

# SYNTAC<sup>®</sup> VF-27

## Kit

### Syntac VF-27

Is a syntactic foam kit that produces a multi-sphere foam with a typical density of 26 - 29 pcf (pounds per cubic foot). The rated service depth of the foam is 3,300 feet (1,000 m). The kit consists of three parts:

Part A: Epoxy resin mixed with hollow glass microspheres.

Part B: Hardener (polyamide).

Part C: Hollow microspheres; FRP shell; typical size 0.3 inch; density 18 pcf.

Because the foam kit incorporates low density, hollow microspheres, the overall density of the cured foam depends directly on how well the microspheres can be packed into a mold or cavity. The expected density range for the foam is 26 - 29 pcf with low density resulting from a high packing factor for the Part C spheres and high density resulting 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 cavity or space with a specific volume. For small cavities, the packing factor will be lower than for large cavities. This is because the spheres exhibit low packing on the cavity walls and small cavities have proportionally more wall area (a higher surface area to volume ratio) than do large cavities.

The density of the cured foam can be estimated for various packing factors by using the equation:

$$\text{Syntac VF-27 Density} = [(PF \times TPD_s) + (100 - PF) \times D_f] \div 100$$

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

**TPD<sub>s</sub> = True Particle Density** of Part C spheres,  
typically 17.8 - 18.8 pcf

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

Example calculation of foam density:

If the Part C spheres, with a typical TPD of 18.3 pcf, pack at 58% in a cavity, then the expected VF-27 density will be 27.4 pcf.

### Safety Information

The Part B (hardener) component of the SYNTAC VF-27 Kit may be extremely irritating to the eyes and may cause severe damage, including blindness. The material may be irritating to the skin and the vapors may be irritating. When Part B is being handled, precautions must be taken to prevent skin and eye contact and to avoid inhalation.

Consult the Material Safety Data Sheets (MSDS's) for all three parts of the SYNTAC VF-27 Kit before use to learn about the health properties and recommended safe handling procedures. Part B must be handled with caution because of its acute health hazards.

The Part A 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.

# SYNTAC® VF-27 Kit

## Typical Properties

The properties listed below for the cured VF-27 foam are for general information and reference. They are not considered to be specifications.

Property	SYNTAC VF-27 Typical Value	
Maximum Service Depth	3,300 feet	(1,000 m)
Density	26 - 29 pcf	(416 - 465 kg/m <sup>3</sup> )
Uniaxial Compressive Strength	2,200 psi	(155 kg/cm <sup>2</sup> )
Uniaxial Compressive Modulus	130 ksi	(9,140 kg/cm <sup>2</sup> )
Bulk Modulus	140 ksi	(9,840 kg/cm <sup>2</sup> )
Weight Gain Percent at 3,300 feet (1,000 m)	24 hours	1 %
	30 days	2 %
	1,000 cycles	3 %

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.

## General Description

The basic procedure for filling a cavity with VF-27 foam is to first pack the Part C macrospheres into the cavity. Then the Part A and Part B are mixed to prepare a foam that is infiltrated into the cavity to encapsulate the spheres.

This foam cures at room temperature over a period of several hours. The resultant VF-27 foam (cured foam encapsulating hollow macrospheres) has a service depth of 3,300 feet (1,000 m), maximum.

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 22 lb (10 kg) for every cu.ft. (0.03 cu.m.) 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.

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-27 resin system gives off heat when the resin and hardener cure into a polymer, the volume of VF-27 castings must be kept relatively small.

10 cu.ft. (0.3 cu.m.) 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. (0.01 cu.m.) 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 (54° - 82°C).

At temperatures of 75° - 95°F (24° - 35°C), full cure may take 2 - 3 days. The curing of VF-27 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.

Full cure of VF-27 foam will require several weeks at temperatures of 30° - 50°F (0° - 10°C).

At 50° - 75°F (10° - 24°C), full cure may take one week for volumes of 1 - 10 cu.ft. (.03 - 0.3 cu.m.).

# SYNTAC® VF-27 Kit

## General Description (continued)

The epoxy resin system in SYNTAC VF-27 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-27 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, surface preparation and release application are required to produce easy release for SYNTAC VF-27.

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 (50 - 75 mm) inside diameter) 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 supplying the Part A component with the hollow glass microspheres mixed 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.

## Packaging Information

1. A size #2 SYNTAC VF-27 kit fills a cavity volume of 5 cu.ft. (0.14 cu.m.) The total weight of all materials in a size #2 kit is 153 lb (69 kg). Excess material is provided for the three components to cover variations in macrosphere packing in the cavities being filled.
2. The packaging for a size #2 kit is:
  - SYNTAC VF-27 Part A: 77 - 81 lb (35 - 37 kg) in one drum
  - SYNTAC VF-27 Part B: 20 lb (9 kg) in one pail
  - SYNTAC VF-27 Part C: 55 lb (25 kg) in one carton
3. 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 if you want to mix roughly. 2.3 cu.ft. (0.065 cu.m.) of foam to encapsulate 2.9 cu.ft. of 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.
4. The amount of Part C spheres that is packaged is roughly 3.0 cu.ft. (0.085 cu.m.) 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 each Part A container must be mixed before use because of the natural tendency of the material to separate. The hollow glass microspheres float and the resin sinks due to their different specific gravities. The Part A containers will not be uniform in composition or consistency 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 any surface preparations (cleaning, releasing, etc.) have been done. The packing of the spheres can be improved by poking with a rod or vibrating (if possible) 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 Part 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 will adversely affect the cure and produce an uncured, 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 (18° - 29°C), before they are mixed. If the foam components are hotter than 85°F (29°C), the pot life may be too short to allow the materials to be mixed and infiltrated.
  7. After the Part A material has been mixed to evenly distribute the hollow glass microspheres in the resin (steps 1 and 2 above), combine it with the proper amount of Part B (weight ratio 3.9 Part A : 1 Part B). Mixing can be with a low shear propeller mixer, low shear planetary mixer (cement mixer, etc.), or even hand mixing with a stick or paddle for small amounts.
- IMPORTANT:** Avoid high speed, high shear mixing which can break the hollow glass microspheres.
8. Mixing of Part A and Part B starts the reaction, which starts the pot life. For the entire 2.3 cu.ft. (0.065 cu.m.) of foam in a size #2 kit (5 cu.ft. / 0.14 cu.m.), the pot life is 45 - 60 minutes at temperatures of 65° - 85°F (18° - 29°C). 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 (21° - 29°C).
  9. When Part A and Part B are combined, it typically requires 3 - 6 minutes to mix the foam to a uniform consistency.

## SYNTAC® VF-27 Kit

### Mixing and Pouring Instructions (continued)

10. After mixing, it is possible to vacuum deair the foam, 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 (736 mm), 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 (736mm), 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 infiltration foam must be put into the cavity (or cavities) within the pot life of the material. This allows the foam to cure as one uniform mass of material.
13. To ensure that the foam mix does not react before it goes into the cavity or before it completely fills the cavity, the processing guideline is:  

Foam volumes of 1 - 4 cu.ft. (.03 - 0.1 cu.m.) should be infiltrated into a cavity within 50 minutes of when Part A and Part B were mixed. In practice, it will generally take 10 - 30 minutes to infiltrate this amount of foam.
14. To be sure the cavity is full when the foam is being injected through tubing into the bottom of the cavity, 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.
15. If the foam is being poured into a cavity, watch for air escaping as the last amounts are added. Add foam as needed if settling occurs.
16. 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.

### Curing Instructions

1. SYNTAC VF-27 cures at 75° - 95°F (24° - 35°C), over 2 - 3 days for castings of 5 cu.ft. (0.14 cu.m.). Cure occurs initially in the center of the casting, as the exotherm heat raises the core temperature, generally to 200° - 300°F (93° - 150°C). The outside of the casting cures more slowly because it is at ambient temperature. The initial cure in the core takes only several hours.
2. At temperatures below 75°F (24°C), cure can take longer and below 50°F (10°C), the cure rate will be very slow due to the low temperature.
3. External heat of 130° - 180°F (54° - 82°C) can be used during cure for castings of 0.5 - 10 cu. ft. (.014 - .28 cu.m.) to shorten the cure time to less than one day. Heating for several hours is sufficient to cure the outside of the foam.
4. The heat can be used as soon as the foam completely fills the cavity or mold, i.e. as the foam itself is curing. Alternately, the heat could be used after the initial cure has occurred in the center of the foam. The added heat will accelerate the cure of the outside foam. When the outside of the foam feels hard to the touch, the entire casting is cured because cure proceeds from the inside out.

## SYNTAC<sup>®</sup> VF-27 Kit

### Hygiene and Chemical Handling Recommendations

The following precautions should be taken when handling Part A and Part B of the SYNTAC VF-27 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 respirators as appropriate.
2. Care should be taken to prevent unnecessary contact with skin and clothing. Wear gloves resistant to chemicals and petroleum distillates. Protective clothing, such as uniforms, coveralls, or shop coats must be worn. Clothing must be washed before reuse.
3. Avoid contact with eyes. Chemical goggles must be worn. A face shield is recommended if splashing is likely.
4. Wash areas of the body exposed to the chemicals thoroughly in hot, soapy water after handling.
5. The Part B (hardener) component of the SYNTAC VF-27 Kit is an irritant to eyes and skin and the vapors can be irritating. When Part B is being handled, precautions must be taken to avoid inhalation and to prevent skin and eye contact. Wear protective clothing, rubber gloves (Neoprene or Buna N) and chemical safety goggles with face shield. The material may be extremely irritating to the eyes and may cause severe damage, including blindness.
6. Clean up spills immediately to prevent accidental contact. Wipe up or scrape up the material, using an absorbent material to soak up the remaining material. The waste must be disposed of in accordance with local, state and federal regulations.

Additional information about safe handling practices for SYNTAC VF-27 KIT Parts A, B and C is contained in the Material Safety Data Sheets (MSDS) for these materials. Contact Trelleborg Emerson & Cuming, Inc. 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.



**TRELLEBORG**

Trelleborg Emerson & Cuming, Inc.  
290 Forbes Boulevard, Mansfield, MA 02048-1817 USA  
Tel: +1 774 719 1400. Fax: +1 774 719 1410  
Email: eandcsales@trelleborg.com  
Website: www.trelleborg.com/eandc