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### TECHNICAL SPECIFICATIONS

#### WAVELENGTH DISPERSIVE SEQUENTIAL X-RAY FLUORESCENCE SPECTROMETER (WDXRF) - 4KW

1. **X-Ray Fluorescence Spectrometer:** Fully automated and computer-controlled brand-new high Power (4KW or more), sequential, Wavelength Dispersive X-Ray Fluorescence Spectrometer is required for quantitative and semi-quantitative analysis of geological powder samples. The equipment should be capable of precisely measuring the concentrations of major elements such as (Si, Ti, Al, Fe, Ca, Mg, Na, K) at % level, and minor and trace elements such as (S, P, Mn, Cr, V, Co, Ni, Cu, Pb, Zn, Sc, Rb, Ga, Sr, Nb, Zr, Y, Ba, U, Th etc.) at ppm level but not limited to these elements only and should have analytical capabilities to measure elements from Fluorine (Z=9) to Uranium (Z=92).
2. **Measurable Elemental Range:** Fluorine (Z=9) to Uranium (Z=92).
3. **X-Ray (High Voltage) Generator:** Programmable, high-frequency X-Ray Generator with a Power rating of **4 KW or more with X-Ray Tube maximum voltage: 60 kV or better and X-Tube Current: maximum 150 mA or better.**
4. **X-ray Tube:** End-window X-Ray tube, Rh-target, allowing programmable kV, mA setting having Beryllium Window thickness between 30  $\mu\text{m}$  to 50  $\mu\text{m}$ . X-Ray tube must have a protective covering or special optics/geometry to minimize the cleaning time or damage to the tube caused by accidental sample spillage and contamination.
5. **Goniometer:** High precision and high-speed microprocessor-controlled goniometer with independent driving mechanism as  $\theta$ - $2\theta$  with minimum angular reproducibility of  $\pm 0.0005$  degree or better for both high sensitivity and high-resolution measurement. The scanning range of the goniometer should be able to cover the entire elemental range as specified.
6. **Spectrometer Optics:** The spectrometer should be equipped with an automatic Sample Changer for a minimum of TWELVE (12) positions or more with an equal number of sample holders/cups to be offered. Primary beam filters, collimators, and minimum EIGHT (08) positions or more crystal

changer with appropriate crystals to be included. Temperature stability inside the spectrometer chamber should be kept within  $\pm 0.1^\circ\text{C}$ .

Optics should be best suitable for analyzing pressed pellets and fused beads. The maximum sample size (pellet) should be about 52 mm (diameter) and 30 mm (height). The system should have an option to select sample spin mode (30-60 rpm) to minimize the effects related to the sample surface inconsistencies. The system should have the facility to ensure that the sample position is always the same during each analysis (sample to optics distance should be constant).

7. **Primary X-Ray beam filters:** Primary beam filter changer should have a minimum of FOUR (4) programmable positions with a minimum of FOUR (4) filters to be offered to eliminate tube target lines (or) reduce background intensity.
8. **Collimators:** Provision for at least THREE (3) primary collimators to be provided for optimum sensitivity and resolution in specified analytical range (elements - F to U). The collimators should be automatically controlled through software.
9. **Sample masks:** Automatic mask changer with THREE (3) suitable masks or area limiting diaphragms should be offered. The diaphragm / mask changer should be automatically controlled through software.
10. **Vacuum optics:** The X-Ray path should be under the vacuum. Sample changeover (loading/unloading) should not interrupt the measurements. X-Ray Tube should remain in full power during sample changeover (loading/unloading). The spectrometer must be equipped with rotary vacuum pump/s to provide stable vacuum conditions for the optics and the sample chamber.
11. **Crystal changer:** Minimum EIGHT positions or better, automatic crystal changer with FOUR (4) crystals as follows to be offered. The optics should include high-performance curved and/or synthetic multilayered crystals to cover the specified elemental range.
  - a) LiF-200 for elemental range K to U
  - b) PET for elemental range Al to Sc
  - c) LiF-220 or equivalent crystal for elemental range Cr to U
  - d) Synthetic crystal for elemental range F to Mg
12. **Detectors:** The spectrometer should have two types of detectors: Flow Proportional Counter (FPC) and scintillation counter (SC).
  - a) Scintillation counter detector: measuring angle range within 2 - 120 degrees (SC),
  - b) Flow proportional counter: measuring angle range within 8 -150 degrees (FPC)
  - c) Slewing rate should be 1400 degrees/minute or better.
  - d) An option for automatic centre-wire cleaning mechanism for FPC detector to minimize the need of physical cleaning will be an added advantage.
  - e) Digital Dual Multi-Channel Analyzer (D-MCA) technology for achieving better resolution during quantification. The count rate (linearity 1%) should be more than 2.5 Mcps or better and 1.5 Mcps or better for the flow proportional Counter (FPC) and scintillation counter (SC), respectively.

13. **Sample Handling:** The spectrometer will be primarily used for pressed pellets and fused beads analysis only.
14. **Dust trap to secure the tube and Optics:** The system should be such that dust generated or in the event of pellet breakage during analysis should not enter the optical chamber. The system should have proper dust trapping and an easy disposal mechanism for protecting the optical chamber.
15. **Sample Chamber and Automatic Sample Changer:** The system should be offered with an automatic sample changer with a minimum of 12 positions and be able to upgrade to 48 positions. Minimum 12 no's sample holders/cups suitable for handling pressed pellets should be offered. The sample chamber should be easily accessible for the user for day-to-day cleaning purposes.
16. **Chiller:** Suitable chiller ( $T < 20^{\circ}$ ) to support 4KW WDXRF equipment.
17. **40T Hydraulic press (1 No.):** 40 tons Semi-Automatic Pellet Press Machine with 40mm die set and steel rings for pressed pellet. The vendor must quote for 50 steel rings. The hydraulic press should be fully operational and tested with full capacity oil filled as required.
18. **Software:** Easy-to-use XRF software package for monitoring and documentation of all parameters of the instrument. Automatic optimization of routine parameters for analysis. Online automated log creation facility to monitor the instrument activities. Full remote access to the instrument for remote monitoring of the system. One set of operation and maintenance manuals of the whole system on CD-ROM.  
The software should perform -
  - a) Quantitative and semi-quantitative (Standard less) analysis with auto theoretical correction for overlapping, correction for photoelectric on fundamental parameter Software, correction for atmosphere, correction for matrix and impurities.
  - b) The software should consist of matching library and standardization library.
  - c) Should have provision for Quantitative analysis based on calibration curves obtained using CRMs (e.g., USGS standards)
  - d) Drift correction library with library drift correction samples
19. **Analytical Capability Test:** During the technical evaluation, the supplier would be requested to demonstrate (in India) the operational capabilities of the instrument within acceptable accuracy and precision ( $< 10\%$ ) for analysis of major, minor and trace elements as mentioned in point 1 on reference materials provided by the customer.
20. **Performance Specifications:** The vendor must have installed a minimum of THREE (3) equipment's of similar technology and comparable capacity WDXRF within India for geological applications, as stated in point 1, in the past FIVE (5) years.
21. **Working Conditions:** Equipment should be suitable for Input power at 230 volts  $\pm 10\%$ , 50/60Hz  $\pm 5\%$  with protective RF ground. The required material for RF ground should be provided by the vendor.

22. **Training and Installation:**

- a. Onsite training for operation and maintenance of the instrument immediately after installation. No supplementary payment for travel, boarding and lodging for the trainer.
- b. Vendor should include in their tender, provision for maintenance tools and initial stock of maintenance spares as are essential for the proper operation and maintenance of equipment.
- c. The vendor should be fully responsible for the manufacturer's warranty in respect of proper design, quality and workmanship of all the equipment accessories etc. covered by the tender.

23. **Service Support:** Remote assistance with the same-day response. Telephone/mail assistance when the user has sufficient knowledge to attempt minor repairs. Maximum onsite response time of FIVE (5) working days for both hardware and software-related problems. Provide the list of users in India, emphasizing reputed Earth Sciences departments, with their contact details. The customer will seek information on service support from the users directly during the technical evaluation stage.

24. **Warranty: The warranty on the system must be at least THREE YEARS** from the date of commissioning, including the warranty for the X-ray tube (for the same period) and also parts non-manufactured by the supplier. All parts, labor and travel must be included in the warranty and at least two maintenance/breakdown service per year should be provided.