

**UNIVERSITY OF MAURITIUS
FACULTY OF ENGINEERING
MECHANICAL AND PRODUCTION ENGINEERING DEPARTMENT**

**HEALTH AND SAFETY IN LABORATORIES DURING
LABWORKS
VACATION TRAINING
MINI PROJECT
FINAL YEAR PROJECT**

This is not a complete list of safety procedures and is a general guidelines to be observed by students when using the equipment and Labs. Please consult the appropriate standards and manufacturers for specific safety procedures.

The safety procedures have been categorized as follows:

- **GENERAL**
- **EQUIPMENT**
- **PROTECTIVE CLOTHING AND EQUIPMENT**
- **FIRE**
- **TOOLS**
- **WORKING AT HEIGHTS**
- **FALLING OBJECTS**
- **ELECTRICAL**
- **CHEMICALS**
- **WELDING & CUTTING**
- **PNEUMATICS**
- **HYDRAULICS**

It is advisable that you read through the whole document before accessing the labs and starting the equipment.

◆ **GENERAL**

- ❖ Before accessing any lab, the student/s must obtain all necessary clearances from the Head of Department and the Academic Staff in charge of the Lab.
- ❖ You are not allowed to work in any lab if the Academic staff in charge of the lab or the Technician is not present i.e. unsupervised.
- ❖ You should not switch on the power to the equipment without the authorization of the Technician.
- ❖ You should not press any switch or push buttons if you are not aware of its/their function/s.
- ❖ Do not use any equipment unless you know how to use it.
- ❖ When working in a lab, familiarize yourself with all the safety procedures related to the lab.
- ❖ While at work take reasonable care for his and other persons safety and health.
- ❖ Identify the mains power switch for the lab.
- ❖ Identify the location of the first aid box and the person who is in charge of it.

- ❖ Identify the location of the portable fire extinguishers.
- ❖ Learn how to use the portable fire extinguishers.
- ❖ The central fire extinguishers are meant for professional firemen. Do not try to use them if you are not familiar with fire fighting procedures.
- ❖ Identify the emergency doors or other emergency exits in the labs.
- ❖ Keep all passageways, stairways, entrances and exits clear.
- ❖ Obey warning signs and danger notices. If you are not familiar with the signs, ask the Technician for the meaning.

❖ EQUIPMENT

- ❖ Get to know all the different parts of the equipment or machine e.g. start button, normal stops, speed change levers, coolant system, etc.. before using any machine.
- ❖ Identify the emergency stops on the equipment before using the equipment.
- ❖ Think before starting any work, in case of doubt ask the technician or the academic staff
- ❖ Ensure that the guards are in place and safety devices are in working order before starting the machine.
- ❖ Never disconnect or deactivate any safety devices on a machine or equipment. If any safety device has failed, have it repaired first and then use the machine.
- ❖ Ensure that the machine is properly set for the job being performed.
- ❖ Use push sticks to direct jobs on dangerous equipment especially if the hands can come very close to the tools e.g. on band saws and rotary machines.
- ❖ Wait for the machine in motion to reach the set running speed before working
- ❖ Wait for the machine to stop completely before setting the speeds, changing tools, making adjustments or unloading parts from the chuck or jigs.
- ❖ Do not leave a machine unattended. Switch off the machine before attending to any other job/s.
- ❖ Do not talk to or disturb an operator while he is working. Signal him and wait until the machine is at a stand still before discussing with him.
- ❖ Do not attempt to stop or slow down a machine with your hands.
- ❖ Do not use bare hands on compressed air to clear chips from machine

❖ PROTECTIVE CLOTHING AND EQUIPMENT (see also WELDING below)

- ❖ Wear protective equipment or clothing provided for protection against bodily injury
- ❖ In case of high level of noise, wear the appropriate ear protectors.
- ❖ Use safety goggles for jobs where flying particles are encountered as in grinding, drilling, turning, etc...
- ❖ Clear chips and turnings from floor and put them in designated containers.
- ❖ Never hold the chips with the hands and pull them from the chuck. Use the provided tools to remove the chips and put in the designated containers.
- ❖ Do not wear rings, chains, long open sleeves or loose clothing when operating a machine. These may get caught in rotating machinery leading to serious injuries.
- ❖ Long hairs may get caught in rotating machinery leading to serious injuries. Use Hair bands or other devices to keep your hair away from the machines.
- ❖ Wear the appropriate type of gloves for the job being performed, taking special care with revolving machinery.
- ❖ Do not wear loose or large gloves that will prevent safe and proper manipulation of components and operation of machines.
- ❖ Do not use gloves if the latter will not allow proper handling of the workpieces.

◆FIRE

- ❖ In case of Fire,
 - Inform the Technician and give the alarm
 - Check that if there is anybody injured. If there is someone injured, move him away from the fire to a safe place and call an ambulance.
 - When in a safe place, do not try to help him unless you are familiar with first aid
 - If it is a small fire try to extinguish it using the portable fire extinguishers.
 - If you do not know what to do, leave the lab and assemble in a safe place.
 - Do not hinder the jobs of professional firemen or the technician.
 - If you are trying to fight a fire always remember where the nearest exit is.
 - Never give your back to the fire

◆TOOLS

- ❖ Keep each tool in its proper place and within easy reach.
- ❖ Do not leave any tools on the rotating parts before starting the machines.
- ❖ Do not place too many tools on the worktable of the machines.
- ❖ Do not place tools on vibrating surfaces or parts of the machines.
- ❖ Do not use tools with mushroom heads or damaged handles.
- ❖ Do not use files or other similar tools without a handle.
- ❖ Use tools which are in good conditions and for the purpose to which they are designed.
- ❖ Do not overload a tool or apply larger than the maximum allowable force or torque.

◆WORKING AT HEIGHTS

- ❖ Do not work at heights if feeling weak or dizzy.
- ❖ Do not overreach while working at heights.
- ❖ Do not use metal ladders around electrical lines.
- ❖ While using ladder, have somebody to hold the ladder at the bottom or tie or lash it at the top.
- ❖ Avoid using ladders near doorways or places where persons pass through frequently. If there is no alternative position, clearly indicate the position of the ladder to prevent head injuries.
- ❖ Do not use badly constructed ladder.
- ❖ Place the ladder on hard and level ground. Do not stand the ladder on loose materials.
- ❖ While climbing ladders, use both hands.
- ❖ Carry tools in a proper bag or have them handled up while climbing ladders.
- ❖ Ensure that the scaffold used for working at heights is secured, and a safe means of access to and fro is maintained.
- ❖ Use appropriate safety devices.

◆ FALLING OBJECTS

- ❖ Wear approved head and foot protection.
- ❖ Do not create falling objects for others
- ❖ Do not stand below potential falling objects.
- ❖ Place weights gently on hangers and do not overload hangers.
- ❖ Use the appropriate weights for the size of the hangers used.
- ❖ During experiments, place a suitable box with soft material to collect any falling weights
- ❖ Use toe boards with guardrails
- ❖ Be certain that material being welded, cut or machined is secured from falling
- ❖ Do not place objects near the edge of overhead structures.
- ❖ Do not place objects on vibrating surfaces unless they are properly secured
- ❖ Place a safety net in areas where there is a risk of objects falling.
- ❖ Clearly identify areas where there is a risk of falling objects with appropriate signs

◆ ELECTRICAL

- ❖ Identify the main power switch for the lab.
- ❖ Identify the emergency stops on the equipment before using the equipment.
- ❖ Do not block the access to the electrical panels.
- ❖ Do not work on electrical equipment, if standing on wet floor or when hands are wet.
- ❖ Get the clearance from the Technician after you have made any electrical connections before you start the machinery.
- ❖ Ground all electrically powered equipment properly.
- ❖ Use the minimum length of cable and without joints.
- ❖ If the cables are joined, ensure that they are properly insulated with the proper insulating material.
- ❖ Use color-coded cables as per standards.
- ❖ Use three pin plugs for tapping power.

◆ CHEMICALS

- ❖ Do not store incompatible chemicals together.
- ❖ Use chemicals in properly ventilated rooms. Note that we are very sensitive to small changes in the composition of the air we breathe.
- ❖ Use appropriate safety devices such as masks, if gases that may affect human health would be evolved. In such a case, inform all the personnel present in the Lab.
- ❖ Get the maximum information on the products of the reaction between the chemicals. If gases or fumes that may affect human health may be evolved, work in a properly ventilated area.
- ❖ Do not taste the contents of any container if you are not sure what it contains.
- ❖ Do not smell the contents of any container, if you are not sure what it contains.
- ❖ Do not store chemicals in soft drink bottles.
- ❖ Do not use the chemicals if the label is missing.
- ❖ Label all bottles containing chemicals properly indicating name of chemicals, concentration and potential dangers.
- ❖ Keep the bottles of chemicals in the designated areas.
- ❖ Do not store or consume food where chemicals are stored or handled.
- ❖ Never apply mouth suction for pipetting.
- ❖ Keep gas cylinders of acetylene or liquefied gases in upright position.
- ❖ Secure the gas cylinders properly with chains.
- ❖ Before doing hot work on vessels containing flammable gases/liquids get them certified as safe for the work.

◆WELDING & CUTTING

- ❖ Weld in appropriately designated areas.
- ❖ Sparks can travel very long distances, ensure that there are no combustible materials in the welding area.
- ❖ Protect the combustible materials with fire resistant material if they cannot be removed.
- ❖ Do not weld or cut in atmospheres containing dangerously reactive or flammable gases, vapors, liquids or dusts.
- ❖ Ensure that the gases and fumes evolved are not toxic. Check with the manufacturer or supplier.
- ❖ Ensure that the welding area is well ventilated either naturally or mechanical ventilation (air extractor).
- ❖ Keep your head out of the fumes.
- ❖ Do not breathe the fumes and wear a respirator where necessary. .
- ❖ Use appropriate protective equipment for the welding process.
- ❖ Note that the same protective equipment cannot be used for oxy-acetylene welding, arc welding, Laser welding etc.. Check the appropriateness of the protective equipment with respect to the welding process.
- ❖ Do not apply heat to a container (reservoir) that can produce flammable vapors.
- ❖ Do not apply heat to a container that has contained an unknown substance.
- ❖ Do not apply heat to unknown materials or material with an unknown coating.

PNEUMATICS

- 1- Use the right Voltage: 12VDC or 24 VDC for electro pneumatic components.
- 2- Always seek the assistance of qualified personnel.
- 3- Isolate controls and power. Tampering can cause injury to the device or to people.
- 4- Don't over power pneumatic devices.
- 5- Don't use non-rated parts.
- 6- Use pressure relief valves on tanks and reservoirs that don't have an auto- drain system.
- 7- Make sure that the PVC used for the long runs is scheduled and rated for the right PSI.
- 8- Repair air leaks immediately regardless of where they are found in your system.
- 9- Wear safety glasses when working with pneumatic devices.
- 10- Avoid air blowers temptation into someone eyes or face.

HYDRAULICS

- 1- Three kinds of hazards exists: Burns from the hot, high-pressure spray of fluids: Cuts or abrasions from flailing hydraulics lines; Injection of fluid into skin.
- 2- Hydraulics systems store fluid under high pressure, be sure not to untight any hydraulics hose without releasing the pressure (during or after operation).
- 3- Proper coupling of high and low pressure hydraulics components and pressure relief valves are important safety measures.
- 4- When working on a hydraulics system with accumulator, make sure that the pressure in the accumulator is relieved/ discharged first.
- 5- Repair any pinhole leaks in hose to avoid injury.
- 6- Pressure relief valves incorporated into the hydraulics system will avoid pressure build-ups during use. Make sure that the valves are properly cleaned and tested periodically for correct operation.
- 7- Keep away contaminants from hydraulics oil.

- 8- If you are working with hydraulics system at a given position, always use a blocking system, e.g. 5/3 way valve.
- 9- Never service the hydraulics system when the motor is running.
- 10- To control a hydraulics system properly, keep it in the right adjustment.

NOTE: Do not hesitate to contact us (enquiry_mech@uom.ac.mu) with your comments and suggestions.

REFERENCES:

1. General Workshop Safety Rules, Sep 2002, University of Mauritius.
2. Safety and Health Fact Sheet No.1, Fumes and Gases, Oct 2003, American Welding Society, USA.
3. Safety and Health Fact Sheet No.5, Electrical Hazards, Oct 2003, American Welding Society, USA.
4. Safety and Health Fact Sheet No.6, Fire and Explosion Prevention, Sept 1995, American Welding Society, USA.
5. Safety and Health Fact Sheet No. 8, Mechanical Hazards, Sept 1995, American Welding Society, USA.
6. Safety and Health Fact Sheet No.9, Tripping and Falling, Sept 1995, American Welding Society, USA.
7. Safety and Health Fact Sheet No.10, Falling Objects, Sept 1995, American Welding Society, USA.
8. FESTO Documentation, safety requirements for Pneumatics and Hydraulics