

Gas Chromatograph General Maintenance Protocol

1 Scope

The purpose of this protocol is to provide general guidelines for maintenance of gas chromatography instruments. This document applies to personnel using the associated instrument(s)/equipment in the following discipline/category of testing: Explosives (chemistry) examinations performed at the Huntsville facility. Refer to the “General Instrument Maintenance Protocol” for overall instrument maintenance guidelines and definitions.

2 Principle

Gas chromatographs available for the analysis of evidence are purchased from a variety of different manufacturers. All instruments eventually require maintenance, troubleshooting, and repair. Although the user interface and hardware fittings may differ, the overall instrument principles and maintenance are similar. Information and procedures concerning performance monitoring of a specific gas chromatograph (GC) can be found in the corresponding instrument’s performance monitoring protocol.

3 Equipment/Materials/Reagents

Any materials (such as septums, columns, liners, etc) and all replacement parts will meet the manufacturer’s specifications and recommendations. Manufacturer’s instrument manuals and specific performance monitoring protocols are generally the best source for this information.

4 Standards and Controls

All standards, solutions, and carrier gases are specified in the appropriate SOP.

5 Calibration

Any procedures used to calibrate and/or verify the integrity of the instrument will be specified in the appropriate SOP.

6 Sampling or Sample Selection

Not applicable.

7 Procedures

7.1 Preventative Maintenance

Each type and model of an instrument may have different, specialized components requiring specific preventative maintenance. Suggested step-by-step directions for specific maintenance procedures may be found in the corresponding manufacturer's instrument manuals for individual instruments. When performed, all preventative maintenance will be entered into the appropriate log. The following procedures are generic in nature and are included for reference. Daily, monthly, and as needed checks are outlined in the appropriate performance monitoring protocol.

7.1.1 Injector

The injector is the most likely place that unwanted sample residue and analytical artifacts may collect over periods of usage. Regular replacements of the septum and liner will aid in reduction and removal of these undesirable interferences. The intervals for checking and replacement are provided in the performance monitoring protocol for individual systems. Internal injector parts should not be touched with bare hands. It is recommended that lint-free gloves be worn when needed and that the operator cool heated areas on the instrument prior to any maintenance.

7.1.1.1 Septum and Liner Replacement

- a. Cool the inlet and turn off the inlet pressure.
- b. Using the manufacturer's instrument manuals as a reference, remove the septum and liner retainer nut. Remove the old septum and replace it with a new septum.
- c. Remove the old liner from the injector with tweezers.
- d. Place the liner straight down into the inlet until the liner sits flush against the inlet base seal and reinstall the septum and liner retainer nut.
- e. Restore the instrument conditions.

7.1.1.2 Replacing the Inlet Base Seal

- a. Cool the oven to room temperature.
- b. Cool the inlet and turn off the inlet pressure.
- c. Using the manufacturer's instrument manuals as a reference, remove the column from the inlet.

- d. Use a wrench to loosen the reducing nut and remove it. Remove the washer and seal inside the reducing nut.
- e. Replace the inlet base seal and washer in the reducing nut.
- f. Reinstall the reducing nut and tighten using a wrench.
- g. Reinstall the column following steps 7.2.1.1 c – h.

7.1 Corrective Maintenance

7.2.1 Column

Typically, the overall separation performance of a GC column will degrade overtime, requiring corrective maintenance. Column maintenance is performed as needed based on instrument performance. The column ends should not be touch with bare hands. It is recommended that lint-free gloves be worn when possible and that the operator cool heated areas on the instrument prior to any maintenance.

7.2.1.1 Clipping the Column

- a. Cool the inlet and oven.
- b. Remove the column from the inlet and remove the column nut from the column.
- c. Place the column nut and a new ferrule on the injector end of the column.
- d. Score the column using a column cutter. The score must be square to ensure a clean break.
- e. Break off the column end and inspect to ensure there are no burrs or jagged edges. A magnifying glass can be used to inspect the end of the column.
- f. Position the column so it extends the required length above the end of the ferrule as specified by the manufacturer. Mark the column underneath the column nut with a marker, typewriter correction fluid, or septum.
- g. Insert the column in the inlet and slide the nut and ferrule up the column to the inlet base. Finger tight the column nut, adjusting the column position so that the mark on the column is even with the bottom of the column nut.
- h. Tighten the column nut an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn so that the column cannot be pulled out from the fitting.

7.2.1.2 Replacing the Column

- a. If detector is a mass spectrometer, it needs to be vented.
- b. Cool the inlet and oven.
- c. After all heating zones are cooled, remove the column from the inlet and detector.
- d. Place a column nut and ferrule on the injector end of the column.
- e. Score the column using a column cutter. The score must be square to ensure a clean break.
- f. Break off the column end and inspect to ensure there are no burrs or jagged edges. A magnifying glass can be used to inspect the end of the column.
- g. Position the column so it extends the required length above the end of the ferrule as specified by the manufacturer. Mark the column underneath the column nut with a marker, typewriter correction fluid, or septum.
- h. Insert the column in the inlet and slide the nut and ferrule up the column to the inlet base. Finger tight the column nut, adjusting the column position so that the marker or correction fluid mark on the column is even with the bottom of the column nut.
- i. Tighten the column nut an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn so that the column cannot be pulled out from the fitting.
- j. Place a column nut and ferrule on the detector end of the column.
- k. Score the column using a column cutter. The score must be square to ensure a clean break.
- l. Break off the column end and inspect to ensure there are no burrs or jagged edges. A magnifying glass can be used to inspect the end of the column.
- m. Position the column so it extends the required length above the end of the ferrule as specified by the manufacturer. The length of the column installed in the detector varies with detector type. Refer to the "Mass Spectrometer General Maintenance Protocol" and the manufacturer's instrument manuals for additional information.
- n. After column is installed at both the inlet and detector, establish a flow of the carrier gas and operating conditions. Refer to the materials provided with the column for specific information for conditioning the column.

8 Instrumental Conditions

Refer to the appropriate procedures outlined in section 7, manufacturer's instrument manuals, or the instrument's performance monitoring protocol for specific instrumental conditions to be used during maintenance procedures.

9 Decision Criteria

Every performance monitoring protocol will have specific decision criteria to determine if the instrument is operating properly. If these should fail, the operator should refer to the 'Decision Criteria' section of the specific performance monitoring protocol. Additional information is provided in the 'Corrective Maintenance' section of the "General Instrument Maintenance Protocol".

10 Calculations

Not applicable.

11 Measurement Uncertainty

Not applicable.

12 Limitations

Only properly trained personnel will perform duties involved in the operation, maintenance, or troubleshooting of any instrument. Instrument-specific limitations will be specified in the appropriate SOP.

13 Safety

Take standard precautions for the handling of all chemicals, reagents, and standards. Refer to the *FBI Laboratory Safety Manual* for the proper handling and disposal of all chemicals. Personal protective equipment should be used when handling any chemical and when performing any type of analysis. Many instrument components are held at temperatures of 250°C and higher. Precautions should be taken to prevent the contact of skin with heated surfaces and areas.

14 References

Instrument Operations Group SOP Manual

Manufacturer's Instrument Manuals for the specific models and accessories used.

“General Instrument Maintenance Protocol” (IOG 001) *Instrument Operations Group SOP Manual*.

“Mass Spectrometer General Maintenance Protocol” (IOG 004) *Instrument Operations Group SOP Manual*.

FBI Laboratory Safety Manual.

FBI Laboratory Quality Assurance Manual.

FBI Laboratory Operations Manual.

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Approval

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TL Approval

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QA Approval

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