



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-L107

Hot Plates and Dry Bath

Standard Operating Procedure

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1. Purpose

This SOP describes the safe operation, maintenance, and hazard mitigation for laboratory hot plates, stirring hot plates, and digital dry bath heaters used within the environmental analysis laboratories.

2. Scope

- **Applies to:** Hot plates, stirring hot plates, and digital dry bath (heat block) heaters used for sample heating, digestion, reagent preparation, and enzymatic or thermal incubations
- **Does not apply to:** Muffle furnaces (see [SOP-L111](#)), water baths, autoclaves, or microwave digestion systems
- **Location:** Environmental analysis laboratories

3. Definitions

- **Dry bath (heating block):** An aluminum block with drilled wells that fits standard tubes (1.5 mL, 15 mL, 50 mL); heated by a resistive element to provide uniform, conductive temperature control without the hazard of a liquid bath.
- **Flash point:** The lowest temperature at which a liquid's vapor can ignite in air; flammable solvents must never be heated above their flash point on an open hot plate.
- **Hot plate:** An electrically heated flat surface used to heat beakers, flasks, or evaporating dishes; may or may not include an integrated magnetic stirrer.
- **Hot plate / stirrer:** A combination unit providing both heating and magnetic stirring; the most common configuration in the EA Program laboratory.
- **Magnetic stir bar:** A PTFE-coated magnetic rod placed in a vessel; rotated by the stirrer magnet beneath the hot plate surface to provide mixing.
- **Set temperature vs. actual temperature:** The temperature displayed on the hot plate controller may differ substantially from the actual liquid temperature; always verify with a calibrated thermometer.
- **Surface temperature limit:** The maximum safe surface temperature of the hot plate; organic solvents should never be heated on an open hot plate above their boiling point or flash point.

4. Responsibilities

Role	Responsibility
Lab PI	Approve SOP, ensure training compliance
Trained Personnel	Follow this SOP, report deviations
New Students	Complete training before independent use

5. Safety and Hazards

Hazards

- **Thermal:** Heating surfaces and metal blocks can exceed 300 °C and remain dangerously hot long after power is disconnected. Contact causes severe thermal burns.
- **Fire and Explosion:** Heating volatile, flammable solvents on an open-bench hot plate can ignite vapors. Standard hot plates are not explosion-proof and may generate sparks from mechanical switches or internal cycling.
- **Electrical:** High current draw can overload circuits. Liquid boil-overs or spills create immediate electrical short risks.

5.1. Required PPE

- ☐ Safety glasses or chemical splash goggles
- ☐ Laboratory coat (fully buttoned)
- ☐ Heat-resistant thermal gloves (when handling active or cooling vessels, blocks, or glassware)
- ☐ Nitrile gloves (underneath thermal gloves if chemical handling is simultaneous)

5.2. Emergency Procedures

In case of burn, spill, or equipment failure, refer to [SOP-L002 Laboratory Safety](#) or call campus safety.

6. Equipment and Materials

6.1. Equipment

Item	Location	Notes
Hot plate / stirring hot plate	Lab bench	Ceramic, aluminum, or silicone-coated top plate
Digital dry bath (heat block)	Lab bench	Interchangeable aluminum blocks for various tube sizes
PTFE-coated stir bars	Supply drawer	Various sizes
External thermocouple probe	Instrument drawer	For independent temperature verification

6.2. Consumables

Item	Notes
Borosilicate glassware	Pyrex or Kimax; certified for thermal stress

Item	Notes
Interchangeable aluminum blocks	Sized for 1.5 mL, 15 mL, or other tube formats

7. Procedure

7.1. Pre-Operational Inspection

1. Inspect the power cord and plug for fraying, exposed wires, or chemical degradation. Do not use if damaged.
2. Ensure the cord does not drape across or contact the heating surface.
3. Verify that the heating surface and aluminum blocks are free of residual chemical films, crusts, or signs of pitting. Clean with a damp cloth if necessary (unit must be unplugged and cool).

7.2. Sample and Vessel Preparation

1. **Glassware inspection:** For hot plates, use only borosilicate glassware (e.g., Pyrex, Kimax) certified for high thermal stress. Inspect for star cracks, hairline fractures, or deep scratches. Discard compromised glassware.
2. **Dry bath alignment:** Ensure the interchangeable aluminum block profile matches your specific sample tubes (e.g., 1.5 mL microcentrifuge tubes vs. 15 mL conical tubes). Incorrect sizing limits thermal contact and degrades temperature control accuracy.

! Sealed Containers

Never heat completely sealed containers on a hot plate. Pressure buildup can cause catastrophic vessel failure.

7.3. Operation and Parameter Adjustment

1. Plug the unit directly into a grounded wall outlet. Avoid extension cords or daisy-chained power strips due to high wattage requirements.
2. Toggle the main power switch to the **ON** position.
3. **Temperature control:** Set the target temperature via the digital interface or analog dial.

💡 External Temperature Probes

If using an external temperature probe (thermocouple), ensure it is securely immersed in the solution and not resting directly against the bottom or side walls of the glassware.

4. **Stirring control (if applicable):** Place the stir bar flat inside the container. Turn the RPM dial slowly from zero to the target velocity. Sudden adjustments can cause the stir bar to decouple (spin erratically), requiring the dial to be reset to zero to re-engage.

7.4. Shutdown and Post-Run Monitoring

1. Turn off the heating and stirring functions by switching controls to 0 or pressing **Stop**.
2. Turn the main power switch to **OFF**.
3. **Hot Top warning:** If the unit features a “Hot Top” indicator light, leave the unit plugged in until the surface drops below 50 °C and the warning light turns off.
4. Once completely cool, wipe down any condensed moisture or accidental spills.

8. Quality Control and Acceptance Criteria

- Verify the set temperature against an independent calibrated thermometer or thermocouple before use with critical samples.
- If the measured temperature deviates by more than ± 5 °C from the set point, remove the unit from service and arrange calibration or repair.

9. Waste Disposal

Waste Type	Container	Disposal Method
Chemical residues	Appropriate waste jug	Per chemical-specific SDS
Damaged glassware	Sharps container	Standard glass waste

10. Maintenance

- **Monthly:** Wipe aluminum dry blocks with a mild laboratory detergent to remove oxidation or mineral buildup. Never use steel wool or abrasive pads.
- **Annually:** Calibrate temperature readouts using a calibrated surface thermometer or reference thermocouple.

11. References

Consult the manufacturer’s manual for model-specific temperature calibration procedures and replacement parts. No external peer-reviewed references apply to this general equipment SOP.

12. Related SOPs

SOP	Title	Relationship
L002	Laboratory Safety	Required prerequisite
L003	Hazardous Materials	Flammable solvent handling
L111	Muffle Furnace	Higher-temperature heating

SOP	Title	Relationship
L409	Microbial Biomass Carbon	Uses dry bath at 56 °C
L315	eDNA Processing	Uses dry bath for extraction

13. Training Record

Training is documented in the lab training log. Before working independently, personnel must:

1. Read this SOP in full
2. Observe a trained operator perform the procedure
3. Perform the procedure under supervision
4. Be signed off by the PI or designated trainer