COUPP-2L Phase I

Installation, Commissioning, and Operations Plan for the Period Before Inner Vessel Installation

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26 July 2010

This document makes explicit the run plan for the first testing period (Phase-I) of the COUPP-2L device in SNOLAB. In phase I, we will install, commission, and operate the full apparatus minus the inner vessel and minus the outer shielding. It is planned that this period last from late July 2010 until the installation of the inner vessel in late August 2010. The COUPP-SNOLAB-Fermilab Accord[1] should be read prior to this document to provide the necessary understanding of the full system.

The Equipment

By the end of July 2010 the full COUPP 2L experiment minus the inner vessel and minus the outer water shielding should be installed underground at SNOLAB. This equipment and its function are detailed in the COUPP-SNOLAB-Fermilab Accord[1].

The Goals

In Phase I we plan to install, commission, and operate the COUPP-2L pressure vessel and the data acquisition and hydraulic controls of the experiment at the SNOLAB site. Some changes have been made since our run in the Fermilab MINOS site including additional alarms and limits and some additional instrumentation. Our goals for Phase-I are as follows:

1) Establish robust remote control of the experiment from Fermilab
2) Confirm the performance of our DAQ and hardware modifications
3) Demonstrate stable unattended operation of the equipment under control of the data acquisition and controls system.

A few weeks of stable operation of the DAQ and controls elements of the experiment will be necessary prior to committing to the installation of the fragile inner vessel assembly and the final commissioning of the apparatus.

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[1] http://coupp-docdb.fnal.gov/cgi-bin/ShowDocument?docid=257

Mechanical Installation

The basic mechanical installation of the experiment consists of

1) Assembly of electronics racks and rack infrastructure (UPS, power distribution, shelves, drawers, supports, etc…)
2) Installation of DAQ components (Computers, monitors, peripherals, networking…)
3) Positioning of the pressure vessel, the hydraulic cart, and the NESLAB heater/chiller unit.
4) Establishment of hydraulic and heater/chiller plumbing connections.
5) Connection of instrumentation and network cabling.

The mechanical installation was largely completed in the week of July 19, 2010 with a few items carrying over to Monday July 26.

Mechanical Installation Punch-List[2]:

1) Internal wiring of the BB-3 breakout box.
2) Installation of correct length serial cable from NESLAB heater/chiller to DAQ computer.

Stepwise Electrical Turn On

After mechanical assembly and the granting of permission to electrically energize equipment the following stepwise turn on will be conducted:

1. Turn on 120VAC electrical power to the UPS and setup remote access to it.
2. Turn on the switched PDU and setup remote access to it.
3. Turn on (2) Linux computers and establish network connectivity.
4. Turn on DAQ PXI crate and check functionality (check if PXI can communicate with all DAQ elements.)
5. Power up hydraulic cart and establish communication to it from the PXI processor.
6. Turn on camera/LED control box (CBOX) and establish functionality.
7. Tune up illumination and focus of the cameras (shutter speed, f-stop, focus, illumination level, gain, and offset)
8. Turn on NESLAB heater/chiller, establish communication to it and test temperature control.
9. Follow NESLAB Limit Setup procedure to adjust high temperature cutout.
10. Install and commission webcams.

Following mechanical installation, permission for basic electrical turn-on was obtained in during the week of July 26, 2010 and much of the work was completed.

[2] Items not yet completed are highlighted in red.

Hydraulic Commissioning Steps:

Following the basic mechanical installation and electrical turn-on, additional approval is required to charge the system with fluids and compressed air and initiate further testing activity. We anticipate permission to proceed on July 27-28 once we've completed review checklist items and upgrade to the hydraulic cart stepping motor drive guard (SNOLAB) is complete. In the event of a fluid spill during any of the following operations, follow the Glycol Spill Clean-Up procedure. Please refer to MSDS sheets for Phase I Operations.

1. Fill the NESLAB fluid reservoir with heat-exchange fluid (distilled water for Phase-I)
2. Following the HRAM Manual Manipulation Procedure, exercise the hydraulic ram C-2 under computer control without hydraulic fluid to confirm behavior of motion limit switches.
3. Charge the over-pressure accumulator tank AC-1 with compressed air following procedure Hydraulic Cart Overpressure Accumulator Charging
4. [ISOLATE AC-2 FROM THE CART AND DON'T USE IT FOR PHASE I, there is a bug in the process diagram, and the filling procedure is not clear] Charge the under-pressure accumulator tank AC-2 with propylene glycol and compressed air following Hydraulic Cart Under-Pressure Accumulator Charging procedure.
5. Partially fill the pressure vessel with propylene glycol following procedure Pressure Vessel Glycol Fill (document 283)
6. Charge the hydraulic cart and with propylene glycol following the Hydraulic Cart Fill Procedure (document 155.)
7. Connect the compressed air to the hydraulic cart and energize the compressed air side of the hydraulic cart following the Hydraulic Cart Compressed Air Startup procedure.
8. Confirm that all temperature and pressure transducer read-backs are working
9. Check for hydraulic leaks and tighten seal bolts as necessary

The above list of actions should take less than a shift if no problems are encountered.

Commissioning Tests Conducted with COUPP Personnel Underground

After completion of mechanical installation, stepwise electrical turn-on, and hydraulic commissioning, of the following set of tests and exercises will be conducted by personnel underground with the equipment.

1) Test the alarms and limits functionality of the DAQ. These tests are largely evaluations of software checks that must be valid before the DAQ obtains permission to expand the chamber. None of these tests involves bypassing or in any way overriding existing alarms or limits. The alarms and limits checklist is as follows:
    a. Confirm loss of expansion permit for camera parameters out of bounds.
    b. Jeter, Alan please expand check-list:

2) Test the ability of the heater/chiller to regulate the temperature of the glycol
    a. This is a straightforward evaluation that simply involves changing the NESLAB temperature regulation set-point to something other than room temperature and then observing the performance.

3) Test the ability to run with a pressure ramp
    a. Once we've confirmed that pressure transducers are reading back successfully and that we're in software communication with the hydraulic cart, this exercise is to manually expand and manually compress the chamber using the "manual expand" and "manual trigger" buttons on the DAQ control panel.

4) Test the run control capability of the DAQ. This is also a straightforward punch-list of basic DAQ functionality for starting and stopping runs.
    a. Regular Run Start/Stop Test at fixed pressure
        i. This test consists of starting a normal run and observing a sequence of expansions. Each expansion will terminate upon attaining a software time-out, which can be set to a short value for the test. The run would be terminated by the execution of a manual "End Run." We would evaluate the logged data to confirm the performance of the hydraulic cart pressure regulation and of the NESLAB temperature regulation.
    b. Auto-Run Start/Stop Test at a fixed pressure
        i. This test consists of initiating a run under "Auto-Run" control. In this mode, the DAQ will automatically start and stop runs

Running with no COUPP Personnel underground

Once the set of tests described in the previous section is successfully completed, the system will run in a steady state mode where data is being accumulated without COUPP personnel underground. Tests of starting and stopping the DAQ remotely will be conducted. Typical steady state running of the system without an inner vessel has auto-run cycle time of 24 hours and an expansion time-out after 1000 seconds. We expect to run in this mode until the arrival of the inner vessel in late August 2010.