

SHIP CONSTRUCTION & STABILITY – LEVEL 3

Registration code – NAUT SCS3

Duration – 180 hours

Pre-requisites

- Grade 9 level of mathematics, algebra and geometry
- Basic computer skills

Course description

This is a course designed to provide ship's officers and captains with the knowledge and skill required to: understand the basic design and construction of various types of vessels, perform basic stability calculations with emphasis on practical skills, extract data from hydrostatic tables and curves, perform calculations related to ship's drafts, trim, list and initial stability.

Required for the following certificates of competencies:

- Master 150T, Domestic
- Master 500T, Domestic
- Master, 500T, Near Coastal

Learning objectives/competencies

Subject	Knowledge required
Competence:	Maintain vessel stability
Understanding stability basic terminology	<p>Terms</p> <p>Meaning of displacement, deadweight, lightship weight, load displacement; Meaning of list, heel, loll; Meaning of gravity, centre of gravity (G), height of centre of gravity above keel/baseline (KG); Meaning of buoyancy, centre of buoyancy (B), reserve buoyancy; Meaning of righting lever (GZ) when the vessel is heeled, metacentre (M), metacentric height (GM) and roll period as an indication of initial stability; Meaning of centre of flotation (F) and trim; Meaning of draft, freeboard, deck edge immersion and downflooding.</p>
Understanding transverse stability principles	<p>Understanding of:</p> <p>Effect of water density on draft and freeboard and Fresh Water Allowance (FWA); Ability to explain using a sketch of a heeled vessel, how the centre of gravity (G) and the centre of buoyancy (B) are acting to create a righting lever (GZ); Effect on stability of adding, removing, transferring and suspending weights; Stable equilibrium, unstable equilibrium, neutral equilibrium; Correcting unstable and neutral equilibrium and angle of loll; Stiff and tender ships; Negative GM and angle of loll; Free surface effect of liquids on stability and the danger of slack tanks; Moment of statical stability; Effects of reduction in freeboard on stability and the dangers of overloading and capsizing.</p>
Practical use of stability data supplied in typical vessels and tugs	<p>Use of displacement and ton per inch / tonne per centimetre (TPI/TPC) scales to determine displacement from draft and vice versa; Understanding of data found in typical vessels and tugs stability booklets; Use of pre-calculated operating conditions to ascertain adequate stability; Recognize situations where the vessel does not meet the pre-calculated operating conditions and ability to rectify the situation; Interpreting curves of statical stability; Effects of reduction in freeboard on stability and the dangers of overloading and capsizing.</p>
Competence:	Maintain seaworthiness of the ship
Transverse stability and trim calculations	<p>Using supplied stability booklet or information, ability to:</p> <p>Calculate final metacentric height (GM) after adding, removing, transferring or suspending weights; Calculate final displacement; Determine the free surface effect and by how much it will affect the metacentric height (GM); Determine the righting lever (GZ) for a given angle of heel; Evaluate the area under the statical stability curve for a given angle of heel; Determine the final trim and final drafts; Determine if calculated data meets established stability criteria; Calculate weight to be loaded, unloaded, transferred in order to achieve the desired trim; Existence of transverse moment exerted on the towing hook; Determine the final list.</p>

subject	Knowledge required
Competence:	Maintain seaworthiness of the ship
Effect of environmental conditions on vessel's stability	Understanding the effect of severe wind and rolling in associated sea conditions, especially in following seas; Effect of water on deck including free surface effect; The effect of ice accretion on stability.
Knowledge of the Canadian Loadline Regulations	Knowledge of the <i>Canadian Loadline Regulations</i> .
Understanding basic construction terminology	<p>Terms:</p> <p>Meaning of length overall, length between perpendiculars, breadth, depth, moulded dimensions, baseline, gross tonnage and net tonnage; Meaning of open and closed construction; Meaning of weathertight and watertight; Knowledge of the principal structural members of a vessel and the proper names for the various parts; Ability to identify structural components on ship's plan and drawings.</p>
Maintain integrity of the hull and superstructures and prevent water flooding	<p>Basic knowledge of:</p> <p>How watertight and weathertight integrity is maintained; Purpose and maintenance of water-freeing arrangements and freeing ports in bulwarks How the minimum size and number of freeing ports required is determined; The construction of doors, door sills, windows, portholes and access openings; The construction of ventilators and air pipes; Sounding devices; Crew protection by bulwarks, rails and guards; How water ingress is prevented through hull openings (valves) & shaft.</p>
Survivability of the vessel in case of flooding and damage control	<p>Understand the construction and importance of bulkheads as strength members and their watertight integrity to prevent total flooding, in particular the collision bulkhead; The functions and construction of bilge and pump systems and water level detectors.</p> <p>Identify damage control techniques for various flooding scenarios as:</p> <p>Small and large hull breach, damaged through hull fittings, split piping, chafed hose, packing gland, etc.</p>
Protection against fires	<p>The purpose and operation of:</p> <p>Quick closing valves on fuel tanks; Fire dampers on ventilators; Fire extinguishing systems.</p>

Subject	Knowledge required
Competence:	Maintain seaworthiness of the ship
Vessel inspection and maintenance	<p>Awareness of the normal maintenance to ensure: Compliance with standards and regulations; Hull, machinery and all equipment remain in good operational order; Corrosion and cathodic protection.</p> <p>Awareness of the Transport Canada Marine Safety and Security inspection regime concerning: Initial inspection and periodic inspection.</p>