

10.6.1 The equipment should be fully guaranteed for performance for 24 months from the date of commissioning and acceptance. A certificate to this effect should be given to VSSC.

10.6.2 The party should provide commitment for after sale service and supply of spare parts for the offered equipment for a period of at least 10 years.

10.6.3 The party shall commit to provide annual maintenance contract after the guarantee period on mutually agreed terms.

10.6.4 Consumables and Spares : List of recommended spare parts for running 100 nos. of cycles with individual quoted price should be mentioned. The party should supply essential spares like electrical fuses, indication lamps, O rings etc along with the equipment

10.6.5 Paint : The outer shell of the furnace chamber and all other components of the Furnace System must be first primed and then finished with two coats of industrial grade paint.

10.6.6Training for operation and maintenance of the furnace for minimum of two persons should be provided at manufacturer's site.

10.6.7 Schedule : Furnace installation is required urgently and as such the time schedule constitutes the essence of the contract. It is desired that the entire work should be completed within 9 (nine) months after the placement of purchase order.

11.0 SPECIAL CONDITIONS

11.1 The offer should be of two part :

11.1.1 1st part - Technical & Commercial bid and

11.1.2 2nd part – Price bid

11.2 A separate quotation for the following optional items should be furnished

11.2.1 Closed loop cooling water system for cooling the furnace & Diffusion pump

11.2.2 Air compressor with drier for compressed air should be furnished.

11.2.3 Hydrogen leak detector system (Pls. refer 9.8.10).