



National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

**STANDARD OPERATING PROCEDURE
FOR THE
RESIDUAL GAS ANALYZER SYSTEMS**

**ENVIRONMENTAL TEST FACILITY BRANCH
STRUCTURAL AND ENVIRONMENTAL TEST DIVISION
TEST LABORATORY
ENGINEERING DIRECTORATE**

THIS PROCEDURE DOES NOT CONTAIN HAZARDOUS OPERATION

**CHECK THE MASTER LIST—
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE**

**STANDARD OPERATING PROCEDURE
FOR THE
RESIDUAL GAS ANALYZER SYSTEMS**

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Release Date: <u>9 / 26 / 2005</u>		Marshall Space Flight Center Specification/Document Change Instruction		Page 1 of 1 _____
		Spec. / Doc. No. <u>ET24-RGA-SOP-001</u>		Copy No.:
Change No./Date	SCN/DCN No./Date	CCBD No./Date	Replacement Page Instructions	
Baseline 9-26-2005	-----	-----	Initial issue for the ET24 Organization. Supersedes MSOP-GS-ETF-435	

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1.0 GENERAL INFORMATION

1.1 PURPOSE

This document describes the procedures for the operation of Residual Gas Analyzers (RGAs) located at the Environmental Test Facility (ETF) in MSFC Building 4619.

1.2 SCOPE

The procedures and practices outlined in this document are to be followed in the operation of all RGAs. This document provides a record copy of RGA Operation.

1.3 APPLICABLE DOCUMENTS

MPR 8715.1	Marshall Safety, Health, and Environmental (SHE) Program
ET24-ETF-OWI-001	Environmental Test Facility Test Operations
ED26 (02-01)	Memorandum for Record, Safety Assessment for the ETF (soon to be issued as an ET24 memo, number unknown)

1.4 SAFETY

All test personnel working in this facility shall be familiar with the safety documents listed above and shall report any safety hazards, unsafe practices, safety incident or near misses to the ETF Branch Chief or the 4619 Building Manager Assistant.

Although there are no hazards associated with operation of the RGA, there are hazards when operating the vacuum chambers. Only personnel trained in vacuum chamber operation and cognizant of chamber hazards shall be permitted to operate the vacuum chambers. Hazards are listed in the Hazards section of each chamber's facility operating procedure (FOP).

1.5 EMERGENCY TELEPHONE NUMBER

In case of an emergencies Call **911**;

Medical	911
Ambulance	911
Fire	911
Security	911
Chemical Spills	911

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Other numbers that can be used for emergency, security, safety, and system maintenance information are:

Medical Center	544-2390
Security	544-4357
Safety	544-0046
Utilities	544-3919
Other Assistance	544-4357 (4-HELP)

1.6 RESPONSIBILITIES

ETF personnel are responsible for the operation of these RGAs. Other task assignments and responsibilities at the ETF shall be in accordance with ET24-ETF-OWI-001.

2.0 GENERAL DESCRIPTION

2.1 RGA DESCRIPTION

The RGAs are Dycor Mass Spectrometers. These units consist of a power source, filament head, electronics unit, and control computer. The RGAs are used for two purposes: chamber leak checking and to display the mass spectra of residual gases in the chambers.

2.2 RGA LOCATIONS

The RGA control computer is located in Building 4619 Room 168 and the RGAs are located on Thermal Vacuum Chambers V1, V2, V7, V20 and Sunspot.

2.3 RGA SPECIFICATIONS

Mass Range: 1 - 300 AMU
 Operating pressure: 1×10^{-4} torr to ultra-high vacuum
 Minimum detectable partial pressure: 5×10^{-12} torr
 Emission Current: .1 to 10mA; 50 mA to degas
 Electron Energy: 30 to 150 Volts to operate; 200 Volts to degas
 Ion Energy: 1 – 10 Volts

2.4 RGA DIMENSIONS

Weight: 4.6 lbs. without quad head, 7.4 lbs. with quad head
 Width: 4.5”
 Length: 9”
 Height: 5.25”

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3.0 RGA OPERATIONS

Complete the As-run Buy-off Sheet if required by the TPS. These sheets are typically provided with the TPS. If none are provided, use a copy of Attachment A.

Sections 3.1, 3.2, or 3.3 can be run independently of other sections.

3.1 SINGLE RGA OPERATIONS

3.1.1 Power Up the RGA and Activate Dycron Software

- 3.1.1.1 Plug in RGA power at the chamber.
- 3.1.1.2 Verify chamber pressure is less than 1×10^{-4} torr.

Caution: Pressure greater than 1×10^{-4} torr will damage the RGA.

- 3.1.1.3 Double Click Dycor Icon.

3.1.2 Connect the RGA

- 3.1.2.1 Click Edit
- 3.1.2.2 Click Device Properties

NOTE: In the following instructions

- \underline{x} = 1 for the Sunspot Chamber;
- \underline{x} = 2 for chamber V2
- \underline{x} = 3 for chamber V7
- \underline{x} = 4 for chamber V1
- x = 5 for chamber V20

- 3.1.2.3 Click Quad x.
- 3.1.2.4 Click OK.
- 3.1.2.5 Verify Live Data box is checked.
- 3.1.2.6 If Live Data box is not checked, check it.
- 3.1.2.7 Check Device Enabled box.
- 3.1.2.8 Click OK.

3.1.3 Verify RGA Successfully Connected

- 3.1.3.1 Click View.
- 3.1.3.2 Click Developments & Log.
- 3.1.3.3 Verify Quad x is online. Verify Quad x is connected.
- 3.1.3.4 Close Developments & Log window.

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3.1.4 Create a Window with a Spectrum Graph

- 3.1.4.1 Click Mode.
- 3.1.4.2 Click Analog.
- 3.1.4.3 Double click graph window.
- 3.1.4.4 Click Scan.
- 3.1.4.5 Select Device Quad x.
- 3.1.4.6 Set Scan Mass Range Low to 1 or per test requester.
- 3.1.4.7 Set Scan Mass Range High to 300 or per test requester.
- 3.1.4.8 Set Samples per AMU to 6 or per test requester.
- 3.1.4.9 Set dwell time: to 15 milliseconds or per test requester.
- 3.1.4.10 Click Display.
- 3.1.4.11 Verify Enable Total Pressure box is checked.
- 3.1.4.12 If Enable Total Pressure box is not checked, check it.
- 3.1.4.13 Set Display Mass Range Low to 1 or per test requester.
- 3.1.4.14 Set Display Mass Range High to 300 or per test requester.
- 3.1.4.15 Check Autoscale box.
- 3.1.4.16 Click OK.

3.1.5 Turn ON the RGA Filament

- 3.1.5.1 Click Control.
- 3.1.5.2 Click Filament.
- 3.1.5.3 Click Quad x.
- 3.1.5.4 Verify the light bulb icon turns yellow.
- 3.1.5.5 Click OK.

3.1.6 Set the Scan Rate

- 3.1.6.1 Click Control.
- 3.1.6.2 Click Schedule.
- 3.1.6.3 Check Continuous.
- 3.1.6.4 Set Scan Interval to 0 or per test request.
- 3.1.6.5 Click OK.

3.1.7 Display Data

- 3.1.7.1 Click Control.
- 3.1.7.2 Click Scan.
- 3.1.7.3 Verify the graph is plotting.

3.1.8 Save Data

- 3.1.8.1 Click File.
- 3.1.8.2 Click Save Data.
- 3.1.8.3 Enter File Name.
- 3.1.8.4 Check Start Saving box.

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- 3.1.8.5 Check Start new file box.
- 3.1.8.6 Click Save.
- 3.1.8.7 Verify floppy disk icon appears in upper right side of window.
- 3.1.8.8 Record data until test is complete or data collection is no longer required.

3.1.9 Stop Saving Data

- 3.1.9.1 Click File.
- 3.1.9.2 Click Stop Saving.

3.1.10 Turn OFF the Filament

- 3.1.10.1 Click Control.
- 3.1.10.2 Click Scan.
- 3.1.10.3 Click Control.
- 3.1.10.4 Click Filament.
- 3.1.10.5 Click Quad x.
- 3.1.10.6 Verify light bulb icon goes off.
- 3.1.10.7 Click OK.

3.1.11 Exit the Program

- 3.1.11.1 Click Edit.
- 3.1.11.2 Click Device Properties.
- 3.1.11.3 Click Quad x.
- 3.1.11.4 Click OK.
- 3.1.11.5 Click General.
- 3.1.11.6 Uncheck Device enabled.
- 3.1.11.7 Click OK.
- 3.1.11.8 Close out program.
- 3.1.11.9 Unplug RGA power at chamber.

3.1.12 View Saved Data

- 3.1.12.1 Double Click Dycor Icon.
- 3.1.12.2 Click File.
- 3.1.12.3 Click Open Data.
- 3.1.12.4 Double Click on test file name.

NOTE: Data on screen is of the last data scan.

- 3.1.12.5 Click **◀◀** button to go to first screen.
- 3.1.12.6 Click **◀** button and **▶** button to navigate one scan at a time.
- 3.1.12.7 Click **▶▶** button to go to last data scan.
- 3.1.12.8 Close out program

3.2 LEAK CHECK

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3.2.1 Power ON the RGA and Activate the Dycor Software

- 3.2.1.1 Plug in RGA power at the chamber.
- 3.2.1.2 Verify chamber pressure is $\leq 1 \times 10^{-4}$ torr.

CAUTION: Pressure greater than 1×10^{-4} torr will damage the RGA.

- 3.2.1.3 Double Click Dycor Icon.

3.2.2 Connect the RGA

- 3.2.2.1 Click Edit.
- 3.2.2.2 Click Device Properties.

NOTE: In the following instructions \underline{x} = 1 for the Sunspot Chamber;
 \underline{x} = 2 for chamber V2
 \underline{x} = 3 for chamber V7
 \underline{x} = 4 for chamber V1
 x = 5 for chamber V20

- 3.2.2.3 Click Quad x.
- 3.2.2.4 Click OK.
- 3.2.2.5 Verify Live Data box is checked.
- 3.2.2.6 If Live Data box is not checked, check it.
- 3.2.2.7 Check Device Enabled box.
- 3.2.2.8 Click OK

3.2.3 Verify RGA Successfully Connected

- 3.2.3.1 Click View.
- 3.2.3.2 Click Developments & Log.
- 3.2.3.3 Verify Quad x is online. Verify Quad x is connected.
- 3.2.3.4 Close Developments & Log window.

3.2.4 Create a Leak Check Window

- 3.2.4.1 Click Mode.
- 3.2.4.2 Click Leak.
- 3.2.4.3 Double Click the Graph.
- 3.2.4.4 Click Display.
- 3.2.4.5 Check Enable leak tone box.
- 3.2.4.6 Set seconds box per test requester.
- 3.2.4.7 Check Logarithmic box.
- 3.2.4.8 Set Upper Limit box to 1×10^{-4} as default or per test requester.
- 3.2.4.9 Set Lower Limit to 3 decades as default or per test requester.
- 3.2.4.10 Click Scan.
- 3.2.4.11 Check Device: box.

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- 3.2.4.12 In Device: box select Quad x using the ▼ arrow and the mouse.
- 3.2.4.13 In the Mass: box select the gas per test requester using the ▼ arrow and the mouse.
- 3.2.4.14 Set Dwell time per test requester using the ▼ arrow and the mouse.
- 3.2.4.15 Click OK.

3.2.5 Turn ON the RGA filament

- 3.2.5.1 Click Control.
- 3.2.5.2 Click Filament.
- 3.2.5.3 Click Quad x.
- 3.2.5.4 Verify light bulb icon turns yellow.
- 3.2.5.5 Click OK

3.2.6 Set the Scan Rate

- 3.2.6.1 Click Control.
- 3.2.6.2 Click Schedule.
- 3.2.6.3 Check Continuous.
- 3.2.6.4 Set Scan Interval per test request.
- 3.2.6.5 Click OK

3.2.7 Display Data

- 3.2.7.1 Click Control.
- 3.2.7.2 Click Scan.
- 3.2.7.3 Verify graph is plotting.
- 3.2.7.4 Perform leak check

3.2.8 Turn OFF Filament

- 3.2.8.1 Click Control.
- 3.2.8.2 Click Scan.
- 3.2.8.3 Click Control.
- 3.2.8.4 Click Filament.
- 3.2.8.5 Click Quad x.
- 3.2.8.6 Verify light bulb icon goes off.
- 3.2.8.7 Click OK

3.2.9 Exit the Program.

- 3.2.9.1 Click Edit.
- 3.2.9.2 Click Device Properties.
- 3.2.9.3 Click Quad x.
- 3.2.9.4 Click OK.
- 3.2.9.5 Click General.
- 3.2.9.6 Uncheck Device enabled.
- 3.2.9.7 Click OK

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- 3.2.9.8 Close out the program.
- 3.2.9.9 Unplug RGA power at chamber.

3.3 MULTIPLE RGAs OPERATIONS

The following are instructions for operating RGAs at two or more chamber.

3.3.1 Power ON the RGA and Activate the Dycor Software

- 3.3.1.1 Plug in RGA power at the chamber.
- 3.3.1.2 Verify chamber pressure is less than 1×10^{-4} torr.

CAUTION: Pressure greater than 1×10^{-4} torr will damage the RGA.

- 3.3.1.3 Repeat steps 3.3.1.1 through 3.3.1.2 for each unit.
- 3.3.1.4 Double Click Dycor Icon.

3.3.2 Connect the RGA.

- 3.3.2.1 Click Edit.
- 3.3.2.2 Click Device Properties.

NOTE: In the following instructions \underline{x} = 1 for the Sunspot Chamber;
 \underline{x} = 2 for chamber V2
 \underline{x} = 3 for chamber V7
 \underline{x} = 4 for chamber V1
 x = 5 for chamber V20

- 3.3.2.3 Click Quad x.
- 3.3.2.4 Click OK.
- 3.3.2.5 Verify Live data box is checked.
- 3.3.2.6 If Live data box is not checked, check it.
- 3.3.2.7 Check Device enabled box.
- 3.3.2.8 Click OK
- 3.3.2.9 Repeat steps 3.3.2.1 though 3.3.2.8 for each unit.

3.3.3 Verifying RGA Successfully Connected

- 3.3.3.1 Click View.
- 3.3.3.2 Click Developments & Log.
- 3.3.3.3 Verify each Quad \underline{x} is online. Verify each Quad \underline{x} is connected.
- 3.3.3.4 Close Developments & Log window.

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3.3.4 Create Windows to show Spectra Graphs

- 3.3.4.1 Click Mode.
- 3.3.4.2 Click Custom2.
- 3.3.4.3 Click Edit.
- 3.3.4.4 Click Add Dⁱsplay.
- 3.3.4.5 Click Analog.
- 3.3.4.6 Click Scan.
- 3.3.4.7 Select Device Quad x.
- 3.3.4.8 Set Scan Mass Range Low to 1 or per test requester.
- 3.3.4.9 Set Scan Mass Range High to 300 or per test requester.
- 3.3.4.10 Set Samples per AMU to 6 or per test requester.
- 3.3.4.11 Set Dwell Time to 15 milliseconds or per test requester.
- 3.3.4.12 Click Display.
- 3.3.4.13 Verify Enable Total Pressure box is checked.
- 3.3.4.14 If Enable Total Pressure box is not checked, check it.
- 3.3.4.15 Set Display Mass Range Low to 1 or per test requester.
- 3.3.4.16 Set Display Mass Range High to 300 or per test requester.
- 3.3.4.17 Click Autoscale box.
- 3.3.4.18 Check OK.
- 3.3.4.19 Size window.
- 3.3.4.20 Perform steps 3.3.4.3 through 3.3.4.19 for each active chamber.

3.3.5 Turn ON the RGA Filaments.

- 3.3.5.1 Click Control.
- 3.3.5.2 Click Filament.
- 3.3.5.3 Click each Quad x.
- 3.3.5.4 Verify each light bulb icon turns yellow.
- 3.3.5.5 Click OK.

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3.3.6 Set the Scan Rate

- 3.3.6.1 Click Control.
- 3.3.6.2 Click Schedule.
- 3.3.6.3 Check Continuous.
- 3.3.6.4 Set Scan Interval per test request.
- 3.3.6.5 Click OK.

3.3.7 Display Data

- 3.3.7.1 Click Control.
- 3.3.7.2 Click Scan.
- 3.3.7.3 Verify each graph is plotting,

3.3.8 Save Data.

NOTE: Each graph shall be saved separately

- 3.3.8.1 Click on graph x to highlight Quad x window.
- 3.3.8.2 Click File.
- 3.3.8.3 Click Save Data.
- 3.3.8.4 Enter File Name.
- 3.3.8.5 Check Start Saving.
- 3.3.8.6 Check Start new file.
- 3.3.8.7 Click Save.
- 3.3.8.8 Verify floppy disk icon appears in upper right side of window.
- 3.3.8.9 Repeat steps 3.3.8.1 through 3.3.8.8 for each RGA.
- 3.3.8.10 Record data until test is complete or data collection is no longer required.

3.3.9 Stop Saving Data.

- 3.3.9.1 Highlight Quad x window.
- 3.3.9.2 Click File.
- 3.3.9.3 Click Stop Saving.
- 3.3.9.4 Repeat steps 3.3.9.1 through 3.3.9.3 for each RGA.

3.3.10 Turn OFF the Filament.

- 3.3.10.1 Click Control.
- 3.3.10.2 Click Scan.
- 3.3.10.3 Click Control.
- 3.3.10.4 Click Filament.
- 3.3.10.5 Click Quad x.
- 3.3.10.6 Verify light bulb icon goes off.
- 3.3.10.7 Repeat steps 3.3.10.5 and 3.3.10.6 for each RGA.
- 3.3.10.8 Click OK.

3.3.11 Exiting the Program

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- 3.3.11.1 Click Edit.
- 3.3.11.2 Click Device Properties.
- 3.3.11.3 Click Quad x.
- 3.3.11.4 Click OK.
- 3.3.11.5 Click General.
- 3.3.11.6 Uncheck Device enabled.
- 3.3.11.7 Click OK.
- 3.3.11.8 Repeat steps 3.3.11.1 through 3.3.11.7 for each RGA.
- 3.3.11.9 Close out program.
- 3.3.11.10 Unplug RGA power at chamber.

3.3.12 View Saved Data.

- 3.3.12.1 Double Click Dycor Icon.
- 3.3.12.2 Click File.
- 3.3.12.3 Click Open Data.
- 3.3.12.4 Double Click on test file name.

NOTE: Data on screen is of the last data scan.

- 3.3.12.5 Click ◀◀ button to go to first screen.
- 3.3.12.6 Click ◀ button and ▶ button to navigate one scan at a time.
- 3.3.12.7 Click ▶▶ button to go to last data scan.
- 3.3.12.8 Close out the program.

4.0 EMERGENCY SHUTDOWN

- _____ 4.1 Close Out the program.
- _____ 4.2 Unplug the RGA (s).

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RGA As-run Buy-off Sheet

Calling TPS or Work Instructions _____ Start Time & Date _____

Test Description _____ End Time & Date _____

3.1 Single RGA Operations

3.2 Leak Check

3.3 Multi RGA Operations

3.1.1 _____

3.2.1 _____

3.3.1 _____

3.1.2 _____

3.2.2 _____

3.3.2 _____

3.1.3 _____

3.2.3 _____

3.3.3 _____

3.1.4 _____

3.2.4 _____

3.3.4 _____

3.1.5 _____

3.2.5 _____

3.3.5 _____

3.1.6 _____

3.2.6 _____

3.3.6 _____

3.1.7 _____

3.2.7 _____

3.3.7 _____

3.1.8 _____

3.2.8 _____

3.3.8 _____

3.1.9 _____

3.2.9 _____

3.3.9 _____

3.1.10 _____

3.3.10 _____

3.1.11 _____

3.3.11 _____

3.1.12 _____

3.3.12 _____