

Annexure- 1

INSULATION AND CHEMICAL SCIENCES LABORATORY (ICH)

TECHNICAL SPECIFICATIONS FOR REFURBISHMENT OF EXISTING VACUUM IMPREGNATION CHAMBER AND SUPPLY OF EPOXY RESIN MIXING CHAMBER

The integrated system comprises of two separate sub systems:

1. Resin hardener mixing system (RMS)
2. Vacuum Impregnation system (VIS)

RMS

The resin-hardener mixing system shall comprise of a cylindrical tank of suitable dimension to accommodate 250 kgs. of resin-hardener mix. It shall be capable of mixing minimum 150 kgs of resin hardener mix. The RMS shall have separate control and monitoring for heating, pressure, mixing and vacuum.

VIS

The Vacuum Impregnation system shall comprise of a cylindrical tank of suitable dimension to accommodate the job. The VIS shall have separate control and monitoring for heating and vacuum. The existing vacuum chamber shall be modified / refurbished as per the requirement.

RMS shall be situated at an elevated platform at a head difference of 15 meters from the highest point of VIS. The outlet of the RMS shall be connected to VIS through a flexible steel chorded hose pipe.



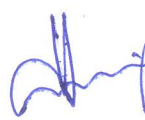
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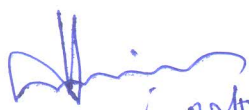
The details of the individual system as detailed below:

Sl. No.	Parameter	Description
1.0	Resin Hardener Mixing System (RMS)	
1.1	Description	Cylindrical Chamber with disc shaped top and bottom.
1.2	Capacity	Container capacity: 250 kg of viscous resin hardener mix Mixing capacity: 150 kg of viscous resin hardener mix
1.3	Mixing system	Motorized controllable mixing arrangement with wide range of RPM to be provided. Thin film degassing mixing methodology to be incorporated for effective mixing of the viscous mix. Speed control of mixing drive for viscous resin hardener mix: Individually adjustable speed control of mixing drive for viscous resin hardener mix via frequency converter, including hard and software to change set values at the monitor. 10 step Speed control system to be provided.
1.4	Heating system	a) Temperature: RMS chamber heating shall comprise of heating by oil through double wall from ambient temperature to 120 degree C. b) Regulation: + / - 2 Degree C of the set value. c) Heating up time: The RMS shall reach and maintain a steady temperature level of 120 Degree C from ambient temperature in a time interval of 1.0 hour or less. d) Cooling time: The RMS shall reach the ambient temperature from set value of 120 Degree C by natural cooling. e) The arrangement shall comprise of oil circulating pump of high feed capacity, oil inlet and outlet with suitable valve mechanism, suitable heater mechanism, thermostatic temperature control, over temperature protection, pressure and temperature indicators, over temperature safety mechanism, diaphragm expansion vessel and other essential system/subsystem required for smooth and precise operation of the heating system.

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1.5	Vacuum & Pressurisation System	a) Vacuum levels: 0 – 10 mbar atmospheric pressure.
		b) The vacuum system shall comprise of Rotary Vacuum Pump with gas ballast device with suction speed of 40 m ³ /h or better, vapour trap, exhaust filter, anti-suction devices, filler with activated carbon to protect the vacuum pump
		c) Pressurization system: The RMS shall comprise of suitable inlets and valve mechanism to allow pressurization of air/ inert gas inside the chamber at an atmospheric pressure of 7 bar.
		d) Indication: Suitable mechanism and arrangement shall be made to precisely measure and display the following: a. Set value and actual Vacuum pressure inside the chamber b. Set value and actual temperature inside the chamber c. Set value and actual air / inert gas pressure inside the chamber d. Level of resin – hardener mix inside the chamber. The output of the level indicator switch shall display in the MIMIC diagram of the display monitor.
		e) View glass: Viewing glass with appropriate illumination shall be provided at the top of the chamber for viewing of material inside the chamber.
2.0	Vacuum Impregnation System (VIS)	
2.1	Description	Cylindrical Chamber (wielded structure) with disc shaped top and bottom.
2.2	Dimension	Existing vacuum chamber 2000 mm length X 700 mm dia. Orientation – horizontal Required VIS 3000 mm X 700 mm dia. Orientation - Vertical Minimum Ground clearance required: 500 mm


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2.3	Heating system	a) The heating system shall provide precise, controlled and uniform heating of the effective length of the cylindrical structure.
		b) VIS chamber heating shall comprise of spiral shaped heating elements (kanthal make or better) with refractory or ceramic tubing insulation on all sides. All precautionary measures to be incorporated in the design to avoid any short circuit of the heating elements.
		c) Suitable and vacuum leak proof lead-in-plate arrangement to be provided for measure of chamber temperature using minimum 6 nos. of precise RTDs. These RTDs shall be used for continuous monitoring of chamber temperature.
		d) One of the RTDs shall be used as input for controlling the heating elements. For precise control and stable heating temperature the operation of heating elements shall be controlled by SSRs.
		e) Suitable thermal insulation to be provided for thermal isolation of the heating element. Multi-layered Mineral wool slabs with low K factor, high density and non-hygroscopic in nature to be employed to isolate and insulate the heating elements.
		f) Temperature: The VIS shall have a precise and controlled heating range of 200 degree C (minimum) from ambient temperature.
		g) Regulation: + / - 2 Degree C of the set value.
		h) Heating up time: The VIS shall reach and maintain a steady temperature level of 200 Degree C from ambient temperature in a time interval of 2 hour or less.
		i) Cooling time: The VIS shall reach the ambient temperature from set value of 200 Degree C by natural cooling.
2.4	Vacuum System	a) Vacuum levels: The vacuum system shall be suitable to maintain a vacuum pressure of less than 0.005 mbar atmospheric pressure.

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		b) The vacuum system shall comprise of Rotary Vacuum Pump with gas ballast device with suction speed of 64 m ³ /h or better, vapour trap, exhaust filter, anti-suction devices, filler with activated carbon to protect the vacuum pump.
		c) The vacuum system for both the chambers must be of reputed make like HiVAC, Kirlosker etc.
		d) Locking arrangement: In view of the stringent vacuum requirement a very effective and leak proof locking system shall be incorporated. Top Cover with bayonet locking arrangement with hydraulic closing and opening system and highly effective sealing system to be provided.
		e) Sealing: A very effective, leak proof sealing system to be incorporated at all mountings – inlet and outlets, vacuum release port, temperature sensors, vacuum sensors, level sensors, view glass (300X200 mm) etc.
		f) Access Port: Suitable and leak proof arrangement shall be provided for measuring the IR, Tan delta and other values of the job inside the chamber
		g) Vacuum release port: Vacuum release port comprising of vacuum gauge and manual release valve mechanism to be provided.
		h) View Glass: Suitable vacuum resistant, leakage proof, transparent viewing glass window of 300 mm X 200 mm (L X B) to be provided on the side of the effective length of the VIS chamber.
		i) Indication & Display: Suitable mechanism and arrangement shall be provided to precisely measure and display the following: i. Set value and actual Vacuum pressure inside the chamber ii. Set value and actual temperature inside the chamber

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		iii. Set value and actual air / inert gas pressure inside the chamber
3.0	Interconnection of the two systems:	a) The RMS and VIS shall operate as independent systems. The operation, data acquisition, display, monitoring, protection and control systems shall be independent and locally controlled through their respective control cabinets housing the HMI and controllers. b) The outlet of the RMS system shall be connected to the inlet port of the VIS through flexible steel chorded hose pipe minimum length of 15 meters. c) The chorded hose pipe shall have flange arrangement for fixation to the respective chambers. Each end shall have a quick coupling arrangement for easy and quick connection to the inlet or outlet ports.
4.0	Control System:	a) The control cabinet shall have PLC of reputed make like Siemens / GE Fanuc / ABB / Allen Bradley / Mitshubishi / Modicon / Delta / Schneider etc. for programming and control as per user defined algorithm, HMI, suitable software for communication and easy control. b) The cabinet shall also house contactors, SSRs, switches, fuses, regulators etc. required for data acquisition, monitoring, control and display. c) Program for cyclic operation of the resin- hardener impregnation facility shall be provided. d) In case of parameters reaching the desired set values acknowledgeable audio alarms shall be initiated. e) Whenever the system is switched on, automatic health check to be started. Only when the system is Ok and acknowledged by the user the system shall be ready for further operations.
5.0	Protection System:	a) Both the systems RMS and VIS shall have separate and independent data acquisition, monitoring, display, and control system. b) Control cabinet of both the system shall be of IP 43 standard or better. c) The heating elements of both the systems shall be suitably insulated to avoid any thermal loss or ELCB.

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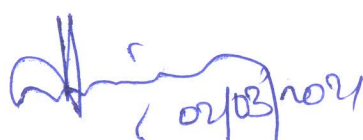
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		d) All mountings of both the systems shall be vacuum leak proof, suitable reinforcement must be incorporated to avoid any vacuum loss.
		e) The metallic body, cabinets, mountings, accessories shall be suitably grounded as per the applicable standards.
		f) Protection to avoid any sort of earth fault, phase fault, over / under voltage, over / under current, etc. shall be provided.
		g) In case of any malfunction, tripping of fuses, opening of doors, fault condition etc. suitable audio-visual alarm shall be provided and the same shall reflect in the HMI display.
		h) Emergency stop switch shall be provided for each system.
6.0	PLC & HMI	a) PLC and HMI of reputed make shall be provided along with the system.
		b) The software activation key, passwords, version, warranty details etc. shall be provided by the supplier.
		c) Soft copy of program / ladder logic and instructions required for complete understanding and modification of program if required.
7.0	Documentation	The vendors shall submit the following documents at the time of delivery of the system at BHEL R & D.
		a) Detailed electrical wiring diagram with proper labelling and traceability (wire ferrule system)– 02 copies
		b) Detailed Schematic diagram of both the systems – 02 copies
		c) Operation manual of both RMS and VIS system – 02 copies. The operation manual shall comprise all the essential and necessary precaution to be taken at the time of operation of the systems.
		d) Detailed trouble shooting guide to detect, locate and solve any fault or fault conditions during operation of the two systems. – 02 copies
		e) Detailed Bill Of Material (BOM) of the items used in the two system which shall include details like – make, serial number, part number, warranty periods,

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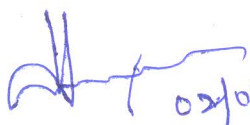
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		location of the item in the two systems etc. – 02 copies
		f) Detailed list of essential spares supplied along with the system. – 02 copies
		g) Detailed list of spares to be maintained for un-interruptible operation of the facility, which shall include item name, item description, make, part number, serial number, quantities to maintain at spare etc.
		h) Soft copy of all the above documents shall be provided in CD (02 nos.) / Pen-drive
8.0	General	a) Provision for climbing the VIS to be provided for access of see through view glass placed at the top disc.
		b) System varnishing: RMS / VIS Chamber: Light Grey RAL 7035 - Control Cabinet: Light Grey RAL 7035
		c) Suitable signage shall be provided for easy identification and traceability of control and power cables.
		d) Air Compressor for operation / control of pneumatic valves of suitable rating is in the scope of supplier.
		e) The modification of the existing vacuum chamber shall be carried out at vendor's workplace. BHEL or any of its representatives shall have free access to visit vendor's work place for inspection and access the progress of work.
		f) All the functional parameters, operation of the systems, protection system, control system etc. shall be verified by BHEL representative at its lab at BHEL R & D, Hyderabad.
		g) Electrical Input: 3P+1N, 415 V, 50 Hz shall be provided at the site of installation of the system. Suitable cables, earth/ground wires, etc. shall be in the scope of the supplier.
		h) The offer shall include all accessories required for smooth operation of the systems.
9.0	Erection, Commission and installation	a) The RMS and VIS shall be installed at a site in BHEL Corporate R and D as per BHEL requirement and to the satisfaction of BHEL Engineer.
		b) All industrial safety provisions and precautions to be observed during E & C at BHEL Corporate R & D.

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		c) The equipment or machinery required for Erection / installation like crane etc. shall be in the scope of supplier.
		d) The E & C shall commence within 7 days of receipt of the items / system at BHEL R & D. A written confirmation via e-mail shall be sent by BHEL in this regard.
10.0	Warranty	Supplier shall provide warranty for 18 months from date of receipt at our stores or 12 months from the date of completion of erection and commissioning whichever is later.

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