

Pressure Controls Upgrade of the Hall B Low Threshold Cherenkov Counters

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In 2018, sectors 3 and 5 of the Low Threshold Cherenkov Counter (LTCC) were installed in Hall B. Later that year, a new pressure controls system was designed that minimizes gas loss during atmospheric changes [1] and makes the LTCC more efficient by enabling the system to add and remove C_4F_{10} to the individual sectors.

In June of 2022, LTCC sectors 2 and 6 were installed. To support the two sectors, the controls hardware was added to the existing system and changes to the LabVIEW pressure controls program were made.

Two Dwyer 616KD-B-02-N differential pressure sensors, with a range of 0" to 6" WC, were added to each sector at the bubbler, Fig. 1, and were integrated into the control systems. Both sensors measure the difference between the pressure in the sector and the atmosphere at the same location. The sensors are monitored independently—one by the LabVIEW-based controls software, Fig. 2, via an analog input channel, and the other by an Omega DP-25c process controller.

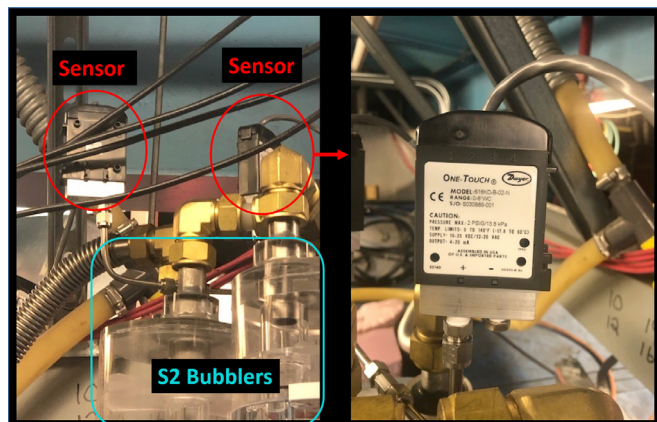


FIG. 1. LTCC sector 2 bubblers, in blue rectangle, and Dwyer differential pressure sensors, red circles, on Forward Carriage, deck two. Right side is zoomed view of the sensor.

The LabVIEW pressure controls software compares the differential pressure P_{diff} signal to the set points of the operating range of 1.75" WC to 2.5" WC, Fig. 3. If P_{diff} is between 1.75" WC and 2.5" WC, no action is taken—both solenoids are closed. If P_{diff} is below 1.75" WC, the supply solenoid is energized to allow gas to fill the detector up to 2" WC. If the pressure is too high, the return solenoid is energized and a pump in the gas shed turns on to extract gas from the sector until the pressure drops to 2.25" WC. The returned gas is stored for reuse in the buffer tanks located in the gas shed. The supply and return stop points prevent the solenoids from turning off and on when the pressure reaches the edge of the operational set point values.

The Omega process controller's differential pressure sensor is independently monitored and the controller will not power the supply or return solenoids if the P_{diff} is outside of the safe operating range of 1" WC to 2.75" WC. While the

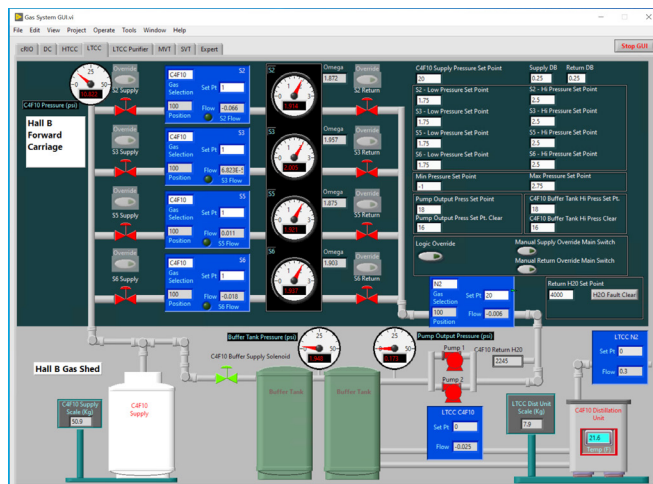


FIG. 2. Screenshot of LTCC LabVIEW gas controls user interface on 06/10/22, with all sectors filled with ~2" WC of C_4F_{10} .

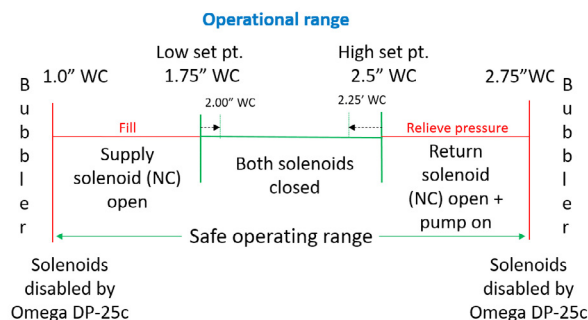


FIG. 3. LTCC controls diagram. The system works to keep the detector between the low and high set points. If the system is outside of the safe operating range, over- or under-pressure is controlled by bubblers.

pressure is outside of the safe operating range, pressure in the detector is controlled by bubblers.

Additionally, two ASCO 120 VAC coils, Fig. 4, for the sector 6 supply and return solenoids were installed. All sectors are instrumented with ASCO coils. All solenoids were tested using the manual configuration of the LTCC controls software to ensure they are operational.

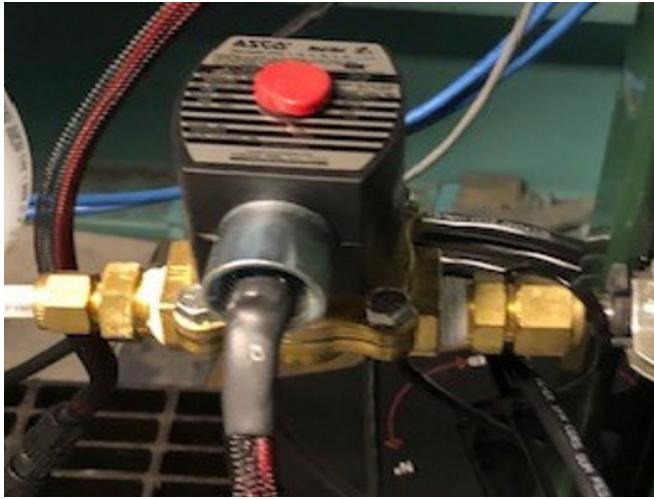


FIG. 4. ASCO 120 VAC coil installed on the sector 6 solenoid.

In conclusion, all four LTCC sectors have been filled with C_4F_{10} . The hardware and the controls systems are operating as expected.

[1] [M. McMullen, et al., *Supply and Recovery Controls for Perfluorobutane Used in Low Threshold Cerenkov Counter*, DSG Note 2019-10, 2019.](#)