

Access and Safety Rules for Kaiser 3085-B Experimental Laboratory for EPES Research Group

Table of Contents

1.	Purpose of the Document.....	3
2.	Experimental Laboratory Space Planning:.....	3
3.	Laboratory Supervisors:.....	5
4.	Laboratory Access:.....	5
4.1	Laboratory Working Hours:	6
4.2	Use of Equipment and Instruments	6
4.3	General Safety Rules:	7
4.4	Use of Specialized Equipment:	9
5.0	Appendix.....	12

1. Purpose of the Document

The Laboratory Kaiser 3085 is divided into two parts: Kaiser 3085-A Office Space, and Kaiser 3085-B Experimental Space. The purpose of this document is to ensure proper use, access and Safety Rules for Kaiser 3085-B Experimental Laboratory for Electric Power and Energy Systems (EPES) research group graduate students. This document also informs the students and users of basic rules, duties, expectations, as well as personal safety that apply to this Laboratory in order to prevent accidents and potential hazardous situations, and ensure that all users have productive working conditions and environment.

2. Experimental Laboratory Space Planning:

The Kaiser 3085-B Experimental Laboratory is sub-divided internally into three sections/areas, with allocation of appropriate research equipment and benches within each area as shown in Fig. 1. These areas are: General Instrumentation; Power System Simulator; High-power Machinery, and General Purpose Small Machines and Power Electronics experimental benches. Each bench and/or equipment may be under different primary supervisor (principal investigator) who is responsible for its use and allocation for various experiments and projects. Please note that some equipment is very specialized, custom-designed, and as such it may be used only for certain experiments/project, and only with approval by its primary supervisor (principal investigator). Please contact and consult the responsible supervisor(s) for requesting and/or scheduling the use of any of the benches or equipment in this Laboratory:

Power System Simulator: Dr. Jose Marti, Dr. Juri Jatskevich, Dr. Christine Chen

High Power Machinery: Dr. Juri Jatskevich

General Purpose Small Machines and Power Electronics Benches: Dr. William Dunford,
Dr. Juri Jatskevich

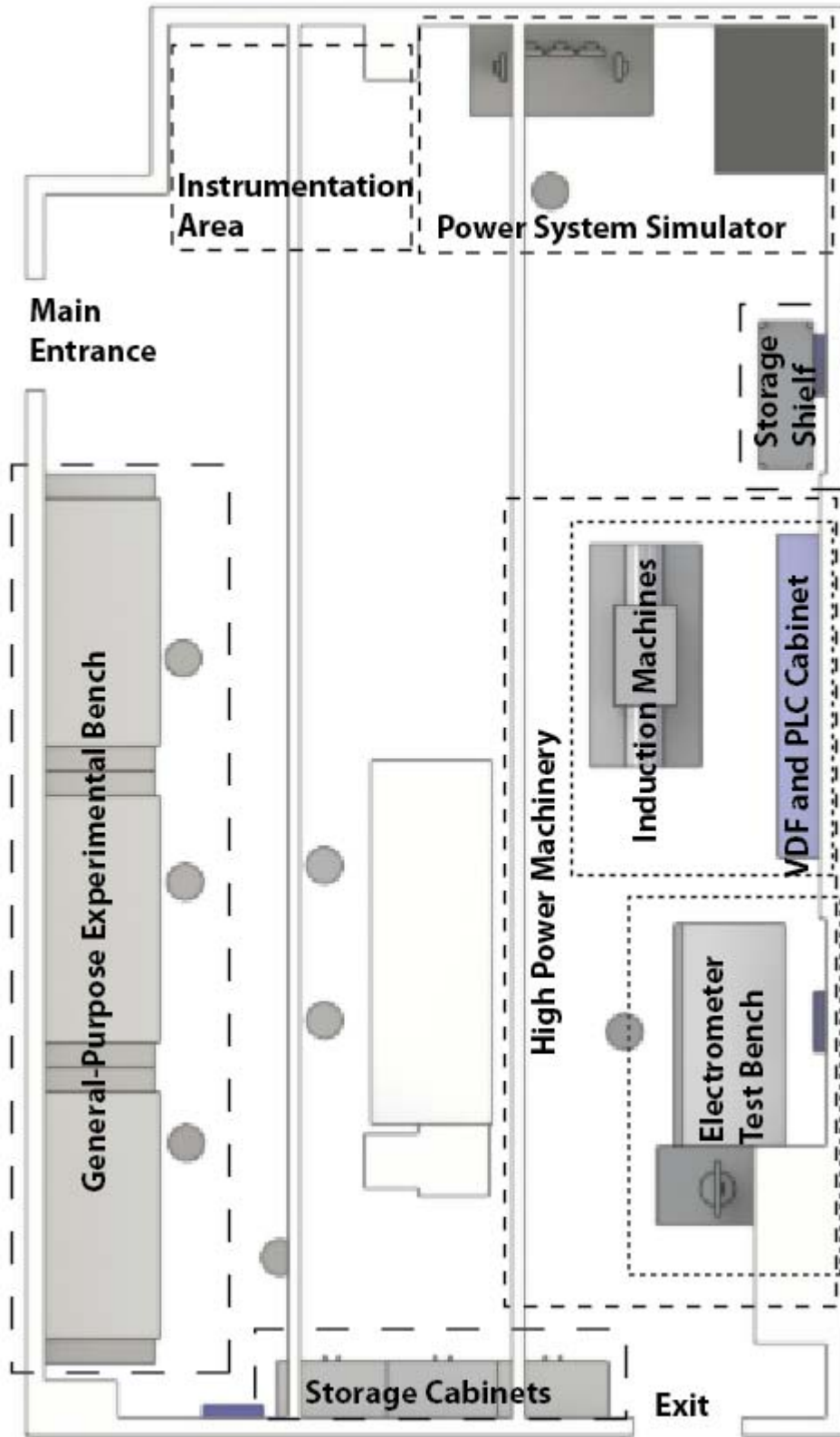


Fig. 1. Location of working areas and benches in Kaiser 3085-B Experimental Laboratory.

3. Laboratory Supervisors:

Presently, Kaiser 3085-B Experimental Laboratory accommodates graduate students who are supervised by the EPES faculty members including: Dr. William Dunford, Dr. Juri Jatskevich, Dr. Jose Marti, and Dr. Christine Chen. Presently, Dr. Juri Jatskevich is also the principal supervisor of this Laboratory. Please refer to UBC ECE Faculty web page, <https://www.ece.ubc.ca/faculty>, for contact information of each of the faculty member.

4. Laboratory Access:

In order to access the lab area, students need to gain both office and lab section access. Please consult the responsible supervisors for the access. In addition, all authorized students must complete a safety quiz prior to gaining access to the lab section access.

Only authorized students with FOB access to both Kaiser 3085-A Laboratory and Kaiser 3085-B Experimental Laboratory are allowed to enter and work here. All new and existing students must read and familiarize themselves with this document and Safety Rules that apply to this laboratory as well as to any specific equipment that they intend to use. Prior to obtaining access, each student must complete and pass the Safety Quiz and present a detailed outline and plan for his/her experiment, listing all procedures and equipment involved in his/her experimental work, and specifying its expected duration.

Students whose primary location is not Kaiser 3085-A / Kaiser 3085-B, may also request the access to Kaiser 3085-B Experimental Laboratory to use its equipment and facility for the duration of their experiment. All such students also must complete and pass the Safety Quiz and present a detailed outline and plan for his/her experiment, listing all procedures and equipment involved in his/her experimental work, and specifying its expected duration. This plan and request must be approved by the student's primary research supervisor, primary owner of the equipment in Kaiser 3085-B that will be used, and by the laboratory principal supervisor Dr. Juri Jatskevich.

In order to obtain access to this laboratory, the student must initiate the access request (email: access@ece.ubc.ca) through his/her primary research supervisor, as well as read and sign the Kaiser 3085-B Experimental Laboratory Access/Use Request Form that can be found in the Appendix at the end of this document. The request for the access must be approved by the student's primary research supervisor and by the laboratory principal supervisor Dr. Juri Jatskevich. Some student may not need to use experimental benches or equipment for all times, in which case their access to Kaiser 3085-A and Kaiser 3085-B will have different duration and expiration.

Generally, the allocation of experimental benches and equipment is done by the mutual agreement of the faculty members based on availability, relative priority as determined by the primary owner of the equipment, and first-come first-served basis. From time to time, the students may need to share the same benches and schedule their experiments in sequence as appropriate.

One person will maintain a document with students' names and their assignment to the experimental benches and/or areas (see Section 4.3). This duty will be passed to most senior graduate student, or post-doctoral fellow, or an Engineer with most experience in experimental research work.

4.1 Laboratory Working Hours:

The authorized students are strongly advised to work only during the regular day time hours and never to work alone very late and/or during weekends. In the circumstance of conflicting schedules, the students are required to inform their supervisor(s) and negotiate mutually agreeable times for their experiments.

4.2 Use of Equipment and Instruments

- a) To operate specialized equipment or instruments, e.g., motor setups, power system simulator, etc., **appropriate special expertise is required**. Please consult the owner supervisor(s) and experienced staff or senior graduate students for questions and the guidance.
- b) In each case, the student's research supervisor is responsible to ensure that his/her student(s) has (have) the **appropriate special expertise required to operate and use any particular equipment and instruments**. If the equipment/instrument belongs to a different faculty member (principal investigator), then the student and his/her research supervisor who intend to use it, must also obtain an approval from the faculty member (principal investigator) who is primarily responsible for this equipment/instrument.
- c) Under normal circumstance, equipment and instruments that belong to Kaiser 3085-B Laboratory are **non-transferable** and should remain inside this lab for all times. All these equipment and instruments may be shared within the laboratory space, but the user must always return it to its original place or shelf storage.
- d) All equipment and instruments that belong to Kaiser 3085-B Laboratory must have clearly visible labels with appropriate identification of the lab and their owner(s).

- e) Authorized students must use the equipment and instruments inside of the Kaiser 3085-B Laboratory and ask permission to use special equipment or instruments from the owner/supervisor.
- f) For lending equipment or instruments from Kaiser 3085-B Laboratory, please consult the responsible owner/supervisor, and fill out the lending form that specifies who lends/borrows the equipment, where it will be used, and for how long.
- g) For borrowing equipment/instruments from other labs, e.g., Kaiser 3075, the student and his/her supervisor must make special arrangements with the principal supervisor of that laboratory and fill out a similar form for lending/borrowing equipment.
- h) Private/loaned equipment or instruments are allowed to be used inside of the lab area only if permission has been granted by the responsible supervisor(s). The equipment and instruments are shareable only if permission has been granted by the owner.
- i) Any improper use of equipment or negligence may result in equipment failure and safety hazard. The student and his/her research supervisor bear the full responsibility for all consequences. To avoid and/or minimize such incidents, please follow the **General Safety Rules** that apply for this Laboratory as well as any other **Safety Rules and Instructions** that may apply for specific equipment or instruments.
- j) Any defective or failed equipment and instruments must be reported to their owner supervisor(s) immediately.

4.3 General Safety Rules:

- a) All personnel are required to have adequate medical insurance that covers any possible injuries that may occur while in this Laboratory.
- b) **No food and/or beverages** are allowed in this Laboratory at any time.
- c) **Wear appropriate clothing** and hair style that is not likely to get in the way of electronics setups or rotating machinery and moving parts! **Close-toe shoes are mandatory!**
- d) Prior to conducting any experiments and/or measurements, all students must be familiarized with this manual and **Safety Rules**, take and pass the **Safety Quiz**, and acknowledge this by their signature and signature of their direct research supervisor in the appropriate Form.
- e) For access and use of any specialized/custom equipment, the students must first study its functionality and safety. The student(s) must present a plan for his/her experiment. This plan must be first approved by the student's research supervisor, and then by the equipment supervisor/owner.

- f) **Your safety is most important!** High voltage equipment in the power lab can cause serious injuries or death. For increased safety, the normal laboratory experiments should be conducted using reduced voltages not exceeding **50 Volts DC or AC**.
- g) **No one** is **permitted** to conduct experiments with **HIGH VOLTAGE (>50V DC/AC)** or **HIGH POWER (>1KW) alone!** Two or more authorized students must be present and work together to conduct any such experiments.
- h) Always double-check your wiring circuit. Avoid short circuits and/or inappropriate use of equipment. The power supplies in the lab are capable of delivering **very high current**. High current can lead to fire, heat hazards, explosions, etc., and result in personal injury and equipment damage.
- i) Have your circuit checked by another authorized student/partner, post-doc, or an Engineer whenever necessary, especially if you are not sure and/or getting suspicious results or measurements.
- j) The laboratory includes small and high-power rotating electric machines that are capable of delivering high speed, torque and force. **Moving mechanical objects can cause serious injuries and damage to equipment, if used or applied inappropriately.**
- k) To avoid hazardous situations, always cover the rotating machinery parts (e.g., shafts, couplings, etc.) with the protective plastic cover, tightly couple and secure the subject electrical machine under study with special screws.
- l) Never put your hands or any other objects near the moving parts (shafts, couplings, etc.) of the machine while operating.
- m) **Avoid any clutter in your experimental working area!** Arrange all wires and components such that nothing can get in the way of rotating machinery and moving parts! When conducting experimental work on a bench or special equipment, the **student(s)** must organize his/her working place **to be safe and uncluttered!**
- n) During the on-going experimental work, the work area must be clearly marked with signs that indicate the name(s) of the student(s), his/her research supervisor, and expected end time.
- o) Do not touch or move experimental setups of other students without permission from the owner.
- p) Never leave an unattended setup live! Always shut down the power after experiment/measurement/test is complete.
- q) Upon completion of the experiments, all equipment and instruments must be returned to their designated places. All equipment/instruments that have been borrowed must be returned.
- r) Please remember to keep the Entrance door to the Laboratory **closed** after entering/leaving. If the door is left open for increased air circulation, please ensure that there is at least one person who can keep an eye on that door and ensure that

no outside visitors are coming/going, disrupting the work, or taking equipment/instruments.

- s) Students who do not have access to Kaiser 3085-B Laboratory are not permitted to conduct any experiments in this Laboratory and are treated as Visitors that must be accompanied and supervised at all times.
- t) The students authorized to work in Kaiser 3085-B Experimental Laboratory **carry full responsibility** for allowing Visitors to enter the lab. Any/All Visitors must be accompanied for their entire duration while in this Laboratory by at least one authorized student.
- u) In the case of accident, immediately notify the responsible supervisors, your fellow students/partners, and seek immediate appropriate medical help.
- v) **In the case of emergency call 911.** First Aid kit is available inside the Laboratory.
- w) Students and their direct research supervisors carry full responsibility for any consequences, injuries and/or damages caused by (or as consequence of) their negligence and/or inappropriate behavior in the laboratory, or any other violation of the safety rules and precautions.

4.4 Use of Specialized Equipment:

Some equipment Kaiser 3085-B Laboratory is very specialized and custom-designed, and as such it may be used only for certain experiments/project, and only with approval by its primary supervisor (principal investigator). For its use, in addition to the General Safety Rules outlined in Section 4.3, more specialized Documentation and Safety Rules apply as well. Please contact and consult the responsible supervisor(s) regarding any specialized equipment and procedures that have to be followed:

Power System Simulator: 16-Core Parallel Simulation Cluster with Multiple Monitors. The Cluster is capable of running Linux and Windows OSs. The cluster is also equipped with multiple IO cards that can be used for interfacing with real-time measurements and controllers for hardware-in-the-loop (HIL) simulations. The specific equipment includes the following:

High Power Machinery area: This area has two motor testing benches, The VFD Induction Machine bench, and The Electrometer Testing bench. Use of these benches is restricted to the students and personnel that are conducting research in related areas and have appropriate theoretical knowledge and practical experience in working with this equipment at live voltages. There are also plug connections to the 28/48/380 VDC system that is located in the neighboring lab Kaiser 3075. The use of high voltage and high power equipment is envisioned in the future, but is restricted for the present time only to special projects.

The VFD Induction Machine bench consists of two 1 HP and one 5 HP machines that are coupled and mounted on a heavy base. The machines are controlled by the VFDs that are mounted in the cabinet on the wall. The VFDs may be controlled manually or using the PLCs that are also mounted in a separate cabinet on the wall. The specific equipment includes the following:

Wherever appropriate, manuals for the equipment can be found either in the bench drawers or online. The student must become familiar with equipment and its manuals prior to using it.

2 X 3HP and 1 X 7.5HP VFD PowerFlex 700 AC Drives

(User Manual: <http://ab.rockwellautomation.com/Drives/PowerFlex-700#documentation>)

Allen Bradley PLC Logix5561

(User Manual: http://literature.rockwellautomation.com/idc/groups/literature/documents/in/1756-in101_-en-p.pdf)

A - Tech Instruments Ltd. DR-2112 Torque sensor (up to 200Nm)

(Specification: <http://www.a-tech.ca/series.php?tab=2>)

2 X 3HP Baldor- Reliance AC Induction Motors (230/460V AC)

(Specification:

http://www2.baldor.com/products/specs.asp?1=1&catalog=CM3546&product=AC+Motors&family=General+Purpose%7Cvw_ACMotors_GeneralPurpose&winding=34WGX269&rating=40CMB-CONT)

1 X 5HP HYUNDAI Crown Signature AC Induction Motor (230/460V AC)

1 X 5kW Custom-made resistor box for the brake mode

The Electrometer Testing bench is equipped with hysteresis dynamometer brake, Yokogawa power analyzer, grooved table top, torque/speed transducer, and adjustable test fixture for mounting the subject machines. The specific equipment includes the following:

Wherever appropriate, manuals for the equipment can be found either in the bench drawers or online. The student must become familiar with equipment and its manuals prior to using it.

Magtrol high speed controller DSP 6001 for the hysteresis dynamometer brake

(Manual: <http://www.magtrol.com/manuals/dsp6001manual.pdf>)

Magtrol hysteresis dynamometer brake HD-715-8N (up to 6.5 Nm, up to 25,000 rpm)

(Manual: <http://www.magtrol.com/manuals/hdmanual.pdf>)

Magtrol torque transducer TM 307/01 (up to 10 Nm, up to 20,000 rpm)

(User Manual: <http://www.magtrol.com/datasheets/tm301-308.pdf>)

Yokogawa 4 Element Power Analyzer WT1600 (up to 50 Amp, 1000 Volt)

(Specification: http://tmi.yokogawa.com/files/uploaded/bu7601_00e_044.pdf)

Magtrol test fixture AM-2

(Description: http://www.magtrol.com/motortest/amf_motor_fixtures.html)

Magtrol grooved table top PT25 B375/L800

(Description: <https://www.isel.com/uk/t-nutenplatte-pt-25.html>)

Magtrol blower Kit 173423 (for head dissipation from the brake, up to 3.6 kW)

(Description: http://www.magtrol.com/brakesandclutches/blower_cooled_brakes.html)

Magtrol Extended and Widened Table 1457L, with custom-made connection box

General Purpose Small Machines: There are two benches that may be used for experiments with small machines in this laboratory. One bench houses a machine-dynamometer setup that is capable of testing machines of up to 50 V, 0.5 HP, 3,000 rpm. This bench is also equipped with PC and a universal Measurement Box that is capable of simultaneous sampling and measurements of up to three channels of currents, up to three channels of voltage, torque, and speed. The real-time measurements can be displayed and recorded using the PC installed on this bench. Another bench is also equipped with the same Measurement Box. This bench also has a grooved table top that may be used to mount various subject motors for testing.

General Purpose Power Electronics Benches: It is envisioned that Kaiser 3085-B Laboratory also will have three general purpose benches for experimental work on various projects. These benches will be located as shown in Fig. 1. Presently, there is only one such bench and it is a temporary metal bench.

5.0 Appendix:

See following pages for an example of Safety Quiz and Access Request Form

Kaiser 3085-B Experimental Laboratory Safety Quiz

Name: _____ Student ID: _____ Date: _____

Circle only one most likely correct answer:

1) Can the students perform experiments in this laboratory **if they do not have** any medical insurance?

- a) No b) Yes c) Yes, if the supervisor allows d) Yes, if under the supervision

2) After you entering/leaving 3085, what should be done immediately?

- a) Make sure the door is closed behind you
b) Look at your cell-phone
c) Leave the door open
d) Do nothing

3) For your safety, the level of voltages should be kept as follows:

- a) < 100V ac and dc b) > 20V dc but < 50V ac c) < 50V ac and dc d) < 50V dc and <200V ac

4) You want to allow visitor(s) to enter the experimental section:

- a) They are free to use the section
b) They can be unaccompanied
c) You take the full responsibility of allowing them to enter the section
d) They don't have access so they are not allowed to enter

5) Moving mechanical objects (rotating machines and actuators in the lab) should be used with care and caution. Otherwise, they can cause serious injuries and damage to equipment because of the following:

- a) They are too heavy
b) They can cause fire
c) They can explode
d) They are capable of delivering high speed, torque and force

6) To reduce the chance of accidents with rotating machines and actuators, you should:

- a) Always cover the dynamometer machine. Avoid sticking your hands or any other objects near the moving parts (shafts, couplings, etc.) of the machine while operating.
b) Let your partner to do all the work with electromechanical devices
c) Ask your supervisor(s) to do all the coupling and configuration for you
d) Ask senior students do all the coupling and configuration for you

7) In case of malfunction and/or failure of equipment, you should:

- a) Keep it quiet as a secret
b) Report this to the responsible supervisor(s), and arrange for alternative solution or use of spare equipment

- c) Ask senior students
- d) Do your best and try to fix the equipment

8) In case of accident, you should do the following:

- a) Keep it quiet and leave the lab as soon as you can
- b) Panic and scream for help. Call 911.
- c) Call your parents and let them know what happens
- d) Immediately notify your fellow students/partners, and seek immediate appropriate medical help. In the case of emergency, call 911.

9) If you feel hungry or thirsty, you can do the following:

- a) Leave experimental section and have food
- b) Bring your own lunch and drink and have it in the experimental section while doing the experiments
- c) Have your drink (water, coffee, juice, etc.) only, but no food
- d) Do not eat, perform experiment while in hunger

10) If you want to use a bench which has an experimental setup on it:

- a) Relocate the setup and use the bench safely
- b) Relocate the equipment from the bench and perform experiment
- c) Seek answers from the responsible supervisor(s)
- d) Look for the setup owner and negotiate solutions

11) You are conducting a 60VDC/10A experiment at 10 pm alone. This is not allowed, why?

- a) It's too late
- b) Power is too high
- c) You are alone, two or more authorized students must be present
- d) Voltage is too high

12) You have finished your experiment, and now it is most appropriate to do the following:

- a) Time to go home
 - b) Shut down the power, clean the setup and then leave
 - c) Leave now, but do the clean-up tomorrow
 - d) Other personal will do the clean-up job for you
-

Kaiser 3085-B Laboratory Access and Equipment Use Request Form

Family Name: _____ First/Given Name: _____

UBC ECE Email: _____ Non-UBC Email: _____

Phone: _____ Cell Phone: _____

Research Program or Status at UBC/ECE: _____

Requesting to use (describe equipment you intend to use): _____

I am attaching a detailed plan for the proposed experiment (yes / no): _____

Expected start date: _____, end date (if known): _____

Instructions are given by (Name of Volunteer Student): _____

Date: _____

By signing below, you are acknowledging that you have read the "Access and Safety Rules for Kaiser 3085-B Experimental Laboratory" and will comply with all conditions and procedures explained therein.

Student's Name and Signature: _____

Date: _____

Student's Primary Research Supervisor at UBC/ECE: I have read and approved the students plan for conducting experimental work in this lab. I certify that the student has all appropriate knowledge of equipment and safety: _____

Date: _____

Kaiser 3085-B Supervisor at UBC/ECE: _____

Date: _____