How to choose the correct bow thruster

A bow thruster provides positive control over movements of the bow, caused by cross wind or current. VETUS offers a wide range of bow thrusters, both electric and hydraulic, to suit a broad variety of boats. One of the latest VETUS developments has been made in collaboration with the Maritime Institute Netherlands, MARIN, the world-famous hydrodynamic laboratory. Working together, Vetus and MARIN have optimized the performance of the bow thruster by developing a unique shaping of the propeller blades. This has resulted in a drastic reduction in cavitation, and thruster noise. The efficiency has improved as well, which results in lower current consumption of up to 10%.

The following overview of the most relevant factors will help you to select the correct bow thruster for your boat.

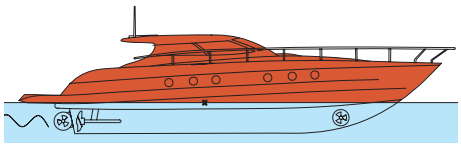
GENERAL INFORMATION

VETUS bow thrusters feature a streamlined bronze tail piece. This streamlining reduces turbulence in the water flow, and provides improved performance with reduced noise. Most VETUS bow thrusters have corrosion-free composite propellers, uniquely shaped to provide maximum thrust with minimum noise. The matching tunnels are available in fibreglass, steel and aluminum, to suit all hull materials. All VETUS bow thrusters are designed to serve as stern thrusters as well. Bronze 3 bladed propellers are available as an option for 220, 230, 285 and 310 kgf models.

THE INFLUENCE OF THE WIND

The force applied to the boat by the wind is determined by wind speed and direction, and the lateral wind draft area of the boat. When the wind speed rises, the wind pressure increases exponentially. The shape and the dimensions of the boat profile about the waterline (the topsides and superstructure) determine the lateral wind draft area. A streamlined hull and superstructure offer less resistance to the wind and a streamlining reduction factor of 0.75 is applied, when calculating the wind pressure.

Wind speed knots	Description	Wind speed ft/s	Wind pressure lbf/sq.ft
10 - 16	moderate breeze	17 - 27	0.40 - 1
16 - 22	fresh breeze	27 - 37	1 - 1.9
22 - 28	strong breeze	37 - 47	1.9 - 3.1
28 - 34	near gale	47 - 57	3.1 - 4.6
34 - 40	gale	57 - 67	4.6 - 6.3



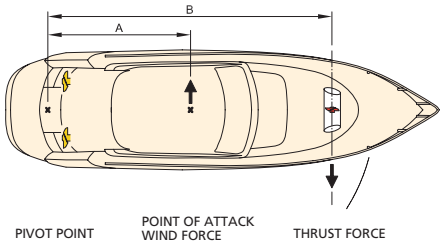
The lateral wind draft area

THE WIND TORQUE

The torque is determined by multiplying the wind force by the distance between the centre of effort of the wind and the centre of rotation of the boat (A). For the vast majority of power boats and full keel sailboats, an approximate torque is calculated by multiplying the wind force by half of the boat's length.

THE THRUST FORCE

It is the thrust force which determines the effectiveness of a bow thruster and not the output of the electric or hydraulic motor in kW or HP. The nominal thrust force is the result of the power of the motor, the shape of the propeller and the drag inside the tunnel. For direct current electric thrusters, battery size and condition, and cables length and gauge, will also effect the performance of the bow thruster. VETUS electrical bow thrusters have a very high thrust of between 28 and 38 lbs/hp. The required thrust force to counter the turning effect of the wind is calculated by dividing the the wind torque in foot pounds by the distance between the centre of the bow thruster tunnel and pivot point of the boat in feet (B). Note: the further forward the tunnel is positioned in the bow, the greater the effect of the thruster. As a rule of thumb, the stern thrusters must be one type smaller than the bow thrusters. For this calculation example a 35 kgf stern thrusters will be the one to choose.



Centres of rotational effort

Calculation example
The boat has an overall length of 36 ft and the lateral wind draft measures 190 sq.ft. It is required that the bow can still be controlled easily when a wind force of 20 knots applies. At a wind force of 20 knots, the wind pressure is:
p = 1.0 to 1.9 lbf/sq.ft i.e.p. (average) 1.45 lbf/sq.ft.

The required torque reads:
T = windpressure x wind draft x reduction factor x distance center of effort to pivot point, (= appr. half the ship's length)

$T = 1.45 \text{ lbf/sq.ft} \times 190 \text{ sq/ft} \times 0.75 \times \frac{36 \text{ ft}}{2} = 3719 \text{ ft.lbs.}$

The required thrust force is calculated as follows:

$$F = \frac{\text{torque}}{\text{distance between center of bow thruster and the pivot point of the boat. (with the transom as pivot of the boat)}} = \frac{3719 \text{ ft.lbs.}}{34.5 \text{ ft.}} = 107.8 \text{ lbf}$$

The VETUS bow thruster which is most suitable for this particular vessel is the 121 lbf model (Beaufort 5), 55 lbf in case of Beaufort 4 and 165 lbf in 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 be 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 35 kgf will be the correct model.

Selection table thrust force - boat length	
55 lbf	suitable for boats from 18 to 28 feet in length
77 lbf	suitable for boats from 21 to 32 feet in length
121 lbf	suitable for boats from 28 to 41 feet in length
132 lbf	suitable for boats from 29 to 42 feet in length
165 lbf	suitable for boats from 34 to 49 feet in length
210 lbf	suitable for boats from 39 to 55 feet in length
275 lbf	suitable for boats from 45 to 66 feet in length
352 lbf	suitable for boats from 54 to 72 feet in length
485 lbf	suitable for boats from 63 to 85 feet in length
507 lbf *	suitable for boats from 65 to 87 feet in length
628 lbf	suitable for boats from 72 to 92 feet in length
665 lbf *	suitable for boats from 72 to 95 feet in length
905 lbf *	suitable for boats from 88 to 112 feet in length
1215 lbf *	suitable for boats from 108 to 141 feet in length

** only available as hydraulically driven bow thruster*