

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

TSC Category	Precision Manufacturing Process					
TSC	Machining					
TSC Description	Manage and perform machining activities to manufacture components and products, incorporating computer numerical control and computer-aided manufacturing processes					
TSC Proficiency Description	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
	PRE-MPR-1036-1.1	PRE-MPR-2036-1.1	PRE-MPR-3036-1.1	PRE-MPR-4036-1.1	PRE-MPR-5036-1.1	
	Carry out common machining operations in manufacturing	Perform computer numerical control (CNC) machining to manufacture components	Use computer-aided design (CAD) modelling with computer numerical control (CNC) processes to machine components	Manage tool room machining by evaluating suitability of various machining technology for manufacturing tasks	Evaluate and optimise machining parameters and process plans to improve product and production process quality	
Knowledge	<ul style="list-style-type: none"> Work holding devices and methods Types and application of cutting tools and tool geometry Cutting speed, feed rate, work piece, cutter revolution and other relevant machining parameters Limits, fits and tolerances Use of hand tools Preventive maintenance on machining tools 	<ul style="list-style-type: none"> Workplace safety and health (WSH) requirements Application of proper personal protective equipment (PPE) Types of commonly used materials and processes in component manufacturing Types of cutting methodology and approaches Types of machining defects and their causes Operating principles and features of multi-axis CNC machining centres Application of ISO codes, addresses, work coordinates and subroutines Types of preventive maintenance Methods of inspection 	<ul style="list-style-type: none"> Two-dimensional (2D) drafting and three-dimensional (3D) modelling with CAD Dimensional tolerances and surface finishes Machinability of common materials Programming of machining operations with computer-aided manufacturing (CAM) CNC turning processes CNC machining centre processes Machining processes and process planning High speed machining technology Multi-axis machining processes 	<ul style="list-style-type: none"> Precision machining technology High-speed machining (HSM) technology Computer numerical control (CNC) grinding technology Non-traditional machining (NTM) technology Electro-discharge machining technology Ultra-precision machining process 	<ul style="list-style-type: none"> Materials used in precision component manufacturing Principles of precision engineering Methods and tools for evaluating machining and engineering processes Evaluation criteria for machining processes Types and impact of recommendations on machining processes Approaches to evaluate quality control procedures Organisational and legislative requirements relevant to machining and engineering processes 	
Abilities	<ul style="list-style-type: none"> Interpret drawings and blueprints Establish job requirements and suitable sequences of operations 	<ul style="list-style-type: none"> Interpret engineering drawings to extract relevant information for part programme and machine configuration set-up 	<ul style="list-style-type: none"> Generate CNC turning processes to machine components Generate CNC milling processes to machine components 	<ul style="list-style-type: none"> Assess suitability of 5-axis, high-speed machining applications against component specifications 	<ul style="list-style-type: none"> Evaluate machining process objectives, in accordance with workplace procedures and legislative requirements 	

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	<ul style="list-style-type: none"> • Verify that correct work material is used • Set up and secure the work piece safely • Select, position and mount appropriate cutting tools • Set machining parameters appropriate to job requirements • Use measuring instruments and/or gauges to check the component for conformance with specifications • Perform periodical maintenance and adjustment of machine tools 	<ul style="list-style-type: none"> • Conduct pre-operational checks and inspections to verify working conditions of tools and machines, according to job requirements • Perform CNC programme verification to eliminate errors and minimise safety risks • Perform multi-axis CNC machining simulations to eliminate machine collisions, near-misses and improve cycle time • Set up multi-axis CNC machining operations, according to safe working practices • Set up components for machining operations according to job requirements • Perform quality checks of finished components for compliance with required specifications and ensure free from defects • Perform preventive maintenance to maintain operational working condition of machines • Report incidences of equipment abnormalities for rectification 	<ul style="list-style-type: none"> • Identify appropriate machines and processes to manufacture components • Execute part programmes on CNC machines to produce components 	<ul style="list-style-type: none"> • Develop multi-axis machining centre technology and applications • Assess suitability of CNC grinding technology and applications against component specifications • Assess suitability of NTM technology against component specifications • Assess suitability of electro-discharge machining and wire-cut technology and applications against component specifications • Assess suitability of ultra-precision machining process against component specifications • Optimise the appropriate machining technology to improve manufacturing process 	<ul style="list-style-type: none"> • Evaluate machining process plans, in accordance with workplace procedures • Identify and propose opportunities for improved machining approaches • Review proposals on the selection of unnecessary processes to eliminate, in accordance with workplace procedures • Evaluate quality control procedures for effectiveness towards quality compliance and regulatory requirements 	
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