
GAS CHROMATOGRAPH-MASS SPECTROMETER (GC-MS) SYSTEM (1 UNIT)

Specifications & Description

- The Gas Chromatograph-Mass Spectrometer (GC-MS) system should directly operate on ~230V and ~50Hz and should minimally comprise of the following:
 - Gas Chromatograph 1 set
 - GC Mainframe, Column Oven and Electronic Pneumatic Control
 - Inlet – Split/Splitless Inlet 1 set
 - Detector
 - Mass Spectrometer 1 set
 - Autosampler
 - Autoinjector Tower 1 set
 - Autosampler Tray 1 set
 - Data Management System & PC
 - Accessories
- The entire system must be a unified platform manufactured by a single vendor to ensure seamless operation.
 - Tenderer must be able to demonstrate that it has a successful set-up of the proposed system and capability to provide after-sales service efficiently and effectively. Please provide the reference list of installation from 2014 to present in Performance Summary for the proposed model or similar series that can deliver the equivalent performance.
 - Tenderer must be able to provide demo unit upon request for the model proposed in this tender or similar series system with equivalent performance for evaluation.

A GC Mainframe

1. The system should consist of 1 inlet and 1 mass spectrometer detector.
2. Full Electronic Pneumatic Control (EPC) available for all inlets and detectors. Control range and resolution can be optimized for the specific inlet or detector module.
3. System should be able to install at least 6 EPC modules, providing control of at least 16 channels of EPC.
4. Comes with atmospheric pressure and temperature compensation such that results do not change even when the laboratory environment does.
5. To have access to service, maintenance and log from the GC front panel.
6. Preprogrammed leak tests.
7. At least 550 timed events.
8. Context-sensitive help.
9. Should be able to initiate clock-time programming from the front panel to initiate events (on/off, method start, etc) at a future date and time.
10. Built in column bleed compensation.
11. Run log to record at least 50 errors that occurred during the last analytical run.

12. Built in ability to update to the latest firmware.
13. Upgradeable to allow solvent bypass, backflush, heart cutting and splitters to multiple detectors capabilities.

B Chromatographic Performance

1. Retention time repeatability : $\leq 0.008\%$ or ≤ 0.0008 min
2. Area repeatability : $\leq 1\%$ RSD

C Column Oven

1. Operating temperature range : approximate $10\text{ }^{\circ}\text{C}$ above ambient to at least $450\text{ }^{\circ}\text{C}$
2. Temperature set point resolution : $0.1\text{ }^{\circ}\text{C}$ or below
3. Programming ramp/plateaus : at least 20 ramps/plateaus
4. Maximum temperature ramp rate : at least **$250\text{ }^{\circ}\text{C/min}$**
5. Max run time : at least 2 hours
6. Oven cool down : 450 to $50\text{ }^{\circ}\text{C}$ in no more than 3 min
7. Oven power safety : System to turn off oven heater automatically when door is opened
8. Must be able to accommodate at least one $60\text{ m} \times 0.32\text{ mm}$ i.d. capillary column.
9. Easy and fast column changing within 1-2 minutes, preferably without the need of column trimming.

D Electronic Pneumatics Control (EPC)

1. Compensation for barometric pressure and ambient temperature changes.
2. Automatic carrier gas shutoff if the inlet pressure drops significantly or if leak is detected.
3. 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
4. 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, to provide more precise retention time locking.
5. Units for pressure : bar, psi and kPa
6. Pressure/flow ramp : Allow ≥ 3 ramp settings in the method
7. Pressure sensor accuracy : $\leq \pm 2\%$
8. Pressure sensor repeatability : $\leq \pm 0.05$ psi
9. Drift : $\leq \pm 0.1$ psi/ 6 months
10. Flow sensor accuracy : $\leq \pm 5\%$
11. Flow sensor repeatability : $\leq \pm 0.35\%$
12. Carrier & makeup gas settings : Selectable for He, H₂, N₂ & argon/methane

E Split/Splitless Inlet (S/SL)

1. Suitable for all capillary columns : Must be compatible with column up to 320 µm id
2. Split ratios : To at least 500:1
3. Support up to 4 modes : Split, Splitless, Pulsed-Split and Pulsed-Splitless.
4. Maximum temperature : At least 400 °C in ≤1°C increments
5. Pressure ranges : 0 to at least 100 psi
6. Total flow setting range : 0 to at least 400 mL/min Helium or Hydrogen
7. Gas saver mode to reduce gas consumption without compromising performance.
8. Programmable septum purge flow control to eliminate "ghost" peaks.
9. Built in turn top inlet sealing system or equivalent for quick and easy liner changes in under 30 seconds without the use of special wrench or tools. This also minimizes the system's exposure to air and instrument downtime.
10. Split and septum purge flow can be changed without changing the column flow.

F Mass Spectrometer

1. Mass Spectrometer must utilize a quadrupole mass filter consisting of a monolithic hyperbolic quadrupole or equivalent configuration such that the rods will not become misaligned over time.
2. The quadrupole's coating should be made of inert material such as gold that will not oxidize, thus keeping maintenance and cleaning to a minimum.
3. The metallic parts of the Ion Source should be constructed entirely from inert material. Stainless steel is not acceptable as it is not suitable for analysis of trace reactive materials. Coating the metallic parts with an inert material is also not acceptable as the coating will wear away over use.
4. The system should have an Electron Multiplier detector
5. Must have high performance synchronous SIM/Scan with automated SIM set up that can convert a full scan method to a SIM or SIM/Scan method. The software must automatically configure the number of SIM groups, SIM cycles across the peak, and the ions added to each group.
6. The system must be able to automatically set up a SIM/scan method from an injected standard.
7. The system must provide one click autotune for PFTBA, with the ability to print out auto-tune results automatically.
8. Source : EI Source
9. Ionization energy : 5-240 eV or better
10. Ionization current : 0-315 µA or better
11. Transfer line temperature : 100-350 °C or better
12. Ion Source temperature : 150-350 °C or better
13. Quadrupole temperature : 110-200 °C or better
14. Filament : Dual filament for EI or fast filament replacing function to reduce instrument downtime
15. Mass range : To at least 1,000 a.m.u. with unit mass resolution over the entire mass range

Equipment 2: Gas Chromatograph Mass Spectrometer

Location: Illicit Drugs Laboratory

Quantity: 1 unit

-
- | | | |
|-----|----------------------|--|
| 16. | Mass resolution | : Unit mass adjustable by tuning |
| 17. | Mass axis stability | : Not more than 0.10 amu/48 hrs |
| 18. | Detector | : Electron Multiplier |
| 19. | Dynamic range | : at least 10^6 |
| 20. | Electronic scan rate | : at least 12,500 amu/sec and scanning at the increments of 0.1 amu or less for better mass resolution |
| 21. | EI scan sensitivity | : at least 600 : 1 S/N for 1 μ L injection of 1 pg of OFN (octafluoronaphthalene), scanning from 50-300 amu when monitor at m/z 272. |
| 22. | EI SIM sensitivity | : Less than 24fg of OFN (octafluoronaphthalene) as derived at 99% confidence level from area precision of eight splitless injection of 100 fg OFN, monitoring at m/z 272 or equivalent |
| 23. | SIM capability | : at least 100 groups of masses, with 60 mass per group or more |
| 24. | Pumping system | : Turbomolecular pump 250 L/s or better |
| 25. | Rough pump | : Quiet/low noise and oil-free foreline pump/rough pump |
| 26. | Maintenance access | : Source, filaments, lenses, mass filter and detector |
| 27. | Maximum total flow | : Allow at least up to 2 mL/min |

G Autosampler

1. 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-MS system.
2. Provide autoinjector tower with an autosampler tray which is capable of handling at least 150 sample vials, the control is random access using the data management software.
3. Sample tray configuration must have at least 3 removable racks.
4. Autoinjector must be auto-aligning and able to be installed or removed without the use of tools.
5. Supports neckless (shell) vials, standard 2 mL vials, and micro vial inserts.
6. Autosampler must use an active vial gripping mechanism (finger like) so that vial is grabbed by the sides rather than under the cap.
7. The sensors on the autosampler should offer the ability to detect whether or not a vial has been grasped.
8. Autoinjector must have standard turret that can hold at least three 2-mL vials at once for use with advanced sampler capabilities.
9. Sensors in the injector turret detect that the sample vial has been transferred to the injector.
10. Sensors to detect the injection port location for easy movement between front and rear inlet ports.
11. Capable of user-definable sandwich injection mode, with up to at least 3 layers of additional liquid in one injection or an air gap for each layer.
12. Fast and on-column default injection types.
13. Programmable dispense rate, draw rate, and injection rate.
14. Fast injections are performed in less than 100ms.

15. 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.
16. User-changeable syringe carriage. Able to accommodate 1, 2, 5, 10, 25, 50, and 100µL
17. Minimum sample injection: ≤10 nL (with 1 µL syringe); ≤0.1µL (with 5 µL syringe)
18. Maximum sample injection volume: ≥50 µL (with 100 µL syringe in standard tower)
19. Injection range: 1% to 50% of syringe volume in increments of 1%.
20. Available solvent-saving mode extends solvent capacity by up to eightfold.
21. Solvent saver mode capable of using 10 to 80% of syringe volume.
22. Adjustable plunger speed.
23. Multiple injection modes: at least 50 injections of specified volume.
24. Capability to run priority samples.
25. 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.
26. The depth of the sampling can be adjusted from the default position to be able to access to very small sample volume.
27. Autosampler's rinse configuration should ensure minimal carryover during analysis:
 - i. 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.
 - ii. Tip of syringe needle should not extend beyond the neck of the waste bottle to avoid contamination.
 - iii. Allow two different types of rinse solvents to be used.
28. Autosampler tray shall allow future integration of barcode reader to allow reading of vial barcode labels. Tenderer shall quote for the **Option** to upgrade the tray with barcode reader and to specify whether the price quoted is for standalone unit, an integrated unit or others in **Annex D of Price Schedule**. Tenderer shall also specify whether the barcode reader quoted is capable to read 1D or 2D barcode. Barcode label printing device is **NOT** required.
29. Please provide a reference/ track records which the barcode reader was successfully integrated: _____

H Accessories

The price quoted for the equipment should minimally include the following:

- One MS maintenance kit. It should include ion source assembly, filament assembly, ion source cleaning kit, alumina absorbent pellet for rough pump traps and others.
- One auto-sampler supply kit. It should include 2 ml sample vials and crimp caps, 4 ml solvent and waste bottles, and 5 µl autosampler syringe (6 units).
- One split/splitless injection port kit. It should include septa (50), O-rings, gold-plated seals, and straight deactivated glass split liner with deactivated quartz wool (6).
- One ion gauge controller to monitor the pressure in the high vacuum chamber.
- All gas traps required for the GC-MS system.

I Specifications for Data Station Software and Operating Software

1. The system software shall be based on Microsoft Windows 10 Professional SP1 operating environment or newer.
2. The software shall be able to control the Gas Chromatograph through local area network (LAN) technology.
3. Must be built-in or integration to ECM control for simultaneous detector data acquisition.
4. Flexible GUI (graphical user interface) to display the instrument status, show real-time plot and change all instrument set points.
5. Lab monitor and Diagnostic software to allow continuous monitoring of GC in real time to alert user maintenance needs and instrument problems
6. Capable of at least four simultaneous signal detector data acquisition.
7. The software must be fully controlled the instrument using pre-stored methods of all the operating parameters.
8. Must have the capability to lock/adjust retention time using user-specified columns and settings to achieve the same retention times for the compounds on every run of the same methods.
9. The system should have capability for simple method transfer between different GC models.
10. **Must be able to use current Agilent in-house mass spectral library in .L format either directly or through conversion**
 - Should conversion of library be required, it must be user friendly and can be done by user
 - The conversion must not cause any loss in mass spectra information (no missing ions and comparable ion ratios)
11. **Must provide the latest version of the Wiley and NIST mass spectra library**
12. Must be able to use and share libraries through network drive
13. Must be able to do library search for minimum 3 libraries at the same time
14. Must be able to load and read data from existing GC-MS systems in the laboratory. Acquired data from proposed system should also be accessible in existing GC-MS systems
15. Tenderer should work with the laboratory for the writing of macros, which can be tagged to the laboratory's in-house GC-MS methods to allow automatic printing of results after analysis; or equivalent function without the need of macro
16. The software shall have the capabilities which include the following features:
 - Built-in trace ion detection capability which will help the detection of low-level compounds in complex matrices.
 - Gain normalization autotune or equivalent.
 - SemiQuant or equivalent for estimating concentrations of non-calibrated compounds base on calibrated compounds.
 - Allows clock-time programming with the ability to start a GC at the user-specified time without user intervention.
17. Able to acquire data, integrate, review and report on an actively running sample.
18. All systems proposed should be compliant to Good Laboratory Practice (GLP) with system suitability, instrument and sequence logbook.
19. Multitasking capability, mass storage of chromatographs and reports, and customised report generator.

-
20. Macro programming capability or ability to do report and sequence customisation (to user required report format) without the need of macro.
 21. User-friendly, intuitive software to facilitate efficient data analysis. Time and effort spent on proposed software to perform the following should not exceed time needed for existing GC-MS system:
 - Selection of spectra and chromatogram, magnification of spectra and chromatogram, integration, spectra subtraction, library search should be completed in a minimum number of clicks compared to the existing GC-MS software.
 22. The software must allow the generation and printing of a magnified mass spectrum. When performing this function, the mass spectrum of the selected compound from the library must also be magnified simultaneously to the same scale and be included and printed in the match report. Printing of the magnified mass spectrum must be easy and with minimum number of clicks, without the need of preconfiguring the printing template for magnified mass spectrum.
 23. Able to perform manual integration of single and group peaks capability for better peak identification.
 24. Able to perform and print out peak overlay and peak stacking for multiple chromatograms.
 25. 1 set of PC with minimum specifications as follow:
 - Operating System: Microsoft Windows 10 Professional SP1 or newer
 - Processor: Intel® Core™ 7th Gen i7 Processor (3.6 GHz, 8 MB Cache, Quad core) 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
 - MS Office 2016 or newer version
 - Optical Mouse
 - Keyboard
 26. **Option item:**
 - i) 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 quote the **option item** in the format set out in **Annex D Price Schedule**.
 - ii) Tenderer shall ensure that the instrument PC/notebook that provided with the instrument 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. If required, an additional network card shall be included to ensure the connectivity to HSA's LIMS system.

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

1. The instrument software must be able to interface with HSA LIMS for the following:
 - (1) Raw Data Files archival & retrieval.
 - (2) Instrument test result report output to PDF for archival.
 - (3) Instrument test result report for result uploading.
 - (4) To accept work list upload from HSA LIMS, if applicable.

2. Tenderer shall ensure the Instrument PC/notebook provided will be able to run
 - (a) OpenLab - Cerity Enterprise Content Manager (ECM) Version 3.3.2.130
 - (b) Open Lab – Cyberprinter

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

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

L Instrument Reports Requirement:

1. The Contractor shall work with Laboratory to ensure the seamless integration and interface with HSA's LIMS system for the instrument report printing and extraction.
2. The system must be able to generate the following for test result:
 - (a) Raw Data File. Please specify the file format: _____
 - (b) Hardcopy print out.

Tenderer shall specify if there are other types of output files can be generated by the instrument. Please specify: _____

3. The following information shall be included and printed in the test result output report to facilitate the integration and interface for result extraction and they are:
 - (a) File
 - (b) Operator
 - (c) Date Acquired
 - (d) Instrument
 - (e) Sample Name
 - (f) Misc Info
 - (g) Vial Number

M Installation, Commissioning, Training and Warranty

1. All systems proposed must be GLP compliant. The tender must include installation and commissioning.
 - An **endorsed copy of 5 x 5 risk assessment form** for the installation of the instrument must be submitted to the laboratory at least 2 weeks before the delivery. A template of this form can be found on MOM website.
2. The system shall come with a minimum **three (3)** years warranty that minimally includes the following:
 - (a) Biannual 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
3. Tenderer shall also quote for the **option** to purchase **2-year post warranty comprehensive maintenance** at the same condition described above for warranty.
4. Contractor should provide accommodate observation by laboratory staff during the maintenance process.
5. Tenderer shall quote for the Option for training as follow:
 - a) Operational training on theory for approximate 55 staff; and
 - b) Hands-on training for operating the system for maximum 6 staffs.

N Technical Support

1. Technical support for hardware, software and application issues must be provided throughout the warranty period.
2. 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 equipment shall be coordinated with the Laboratory.

COMPLIANCE TO REQUIREMENT SPECIFICATIONS

I hereby confirm that I can meet all the Requirement Specifications as stated above.

YES / NO*

PART 3: REQUIREMENT SPECIFICATIONS
Equipment 2: Gas Chromatograph Mass Spectrometer
Location: Illicit Drugs Laboratory

HSA000ETT18300065

Quantity: 1 unit

*Please indicate any non-compliance here should there be any.

Reference To	Remarks