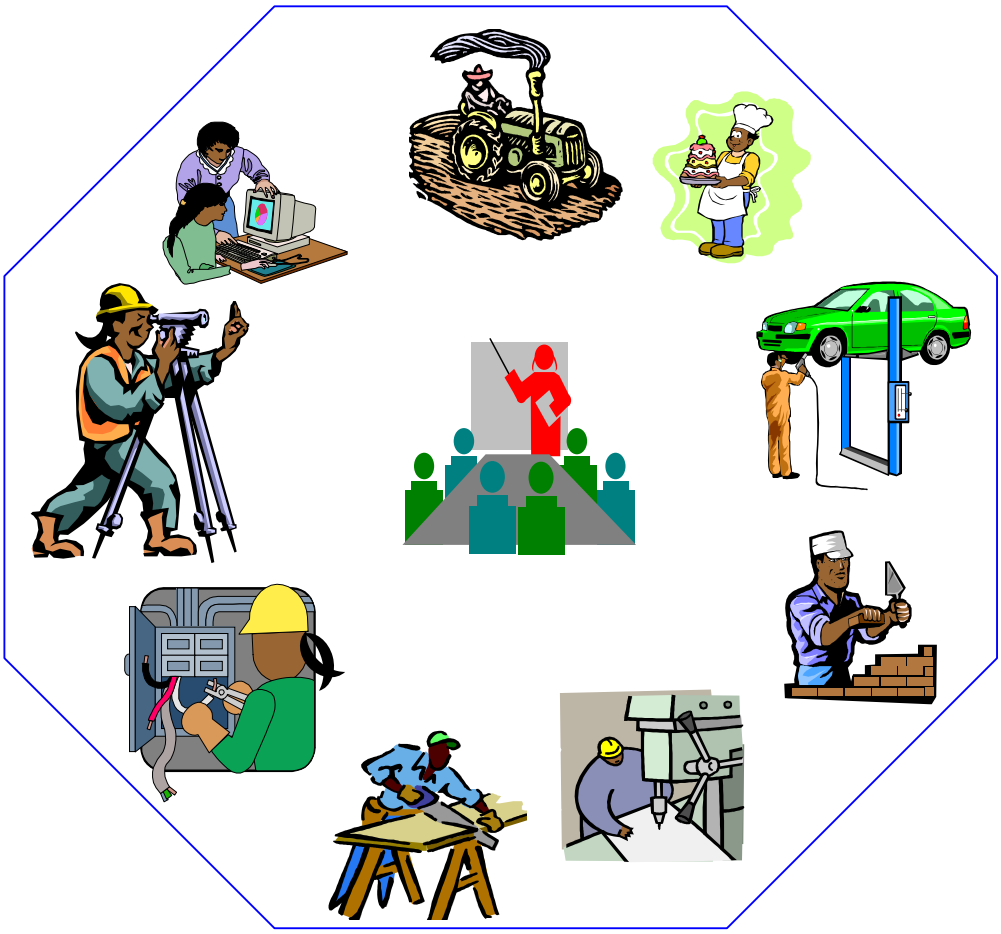
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

MACHINING

NTQF Level II-III



Ministry of Education
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Introduction

Ethiopia has embarked on a process of reforming its TVET-System. Within the policies and strategies of the Ethiopian Government, technology transformation – by using international standards and international best practices as the basis, and, adopting, adapting and verifying them in the Ethiopian context – is a pivotal element. TVET is given an important role with regard to technology transfer. The new paradigm in the outcome-based TVET system is the orientation at the current and anticipated future demand of the economy and the labor market.

The Ethiopian Occupational Standards (EOS) is the core element of the Ethiopian National TVET-Strategy and an important factor within the context of the National TVET-Qualification Framework (NTQF).They are national Ethiopia standards, which define the occupational requirements and expected outcome related to a specific occupation without taking TVET delivery into account.

This document details the mandatory format, sequencing, wording and layout for the Ethiopia Occupational Standard which comprised of Units of Competence.

A Unit of Competence describes a distinct work activity. It is documented in a standard format that comprises:

- Occupational title, NTQF level
- Unit title
- Unit code
- Unit Descriptor
- Elements and Performance criteria
- Variables and Range statement
- Evidence guide

Together all the parts of a Unit of Competence guide the assessor in determining whether the candidate is competent.

The ensuing sections of this EOS document comprise a description of the respective occupation with all the key components of a Unit of Competence:

- the chart with an overview of all Units of Competence for the respective occupation including the Unit Codes and the Unit Titles
- the contents of each Unit of Competence (competence standard)
- occupational map providing the Technical and Vocational Education and Training (TVET) providers with information and important requirements to consider when designing training programs for this standards, and for the individual, a career path

UNIT OF COMPETENCE CHART

Occupational Standard: Machining		
Occupational Code: IND MAC2		
NTQF Level II		
IND MAC2 01 0217 Prepare Basic (2D) Engineering Drawing Using CAD	**IND MAC2 02 0217** Perform Mensuration and Calculation	**IND MAC2 03 0217** Maintain Tools and Equipment
IND MAC2 04 0217 Perform Intermediate Lathe Operations	**IND MAC2 05 0217** Perform Intermediate Milling Operations	**IND MAC2 06 0217** Perform Intermediate Grinding Operations
IND MAC2 07 0217 Perform Tool Grinding Operations	**IND MAC2 08 0217** Carry out Heat Treatment	**IND MAC2 09 0217** Participate in Workplace Communication
IND MAC2 10 0217 Work in Team Environment	**IND MAC2 11 0217** Develop Business Practice	**IND MAC2 12 0217** Standardize and Sustain 3S

NTQF Level III

IND MAC3 01 0217 Perform Advanced Engineering Detail Drafting Using CAD	**IND MAC3 02 0217** Perform Basic CAD/CAM Applications	**IND MAC3 03 0217** Perform Advanced Lathe CNC Operations
IND MAC3 04 0217 Perform Advanced CNC Milling Operations	**IND MAC3 05 0217** Perform Advanced Grinding Operations	**IND MAC3 06 0217** Perform EDM Plunger and Wire Operations
IND MAC3 07 0217 Perform Advanced Press Operations	**IND MAC3 08 0217** Manufacture Jigs and Fixtures	**IND MAC3 09 0217** Manufacture Press Tools and Die
IND MAC3 10 0217 Perform Fitting and Assembly	**IND MAC3 11 0217** Test and Dry-Run Tool and Die Components	**IND MAC3 12 0217** Monitor Implementation of Work Plan/Activities
IND MAC3 13 0217 Apply Quality Control	**IND MAC3 14 0217** Lead Workplace Communication	**IND MAC3 15 0217** Lead Small Teams
IND MAC3 16 0217 Improve Business Practice	**IND MAC3 17 0217** Prevent and Eliminate MUDA	

NTQF Level II

Occupational Standard: Machining Level II	
Unit Title	**Prepare Basic (2D) Engineering Drawing Using CAD**
Unit Code	**IND MAC2 01 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to perform manual drafting and computer aided drafting to produce simple Two Dimensional (2D) metal engineering drawings, part and material lists.

Elements	Performance Criteria
1. Identify drawing requirements	1.1. Specifications and other data are determined from work order and specification, actual sample or relevant documents 1.2. All necessary data are identified and analyzed to produce the norm/ standards drawing 1.3. Drawing requirements are verified by ***relevant personnel*** and timeframes for completion are established in accordance with standard operating procedures
2. Prepare drawings or make changes to existing drawings	2.1. ***Drafting principles*** are applied to produce a drawing that is consistent with standard operating procedures 2.2. Dimensions, notes and specifications are indicated in the drawing in accordance with drafting principles and standards 2.3. Completed drawing is presented for approval in accordance with standard operating procedures 2.4. Completed drawing is presented for approval in accordance with standard operating procedures
3. Prepare engineering parts list	3.1. Component parts and material are identified and organized by component type and/or in accordance with company/customer requirements 3.2. Parts lists ***records*** are completed in accordance with standard operating procedures
4. Issue approved drawing	4.1. Approved drawing and/or norm parts lists are copied and ***issued*** to relevant personnel in accordance with standard operating procedures. 4.2. Approved drawings and/or norm parts lists are stored and catalogued in accordance with standard operating procedures

Variable	Range
Relevant personnel	May include, but is not limited to: • Supervisor • Technical personnel • Manufacturers • Suppliers

	• Contractors • Customers
Drafting principles	May include, but is not limited to: • Local standards • International standards
Records	May include, but is not limited to: • Cataloguing • Issuing security classifications • Filing • Preparing distribution lists
Issued	May include, but is not limited to: • Hard copy • Photographic • Soft copy • Slide or transparency form including presentation as a single drawing and/or with other drawings • Support documentation as a package

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Identified drawing requirements • Prepared engineering .drawing or made changes to existing drawing • Prepared engineering parts list • Issued approved drawing
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Types and uses of drafting equipment and drawing instruments • Requirements and purpose of the engineering drawing and/or parts list • Sources of relevant data/information • Drafting principles to be applied in the preparation of drawing • Drawing symbols and standards • Isometric, orthographic and exploded view drafting • ISO Tolerances and fits • Shop mathematics (geometric principles and trigonometric functions • Types and forms of supply of engineering materials • Types and uses of measuring instruments (scale, steel rule, • Basic machine shop operations • Procedures in checking, recording, copying and issuing completed drawings and/or parts lists • Procedures for safe handling, filing and storage of drawings and/or parts lists • Pattern development procedures for sheet metal work • Procedures in issuing approved drawings and/or parts lists

	• Safe work practices
Underpinning Skills	Demonstrate skills of: • Using drafting equipment and instruments • Using measuring instruments • Reading and interpreting drawings and sketches • Performing basic mathematical computations • Producing/changing drawing to conform with the relevant standards • Producing the component parts list with part name, description of part, material specification or part number, quantities and all other details specified by the customer and/or organizational procedures • Recording completed drawings and or parts lists in accordance with standard operating procedures • Copying and issuing approved drawings and/or part lists • Communication skills
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/ Written Test • Observation/ Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Perform Mensuration and Calculation**
Unit Code	**IND MAC2 02 0217**
Unit Descriptor	This unit covers skills and knowledge and attitude required to perform mensuration and calculation on metal engineering applications based on ISO standards.

Elements	Performance criteria
1. Select measuring instruments	1.1. Object or component to be measured is identified, classified and interpreted according to the appropriate regular ***geometric shape*** and drawing standard 1.2. Measuring tools are selected/identified as per object to be ***measured*** or work requirements 1.3. Alternative measuring tools are used without sacrificing cost and quality of work
2. Carry-out measurements and calculations	2.1. Accurate measurements are obtained according to work requirements / ISO standard 2.2. Calculation needed, including but not limited to: trigonometric functions, algebraic computations are performed to complete work tasks using the four basic process 2.3. Numerical computation is self-checked and corrected for accuracy 2.4. Where appropriate, formulae are constructed to enable problems to be solved based on applied calculations 2.5. ***Instruments*** are read to the limit of accuracy of the tool
3. Perform calculations on algebraic expressions	3.1. Transposition of formulae are carried out to isolate the variable required, involving the ***four fundamental operations***. 3.2. Equations involving one unknown are solved correctly 3.3. Percentages are computed using appropriate formula. 3.4. Ratio and proportion are computed using appropriate formula

Variable	Range
Geometric shape	May include, but is not limited to: • round • square • rectangular • triangle • sphere • conical

	• semi-circle • other irregular shapes
Measurements	May include but not limited to: • Linear • Volume • Area • Wattage • Voltage • Resistance • Amperage • Frequency • Impedance • Conductance • Capacitance • Displacement • Inside diameter • Circumference • Length • Thickness • Outside diameter • Taper • Out of roundness • Oil clearance • End play/Thrust clearance
Instruments	May include, but is not limited to: • Micrometer (In-out, depth) • Vernier caliper (out, inside) • Dial gauge with mag, std. • Straight edge • Thickness gauge • Torque gauge • Small hole gauge • Telescopic gauge • Try-square • Protractor • Combination gauge • Steel rule • Voltmeter • Ammeter • Mega-Ohm meter • Kilowatt hour meter • Gauges • Thermometers
Four fundamental operations	May include, but is not limited to: • Addition (+), Subtraction (-), Multiplication (x) and Division (/)
Units	May include, but is not limited to: • Fractions • Mixed numbers • Decimal

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Perform calculation: ➢ using four fundamental operations ➢ involving fractions and mixed numbers ➢ involving fractions and decimals

	➢ On algebraic expressions ➢ Involving ratio and proportion • Select and prepare appropriate measuring instruments in accordance with job requirements • Perform measurements and calculations according to job requirements/ ISO
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Inch and metric system of measurements • Linear measurement • Dimensions • Unit conversion • Ratio and proportion • Trigonometric functions • Algebraic equations • Four fundamental operations • Method of transposing formulae • Equation formulation
Underpinning Skills	Demonstrates skills in: • Performing calculations using pen and paper or with the use of calculator • Performing calculation by addition, subtraction, multiplication and division; trigonometric functions and algebraic equations • Visualizing objects and shapes • Interpreting formulas for volume, areas, perimeters of plane and geometric figures • Proper handling of measuring instruments • Performing calculation by addition, subtraction, multiplication and division; trigonometric functions and algebraic equations • Visualizing objects and shapes • Interpreting formulas for volume, areas, perimeters of plane and geometric figures • Proper handling of measuring instruments
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Maintain Tools and Equipment**
Unit Code	**IND MAC2 03 0217**
Unit Descriptor	The unit covers competence required in carrying out compulsory and routine safety and maintenance checks on machines and equipment, measuring instruments and tools in a manufacturing setting.

Elements	Performance Criteria
1. Undertake program safety and maintenance checks	1.1. Tools and ***machines/equipment*** are inspected/checked according to workplace routine 1.2. ***Checks*** are undertaken safely and to prescribed operational procedures. 1.3. Measuring instruments are checked and calibrated in accordance with manufacturer's instructions 1.4. Non-functional tools, instruments and equipment are segregated and labeled according to classification 1.5. Status/report is recorded on pro-forma or reported orally based on operational processes
2. Undertake basic program maintenance	2.1. Machines/equipment are cleaned and lubricated using appropriate lubricant, according to preventive maintenance schedule or manufacturer's specifications/instructions following standard procedures 2.2. Removal/replacement of ***consumable components*** is undertaken to prescribed procedure and instructions 2.3. Fluids and lubricants are replaced and/or topped up to prescribed schedule and according to manufacturer's instructions 2.4. Minor machine repairs performed according to manual instruction or workplace procedures 2.5. Machine moving parts adjusted to manufacturer's specifications.
3. Perform basic preventive maintenance of tools	3.1. ***Tools*** are checked for defects/functionality based on specifications 3.2. Defective hand tools are reported for repair or replacement due to standard procedures 3.3. Tools are cleaned using appropriate ***cleaning materials*** and according to standard procedures 3.4. Tools are lubricated and stored according to prescribed procedures

	3.5. Necessary reports are accomplished in accordance with workplace procedures
4. Inventory tools and equipment	3.1. Inventory of tools, instruments and equipment is performed in accordance with workplace procedures 3.2. Inventory results are documented / recorded in appropriate forms as per company regulations 3.3. Tools and equipment are stored safely in appropriate locations in accordance with manufacturer's specifications or company policy

Variable	**Range**
Machine/equipment	May include, but is not limited to: • Manual, semi-automatic and automatic machines of a stand-alone continuous production or process nature
Checks	May include, but is not limited to: • Programmed safety and maintenance checks • Adjustments of a limited nature including safety guards, stops, wear pads and tool holders, nipping up glands and adjustment of scrapers and aprons
Consumable components	May include, but is not limited to: • Air filters, oil wipers, grease containers, tool tips, indicator globes, fluids and lubricants, guides and limit switch actuators
Tools	May include, but is not limited to: • Cutting tools - hacksaw, crosscut saw, rip saw • Boring tools - auger, brace, gimlet, hand drill • Holding tools - vice grip, C-clamp, bench vice • Threading tools - die and stock, taps • Measuring instruments- • Hand tools-allen key hammer plaires
Cleaning materials	May include, but not limited to: • Rust remover • lubricants • rugs... Etc.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and Skill of: • Performed operational maintenance of machines/equipment and tools • Selected and used appropriate processes, tools and equipment to carry out task • Identified functional and non-functional tools and equipment • Checked, lubricated and calibrated tools, equipment and instruments according to manufacturer's specifications • Replaced defective tools, equipment and their accessories • Observed and applied safe handling of tools and equipment

	and safety work practices • Prepared and submitted inventory report, where applicable • Maintained workplace in accordance with OHS regulations • Stored tools and equipment safely in appropriate locations and in accordance with company practices
Underpinning Knowledge and Attitude	Must demonstrate knowledge of: • Programmed maintenance and safety check procedures for the specified machine/equipment • Common defects of machines/equipment and hand tools • Hand tools maintenance procedures • Recording/reporting requirements • Types and uses of lubricants and cleaning materials • Types and uses of measuring instruments • Safe work practices and procedures • Hazards and control measures associated with operational maintenance of machines / equipment • Good housekeeping
Underpinning Skills	Must demonstrate skills of: • Undertaking programmed safety and maintenance checks • Undertaking programmed operational maintenance • Entering routine and familiar information onto proformas and standard workplace forms • Maintaining hand tools • Following routine information on written procedures • Following oral instructions • Orally reporting routine information
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Perform Intermediate Lathe Operations**
Unit Code	**IND MAC2 04 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required to setup work-piece to drawing specifications. It details the requirements for performing lathe operations considered as 'intermediate' such as turn, facing, taper turning, grooving, boringand machining components using chuck, cutting single and double start "v"& squarethread (internal and external).

Elements	Performance Criteria
1. Determine job requirements	1.1. Drawings are interpreted to produce component to specifications. 1.2. Sequence of operation is determined to produce component to specifications. 1.3. ***Cutting tools*** are selected according to the requirements of the operation
2. Set-up work piece	2.1. ***Work piece*** is mounted and centered on chuck to required level of accuracy using appropriate tools and equipment and in accordance with worksite procedures. 2.2. Work piece is setup using appropriate instruments/equipment based on standard procedure. 2.3. Setup operations are performed applying ***safety procedures*** and using personal protective devices due to OHS regulations
3. Perform lathe operations	3.1. Speeds and feeds are calculated using appropriate mathematical techniques and reference material according to standard 3.2. Depth of thread cut and taper angle are calculated according to standard instructions 3.3. Selected ***lathe accessories*** are used based on the requirements of the operation. 3.4. ***Lathe operations*** are performed to produce component in compliance with specifications. 3.5. Operations are performed applying knowledge on safety procedures and using personal protective devices due to OHS standards
4. Comply with Quality Assurance	4.1. Work piece is checked/measured using appropriate techniques, ***measuring tools*** and equipment in conformance with specification 4.2. Work piece is checked in conformance with finished quality

	4.3. Deviations are handled appropriately in accordance with organization procedures and standard

Variable	Range
Cutting tools	May include, but not limited to: • High speed steel for turning, facing, groving, parting and thread cutting • Inserts • Drills • Boring tool • Knurling tools
Work piece	May include, but not limited to: • Ferrous • non-ferrous
Safety procedures	May include, but not limited to: • Equipment and tools • Materials • Persons
Lathe accessories	May include, but not limited to: • 3- and 4-jaw chucks • Face plates • Lathe centres (died and live centers) • Drill chucks • Boring bar • Lathe dog • Follow and steady rest • Taper attachment • Sleeves • Stopper
Lathe operations	May include, but not limited to: • Facing • Straight turning • Drilling, boring • Parting-off, groving and recessing • Face and turn external shapes (radii, cones) • Single and double start internal and external thread cutting • Taper turning (internal and external) • Turning diameters between centres • Internal and external thread(v, square and aqume) • Knurling
Measuring tools	May include, but not limited to: • Steel ruler • Verniercalliper/Digital calipers • Micrometer • dial indicator

	• Gauges (thread, pin, depth, surface comparator, radius, screw pitch, slip or block, taper, plug)

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and Skill of: • Determined job requirements • Setup the machine& work-piece. • Performed turning, threading, etc. Operations • Checked/measured the work-piece
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Shop safety practices • Drawing interpretation • Shop mathematics • Measurements • Materials and related science • Lathe machine operations
Underpinning Skills	Demonstrate skills in: • Selecting and setting cutting tools • Using measuring instruments • Verifying work-piece specifications • Computation of feed, cutting speed and machine rpm • Perform turning, threading, boring, drilling etc.
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Perform Intermediate Milling Operations**
Unit Code	**IND MAC2 05 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to set-up and mill work-piece according to the drawing. It details the requirements for performing milling operations considered as "intermediate" such as indexing, milling splines and equally-spaced grooves, 45 serrations in cylindrical work –piece and rack, ratchets, converging faces, large radial slots and internal radii.

Elements	Performance Criteria
1. Determine job requirements	1.1. Drawings are interpreted to produce component to specifications. 1.2. Sequence of operation is determined to produce component to specifications. 1.3. ***Cutting tools*** are selected according to the requirements of the operational standards
2. Set-up work piece	2.1. ***Work piece*** is setup to required level of accuracy using appropriate instruments/equipment and in accordance with standard procedures. 2.2. Setup operations are performed applying safety procedures and using personal protective devices based on OHS. 2.3. Setup is ensured to be safe with compliance to work operation.
3. Perform milling operations	3.1. Speeds and feeds are calculated using appropriate mathematical techniques and reference material based on standards. 3.2. ***Milling machine accessories*** used are made appropriate to the requirements of the operational standards. 3.3. ***Milling operations*** are performed to produce component inclusive gears to specifications. 3.4. Milling operations are performed applying knowledge on safety procedures and using personal protective devices based on OHS.
4. Check/ measure work piece	4.1. Work piece is checked/measured using appropriate techniques, ***measuring tools*** and equipment in conformance to specification 4.2. Work piece is checked in conformance with finished quality 4.3. Deviations are handled appropriately in accordance with organization procedures and standard

Variable	Range
Cutting tools	May include, but not limited to: • Side and face cutters • Gear cutter and other formed cutter • Slitting cutter • End mills and Drill bit • Shell end mills • T-slots and Dovetail cutters • Counter Sink and counter bore Tool • Boring tool and Radius cutter
Work piece	May include, but not limited to: • Ferrous and non-ferrous types
Milling machine accessories	May include, but not limited to: • Work holding devices • Indexing head • Footstock • Sloting attachment • Rotary table
Milling operations	May include, but not limited to: • Indexing • Straddle-milling • Milling splines • Milling equally-spaced grooves • Milling 450 serrations on cylindrical work-piece • Milling spur gear, helical, worm well and rack • Milling ratchet • Milling converging faces • Milling large radial slots • Milling internal radii
Measuring tools	May include, but not limited to: • Steel rule • Verniercaliper and digital calipers • Micrometer(internal, externa and depth micrometer) • Gauges (height ,bore, surface finish/comparator, radius, depth, blocks) • Gear tooth caliper • Dial indicater

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and Skill of: • Determined job requirements • Set up the machine and work piece. • Performed milling operations • Checked/measured the work piece
Underpinning	Demonstrate knowledge of:

Knowledge and Attitude	• Shop safety practices • Drawing interpretation • Shop mathematics • Measurements • Materials and related science • Millingmachine operations
Underpinning Skills	Demonstrate skills in: • Selecting and setting cutting tools • Using measuring instruments • Verifying work-piece specifications • Computation of feed, cutting speed and machine rpm • Perform different milling operations.
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Perform Intermediate Grinding Operations**
Unit Code	**IND MAC2 06 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to perform intermediate grinding operations conforming to the required specifications.

Elements	Performance Criteria
1. Set up work	1.1. Work requirements and sequence of operations are determined from ***specifications*** and according to standard procedures accordingly 1.2. Tool and cutter grinding wheels are selected, based on knowledge of discs and grinding agents, and are ***balanced*** and dressed according to operational standards 1.3. Correct and appropriate ***work holding devices*** are selected and applied in accordance to appropriate machine device. 1.4. ***Grinding wheels*** are selected, balanced and dressed to form and size based on standard requirements 1.5. Accessories are selected to facilitate production to task specifications.
2. Perform intermediate grinding operations	2.1. ***Grinding machines*** are set up and adjusted in accordance with defined procedures 2.2. ***Grinding work*** is performed safely, utilizing all guards, safety procedures and personal protective clothing and equipment based on OHS 2.3. Grinding operations are performed in accordance with operational standards 2.4. OHS measures and procedures are observed throughout the machining operations
3. Quality assure components in conformance to specifications	3.1. Components are checked using standard techniques, tools and equipment 3.2. Required grade of tolerance is determined based on drawing and work standards

Variables	Range
Specifications	May include, but not limited to: • Dimensions and tolerances, • geometry • surface finish
Balanced	May include, but not limited to: • Static and dynamic balancing
Work holding	May include, but not limited to:

devices	• Vices, clamps, magnetic chucks, face plates, collets, 3/4 jaw chuck, etc.
Grinding wheels	May include, but not limited to: • Wheel selection criteria includes shape, types and grit/bond composition
Grinding machines	May include, but not limited to: • Surface, cylindrical and eccentric grinding machines
Grinding work	May include, but not limited to: • Blocks • Finished products such as blades, shaft, ..etc • Shapes and forms.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate Knowledge and Skill of: • Determined job requirements • Setup the work piece • Performed grind operations • Checked conformance with specifications
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Safety hazards associated with grinding machines and sequence of operations • Application of a range of holding devices/accessories • Selecting specific clamping and work holding devices • Coolant selection/function • Standard grinding wheel shapes • Range of abrasive materials • Factors impacting grinding wheel selection including • Grain size of abrasive particles; grade or strength ofbond; and bond material • Grinding operations/procedures • Function of any grinding accessories • Application of tools, techniques and equipment • Components for conformance to specifications • Risks and control measures associated with grinding • Application of personal protective equipment safe work practices and procedures • Read and interpret drawings, machining tolerances, basic metallurgy, basic metrology, bench work, drilling operations, power hack saw operations.
Underpinning Skills	Demonstrate skills to: • Read and interpret drawings and machining tolerances • Select grinding wheels • Dress grinding wheel to form and size • Balance grinding wheels • Set-up grinding machines • Carry-out surface grinding

	• Perform cylindrical grinding • Balancing/dressing grinding wheels • Test conformance to specifications • Work with precision measurement equipment • Measure components to specified tolerances • Perform numerical operations, geometry and calculations / formulae for intermediate grinding operations
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Perform Tool Grinding Operations**
Unit Code	**IND MAC2 07 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to set-up and grind cuttingtools according to specifications.

Elements	Performance Criteria
1. Determine job requirements	1.1. Drawings are interpreted and sequence of operations is determined based on standard 1.2. Tool and cutter grinding wheels are selected based on knowledge of discs and grinding agents. 1.3. Accessories and ***holding devices*** are selected to facilitate production in compliance with specification 1.4. Correct safety procedures are observed, and protective clothing and safety glasses are worn due to OHS regulations
2. Perform grinding operation	2.1. ***Tool grinding machine***s are operated to sharpen and shape the full range of tools and cutters due to requirements 2.2. Parallel internal and/or external grinding is carried out in accordance with regulations
3. Check conformance with specifications	3.1. ***Components*** are checked and measured using appropriate techniques, tools and equipment in conformance with specification

Variable	Range
Holding devices	May include, but not limited to: • Vices • Clamps • Magnetic chucks • Face plates • Collets • 3/4 jaw chuck and adapters
Tool grinding machine	May include, but not limited to: • Tool sharpening machine
Components	May include, but not limited to: • Side and face cutters, • End mill, • Form module milling cutters • Flat, vee and circular form tools and hobs, • Slitting saws, • Drills • Boring and parting/grooving tools

	• Thread cutting tools
Wheels grinding discs and grinding agents	May include, but not limited to: • Shape • Grit/Bond composition

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate : • Prepared for grinding works • Performed grinding operations • Checked conformance to specifications
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Electing the chosen sequence and functions of operations • Criteria for grinding wheel selection • Grinding wheel dressing procedures and wheel dressing tools source(s) of data on tool geometry for the full range of tools and cutters, including the terminology used to describe the tool geometry • Procedures to be followed when parallel or taper grinding on a tool and cutter grinder • Tools, techniques and equipment used to check ground components for conformance with the following specifications: • Dimensions and tolerances • Geometry and tolerances • Use and application of personal protective equipment • Safe work practices and procedures
Underpinning Skills	Demonstrates skills in: • Reading, interpreting and following information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents • Checking and clarifying task related information • Preparing operational work plan • Performing numerical operations and calculations within the scope of this unit • Performing safety checks of equipment • Selecting tool and cutter grinding accessories • Sharpening/shaping tools and cutters • Checking components for conformance with specifications • Using precision measurement equipment within the scope of this unit
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning

Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Carry out Heat Treatment**
Unit Code	**IND MAC2 08 0217**
Unit Descriptor	This unit covers the competence in performing heat treatment of ferrous metals, selecting the appropriate process to achieve the desired result using a variety of equipment.

Elements	Performance Criteria
1. Prepare for work	1.1. Work requirements are determined from engineering drawing, job sheet or verbal instructions 1.2. ***Heating equipment*** are selected for the required heat treatment process. 1.3. Equipment is selected according to standard operating procedures and/or manufacturer's instructions 1.4. Personal protective equipment/devices are used in accordance with Occupational Health and Safety (OHS) requirements
2. Operate heating equipment	2.1. Hazards are identified and control measures implemented to maintain a safe work environment. 2.2. Furnace start-up is performed as per standard operating procedures and safety requirements. 2.3. Required heating temperature, soaking time and cooling time are applied and maintained according to standard operating procedure 2.4. ***Materials*** are heat treated to achieve required result in accordance with standard operating procedures and customer requirements
3. Quality assure and clean up	3.1. Heat treated material is tested for required result in accordance with standard operating procedures 3.2. Work area is cleared and materials are disposed of/or recycled in accordance with legislation and workplace procedures 3.3. Tools and equipment are cleaned, checked, maintained and stored in accordance with manufacturers' recommendations and workplace procedures 3.4. Documentation is completed in accordance with workplace requirements

Variable	Range
Heating equipment	May include, but not limited to: • Pit furnace • Box type furnace

	• Boggie (car type) furnace or • Muffle furnace
Materials	May include, but not limited to: • Ferrous metals of various types and thicknesses
Heating process	May include, but not limited to: • Heating/quenching, tempering and annealing
Heat treatment process	May include, but not limited to: • Stress relieving • Annealing • Normalizing • Quenching (air, water, oil) • Tempering • Carburizing • Hardening

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Determined job requirements • Set-up heat treatment equipment • Loaded/ arranged the materials • Operated and monitored heating equipment • Heat treated materials • Shut down furnace
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Metal chemical composition. • Different heat-treatment processes, equipment and application. • Heat-treatment faults and counter-measures. • Destructive and non-destructive testing of metals. • Mechanical / physical properties of metals. • Time, temperature diagram of metals. • Use of personal protective unit. • Safe work practices and • Work place procedures.
Underpinning Skills	Must demonstrate skills of: • Selecting appropriate heat-treatment equipment and process. • Identifying and rectifying heat-treatment faults (equipment and process). • Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, manufacturers manual and instructions, chart, list, drawings and applicable reference documents. • Entering routine and familiar information into pro-forms and standard workplace form. • Perform standard metal hardness tests. • Check and clarify tasks selected information.

Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Participate in Workplace Communication**
Unit Code	**IND MAC2 09 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

Elements	Performance Criteria
1. Obtain and convey workplace information	1.1. Specific and relevant information is accessed from ***appropriate sources***. 1.2. Effective questioning, active listening and speaking skills are used to gather and convey information. 1.3. Appropriate ***medium*** is used to transfer information and ideas. 1.4. Appropriate non- verbal communication is used. 1.5. Appropriate lines of communication with supervisors and colleagues are identified and followed. 1.6. Defined workplace procedures for the location and ***storage*** of information are used. 1.7. Personal interaction is carried out clearly and concisely.
2. Participate in workplace meetings and discussions	2.1. Team meetings are attended on time. 2.2. Own opinions are clearly expressed and those of others are listened to without interruption. 2.3. Meeting inputs are made consistent with the meeting purpose and ***protocols*** established. 2.4. ***Workplace interactions*** are conducted in a courteous manner. 2.5. Questions about simple routine workplace procedures and matters concerning working conditions of employment are asked and responded. 2.6. Meetings outcomes are interpreted and implemented.
3. Complete relevant work related documents	3.1. Range of ***forms*** relating to conditions of employment is completed accurately and legibly. 3.2. Workplace data is recorded on standard workplace forms and documents. 3.3. Basic mathematical processes are used for routine calculations. 3.4. Errors in recording information on forms/ documents are identified and properly acted upon. 3.5. Reporting requirements to supervisor are completed according to organizational guidelines.

Variable	Range
Appropriate sources	May include, but is not limited to: • Team members • Suppliers • Trade personnel • Local government and Industry bodies
Medium	May include, but is not limited to: • Memorandum • Circular • Notice • Information discussion • Follow-up or verbal instructions and Face to face communication
Storage	May include manual filing and computer-based filing systems
Protocols	May include, but is not limited to: • Observing meeting • Compliance with meeting decisions • Obeying meeting instructions
Workplace interactions	May include, but is not limited to: • Face to face • Telephone • Electronic and two way radio • Written including electronic, memos, instruction and forms, non-verbal including gestures, signals, signs and diagrams
Forms	May include but not limited to personnel forms, telephone message forms, safety reports

Evidence Guide	
Critical Aspects of Competency	Demonstrates skills and knowledge to: • Prepare written communication following standard format of the organization • Access information using communication equipment • Make use of relevant terms as an aid to transfer information effectively • Convey information effectively adopting the formal or informal communication
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Effective communication • Different modes of communication • Written communication • Organizational policies • Communication procedures and systems • Technology relevant to the enterprise and the individual's work responsibilities
Underpinning Skills	Demonstrate skills to:

	• Follow simple spoken language • Perform routine workplace duties following simple written notices • Participate in workplace meetings and discussions • Complete work related documents • Estimate, calculate and record routine workplace measures • Do basic mathematical processes of addition, subtraction, division and multiplication • relate to people of social range in the workplace • Gather and provide information in response to workplace Requirements
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Work in Team Environment**
Unit Code	**IND MAC2 10 0217**
Unit Descriptor	This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

Elements	Performance Criteria
1. Describe team role and scope	1.1. The ***role and objective of the team*** are identified from available ***sources of information***. 1.2. Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources.
2. Identify own role and responsibility within team	2.1. Individual role and responsibilities within the team environment are identified. 2.2. Roles and responsibility of other team members are identified and recognized. 2.3. Reporting relationships within team and external to team are identified.
3. Work as a team member	3.1. Effective and appropriate forms of communications are used and interactions undertaken with team members who contribute to known team activities and objectives. 3.2. Effective and appropriate contributions are made to complement team activities and objectives, based on individual skills and competencies and ***workplace context***. 3.3. Protocols are observed in reporting using standard operating procedures. 3.4. Contribution is made to the development of team work plans based on an understanding of team's role and objectives and individual competencies of the members.

Variable	Range
Role and objective of team	May include, but is not limited to: • Work activities in a team environment with enterprise or specific sector • Limited discretion, initiative and judgment maybe demonstrated on the job, either individually or in a team environment
Sources of information	May include, but is not limited to: • Standard operating and/or other workplace procedures • Job procedures • Machine/equipment manufacturer's specifications and instructions

	• Organizational or external personnel • Client/supplier instructions • Quality standards • OHS and environmental standards
Workplace context	May include, but is not limited to: • Work procedures and practices • Conditions of work environments • Legislation and industrial agreements • Standard work practice including the storage, safe handling and disposal of chemicals • Safety, environmental, housekeeping and quality guidelines

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Operate in a team to complete workplace activity • Work effectively with others • Convey information in written or oral form • Select and use appropriate workplace language • Follow designated work plan for the job • Report outcomes
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Communication process • Team structure • Team roles • Group planning and decision making
Underpinning Skills	Demonstrate skills to: • Communicate appropriately, consistent with the culture of the workplace
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Develop Business Practice**
Unit Code	**IND MAC2 11 0217**
Unit Descriptor	This unit covers knowledge, skills and attitude required to establish a business operation from a planned concept. It includes researching the feasibility of establishing a business operation, planning the setting up of the business, implementing the plan and reviewing operations once commenced, customer handling, developing and maintaining business relationships.

Elements	Performance Criteria
1. Identify business opportunities and business skills	1.1. The concept of paradigm shift and means of divergent thinking are elaborated and strategies to look beyond the boundaries are discussed. 1.2. ***Unusual business opportunities*** are identified. 1.3. Feasibility on ***business skills and personal attributes*** is assessed and matched against those perceived as necessary for a particular business opportunity. 1.4. New behavior on how problems can be the pivotal source of business opportunity is elaborated and experience taken. 1.5. Assistance sought with feasibility study of ***specialist and relevant parties*** is discussed, as required. 1.6. Impact of emerging or changing technology, including e-commerce, on business operations is evaluated. 1.7. Practicability of business opportunity is assessed in line with perceived ***business risks***, returns sought, personal preferences and resources available. 1.8. Business plan is revised in accordance with the identified opportunities.
2. Plan for the establishment of business operation	2.1. Organizational structure and operations are determined and documented. 2.2. Procedures are developed and documented to guide operations. 2.3. Financial backing is secured for business operation. 2.4. Business legal and regulatory requirements are identified and compiled. 2.5. ***Human and physical resources*** required to commence business operation are determined. 2.6. Recruitment and procurement strategies are developed.
3. Implement Business Development Plan	3.1. Physical and human resources are obtained to implement business operation.

	3.2. ***Operational unit*** is established to support and coordinate business operation. 3.3. Simulations on the development plan are well discussed and understood. 3.4. Implementation manual is discussed and understood. 3.5. Marketing the business operation is undertaken. 3.6. Monitoring process is developed and implemented for managing operation. 3.7. ***Legal documents*** are carefully maintained and relevant records kept and updated to ensure validity and accessibility. 3.8. Contractual procurement rights for goods and services including ***contracts with relevant people*** are negotiated and secured as required in accordance with the business plan. 3.9. Options for leasing/ownership of business premises are identified and contractual arrangements completed in accordance with the business plan.
4. Review implementation process and take corrective measures	4.1. Review process is developed and implemented for implementation of business operation. 4.2. Improvements in business operation and associated management process are identified. 4.3. Identified improvements are implemented and monitored for effectiveness.
5. Establish contact with customers and clarify needs of customer	5.1. Persuasion strategies are developed and discussed. 5.2. Welcoming customer environment is maintained and Customer is greeted warmly according to enterprise policies and procedures. 5.3. Information is provided to satisfy customer needs. 5.4. Information on customers and service history is gathered for analysis. 5.5. Customer data is maintained to ensure database relevance and currency. 5.6. Customer needs are accurately assessed against the products/services of the enterprise. 5.7. Customer details are documented clearly and accurately in required format. 5.8. Negotiations are conducted in a business-like and professional manner.

	5.9. Benefits for all parties are maximized in the ***negotiation through use of established techniques*** and in the context of establishing long term relationships. 5.10. The results of negotiations are communicated to appropriate colleagues and stakeholders within appropriate timeframes. 5.11. ***Opportunities to maintain regular contact*** with customers are identified and taken-up.
6. Develop and Maintain Business Relationship	6.1. Features and benefits of products/services provided by the enterprise are described/ recommended to meet customer needs. 6.2. Alternative sources of information/advice are discussed with the customer. 6.3. Information needed is pro-actively sought, reviewed and acted upon to maintain sound business relationships. 6.4. Agreements are honored within the scope of individual responsibility. 6.5. Adjustments to agreements are made in consultation with the customer and information shared with appropriate colleagues. 6.6. Relationships are nurtured through regular contact and use of effective interpersonal and communication styles.

Variable	Range
Unusual Business opportunities	May include, but is not limited to: • Public holidays • Ceremonies • Natural disaster • Campaigns
Business opportunities	May include, but is not limited to: • Expected financial viability • Skills of operator • Amount and types of finance available • Returns expected or required by owners • Likely return on investment • finance required • Lifestyle issues
Business skills and personal attributes	May include, but is not limited to: • Technical and/ or specialist skills • Managerial skills • Entrepreneurial skills • Taking calculated risk skills • Willingness to take calculated risks

	• Willingness to work under pressure
Specialist and relevant parties	May include, but is not limited to: • Chamber of commerce • Financial planners and financial institution representatives, business planning specialists and marketing specialists • Accountants • Lawyers and providers of legal advice • Government agencies • Industry/trade associations • Online gateways • Business brokers/business consultants
Business risks	May include, but is not limited to: • Occupational health and safety • Environmental risks • Relevant legislative requirements • Security of investment • Market competition • Security of premises/location • Supply and demand • Resources available
Human and physical resources	May include, but is not limited to: • Software and hardware • Office premises and equipment • Communications equipment • Specialist services through outsourcing, contracting and consultancy • Staff • Vehicles
Operational unit	May include but not limited to different departments, sections, teams, divisions, etc. staffed with required personnel and equipped to service and support business
Legal documents	May include, but is not limited to: • Partnership agreements, constitution documents, statutory books for companies (register of members, register of directors and minute books), certificate of Incorporation, franchise agreements and financial documentation, appropriate software for financial records • Occupational Health and Safety (OHS) • Recordkeeping including personnel, financial, taxation, and environmental
Contracts with relevant people	May include, but is not limited to: • business owners, suppliers, employees, agents, land owners, distributors, customers or any person with whom the business has, or seeks to have, a performance-based relationship
Negotiation techniques	May include, but is not limited to:

	• Identification of goals, limits • Clarification of needs of all parties • Listening and questioning • Non-verbal communication techniques • Appropriate language and situation • Bargaining • Developing options • Appropriate cultural behavior • Confirming agreements
Opportunities to maintain regular contact	to maintain regular contact with customers may include: • Informal social occasions • Ceremonies • Exhibitions • Industry functions • Association membership • Co-operative promotions • Program of regular telephone contact

Evidence Guide	
Critical Aspects of Competence	Demonstrates knowledge and skills in: • That a business operation has been planned and implemented from initial research of feasibility of the business and completion of the plan, through implementing the plan and commencing operations • The ability to evaluate the results of research and assess the likely viability and practicability of a business opportunity, taking into account the current business/market climate and resources available • Treating customers in a courteous and professional manner • Building and maintaining relationships to achieve successful business outcomes
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Paradigm shift • Unusual business opportunities • Feasibility study • Business structure • Federal and regional government legislative requirements affecting business operations, especially in regard to OHS, EEO, industrial relations and anti-discrimination • Procurement and recruitment strategy • Operational unit • Monitoring process • Business systems and operations • Relevant marketing, management, sales and financial concepts • Options for financing

	• Business premises and ownership • Lease • Methods for researching business opportunities • Methods of identifying relevant specialist services to complement the business • Advertising and promotion • Distribution and logistics • Terms and conditions in contractual agreement • Record keeping duties • Operational factors relating to the business (provision of professional services, products) • Customer need assessment • Source of information • Operational knowledge of enterprise policies and procedures in regard to: ➢ customer service ➢ dealing with difficult customers ➢ maintenance of customer databases ➢ allocated duties/responsibilities ➢ General knowledge of the range of enterprise merchandise and services, location of telephone extensions and departments/sections • Basic operational knowledge of industry/workplace codes of practice in relation to customer service • negotiation and communication techniques appropriate to negotiations that may be of significant commercial value
Underpinning Skills	Demonstrate skills of: • Hunting and exploiting unusual business opportunities • Interpreting legal requirements, company policies and procedures and immediate, day-to-day demands • Conducting feasibility study • Developing new behavior • Using technology • Marketing skills • Business planning skills • Entrepreneurial skills • Time management skills • Customer handling skills • Communication skills including questioning, clarifying, reporting, and giving and receiving constructive feedback • Technical and analytical skills to interpret business documents, reports and financial statements and projections • Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities • Problem solving skills to develop contingency plans • Using computers and software packages to record and

	manage data and to produce reports • Interpreting business information, numeracy skills for data analysis to aid research • Negotiation to conduct business activities • Research to identify a business opportunity and to conduct a feasibility study • Analytical skills to assess personal attributes and to identify business risks • Observation skills for identifying appropriate people, resources and to monitor work • Persuasion and networking skills • Welcoming customers • Information seeking skills to collect, organize and understand information related to collating and analyzing customer information to identify needs • Establishing diagnostic processes which identify and recommend improvements to customer service
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level II	
Unit Title	**Standardize and Sustain 3S**
Unit Code	**IND MAC2 12 0217**
Unit Descriptor	This unit of competence covers the knowledge, skills and attitudes required by worker to standardize and sustain 3S to his/her workplace. It covers responsibility for the day- to-day operations of the workplace and ensuring that continuous improvements of Kaizen elements are initiated and institutionalized.

Elements	Performance Criteria
1. Prepare for work.	1.1. Work instructions are used to determine job requirements, including method, material and equipment. 1.2. Job specifications are read and interpreted following working manual. 1.3. ***OHS requirements***, including dust and fume collection, breathing apparatus and eye and ear personal protection needs are observed throughout the work. 1.4. ***Safety equipment and tools*** are identified and checked for safe and effective operation. 1.5. ***Tools and equipment*** are prepared and used to implement 3S.
2. Standardize 3S.	2.1. Plan is prepared and used to standardize 3S activities. 2.2. ***Tools and techniques*** to standardize 3S are prepared and implemented based on ***relevant procedures***. 2.3. Checklists are followed for standardize activities and ***reported*** to ***relevant personnel***. 2.4. The workplace is kept to the specified standard. 2.5. Problems are avoided by standardizing activities.
3. Sustain 3S.	3.1. Plan is prepared and followed to standardize 3S activities. 3.2. ***Tools and techniques*** to sustain 3S are discussed, prepared and implemented based on relevant procedures. 3.3. Workplace is inspected regularly for compliance to specified standard and sustainability of 3S techniques. 3.4. Workplace is cleaned up after completion of job and before commencing next job or end of shift. 3.5. Situations are identified where compliance to standards is unlikely and actions specified in procedures are taken. 3.6. Improvements are recommended to lift the level of compliance in the workplace.

	3.7. Checklists are followed to sustain activities and report to relevant personnel. 3.8. Problems are avoided by sustaining activities.

Variable	Range
OHS requirements	May include, but is not limited to: • Are to be in accordance with legislation/ regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of firefighting equipment, enterprise first aid, hazard control and hazardous materials and substances. • Personal protective equipment is to include that prescribed under legislation/regulations/codes of practice and workplace policies and practices. • Safe operating procedures are to include, but are not limited to the conduct of operational risk assessment and treatments associated with workplace organization. • Emergency procedures related to this unit are to include but may not be limited to emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.
Safety equipment and tools	May include, but is not limited to: • Dust masks/goggles • Glove • Working cloth • First aid and safety shoes
Tools and equipment	May include, but is not limited to: • Paint • Hook • Sticker • Signboard • Nails • Shelves • Chip wood • Sponge • Broom • Pencil • Shadow board/ tools board
Tools and techniques	May include, but is not limited to: • 5S Job Cycle Charts • Visual 5S • The Five Minute 5S • Standardization level checklist • 5S checklist • The five Whys and one How approach(5W1H)

	• Suspension • Incorporation and Use Elimination
Relevant procedures	May include, but is not limited to: • Assign 3S responsibilities • Integrate 3S duties into regular work duties • Check on 3S maintenance level • OHS measures such as signage, symbols / coding and labeling of workplace and equipment • Creating conditions to sustain your plans • Roles in implementation
Reporting	May include, but is not limited to: • Verbal responses • Data entry into enterprise database • Brief written reports using enterprise report formats
Relevant personnel	May include, but is not limited to: • Supervisors, managers and quality managers • Administrative, laboratory and production personnel • Internal/external contractors, customers and suppliers
Tools and techniques	May include, but is not limited to: • 5S slogans • 5S posters • 5S photo exhibits and storyboards • 5S newsletter • 5S maps • 5S pocket manuals • 5S department/benchmarking tours • 5S months • 5S audit • Awarding system • Big cleaning day • Patrolling system may include: ➢ Top management Patrol ➢ 5S Committee members and Promotion office Patrol ➢ Mutual patrol ➢ Self-patrol ➢ Checklist and Camera patrols

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Discuss the relationship between Kaizen elements. • Standardize and sustain 3S activities by applying appropriate tools and techniques.
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Elements of Kaizen • Ways to improve Kaizen elements • Benefits of improving kaizen elements

	• Relationship between Kaizen elements • The fourth pillar of 5S • Benefits of standardizing and sustaining 3S • Procedures for standardizing and sustaining 3S activities • Tools and techniques to sustain 3S • Relevant Occupational Health and Safety (OHS) and environment requirements • Plan and report • Method of communication
Underpinning Skills	Demonstrates skills of: • Improving Kaizen elements by applying 5S • Standardizing and sustaining procedures and techniques to avoid problems • Technical drawing • Procedures to standardizing 3S activities • Analyzing and preparing shop layout of the workplace • Standardizing and sustaining checklists • Preparing and implementing tools and techniques to sustain 3S • Working with others • Reading and interpreting documents • Observing situations • Solving problems by applying 5S • Communication skills • Preparing labels, slogans, etc. • Gathering evidence by using different means • Using Kaizen board properly in accordance the procedure • Reporting activities and results using report formats
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

NTQF Level III

Occupational Standard: Machining Level III	
Unit Title	**Perform Advanced Engineering Detail Drafting Using CAD**
Unit Code	**IND MAC3 01 0217**
Unit Descriptor	This unit covers competence in producing drawings components complete with surface texture and dimensions using manual drafting and CAD system. Drawing components may include assembly, layout and detail drawings.

Elements	Performance Criteria
1. Determine drawing requirements	1.1. Requirements and purpose of ***drawing*** are checked and interpreted from work order, from workshop manuals, customer specifications, product suppliers, and designers
2. Prepare assembly, lay- out and detail drawing	2.1. All drawing details and specifications are determined and inserted to ensure functional operation and suitability with accordance to standard. 2.2. Drawing, including auxiliary views, sections and assemblies in ISO first and third angle projection are produced by using manual ***instruments*** and ***CAD*** 2.3. Components, standard parts, material and/or assemblies are selected from data sheets or manufacturers' catalogues to meet specifications.
3. Quality assure drawing	3.1. Drawings are checked to ensure compliance with ***geometric tolerances*** and specifications. 3.2. Drawings are checked to ensure that ***limits and fits*** assembly/fabrication is made possible based on applied standards 3.3. Drawings are issued, filed and stored according ***ISO standard*** to workplace systems and procedures.

Variables	Range
Drawing	May include, but not limited to: • Assembly drawing • Lay-outdrawing • Detail drawing • Component drawing
Instruments	May include, but not limited to: • T- square • Protractor's • Drawing board • Pencil • Ruler etc
CAD	May include, but not limited to: • Computer Aided Design Systems

Geometric tolerances	May include, but not limited to: • Parallelism • Perpendicularity, • Concentricity • Squareness • Run out • Flatness • Circularity
Limits and fits	May include, but not limited to: • Shaft basis system • Hole basis system
ISO standard	May include, but not limited to: • European and American standard or equivalent and its application
Appropriate symbols	May include, but not limited to: • Perpendicular • Finish • Parallel • Diameter

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Prepared assembly, lay-out and detail drawing complete with surface texture, tolerances and dimensions • Produced drawings in third angle projection including auxiliary views, sections and assemblies • Produced drawing using CAD system
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Standard engineering drawing symbols, references and terminology • Projection and projection lines • Arrangements and designs/lay-out • General tolerance, limits and fits • Shaft and hole basis • Extremes off it • Surface texture • Geometric tolerances (no datum references, flatness, roundness etc. And with datum reference e.g. Parallel squareness) • CAD system and its application • Specifications and/or requirements of the component, assembly or layout to be drawn • Functional operation of the component/assembly to be drawn • Surfaces which are to be in contact or separated • Appropriate type of fit for contacting surfaces • Reasons for selecting the chosen type of fit

	• Effect of surface finish on the performance/operation of surfaces • Appropriate datum points • All appropriate lineal, diametric and geometric tolerances • Procedures for determining tolerances including numerical operations, geometry and calculations/formulae within the scope of this unit • Requirements of ISO standards or equivalent for the drawing(s) to be produced • Specifications of the components, materials and/or assemblies • Appropriate components and materials from supplier/manufacturers' catalogues • Reasons for selecting the chosen components and/or materials • Procedures for checking and approving drawings • Drawing specifications • Methods of manufacture/assembly/fabrication from the drawing(s) • Safe work practices and procedures
Underpinning Skills	Demonstrates skills of: • Producing drawings in accordance with acceptable standard and required specifications • Checking drawings for conformance to specification • Checking drawings to ensure that assembly/fabrication is possible • Reading, interpreting and following information on written job instructions, specifications, standard operating procedures • Using CAD system
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Perform Basic CAD/CAM Applications**
Unit Code	**IND MAC3 02 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to link designed basic CAD 2D and 3D parts with programmed CAM/ CNC machining processes.

Elements	Performance Criteria
1. Determine job requirements	1.1. Requirements and purpose of part are checked and interpreted ***drawing*** from work order, from workshop manuals, customer specifications, product suppliers, and designers
2. Design detailed part drawing	2.1. All drawing details and specifications are determined and inserted, which includes ***limits and fits***, surface texture, datum references and ***geometric tolerances*** to ensure functional operation and suitability according to standard 2.2. Two-dimensional ***Computer Aided/Automated Design (CAD)*** blueprint of the part is reviewed for CAM application in compliance with standards
3.Translate CAD in CNC machine program	3.1. Coordinates are calculated for simple tool path machining functions based on drafted part to be produced 3.2. Tools and materials for the job are selected and the sequence of cutting and finishing operations are planned based on operational procedures 3.3. Program is written into a standardized Computer Aided/Automated Manufacturing (CAM) code / process 3.4. Program is simulated and edited according to standard operating procedure 3.5. Program is downloaded and stored according to standard operating procedures.
4. Perform appropriate CAM / CNC operations	4.1. Tools are set and part is mounted or set in accordance with standard operating procedures 4.2. Dry run is performed in accordance with the desired tool path movement 4.3. CAM/CNC operations are performed to produce part according to CAD drawing specifications 4.4. Corrective measures/adjustments are performed if necessary based on operational procedures 4.5. Occupational health and safety procedures and environmental guidelines are observed throughout the operation

5. Comply with quality assurance	5.1. Program must be changed if errors are found and retested until program is effective based on operational procedures 5.2. Designed part is checked and measured in conformance to specification and quality outcomes 5.3. Appropriate methods, measuring tools and equipment are utilized in accordance with standard

Variables	**Range**
Drawing	May include, but not limited to: • Assembly drawing • Lay-outdrawing • Detail drawing • Component drawing
Limits and fits	May include, but not limited to: • Shaft basis system • Hole basis system
Geometric tolerances	May include, but not limited to: • Parallelism • Perpendicularity, • Concentricity • Squareness • Run out • Flatness • Circularity
CAD	May include, but not limited to: • Computer Aided Design Systems
ISO standard	May include, but not limited to: • European and American standard or equivalent and its application
Appropriate symbols	May include, but not limited to: • Perpendicular • Finish • Parallel and Diameter

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Prepared detail drawing complete with surface texture, tolerances and dimensions • Produced drawing using CAD system and manual drafting • Conducted pre-start checks • Set machine • Instructed the operator
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • CAD / CAM system and its application • Specifications and/or requirements of the part to be drawn

	• Effect of surface finish on the performance/operation of surfaces • Appropriate datum points • All appropriate lineal, diametric and geometric tolerances • Procedures for determining tolerances including numerical operations, geometry and calculations/formulae within the scope of this unit • Requirements of ISO standards or equivalent for the drawing(s) to be produced • Drawing specifications • Methods of manufacture from the drawing • Work holding fixtures/devices/tools and preset tooling for different machining • Reasons for establishing tool offsets • The purpose of datum settings • Source(s) of information on tool offsets and datum settings • Procedures to program and load programs • Procedures for verifying loaded programs • Pre-start checks • Machine setting and operating procedures • Product or part specifications in relation to the machining process • measuring devices for checking parts or products • effects of worn or damaged tooling • corrective action for worn or damaged tooling • Risks and control measures associated with numerical and computer controlled machines, including housekeeping • safe work practices and procedures
Underpinning Skills	Demonstrates skill in: • Reading, interpreting and following information on written job instructions, specifications, standard operating procedures • Producing drawings in accordance with acceptable standard and required specifications by using CAD/CAM system • Planning and sequencing operations • Checking and clarifying task related information • Loading and verifying programs • Conducting pre-start checks • Following and checking safety features and safety equipment for correct operation • Performing numerical operations and calculations/formulae within the scope of this unit • Setting and adjusting machines • Measuring and verifying first-off samples • Instructing machine operators on the sequence of operations • Identifying worn or damaged tooling and taking appropriate corrective action

Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Perform Advanced Lathe CNC Operations**
Unit Code	**IND MAC3 03 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to perform advanced CNC lathe machining operations which includes programming and set up.

Elements	Performance Criteria
1. Determine job requirements	1.1. Drawings are interpreted to produce component to specifications. 1.2. Sequence of operation is determined to produce component according to specification. 1.3. Cutting tools, ***instruments*** and machine ***accessories*** are selected according to the requirements of the operation. 1.4. Cutting ***speed and feeds*** rate are calculated based on work- piece and cutting tool material specifications 1.5. Process/job/adjustment sheets are filled up with relevant machine, tool and raw material data due to standard
2. Prepare CNC lathe machining process / Write program	2.1. Coordinates are calculated for simple tool path machining functions based on part or product to be produced. 2.2. Program is written in standard ***CNC lathe operations***, code format and in accordance with standard operating procedures. 2.3. Program is simulated and edited according to standard operating procedures. 2.4. Program is documented and saved to the machine according to standard operating procedures. 2.5. Program is downloaded to the machine according to standard operating procedures .
3. Perform appropriate Lathe operations	3.1. Work-piece is mounted or set in accordance with standard operating procedures. 3.2. Dry run is performed in accordance with the desired tool path movement. 3.3. ***Advance CNC lathe operations*** are performed to produce component according to drawing specifications. 3.4. ***Corrective measures/adjustments*** are performed if necessary due to standard 3.5. Occupational health and safety are observed throughout the operation

4. Comply with Quality assurance	4.1. Components are checked for conformance to specification using appropriate techniques and procedures. 4.2. Deviations are handled appropriately in accordance with organization procedures and standard 4.3. Product quality of the CNC production is compared with conventional production.

Variables	**Range**
Instruments	May include, but is not limited to: • Vernier calipers • Micrometer • Gauges (telescopic gauge, thread pitch gauges, radius gauge, bore gauge, center gauge, depth gauge, pingauge) • Dial indicator • Digital read-out equipment
Accessories	May include, but is not limited to: • Three and four jaw chucks, dead centers, live center face plate, drive plate and lathe dog, steady and follower rests, and tailstock
Speeds and feeds	May include, but is not limited to: • Setting up machine, changing gears and speeds, manual or using command.
CNC Lathe Operations	May include, but is not limited to: • Facing • turning • Cutting recess, shoulders, grooves, fillets and chamfers, drilling, boring, tapper thread , • Thread cutting • Parting-off • Bar feeding
Advanced CNC lathe operations Includes	May include, but is not limited to: • automatic parallel and taper turning, internal and external turning including boring drilling, reaming, thread cutting, eccentric turning, parting off, profile turning
Corrective measures /adjustments	May include, but is not limited to: • Replacement of cutting tools • Adjustment of tool offset • Adjustment of cutting speed and federate

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Turned work-piece • Checked and measured work-piece • Programming and setup

Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Shop safety practices may include: ➢ Safe working habits ➢ Identification of hazardous areas ➢ Protective clothing and devices ➢ Safe handling of tools, equipment and materials ➢ Housekeeping ➢ First-aid ➢ Fire extinguishers • Drawing interpretation may include: ➢ Standard drawing scales, symbols and abbreviations ➢ Orthographic and isometric drawings ➢ 1st and 3rd angle projections ➢ Assembly and detail drawings ➢ Interpreting tolerances, limits and fits ➢ Surface finish • Shop mathematics may include: ➢ Basic arithmetic operations ➢ Fractions and decimals ➢ Percentages and ratios ➢ Conversion of units (English to metric) ➢ Trigonometric functions ➢ Pythagorean theorem • Measurements may include: ➢ Linear measuring tools (vernier,micrometer) ➢ Precision angular measuring tools ➢ (Vernier bevel protractor) ➢ Geometrical tolerances measuring tools ➢ (dial test indicator, radius gauge, vernier height gauge, 2 pt. bore gauge, 3 pt. bore gauge) ➢ Dial indicator • Materials and related science may include: ➢ Classification and mechanical properties of engineering materials • CNC Lathe machine operations may include: ➢ Lathe types and specifications ➢ Lathe parts and functions ➢ Setting cutting speed, rpm, feed ➢ Work-holding and tool holding devices ➢ Tool offset and tool geometry ➢ Tool set up in turning operations • Lathe accessories, fixtures and attachments
Underpinning Skills	Demonstrates skills to: • Selection of cutting tools • Using measuring instruments • Determining work-piece specifications • Computation of feed, cutting speed and machine rpm

	• Preparatory function G – codes • Miscellaneous function M-code • User address • Setup of CNC Lathe Machine • Simulate program • Perform Dry run • DNC controlee • Perform machining operations • Adjust tool parameters • Application of bar feeder(optional) • Using of profile projector(optional)
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Perform Advanced CNC Milling Operations**
Unit Code	**IND MAC3 04 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to perform advanced CNC milling operations conforming to the required specifications.

Elements	Performance Criteria
1. Determine job requirements	1.1. Drawings are interpreted to produce component to specifications. 1.2. Sequence of operation is determined to produce component according to specification. 1.3. Cutting tools are selected according to the requirements of the operation. 1.4. Cutting speed and feed rate are calculated based on work piece and cutting tool material standard 1.5. Process/job/adjustment sheets are filled up with relevant machine, tool and raw material data according to machine standard.
2. Write or load CNC milling machine program	2.1. Coordinates are calculated for simple and advanced tool path machining functions based on part or product to be produced in accordance with standard 2.2. Program is written in standard CNC milling operation code format and in accordance with standard operating 2D and 3D.procedures 2.3. Program is simulated and edited according to standard operating procedures. 2.4. Program is documented and saved to the machine according to standard operating procedures. 2.5. Program is downloaded to the machine according to standard operating procedures (if required).
3. Perform milling operations	3.1. Work piece is mounted or set in accordance with standard operating procedures 3.2. Machine zero and work zero are performed in accordance the standard 3.3. Dry run is performed in accordance with the desired tool path movement 3.4. DNC is performed in accordance with product type 3.5. ***CNC milling operations*** are performed to produce component according to drawing specifications 3.6. ***Corrective measures/adjustments*** are performed if necessary based on operational procedures

	3.7. Safety procedures and environmental protection are observed during machining operation 3.8. Personal protective devices are used in accordance with Occupational Health and Safety (OHS) requirements throughout the process.
4. Comply with Quality assurance	4.1. Work piece is checked and measured in conformance to specification and quality output 4.2. Appropriate methods, ***measuring tools*** and equipment are utilized throughout the operation with compliance to standards. 4.3. Defective work pieces are marked, recorded and reported for proper action based on operational requirements 4.4. compare product quality of the CNC production with conventional production.

Variables	**Range**
CNC milling operations	May include, but is not limited to: • face milling • cutting shoulders, grooves, fillets and chamfers, drilling, boring • a variety of cutters including angle, gang, end, shell, slot, form, slitting, core, cavity
Corrective measures /adjustments	May include, but is not limited to: • Replacement of cutting tools • Adjustment of tool offset • Adjustment of cutting speed and federate
Measuring tools	May include, but is not limited to: • Vernier caliper (Digital or readout) • Micrometer (Digital or readout) • Gages (thread, drill, surface comparator / roughness tester, radius, screw pitch, taper)
Cutting parameter	May include, but is not limited to setting up machine, feed and speed calculations

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • milled work piece • checked and measured work piece • input program • set-up machine
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Shop safety practices may include: ➢ Safe working habits ➢ Identification of hazardous areas ➢ Protective clothing and devices

	➢ Safe handling of tools, equipment and materials ➢ Housekeeping ➢ First-aid ➢ Fire extinguishers • Drawing interpretation may include: ➢ Standard drawing scales, symbols and abbreviations ➢ Orthographic and isometric drawings ➢ 1st and 3rd angle projections ➢ Assembly and detail drawings ➢ Interpreting tolerances, limits and fits ➢ Surface finish • Shop mathematics may include: ➢ Basic arithmetic operations ➢ Fractions and decimals ➢ Percentages and ratios ➢ Conversion of units (English tometric) ➢ Trigonometric functions ➢ Pythagorean theorem • Measurements may include: ➢ Linear measuring tools (vernier, micrometer) ➢ Precision angular measuring tools ➢ (Vernier bevel protractor) ➢ Geometrical tolerances measuring tools ➢ (dial test indicator, radius gauge, vernier height gauge, 2 pt. bore gauge, 3 pt. bore gauge) ➢ Dial indicator • Materials and related science may include: ➢ Classification and mechanical properties of engineering materials • CNC Milling machine operations may include: ➢ Milling types and specifications ➢ Milling parts and functions ➢ Setting cutting speed, rpm, feed ➢ Work-holding and tool holding devices ➢ Tool offset and tool geometry • Tool set up in milling operations may include: ➢ Milling Machine accessories, fixtures and attachments
Underpinning Skills	Demonstrates skills to: • Selection of cutting tools • Use of measuring instruments • Determining work-piece specifications • Computation of feed, cutting speed and machine rpm • Preparatory function G – codes • Miscellaneous function M - code • User address • Setup of CNC Milling Machine • Simulate program

	• Perform Dry run • Perform DNC operation • Perform machining operations • Adjust tool parameters • Using of profile projector(optional)
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Perform Advanced Grinding Operations**
Unit Code	**IND MAC3 05 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to perform advanced grinding operations conforming to the required specifications.

Elements	Performance Criteria
1. Set up work	1.1. Job requirements and sequence of operations are determined based on ***specifications***
	1.2. Correct and appropriate ***work holding devices*** are selected and applied according to ***machine*** type.
	1.3. ***Grinding wheels*** are selected by its type, form and size, checked if it has cracked or not, balanced and dressed with compliance to standard.
	1.4. Accessories are selected to facilitate production in accordance with task specifications.
2. Perform advanced grinding operations	2.1. Grinding machine is set up and adjusted in accordance with defined procedures.
	2.2. Grinding operations are performed safely, following all guards, safety procedures and personal protective clothing and equipment due to standard
	2.3. Specialized grinding operations are performed following the standards
	2.4. OHS measures and procedures are observed throughout the machining operations
3. Check components for conformance to specifications	3.1. Components are checked for conformance to specification using appropriate techniques, tools and equipment
	3.2. Required grade of tolerance is determined based on working drawing

Variables	Range
Specifications	May include, but not limited to: • Dimensions, tolerances and surface finish
Work holding devices	May include, but not limited to: • Vices, clamps, magnetic chucks, face plates, collets, 3/4 jaw chucked.
Machine	May include, but not limited to: • Surface, cylindrical and center less machines
Grinding	May include, but not limited to: • Die and tools • Blades

	• Jig grinding, • Grinding eccentrics, • Thread grinding, • Gauges, • Shapes and forms.
Grinding wheels	May include, but not limited to: • Wheel selection criteria includes shape and grit/bond composition

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of competence to: • Determined job requirements • Setup the work piece • Performed grinding operations • Checked conformance with specifications
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Safety hazards associated with grinding machines and sequence of operations • Application of a range of holding devices/accessories • Specific clamping and work holding devices • Coolant selection/function • Standard grinding wheel shapes • Range of abrasive materials • Factors impacting grinding wheel selection including Grain size of abrasive particles; grade or strength of Bond; and bond material • Grinding operations/procedures • Function of any grinding accessories • Application of tools, techniques and equipment • Components for conformance to specifications • Risks and control measures associated with grinding • Application of personal protective equipment safe work practices and procedures • Read and interpret drawings , machining tolerances, basic metrology and bench work
Underpinning Skills	Demonstrate skills to: • Read and interpret drawings and machining tolerances • Select grinding wheels • Dress grinding wheel to form and size • Balance grinding wheels • Check grinding wheels • Set-up grinding machines • Carry-out surface grinding • Perform cylindrical grinding • Perform center less grinding • Test conformance to specifications

	• Work with precision measurement equipment • Measure components to specified tolerances • Perform numerical operations, geometry and calculations/formulae for advanced grinding operations
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Perform EDM Plunger and Wire Operations**
Unit Code	**IND MAC3 06 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to perform advanced EDM Plunger and Wire program, operation conforming to the required specifications.

Elements	Performance Criteria
1. Determine work requirements	1.1. Drawings are interpreted, and sequence of operations is determined with accordance to standard 1.2. Correct electrode is selected to ensure finished component conforms to drawing specifications. 1.3. Electrode surface area is calculated and process parameters are set to give safe, accurate and efficient operation 1.4. Comprehensive OHS procedures are observed
2. Prepare EDM machining operations	2.1. Accessories and work-holding fixtures are installed to ensure required position is obtained due to standard 2.2. Machine and ***work piece*** is aligned to specified datum points in accordance with worksite standard procedures 2.3. Program 2D elements and machine code functions are defined to meet specifications
3. Perform electro-discharge machining (EDM)	3.1. Electro-discharge machine is operated to produce components to drawing specifications 3.2. Machine is cleaned and waste material disposed of in accordance with worksite procedures.
4. Check components for conformance to specification	4.1. Components are checked using appropriate techniques, ***tools*** and equipment with conformance to specification 4.2. Measurements are recorded in accordance with worksite procedures.

Variables	Range
Work piece	May include, but is not limited to: • Correct use of work holding devices and selection of EDM fluids, spark generation, cycle time, power settings, and dielectric fluids for the requirement of a particular job
Tools	May include, but is not limited to: • Includes all types and grades of graphite electrodes • Wire electrode material
CNC programming	May include, but is not limited to: • Simulator or on machine tool
Parameters settings	May include, but is not limited to: • Power settings

	• Surface finish • Metal removal rate • Work piece material • Electrode material and wear • Selection of DI-electric • Flushing rate and method • Spark gap • Depth to be machined • Fed rate and Wire speed

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Determine work requirements • Prepare EDM machining operations • Perform Electro-Discharge Machining (EDM) • Check components for conformance to specification
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Safety hazards associated with the use of electro-discharge machines • The job requirements • The sequence of operations to achieve the job requirements • The electrode type and geometry required to achieve the specified outcome • The effects of material to be machined on the electrode material and geometry • The procedures for producing electrodes for the electro-discharge machining process • The coordinates of the feature(s) to be machined • The coordinates of the electrode relative to the machine datum • The procedures for operating the electro-discharge machine to produce components • The tools, techniques and equipment appropriate to the checking of machined components • The procedures for checking machined components for conformance to specification • The reasons for selecting the tools, techniques and equipment to be used
Underpinning Skills	Demonstrates skills in: • Following relevant safety procedures • Obtaining and interpreting relevant drawings, job instructions and specifications • Selecting correct electrode to ensure that the finished product conforms to specification • Determining the coordinates of the work pieces relative to the machine datum

	• Calculating machining parameters necessary to achieve the safe, accurate and efficient machining of the work piece • Calculating the surface area of the electrode \ • Positioning work piece and electrode to enable the safe, accurate and efficient machining of the required feature(s) • Producing components to specification
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Perform Advanced Press Operations**
Unit Code	**IND MAC3 07 0217**
Unit Descriptor	This unit covers competence required in performing advanced press operations, recognizing and rectifying deviations and faults in the product/ output, raw material or feed stock, tooling and machine/process.

Elements	Performance Criteria
1. Determine work requirements	1.1. Drawings, work instructions and specifications are interpreted and task is understood including press machine/process selection and settings due to requirements 1.2. Tools and equipment are identified according to press requirements.
2. Prepare and perform press machine for operation	2.1. Pre-start checks are undertaken to standard operating procedures 2.2. Safety equipment and guards are checked for correct position and operation based on regulations 2.3. Equipment, raw material and tooling are verified and set up to match task requirement 2.4. Machine/process is operated in accordance with job instructions or standard operating procedures. 2.5. Machine/process output is handled and stored in a manner not likely to cause damage, based on requirements 2.6. Production data is recorded to standard operating procedures
3. Monitor machine/process	3.1. Machine/***work processes*** are monitored for safe and correct operation 3.2. Emergency procedures are understood and followed in accordance with standard operating procedures
4. Assure quality outcomes	4.1. Product and material ***faults/deviations*** are recognized and rectified in accordance with all standard operating procedures 4.2. Workplace problems are promptly identified and considered from an operational and customer service perspective 4.3. Product end control is pursued against standards and specification and documented

Variables	Range
Work processes	May include, but is not limited to: • Drawing

	• Blanking • Bending • Coining • Sizing • Extruding, • Forming • Shaping
Faults and deviations	May include, but not limited to: • Deviations and faults of the machine, raw material, process equipment and process: • Splits, warping, deformation, dimensional errors, etc. • Gauge variation, hardness, colour variation etc. • Marks, missing detail, dimensional errors, etc. • Distortion

Evidence Guide	
Critical Aspects of Competence	Assessment must confirm appropriate knowledge and skills to: • Ability to effectively set up press operation process , monitor and respond to a range of common operational and service issues in the workplace • Be capable of applying the competency in new and different situations and contexts
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Job requirements • Pre-start checks • Machine/process start-up and unloading procedures • Types of product, process, tooling and machine faults/deviations and corrective actions • Consequences of selecting incorrect processes for nominated materials • Programmed operational maintenance requirements • Roles and responsibilities in monitoring work operations • Hazards and control measures associated with advanced press operations • Procedures to be followed in emergency situation • Documentation requirements • Quality assurance, principles of workflow, planning and problem solving
Underpinning Skills	Demonstrate skills in: • Planning and organizing workflow • Following work / process instructions • Checking and clarifying task-related information • Undertaking manual handling • Determining required adjustments to process • Identifying and rectifying faults/deviations in product, process, tooling and machine

	• Monitoring and improving workplace operations • Maintaining workplace records
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Manufacture Jigs and Fixtures**
Unit Code	**IND MAC3 08 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in manufacturing jigs and fixtures using standard and CNC machines, and hand tools. It includes assembly of its component and fittings.

Elements	Performance Criteria
1. Determine and prepare job requirements	1.1. Jigs and fixture requirements are determined ***type and design*** from customer's components drawings, prints or sample component 1.2. Jigs and fixtures design is interpreted and visualized from type Jigs/fixtures drawings, prints or plan and checked against customer requirements 1.3. Machine tool to be used to produce components is assessed and considered in jigs and fixtures design based on standards 1.4. Selected machine tool mounting requirements are determined to ensure any special or additional provisions are incorporated in jigs and fixtures design due to specifications
2. Select materials	2.1. Appropriate materials are selected and obtained to meet jigs and fixtures requirements 2.2. ***Selected materials*** are tested for hardness according to specifications 2.3. Plan is developed to sequence and stage manufacturing process
3. Produce and assemble components	3.1. ***Appropriate machines*** and machining process are selected based on a range of standard/special tool room machines. 3.2. Appropriate hand tools and hand held power tools are selected and used to manufacture jig and fixture components to specification. 3.3. Where practical, prototype or section is produced for testing based on specifications 3.4. Standardized jigs and fixture components are selected based on working drawing 3.5. Occupational health and safety procedures and environmental protection guidelines are observed throughout the process
4. Assure quality prototype	4.1. First-off components are measured and tested against specification.

	4.2. Jigs and fixture are modified if necessary to produce components to specification. 4.3. Modified jigs and fixture are re-tested and component produced due to requirements 4.4. Conformance to specification is verified and reported according to standard operating procedures. 4.5. All deviations or modifications to original jigs and fixture design, prints or plans are recorded and reported, where necessary according to standard operating procedures.
5. Work clean up	5.1. Extant materials are disposed of or recycled in accordance with workplace procedures 5.2. Work area , tools and equipment are cleaned, checked, maintained and stored in accordance with manufacturers' recommendations and workplace procedures 5.3. Documentation is completed in accordance with work place requirements

Variables	**Range**
Type and design	May include, but is not limited to: • Simple and intermediate jigs and fixture design • Simple and compound jig and fixture
Selected materials	May include, but is not limited to: • Ferrous material • Non-ferrous material
Appropriate machines	May include, but is not limited to: • Lathe, milling, grinding, boring, etc.
Hand and power tools	May include, but is not limited to: • Portable grinder and die grinder • Portable drill • Files, hacksaw, hammers, punch

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Determined and prepared work requirements • Selected material for jigs and fixture • Performed appropriate machining operations • Assembled tooling components • Trial tooling
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Type of jig and fixture to be manufactured • Machine(s) in which the jigs and fixtures is to be used • Jig and fixture design concept in terms of customer specifications and proposed production machine(s) • Method of mounting the jig and fixture in the machine tool

	• Basic metallurgy inclusive hardness test, basic metrology ,basic machine drawing, basic electricity – electronics, basic hydraulic systems, bench work, drilling operations, power hack saw operations, machine elements and arc welding technology • Hand and hand held power tools procedures for fitting/assembling jig &fixture components • Precautions to be taken when fitting/assembling jig and fixtures components • Specifications of the finished product • Procedures for reporting the conformance of the component/product produced or modified in accordance with the jig and fixture specifications • Risks and control measures associated with the manufacture of jig and fixture and gauges • Safe work practices and procedures • Appropriate testing instruments for checking the components produced
Underpinning Skills	Demonstrates skills of: • Reading and interpreting drawings and machining tolerances, • Lathe operation • Milling operation • Grinding operation • Boring operation • Fitting • Bench work which includes cutting, filling, drilling, reaming, threading etc.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Manufacture Press Tools and Die**
Unit Code	**IND MAC3 09 0217**
Unit Descriptor	This unit covers the knowledge, attitudes, and skills required to manufacture press tools and die. It includes assembly and test of manufactured tooling and components.

Elements	Performance Criteria
1. Determine and prepare job requirements	1.1. Tool and die requirements are determined from customer's components drawings, prints or sample component. 1.2. Tool and die type and design are conceptualized and planned with reference to customer's specifications 1.3. production machines to be used to produce the components are assessed considering ***tool and die design*** based on applied standards 1.4. Tool and die design is interpreted and visualized from drawings, prints or plan and checked against customer requirements.
2. Select materials	2.1. ***Appropriate materials*** are selected and obtained to meet tool and die requirements due to standards 2.2. Comprehensive plan is developed to sequence and to perform manufacturing process requirements
3. Manufacture components	3.1. ***Appropriate machines*** and processes are selected based on required operation 3.2. Machining operations are performed to produce component in accordance with specifications 3.3. Appropriate hand tools are used to manufacture ***tooling components*** to specification 3.4. Occupational health and safety procedures are observed throughout the manufacturing process
4. Assemble components	4.1. Tooling components are checked, fitted/assembled using acceptable tool making techniques and procedures to specifications.
5. Assure quality prototype	5.1. First-off prototype is tested against all specification. 5.2. Prototype is modified and tested ***Hand tools and hand held power tools*** if necessary to produce components to specification 5.3. Where necessary all deviations or modifications to original tooling design, prints or plans are recorded and reported according to standard operating procedures.

Variables	Range
Tool and Die design	May include, but is not limited to: • Tool and die design • Single die • Compound die • progressive die
Appropriate materials	May include, but is not limited to: • Ferrous materials • Non-ferrous materials
Appropriate machines	May include, but is not limited to: • Milling Machine • Lathe Machine • Surface grinder • Cylindrical grinder • Tool and cutter grinder • CNC Lathe machine • CNC Milling machine • CNC EDM machine • Press machine • Special purpose machines
Tooling components	May include, but is not limited to: • Punch • Die • Die holder and punch holder • Stripper and strip guide • Upper bolster and lower bolster • Pillar • Bushing • shank • Die set • Ejection mechanism • Feeding mechanism
Hand tools and hand held power tools	May include, but is not limited to: • Portable grinder and die grinder • Portable polishing machine • Portable drill • Files, Hacksaw, Hammers, punch, etc. • Filer and pin gauge

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Determined and prepared job requirements • Selected appropriate material for press tool • Performed appropriate machining operations • Assembled tooling components • Test tool

Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Interpret manual and CAM programming • The type of tooling to be manufactured • The machine(s) in which the tooling is to be used • The tooling design concept in terms of customer specifications and proposed production machine(s) • The performance requirements of the tooling • The appropriate materials for each component of the tooling to be produced • The effect of material hardness on machinability of the material • The appropriate tools to be used to manufacture tooling components • The procedures for documenting plans for the manufacture of tooling • Procedures for fitting/assembling the tooling components • The specifications of the finished product • Causes of any non-conformance to specification • Procedures for reporting/recording the conformance or modifications of the component/product produced by the tooling to specifications • Risks and control measures associated with the manufacture of tools and gauges, including housekeeping • Safe work practices and procedures
Underpinning Skills	Demonstrates skills to: • Interpret manual and CAD drawings and CAM • Prepare sequential plan for the manufacture of the required tooling • Test tooling material for hardness • Work with hand tools and hand held power tools • Perform all relevant machining operations • Assemble and fit tooling components • Specify tool parts using all relevant measuring techniques • Record modifications or alterations to original tooling design
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/ Written Test • Observation/ Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Perform Fitting and Assembly**
Unit Code	**IND MAC3 10 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in the fitting and assembly of blanking and piercing dies, bending dies and progressive dies (limited to 2-starion), injection moulds, blow moulds and vulcanizing moulds.

Elements	Performance Criteria
1. Determine die parts to be fitted with one another	1.1. Assembly drawings are interpreted to determine which part to be fitted with another part based on standards 1.2. ***Fitting tools and equipment*** are identified according to fitting requirements.
2. Fit die and mould parts	2.1. Die and mould holes are manufactured to template size and required angle clearance 2.2. Stripper plate openings are fitted with die according to work specification 2.3. Cavity and core holding plates are fitted with cavities according to work specification 2.4. Core cavity holder plates are fitted to bottom bolster plate according to work specification 2.5. Stripping/ejection mechanism fitted according to work specification
3. Machine assembly holes	3.1. Die base is assembled to bottom bolster according to work procedure. 3.2. Punch plate or punch pedestal is drilled for mounting to punch holder according to work procedure 3.3. Stripper plate, core and cavity holder plates die and punch plate and guide pin holes are drilled and tapped according to work procedure. 3.4. Drilling operations of screw holes are done according work procedure
4. Assemble die and mould	4.1. All parts are assembled as required following standard procedures and operational set ups
5. Comply with Quality Assurance	5.1. Die/mould is tested for alignment and adjustment made according to found errors and as per work procedure 5.2. Work area, inclusive tools and equipment are cleared and materials disposed of or recycled in accordance with workplace procedures. 5.3. Documentation is completed in accordance with workplace requirements.

Variables	Range
Fitting tools and equipment	May include, but not limited to: • Set of files • Vise with soft jaws • Transfer screws • Transfer punches • Angle plate • Vernier height gage • Center punch • Parallel clamps • Set of twist drills • Hand taps • Counter bore • Portable electric drill • Parallel set • Reamers • Allen wrench • Scribers • Shims • dowels Equipment may include: • Filing machine • Die lifter

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • die hole filed to a template and angle clearance • Cavity and core filed and polished • Assembly holes drilled following the standard work procedure • Die/mould assembled according to the right sequence
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Punch and die clearances and applications • Molding parameters • Types of file • 2-reference method of layout • Determining tap drill size
Underpinning Skills	Demonstrates skills in: • Layout using vernier height gauge • Filing of die hole using template • Filing and polishing core and cavity having simple features and contours • Drilling of holes on mating parts • Filing radius of punch corners • Hole tapping • Counter boring of holes

	• Using transfer screws and transfer punch
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Test and Dry-Run Tool and Die Components**
Unit Code	**IND MAC3 11 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in the press tool and mould setting and adjusting press and moulding machine for the testing of pressed and molded products.

Elements	Performance Criteria
1. Set up press and die	1.1. Press and moulding machines are checked for suitability to shut height based on machine specification 1.2. Material is strip or blank cut to required size or width and grain orientation due to specifications 1.3. Plastic and rubber raw ***materials*** are checked, as required 1.4. Die set on the lower bolster plate and punch shank are inserted into ram-hole and tightened due to operational procedures 1.5. Press ram is adjusted to bottom dead center with the punch end to the required punch setting 1.6. Press is operated manually to check position of punch due to operational procedures
2. Setup mould and mouling machines	2.1. Moving half of mould is clamped to moving side of machine, ejector system adjusted to eject product based on operational procedures 2.2. Fixed side of mould is clamped to fixed side of machine checking alignment based on machine operations 2.3. Maximum mould opening is adjusted based on machine operation 2.4. Cycle time and temperature are adjusted to requirements
3. Operate mould and press machines	3.1. Moulding machine is operated according to standard procedure. 3.2. Started up is pressed safely and correctly according to machine operations 3.3. Material is loaded and the ***press*** tripped for sample product according to machine operations
4. Check conformance of product	4.1. Sample product is inspected for dimensional errors and deviations. 4.2. Die/mould is corrected using appropriate techniques/process 4.3. Standard procedures and OHS measures are observed throughout the process

	4.4. Documentation is accomplished/completed in compliance with operational regulations

Variables	**Range**
Materials	May include, but not limited to: • Low carbon steel, Silicon steel, brass, copper • Blank/Plastic raw material may include: ➢ Strip material ➢ Single blank material
Press	May include, but not limited to: • Press shut height • Parts and functions

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Selected the right moulding and press machines for use intesting • Prepared the required blank materials • Set the die according to procedures • Operated the press and moulding machines safely and correctly • Inspected the sample produced • Rectified the die to correct deviation if needed
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Application of a range of materials • Tools, techniques and equipment for testing • Tools, techniques and equipment for checking • Components for conformance to specifications • Operations, including housekeeping • Use and application of personal protective equipment safe work practices and procedures • Read and interpret drawings , tolerances, basic metallurgy, basic metrology, basic electricity / electronics, bench work, machine elements
Underpinning Skills	Demonstrates skills to: • Setting appropriate machines • Operating machines • Inspecting product and checking conformance to specifications • Rectifying die • Observing OHS
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test

	• Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Monitor Implementation of Work Plan/Activities**
Unit Code	**IND MAC3 12 0217**
Unit Descriptor	This unit covers competence required to oversee and monitor the quality of work operations within an enterprise. This unit may be carried out by team leaders or supervisors.

Elements	Performance Criteria
1. Monitor and improve workplace operations	1.1. Efficiency and service levels are monitored on an ongoing basis. 1.2. Operations in the workplace have been supported overall enterprise goals and quality assurance initiatives. 1.3. Quality ***problems*** and issues are promptly identified and adjustments made accordingly. 1.4. Procedures and systems are changed in consultation with colleagues to improve efficiency and effectiveness. 1.5. Colleagues are consulted about ways to improve efficiency and service levels.
2. Plan and organise workflow	2.1. Current workload of colleagues is accurately assessed. 2.2. Work is scheduled in a manner which enhances efficiency and customer service quality. 2.3. Work is delegated to appropriate people in accordance with principles of delegation. 2.4. Workflow is assessed against agreed objectives and timelines and colleagues are assisted in prioritisation of workload. 2.5. Input regarding staffing needs is provided to appropriate management.
3. Maintain workplace records	3.1. ***Workplace records*** are accurately completed and submitted within required timeframes. 3.2. Where appropriate, completion of records is delegated and monitored prior to submission.
4. Solve problems and make decisions	4.1. Workplace problems are promptly identified and considered from an operational and customer service perspective. 4.2. Short term action is initiated to resolve the immediate problem where appropriate. 4.3. Problems are analysed for any long term impact and potential solutions assessed and actioned in consultation with relevant colleagues. 4.4. Where problem is raised by a team member, they are encouraged to participate in solving the problem.

	4.5. Follow up action is taken to monitor the effectiveness of solutions in the workplace.

Variables	**Range**
Problems	May include, but is not limited to: • Difficult customer service situations • Equipment breakdown/technical failure • Delays and time difficulties • Competence
Workplace records	May include, but is not limited to: • Staff records and regular performance reports

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • Ability to effectively monitor and respond to a range of common operational and service issues in the workplace • The role of staff involved in workplace monitoring • Quality assurance, principles of workflow planning, delegation and problem solving
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Roles and responsibilities in monitoring work operations • Overview of leadership and management responsibilities • Principles of work planning and principles of delegation • Typical work organization methods appropriate to the sector • Quality assurance principles and time management • Problem solving and decision making processes • Industrial and/or legislative issues which affect short term work organization as appropriate to industry sector
Underpinning Skills	Demonstrate skills to: • Monitor and improve workplace operations • Plan and organize workflow • Maintain workplace records
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Apply Quality Control**
Unit Code	**IND MAC3 13 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in applying quality control in the workplace.

Elements	Performance Criteria
1. Implement quality standards	1.1. Agreed quality standard and procedures are acquired and confirmed. 1.2. Standard procedures are introduced to organizational staff/personnel. 1.3. Quality standard and procedures documents are provided to employees in accordance with the organization policy. 1.4. Standard procedures are revised/updated when necessary.
2. Assess quality of service delivered	2.1. Services delivered are ***quality checked*** against organization ***quality standards*** and specifications. 2.2. Service delivered are evaluated using the appropriate evaluation ***quality parameters*** and in accordance with organization standards. 2.3. Causes of any identified faults are identified and corrective actions taken in accordance with organization policies and procedures.
3. Record information	3.1. Basic information on the quality performance is recorded in accordance with organization procedures. 3.2. Records of work quality are maintained according to the requirements of the organization.
4. Study causes of quality deviations	4.1. Causes of deviations from final outputs or services are investigated and reported in accordance with organization procedures. 4.2. Suitable preventive action is recommended based on organization quality standards and identified causes of deviation from specified quality standards of final service or output.
5. Complete documentation	5.1. Information on quality and other indicators of service performance is recorded. 5.2. All service processes and outcomes are recorded.

Variable	Range
Quality check	May include, but is not limited to: • Check against design / specifications • Visual and Physical inspection
Quality standards	May include, but is not limited to:

	• Materials • Components • Process • Procedures
Quality parameters	May include, but is not limited to: • Standard Design / Specifications • Material Specification

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Check completed work continuously against organization standard • Identify and isolate faulty or poor service • Check service delivered against organization standards • Identify and apply corrective actions on the causes of identified faults or error • Record basic information regarding quality performance • Investigate causes of deviations of services against standard • Recommend suitable preventive actions
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Relevant quality standards, policies and procedures • Characteristics of services • Safety environment aspects of service processes • Evaluation techniques and quality checking procedures • Workplace procedures and reporting procedures
Underpinning Skills	Demonstrates skills to: • Interpret work instructions, specifications and standards appropriate to the required work or service • Carry out relevant performance evaluation • Maintain accurate work records • Meet work specifications and requirements • Communicate effectively within defined workplace procedures
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Lead Workplace Communication**
Unit Code	**IND MAC3 14 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to lead in the dissemination and discussion of information and issues in the workplace.

Elements	Performance Criteria
1. Communicate information about workplace processes	1.1. Appropriate ***communication method*** is selected. 1.2. Multiple operations involving several topics areas are communicated accordingly. 1.3. Questions are used to gain extra information. 1.4. Correct sources of information are identified. 1.5. Information is selected and organized correctly. 1.6. Verbal and written reporting is undertaken when required. 1.7. Communication skills are maintained in all situations.
2. Lead workplace discussion	2.1. Response to workplace issues is sought. 2.2. Response to workplace issues are provided immediately. 2.3. Constructive contributions are made to workplace discussions on such issues as production, quality and safety. 2.4. Goals/objectives and action plan undertaken in the workplace are communicated.
3. Identify and communicate issues arising in the workplace	3.1. Issues and problems are identified as they arise. 3.2. Information regarding problems and issues are organized coherently to ensure clear and effective communication. 3.3. Dialogue is initiated with appropriate staff/personnel. 3.4. Communication problems and issues are raised as they arise.

Variable	Range
Methods of communication	May include, but is not limited to: • Non-verbal gestures • Verbal • Face to face • Two-way radio • Speaking to groups • Using telephone • Written • Using Internet • Cell phone

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Deal with a range of communication/information at one time • Make constructive contributions in workplace issues • Seek workplace issues effectively • Respond to workplace issues promptly • Present information clearly and effectively written form • Use appropriate sources of information • Ask appropriate questions • Provide accurate information
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Organization requirements for written and electronic communication methods • Effective verbal communication methods
Underpinning Skills	Demonstrates skills to: • Organize information • Understand and convey intended meaning • Participate in variety of workplace discussions • Comply with organization requirements for the use of written and electronic communication methods
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Lead Small Teams**
Unit Code	**IND MAC3 15 0217**
Unit Descriptor	This unit covers the skills, knowledge and attitudes required to determine individual and team development needs and facilitate the development of the work group.

Elements	Performance Criteria
1. Provide team leadership	1.1. ***Learning and development needs*** are systematically identified and implemented in line with ***organizational requirements***. 1.2. Learning plan is collaboratively developed and implemented to meet individual and group training and developmental needs. 1.3. Individuals are encouraged to self-evaluate performance and areas identified for improvement. 1.4. ***Feedback on performance*** of team members is collected from relevant sources and compared with established team learning process.
2. Foster individual and organizational growth	2.1. Learning and development program goals and objectives are identified to match the specific knowledge and skills requirements of competence standards. 2.2. ***Learning delivery methods*** are made appropriate to the learning goals, the learning style of participants and availability of equipment and resources. 2.3. Workplace learning opportunities and coaching/ mentoring assistance are provided to facilitate individual and team achievement of competencies. 2.4. Resources and timelines required for learning activities are identified and approved in accordance with organizational requirements.
3. Monitor and evaluate workplace learning	3.1. Feedback from individuals or teams is used to identify and implement improvements in future learning arrangements. 3.2. Outcomes and performance of individuals/teams are assessed and recorded to determine the effectiveness of development programs and the extent of additional support. 3.3. Modifications to learning plans are negotiated to improve the efficiency and effectiveness of learning. 3.4. Records and reports of competence are maintained within organizational requirement.
4. Develop team commitment and cooperation	4.1. Open communication processes are used by team to obtain and share information.

	4.2. Decisions are reached by the team in accordance with its agreed roles and responsibilities. 4.3. Mutual concern and camaraderie are developed in the team.
5. Facilitate accomplishment of organizational goals	5.1. Team members are made actively participatory in team activities and communication processes. 5.2. Individual and joint responsibility has been developed teams members for their actions. 5.3. Collaborative efforts are sustained to attain organizational goals.

Variable	**Range**
Learning and development needs	May include, but is not limited to: • Coaching, mentoring and/or supervision • Formal/informal learning program • Internal/external training provision • Work experience/exchange/opportunities • Personal study • Career planning/development • Performance appraisals • Workplace skills assessment & Recognition of prior learning
Organizational requirements	May include, but is not limited to: • Quality assurance and/or procedures manuals • Goals, objectives, plans, systems and processes • Legal and organizational policy/guidelines and requirements • Safety policies, procedures and programs • Confidentiality and security requirements • Business and performance plans • Ethical standards • Quality and continuous improvement processes and standards
Feedback on performance	May include, but is not limited to: • Formal/informal performance appraisals • Obtaining feedback from supervisors and colleagues • Obtaining feedback from clients • Personal and reflective behavior strategies • Routine and organizational methods for monitoring service delivery
Learning delivery methods May include, but is not limited to:	May include, but is not limited to: • On the job coaching or mentoring • Problem solving • Presentation/demonstration • Formal course participation • Work experience and Involvement in professional networks • Conference/seminar attendance and induction

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Identify and implement learning opportunities for others • Give and receive feedback constructively • Facilitate participation of individuals in the work of the team • Negotiate learning plans to improve the effectiveness of learning • Prepare learning plans to match skill needs • Access and designate learning opportunities
Underpinning Knowledge and Attitude and Attitude	Demonstrates knowledge of: • Coaching and mentoring principles • How to work effectively with team members who have diverse work styles, aspirations, cultures and perspective • How to facilitate team development and improvement • Methods and techniques for eliciting and interpreting feedback • Methods for identifying and prioritizing personal development opportunities and options • Career paths and competence standards in the industry
Underpinning Skills	Demonstrates skills to: • Read and understand a variety of texts, prepare general information and documents according to target audience; spell with accuracy; use grammar and punctuation effective relationships and conflict management • Receive feedback and report, maintain effective relationships and conflict management • Organize required resources and equipment to meet learning needs • Provide support to colleagues • Organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes • Facilitation skills to conduct small group training sessions • Relate to people from a range of social, cultural, physical and mental backgrounds
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written exam • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting

Occupational Standard: Machining Level III	
Unit Title	**Improve Business Practice**
Unit Code	**IND MAC3 16 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required in promoting, improving and growing business operations.

Elements	Performance Criteria
1. Diagnose the business	1.1. ***Sources data*** is identified; ***data required*** for diagnosis is determined and acquired based on the business diagnosis toolkit. 1.2. Value chain analysis is conducted. 1.3. ***SWOT analysis*** of the data is undertaken. 1.4. ***Competitive advantage*** of the business is determined from the data.
2. Benchmark the business	2.1. Product or service to be benchmarked is identified and selected. 2.2. Sources of relevant benchmarking data are identified. 2.3. ***Key indicators*** are selected for benchmarking in consultation with key stakeholders. 2.4. Key indicators of own practice are compared with benchmark indicators. 2.5. Areas of improvements are identified.
3. Develop plans to improve business performance	3.1. A consolidated list of required improvements is developed. 3.2. Cost-benefit analysis is determined for required improvements. 3.3. Work flow changes resulting from proposed improvements are determined. 3.4. Proposed improvements are ranked according to agreed criteria. 3.5. An action plan is developed and agreed to implement the top ranked improvements. 3.6. ***Organizational structures*** are checked to ensure they are suitable.
4. Develop marketing plans	4.1. The practice vision statement is reviewed. 4.2. Practice ***objectives*** are developed/ reviewed. 4.3. Market research is conducted and result is obtained. 4.4. Target markets are identified/ refined. 4.5. ***Market position*** is developed/ reviewed. 4.6. ***Practice brand*** is developed.

	4.7. ***Benefits*** of products or services are identified. 4.8. ***Promotion tools*** are selected and developed.
5. Develop business growth plans	5.1. Plans are developed to increase profitability 5.2. Proposed plans are ***ranked*** according to agreed criteria. 5.3. An action plan is developed and agreed to implement the top ranked plans. 5.4. Business work practices are reviewed to ensure they support growth plans.
6. Implement and monitor plans	6.1. Implementation plan is developed in consultation with all ***relevant stakeholders***. 6.2. Success indicators of the plan are agreed. 6.3. Implementation is monitored against agreed indicators. 6.4. Implementation is adjusted as required.

Variable	**Range**
Data sources	May include primary data and secondary sources
Data required	May include, but is not limited to: • Organization capability • Appropriate business structure • Level of client service which can be provided • Internal policies, procedures and practices • Staff levels, capabilities and structure • Market and market definition • Market changes/market segmentation • Market consolidation/fragmentation • Revenue • Level of commercial activity • Expected revenue levels, short and long term • Revenue growth rate • Break even data • Pricing policy • Revenue assumptions • Business environment • Economic conditions • Social factors • Demographic factors • Technological impacts • Political/legislative/regulative impacts • Competitors, competitor pricing and response to pricing • Competitor marketing/branding • Competitor products
SWOT analysis	May include, but is not limited to:

	• Internal strengths such as staff capability, recognized quality • Internal weaknesses such as poor morale, under-capitalization, poor technology • External opportunities such as changing market and economic conditions • External threats such as industry fee structures, strategic alliances, competitor marketing
Competitive advantage	May include, but is not limited to: • Quality • Pricing • Cost • Location • Technology • Delivery • Timeframe • Promotion • Niche marketing • Support from government
Key indicators	May include, but is not limited to: • Staffing • Cost and expenses • Personnel productivity (particularly of principals) • Goodwill • Profitability • Price structure • Customers base • Productivity • Quality • System
Organizational structures	May include, but is not limited to: • Lines of authority and reporting relationship
Objectives	May include, but is not limited to: • Market share growth • Revenue growth • Profitability • Productivity • Innovation
Market position	May include, but is not limited to: • The goods or service provided • Product mix • The core product - what is bought • The tangible product - what is perceived • The augmented product - total package of consumer • Features/benefits • Product differentiation from competitive products • New/changed products

	• Price and pricing strategies (cost plus, supply/demand, ability to pay, etc.) • Pricing objectives (profit, market penetration, etc.) • Cost components • Market position • Distribution strategies • Marketing channels • Promotion • Target audience • Communication
Practice brand	May include, but is not limited to: • Practice image • Practice logo/letterhead/signage • Phone answering protocol • Facility decor • Slogans • Templates for communication/invoicing • Style guide • Writing style • AIDA (Attention, Interest, Desire and Action)
Benefits	May include, but is not limited to: • Features as perceived by the client • Benefits as perceived by the client
Promotion tools	May include, but is not limited to: • Networking and referrals • Seminars • Sales promotion • Advertising • Personal selling • Press releases • Publicity and sponsorship • Brochures • Newsletters (print and/or electronic) • Websites • Direct mail • Telemarketing/cold calling
Ranking	May include, but is not limited to: • Importance • Urgency • Technology • Resource availability
Relevant stockholders	May include, but is not limited to: • Micro and Small Enterprises development • Non-Government Organizations (NGOs) • Finance institutions

	• Capital goods leasing enterprise

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge of: • Identifying the key indicators of business performance • Identifying the key market data for the business • A wide range of available information sources • Acquiring information not readily available within a business • Analyzing data and determine areas of improvement • Negotiating required improvements to ensure implementation • Evaluating systems against practice requirements • Forming recommendations and/or make recommendations • Assessing the accuracy and relevance of information
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Data gathering and analysis • Value chain analysis • SWOT analysis • Competitive advantage • Cost benefit analysis • Target market • Marketing principles • Organizational structure • Marketing mix • Promotion mix • Market position • Branding Profitability demonstrates knowledge of: • Data gathering and analysis • Value chain analysis • SWOT analysis • Competitive advantage • Cost benefit analysis • Target market • Marketing principles • Organizational structure • Marketing mix • Promotion mix • Market position • Branding • Profitability
Underpinning Skills	Demonstrates skill in: • Benchmarking skills • Communication skills • Computers kills to manipulate data and present information • Negotiation skills • Preparing action plan

	• Conducting market research • Identifying target market • Identifying suitable marketing mix • Preparing promotional tools • Problem solving • Planning skills • Monitoring and evaluation • Ability to acquire and interpret relevant data • Use of market intelligence • Development and implementation strategies of promotion and growth plans • Ability to acquire and interpret required data, current practice systems and structures and sources of relevant benchmarking data • Applying methods of selecting relevant key benchmarking indicators • Communication skills • Working and consulting with others when developing plans for the business • Negotiation skills • Using computers to manipulate, present and distribute information
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Machining Level III	
Unit Title	**Prevent and Eliminate MUDA**
Unit Code	**IND MAC3 17 0217**
Unit Descriptor	This unit of competence covers the knowledge, skills and attitude required by a worker to prevent and eliminate MUDA/wastes in his/her their workplace. It covers responsibility for the day-to-day operation of the work and ensures Kaizen elements are continuously improved and institutionalized.

Elements	Performance Criteria
1. Prepare for work.	1.1. Work instructions are used to determine job requirements, including method, material and equipment. 1.2. Job specifications are read and interpreted following working manual. 1.3. ***OHS requirements***, including dust and fume collection, breathing apparatus and eye and ear personal protection needs are observed throughout the work. 1.4. Appropriate material is selected for work. 1.5. ***Safety equipment and tools*** are identified and checked for safe and effective operation.
2. Identify MUDA.	2.1. Plan of MUDA identification is prepared and implemented. 2.2. Causes and effects of MUDA are discussed. 2.3. ***Tools and techniques*** are used to draw and analyze current situation of the work place. 2.4. Wastes/MUDA are identified and measured based on ***relevant procedures***. 2.5. Identified and measured wastes are reported to relevant personnel.
3. Eliminate wastes/MUDA.	3. 1. Plan of MUDA elimination is prepared and implemented. 3. 2. Necessary attitude and ***the ten basic principles for improvement*** are adopted to eliminate waste/MUDA. 3. 3. Tools and techniques are used to eliminate wastes/MUDA based on the procedures and OHS. 3. 4. Wastes/MUDA are reduced and eliminated in accordance with OHS and organizational requirements. 3. 5. Improvements gained by elimination of waste/MUDA are reported to relevant bodies.
4. Prevent occurrence of wastes/MUDA.	4.1. Plan of MUDA prevention is prepared and implemented. 4.2. Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement are discussed and prepared.

	4.3. Occurrences of wastes/MUDA are prevented by using ***visual and auditory control methods***. 4.4. Waste-free workplace is created using ***5W and 1H***sheet. 4.5. The completion of required operation is done in accordance with standard procedures and practices. 4.6. The updating of standard procedures and practices is facilitated. 4.7. The capability of the work team that aligns with the requirements of the procedure is ensured.

Variable	**Range**
OHS requirements	May include, but is not limited to: • Are to be in accordance with legislation/ regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of firefighting equipment, enterprise first aid, hazard control and hazardous materials and substances. • Personal protective equipment is to include that prescribed under legislation/regulations/codes of practice and workplace policies and practices. • Safe operating procedures are to include, but are not limited to the conduct of operational risk assessment and treatments associated with workplace organization. • Emergency procedures related to this unit are to include but may not be limited to emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.
Safety equipment and tools	May include, but is not limited to: • dust masks / goggles • glove • working cloth • first aid and safety shoes
Tools and techniques	May include, but is not limited to: • Plant Layout • Process flow • Other Analysis tools • Do time study by work element • Measure Travel distance • Take a photo of workplace • Measure Total steps • Make list of items/products, who produces them and who uses them & those in warehouses, storages etc. • Focal points to Check and find out existing problems • 5S

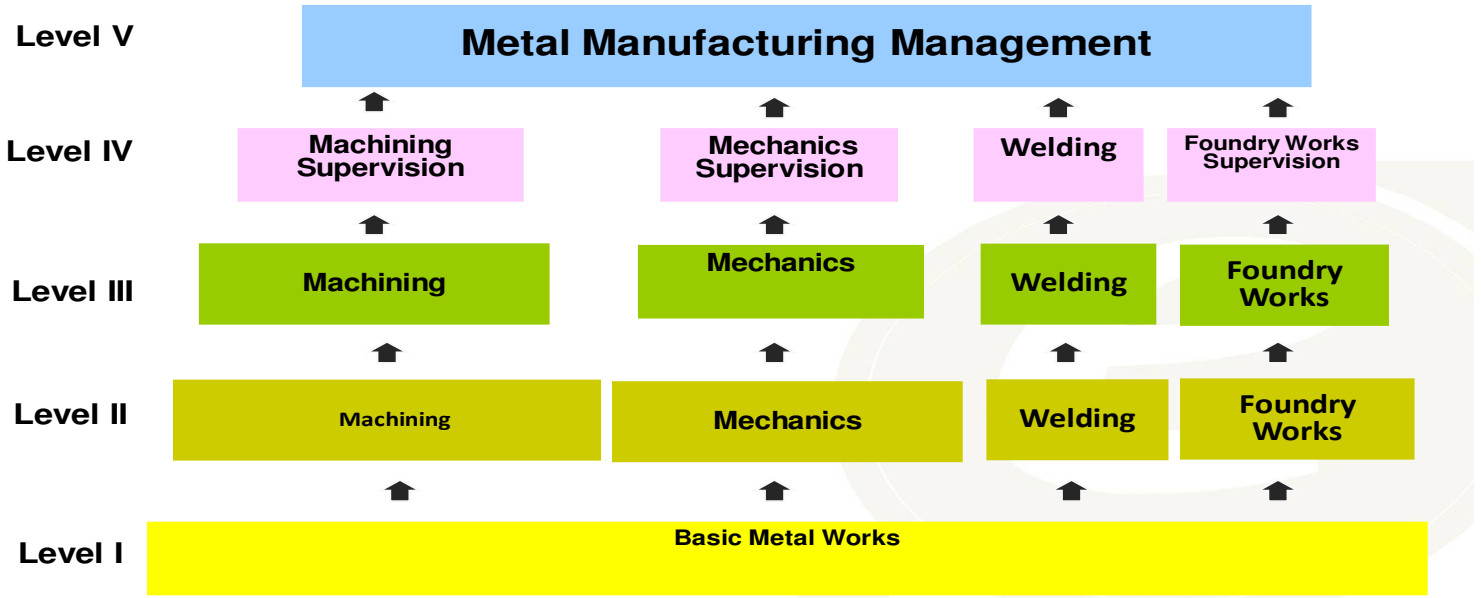
	• Layout improvement • Brainstorming • Andon • U-line • In-lining • Unification • Multi-process handling & Multi-skilled operators • A.B. control (Two point control) • Cell production line • TPM (Total Productive Maintenance)
Relevant procedures	May include, but is not limited to: • Make waste visible • Be conscious of the waste • Be accountable for the waste. • Measure the waste.
The ten basic principles for improvement	May include, but is not limited to: • Throw out all of your fixed ideas about how to do things. • Think of how the new method will work- not how it won. • Don't accept excuses. Totally deny the status quo. • Don't seek perfection. A 5o percent implementation rate is fine as long as it's done on the spot. • Correct mistakes the moment they are found. • Don't spend a lot of money on improvements. • Problems give you a chance to use your brain. • Ask "why?" At least five times until you find the ultimate cause. • Ten people's ideas are better than one person's. • Improvement knows no limits.
Visual and auditory control methods	May include, but is not limited to: • Red Tagging • Sign boards • Outlining • Andons • Kanban, etc.
5W and 1H	May include, but is not limited to: • Who • What • Where • When • Why • How

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Discuss why wastes occur in the workplace • Discuss causes and effects of wastes/MUDA in the

	workplace • Analyze the current situation of the workplace by using appropriate tools and techniques • Identify, measure, eliminate and prevent occurrence of wastes by using appropriate tools and techniques • Use 5w and 1h sheet to prevent
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Targets of customers and manufacturer/service provider • Traditional and kaizen thinking of price setting • Kaizen thinking in relation to targets of manufacturer/service provider and customer • Value • The three categories of operations • The 3“MU” • Waste/MUDA • Wastes occur in the workplace • The 7 types of MUDA • The Benefits of identifying and eliminating waste • Causes and effects of 7 MUDA • Procedures to identify MUDA • Necessary attitude and the ten basic principles for improvement • Procedures to eliminate MUDA • Prevention of wastes • Methods of waste prevention • Definition and purpose of standardization • Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement • Methods of visual and auditory control • TPM concept and its pillars. • Relevant OHS and environment requirements • Plan and report • Method of communication
Underpinning Skills	Demonstrates skills to: • Draw and analyze current situation of the work place • Use measurement apparatus (stop watch, tape, etc.) • Calculate volume and area • Use and follow checklists to identify, measure and eliminate wastes/MUDA • Identify and measure wastes/MUDA in accordance with OHS and procedures • Use tools and techniques to eliminate wastes/MUDA in accordance with OHS procedure • Apply 5W and 1H sheet • Update and use standard procedures for completion of

	required operation • Work with others • Read and interpret documents • Observe situations • Solve problems • Communicate • Gather evidence by using different means • Report activities and results using report formats
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

METALS MANUFACTURING



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