

AUPSL-SAFETY-0002
(Magnet Standard Operating Procedures)

Auburn University
Plasma Sciences Laboratory

Magnet Standard Operating Procedures
Version 1.0

Applicable to the following Leach Science Center rooms:

PSL Magnet Lab area:
Development Lab - 163 / 163A
Control Room / MDPX Main Cell / Utility Rooms - 169 Suite

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Auburn University Plasma Sciences Laboratory: Magnet Lab
Standard Operating Procedures
(including tool and magnetic materials management)

This document is intended to provide a set of operational procedures for the Auburn University Plasma Sciences Laboratory (AUPSL) – Magnet Lab [Leach Annex 163/163A (Development Labs) and Leach Annex 169 suite (Control room, MDPX Main Cell, and Utility room)]. This document specifies the procedures that will be in place for the Magnet Lab to ensure that the safety protocols defined in the PSL Safety Manual are maintained.

Definitions:

MDPX Operator – will refer to AUPSL trained personnel that are authorized and trained to start up the magnet system, shut down the magnet system, carry out emergency procedures, carry out research projects, and work in the MDPX Main Cell when the magnets are energized.

MDPX Staff– will refer to AUPSL trained personnel that are authorized and trained to carry out research projects using the MDPX device. MDPX Staff may enter the MDPX Main Cell under the supervision of a MDPX Operator if the magnets are de-energized. MDPX Staff will be properly trained so that in the event of a significant emergency, they may be allowed accompany a MDPX Operator into the MDPX Main Cell if the magnets are energized.

MDPX User – will refer to all other personnel who make use of the Magnet Lab for research purposes. MDPX Users may ONLY enter the MDPX Main Cell under the direct supervision of a MDPX Operator and only for the purposes of installing / removing their research hardware.

Safety precautions at all times:

1. Only tools that are located in the **red** (ferrous tools) and **yellow** (MRI-safe) tool chests in the control room may be used in the Magnet Lab spaces. No tools – including those located in the PSL main lab (Leach 208/209/215), Microgravity lab (Leach 157), the Development labs (Leach 163 / 163A) - may be brought into the Magnet Lab at any time.
 - a. If a tool is not in the Magnet Lab, but is in one of the other PSL laboratories – a part may be taken to one of those labs to be worked on. Depending upon the nature of the work performed on the part (e.g., it was drilled and metal shavings were created), the part should be screened using the magnetic field test stand in the Development lab. The tool should be added to the purchase list if it will be frequently used.
 - b. If the part cannot be readily moved to one of the other PSL laboratories to be worked on – work on that part will halt until the appropriate tool can be ordered. The new tool will be shadowed, inventoried, and placed in the Magnet Lab tool kits for future use.
 - c. At the end of a work period, a person will remove all of the tools they have used from the MDPX main lab and return them to their proper places in the tool boxes.
2. Extreme care will be taken when using tools and/or parts in the MDPX main room.

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- a. Tools are to be kept in one of the small yellow toolboxes when working in the MDPX cell.
 - b. Small parts (nuts, bolts, screws, etc.) are to be kept in one of the plastic containers when working in the MDPX cell.
 - c. Operations that may produce metallic shards (e.g., drilling, filing, etc.) may only take place in the MDPX cell under unusual circumstances. These operations may only take place with the approval of the group PIs (Prof. Thomas and Konopka) and the supervision of the lab technician (D. Artis). After such an operation, the person who performed this operation will completely clean the affected area and check the area using a magnet to pick up any fragments.
3. Installation of non-AUPSL equipment
- a. It is recognized that as part of the “user facility” mode of operation for the AUPSL Magnet Laboratory, external users (e.g., MDPX Users) may bring hardware to Auburn University for use on the MDPX device.
 - b. External users must certify that their hardware is constructed from non-ferrous materials and will provide a list of materials used in the construction / fabrication of their hardware. This list should pay particular attention to fastening hardware (screws, nuts, bolts, etc.).
 - c. All external hardware WILL BE tested in the AUPSL magnet test stands to confirm that non-magnetic materials are being used.
 - d. AUPSL personnel will actively work with external users to remedy any potential hazards; however, the AUPSL reserves the right to refuse installation of any hardware that either the MDPX Operators and MDPX Staff feel may pose a danger to personnel or experimental hardware.
 - e. All external users will strictly obey all rules and regulations of the Magnet Lab; failure to do so may result in removal from the laboratory facility.

Tool management (no magnetic field operation) – Condition Green

This criterion may be applied to extended periods (e.g., periods of longer than two weeks) when magnetic fields will not be present in the laboratory. Under this condition, tools (including ferrous tools) may be taken into the MDPX cell – subject to the precautions listed in (1) and (2). Lab users are strongly encouraged to use the magnet test stand that will be located in Rm. 163 to verify if items are ferrous.

Transition to magnet operation (to occur 3 or more working days prior to a magnet startup):

To begin the transition to magnet field operation, the Magnet Lab will have a transition from Condition Green to Condition Red. The PIs (Thomas/Konopka) will be responsible for jointly defining the date at which this transition will occur.

Key event that will occur during at the beginning of the transition period will be securing the laboratory. This event is anticipated to take between ½ to 1 working day. The following activities will occur:

1. Science / research operations will halt on that day.

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2. There will be a complete tool inventory of the Magnet Lab.
3. There will be a thorough inspection of the entire Main Cell
 - a. A visual inspection of all parts of the Main Cell to find and remove all stray parts / equipment.
 - b. All ferrous material will be removed from the Main Cell. Unknown / unfamiliar items must be taken to the magnet test stand (in Leach 163) for evaluation.
 - c. A sweep of the Main Cell to find any magnetic materials (metal shavings, screws, etc.) that may have fallen onto the floor.
4. A switch to strict tool management and control; i.e., Condition Red.

Tool management (magnetic field operation) – Condition Red

Under this operational condition, the Magnet Lab will be under strict management control – regardless of whether the magnets are energized. All tools will be under the same constraints listed in the general policies and Condition Green with the following additional controls:

1. Any tools removed from either the main or MRI-safe tool kits must be checked in / checked out using the attached form.
2. Under no circumstances is anyone to enter the MDPX Main Cell without an approved Operator remaining in the control room – regardless of whether or not the magnets are energized.
 - a. While several tools may be removed from the cabinets at one time, EACH item is subject to the check in / check out procedure.
 - b. Tools should not be “borrowed” by another person. [The preferred procedure is that a tool should be checked in by the current user and checked out by the new user.]
3. **WHEN MAGNETS ARE ENERGIZED** – this is a potentially lethal environment due to the affect of magnetic fields on ferrous materials. The policies listed below are intended to secure the safety of both individuals and equipment. These are no-exceptions policies: *failure to obey these policies could result in immediate termination.*
 - a. All Magnet Lab personnel are **restricted from allowing any persons** (e.g., custodians, facilities, risk management, non-MDPX team members, etc.) to enter the MDPX cell under any circumstances. MDPX Operators, Staff, and Users are to remain absolutely vigilant at all times.
 - b. **Only the MRI-safe tools may be taken into the MDPX cell – and only if there is an approved operator that remains in the control room.** CRITICAL: any other items may be subject to magnetic forces that could pull them into the magnets. Failure to obey this policy could result in serious damage to personnel and equipment. *This is a no-exceptions policy: failure to obey this policy may result in immediate termination.*
 - c. In the event of an emergency (personnel injury, fire, etc.) an appropriate emergency plan will be implemented by an approved MDPX Operator.

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For the SOP of the MDPX magnet system, it is assumed that the Magnet Lab will be in Condition Red (as defined in the sections above).

Magnet pre-start:

1. A visual survey of the tool boxes will be performed to confirm that all tools in the laboratory are accounted for. The tool box log book will be signed as described in the tool management procedures document (AUPSL-Safety-0003)
2. A survey of the MDPX Main Cell will be performed to confirm that no loose parts (nuts, bolt, etc.) are present.
3. A visual inspection of the Main Cell and Utility Rooms will be performed to confirm that no personnel are present in either area.
4. **IMPORTANT NOTE:** The magnet “pre-start” and “ramp-up” procedures may be performed by a single MDPX Operator.

Magnet ramp-up and operation:

1. Magnet power supplies can now be energized.
2. The Operator should confirm that all of the indicator lights for the lab have been activated.
3. The magnets can now be ramped to their operating conditions.
4. During the ramp-up phase, the magnetic field sensors should be periodically checked to ensure that they are operating properly.
5. **IMPORTANT NOTE:** Once the magnets are being energized, only a trained MDPX Operator is allowed to enter the Main Cell.
 - a. IF access to the MDPX Main Cell is required, a second MDPX Operator **MUST** be present in the Control Room; at no time while the magnets are energized shall an MDPX Operator **NOT** be present in the Control Room.
 - b. For “normal” research operations, the **MINIMUM** personnel present should be: (1) MDPX Operator and (1) MDPX Staff.
 - c. For any operation that requires access to the MDPX Main Cell while the magnets are energized, the **MINIMUM** personnel present should be: (2) MDPX Operators and (1) MDPX Staff.
 - d. When external users are present, the **MINIMUM** personnel present should be: (1) MDPX Operator, (1) MDPX Staff, and (1) MDPX User.

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Document History

Version	Author	Date	Comment
1.0	E. Thomas, Jr.	5/28/2013	First complete version