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| Leak Testing with an RGA |
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##

# Purpose and Scope

The following procedures defines the steps to conduct a leak test with a RGA. This procedure will outline the equipment needed to conduct a leak test with a RGA along with the steps that must be followed to complete one. In addition, this procedure will outline what to do if a leak is found along with the ways to calculate the size of the leak.

**It is expected that users following this procedure must be knowledgeable and experienced in leak testing before beginning this procedure.**

# References

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| Document Name | Hyperlink | Description |
| Leak Check Calculation | [Link](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-248733/RGALeakSizing.xlsx) | This document describes the way to calculate the size of a leak if one if found |

# Terms and Definitions

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| Abbreviation | Meaning  | Notes |
| RGA | Residual Gas Analyze |  |
| UHV | Ultra High Vacuum |  |
| He | Helium |  |

# Required Equipment

The following is a complete list of all the necessary equipment required to perform a leak check with a RGA:

* Clean UHV pump station with a Residual Gas Analyzer (RGA)
* Computer with RGA software
* Serial cable to connect RGA to computer
* Calibrated helium gas leak rate unit (≤4.0E-10 atm/cc He)
* Helium leak test wand
* Helium source (< 20 psi)
* Appropriately sized cleanroom bag for final leak test

# Process Details

## Before starting this procedure the following conditions must be met:

* The system must be under vacuum with the turbo pump station pumping on the component that are about to be leak checked (isolation valves open).
* The RGA must be under vacuum and be part of the evacuated system to be leak tested (RGA isolation valve open).
* The total system pressure at the pump must be at or below 3.0E-6 mbar.

## Setup the RGA for leak testing:

* Ensure that the serial port communications cable is plugged into the correct receptacle on the back of the RGA
* Open the valve to the calibrated helium gas leak rate on the pump station
* Turn on the RGA
* Start up the RGA software on the computer and connect to the RGA.
* Turn on the filament and run the analog scan.
* Turn on the total pressure reading in the software.
* When the RGA total pressure is at or below 3e-6 Torr turn on the electron multiplier.
* Select “Leak Test Mode” and set the scan speed to “3” in the appropriate area.

## Initialization of Leak Test

* Start the RGA scan and allow the scan to run for at least ten minutes before proceeding to the next step. (This will allow the RGA to warm up and stabilize)
* Verify that the trace on the leak test scan has stabilized and is flat.
	+ **If the trace is not flat, stop and inform he supervisor.**
* Close the valve to the calibrated helium gas leak rate on the pump station.
	+ Watch the scan for a noticeable drop when the valve is closed.
	+ **If a noticeable drop in the trace cannot be seen, stop and inform he supervisor.**
* Allow the scan to run for a minimum of five minutes or until the trace is flat again.
	+ **If the trace is not flat, stop and inform he supervisor.**

## Perform Rough Leak Test:

* Generously spray the component(s) to be tested with helium, using the helium leak test wand.
	+ Be sure to spray all connections and welds associated with the component.
	+ Monitor the helium trace on the chart for any increases in helium partial pressure.
* If a helium increase on the trace is not noticed, continue to step 5.5 in this procedure.
* If a helium increase is noticed on the trace, continue to step 5.6 in this procedure.

## Final Leak Test:

* Open the valve to the calibrated helium gas leak rate on the pump station.
* Start a scan and allow the scan to run for five minutes.
	+ Verify that the trace on the leak test scan has stabilized and is flat.
* Close the valve to the calibrated helium gas leak rate on the pump station.
	+ Watch the trace for a noticeable drop when the valve is closed.
* Allow the scan to run for another three to four minutes.
	+ The trace must again be flat to continue.
* Bag the component or area to be leak tested and generously fill the bag with helium.
* Seal the bag with vinyl tape to retain the helium.
	+ Monitor for a helium rise in the trace.
* The component is leak tight if no change in helium partial pressure was seen with-in five minutes after the helium was sprayed into the bag.
* If the component is not leak tight because a helium rise was seen, proceed to section 5.6 and locate and size the leak.
* Save the scan and document the following information in the appropriate location:
	+ The leak rate size (if one is found)
	+ When the valve to the calibrated helium gas leak rate was closed
	+ When the bag was filled with helium
	+ Component description
	+ Date and who performed the leak test
	+ An example can be found in the Appendix
* Unless otherwise directed by supervisor, turn off the electron multiplier, filament, and close the RGA software.

## Leak Isolation:

* Allow the helium trace on the chart to return to its previous baseline.
* Start by spraying a “small flow” of helium at the area where the helium rise was first noticed on the graph.
	+ Slowly move backwards, and retrace the original helium spray path until a partial pressure increase is seen again on the graph.
	+ Continue isolating the leak by allowing the trace to return to its previous baseline and spraying different areas until the leak is identified to be at a certain location.
* Once the leak has been located, identify it and size the leak if desired.
	+ Sizing a leak is explained in step 5.7.
* Save the scan and document the following information in the appropriate location:
	+ The leak rate size (if one is found)
	+ When the valve to the calibrated helium gas leak rate was closed
	+ When the component was sprayed
	+ Component description
	+ Date and who performed the leak test
	+ An example can be found in the Appendix
* Unless otherwise directed by supervisor, turn off the electron multiplier, filament, and close the RGA software.

## Sizing a Leak

* Open the helium standard leak rate and allow the RGA helium trace to stabilize.
	+ Take note of the helium partial pressure with the leak rate open.
	+ Take note of the helium leak rate size.
* Close the helium standard leak and take note of the helium partial pressure with the leak rate closed.
* Bag the area that has the leak and seal the bag with vinyl tape as much as possible.
* While watching the trace on the RGA, fill the bag generously with helium trying to get 100 percent helium around the leak until the helium trace has risen and stabilized.
* Take note of the helium partial pressure with 100 percent helium around the leak.
* Calculate the size of the leak by entering the correct numbers into the yellow boxes in the “Leak Check Calculation” found in section 2.0.
* If the leak rise is small enough to directly compare to the leak rate drop on the graph use a simple proportion to calculate leak size. This method is preferred for small leaks because of its accuracy.

# Appendix

## Example of Leak Test Chart



Cavity pair 131-132 clean room leak test

C50-CP-011

Performed by: Steve Castagnola, Tina Menefee

Date: 1/18/07

Notes: Installed tent over the pair and taped all openings to retain helium. Calibrated leak size- 3.18 e-10 Tl/s. Closed calibrated leak at 07:30 minutes on the chart. Started filling tent at 39:00 minutes. Stopped spraying helium at 49:00 minutes.

# **Revision History**

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| Rev # | Revision or update: | Effective: |
| Release  | Initial Release  |  |

# **Approvals**

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