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"Through the use of precisely molded foam pieces a highly accurate model or pattern for the desired casting can be made."



Complex internal passageways are in the mold itself, not formed by cores.

For marine manifolds, elbows and thermostat housings, an accurate casting is crucial for the proper function of the engine part.

GLM Manifolds have increased passageways and an added 30-40% water cooling area to provide more horsepower to your engine.

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GM V6 w/ 4" Riser	No. 58222	- Cast Iron	Call for price	No. 59225	- Aluminum	Call for price
GM V8 S.B. w/ 3" Riser	No. 58231	- Cast Iron	Call for price	No. 59233	- Aluminum	Call for price
GM V8 S.B. w/ 4" Riser	No. 58232	- Cast Iron	Call for price	No. 59235	- Aluminum	Call for price
GM V8 B.B. w/ 3" Riser	No. 58241	- Cast Iron	Call for price	No. 59243	- Aluminum	Call for price
GM V8 B.B. w/ 4" Riser	No. 58242	- Cast Iron	Call for price	No. 59245	- Aluminum	Call for price
Ford V8 302/351 CID Carb.	No. 58490	- Cast Iron	Call for price			
Ford V8 302/351 CID EFI	No. 58491	- Cast Iron	Call for price			
Volvo GM V6 to 1993	No. 58640	- Cast Iron	Call for price			
Volvo GM V8 to 1993	No. 58630	- Cast Iron	Call for price			
OMC GM V8 S.B.	No. 58410	- Cast Iron	Call for price			
OMC/Volvo GM V8 5.7L	No. 58430	- Cast Iron	Call for price			

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GM V8 305/350 CID No. 58990 - Cast Iron **Call for price**



and the rest, they just follow.

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Lost Foam: A New Wave of Sand Casting Swells in the Marine Industry

By Michael D. Pike / GLM Staff

With the growing demand for high quality aftermarket marine products, new technological advances have impacted the marine industry in a huge and significant way. While one sand casting process has dominated the industry thus far, a new sand casting process just superseded the traditional method. This new sand casting method creates a far superior product, increasing the performance, power and precision of your boat engine. Most metal products such as marine engine manifolds and elbows are produced by a sand casting process, but what exactly is sand casting?

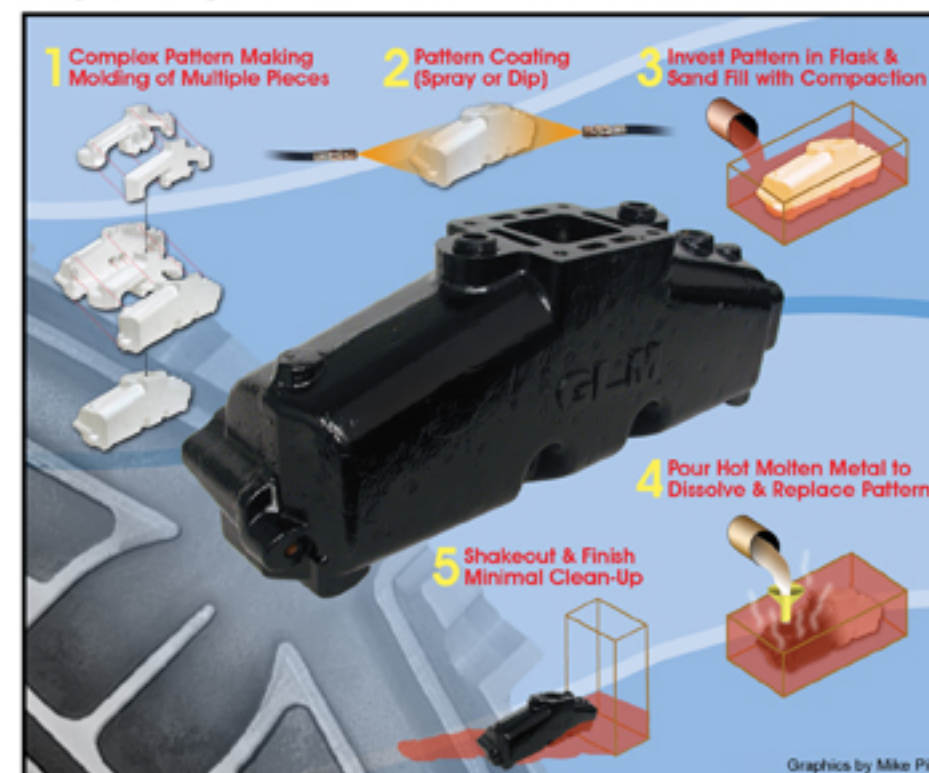
Sand Casting is the process of producing an object identical to a "pattern" of that object by pouring molten metal into a sand impacted mold. Once the metal cools it forms a replica of the object desired. The two types of sand casting used to create marine manifolds and elbows are "Green Sand" casting and the new innovative "Lost Foam" casting. In "Green Sand" casting the pattern is removed from the mold once the sand is compacted creating a cavity for the molten metal to fill when it is poured into the mold. This process uses a two-piece casting flask known as cope (top section) and drag (bottom section) to allow the mold to split apart and the pattern to be removed. In "Lost Foam" casting the solid foam pattern stays invested in the one-piece flask and the molten metal dissolves the foam as it replaces the shape to form the object desired. The pattern is "lost" in the process; therefore a new pattern must be made for every mold. The "Green Sand" casting method is more commonly used today but a new wave of technology shows clear advantages for "Lost Foam" casting. In most sand casting the sand is reddish in color, in "Green Sand" casting is the sand really green?

Green Sand Casting

The term "Green" is applied when water is added to the sand to activate a clay binder (like bentonite clay) and identifies the sand as wet sand. "Green" sand is bonded sand because there is a mixing agent added to it to create a better or more solid compound. This sand-clay mixture is compacted in a flask around a desired pattern created with cores to form an impression of the desired object. Patterns can be created with wood, plastic, metal or the new polystyrene (EPS) beads. Once the pattern and cores are removed from the flask a cavity is formed for the molten metal to fill. Some molds are split into two halves, known as the cope and drag system, to allow the pattern to be removed. Once the mold is created and the halves are split, the excess metal forms fins which need to be grinded down during the finishing stages. Since there are great dimensional allowances in this process, the pattern may not be an exact replica of the object desired. There-

fore the pattern must be altered to accommodate for physical differences. These differences include the expansion and contraction of the sand and metal during the casting process. This process requires a gating network including risers to allow the molten metal to flow into the cavity. Any turbulence during flow could cause slagging or loose sand to enter the mold and compromise the integrity of the cast. This shows the importance of the risers which are set in place to keep the flow of the molten metal moving. It is necessary to have a good gating system and risers to produce a solid cast. Once the metal cools the sand is removed and the casted shape enters the finishing stages. "Green Sand" casting is not a precision casting process and provides a porous surface finish.

and can be used to create objects that traditional "Green Sand" casting has had difficulty replicating. These patterns can be formed by gluing separate foam pieces together to create complex patterns or can simply be carved out with traditional carving tools. Through the use of precisely molded foam pieces a highly accurate model or pattern for the desired casting can be made. This pattern can easily be sanded to create a fine finish to be represented on the final product. The foam is treated during the molding process by first pre-expansion, then a steam fusion followed by an in-mold cooling cycle. This stabilizes the foam to form perfect molds for casting. Once the pattern is created it is thoroughly coated with an insoluble ceramic solution to



Advantages to Green Sand:

- Green Sand has properties which are adjustable within a high range allowing the usage in various sand casting automated machines with many different alloys.
- For high volume production.
- Surface finish = 250 to 600 micro in.
- Best if used on objects where accuracy is not crucial due to core movement and mold shifts.

Sometimes the traditional methods are not always the very best methods. GLM Products, Inc. in Monrovia, CA set a new standard in the aftermarket marine industry by introducing the new "Lost Foam" casting method used to create their manifolds, elbows and thermostat housings. Let's take a look now at this new and improved sand casting process and find out what makes it superior to the traditional casting method.

Lost Foam Casting

"Lost Foam" is a casting process where foam (polystyrene) patterns are used to create the molds which hot molten metal dissolves, forming the object desired. This new process is very cost effective

create a barrier for the molten metal not to pass through in the casting process. This coating also reinforces the structure of the pattern. After drying, the pattern is "invested" into a flask where un-bonded or dry sand is poured into the mold until every passageway inside and outside the pattern are completely covered with sand. Then through the use of a specially designed funnel (sprue), molten metal is poured in, which decomposes and vaporizes the foam piece allowing the metal to replace its shape. The pattern is then "lost" in the process. Once the casting hardens, the sand is removed; the component is inspected and very little machining is required in the finishing stages. Lost Foam casting can be poured with various metals to include: Iron, Aluminum and Copper-based alloys.

Lost Foam Casting is a method that was developed in 1964 by M.C. Flemmings where he perfected an already existing foam casting process developed by H.F. Shroyer in 1958 known as "full mold process". Both casting processes use foam patterns placed in compacted sand to form a mold. However, Flemmings process differs from Shroyer's process by the use of un-bonded sand vs. bonded

sand in the mold. Below are some key advantages to "Lost Foam" casting.

Advantages to Lost Foam:

- The unique properties of foam allow for easy carving & gluing producing complex patterns.
- Complex internal passageways are in the mold itself, not formed by cores.
- More rigid, less chance of failure.
- More durable and reliable than other types of casting technology.
- Greater control over the accuracy of the cast-wall thickness, preventing thin spots that can corrode prematurely.
- Longer corrosion resistance, lost foam process improves life (especially in saltwater).
- A cavity-less process with no structural limitations for molds with the elimination of cores and sand binders.
- Surface finish = 60 to 250 micro in.
- Castings maintain smooth surface with no fins around coreprints or parting lines due to the one-piece flask.
- Complex components can be formed where other casting processes require multiple components to be assembled.
- Excellent dimensional tolerances for precision casting.
- Lower production cost than traditional "Green Sand" casting.
- Castings made from 1lb. up to thousands of lbs. with no size limitations.
- Lost Foam is an environmentally friendly process.
- The sand is un-bonded and can be recovered and re-used at a low cost.

For marine exhaust manifolds, elbows and thermostat housings, an accurate cast is crucial for the proper function of the engine part. The main purpose of the marine manifolds is to cool the exhaust gases and direct them out of the engine. Inside each manifold are separate compartments to segregate the exhaust gas pulses and the water cooling areas. The integrity of the thin walls that separate the compartments must be to the highest level. Any high or low spots in the wall, any imperfections or pin holes can cause serious if not fatal damage to your boat engine. "Lost Foam" casting is preferred for this high level of integrity and accuracy of the casted object. "Green Sand" casting allows for movement and shift of the cores that are trying to form these segregated compartments and could compromise the function of the manifold. These compartments are an actual part of the pattern in "Lost Foam" casting and can not move or shift during casting. This allows for consistent wall thickness throughout the manifolds eliminating the voids that could lead to failure. GLM manifolds have increased passageways and an added 30-40% water cooling area to provide more horsepower to your engine. With the "Lost Foam" process, a new definition of high quality manifolds, elbows and thermostat housings can be offered to the marine industry, setting a new standard for all the other aftermarket manufacturers to follow. [www.glmmarine.com]