

Skills Framework for Precision Engineering

Overview of Technical Skills & Competencies (TSC)

TSC Category	TSC Title	TSC Description	Proficiency Levels					
			Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Automation Management	Automated Operation Monitoring	Ensure smooth automation operations by maintaining and monitoring the automated systems and manufacturing process flows						
	Automated System Design	Design and commission automated systems as well as evaluate the system design specification against functional requirements						
	Automation Process Control	Apply automation process control to monitor performance metrics and quality of manufacturing outputs to determine the optimal settings as well as productivity improvement strategies						
	Automation System Maintenance	Maintain automation systems to meet operation requirements as well as propose strategies for the automation systems performance improvement						
Big Data Analytics	Data Analytics System Design	Integrate the use of data analytics in the production environment for the identification of bottlenecks and system improvements						
	Data Synthesis	Analyse factory automation and manufacturing data to monitor the manufacturing processes for operations and product or process flow optimisation						
Business and Organisational Management	Budgeting	Prepare organisational budgets to support short- and long-term business plans through forecasting, allocation and financial policy setting						
	Business Data Analysis	Implement data analytics within the organisation to generate business insights and intelligence through the use of statistical and computational techniques and tools, algorithms, predictive data modelling and data visualisation						
	Business Innovation	Identify and evaluate digitisation and innovative business opportunities provided by new advancements in information and communication technology to establish new services or businesses to bridge the physical and digital worlds						
	Business Planning	Develop business plans by reviewing existing resources to identify growth opportunities to achieve sustainable competitive advantage leading to a high exit valuation						
	Competitive Business Strategy	Formulate and implement competitive marketing strategies in a manufacturing organisation						
	Enterprise Risk Management	Develop and implement risk management strategies to support business operations						
	Networking	Identify and establish industry stakeholder relationships at all levels of business operations to further the organisation's strategies and objectives						
	Organisational Analysis	Evaluate factors that can affect the organization's performance as well as strategically assessing the organization's own resources and potential for improvement						
	Project Management	Execute projects by managing stakeholder engagement, resources, budgets and resolving problems						
	Risk Compliance and Governance	Enforce corporate governance and risk compliance within the organisation through the establishment of policies, compliance programmes and management						
Engineering and Manufacturing Fundamentals	Computer-aided Design	Use computer-aided design software and tools to design products, components and machine parts for manufacture						
	Computer-aided Manufacturing	Manage computer-aided manufacturing systems and perform computer numerical control part programming to manufacture components and products						
	Geometric Dimensioning and Tolerancing	Define and verify acceptable engineering tolerances of products' and parts' geometry						
	Heat Treatment Processing	Analyse effects of heat treatments to determine suitable materials and treatment processes to achieve required material properties for manufactured components and products						
	Hydraulic Systems Management	Design, repair and operate hydraulic systems within a manufacturing environment						
	Metallic Material Characterisation	Conduct tests and measurement taking to evaluate suitability of metallic materials for uses in manufacturing						
	Pneumatic Systems Management	Design, repair and operate pneumatic systems within a manufacturing environment						
	Polymeric Material Characterisation	Conduct tests and measurement taking to evaluate suitability of polymeric materials for uses in manufacturing						
Maintenance	Equipment Maintenance	Maintain tools and equipment to meet operation requirements as well as propose strategies for tools and equipment performance improvement						
	Maintenance Coordination	Establish and implement organisational maintenance strategies and systems for equipment and plant						
Manufacturing and Operations	Cleanliness and Contamination Control	Establish and implement contamination and cleanliness controls in the manufacturing work environment						

	Manufacturing Process Management	Perform process engineering and ensure the stability of the manufacturing process as well as troubleshoot process deviations and propose strategies for process performance improvement	
	Manufacturing Technology	Optimise manufacturing processes, utilising available and applicable technologies	
	Metrology Management	Manage metrology techniques for process performance measurement as well as develop metrology recipes for process optimisation	
	Precision Measurement	Perform precision measurements with relevant techniques and equipment to meet conformity requirements	
	Production Line Set-Up	Design mechanism units, systems and drives for industrial manufacturing applications	
	Production Shut-down and Re-start	Manage shutdown and restarting of production process to minimise loss and/or damage of assets as well as ensure the safety of personnel during shut down and restarting	
Network Technology Management	Augmented Reality Application	Facilitate the design and implementation of augmented reality applications to increase efficiency of work processes	
	Cyber Risk Management	Develop cyber risk assessment and treatment techniques that can effectively pre-empt and identify significant security loopholes and weaknesses,	
	Internet of Things Management	Interrelate computing devices, equipment and machines' data in a networked environment to provide specific solutions	
	User Experience Design	Conceptualise, project and make enhancement of the user's interaction and engagement with an IT product and/or service based on a robust analysis and understanding of the product and/or service's performance vis-a-vis the user's desired experience and outcomes. This involves creating wire frames to adequately guide and inform subsequent planning and development processes, and making enhancements to optimise the user's experience of the product and/or service	
	User Interface Design	Design user interfaces for machines and software, incorporating visual, technical and functional elements that facilitate ease of access, understanding and usage. This would involve adding, removing, modifying or enhancing elements to make the user's interaction with the product as seamless as possible	
	Virtual Reality Application	Employ the use of virtual reality technology in work-related applications, training and to support organisational decision-making in relation to new designs for products, work procedures, workspace layouts and other experiments	
Organisational Development	Change Management	Implement organisational change smoothly as well as manage reactions to ensure seamless transition during change	
	Conflict Management	Perform conflict management within the organisation to assist members in resolving grievances and disputes	
	Learning and Development	Plan employees' learning and development activities to maximise employee contribution as well as building a skilled workforce	
	Vision Leadership	Articulate clear, inspiring organisational goals, plans and priorities, as well as, display behavioural characteristics within the workplace in accordance to organisational values	
Precision Manufacturing Process	Additive Manufacturing	Design and apply additive manufacturing workflows to create three-dimensional objects	
	Cutting	Manage and implement material removal processes and activities to manufacture components and products	
	Injection Mould Design	Design moulds for manufacturing of product through plastic injection moulding processes	
	Jigs and Fixture Design	Facilitate implementation of production operations through the design of jigs and fixtures required for manufacturing activities	
	Laser and Optics Application	Use of laser and optics to automate manufacturing processes by introducing amplified electromagnetism and optical technologies for steelwork and alignment processes	
	Machining	Manage and perform machining activities to manufacture components and products, incorporating computer numerical control and computer-aided manufacturing processes	
	Material Joining	Fabricate components and construct different structures by bringing together parts of different properties, dimensions and compositions	
	Metal Forming	Develop and optimise metal forming processes for manufacturing of quality products	
	Metal-based Additive Manufacturing	Evaluate potential applications of additive manufacturing with a specialised emphasis on metallic product manufacturing	
	Non-destructive Testing	Execute non-destructive tests to ensure structural integrity, insulation resistance, continuity and satisfactory performance of electrical equipment and installations against organisational and regulatory standards and requirements	
	Plastic Injection Moulding	Manage and implement injection moulding systems and processes to manufacture polymer-based products	
	Polymeric Additive Manufacturing	Evaluate potential applications of additive manufacturing with a specialised emphasis on polymeric product manufacturing	

	Product and Machine Assembly	Utilise component preparation, assembly and troubleshooting techniques to assemble manufacturing equipment, end-products and sub-components	
	Surface Preparation and Protection	Apply appropriate surface preparation and protection techniques, based on surface material, operating conditions and maintenance requirements	
	Welding	Manage the application of welding, as a specialised subset of technologies, tools and processes for joining of metallic parts and components in manufacturing operations	
Procurement	Procurement Performance Monitoring	Monitor procurement performance to cut costs, alleviate risks, and drive continuous process improvement by measuring and analysing vendor and process efficiency	
	Supply Chain Solutioning	Develop new operating models and solutions for customers to manage their supply chain needs as well as improve inventory levels, delivery time and cost saving	
Product Development	Engineering Product Design	Facilitate the design of products to meet requirements for functionality and performance	
	Manufacturing Process Design	Analyse the design of the product to identify potential manufacturing risks and problems for the reduction of manufacturing costs	
	New Product Introduction	Support new production by validating build plan to achieve cost-effective production and assembly as well as meeting design specifications	
	Research and Development	Optimising manufacturing processes, material developments and development of new product line	
Production Management	Production Performance Management	Plan and manage resources to optimise production performance as well as manage production constraint and improve manufacturing efficiency	
	Production Planning	Establish and execute the production plan to meet production targets and cycle time indices	
	Production Resource Management	Plan and control capacity and quality issues to meet organisational needs as well as schedule resources to synchronise production processes	
Productivity and Innovation	Continuous Process Improvement	Apply continuous improvement processes to improve products, services or processes seeking incremental	
	Innovation Management	Respond to external or internal opportunities and apply creativity to introduce new ideas, processes or products	
Quality Management	Failure Analysis	Examine the electrical and physical defects evidence to verify the causes of failure as well as identify the failure modes	
	Quality Process Control	Implement quality process controls to improve and stabilise production in order to avoid or minimise issues leading to defects	
	Quality System Management	Coordinate and direct the organization's activities to meet customer and regulatory requirements as well as identify opportunities for improvement	
System Integration	Embedded System Integration	Implement control systems to perform pre-defined tasks and also real-time monitoring for the real world	
Technology Road Mapping	Technology Road Mapping	Plan short-term and long-term goals with specific technology solutions to help meet those goals in order to make capital out of future market needs	
Value Engineering	Carbon Footprint Management	Quantify and reduce the organisational carbon footprint	
	Lean Manufacturing	Apply concepts, tools and techniques of 'lean' manufacturing to improve efficiency in a manufacturing organisation	
	Sustainable Manufacturing	Manage efficient use of energy and other utility resources to promote sustainable manufacturing operations	
	Value Analysis	Establish the organisational value stream, enhance value-add and reduce costs	
Workplace Safety and Health Management	Emergency Response Management	Implement emergency management to ensure the readiness of the stakeholders in addressing emergencies that may arise in the workplace	
	Workplace Safety and Health System Management	Ensure systematic process in the managing of workplace safety and health-related activities in the workplace	
	Workplace Safety and Health Practice	Implement workplace safety and health practices in the manufacturing environment	

General Descriptors for TSC – For Reference Purposes

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Responsibility (Degree of supervision and accountability)					
Work under direct supervision Accountable for tasks assigned	Work with some supervision Accountable for a broader set of tasks assigned	Work under broad direction May hold some accountability for performance of others, in addition to self	Work under broad direction Hold accountability for performance of self and others	Accountable for achieving assigned objectives, decisions made by self and others	Accountable for significant area of work, strategy or overall direction
Autonomy (Degree of decision-making)					
Minimal discretion required. Expected to seek guidance	Use limited discretion in resolving issues or enquiries. Work without frequently looking to others for guidance	Use discretion in identifying and responding to issues, work with others and contribute to work performance	Exercise judgment; Adapt and influence to achieve work performance	Provide leadership to achieve desired work results; Manage resources, set milestones and drive work	Empower to chart direction and practices within and outside of work (including professional field/ community), to achieve/ exceed work results
Complexity (Degree of difficulty of situations and tasks)					
Routine	Routine	Less routine	Less routine	Complex	Complex
Knowledge and Abilities (Required to support work as described under Responsibility, Autonomy and Complexity)					
<ul style="list-style-type: none"> Recall factual and procedural knowledge Apply basic skills to carry out defined tasks Identify opportunities for minor adjustments to work tasks 	<ul style="list-style-type: none"> Understand and apply factual and procedural knowledge in a field of work Apply basic cognitive and technical skills to carry out defined tasks and to solve routine problems using simple procedures and tools Present ideas and improve work 	<ul style="list-style-type: none"> Apply relevant procedural and conceptual knowledge, and skills to perform differentiated work activities and manage changes Able to collaborate with others to identify value-adding opportunities 	<ul style="list-style-type: none"> Evaluate and develop factual and conceptual knowledge within a field of work Select and apply a range of cognitive and technical skills to solve non-routine/abstract problems Manage work activities which may be unpredictable Facilitate the implementation of innovation 	<ul style="list-style-type: none"> Evaluate factual and advanced conceptual knowledge within a field of work, involving critical understanding of theories and principles Select and apply an advanced range of cognitive and technical skills, demonstrating mastery and innovation, to devise solutions to solve complex and unpredictable problems in a specialised field of work Manage and drive complex work activities 	<ul style="list-style-type: none"> Synthesise knowledge issues in a field of work and the interface between different fields, and create new forms of knowledge Employ advanced skills, to solve critical problems and formulate new structures, and/or to redefine existing knowledge or professional practice Demonstrate exemplary ability to innovate, and formulate ideas and structures