

Introduction

Some of the hazards related with equipment used in research labs include

- Electrical hazards
- Hot surface which can cause burns and which can be a source of ignition.
- High noise levels
- Unguarded rotating parts
- Use of vacuum which can cause implosion.
- Use of high pressure
- Generation of magnetic fields
- Ultra violet and infra red radiation

Many accidents in research laboratories result from improper use and lack of maintenance of equipment.

The following precautions must be adopted while working with equipment in the laboratory.

- Refer the operating manual/user manual of the equipment before starting operation. The manual will contain details of hazards and safety precautions to be taken during installation, operation and maintenance.
- The operating manuals of equipment must be located at an easily accessible location in the laboratory.
- Personnel who are not authorised and trained must not carry out operation of the equipment.
- New users must carry out the operation under guidance of senior research scholars.
- A schedule for maintenance and inspection of equipment must be prepared as per manufacturer's instruction and must be adhered to.
- Unauthorised maintenance activity must not be done. Service personnel must be contacted where required.
- Switch off and unplug the equipment while making adjustments.
- Switch off the equipment at the end of the operation and when not in use.

- Use personal protective equipment as recommended by the manufacturer while operating the equipment.
- Equipment with specific hazards must not be left unattended.
- Display contact details and action to be taken in case of emergency near the equipment.
- Display caution signages to warn visitors about the hazards. Equipment out of order or not in use must be labelled.



- Precautions must be taken to prevent inadvertent energisation of the equipment during maintenance activities.
- High pressure equipment must not be located inside the laboratory work area. Same must be in a separate room.



- Standard operating procedures (SOP) must be prepared and followed.
- Source of power must be at an easily accessible location so that it can be switched off quickly in case of emergency.
- Electric wires of equipment must not be laid along the passage where it can be a trip hazard. Same must be kept away from hot surfaces which can cause damage to the insulation of the wire.
- Emergency stop switch must be prominently labelled.
- Rotating parts of the equipment must be guarded. Loose clothing, jewelry that can get entangled must not be used. Confine long hair while working in the laboratory.
- Always use safety glasses while working with laboratory equipment.

Commonly used laboratory equipment and precautions to be taken during usage

Heating Devices

- Ensure that the heating element of the equipment is in good condition. If the elements are exposed, ensure that it is repaired or replaced.
- Variable transformers must be placed outside the fumehood. This helps to prevent spillage of chemicals/water over it and prevent chances of ignition of flammable vapours due to the spark produced by it.
- Electrical connections to the heating device must be fully insulated to prevent electric shock.
- Keep combustible materials away from heating devices.
- Care to be taken to prevent chemicals from coming in contact with the heating element.
- Overheating of the heating equipment can lead to fire. Use of temperature sensing devices helps to cutoff power if there is a sudden increase of temperature.
- Display caution signages to warn against hot surface.

Ovens

- Laboratory ovens must not be used for heating food items, as the air inside would be contaminated.
- Ensure that the materials placed inside for heating are thoroughly washed and doesn't contain traces of chemicals.
- Maintain air space around the oven as recommended by the manufacturer.
- Use protective equipment while handling hot materials.

Hot plates



- Always consider the surface of the hot plate as hot.
- Ensure that the electrical cord of the hot plate doesn't come in contact with the heating surface.
- The controls on the hotplate must be properly labelled to easily distinguish between the stirrer and temperature controls.

Heating Mantles

- Care must be taken to prevent water or other chemicals from spilling into the mantle.



- Placing the heating mantle on a lab jack helps to quickly remove it in case of a sudden increase of temperature.

Oil baths

- Prevent water being spilled into the bath, as this can cause the splatter of the hot material.
- Prevent overheating of the oil. Monitor the temperature of the oil.
- Use of thermal sensing devices helps to turn off the electric power if the oil bath overheats.
- Oil baths must be well mixed to ensure that there are no hot spots around the heating elements.
- The heated oil must be placed in a secondary container (heat resistant tray) to contain the spill in case of breakage.
- The oil bath must be placed on a stable support, e.g., lab jack.
- The equipment used must be clamped high enough so that if there is a sudden overheating the heating element on the lab jack can be lowered immediately.
- Wear heat resistant gloves when handling a hot bath.

Heat guns

- Never use heat guns near open containers containing flammable liquid or inside the fume hood where flammable vapors could be present.
- The heating element or the switch of the heat gun can become a source of ignition.

Microwave Ovens



- Use lab purpose microwave ovens.
- Do not place any material between the sealing surface and the door on the oven's front face.
- Do not overheat samples.
- The materials used inside the oven must be those specified by the manufacturer.
- Do not use metal containing objects in the microwave, as they can cause arcing.
- Do not heat sealed containers in a microwave oven, as they can explode.

Centrifuges



- The centrifuge rotor is subjected to high mechanical stress at rotation speeds.
- Accidents result from improper loading or balancing of the rotors. These cause them to dislodge during spinning, resulting in serious damage and personal injury.

The following precautions must be taken while using centrifuges:

- Balance the load properly.
- Do not overfill the centrifuge tubes.
- Ensure that the centrifuge tubes are placed properly.
- Ensure that the lid of the centrifuge is closed before starting the centrifuge.
- Do not run a rotor beyond its maximum rated speed.
- Keep a maintenance log.
- Always use the rotor specified by the manufacturer.
- Look for signs of corrosion of the rotors.
- Check the cone area for cracks.
- Check for corrosion or cracks in the tube cavity.

Vacuum work

- Use of vacuum has the risk of implosion which can result in flying glass fragments and spillage of chemicals.
- Evacuated glass vessels may collapse violently either by strain to which it is subjected or due to an accidental blow.
- Glassware under vacuum must be kept behind a shield.
- Vacuum pumps must be protected by cold traps and their vents must be exhausted to a hood.
- If the oil is contaminated, it must be changed before further use.
- The belt drive of the vacuum pump must be covered with a machine guard.
- Check the glass apparatus for cracks each time before they are used.
- Use only thick walled glass apparatus specifically designed for vacuum use.

Desiccators



- If a glass vacuum desiccator is used, it must be made of pyrex or similar glass.
- It must be wrapped with friction tape or shields must be provided around the same for protection from flying particles if the vessel implodes.
- Do not carry or move an evacuated desiccator.

- Take care while opening the valve, as sudden inrush of air can cause spraying of the contents.

Rotary evaporators



- Completely enclose in a shield to guard against flying glass, or tape the components for protection from implosion.
- Rotation speed and application of vacuum to the flask must be increased gradually.

Refrigerators

- The chemicals stored inside the refrigerators can release vapours, which can form a flammable vapour air mixture inside. In domestic refrigerators the light or the thermostat can become a source of ignition.
- Only lab purpose intrinsically safe refrigerators must be used for storing flammable chemicals.
- Solvents in open containers or uncapped bottles must not be stored inside the refrigerator.
- Secondary containers must be used for storing chemicals to contain spill.
- Incompatible chemicals must not be stored together.
- Lab refrigerators must never be used to store food or beverages meant for human consumption.
