

Should your offer be accepted, the Requirement Specifications as set out in this Part and shall govern the Contract between the Authority and your company.

Equipment 1: Sector Field - Inductively Coupled Plasma Mass Spectrometer (SF-ICP-MS) System Location: Chemical Metrology Laboratory (CML) Quantity: 1	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
General	
1) The system shall consist of a computer-controlled Sector Field - Inductively Coupled Plasma Mass Spectrometer (SF-ICP-MS). The SF-ICP-MS shall be able to achieve the lowest detection limit (specified in Clause. 2) in multi-elemental analyses, especially in complex matrices, through mass resolution of interferences, high sensitivity and low detector dark noise.	Yes/ No
2) The system shall meet the following key specifications: a. Sensitivity: $\geq 2 \times 10^{10}$ counts per second (cps)/ppb ^{115}In (1 ppb tune solution). b. Detection power: ≤ 1 ppq for non-interfered nuclides. c. Dark noise: ≤ 0.2 cps. d. Dynamic range: $\geq 10^9$ linear with automatic gain calibration. e. Mass resolution: ≥ 300, $\geq 4,000$, $\geq 10,000$, computer-controlled. f. Mass stability: 25 ppm / 8 hours. g. Signal stability: ≤ 1.0 % RSD over 10 minutes and < 2.0 % RSD over 5 hour. h. Scan speed (magnetic): m/z 7 to 240 to 7 ≤ 150 ms. i. Scan speed (electric): 1 ms/jump, independent of mass range. j. Vacuum at lens stack and ESA $\leq 5 \cdot 10^{-7}$ mbar. k. Transport efficiency of sample analyte to plasma: $\geq 90\%$.	Yes/ No
3) The system must have safety features to allow safe shutdown, so that the system will not be damaged in the event of loss of power, gas supply, water-cooling, or other system malfunction. In addition, all events must be automatically logged with information comprising the event description, time and date. The logs must be retrievable by the user.	Yes/ No
4) Due to space constraint, the instrument's dimension, including auto-sampler, should not exceed 3000 x 900 mm (W x L). Additional spaces are available for other supporting hardware that do not need to be adjacent to the main instrument, such as chiller, uninterrupted power supply, external pump (if any). The maximum available spaces and location for the main instrument, computer system and supporting hardware are shown in blue in the floor plan. Please refer to Appendix 1 for the floor plan of the area.	Yes/ No
5) To fit in the current infrastructure, the system must employ not more than three exhaust vents with the following flow rates: ≤ 7.0 m³/min for two ports and ≤ 1.5 m³/min for the third port. This is important to keep a positive air pressure in the cleanroom laboratory without overloading the existing air handling system.	Yes/ No
6) The system must maintain optimum performance (specified in Clause 2) under the following conditions: a. Temperature: between 18°C and 30°C inclusive. b. Humidity (non-condensing): between 45% and 65% inclusive.	Yes/ No

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<u>Major hardware and software components (SF-ICP-MS)</u>	
7) The system shall minimally consist of, but not limited to, the following components, complete with all software/hardware and accessories for interfacing with: a. Sample introduction system b. Plasma generation and interface c. Vacuum system d. Mass analyser e. Detector system f. Water chiller recirculator g. Integrated auto-sampler h. Data system and control software i. Computer and printer j. System installation, commissioning, training, warranty, service support and implementation	Yes/ No
8) The system must feature an open-architecture sample introduction system with the nebuliser and spray chamber located outside of the torch box to facilitate the maintenance and changeover to alternative sample introduction devices by user.	Yes/ No
9) The sample introduction system shall have: a. a quartz concentric nebulizer b. a quartz spray chamber with a computer-controlled peltier cooling device for efficient cooling and precise temperature stabilisation c. three independent and computer-controlled Ar mass flow controllers for torch and nebulizer d. a peristaltic pump for sample feed and drain e. The sample introduction system shall be acid-resistant.	Yes/ No
10) The plasma generation and interface shall have (minimally): a. a 2 KW, 27.1 MHz solid state RF generator, with automatic power matching network, fully protected b. an ICP torch system, mounted on computer controlled x,y,z adjustment mechanism c. a quartz injector tube for torch system d. a CD-2 capacitive decoupling torch e. a water-cooled plasma interface with high-efficiency ion extraction optics f. 1 set (nickel) of self-adjusting sampling and skimmer cones that are easily exchanged (if mounting kit is required to exchange the cones, it shall be included)	Yes/ No

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g. an automatic gate valve between plasma interface and focusing lens system h. a focusing lens system for optimal beam conditioning between plasma interface and analyzer	
11) Vacuum system shall have: a. a five-stage differential vacuum system consisting of four turbo molecular pumps and two mechanical pumps b. full protection in the event of an system failure, so that the vacuum is always maintained	Yes/ No
12) Mass analyzer shall have: a. a double focusing sector field analyzer with reversed Nier-Johnson geometry or equivalent (field sequence: magnetic sector field – electrostatic sector field) b. an analyzer that is thermally encapsulated and temperature controlled for optimal stability of mass scale c. a fully laminated high speed magnet d. accelerating voltage of 8 kV (applied to analyzer) e. an ion source (plasma) at ground potential for easy and safe connection of sample introduction systems f. a full protection g. three fixed slit width settings for both entrance (source) and exit (detector) slit h. corresponding mass resolutions (10% valley definition): • ≥ 300 (flat top peak shape) • ≥ 4000 (triangular/Gaussian peak shape) • ≥ 10000 (triangular/Gaussian peak shape) i. Full Width at Half Maximum (FWHM) resolution definitions of approximately 600, 8,000 and 20,000 for low, medium and high resolution, respectively j. slits that are under data system control	Yes/ No
13) Detector system shall have (minimally): a. an 8 kV conversion dynode for low detector mass bias and effective signal conversion (ions to secondary electrons) b. a combined analog/ion counting secondary electron multiplier (SEM) with plug-in design for easy exchange c. the ability to perform simultaneous acquisition and registration of analog and ion counting information d. fully automatic gain calibration between analog and ion coupling operation to achieve a linear dynamic range of $> 10^9$ within one scan without user interaction and without prior knowledge of signal intensities e. a detector dark noise < 0.2 cps	Yes/ No

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14) Water circulator shall have a refrigerated water chiller recirculator for cooling of electromagnet coil, etc. (50 Hz).	Yes/ No
15) Integrated auto-sampler shall be: a. supplied with at least two standard-sized racks (21 and 90 positions) b. able to analyze both small and large volume samples from <1 mL to 250 mL within a single run c. able to perform ICP-MS cone maintenance without disconnecting or moving the sampling d. able to specify the probe depth for each sample rack e. a unique x-y motion that eliminates mechanical components moving over sample vials f. a probe retraction speed control to reduce or eliminate hanging droplets g. rigid Teflon-encapsulated carbon-fiber reinforced probe with inert sample flow path (metal-free) h. dual flowing rinse stations to reduce blanks and cross contamination	Yes/ No
16) The following accessories shall be included. a. Stable introduction system consisting of a dual cyclonic/double pass spray chamber for high precision measurements and a low flow nebulizer. b. Uninterrupted power supply (for at least 15 min).	Yes/ No
17) Data system and control software shall have: a. an integrated front end processor for real time data acquisition and instrument control b. communication between front end processor and host data system by a LAN connection c. a complete set of instrument control software for fully automated analyses, including control auto-sampler, multi-window tuning and diagnosis d. auto-tuning for all relevant parameters (flexible auto-tune configurator) e. a complete set of data acquisition, data evaluation and report generation software The system shall be able to link to a network, including remote instrument control via network, internet or modem.	Yes/ No
18) The computer shall at least have the following configuration: a. 3.8 GHz dual core processor or equivalent b. 16 GB RAM c. 2 TB hard drives d. USB 3.0 e. DVD RW (CD RW capable) f. mouse and keyboard	Yes/ No

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g. high resolution 24 inch (minimum) flat screen color monitor	
19) A LaserJet printer that allows automatic double-sided printing must be provided.	Yes/ No
20) Windows 10 Professional Operating System, Microsoft Office (lifetime version), PDF Creator (lifetime version) and any other computer interfaces, cables and software drivers for the system to be usable at optimum conditions must be provided.	Yes/ No
21) The software shall have: a. real time graphics during analysis b. a built-in database with which the system selects/recommends the best isotope mass for analysis for each sample c. features and protocols for method development and method diagnosis d. the capability to reprocess all stored data – samples and standards without having to rerun the solutions again e. compatible with Microsoft Office applications i.e. Microsoft Excel. Data from Microsoft Excel can be directly copied and pasted or imported/exported onto the sequence list of the software. f. flexibility to add samples into the sequence during an analysis without having to stop and restart the sequence g. a reset/stop switch to prevent sample wastage in the case of an emergency h. a full graphical instrument control and tune window with the ability to display multiple system parameters concurrently in real time i. an electronic record of the tuning report that contain all aspects of system performance and time stamped record for audit trail purposes	Yes/ No
22) Fully automated system shutdown must be available via the instrument control window, and automated, unattended shutdown of the plasma and any connected peripherals at the end of analysis must also be provided.	Yes/ No
23) In standby mode, the slide valve shall be shut to maintain vacuum and all plasma, additional and cell gases are turned off.	Yes/ No
24) All tuning parameters must be able to be stored and retrieved at any time. Full auto-tune capability must be provided. The auto-tune software must be able to simultaneously optimise the ion signal while adjusting the plasma parameters to reduce interferences and background.	Yes/ No
25) In the case of malfunction a real time, plain language, error message shall be flagged on the computer screen and saved to an instrument log in case the fault shall be transient or occur during unattended operation.	Yes/ No
26) The system must be capable of analysing all interference prone elements. Hence, the systems must be able to analyse elements such as arsenic, potassium, and chloride isotopes without the need of interference correction equations.	Yes/ No

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<u>Installation, Commissioning, Training and Warranty</u>	
27) Prices quoted must include delivery, installation, commissioning, initial calibration and operator training (for 6 to 10 staffs). Certificates shall be issued to the trained staffs. The system must come with a minimum 1 year warranty. The warranty must cover the overall system (both hardware and software) that minimally include: ○ unlimited breakdown calls and on-site services during Operating Hours i.e. 8 am to 5.30 pm from Monday to Friday excluding Saturday, Sunday and Public Holidays; and ○ supply of replacement of parts and repair consumables; and ○ at least 1 PM per year with PM kit ; and ○ provision of software revisions. a. The PC and its installed softwares must come with at least 3-year warranty and accompanied with their system recovery CDs or DVDs. b. The Contractor is required to oversee and ensure successful system integration, site preparation, installation and necessary configuration of the system.	Yes/ No
28) Option to purchase: Tenderer is required to quote comprehensive maintenance contract for additional 3 years after the warranty period. The comprehensive maintenance contract shall cover the overall system including hardware and software. The price quoted shall minimally include the following: ○ provision of unlimited breakdown calls and on-site services during Operating Hours; and ○ provision of supply of replacement of parts and repair consumables; and ○ to provide 1 preventive maintenance per year with PM kit; and ○ provision of software revisions at no additional cost.	Yes/ No
29) Tenderer shall quote the unit prices of wear and tear consumables listed in Annex C – Price and Submission Information, Schedule of Rates (SOR). The term “Provisional Sum” shall mean a sum provided for the purchase of wear and tear consumables in Annex C – SOR as well as other consumable costs which cannot be entirely foreseen, defined or detailed at the time the documents are issued. Other consumables shall include bonnet, shield plate, oil reservoir, filter cartridge, water filter, tubing, O-ring, rinsing bottle, gas fitting and etc. Provisional Sum where not require, shall be deducted in part of in whole form the Contract without any claim whatsoever including loss of profit.	Yes/ No
30) A declaration of Conformity Certificate and system validation certificate must be provided upon commissioning of equipment. All systems proposed must be GLP compliant.	Yes/ No
31) The Contractor shall coordinate with the Laboratory for the delivery of the equipment. A Risk Assessment Report in 5 x 5 matrix must be provided prior to the delivery.	Yes/ No

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32) The quote shall include any cost involved for the application of the import license for SF-ICP-MS. The Contractor shall facilitate the application of the import license.	Yes/ No
33) Contractor is required to provide after-sales support from engineers and application chemists in Singapore. The following information shall be provided: a) The contacts (handphone number and email) of at least two engineers with a minimum of 3 years' experience handling the SF-ICP-MS system (please provide information in Annex C – Price and Submission Information, Local Service Support); and b) Immediate instruction for trouble shooting by telephone when requested,	Yes/ No
34) Contractor must have sold, installed and offered preventive maintenance of at least 1 unit of SF-ICP-MS system in Singapore within the past 15 years. Track record(s) of the installation site to be provided at Annex C – Price and Submission Information, Track Records.	Yes/ No
35) Contractor shall guarantee that the spare parts, consumables and services for the system will be available for a period of at least 10 years from the date of discontinuation of the system and shall further undertake to locally supply or make available these parts/consumables for the said period.	Yes/ No
36) Contractor must be able to provide on-site system operation and user maintenance training by certified engineer(s). The certificate(s) shall be provided upon request.	Yes/ No
<u>Performance of Services</u>	
37) The Contractor shall perform the services in the manner as specified in the tender in order to maintain the equipment in good working order. The services to be performed by the Contractor shall consist of Preventive Maintenance and Corrective Maintenance as described below. (I) Preventive Maintenance: a. The Preventive Maintenance shall consist of routine maintenance of the equipment, including but not limited to the testing of functions and inspecting of the condition of the equipment in order to keep the equipment safe for use and in good working order; and Adjustment and/or repair of any defect in or malfunction of the equipment discovered by the Contractor's representatives during the course of routine maintenance checks. b. The Preventive Maintenance performed shall be in compliance with the manufacturer's recommendation. c. The Preventive Maintenance shall be carried out and completed during Operating Hour. (II) Corrective Maintenance:	Yes/ No

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a. Upon receipt of oral or written notice from the Authority, the Contractor shall use its best endeavours to ensure that suitably qualified and duly authorised representatives attends to the Authority onsite, within the response time of not more than 24 hours upon receipt of oral/written notification if the urgent request (e.g. project with strict deadline) is made on a Working Day. The representative shall provide immediate instruction for trouble shooting by telephone, when requested. If the urgent request (e.g. project with strict deadline) is made on a non-working day, the Contractor shall respond onsite within the first 24 hours of the beginning of the next Working. b. For urgent breakdowns (e.g. project with strict deadline), the Contractor is to complete any on-site service, repair, or replacement or adjustment of components within 2 working days when parts are available in Singapore, within 5 working days when parts are not available in Singapore and are needed to be ordered from overseas from and including the date on which the Contractor was given notice pursuant to Clause II(a) unless the Authority had agrees in writing to have the time period extended.	
<u>Replacement of Components</u>	
38) The Contractor shall inform the Authority of any part or component of the equipment that needs to be replaced. Prior written approval must be issued by the Authority before the replacement may be effected unless the replacement required is deemed urgent by the Authority in which case a verbal approval (which shall subsequently be confirmed in writing) obtained from an authorised officer of the Authority shall suffice. 39) The Contractor shall use all reasonable endeavours to supply only original or genuine replacement components, which are required to maintain the equipment in good working order. All replacement components shall be provided free-of-charge during the period of warranty period and post warranty comprehensive maintenance contract.	Yes/ No

Please indicate any non-compliance to requirement specifications here should there be any.

Reference To	Remarks