Ship Trim and New Draughts after Loading or Discharging a Weight

Bodily sinkage, change of trim and new forward and aft draughts of a ship after adding or removing a weight, from TPC, the moment to change trim and LCF.

Method: Change of trim and draughts by MCTC and TPC

Input parameters

Unit system: SI

Parameter	Value	Unit
Weight added (negative = discharged)	300.00	t
Its distance aft of the LCF (negative = forward)	-40.000	m
Displacement before loading	15,000	t
Longitudinal metacentric height	150.00	m
Length between perpendiculars	140.00	m
LCF from the aft perpendicular	68.000	m
Tonnes per centimetre immersion	22.000	t/cm
Initial draught aft	7.8000	m
Initial draught forward	7.2000	m

Calculated results

Parameter	Value	Unit
Moment to change trim 1 cm ΔGM_L/(100L)	160.71	tf·m/cm
Bodily sinkage w/TPC	136.36	mm
Change of trim (positive = by the stern)	-746.67	mm
New draught aft	7.5737	m
New draught forward	7.7204	m
New trim T_A' − T_F'	-0.14667	m

Notes for this case

- Small weights (below about 10 % of the displacement): sinkage w/TPC at the LCF plus the trimming moment w·x over MCTC, shared between the ends in proportion to their distances from the LCF.

Formula and method

$$\delta = \frac{w}{TPC}, \quad \Delta t = \frac{w\,x}{MCTC}, \quad MCTC = \frac{\Delta\, GM_L}{100 L}$$

$$\Delta T_A = \Delta t\,\frac{l_{CF}}{L}, \quad \Delta T_F = \Delta t\,\frac{L - l_{CF}}{L}$$

Variables

w	Weight added (negative = discharged)	kg
x	Its distance aft of the LCF (negative = forward)	m
Δ	Displacement before loading	kg
GM_L	Longitudinal metacentric height	m
L	Length between perpendiculars	m

l_{CF}	LCF from the aft perpendicular	m
TPC	Tonnes per centimetre immersion	kg/m
T_A	Initial draught aft	m
T_F	Initial draught forward	m
$MCTC$	Moment to change trim 1 cm ΔGM_L/(100L)	N
δ	Bodily sinkage w/TPC	m
Δt	Change of trim (positive = by the stern)	m
$T_A{}'$	New draught aft	m
$T_F{}'$	New draught forward	m
t'	New trim T_A' − T_F'	m

Method and standards

Trim by moment to change trim.

Assumptions and limits

- Small changes; hydrostatic particulars constant.

References

Change of trim and draughts by MCTC and TPC

Report details

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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-trim-change

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Reopens the calculator with the inputs of this report.