

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

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| TSC Category | Marine and Offshore System Design | | | | | |
| TSC | Instrumentation and Control System Design | | | | | |
| TSC Description | Design instrumentation and control systems to measure and control the process variables of operating equipment and systems by interpreting equipment and system parameters | | | | | |
| TSC Proficiency Description | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 |
| | | MAR-MSD-2009-1.1 | MAR-MSD-3009-1.1 | MAR-MSD-4009-1.1 | | |
| | | Carry out troubleshooting, service and repair on electro-technological equipment by employing the principles of electricity | Review marine equipment and ship system designs and identify types and locations of equipment to be installed for measuring process variables to enhance remote monitoring and control of systems | Establish control system configurations to enhance remote monitoring and control capabilities for new product designs, ship system designs and marine equipment designs | | |
| Knowledge | | <ul style="list-style-type: none"> • Characteristics of direct current (DC) circuits, alternating current (AC) circuits and voltage • Characteristics and maintenance requirements of DC supply panels • Operation of single phase and three phase AC circuits • Types, characteristics and applications of common electrical loads • Techniques for checking functions and rectifying common faults in magnetic circuits of motors • Methods of control for lighting circuits • Operation and applications of pneumatic, electro-pneumatic, hydraulic and electro-hydraulic systems in the marine industry | <ul style="list-style-type: none"> • Types of electrical controls used in industrial machines • Concepts, strengths and limitations of electronics, hydraulics and pneumatics in marine control systems • Operating principles of governors • Preparation of compressed air in pneumatic systems • Types of pneumatic and electro-pneumatic components • Operation principles of pneumatic and electro-pneumatic systems • Operational principles and applications of differential pressure and thermostatic switches • Open- and closed-loop control systems | <ul style="list-style-type: none"> • Aspects of electrical safety and protection, including explosive environment concerns • Interpretation of component datasheets • Electrical loading calculations • Motor, pneumatic, sensors and control systems and other electrical sub-systems • Types of instrumentation and control drawings • Electronic system design techniques • Electrical system functional tests procedures • Principles of mechanical power transmission systems • Advanced hydraulic and pneumatic systems • Concept of computer-based programmable logic controllers (PLC) | | |

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| | | <ul style="list-style-type: none"> Hydraulic and pneumatic schematic control diagrams Relevant workplace safety and health (WSH) practices, guidelines and regulations, safe working procedures and use of protective equipment for electrical work Relevant quality assurance and quality control (QA/QC) policies and procedures | <ul style="list-style-type: none"> Electro-pneumatics symbol diagrams and circuit diagrams Safety and precautionary requirements for ship and rig designs involving explosive environments Classification society and international safety requirements for electrical equipment and instruments | <ul style="list-style-type: none"> Organisational and legislative requirements | | |
| Abilities | | <ul style="list-style-type: none"> Maintain electrical DC equipment Maintain single phase and three phase AC equipment Conduct checks on simple magnetic circuits and electrical final circuits Interpret schematic control diagrams for pneumatic, electro-pneumatic, hydraulic and electro-hydraulic systems Maintain marine electro-pneumatic control systems Apply object-oriented programming Construct programmes with user-defined functions and sub-routines Convert algorithms into programming codes | <ul style="list-style-type: none"> Perform analysis to determine control requirements of machines Produce graphical user interfaces for automation control of machines' systems in accordance with design specifications Analyse the strengths and weaknesses of designs against design criteria Verify compliance and functionality of installations Determine parameters of proportional integral derivative (PID) controllers Set up and install pressure switches, switch gears, control gears and other control system components Infer final mechanical effects of sensor programming | <ul style="list-style-type: none"> Perform analysis to determine mechanical power and transmission requirements of machines Establish pneumatic, electro-pneumatic and programmable logic controllers requirements from design specifications Establish electrical requirements for other internal systems of machineries and equipment Produce electrical design drafts of machines' electrical systems in accordance with design processes Verify suitability of equipment for explosive environment use Design control systems for a variety of applications Predict aftersales support requirements | | |

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| | | | <ul style="list-style-type: none"> • Identify potential hazards in using programmable sensors in lieu of manpower • Create contingency procedures for local and remote interventions | <ul style="list-style-type: none"> • Review programming inputs and guide improvements • Conduct feasibility studies for new programmable equipment | | |
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