

Oven Cure Standard Operating Procedure (SOP)

Author: Dayna Erdmann (daynae@mit.edu)

Purpose

The purpose of this procedure is to provide a step-by-step guide for members to use the oven in TLAMS for curing composites. The composite fin can, one of the pieces of hardware that requires an oven cure, will be vacuum-bagged while curing in the oven, which requires the appropriate heat-resistant peel ply, release film, bleeder fabric, vacuum bag and vacuum tape.

Important Notes:

- When using West Systems epoxy, the total cure time is ~12 hours (including preparation and ramping up/down)
- **Always** have another person in the lab at all times for safety
- It is **highly** recommended to have shifts so that one person does not have to watch the oven the whole time!

Prerequisites

All participants in the layup must have general Rocket Team lab safety training, and must have completed a respiratory medical evaluation at MIT Medical, and a respirator fit check in EHS. All participants should be wearing gloves, safety goggles, a protective jacket, and a respirator when opening the oven after the cure cycle is complete.

Risks and Mitigation

Fire

Risk: Because the procedure involves using an oven up to 300F, there is a risk of fire.

Mitigation: Wear a protective jacket and safety glasses. Monitor the oven at **all times** during the cure cycle, and when adjusting the temperature, do so slowly (2-5F per minute). Ensure that all vacuum bagging materials are heat-resistant up to the maximum temperature of the cure cycle (in the case of West Systems epoxy, this is 300F). This includes the peel ply, release film, bleeder fabric, vacuum bag, vacuum tape, and the hose and fixtures used to attach the vacuum pump through the port in the oven.

Fumes from epoxy

Risk: While the composite is curing, the epoxy may reflow and start to release fumes.

Mitigation: Wear a respirator while removing the hardware from the oven after curing, and store in a well-ventilated area after curing.

Handling composite after oven cure

Risk: The composite might still be hot after the oven cure, and once unbagged, the sharp edges of the composite will be exposed.

Mitigation: Wait until the oven has cooled completely (to room temperature) and wear nitrile gloves when handling the composite. Exercise caution and do not make any hasty movements in order to avoid injury.

Required Materials for Oven Cure

- Fin can (or other composite to be cured)
- Bagging materials
 - Peel ply
 - Heat-resistant release film
 - Bleeder fabric
 - Vacuum tape
 - Stretchalon 800 vacuum bag
- Vacuum materials
 - Vacuum pump
 - Vacuum fixtures and tubing

- Wrench
- Protective coat
- Safety goggles
- Respirator
- Tape (to hold down dial on oven)
- Nitrile gloves

OVEN CURE PROCEDURE

***For all ramping up/down steps, the temperature should not change by more than 2-5F per minute. When adjusting the temperature of the oven using the manual dial in the middle of the control panel, remember to tape down the dial when the temperature is done being adjusted, because otherwise it will “wobble” out of place and the temperature will change.**



^Temperature display



^Control panel with START/STOP buttons, dial, and heat breakers



^Vacuum pump with correct pressure

Prepare Composite/Vacuum Bagging

- 1) Follow the “Vacuum Bagging” procedure for vacuum bagging the composite to be cured.
- 2) Attach a brass fixture and metal (high-temp resistant) tubing to the vacuum connector using a wrench.
- 3) Position the composite inside the oven (which is turned **OFF**) and run the tubing through the port hole on the right side of the oven.
- 4) Connect the other end of the tubing to the vacuum pump.
- 5) Turn ON the vacuum pump and open the valve, monitoring the pressure change (it should drop down to -27 inHg and remain stable. Small deviations are ok, but large changes signify that there is a leak in the vacuum bagging).
- 6) Close the door of the oven.

Turn on Oven

- 1) Ensure that the dial is turned to 150F and the door to the oven is closed.
- 2) Press the black “**START**” button on the left side of the control panel.
- 3) Turn on both of the heat breakers on the right side of the control panel.

West Systems Cure Cycle

For all the following steps, monitor the temperature using the digital display on top of the oven (left side). Do not change the temperature by more than 2-5F per minute, and when you reach the 3-hour “hold” period, tape down the dial or else it will wiggle out of place.

- 1) Ramp up* to 150F and hold for 3 hours
- 2) Ramp up to 250F and hold for 3 hours
- 3) Ramp up to 300F and hold for 3 hours
- 4) Ramp down to 100F

Turn off oven and let cool to room temperature

- 1) Turn off the heat breakers.
- 2) Press the red “STOP” button on the left side of the control panel.
- 3) Once the oven has cooled to ~75F, turn OFF the vacuum pump.
- 4) Wearing gloves, untighten the vacuum connector connecting to the vacuum pump.

Carefully remove composite

- 1) Wearing a protective coat, goggles, respirator and gloves, carefully remove the composite from the oven.
- 2) Carefully remove the bagging materials.
- 3) Store in a well-ventilated area.
- 4) When post-processing (sanding the composite), wear a respirator, safety goggles and nitrile gloves.

Date	Revision	Changes Made
11/20/2018	1.0	N/A
12/26/2018	1.1	Added “Important Notes”, updated required materials to include a wrench