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HALL D PROCEDURE NO.:
D00000-10-02-P001 Rev -

TITLE: FDC/CDC GAS SYSTEM OXYGEN PURGE

DATE: 04/22/2014

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REV.	DESCRIPTION	BY	CHK.	APP.	APP.	DATE
A	Added additional references / changed order of purge in gas shed /updated Table 1	SS	DB	LP	BZ	6/17/14

References:

Hall D - GlueX Utilities Gas Systems - Hall D Detector Gas System P&ID D00000-10-02-5002
Hall D - GlueX Utilities Gas Systems - Detector Gas System Assembly D00000-10-02-0000
Hall D - GlueX Utilities Gas Systems - Detector Rack Shelf Sub-Assembly D00000-10-02-1004
Hall D - GlueX Utilities Gas Systems - Detector Blend Tank Sub-Assembly D00000-10-02-1002
Hall D - GlueX Utilities Gas Systems - Detector Alcohol Cold System Assembly D00000-10-02-1000
Hall D - GlueX Utilities Gas Systems - Detector Main Gas Panel D00000-10-02-1010
Hall D - GlueX Utilities Gas Systems - Detector CDC /FDC Bypass Panel D00000-10-02-1008 / -1009

NOTE: FAILURE TO FOLLOW THIS PROCEDURE IN THE ORDER THAT IT IS WRITTEN WITHOUT INPUT FROM SUBJECT MATTER EXPERTS MAY CAUSE DAMAGE TO THE FORWARD AND OR CENTRAL DRIFT CHAMBERS.

Abbreviations:

Manual Valve – MV
Check Valve – CV
Pressure Regulator – PR
Pressure Transmitter – PT
Pressure Gauge – PG
Bubbler Never – BN
Bubbler Always – BA
Normally Open – NO
Normally Closed – NC
Programmable Logic Controller – PLC

Gas System Purge (~ 5 Days) - The purpose of this procedure is the purge the gas lines with Argon/CO2 mixtures and purge it from Oxygen contamination. **Gas Room Purge (~ 2 Days)**

1. **VERIFY** that all Gas System Manual Valves (MV) are in the **CLOSED** state.
2. **ENSURE** PR201 (PR) and PR202 (PR) read 0 psi and **OPEN** MV133 (NO) and MV134 (NO). **NOTE:** MV133 and MV 134 are for components maintenance only.
3. Inside the Gas Room **ENSURE** Manual Valves MV135 (NO), MV136 (NO), MV137 (NC), MV138 (NC), MV139 (NO) and MV140 (NO) are **CLOSED**.
4. **SET** Pressure Regulators PR201 (PR) and PR202 (PR) to 50 +/- 2psi.
5. **OPEN** the following Manual Valves (MV) in the following order: MV117 (NO), MV118 (NO), MV119 (NO), MV120 (NO), MV121 (NO) and MV122 (NO).
6. **VERIFY** Pressure Gauge PG401 (PG) and PG402 (PG) / Pressure Transmitter PT501 (PT) and PT502 (PT) read 50 +/- 2psi.
7. **OPEN** the following valves in the following order: MV127 (NO), MV128 (NO), MV129 (NO) and MV130 (NO).
8. **VERIFY** Brooks Controller 1 & 2 settings per *Table 1.* But, DO NOT start the blend process.

		Measure Units	Blend	Time Base	PV Signal Type	PV Full Scale	SP Signal Type	SP Full Scale	SP Function	Gas Factor	SP (Blend)
CDC Brooks Controller 1	**Master**	bar	Master	n/a	4-20mA	1.8 bar	4-20mA	1.8 bar	Blend	1.002	100%
	MFC1	litre	**CO2**	min	4-20mA	l/m	4-20mA	4 l/m	Blend	0.773	(50%)
	MFC3	litre	**Ar**	min	4-20mA	l/m	4-20mA	2 l/m	Blend	1.395	(50%)
FDC Brooks Controller 2	**Master**	bar	Master	n/a	4-20mA	1.0 bar	4-20mA	1.0 bar	Blend	1.002	100%
	MFC2	litre	**CO2**	min	4-20mA	l/m	4-20mA	1.4 l/m	Blend	0.773	(60%)
	MFC4	litre	**Ar**	min	4-20mA	l/m	4-20mA	1.4 l/m	Blend	1.395	(40%)

Table 1 Flow Settings for Nitrogen Calibrated MFCs

NOTE: ENSURE THERE IS NO ALCOHOL IS PRESENT IN THE SYSTEM

9. **REMOVE** plug at the alcohol fill port.
10. In the Gas Room **OPEN** the following valves in the following order MV135 (NO), MV136 (NO) and MV162 (NC), and MV163 (NC).
11. **START** the blend process on Brooks Controllers 1 - CDC & 2 - FDC ~ **PRESS** "HOME" button for minimum of **~ 3 seconds.**
12. **PURGE** Gas Shed system in this configuration for **~ 2 Days**
13. **OPEN** Vent Valves MV158 (NC) and MV159 (NC) **PURGE** lines for ~ 15 min.
14. **OPEN** Refrigerator door
15. **OPEN** Alcohol Drain Valves MV160 (NC) and MV161 (NC) **PURGE** lines for ~ 15 min.
16. **CLOSE** MV162 (NC) and MV163 (NC) and **REINSTALL** the plug in the Alcohol fill port.
17. **CLOSE** Vent Valves MV158 (NC) and MV159 (NC),
18. **CLOSE** Drain Valves MV160 (NC) and MV161 (NC) **CLOSE** Refrigerator door
19. **OPEN** Bypass Valves MV137 (NC) and MV138 (NC)
20. **OPEN** MV139 (NO) and MV 140 (NO)
21. **CONTINUE ~** In Hall D at the Detectors Gas Panel **VERIFY** that MV141 (NC) is **CLOSED**.
22. **VERIFY** the following valves are **CLOSED** MV142(NO), MV152(NO), MV143(NO), MV153(NO), MV144(NO), MV154(NO), MV145(NO), MV155(NO), MV146(NO) MV156(NO) MV147 (NC), MV148 (NC), MV149 (NC), MV150 (NC), & MV151 (NC)
23. **SET** Brooks Controllers 3 - CDC & 4 - FDC settings per *Table 2*.

		Measure Units	Time Base	PV Signal Type	PV Full Scale	SP Signal Type	SP Full Scale	SP Function	Gas Factor	SP Rate
CDC Brooks Controller 3	**MFC5**	l/m	min	4-20mA	6 l/m	4-20mA	6 l/m	Rate	1.0675	1.00 l/m
FDC Brooks Controller 4	**MFC6**	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm
	MFC7	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm
	MFC8	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm
	MFC9	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm

Table 2 Flow Settings for Nitrogen Calibrated MFCs

24. **START** the blend process on Brooks Controllers 3 - CDC & 4 - FDC **~ PRESS** "HOME" button for minimum of **~ 3 seconds.**
25. **OPEN** the following valves in order: MV147 (NC), MV148 (NC), MV149 (NC), MV150 (NC), MV151 (NC)
26. **VERIFY** that Bubbler Always (BA) BA901, BA902, BA903, BA904 and BA905 begin to bubble within **~ 5 minutes.**
27. **VERIFY** Bubblers Never (BN) BN801, BN802, BN803, BN804 and BN805 are **NOT** bubbling.
28. **RUN** the gas system in this configuration for **~ 2 Days.**
29. **IN GAS SHED - CLOSE** Bypass Valves MV137 (NC) and MV138 (NC)

Purge Pressure Taps (~ 30 Minutes) - The purpose of this procedure is the purge the input and output pressure tap-lines of the FDC and CDC and the output tab-lines to the Oxygen analyzer system. **Hall D Gas Controls PURGE (~ 1 Day)**

NOTE: The system should be in the same configuration as **Step 28** of the:
Gas System Purge procedure.

1. To flush the gas system **OPEN** Solenoid Valves (SV) groups SV601 and SV603, SV636 thru SV640, SV628 thru SV631 and SV632 thru SV635.
2. **DISCONNECT** the input gas line to Pressure Transmitter (PT) PT505 and PT507 to create a vent for the gas.
3. After approximately **~ 1/2 hour** - **RECONNECT** the gas lines to PT505 and PT507.
4. **CLOSE** SV601 and SV603, SV636 thru SV640, SV628 thru SV631 and SV632 thru SV635.
5. **VERIFY** that BA901, BA902, BA903, BA904 and BA905 start to bubble within a 5 minutes.
6. **VERIFY** BN801, BN802, BN803, BN804 and BN805 are **NOT** bubbling.
7. **OPEN** SV636 thru SV640 and **INSTALL** a quick disconnect fitting with a vent hose at: Check Valve (CV) CV313.
8. **PURGE** for **~ 30 minutes.** Bubblers BA901, BA902, BA903, BA904 and BA905 may not bubble at this time.
9. **CLOSE** SV636 thru SV640.

Detector Purge (~ 3 Days) - The purpose of this procedure is to switch from bypass to Detector operations.

NOTE: The system should be in the same configuration as **Step 9** of the:
Purge Pressure Taps procedure.

1. **OPEN** the following valves in the following order MV152 (NO), MV153 (NO), MV154 (NO), MV155 (NO), MV156 (NO).
2. **OPEN** the following valves in the following order MV142 (NO), MV143 (NO), MV144 (NO), MV145 (NO), MV146 (NO).
3. **CLOSE** the following valves in the following order MV147 (NC), MV148 (NC), MV149 (NC), MV150 (NC) and MV151 (NC).
4. **VERIFY** - BA901, BA902, BA903, BA904 and BA905 start to bubble within a **~ 5 minutes.**
5. **VERIFY** - BN801, BN802, BN803, BN804 and BN805 are **NOT** bubbling.

		Measure Units	Time Base	PV Signal Type	PV Full Scale	SP Signal Type	SP Full Scale	SP Function	Gas Factor	SP Rate
CDC Brooks Controller 3	**MFC5**	l/m	min	4-20mA	6 l/m	4-20mA	6 l/m	Rate	1.0675	1.00 l/m
FDC Brooks Controller 4	**MFC6**	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm
	MFC7	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm
	MFC8	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm
	MFC9	sccm	min	4-20mA	500 sccm	4-20mA	500 sccm	Rate	1.002	100 sccm

Table 3 Flow Settings for Nitrogen Calibrated MFCs

6. **SET** flow rates of MFC's per *Table 3* above.
7. **RUN** for **~ 3 days.**

Detector Pressure Tap Purge (~ 30 Minutes) - The purpose of this procedure is to purge the pressure-tap lines from both FDC and CDC.

NOTE: The system should be in the same configuration as **Step 7** of the: Purge Pressure Taps procedure.

1. To purge the detector pressure taps **OPEN** Solenoid Valves (SV) groups SV604 thru SV609, SV610 thru SV615, SV616 thru SV621 and SV622 thru SV621.
2. **DISCONNECT** the input gas line to Pressure Transmitter (PT) PT506 to create a vent for the gas.
3. Bubbler Always BA901, BA902, BA903, BA904 and BA905 may stop bubbling during this operation.
4. After approximately **~ 3 Minutes - CLOSE** Solenoid Valves (SV) groups SV604 thru SV609, SV610 thru SV615, and SV616 thru SV621 and SV622 thru SV621 and wait **~ 5 Minutes** for pressure to build.
5. **OPEN** Solenoid Valves (SV) groups SV604 thru SV609, SV610 thru SV615, and SV616 thru SV621 and SV622 thru SV621.
6. Repeat Steps 4 and 5 several times to ensure pressure taps are flushed then proceed to Step 7.
7. **RECONNECT** the gas line to PT506.
8. **CLOSE** SV601 and SV603, SV636 thru SV640, SV628 thru SV631 and SV632 thru SV635.
9. **VERIFY** that BA901, BA902, BA903, BA904 and BA905 start to bubble within a 5 minutes.
10. **INITIATE** Gas System PLC pressure scanning sequence.
11. At this point the **Alcohol Bubblers** MAY be filled with alcohol.

The gas system will now be in normal operation configuration.