

**SKILLS FRAMEWORK FOR AEROSPACE
TECHNICAL SKILLS AND COMPETENCIES (TSC) REFERENCE DOCUMENT**

TSC Category	Manufacturing and Operations					
TSC	Production Line Set-Up					
TSC Description	Design mechanism units, systems and drives for industrial manufacturing applications					
TSC Proficiency Description	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
		AER-OPR-2059-1.1	AER-OPR-3059-1.1	AER-OPR-4059-1.1	AER-OPR-5059-1.1	AER-OPR-6059-1.1
		Design electric drives and electromechanical systems in a range of industrial applications at the workplace	Design mechanism units of machines for a range of industrial applications	Design mechanical and electrical systems for standalone automated industrial machines	Design equipment and products of high precision, accuracy and reliability	Evaluate production machinery and automation systems for effectiveness and reliability
Knowledge		<ul style="list-style-type: none"> Types and usage of electric drives, electromechanical system devices and electrical circuit diagrams Types of hardware and software for design drawing Interpretation of control requirements and ISO circuit diagram symbols Industry standards used in operating electric drives and electromechanical systems Design principles of electrical circuit operations of electric drives and electromechanical system components Procedures for checking, verifying and amending completed electrical control circuit Industrial health and safety risks involved in designing electric drives and electromechanical systems Organisational procedures for submission of completed 	<ul style="list-style-type: none"> Essential stages of the design process Fundamentals of machine mechanisms Association between assembly drawings, detailed drawings and bills of material (BOM) Surface roughness obtainable from manufacturing processes Limits and fits Hole basis and shaft basis of tolerance Applications of geometric dimensioning and tolerancing (GD&T) to engineering drawings Tolerance stacking analysis Machine elements selection in machine design Part and assembly modelling Under-damped, over-damped, and critically damped motion with machine Machine vibration analysis, testing and balancing procedures 	<ul style="list-style-type: none"> Principles of alternating and direct electrical currents (AC/DC) Types of electrical controls used in industrial machines Electrical safety and protection Electrical loading calculations Types of electrical sub-systems, electrical drawings, enclosures and wiring accessories Tolerance stacking analysis Concept of electrical interference Electrical connection techniques and grounding principles Electrical system functional tests procedures Mechanical power transmissions, hydraulic and pneumatic systems Concept of computer-based and programmable logic control (PLC) Principles and applications of finite element method (FEM) 	<ul style="list-style-type: none"> Concepts of exact constraints and over-constraints Principles of elastic averaging and Herzian stress Types of materials for precision machine structures Characteristics of rotary and linear bearings, couplings, linear drives, gears and gear transmissions Principles of guideway design to achieve precision linear motion Types of guideway systems and their characteristics Concepts of degrees of freedom for planar linkage mechanisms Kinematic design procedures of linkage mechanisms Performance characteristics of flexure-based mechanisms Homogeneous transformation matrix (HTM) model of a machine 	<ul style="list-style-type: none"> Principles of precision engineering Methods and tools for evaluating machinery and automation systems Evaluation criteria for machinery and automation systems Types and impact of recommendations on engineering processes Organisational and legislative requirements

**SKILLS FRAMEWORK FOR AEROSPACE
TECHNICAL SKILLS AND COMPETENCIES (TSC) REFERENCE DOCUMENT**

		<p>circuit diagrams, part list and control requirements, for reporting faulty electric drives and electromechanical system devices, recording and compiling of work documentation</p> <ul style="list-style-type: none"> • Proper disposal of waste materials and housekeeping procedures 			<ul style="list-style-type: none"> • Combinational rules of errors 	
Abilities		<ul style="list-style-type: none"> • Identify control sequences based on control requirements and electrical diagrams • Identify and select required electric drive components and electromechanical system devices based on control requirements • Design electric drives and electromechanical systems in accordance with control requirements • Check completed circuit diagrams to ensure control requirements are met • Connect electrical drives, electromechanical system and test equipment, in accordance with specifications of completed circuit diagram and approved written work instructions • Test electric drives and electromechanical systems, in accordance with established organisational procedures • Maintain documentation of testing results and records 	<ul style="list-style-type: none"> • Produce statements of function and design requirements for devices, in accordance with machine specifications • Identify machine mechanisms, according to design specifications • Identify geometric features of engineering drawings • Interpret types of dimensioning, datum references, dimension limits, surface sign and finish applied on components • Interpret the basis and class of fit applied on components • Size out appropriate machine elements to accomplish desired designs • Produce the parametric models of parts and assemblies in accordance with the assignment specifications • Visualise practical phenomena of vibration and solve related problems • Account for vibration analysis in designs 	<ul style="list-style-type: none"> • Interpret component datasheets • Perform analyses to determine mechanical power and transmission requirements of machines • Perform calculations to determine electrical loading requirements for mechanical power and transmission • Establish electrical requirements from the machines' other internal systems • Produce electrical design drafts of machines' electrical systems, in accordance with design processes • Analyse the strengths and weaknesses of the designs against design criteria • Recommend improvements to engineering designs that may improve machine performance • Perform finite element modelling to analyse and measure vibration of mechanical systems and machine structure to identify weaknesses 	<ul style="list-style-type: none"> • Perform analyses to determine precision machines' requirement performance • Perform performance specification analyses on sensors and actuators, automation control systems, electrical systems and human-machine interface (HMI) systems • Design system integration for selected components, in accordance with precision machine requirements • Report on the selected components used to meet machine system requirements, encompassing economics, environment and safety considerations • Develop machine design specification drawings • Suggest modifications to existing systems and develop new and/or alternative systems to improve performance 	<ul style="list-style-type: none"> • Evaluate methods of analyses used to determine requirements of precision machine performance • Evaluate findings from performance specification analyses pertaining to selection of sensors and actuators • Evaluate findings from performance specification analyses pertaining to automation control systems, electrical systems and human-machine interface (HMI) systems • Evaluate system designs for integration of selected components, in accordance with precision machine requirements • Evaluate final reports on the selected components used to meet the machine system requirements • Evaluate machine design specification drawings • Conduct costs-of-quality analyses related to

**SKILLS FRAMEWORK FOR AEROSPACE
TECHNICAL SKILLS AND COMPETENCIES (TSC) REFERENCE DOCUMENT**

		<ul style="list-style-type: none"> • Shut down electric drives and electromechanical systems, in accordance with established organisational procedures • Disconnect electric drives, electromechanical system devices and test equipment • Label, isolate and report clearly any faulty components or devices identified during work activities 	<ul style="list-style-type: none"> • Produce the engineering drawings from the models of parts and assemblies, with appropriate presentations, in accordance with the assignment specifications 			products to identify areas for improvement
--	--	--	--	--	--	--