

# SYNTAC® VF-22

## Kit for 22 pcf Multi-sphere Syntactic Foam

### Syntac VF-22

Is a high performance syntactic foam kit that produces a multi-sphere foam with a typical density of 20-24 pcf. The kit consists of three parts:

Part A: Epoxy resin mixed with hollow glass microspheres.

Part B: Hardener.

Part C: Hollow macrospheres, FRP shell;  
typical size: 0.3 inch, density: 12 pcf.

### Notes

1) Because the foam kit incorporates low density, hollow macrospheres, the overall density of the cured foam depends directly on how well the macrospheres can be packed into a mold or cavity. The expected density range for the foam is 20 - 24 pcf. Lower density results from a high packing factor for the Part C spheres and higher density results from a low packing factor.

Packing factor is defined as the fraction of volume, expressed as a percent, that the spheres occupy when they are in a known volume. For small volumes, the packing factor will be lower than for large volumes. This is because the spheres show low packing on the cavity walls and small volumes have proportionally more wall area (a higher surface area to volume ratio) than do large volumes. The density of the cured foam can be estimated for various packing factors by using the equation:

$$\text{Syntac VF-22 Density} = [(PF \times TPD_s) + (100 - PF) \times D_f] \div 100$$

**PF = Packing Factor** of Part C spheres, expressed as a percent

**TPD<sub>s</sub> = True Particle Density** of Part C spheres,  
typically 11.0 – 13.0 pcf

**D<sub>f</sub> = Density of foam** (Part A + Part B) infiltrated around the spheres,  
typically 40 pcf.

If the Part C spheres, with a typical TPD of 12 pcf, pack at 58% in a cavity or other type of volume, then the expected VF-22 density will be 23.8 pcf.

2) This service depth is for general information only. It is the sole responsibility of the user to select material based on depth, time at depth, nature of payload, and appropriate safety factor.

Typical Properties (Cured Foam)		
Density, pcf (g/cc)	Note 1	22 (0.35)
Hydrostatic Service Depth, feet (Meters)	Note 2	600 (180)

Information is for guidance only and does not constitute a specification. Trelleborg Emerson & Cuming, Inc. reserve the right to alter this document without prior notice.

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## Safety Information

The Part A and Part B and Part C components present no unusual safety hazards, but they should still be handled with standard chemical safety procedures to prevent skin or eye contact, ingestion or inhalation. It is recommended to wear protective gloves and safety glasses equipped with side shields when handling, mixing, or pouring the Part A and Part B liquid materials.

Consult the Material Safety Data Sheets (MSDS's) for the three parts of the SYNTAC VF-22 Kit before use to learn about the health properties and recommended safe handling procedures. Contact Emerson & Cuming, Inc. for the appropriate MSDS's.

## General Description

The epoxy resin and polyamide hardener used in Parts A and B are designed for room temperature curing. The Part C spheres are lower in density than the foam mix that is put around them so they have a natural tendency to float out of the foam. They have a buoyant force of roughly 28 lb per cubic foot (pcf) of sphere volume. In order to keep the Part C spheres and the foam together while the foam is curing, it is necessary to confine the spheres so they cannot float out of the cavity.

When the spheres have been confined, the foam can be infiltrated around them in one of two basic methods:

1. Foam can be introduced into the cavity through tubing that is connected to the bottom of the cavity. As foam flows into the cavity it rises around the spheres. If the cavity is evacuated, the foam will surround the spheres without trapping air, depending on the quality of the vacuum. If the cavity is not evacuated, the foam will rise and force air out the top of the cavity, but there is some potential for air entrapment.
2. Foam can be introduced into the cavity from the top and allowed to flow down to surround the spheres. If the cavity is evacuated, the foam will again encapsulate the spheres with little or no air entrapment.

If the cavity is not evacuated, there is more chance for air entrapment because the air must escape as the foam flows down.

When the foam is poured from the top, it can flow through tubing into a hole in the top cover, in which case vent holes in the cover or a vacuum in the cavity are needed to remove the air. Alternately, the cover could be an open mesh or screen material that confines the macrospheres, but provides multiple openings for pouring the foam and also for allowing the air to escape.

Because the Syntac VF-22 resin system gives off heat when the resin and hardener cure into a polymer, the volume of VF-22 castings must be kept relatively small: 10 cu. ft. is an upper limit for casting volume in order to minimize the effects of exotherm. Very small volumes, i.e. generally 0.5 cu. ft. or less, can require some additional heat to complete the cure because they do not produce much exotherm heat. If additional heating is needed, the preferred temperature range is 130° -180°F.

Full cure of VF-22 foam will require several weeks at temperatures of 50°F or below. At 50° - 75°F, full cure may take one week for volumes of 1 - 10 cu. ft. At temperatures of 75° - 95°F, full cure may take 2 - 3 days. The curing of VF-22 foam will occur quickly for the center of the foam where the exotherm produces the highest temperature. Curing occurs more slowly for the outer surfaces of the foam, which are exposed only to the ambient temperature.

The epoxy resin system in Syntac VF-22 has excellent adhesive properties and will develop a strong bond with most clean, dry surfaces. If extra bonding strength is needed for rubber, fiberglass, metal or other types of surfaces, then proper cleaning and degreasing steps should be used.

If a casting of Syntac VF-22 is designed to be removed from the mold after it has cured, then careful preparation of the mold surfaces is essential to obtaining easy release. Mold surfaces should be smooth, free of undercuts and drafted, if possible. The recommended release is any standard type of wax or silicone release. Proper surface quality, preparation and release application are required to produce easy release for VF-22.

The foam that results when Part A and B are mixed is a pourable, flowable foam designed to flow through tubing (typically 2 - 3 inch i.d.) or pour from a bowl. It is also low in viscosity, so that it deairs easily and flows around the Part C spheres easily and completely. The viscosity and consistency of the foam is controlled by mixing the hollow glass microspheres in at a constant volume level. It is not necessary to vacuum deair the foam before it is infiltrated, but deairing can be done if less air entrapment in the casting is required. A foam mix that has been deaired must be poured or infiltrated carefully to avoid trapping air.

# SYNTAC<sup>®</sup> VF-22 Kit for 22 pcf Multi-sphere Syntactic Foam

## Packaging Information

1. For a 7 cubic foot kit, the three parts are packaged in individual containers as follows:

**Part A:** Drum 109 lb in one 30 gallon drum

**Part B:** 28 lb in one 5 gallon pail

**Part C:** Cartons 25.5 lb in each of two cartons  
(51 lb total for one kit)

2. The mixing ratio for Part A and Part B is 3.9 parts A to 1.0 part B (by weight). This is the same ratio that they are packaged in, so it is possible to use the entire contents of each container without weighing. A 7 cu. ft. kit has roughly 3.4 cu. ft. (25 gal.) of foam encapsulating the Part C spheres. It is possible to mix a smaller volume of foam by using the weight ratio of 3.9:1 to apportion the Part A and Part B.
3. The amount of Part C spheres that is packaged for a 7 cu. ft. kit is roughly 4 cu. ft. on a true volume basis, i.e. the volume of just the spheres. The amount that is used will depend on the cavity volume and how well they pack in this volume.

## Mixing and Pouring Instructions

1. The contents of the Part A container must be mixed before use because of the natural tendency for the components to separate. The Part A container will not be uniform in composition after sitting for several days or longer.
2. To mix Part A, use a low-shear mixer, e.g. propeller-blade at low speed, stirring paddle, etc. to slowly blend the resin and microspheres. The top of the mixture will appear dry when the spheres have had time to float. Re-mix until the entire container is uniform. Be sure to weigh out a portion of the Part A container only after it has been re-mixed to a uniform consistency and density.
3. The Part C spheres should be poured or scooped into the cavity after all surface preparations (cleaning, releasing, etc.) have been done. The packing of the spheres can be improved by poking with a rod or vibrating to redistribute them. To ensure that the spheres and foam have the optimum surface contact and adhesion, do not allow the spheres to be contaminated with grease, dirt or other foreign matter. The spheres must be clean and dry before they are used.
4. After the spheres have been loaded and confined in the cavity, hook up the hardware (if needed) that is used to introduce the foam into the cavity. Once the Part A and B are mixed, they must be used within their pot life so the hardware preparations must be done before mixing.
5. The mixing equipment and associated hardware must be clean and dry before used. Water or other contaminants may affect the cure and produce a low strength, poor quality casting.
6. To ensure optimum pot life for the foam, Part A and Part B should be at 65° - 85°F before they are mixed.
7. After the Part A material has been mixed, combine it with the proper amount of Part B (weight ratio 3.9 : 1 Part A : Part B). Mixing can be with a low shear propeller mixer, low shear planetary mixer (cement mixer, etc.), or with hand stirring for small amounts. Avoid high speed, high shear mixing which can break the hollow glass microspheres.
8. Mixing of Part A and Part B starts the reaction that affects the pot life. For the entire 3.4 cu. ft. of foam in a 7 cu. ft. kit, the pot life is 45 - 60 minutes at temperatures of 70° - 85°F. Small volumes or lower temperatures will lengthen the pot life. Higher temperatures or larger volumes will shorten the pot life. The optimum temperature range for pot life and flowability is 70° - 85°F.
9. When Part A and Part B are combined, it typically requires 3 - 6 minutes to mix to a uniform consistency.
10. After mixing, the foam can be deaired if this is desired. The foam should be evacuated in an over-sized container (to allow for rising) under a vacuum of 29 in Hg, minimum. The foam will rise and then collapse after all the air has been removed. Allow enough room for the foam volume to rise by at least three-fold, typically. Keep the deairing time short (typically 2 - 5 minutes) to avoid pot life problems.
11. If the cavity is evacuated, the vacuum should be 29 in Hg, minimum and evacuation should occur before the foam is mixed.
12. The foam mix should be infiltrated into the cavity as soon as possible after mixing (and deairing). The pot life is really a factor only for the material as mixed. When it starts to fill the cavity, the amount of mixed foam in the mix container or transfer container gets smaller so the pot life is extended. As the foam fills the cavity, this is the part that starts to react, so the cavity must be filled before the foam reacts.
13. To ensure that the foam mix does not react before it goes into the cavity or before it completely fills the cavity, the guideline is: Foam volumes of 1 - 4 cu. ft. should be infiltrated into a cavity within 50 minutes of when Part A and Part B were first mixed. In practice, it will generally take 10 - 30 minutes to infiltrate foam volumes in this range.
14. To be sure the cavity is full, it is advisable to have foam flow out of tubing attached to air vent holes. The vent holes should be at the highest parts of the cavity. The tubing can be closed off when foam starts to fill it. Alternately, the foam can just be allowed to run out the air vent holes and then the holes can be plugged. If the foam is being poured into a cavity, watch for air escaping as the last amounts are added. Add foam as needed.
15. After a cavity is full, close off all inlet and outlet tubing (if present) and plug vent holes to keep the foam in place as it cures.

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### Curing Instructions

1. Syntac VF-22 cures at 75°- 95°F over 2 - 3 days for castings of 0.5 - 10 cu. ft. Cure occurs initially in the center of the casting, as the exotherm heat raises the core temperature, generally to 200°- 300°F. The outside of the casting cures more slowly because it is at ambient temperature. The initial cure in the core takes only several hours for castings of 0.5 - 10 cu. ft.
2. At temperatures below 75°F, cure can take longer and below 50°F, the cure rate can be greatly slowed down.
3. External heat of 130°- 180°F can be used during cure for castings of 0.5 - 10 cu. ft. to shorten the cure time to less than one day. The heat can be used during the cure or after the initial cure has occurred to accelerate the cure of the outside foam.
4. When the outside of the foam feels hard, the entire casting is cured because cure proceeds from the inside out.

### Hygiene and Chemical Handling Recommendations

The following precautions should be taken when handling Part A and Part B of the Syntac VF-22 kit.

1. Avoid breathing vapors. Local exhaust ventilation is recommended if vapors or mist are generated. If exhaust ventilation is not available or is inadequate, use NIOSH approved respirators as appropriate.
2. Care should be taken to prevent unnecessary contact with skin and clothing. Wear gloves resistant to chemicals and petroleum distillates.
3. Protective clothing, such as uniforms, coveralls, or shop coats must be worn. Clothing must be washed before reuse.
4. Avoid contact with eyes. Chemical goggles must be worn. A face shield is recommended if splashing is likely.

5. Wash areas of the body exposed to the chemicals thoroughly in hot, soapy water after handling.
6. Clean up spills immediately to prevent accidental contact. Wipe up or scrape up the material, use an absorbent material to soak up the remaining material.
7. The waste must be disposed of in accordance with local, state and federal regulations.

Additional information about safe handling practices for SYNTAC VF-22 KIT Parts A, B and C is contained in the Material Safety Data Sheets (MSDS) for these materials. Contact Emerson & Cuming Composite Materials for the appropriate MSDS's.

### Warranty

This information is to the best of Trelleborg Emerson & Cuming, Inc. knowledge, accurate as of the date published. The information relates only to the specific material designated herein and is not intended for the application or use of the material with any other material or in any process not specifically described. The information is intended as a general guide only and does not constitute any warranty or representation whatsoever. Trelleborg Emerson & Cuming, Inc. hereby disclaims all express and implied warranties arising from the user's reliance on or use of the information.



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