

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

<b>TSC Category</b>	Marine and Offshore System Design					
<b>TSC</b>	Cooling System Design					
<b>TSC Description</b>	Design cooling systems for ships, rigs and/or conversions to ensure sufficient cooling for engines, auxiliary equipment and fluids by evaluating individual and composite systems cooling requirements, cooling medium capacities, pump and piping system specifications and types of cooling media required					
<b>TSC Proficiency Description</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>	<b>Level 5</b>	<b>Level 6</b>
			<b>MAR-MSD-3005-1.1</b>	<b>MAR-MSD-4005-1.1</b>	<b>MAR-MSD-5005-1.1</b>	
			Analyse flow rates and cooling equipment capacities required for ships, rigs and/or conversions by retrieving data from the equipment lists and equipment and pipeline drawings, and executing marine calculations	Develop cooling system specification sheets and sketches by integrating information from marine engineering calculations with the cooling media to be handled and identifying the types and locations of cooling systems required to provide sufficient cooling to all exothermic systems on-board	Guide the formulation of cooling system specification sheets and sketches, approve equipment lists, position lists and calculations that are in line with the equipment manufacturers' recommendations and regulations, and ensure that equipment specific cooling systems are synced with the specific ship, rig and/or conversion systems	
<b>Knowledge</b>			<ul style="list-style-type: none"> <li>Principles of cooling systems</li> <li>Cathodic protection and sacrificial anodes for corrosion protection for seawater systems</li> <li>Principles of fluid dynamics</li> <li>Types of specification sheets and pipeline drawings</li> <li>Types of equipment and systems that require cooling</li> <li>Methods of heat transfer</li> <li>Basic principles of thermodynamics</li> <li>Principles of numerical computation of flow rates</li> <li>Methods of numerical computation of cooling requirements of each equipment and system</li> </ul>	<ul style="list-style-type: none"> <li>Methods of segregating sea water, fresh water, distilled water and other grades and/or types of cooling water</li> <li>Types and specifications of pumping equipment for cooling media</li> <li>Types of pipeline configurations for cooling media</li> <li>Types and specifications of coolers</li> <li>Sensors for pressure and flow measurements</li> <li>Actuators for pressure and flow regulation</li> <li>Factors affecting heat generation for each equipment</li> <li>Principles of system drawings</li> </ul>	<ul style="list-style-type: none"> <li>Procedures for formulating cooling systems</li> <li>Methods of evaluating effectiveness of cooling systems</li> <li>Evaluation criteria for measuring effectiveness of cooling systems</li> <li>Manufacturers' recommendations and limitations</li> <li>Legislative requirements governing cooling system operations</li> </ul>	

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			<ul style="list-style-type: none"> <li>Conventions used in system drawings</li> </ul>			
<b>Abilities</b>			<ul style="list-style-type: none"> <li>Determine appropriate data for executing relevant cooling water system design calculations</li> <li>Identify sources for retrieving relevant data</li> <li>Execute accurate flow rate, tank capacity and cooling requirement calculations</li> <li>Interpret structural and arrangement drawings</li> <li>Interpret equipment drawings</li> <li>Evaluate system reliability based on design specifications</li> </ul>	<ul style="list-style-type: none"> <li>Identify suitable cooling systems based on the types of equipment</li> <li>Evaluate types of pumping and piping systems required for specific cooling systems</li> <li>Identify pump and pipe specifications based on the grades and/or types of cooling media to be handled</li> <li>Incorporate system isolation based on grade and/or types of cooling medium</li> <li>Ensure safety features meet classification rules and requirements</li> <li>Draft cooling system design drawings to be used by the manufacturing department</li> </ul>	<ul style="list-style-type: none"> <li>Design process workflows to execute cooling system designs</li> <li>Evaluate performance specification analysis on selection of sensors and actuators</li> <li>Evaluate performance specification analysis on selection of pumping systems</li> <li>Evaluate performance specification analysis on selection of piping specifications and configurations</li> <li>Evaluate efficiency of cooling equipment</li> <li>Evaluate application of industry standards and international conventions in drawings</li> <li>Evaluate final reports on selected components used to meet the system requirements</li> </ul>	