

**SKILLS FRAMEWORK FOR MARINE AND OFFSHORE
TECHNICAL SKILLS & COMPETENCIES (TSC) REFERENCE DOCUMENT**

TSC Category	Marine and Offshore System Design					
TSC	Ballast System Design					
TSC Description	Design ballast systems for ships, rigs and/or conversions by interpreting trim and stability tables and applying principles of fluid dynamics, pumping and piping systems, in compliance with regulations					
TSC Proficiency Description	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
			MAR-MSD-3001-1.1	MAR-MSD-4001-1.1	MAR-MSD-5001-1.1	
			Analyse ballast flow rates and pump system capacities required to stabilise ships, rigs and/or conversions in varying load and weather conditions by retrieving data from piping schematic, general arrangement drawings and marine engineering calculations	Develop ballast system design plan specification sheets and sketches by integrating information from marine engineering calculations with tank locations and capacities, and identifying suitable ballast equipment to be installed on-board ships, rigs and/or conversions	Verify whether equipment lists, position lists and calculations for ballast designs are in line with regulations and equipment manufacturers' recommendations	
Knowledge			<ul style="list-style-type: none"> Principles of fluid dynamics Piping schematic and general arrangement drawings Conventions used in ballast system drawings Principles of numerical computation of flow rates and tank capacities Behaviours of ships, rigs and conversions in varying load conditions Principles of structural stress analysis 	<ul style="list-style-type: none"> Types of ballast systems Methods of segregating different ballast water grades Types of ballast pumping equipment Types of ballast pipeline configurations Sensors for pressure and flow measurements Actuators for pressure and flow regulation Factors affecting stability of structures Principles of system drawing processes Types of loading software for ships, rigs and conversions Behaviours of ships, rigs and conversions in varying weather conditions Methods for evaluating ballasting processes 	<ul style="list-style-type: none"> Procedures for formulating ballast systems Evaluation criteria for ballasting processes Manufacturers' recommendations and limitations Legislative requirements governing ballast systems Material selection and classification society requirements for ballast system materials 	

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<p>Abilities</p>			<ul style="list-style-type: none"> • Determine appropriate data for executing relevant ballast system design calculations • Identify sources for retrieving relevant data • Execute accurate flow rate, tank capacity and stability calculations • Interpret piping schematics and general arrangement drawings • Upload hull form calculations into loading software to tabulate ballast calculations • Evaluate system reliability from design specifications 	<ul style="list-style-type: none"> • Identify suitable ballast systems based on the type of ship and rig and conversion specifications • Evaluate types of pumping and piping systems required for specific ballast systems • Analyse results of ballasting computations • Incorporate system isolation based on grade of ballast water • Incorporate relevant safety features in ballast systems • Produce ballast system design drawings to be used by the manufacturing department 	<ul style="list-style-type: none"> • Design process workflows to execute ballast system designs • Evaluate performance specification analysis on selection of sensors and actuators • Evaluate performance specification analysis on selection of pumping systems • Evaluate performance specification analysis on selection of piping specifications and configurations • Evaluate application of industry standards and international conventions in drawings • Evaluate final reports on selected components used to meet the system requirements 	
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