Stability Formulae Sheet

NB. These formulae and symbols are for guidance only and other formulae which give equally valid results are acceptable.

$$\rho = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{RD} = \frac{\rho_{\text{SUBSTANCE}}}{\rho_{\text{FW}}}$$

$$\nabla = (\text{L} \times \text{B} \times \text{d}) \times \text{C}_b$$

$$\Delta = \nabla \times \rho$$

$$\text{DWT} = \Delta - \Delta_{\text{LIGHT}}$$

$$\text{A}_\text{W} = (\text{L} \times \text{B}) \times \text{C}_\text{W}$$

$$\text{TPC} = \frac{\text{A}_\text{W}}{100} \times \rho$$

$$\text{Sinkage/Rise} = \frac{\text{w}}{\text{TPC}}$$

$$\text{FWA} = \frac{\Delta_{\text{SUMMER}}}{4 \times \text{TPC}_{\text{SW}}}$$

$$\text{DWA} = \frac{(1025 - \rho_{\text{dock}})}{25} \times \text{FWA}$$

$$\text{MSS} = \Delta \times \text{GZ}$$

$$\text{GZ} = \text{GM} \times \sin\theta$$

$$\text{GZ} = [\text{GM} + ½\text{BM}\tan^2\theta]\sin\theta$$

$$\text{GZ} = \text{KN} - (\text{KG} \times \sin\theta)$$

$$\text{Dynamic Stability} = \text{Area under GZ curve} \times \Delta$$

$$\text{Area under curve (SR1)} = \frac{1}{3} \times \text{h} \times (\text{y}_1 + 4\text{y}_2 + \text{y}_3)$$

$$\text{Area under curve (SR2)} = \frac{3}{8} \times \text{h} \times (\text{y}_1 + 3\text{y}_2 + 3\text{y}_3 + \text{y}_4)$$

$$\lambda_0 = \frac{\text{Total VHM}}{\text{SF} \times \Delta}$$

$$\lambda_{40} = \lambda_0 \times 0.8$$

$$\text{Actual HM} = \frac{\text{Total VHM}}{\text{SF}}$$

$$\text{Approx' Angle of Heel} = \frac{\text{Actual HM}}{\text{Max' Permissible HM}} \times 12°$$

$$\text{Reduction in GZ} = (\text{GG}_\text{H} \times \cos\theta) + (\text{GG}_\text{V} \times \sin\theta)$$

$$\text{Rolling Period T (secs)} = \frac{2 \times \pi \times \text{K}}{\sqrt{\text{g} \times \text{GM}}}$$

Stability Formulae Sheet

$$GG_{H/V} = \frac{w \times s}{\Delta}$$

$$FSC = \frac{i}{\Delta} \times \rho_T$$

$$FSC = \frac{l \times b^3}{12 \times \Delta} \times \rho_T$$

$$FSC = \frac{FSM}{\Delta}$$

$$\tan\theta = \frac{GG_H}{GM}$$

$$KG = \frac{\Sigma Moments}{\Sigma Weights}$$

$$GG_H = \frac{\Sigma Moments}{\Sigma Weights}$$

$$GM = \frac{w \times s \times length}{\Delta \times deflection}$$

$$\text{tan angle of Loll} = \sqrt{\frac{-2 \times GM}{BM_T}}$$

$$\text{GM at angle of Loll} = \frac{2 \times \text{initial GM}}{\cos\theta}$$

$$\tan\theta = \sqrt[3]{\frac{2 \times w \times s}{\Delta \times BM_T}}$$

$$\text{Draught when heeled} = (\text{upright draft} \times \cos\theta) + (½ \times \text{beam} \times \sin\theta)$$

Position of the Metacentre

$$KM_T = KB + BM_T$$

$$BM_T = \frac{I_T}{\nabla}$$

$$BM_T\ (box) = \frac{L \times B^3}{12 \times \nabla}$$

$$\text{Distance Summer LL to Winter LL} = \frac{1}{48}\ \text{Summer draft}$$

$$\text{Distance Summer LL to Tropical LL} = \frac{1}{48}\ \text{Summer draft}$$

Stability Formulae Sheet

$$KM_L = KB + BM_L$$

$$BM_L = \frac{I_L}{\nabla}$$

$$BM_L(\text{box}) = \frac{L^3 \times B}{12 \times \nabla}$$

$$MCTC = \frac{\Delta \times GM_L}{100 \times LBP}$$

$$CoT = \frac{\Sigma \text{Trimming Moment}}{MCTC}$$

$$\text{Change of trim aft} = \text{change of trim} \times \frac{LCF}{LBP}$$

$$\text{Change of trim fwd} = \text{change of trim} \times \frac{LBP - LCF}{LBP}$$

$$\text{True mean draught} = \text{draught aft} \pm \left(\text{trim} \times \frac{LCF}{LBP}\right)$$

$$\text{Trim} = \frac{\Delta \times (LCG \sim LCB)}{MCTC}$$

$$P = \frac{\text{trim} \times MCTC}{LCF}$$

$$P = \text{Reduction in TMD x TPC}$$

$$\text{Loss of GM} = \frac{P \times KM_T}{\Delta} \quad \text{or} \quad \frac{P \times KG}{\Delta - P}$$

$$\tan\theta = \frac{v^2 \times BG}{g \times R \times GM}$$

$$\text{Permeabili ty}(\mu) = \frac{\text{Volume available for Water}}{\text{Volume available for Cargo}} \times 100$$

$$\text{Solid Factor} = \frac{1}{RD}$$

$$\text{Permeabili ty}(\mu) = \frac{\text{SF of Cargo - Solid Factor}}{\text{SF of Cargo}} \times 100$$

$$\text{Effective length} = l \times \mu$$

$$\text{Sinkage} = \frac{\text{Volume of Bilged Compartmen t} \times \text{Permeabili ty}(\mu y}{\text{Intact Water Plane Area}}$$

$$I_{PARALLEL\ AXIS} = I_{CENTROIDAL\ AXIS} + As^2$$

$$\tan\theta = \frac{BB_H}{GM_{BILGED}}$$

Stability Formulae Sheet

Correction to observed drafts =

$$\frac{l_1}{L_1} \times \text{Trim}$$

Midships draft corrected for deflection =

$$\frac{d_{FP} + (6 \times d_M) + d_{AP}}{8}$$

Correction of Midships draft to True Mean Draft when CF not midships =

$$\frac{\text{Distance of CF from Midships} \times \text{Trim (True Trim at Perp's)}}{\text{LBP}}$$

Second Trim Correction for position of CF if trimmed hydrostatics are not supplied (form correction) =

$$\frac{\text{True Trim} \times (\text{MCTC}_2 - \text{MCTC}_1)}{2 \times \text{TPC} \times \text{LBP}}$$

Alternative form Correction =

$$\frac{50 \times \text{True Trim}^2 \times (\text{MCTC}_2 - \text{MCTC}_1)}{\text{LBP}}$$