

Heat Transfer Laboratory Safety Plan

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1. Introduction to Laboratory Safety

Laboratory settings are essential for research and education, but because of the inherent dangers of chemicals, biological agents, machinery, and other elements, they can be extremely dangerous. This handbook's objective is to provide an overview of the safety procedures required to safeguard everyone in the laboratory. By reducing hazards and averting mishaps, these protocols guarantee a secure and effective atmosphere for students, employees, and guests.

2. General Laboratory Safety Rules

- **Personal Protective Equipment (PPE):**
 - Lab coats, gloves, and safety goggles must be worn at all times.
 - Specific PPE (e.g., face shields, respirators) must be used depending on the hazards present (e.g., working with corrosive materials, biological substances, or volatile chemicals).
 - Always inspect PPE before use for damage or contamination.
- **No Eating or Drinking:**
 - No food or beverages are allowed in the laboratory. This reduces the risk of chemical ingestion or contamination.
 - Ensure that hands are thoroughly washed before leaving the laboratory.
- **Work Area Organization:**
 - Keep workspaces clean and uncluttered to reduce the risk of spills, accidents, and contamination.
 - Avoid leaving hazardous materials unattended.
- **Access to the Laboratory:**
 - Access to restricted areas (e.g., chemical storage rooms, biohazard labs) should only be granted to authorized personnel who have received appropriate safety training.

- **Chemical Hygiene:**

- Always check the labels on containers to verify their contents.
- Use fume hoods and ventilated spaces when handling volatile or toxic substances.

- **Equipment Handling and Training:**




- Proper training is required before operating any equipment.
- Only use equipment for its intended purpose. Ensure all equipment is in good working condition and properly calibrated.





- **Waste Disposal:**

- Dispose of hazardous materials according to specific guidelines (chemical, biological, radioactive, or general waste).
- Label waste containers clearly with contents and hazard class.




3. Laboratory Safety Symbols, Signs, and Meanings








Understanding the various symbols and signs used in the laboratory is crucial for personal safety. Each symbol represents specific hazards that can be dangerous to health.

Name of the symbol	Symbols	Meaning
General Warning	 General Warning	Presence of possibly hazardous materials/environment
Health Hazard	 Health Hazard	Presence of chemical, physical, or biological factors with the potential to have a negative effect on our health
High Voltage	 High Voltage	Supply of high-voltage electricity







Name of the symbol	Symbols	Meaning
Electric Hazard	 Electric Hazard	Risk of getting electric shock. (The device might give mild to severe electric shock.)
Flammable Material	 Flammable Material	Presence of combustible materials (a substance that can easily burn)
Explosive Material	 Explosive Material	Presence of explosive and/or self-reactive substances
Hot Surface	 Hot Surface	Risk of burning if you touch with naked hands

Entry/Working requirement symbols in the lab

Name of the symbol	Symbols	Meaning
Gloves Required	 Gloves Required	Must use protective gloves in this area/while working in this area
Safety Glasses Required	 Safety Glasses Required	Must use protective/safety goggles in this area/while working in this area
Safety Shoes Required	 Safety Shoes Required	Must use closed-toe shoes in this area/while working

Name of the symbol	Symbols	Meaning
Lab Coat Required	 Lab Coat Required	Must wear lab coat (apron) while in this area
Protective Clothing Required	 Protective Clothing Required	Must wear full protective clothing
Respirator Required	 Respirator Required	Must wear a breathing mask/respirator; the presence of contaminated air
Face/Safety Mask Required	 Face Mask Required	Must wear face/dust/safety masks
Face Shield Required	 Face Shield Required	Must wear face shield while working
Hair Protection Required	 Hair Protection Required	Must wear hair protection before working
Hearing Protection Required	 Hearing Protection Required	Must wear a hearing protection device while working

Location symbols of a specific object in the lab

Name of the symbol	Symbols	Meaning
Fire Extinguisher	 Fire Extinguisher	The location where the fire extinguisher is placed
First Aid	 First Aid	The place with the first aid box and materials
Drinking Water	 Drinking Water	Indicates safe water for drinking
Fire Blanket	 Fire Blanket	The location where the fire blanket is placed
Fire Hose	 Fire Hose	The location where the hose with water or any fire retardant is placed
Emergency Bell	 Emergency Bell	Bell to be pressed during an emergency like fire or accident.

6. Emergency Procedures

Lab safety relies on preparedness. In case of an emergency, knowing what to do can save lives.

- **General Emergency Response:**

- **Remain Calm:** Try to keep a clear mind and follow emergency procedures.
- **Alert Others:** Call for help and alert everyone in the lab of the emergency.
Activate the nearest emergency alarm if necessary.
- **Evacuation:** Follow evacuation protocols as per the building's emergency plan.
Do not use elevators during a fire emergency.

- **Fire Safety:**

- **Fire Prevention:** Regularly inspect lab equipment and wiring to prevent electrical fires. Ensure that combustible materials are stored properly.
- **Evacuation Plans:** Familiarize yourself with escape routes and emergency exits.
Conduct regular fire drills to practice evacuation procedures.
- **Fire Extinguisher Types:** Know the difference between extinguishers (e.g., water, CO₂, foam) and which ones are suitable for different types of fires (A, B, C, D, K).
 - A fire extinguisher is a "first aid" tool (It's not meant for controlling large fires).
 - Suitable only for small, contained fires (Do not attempt to fight a large fire).
 - Limited duration: Depending on size, it sprays for 10 to 30 seconds.
 - Limited range: Typically, 5 to 10 feet, depending on the type and size.
 - Fire in front, exit behind: Always position yourself between the fire and your exit route.
 - Have a backup extinguisher and an observer: Ensure you have someone watching with an extra extinguisher for support.
 - If you're unsure, evacuate! If you don't feel confident in handling the fire, don't attempt it.
 - How to use a portable fire extinguisher: Follow the "P.A.S.S." method to tackle the flames:
 - **P – Pull the Pin**

This unlocks the extinguisher, ensuring it's ready for use.

- **A – Aim at the Base of the Flames**

Direct the nozzle towards the fire's source, where it's most effective. Aiming at the flames themselves won't do the trick!

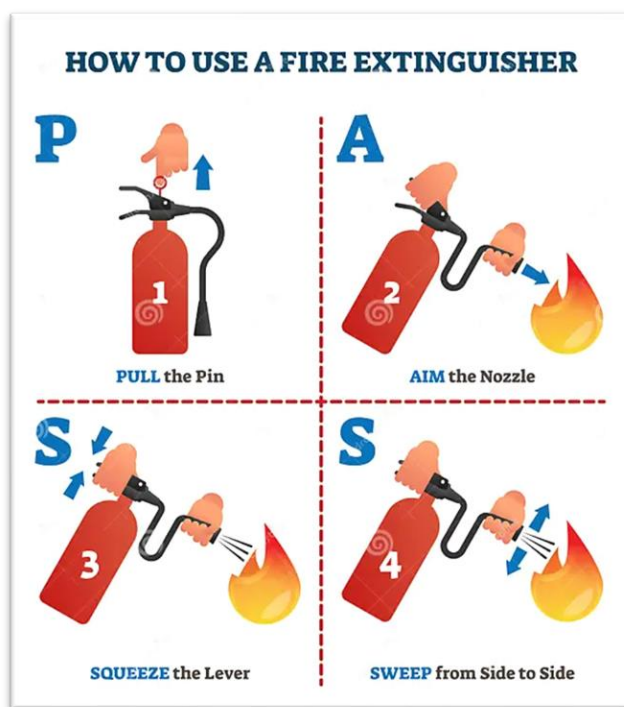
- **S – Squeeze the Trigger**

Gently press the trigger to release the extinguishing agent, all while keeping the extinguisher upright for optimal performance.

- **S – Sweep Side to Side**

Move the nozzle in a sweeping motion, covering the entire fire area. Continue until the fire is fully out, or you need to retreat for safety.

- By following these four easy steps, you can take control of small fires and prevent them from escalating. Always remember: safety comes first-if in doubt, evacuate and call for help!



- **Chemical Spill Response:**

- **Small Spills:** For minor chemical spills, use spill kits available in the lab. Contain the spill and neutralize or absorb with appropriate materials.

- **Large Spills:** Evacuate the area and contact the emergency response team immediately. Use the emergency eyewash and safety shower if necessary.
- **Explosion or Chemical Reaction:**
 - In case of an explosion, immediately evacuate and do not attempt to extinguish the fire unless trained to do so.
 - Isolate the area and inform emergency responders of the substances involved.
- **Medical Emergencies:**
 - **Cuts or Burns:** Clean the wound with water and apply bandages. For burns, apply cool water but avoid ice.
 - **Chemical Exposure:** For chemical splashes, rinse the affected area with water for 15 minutes and seek medical attention.
 - **Cardiopulmonary Resuscitation (CPR):** If someone stops breathing due to a shock or injury, call for medical help and begin CPR if you are trained to do so.

7. Earthquake Response Procedures

While laboratory accidents are common, natural disasters like earthquakes can pose unique challenges.

- **Before an Earthquake:**
 - Secure heavy equipment to prevent it from falling.
 - Know where your emergency supplies are located.
- **During an Earthquake:**
 - **Drop, Cover, and Hold On:** Drop to the ground, cover your head, and hold onto furniture until the shaking stops.
 - Move away from windows, shelves, and overhead equipment.
- **After an Earthquake:**
 - **Check for Injuries:** Assess yourself and others for injuries and provide first aid.
 - **Inspect the Lab:** Check for chemical spills, broken glass, and equipment malfunctions.
 - **Evacuate:** Follow the building's evacuation protocols and wait for further instructions from emergency personnel.

8. First Aid Procedures for Common Injuries

- **Eye Exposure to Hazardous Chemicals:**
 - Use the nearest eyewash station immediately. Flush eyes for at least 15 minutes, lifting the eyelids to ensure thorough rinsing.
 - Seek medical attention if irritation persists.
- **Cuts, Punctures, and Lacerations:**
 - Clean the wound with antiseptic, apply pressure to stop bleeding, and cover with a sterile dressing.
 - For severe injuries, seek immediate medical attention.
- **Electrical Shock:**
 - **Do not touch the person** if they are still in contact with the power source. Cut off the power if safe to do so.
 - Begin CPR if necessary and call for emergency medical assistance.

Safety in Laboratories for Heat Transfer Lab

Sessional Course: ME 306 and ME 266*

The experiments of ME 306 and ME 266* are conducted in Heat Transfer Laboratory, on the ground floor of ME Building.

[* offered to the students of other departments.]

Heat Transfer Laboratory

Location: ME Building, Ground Floor

Students of Level - 3 Term - 1 and Level - 3 Term - 2 are offered in doing their sessional courses in Heat Transfer Laboratory. This lab is one of the strong laboratories in Mechanical Engineering Department (BUET).



Students are able to know about all the modes of heat Transfer while performing sessional classes. Determination of thermal conductivity by Steady-State method, Radiation heat transfer, Thermal

contact-conductance, Heat transfer from extended surface, Boiling heat transfer, Heat transfer by Forced convection etc. are some major fields where students perform their experiments.

Besides in doing experiment, this lab provide facility for final year project and research work leading to post graduate degrees.

Experiments conducted in this laboratory under ME 306 Heat Transfer Sessional and ME 266* Thermal Engineering and Heat Transfer Sessional courses:

1. (a) Determination of Thermal Conductivity of Metals (Copper and Aluminum)
(b) Study of Thermal Contact Resistance
2. Study of Radiation Heat Transfer
3. Study of Boiling Heat Transfer
4. Study of Forced Convection Heat Transfer Over a Flat Plate

Apparatus	
	Sample experimental setup name 1
	Sample experimental setup name 2

Apparatus



Sample experimental setup name 3



Sample experimental setup name 4

Safety Requirements

Some of the safety requirements while doing these experiments are enlisted but not limited to the followings:

1. Always wear shoes before entering lab.
2. Do not touch anything without the permission of instructor/lab assistant.
3. Read carefully the lab manual before performing experiments.
4. Check electrical connections before starting the equipment.
5. Do not put your hands while the machine is in operation.
6. Do not tamper measuring instruments.
7. Do not open the casing of the equipment.
8. Do not unplug any electrical connection.
9. Switch off the power supply to the experimental setup on completion of the experiment.

10. Do not leave the dye container on the working tables.
11. Use safety goggles wherever necessary.
12. Familiarize yourself with emergency shut-off procedures for main electric switches in case of accidents.
13. Have a first aid kit readily available and ensure personnel are trained in basic first aid.
14. Ensure all personnel are aware of fire exit routes and procedures in case of an emergency.
15. Keep fire extinguishers readily accessible and ensure personnel are trained in their use.

References

1. **U.S. Occupational Safety and Health Administration (OSHA):** *Laboratory Safety Standards.* <https://www.osha.gov>
2. **Centers for Disease Control and Prevention (CDC):** *Biosafety in Microbiological and Biomedical Laboratories.* <https://www.cdc.gov>
3. **National Fire Protection Association (NFPA):** *Fire Safety in Laboratories.* <https://www.nfpa.org>
4. **American Chemical Society (ACS):** *Guidelines for Chemical Safety.* <https://www.acs.org>
5. **American National Standards Institute (ANSI):** *Laboratory Safety Guidelines.* <https://www.ansi.org>
6. <https://microbenotes.com/laboratory-safety-symbols/>
7. <https://www.ou.edu/>
8. <https://www.dreamstime.com/>

Emergency Contact List

Designation	Name	Phone No.
Head of the Department (ME)	Dr. Md. Afsar Ali	Office: 880-2-9665636 Mobile: 01552415088

BUET telephone operator (PABX)	Phone No.	BUET Office
	55167100	0

Medical Center:

Emergency	6666/01726698851
Medical Centre office	7798
Reception	2222

Designation	Name	Phone No.	BUET Office
Chief Medical officer	Dr. Abu Hena Abid Zafr	01309005333	7344
Senior medical officer	Dr. Md. Hasib Iskandar	01720960997	7817
Senior medical officer	Dr. SK. Hasanul Banna	01737392095	7823
Medical officer	Dr. Josmina Akter Chowdhury	01980090205	7729
Medical officer	Dr. Rokeya Sultana Sumi	01763494945	6863
Medical officer	Dr. Sazzad Hossain Razib	01710960241	

Fire service and civil defense:

Fire Brigade Emergency/Enquiry	199
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Place	Mobile	Phone
Polashi	01716354370	02-8628688
Mirpur Road	01730002229	02-9001055

Mohammadpur	01712970093	02-9112078
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Police & Security:

Designation	Phone
Emergency Call	999
DMP Police Emergency	01713398311/9551188
DMP Control Room	01817602050/9575500

University security & other

Designation	BUET Office
Security Emergency Call	7777
Security officer	7482
Electricity & Plumbing	7323 /01997902626
Shaheed Minar Gate (Main Gate)	7812
West Palashi (Main Gate)	6592
Bakshi Bazar R/A Gate	7825
Dhakeswari R/A Gate	7759
Palashi R/A Gate	7692
Azad R/A Gate	7760
71,72 No. Building Gate	6330