

Checkout 2 and Puncture Seals

V11

Changes from version 9

Configuration: TEGA Checkout I has been run and the instrument health should have been verified as nominal

Gas(es) used: Flows Carrier gas

This procedure is a more extensive checkout of the instrument and it will also puncture the seals. After this procedure is run, TEGA should be fully checked out and ready for science operations. Does not use any pressure regulation but depends on time cycling of Carrier regulation valve.

Filaments used: Filament 0

SW Version (386): V513

EGA (196): V321

Mode Table: V112

Super modes and Sweep modes used: SM 3, SM 4, Sweep 38,

EEProm Sequences Used: 30A (31A), 24A(25A), 3B(4B), 9B(10B), 90A, 7A

Objectives: (believe this is about the proper time order)

0. Turn on EGA and prepare for Science measurement

1. Document gas in trapped volumes of TEGA plumbing –TA, GEC.

Document what gas remains at the inlet to each EGA Aker valve. Document how long it takes to fill the TA sample inlet manifold. (We will have some gas trapped between the bypass valve and the TA seal, so we will fill this chamber via both seals. The volume of the trapped gas is about 1 ml, whereas the volume of the TA sample manifold is about 1.5 ml. These data suggest we can decode the rate at which the volume fills via the exit frit vs. via the EGA filter frit) Document the two time constants for filling the GEC volume (inlet conduction and GEC internal conduction). Document the ratio of conduction of the two different EGA CMLs. Gets at least a rough idea to see if we can detect H₂O and at least the start of H₂O equilibration

Assumed starting conditions:

Instrument is on and EGA warmed up. All valves (Asco and Aker) are closed.

2. Calibrate/Characterize TA manifold pressure transducer response to pressure and manifold operating temperature.

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Puncture gas supply seals(Carrier, Calibration)

Document the time constant and response of the TA manifold and exit pressure transducers at two manifold temperatures. Takes advantage of pressure to measure decay time constant of exit path. c) Puncture gas supply seals(Carrier, Calibration)

Assumed starting conditions:

EGA TA sample seal has not been punctured Required EEPROM Sequence for Carrier gas valve actuation has been burned(valve open valve close). Assume 2mS default for valve state change is set. All valves on manifold are closed. Assume EGA TA seal has been punctured.

With TA manifold at ambient pressure and -20 C Temperature

3. Puncture-seal_atmosphere_check procedure

a) Measure Flow/diffusion rates in EGA TA inlet as EGA manifold puncture seal opened. Document first Atmospheric measurements.

b) Measure Flow/diffusion rates in EGA GEC inlet as system is vented to Atmosphere.

4. Document TA Cell inlet and outlet flow characteristics

The objectives of this test are to measure the gas conduction of each of the frits

Starting conditions:

All Asco and Aker valves are closed, but the carrier and cal gas tank seals have been punctured.

5. Flush TA manifold and TA CML before shut down

Flush the TA sample inlet so it does not contain atmospheric gases when we shut down.

Assumed starting conditions:

The carrier gas tank seal has been punctured, and we know how to regulate the gas pressure in the manifold. The Puncture-seal_atmosphere_check.doc procedure, or something like it, has already been run. We are running a hop mode geared toward atmosphere data. Ideally there should not be a lot of gas in the atmosphere CML volume as it will mask out the CO2 being flushed out of the TA sample manifold. (We could do better in this regard by running it when we have not yet opened the atmosphere inlet valve on the same day. So doing will make it easier to see how quickly we flush out the CO2. We will do this every time we have a TA sample run.)

We are running a hop that monitors CO2 and N2.

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START

1. Turn on and warm up EGA (TBR minutes):

- 1.1. Turn TEGA ON (takes 2.5 min)
- 1.2. Start TA manifold Temperature control at -20 C.
- 1.3. Start EGA manifold temperature control at ~~+35~~ C
- 1.4. Turn EGA ON
- 1.5. Run EGA_Prep
- 1.6. Run SM 3 (low data rate mode)

Deleted: -20

2. TA Pressure Transducer Checkout Procedure(puncture cal/carrier):

- 2.1. Set Internal timeout to 60 min.
- 2.2. Set GV timeout to 15. (this forces sequence shutdown if puncture does not succeed)
- 2.3. Set Manifold Pressure ENG channel to high rate (1s)
- 2.4. Set outlet pressure ENG channel to high rate (1s)
- 2.5. Puncture the TA Manifold seal. (cal/carrier gas seals).
- 2.6. wait for TA Done (5 to 15 minutes, nominal 445s in eqm1 TVAC)
 - 2.6.1. IF GV TEGA_DONE does not go true VML block will call TEGA_Shutdown
- 2.7. Open bypass
- 2.8. Run ~~14~~ cycles (max pressure in range of 150mB) at 60 seconds per cycle.
- 2.9. Open outlet (vents through cell 0 outlet frit)
- 2.10. Run EGA Cal_Scans (set2, 3200V) (cal_scans stops SM
- 2.11. Change TA manifold Temperature control to 65° C
- 2.12. Deleted ▼
- 2.13. Run EGA gain check(includes mode 38) – End MV @ 3200V
- 2.14. Start SM 4 (ATM)

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Deleted: Change EGA manifold
Temperature control to 35° C

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- 2.15. Wait 5 minutes
- 2.16. Close Outlet valve
- 2.17. Run 14 cycles of valve open close at 60 seconds per cycle.
- 2.18. Open Outlet (vents through cell 0 outlet frit)
- 2.19. Wait two minutes
- 2.20. Close Outlet
- 2.21. Close Bypass
- 2.22. FPGA B Dump

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3. Puncture-seal_atmosphere_check procedure:

- 3.1. Open TA sample valve
- 3.2. FPGA B Dump
- 3.3. Pause **2** minutes to see what was in the inlet manifold. (should have been in a vacuum or close)
- 3.4. Set GV timeout to 15. (this forces sequence shutdown if puncture does not succeed)
- 3.5. Puncture seal on EGA (reading mars atmosphere now through the TA Sample valve)
- 3.6. Wait for seal TA done. (Nominal 433 sec up to 15 min. Note that Internal timeout is 60 minutes)
 - 3.6.1. IF GV TEGA_DONE does not go true VML block will call TEGA_Shutdown
- 3.7. Pause **20** minutes to give measurement a chance to equilibrate.
- 3.8. Close TA sample valve. (Note: CML will be full of atmosphere gas.)
- 3.9. FPGA B Dump
- 3.10. Pause 120 s
- 3.11. Sample_Atmos (Open, close, FPGA B)
- 3.12. Pause 120 s (to see what is left in the GEC volume, if any following all of our venting in cruise.)
- 3.13. Open GEC valve

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- 3.14. Pause 30 s
- 3.15. Sample_Atmos
- 3.16. Pause 30 s
- 3.17. Sample_Atmos
- 3.18. Pause 60 s
- 3.19. Sample_Atmos
- 3.20. Pause 600 s
- 3.21. Sample_Atmos
- 3.22. Close GEC valve.
- 3.23. Pause 60 s
- 3.24. Sample_Atmos
- 3.25. Pause 600 s
- 3.26. Sample_Atmos

** Note: SM 4 still running at the end of Section 3

4. TA Manifold Checkout Procedure and TA CML Flush

- 4.1. Execute 7 cycles of carrier valve with 10s delay between (150 to 170 mB, delay helps gas expand before reopening valve)
- 4.2. Wait 1 minutes .
- 4.3. Open TA sample valve.
- 4.4. Wait 1 minutes .
- 4.5. Open bypass valve
- 4.6. Pause 1 minute (to watch pressure decline and get conduction of bypass frit)
- 4.7. Set Carrier valve to cycle at 10 second period.(gives at least 2 cycles per frit)
- 4.8. FPGA B Dump
- 4.9. Pause 5 minutes (to get reading on pressure gauge at EGA manifold as we approach steady state)

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- 4.10. Close TA Sample Valve
- 4.11. FPGA Dump
- 4.12. Pause 30 s (to build pressure back up)
- 4.13. Set oven 0
- 4.14. Open outlet valve
- 4.15. Pause 30 s (to look for leakage rate through oven outlet frit)
- 4.16. Close outlet valve
- 4.17. Pause 30 s (to build pressure back up)
- 4.18. Cycle the previous five steps through the seven remaining ovens
- 4.19. Close bypass valve
- 4.20. Pause 30 s (to build pressure back up)
- 4.21. Set oven 0
- 4.22. Open inlet valve
- 4.23. Pause 30 s (to look for leakage rate through oven outlet frit)
- 4.24. Close inlet valve
- 4.25. Pause 30 s (to build pressure back up)
- 4.26. Cycle the previous five steps through the seven remaining ovens
- 4.27. Stop periodic cycling
- 4.28. Open Bypass
- 4.29. Shut down Heater regulation

5. EGA Scans

- 5.1. Run sweep mode 38 (full scan @3200; 5 minutes)
- 5.2. Set MV to 2800
- 5.3. Run sweep mode 38 (full scan; 5 minutes)

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5.4. Shut Down EGA

5.5. Close Bypass

5.6. Shut Down TEGA(FPGA dump generated by shutdown sequence)

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A. Sample_Atmos Block

- a Open Atmosphere inlet valve
- b Close Atmosphere valve
- c FPGA dump

B. Sample_TA Block

- a Open TA sample valve
- b Close TA sample valve
- c FPGA B dump
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