

The SOLID HGC Gas System

George Jacobs

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Physics Detector Support Group

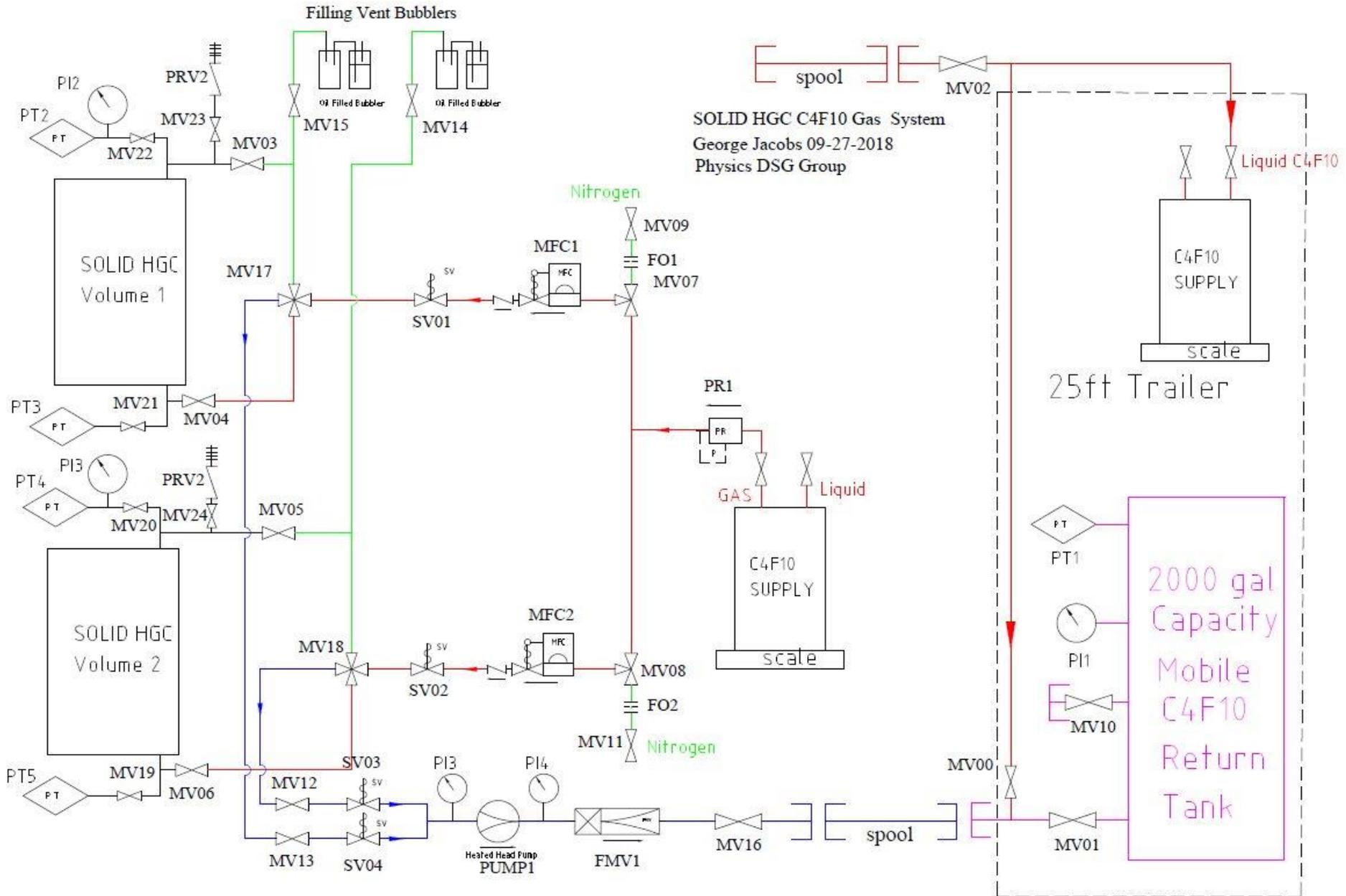
The SOLID HGC Gas Volume Details

- C4F10 is the radiator gas
- The detector operates at 1.5 atm pressure (~7 psig)
- There are two detector volumes, each ~10,000 liters
- The detector volumes will each contain 150kg of C4F10 gas

The C4F10 Gas System Details

- The gas system performs three main functions
 - 1) Gas Volume Fill
 - 2) Gas Volume Removal and Storage
 - 3) Maintain 1.5 atm pressure
- The gas system does not perform C4F10 gas recovery for reuse (distillation)
- C4F10 gas recovery for reuse utilizes the Hall B Distillation system located in Bldg 96B
- This version of the gas system uses a mobile gas return tank to collect the gas from the detector volumes prior to maintenance
- Current C4F10 price quote from F2 Chemicals is \$260 USD per Kg

C4F10 Gas System P&I Diagram



Detector Volume Fill Operation Steps

- 1) Nitrogen purge to remove oxygen and water vapor using Vent Bubblers
- 2) Nitrogen test fill and pressurization to determine detector leak rate (Critical Step)
- 3) C4F10 initial fill to displace nitrogen using Vent Bubblers
- 4) C4F10 pressurization with Vent Bubblers isolated

Maintaining Detector Pressure

- Gas flows into the detector volume to increase pressure at the low limit
- Gas flow stops when pressure increases to the high limit
- The MFC is used to record total gas flow over time to monitor the leak rate over time
- Gas flow is only required due to leakage – “Fill & Seal” detector

Gas Volume Removal and Storage – C4F10 Gas Transfer to Return Tank

- Connect the return tank to the recovery line using the flex line spool piece
- Purge the return tank and lines with N2 gas.
- Pump out the return tank and lines with a vacuum pump.
- Switch over to N2 gas
- Switch the flow reversal valve to flow into the top of the gas volume.
- Change flow control parameters to gas recovery setpoints
- Transfer C4F10 gas from the detector volume to the return tank

Controls and Monitoring

PT1 - Pressure Transducer for return tank pressure

PT2 - Pressure Transducer for pressure at the top of Volume 1

PT3 - Pressure Transducer for pressure at the bottom of Volume 1

PT4 - Pressure Transducer for pressure at the top of Volume 2

PT5 - Pressure Transducer for pressure at the bottom of Volume 2

MFC1 - Gas Flow to Volume 1

MFC2 - Gas Flow to Volume 2

C4F10 Scale - Weight of C4F10 Supply

Detector Volume Overpressure Protection

PRV1 - Adjustable Proportional Relief Valve for Volume 1

PRV2 - Adjustable Proportional Relief Valve for Volume 2

FO1 - Flow limiting orifice for N2 gas supply

FO2 - Flow limiting orifice for N2 gas supply

Summery

The SOLID HGC is a “Fill & Seal” detector operating at 1.5 atm.

The gas system MFC’s are used to determine detector volume leak rate.

A “leak tight” detector volume is critical due to the cost of the gas, \$260 USD per Kg.

There are only two sources of gas loss in this system

- 1) Detector volume leakage
- 2) Loss during Recovery and Distillation operations

Atmospheric pressure changes are too small to effect detector pressure.

The mobile return tank eliminates the need for a fixed tank and heated gas line installation.

Only minor changes are required for the Hall B Distillation system connections.