	INDIAN INSTITUTE OF TECHNOLOGY BOMBAY **MATERIALS MANAGEMENT DIVISION** **Powai, Mumbai - 400076**

Technical specifications of Helium Liquefier System

A Helium Liquefier

S NO.	Requirements	Remarks
1.	The energy-efficient Liquefier with an internal purifier capable of producing in "pure" mode(99.999%) with a Guaranteed Helium liquefaction rate of i. 32 lt/hr without LN2 precooling ii. 56 lt/hr with LN2 precooling.	
2.	Integrated automatic helium re-purifier capable of handling up to 10% air impurity normally and up to 20% air impurities on a momentary basis in the feed helium gas. The integrated line drier unit should be capable of handling moisture, air impurities contents in the helium gas, along with the hot air blower for regeneration purposes.	
3.	Fully pre-programmed PLC control panel with a suitable operator panel and remote operation and remote diagnostic.	
4.	The offered model and type of the liquefier should be highly energy-efficient, less in maintenance cost, rugged, and highly reliable in operation and control.	
5.	The offer must confirm that the liquefier is of fully automatic, fool-proof, and fail-safe operation, Full automatic control for cool-down and is equipped with an adequate number of Annunciators, Alarms, and Safety devices. It must also contain the description and operation of such automation systems and devices.	
6.	The offered model should confirm that It should be possible to operate the entire machinery from the operator interface panel integrated into the machine	
7.	**Power and typical ambient temperatures** The liquefier must be operable operate on i. The electrical supply 230 V ± 10% single Phase, 50 Hz & 415 V ± 10%, 3 Phase, 50Hz. ii. Ambient temperature (◦C) : 10-45 C.	

	iii. Total Required Power in KW Should be mentioned. iv. The required number of MCCB with rating should be mentioned in both 3 phase and single phase. v. Required Cable size before MCCB should be mentioned. vi. Power quality monitoring and compressor trip setting to be written vii. The offer must certify that all the machinery, equipment, instruments, and controls will keep working and will remain safe at these parameters of the electrical supply viii. The offer must certify that in case the electrical supply parameters change beyond the range given above, the system may shut down but all its components will remain safe from any damage.	
8.	The offer must give performance data on guaranteed liquefying rate with and without liquid nitrogen pre-cooling along with the chart on liquefaction rate wrt various percentage of air impurities.	

B Feed Gas Compressor:

S No.	Requirements	Remarks
1.	Compatible Rotary screw type recycle compressor for feed gas helium to liquefier. Compressor should be water-cooled.	
2.	Oil removal system and Gas management panel.	

D Liquid Helium Dewar (Mother Dewar):

S No.	Requirements	Remarks
1.	Liquid helium Dewar of 2000 liters capacity.	
2.	The Mother Dewar (MD) should be equipped with a superconducting liquid level and show liquid level in equivalent height/percentages. The system should be visualized on-screen with liquid level in Liters	
3.	MD Should be equipped with mountings such as. i. The liquid receiving port from the Cold box, ii. Liquid withdrawal port iii. Electrical pressure building system/ suitable heater with the control from the PLC iv. compound manometer v. the necessary number of safety valves vi. the necessary number of vent valves vii. vibration damper viii. rupture disc, etc.	
4.	Necessary adapters / pump out port for the evacuation of the	

	mother Dewar vacuum jacket should be provided.	
5.	The offer must confirm that the liquefier operating procedure will allow the transfer of liquid helium from the Mother Dewar into child dewars without adversely affecting the liquefaction process in any mode of operation	

E Essential Requirements:

S No.	Requirements	Remarks
1.	**Buffer Vessel** i. A Pure Helium gas buffer vessel of8000 L water capacity should be provided by the manufacturer.	
2.	**Liquid Transfer line from Cold Box to MD** i. Co-axial Remote delivery tube (RDT) compatible with the Mother Dewar for transferring Liquid from cold box to mother Dewar	
3.	**Flexible insulated Transfer Siphon** - compatible with the Mother Dewar for transferring Liquid from mother Dewar to user dewars i. Flexible length: Should be intake length+0.5m ii. The transfer tube intake leg length: Should be decided by vendor based on the Mother Dewar iii. The transfer tube decant leg length: 1.2m & OD Dia: 7/16” iv. Transfer tube should be equipped with a shutoff /needle valve for transferring Helium from the MD to portable dewars. The valve preferred at the MD end. v. Necessary adapters for the evacuation of the Coaxial Transfer line jackets should be provided.	
4.	External cryogenic charcoal adsorber with accessories like heater, hose pipes, interconnecting pipes, etc.	
5.	**The operation, Remote Monitoring and Remote Diagnostic:** i. The operation of the compressor and the liquefier should be integrated via a Programmable Logic Controller (PLC). The PLC should in turn communicate with a computer for remote operation, monitoring & data logging. ii. The HMI should include a suitable touch screen based panel loaded with Graphical Process Visualization for the plant operation and control. iii. Ethernet or Profibus or equivalent-based communication between the monitoring PC and the PLCs on the compressor and liquefier is preferred.	

	iv. Required software, licence should be supplied along with the HMI panel v. It should be possible to operate the entire machinery from the Operator interface panel integrated on the machine and from the remote computer.	
6.	**Multi-Component detector** offer must include a Multi-Component detector with pyrolyser for detecting air impurities in vpm and oil aerosol impurities in ppb such as i. Nitrogen ii. Moisture, iii. Hydrocarbons iv. Oil mist.	
7.	Maintenance toolkit for the routine maintenance of the liquefier system.	
8.	**Piping, routing, layout & Installation** i. The manufacturer should provide the specifications and grades of all pipings. We will arrange these from our end. ii. The vendor should provide the instrument/electrical interconnecting cable with compatiable terminal lugs for the items supplied by them. The appropriate length will have to be decided by the vendor based on the site plan. iii. The user (IIT Bombay) will only provide the main compressor and control panel power cable. iv. Provision of plant and equipment layout plan, piping layout plan based on our site location and conditions. v. Provision of technical assistance/supervision in the plant pre-installation, pre-commissioning check at the installation site. vi. Should discuss with the customer the process flow diagrams, connecting tubes specifications, Electrical cable requirements/specifications as per the room size available before starting the fabrication. vii. The offer should mention the scope of installation and commissioning. viii. Plant commissioning and operator training of the liquefier at our site.	
9.	**Documentation & Technical support** i. Operation manual, other documents like troubleshooting/maintenance/warranty, etc should be in English. One hardcopy and a searchable pdf softcopy to be provided. ii. The documentation must follow the standard cryogenic engineering design codes. iii. Provision of technical assistance/supervision in the plant pre-installation, pre-commissioning check at the installation site.	

	iv. Final performance & acceptance test of helium liquefier as mentioned in the above offer at our site should be provided.	
10.	**Factory test** i. All the factory test and validation test data should be provided to the customer. ii. The vendor should assure that the Normal Evaporation Rate (NER) of the supplied mother dewar should be at par with the latest industry standard. iii. Pressure vessels, lines, and associated items must be fabricated as per the pressure equipment standards/directives and tested. The test certificates of various parts should be provided	
11.	Final performance & acceptance test of helium liquefier as mentioned in the above offer to be demonstrated at our site.	
12.	The offer must certify that the liquefier and its components will safely withstand the site conditions of our institute.	
13.	The offer must furnish preventive maintenance schedules for the liquefier and its components inclusive of mechanical, electrical, and electronic systems viz. cold box, compressor, pumps, meters, switch gears, control circuit etc.	
14.	The offer must contain the shape, size, weight, and utility requirement of major equipment, component, and instrument along with its suggested layout, piping arrangement, wiring diagram, required site conditions, etc., as the case may be.	
15.	The offer must contain shipment packing size, weight, and volume of major equipment and component	
16.	The offer must list all the utilities that are expected from the Institute which are i. Electric power (KVA/KW load of each piece of equipment) ii. Chilled water (pressure, flow rate, and temperature rise i.e. tonnage of refrigeration consumed) iii. Atmospheric cooling air (Fan specifications, Duct sizes, Free space required around units, etc., if required) iv. Type of floor, Ceiling height, Lifting arrangements for installation and disassembly for maintenance (Clarify the method of lifting and the ceiling height needed at the time of installation and for maintenance at a later stage).	
17.	**Warranty, Spare parts, midlife upgrade, Delivery, etc** i. One year standard warranty. ii. Spare parts for 1 year after the standard warranty period is over. iii. The offer must confirm that the warranty will start from	

	the date of satisfactory commissioning in the Institute. iv. A potential "midlife upgrade" of the electronics and control system should be discussed with the customers. It is expected that in about 10 years the communication protocols and computers used in the setup will become outdated and unserviceable. The control system must be built in such a way the PLC and the associated systems are upgradeable to a newer CPU and communication protocols. v. The offer must state delivery time, payment terms, warranty terms, number of years that the spares support is likely to be available, Type of after-sale, and maintenance support available from the suppliers and their representatives in India.	
18.	The offer must contain the names, addresses and contact details of the organizations where similar liquefiers have been supplied in recent years in India and abroad along with the respective commissioning dates and contact details of the concerned person	