



INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION
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PR No. 1000016008 (Rfx No. 6100000824)

Detailed Technical Specification for Magnetic Property Measurement System

Description: We intend to procure a fully automated computer-controlled cryogen-free SQUID-based Magnetic Property Measurement System operational in the temperature range of ≤ 1.8 K to ≥ 1000 K and magnetic fields up to ± 7 Tesla or higher. The instrument should have a strong track record for the specified measurement options including but not limited to the measurements of bulk, thin-film, single crystal, and nano-particle based organic, inorganic samples.

Base System & Cryogenic specifications:

1. The system must accomplish the initial cool-down directly from Helium gas within 40 hours (maximum). Provide supporting data and log files with the offer. A demonstration will be asked during technical evaluation.
2. We prefer the system which can operate with as little liquefied helium as possible. The maximum quantity of liquid helium collected through condensation of the helium gas must not exceed 25 liters when the system is operating at its full capacity. The vendor must mention the He reservoir capacity.
3. Cooldown should be totally automated without the need for any kind of manual intervention. There should not be any need for the external vacuum pump etc. to complete the process.
4. The system should have either one/two He gas bottles connected simultaneously
5. The system should show the status display of the Cylinder.

A. Magnet Control Specifications:

6. Superconducting magnet with longitudinal field in the range of ± 70 kOe or Higher
7. Field uniformity $\pm 0.01\%$ over at least 4 cm.
8. Remanent field: 5Oe or less when oscillating from full field to zero. (Using a degaussing procedure the remnant field should be reduced to 1 Oe)
9. The system must achieve zero field to 7 tesla in < 2 minutes. Provide supporting data with data files with the offer. A demonstration will be asked during technical evaluation.
10. Field charging resolution must be 0.35 Oe or better.
11. The system should have a degaussing or magnet reset option.

B. Temperature Control Specifications:

12. Temperature range of ≤ 1.8 K or lower to ≥ 400 K and ≥ 1000 K with high-temperature option.
13. The system should provide a maximum cooling rate. Provide supporting data with data files with the offer. The demonstration will be asked during technical evaluation.

14. 300 K to 10 K stable should be achieved within 17 minutes & 10 K to 1.8 K stable must be achieved in ≤ 5 minutes. Provide supporting data with data files with the offer. A demonstration will be asked during technical evaluation.
15. The system must feature a finely tuned flow impedance or needle valve along with sophisticated temperature control software to allow continuous operation at 1.8 K as well as smooth temperature control through the 4.2 K liquid helium boiling point.
16. At least three thermometers should be available in the base system.
17. System temperature stability must be $\pm 0.5\%$ or better. The vendor must provide the temperature stability data @ 1.8 K for minimum 48 hours with supporting logfiles. Without log data, the claim will not be accepted.
18. Data for Thermal Cycling 5 times. I.e. 400K-1.8K back to 400K and 1.8K for 5 or more cycles in temperature vs time format must be provided. Provide supporting data with data files with the offer.

C. DC Measurement Mode:

19. DC measurement temperature range from 1.8 K to 400 K and 300 K to 1000 K.
20. An appropriate sample holder compatible with the above temperature range mentioned must be provided by the company.
21. The sample rod should possess low thermal expansion
22. Different types of sample holders are compatible for bulk magnetic measurements (Example: metal oxides) and discrete molecular samples (Single-molecule-Magnet)
23. Sensitivity of $\leq 5 \times 10^{-8}$ emu at zero fields for ≤ 2500 Oe. Full-field sensitivity should be better than 6×10^{-7} emu in DC Mode.
24. Variable drive amplitude from 0.1 to 7 mm or bigger.
25. DC SQUID scan measurements should collect at least 500 points or more (SQUID output vs sample position) to fit and calculate each measurement curve to maximize accuracy. Multiple averages should utilize multiple curves. Provide supporting data.
26. The vendor must provide a high-resolution MH Loop measurement over ± 7 T, with ≥ 500 data points acquired within 4 hours and RMS noise should be less than 1×10^{-6} emu. The vendor also has to provide datafiles for the same. A demonstration will be asked during the evaluation.

D. AC Susceptibility Measurement:

27. AC Susceptibility measurement temperature range from 1.8 K to 400 K.
28. AC frequency range must be 0.1 Hz to 1 kHz or higher
29. Peak AC Amplitude of ≤ 0.1 Oe to ≥ 10 Oe
30. AC Moment Sensitivity must be 5×10^{-8} emu or better over the entire field range
31. Phase Angle Accuracy must be $\leq \pm 0.5^\circ$ over the entire AC measurement frequency spectrum. Please provide supporting data.
32. Please provide AC Susceptibility measurement data from 0.1 to 1 kHz with 1 Oe amplitude for the Cobalt ferrite (CoFe₂O₄) nanoparticles in mineral oil. Data files will be asked for confirmation.

E. High-Temperature measurements:

33. The oven accessory must be capable of measuring DC and VSM measurements from 300K to 1000K. Provide the supporting information for the claimed temperature range.
34. Temperature accuracy should be $\leq 2\%$ after stabilizing
35. Provide the high-temperature measurement data with all, DC and VSM measurements modes separately in support of the claim. Data files will be asked.

F. Sample rotator:

36. Temperature range from 1.8 K to 400 K.
37. This option must facilitate stepper motor fully integrated into the sample rod to allow fully automated sample measurements as a function of angle.
38. The rotation Range must cover a full 360° .
39. Angular Step Size of $\leq 0.1^\circ$
40. It must be compatible with the above accessories. i.e. DC Scan & AC Susceptibility
41. System software should be able to control the sample holder plate with the rotator motor, allowing fully automated sample measurements as a function of angle.
42. Provide the Angle dependent data measured at low temperature (≤ 5 K). Data files will be asked.

G. UPS and Chiller

43. The vendor should offer suitable UPS (with 30% more output than the maximum power utilization expected by the instrument, with a minimum battery backup of 60 min or more) and a compatible Chiller with the offer. It should be compatible with Indian voltage (220 V/50 Hz)

H. Other important points:

44. We are looking for a turn-key solution and hence the vendor is responsible for the full installation, commissioning, testing, and training.
45. The vendor must provide a detailed compliance statement with respect to each technical specification in the tender document duly supported by the manufacturer's literature or documents. Any other claim will not be accepted and may lead to the rejection of the bid.
46. The vendor may be asked to demonstrate all mentioned specifications in a similar Cryogen-free system installed in India within 2 weeks of the technical bid opening date. Travel expenses should be borne by the vendor.
47. Comprehensive Warranty: Minimum 5 years from the date of installation and OEM/vendor should give in writing additional 8-10 years of comprehensive maintenance support with additional charges as per the prevailing rates. Instruments that are likely to be obsolete in this time frame should not be quoted.
48. Installation and adequate training should be carried out by qualified service engineers at the user site. The vendor must furnish the details of the trained service engineers stationed at Mumbai to ensure quick and regular support.
49. Standard samples are to be provided by the company for testing the instruments at the time of installation on-site to the quoted accuracy in the given technical specifications for the demonstration of the performance of the equipment.

50. Guaranteed specifications to be demonstrated at the time of installation. Any necessary standard samples for that purpose should be brought by the service engineers.
51. Printed literature and published papers in support of all compliance to the prescribed specifications should be provided.
52. The vendor must provide a compliance statement IN TABULAR FORM with respect to each technical specification in the tender document duly supported by the manufacturer's literature and published papers. Any other claim will not be accepted and may lead to the rejection of the bid.
53. Technical evaluation by the institute may include a demonstration to verify functionalities and capabilities of the system quoted