Site Implementation Recommendations

for AutoGC sites with Agilent-Markes PAMS Systems

Listed below is the equipment supplied by Agilent in their PAMS Ozone Precursor system along with ancillary equipment required for the 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

About the Orsat Applications:

MERLIN MICROSCIENCE DILUTION SYSTEM (MMSD)   Orsat has installed, maintained, and operated AutoGC systems for several state agencies for over 25 years and has developed a dynamic dilution system, the Merlin MicroScience Dilution (MMSD) System, to be used on unattended systems to monitor system performance. This system utilizes a 1 ppmC mixture to generate a ppb-level check standard that can be run automatically using the EZChrom sequence file. This daily check standard daily is essential to quality control, and the MMDS system allows operators and data validators 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, as well as to maintain peak identification by providing multiple reference peaks for the EZChrom software. Components such as acetylene and 1,3-butadiene are of particular interest because on their unique behavior.

The MMDS system is based on the dilution of span gas with zero gas from the total organic carbon (TOC) gas generator. By calibration of span and zero gas orifices via pressure settings, operators can generate multiple dilutions at ratios from 1:3 to up to 1:1000. Thus, starting concentrations of 1 ppmv can be diluted to 1 ppbv. Because 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 stainless steel wetted parts and low volume 1/16″ stainless steel tubing to ensure low reactivitly. Automatic operation is achieved with two solenoids. Zero gas flows continuously through the nafion device, and a three-way solenoid diverts the stream to the sample

Impurity	Carbon Number	Concentration (ppmC)
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
1-Hexene	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
p-Diethylbenzene	10	1 .00

Table 1. Calibration Verification Standard

manifold. To introduce either a blank humidified air sample or a diluted standard to the sample manifold, a second two-way solenoid allows the span gas to be turned on or off. Finally, the MMSD system includes a latching relay device to allow the Orsat software to operate the solenoids. In addition, it requires a hard reset signal

to eliminate the release of the normally closed valve at the end of the chromatographic run, because the end of the run does not correlate to the end of the sample collection on the Markes UNITY Thermal Desorber.

Software Enhancements

Orsat's unique software enhancements play an important role in the automation of the entire AutoGC system hardware.

EZSEQUENCE   This Visual Basic routine generates a text file (TX0) that when imported into the build sequence module of EZChrom, creates a standardized sequence composed of pre-defined methods. The sequence includes daily calibrations and blanks, and specifies a unique file naming protocol for results that includes the designation of site, column, date, and hour of day.

MVALVE   This Visual Basic program allows sample introduction to be controlled by the sequence file. It is configured to control the solenoid valves in the Merlin Sample Interface 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 program is executed from within the EZChrom method file and generates a zip file containing all raw result and TX0 files for each day, and at the end of the day, archives the methods used to generate the data that day. MMove requires a very specific file structure on the computer and requires the pre-defined methods developed with the Orsat system.

Recommended System Modifications

Several modifications are recommended on systems operated in conjunction with the above software and hardware.

AIR SYSTEM   The air system is the most heavily used piece of the AutoGC system. Checks and redundancy in the air system are particularly important in this field application. A mass flow meter should be installed on the TOC generator to monitor the use of TOC air. This ensures operators are able to easily detect leaks and overflow conditions. An inline regulator should also be used on the TOC output to ensure constant pressure is supplied to the GC/TD. This regulator should require a minimum pressure drop of 10 psig.

To ensure adequate dry air is available for the TD and MMSD systems as well as reduce demand on the TOC gas purifier, an additional zero air purifier should be installed to supply hydrocarbon free air for the FIDs in the GC.

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

HYDROGEN GENERATOR (OPTIONAL)   A single cylinder of hydrogen will supply over 30 days of continuous operation. However, to avoid time consuming gas delivery arrangements as well as cylinder tracking and demurrage costs, it may be advantageous to use a hydrogen generator. A hydrogen generator must, however, be configured for auto-restart to accommodate power outages which occur commonly at remote sites. If the generator loses power for any period of time it will need to build pressure on restart. Therefore, it is necesary to keep a backup cylinder and configure the system with an automatic switch-over manifold to maintain the system during the generator's recovery period. Orsat can supply, install, and configure this system on request.

Other Site Recommendations:

BACKUP POWER   An uninterruptible power supply (UPS) system, or battery backup, is recommended to prevent data loss or corruption on the computer in the event of power loss. However, backup power cannot be practically supplied to the GC system, and even short power failures will cause the system to stop. A site-wide power monitor is thus also recommended to alert operators when power failures occur.

SAMPLING MANIFOLD   When a glass minifold is used for the retrieval of external ambient air, heat traced Sulfinert® stainless steel lines (1/8″) should be installed using flexible tape heaters and insulation with a variable AC transformer, or VARIAC™, to control the temperature. Lines from the dilution system (MMDS) to the sample line should also be heated.

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