Standard Operating Procedure – Thermolyne Ovens

About this SOP
This document describes the standard operating procedure for using any of the Thermolyne ovens in room 157 Engineering II. It covers hazards, emergency procedures, basic specifications and operating procedures.

Who to Contact
If you have any questions or concerns or would like to report a problem with any of the Thermolyne ovens contact the laboratory's manager or the laboratory's safety coordinator. The names, office numbers and phone numbers of these people are located on the "Emergency Contact" sheet post on the inside of the door to the laboratory.

Hazards
The use of these ovens presents the following types of hazards:

- Electrical: these are electrically powered ovens which may require up to 2 kW of power. This power can be lethal or may lead to fires if not handled correctly. Avoid touching any exposed wiring, do not let the ovens get wet, keep the area around the ovens clean and dry and inspect the external wiring regularly. Finally, do not attempt repairs on these ovens while power is still available to it.
- Fire: the temperatures generated can quickly cause a fire inside the oven and in the surrounding laboratory. Correct use of these ovens and prudence in choice of materials to put in the ovens will prevent fires from starting.
- Chemical: Oxidation, melting, violent reactions, out-gassing of your specimen or part may create chemical hazards such as toxic, or corrosive, or flammable gasses or liquids. Reactions with the materials used in the inner walls of the furnace might also occur. Think carefully about what you will be placing in these ovens so that potential chemical hazards do not become real chemical emergencies.

Emergency Procedures
Basic emergency procedures were covered in your general laboratory safety training. If you have not received this training then you cannot work in this laboratory, much less use the ovens.

Emergencies related to the use of these ovens are most likely related to the hazards described above. If an emergency should occur then deal with it to the best of your ability and according to established emergency procedures such as those summarized in the R.A.C.E. acronym. No matter what the emergency, contact the laboratory's safety coordinator to report the incident.

Specifications
Before using any of the Thermolyne ovens review the specifications to make sure they are appropriate for your needs. These are general purpose ovens designed to heat a wide variety of materials in air. A summary of their specific specifications are:

- Power requirements: 12 amps at 115 VAC, 60 Hz
- Temperature Range: 100-1100°C max, 1000°C max recommended
- Chamber Materials:
- Internal dimensions:
- Heating and Cooling Rates: the following table summarizes the heating and cooling times for several set points.

Temperature Set Point, °C	Time Required to Heat from Room Temperature	Time Required to Cool to Room Temperature
200	xx hours	xx hours
400		
600		
800		
1000		

Safe Materials to Place in this Oven

It is very important that one not put materials in these ovens that might damage the ovens or create a hazardous situation. Before you put anything in the oven make sure it is safe to heat this part to the desired temperature. Consider the following situations:

- Combustion: since all heating will be in air, some materials such as paper, polymers, epoxies and even some materials when in powder form may catch fire or even explode.
- Charring: even if a combustible material does not actually catch fire it may smolder and char, giving of noxious gasses and blackening the oven
- Melting: if a polymer, glass, ceramic or metal melts in the oven it may permanently damage the oven's lining. In liquid form it may even attack the lining, melting holes in it and leaking onto the electronics below. Please remember that two materials placed in contact may have significantly lower melting temperature that either would have separately.
- Oxidation: most materials placed into the oven will oxidize. If you cannot tolerate any oxidation then you should place your sample in an air-free container such as an evacuated and close quartz tube.
- Thermal Expansion: A solid specimen being remelted in a crucible will expand while still solid and may crack the crucible. Once the material has melted it may leak out, damaging the oven. The use of secondary containment such as a larger crucible will prevent damage to the oven and it will protect your material.
- Fumes: these ovens are not vented directly to a scrubber or to the roof. Do not heat materials in these ovens if they will produce dangerous or annoying levels of such gasses.

Operating Procedure

1. Inspect the Oven

Before using the furnace inspect it and its surroundings for the following:

- Make sure the electric power connections are made correctly and that the power cable is not

damaged.

- Make sure that the area around the oven is clear. The oven should have at least 6-inches clearance around it and there should be no paper or other flammable materials on or near it.
- Inspect the inside of the oven to make sure it is clean and that no one has left their specimen or any other fixtures in it.

Do not use the oven until all necessary corrections have been made.

2. "Oven in Use" Notification

Use one of the signs provided to post your name, the times and dates you will be using the oven, the temperatures you will be using, the type of materials you are working with and a phone number, office number and/or email address where you can be contacted in case anything goes wrong. On the back of the card note any special precautions or comments that someone rescuing your specimen might need to know. If no cards are available then make up one of your own.

3. Start Heating

Turn on the oven by pressing the main power switch in the lower right. The controller will perform a brief self-test during which the display shows .... . When the self-test is complete the display will show the current set point and temperature. At this point the controller is not only ready but it has already started heating. Press and hold the x or x buttons to increase or decrease the temperature set point.

4. Load the Specimen

Before you put anything in the oven make sure it is safe to heat this part to the desired temperature. Also consider the fact that your specimen is in contact with other materials and that additional reactions, possibly even melting, may occur. Make sure you have everything your are going to need: safety equipment, tools, etc. Make sure there is a clear and safe place to put the part when you eventually take it out. Once you have made these preparations use the following procedure to load your specimen.

- Protective equipment such as gloves, aprons, face shields and long tongs are available and are located near the ovens. Use what you think is appropriate for the materials and temperatures you are working with.
- Open the oven's door. The power to the heating elements is automatically turned off.
- Load your specimen or part. Make sure it is not touching the heating elements or an electrical short might occur when you close the door.
- Close the door. The power to the heating elements will be restored and the oven will start heating back to the set point.
- Clean up the area around the oven and store the protective equipment properly.

5. Removing the Specimen

Before you start to take anything out of the oven make sure you have everything your are going to need, especially if the specimen is still hot. Make sure there is a clear and safe place to put the part, or that your quench tank is ready, or if you drop the part that you have in place a plan for dealing with the situation. Once you have made these preparations use the following procedure to remove your specimen.

- Protective equipment such as gloves, aprons, face shields and long tongs are available and are located near the oven. Use what you think is appropriate for the materials and temperatures you are working with.

- Open the oven's door. The power to the heating elements is automatically turned off.
- Remove your specimen or part and, if still hot, carefully place it on a heat resistant surface.
- Close the door. The power to the heating elements will be restored and the oven will start heating back to the set point.
- Clean up the area around the oven and store the protective equipment properly.

6. Finishing Up

When you are completely finished using the oven you must do the following:

- Turn off the oven.
- Clean up the inside of the oven. Make sure all of your specimens, parts, fixtures, etc. are removed and use compressed air to gently blow out the finer particles. If the oven is still hot you may have to wait a while for it to cool first.
- Clean up the area around the oven, including anything you dropped on the floor.
- Put all tools and protective equipment back in their proper places.
- Remove your "Oven in Use" card and dispose of it.