Piston Purge Procedure

M. Zuckerbrot – 10/7/14

I. General Requirements
   a. The piston purge should be done in combination with, or prior to, the pressure test of
      the cryostat to avoid diluting the air in the tank
   b. The goal is about a 0.3 m/hr vertical velocity in the tank during the purge at the center
      of the tank
   c. The total time will likely be 50 hours or more
   d. Having the 500 gallon dewar filled to be used as a supply is preferable, but 160 L dewars
      can also be connected to the Argon gas line upstream of the regulator, this way the
      mass flow controllers can be used
      i. One 160 L dewar is equivalent to one cryostat volume of room temperature
         argon gas at atmospheric pressure, at least 4 should be on hand
   e. The gas analyzers need to be commissioned and active, or at the very least the dew
      point meter, the DF310 oxygen analyzer, and the LDETEK nitrogen analyzer
   f. The warm molecular sieve should be fully regenerated before the purge

II. Valve lineup
   a. See the marked up P&ID toward the end of this document for the proper initial valve
      lineup, make sure the argon gas line and cryostat are initially isolated as shown
      i. Inlet routing is outlined in green, vent routing in red, open valves outlined with
         green circles, closed valves with red circles, routes involved with intermediate
         steps outlined in yellow, and valve involved with intermediate steps which are
         initially closed are outlined with yellow circles

III. Procedural Steps
   a. Follow the initial valve lineup from the previous step, the argon gas line should be
      isolated by MV639 and the cryostat should be in bypass mode with PV815 and PV816
      closed and FCV800 fully open
   b. Open MV639 and set FCV657 to 480 SCFH
   c. Take note of the pressure in the warm mole sieve (PT847), it should give an indication of
      what the pressure in the cryostat will be at the current flow rate
i. The pressure should be around 4 psig or less, if it looks to be higher than expected plan out additional venting using the liquid return line, cryostat to condenser line, and condensers to cryostat line

ii. Any additional venting should be done through both ends of the tank simultaneously for flow distribution and should be minimized

d. Verify the system is venting properly through both the main cryostat vent and the manual vent in the pit to verify the routing is correct

e. Take gas analyzer readings from the outlet line using MV823 and verify the source gas contamination levels are acceptable

f. Start flow to the cryostat. Open PV816, then PV815, and close FCV800 to 0%

   i. Allow some time for the cryostat to reach stable pressure shown by PT150 and verify it is near atmospheric conditions

g. The dew point can be monitored throughout the process, the oxygen and nitrogen will have to checked periodically until the values are in the range of the analyzers (5,000 ppm oxygen and 100 ppm nitrogen)

h. The purge will reach one cryostat volume change in about 13 hours at 480 SCFH and should be continued until the analyzer readings are acceptable

i. Once one volume change is complete, the other lines and ports connecting to the cryostat should be manually vented. A Dwyer flow meter with a control valve can be used to estimate the time needed to purge based on the line volume

   i. Bleed the top and bottom instrument ports using MV120 and MV121 located on the 5 valve manifold on the cryostat instrument panel, the volumes are approximately 0.3 cf each.

   ii. Bleed MV160 and MV159 on each end of the cryostat, the volumes are about 0.2 cf each.

   iii. Bleed the relief valve ports by opening MV134 and MV136 and the large vent MV140, the total volume of all of them is about 0.4 cf

   iv. Bleed the vacuum pumpout ports with the small manual valves, the volume is about 1 cf each

   v. Bleed the cryostat to condenser line by opening MV240 and MV250, the total volume is about 0.5 cf.
vi. Bleed the condensers to cryostat line by opening PV256 and MV246, the volume is about 0.25 cf

vii. Bleed the liquid return line by opening FCV191 and MV315, the volume is about 0.25 cf

j. Do a final check of the system purity once manual venting is complete with the gas analyzers and determine if the purge is ready to be stopped

k. When purging is complete stop the argon gas flow and the cryostat, close the cooldown inlet and outlet valves, the chimney purge block valve, and the cryostat vents