

Nordic Tugs Stability & Buoyancy Evaluation

By Joe Franett, VP of Operations Nordic Tugs

Our Nordic Tugs have a reputation for being very seaworthy. Some say the boat can take way more than the crew can. But just how stable, buoyant and seaworthy are they? I'm sure designer Lynn Senour had the calculations done 28 years ago and although the boats haven't changed drastically over the years, they have changed. If there was good written documentation back then, it needed to be updated.

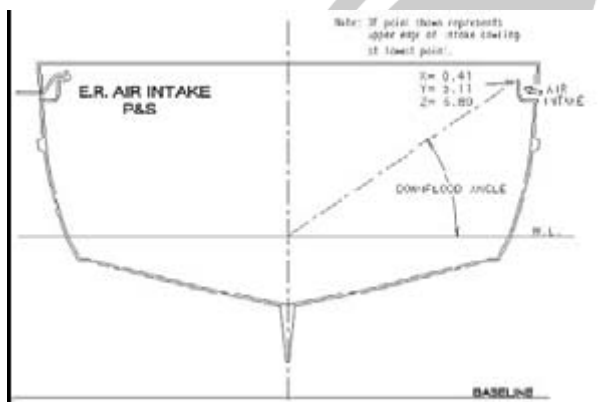
The 32, 37 and 42 were completely and thoroughly tested this past winter to document the vessels' ability to handle the high seas. The main reason to have this done was to pass the CE certification to ship our boats to Europe. We started by choosing one of four different categories or classes to rate the boats' seaworthiness from the ISO standards 12217-1. We chose Category "B", which states, "This vessel is designed for waves of up to 4 m (13 feet) significant height and a wind of Beaufort Force 8 or less (34-40 knots)." "Such conditions may be encountered on offshore voyages of sufficient length or on coasts where shelter may not always be immediately available. These conditions may also be experienced on inland seas of sufficient size for the wave height to be generated. Winds are assumed to gust to 21 m/s (41 knots)."

The ISO definition says, "The significant wave height is the mean height of the highest one-third of the waves, which approximately corresponds to the wave height estimated by an experienced observer. Some waves will be double this height." Why Category "B"? Category "A" is mostly for ocean-going vessels operating in Beaufort force 10 (48-55 knot) winds and associated wave heights of 20-30'. Category "C" is for lesser boats operating in wave heights to 6 1/2' and winds to Beaufort force 6 (22-27 knots). Category "D" is mostly for boats operating in inland and sheltered waters.

The process began by collecting data on a completed boat in a calm harbor with accurate line drawings and movable weights. For weight transfer, we used 2 empty plastic 55 gallon drums and a garden hose from the dock water. We hired Naval Architect and Professional Engineer, Rick Etsell, from Pacific Motor Boat Design in Anacortes to do all the required measurements and calculations for us to submit the final documents to the CE inspectors. Rick started by measuring the specific gravity of the sea water and calculating the weight of the fuel and water on board. He measured the free board, down flooding points, drainage ports, water barrels (movable weight) and anything else measurable. Then he set up a pendulum from the pilothouse overhead to the lower deck that was about 8 feet long with a pointed weight on the end. He then filled one barrel

on the outboard edge of the cockpit and measured its distance to the centerline. He noted the list of the boat via the pendulum and measuring board and continued the same procedure filling both barrels and moving them specified distances from centerline on the aft deck. When the inclining test was done and all the weights and measurements were complete, he went back to his office to calculate the down-flooding openings, the down-flooding-height, the down-flooding angle, the offset-load and the resistance to waves and wind. A few weeks later he sent us a very accurate, detailed package of information.

The results were better than we expected. The boats were indeed well designed. We were nervous that we would have to modify or move scuppers, drains, air intakes or any number of things. The



only thing we were required to do was to increase the height of the engine air intake "snorkel" or baffle that extends upward to prevent sea water from entering through the opening. We had to increase its height by $\frac{3}{4}$ " and angle it inboard $\frac{3}{4}$ " (see photos above). The reason for this was the down-flooding point was just barely too low when the boat is heeled over at the maximum

calculated angle. That angle is slightly different on each boat but the 32, for example, has a critical down-flooding point of 45.5 degrees when light and 40 degrees when loaded. Aside from passing category "B" and receiving our CE certification, we obtained a great amount of interesting data. The reports include maximum loading, righting arm, vertical and horizontal center of gravity, metacentric height (GM), height of transverse metacenter (KM) and a lot more useful information to those of you with specific needs.



Some of this will end up on a page in the new owner's manuals. We have had requests for this information in the past from equipment installers, owners and lift and trailer makers. We couldn't give them a definite answer then, but we can now. You can rest assured that the boats you thought could handle the big weather have proven on paper that they are what you thought they were. They're as safe and seaworthy as our history has proven.