

# Buehler Cast N' Vac 1000 Embedding System

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## Standard Operating Procedure

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### Overview

This document will provide a detailed operation procedure of the Buehler Cast N' Vac 1000 Embedding System. Formal Training is required for all users prior to using the system.

### Revision History

#	Revised by:	Date	Modification
1	Matt Bilton	Nov. 17, 2016	First version
2	Lis Melo	Aug. 26, 2019	New figures, text and workflow modifications
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## General Information

Buehler's Cast N' Vac 1000 evacuates trapped air from the samples with the embedding material. Without the presence of air, the embedding material fills the specimen pores and eliminates gaps within the specimen. As a result, edge retention is enhanced and fragile samples are supported during grinding and polishing.

The vacuum pump supplies low enough pressure to quickly evacuate trapped air from any porous specimen. The high strength plastic chamber maintains vacuum throughout casting by means of an O-ring seal.

Several samples may be prepared simultaneously using the rotary table within the vacuum chamber.

The use of the epoxy embedding system is included with the fumehood in wetbench #9. Please make sure to book the tool time for wetbench #9 for the entire duration of the experiment, including setting up and putting away the apparatus. If there are concerns of other users using the fumehood while the epoxy cures, please make sure to book the wetbench until the resin has cured and samples are removed from the fumehood. Please label any samples left in the fumehood overnight.

Main components:

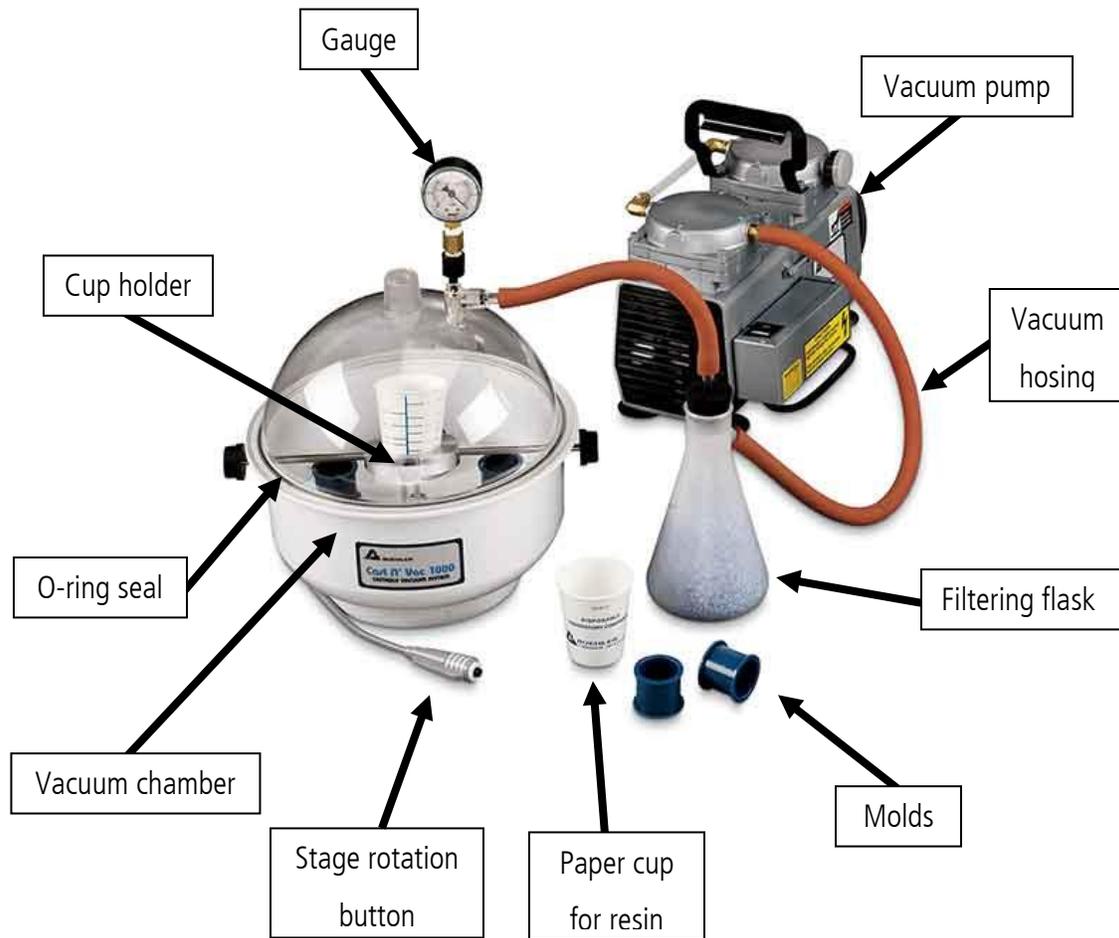


Figure 1: Main components of the Cast N' Vac embedding system

## Safety

The Cast N' Vac 1000 is designed for use in dry, indoor laboratory environments, away from strong electromagnetic fields and within normal temperature ranges (5 – 40 °C), and non-condensing humidity ranges (30 – 90%).

### Important safety instructions:

- Only trained users are permitted to operate the Cast N' Vac system.
- Always use the system within a fume hood (wetbench #9).
- Wear safety glasses, protective gloves and a lab coat at all times.
- For hot specimens, always handle with heat protective equipment (e.g. gloves).
- Do not operate the machine in the presence of flammable liquids, gases or dust.
- If there is a problem with the tool, do not attempt to repair yourself. Always speak with the tool owner.

### Resin handling, care and waste disposal:

- Uncured liquid epoxy resins and hardeners can be irritant to the eyes and skin, as well as toxic to aquatic organisms. To prevent risk of exposure, all handling of the resins, hardeners and use of the casting system must all take place within a designated fume hood (wetbench #9).
  - Cured (solid) epoxy resins are generally classified as non-hazardous, and so **only when cured can molds be removed from the fume hood.**
- Solid resin waste can be disposed of safely in the **chemical solid waste bin**. Stirring sticks for the resin must also be left to cure before disposal.
- Liquid resins and hardeners must never be disposed of in a drain.
  - In the event of a spill, scoop or wipe up resin with an absorbent paper towel. Clean the area and any tools with detergent solution. Place any solid waste within a plastic zip-lock bag and wait for any resin to dry before disposing in the chemical solid waste bin. Refer where necessary to the appropriate MSDS sheet for the epoxy resins and hardeners.

- Always notify a 4D LABS member of staff, who can assist with a safe clean-up.

## Consumables and Accessories

Items required for use with the Cast N' Vac are currently stored in the drawers next to the Wetbench #9.

These include:

- Mold cups
- Stirring sticks
- Cups
- Vacuum grease
- Q-tips

The resins are located in the flammables cabinet in room #6140. Weighting paper and a portable balance are available in the drawer next to the wetbench #9. Ask the tool owner if you require any assistance.

## Operation

1. Before starting, place several paper towels at the back of the fumehood:
  - a. on the left side for waste disposal and
  - b. on the right side for curing the molds with a label including your name, material name, any hazards involved, contact info and date.
2. Select the appropriate mold size and number of molds for your sample(s).
3. Apply the release agent on the mold inner surfaces using the Q-tips.
  - a. Put a small amount on the cap and dispose of any excess on the paper towels placed at the back of the fumehood.
4. Place your samples inside the molds.
  - a. For some thin and malleable samples, it may be necessary to sandwich the sample between hard plastic papers (i.e. folders or overhead paper) of similar size to the sample.

- b. Thin samples can be held upright by placing it between enrolled plastic clips (available in the drawer).
5. Select the appropriate resin for your sample and use the stirring rod to ensure a homogenous mixture. Refer to the supplementary Technical Information Guide on Castable Molding Compounds.
  - a. To avoid being wasteful please use only the volume that you need. Use 10-15 g approx. of resin + hardener for the small mold and 15-20 g for the larger molds (need a total of 3 if using the central force holder in the polisher).
    - i. For **Epoxy Cure** use 100 parts resin to 23 parts hardener (by weight). For an approx. total 10 g: use 8 g resin to 1.85 g of hardener.
    - ii. For **Epoxy Thin** use 100 parts resin to 45 parts hardener (by weight). For an approx. total 10 g: use 7 g resin to 3.15 g of hardener. For an approx. total of 15 g: 10.5 g resin and 4.73 g hardener.
    - iii. For **Epoxy Heat** use 100 parts resin to 20.6 parts hardener (by weight). For an approx. total 10 g: use 8 g resin to 1.64 g of hardener.
  - b. The resin and hardener should be weighed using the portable balance with a weighting paper (available in the drawer) on top to protect the balance from any spills. Make sure to turn off the balance once done.
  - c. Tilt the cup to approximately 45 degrees and slowly mix the solution to avoid bubble formation.
  - d. As you mix the solution, a haze will form. Continue mixing until all the haze goes away, and the solution looks homogeneous.
6. Carefully pinch the cup's edge to form a spout for a more controlled pour.
7. Set-up the vacuum chamber and the filtering flask inside the fume hood (wetbench #9; see Figure 2).
  - a. Disconnect the hose connecting the filtering flask with the pressure gauge/valve and move the flask and the chamber separately into the fumehood.
  - b. Take care when moving each component into the fume hood. Ask a staff member for assistance if necessary.
8. Ensure the vacuum hose line between the pump and the filtering flask is connected, as well as the hose between the flask and the chamber.



Figure 2: Embedding system set-up within the fume-hood

9. Plug in the vacuum chamber cable into the main power supply.
10. Before use, check that the vacuum hose assembly is secure.
11. Check that the O-ring seal in the vacuum chamber is lined with vacuum grease.
  - a. If necessary, apply a light film of vacuum grease (grease is stored in the drawer beneath the pump, ask a staff member for any assistance).
  - b. Do not apply excessive amounts of grease, as this can cause the lid to move under the vacuum.
12. Place the cup into the cup holder.
13. Adjust and tighten the cup stop to prevent the cup from slipping or falling out when the cup is tilted.
14. Place and position the mold(s) containing the specimen(s) on the liner to determine the resin flow position in relation to the center of each mold as shown in Figure 3. The molds placed on the liner can be rotated by pressing the stage rotation button to ensure all molds are aligned with where the resin will pour.

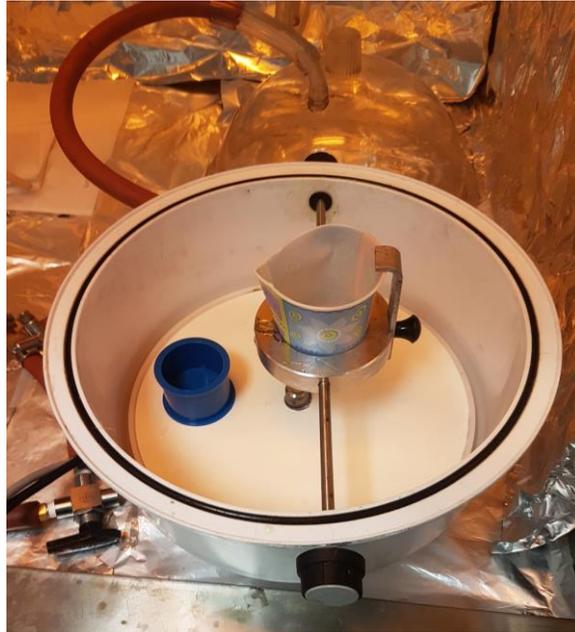


Figure 3: Embedding system set-up within the fume-hood

15. Place the plastic dome on the vacuum chamber and seal the chamber. Make sure that the relief opening is not aligned with the samples as shown in Figure 4.
16. Turn on the vacuum pump (main switch) and open the valve (turn the valve 180 degrees to open it) to allow the pressure change in the chamber.
17. When the pressure gauge reads -20 in. Hg, close the valve to the chamber and wait for 10 secs (requires a 90 degree turn of the valve). Then, slowly release the pressure by opening the valve. Releasing the pressure allows air to slowly enter the vacuum chamber.
  - a. Epoxy cures at a faster rate under vacuum. The pressure can be lower than -20 in. Hg, but there is a risk that the epoxy in the outer part of the mold will cure faster than the epoxy in the inner part of the mold.
18. Repeat step 17.
19. After releasing the pressure, open the valve to -20 in. Hg and close the valve (vacuum will be applied in the chamber). Note that steps 17-18 may be skipped if desired by the user.



Figure 4: Embedding system set-up within the fume-hood with mold

20. Slowly rotate the casting-knob counter-clockwise to pour the resin into the mold(s) while in vacuum.
  - a. NOTE: After pouring, do not immediately raise the cup to a vertical position. Keep the cup slightly tilted until the resin stops dripping.
  - b. Press the revolving table switch to move the next mold into position.
  - c. After approximately 10 secs of pouring the resin onto the sample, slowly release the pressure.
  - d. Repeat step 17 another 2 times (this step may be skipped if desired).
  - e. The user has the option of pouring the resin only to cover the sample in vacuum, and pour the remainder of the resin without the vacuum.
21. Once the pouring of the resin is complete, slowly rotate the base of the vacuum gauge so the relief opening is not on top of the samples.
22. Turn off the vacuum pump.
23. Slowly release the pressure from the chamber.
  - a. The sudden rush of air into the vacuum chamber may disturb the resin causing the resin in the molds to spill or splatter.

24. Once the vacuum in the chamber has dissipated, the vacuum chamber can be opened and the samples may be removed.

### Wrapping up the experiment / Waste disposal

1. Make sure samples are removed from the vacuum chamber and the vacuum pump is turned off.
2. Disconnect the filtering flask from the vacuum chamber to vent the line to the vacuum pump (the pump should be turned off before venting).
3. Place all waste contaminated with epoxy at the back of the fumehood and wait until it cures for disposal in the chemical solid waste bin.
4. Leave samples on the right hand side at the back of the fumehood (wetbench #9) until the epoxy has cured. Place a label with your name, contact info and sample information (including any hazards).
5. Make a ticket for the time wetbench #9 was occupied and for any epoxy used.
6. Once the epoxy is cured, remove the embedded samples carefully from the molds.
7. Please clean the molds of residual resin using isopropanol and Kimtech wipes (always wear gloves). Place the wipes into the chemical solid waste bin.
8. Dispose of all waste (including the cup, stirring rod, etc) into the chemical solid Waste bin after the resin is cured.

### Recommended Curing Times

1. For Epoxy Cure: cure time = 6 hours (Temp < 40 °C)
2. For Epoxy Thin: cure time = 9 hours (Temp < 30 °C)
3. For Epoxy Heat: cure time = 90 minutes at 55 °C. Use vacuum oven in the Thermal Processing Lab.

More details on the use of each epoxy type can be found on the supplementary Technical Information Guides.

## References and Files

Buehler Cast N' Vac 1000 Operators Manual

Technical Information Guide: Castable Molding Compounds (Buehler)

Technical Information Guide: Final Polishing & Preparation Guides (Buehler)

## Contact Information

Questions or comments in regard to this document or Buehler Cast N' Vac Embedding system should be directed towards the tool owner(s) in 4D LABS at Simon Fraser University, Burnaby, BC, Canada. The current tool owners can be found at: <http://4dlabs.ca/our-capabilities/equipment/epoxy-embedding-system.html>.