

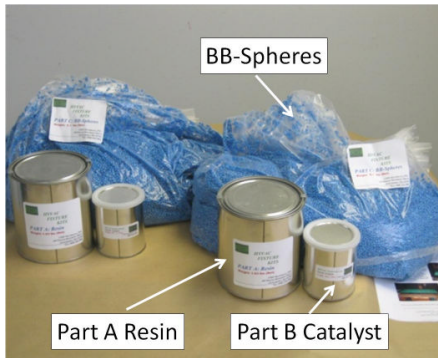


Innovative Tooling Materials for Thermoforming

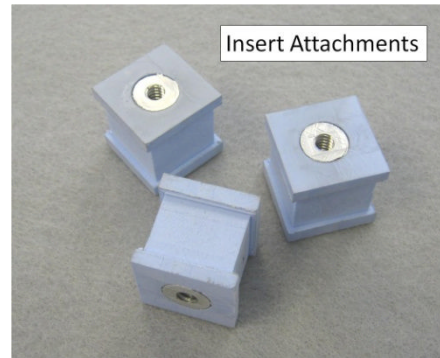
HYVAC[®] Vacuum Fixture, Mixing and Assembly Instructions

NOTE: The adhesive used to bind HYVAC material together is a two-part, room temperature cure system. It begins to cure upon mixing and quickly becomes tacky. For ease of use, it is recommended to have all tools, fixtures and needed parts laid out prior to mixing the HYVAC adhesive.

KIT CONTENTS:



OPTIONAL:



Tools/Fixtures/Items you will need to provide:

- Safety Glasses – should be worn at all times when working with uncured HYVAC and mold release materials.
- Disposable Gloves (it is easiest to have several pairs available) – should be worn at all times when working with uncured HYVAC and mold release materials.
- Stir stick (to mix adhesive in can).
- Cavity being used to make the fixture.
- Small block of wood (typically a 3” long piece of a 2x4 is suitable) for tamping HYVAC mixture into place.
- Backing plate with insert attachments. **THIS SHOULD BE MADE PRIOR** to mixing HYVAC.
- Silicone based Mold Release
 - Frekote AC-4368 is recommended (www.henkel.com/frekote)
 - Alternate: 054420 Silicone Spray (<http://www.freemansupply.com/SiliconeSpray.htm>)

Items you may need:

- Gasket Tape
 - All Star Adhesives (<http://www.allstaradhesives.com>)
- Urethane Sealant
 - 3M PowerLine 550 is recommended (Grainger Part# 4YDH1, <http://www.grainger.com>)



1. Fixture Design:

- 1.1. Before mixing a HYVAC kit, it is important to consider if any areas of the fixture will need to be impermeable to air. Areas of cured HYVAC material can be sealed off with a urethane sealant (3M PowerLine 550 is recommended), as shown in Figure 1.
- 1.2. Alternatively, areas of the cured HYVAC material can be sealed off with an epoxy resin system.

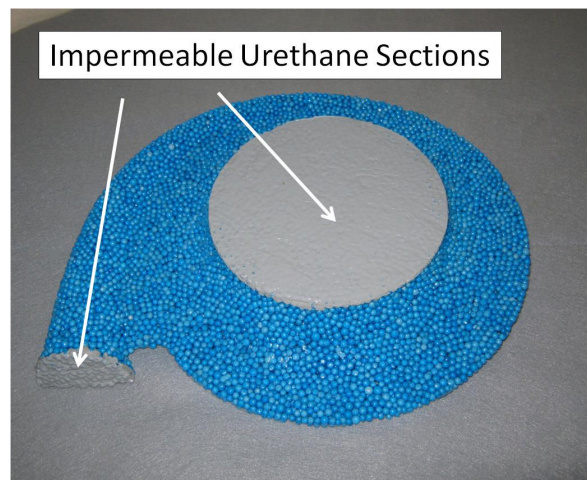


Figure 1. HYVAC fixture with impermeable section.

2. Backing Plate & Attachment Points

- 2.1. In addition to fixture design, it is important to design and machine a backing plate and attachment points for the fixture. The back side of a HYVAC fixture is shown in Figure 2 to illustrate typical attachment points.
- 2.2. Backing plates can be made of Plexiglass[®], plywood, MDF board, etc. The backing plate needs to be large enough so that gasket tape can be adhered along the perimeter of the HYVAC fixture. A hole will need to be drilled/tapped in the center of the backing plate for a pipe to hose adapter. A straight adapter with a minimum 2.0” diameter is recommended. (Elbow fittings dramatically reduce the amount of vacuum through the fixture.) The bottom side of a backing plate with a vacuum port and insert attachments, after fixture construction, is shown in Figure 3.
- 2.3. A minimum of two attachment points are needed. Larger fixtures will require additional attachment points. CMT sells attachment points with 1/4-20 threaded aluminum inserts installed in the center. A typical backing plate, with gasket tape, is shown in Figure 4.

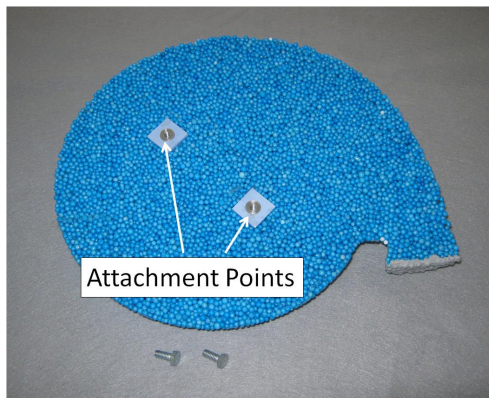


Figure 2. HYVAC fixture with CMT attachments.

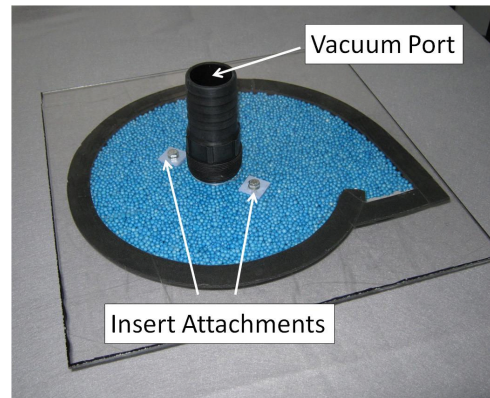
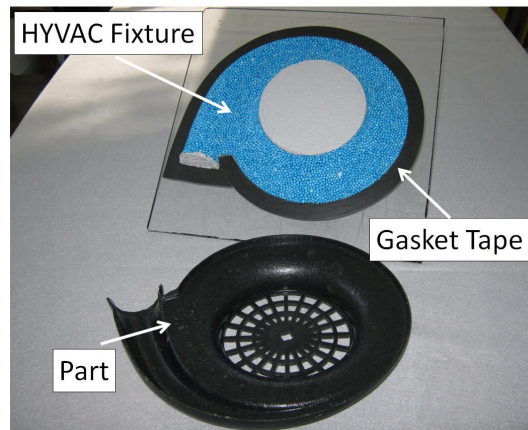


Figure 3. Fixture on backing plate.



(Part compliments of Plasti-Lab Technologies)

Figure 4. HYVAC fixture on backing board.

3. Preparation

- 3.1. Wear safety glasses and gloves when working with mold release.
- 3.2. Determine the amount of HYVAC material needed to fill the fixture cavity. Each bag of spheres provided will fill a 0.25 ft³, or approximately 1.9 gallon volume.
- 3.3. Clean and mold release the cavity that will be used. Follow the recommended manufacturer's procedure when applying the mold release.
- 3.4. Apply mold release to the backing plate making sure no release contacts the insert attachments. (The insert attachments will be pushed into the HYVAC mixture at a later stage and must bond to the HYVAC spheres.)



4. Mixing the Components

- 4.1. Always wear safety glasses and gloves when handling uncured HYVAC.
- 4.2. Open the Part A can and thoroughly stir resin for one minute. Part A contains a fiber reinforcement that may settle over time so it must be thoroughly mixed before adding Part B. Part A should be at a temperature of at least 70 °F prior to mixing. The material may be warmed up to 95 °F to ease mixing, but should never exceed 100 °F to avoid exothermic reactions.
- 4.3. Open the Part B catalyst can and transfer into the Part A resin container. Mix thoroughly for 1 to 2 minutes.
- 4.4. Open the bag containing the BB-Spheres.
- 4.5. Drizzle about half of the Part A / Part B resin mixture over BB-Spheres. Close the top of the bag by hand leaving air in the bag such that it resembles an inflated balloon surrounding the sphere/adhesive mixture. Shake the bag to evenly coat the spheres with resin.



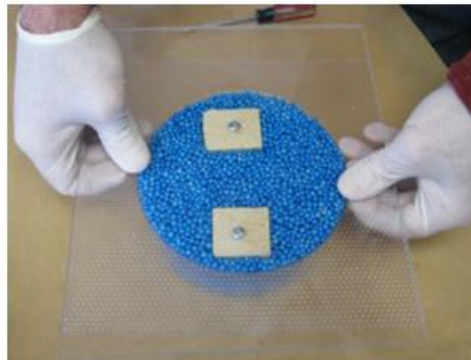
- 4.6. Open the bag again and pour the remaining resin over the spheres. Close the top of the bag by hand leaving air in the bag. Rotate and shake the bag to evenly coat the spheres with resin. The spheres should clump together and appear wet.
- 4.7. Open the bag and dump the contents into the mold released cavity. Using a gloved hand or trowel spread the wet mix evenly throughout the cavity.
- 4.8. Gently tamp down the wet spheres with a flat piece of wood or similar tool. Add additional spheres as needed to fill the cavity.
- 4.9. Once the cavity has been filled with spheres, the backing plate can be added. With a gloved hand or brush, spread a thin layer of residual Part A / Part B resin mixture over the sides and bottoms of the attachments. Remember, the backing plate must be mold released as describes in Step# 3.4.



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- 4.10. Align the backing plate with the cavity and press the attachments into the resin soaked spheres. Secure the backing plate to the cavity with clamps or screws. Alternatively, the entire part can be vacuum bagged to apply uniform pressure.



- 4.11. Once the backing plate is clamped to the cavity, the entire assembly should be flipped over so that any excess resin drains down towards the backing plate.
- 4.12. Allow the assembly to cure at room temperature for a minimum of 12 hours. To accelerate the cure, the assembly can be heated at 120 F for 3 hours.
- 4.13. Once the material is cured, demold the assembly from the cavity. Remove the backing plate from the attachments. Clean the backing plate with alcohol to remove the mold release.
- 4.14. Reattach the backing plate to the attachments. Adhere gasket tape to the backing plate along the perimeter of the HYVAC fixture for best seal.

5. Usage

- 5.1. High volume rather than high vacuum is required for optimal HYVAC performance. A basic shop vacuum system with 2.0" diameter vacuum line and an unrestricted flow path is easily sufficient.