



## NEW BOATBUILDERS HOME PAGE

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### How much of a load is too much?

Since the publication of the report on the Ethan Allen disaster, much has been written about how many passengers a boat should carry and what weight should be used for each person. The Ethan Allen carried passengers for hire. It was not a recreational boat, but the question has also arisen about how many persons should be allowed on recreational boats. You will find links to reports about the Ethan Allen at the end of this article.

The problem is that when we talk about the number of persons on a commercial boat, and the number of persons on a recreational boat we are comparing apples and oranges. On a commercial vessel all of the calculations are based on the number of passengers, using an arbitrary value for weight of a single passenger. On a recreational boat all of the load calculations are based on the boat's displacement weight, that is, the ability to carry load and the number of passengers is the very last figure calculated.

On a commercial vessel, the number of passengers is estimated based on the lesser of the following criteria:

1. Length of rail: one passenger for each 30 inches of rail at the sides and stern., or,
2. The deck area; one passenger per 10 square feet of deck area, excluding spaces listed in 46 CFR 176.113, which include, among other areas, concession stands, toilets, lifesaving gear storage spaces, required aisle area, or
3. The fixed seating areas, or fixed seating; one passenger for each 18 inches of fixed seating width.

The stability of the vessel is then determined using the number of passengers allowed based on the initial determination. An SST (simplified stability test) is conducted, based on the Coast Guard criteria of 140 pounds per person. If the boat does not pass the stability test then the number of passengers is based on the weight of passengers that would pass the test at 140 lbs per passenger. The Ethan Allen investigation has determined that this weight is too low, and should be at least 174 pounds. The Coast Guard has raised it to 184.

The capacity is based on stability because on larger boats the displacement weight is so great as to create an unrealistic amount of passenger weight that could be carried. But, passenger weight and placement has a significant effect on the stability. Capsize is the issue. Capsize leads to sinking. Especially, if as in the case of the Ethan Allen, the boat is near its limits of stability and the passenger load suddenly shifts to one side.

But on a recreational boat the number of passengers is the last number calculated. The really important value is the amount of weight that can be carried. This is based on the displacement weight of the boat. Displacement weight is the weight of water displaced when the boat is immersed to the point that water would begin to enter the boat. Each boat has a float plane, which is a line above which water will enter the boat. The volume of the boat below the float plane is the value used to determine the displacement weight. It equals the weight of water displaced less the weight of the boat. This same value can be achieved by putting weight in the boat until water comes in.

On outboard powered boats over 2 horsepower and under 20 feet in length, that amount of displacement weight is divided by five (5) giving you the maximum safe load. The engine, battery, motor and controls weight is then subtracted. This gives a weight which becomes the persons weight. Then a formula is used to calculate the number of persons.

This figure is a very conservative figure. First of all it would take five times the maximum weigh capacity to come anywhere near sinking the boat. So you have a 5 times safety factor. Plus that the values for engine, batteries and controls are all based on the heaviest weights of equipment available on the market. Again this is being conservative and allowing a large safety margin. Keep in mind that on a small boat addition of a small amount of weight has a much greater affect on stability and the vessels freeboard than the same size weight on a much larger vessel. So the logical value to base how much the boat can carry is not passengers, but total weight.

In addition monohull boats less than 20 feet in length are required to have level flotation. That is, if they fill with water they must float in a relatively level attitude. There is a stability portion to the test for level flotation which does not allow the boat to heel more than 30 degrees to one side or the other when a percentage of the passenger weight is on that side of the boat. When a boat cannot meet this test they must either add flotation, or reduce the weight allowed for persons.

On inboard boats under twenty (20) feet the process is similar. The displacement weight is determined, the boat, engine, and controls weights are subtracted out and the result is divided by seven (7). So now the safety factor is seven. The Maximum Persons Capacity is the Maximum Weight Capacity minus the boat weight. However, on an inboard boat a modified stability test is used to determine the maximum persons weight if the persons weight is less than 550 pounds. Weight is added to one side of the boat until the point where water would enter. That weight is divided by 0.6. (The same as multiplying by 1.6667.) But again the final figure is weight.

The weight capacity is the amount that should not be exceeded. However, to provide operators with a guide line, the number of persons is determined by adding 32 to the Maximum Persons Capacity and dividing by 141. Originally the Coast Guard did not want to put this figure on the capacity label. The position was that weight is the real issue not the number of passengers. But the industry wanted a number of passengers on the label as a guide for the consumer so it was added. The number of persons has also become a convenient number to use for law enforcement officers when doing a safety boarding. However, most officers know that the real measure is the weight capacity.

If any change is made it should be eliminating the number of persons from the label. The critical factor is how much weight the boat can safely carry. It doesn't matter if it is two adults, a boy, and a dog, or 6 children. The total weight is the important value that should not be exceeded. However, short of that, if the amount of weight per person is changed then it will be the industry that is adversely impacted, and the maximum persons capacity in pounds will not change.

As an aside; under Federal law it is not a violation to exceed these numbers. This requirement applies to boat manufacturers. They must put the labels on the boat and the numbers on the label cannot exceed the calculated, or tested, maximum capacities. A Coast Guard boarding officer will not cite an operator for exceeding the numbers on the label unless in their estimation the boat is grossly overloaded. Then the operator will be cited for negligent operation. The catch is many states have passed laws making it a violation to exceed the numbers on the label, and insurance companies take a dim view of exceeding the numbers.

NTSB News report on Ethan Allen <http://www.nts.gov/pressrel/2006/060725.htm>

The NTSB Report [http://www.nts.gov/Publictn/M\\_Acc.htm](http://www.nts.gov/Publictn/M_Acc.htm))

Popular Mechanics Article on the Accident:

<http://www.popularmechanics.com/outdoors/boating/4199636.html>

BoatUS on FindArticles.com

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