

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Occupation: Master Craftsman

Occupation Description:

The Master Craftsman possesses advanced knowledge and experience in manufacturing techniques and leverages on these to resolve complex technical issues, while serving as an expert resource to others. He/She optimises production activities, processes and systems with a view to increase manufacturing productivity improvements.

The Master Craftsman supervises a team to meet production targets and product quality standards while ensuring compliance to Workplace Safety and Health and other regulatory requirements.

As a subject matter expert, the Master Craftsman conducts training needs analysis, develops training programmes, and trains and coaches machinists, senior machinists and process specialists.

Important Points to Note about this Document

This document is intended purely to provide general information to enable individuals, employers and training providers to be informed about the skills for career, training and education purposes. SkillsFuture Singapore Agency provides no warranty whatsoever about the contents of this document, and does not warrant that the courses of action mentioned in this document will secure employment, promotion, or monetary benefits. WDA will not be liable for any loss, damage or expense that individuals may incur as a result of reliance on the contents of this document.

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

The skills expected of the Master Craftsman are summarised as below:

Skill Category	Skill Sub-Category	Skills	
Technical and Engineering Fundamentals	Numerical and Analysis Methods	PRE-TEF-5034-1	Apply Mathematical Concepts in Engineering Solutions
	Computer Technology	PRE-TEF-5032-1	Manage Computer-aided Design (CAD) Techniques
		PRE-TEF-5033-1	Manage Computer-aided Manufacturing (CAM) Techniques
	Materials and Metallurgy	PRE-TEF-5035-1	Apply Advanced Manufacturing Technology and Process
PRE-TEF-5036-1		Evaluate Advanced Materials Technology	
Technical and Engineering Design	Components and Modules	PRE-TED-5015-1	Apply Mechanics in Design Solutions
Precision Manufacturing Processes	Machining Processes	PRE-PMP-5053-1	Apply Automatic Control for Machines
		PRE-PMP-5054-1	Apply Solid Modelling and Drafting for Machine Parts
		PRE-PMP-5055-1	Develop Mechanical Fixtures Design
		PRE-PMP-5056-1	Manage Advanced CNC Machining
		PRE-PMP-5057-1	Manage Advanced Mould Design
		PRE-PMP-5058-1	Manage Advanced Tool-room Machining
	PRE-PMP-5059-1	Manage Process Optimisation and Cutting Technologies	
	Forming Processes	PRE-PMP-5060-1	Manage Plastics Injection Moulding
PRE-PMP-5061-1		Manage Plastics Materials Technology	

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Category	Skill Sub-Category	Skills	
	Sub-assembly and Final Assembly Processes	PRE-PMP-5062-1	Apply Mechanical Components and Peripherals in Automated Equipment
	Production Shop Floor Optimisation	PRE-PMP-5063-1	Apply Pedagogy Methodology for the Workplace
		PRE-PMP-5064-1	Apply Pedagogy Methodology in On-the-Job Training and Information Technology
PRE-PMP-5065-1	Manage Shop Floor Monitoring and Processes		
Quality		PRE-QUA-5014-1	Manage Quality Systems
		PRE-QUA-5015-1	Manage Advanced Metrology and Quality Assurance
Engineering Project Management		PRE-EPM-5001-1	Manage Engineering Projects (CAM and CNC Machining)
		PRE-EPM-5002-1	Manage Engineering Projects (Mould Design and Process)
Additive Manufacturing		PRE-AMA-5005-1	Apply Advanced Design for Additive Manufacturing
		PRE-AMA-5006-1	Manage Advanced Additive Manufacturing Technologies and Applications
		PRE-AMA-5007-1	Manage Innovative Product Development Using Additive Manufacturing
Workplace Safety and Health		PRE-WSH-4005-1	Supervise Manufacturing Work for Workplace Safety and Health
		PRE-WSH-4006-1	Manage Workplace Safety and Health Systems

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Category	Skill Sub-Category	Skills	
Manufacturing Productivity and Innovation		PRE-MPI-4008-1	Manage Continuous Improvement
		PRE-MPI-5015-1	Manage Manufacturing Productivity Improvement
		PRE-MPI-5016-1	Manage Process Improvement
		PRE-MPI-5017-1	Manage Productivity Improvement Tools
Business Analytics		PRE-BAN-5003-1	Operationalise Analytics Models
Business Negotiation		BM-BN-501E-1	Manage and Direct Negotiations
Communication		BM-COM-506E-1	Conduct Presentations to Senior Management
		BM-COM-502E-1	Establish and Maintain Strategic Business Partner Relationships
Human Resource Management		PRE-HRM-5003-1	Develop On-the-Job Training Programmes
		PRE-HRM-5004-1	Develop Workplace Learning Plans
Info-Communication Technologies		PRE-ICT-5002-1	Produce Advanced Spreadsheet Outputs using Spreadsheet Applications
Intellectual Property		PRE-IPR-5001-1	Apply Basic Knowledge of Intellectual Property to Support IP-related Organisational Procedures
Leadership and People Management		LPM-RLT-401C-0	Cultivate Workplace Relationships and Diversity
		LPM-PER-401C-0	Develop Self to Maintain Professional Competence at Managerial Level
		LPM-DEV-401C-0	Develop Team Leaders through

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Category	Skill Sub-Category	Skills
		<p>Capability Development and Coaching</p> <p>LPM-CHG-401C-0 Facilitate Innovation and Lead Team Leaders to Implement Change</p> <p>LPM-VIS-401C-0 Lead Team Leaders to Develop Strategies and Governance Management</p> <p>LPM-RES-301C-0 Monitor and Reward Performance Across Teams to support Achievement of Results</p>
Project Management		<p>BM-PM-502E-1 Establish Project Feasibility</p> <p>BM-PM-503E-1 Establish Project Scope</p>
Sales and Marketing		<p>PRE-SMA-4001-1 Understand Sales and Marketing in a Manufacturing Organisation</p>
Risk Management		<p>BM-RM-404E-1 Manage Risk in the Business Unit</p>
Strategy Planning and Implementation		<p>PRE-SPI-4002-1 Understand Business Management</p>
Personal Management and Development		<p>ES-PMD-401G-1 Develop Personal Effectiveness at Managerial Level</p> <p>ES-PMD-501G-1 Develop Professional Image and Competence to Achieve Personal Career Goals</p>
Analytical, Conceptual and Evaluative		<p>ES-ACE-501G-1 Apply Systems Thinking in Problem Solving and Decision Making</p>
Interpersonal		<p>ES-IP-501G-1 Manage Cross Functional and Culturally Diverse Teams</p>

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-TEF-5034-1	Skill Category	Technical and Engineering Fundamentals
		Skill Sub-Category <i>(where applicable)</i>	Numerical and Analysis Methods
Skill Title	Apply Mathematical Concepts in Engineering Solutions		
Skill Description	This skill describes the ability to analyse and incorporate mathematical concepts in engineering. It also includes application of the mathematical tools and techniques that are essential for solving engineering problems		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Engineering functions • Determinants • Matrices • Trigonometry • Vectors 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Sketch graphs of various straight lines, quadratic, trigonometric, logarithmic and exponential functions • Analyse properties of determinants and matrices • Use Cramer's rule and matrix method to solve simultaneous linear equation • Use trigonometric identities to solve trigonometric equations • Perform 2D and 3D vector calculations, including unit vectors 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review the mathematical tools and techniques to improve efficiency in solving engineering problems 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Facilitate team discussions to generate ideas to solve engineering problems
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Improve and update professional knowledge in the field through research and discussion with colleagues
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Apply mathematical concepts in engineering solutions must include:</p> <ul style="list-style-type: none"> • Interpretation of machine specifications, graphs etc. • Use of mathematical skills to estimate machine/component costs • Use of mathematical skills to calculate cutter cutting speed and feed rate • Use of scientific calculator to solve general engineering calculations • Use of trigonometry to calculate angles and length • Use of trigonometry for metrology

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	PRE-TEF-5032-1	Skill Category	Technical and Engineering Fundamentals
		Skill Sub-Category <i>(where applicable)</i>	Computer Technology
Skill	Manage Computer-aided Design (CAD) Techniques		
Skill Description	This skill describes the ability to create solid models of engineering components or parts of a device or equipment. It also includes applying 3D CAD solid modelling concepts and design skills.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Overview of CAD environment • Engineering CAD practices • Basic analytical, modelling and design skills in 3D modelling • Fundamentals of 3D CAD solid modelling, co-ordinate systems, datum and planes, primitive features, curves, sketches and drafting in engineering • Overview of assembly environment • Overview of drafting environment 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Use features of 3D CAD modelling environment to create solid models • Apply explicit curves to create closed shapes • Apply sketches and its constraints to create closed shapes • Apply extrusion, revolve and swept features to the closed shapes formed from explicit curves and sketches to create solids • Create solid models using primitive features • Create and refine complex 3D solid models of components using different modelling techniques and the union and subtract features • Create a draft or drawing, consisting of orthographic views, to represent a part of an assembly component • Create a drawing to communicate design requirements • Apply the fundamental concept of assembly to design and build a CAD model of a device or equipment • Interpret a solid model or assembly using orthographic views 		
Innovation and Value Creation <i>It refers to the ability</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review design processes to identify good design practices 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p><i>to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<ul style="list-style-type: none"> • Review final designs according to the product specifications
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Collaborate with co-workers to identify improvements to design • Seek feedback on proposed steps to achieve performance of design topology
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own design knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Apply Computer-Aided Design (CAD) techniques includes:</p> <ul style="list-style-type: none"> • Engineering CAD Practices • Analytical, modelling and design skills in 3D modelling that are essential for components, device or equipment design • Fundamentals of 3D CAD solid Modelling, co-ordinate systems, datum and planes, primitives, curves, sketches and drafting in the engineering environment <p>Relevant legislation and regulatory requirements includes:</p> <ul style="list-style-type: none"> • Workplace Safety and Health regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-TEF-5033-1	Skill Category	Technical and Engineering Fundamentals
		Skill Sub-Category <i>(where applicable)</i>	Computer Technology
Skill	Manage Computer-aided Manufacturing (CAM) Techniques		
Skill Description	This skill describes the ability to produce tool path information through the use of 3D geometric models of the part and post-process the tool path data into machine specific codes for 3-axis and multi-axis computer-numerical control (CNC) machining. It also includes selecting the cutting tools, machining parameters and strategies, as well as verifying tool paths used for machining components of various geometries.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Overview of CAM modules • Operation and parameter settings • Programme generation and verification • Post processing 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	The ability to: <ul style="list-style-type: none"> • Assess 2D tool path generation using objects for 3-axis CNC machining • Assess 3D tool path generation using objects for 3-axis CNC machining • Assess 3D tool path generation using objects for multi-axis CNC machining • Interpret machining parameters and strategies • Apply CAM techniques for precision components, mould inserts, aerospace and oil and gas applications • Produce safe and efficient tool paths for the machining processes and adhering strictly to specifications • Apply the appropriate CAM programming technology • Evaluate post-process tool path data to generate machine specific codes 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review current activities and present ideas for work improvement
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review specifications and seek clarification from clients
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p>(where applicable)</p> <p><i>It refers to the critical circumstances and context that the skill may be demonstrated.</i></p>	<p>Application of Computer-aided Manufacturing (CAM) techniques must include:</p> <ul style="list-style-type: none"> • Engineering CAM practices • CAM programming skills using 3D models essential for CNC machining process • Fundamentals of CAM software, cutting tools, geometry, cutting methods, machining parameters, tool path generation and verification and post-processing in manufacturing environment <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health Regulations

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

	<ul style="list-style-type: none">• Organisational standard operating procedures for operation of equipment• Personal Protective Equipment (PPE)
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-TEF-5035-1	Skill Category	Technical and Engineering Fundamentals
		Skill Sub-Category <i>(where applicable)</i>	Materials and Metallurgy
Skill	Apply Advanced Manufacturing Technology and Process		
Skill Description	This skill describes the ability to evaluate and select suitable traditional and non-traditional machining technology to optimise manufacturing processes. It also includes evaluation of laser beam machining and ultrasonic machining.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Traditional machining processes • Principles in traditional machining • Types of non-traditional machining (NTM) processes • Types of energy applied in NTM • Needs of NTM in the industry • Areas of applications for NTM in precision and other industries. • Laser beam machines • Laser beam machining technology and applications • Principles of ultrasonic machining (USM) • Ultrasonic machine design and construction • USM technology and applications. 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	The ability to: <ul style="list-style-type: none"> • Evaluate methods for selecting suitable traditional machining technology • Evaluate methods for selecting non-traditional machining (NTM) technology • Analyse types of energy in NTM technology to optimise the manufacturing process • Review requirements for NTM processes to select most suitable technology • Review types of NTM in precision engineering and other Industries to select most suitable technology • Review concept of laser beam machining (LBM) in accordance to requirements • Review concept of ultrasonic machining (USM) in accordance to requirements 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate and select the appropriate technology and optimise manufacturing processes to maximise efficiency
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Arrange team discussions with colleagues to evaluate and select suitable traditional and non-traditional machining technology • Consult and incorporate stakeholders' feedback during development of manufacturing process
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to review effectiveness of traditional and non-traditional machining technology • Update own learning in use of new applications e.g., ultrasonic machine design and construction and USM technology
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Types and concepts of laser technology must include:</p> <ul style="list-style-type: none"> • Practical applications of laser technology <p>Ultrasonic technology must include:</p> <ul style="list-style-type: none"> • Use of ultrasonic technology may include: • Practical applications <p>Use of tools and equipment must include:</p> <ul style="list-style-type: none"> • Operation manual • Technical manual and instructions • Lab sheets • Work-piece material

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

	<p>Rules and regulations must be followed as per the current directive:</p> <ul style="list-style-type: none">• Workplace Safety and Health Act <p>Apply procedures, must include:</p> <ul style="list-style-type: none">• Organisational processes and procedures• Technical manual and instructions
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-TEF-5036-1	Skill Category	Technical and Engineering Fundamentals
		Skill Sub-Category <i>(where applicable)</i>	Materials and Metallurgy
Skill	Evaluate Advanced Materials Technology		
Skill Description	This skill describes the ability to characterise metals and assess the suitability of the metals for manufacturing components. It also includes using different mechanical and optical methods to characterise and assess materials.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Principles of precision engineering • Types of metals • Properties of metals • Methods for measuring mechanical properties of metals • Methods for measuring thermal properties of metals • Methods for measuring optical properties of metals • Methods for measuring chemical properties and microstructure of metals • Methods for relating material property measurements to component requirements • Metal treatment processes 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review the required properties of components to shortlist the range of metals that can meet the requirements • Select appropriate methods and instruments to measure mechanical properties of metals • Select appropriate methods and instruments to measure thermal properties of metals • Select appropriate methods and instruments to measure optical properties of metals • Select appropriate methods and instruments to measure chemical properties and microstructure of metals • Perform measurements to analyse and determine characteristics of metals • Assess the suitability of material characteristics for components in accordance to functional and legislative requirements 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Review treatment processes, for metals selected, for possibilities to exceed functional requirements
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Communicate with customers, colleagues and team to assist in establishing timeframes and requirements
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Engage in self-reflection to review resources spent and accuracy of measurements and material assessments Update own learning in material science and measuring technologies, by subscribing to diverse learning channels and participating in peer review platforms
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Principles of precision engineering must include:</p> <ul style="list-style-type: none"> Advanced concepts of material science Advanced concepts of mechanics Advanced concepts of thermodynamics Advanced concepts of optics and wave theory Advanced concepts of measurement <p>Types of metals must include:</p>

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

- Base metals
- Alloys
- Ferrous metals
- Non-ferrous metals
- Noble metals

Properties of materials must include:

- Mechanical properties
- Thermal properties
- Optical properties
- Chemical properties and microstructure characteristics

Methods of measurement must include:

- X-ray diffraction and fluorescence techniques, scanning electron microscopy, energy dispersive spectroscopy

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-TED-5015-1	Skill Category	Technical and Engineering Design
		Skill Sub-Category <i>(where applicable)</i>	Components and Modules
Skill Title	Apply Mechanics in Design Solutions		
Skill Description	This skill describes the ability to incorporate fundamental principles of engineering mechanics and concepts in the engineering context. It also includes using a systematic approach to perform analysis and determine design.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Addition and subtraction of vectors using trigonometry • Free body diagrams • Resultants of concurrent force systems • Resultants of non-concurrent force systems • Beam reactions • Frictional force exerted by two contacting surfaces • Moments of inertia • Centroid of a area • Area moment of inertia of a cross-section • Stress and strain relationship • Elastic deformation in simple structures • Construction of shear force and bending moment diagrams 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Perform calculations of forces, and construction of free body diagrams, to develop design solutions • Calculate the resultants of concurrent force systems • Determine the reactions and resultants of equilibrium systems • Determine frictional forces on two contacting surfaces • Determine the centroid and area moment of inertia of different cross-sections • Calculate stresses in simple structures to determine feasibility • Develop shear force diagrams, and bending moment diagrams, to determine the size of a structural member of a given material 		
Innovation and Value Creation <i>It refers to the ability</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review engineering mechanics to improve application of the principles 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p><i>to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>in the engineering context</p> <ul style="list-style-type: none"> • Evaluate unique design solutions through innovative design management processes
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Discuss new advances with team members to improve application of the principles in the engineering context • Share own knowledge and specificity of the field with colleagues • Consult with clients and key stakeholders on aspects of design solutions
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Develop own professional knowledge and expertise
<p>Range of Application <i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Apply mechanics in design solutions must include:</p> <ul style="list-style-type: none"> • Fundamental principles of engineering mechanics • Application of the concepts in the engineering context, which includes concurrent and non-concurrent force systems, friction, moment of inertia and topics on strength of materials

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5053-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Machining Processes
Skill	Apply Automatic Control for Machines		
Skill Description	This skill describes the ability to design, interpret and apply actuators, sensors, pneumatics and electro-pneumatics components with Programmable Logic Control (PLC) programming in equipment building and automation.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Fundamental of automatic control for machines • Automatic control • Programmable Logic Control (PLC) programme • Assembly techniques 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Perform automated controller and I/O interfacing with PLC • Apply GRAFCET and generate process application with ladder logic diagram • Develop ladder logic solution using timers, counters and instructions • Apply IEC 61131-3 programming standard for automation processes • Assemble modular production systems as per drawings • Complete system integration and troubleshooting 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Design and program automated production system with greater flexibility without foregoing specifications or requirements • Review current activities and present ideas for work improvement 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>performance and/or enhance business values that are aligned to organisational goals.</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> • Review specifications to seek clarification from clients
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
Range of Application <i>(where applicable)</i> <i>It refers to the critical circumstances and context that the skill may be demonstrated.</i>	Applying automatic control for machines must include: <ul style="list-style-type: none"> • Automatic control • Programmable Logic Controller (PLC) programme • Assembly techniques Relevant legislation and regulatory requirements must include: <ul style="list-style-type: none"> • Workplace safety and health regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5054-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Machining Processes
Skill	Apply Solid Modelling and Drafting for Machine Parts		
Skill Description	This skill describes the ability to manage and use Computer-aided Design (CAD) systems to design machine parts and assemblies, in compliance with drawing standards. This also includes solid modelling and drafting for machine parts and materials and Geometric Dimensioning & Tolerancing (GD&T).		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Computer-aided Design (CAD) applications for machine parts • Analytical skills in 3D modelling • Assembly techniques • Material selection • Geometric Dimensioning & Tolerancing (GD&T) • Communication of design through drafting 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Generate CAD models for machine parts • Perform different ways of building machine parts' models • Generate machine parts using sketches, explicit curves and primitive features • Create top-down and bottom-up assemblies • Produce machine module assembly drawings • Produce exploded view for assemblies • Create animation for assemblies • Create models in orthographic view • Produce detailed drawings with dimensions for machine parts, in compliance with drawing standards 		
Innovation and Value Creation <i>It refers to the ability</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review design process to identify best design practices • Review to improve final designs according to the machine 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p><i>to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>specifications</p>
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Collaborate with co-workers to identify design improvements • Seek feedback on proposed designs to achieve performance of machine elements
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and context that the skill may be demonstrated.</i></p>	<p>Applying solid modelling and drafting for machine parts must include:</p> <ul style="list-style-type: none"> • Automation design • Machine design • Machine assemblies • Fixture design • Tooling design • Interpretation of drawings for QA department <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health Regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5055-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Machining Processes
Skill Title	Develop Mechanical Fixture Design		
Skill Description	This skill describes the ability to design and model mechanical design fixture assemblies for manufacturing. It also includes producing mechanical fixture design assembly drawings.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Fundamentals of jigs and fixtures design • Design of locators: supporting and locating principles • Design of clamps: clamping and work holding principles • Modular construction of jigs and fixtures • Specialised work holdings • Mechanical fixtures design group projects 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify datum or reference surfaces to be used as location features for jigs and fixtures design • Draw the 6- or 12-degrees of movements of a free body • Generate 3-2-1 and/or 4-2-1 principles of location to constrain a free body movement • Sketch the application of locating pins and buttons • Select appropriate clamping methods for work holdings • Design mechanical fixture designs in accordance with workplace instruction • Produce mechanical fixture design assembly drawings to assist in design processes • Ease difficulties in work holding for manufacturing operations: <ul style="list-style-type: none"> ○ When the work piece is difficult to hold without special equipment ○ Small-scale production when inter-changeability is important 		
Innovation and Value Creation <i>It refers to the ability</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Adapt and modify in a variety of ways to suit large-scale production 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p><i>to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<ul style="list-style-type: none"> • Reduce wastages and increase productivity
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Collaborate with co-workers to improve fixture design • Seek feedback on fixture design to enhance manufacturing processes
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Improve own knowledge and experience of the field through discussion with colleagues and by solving problems of design construction together
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Applying mechanical fixture designs must include:</p> <ul style="list-style-type: none"> • The six principles of fixtures design: <ul style="list-style-type: none"> ○ Choose work reference surfaces; ○ 3-2-1 point of locating; ○ Quick clamping; ○ Ttool and materials chips clearance; ○ Stability and rigidity, ○ Handling and other general considerations <p>Relevant legislation and regulatory requirement must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health Regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5056-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Machining Processes
Skill	Manage Advanced CNC Machining		
Skill Description	This skill describes the ability to produce parts confidently and efficiently in accordance with specifications. It also includes advanced Computer Numerical Control (CNC) machining applications supported with various advanced peripheral equipment and software.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Classification of Computer Numerical Control (CNC) machines • CNC lathes and CNC machining centres • 3-axis and multi-axis machining techniques • 5-axis positional machining vs 5-axis continuous machining • CNC control systems and part programming • Part programmes transfer between data servers and CNC machines • Setting up the CNC machines • Machining of parts • Relevant legislation and regulatory requirements 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Analyse various techniques in CNC machining • Perform part programming on various CNC control systems • Manufacture of parts using CNC machining techniques, based on specifications • Verify the correctness of the manufactured part against specifications • Minimise material consumption by adhering strictly to specifications 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review current activities, and present ideas for work improvement • Analyse various techniques in CNC machining to improve efficiency in manufacturing of parts 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>values that are aligned to organisational goals.</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review specifications to seek clarification from clients
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and context that the skill may be demonstrated.</i></p>	<p>Applying advanced CNC machining must include:</p> <ul style="list-style-type: none"> • CNC part programming • Set-up of different CNC machines • Application of tool pre-setters and data servers • Machining of parts with different materials <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health regulations • Organisational standard operating procedures for operation of equipment • Personal Protective Equipment (PPE)

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5057-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Machining Processes
Skill	Manage Advanced Mould Design		
Skill Description	This skill describes the ability to analyse, select and design plastic injection moulds. It also includes advanced mould temperature control methods and the selection of mould materials, standard components and moulding machines.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Techniques for designing advanced injection moulds • Engineering CAD practices in 3D mould design • Different types of mould parting lines, gates and ejection • Mould shrinkage factors and calculations • Number of cavities calculation, and different types of mould layouts • Types of mould parting methods • Types of mould bases and their functions • Types of mould temperature control methods • Classification and quantifying of mould components • Types of hot runner components • Methods used for unscrewing in moulds • Constructing tandem moulds • Features of micro moulds • Features of liquid silicone rubber moulds • Sources for mould standard components and cost considerations • Types of mould materials and their processing 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Design injection moulds for plastics parts using 3D CAD software • Verify designs against mould design review checklists to ensure quality • Analyse, select and design plastic injection moulds according to organisational needs 		
Innovation and Value Creation	<p>The ability to:</p> <ul style="list-style-type: none"> • Participate in mould design processes and provide input to optimise 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>mould designs</p> <ul style="list-style-type: none"> • Review current practices and present ideas for design improvements
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review specifications to seek clarification from clients
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Applying advanced mould design must include:</p> <ul style="list-style-type: none"> • Defining parting lines, gates and ejections for part models • Applying mould shrinkage to part models • Selecting number of cavities and cavity layouts for moulds • Designing mould partings using CAD applications • Selecting and constructing mould bases • Designing mould temperature control methods • Selecting standard components for moulds • Selecting mould plates and insert materials • Completing bills of materials for mould assemblies • Applying hot runner mould design concepts • Applying unscrewing mould design concepts • Applying tandem mould design concepts • Applying micro mould design concepts • Applying liquid silicone rubber mould design concepts

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Relevant legislation and regulatory requirements must include:

- Workplace Safety and Health Regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5058-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Machining Processes
Skill	Manage Advanced Tool-room Machining		
Skill Description	This skill describes the ability to manage and apply advanced tool-room machining technology in electro-discharge machining and wire-cut, grinding, high speed machining, multi-axis machining, non-traditional machining, ultra-precision machining and micro-machining processes.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <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 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Assess 5-axis high speed machining applications by identifying the component specifications • Develop multi-axis machining centre technology and applications • Evaluate CNC grinding technology and applications by identifying the component specifications • Assess non-traditional machining technology by identifying the component specifications • Assess electro-discharge machining and wire-cut technology and applications by identifying the component specifications • Evaluate ultra-precision machining process by identifying the component specifications 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Optimise the appropriate machining technology to improve the process • Minimise machining processes to achieve cost effectiveness • Review current activities and present ideas for work improvements 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>improve work performance and/or enhance business values that are aligned to organisational goals.</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> • Review specifications and seek clarification from clients
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
Range of Application <i>(where applicable)</i> <i>It refers to the critical circumstances and context that the skill may be demonstrated.</i>	Applying advanced tool-room machining must include: <ul style="list-style-type: none"> • Precision machining and practices • Precision engineering industry products manufacturing • High speed machining (HSM) and practices • CNC grinding technology and practices • Non-traditional machining (NTM) and practices • Electro-discharge machining and practices • Ultra-precision machining and practices Relevant legislation and regulatory requirements must include: <ul style="list-style-type: none"> • Workplace Safety and Health regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5059-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Machining Processes
Skill	Manage Process Optimisation and Cutting Technologies		
Skill Description	This skill describes the ability to evaluate different combinations of cutting tools, cutting technology and machining strategies, to select optimal parameters for improving machining productivity, and to achieve the required product specifications. It also includes optimising machining processes for materials used in mould and tool making and precision component manufacturing.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Cutting tool geometry and tool materials • Chip formation and heat generation in metal cutting • Tool wear and tool life • Selection of machining conditions • Machining process optimisation 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	The ability to: <ul style="list-style-type: none"> • Assess tool wear mechanisms • Analyse factors affecting tool life to improve efficiency • Evaluate cutting tool material characteristics for correct machining applications • Identify conditions affecting the formation of the three main types of chips <ul style="list-style-type: none"> • Create optimised tool paths using Computer-aided Manufacturing (CAM) software for Computer Numerical Control (CNC) machining • Review optimum milling processes by evaluating and selecting appropriate machining parameters 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Produce CNC programs that minimise the cycle time for fabricating components using CNC machines
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Collaborate with co-workers to identify areas of improvement • Seek feedback to achieve optimal machining process performance
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Acquire knowledge on cutting tool and machining processes by accessing current information through the internet and vendors' documentation for fabricating components using CNC machining • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and context that the skill may be demonstrated.</i></p>	<p>Applying process optimisation and cutting technologies must include:</p> <ul style="list-style-type: none"> • Generation of tool paths using CAM software that is optimised for minimum processing time and maximum tool life <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health Regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5060-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category	Forming Processes
Skill	Manage Plastics Injection Moulding		
Skill Description	This skill describes the ability to perform plastics injection moulding process set up, optimisation and control, supported by injection moulding machines and peripherals to produce parts in accordance to specifications. It also includes operation of the machines, setting up the mould and process optimisation.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Fundamentals of the injection moulding process • Process control and automation in injection moulding • Advanced moulding techniques • Clean room moulding fundamentals 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Establish an injection moulding process in accordance to specifications • Perform proper procedures for mould inspection, preparation, mould set-up and safety precautions • Perform mould set up to establish stable and efficient injection moulding processes • Verify the quality of moulded parts against requirements • Complete troubleshooting of moulding defects to assure quality 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review current activities and present ideas for work improvements • Optimise the specific machine operation to operate different types of injection moulding machines 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>organisational goals.</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review outputs and discuss with the project team to improve efficiency
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Applied plastics injection moulding must include:</p> <ul style="list-style-type: none"> • Mould set-up in 'Set-up' mode • Mould clamping setting in 'Manual' mode • Metering, injection and holding parameters settings • Operate machines in 'Single cycle' mode • Operate machines in 'Automatic/ Continue cycle' mode • Operate machines with automation systems <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health regulations • Organisational standard operating procedures for operation of equipment • Personal Protective Equipment (PPE)

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5061-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Forming Processes
Skill	Manage Plastics Material Technology		
Skill Description	This skill describes the ability to conduct lab experiments to determine the tensile property, melt flow index, impact strength, heat deflection and thermal properties of polymer materials.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Introduction to plastics • General properties of plastics • Types of plastics, additives and applications • Plastics testing 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Assess the two main polymerisation methods to create polymer chains • Analyse how molecular weight and polymer structure can affect material properties • Evaluate the important factors that affect the viscosity of materials • Compare the differences between commodity and engineering polymers • Evaluate changes in properties associated with adding fillers and fibres to thermoplastic materials • Examine tensile, melt flow index, heat deflection and thermal properties of polymer materials • Carry out testing for different plastics, in accordance with standard procedures 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review current activities and present ideas for work improvement 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>improve work performance and/or enhance business values that are aligned to organisational goals.</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> Review testing results and discuss with project teams and clients on improvements
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> Share own knowledge and specificity of the field with colleagues and develop professional knowledge
Range of Application <i>(where applicable)</i> <i>It refers to the critical circumstances and context that the skill may be demonstrated.</i>	Applying plastics material technology must include: <ul style="list-style-type: none"> Types of polymerisation processes Effects of polymer structure, molecular weight and morphology on the properties of polymer materials Effects of temperature and strain rate on the mechanical properties of polymer materials Applications of additives, fillers and fibers Material testing, such as tensile, melt flow index, heat deflection temperature and thermal properties of polymer materials Relevant legislation and regulatory requirements must include: <ul style="list-style-type: none"> Workplace Safety and Health regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5062-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Sub-assembly and Final Assembly Processes
Skill	Apply Mechanical Components and Peripherals in Automated Equipment		
Skill Description	This skill describes the ability to select and apply mechanical components and support maintenance equipment. It also includes understanding the various types of machine elements and peripherals used in automated assembly systems.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Interpretations of machine drawings, part-lists and bills of materials • Mechanical components for automated equipment • Cam and mechanism designs • Peripherals in automated equipment 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Determine the pitch of both unified (inch series) and ISO threads • Select correct methods to prevent threaded screws from loosening due to external vibration • Use the correct type of bearings, bearing seals and implement proper types of bearing mountings for different engineering applications • Select suitable types of couplings for aligned and on-aligned shaft mountings • Select correct types of springs (tension / compression) for different engineering applications • Select gear systems to suit different speed, torque and power requirements • Draw displacement, velocity and acceleration diagrams for defined cam systems • Determine missing segment motion profiles, using available standard motion profiles (harmonic or cycloidal), to form suitable cam profiles for normal or high speed applications 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

	<ul style="list-style-type: none"> • Select and implement vibratory bowl part feeding systems with proper operating parameters • Select various types of orientating devices to form proper orientating systems • Select different types of end effectors for different operations • Analyse and calculate Geneva mechanism basic parameters for indexing rotary work-stations • Develop the selection and implementation of suitable conveyor systems to move parts, or sub-assemblies, in relatively large quantities, between specific locations over a fixed part • Minimise material consumption by adhering strictly to specifications and standards
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review current activities (materials selection, fabrication and usage) and present ideas for work improvements • Develop conceptual designs of work carriers to hold sub-assemblies, or work-pieces, in proper orientation, and transfer from one work-station to another, to increase versatility
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Seek clarification from customers on parts specifications, where necessary • Constantly review specifications with clients to reduce waste and costs
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Continually improve and upgrade knowledge in materials, designs and applications • Share own knowledge and specificity of the field with colleagues and develop professional knowledge

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p>Range of Application <i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and context that the skill may be demonstrated.</i></p>	<p>Applying mechanical components and peripherals in automated equipment must include:</p> <ul style="list-style-type: none">• Interpretation of machine drawings, part-lists and bills of materials• Engineering materials <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none">• Workplace Safety and Health regulations• Organisational standard operating procedures for operation of equipment• Personal Protective Equipment (PPE)
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5063-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Production Shop Floor Optimisation
Skill	Apply Pedagogy Methodology for the Workplace		
Skill Description	This skill describes the ability to apply the knowledge required in managing the competencies for a “Train-the-Trainer” programme at a workplace, related to the precision engineering environment. It also includes application of Vocational Education and Training (VET), Continuing Education and Training (CET) and Training Needs Analysis (TNA).		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • The definitions of global Vocational Education and Training (VET) and Continuing Education and Training (CET) • Concept of the Singapore Continuing Education and Training (CET) Masterplan • Impact of andragogy on adult learner characteristics and learning • Concept, scope, processes and specifications of a Training Needs Analysis (TNA) 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Apply global VET and CET models • Apply learning theories and andragogical approaches to maximise teaching and learning at the workplace • Determine the design specifications of a Training Needs Analysis • Complete and submit reports to meet stakeholders’ requirements 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate and select appropriate training strategies based on workplace requirements 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>aligned to organisational goals.</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Arrange discussions with stakeholders, colleagues and teams to assist in establishing timeframes and requirements • Consult and incorporate stakeholders' feedback during development of plans and codes of conduct for data reporting • Obtain buy-in and seek endorsement on plans to meet workplace requirements
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to review effectiveness of training in meeting workplace requirements • Update own knowledge by subscribing to diverse learning channels and participating in peer review platforms
Range of Application <i>(where applicable)</i> <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	<p>Vocational Education and Training (VET) and Continuing Education and Training (CET) must include:</p> <ul style="list-style-type: none"> • Models of VET and CET <p>Singapore Continuing Education and Training (CET) must include:</p> <ul style="list-style-type: none"> • CET Masterplan <p>Andragogy and adult learning must include:</p> <ul style="list-style-type: none"> • Adult learning theories and approaches <p>Maximising teaching and learning at the workplace must include:</p> <ul style="list-style-type: none"> • Impact of learning theories and andragogical approaches <p>Training Needs Analysis (TNA) must include:</p> <ul style="list-style-type: none"> • Scope and requirements

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

	<p>Reporting to stakeholders must include:</p> <ul style="list-style-type: none">• Design specifications for conducting a Training Needs Analysis (TNA) <p>Tools and equipment must include:</p> <ul style="list-style-type: none">• Trainer’s guide• Learner guide <p>Regulations must include:</p> <ul style="list-style-type: none">• Workplace Safety and Health Act <p>Procedures must include:</p> <ul style="list-style-type: none">• Organisational processes and procedures• Technical manuals and instructions
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5064-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Production Shop Floor Optimisation
Skill	Apply Pedagogy Methodology in On-the-Job Training and Information Technology		
Skill Description	This skill describes the ability to plan, design and deliver Train-the-Trainers' programmes, using On-the-Job Training (OJT) and presentation skills that engage the use of Information Technology (IT) as a learning tool.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Workplace learning strategies and plans • On-the-Job Training (OJT) frameworks and training materials • Processes used to facilitate adult learning and adult training • Criteria for designing assessment frameworks, which include competency-based assessments, for use at workplace. • Assessment plans, methods and tools used in workplace assessments • Requirements for 'Train-the-Trainer' programmes 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Determine and select appropriate learning strategies for the workplace • Develop OJT materials, based on adult learning principles • Employ training and facilitation skills to engage the adult learners/workers to meet learning outcomes • Prepare frameworks for assessment of workplace training. • Complete methodology frameworks for 'Train-the-Trainer' programmes 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate and select appropriate training based on workplace requirements, and suggest new training strategies to improve learning outcomes 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Arrange discussions with colleagues and teams to assist in establishing feasible teaching plans • Consult and incorporate stakeholders' feedback during development of teaching plans and codes of conduct for data reporting • Obtain buy-in and seek endorsement on teaching plans to best meet workplace requirements
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to review achievement of training outcomes in meeting workplace requirements • Update own knowledge by subscribing to diverse learning channels and participating in peer review platforms
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Learning at the workplace must include:</p> <ul style="list-style-type: none"> • Appropriate learning strategies at the workplace <p>OJT details must include:</p> <ul style="list-style-type: none"> • Materials needed for On-the-Job-Training <p>Training and Facilitation techniques must include:</p> <ul style="list-style-type: none"> • Skills needed at the workplace <p>Assessment strategies must include:</p> <ul style="list-style-type: none"> • Frameworks for assessment <p>Development of assessment plans must include:</p> <ul style="list-style-type: none"> • Assessment delivery methods

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

	<p>Conducting an assessment must include:</p> <ul style="list-style-type: none">• Train-the-Trainer programmes <p>Use of tools and equipment must include:</p> <ul style="list-style-type: none">• Trainer’s guide• Learner’s guide <p>Rules and regulations must include:</p> <ul style="list-style-type: none">• Workplace Safety and Health Act <p>Procedures and supporting documents must include: :</p> <ul style="list-style-type: none">• Technical manuals and instructions
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-PMP-5065-1	Skill Category	Precision Manufacturing Processes
		Skill Sub-Category <i>(where applicable)</i>	Production Shop Floor Optimisation
Skill	Manage Shop Floor Monitoring and Processes		
Skill Description	This skill describes the ability to manage essential phases of project development and the structured approach to managing shop floor processes. It also includes evaluation and application of shop floor process monitoring tools to better manage shop floor related issues.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Manufacturing systems • Shop floor monitoring and control • Project management 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify the requirements of basic manufacturing systems to meet workplace procedures • Analyse the different functions comprising manufacturing systems, to assist in design processes • Identify the five advanced manufacturing systems • Evaluate and use the basic features of the 'Shop Floor Monitoring' software tool to manage shop floor related issues • Apply the basic features of the 'Shop Floor Monitoring' software to create simple equipment monitoring models • Identify and use the advanced features of the 'Shop Floor Monitoring' software for monitoring shop floor processes • Apply and create process models, using advanced process monitoring features, to develop structured approaches to project development • Evaluate and identify the various components of project plans • Assess, identify and use basic features of project management tools in accordance with workplace procedures • Apply the basic features of project management tools to create project 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

	activities and schedules to better manage shop floor processes
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Review and evaluate new features in project management tools to create project activities and schedules to improve efficiency of shop floor processes To provide solutions within own area of responsibility, in accordance with workplace procedures, through practical knowledge
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Arrange discussions with customers, colleagues and teams to assist in establishing timeframes and requirements Consult and incorporate stakeholders' feedback during development of project plans
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Engage in self-reflection to review effectiveness of shop floor process monitoring tools for better management of shop floor related issues Update own knowledge in essential phases of project development
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Fundamentals on manufacturing systems must include:</p> <ul style="list-style-type: none"> Shop floor activities: Shop floor monitoring and control Project management <p>Tools and equipment must include:</p> <ul style="list-style-type: none"> Technical manuals and instructions Shop floor monitoring and project management software

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

- Computer

Rules and regulations must be followed as per the current directive:

- Workplace Safety and Health Act

Procedures and supporting documents must include:

- Organisational processes and procedures
- Technical manual and instructions

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-QUA-5014-1	Skill Category	Quality
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Quality Systems		
Skill Description	This skill describes the ability to manage internal quality systems, external quality assurance and be able to apply them to the workplace. It also includes maintenance of quality control record systems.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Quality systems monitoring • Coordination with external suppliers and clients • Quality control record systems and maintenance 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Monitor quality systems to make decisions relating to quality • Review procedures to provide innovative solutions to quality improvement • Identify and select quality suppliers • Liaise with external suppliers and clients • Maintain quality control record systems • Develop and maintain quality control record systems to meet quality requirements 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate, review and improve procedures to provide innovative solutions to quality improvement 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>organisational goals.</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> • Discuss with colleagues and teams to improve maintenance of quality control record systems
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> • Update information on quality systems • Source for the latest information on monitoring quality systems
Range of Application <i>(where applicable)</i> <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	Tools and equipment must include: <ul style="list-style-type: none"> • Inspection equipment • Measuring devices Rules and regulations must include: <ul style="list-style-type: none"> • Legislation applicable to production processes • Standards and codes of practice relevant to products Procedures must include: <ul style="list-style-type: none"> • Organisational quality assurance and quality control procedures • Organisational procedures for the supply and receipt of materials

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-QUA-5015-1	Skill Category	Quality
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Advanced Metrology and Quality Assurance		
Skill Description	This skill describes the ability to manage hands-on practical and measuring techniques, using various types of precision metrology equipment. It also includes the principles of surface finishes, roundness, coordinate measuring machines, concepts of interpreting and measuring Geometric Dimensioning and Tolerancing (GD&T) symbols indicated on manufacturing drawings and statistical process control and its applications.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Metrology standards and terminologies • Types of measuring errors • Interpretation of Geometric Dimensioning and Tolerancing (GD&T) • Methods of inspection using coordinate measuring machines (CMM) • Measurement of roundness • Measurement of surface textures • Basic statistical methods • Process capability index 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Define metrology standards for length measurement according to quality requirements • Interpret measurement terminologies for the field of calibration and measurement • Identify and analyse types of measuring errors for evaluation of calibration and measurement capabilities • Interpret and measure GD&T symbols on a drawing for the measurement of a product for conformity • Perform layout inspections using CMM for product conformity • Measure and analyse cylindrical parts using roundness measuring machines for verification of product quality • Measure surface finishes of parts for verification of the surface conformity and its applications • Document processes using basic statistical methods for measurement reports and QA records • Document process capability indexes for records and present to 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

	customers and QA department
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate the risks of inaccurate data and optimise resources used for inspection and measurement, based on risk profile, to maximise value of quality assurance activities
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Arrange discussions with customers, colleagues and teams to assist in establishing timeframes and requirements • Consult and incorporate stakeholders' feedback during development of plans and codes of conduct for data reporting • Obtain buy-in and seek endorsement on plans to meet quality requirements
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to review effectiveness of inspections and measurements in meeting quality requirements • Update own learning in quality inspections and measurement by subscribing to diverse learning channels and participating in peer review platforms
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Introduction to metrology standards must include:</p> <ul style="list-style-type: none"> • Classification • Definition of metre • Importance of standards • Classification of standards • Calibration, traceability and measurement of uncertainty

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Types of measuring errors must include:

- Introduction
- Type of errors
- Analysing of errors
- Compound errors

Geometric Dimensioning and Tolerancing (GD&T) symbols must include:

- Identifying, interpreting and measuring GD&T symbols
- Analysing bonus tolerance

Using Coordinate Measuring Machines (CMM) must include:

- Introduction to CMM
- Basic requisites of CMM
- Machine configuration
- Operation principles of CMM
- Method of operation
- Probes
- Part program

Measurement of roundness include:

- Introduction to roundness measurement
- Types of irregularities of a circular part

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-EPM-5001-1	Skill Category	Engineering Project Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Engineering Project [CAM and CNC Machining]		
Skill Description	This skill describes the ability to manage and apply concepts and skills acquired in the areas of advanced Computer Numerical Control (CNC) machining. It also includes planning, execution, evaluation, analysis and monitoring the progress of the engineering projects.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Computer-aided Design (CAD) modelling of engineering components • Computer-aided Manufacturing (CAM) strategies and applications • Selection of machining parameters for Computer Numerical Control (CNC) machining • Post-processing execution • CNC engineering project management • Analysis of CNC machining results according to specifications Concept and classification of cost accounting 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Propose projects for design and development • Design and model using CAD software • Generate CAM data for CNC machining • Execute post-processing of CAM data to NC data for machining • Select machine tools and cutting parameters for projects • Perform machining operation on CNC machines to produce designed parts • Present the progress on projects for approval • Explain the concept and classification of cost accounting to stakeholders • Apply standard costing to determine costing and control for materials • Perform break-even and cost-volume-profit analysis 		
Innovation and Value Creation <i>It refers to the ability</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Conduct brainstorming sessions on the selection of products for design and development 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p><i>to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<ul style="list-style-type: none"> • Evaluate and propose projects for design and development • Analyse results and recommend or propose solutions
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Collaborate with co-workers to identify areas of improvement • Seek feedback to achieve optimal project execution
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and context that the skill may be demonstrated.</i></p>	<p>Managing engineering projects [CAM and CNC machining] must include:</p> <ul style="list-style-type: none"> • Project brainstorming and planning skills • Engineering CAD practices • Engineering CAM applications • CNC machining applications. • Teamwork skills and problem solving • Analytical skills through project phases • Costing principles and techniques applied in costing systems • Management accounting techniques for decision making, planning and control <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-EPM-5002-1	Skill Category	Engineering Project Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Engineering Project [Mould Design and Process]		
Skill Description	This skill describes the ability to use project management skills in advanced mould design, plastics materials, plastics processing and computer flow analysis. It also includes design for manufacturing, mould design, selection of the injection mould machine and the optimisation of the injection moulding process.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Applications of mould design software • Plastic materials • Design for manufacture • Mould design calculations • 3D mould designs • Process optimisation • Project planning and execution • Report writing and presentation • Injection moulding processes and optimisation • Presentation skills 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	The ability to: <ul style="list-style-type: none"> • Propose projects for mould design • Select plastic material for products • Design and model plastic products, according to specifications • Determine number of mould cavities, mould layouts and the runner systems • Perform design for manufacture • Determine sizing of mould inserts and mould bases • Determine parting surfaces • Create core cavity inserts • Design moulds, including assembly and detailed drawings to manage engineering project in mould design and process • Evaluate and perform mould set-ups and trial runs • Complete optimisation of injection moulding processes 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review product designs to improve moulding tool productivity • Identify improvements in moulding tool designs to reduce costs
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Collaborate with co-workers to identify areas of improvement • Seek feedback on proposed steps to achieve performance to drive productivity
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Share own knowledge and specificity of the field with colleagues and develop professional knowledge
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and context that the skill may be demonstrated.</i></p>	<p>Managing engineering projects [mould design and processes] must include:</p> <ul style="list-style-type: none"> • Identifying the product design requirements • Specifying types of moulding tools of products <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-AMA-5005-1	Skill Category	Additive Manufacturing
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Apply Advanced Design for Additive Manufacturing		
Skill Description	This unit describes the ability to use digital and additive manufacturing techniques to design and develop new product development processes, from concept to commercialisation. It also includes design methodologies, such as Design for Excellence (DFX), idea generation and concept scoring.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Product development processes and terminology • Product planning • Customer needs and product specifications • Quality function deployment • Concept generation and scoring • Platform strategies and leveraging • Design parameters and rules for additive manufacturing • Finite element structural analysis and design topology optimisation 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	The ability to: <ul style="list-style-type: none"> • Identify and outline the product development process across the whole product lifecycle • Generate product specifications and create functional additive manufacturing representation models • Generate concepts and perform concept screening and concept scoring • Assess and adopt product architecture, modularity and platform strategies for additive manufacturing • Apply design rules and methods for additive manufacturing processes • Check and apply finite element analysis methods to perform design topology optimisation of design for additive manufacturing • Document the complete product development process of designing a product with additive manufacturing, from concept to commercialisation 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review and evaluate the processes of designing products with additive manufacturing techniques for new applications, adding value to the manufacturing process • Explore possibilities of using digital and additive manufacturing techniques to develop new products
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Lead discussions with colleagues and teams to assist in establishing timeframes and requirements • Obtain buy-in and seek endorsement on the plans to use new designs and additive technology for manufacturing products
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to explore alternative manufacturing techniques to best meet component requirements • Update own learning in design techniques and additive manufacturing requirements, by subscribing to diverse learning channels and participating in peer review platforms
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Product development processes must include:</p> <ul style="list-style-type: none"> • Key functions in product development • Factors that lead to successful product development • Challenges faced by designers in product development • Six phases of the product development process • Variants of product development processes <p>Product planning must include:</p> <ul style="list-style-type: none"> • Different types of product development projects • Five step product planning process for a product • Product lifecycle management

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Customer needs and product specification must include:

- Methods to identify customer needs
- Interpreting customer needs from customer statements
- Organising and writing customer needs

Design parameters and rules for additive manufacturing must include:

- Application methods of design for excellence (DFX) techniques in product design
- Design considerations for preparing designs for additive manufacturing fabrication

Documentation must include:

- Checklists
- Data sheets
- Computer data

Tools and equipment must include:

- Teaching kits
- Relevant additive manufacturing systems and software training kits
- 3D Computer-aided Design (CAD) and Computer-aided Engineering (CAE) training software

Rules and regulations must include:

- Workplace Safety and Health Act

Procedures must include:

- Organisational processes and procedures
- Technical manuals and instructions

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-AMA-5006-1	Skill Category	Additive Manufacturing
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Advanced Additive Manufacturing Technologies and Applications		
Skill Description	This skill describes the ability to manage advanced additive manufacturing technologies and applications. It also includes high-mix-low-volume direct rapid manufacturing, application of rapid tooling with conformal cooling, medical additive manufacturing and material classification to planning and management of advanced additive manufacturing.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Techniques of advanced additive manufacturing • Applications of advanced additive manufacturing • Materials for advanced additive manufacturing • Costing and lead-time estimation • Resource planning and scheduling for advanced additive manufacturing • Preparation for advanced additive manufacturing fabrications 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify advanced additive manufacturing techniques for various applications • Classify materials for additive manufacturing, according to product requirements of various applications • Prepare lead-time, costing, resource requirement and schedule, based on specific additive manufacturing processes and materials • Perform advanced additive manufacturing fabrication, based on specific applications • Check for conformance of processes, using relevant analysis and error checking software • Document simulation and analysis results 		
Innovation and Value Creation <i>It refers to the ability to generate</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review and evaluate additive manufacturing techniques for new applications, adding value to the manufacturing process • Explore possibilities of using advanced additive manufacturing 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p><i>purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>technology in new areas of manufacturing e.g., components for the medical industry</p>
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Lead discussions with colleagues and teams to assist in establishing timeframes and requirements • Obtain buy-in and seek endorsement on the plan to use advanced additive technology for manufacturing components
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to explore alternative manufacturing techniques to best meet component requirements • Update own learning in additive manufacturing requirements by subscribing to diverse learning channels and participating in peer review platforms
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Advanced additive manufacturing techniques must include:</p> <ul style="list-style-type: none"> • Powder bed fusing techniques for metal fabrication • Laser energy deposition techniques for metal fabrication • Advanced additive manufacturing techniques for plastic fabrication <p>Material for additive manufacturing must include:</p> <ul style="list-style-type: none"> • Liquid-based material for plastic products • Solid-based material for plastic products • Powder-based material for plastic or metal products <p>Costing and lead-time estimation must include:</p> <ul style="list-style-type: none"> • Costing for machine usage, materials, manpower etc. • Estimation of lead-time for specific additive manufacturing processes

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Resource planning and scheduling must include:

- Resource planning for specific additive manufacturing processes
- Scheduling for specific additive manufacturing processes

Documentation must include:

- Checklists
- Data sheets
- Computer data

Tools and equipment must include:

- Teaching kits
- Relevant additive manufacturing systems and software training kits
- 3D Computer-aided Design (CAD) and Computer-aided Engineering (CAE) training software

Rules and regulations must include:

- Workplace Safety and Health Act

Procedures and supporting documents must include:

- Organisational processes and procedures
- Technical manuals and instructions

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-AMA-5007-1	Skill Category	Additive Manufacturing
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Innovative Product Development Using Additive Manufacturing		
Skill Description	This unit describes the ability to manage rapid manufacturing, material selection, data preparation, advanced additive manufacturing processes and their applications. It also includes planning of projects, execution, evaluation, analysis and monitoring the progress of projects.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Techniques of advanced additive manufacturing • Product development processes and terminology • Applications of advanced additive manufacturing • Materials for advanced additive manufacturing • Design parameters and rules for additive manufacturing • Resource planning and scheduling for advanced additive manufacturing • Preparation for advanced additive manufacturing fabrication 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify techniques to develop solutions and designs for projects • Plan and apply project schedules with the use of Gantt charts • Prepare projects for design and development • Prepare detail drawings and 3D model designs using Computer-aided Design (CAD) software • Perform advanced additive manufacturing fabrication, based on specific applications • Check and analyse results, • Document results and recommended solutions 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review and evaluate advanced additive manufacturing processes for new applications, adding value to the manufacturing process • Explore possibilities of using additive manufacturing techniques to make manufacturing processes more efficient 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>values that are aligned to organisational goals.</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Lead discussions with colleagues and teams to assist in establishing timeframes and requirements • Obtain buy-in and seek endorsement on the plan to develop new innovative product development processes using additive technology for manufacturing products
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to explore alternative manufacturing techniques to best meet product requirements • Update own learning in product development and additive manufacturing requirements by subscribing to diverse learning channels and participating in peer review platforms
Range of Application <i>(where applicable)</i> <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	<p>Advanced additive manufacturing project techniques must include:</p> <ul style="list-style-type: none"> • Powder bed fusing techniques for metal fabrication • Laser energy deposition techniques for metal fabrication • Advanced additive manufacturing techniques for plastic fabrication <p>Design parameters and rules for additive manufacturing must include:</p> <ul style="list-style-type: none"> • Methods for applying design for excellence in product design techniques • Design considerations for preparing designs for additive manufacturing fabrication <p>Product development process must include:</p> <ul style="list-style-type: none"> • Key functions in product development • Factors that lead to successful product development • Challenges faced by designers in product development • Six phases of the product development process • Variants of product development processes

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

	<p>Documentation must include:</p> <ul style="list-style-type: none">• Checklists• Data sheets• Computer data <p>Tools and equipment must include:</p> <ul style="list-style-type: none">• Teaching kits• Relevant additive manufacturing systems and software training kits• 3D Computer-aided Design (CAD) and Computer-aided Engineering (CAE) training software <p>Rules and regulations must include:</p> <ul style="list-style-type: none">• Workplace Safety and Health Act <p>Procedures must include:</p> <ul style="list-style-type: none">• Organisational processes and procedures• Technical manuals and instructions
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**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	PRE-WSH-4005-1	Skill Category	Workplace Safety and Health
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill Title	Supervise Manufacturing Work for Workplace Safety and Health		
Skill Description	This skill describes the ability to identify common safety and health hazards and take appropriate control measures while working in the metal working or other manufacturing industry. It also includes the ability to identify WSH hazards, evaluate and control risks, carry out WSH inspections, implement WSH training and promotional programmes, conduct accident investigations and prepare reports.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Importance of Workplace Safety and Health (WSH) • Consequences of unsafe work practices and workplace conditions • Salient WSH legal and other requirements relevant to manufacturing industry • Overview of WSH management system • WSH duties and responsibilities of supervisor in the manufacturing industry • Risk management process • Typical hazards in manufacturing industry • Methods for hazard identification • WSH control measures • 5S housekeeping • Types of organisational WSH inspections • WSH training and promotional programmes • Incident investigation and reporting • Permit-To-Work (PTW) 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the</i>	The ability to: <ul style="list-style-type: none"> • Identify WSH hazards, evaluate and control risks in manufacturing industry in accordance with risk management process • Carry out WSH inspections in accordance with organisational inspection procedures • Implement WSH training and promotional programmes in accordance with legal and other organisational requirements • Conduct incident investigation and prepare report in accordance with legal and other organisational requirements 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>changes at work.</i>	
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Provide constructive suggestions to evaluate WSH hazards at the workplace • Contribute ideas to improve desired outcomes of process, human and cultural factors and workplace or work-related factors in accordance to legal and organisational requirements
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify the unsafe acts or conditions present and recommend corrective actions to management
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Reflect on possible errors in evaluating risks • Keep up-to-date on changes in the Workplace Safety and Health Act
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances that the skill may be demonstrated.</i></p>	<p>Tools and equipment must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health signage • Personal protective equipment <p>Procedures and supporting documents must include:</p> <ul style="list-style-type: none"> • Appropriate work documents • Work instructions

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

	<ul style="list-style-type: none">• Organisation work procedures and specifications <p>Rules and regulations must include:</p> <ul style="list-style-type: none">• Workplace Safety and Health Act• Approved codes of practice
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-WSH-4006-1	Skill Category	Workplace Safety and Health
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Workplace Safety and Health Systems		
Skill Description	This skill describes the ability to apply Workplace Safety and Health (WSH) procedures and practices to ensure the safety of the production teams. It also includes ensuring compliance with standards and managing the identification of hazards and assessment of risks.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Organisational policies and procedures relating to Workplace Safety and Health (WSH) • Personal Protective Equipment (PPE) • Safety signs and symbols • Industry Codes of Practice (CP) and Singapore Standards (SS) • Rules and regulations • Workplace Safety and Health regulations 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Manage the day-to-day performance of WSH activities • Ensure that work is carried out safely, in accordance with organisational procedures and legislative requirements • Identify and manage workplace hazards • Ensure compliance to workplace procedures for risk control measures • Manage and supervise programmes to ensure emergency equipment is identified, available and maintained • Oversee incident reporting, in accordance with organisational procedures and legislative requirements 		
Innovation and Value Creation <i>It refers to the ability to generate</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Propose improvements to organisational WSH procedures to enhance the organisation's ability to comply with regulatory requirements 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>purposive ideas to improve work performance and/or enhance business values that are aligned to organisational</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> • Communicate WSH procedures and risk control measures to the production teams
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> • Identify appropriate training for production teams, in accordance with organisational and regulatory requirements • Keep abreast of changes to WSH regulations and other regulatory requirements through legislative forum sharing
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	Industry Codes of Practice (CP) and Singapore Standards (SS) must include: <ul style="list-style-type: none"> • CP for safety in welding and cutting (and other operations involving the use of heat) • CP for selection, use and maintenance of respiratory protective devices • CP for selection, use, care and maintenance of hearing protectors • SS 217, Specification for industrial safety signs • SS 473, Specification for personal eye-protectors – Part 1: General requirements • SS 473, Specification for personal eye-protectors – Part 2: Selection, use and maintenance • CP 98, Material Safety Data Sheet (Safety Data Sheet)

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Rules and regulations must include:

- Workplace Safety and Health Act
- Environmental Management Act
- ISO 14000

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	PRE-MPI-4008-1	Skill Category	Manufacturing Productivity and Innovation
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Continuous Improvement		
Skill Description	This skill describes the ability to manage, implement and facilitate an organisation's systems and processes relating to continuous improvement. It also includes application of the organisation's systems and processes to the workplace.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Identification of improvement opportunities • Direct continuous improvement activities • Management of systems and processes to facilitate continued improvement • Monitoring and evaluation of improvement processes 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Manage and implement continuous improvement systems • Promote team support, and coach team members, toward continuous improvement • Gather, access and record production information to track improvement • Analyse, synthesise and interpret information • Design and apply improvement tools and strategies • Monitor and evaluate improvement processes • Identify improvement opportunities • Discuss and direct continuous improvement activities • Manage systems and processes to facilitate continued improvement • Monitor and evaluate improvement processes 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate, identify and introduce innovative improvement opportunities to meet organisational goals • Identify improvement activities associated with concepts of process management and improving customer satisfaction
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Discuss and direct continuous improvement activities with teams to improve customer satisfaction
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Update knowledge and skills in monitoring and evaluating improvement processes to achieve the goals set by the organisation
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Tools and equipment must include:</p> <ul style="list-style-type: none"> • Continuous Improvement tools and techniques • Communication and information technology, e.g. email, Internet, TQM tools <p>Work-related documents and texts;</p> <ul style="list-style-type: none"> • Precision measuring equipment and tools <p>Regulations must include</p> <ul style="list-style-type: none"> • ISO 14000 (Environmental) • ISO 9000 (Quality) • Workplace Safety and Health requirements • Relevant Singapore Government legislation, regulations, guidelines and procedures • Organisational policies and procedures

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Procedures and supporting documents must include:

- Organisational policies and procedures
- Liaising and communicating with colleagues, teams, supervisors, managers, QA, continuous improvement personnel, internal and external consultants and experts

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-MPI-5015-1	Skill Category	Manufacturing Productivity and Innovation
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Manufacturing Productivity Improvement		
Skill Description	This skill describes the ability to understand, improve and optimise production activities, processes and systems, to increase overall productivity of manufacturing operations. It also includes understanding concepts of productivity and the tools and techniques applicable to draft productivity improvement implementation plans.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Productivity concepts • Production management and lean manufacturing • Process flow improvement and input resource management 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify relevant productivity indicators to improve production activities • Identify the wastes of production to optimise processes • Identify key manufacturing performance measures to increase overall productivity • Perform inventory classification using ABC analysis • Determine number of kanbans required • Determine production capacity 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify the steps required to achieve performance in driving productivity improvements • Draft productivity improvement implementation plans • Identify manufacturing lead time elements and areas for improvement • Evaluate key manufacturing performance measures to achieve higher productivity returns 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>values that are aligned to organisational goals.</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Arrange discussions with colleagues and teams to identify the steps required to achieve performance in driving productivity improvements
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to review effectiveness of inspections and measurements in meeting quality requirements • Update own learning in productivity improvement concepts
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Knowledge covered must include:</p> <ul style="list-style-type: none"> • Productivity concepts • Analytical skills in production and inventory management and process flow and resource management • Fundamentals of lean manufacturing and just-in-time in a manufacturing environment <p>Tools and equipment must include:</p> <ul style="list-style-type: none"> • Operational manuals • Technical manuals and instructions • Training software • Measuring instruments <p>Rules and Regulations must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health Act <p>Applied procedures must include:</p> <ul style="list-style-type: none"> • Organisational processes and procedures • Technical manuals and instructions

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

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| | <ul style="list-style-type: none">• Interactions with people, who may include:<ul style="list-style-type: none">○ Co-workers○ Supervisors○ Regulatory auditors |
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-MPI-5016-1	Skill Category	Manufacturing Productivity and Innovation
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Process Improvement		
Skill Description	This skill describes the ability to achieve the goals set by the organisation, using variety of process improvement methodologies. It also includes adopting a systematic approach in improving processes through process mapping, analysis and redesigning.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Concepts of process management • Organisational goals vis-à-vis customer expectations and requirements • Process continuous improvement methodologies • Definitions of process relationships • Process mapping techniques • Process mapping conventions or symbols • Types of data and how data should be recorded • Process control for variable and attribute data • Methods of presenting process data • Process capability • Change solicitation processes • Change resolution processes • Standardisation of processes 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify improvement activities associated with concepts of process management, and improving customer satisfaction using systematic process improvement models to meet the organisational goals • Define process relationships using suitable process mapping techniques • Present process maps graphically using standard process mapping conventions or symbols, to accurately depict the sequence of events to build products, or produce outcomes • Perform process analyses for waste or non-value activities, to facilitate redesigning of the processes, in accordance with process improvement models • Redesign processes using the results of analyses, and recommend potential measures to improve the functioning of processes to meet 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

	<p>organisational goals</p> <ul style="list-style-type: none"> • Execute changes to process and resolve issues encountered, in accordance with change solicitation processes • Standardise redesigned processes to make changes stay permanently, by proper documentation and training
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Introduce specific systematic approaches to improve processes to meet organisational goals
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Initiate discussions with colleagues and teams to develop systematic process improvement models, in improving customer satisfaction to meet the organisational goals
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Acquire knowledge and skills in bringing the resources and processes together to achieve the goals set by the organisation
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be</i></p>	<p>Knowledge and analysis must include:</p> <ul style="list-style-type: none"> • Improvement activities associated with concept of process management and improving customer satisfaction • Systematic process improvement model • Process continuous improvement methodologies adopted by organisations

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>demonstrated.</i>	<ul style="list-style-type: none">• Organisational goals to be achieved vis-à-vis customer expectations and requirements• Define process relationship and process mapping techniques• Process mapping conventions or symbols used• Types of data and how data should be recorded:• Process capability:• Execute the change solicitation and resolution process:• Use of tools, equipment and software:• Apply procedures and supporting documents:• Working with people
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**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	PRE-MPI-5017-1	Skill Category	Manufacturing Productivity and Innovation
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Productivity Improvement Tools		
Skill Description	This skill describes the ability to manage productivity improvement activities in the organisation. It also includes identifying, directing, evaluating and monitoring improved productivity processes.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Organisational goals and targets • Plan-Do-Check-Act (PDCA) system of improvement • Types of organisational structures • Team- building processes • Procedures to make decisions in a team • Types of recognition • Communication skills • Performing process mapping • Business process re-engineering • Basic statistics • Data collection and analysis tools • Root cause analysis tools • Control charts • Idea generation tools • Decision-making techniques • Plotting project Gantt charts • Standard operating procedures • Objectives and processes of benchmarking • Internal and external benchmarking and best practice principles and practices 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Organise productivity teams to identify improvement opportunities • Identify methods of recognition • Enhance process mapping on existing processes to monitor and evaluate improved processes • Utilise tools for idea generation and decision-making • Perform processes of procedure standardisation to manage quality systems 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>at work.</i>	<ul style="list-style-type: none"> • Carry out problem analyses to direct productivity improvement activities
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify opportunities for productivity improvements • Implement productivity improvements • Review performance improvements before and after implementation • Identify further improvement opportunities using benchmarking • Compare productivity benchmarks for improvement gains and comparisons
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Establish team-building activities to identify improvement opportunities • Facilitate team decision-making to evaluate improvement activities
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Develop professional knowledge and skills to improve productivity
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Applying productivity improvement tools must include:</p> <ul style="list-style-type: none"> • Identifying improvement opportunities and directing productivity improvement activities • Managing quality systems or processes for productivity improvement • Monitoring and evaluating improved processes <p>Relevant legislation and regulatory requirements must include:</p> <ul style="list-style-type: none"> • Workplace Safety and Health regulations

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-BAN-5003-1	Skill Category	Business Analytics
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Operationalise Analytics Models		
Skill Description	This skill describes the ability to deploy the agreed statistical models into the production environment for users' operational use. It also includes working with relevant stakeholders to define the requirements of the deployed model, educating users and monitoring the model to ensure it stays aligned with the business.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Considerations of analytics architecture • Analytics architecture • Existing analytical tools or data warehouse in the organisation 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Select runtime environments for the statistical models to be deployed, and user requirements, with the relevant stakeholders • Define analytics architecture requirements with IT teams to deploy the statistical models • Develop the processes, to support the operations of the model, with relevant stakeholders • Monitor and tune the deployed models to ensure they deliver the expected outcomes and aligns with the business changes 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance</i>	N/A		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>and/or enhance business values that are aligned to organisational</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	N/A
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	N/A
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	<p>Considerations of analytics architecture must include:</p> <ul style="list-style-type: none"> • Performance of the analytical architecture • Access to data • Data security • Users' skill sets

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	BM-BN-501E-1	Skill Category	Business Negotiation
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage and Direct Negotiations		
Skill Description	This skill describes the ability to manage and direct negotiations to achieve organisation's desired outcomes. It also includes planning and preparing for negotiation, implementing negotiation guidelines and providing feedback for negotiation policy refinement.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Negotiation styles • Results of effective negotiation • Conditions for successful negotiation 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Plan and prepare for negotiation in accordance with negotiation strategies to achieve desired negotiation outcomes • Implement negotiation guidelines during negotiation process to achieve desired outcomes 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Provide feedback to relevant parties to refine negotiation policy
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify and address needs and concerns of negotiating team with regard to negotiation process, roles and responsibilities to maintain positive working relationships
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Source for past negotiation plans to gain insights to develop current negotiation plan to achieve desired outcomes
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>N/A</p>

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	BM-COM-506E-1	Skill Category	Communications
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Conduct Presentation to Senior Management		
Skill Description	This skill describes the ability to conduct presentation to senior management. It also includes identifying presentation objectives and modes, preparing collaterals, delivering key messages and reviewing presentation outcomes to enhance future performance.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Presentation guidelines to present to senior management • Types of presentation collaterals • Techniques to engage target audience 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Establish objectives of presentation and identify appropriate presentation modes to meet organisational requirements • Determine deliverables for target audience to develop presentation collaterals • Use appropriate presentation modes to deliver appropriate messages to target audience 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review presentation outcomes to enhance future performance
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Assess reactions of target audience towards the presentation to respond appropriately to address their concerns
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Seek guidance and advice from peers and supervisors on past presentations to gain insights to plan the presentation
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>N/A</p>

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	BM-COM-502E-1	Skill Category	Communication
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Establish and Maintain Strategic Business Partner Relationships		
Skill Description	This skill describes the ability to establish and maintain strategic business partner relationships. It includes identifying strategic business partners, evaluating their contributions towards organisational objectives, developing action plans to enhance relationships as well as reviewing the quality of relationships with strategic business partners.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Strategic business partners' and their issues of interest • Ways that organisation's strategic business partners may contribute to its strategic objectives • Contributions made by strategic business partners • Agreements between organisation and strategic business partners • Legal, regulatory, ethical and socio-cultural considerations related to maintaining strategic business partner relationships 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify strategic business partners who may contribute to organisational strategies and objectives to establish and maintain business relationships • Evaluate strategic business partners' contributions to achieving organisational strategies and objectives to determine action plans to enhance business relationships • Develop action plans to enhance relationships with strategic business partners 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review quality of professional relationships with strategic business partners to identify areas for improvement 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>enhance business values that are aligned to organisational</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> • Sustain professional relationships with strategic business partners to support organisational strategies and objectives
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> • Engage in self-reflection to identify new platforms which offer opportunities to establish strategic business relationships with potential partners to support organisational objectives
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	Legal, regulatory, ethical and socio-cultural constraints related to maintaining strategic business partner relationships must include: <ul style="list-style-type: none"> • Relevant legislation • Codes of practice • Business ethics • Policies and guidelines • Social responsibilities • Cultural and societal expectations and influences

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	PRE-HRM-5003-1	Skill Category	Human Resource Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Develop On-the-Job Training Programme		
Skill Description	This skill describes the ability to plan and develop On-the-Job Training (OJT) programmes to achieve organisational needs. It also includes the characteristics of OJT, planning OJT programmes, developing OJT blueprints, creating OJT materials, and evaluating OJT programmes.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • On-the-Job Training (OJT) frameworks, including structured and unstructured OJT • Roles of the relevant stakeholders • Process of designing and developing OJT blueprints and OJT materials • Five- step coaching process • Processes for evaluating OJT programme design • Processes for reviewing and critiquing OJT blueprints' quality • Trends and developments in OJT 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Determine the parameters of OJT programmes, based on relevant stakeholders' requirements • Design and develop OJT blueprint, in accordance to the findings of the training needs analysis (TNA) • Develop the required OJT training materials, based on adult learning principles and sound instructional design concepts • Review and critique quality of existing OJT blueprints 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate effectiveness of OJT programme designs to meet organisational needs 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>enhance business values that are aligned to organisational</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> • Engage key stakeholders in the design of OJT blueprints to ensure their relevance
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	N/A
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	N/A

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	PRE-HRM-5004-1	Skill Category	Human Resource Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Develop Workplace Learning Plans		
Skill Description	This skill describes the ability to develop workplace learning plans to meet the learning and development needs of the organisation. It also includes development and evaluation of workplace learning plans and incorporation of relevant workplace learning strategies.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Workflow review process to establish learning and training needs in the workplace • Workplace learning strategies • Trends and developments in workplace learning 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Establish the scope and requirements for workplace learning, using workflow process reviews with relevant stakeholders • Determine and select appropriate workplace learning strategies, based on findings from workflow process reviews • Develop workplace learning plans, incorporating relevant workplace learning strategies with contextualisation 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Validate workplace learning plans for design improvements 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>enhance business values that are aligned to organisational</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> • Consult with stakeholders on draft workplace learning plans
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> • Keep abreast of trends in workplace learning and development to maintain currency of learning and development plans
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	N/A

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-ICT-5002-1	Skill Category	Info-Communication Technologies
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Produce Advanced Spreadsheet Outputs using Spreadsheet Applications		
Skill Description	This skill describes the ability to use spreadsheet applications to produce advanced spreadsheet outputs for management reports. It also includes in-depth knowledge of MS Excel, including its features.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Formatting of cells and worksheets • Functions and formulas • Charts • Analyses with tables, sorting and filtering 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Apply advanced formatting options in handling worksheets • Use functions associated with logical, statistical, financial and mathematical operations • Create charts and apply advanced chart formatting features • Work with tables and lists to analyse, filter and sort data • Use linking, embedding and importing features to integrate data 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Enhance productivity by working with named cell ranges, macros and templates 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>values that are aligned to organisational</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Validate and audit spreadsheet data • Collaborate on and review spreadsheets with key stakeholders
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	N/A
<p>Range of Application</p> <p>(where applicable)</p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	N/A

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-IPR-5001-1	Skill Category	Intellectual Property
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Apply Basic Knowledge of Intellectual Property (IP) to support IP-related Organisational Procedures		
Skill Description	This skill describes the ability to analyse the various types of Intellectual Property (IP) supporting organisational procedures and applying IP knowledge to support implementation of IP registration procedures Singapore.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Definition of Intellectual Property (IP) • Types of IP • Sources from which information about IP can be obtained • Registration procedures of various types of IP in Singapore 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Analyse various types of IP in accordance with organisational procedures • Collate necessary IP-related materials for IP applications • Support organisational procedures, in collaboration with appropriate IP experts • Apply IP knowledge to support implementation of IP registration procedures in Singapore 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Implement organisational IP-review processes 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>values that are aligned to organisational</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	N/A
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	N/A
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	Types of IP must include: <ul style="list-style-type: none"> • Copyrights • Registered and unregistered trade marks (including certification marks, and a consideration of domain names and company/business names) • Patents, which may include software • Trade secrets and confidential information • Registered designs • Plant varieties • Geographical indications • Layout-design of integrated circuits

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	LPM-RLT-401C-0	Skill Category	People and Relationship Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Cultivate Workplace Relationships and Diversity		
Skill Description	This skill describes the ability to cultivate collaborative and productive relationships at the workplace to support organisational priorities. It also includes building workplace relationships, promoting organisational diversity through systems and processes and managing of conflicts.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Legal and ethical considerations relating to participation in internal and external networking opportunities, conflict management and workplace diversity • Organisational policies and procedures relating to business networking, organisational diversity and conflict management • Relevant professional or industry codes of practice and standards relating to business networking • Implications and impact of networking and collaboration opportunities on employees and the organisation • Relevant local, regional and international networks • Common barriers to developing a diverse and cooperative workplace • Workforce characteristics and trends 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	The ability to: <ul style="list-style-type: none"> • Establish working relationships with network members to improve knowledge sharing and networking opportunities • Pursue collaborative opportunities to support beneficial outcomes • Facilitate information exchange among network members to support organisational and team priorities • Develop and monitor the implementation of systems and processes to support organisational diversity strategies • Identify sources of conflict and negotiate issues to reach mutually acceptable outcomes 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Review the effectiveness of the conflict resolution strategies and take action to prevent the recurrence of conflict
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Adjust interpersonal style and respond appropriately to emotional cues when interacting with others to meet the requirements of the social and cultural business context
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Keep abreast of organisational diversity management systems and processes by subscribing to diverse learning channels to enhance own knowledge for workplace application
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>N/A</p>

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	LPM-PER-401C-0	Skill Category	Leadership and People Management
		Skill Sub-Category <i>(if applicable)</i>	N/A
Skill	Develop Self to Maintain Professional Competence at Managerial Level		
Skill Description	This skill describes the ability to communicate effectively and influence decision making as a manager of team leaders. It also includes demonstrating commitment to self- development.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Legal and ethical considerations relating to organisational communication and decision making • Organisational policies and procedures relating to organisational communication and development of professional competence • The relationship between high level strategy and the development and implementation of business plans and processes at department level • Types of decision making models, methods and techniques • Implications and impact of communication processes on stakeholders • Implications and impact of own leadership style and capability on employees and the organisation 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Use appropriate methods of communication to delegate responsibilities and duties to team leaders • Seek feedback from team leaders to enhance team cohesion and ensure common understanding of goals and requirements • Model effective communication techniques and behaviours to demonstrate organisational values and ethics • Contribute to the development of implementation plans to support strategic priorities and facilitate decision making process to garner support for the implementation plans 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Address barriers to communication to improve collaboration and effectiveness when working with team leaders 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>performance and/or enhance business values that are aligned to organisational</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Influence team leaders to pursue actions to support the achievement of the organisation’s strategic priorities • Recognise own emotional states, their causes and effects on one’s communication with others to maintain positive interpersonal relationships
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one’s self within and outside of one’s area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify areas for improvement and training to maintain currency of knowledge and skills through self-assessment and evaluation on current and future requirements of own work role
<p>Range of Application</p> <p>(where applicable)</p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	N/A

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	LPM-DEV-401C-0	Skill Category	People Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Develop Team Leaders through Capability Development and Coaching		
Skill Description	This skill describes the ability to identify team leaders' skill requirements and facilitate their learning opportunities to enhance performance. It also includes coaching of team leaders to help them develop their skills and gain confidence.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Legal and ethical considerations relating to the management of capability development • Organisational policies and procedures relating to capability development • Relevant professional or industry codes of practice and standards relating to management of capability development as a manager of a department or cross functional team • Implications and impact of coaching and mentoring activities on the individuals participating in the process • Models and methods of training needs analysis • Market trends and developments on new and emerging skill requirements, and learning and development 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review organisational strategies and business plans to identify impact on team competency requirements • Review current skills of team leaders using appropriate methods and tools to identify skills requirements • Work with team leaders to establish their learning priorities and learning and development plans • Identify learning and development opportunities and provide resources and support to facilitate the development of team leader skills 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review capability development approach for team leaders to identify areas for improvement
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Provide coaching to team leaders to enhance their role performance, taking into consideration their emotional states
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review coaching outcomes against coaching goals to identify areas for improvement in the coaching process • Improve own coaching skills by subscribing to diverse learning channels and participating in peer discussion platforms to enhance workplace performance
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>N/A</p>

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	LPM-CHG-401C-0	Skill Category	Change Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Facilitate Innovation and Lead Team Leaders to Implement Change		
Skill Description	This skill describes the ability to work with team leaders to manage change processes. It also includes facilitating innovation at the workplace, implementing change strategies and processes and evaluating the impact of change.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Legal and ethical considerations relating to change management • Organisational policies and procedures relating to the change management • Relevant professional or industry codes of practice and standards relating to change management • Key concepts and importance of a learning organisation in relation to organisational change • Theories and principles of change management • The differences between and attributes of positive and negative risks 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Support enterprising behaviour and risk taking among team leaders by modelling enterprising behaviours and rewarding innovation to encourage desired behaviours • Assign roles and responsibilities to implement change strategies and processes • Identify systems and behaviours that may support or limit implementation activities to facilitate implementation • Work with team leaders to anticipate and plan for predictable consequences of change by applying systems thinking • Analyse data and feedback from team leaders to establish trends and identify actions and resources required to ensure change processes generate required benefits 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify opportunities for growth or improvement based on current achievements • Develop and review systems to share learnings from change implementation processes to guide future actions for improvement
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Demonstrate empathy by acknowledging and addressing the feelings and perspectives of team leaders arising from the impact of change implementation to ensure individual needs are addressed
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify competencies to help individuals and teams to respond positively to change • Keep abreast of change management systems and processes by subscribing to diverse learning channels and participating in peer discussion platforms to enhance own knowledge for workplace application
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>N/A</p>

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	LPM-VIS-401C-0	Skill Category	Leadership
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Lead Team Leaders to Develop Business Strategies and Governance Management		
Skill Description	This skill describes the ability to lead team leaders in the development of business unit strategies, operational plans and corporate governance management to meet organisational needs. It also includes providing direction and guidance to team leaders through regular engagement, modelling of leadership and expected behaviours.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • The relationship between high level strategy and the development and implementation of team plans and processes • The relationship between high level strategy the development and implementation of business systems and processes to support corporate governance • Organisational policies and procedures relating to the development of departmental or business unit strategies, and corporate governance compliance management • Legal and ethical considerations relating to corporate governance • Relevant professional or industry codes of practice and standards relating to corporate governance • Implications and impact on employees and the organisation arising from team planning process and corporate governance management process 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Facilitate team leaders' involvement in the development of departmental or business unit strategies to achieve business objectives • Lead team leaders to identify trends and issues impacting team performance and develop team operational plans to achieve team objectives • Communicate organisational values and expectations of behaviour in the workplace to guide team leaders in their behaviour and performance • Engage regularly with team leaders to provide the required support to achieve business unit goals 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

	<ul style="list-style-type: none"> Model leadership and behaviours to demonstrate application of organisational values, behaviours and governance priorities in all actions
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Develop and modify systems and processes to improve compliance management on corporate governance and social responsibilities requirements
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Communicate departmental or business unit strategic priorities to stakeholders to garner their support and buy-in Assess emotional states of team leaders and respond appropriately to emotional cues when leading team leaders to ensure individual needs are addressed
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Engage in regular self-reflection to identify own areas for improvement in leading strategy planning Improve own strategy planning skills by subscribing to diverse learning channels and participating in peer review platforms to enhance workplace performance
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill</i></p>	N/A

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>may be demonstrated.</i>	
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	LPM-RES-301C-0	Skill Category	Results Achievement
		Skill Sub-Category (where applicable)	N/A
Skill	Monitor and Reward Performance in a Team to Support Achievement of Results		
Skill Description	This skill describes the ability to implement team plans and monitor team's progress towards the achievement of results. It also includes managing and rewarding team performance.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	The ability to understand: <ul style="list-style-type: none"> • Organisational policies and procedures relating to interpretation and implementation of plans, and performance management processes and tools • Legal and ethical considerations relating to performance management and performance contracts • The relationship between business objectives and the development and implementation of plans and processes at the team level • The relationship between high level strategy and performance management processes at the team level • Implications and impact of performance management process on employees and the organisation 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	The ability to: <ul style="list-style-type: none"> • Work with team members to interpret team plans to seek common understanding • Allocate tasks and resources to team members based on each individual's skills, knowledge and experiences to ensure optimal deployment of team members • Negotiate and document the deliverables and performance expectations of each team member to track achievement of results • Lead team performance and monitor implementation of team plans to generate desired results • Provide regular feedback to team members to maintain awareness of expected and actual performance • Monitor and assess emerging risks that may impact on team performance and identify appropriate control and contingency measures to address risks 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

	<ul style="list-style-type: none"> • Report on evaluation of team plan implementation to update management team • Manage and reward employee performance to ensure performance standards are met in accordance to team requirements • Identify learning and development programmes to support team and own performance
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Work with team members to evaluate outcomes of team plan implementation and team performance against success criteria to determine areas for improvements
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Assess emotional states of team members and respond appropriately to emotional cues when managing team performance to ensure individual needs are addressed
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Keep abreast of performance management processes by subscribing to diverse learning channels and participating in peer discussions to enhance own competence in managing performance management

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>N/A</p>
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	BM-PM-502E-1	Skills Category	Project Management
		Skills Sub-Category <i>(where applicable)</i>	N/A
Skill	Establish Project Feasibility		
Skill Description	This skill describes the ability to assess the feasibility of and authorise projects based on feasibility assessment results. This includes carrying out project feasibility studies.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Organisational objectives and capabilities • Assessment process • Methods to evaluate assessment models' findings • Feasibility factors • Measures of project benefits and outcomes 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate alignment of project with organisational objectives • Assess feasibility of carrying out project in accordance with organisational capabilities • Recommend authorisation of projects in accordance with feasibility assessment results 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Seek inputs from supervisors to add value to the project feasibility assessment findings and recommendations 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>organisational</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Assess emotional states and respond appropriately to emotional cues when addressing project feasibility with project teams to maintain positive working relationships
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> Improve own capability in conducting project feasibility assessment by subscribing to diverse learning channels and discussion platforms to enhance workplace performance
<p>Range of Application</p> <p>(where applicable)</p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	N/A

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	BM-PM-503E-1	Skills Category	Project Management
		Skills Sub-Category <i>(where applicable)</i>	N/A
Skill	Establish Project Scope		
Skill Description	This skill describes the ability to define and authorise changes to a project's scope to ensure its successful completion. This involves defining project objectives and scope.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Relevant stakeholders • Components of project plans • Change management process • Project charter • Project outcomes 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Define project objectives and scope to meet organisational needs and guidelines or policies • Authorise project scope in accordance with organisational procedures for project execution 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Review and authorise changes to project scope to ensure that project objectives are fulfilled 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>organisational</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Demonstrate empathy and appreciation of stakeholders' views when defining and establishing project scope to ensure individual concerns are acknowledged and addressed
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Study past projects to gain insights to establish current project scope
<p>Range of Application</p> <p>(where applicable)</p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	N/A

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	PRE-SMA-4001-1	Skill Category	Sales and Marketing
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Understand Sales and Marketing in a Manufacturing Organisation		
Skill Description	This skill describes the ability to understand the concept of sales and marketing in a manufacturing organisation context. It also includes identification of opportunities for competitive advantage and understanding the marketing mix of the organisation.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Relevant industry and market practices and standards • Four marketing essential elements • Organisations' marketing plans and competitive advantages • Workplace Safety and Health regulations 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Identify the organisation's current and emerging competitors • Determine the marketing mix, in relation to the organisation's targeted competitive advantage 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Analyse the organisation's marketing plans to assess suitability in supporting the organisation's competitive advantage 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>aligned to organisational</i>	
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	N/A
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> • Analyse data and emerging trends through market research to understand the organisation's market potential
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i>	Four marketing essential elements must include: <ul style="list-style-type: none"> • Product – brand, quality, product range, packaging, delivery and customer service • Place – warehousing, outlet location, type of outlet, wholesalers, retailers and franchisers • Price – product cost, wholesale price, retail price, guarantees, allowances, deals, discounts and delivery terms • Promotion – internal marketing, word of mouth, branding, public reaction, sales promotion, personal selling, direct marketing, sponsorship, exhibitions, merchandising, packaging, corporate image and advertising

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	BM-RM-404E-1	Skills Category	Risk Management
		Skills Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Risk in the Business Unit		
Skill Description	This skill describes the ability to evaluate and review a business unit's compliance with applicable legislative and regulatory requirements. It includes identifying relevant compliance requirements, areas of non-compliance, and proposing recommendations to stakeholders to close the non-compliance gap.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Relevant legislation and regulations applicable to industry • Appropriate sources of information on internal and external compliance requirements • Methodologies for both internal and external monitoring and evaluation • Data on compliance • Relevant stakeholders • Implications of non-compliance with relevant legislation and regulations 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Interpret corporate governance policy for execution to ensure compliance on roles, accountabilities and responsibilities of employees • Develop processes to operationalise the corporate governance policy for the business unit • Communicate corporate governance policy to relevant stakeholders in accordance with organisational procedures to facilitate organisational compliance • Evaluate compliance with corporate governance policy to determine appropriate follow up action 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Access appropriate sources of information to analyse relevant compliance requirements applicable to the business unit • Interpret relevant legislation and regulations, legal documents, standards and codes of practice relevant to the business unit to 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>performance and/or enhance business values that are aligned to organisational</i>	<p>identify possible areas of non-compliance</p> <ul style="list-style-type: none"> • Evaluate and report data on compliance to relevant stakeholders according to information format requirements to ensure stakeholder are updated and consulted
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Apply ethical code of practice in the evaluation of compliance by business unit to ensure adherence to legislation and regulatory requirements
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Keep abreast of the latest legislative and regulatory requirements applicable to the organisation by subscribing to various information channels to ensure currency of knowledge and organisational compliance
<p>Range of Application</p> <p>(where applicable)</p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Relevant legislation and regulations must include:</p> <ul style="list-style-type: none"> • Post incorporation Accounting and Corporate Regulatory Authority (ACRA) regulatory requirements, which may include: <ul style="list-style-type: none"> • Company secretary • Annual general meeting • Financial year end • Annual return • Directors' report • Registration number • Inland Revenue Authority of Singapore (IRAS) filing requirements, which may include: <ul style="list-style-type: none"> • Timeline for filing requirements • Estimated chargeable income • Tax return filing • Audited or unaudited accounts • Accountants Act • Business Registration Act

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

	<ul style="list-style-type: none">• Companies Act• Companies Act Reform• Workplace Safety and Health Act• Employment Act
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**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	PRE-SPI-4002-1	Skill Category	Strategy Planning and Implementation
		Skill Sub-Category	N/A
Skill	Understand Business Management		
Skill Description	This skill describes the ability to understand an organisation's business and management functions and issues. It also includes knowledge of management principles and organisational structures.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Classical management theories • Management principles • Japanese management principles • Organisational structures • Management functions in an organisation • Management issues in relation to productivity, quality, profitability and human relations 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Relate management principles to the organisation's business • Assess diverse organisational structures' suitability for manufacturing organisations • Correlate organisation functions in a typical manufacturing organisation with modern management practices 		
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Analyse management issues in relation to productivity, quality, profitability and human relations in relation to the organisation's business 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>aligned to organisational</i>	
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	N/A
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	N/A
<p>Range of Application (where applicable)</p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Classical management theories must include:</p> <ul style="list-style-type: none"> • Fredrick W Taylor • Max Weber • Henri Fayol • Hawthorne Works Experiments <p>Japanese management styles must include:</p> <ul style="list-style-type: none"> • Kaizen • Poka Yoke • Kanban <p>Organisational structures must include:</p> <ul style="list-style-type: none"> • Tall • Flat • Hierarchical • Centralised • De-centralised

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

- Matrix

Management functions in an organisation must include:

- Planning
- Organising
- Leading
- Resourcing
- Controlling
- Resourcing – personnel, finance, materials, facilities

Management issues in relation to productivity, quality, profitability and human relations must include:

- Leadership
- Motivation
- Team dynamics
- Industrial relations
- Use of technology
- Lean manufacturing
- Agile manufacturing

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	ES-PMD-401G-1	Skill Category	Personal Management and Development
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Develop Personal Effectiveness at Managerial Level		
Skill Description	This skill describes the ability to establish personal goals and evaluate them to justify one's roles and responsibilities in the achievement of organisational goals. It also includes time management, maintaining work-life balance, stress management and management of personal finances.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Types of motivational factors affecting personal goal setting and achievement • Strategies to link one's role and responsibilities to individual and organisational success • Factors that may affect the achievement of organisational goals • Benefits of prioritising work according to goals set • Barriers to effective time management that hinder the achievement of goals • Assistance available to overcome barriers to effective time management • Practices that promote personal well-being and aspects of personal management • Issues and problems related to personal and family responsibilities and their impact on work • Common sources of assistance available to support personal management • Sources of information for financial products • Factors to consider when using and maintaining credit 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Evaluate personal goals and align them to organisational goals • Justify one's role and responsibilities and their contribution towards the achievement of organisational goals • Manage time and resources to meet organisational goals • Examine the applicability of the common types of financial products for one's financial context • Promote work-life balance programmes to achieve organisational 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<i>manage the changes at work.</i>	effectiveness
Innovation and Value Creation <i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational</i>	The ability to: <ul style="list-style-type: none"> Analyse causes of stress that affect self and staff and develop strategies and techniques to manage them
Social Intelligence and Ethics <i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i>	The ability to: <ul style="list-style-type: none"> Apply Emotional Intelligence and people-management techniques to get assistance from appropriate people such as consultants, peers and subordinates
Learning to Learn <i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i>	The ability to: <ul style="list-style-type: none"> Evaluate personal strengths and weaknesses and develop strategies to overcome weaknesses and leverage on personal strengths to contribute towards the achievement of organisational goals Evaluate one's existing financial situation using appropriate tools, and develop a plan to manage such a position
Range of Application (where applicable) <i>It refers to the critical circumstances and contexts that the skill</i>	N/A

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

may be demonstrated.

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Skill Code	ES-PMD-501G-1	Skill Category	Personal Management and Development
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Develop Professional Image and Competence to Achieve Personal Career Goals		
Skill Description	This skill describes the ability to leverage on traditional and new media tools to develop personal branding and professional image and achieve personal career goals. It also includes conducting marketing research, networking and presentations.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Factors to be considered in formulating personal career goals • Personal career portfolio and its characteristics • Aspects and benefits of personal branding • Definition of new media • Comparison of the various types of new media to promote personal brand • Characteristics of professional image • Types of social skills for networking sessions • Types of networking situations that can help one in securing job and assignment opportunities • Verbal and non-verbal (body) language that affect effectiveness of one's presentation • Aspects of effective presentation skills 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Conduct market research to establish personal career opportunities and develop a career plan to meet personal career goals • Review requirements of selected career path to develop a personal career portfolio • Synthesise personal competencies to develop personal brand and optimise use of new media to promote personal brand 		
Innovation and	The ability to:		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational</i></p>	<ul style="list-style-type: none"> • Use effective presentation skills to promote personal competencies and brand to secure job or assignments
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Demonstrate genuine interest and empathy for others by developing social and networking skills using new media tools and appropriate interpersonal approaches
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Assess personal competencies to formulate personal career goals • Develop and maintain professional image to project personal brand • Maintain professional competence to ensure the continuing relevance of personal brand and competencies to relevant stakeholders • Review achievement of personal career goals and develop corrective strategies to address unrealised career goals
<p>Range of Application</p> <p>(where applicable)</p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Definition of new media must include:</p> <ul style="list-style-type: none"> • Integration of traditional media such as film, visual, images, music, spoken and written word, with the interactive power of computer and communications technology, computer-enabled consumer devices and the Internet

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	ES-ACE-501G-1	Skill Category	Analytical, Conceptual and Evaluative
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Apply Systems Thinking in Problem Solving and Decision Making		
Skill Description	This skill describes the ability to apply systems thinking to assess organisational issues. It also includes formulating and implementing solutions to address issues typically encountered by one assuming a managerial role.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Definitions of systems thinking • Benefits of systems thinking • Organisation from a systems perspective • Situations that can affect the achievement of desired goals and outcomes • Comparison of the various system thinking tools and their application • Comparison of the various systems thinking approaches and their application to problem-solving • Characteristics and application of the decision-making models • Limitations of appropriate evaluation process to assess effectiveness of chosen solutions • Possible success indicators of chosen solutions 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes at work.</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Analyse issues that affect the achievement of desired goals and outcomes in the macro context • Apply systems thinking approaches and processes to identify the root causes of non-achievement of desired goals and outcomes and the homeostasis of the organisation • Develop an implementation plan for the chosen solutions to resolve issues that affect the achievement of desired goals and outcomes in an organisation • Assess the effectiveness of the chosen solutions using an appropriate evaluation process 		

SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Use systems thinking tools to formulate possible solutions to resolve issues that affect the achievement of desired goals and outcomes • Select suitable solutions using established criteria to resolve issues that affect the achievement of desired goals and outcomes • Recommend corrective actions to improve chosen solutions
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Document the process of applying systems thinking in problem-solving and decision-making according to organisational guidelines and appropriate methods
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Engage in self-reflection to view problems from a holistic manner taking into account overall structures, patterns and cycles
<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>Definitions of systems thinking must include:</p> <ul style="list-style-type: none"> • A way of helping a person to view systems from a holistic perspective that includes seeing overall structures, patterns and cycles in systems, rather than seeing only isolated events in the system • A way to identify the root causes of issues in organisations and to address them • A way of understanding that emphasises the relationships among a system's parts, rather than the parts themselves <p>Systems thinking approaches and their application to problem-solving must include:</p> <ul style="list-style-type: none"> • Soft Systems Methodology (SSM) which includes:

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

	<ul style="list-style-type: none"> ○ Identification of outputs, attributes, criteria, measurements scales and models ○ Search for and generate different alternatives ○ Designing interventions to various components ○ Confirming system with relevant stakeholders ● Total Systems Intervention (TSI) which includes: <ul style="list-style-type: none"> ○ Creativity phase: Focuses on different aspects of the organisation's functioning ○ Choice phase: Choosing a set of methodologies to suit particular characteristics of the organisation's situation ○ Implementation phase: Generating specific proposal for change ● Systems design which includes: <ul style="list-style-type: none"> ○ Forecasting ○ Model building and simulation ○ Optimisation and control ● Strategic Assumption Surfacing and Testing (SAST) includes: <ul style="list-style-type: none"> ○ Group formation: A large group of people split into various groups ○ Assumption surfacing and rating: Groups discuss and list all assumptions inherent in systems ○ Within group dialectic debate: <ul style="list-style-type: none"> ● Eliminates irrelevant assumptions ● Ensures that assumption is self-evident and significant in the outcome of the strategy chosen and implemented ○ Between groups dialectic debate: <ul style="list-style-type: none"> ● Extracts agreed assumptions ○ Debates on contentious assumptions to achieve agreement <ul style="list-style-type: none"> ● Final synthesis ● Groups all come together to propose and resolve all outstanding controversies ● Policy decisions will be made then ○ Critical Systems Heuristic (CSH) which includes: <ul style="list-style-type: none"> ● To identify boundary judgements systematically ● To analyse alternative reference systems for defining a problem or assessing a solution proposal ● To challenge in a compelling way any claims to knowledge or rationality or improvement that rely on hidden boundary judgments or take them for granted
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SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN

Skill Code	ES-IP-501G-1	Skill Category	People and Relationship Management
		Skill Sub-Category <i>(where applicable)</i>	N/A
Skill	Manage Cross Functional and Culturally Diverse Teams		
Skill Description	This skill describes the ability to manage workplace diversity and manage a diverse work team to achieve an organisation's goals. It also includes creating a positive work environment for diverse teams and establishing effective communication systems and strategies in communication and conflict resolution.		
Knowledge and Analysis <i>It refers to gathering, cognitive processing, integration and inspection of facts and information required to perform the work tasks and activities.</i>	<p>The ability to understand:</p> <ul style="list-style-type: none"> • Types of diversity markers and their implications in a work team • Characteristics of major cultural dimensions • Common cultural diversity issues at the workplace • Team management strategies • Designing common goals and objectives • Maximizing team effectiveness and synergy • Ways in which diversity issues affect interpersonal relationships • Components of a communication system to facilitate communication among members of a diverse work team • Application of social competence in the context of diversity • Impact of cultural taboos on the effectiveness of a diverse work team • Strategies to convey negative news or performance to members of diverse cultures 		
Application and Adaptation <i>It refers to the ability to perform the work tasks and activities required of the occupation, and the ability to react to and manage the changes</i>	<p>The ability to:</p> <ul style="list-style-type: none"> • Examine the differences among the background of members in a diverse work team and their implications on maximizing team effectiveness and synergy to achieve common goals and objectives • Establish a system to facilitate communication among members within a diverse work team by applying effective communication techniques and social competence 		

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<i>at work.</i>	
<p>Innovation and Value Creation</p> <p><i>It refers to the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to organisational goals.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Assess diversity issues that have implications on a work team working towards common goals and objectives
<p>Social Intelligence and Ethics</p> <p><i>It refers to the ability to use affective factors in leadership, relationship and diversity management guided by professional codes of ethics.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Align diverse work teams towards common goals and objectives • Establish a positive work culture in a diverse work team • Moderate diverse perspectives and opinions across team members from different disciplines and cultures
<p>Learning to Learn</p> <p><i>It refers to the ability to develop and improve one's self within and outside of one's area of work.</i></p>	<p>The ability to:</p> <ul style="list-style-type: none"> • Appreciate and empathise with the diverse needs, thoughts and feelings of team members in achieving desired outcomes

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

<p>Range of Application</p> <p><i>(where applicable)</i></p> <p><i>It refers to the critical circumstances and contexts that the skill may be demonstrated.</i></p>	<p>N/A</p>
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**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Version Control

Version	Date	Changes Made	Edited by
1.0	12 October 2016	Initial Version	SSG and EDB

Definitions of the Five (5) Domains

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING
SKILLS STANDARDS FOR
MASTER CRAFTSMAN**

Domain	Definition
Knowledge and Analysis	Knowledge includes the gathering of facts and information through traditional and digital forms. Analysis involves the cognitive processing, integration and inspection of single or multiple sources of facts and information required to perform work tasks and activities and takes into consideration, the work contexts in which the tasks and activities are carried out. The result of knowledge and analysis produce judgements on work tasks/activities/issues/areas, and the conceptualisation of solutions to solve problems at work.
Application and Adaptation	Application involves the ability to perform work tasks and activities defined by the requirements of the occupation. Adaptation involves the ability to react to and manage the changes in the work contexts. The result of application and adaptation leads to the production of psycho-motor actions and behavioural reactions to the work tasks/activities/issues/areas, and the execution of the planned solutions to solve problems at work.
Innovation and Value Creation	Innovation includes the ability to generate purposive ideas to improve work performance and/or enhance business values that are aligned to the organisational goals. As a result of innovation, the organisation is able to reap the values from individual or team contributors to achieve organisational growth.
Social Intelligence and Ethics	Social intelligence includes the ability to appreciate and use affective factors in leadership, relationship and diversity management guided by professional codes of ethics as effective individuals or team contributors.
Learning to Learn	Learning-to-learn includes the ability to improve on self-development within and outside of one's area of work. It involves the continual inspection of one's knowledge, analytical, application, adaptive, innovative and social skills that are needed to perform the work optimally and/or solve problems effectively.