

Tender Notification for the procurement of a cryogen free dilution refrigerator (DR) with optical access

Last Date for submission of tenders: 29th June 2020, 5 pm

Reference No: CENSE/AMG/HR/054/2020

Dear Sir/Madam,

Kindly send lowest quotation for the following item on C.I.P. Bangalore basis. The quotation should clearly indicate the terms of delivery, delivery schedule, transportation charges, if any, payment terms etc.

Terms and Conditions

1. The bid should be submitted in the two-cover system, i.e. technical bid and commercial bid separately in sealed covers. The technical bid should contain all commercial terms and conditions, except the price.
2. In the commercial bid, the price should be inclusive of all discounts.
3. The technical bid must contain a point-by-point technical compliance document.
4. If needed, a meeting for any technical clarifications can be scheduled with the undersigned by sending an email.
5. The lead time for the delivery of the equipment should not be more than 10 months from the date of receipt of our purchase order. It should be clearly mentioned in the technical and commercial bids.
6. The Institute reserves the right to accept or reject any bid, or to annul the bidding process and reject all bids, at any time prior to the award of contract without thereby incurring any liability of the affected bidder or bidders.
7. **Three years comprehensive warranty** is a must for all the components. Please specify the service plan like whether the local distributor will address the issue or the parent company.
8. All the quotations must be valid for at least 60 days at the time of submission.
9. List of customers and references: Proven track record of installation and service to customers based in India and at least five sites globally.
10. Terms and conditions for the annual maintenance contract beyond the warranty period should be mentioned.
11. Payment Terms: The quotation should be in the currency of the country of origin. The payment will be through confirmed irrevocable Letter of Credit (LoC). Alternate modes of payment can be suggested with suitable justification.
12. After the award of purchase order, the vendor must provide an Order Acknowledgement within 30 days from the receipt of the Purchase Order.
13. Please quote the price of each optional line item, separately.
14. Custom Duty Exemption and GST exemption -- IISc is registered with DSIR for availing custom duty exemption (CDE) for import orders and GST exemption (for INR orders in India). IGST is NIL for import order for IISc. Bidders should consider all these facts while submitting their bid. For import order, the Bill of Entry must be in the name of IISc for availing CDE. GST exemption certificate will be provided subject to submission of proforma invoice.

Technical specifications of optical dilution refrigerator:

Mandatory requirements:

1. **Base Unit: Cryogen-free dilution refrigerator with optical access** with the below technical and user specifications
2. **Base temperature:** Guaranteed base temperature less than 10 mK at the sample position (away from the mixing chamber). This base temperature should be achieved with factory installed wiring and RF.
3. **Total cool-down time** should be less than 32 hours to reach the base temperature from room temperature (Note that this includes the pre-cooling time, if any to an intermediate temperature stage). Please provide the plots of measurements of the system performance (such as cool-down vs time) clearly specifying the conditions under which the measurement was conducted.
4. **Cooling power:** At least 12 microwatt of cooling power at the sample position (measured away from the mixing chamber) at 20 mK, at least 250 microwatt of cooling power (measured away from the mixing chamber) at 100 mK. The system should have an appropriate amount of He3/He4 mixture to achieve the above-mentioned parameters. Please specify the amount of He3/He4 gases.
5. The **temperature should be stable** within 1% of the set temperature and can be controlled all the way between base temperature till 3 K. Provide plot of temperature as a function of time (over 10 minutes duration) at (i) any temperature between 50 mK and 300 mK, (ii) any temperature between 0.75 K and 1.5 K, (iii) any temperature between 2.5 K and 3 K.
6. **Pulse tube cryocooler:** A pulse tube cryocooler (with compressor and remote motor) having a cooling power of at least 1.25 watt at 4.2 K.
7. **Cryostat:** The cryostat must have a single vacuum space with all hermetic seals such as O-ring seal at room temperature -- no exchange gas, no indium seal, no Kapton seal, light-weight outer vacuum jacket and radiation shields enabling one-person manual assembly.
8. **Dimensions of the cold plate and sample space:** The cold plate at mixing chamber should be at least **290 mm** in diameter and it should have at least **300 mm** of vertical space below the mixing chamber plate (till the inner most radiation shield).
9. **Optical access from sides:**
 - a. Windows (1 cm clear view minimum) from four sides in the visible spectrum made of Quartz.
 - b. Customer should be able to change the windows, e.g. for a different spectral range.
 - c. Blank flanges should be available.
10. **Temperature Controller:** Fully automated temperature control with appropriate temperature sensors, heaters, and heat-switches.
11. **Pumping system:** Suitable dry pumping system for the dilution unit having turbo molecular pump with oil free backing pump, compressor for the mixture. Please specify the specification of all pumps and compressors. Please specify if the same pumping system can also be used to evacuate the sample vacuum space.

12. **Suitable gas handling system:** With required pressure gauges and overpressure valves etc. The pumps should be electrically isolated from the cryostat. The gas handling system should have appropriate pressure release valves to collect the mixture back to the dump in the event of power failure or emergencies.
13. **Cold trap:** Appropriate cold traps to operate the fridge for long durations (> 6 months) without blockage issues in the circulation loop.
14. **Support feature:** Floor mounted standard support frame for the pumping bellows and the cryostat
15. **Mechanical Vibrations:** Less than 100 nm amplitude near 100 Hz (in both horizontal and vertical directions) at the mixing chamber plate while the fridge is in operation.
16. **Isolation:** Pulse tube should have mechanical vibration isolation from the rest of the cryostat. Pulse tube and compressor should be electrically isolated from the cryostat.
17. **Cooldown procedure, safety, and control software:** Automatic cool down to base temperature. Safety interlocks allowing unattended operation; remote control operation; continuous monitoring and logging of the system parameters. Control software should be based on windows 10 or higher version operating system architecture. Free upgrades of software.
18. Testing and training should be done during onsite installation
19. Provide soft and hard copy of the manual and supporting documents
20. **Wiring:**
 - a. 4x 0.86mm SCuNi-CuNi (centre conductor is silver plated) attenuated semi-rigid SMA (18 GHz) coaxial lines from RT to mK flange with suitable thermalization at different intermediate flanges. All 4 coaxial lines must have enough flexibility and length to accommodate the insertion or removal of fixed cryo-attenuator with values specified in optional line item below.
 - b. 4x 0.86mm SCuNi-CuNi (centre conductor is silver plated) attenuated semi-rigid SMA (18 GHz) coaxial line from room temperature to 4K flange (part of the output lines)
 - c. 4x 0.86mm NbTi-NbTi semirigid superconducting SMA (18GHz) co-axial line from 4K flange to mixing chamber. All 4 coaxial lines must have enough spacing, flexibility and length to accommodate the insertion of cryo-compatible isolators at different stages, and low noise amplifiers at 4K stage. See optional line item below for the possible components. Dimensions of these components can also be provided upon request to the undersigned.
 - d. Signal wiring: 12x flexible coax cables with SSMC termination (please include mating connectors) and SMA at room temperature.
 - e. DC wiring: 12x twisted pair experimental wiring (24 wires 36 AWG phosphor-bronze) from room temperature to mixing chamber flange – additional breakout at 4K. 12x low-

Ohmic twisted pair experimental wiring (Cu+NbTi/CuNi) from room temp. to mixing chamber – additional thermal anchoring to pulse tube and break out at 4K.

Optional items:

21. Optical access from below:

- a. Reference to windows on radiation shields, additional set of windows from bottom with minimum 1 cm clear path.
- b. The light illuminated from bottom must not hit the cold parts, necessitating a laterally shifted mixing chamber.
- c. Customer should be able to change the windows, e.g. for a different spectral range
- d. Blank flanges should be available

22. Multimode Optical fibres: Two multimode optical fibres, 400-micron diameter from RT to mixing chamber with at least 20% extra length

23. Single mode Optical fibres Two single mode optical fibres, 100-micron diameter for the visible, should be polarization maintaining, from RT to mixing chamber with at least 20% extra length

24. Extra high frequency wiring:

- a. 4x 0.86mm SCuNi-CuNi (centre conductor is silver plated) attenuated semi-rigid SMA (18 GHz) coaxial lines from RT to mK flange with suitable thermalization at different intermediate flanges. All 4 coaxial lines must have enough flexibility and length to accommodate the insertion or removal of fixed cryo-attenuator with values specified in optional line item below.
- b. 4x 0.86mm SCuNi-CuNi (centre conductor is silver plated) attenuated semi-rigid SMA (18 GHz) coaxial line from room temperature to 4K flange (part of the output lines)
- c. 4x 0.86mm NbTi-NbTi semirigid superconducting SMA (18GHz) co-axial line from 4K flange to mixing chamber. All 4 coaxial lines must have enough spacing, flexibility and length to accommodate the insertion of cryo-compatible isolators at different stages, and low noise amplifiers at 4K stage. See optional line item below for the possible components. Dimensions of these components can also be provided upon request to the undersigned.

25. Extra DC-wiring: – All wires should be terminated with suitable connectors at room temperature, 4K plate, and at mixing chamber plate. All wires should have proper thermal anchoring at each temperature stage. (i) 12x twisted pair experimental wiring (24 wires 36 AWG Copper) from room temperature to 4K to power the low noise amplifiers. (ii) 12x twisted pair experimental wiring Cu (from RT to 4K) and NbTi from 4K to the mixing chamber.

26. Capillary filling lines: 3x capillary filling lines from RT to mixing chamber.

27. Cryo-attenuators -- 4 sets of cryo-compatible fixed attenuators. One set consists of 10dB@70K, 20 dB@4K, 10 dB@Still plate, 10 dB@cold plate, 10 dB@mixing chamber plate.

28. **Cryogenic low noise amplifiers** – 3 units of Model LNC4_8C, 1 units of Model LNC0.3_14A from Low Noise Factory. Include the appropriate power supply.
29. **Cryogenic microwave isolators** – 4 units of LNF-ISISC4_12A without magnetic shielding. Mounting position of components can be provided upon a suitable request.
30. **Air compressor** for pneumatic valves
31. **Warm up heaters** to reduce the warmup time from base temperature to room temperature (if not included in the standard unit).
32. **Mixture compressor bypass** manifold to allow circulation of mixture after condensation without requiring the mixture to go through the compressor.
33. **High voltage wiring**: 10x high voltage wires, typically made by putting a Manganin wire inside Teflon sleeves
34. **Getting the system magnet ready**, such that one can add a 6T-1T-1T vector magnet at a later stage. Please provide the technical add-ons required to make the system ready for integrating a magnet system at a later stage.
35. **3D vector magnet system** (include power supply and persistent mode switch) with 6T-1T-1T along xyz. This should come with optical access. If this add-on will require upgradation of the pulse tube, please specify that as well with appropriate costing.
36. **Extra He3 gas**: Provide 15 Litres @ NTP of He3 gas (minimum purity 99.9%)

Contact:

Ambarish Ghosh
Associate Professor
Centre for Nano Science and Engineering
Indian Institute of Science, Bangalore
Email- ambarish@iisc.ac.in