**Leak Localization Procedures**

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**State of the 44 inch gate valves**

GV3 hard closed

GV10 hard closed

**Calibration procedure for RGA**

Using the calibrated nitrogen leak, determine the ion current at amu 14 and 28 with the 10inch gate valve closed using only the local ion pump and discharge gauge as pumps. The procedures are to be done on both RGA.

*Equilibrium measurement:* After purging the leak with the RGA filament off, turn the filament on again and after a minute of establishing a baseline, close the leak and record the change in ion current for one minute. Open the leak for one minute and then close it again recording for a minute.

*Dynamic measurement 1:* Adjust the sampling rate of the RGA to 0.1 seconds per sample and turn off the inter sample calibration . Purge the leak with the RGA filament off. Leave the leak open and turn the filament on. Establish a 15 second baseline then turn off the ion pump and watch the rise of the ion currents to a maximum ion current at amu 28 of 10-9 amperes. Turn the ion pump on and watch the reduction in the ion current until it levels off again. Establish the level baseline for 15 seconds.

*Dynamic measurement 2:* Adjust the sampling rate of the RGA to 0.1 seconds per sample and turn off the inter sample calibration. Purge the leak with the RGA filament off. Leave the leak open and turn the filament on. Establish a 15 second baseline then close the all metal valve adjacent to the RGA to isolate it from the ion pump and discharge gauge. Watch the rise of the ion currents to a maximum ion current at amu 28 of 10-9 amperes. Open the all metal valve and watch the reduction in the ion current until it levels off again. Establish the level baseline for 15 seconds.

*Leak size and normalization measurement:* The idea is to determine the leak size using the rate of rise in pressure into the unpumped beamtube. The measurement involves monitoring amu2, 14, 28, 32 and 40. The amu values correspond to molecular hydrogen, atomic nitrogen, molecular nitrogen, molecular oxygen and atomic argon. It is useful to monitor the new discharge gauges mounted on the beamtube simultaneously with the RGA. The RGA sampling rate can be reduced to a sample every 10 minutes with an integration time per sample of 2 seconds. The measurement begins with a day of establishing an equilibrium baseline in the beamtube with all four ion pumps operating. Then all four of the pumps are turned off simultaneously and the rise in pressure is observed until the discharge gauges reach 3 x 10-6 torr or the ion current at amu 28 reaches 3 x 10-10 amperes. When this occurs the 4 ion pumps are once again turned on and the record is kept until the pressure returns to initial baseline.

*Leak localization measurement 1:* The idea is to localize the leak by using the beam tube as a gas flow impedence proportional to the length between the leak and the pump. The measurement begins after a day of equilibration where all four ion pumps have been on. Both RGA are set up to take a sample every 10 minutes with an integration time per sample of 2 seconds . The amu values are the same as for the leak size and normalization measurement. The record keeping begins with the time for equilibration. After the day of equilibration the two ion pumps at the LVEA end are turned off and data is taken until a new baseline has been established. The recording continues for a day after the new equilibrium value has been reached and then the pumps in the LVEA are once again turned on. The record keeping again goes until one day after the original equilibrium value has been attained.

*Leak localization measurement 2:* The measurement begins after a day of equilibration where all four ion pumps have been on. Both RGA are set up to take a sample every 10 minutes with an integration time per sample of 2 seconds . The amu values are the same as for the leak size and normalization measurement. The record keeping begins with the time for equilibration. After the day of equilibration the two ion pumps at the y end are turned off and data is taken until a new baseline has been established. The recording continues for a day after the new equilibrium value has been reached and then the pumps at the y end are once again turned on. The record keeping again goes until one day after the original equilibrium value has been attained.