

## HOW TO CHOOSE THE CORRECT BOW AND STERN THRUSTER

After you have selected your type of thruster, the following tool can be used to calculate the required thrust force or you can use the table below to select your ideal thruster.

### The influence of the wind

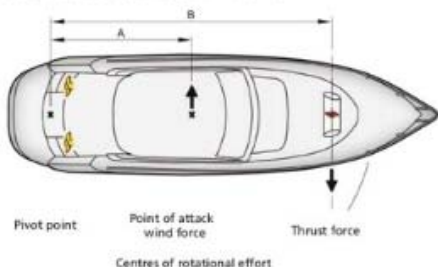
The force applied to the boat by the wind is determined by the wind speed, the wind angle and the lateral wind draft area of the boat. If the wind blows at right angles to the boat, this wind pressure is most difficult to counter. However, this is seldom the case and as most boat superstructures are fairly streamlined, a reduction factor of 0.75 is generally applied, when calculating the wind pressure.

### The turning moment

The turning moment is calculated by multiplying the wind force by the distance (A) between the centre of effort of the wind and the point of rotation of the boat. In order to simplify this somewhat: for the vast majority of boats a rule of thumb may be applied that the turning moment is calculated by multiplying the wind force by half of the boat's overall length.

### The thrust force

It is the thrust force which is the true measure of a bow thruster's usefulness and not the output of the electric or hydraulic motor in kW or HP. The nominal thrust force is a combination of the motor power, the shape of the propeller and the efficiency losses inside the tunnel. VETUS electrical bow thrusters have a very high thrust of between 17 and 23 kgf per kW motor power. The required thrust force to counter the effects of the wind is now calculated by dividing the turning moment by the distance (B) between the centre of the bow thruster tunnel and the pivot point of the boat. Note: the further forward the tunnel can be positioned, the greater effect the thruster will have.



Wind force Beaufort	Description	Wind speed m/s (ft/s)	Wind pressure N/m <sup>2</sup> - (kgf/m <sup>2</sup> )
4	moderate breeze	5,5 to 7,9 (17 - 27)	20 to 40 - (2,0 to 4,1)
5	fresh breeze	8,0 to 10,7 (27 - 37)	41 to 74 - (4,2 to 7,5)
6	strong breeze	10,8 to 13,8 (37 - 47)	75 to 123 - (7,7 to 12,5)
7	near gale	13,9 to 17,1 (47 - 57)	125 to 189 - (12,7 to 19,2)
8	gale	17,2 to 20,7 (57 - 67)	191 to 276 - (19,4 to 28,2)

### Calculation example

The boat has an overall length of 36 ft. (11 metre) and the lateral wind draft measures 194 ft.<sup>2</sup> (18 m<sup>2</sup>). It is required that the bow can be controlled easily when wind force Beaufort 5 applies. At wind force Beaufort 5, the wind pressure is: Rho= 41 to 74 N/m<sup>2</sup>, i.e. Rho (average) = 60 N/m<sup>2</sup>.

The required torque is

$$T = \text{wind pressure} \times \text{wind draft} \times \text{reduction factor} \times \text{distance centre of effort to pivot point, (=approx. half the ship's length)}$$

$$T = 60 \text{ N/m}^2 \times 18 \text{ m}^2 \times 0,75 \times \frac{11}{2} \text{ m} = 4455 \text{ Nm}$$

The required thrust force is calculated as follows

$$F = \frac{\text{torque}}{\text{distance between centre of bow thruster and the pivot point of the boat (with the transom as pivot of the boat)}} = \frac{4455 \text{ Nm}}{10,5 \text{ m}} = 420 \text{ N (42 kgf)}$$

The most suitable VETUS bow thruster is for this particular vessel is the 99 lbf (45 kgf) (55 lbf (25 kgf) in the case of Beaufort 4 and 156 lbf (75 kgf) in the case of Beaufort 6). Always bear in mind that the effective performance of a bow thruster will vary with each particular boat, as the displacement, the shape of the underwater section and the positioning of the bow thruster will always remain variable factors. As a rule of thumb it can be assumed that the stern thruster may be "one model smaller" than the bow thruster model, as it has been calculated. Therefore, in this case a stern thruster type 77 lbf (35 kgf) will be the correct model. Below is a selection table of bow thruster models against recommended boat length. Please note that this table is given for general guidance only and the calculation shown above should be used whenever possible. If you are in any doubt about the best thruster for your boat, your VETUS support representative will be glad to help you with the decision.

Selection table thrust force - boat length

	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	.....	43
Metre:	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	.....	43
Feet:	20	26	33	39	46	52	59	66	72	79	85	92	98	105	112	.....	141
25 kgf																	
35 kgf																	
45 kgf																	
55 kgf**																	
60 kgf																	
75 kgf																	
95 kgf**																	
125 kgf																	
160 kgf**																	
220 kgf																	
230 kgf*																	
285 kgf																	
310 kgf*																	
410 kgf*																	
550 kgf*																	

\* only available as hydraulically driven bow thruster

\*\* available as hydraulically and electrical driven bow thruster