Design of the Nitrogen Gas Purge Panel for the Hall B RICH II Detector

George Jacobs, Mary Ann Antonioli, Peter Bonneau, Aaron Brown, Pablo Campero, Brian Eng, Mindy Leffel, Tyler Lemon, Marc McMullen, and Amrit Yegneswaran
Physics Division, Thomas Jefferson National Accelerator Facility, Newport News, VA 23606
August 31, 2021

This note describes the design of the nitrogen gas purge panel for the RICH II detector to be assembled in the Experiment Equipment Lab.

The RICH II detector requires a dry nitrogen gas purge to remove water vapor from the detector volume to keep the aerogel radiator material inside the detector dry.

A purge panel was designed to facilitate a continuous flow of pure (99.987%) nitrogen gas to minimize water absorption by the aerogel. The panel is a standalone unit, which will supply up to 66 liters per minute of nitrogen gas, supplied by a high pressure (200 psi) liquid nitrogen dewar, Fig. 1. The dewar is connected to the nitrogen gas panel by a commercially available, 0-50 psi, output pressure regulator assembly. A flow limiting orifice and relief valve were added to the pressure regulator assembly to limit gas pressure to 90 psi to prevent damage to downstream components. Gas flows to the purge panel from the dewar via a 1/2” (outer diameter) nylon tube.

Manual valve MV1 is the panel isolation valve. Relief valve RV1 protects the panel components by limiting the gas pressure to 90 psi.

The nitrogen gas supply first passes through a series of three filters—F1, F2, and F3—before it flows downstream to the detector, Fig. 2. F1 is an activated charcoal filter that removes organic vapors and volatile organic compounds to less than 0.01 ppm gas concentration. F2 is a HEPA filter that removes particles larger than 0.01 micron in size. F3 is a dual type filter, removing particles larger than 0.003 microns in size, while coalescing any oil vapors remaining in the gas.

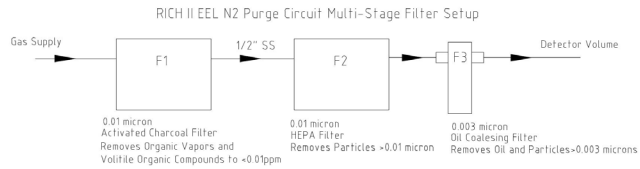

FIG. 2. Filter sequence.

The filtered gas pressure is then reduced by a high precision pressure regulator PR1 to maintain a constant gas supply pressure to FMV1, the flow meter with a manual valve. A constant inlet gas pressure is required to maintain a constant gas flow from the manual flow meter. FMV1 is used to control gas flow to the detector volume. The mass flow meter MFM1 provides a signal to EPICS for remote monitoring of the nitrogen purge gas flow. A 1/2” nylon tube carries the gas from the purge panel to the detector.

The nitrogen gas purge panel components are mounted onto an aluminum strut frame using tubing clamps. The panel has legs so that it can be placed on a table for ease of access.

To conclude, the nitrogen purge panel filters nitrogen gas using three filters. A pressure regulator and a manual flow meter supply up to 66 slm of pure dry nitrogen gas to the RICH II detector to minimize water vapor around the aerogel radiator.

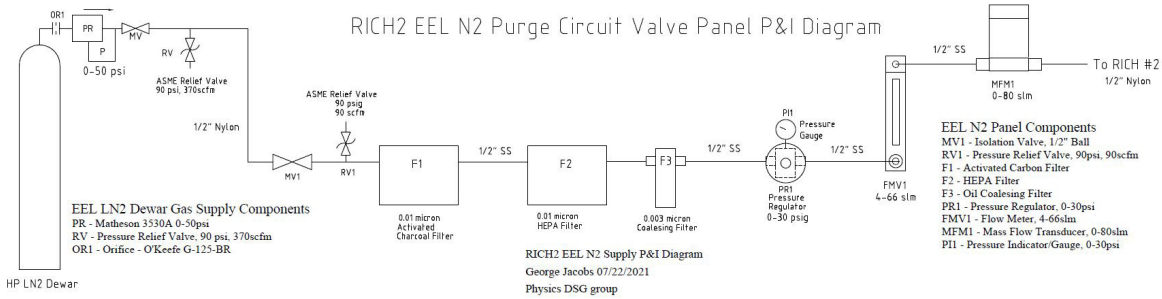

FIG. 1. Front panel piping and instrumentation.