**Standard Operating Procedures for Use and Routine Maintenance of Furnaces**

**This is an SOP template and is not complete until:**

**1) lab and equipment specific information is entered into the box below 2) lab and equipment specific protocol/procedure is added to the protocol/procedure section 3) Lab and equipment specific information (highlighted in RED) is added to each section, and
4) SOP has been signed and dated by the Principal Investigator/Responsible Party and relevant lab personnel.**

**Heading/Approval**

| **Building/Room(s)/Equipment covered by this SOP:** | Click here to enter text. |
| --- | --- |
| **Department:** | Click here to enter text. |
| **Principal Investigator Name:** | Click here to enter text. |
| **Principal Investigator Signature/Date:** | Click here to enter text. |
| **This SOP was created by (if not PI): Name/Title/Date/Signature/Date** | Click here to enter text. |

# **Section 1 - Purpose and Scope**

This document describes the procedures and policies for routine maintenance and use of the furnace. This SOP is not a substitute for detailed routine inspection of furnace equipment by trained certified/qualified service personnel as specified by the instrument manufacturer. The scope of this document is to establish user routine maintenance procedures. Instrument repair is outside the scope of this document.

# **Section 2 - Responsibilities**

This document is maintained by the Principal Investigator (PI), Responsible Party (RP), or a designee. The PI/RP or the designee is responsible for general maintenance and repairs of the equipment. If a user feels that the equipment needs repair or is not operating correctly, please notify the PI/RP or designee immediately.

All users must read this document and obtain training and approval and from the PI or designee prior to performing maintenance of the equipment.

Users are responsible for following laboratory procedures after training is completed and documented.

This SOP describes routine maintenance of furnace equipment. Do not attempt repair or service of damaged equipment. If service is required, Contact the PI/RP or designee immediately.

# **Section 3 - Definitions**

**Air filter:** A screen containing specific materials (based on your furnace make and model the filter materials might be different but all act to filter the air circulating in and out of the system).

**Air ducts:** Ducts that allow air to flow in and out of the furnace.

**Heat exchanger:** An apparatus found within the furnace that allows for heat to be moved from one portion of the furnace to another.

**Combustion Chamber:** The chamber found within the furnace where natural gas is burned for the use of the furnace.

**Ignition button**: The button that starts the ignition of natural gas within the combustion chamber of the furnace.

**Gas valve:** The gas valve allows for both the intake of gas as well as the control of how much gas is present within the gas furnace.

**Section 4 - Precautions** [Insert/edit to include Lab Specific Information]

**Sensitive interior parts**

Gas furnaces can reach a temperature of 1700 Celsius. The heating elements for the furnaces are exposed and can be easily damaged if bumped or scraped. They are very expensive to replace.

**Burn Warning**

The furnace heating elements are operated at a high temperature and can be dangerous if touched. If you happen to burn yourself on any part of the furnace, switch off the furnace and immediately cover your burn with a paper towel and seek medical attention (Note: Most people would want to run their hands under cold water, but this could lead to further tissue damage).

**Do not repair furnace by yourself**

Do not attempt to repair or service the equipment. If service is required, contact the PI or Responsible Parties immediately.

**Burn-off Warning**

If material being used is hazardous or contains burn-off products that can damage the furnace the user must first consult with the PI RP or designee in order to establish safe and permissible release of by-products. For example, it may be appropriate for the furnace to be placed in a certified fume hood.

**Section 5 - Personal Protective Equipment (PPE)**

Use the proper PPE as required by user SOP [specify here] when performing routine maintenance on furnace equipment.

Example PPE: High temperature gloves, face shields, and furnace tongs are provided for your safety.

**Section 6 – Required Tools** [Insert/edit to include Lab Specific Information]

**Section 7 - Routine Maintenance and Use Procedure**

Following is a step-by-step description of a general routine maintenance procedures. Note that laboratory individuals are not meant to repair furnace equipment but are expected to maintain equipment, to the best of one’s ability, at fully optimal conditions.

Note the location of fire extinguishers and the nearest exits in the case of equipment fires.

Each piece of equipment can be unique, and some steps may not be required, additional steps may be required, or the order may vary. Refer to user manual and [Insert/edit to include Lab Specific Information]

1. Determine the type of process required before beginning. If you are using a gas furnace and your process doesn’t require temperatures above 1000 Celsius then use a box furnace. If your process utilizes temperatures below 1000 Celsius it could damage the heating elements in a gas furnace.

2. Check that the furnace is available.

3. Fill out the furnace use log.

4. Inspect the furnace condition prior to connecting to energy source and turning on main power. Check the following:

- Ensure that the furnace placement allows for sufficient airflow around the furnace. Verify that the clearance meets the requirements specified in the user manual.

- Inspect the plug and power cord for damage. If any damage is noted, notify PI/RP or designee and do not operate furnace.

-Inspect the furnace for any debris, remove using manufacturer’s instructions [specify here].

- Inspect the door gaskets and port inserts for integrity. Any degredation will allow heat to escape and compromise the operation. Notify PI/RP or designee if any loss of integrity is noted, do not proceed until granted approval.

5. Place a sign on the furnace to indicate that the furnace is in use.

6. Place the material carefully in the furnace. Do not touch the edges. Do not put material in the furnace that is too big or that could boil over, sputter, or in any other way cause damage to the furnace. If you are unsure of the melting temperature of your material, a sample container should be used which can contain your material in a liquid form. This will help to protect the furnace insulation from contamination and damage. Furnace insulation is very expensive to replace. It is best to maintain sufficient clearance around all items in the furnace to assure proper convective currents around your sample. Placing the samples on stands assures currents around most of the bottom of the sample. **If a stand is used, confirm that the stand can withstand the maximum temperature of the furnace.**

NOTE: Material should be placed in the furnace before starting the program. Opening the furnace at high temperatures will damage the heating elements.

8. Program the furnace: See controller and/or furnace user manual. If the furnace takes an unusual amount of time to reach desired temperature, or if temperature is fluctuating more than expected, document the issue and notify PI/RP or designee.

9. After the program is complete, allow the furnace to cool. Do not open the furnace until the oven and its contents have cooled sufficiently for safe handling. Material may not appear hot under 600 °C. Do not set materials from the furnace on any wood surfaces. Use a metal table and/or high temperature refractory materials in the lab for that purpose.

10. Turn off the main power to the furnace.

If a spill occurs, wait until the furnace is completely cool before attempting clean up. Refer to material SOP for proper clean up and disposal procedures.

11. A burn kit is available in the lab. If an accident occurs that is life threatening, call 911 immediately. If a minor accident occurs, it is recommended that the injured party go to Hall health or an alternate medical provider. Communicate the accident to your supervisor and fill out an accident report for any incident or near miss. Accident reporting information can be found at: <https://www.ehs.washington.edu/workplace/accident-and-injury-reporting>

**Section 8 - Emergency Procedures** [Insert/edit to include Lab Specific Information]

Do not attempt to repair or service the equipment yourself. Notify your PI/RP or designee about equipment issues and any equipment repairs are needed. One of the greatest risks when it comes to furnace malfunctions are fires and explosions. Most furnaces will have a built in fail-safe system which shuts down the power to the furnace during an explosion; however, seek shelter immediately and contact the PI/RP or designee and make sure the rest of the lab personnel and equipment are safe.

**Section 9 - Related Documents**

Appendix A: Equipment User Manual

Appendix B: Equipment Use SOP

Appendix C: User Log (example)

Appendix D: Maintenance Log (electronic link and paper example)

**Section 10 - Implementation and Training [signature of all users is required]**

* Prior to using furnace and/or performing routine maintenance procedures described in this SOP, laboratory personnel must be trained on the hazards described in this SOP, how to protect themselves from the hazards, and emergency procedures.
* Ready access to this SOP, to the instrument user manual, and to any applicable Safety Data Sheet for each hazardous materials described in the SOP must be made available in the lab space(s) where these procedures are performed.
* The Principal Investigator (PI), or Responsible Party, or designee, must ensure that their laboratory personnel have attended appropriate laboratory safety training (and refresher training where applicable).
* Training must be refreshed following any revision to the content of this SOP.
* Training must be documented. *This training sheet is provided as one option; other forms of training documentation (including electronic) are acceptable, but records must be accessible and immediately available upon request.*

 **I have read and understand the content of this SOP:**

| **Name** | **Signature** | **Date** |
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