FINAL SPECIFICATION AFTER 2nd MEETING

DETAIL TECHNICAL SPECIFICATION OF HIGH TEMPERATURE VACCUM SINTERING FURNACE:

Sl. No.	Key Features	Our requirement:
1.	Furnace type:	Horizontal front loading cold walled Vacuum Sintering Furnace.
2.	Maximum Temperature:	1750^0 C (+/- 10^0 C) for 4 hrs minimum in vacuum , argon ,nitrogen and Argon + 5% Hydrogen gas mixtures .
3.	Continuous working temperature:	1700^0 C (+/- 10^0 C) for 24 hrs, in vacuum , argon ,nitrogen and Argon + 5% Hydrogen gas mixtures.
4.	Application	• Vacuum and controlled atmosphere sintering of Metal and ceramic Injection moulded parts for Engineering application. • Vacuum and controlled atmosphere Heat treatment of engineering component.
5.	Hot Zone	• Size :200(H)X 200(W)X300 (L) m.m.(minimum) • Temperature variation +/- 10 °C (max.) over the whole working range. • Over-temperature cutout Controller for thermal protection (class 2) to protect the furnace and sample. • Provision must be done to supply/purge gases (Argon/ Nitrogen,) in case of power failure. • Two sliding trays (graphite)must be provided to place the specimen. • Weight carrying capacity of the Hot zone should be at least 5 kg.
6.	Heating element	Isostatic pressed Graphite heating element for uniform heating.
7.	Vaccum	• Furnace should be designed for controlled vacuum pumping speeds appropriately controlled by software/PLC for handling powders samples. • The furnace must have appropriate sealing with water cooling jacket to ensure vacuum level of 1-10 milli bar (10^{-2} to 10^{-3} bar) at room temperature as well as highest operating temperature. • The vacuum pumping system should consists of Direct drive rotary vane pump and roots pump (with suitable condenser) to create the above mentioned vacuum and the relevant fittings is to be supplied. • Vacuum valves should be electro pneumatically operated with transmitter type pirani sensor gauge. • All the weldments/joints/valves of the furnace should be checked using MSLD to ensure the desired vacuum level as per specification.
8.	Controlled Atmosphere	• Air tight chamber with proper high temperature sealing is to be fitted within the chamber to withstand both positive and negative pressure (vacuum level as discussed above).. • The chamber must have the purging facility of Argon, Nitrogen and argon+5% hydrogen mixture gases with positive pressure (max 1.3 bar) throughout the sintering cycle whenever it is required. • It must have switching (purging/flushing) capability from vacuum to requisite atmosphere at any temperature with necessary pressure safety valves.. • Must consist of software controlled process gas management/controlled atmosphere system.

9.	Basic construction of chamber & f/c	• All the basic construction of the furnace will be of stainless steel (304 L or equivalent grade material). • Direct heat exposed parts to be made of heat resistant Graphite /Graphite fiber board / sacrificial layer of carbon fibre composite insulation material with double walled water cooled shell to make the furnace robust ,long life and easy to maintain. • Hydrogen Safety System with after burner is to be fitted in synchronization with the exhaust system. • Water-Cooled Flange type Door and furnace wall is required • All the pipelines fitting must be of SS304 or similar grade material. • Exhaust valve to wave out the exhaust gases. • Safety system for overshoots of gas pressure inside the chamber with hooter. • The volatiles must not react with heating elements (specifically volatiles,hydro-carbons, impurities). • Provision should be there to displace unburn/explosive gases manually in case of emergency (power failures,sensor problem etc.)
10.	Cooling system	• The total cooling system of the furnace to be taken from the central manifold distribution with control valves for independent operation with proper sensing signal for PLC. • The specification for the chiller (required for closed loop chilling must to be provided supplied with the furnace to overcome the heating load in various atmospheric/temperature condition.
11.	Gas Purging arrangement	• Must be fitted with individual flow meters to purge Nitrogen, Argon , argon+5% hydrogen mixture gases during the process . • necessary flow valve with gas line connections within the chamber to create a positive pressure even at its maximum working temperature as and when required . • Gas flow rate = 1-50 ml/min • All gas line fittings must be easy operational.
12.	Power	415V, 3- phase ,Thyristor base power control with stepdown transformer etc. as required.
13.	Mandatory Mounting in control Panel	The furnace should be fitted with safety thermocouple (C -type) with display. Necessary Ammeters and Voltmeters are required. Pressure indicator & vacuum Indicator, load and phase lamps/ indicators etc. to be fitted. The furnace should be fitted with over temperature cut off for safety purpose.
14.	Thermocouples	One thermocouple must be placed in the heating Zone for direct measurement of the temperature (C-Type) another in a suitable position near heating element with tantalum /high alumina sheathed.
15.	Furnace control unit	The furnace should be fitted with PLC controlling unit with suitable software (SCADA etc.) containing PID controller (make: Eurotherm /Honeywell) to synchronize the furnace operation having the following minimum features: No. Of Programme: Minimum 4 nos. • Pattern status: Must have at least 16 segments (Ramp + Soak) • Control Configuration: 0.5^{0}C/ Min or lesser to 5 ^{0}C/min or greater (Heating & cooling) ▪ Process value i. Set Value ii. Status indication iii. Mode indication iv. Pressure Indication in the tube (if possible) • Accuracy: +/- 10^{0}C at 600^{0}C -1750^{0}C • Temperature protector: Solid state with audio signal/manual state. • All the display and control should be in the CONTROL PANEL mandatorily having auto and manual control features. Necessary software must be provided for operating the furnace through computer. • Scan time/Logging time: Programmable i. Facility to view the real time line graph of the total sintering cycle (heating &cooling) and the data must be stored in a separate file ii. Data base must be created in the back ground which can be seen in tabular form with real time and date for process cycle reporting. iii. The records can be searched by date and time or by the user selectable field. iv. The program of ramp & soak, tuning and start & stop must be done by software through branded computer (computer to be provided with the system).

		v. In process programme/cycle editing facility. There must be an additional provision for controlling the furnace manually in case of emergency.
16.	Safety devices &interlocks	All the required safety devices and interlocks to be provided for trouble free and smooth operation and to prevent accidental failures to furnace and operator.
17.	Warranty :	Comprehensive onsite warranty for 1year (at least) including heating element.
18.	Documentation & Training:	Operation & maintenance manual of the furnace in English Language must be provided in CD or hard copy, 3-days training must be provided on operation & maintenance of the furnace at CSIR-CMERI after commissioning.
19.	Thyristor	Full automatic (make : Eurotherm/ AEG/Yudian)
20.	Control Cables	Standard copper conductor, PVC insulated, extruded PVC inner sheathed, steel wire armored, FRLS PVC outer sheathed as per IS: 1554 (part-I) Make :Finolex, Mescab etc..
21.	Fuses ,contactors etc.	Power contactor, MCB, Fuse etc. should be make of L&T , Siemens or equivalent reputed brand.
22.	Vendor Qualification criterion	Vendor must provide documentary evidence (purchase order / Commissioning certificate etc.) of supplying 3 nos. of similar type furnaces (operating Temperature above 1600^0C and operating pressure 10^{-2} bar or less) in Public sectors/Govt. Research institute/Govt. Academic organization in India within last 5 years..
23.	General Terms	1. For authorized vendor an authorization letter from OEM to be submitted. 2. General Layout Drawings with hot zone, Vacuum pumping ,,electrical & electronics control schematic diagrams to be approved before manufacturing. 3. Vendors must submit list of spares required for 3 years trouble free running.
24.	Inspection & acceptance Test	• Pre-dispatch inspection will be carried out at Vendor's site by CSIR- CMERI personnel as per the enclosed sintering cycle. At least 3 such cycles must be demonstrated to ensure repeatability in terms of set temperature and pressure. The cost of running the furnace during pre-dispatch trial/inspection must be included in the offer. • Final Acceptance Test to be carried out with trial run of samples, in different programmes for 3 cycles to inspect and test the • machine performance before releasing the test certificate. at CSIR_CMERI,Durgapur