



AutoGC

Site Implementation Recommendations

for AutoGC sites with Agilent-Markes PAMS Systems

The equipment supplied by Agilent in their PAMS Ozone Precursor system is listed below along with necessary ancillary equipment required for the unattended, automated operation of the system.

- Agilent PAMS Ozone Precursor system:
 - Agilent 7890B GC
 - Markes UNITY-xr AirServer
 - Thermal Desorber (optional Kori-xr), trap, columns, and Dean's switch
- Parker Balston TOC1250 TOC Air Generator
- Parker Balston 75-83 Zero Air Purifier
- Compressor (135 psig 3 gal 2.3 scfm) with 100 psig regulated output
- Computer
- OLS EZChrom CDS version A.04.07 or higher
- Orsat Software Applications
- Merlin MicroScience Dilution (MMSD-VOC or MMSD-MPV) System

Orsat Applications

Merlin MicroScience Dilution System (MMSD)

Orsat has operated ozone precursor systems for several state agencies for over 20 years and has developed a dynamic dilution system, the Merlin MicroScience Dilution (MMSD) System, to be used on unattended systems to check the system performance. This system utilizes a 1 ppmv mixture to generate a ppb-level check standard that can be run automatically using the EZChrom Sequence file. Running this check standard daily provides operators and data validators with both retention time and recovery information allowing continuous quality management of the system without time consuming site visits.

Table 1 lists the recommended standard that is used both to check recoveries of benzene and propane but also to maintain peak identification by providing multiple reference peaks for the EZChrom software. Several components (including acetylene and 1,3-butadiene) are of interest based on their unique behavior.

The system is based on the dilution of span gas with zero gas from the total organic carbon (TOC) gas generator. Multiple dilutions at ratios from 1:3 to up to 1:1000 are possible by calibration of span and zero gas orifices. Thus starting concentrations of 1 ppmv can be diluted to 1 ppbv. Since concentrations this low are adversely affected by low humidity, the system is equipped with a nafion device to humidify the zero gas prior to the dilution point. This system is manufactured of all Sulfinert® stainless steel wetted parts and low volume 1/16" stainless steel tubing. It is equipped with

| Impurity | Carbon Number | Concentration (ppmv) |
|------------------------|---------------|----------------------|
| Ethane | 2 | 1.00 |
| Propane | 3 | 1.00 |
| n-Butane | 4 | 1.00 |
| Acetylene | 2 | 1.00 |
| n-Pentane | 5 | 1.00 |
| 1,3-Butadiene | 4 | 1.00 |
| 2-Methylpentane | 6 | 1.00 |
| Hexane | 6 | 1.00 |
| Benzene | 6 | 1.00 |
| Toluene | 7 | 1.00 |
| m-Xylene | 8 | 1.00 |
| n-Propylbenzene | 9 | 1.00 |
| 1,2,4-Trimethylbenzene | 9 | 1.00 |

Table 1. Calibration Verification Standard

two solenoids for automatic operation. Zero gas is flowing through the nafion device continuously and a three-way solenoid is used to divert the stream to the sample manifold when the appropriate method is used in the sequence. A second two-way solenoid allows

the span gas to be turned on or off. This allows the automatic introduction of either a blank humidified air sample or a diluted standard to the sample manifold. Included with the MMSD system is a latching relay device which allows the Orsat software to operate

the solenoids and requires a hard reset signal. Thus the release of the normally closed valve at the end of the chromatographic run which does not correlate to the end of the sample collection on the Markes UNITY Thermal Desorber is eliminated.

Orsat Software Enhancements

Several enhancements are available to completely automate the PE Ozone Precursor system and the Merlin MicroScience Dilution System.

EZSEQUENCE This visual basic routine generates a text file that can be imported into the build sequence module of EZChrom. This results in a unique sequence using pre-defined methods. The sequence and specific methods provide for calibrations and blanks to be run daily and give files a naming paradigm which allows the designation of site, column, date, and hour of day.

MVALVE This visual basic routine is used to control sample introduction from the sequence. It is configured to control the solenoid valves configured by Orsat to introduce both the diluted

check standard and blank from the dilution system as well as additional retention time standards and second-source, statically-diluted canister samples.

MMOVE This visual basic routine is executed from within the method file of EZChrom and generates a zip file which is built with each complete result file generated by EZChrom. The zip file includes the data file and TXO files for all data and at the end of the day archives the methods used to generate the data. This routine requires a very specific file structure on the computer and requires the pre-defined methods developed with the Orsat system.

Recommended Modifications

The following modifications have been made on systems operated in conjunction with the above value-added software. These modifications are included if Orsat is contracted to do installation and qualification of the site.

AIR SYSTEM A mass flow meter has been installed on the exit of the TOC generator due to the high usage of TOC air for FIDs, nafion, and MMSD. This allows operators to detect leaks or overflow conditions. An inline regulator is used on the TOC outlet to give the GC/TD constant pressure. This regulator requires a minimum pressure drop of 10 psig.

To ensure adequate dry air is available for the TD and MMSD system, an additional zero air purifier is used to supply hydrocarbon free air for the FIDs in the GC, thus reducing the demand on the TOC gas purifier.

CARRIER GAS SYSTEM To enhance the retention time stability of the system, a helium purifier is installed on the carrier gas supply.

Other Site Recommendations:

SAMPLING MANIFOLD Sulfinert® Stainless steel lines (1/8") have been used from the glass manifold normally used for the retrieval of ambient air from outside the monitoring site and should be heat traced. Flexible tape heaters and insulation have been used to accomplish this and a common variac is used to control the temperature. Lines from the dilution system to the sample line are also heated.

BACKUP SYSTEMS A UPS Backup system is used to support the computer CPU in the event of a loss of power. Since the PE Integral Link Interface which is part of the GC system cannot practically be backed up and power failures of even short duration will cause the system to halt, a power monitor is recommended to alert operators when this condition occurs.

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