
Island Packet 465

STABILITY

by Bill Bolin, VP, Sales and Marketing

We here at Island Packet Yachts have all become familiar with safety and seakeeping issues, so much so that I have taught a number of seminars on the subject at several boat shows over the past several years. Here is the heart of my explanation of general stability issues and how they relate to your Island Packet. -BB

Stability is defined, in boat designer parlance, as the ability of a yacht to resist capsize and, if it does capsize, the capacity of that yacht to recover to an upright position. The first part of the equation, *resistance to capsize*, comes mainly from two different sources: the yacht's *form stability* and the yacht's *displacement*. Picture a Jon boat (flat bottomed, beamy) and a canoe (round bottom, narrow). The Jon boat has more "form stability" than the canoe and is less likely to capsize. It should also not be too much of a stretch to understand that a heavier displacement yacht will be less likely to capsize than a lighter one. Imagine a large ocean going container ship and a small fishing runabout. It's going to be much harder (take much more energy) for the heavier ship to capsize.

But what happens if a yacht does capsize? The ability to recover comes from a number of areas: was the yacht water tight (or did an open companionway or hatches allow seas to board the vessel), where is the yacht's center of gravity and what is the shape of the yacht's stability curve?

Most of you have seen a stability curve in the sailing magazines or product brochures. It illustrates the overall stability of a yacht, its sail carrying power (stiffness) and how easily or quickly a yacht might recover from a capsize. Let's look to see how these curves are generated.

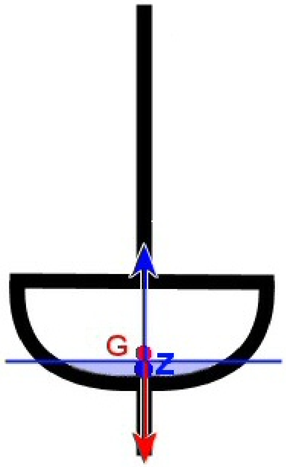


FIGURE 1

At rest, a yacht has two diametrically opposing forces acting on it: *gravity*, holding the yacht down in the water, and *buoyancy*, keeping the yacht afloat. A designer locates the geometric center of these forces with the center of gravity (labeled as "G") and the center of buoyancy (as "Z") as shown in Fig. 1, above.

When a yacht heels the center of gravity remains fixed, but the center of buoyancy moves as the shape of the submerged hull changes (Fig 2).

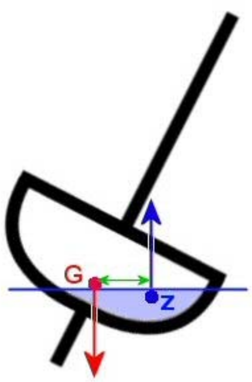
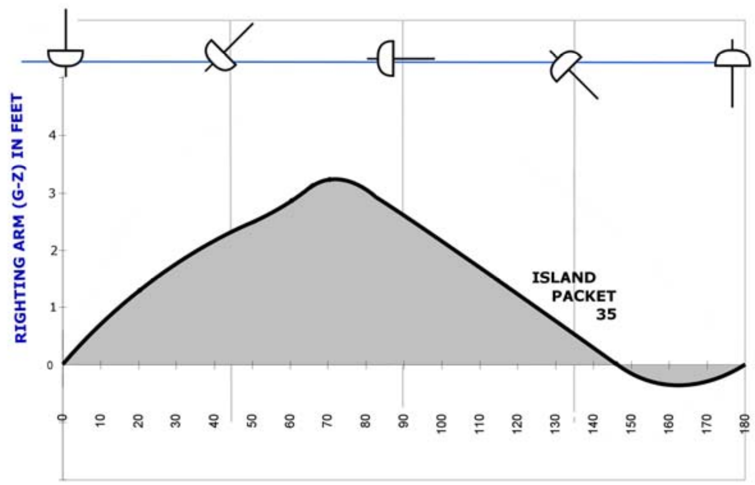


FIGURE 2

The horizontal distance between the moving center of buoyancy and the fixed center of gravity is called the "righting arm" and can be plotted on a graph for various angles of heel (Fig 3). As the yacht heels at increasing angles, at some point the two centers are again directly above one another and a heel angle beyond this point will result in the yacht capsizing, that is, going to an inverted position. This point where the G-Z distance is again zero is the yacht's *limit of positive stability* (LPS). LPS occurs around 120 degrees of heel for a typical fin keeled boat, and on average about 140 degrees for an Island Packet model. Should waves push a yacht beyond this LPS point, the yacht will want to go to a fully inverted position and remain there until such time as wave action returns it to a point where it can recover.

FIGURE 3



A stability curve can also supply you with the "righting moment" of a yacht, or the force (torque) trying to put the yacht back into an upright and static position. In Figure 4 (next page), I have taken the displacement of a pretty typical 46 foot fin keeled yacht (Brand X) and an Island Packet 460 and multiplied these numbers by their respective righting arms (in feet) to get "foot pounds of force" at various angles of heel. The resulting curves show the amount of torque each yacht exerts throughout the stability range. Note that at just 15 degrees of heel (a typical sailing angle) the IP460 is exerting over 20,000 foot pounds of torque that balances the heeling force of the sails. Let the sheets go and the yacht comes back upright quickly! And the fin keeled boat, at this same angle of heel, has about half the righting moment, due to both a shorter righting arm and lower displacement.

You can look at this data another way, too. It takes 20,000 foot pounds of force to heel the IP over to 15 degrees, giving the yacht great sail carrying capacity. The fin keel boat gets over to

15 degrees with just half the wind pressure, meaning reefing early might be a good idea!

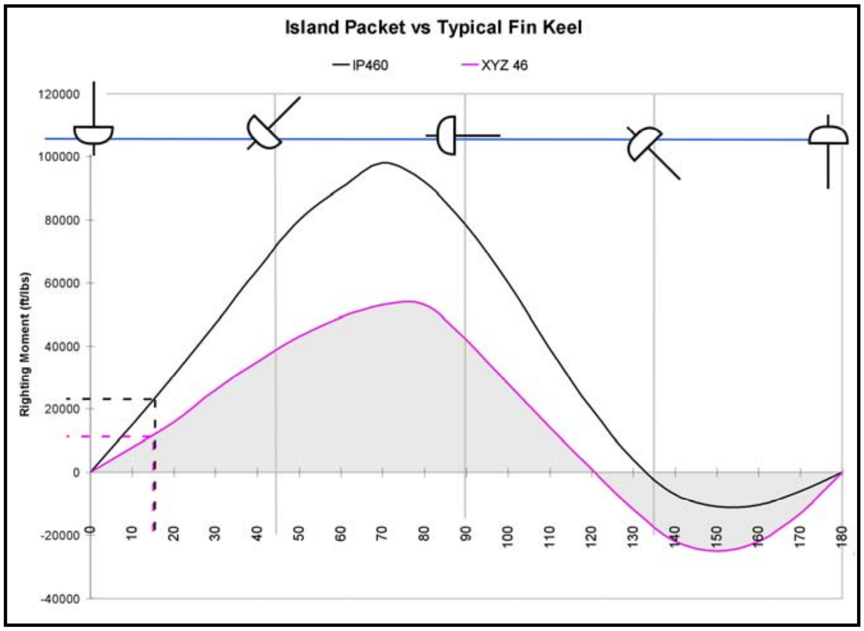


FIGURE 4

One more noteworthy observation one can glean from the stability curve: the area "underneath" the curve, both above and below the "x" axis (as represented by the shaded areas in both Figures 3 and 4) relates to the amount of *energy* needed to heel the yacht to any given point. Note in Figure 4 how much more energy is needed for an Island Packet to get to its LPS vs. the fin keel yacht. Likewise, it takes far less energy for an Island Packet to right itself after a capsize than a typical fin keeled boat (look at the relative areas below the horizontal "x" axis). Which yacht would you want to be on in strong winds and big seas?

Our owners tell us that one of the things they like the most about our yachts is their high level of *safety and seakeeping*. The combination of a relatively high righting moment, the extended range of positive stability and the low level of energy needed to recover from a capsize helps deliver both safety and seakeeping. **-BB**

Island Packet 460