

# *Express*

THE *ULTIMATE SAILING MACHINE*

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ALSBERG BROTHERS BOATWORKS

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## THE RIGHT STUFF

High quality construction is probably the most important single characteristic that affects how much you will enjoy your boat. It affects performance, sea worthiness, comfort, aesthetics, and maintenance. Most important, because any sailboat should be considered an investment, quality construction directly affects resale value. A reasonable understanding of modern yacht construction is essential to make an informed decision about which boat to invest in. Unfortunately, the average boat buyer, unless they are a naval architect or a skilled boat builder, typically lacks the expertise to judge one boat's construction vs. another's. For most buyers, good construction means shiny gelcoat, well-oiled teak and good looking upholstery. Unfortunately, cosmetic detailing has little direct relationship to structurally sound construction. The following information is intended to give concerned laymen the tools they need to make informed decisions about the yachts they trust their lives and hard earned cash to.

### HISTORY

The reason for putting weight into a boat is to make it strong. The reason to take weight out of a boat is to make it perform better. These two basic needs conflict and the essential art of boatbuilding has been to resolve the conflict.

How strong does a boat have to be? Strong enough to withstand an extreme storm. How well does a boat have to perform? There are no restrictions on performance. Whether you are sailing to the fishing grounds, carrying cargo, carrying passengers, going cruising or going racing, a faster, easier to handle boat has always been a better boat.

Because of this fact, for the last 10,000 years the trend in boatbuilding has been towards lighter and lighter boats. As our understanding of construction has improved, we have been able to build lighter boats that are able to withstand storms, and because of reduced weight they usually perform more satisfactorily. The key to weight reduction is state of the art engineering properly executed. Over the years, various boatbuilding codes have been developed to give boatbuilders a guide to building safe boats. During the early part of this century the two most sophisticated codes were Nevin's rules and Herreshoff's rules. When fiberglass became the material of choice these "wood boat" rules no longer applied. Lloyd's of London's rules became the best rule for modern boats. After the Fastnet tragedy of 1979 where lives were lost in an extreme storm, work proceeded on a boat building code that would be more stringent and scientific than Lloyd's of London's rules. It was intended that this new rule would set a higher standard for yacht construction that would prevent tragedy at sea. This rule is called the American Bureau of Shipping's Guide for Building and Classing Offshore Yachts. The first criteria that you should know about your boat is whether it exceeds the ABS guidelines. The Express line of boats, as designed by Carl Schumacher and built by Alsberg Brothers Boatworks, exceeds the ABS guidelines and therefore gives you the best chance of surviving the worst that the sea can deliver. More important, because very few yachtsmen will ever encounter an extreme storm in their lifetime, Express boats are built to last years in normal use and as a result, carry limited lifetime warranties on their hull/deck structure.

## STRUCTURAL OVERVIEW

The modern yacht is complex to analyze structurally. In the days of wooden boats, thicker, heavier planking meant stronger. The ABS guidelines understand that with modern yachts, hull thickness or weight means nothing by itself. Among other things, the quality of the fiberglass laminate can have more importance than the quantity. For example, the Express 37 exceeds the stringent ABS guidelines and weighs 10,000 lbs. If instead of unidirectional fiberglass we used conventional mat/woven roving laminates, it would have to weigh 13,800 lbs. to equal the same basic hull strength. If we used chopper gun fiberglass it would have to weigh 36,700 lbs. to equal the same basic hull strength. The owner of the chopper gun boat might find false security in the thickness and sheer weight of his boat. The truth is that his boat will be slower, wetter and harder to sail and consequently less fun to sail than the Express. It will have larger sails, bigger winches, a taller mast and will push more water around, all of which strain the hull more, therefore shortening its life expectancy, increasing the maintenance required, and decreasing the safety factor. The chopper gun boat will have more of a tendency to pitch, roll, and in general will be less comfortable at sea than an Express. Fortunately, not many builders use chopper gun fiberglass any more. Most conventional boats are made out of chopped strand mat and woven roving. But still, these boats use less efficient structural systems than they might. They can be plenty seaworthy. The penalty that they pay is that their excess weight will make them less satisfying to sail. Let's be perfectly clear about this:

**The only good reason to own a sailboat is because it can be deeply satisfying to be noiselessly propelled by the wind. Less elegant structural systems are used primarily because they are cheaper. Those who would compromise your sailing enjoyment to save a few dollars are making an awful compromise.**

Lest we mislead you, the building of an efficient sailing machine is much more complex than merely which glass fiber is used. This comparison was done only to give you a feel for how one particular choice can directly affect your sailing enjoyment. We will try to compare all of the various materials and techniques available to the modern boatbuilder. Better boats obviously use more of the right stuff. At Alsberg Brothers, we also consider how each material will function within a system so that we can get each material to "over-achieve" within that system to build greater reserves of strength.

**FIBERGLASS.** When most people say fiberglass they are thinking of fiberglass reinforced plastic (FRP). When a boatbuilder says fiberglass he is just talking about the dry, flexible fibers themselves. The best form that fiberglass comes in is unidirectional. The various forms of unidirectional glass are composed of very long, very straight fibers. Unidirectionals are stronger, don't stretch much, have greater impact resistance, allow laminates with high glass to resin ratios (50% or better) and consequently have high strength to weight ratios. Their disadvantage is that they are more expensive and require the highest skill level of workmanship to achieve its better properties. Woven cloth and woven roving have acceptable strength and stretch characteristics. When

sandwiched between layers of chopped strand mat it has acceptable impact strength. It is easy to work with and inexpensive. It produces medium glass to resin ratios (30-50%). Chopped strand mat or chopper gun fiber is the cheapest, easiest to work with form of fiberglass. It has relatively low strength but if enough is used it can produce a strong hull. It has the poorest glass to resin ratio (20-30%). In better boats, a thin mat layer is used next to the gelcoat to improve the gelcoat finish. It also has superior adhesive properties and is often used for its advantage in bonding. In general the more of the high grade forms of fiberglass that are used in a boat, the better the strength to weight characteristics will be. The basic Express 37 hull laminate schedule is 3/4 oz. mat, 36 oz. unidirectional, 3/4 oz. mat, 3/4" balsa core, 36 oz. unidirectional. A manufacturer who is proud of their glass work should be able to tell you what their laminate schedule is.

**RESIN.** FRP construction is called a composite because it is composed of both fiberglass and resin as a system. Epoxies and modified epoxies are the best resins being used today. Because they are flexible, they have the best impact resistance. Their flexibility closely matches that of fiberglass which makes epoxy laminates stronger and tougher. They are better adhesives so they have greater resistance to delamination. They are more water resistant to help prevent blistering. Epoxy based resins are more dimensionally stable and help your hull to maintain its smooth, fair shape over the years. They are also more chemically stable. This means that not only does an epoxy boat start out stronger but also Navy studies indicate that years from now an epoxy boat will have lost less than 10% of its strength while a polyester boat will lose over 50% of its

originally lower strength. Polyester resins are used in the vast majority of boats built today. It is cheap, easy to work with, and can build an acceptably strong boat. It comes in two types, Ortho and Iso. Ortho is the cheapest, has the lowest physical properties and is frequently cited as a prime contributor to the much talked about blistering or boat pox problem. Iso-polyester resin is a higher quality form of polyester that seems less prone to blistering. Polyesters flex about half as much as epoxy based resins. This makes polyester boats more brittle or less impact resistant. In fact, because polyesters are less flexible than fiberglass most times they fail long before the glass itself. Alsberg Brothers Boatworks has used epoxy based resin since 1980. Originally we used vinyl modified epoxy. We now use acrylic modified epoxy. We feel that the quality of your boat in large part depends on the quality of the resin used.

**Glass to Resin Ratios.** We've mentioned glass to resin ratios because they are one sign of the quality of a boat. Even the very best resins are relatively brittle. Glass fibers are very resilient but they depend on resin to do their job. The best combination for a tough hull is a high glass to resin ratio, say 50% or better. As glass content relative to resin goes down, so does resilience. This not only lowers initial strength, one of the reasons the older hulls go "soft" is because excess resin tends to get tiny microscopic fractures. As the boat ages, the normal flexing that a hull goes through multiplies the amount of these tiny fractures and slowly you start noticing that your boat doesn't hold its headstay tension as well as it used to or oil cans a little more. A certain amount of this is normal in any boat. In an Express, much of our engineering is directed toward increasing the life expectancy of hulls by using materials and techniques that yield high glass to resin ratios. Not only does this produce a tougher, longer-lived hull, it reduces weight which improves performance.

**Gelcoat.** Much has been written about gelcoat flaws such as blistering, crazing, fading and cracking. Over their lives, all gelcoats, paints or varnishes that are exposed to the sun will lose some of their shine and will fade. The better finishes don't last forever they just last longer. Most boats use Ortho or Iso gelcoats. Express yachts use Iso-NPG Gelcoats. Iso-NPG gelcoat is a new product that offers superior gloss and color retention. It is also highly touted as blister resistant. Because of our superior epoxy based resins, we have never had a problem with blistering. Iso-NPG gelcoats add even greater resistance to blistering. The only disadvantage of Iso-NPG gelcoats is that they take greater skill to apply and they cost more.

**Core Construction.** There are two basic methods of laminating the skin of a hull or deck, cored or uncored. Uncored construction is known as single skin construction. Cored construction is known as sandwich construction, where the sandwich is composed of two FRP skins with a core separating them. Cored construction is often compared to an "I" beam where there are two flanges (like skins) separated by a light web (like a core). The reason engineers use "I" beam-like construction throughout all sorts of structures is because it is stiffer for a given weight. Stiffness in a hull or beam goes up as the square of the thickness. For example, if you were to compare an Express 37 with a 1" thick cored hull to a similar size 37 footer with an uncored 1/4" hull, the Express would be almost 16 times as stiff for the same weight. Increased stiffness means your hull will flex less. As we mentioned in our discussion of glass to resin ratios, reducing flexing significantly extends the life of your yacht. Cored or sandwich construction is such an obvious choice for modern yacht construction that you will find that virtually all quality yachts use it.



There are two basic types of core used in sandwich construction, end grain balsa and PVC foam. You will often hear much mythology about which is the "right" core and which is the "wrong" core. Both cores are Lloyd's and ABS approved and when properly used in a well designed laminate, they can produce excellent, high strength to weight ratio laminates.

More important than which core is used is how it is applied. There are two methods. The first and by far the most common method is to apply it like kitchen tile. A notched trowel is used to apply an adhesive putty to the outer skin of the laminate and then the sheets of core are pressed down by hand or roller pressure until the sheets bond to the first skin. The second skin is then laminated by normal means to the exposed top surface of the core. Although many fine boats have been built this way, this method has several flaws. It requires quite a bit of this putty to get good results. This thick putty adds little strength but doesn't add quite a bit of weight. Because the core is opaque, it is impossible to tell if it has voids lurking underneath between it and the first skin. The thick putty is mostly resin which makes it brittle and therefore poor on impact and poor on longevity. Its advantage is that it is cheap and easy to do.

A very few of the best manufacturers use a system borrowed from the safety conscious aircraft industry called vacuum bagging. With this method, we are able to bond the core in an Express with a thin 3/4 oz. mat which has superior bond characteristics compared to a putty. While mat is not the strongest form of glass fiber, it has significantly greater strength than a putty. Because it is thinner than a putty and is less resin rich, it is considerably more resilient thereby increasing impact resistance and longevity. The vacuum bag process is difficult to describe. Essentially,

the core is placed against the wet mat and first skin then covered with a sheet of vacuum plastic or "bag" which is sealed around its edge to the first skin. A vacuum is applied which causes the "bag" to collapse onto the core pressing the core firmly against the first skin with atmospheric pressure. This "clamping" pressure can reach a ton per square foot and is perfectly even across the surface. The vacuum also sucks out any air that might be hidden under the opaque core thus eliminating the dangers of voids. Most builders don't vacuum bag because it is a technique that is costly and difficult to master. We have built nearly 200 trouble free Express boats since 1980 using this elegant technique.

**Furniture as structure.** The first thing that you should ask about the interior of your boat is not "how many does she sleep" but "how are the bulkheads designed and bonded". A hull and deck by themselves have long unsupported spans that can seem quite flexible. The flexibility of a beam or hull surface is proportional to the square of the span. For this reason, it is essential for seaworthiness to increase the stiffness of your yacht by decreasing the length of its unsupported spans. The ABS recognizes this and one of the most essential parts of their rule is bulkhead placement. In some boats bulkhead placement is determined by considerations like where the dining table fits best. Many of these same types of boats have floating bulkheads or partially bonded bulkheads. This is done because their builders view bulkheads as partitions, not load bearing hull stiffeners. In an Express, bulkheads are carefully engineered to carry significant loads. Notice the number of bulkheads in the keel/mast area. These bulkheads are all fully bonded on both sides and around the circumference of each one. We don't stop there. All furniture,

even the chart table, galley and V-berths are fully bonded and designed to carry loads as well as charts, pots and pans, and sleeping crew. The interior was designed for beauty, comfort and efficiency at sea as well as structural integrity. Throughout the interior, even in the hidden places you will see carefully bonded, immaculately executed glass work. Look carefully and you see many small touches like limber holes in even the out of the way places. The woods and painted finishes are all designed to be "wash and wear". This means that you don't need to worry about strange odors and mildew smells collecting in carpeted hull surfaces or liners designed to hide less elegant glass work. We, like most experienced sailors, believe that you should be able to pour a cup of water anywhere in a boat and it should find its way to the bilge without causing harm. The details in an Express interior are too numerous to mention but our best compliments come from owners who have spent years recognizing all of the small thoughtful touches that are not found in lesser boats.

**Hull to Deck Joint.** Hull to deck joints are much talked about when sailors talk boats. This is because in many boats the deck is placed on the hull with what is called a hat box joint. This means just what it sounds like. The deck has a vertical flange that overlaps the top edge of the hull. The seam is filled with caulking and then screwed or pop riveted together. You can usually tell this kind of joint because it typically has a vinyl or rubber rubstrake that covers the seam a few inches below the gunwale. These sometimes leak because the contact area at the joint is small and that allows the joint to flex. If caulking is constantly flexed it eventually leaks. This joint is used because it allows a boat to be built in a mold that doesn't break apart. This eliminates cosmetic seam repair which lowers

cost. An Express comes out of a mold that breaks apart on centerline. This allows it to have an inward turning hull and flange that is over 3" wide. This surface is rough sanded and then permanently bonded to the deck with an enormously strong, catalyzed rigid adhesive. Then it is bolted together with massive through bolts through its aluminum toerail. This enormous bonding area combined with our special rigid adhesive toerail bolts makes a permanent monocoque hull/deck structure that has never leaked. The disadvantage is that some cosmetic seam detailing is required. Most of the best boatbuilders use this sort of hull/deck joint.

**Rigging.** There are numerous suppliers of high quality hardware to the marine trades. The question of which brand is used is less important than the question of whether rigging systems have been thoughtfully designed, selected and installed. At Alsberg Brothers, we select our hardware carefully from the catalogues of the most prestigious names in marine hardware. We select for ease of function, durability and especially for adequate sizing. It is not uncommon for some boat builders to under winch a boat or omit an important sail control like a backstay adjuster or reefing system. Fastening systems vary quite a bit from boatbuilder to boatbuilder. Many experienced sailors and marine surveyors are impressed by our extensive use of backing plates, oversized washers and our custom-made stainless steel barrel nuts that are exclusive to our boats. These backing plates and oversized washers distribute rigging loads to the deck more evenly thereby making all of your hardware more trouble-free. Our custom fasteners show us to have an attractive functional appearance to the cabin overhead that makes maintenance of your deck fittings easy should some problem occur with a clew or winch. When you inspect any boat, check to see if all of the fittings are easily accessed and properly fastened.

**Spars.** Our boats come standard with custom fabricated, tapered, black anodized masts. Rod rigging is standard. Every detail on our spars is current state of the art. Perhaps the reasons that our spars have historically had such a low incidence of problems is because we use the best methods. One of the first places that a builder can cut costs is to eliminate anodizing. No matter what anybody may say, paint will quickly deteriorate on a spar. Repainting your spar every few years is a non-trivial maintenance cost. Anodizing is the closest thing to a lifetime finish.

## **CONCLUSION**

We have given you a brief overview of some of the construction related issues that a concerned buyer should be aware of before selecting a yacht. Obviously, we have only been able to hit the high points on many issues. It would take volumes to explain all of the critical decisions that we have made in trying to achieve the ultimate sailing machine.

Most importantly, you should remember that the most important ingredient in a fine yacht is not merely the materials and techniques used, it is the people that used them. Our craftsmen and their continuing concern with achieving excellence is an ingredient that is tough to quantify. The fact that our boats each have over 50 pages of quality control documents generated by our careful manufacturing control procedures gives you the highest assurances of trouble-free ownership. Because of the care that we know goes into each one of our Express boats, our final assurance of quality that we can give you is a limited lifetime warranty to the original buyer on hull and deck structure.