

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: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
(1) Critical Specifications	
· The proposed system must be a Fast Liquid Chromatograph	☒ Yes/ No
· The entire system must be a unified platform to be supplied by a single Contractor to ensure seamless operation	☒ Yes/ No
· The Contractor must be the direct manufacturer with an established network for after-sales support – engineers, application and logistics in Singapore	☒ Yes/ No
· The Tenderer must demonstrate that it has a proven appropriate set-up and capability to provide after-sales service efficiently and effectively in Singapore for the proposed system in the tender or other fast LC system by the same manufacturer. Please provide the awarded contracts for the sales/ provision of maintenance support of fast LC system from 2017 to 2019 in Annex D to Part 3 – Price and Submission Information .	☒ Yes/ No
(2) Binary/Quaternary pump	
· Allow gradient formation	☒ Yes/ No
· Should have at least two dual pistons in series pumps with servo-controlled variable stroke drive, floating piston design and active inlet valve (or equivalent)	☒ Yes/ No
· Should be capable of standalone operation when software is not in use	☒ Yes/ No
· Flow range: minimum 0.050 to 2.200 mL/min with 0.01 mL/min increments (or better)	☒ Yes/ No
· Flow precision: ≤0.075% RSD	☒ Yes/ No
· Flow rate accuracy: within ± 1% of set value or 10 mL/min, whichever greater	☒ Yes/ No
· Operating pressure range should be able to reach up to at least 800 bars	☒ Yes/ No
· Pressure pulsation: ≤ 2% amplitude or ≤ 3 bar or whichever better, at 1 mL/min isopropanol for all pressures above 10 bars	☒ Yes/ No
· Compressibility: Pre-defined, based on mobile phase compressibility	☒ Yes/ No
· Working pH range for all components: minimum 2 to 12 to be available as standard	☒ Yes/ No
· Compatible with phosphate buffers.	☒ Yes/ No

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· Pump delay volume: ≤ 900 µL	☒ Yes/ No
· Composition range: Settable from 0 – 100% per channel	☒ Yes/ No
· Composition precision: ≤0.5% RSD	☒ Yes/ No
· Composition accuracy: ≤ 0.5% absolute	Yes/ No
· Should have solvent selection valve in order to combine 2 out of 4 solvents for binary gradient or to select different solvent for flushing column	☒ Yes/ No
· Pump must be able to run with existing columns sizes as follow: • ID 2.1 mm, 3 mm and 4.6 mm; • 5 µm, 3.5 µm and sub-2-µm particle columns; and • Superficially porous columns.	☒ Yes/ No
· Inclusive of solvent cabinet; complete with minimum five sets of filters and caps (with 4 holes) and automatic rinsing kit	☒ Yes/ No
· The Contractor is required to provide solvent cabinet(s) that able to hold at least one 5-litre round bottle (with circumference of approx. 60cm) together with three 1-litre round bottles (with circumference of approx. 33cm)	☒ Yes/ No
(3) Solvent degasser	
· No. of independent channels: at least 4	☒ Yes/ No
· Internal volume: At least 400 uL per channel to allow for fast and easy flushing, purging, priming, and solvent exchange	☒ Yes/ No
· Working pH range for all components: at least 2 – 12 as standard	☒ Yes/ No
(4) Auto-sampler	
· Operating pressure range should be able to reach up to at least 800 bars	☒ Yes/ No
· Able to accommodate minimum 96 samples of 2 mL vials	☒ Yes/ No
· Able to use vials with rubber, silicone and PTFE septa as well as insert	☒ Yes/ No
· Minimum Injection volume: 0.1 - 10 µL without loop change in ≤ 0.1 µL increments	☒ Yes/ No
· Precision: <0.3% RSD	☒ Yes/ No
· Accuracy: ≤2%	☒ Yes/ No
· Automated or programmed needle wash function which can be turned on or off to minimise carryover. Needle wash function should preferably not impact sample loop and injection volume. Contractor should provide clear	☒ Yes/ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
information from existing published material on how the needle wash is carried out	
Additional needle flush station with a peristaltic pump or equivalent function to wash the exterior of the needle	☒ Yes/ ☐ No
Carryover must be $\leq 0.1\%$ without needle wash (if applicable); and $< 0.05\%$ with external needle wash. No carryover should be observed using 12 mg/mL of caffeine at UV wavelength of 280 nm with needle wash.	☒ Yes/ ☐ No
Injection cycle time: Not more than 50 sec per sample	☒ Yes/ ☐ No
Equipped with high pressure valve that allows use of 1.8-μm fully porous particle column or superficially porous column	☒ Yes/ ☐ No
Pre-treatment function that minimally includes reagent addition, dilution and mixing must be available.	☒ Yes/ ☐ No
Overlapped injection ability to increase productivity that can be used with both full and partial sequence run	☒ Yes/ ☐ No
System must have a transport mechanism that uses an X-Z-Theta robot (or equivalent) to optimise vial positioning by the gripper arm of the autosampler.	☒ Yes/ ☐ No
Autosampler should be able to perform injection from the correct vial position consistently for all samples on sample tray. There should be no instances for wrong vial injected or skipping of vials.	☒ Yes/ ☐ No
Needle material or needle coating should be compatible with vials using rubber, silicone and PTFE septa and be able to withstand high throughput injections without significant wear off or carryover. Published information about the needle material and ruggedness shall be submitted upon request.	☒ Yes/ ☐ No
The price quoted shall include at least: (1) 1 x minimum 96-vial (2-ml) thermostatted tray (4°C to 40°C); and (2) 1 x 40-vial (2-ml) tray (if applicable)	☒ Yes/ ☐ No
(5) Column compartment	
Temperature range: 10 °C below ambient to at least 80 °C	☒ Yes/ ☐ No
Temperature accuracy: $\pm 1^\circ\text{C}$ or less	☒ Yes/ ☐ No
Column capacity: at least 2 columns of 300 mm length	☒ Yes/ ☐ No
One column switcher to switch minimally between two columns (at least 300 mm length).	☒ Yes/ ☐ No
(6) Diode Array Detector	

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Detection type: At least 512-element photodiode array	☒ Yes/ ☐ No
Lamp type: Deuterium lamp	☒ Yes/ ☐ No
Able to monitor at least 4 compound specific wavelengths simultaneously during a single analysis without loss in sensitivity	☒ Yes/ ☐ No
Signal and spectra sampling rate: ≥ 80 Hz	☒ Yes/ ☐ No
Short-term noise: $\leq \pm 8 \mu\text{AU/cm}$ with 10 mm path length cartridge cell	☒ Yes/ ☐ No
Signal drift: $\leq 1 \times 10^{-3}$ AU/hr at 230 nm or equivalent	☒ Yes/ ☐ No
Upper linearity limit: ≥ 2.0 AU (Based on ASTM method)	☒ Yes/ ☐ No
Wavelength range: At least 190 – 500 nm	☒ Yes/ ☐ No
Wavelength accuracy: Better than ± 1.0 nm, self-calibration with deuterium lines, verification with holmium oxide filter	☒ Yes/ ☐ No
At least two programmable slit width between 1 nm-8 nm	☒ Yes/ ☐ No
- Include flow cell with equivalent or better features: 10 mm pathlength max, $<2 \mu\text{L}$ volume, withstand at least up to 80 bar pressure	☒ Yes/ ☐ No
Include data analysis software for spectra evaluation with purity and spectra matching functions. Contractor shall provide sufficient information and training to help users understand the peak purity function as well as the basis of spectra matching on the System.	☒ Yes/ ☐ No
Able to create and register UV spectra to the UV library in the system. Please provide screenshot for the UV library	☒ Yes/ ☐ No
Radio frequency identification (RFID) tags for flow cells and UV lamp that record parameters such as cell dimensions, lamp usage, serial number, etc.	☒ Yes/ ☐ No
Able to select reference wavelength for elimination of background interference	☒ Yes/ ☐ No
The system must have a built-in data recovery feature which help prevent data losses in the event of communication breakdown between system and PC	☒ Yes/ ☐ No
(7) Chromatographic software	
The software should have an user interface that allows the complete control of the liquid chromatographic system including access to all method parameters, data acquisition, data analysis, method automation, reporting, generation of customised reports, and system management utilities	☒ Yes/ ☐ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
Operating software should have multi-tasking capability – capable of control, data acquisition, data evaluation, automation and reporting.	☒ Yes/ No
Software should minimally have functions for wavelength optimisation, generation of peak purity reports, spectral libraries search for compound identification, and mathematical operations such as normalisation, subtraction and smoothening.	☒ Yes/ No
Must be able to run at the same time with other programs on the computer such as word processors and also export information to other programs through industry standard protocols and file formats	☒ Yes/ No
Software should preferably have functions for updating of volumes for all four solvents attached to the pump(s) independently.	☒ Yes/ No
Software should allow shutdown after a sequence is completed. Software should preferably also allow shutdown when calculated remaining solvent volume in any of the solvent bottles reaches below a certain threshold.	☒ Yes/ No
Must have built-in or integration path to OpenLab ECM for central secure long-term data storage	☒ Yes/ No
Configurable access control to different functions of software	☒ Yes/ No
Software must be able to provide log/ trails for method and results changes.	☒ Yes/ No
Reports are customisable according to the laboratory's needs. Assistance is to be provided by the Contractor to ensure the seamless integration and interface with LISA for the system report printing and extraction	☒ Yes/ No
System should be able to import and run a sequence file (usually in csv or txt file format) generated by LISA	☒ Yes/ No
Software should preferably be able to read UV library in “.uvl” format. If the software to be provided is unable to read “.uvl” format, Contractor is required to provide assistance to ensure the library can be accessed and used on the new software.	☒ Yes/ No
Include software with intuitive diagnostic and monitor capabilities and alert functions for problem notifications	☒ Yes/ No
Software should preferably be able to include both chromatogram and purity results for each analysis in a single report template which can be printed out directly from the software	☒ Yes/ No
(8) Computer and Printer	
- PC (Specifications of the following should be equivalent or better) - Intel® Core™ 8th Gen i7 Processor (3.6 GHz, 8 MB Cache, Quad core) or better	☒ Yes/ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
• Monitor: 20" IPS LED Monitor • Hard Disk: 1 TB 7200 rpm SATA 6Gb/s HDD • Memory: 16 GB DDR4 RAM • Optical Mouse • Keyboard • Operating System: Microsoft Windows 10 Professional SP1 or newer version • 2 network cards	
• Printer: Laserjet network printer with at least 1200x1200dpi resolution and prints at least 32 pages per minute. The printer must be capable of automatic duplex printing.	☒ Yes/ No
• The Contractor shall ensure that the system PC/notebook provided with the system is network ready and able to connect to HSA's network for interfacing with LISA (Laboratory Information & Scientific Administration) system. If required, additional network cards shall be included to ensure the connectivity to LISA	☒ Yes/ No
(9) Other Features	
• System should be compatible with existing LC methods that allow direct method transfer from current Shimadzu Nexera Series UHPLC systems	☒ Yes/ No
• Modular design that has flexible configuration options and true front accessibility for all components	☒ Yes/ No
• Able to run in 2 modes: HPLC and fast LC without the need for modification of hardware	☒ Yes/ No
• The proposed system must be incorporated with GLP features that includes: I) Early maintenance feedback with display for a) Pump: litres of mobile phase pumped, mobile phases and seal wear b) Autosampler: number of injections, user-settable limits messages c) Detector: lamp time, lamp energy, date of last lamp replacement II) User-set limits for feedback messages for timely replacement of parts III) Electronic records of maintenance and errors for all modules in a log book	☒ Yes/ No
• The system shall come with safety and maintenance requirements that includes extensive diagnostics, error detection and display, leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas	☒ Yes/ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
There shall have storage of all details of analytical method including system set points, data acquisition, data evaluation and reporting parameters as one analytical specification.	☒ Yes/ ☐ No
(10) Integration with HSA's LISA (Laboratory Information & Scientific Administration) System	
- The Contractor shall ensure the system PC/notebook provided is able to run (a) OpenLAB – Cerity Enterprise Content Manager (ECM) Version 3.3.2 (b) OpenLAB – Cyberprinter (c) Must have built-in or integration path to OpenLAB ECM for central secure long-term data storage	☒ Yes/ ☐ No
(11) Middle-Tier Software for integration with LISA	
- The Contractor shall ensure the system software will be able to have direct interface to LISA for the following: - Raw Data Files archival & retrieval - System test result report output to PDF for archival System test result report for result uploading.	☒ Yes/ ☐ No
- Tenderer shall specify the format of the system software and outputs. a) Software: _____ b) Output format: _____	☒ Yes/ ☐ No
Tenderer shall propose a complete and comprehensive solution to ensure the seamless interface between the system software and LISA, and to meet the requirements as specified above. The proposal shall include required hardware, system software, application software and professional services. Please submit your proposed solution in Annex D to Part 3 – Price and Submission Information.	☒ Yes/ ☐ No
(12) Configuration and setting of System PC/Notebook for integration with LISA	
Contractor shall work with HSA assigned personnel for the setting up and configuration of System PCs / notebook to ensure the connection to the HSA network as well as integration to LISA	☒ Yes/ ☐ No
- Contractor shall work with HSA personnel for the following: - To define and assign a Hostname and/or PC name given by HSA to facilitate the System management on HSA network	☒ Yes/ ☐ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
- To define the Raw Data file structure & directory assigned by HSA to facilitate the automation of electronic archival and retrieval of files - To work with LISA vendor, if required, to ensure the system report print out to be in PDF file format - To perform UAT to ensure the integration to LISA is running fine	
(13) System Reports Requirement	
Contractor shall work with Laboratory to ensure the seamless integration and interface with the Laboratory's Information Management System for the system report printing and extraction	☒ Yes/ ☐ No
- Tenderer shall provide HSA the following output format for the System Test Result output and they are: - Raw Data File: _____ - Electronic output file: _____ - Hardcopy print out: _____ Please state if there are other output files can be generated by System: _____	☒ Yes/ ☐ No
- The following information must be able to be captured and printed on the above mentioned System Test Result output format to facilitate the integration and interface for result extraction and they are: - Data file name - Method used - Operator - Date Acquired - System - Sample Name - Misc Info - Vial Number	☒ Yes/ ☐ No
The sequence and sequence printout should include the following information: - Sequence line - Type of sample - Vial number - Data file name - Name of Method - Sample Information (with at least 2 lines of information) - Amount of sample	☒ Yes/ ☐ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
• Volume of sample • Dilution factor • Internal Standard Amount	
The library and library matching printout should include the following information: • Sequence line • Type of sample • Vial number • Data file name • Name of Method • Display of UV spectrum of target • Results of the UV library match	Yes/ No
Contractor shall assist user to configure the required information should additional information/ parameters need to be included.	Yes/ No
(14) Installation, Commissioning, Training and Warranty	
All systems proposed must be GLP compliant	Yes/ No
Prices quoted must include installation and commissioning, warranty, operator training and LC starter kit.	Yes/ No
a) Operational training on theory for approximately 55 staff on HSA premises b) Hands-on training for operating the system model submitted in this tender must be provided for 3-10 persons.	Yes/ No
An endorsed copy of 5x5 risk assessment form for the installation of the system must be submitted to the laboratory 2 weeks before the delivery. A template of this form can be found on MOM website.	Yes/ No
The system should come with at least three (3) years warranty that covers the system hardware, software and computer. The warranty shall minimally include the following: a) Unlimited breakdown calls and on-site support services during Office Hours from 8:00 am to 5:30 pm Monday to Friday excluding Saturday, Sunday and Public Holidays; b) Provision of software upgrade or revisions c) Semi-annual preventive maintenance (PM) (2PM/year); d) Replacement of consumable parts based on the frequency as stated in Appendix 1 (or equivalent) that is in accordance to IDL's requirement; e) Include all replacement parts; and	Yes/ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
f) Include all repair consumables for PM, repair and other maintenance services that are performed by the Contractor Contractor should accommodate observation by laboratory staff during the maintenance process. Any software revisions should also be provided free-of-charge.	
(15) Technical support	
· Contractor shall provide full assistance in terms of hardware, software and application support. This is to ensure that the system is fully validated with relevant methods for casework within 3 months after commissioning	☒ Yes/ ☐ No
(16) Delivery	
· The delivery of the system is to be coordinated with the Laboratory.	☒ Yes/ ☐ No
(17) Option to purchase: 4-year post warranty comprehensive maintenance services on biennial renewal basis	
Tenderer shall quote for the option to purchase 4-year comprehensive maintenance contract on biennial renewal basis. The contract shall minimally include the following: a) Unlimited breakdown calls and on-site support services during Office Hours from 8:00 am to 5:30 pm Monday to Friday excluding Saturday, Sunday and Public Holidays; b) Provision of software upgrade or revisions c) Semi-annual preventive maintenance (PM) (2PM/year); d) Replacement of consumable parts based on the frequency as stated in Appendix 1 (or equivalent) that is in accordance to IDL's requirement; e) Include all replacement parts; and f) Include all repair consumables for PM, repair and other maintenance services that are performed by the Contractor The coverage for post warranty comprehensive maintenance contract must be extended to system hardware, software and computer.	☒ Yes/ ☐ No

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
Replacement and Purchase of Components 1. The Contractor shall inform the Authority of any part or component of the System 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. 2. The Contractor shall use all reasonable endeavours to supply only original or genuine replacement components, which are required to maintain the system in good working order.	☒ Yes/ ☐ No
Guarantee 3. The Contractor hereby warrants that all the System and every part or unit thereof serviced by the Contractor shall conform to the requirements of this Contract and be free from any defect or deficiency in their performance or workmanship for a period of three (3 months) from the date of acceptance of the Services by the Authority (hereinafter referred to as "the System Guarantee Period"). The Contractor hereby also warrants that all materials and every part or unit thereof, used for the Services shall be free from any defect in manufacture or any defect arising out of design, workmanship or materials used or any failure or malfunction due to quality of material, workmanship, design, assembly, installation or integration for a period of three (3) months from the date of acceptance of the materials by the Authority (hereinafter referred to as "the Materials Guarantee Period"). The System Guarantee Period and the Materials Guarantee Period shall collectively be known as the "Guarantee Period". 4. Where during the Guarantee Period, any part or unit of the System serviced by the Contractor or materials used for the Services or supplied therefor are found to be defective of any of the reasons specific in Clause 3 above, the Contractor shall at the written request of the Authority replace the same at the expense (including freight charges, transportation costs or other incidental charges) of the Contractor or if the Authority so agrees make good or repair the same at the expense (including freight charges, transportation costs and other incidental charges) within a Guarantee Turn-Around-Time of 7 days. The System or materials or part or unit thereof so replaced or repaired shall be subject to the Guarantee under this Clause for the Authority or three (3) months whichever is later and such balance of the Guarantee Period shall begin to run only from the date of receipt of the part or unit so replaced or repaired by the Authority.	☒ Yes/ ☐ No
(18) Sample Evaluation	

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>						
1. Tenderer is required to perform testing for two (2) sets of samples (Samples Set A & B) and these must be tested without further manipulation and using the conditions provided in the <i>Instructions for Sample Testing</i> that will be provided. The samples must be analysed on <u>the system model proposed</u> in this tender using: a) Column: ZORBAX SB C8, 50 x 4.6mm i.d., 1.8 µm (Agilent Part No. 827975-906-SB-C8); and b) In-line Filter: Fast LC In-line Filter, 4.6mm, 0.2µm filter (Agilent Part No. HP 5067-1553) 2. Tenderer are require to provide their own columns and in-line filter for the testing. No reimbursement will be made to Tenderer for the purchase of columns and in-line filter to test the samples. 3. Annex E - Summary Sheet for Sample Testing Results must be completed after the analysis is completed. Please see table below for the sample testing timeline & requirements. <table border="1" data-bbox="207 1070 1145 1491"> <tr> <td data-bbox="207 1070 440 1133">Set of Samples</td> <td data-bbox="440 1070 1145 1133">A & B</td> </tr> <tr> <td data-bbox="207 1133 440 1379">Sample Collection</td> <td data-bbox="440 1133 1145 1379"> Samples will be sent down by laboratory staff and the analysis shall be performed on the same day, during the tender submission period and 3 days before tender closing date. Please email Tan_Siew_Hoon@hsa.gov.sg to arrange for sample testing dates. </td> </tr> <tr> <td data-bbox="207 1379 440 1491">Submission of Annex E</td> <td data-bbox="440 1379 1145 1491">To submit within 2 weeks after tender closing date.</td> </tr> </table> - The unutilized samples must be returned to the Authority after the test analysis is completed. - If Tenderer requires to extend the deadline for result submission, please write in to the Authority and a maximum of 7 working days can be provided. The detail results and supporting documents for Annex E (Samples Set A & B) shall be submitted within 2 weeks after tender closing date.	Set of Samples	A & B	Sample Collection	Samples will be sent down by laboratory staff and the analysis shall be performed on the same day, during the tender submission period and 3 days before tender closing date. Please email Tan_Siew_Hoon@hsa.gov.sg to arrange for sample testing dates.	Submission of Annex E	To submit within 2 weeks after tender closing date.	☒ Yes ☐ No
Set of Samples	A & B						
Sample Collection	Samples will be sent down by laboratory staff and the analysis shall be performed on the same day, during the tender submission period and 3 days before tender closing date. Please email Tan_Siew_Hoon@hsa.gov.sg to arrange for sample testing dates.						
Submission of Annex E	To submit within 2 weeks after tender closing date.						

Equipment 1: Fast Liquid Chromatograph Location: IDL	Compliances (Yes/ No) <i>**If No, please indicate reason of non-compliances.</i>
4. Analysis result of each test sample from Sample Set A must minimally meet the following criteria in order to be scored for respective criteria. Please refer Annex C to Part 3 – Evaluation Criteria for the evaluation criteria. a) The results of each sample injection is <5% of the true value b) The RSD for the results of each test sample is <4% c) Each sample injection has acceptable peak purity results (i.e. peak purities passed). Tenderer should indicate the criteria of an acceptable peak purity and whether any further data correction was done. 5. Analysis result of each test sample from Sample Set B must minimally meet the following criteria in order to be scored for respective criteria. Please refer Annex C to Part 3 – Evaluation Criteria for the evaluation criteria. a) Each sample injection has acceptable peak purity results (i.e. peak purities passed). Tenderer should indicate the criteria of an acceptable peak purity and whether any further data correction was done.	

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

Reference To	Remarks

EQUIPMENT 2: GAS CHROMATOGRAPHY WITH FLAME IONIZATION DETECTOR (GC-FID)

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 2: GAS CHROMATOGRAPHY WITH FLAME IONIZATION DETECTOR (GC-FID)
(ONE UNIT)**Specifications & Description****A. GC Mainframe**

- The system should consist of 1 inlet and 1 flame ionization detector.
- Full Electronic Pneumatic Control (EPC) available for all inlets and detectors. Control range and resolution are optimized for the specific inlet or detector module.
- System must be able to install up to 5 EPC modules, providing control of up to 13 channels of EPC.
- Standard atmospheric pressure and temperature compensation so that results do not change even when the laboratory environment does.
- To have access to service, maintenance and log from the operating panel.
- Preprogrammed leak tests.
- 550 timed events.
- Should be able to initiate clock-time programming from the operating panel to initiate events (on/off, method start, etc) at a future date and time.
- Built in column bleed compensation.
- Run log to record at least 50 potential errors that occurred during the last analytical run.
- Built in ability to update to the latest firmware.
- Upgradeable to allow Solvent Bypass, Backflush, Heart Cutting and Splitters to Multiple Detectors capabilities.

B Chromatographic Performance

- Retention time repeatability : $\leq 0.008 \%$ or $\leq 0.0008 \text{ min}$
- Area repeatability : $\leq 1 \%$ RSD

C Column Oven

- Operating temperature range : 10°C above ambient to at least 450°C
- Temperature set point resolution : 0.1°C or below
- Programming ramp/plateaus : at least 20 ramps/plateaus, allowing negative ramp
- Maximum temperature ramp rate : at least 250°C/min
- Max run time : at least 2 hours
- Oven cool down : 450 to 50°C in not more than 3 min
- Ambient rejection : $\leq 0.01^\circ\text{C}$ for a 1°C ambient change
- Oven power safety : Turn off automatically when door is opened
- Must accommodate at least two $60 \text{ m} \times 0.32 \text{ mm}$ i.d. capillary column.
- Easy and fast column changing within 1-2 minutes without using any column mounting jig and the need of column trimming.
- Easily removable, disposable guard chip to prevent unwanted material from depositing on the head of a column, hence eliminate the need to trim the column.

D Electronic Pneumatics Control (EPC)

- Compensation for barometric pressure and ambient temperature changes.
- Must have automatic leak checking which can be enabled by user for every run so that the system alerts the user when a leak is detected
- Automatic carrier gas shutoff if the inlet pressure drops significantly.

EQUIPMENT 2: GAS CHROMATOGRAPHY WITH FLAME IONIZATION DETECTOR (GC-FID)

- Pressure setpoints must be able to be adjusted by increments of $\leq \pm 0.001$ psi for the range 0.000 to 99.999 psi; $\leq \pm 0.01$ psi for the range 100.00 psi to 150.00 psi.
- Units for pressure : bar, psi and kPa
- Pressure/flow ramp : Allow ≥ 3 ramp settings in the method
- Pressure sensor accuracy : $\leq \pm 2$ %
- Pressure sensor repeatability : $\leq \pm 0.05$ psi
- Temperature Coefficient : $\leq \pm 0.01$ psi/ $^{\circ}\text{C}$
- Drift : $\leq \pm 0.1$ psi/ 6 months
- Flow sensor accuracy : $\leq \pm 5$ %
- Flow sensor repeatability : $\leq \pm 0.35$ %
- Carrier & makeup gas settings : Selectable for He, H₂, N₂ & argon/methane
- Column flow control modes : constant pressure, constant flow, ramped pressure, ramped flow

E Split/Splitless Inlet (S/SL)

- Suitable for all capillary columns : Must be compatible with column up to 320 μm id
- Split ratios : To at least 500:1
- Support up to 4 modes : Split, Splitless, Pulsed-Split and Pulsed-Splitless
- Maximum temperature : At least 400 $^{\circ}\text{C}$ in $\leq 1^{\circ}\text{C}$ increments
- Pressure ranges : 0 to at least 100 psi
- Total flow setting range : 0 to at least 400 mL/min for Helium or Hydrogen
- Gas saver mode to reduce gas consumption without compromising performance.
- Adjustable septum purge flow control to eliminate "ghost" peaks.
- Built in turn top inlet sealing system or equivalent for quick, easy, injector liner changes in under 30 seconds without the use of special wrench or tools.
- Split and septum purge flow can be changed without changing the column flow

F Flame Ionization Detector (FID)

- Maximum Operating Temperature : At least 450 $^{\circ}\text{C}$
- Minimum detectable level (for tridecane) : < 1.8 pg C/s
- Linear Dynamic Range : $> 10^7$ ($\pm 10\%$)
- The detector should offer full-range digital data path to enable peaks to be quantified over the entire 10^7 concentration range in a single run.
- Data rates up to 500 Hz accommodate peaks as narrow as 10 millisec at half height.
- Standard electronic pneumatic control for three gases:
 - Air: 0 to 800 mL/min
 - H₂: 0 to 100 mL/min
 - Makeup gas (N₂ or He): 0 to 100 mL/min
- Must have flameout detection and automatic re-ignition.

G Autosampler

- Tenderer should quote for a single-function liquid autosampler (without additional headspace or solid-phase microextraction functions) in order to ensure reproducible injection results and reliable communication with the GC system.
- Autoinjector must have standard turret that can hold at least three 2-mL vials at once for use with advanced sampler capabilities.
- Autoinjector must have a sample tray which is capable of handling at least 150 sample vials.
- Sample tray must have at least 3 removable tray racks.
- Autoinjector must be auto-aligning and able to be installed or removed without the use of tools.
- Supports neckless (shell) vials, standard 2 mL vials, and micro vial inserts.

EQUIPMENT 2: GAS CHROMATOGRAPHY WITH FLAME IONIZATION DETECTOR (GC-FID)

- Sampler tray must use an active vial gripping mechanism (finger like) so that vial is grabbed by the sides rather than under the cap.
- Sampler tray's vial gripping mechanism must have a sensor that verifies whether a vial has been grasped.
- Prefer to have shorter & simple steps in replacement of syringe (i.e., without using a plunger holder, barrel holder, etc).
- Capable of user-definable sandwich injection mode, with up to 3 layers of additional liquid in one injection or an air gap for each layer.
- The autoinjector should have illumination on the syringe to allow operator to verify the syringe's proper functioning and that the correct type has been installed.
- Sensors in the injector turret detect that the sample vial has been transferred to the injector
- Adjustable dispense rate, draw rate, and injection rate.
- Fast injections are performed in less than 100ms.
- User-changeable syringe carriage. Able to accommodate 1, 2, 5, 10, 25, 50, and 100µL.
- Injection range: 1 to 50% of syringe volume in increments of 1%.
- Minimum sample injection: ≤0.1µL (with 10 µL syringe)
- Maximum sample injection volume: ≥50 µL (with 100 µL syringe in standard tower)
- Available solvent-saving mode extends solvent capacity by up to eightfold.
- Solvent saver mode capable of using 10 to 80% of syringe volume.
- Adjustable plunger speed.
- The depth of the sampling can be adjusted from the default position to be able to access to very small sample volume.
- Next sample overlap support decrease analysis time and increase throughput by performing pre-run rinses and picking up the next sample before the current run is complete.
- Autosampler's rinse configuration should ensure minimal carryover during analysis:
 - Total wash solvent volume (usable volume; or volume above the minimum fill line of the solvent wash vials) should be at least 20 mL distributed in at least 4 solvent wash vials to ensure adequate washing of the syringes for a full sequence of 150 samples with the laboratory's current wash settings.
 - Tip of syringe needle should not extend beyond the neck of the waste bottle to avoid contamination.
 - Allow two different types of rinse solvents to be used.
 - Capable of adding a sample solution with an internal standard solution in certain proportion and then mixing before injection.
- Autosampler shall have an integrated barcode reader or an additional module attached to the autosampler to allow reading of vial barcode labels. Tenderer shall have at least one reference/track record which the barcode reader was successfully integrated. Barcode label printing device is NOT required.

Please provide at least one track record of successful integrated barcode reader on the autosampler.

Model of the system	Year of installation (eg. 2017)	Company

H Accessories

- One GC start up kit.
- Gas traps for (carrier gas of) the GC system

I Specifications for Data Station Software and Operating Software

- The system software shall be based on Microsoft Windows 10 Professional SP1 operating environment or newer.
- The software shall be able to control the Gas Chromatograph through local area network (LAN) technology.
- Flexible GUI (graphical user interface) to display the system status, show real-time plot and change all system set points.
- Offer complete control of the GC system, including access to all method parameters and enhanced functionality like valve time events programme.
- Must be built-in or integration to ECM control for simultaneous detector data acquisition.
- Two or more simultaneous signal detector data acquisition
- The software must be able to fully control the system using pre-stored methods of all the operating parameters.
- Must have Retention Time Locking capability using user-specified columns and settings and able to achieve the same retention times for the compounds on every run of the same methods.
- Lab monitor and Diagnostic software to allow continuous monitoring of GC in real time to alert user maintenance needs and system problems
- Allows clock-time programming with the ability to start a GC at user-specified time without user intervention.
- Able to acquire data, integrate, review and report on an actively running sample.
- Capable of generated customized reports.
- The system should have capability for simple method transfer between different GC models.
- All systems proposed should be compliance to Good Laboratory Practice (GLP) with system suitability, system and sequence logbook.
- Macro programming capability or ability to do report and sequence customisation (to user required report format) without the need of macro.
- PC (Specifications of the following should be equivalent or better)
 - Operating System: Microsoft Windows 10 Professional SP1 or newer
 - Processor: Intel® Core™ 8th Gen i7 Processor or better
 - Monitor: Minimum 22" IPS LED Monitor
 - Hard Disk: 1TB 7200 rpm SATA 6Gb/s HDD or better
 - Memory: Minimum 16 GB DDR4 RAM
 - Optical Mouse
 - Keyboard
 - An additional network card
- Laserjet network printer with at least 1200x1200dpi resolution and prints at least 32 pages per minute. The printer must be capable of automatic duplex printing.
- Tenderer shall ensure that the system PC/notebook that provided with the system is network ready and be able to connect to the HSA's network for interfacing with HSA's LIMS (Laboratory Information Management Software) system, e.g. LISA, LabWare, etc.

J Integration with HSA's LIMS system (e.g. LISA, LabWare)

- The system software must be able to interface with HSA LIMS for the following:
 - (1) Raw Data Files archival & retrieval.
 - (2) System test result report output to PDF for archival.
 - (3) System test result report for result uploading.
 - (4) To accept work list upload from HSA LIMS, if applicable.
- Tenderer shall ensure the System PC/notebook provided will be able to run
 - (a) OpenLab - Cerity Enterprise Content Manager (ECM) Version 3.3.2.130
 - (b) Open Lab – Cyberprinter

- System should be able to import and run a sequence file generated by LIMS. The sequence file generated is usually in csv or txt file format.

K Configuration and setting of System PCs/Note for integration with HSA's LIMS system:

- The Contractor shall work with HSA assigned personnel for the setting up and configuration of System PCs / notebook to ensure the connection to the HSA network as well as integration to HSA's LIMS system.
- The Contractor shall work with HSA personnel for the following:
 - (1) To define and assign a Hostname and/or PC name given by HSA to facilitate the system management on HSA network.
 - (2) To define the Raw Data file structure & directory assigned by HSA to facilitate the automation of electronic archival and retrieval of files.
 - (3) To work with HSA's LIMS system Contractor required, to ensure the system report print out to be in PDF file format.
 - (4) To perform UAT to ensure the integration to HSA's LIMS system is running fine.

L System Reports Requirement

- The Contractor shall work with Laboratory to ensure the seamless integration and interface with LIMS for the system report printing and extraction.
- The Contractor shall provide HSA the following output format for the System Test Result output and they are:
 - (1) Raw Data File
Please specify the file format: _____
 - (2) Hardcopy print out

Tenderer should specify if there are other types of output files that can be generated by System.
Please specify: _____

- The following information shall be included and printed in the System report to facilitate the integration and interface for result extraction and they are:
 - (1) Data File Path
 - (2) Date Acquired
 - (3) Acquisition Method Path
 - (4) Operator
 - (5) Sample Name
 - (6) Sample Info
 - (7) Vial Number
 - (8) Sample Amount
 - (9) Volume of Sample
 - (10) Dilution Factor
- The sequence and sequence printout should include the following information
 - (1) Sequence Line
 - (2) Sample Type
 - (3) Vial Number
 - (4) Data File Name
 - (5) Name of Method
 - (6) Sample Information
 - (7) Amount of Sample
 - (8) Volume of Sample
 - (9) Dilution Factor
 - (10) Internal Standard Amount

M Installation, Commissioning, Training and Warranty

- All systems proposed must be GLP compliant. The tender must include installation and commissioning.
- An **endorsed copy of risk assessment form** for the installation / maintenance / repair of the system must be submitted to the laboratory at least 1 week before the delivery. A template of this form can be found on MOM website.
- The system shall come with a minimum **one (1) year** warranty that minimally includes the following:
 - (a) One preventive maintenance (PM);
 - (b) Supply of PM kit if applicable;
 - (c) Unlimited breakdown calls and on-site services during Office Hours i.e. 8am to 5:30pm from Monday to Friday except Sat, Sun & Public Holidays;
 - (d) Supply of replacement of parts;
 - (e) Update/upgrade of software version
- Tenderer shall also quote for the **option** to purchase **2-year post warranty comprehensive maintenance** at the same condition described above for warranty, except with biannual PM.
- Contractor should accommodate observation by laboratory staff during the maintenance process.
- Tenderer shall quote for the Option for training as follow:
 - a) Operational training on theory for approximate 55 staffs; and
 - b) Hands-on training for operating the system for 6 staffs. The number of attendee to be confirmed after the award of tender.

N Technical Support

- Technical support for hardware, software and application issues must be provided throughout the warranty period.
- The technical support team must be able to assist Laboratory to complete the report customisation, method setup, transfer and validation of methods within 3 months from the date of request.

O The delivery of the system shall be coordinated with the Laboratory.

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

Reference To	Remarks