



BUILDING A TALENT TRUST

# Department of Mechanical and Mechatronics Engineering University of Waterloo

## **MME Laboratory Health and Safety Manual**

### **Contacts, Regulations and Guidelines for Undergraduate Students**

This Manual and Regulations are applicable to all undergraduate students  
in the  
Department of Mechanical and Mechatronics Engineering.

**Everyone must sign a Health and Safety Declaration sheet;  
otherwise,  
participation in Labs or Workshops will be refused.**

The MME Online Safety Quiz is recommended for all  
students who enter labs and can be found at:

[http://www.safetyoffice.uwaterloo.ca/hse/online\\_training/MTE/MTE.html](http://www.safetyoffice.uwaterloo.ca/hse/online_training/MTE/MTE.html)

**Last Revised: June 2013**

## **Emergency Phone Numbers**

<b>Fire, Ambulance, Police</b>	911
<b>Security/UW Police</b>	22222
<b>Plant Operations</b>	33793
<b>On-Campus Health Services</b>	84096
<b>Poison Information Centre</b>	6-519-749-4220
<b>Director of Safety: Kevin Stewart (COM-106)</b>	35814
<b>Safety Office</b>	33587
<b>For Chemical Spills or Radiation Exposure</b>	22222
<b>Department of Mechanical Engineering: Marlene Dolson (E5-3051)</b>	33328
<b>Department Chair: Jan Huissoon (E5-3027)</b>	84508
<b>Laboratory Director: Michael Herz (E3-2111)</b>	33026

## ACCIDENTS

In case of an accident follow the instructions posted in each Laboratory, or

1. **Small injuries** during normal business hours should be managed at our primary First Aid Station in E3-2108H. There is a sink and a First Aid Kit there. If you are not sure that you could make it there safely, call for help or get to a phone and dial 22222.

Mechanical Engineering Department staff who are trained in First Aid are listed on Page 1 of this Safety Manual.

2. **Severe injury** cases should be handled by calling **911**. On placing an emergency call, the Campus Police automatically receive a signal, and display indicates the exact location of the call to which an officer is then immediately dispatched. If the emergency is not in the same location as the call is placed, someone should wait near the phone from which the call was made to direct the officer to the scene.
3. If in any doubt, call the UW Police at 22222 who can help with any issue.
4. Review the use of emergency eye/face washes and showers at our Safety' Office's webpage:  
[http://www.safetyoffice.uwaterloo.ca/hse/eyewash/eyewash\\_standard.htm](http://www.safetyoffice.uwaterloo.ca/hse/eyewash/eyewash_standard.htm).

We have the following devices installed in Mechanical Engineering labs:

- E3-2101 Eye/Face Wash/Drench Hose
  - E3-2105 Eye/Face Wash/Drench Hose
  - E3-2118E Eye/Face Wash and Shower Combination
  - E3-2126 Mens Washroom - Showers
  - E3-2137 Eye/Face Wash/Drench Hose
  - These stations are shown on the maps at the end of this document.
5. **All** accidents, no matter how small, **must be reported within 24 hours** to the Lab Director, Michael Herz, E3-2111 ext. 33026, or the Mechanical Engineering Department Secretary. This is a Government (Worker's Compensation Act) requirement and could result in a **FINE** if ignored.

## FIRES

If you discover a fire:

1. Actuate the nearest wall mounted fire alarm (pull station).
2. Do not attempt to extinguish the fire.
3. Close the window(s) if possible.
4. If possible, shut down the experiment or turn off associate services.
5. Do not waste time gathering papers or personal belongings.
6. Vacate the area, and close door(s).
7. Leave the building. **WALK, DO NOT RUN. DO NOT USE AN ELEVATOR.**
8. **Report to the Fire Department if anyone is suspected of still being in the building after the general evacuation.**
9. Obey the Fire Wardens. Fire Wardens are assigned to Evacuation Areas and Exit Doors. You can find the list of current Fire Wardens for each building on the Safety Office web page:  
[http://www.safetyoffice.uwaterloo.ca/hse/fire/building\\_evac\\_proc.html](http://www.safetyoffice.uwaterloo.ca/hse/fire/building_evac_proc.html).

**NOTE: It is the responsibility of each instructor, teaching assistant (TA) and supervisor to co-ordinate the evacuation of persons associated with activities under his/her direction.**

## SAFETY PRACTICES IN THE LABORATORY

**Safe practice is an attitude and a knowledgeable awareness of potential hazards.**

Safety is a mutual responsibility and requires the full co-operation of everyone in the laboratory. **This co-operation means that each student and instructor will observe safety precautions and procedures.** Thoroughly acquaint yourself with the location and use of safety facilities. Become familiar with safety precautions and emergency procedures **before** undertaking any laboratory work. Familiarize yourself with the method of operation, and all hazards involved, before commencing an experiment. See that necessary safety equipment is readily available and in useable condition.

### SAFETY RULES FOR THE MECHANICAL ENGINEERING LABORATORY

The practice of safety in the laboratory requires:

- A. **The desire on the part of the individual to protect themselves and their associates** and
- B. **The need to follow a set of rules.**

The former can be termed safety morale and is an essential part of accident prevention. The following rules must be rigidly and impartially enforced. Non-compliance may result in dismissal or suspension from the laboratory.

1. The beginning of safe operation is an understanding of what is to be done and how the equipment operates. It is your responsibility to familiarize yourself with the experiment, equipment, recording facilities, etc. **before** beginning the actual work, so that you are not forced into panic actions. Seek advice, if necessary, from Technicians (if you are in the Student Machine Shop, seek advice from the Supervisor). The Laboratory Director, Technicians and the Student Shop Supervisor have full authority to stop any work which, in their judgement, is considered unsafe.
2. **Never** operate equipment alone; make certain that others present know how to react in an emergency. This is *especially* important when working in the evening or at night; operate a 'buddy' system in case an emergency arises. Always warn others of possible hazards, and **do not engage in horseplay.**

3. Some equipment (machine tools, presses, furnaces, etc.) present special hazards. Consider the consequences of every move before you make it. Remove all tools, specimens, etc. that may fall between or be in the way or fly off of, rotating or moving parts. A common example is the key used to tighten the chuck of a lathe.
4. If something goes wrong, **do not panic**. Think, take your time, and then act. You must know how to **stop** a machine in an emergency mode. Never try to retrieve a situation by reaching between moving parts, or by grabbing hot, corrosive, etc., surfaces.
5. **Safety glasses** must be worn during any cutting, grinding, chipping or sawing operations on all materials such as concrete, ferrous and non-ferrous metals and alloys, ceramics, plastics, wood, etc. In addition, **splash goggles** and **face guards** must be worn if there is a possibility of a liquid jet erupting, or solid debris flying, or intense heat radiation. Safety glasses, splash goggles and face guards are available in the Manufacturing Lab, Room E3-2137; High Pressure Lab, Room E3-2105; Materials Lab, Room E3-2119; Thermal Lab, Room E3-2108; and Engineering Student Shop, Room E3-2101.
6. Special glasses are required in specific areas: **Welding goggles** for arc or oxyacetylene welding. **Laser goggles** when working with a laser. These are specific to individual laser wave lengths. There are several high power (Class III or Class IV) laser units in the labs which could cause severe eye and tissue damage. Remove all reflecting objects such as rings, medallions, etc. Do not approach too close to the laser beam.  
**Note: Laser Safety Program (contact Ian Fraser at ext 36268).**
7. **Clothing and Protective Footwear:**
  - a. Protective footwear must be worn in all labs and machine shop areas.
  - b. If carrying out arc welding, any exposed skin should be covered to prevent burns from radiation. A **leather apron** should be worn, when appropriate, to prevent burns from metal splatter.
  - c. **Safety hats** must be worn when there is a chance of objects falling, or cutting or bruising your head on projectiles. Hats are available in the Fluids Lab, and from the Lab Director.
  - d. **Appropriate gloves** must be worn when working with corrosive fluids, hot furnaces, sharp objects, etc. Gloves are available or may be requested from the Technicians. **Ear protection** must be worn in high noise areas. They are available from Richard Gordon, Room E3-2137A.
  - e. **Respirator masks** are available for work in an atmosphere that contains

noxious fumes and/or particulates, but several days notice may be required by the Lab Technicians to order this type of equipment.

**Note: When working around equipment with moving parts, it is imperative that long hair be covered in a net or tied up, no ties are worn, loose clothing is tied back, and jewellery is removed (better to remove a wedding ring than have it and a finger torn off by the equipment).**

8. Use tongs, grips, holders, etc. for placing specimens and workpieces into hot, or potentially dangerous equipment.
9. Maintain an orderly work area at all times. If you spill something, wipe it up (or get it cleaned up) immediately.
10. If equipment is to be left in operation **unattended, a sign must be posted**, with the names of the operator and supervisor together with phone numbers.
11. Unless otherwise instructed, return all tools, equipment and unused specimens to the designated area or person, switch off equipment and pull plugs from electrical outlets.
12. **Report all equipment faults, breakage, or unsafe conditions to the Laboratory Technicians immediately**, who in turn will inform the Laboratory Director within 24 hours.
13. Before using any chemicals or other potentially hazardous materials, a student must familiarize himself with its properties, hazard ratings, and safe handling procedures. Some useful references are available in E3-2119D in the Materials Lab. If in any doubt, a student must contact their Supervisor, Lab Director or Laboratory Technicians, before proceeding.
14. The smoking of cigarettes, cigars, or pipes is forbidden throughout the University of Waterloo buildings except in a few designated areas.
15. The consumption of alcohol is forbidden throughout the University of Waterloo premises, except in licensed rooms.
16. Bicycles are prohibited inside University buildings.

In addition to the above stated safety rules, when working in the laboratory, familiarize yourself with the location of the **First Aid Kits**, safety showers, eye wash stations, etc.

## ENGINEERING STUDENT SHOP IN E5-1101D:

Supervisor: Andrew Urschel, Ext 32301.

This facility provides various equipment to help with hands-on student projects. The shop hours are 8:30 a.m. to 9:00 p.m. Monday through Fridays, and 10 a.m. to 5 p.m. on Saturdays.

## ELECTRICAL EQUIPMENT

The “Recognized Certification Agency marking” signifies that the equipment meets certain government standards. In general, it gives assurances that

1. Proper grounding has been established
2. There are no bare terminals
3. Insulation is adequate
4. CSA, E SA, or equivalent approval requirements have been met

**NOTE: see attached symbols**

Equipment built specifically for research also has to meet these requirements. The dangers of electronic current:

1. D.C. and low-frequency a.c. travels through the body fluids. A normal dry skin will give about 10 k $\Omega$  between the hands. Hence for 120V a.c., a current of 12mA will flow through the body. This will cause pain to a normal healthy adult. Any sweat on the hands will greatly reduce (by a factor of ten) the resistance, and increase current flow.  
“Let-go” current threshold is           16mA  
Respiratory paralysis                    25-100 mA  
Probable death                            100 mA
2. High frequency a.c. travels over the tissue surface; that is why you can stand the 15,000V, low current acting on a spark plug. Measuring between points on the surface of tissue the resistance is 300 $\Omega$ /in. This is significantly lower when tissue is moist due to emotion or stress, causing the skin to sweat.
3. The rule is: **do not touch** live equipment. If you must, keep one hand in your pocket, so that shock does not travel through the body across the heart. This improves the chances of survival.
  - keep hands dry
  - use rubber shoes and stand on a rubber mat
  - be very careful to discharge all capacitors, especially those associated with CRT tubes, i.e. in video terminals, etc.

## **NOISE**

Noise is not a significant problem at the University of Waterloo, but you will be aware of it in industry. Surveys show that the average noise level to which a person is subjected in industry has been rising at a rate of around 1 dB/year. The increase has been so gradual that most people do not notice it. Millions of people suffer from hearing loss later in life from work conditions and, more recently, leisure noise (particularly snowmobiles and rock music).