Anchor Holding Capacity and Chain Scope

Holding of an anchor and chain lying on the seabed, and the suspended chain length (catenary) needed to keep the pull horizontal at the anchor for a load and depth.

Method: Catenary mooring line statics

Input parameters

Unit system: SI

Parameter	Value	Unit
Anchor mass	1,500.0	kg
Anchor holding power ratio (holding/weight)	7.0000	
Chain mass per metre (in air)	50.000	kg/m
Chain length lying on the seabed	60.000	m
Chain–seabed friction coefficient	0.75000	
Water depth plus fairlead height	25.000	m
Horizontal design load	150.00	kN

Calculated results

Parameter	Value	Unit
Anchor holding	89.525	kN
Chain friction on the seabed	19.184	kN
Total holding	108.71	kN
Suspended chain length needed	134.97	m
Chain tension at the fairlead	160.66	kN
Scope ratio	7.7989	

Notes for this case

• Holding = anchor efficiency × submerged anchor weight + friction of the grounded chain, μ × submerged chain weight on the bottom (steel in seawater keeps 87 % of its weight). For the pull to be horizontal at the anchor, the catenary needs a suspended length s = √(h² + 2hT_H/w), w the submerged weight per metre; the top tension is T_H + wh. Holding power ratios range from about 3–5 for stockless anchors to 10–30 or more for high-holding-power types in good sand or clay.

Formula and method

$$H = E_a m_a g' + \mu_c w L_g, \quad s = \sqrt{h^2 + 2h\frac{T_H}{w}}, \quad T_{top} = T_H + wh$$

Variables

m_a	Anchor mass	kg
E_a	Anchor holding power ratio (holding/weight)	-
m_c	Chain mass per metre (in air)	kg/m
L_g	Chain length lying on the seabed	m
μ_c	Chain–seabed friction coefficient	-
h	Water depth plus fairlead height	m
T_H	Horizontal design load	N
H_a	Anchor holding	N
H_c	Chain friction on the seabed	N
H	Total holding	N

s	Suspended chain length needed	m
T_{top}	Chain tension at the fairlead	N
$(s + L_g)/h$	Scope ratio	-

Method and standards

Anchoring.

Assumptions and limits

- Uniform chain; steel in seawater; no seabed slope or current on the chain.

References

Catenary mooring line statics

Report details

Report reference	FCC-G6N2-H89A (the same inputs always give the same reference)
Generated	23 November 2026, 18:00 UTC
Calculator	Anchor Holding Capacity and Chain Scope
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/anchor-holding-chain-scope

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.