

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

<b>TSC Category</b>	Marine and Offshore System Design					
<b>TSC</b>	Pump and Piping Design					
<b>TSC Description</b>	Apply hydraulic and fluid dynamics principles to design efficient pump and piping systems for liquids and gases by understanding principles of fluid flow, interaction between fluid layers and pipe materials, and losses in transmission					
<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-3014-1.1</b>	<b>MAR-MSD-4014-1.1</b>	<b>MAR-MSD-5014-1.1</b>	
			Analyse pump and pipe specifications based on flow rates, tank locations and designs, machinery position lists, and fuels, lubes and cooling water requirements for ships, rigs and/or conversions by retrieving data from the equipment lists and product designs and executing marine engineering calculations	Integrate information from marine engineering calculations with the properties of fluids, construction materials of marine equipment and tank designs and coatings, and recommend appropriate pump and piping designs including construction materials, capacities and locations and publish specification sheets and sketches	Review whether material, equipment and position lists and calculations are in alignment with the equipment manufacturers' recommendations to ensure that the equipment specific to pump and piping systems are synced with the ships, rigs and/or conversions specific systems, and approve the final pump and piping designs	
<b>Knowledge</b>			<ul style="list-style-type: none"> <li>Principles of fluid dynamics</li> <li>Types of marine design drawings and specifications</li> <li>Characteristics of centrifugal, positive displacement and other types of pumps, and types of losses in each pumping system</li> <li>Types of equipment to be connected to pump and piping systems, and methods to determine required piping configurations</li> <li>Specific pump and piping requirements for air, water, fuel, steam and other media</li> <li>Pump and pipe material specifications</li> </ul>	<ul style="list-style-type: none"> <li>Principles of pump and piping systems</li> <li>Methods of segregating different pump and piping sections</li> <li>Applications of centrifugal, positive displacement and other types of pumps</li> <li>Classification requirements of various pump systems</li> </ul>	<ul style="list-style-type: none"> <li>Procedures for formulating pump and piping systems</li> <li>Methods of evaluating effectiveness of all pump and piping sections</li> <li>Evaluation criteria for measuring effectiveness of pump and piping systems</li> <li>Advanced principles of equipment drawings to ascertain pump and piping requirements for each equipment</li> <li>Manufacturers' recommendations and limitations</li> <li>Legislative requirements governing overboard pipe connections and other</li> </ul>	

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			<ul style="list-style-type: none"> <li>Types and uses of pipe fittings, pipe joints, penetrations and expansion pieces</li> <li>Numerical computation of flow rates</li> <li>Methods of interconnecting specific pump and piping sections to provide standby arrangements</li> <li>Sensors for pressure and flow measurements</li> <li>Actuators and control systems for pressure and flow regulation</li> <li>Factors affecting pumping capacities</li> </ul>		<p>pump and piping systems</p>	
<b>Abilities</b>			<ul style="list-style-type: none"> <li>Determine appropriate data for executing relevant pump and piping system design calculations</li> <li>Identify sources for retrieving relevant data</li> <li>Execute marine engineering calculations to ascertain accurate flow rates, tank capacities and equipment specific pumping requirements</li> <li>Interpret structural and arrangement drawings to ascertain locations and piping configurations</li> <li>Evaluate reliability of system and maintenance needs</li> <li>Decipher pumping requirements for each equipment by interpreting equipment drawings</li> </ul>	<ul style="list-style-type: none"> <li>Identify suitable pump and piping configurations based on the equipment and related systems</li> <li>Execute pipe stress analysis incorporating fluid properties, dimensions of pipes and materials for construction</li> <li>Incorporate suitable pipe supports to prevent rupture or failure of pipes</li> <li>Evaluate pump and pipe material specifications based on the fluid being handled</li> <li>Incorporate instrumentation and controls in pump and piping system designs</li> <li>Indicate capacities of all pumps in system designs</li> </ul>	<ul style="list-style-type: none"> <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 pumps</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>	

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			<ul style="list-style-type: none"> <li>• Cater for pumping losses while designing systems</li> </ul>	<ul style="list-style-type: none"> <li>• Incorporate system isolation based on fluids being carried and equipment being served</li> <li>• Incorporate relevant safety features in the systems</li> <li>• Produce pump and piping design drawings and specification sheets to be used by the manufacturing department</li> </ul>		
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