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Project: D0 Solenoid
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Subject: Checklist for Operation of Solenoid & CF Toroid for Field Mapping

This checklist is to be used for Operation of the Solenoid and the Central Field (CF) Toroid during field mapping tests. The detector is located in the assembly pit. The End Field toroids (EF) are not connected.

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Preparation of Security:

- Install barrier tapes and flashing lights in the following locations to warn workers away from danger areas:
 - ❑ North end of CF to in the area of DC connections and intense solenoid magnetic field.
 - ❑ South end of CF in area of intense solenoid magnetic field.
 - ❑ Clean room access door to the south pit.
 - ❑ Access ladder to the control Dewar platform.
- Install "Magnetic Field" warning signs in the following places:
 - ❑ Main control room, one sign at each entry point.
 - ❑ South catwalk, one sign at each end.
- ❑ Install barrier tapes and no access signs in the south stairwell on second level just below room 210.
- Lock the following access doors to the pit:
 - ❑ Northwest stairwell door.
 - ❑ Main control room.
 - ❑ South stairwell.
 - ❑ Cleanroom.
- ❑ Tag the overhead crane as follows: "Do not operate crane beyond clean room hatch during solenoid operation" .
- ❑ Make public address announcement as follows: "Attention, the central field toroid and solenoid are about to be energized, please vacate and remain clear of the pit area until further notice". Repeat the message.
- ❑ Walk through the entire area including the east and west trusses and make certain that no one is still in the pit area and that no loose material exists within the taped magnetic field limited access area.

Preparation of CF Toroid:

- Verify that the CF toroid is in the closed position.
- Inspect all DC cables, connections and bus work on north side of CF and at the north sidewalk power flags. They must be clean, tight, and protected from inadvertent contact. Connections within normal reaching distance of workers must be covered with insulating material.
- Verify that the LCW system is operating and that the LCW resistivity is $> 3.0 \text{ MegOhms/cm}^2$ (meter in room 604).
- Megger the CF coils: (Only if there is reason to believe the circuit has been disturbed) Initial if N/A _____.
 - 1) Turn off ground fault detector
 - 2) Unseat power supply regulator module
 - 3) Measure resistance to ground from a power supply DC connection. Record value here _____ (normal $10\text{k}\Omega$ @ 250V).
 - 4) Turn on ground fault detector
 - 5) Reseat power supply regulator module.
- Verify that the power supply filter cage is padlocked.
- Verify that the power supply main switch on the power supply is off, then energize the WAMUS Power Supply Breaker in the utility entry room.
- Verify that the Accelerator Permit is jumpered out on the back of the interface chassis.
- Reset the interlock chassis and verify that all interlocks are made up.
- Verify that the power supply is in the following mode:
 - 1) Control = Remote
 - 2) Reference = External
 - 3) Regulation = Current
- Unlock power supply and turn on its main AC breaker handle to the "ON" position
- Reset the power supply and verify that all faults are clear.

Power supply is ready for remote operation via the control room Macintosh. Set up the Macintosh as follows:

- 1) On the Apple menu, select Magnet Control II.
- 2) On Magnet Control II application menu, select File > Open > Muon Stuff > Magnet Parameters
- 3) On Magnet Control II application menu, select Options > enable settings.

Preparation of Solenoid:

- Inspect The Power Bus - Examine the following items:
 - The flexible cable connections that connect the power flags to the control platform water-cooled bus. These connections shall be neatly insulated with silicon material and free of any extraneous test leads. The area around the connections shall be free of trash, abandoned tools and etc.
 - The flexible cable connections that connect the control platform water-cooled bus to the fixed building bus. Same conditions as noted above.
 - The fixed building bus tray covers are all fastened in place.
 - The solenoid dump resistor is in fact connected across the bus in Room 511. All fasteners must have paint seals to prove that they have been properly torqued.
- Cooling Water System - Verify that the low conductivity water (LCW) cooling system is prepared to function by examining the following items.
 - The four (4) manual LCW valves supplying equipment inside Room 511 are in the "ON" position.
 - The LCW supply pressure gauge inside Room 511 reads at least 90 psi.
 - There are no obvious water LCW leaks.
 - Flush the power supply and buswork using the "Flush PS/Bus 1 min." button on the DMACS LCW screen.

- ❑ Reversing/Dump Switch Power - Remove the padlock and engage the Reversing Switch/Dump Switch disconnect to the "ON" position. Leave the open padlock with the switch.
- Validate Quench Detector System
 - ❑ Reset the system interlocks (interlock control screen).
 - ❑ Verify that the following interlocks status are "OK" (interlock control screen):
 - Lead A (vapor cooled lead A)
 - Lead B (vapor cooled lead B)
 - Trans A (transition lead A)
 - Trans B (transition lead B)
 - Chimney A (chimney lead A)
 - Chimney B (chimney lead B)
 - CT Imbal (center tap imbalance)
 - QT Imbal (quarter tap imbalance)
 - ❑ Close the Dump Switch if it is not already closed (dump switch control screen).
 - ❑ Trigger the quench detector test (select "Trigger" on the quench detector control screen).
 - ❑ Verify that ALL of the interlocks status listed above are "Not OK" (interlock screen).
 - ❑ Verify that the Dump Switch has opened (Dump Switch "Not Ok").
 - ❑ Close the Dump Switch again (dump switch control screen).
 - ❑ Megger the solenoid system (Only if there is reason to believe the circuit has been disturbed) Initial if N/A _____.
 - 1) Verify that the LCW Resistivity interlock is made up.
 - 2) Unseat the power supply regulator module.
 - 3) Verify that the dump switch is open (disables ground fault detector).
 - 4) Place filter grounding knife switch into the "megger" position.
 - 5) Connect the megger instrument to the megger test point and ground bus on the filter.
 - 6) Set the megger to 250V and record the reading here _____ (20k Ω @ 250V is normal).
 - 7) Remove megger, return grounding switch to normal position, and replace power supply regulator module.
- Power Supply AC Power
 - ❑ Verify that the power supply is in the following mode:
 - 1) Control = Remote
 - 2) Reference = External
 - 3) Regulation = Current
 - ❑ Remove the padlock and engage the Power Supply disconnect to the "ON" position. Leave the open padlock with the switch.
 - ❑ Engage the Power Supply front panel AC breaker handle to the "ON" position.
 - ❑ Reset the power supply and verify that all faults are clear.
- Room 511 air conditioning
 - ❑ Verify that the two overhead air conditioners in room 511 are on. Disconnect switches are on the west wall.

The solenoid power system is now ready to operate from a DMACS terminal. Refer to the standard operating procedure for operating the solenoid (Engineering note H980826B available online at <http://www-d0.fnal.gov/~hance/solenoid.htm>).

After Testing - Removal of Security and Lockout of Equipment

- ❑ Turn off CF and Solenoid power supplies using normal procedures.
- ❑ Turn off AC breaker handle on CF power supply and install configuration lock.
- ❑ Turn off main breaker for CF power supply (WAMUS) in utility entry room.
- ❑ Verify that the solenoid current has reached zero before turning off AC breaker handle on solenoid power supply.
- ❑ Turn off disconnect for solenoid power supply and install configuration lock.
- ❑ Turn off disconnect for reversing/dump switch cabinet and install configuration lock.
- ❑ Remove rope barriers and turn off flashing lights at all stations.
- ❑ Remove tag from overhead crane.
- ❑ Remove "Magnetic Field" warning signs from catwalk and control room.
- ❑ Make announcement over the PA system if applicable: "Attention - Solenoid and CF testing are complete, the pit area is now open". Repeat the announcement.