Safety rules for work in laboratories at The Department of Energy Technology, Aalborg University

The rules are applicable to laboratories in and around Pontoppidanstræde
Safety rules can also be found at https://www.et.aau.dk/Safety/

PURPOSE

The purpose of the safety rules is to make the laboratories a safe place to work, and to prevent accidents.

LABORATORY TYPES, WORKSHOPS AND ACCESS

The laboratories are divided into two categories:

- Standard laboratories which are open to those, who have completed an approved safety course and have signed a Work Place Permit form (WPP), see Appendix 1.
- Specialized laboratories, which are open to those, who have obtained special permission and instruction from the laboratory responsible and/or have completed a special safety course and have signed a WPP, see Appendix 1.

There are two categories of workshops:

- Workshops which are open to those who have received instructions; thereby allowing them to work with all tools available in these workshops.
- Workshops which are only open to laboratory staff employed at the Department.

LABORATORY OPENING HOURS

The normal opening hours of the laboratories are 08:00 to 15:30 on weekdays, however 08:00 to 15:00 on Fridays. Students are not allowed to access the laboratories outside of normal opening hours unless they have received special permission.

EQUIPMENT

Instruments and other equipment may only be removed from the laboratory if a special agreement has been made with the laboratory staff; all loans must be registered in the logbook kept by the laboratory responsible.

Instruments and other equipment borrowed for a setup must appear in the WPP.

When an experiment has been completed, all equipment must be cleaned and returned to its proper place, unless other agreement has been made.

Instruments, equipment, components and cords which are not being used in an experimental setup must be returned to their proper places. Instruments, equipment, components and cords with suspected defects must be handed over to laboratory staff together with a written description of the defects.

Defective equipment may only be repaired by laboratory staff.

Private equipment and tools may only be used in laboratories if special permission has been given by the laboratory responsible.

Private use of laboratory equipment may only take place if special permission has been given by the laboratory responsible.

FIXED INSTALLATIONS

Any changes or modifications of fixed setups, operation of main switches must only be carried out by qualified members of staff. This is also the case for coupling to all fixed thermal and hydraulic setups such as the cooling tower, cooling water and hydraulics. Observed defects and faults must be reported immediately to the laboratory responsible/laboratory staff. The mounting of power supply cords on instruments/equipment may only be carried out following consultation with the laboratory responsible/laboratory staff. Employees, students and guests must not make extension cords, neither single-phase nor three-phase.

GENERAL SAFETY PRECAUTIONS

When students and PhD students are working on a setup to which voltage is applied or a setup in operation, a minimum of two persons must be present in the laboratory. Members of staff are also encouraged to comply with this rule, and to inform colleagues if they are working alone with laboratory setups. In special circumstances, where no safety risks are associated with student setups, the Department may make an exemption from this rule.

All persons working in the laboratories must always prepare a WPP describing the setup and the experiments to be carried out. Persons not affiliated with AAU, Department of Energy Technology are not allowed to work or stay in the laboratories. All should plan and organize practical experiments so that they are performed in a way which complies with both safety rules and health regulations. Furthermore they must check if personal protective equipment should be used - such as ear protection, eye protection, respirator, gloves, local exhaust ventilation etc. Safety shoes should always be worn in case of lifting heavy equipment and should always be worn in the marked area.

Employees, students, PhD students and guests must read the manuals and instructions for the equipment to be used thoroughly before a new experiment is initiated. If the experimental setup is used together with fixed setups or installations or in a specialized laboratory, instructions and guidelines for the equipment or laboratory in question must be studied carefully. If these are not sufficient, or if queries arise, ones academic supervisor or the laboratory responsible needs to be contacted.

Employees, students, PhD students and guests must pay attention to the location of emergency stops and other switches of the experimental setup.

Students, PhD students and guests must not apply voltage to test setups or set them in operation until the academic supervisor or the laboratory responsible has approved the setup. This approval must be given on the basis of the WPP. This WPP must also be made by employees having experimental setups.

Employees, students, PhD students and guests must keep the test area and its surroundings tidy. The setup must be labeled with project group name, group number, group room, email address and name of academic supervisor.

Employees, students, PhD students and guests may only dismantle and open equipment if this has been agreed with the laboratory supervisor, including a description of the procedure to be followed by the students.

Employees, students, PhD students and guests must use gloves, eye protection equipment and other special clothing if required by the circumstances.

Running is not allowed in workshops and laboratories.

Food and drink are not permitted in laboratories.

The general safety rules apply in all laboratories and workshops. Please note that additional rules may apply to specialized laboratories; these will be described in the sections below.

ELECTRICAL SETUPS AND SPECIALISED LABORATORIES

Experimental setups that are in operation and/or under voltage, must be marked with yellow warning signs.

The sign must be removed when the setup is not operating. Warning signs can be obtained from laboratory staff.

Open setups with live parts to which voltages above 25 V AC or 60 V DC are applied, must be protected against direct contact by a shielding device, for instance a chain. The chain must be placed at a height of 1.1 to 1.3 meters, and the distance between the chain and the live parts must be at least 20 cm. Students and staff working on the setup may work within the chained area, whereas everyone else must stay outside of the chained area. There must be a free walking area of a width of at least 70 cm outside of the chained area. The chains are available from the laboratory staff.

When leaving experimental setups to which voltage is applied, employees, students, PhD students and guests must first obtain permission from the laboratory responsible and make sure the setups are completely screened off. Setups must be marked so as to make it apparent that voltage is applied to them and an experiment is running.

Any changes in experimental setup or circuit must only be made after the power has been turned off.

Capacitors with an imprinted voltage above 60 V are placed in a cupboard marked with the sign “High Voltage Capacitors”; when they are not in used, they must always be returned to the cupboard to be discharged and fitted with a discharging device. For supercapacitors see section 4.

In case of experimental setups which are not galvanically isolated from the grid, an isolation transformer must be used; this must be placed on the supply side in front or the oscilloscope or other measuring instrument, in case these are not fitted with integrated galvanic isolation.

When working with batteries, see SETUPS WITH FLAMMABLE FLUIDS AND GASES AND ELECTROCHEMICAL CELLS (page 5)

Voltages above 1000 V AC or 1500 V DC may only occur in setups located in “Locked power operator’s stations”, including the following rooms:

The high-voltage laboratory in room 1.125 at Pon 109, and locked enclosure at Pon 107, room 2.117.

Everyone working in these laboratories should read Appendix 2

“Safety rules for working with high voltage”

HYDRAULIC AND MECHANICAL SETUPS AND SPECIALISED LABORATORIES

Test setups in operation must be marked with a yellow caution sign

Guards must be placed on all pressurized setups. It is not permitted to be inside of the screen enclosure while experiments are in progress in the setup, or when this is in a pressurized condition.

Guards must always be placed on rotating machine parts and shafts in operation.

Always check that equipment, components, fittings and hydraulic hoses, etc., are dimensioned to match the desired pressure, flow and temperature. Hydraulic pipes are color marked; red for 350 bar, and blue for 200 bar.

Drip trays and skid proof mats must be used under and around setups in which oil spill may occur.

In case of skin contact with hydraulic oil, wash the affected area with soap as the oil may provoke allergy.

Only instructed laboratory staff are permitted to make changes in experimental setups.

When experimental setups are not in use, they must be relieved of pressure if possible, and must always be placed in safe positions. The above applies to cranes etc., which must be placed in the lowest position.

SETUPS WITH INFLAMMABLE FLUIDS, GASSES AND ELECTROCHEMICAL CELLS AND SPECIALISED LABORATORIES

If hazardous substances and chemicals are included in a project work, the workplace instructions (APB) for the substance(s) and chemical(s) must be studied, and the mandatory guidelines must be followed.

Workplace instructions may be found at www.kemibrug.dk; using normal AAU login and password (xxx@et.aau.dk or yyy@student.aau.dk).

In setups including systems with fluids, electrical systems and pressurized constructions, the following guidelines should be observed to the extent possible:

- Electrically conductive fluids should, to the extent possible, be placed under the electrical installation in order to prevent accidental short circuits in case of leakage.
- When a setup is not used, care must be taken to shut off gas supplies and leave the setup in a safe condition.
- When using non-metal based pipes, special care must be taken not to place these close to heat sources in order to prevent hose burst.
- Electrical circuits or components that might ignite or spark combustible gases and fluids should be placed outside of fume cupboards where combustible gases and fluids are used; examples of these are brushed DC motors, electromechanical relays, fuses etc.
- Care must be taken to ensure that setups with gases and chemical reactors are primarily undertaken in well ventilated areas, e.g. fume cupboards, and with gas alarms that can detect any possible leakages or the presence of high concentrations of hazardous substances.
- In the case of a gas alarm, a visual and audible alarm will be activated, and if accidental high gas concentrations are detected, the fuel supply will be interrupted. The laboratory supervisor or any other designated persons must be contacted in case of gas alarms, and instructions must be given to all laboratory staff as regards any special action to be taken at the sounding of an alarm. The reason for the gas alarm must be entered in the log book located in the alarm box.
- Do not access a laboratory with an active alarm; contact the laboratory responsible.
- Pressure bottles must be transported with care and must always be secured and protected when used to make sure they cannot fall over.
- Prolonged storage of flammable liquids and gases for laboratory setups must be agreed with the responsible laboratory staff.

Note: Typical signals of gas explosions are small bangs, crackling or sudden heat development. Remember that some combustible fluids and gases burn with an invisible flame, for instance hydrogen and some alcohols.

In setups using batteries, the following guidelines must be followed:

- Manuals, Material Safety DataSheet (MSDS) or the like must be accessible for the battery cells used; they must be entered in the WPP of the students, and laboratory staff must receive information as regards special safety requirements.

- Open conductors and connectors must be protected against accidental short circuits by the use of non-electricity conductive shielding and LAUS tools.

- Wires or electrodes of temporarily unused batteries must be secured against accidental short circuits by shielding or clear labeling.

- Some battery types may catch fire which is difficult to extinguish. When using battery types that are particularly flammable, explosive or gas emitting in the event of an accident, a setup must be planned which enables the removal of batteries in case of an accident.

- Some batteries develop hydrogen, a flammable gas, when charging and must therefore be charged in specially ventilated spaces, such as a battery charging room (see Appendix 1 for the location of the room).

- Unused batteries of a capacity of more than 5Ah must be stored in dedicated battery charging rooms, see Appendix 1 for the location of such rooms, or similar ventilated rooms. Major quantities of batteries or unused batteries must be clearly marked as regards ownership.

- If Li-ion batteries are used, a Battery Management System or other monitoring and safety device must be available in order to avoid overvoltage, under voltage, extreme temperatures etc., all of which may cause a fire.

- If major networks of supercapacitors and ultra-capacitors are used, a cell balancing system must be installed to ensure safe charging of individual capacitors. Storage of supercapacitors must take place by the mounting of a discharging device in dedicated battery charging rooms, see Appendix 1.

Dispensation from the above rules may be obtained in writing from the laboratory responsible in question (see the list on page 14). The setup must be clearly labeled with the information that dispensation was granted from the general guidelines and a description of the content of the dispensation.

SETUPS WITH LASER EQUIPMENT

In case laser equipment class 3a or above is used in a setup, the entire laboratory will classify as a specialized laser equipment laboratory.

At all laser equipment laboratories class 3a or above, all entrance doors must display a “DESIGNATED LASER AREA” label.

- People working on the experimental setup must be instructed in the use of laser equipment and must complete a laser safety course before they are allowed to commence work on the setup.

- If the laser is used outdoors, it must be ensured that BL 3-41 "provision on the use of laser light for outdoor purposes" is observed. Violation of this provision may be punished with a fine or in accordance with the rules laid down in chapter five of the criminal code, cf section 149, subsection 14 of the Danish Aviation Act.

- The use of experimental setups that require class 3a lasers or higher must only take place by prior agreement with the laboratory responsible.

- Setups in which laser equipment is used may only occur during laboratory opening hours. Dispensation may be given in connection with certain experiments in special cases where operations lasting beyond the normal opening hours of the laboratory are necessary. In such cases, special precautions must be taken to the extent possible to ensure that failure in setup subsystems does not cause damage to people, buildings or equipment.

- In connection with an experimental setup using laser equipment, a workspace and a measuring area must be defined in which a lightproof barrier must be established. In the workspace, it must be possible for users to work at minimal risk; however, no-one is allowed to access the measuring area while laser equipment is in operation.

- The workspace is limited by the room in which the laser setup is located. All entrance doors must display a “DESIGNATED LASER AREA” label. The workspace is marked with a yellow/black chain as well as warning labels. No-one except the Laser Safety Officer (LSO) may enter the designated laser area at any time.

- An appointed Laser Safety Officer (LSO) must ensure that the measuring area of the experimental setup is shielded in a satisfactory manner to make sure that laser light or reflections do not pose a safety risk to people working in the designated area.

- Action must be taken to prevent laser beams from being seen outside of the workspace. Persons staying in the workspace while laser equipment is in operation are required to wear safety glasses protecting against light on the laser wavelength being used.

- In connection with the preparation of laser equipment (up-lining etc.), where lightproof shielding may be difficult, the entire room must always be sealed off as described above. In addition, a blue light will be present outside all entrance doors to the laboratory. An LSO must participate in this part of the work. To the widest extent possible, safety glasses must be

worn during preparation. During preparation, the laser equipment must be set at the lowest possible light output.

- People who are working with laser equipment, or are present in a work or measuring area where laser equipment is in operation must not wear jewelry, watches or other shiny objects as these may cause accidental uncontrolled reflection.
- In the construction of experimental setups, shiny surfaces must be avoided in areas exposed to laser light.
- Experimental setups must be equipped with warning signs and necessary shielding.
- People who are working in the laboratory must, without exception, follow all instructions given by the LSO or the laboratory staff supervising the experiment.

WORK IN DEPARTMENT WORKSHOPS

The following rules must be observed in connection with work in the workshops:

- Access is only permitted for people wearing safety footwear
- For work with rotating machines the following applies:
    - No loose-fitting clothing is allowed
    - No gloves are allowed
    - A rotating machine should never be left unshielded
- No flammable clothing is allowed for thermal cutting/joining or when using burners/open fire
- No use of machines and tools without adequate instruction/authorization from the workshop staff
- No access to the welding booth and grindery or other premises in which welding/grinding is taking place for people without a section 26 course certificate.
- The workspace must be kept neat and tidy
- Tools and equipment may only be removed from workshops by agreement with the workshop staff and must be returned immediately after use.
- No tools should be returned in faulty condition; any defects must be communicated to the workshop staff
- Compressed air and gases must be turned off at the shut-off valve at the end of each working day

BIO FUEL & PACKAGING LAB

General:

- No use of instruments or equipment without required instruction/permission from the lab responsible
- Food and drinks are not allowed in the laboratories
- Cleaning up in the lab is the responsibility of the user. Chemicals must be returned to the chemical cupboard, glass equipment must be washed and returned to the glass cupboard and tables must be wiped off.
- In case of any doubts regarding the use of chemical substances in lab, please contact working environment representative Anne Kofoed Rasmussen (akr@et.aau.dk, phone: 2041 5752) or Frank Rosenbeck (fro@et.aau.dk, phone: 99403346). Both Frank and Anne are responsible for the disposal of waste from the labs.

Chemicals:

Instruction: Before using chemicals, the directions for the chemicals must be downloaded from “kemibrug” where instructions can be found in Danish and English. Directions for use must be read and examined and specifications must be followed. “Kemibrug” can be found on http://www.kemibrug.dk and can be used with AAU mail address and password

Labeling: All chemicals and mixtures must be labeled with a Danish label with the applying pictograms and risk phrases. Labels can be printed using “kemibrug”.

It is not allowed to store unlabeled samples, chemicals or mixtures in the lab. This is also the case for fume hoods, chemical cupboards etc. In rare cases, it is however allowed to store unlabeled samples in fume hoods provided that they are used or disposed the same day.

Storage: Chemicals must be stored in ventilated cupboards and separate respecting the following four storage categories:

- **Poisonous substances:** Poisonous/toxic substances require locked storage and inventory of goods. A safety responsible person must be appointed. If a toxic substance is also inflammable, the substance must be kept with the poisonous substances.
- **Inflammable substances:** Inflammable substances must be kept separately. In case of liquids, the limit is 50 storage units pr. laboratory/storage facility with fire separation towards other labs/storages (1 storage unit = 1 liter for most organic solvents).
- **Acids:** Acids must be kept separately and apart from other substances, with which they could form dangerous combinations. For example organic solvents and alkaline substances.
- **Other chemicals:** Other chemicals include bases which is often solid substances.

In Bio Mass lab there are separately marked cupboards for all four categories.

Storage of oil samples: There are additional requirements for the storage and treatment of oil samples. Samples must be kept under constant venting and in the cupboards designed for this purpose. Samples must be labeled with content, pictograms and risk phrases.

Protective equipment

Protective gear must be used referring to the descriptions in the instructions.

- Lab coat: If chemicals are handled, a lab coat must be used.
- Gloves: Different gloves are used for different purposes. When handling corrosive liquids, gloves made of nitrile/latex must be used. When handling hot objects, thermo-gloves or working gloves must be used.
- Safety shoes: When handling heavy objects, safety shoes must be used.
- Safety goggles: Goggles must be worn when there is a risk that chemicals or hot/cold objects could get into the eyes.
- Walk-in cabin: When working in a Walk-in cabin, the person must carry safety equipment corresponding to the dangers. This means face protection or half mask and disposable coverall if chemicals which can penetrate the skin are handled.

Registration: All chemicals must be registered in ”kemibrug”. The registration must be performed by the lab administrator for relevant laboratory where the chemical is stored.

Refrigerator: It is not allowed to keep fresh organic material (such as algae) in the refrigerator for longer periods. For short term storage, the material must be sealed in air and waterproof wrapping.

Use of fume hoods/point suction: Handling of chemicals harmful to health must allways take place in fume hoods. When this is not possible, local point suction must be used (for instance during weighing or working with analysis instruments).

Pressurized equipment: Setups using pressurized units must be approved by the laboratory responsible before experiments are initiated.

Sand bath: When using the sand bath, goggles and thermo-gloves must be used. The safety precautions in the manual for installation and removal of micro-reactors must be followed.

Pressurized bottles: Pressurized bottles must be fastened with chains or kept secured in a wagon.

Waste: Waste must be sorted according to the sorting guidelines according to which substances such as halogens, sulfur, peroxides etc. the waste contains. Waste must be disposed in containers intended for disposal of the chemicals in question.

Liquid waste must be kept in bottles under ventilation – preferably in a ventilated base unit of a fume hood.

Used needles must be disposed in authorized needle-boxes from RenoNord.

WORK IN STUDENT WORKSHOPS

Only students with a project work permit may use the student workshop.

Only students who have attended a demonstration of and an introduction to the workshop at a special course may use all workshop tools and facilities during normal opening hours.

No tools may be removed from or brought into the workshop. If tools are needed in other locations, tool boxes may be borrowed from the workshop-responsible students. However, tools marked with a blue color may be taken to other locations provided they are returned immediately after use.

Users must tidy up, return tools to their places and clean the laboratory after each workday in the workshop.

No experiments may be run in the student workshop.

Outdoor clothing and bags must be placed in the cloakroom and must not be placed in the workshop.

Groups or individuals who do not comply with workshop rules may lose their access permit to the workshop.

All damage, mistakes and shortage of materials must be reported to the student in charge of the workshop. The student in charge of the workshop will currently supervise the workshop and take stock of material consumption once a week as a minimum.

The student in charge of the workshop may, at any time, expel groups that do not comply with the written workshop rules and the general code of conduct applying in workshops. Complaints against decisions made by the student in charge of the laboratory may be made to the member of staff in charge of the laboratory.

ACCIDENTS AND NEAR-ACCIDENTS

In case of personal injury, use the five first-aid key phrases

1. Stop the accident (press the emergency stop button and disconnect the power supply)
2. Provide life-saving first aid
3. Ring 112 to call for help
4. Provide normal first aid
5. Call the responsible laboratory technician or a member of the security group

Specific guidelines for electrical accidents If a person is affected by a voltage above 25 V AC or 60 V DC, help must always be called for on Tel. 112; make sure you inform the emergency dispatch center that you are calling about an electrical accident.

Near-accidents: Contact the person in charge of the laboratory, who will assist you in registering the near-accident.

REMEMBER THAT

Students carrying out practical exercises or work-related experiments are covered by the Danish Work Environment Act; this means that the educational institution is responsible for ensuring that activities in the workshop (exercises and experiments) take place in a safe and healthy environment.

IMPROVEMENTS

It is the responsibility of the working environment committee to currently update safety regulations, and if you have any suggestions as to the improvement of the level of safety in laboratories or for additions to the present regulations, please submit these to a member of the safety committee.

Members and organisation of the working environment committee

Role	Name	Discipline	Email	Tel.
Chairperson	Lasse Rosendahl	ET	lar@et.aau.dk	+45 9940 9263
Minute taker	Anette Larsen	ET	all@et.aau.dk	+45 9940 3623
Designated supervisor	Mads Pagh Nielsen	Gas/Chemicals	mpn@et.aau.dk	+45 9940 9259
Designated supervisor	Lasse Schmidt	Hydraulics/Mechanics	lsc@et.aau.dk	+45 9940 7213
Designated supervisor	Henrik Sørensen	Office/Laser	hs@et.aau.dk	+45 9940 3306
Designated supervisor	Tamas Kerekes	Electricity	tak@et.aau.dk	+45 9940 3308
Elected employee representative	Walter Neumayr	Electricity	wn@et.aau.dk	+45 9940 9270
Elected employee representative	Christian W Dissing	Office	cwd@et.aau.dk	+45 9940 9443
Elected employee representative	Mads Lund	Electricity/Mechanics	mal@et.aau.dk	+45 9940 9272
Elected employee representative	Anne Vibeke Kofoed Rasmussen	Gas/Chemicals	akr@et.aau.dk	+45 2041 5752

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Appendix 1

List of laboratories and specialised laboratories at the Department of Energy Technology

105, Pontoppidanstræde

Function/laboratory name	Room	Laboratory responsible
Measuring, Control & Aligment	1.109	Jan Christiansen/Henrik Nielsen
Danfoss	1.122	Jan Christiansen/Danfoss
Flex Laboratory	3.119	Jan Christiansen
Flowlab	4.105	Henrik Sørensen/Jan Christiansen
Fluid Power Actuators and Components	2.125	Michael Møller Bech/Jan Christiansen
Fluid Power and Mechatronic Systems	2.117	Michael Møller Bech/Jan Christiansen
Heavy Lab	2.117	Jan Christiansen
Machine workshop	1.126	Henrik Nielsen/Bjørn B Jensen
Model workshop	1.107	Flemming Larsen/Frank Rosenbeck
Power Electronics Power Distribution Laboratory	3.104	Xiongfei Wang/Jan Christiansen
Cleaning and painting	1.106	Flemming Larsen/Frank Rosenbeck
Workshop, assembly	2.105	Jan Christiansen/Bjørn B Jensen

107, Pontoppidanstræde

Function/laboratory name	Room	Laboratory responsible
Power Electronics Power Distribution Lab.	3.104	Xiongfei Wang/Jan Christiansen
Cleaning and painting	1.106	Flemming Larsen/Frank Rosenbeck
Workshop assembly	2.105	Jan Christiansen/Bjørn B Jensen
Battery storage	2.136	Mads Lund
Bio Fuel Analysis	2.144	Lasse Rosendahl/Anne K
Bio Fuel Combustion	2.143b	Lasse Rosendahl/Jan Christian-sen/Anne K Rasmussen
Bio Fuel Combustion	2.143c	
Bio Fuel Production	2.143a	
Drives Control	3.107	Tamas Kerekes/Jan Christian-sen/Mads Lund
Drives Test	3.111	Kaiyuan Lu/Mads Lund/Jan Christian-sen
Drives Traction	2.137	Peter O Rasmussen/Jan Christiansen
ECO Racer	1.101	Simon L Sahlin/Jan Christiansen
Electrical Engineering Laboratory	2.109	Szymon Beczkowski/Walter Neumayr
Flexible Thermal Laboratory	1.101-1.105	Jan Christiansen/WN/MPN/HS
Flexible Thermal Laboratory	1.109-1.115	Jan Christiansen/WN/MPN/HS
Fuel Cells and Electrofuels Laboratory	2.129	Simon L Sahlin/Jan Christiansen
Storage	2.103	Walter Neumayr
Storage/workshop	2.203	Walter Neumayr
Low Power Energy Harvesting	2.134	Alireza Rezaniakolaei/J Christiansen
National Instrument	3.101	Jan Christiansen/Henrik Søren-sen/Michael Møller Bech
PE Component Analysis	2.101	Chungen Yin/Walter Neumayr
PE Packaging	1.123	Chungen Yin/Walter Neumayr
Power Electronics Converter Laboratory	2.105	Yongheng Yang/Walter Neumayr
Power Electronics Reliability	2.118	Francesco Iannuzzo/Walter Neumayr
Power Electronics Systems	2.117	Szymon Beczkowski/Walter Neumayr
Students' Electrical Workshop	1.121	Jan Christiansen/W Neumayr/Stud
Students' Mechanical Workshop	1.119	J Christiansen/Walter Neumayr/Stud
Thermal Systems and Components Lab.	2.130	Carsten Bojesen/Jan Christiansen
Battery Systems Test Lab	2.231	Daniel-Ioan Stroe/Mads Lund
Electrical Engineering Laboratory	2.211	Szymon Beczkowski/Walter Neumayr
Fuel Cells and Electrofuels Laboratory	2.229	Simon L Sahlin/Jan Christiansen

109, Pontoppidanstræde

Function/laboratory name	Room	Laboratory responsible
AC Microgrid Lab	1.117	Josep M. Guerrero/Juan C. Vasquez/Mads Lund
DC Microgrid Lab	1.117	Josep M. Guerrero/Juan C. Vasquez/Mads Lund
EMC Laboratory	1.113	Pooya Davari/Mads Lund
Smart Energy Systems Laboratory	1.103	Florin Iov/Mads Lund
Wind Power System Laboratory	1.103	Zhou Liu/Mads Lund
Modular Multilevel Converters Laboratory	1.104	Remus Teodorescu/Mads Lund
High Voltage	1.125	Claus Leth Bak/Mads Lund
HV Control	1.124	Claus Leth Bak/Mads Lund
PV Systems Lab	1.135-1.137	Sergiu Spataru/Tamas Kerekes/Dezso Sera/Mads Lund
Storage room	1.126	Mads Lund
Workshop	1.129	Mads Lund
Advanced Control of Power Converters for Future Energy Systems	1.121	Tomislav Dragicevic/Mads Lund
MV test lab	MV building	Claus Leth Bak/Mads Lund
MV control	MV building	Claus Leth Bak/Mads Lund
PV Outdoor Test Platform	MV building	Dezso Sera/Sergiu Spataru/Mads Lund/Jan Christiansen
PV Monitoring Station	MV building	Dezso Sera/Sergiu Spataru/M Lund
IoT Microgrid laboratory	no number	Josep M. Guerrero/Juan C. Vasquez/Mads Lund

Outdoor platforms

Function/laboratory name	Room	Laboratory responsible
Yard Pon 109 (elefantgården)		Mads Lund
Outdoor test platform 1		Jan Christiansen/Tamas Kerekes
Outdoor test platform 2		Jan Christiansen/Torben O Andersen
Outdoor test platform 3 bio fuel		Jan Christiansen/Lasse Rosendahl

Appendix 2
Safety rules for **work with high voltages**

These safety rules are valid for work with voltages above 1000Vrms ac-voltages or 1500Vdc-voltages from systems capable of supplying currents above 5 mA or systems which include capacities with energy higher than 10 Ws.

1. When working with high voltages, two persons must always be present. All persons, who take part in the test, must be confident with the used test system and should be capable of closing down the systems. From a practical point of view, a person working close to the test set-up can be considered a member of the test (a so-called help guard). This person should be aware that he or she is a test member and should be confident with the test system, the used test set-up and these safety rules.

2. In arrangement with the head of the laboratory or his substitute the person, is making the high voltage test has the full responsibility for the technical as well as the safety part of the test. In case of several test members, one of the members only, is responsible and the other members must obey this persons authority.

   The responsible person must control the following:

   - That the test set-up, the safety grid and the test are made in agreement with these safety rules
   - That all test members are confident with the used test set-up
   - That all test members are aware of these safety rules

   Furthermore, the responsible person of the test must take care that continuous information is given to the other test members, such as:

   - Removal of grounding sticks and closing of the safety grid
   - Connection of the power supply
   - Decoupling of the power supply
   - Opening of the safety grid and grounding of the test set-up

   If a help guard is used during the test, the responsible person of the test must inform the help guard of starting up and closing down the test.

   NB! A safety guard must only be entered with permission from the responsible person of the test in this area.

3. If one of the test members is leaving the test, this information must be given to the responsible person of the test

4. The voltage supply to the test system must take place via two series connected switches which both must be in switched-off position when working on the test set-up.

5. During set-up of test systems all parts, which can be supplied with high voltage, should be placed with a secure distance to the measuring equipment and the controlling parts to secure that these parts are not being injected with high voltages at unwanted flashovers. The distance from the equipment carrying high voltages to walls and other building parts should be at least 1m per 400 kV impulse voltages and at least 1m per 200 kV alternating voltages, yet at least 0.5m

6. The test system is to be secured with a mechanical and an electrical barrier. On the barrier (safety grid) warning signs must be set up. When the test system is not being used the door in the safety grid must be left open. The distance from the safety grid to the voltage carrying parts must be at least 0.5m or the distances mentioned in rule number 5.

7. In every test set-up such a number of grounding sticks (at least one) must be used so that all necessary parts of the set up can be grounded permanently after opening the safety grid.

   NB! Removal of the grounding stick(s) is(are) the last thing to be done before the safety grid is closed, and the grounding sticks are the first thing to be put on after the safety grid has been reopened.

8. After the grounding sticks (rule number 7) has been removed from the test set-up the safety grid is closed. When the safety grid is closed, no one must be inside the test area as well as no one must set foot on the test area without opening the safety grid. When the safety grid is closed, the test set-up is regarded as supplied by voltage. This means that the test set-up is not to be left.

   NB! During long term tests, an agreement with the head of the laboratory or his substitute must be made since special rules have to be used for long term tests.

9. As energized capacitors can lead to dangerous voltages, the capacitors in the test set-up must be efficiently grounded before working on the test set-up. It is not enough just to short circuit the capacitors with the grounding stick as dielectrical repercussions can lead to new high voltages on the capacitors. Therefore, the capacitors in the circuit must be permanently grounded when the test area is opened. Series coupled capacitors are only made without voltages by short circuiting the terminals if all capacitors have the same time constant. Before series coupled capacitors are touched they must therefore be efficiently grounded separately.
   Capacitors, which are not used in a test set-up, should normally be short circuited.

10. The test set-up must be grounded with regard to safety, measuring and service as bad or missing earthing connections may lead to dangerous voltages, for instance on the measuring circuit. All earth connections must be properly made (screwed together, soldered or made by another approved connection) and they should be placed with uninsulated leads so that they are visible.

11. The operation procedure for the different test set-ups must be obeyed.

    For students working in the High Voltage Laboratory the following must also be obeyed:

12. Students, working in the laboratory must unconditionally follow the directions given by the personal in the laboratory who has the supervision of the test.

13. During test one of the students (rule number 2) has the responsibility for the whole test team. Before voltage is connected to the system, the test set-up and the safety grid must be approved by the supervisor who also must approve and supervise the test until the test set-up with capacitors is made without voltage and grounded efficiently. The test set-up must not be touched until permission is given by the supervisor.

No dispensation is given to these safety rules without agreement from the head of the laboratory or his substitute in each case.

I understand and agree on the above safety rules

Date:_____ Name:_____