

Aquafax



Inboard

How to Calculate the Rudder Torque of your Boat

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When the torque necessary to manoeuvre a boat is not specified by a naval architect nor by the shipbuilders yard, it can be calculated as follows:

It must be known that the torque necessary to manoeuvre the boat depends on:

- The speed of the water flowing on the surface of the rudder at a certain angle
- The rudder size
- The total sweep of the rudder (& part of the boat when the rudder shaft is not perpendicular)
- The compensating service

ULTRAFLEX METHOD

The torque calculation for a maximum speed of about 25 knots:

$$T = S \times [(0.4a) - b] \times V^2 \times k$$

T = Torque in kgm

S = Total surface area of the rudder in M² (h x a)

h = Height of the rudder in M

a = Width of the rudder in M

b = The value of the compensation in M

V = Speed of the boat in knots

k = Coefficient according to the total angle of the rudder

Port to Starboard 50° k = 10.84

Port to Starboard 60° k = 13.01

Port to Starboard 70° k = 15.89

Port to Starboard 80° k = 17.80

Port to Starboard 90° k = 19.52

Straightening according to type of boat:

- For boats equipped with jet engines T x 1.3

- For power boats with two engines and one rudder T x 0.5

- For sailboats T x 0.5

- For twin rudders T x 2

Ultraflex Calculation Example

Assume a rudder with:

Height of 0.5m (h)

Overall width of 0.35m (a)

Balance of 0.10m (b)

Maximum boat speed = 22 knots

port to Starboard = 70°

The maximum torque on the rudder blade is given by:

$$T = S \times [(0.4a) - b] \times V^2 \times k$$

$$T = S \times (0.4a - b) \times V^2 \times 15.89$$

$$T = (0.5 \times 0.35) \times [(0.4 \times 0.35) - 0.10] \times 22^2 \times 15.89$$

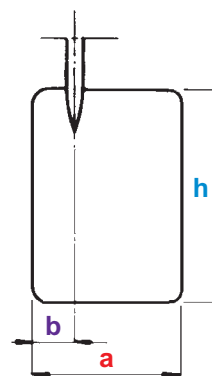
$$T = 0.175 \times 0.04 \times 484 \times 15.89$$

$$T = 53.9\text{kgm}$$

Assuming twin rudders

$$\text{Maximum steering torque} = (53.9 \times 2) = 107.8\text{kgm}$$

Therefore the appropriate cylinder = 4-48034 (max torque rating of 111kgm)



BCS METHOD

a = Height of Rudder

b = Width of Rudder

c = Balance of Rudder

d = Centre of Pressure

S = Force

V = Speed of Boat

A = Surface area of Rudder

$$d = (0.372 \times b) - c$$

$$S = 8.16 \times V^2 \times A$$

$$MT = \text{Torque per rudder in kgm} = S \times d$$



BCS Calculation Example

Assume a rudder with:

Height of 1.10m (a)

Overall width of 0.65m (b)

Balance of 0.21m (c)

Maximum boat speed = 18 knots

The maximum torque on the rudder blade is given by:

$$d = (0.372 \times 0.65) - 0.21 = 0.03$$

$$A = 1.10 \times 0.65 = 0.71\text{m}$$

$$S = 8.16 \times 324 \times 0.71 = 1877.12$$

$$MT = 1877.12 \times 0.03 = 56.31\text{kgm}$$

$$MT = 1877.12 \times 0.03 = 56.31\text{kgm}$$

Assuming twin rudders

$$MT = 2 \times 56.31 = 112.62\text{kgm}$$

