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Polymer Infiltration Device

User Manual

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Notation

EAFBRL Eglin Air Force Base Research Lab



1 Equipment

Item	Quantity
Vacuum Resin Trap Catch	1
Squeeze-Line Clamp	2
Econo Tacky Tape	1
Vacuum tube 1/4 in	2
Pipe brass hose bard	1
Quick connect release kit	1
Quick connect nipple	1
Leak free bulkhead	1
Gas ptfе tape	1
Vac gauge 1/4 in	1
Hvac flare	1
Cast acrylic (14in x14in)	2
Cast acrylic (12in. x36in.)	1
Cast tubing	1
Vacuum pump	1
Plain steel angle	2
3/16 A36 plate 2ftx2ft	1

1.1 Degas Chamber

1.2 Vacuum Pump



2 Setup

2.1 Bolt the base plate to the metal frame and ensure the plate is secured. Tube 1 is fed through the center hole in the base plate. Some of the top of the tube should be visible above the base plate. Place gum tape around tub 1 and the bottom of the base plate. This will ensure an air tight seal. Add a small amount of sealant into the channel located on the base plate and secure the vacuum tube onto the base plate. Add a small amount of sealant in the channel on the lid. Place the lid onto the vacuum chamber and allow both the base plate and lid to dry fully.

2.2 The t-value for the atmospheric valve and VAC1 should be put into place in one hole on the top of the lid and the pressure gauge into the other. Add a small amount of gum tape between the t-valve and the lid and the pressure gauge and the lid to ensure an air tight seal.

2.3 Join the four walls of the jig so that the walls abut each other. Place sealant into the cracks of the joints and clamp together until fully dry. Add a small amount of sealant to the tops and bottoms of the walls of the jig and place the top and bottom plates onto the jig walls. Clamp until dry.

2.4 The bottom of tube 1 is fed through the hole in the top of the jig plate. Clamp 1 is placed in a convenient position between the jig top and the bottom of the base plate. Tube 2 is fed through the hole in the bottom jig plate. Attach clamp 2 in a convenient position between the end of tube 2 and the bottom of the jig. The other end of tube 2 is connected to the catch can.



3 Operation Instructions

3.1 Prep

- 3.1.1 Remove lid from vacuum chamber and place a clean funnel inside with the nozzle facing down.
- 3.1.2 Place lid back on top of the chamber and ensure silicone channel is well seated.
- 3.1.3 Close atmospheric ball valve on the lid, leaving the VAC 1 valve open.
- 3.1.4 Close Clamp #2 located below the Jig assembly, leaving Clamp #1 open.
- 3.1.5 Using the quick connector fitting, attach the vacuum pump to the VAC 1 connection on the vacuum chamber lid.
- 3.1.6 Turn vacuum pump ON and allow chamber to reach maximum vacuum pressure.
- 3.1.7 Close VAC 1 ball valve and then turn vacuum pump OFF, make note of the chamber's pressure.
- 3.1.8 Wait 5-10 minutes and check for any variation in chamber pressure. If pressure has changed check for leaks in the jig and chamber seals and then repeat steps 2 through 8.
- 3.1.9 If chamber and jig seals are successful, close Clamp #1 located above the jig assembly and OPEN Atmospheric and VAC 1 valves.

3.2 Operation

- 3.2.1 Remove vacuum chamber lid and pour mixed Sylgard 184 silicone into the funnel.
- 3.2.2 Place lid back on top of the chamber and ensure silicone channel is well seated.
- 3.2.3 Close Atmospheric valve and turn vacuum pump ON.
- 3.2.4 Allow enough time for the silicone to fully degas.
- 3.2.5 Once silicone is fully degassed, OPEN Atmospheric valve.
- 3.2.6 Using the quick connector fitting, detach the vacuum pump from the VAC 1 location and reconnect the pump to VAC 2 located on the catch can.
- 3.2.7 Turn vacuum pump ON and allow maximum vacuum pressure to be achieved.
- 3.2.8 Open Clamp #2 located below the jig assembly.
- 3.2.9 Open Clamp #1 located above the jig assembly, silicone will begin to flow.
- 3.2.10 Continue to pull vacuum until a steady flow of silicone is seen entering the catch can.
- 3.2.11 Close both Clamp #1 and Clamp #2 and turn the vacuum pump OFF.
- 3.2.12 Allow a minimum of 24 hours for the silicone to cure before removing from the jig assembly.



4 Safety Procedures

The following section provides information on how to use the vacuum pump and vacuum chamber system and Sylgard 184 safely and what to do in case of an emergency.

4.1 How to use safely

Make sure to wear safety goggles when handling Sylgard 184 and when the vacuum pump is in use. Check to make sure the vacuum tubing has no cracks or holes. Make sure all connections are sealed before pulling vacuum to avoid the chamber breaking. Make sure to be in a well ventilated area when using the vacuum pump. Avoid eye contact and do not breathe spray or mist when the Sylgard is being mixed. In an event of a spill of the Sylgard, contain the spill by bunding and mopping up with absorbent material and placing in a vented container. Employ bunding in order to prevent spreading or entering into drains, ditches, or rivers, by using sand, earth, or other appropriate barriers. It is important to clean up spills since the spill area can become extremely slippery. Sylgard 184 is regarded as hazardous waste in the RCRA Hazard class and needs to be disposed of based on state or local laws. Store excess Sylgard 184 in a closed container away from water or moisture in a well ventilated area because of the hydrogen gas that slowly evolves over time from the silicone. Make sure to store the Sylgard at a maximum of 32 degrees Celsius and do not store in glass containers.

4.2 What to do in case of an emergency

The main risks associated with Sylgard 184 arise from aerating it, and when it is burning. If a fire occurs make sure to call 911. The Sylgard Material Safety Data Sheet advises to, "Use AFFF alcohol compatible foam or water spray (fog). Most fire extinguishing media will cause



hydrogen release. Thus, in poorly ventilated or confined spaces, the accumulation of hydrogen may result in flash fire or explosion if ignited. Applying foam may release flammable hydrogen gas that can be trapped under the foam." In order to help extinguish the fire, use dry powder and do not allow extinguishing medium to contact container contents. If Sylgard 184 comes in contact with eyes or skin be sure to wash the affected area for 5 minutes and seek medical attention if irritation persists.



5 Trouble Shooting

There are three distinct areas where issues utilizing the polymer infiltration device arise, the tubing, the pump and the jig.

5.1 Tubing

The tubing must be replaced after each batch of lattices that are infiltrated as the silicone will harden and cause blockages. A batch is defined by either the total use of silicone degassed in the vacuum chamber or the silicone used during the pot life of the silicone. The tubing is not durable enough to clean and reuse.

5.2 Pump

The issues most often encountered relating to the pump are improper tubing seals. The pressure gauge will reveal this issue. The correct response to this issue is to diagnose where the leak is and apply gum tape to the problem area.

5.3 Jig

The jig will occasionally encounter an improper seal leading to silicone leaks. This can be visually identified easily. The issue is caused by improper sealing using hot glue. The lattice must be removed and discarded due to imperfections. The hot glue must be liberally applied to all corners of the jig to ensure a good seal.





Appendices



Appendix A: Specification Sheets and Safety Information

A.1 Sylgard 184



References

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