Ship Squat in Shallow or Confined Water (Barrass)

Maximum squat of a ship moving through shallow or confined water from its block coefficient, speed and blockage, by Barrass's formula, with the under-keel clearance.

Method: Barrass's maximum squat formula

Input parameters

Unit system: SI

Parameter	Value	Unit
Block coefficient	0.80000	
Speed through the water	9.0000	kn
Ship breadth	32.000	m
Static draught	12.000	m
Water depth	14.000	m
Channel width (0 for open water)	0	m

Calculated results

Parameter	Value	Unit
Blockage factor b·T/(W·h) (0 in open water)	0	
Confinement factor (1 open water to 2 confined)	1.0000	
Maximum squat	0.64800	m
Under-keel clearance while moving	1.3520	m
Depth-to-draught ratio	1.1667	

Notes for this case

• Barrass: δ_max = K C_B V_k²/100 m with K = 5.74 S^0.76 between 1 (open water) and 2 (confined channels), for h/T between 1.1 and 1.4. Full-form ships squat by the bow, fine-form ships by the stern.

Formula and method

$$\delta_{max} = \frac{K C_B V_k^2}{100} \text{ m}, \quad K = 5.74 S^{0.76} \ (1 \le K \le 2), \quad S = \frac{bT}{Wh}$$

Variables

C_B	Block coefficient	-
V	Speed through the water	m/s
B	Ship breadth	m
T	Static draught	m
h	Water depth	m
W	Channel width (0 for open water)	m
S	Blockage factor b·T/(W·h) (0 in open water)	-
K	Confinement factor (1 open water to 2 confined)	-
δ_{max}	Maximum squat	m
UKC	Under-keel clearance while moving	m
h/T	Depth-to-draught ratio	-

Method and standards

Empirical squat prediction.

Assumptions and limits

- Barrass's range: h/T about 1.1 to 1.4, steady speed, no passing ships.

References

Barrass's maximum squat formula

Report details

Report reference	FCC-9HH5-WASM (the same inputs always give the same reference)
Generated	23 November 2026, 18:00 UTC
Calculator	Ship Squat in Shallow or Confined Water (Barrass)
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/marine/ship-squat-barrass

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.