

PROCEDURE

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DEFINE THE SCOPE OF WORK

Title:	Demagnetization of In Situ Cryomodule		
Location:	(LERF Vault) Building 18		
Risk Classification (per Task Hazard Analysis attached) (See ESH&Q Manual Chapter 3210 Appendix T3 Risk Code Assignment.)		Highest Risk Code Before Mitigation (3 or 4):	3
		Highest Risk Code after Mitigation (N, 1, or 2):	1
Owning Organization:	SRF	Date:	23 Oct 2018
Document Owner(s):	R Legg, J Fischer, G. Cheng		
Document History (Optional)			
Revision:	Reason for revision or update:	Serial number of superseded document	

ANALYZE THE HAZARDS

1. Purpose of the Procedure – Describe in detail the reason for the procedure (what is being done and why).

The purpose of this procedure is to reduce the center magnetic field of the cryomodule by applying a slowly alternating DC magnetic field to the vacuum vessel.

This magnetic field is produced by running up to 65 amps through a series of solenoid type coils made up of 4 AWG THHN wire wound around the vacuum vessel. The current is produced by a programmable 80 volt, 75 amp DC power supply powered by 208 VAC, 3 phase, 30A service. The procedure produces a magnetic field, which requires an exclusion zone. The power supply is rack mounted. Do NOT try to remove the power supply from the rack. It is heavy and poses a lifting hazard.

2. Scope – include all operations, people, and/or areas that the procedure will affect.

This procedure is to be used for all instances involving the use of the demagnetization system in the LERF Vault. The work will be directed by SRF employees.

3. Description of the Facility – include floor plans and layout of a typical experiment or operation.

The work will be performed in the LERF vault (building 18) .

4. Authority and Responsibility:

4.1 Who has authority to implement/terminate

Gary Cheng, John Fischer, Gigi Ciovanti

4.2 Who is responsible for key tasks

Test coordinator is responsible for setting up roped off test area, posting guards and preventing entry to area during test

4.3 What are the Training Requirements (See http://www.jlab.org/div_dept/train/poc.pdf)

SAF 104, SAF603A, and review of this Procedure

5. Personal and Environmental Hazard Controls Including:

5.1 Shielding

N/A

5.2 Interlocks

N/A

5.3 Monitoring systems

Use of personnel to guard against entrance to test area during demagnetization process.

5.4 Ventilation

N/A

5.5 Other (Electrical, ODH, Trip, Ladder) (Attach related Temporary Work Permits or Safety Reviews as appropriate.)

Red rotating beacon to indicate when magnetic field is energized.

6. List of Safety Equipment:

6.1 List of Safety Equipment:

Stanchions and rope to restrict access.

Red Beacon to indicate Magnetic field present.

Signs to indicate 5 Gauss border

PPE - full sleeve shirt, full pants. Shirt and pant should be made from natural fibers.

6.2 Special Tools:

Signage for 5 G border.



DEVELOP THE PROCEDURE

1. Associated Administrative Controls

ES&H chapters 6420T3 sections 4.1.2 and 4.2.1.

Procedure must be read and signed by all operating personnel.

2. Operating Guidelines

- The test must be operated by a Test Coordinator and two guards.
- The vacuum vessel will be grounded.
- The DC power supply and rack will have a wire of at least 12 AWG to one of the planned building grounds.

- The area for 7.5 feet around the cryomodule's vacuum vessel (excluding end cans) under test must be roped off and signs indicating Strong magnetic field affixed.
- The insulation between the wire on the vacuum vessel and the vacuum vessel will be tested with a Megger or leakage current tester. Leakage current shall be less than 5 microamps at 600 VDC.
- Before the power supply is energized, the red flashing beacon must be energized.
- Place the power supply controls in the proper configuration before energizing.
- Do not plug/unplug the power supply while manipulating test leads.
- Use appropriate PPE as indicated in 6.1 above.

3. Notification of Affected Personnel (who, how, and when)

The Test Coordinator and the two guards will erect the stanchions and ropes at a 7.5 feet distance from the vacuum vessel. They will notify all personnel working in the area prior to starting the test and again when energizing the red beacon. During the test the guards will warn away personnel who enter the general area of the test.

4. List the Steps Required to Execute the Procedure: from start to finish.

1. Cordon off area per Hazard Analysis Form. Post High Magnetic Field signs accordingly.
 2. Ensure that all loose ferromagnetic materials (tools, nails, etc.) are removed from the interior of the vacuum vessel.
 3. Ensure that all loose ferromagnetic materials (tools, nails, etc.) are removed from the specified distance in the Hazard Analysis Form.
 4. Check all connections on the coils on the vacuum vessel.
 5. Check connections for damage.
 6. Ensure that all the connectors are firmly attached to each other.
 7. All the coils must be in series with each other.
 8. Connect the two leads from the end coils to the back of the power supply using the two-lead power pole connector.
 9. Ensure that the Emergency Stop Button is depressed (i.e. open circuit).
 10. Check and make sure that the Emergency Stop Button is connected to the power supply through the BNC connectors.
 11. Connect (or check) the power supply rack cable to the back of the power distribution box.
 12. Wear clothing made from natural fibers.
 13. Connect the power supply rack cable to the 208 V / 30 A receptacle.
 14. Make sure there is power supply for the laptop/PC. Turn ON PC and bring up program.
 15. Turn on the red beacon and inform guards the power supply is energized.
 16. Ensure the program is set to 0 Amperes.
 17. Retract the Emergency Stop Button (i.e. close circuit).
 18. Turn ON the power supply (PWR black switch).
 19. Set the current to 65 Amperes in the program.
 20. RUN the program.
 21. Ensure that the program is displaying the same current as displayed on the front displays of the power supply.
- Concluding tasks upon completion of demagnetization
22. STOP program.
 23. Turn OFF the power supply (PWR black switch).
 24. Depress the Emergency Stop Button (i.e. open circuit).

25. Ensure that all clothing is made from natural fibers.
26. Disconnect power supply rack cable from the 208 V / 30 A receptacle.
27. Shut off red beacon.

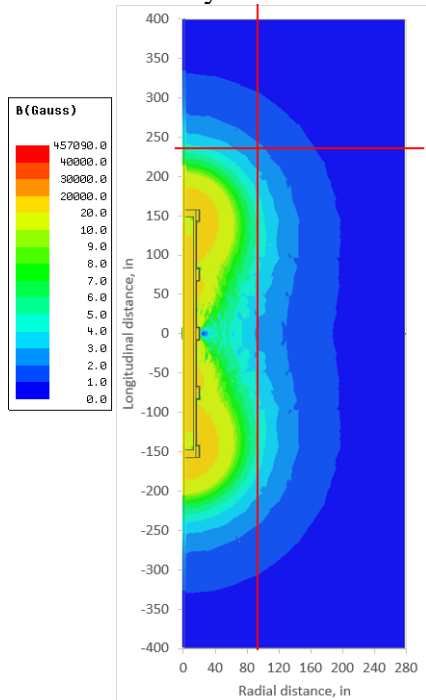
5. Back Out Procedure(s) i.e. steps necessary to restore the equipment/area to a safe level.

1. Depress the Emergency Stop Button (i.e. open circuit).
2. STOP program on PC.
3. Turn OFF the power supply (PWR black switch).
4. Ensure that all clothing is made from natural fibers.
Disconnect power supply rack cable from the 208 V / 30 A receptacle.

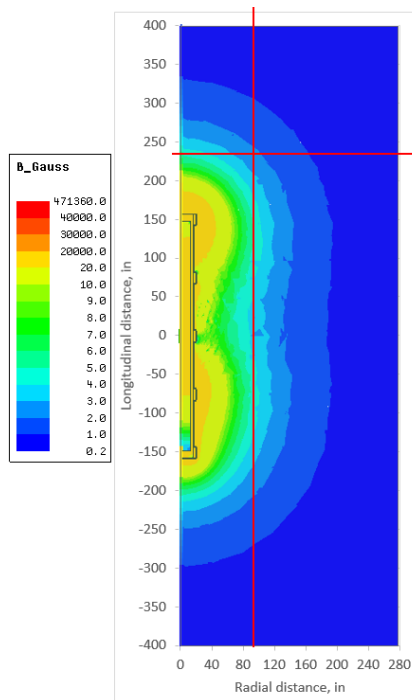
6. Special environmental control requirements:

6.1 Environmental impacts (See [EMP-04 Project/Activity/Experiment Environmental Review](#))

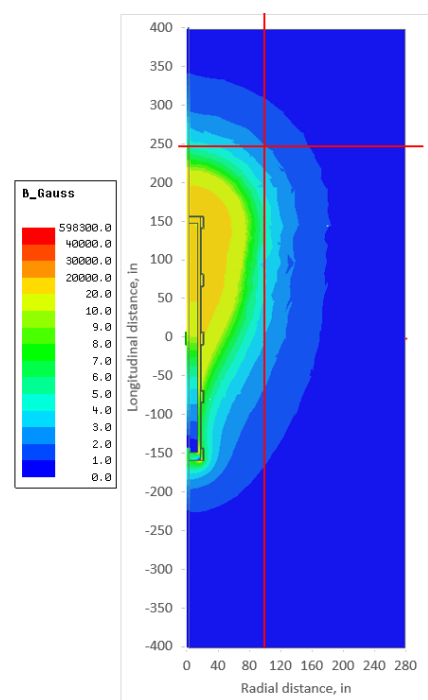
This test produces a magnetic field around the C20 cryomodule. Refer to “LERF C20 CM Demag Field Analysis” for details.



400-turn, 60A, 4 CUs field



300-turn, 65A, 3 CUs field



300-turn, 65A, CU4 field

As can be seen from the field plots, high field > 20,000 Gauss is contained inside the cryomodule. So people without medical implants may operate the demagnetization without staying outside of the cordoned area. People with pacemakers/medical implants shall stay outside of the 5 Gauss boundary.

6.2 Abatement steps (secondary containment or special packaging requirements)

- Use stanchions and ropes 7.5 feet from the cryomodule's vacuum vessel (excluding end cans) to provide exclusion zone.
- Red beacon to indicate when power supply used in test is energized.
- Two guards to prevent entry into the exclusion zone during test.

7. Unusual/Emergency Procedures (e.g., loss of power, spills, fire, etc.)

In the case of an injury, the Test Coordinator will call 911 and then 5822 to notify the guards. Additional

emergency information is available at www.jlab.org/intralab/emergency

1. If an emergency, the Test Coordinator will depress the Emergency Stop Button (i.e. open circuit to coil).
2. The coil has a fuse in series with it. In the case of a short circuit of the coil or its leads, the fuse will open and terminate the test.

After the coil is deenergized, the power supply will be disconnected from AC power.

8. Instrument Calibration Requirements (e.g., safety system/device recertification, RF probe calibration)

Megger / leakage current tester used to check insulation shall have valid calibration.

9. Inspection Schedules

N/A