



rev. 8/16/06

TRIM TAB DEPLOYMENT FORCE CALCULATIONS

The following formula was developed at the Stevens Institute in Hoboken, New Jersey, in the 1970's and has been found to be reasonably accurate. The formula is used to calculate the force on a tab actuator which is the same as the force the actuator has to be able to exert to deploy the tab. Note that this formula has nothing to do with tab selection. It only predicts the force which will be needed to deploy a given tab under given conditions. This information is needed in order to determine how many actuators a tab may need to keep all actuators operating within reasonable force limits. Tab selection will still remain a matter of experience and judgment.

The factors needed are as follows:

- F= Force in pounds (to be calculated)
- V= Boat speed in miles/hour
- D= Tab deflection in degrees from horizontal
- C= Tab chord in inches (tab hinge aft)
- W= Tab width in inches (port to starboard)
- P= Actuator attachment point from hinge in inches (7.75" is the Lectrotab standard)
- A= Actuator incline from vertical in degrees (30° is the Lectrotab standard)

$$F= (V \times 1.466)^2 \times D \times (C/12)^2 \times W/12 \times .0064 \times (1 + A/100) \times 12/P$$

In a recent case where in a single actuator per tab installation, the tabs did not deploy fully, the formula did help analyze the situation. The tabs were 12 x 36 inches and the boat speed was 24 mph. To find the force needed to push the tab to 21 degrees, D would equal 21. P was our standard 7.75 inches.

$$F= (24 \times 1.466)^2 \times 21 \times 1 \times 3 \times .0064 \times (1 + 30/100) \times 12/7.75 = 1004.6$$

The Lectrotab actuator, at 14.1 volts at the actuator, stalls at about 1000 pounds. If you assume some voltage drop to the actuator, the capability could be down to 800 pounds, so there is no wonder that the tabs would not deploy to 21 degrees at full speed of 24 mph when the formula shows a need for 1004 pounds.

Typically, for long life, we recommend keeping the actuator load to 700 pounds or less. In this case, if two actuators were used, the load on each would be 502 pounds which would be reasonable. Two actuators was our recommendation and it solved the problem.

CAUTION

Above 30 MPH and especially above 40 MPH, the water flowing onto the tab begins to change from laminar to turbulent flow which disrupts the calculated result. It's like the result of disturbed water entering a propeller resulting in cavitation wherein propeller performance becomes unpredictable.