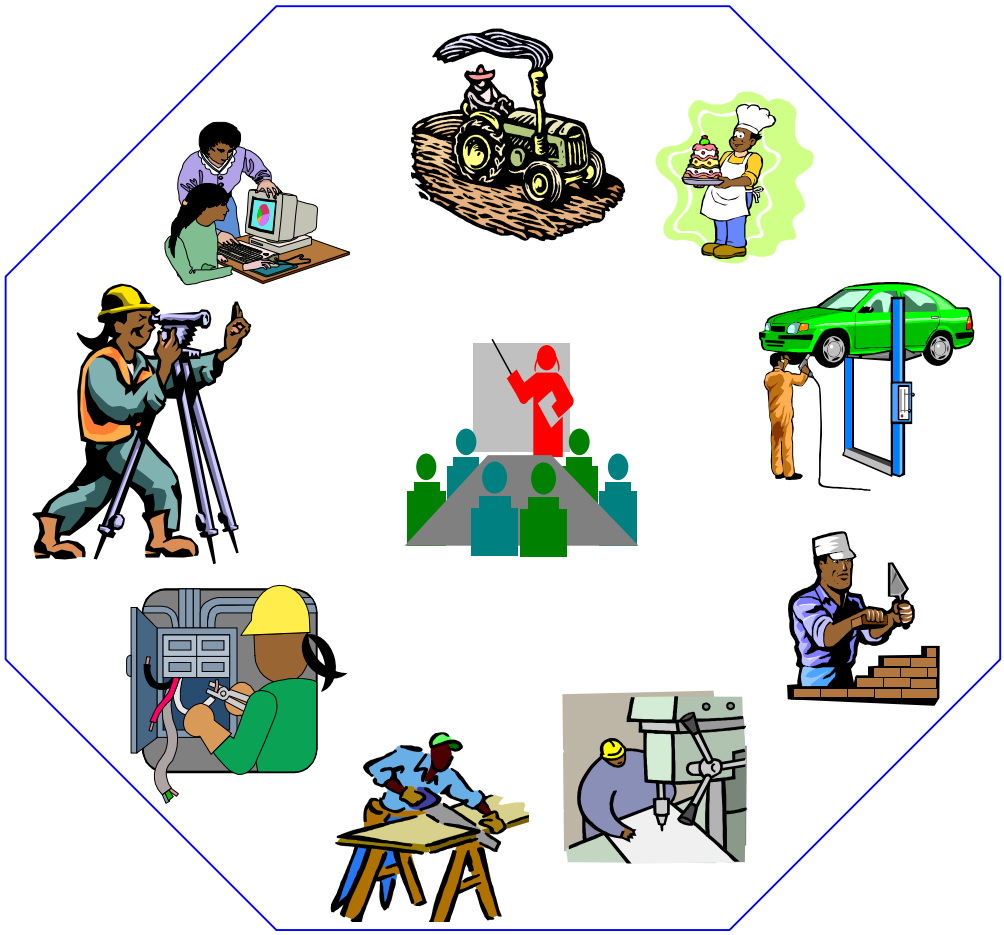
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

MECHANIICS

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: Mechanics		
Occupational Code: IND MCS		
NTQF level II		
IND MCS2 01 0217 Perform Mensuration and Calculation	**IND MCS2 02 0217** Perform Geometric Development	**IND MCS2 03 0217** Prepare Basic 2D Engineering Drawing Using CAD
IND MCS2 04 0217 Maintain Tools and Equipment	**IND MCS2 05 0217** Weld Using Shielded Metal Arc Welding (SMAW)	**IND MCS2 06 0217** Perform Oxyacetylene Welding
IND MCS2 07 0217 Carry out Heat Treatment	**IND MCS2 08 0217** Perform Hammer Forging	**IND MCS2 09 0217** Perform Manual Production Assembly
IND MCS2 10 0217 Maintain and Repair Mechanical Drives and Transmission Assemblies	**IND MCS2 11 0217** Perform Equipment/Machine Layout, Setting and Leveling	**IND MCS2 12 0217** Install and Maintain Fluid Power Pipes and Tubes
IND MCS2 13 0217 Participate in Workplace Communication	**IND MCS2 14 0217** Work in Team Environment	**IND MCS2 15 0217** Develop Business Practice
IND MCS2 16 0217 Standardize and Sustain 3S		

NTQF level III

IND MCS3 01 0217 Perform Advanced Engineering Detail Drafting by using CAD	**IND MCS3 02 0217** Perform Advanced Geometric Development	**IND MCS3 03 0217** Perform Gas Metal Arc Welding (GMAW)
IND MCS3 04 0217 Perform Gas Tungsten Arc Welding (GTAW)	**IND MCS3 05 0217** Perform Precision Assembly	**IND MCS3 06 0217** Perform Machine/Plant Installation
IND MCS3 07 0217 Maintain and Repair Engineering Components	**IND MCS3 08 0217** Undertake Commissioning of Plant and Equipment	**IND MCS3 09 0217** Install and Maintain Basic Pneumatic and Hydraulic Systems
IND MCS3 10 0217 Install Electrical Measuring Instruments and Control Devices	**IND MCS3 11 0217** Perform Maintenance and Repair on Industrial Electrical Machines and Drives	**IND MCS3 12 0217** Monitor Implementation of Work Plan/Activities
IND MCS3 13 0217 Apply Quality Control	**IND MCS3 14 0217** Lead Workplace Communication	**IND MCS3 15 0217** Lead Small Teams
IND MCS3 16 0217 Improve Business Practice	**IND MCS3 17 0217** Prevent and Eliminate MUDA	

NTQF Level II

Occupational Standard: Mechanics Level II	
Unit Title	**Perform Mensuration and Calculation**
Unit Code	**IND MCS2 01 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. Measuring tools are selected/identified as per object to be measured according to work requirements and applied standards 1.2. Correct specifications are obtained from relevant sources and standards
2.Perform measurements and calculations	2.1. Accurate ***measurements and calculation*** are obtained according to work requirements and ISO standards using appropriate measuring instruments and systems 2.2. Numerical computation is self-checked and corrected for accuracy based on standards 2.3. ***Instruments*** are read to the limit of accuracy of the tool according to specification
3. Perform calculations on algebraic expressions	3.1. Simple calculations and transpositions are performed on algebraic expressions using the ***four basic arthimetic operations***. 3.2. Where appropriate ***unit*** and formula are constructed to enable problems to be solved based of mathematic standards and ***Geometric shapes***
4. Compute percentage and ratio	4.1. Percentages are computed using appropriate formula. 4.2. Ratio and proportion are computed using appropriate formula

Variable	Range
Measurements and calculations	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 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 and Telescopic gauge • Try-square and Protractor • Combination gauge • Steel rule • Voltmeter • Ammeter • Mega-Ohmmeter • Kilowatt hour meter • Gauges and Thermometers • Surface fininsh • Profile projector • Hardness tester • Bench work concentricity • Go and no go gauges, Radius, Pitch,block, pin and filler gagues • Tooth thickness calipers
Four basic arithmetic operations	May include, but not limited to: • Addition (+), Subtraction (-), Multiplication (x) and Division (/)
Unit	May include, but not limited to: • Fractions • Mixed numbers • Decimal
Geometric shapes	May include, but not limited to: • Round • Square • Rectangular • Triangle • Sphere and • Conical

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Performed calculation using four basic arthimetic operations involving: ➢ Fractions and mixed numbers ➢ Fractions and decimals on algebraic expressions ➢ Ratio and proportion • Selected and prepared appropriate measuring instruments in accordance with job requirements • Performed measurements and calculations according to job requirements
Underpinning Knowledge and Attitude	Must demonstrate knowledge of: • English and metric system of measurements • Linear measurement and dimensions • Unit conversion • Ratio and proportion • Trigonometric functions • Algebraic equations • Four arthemetic operations • Method of transposing formulae • Equation formulation
Underpinning Skills	Must demonstrate skills of: • 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
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: Mechanics Level II	
Unit Title	**Perform Geometric Development**
Unit Code	**IND MCS2 02 0217**
Unit Descriptor	This unit covers competence required in marking out general fabrications using geometric development.

Elements	Performance criteria
1. Transfer dimensions from a detail drawing to work	1.1. Specifications and work requirements are determined and understood using correct and appropriate calculations 1.2. Development is carried out to specifications or standard operating procedures using appropriate tools and equipment 1.3. Datum points are correctly established and marked appropriate to task requirements
2. Make templates as required	2.1. Appropriate ***template material*** is chosen based on specifications 2.2. Templates are produced to specification. 2.3. Correct ***storage procedures***, including labeling and identification are followed according to standard operating procedures.
3. Develop patterns as required	3.1. Parallel line, radial line and triangulation ***development methods*** are chosen and applied to standard 3.2. ***Allowances*** for fabrication and assembly are correctly determined and transferred based on specification
4. Interpret relevant codes, standards and symbols	4.1. Relevant standards/codes and symbols are interpreted. 4.2. Requirements of ***standards/codes*** are interpreted and applied to materials and process specification
5. Estimate quantities of materials from detail drawings	5.1. Materials are correctly identified based on standard 5.2. Quantities are estimated from drawings due to specification 5.3. Material wastage is minimized in compliance with environmental requirements

Variable	Range
Template material	• Steel plate, perspex, timber, cardboard, paper etc.
Storage procedure	• Including labeling, identification, e.g. template lofts
Development methods	• Parallel line, radial line and triangulation
Allowances	• Thickness, bend, pitch, angle, circumference, perimeter
Standards/codes	• All work carried out in accordance with legislative and regulatory requirements

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Marking out general fabrications using geometric development • Transferring dimensions from a detail drawing to work • Making templates as required • Developing patterns as required • Interpreting relevant codes, standards and symbols • Estimating quantities of materials from detail drawings
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Specifications of work • Tools and equipment • Development preparation • Datum points • Materials used for the preparation of templates • Manufacturing allowance considerations • Template development, labeling, identification and storage requirements • Development methods and applications • Fabrication and assembly allowances • Sources of data on fabrication • Relevant standards and codes
Underpinning Skills	Must demonstrate skills of: • Performing geometric calculations • Carrying out geometric development • Establishing datum points • Producing templates to specification • Labeling and storing templates • Developing patterns • Making fabrication and assembly allowances • Determining material and component quantities • Minimizing material wastage
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: Mechanics Level II	
Unit Title	**Prepare Basic 2D Engineering Drawing Using CAD**
Unit Code	**IND MCS2 03 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 and 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	**Maintain Tools and Equipment**
Unit Code	**IND MCS2 04 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 programmed 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 programmed 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 are performed according to manual instruction or workplace procedures 2.5. Machine moving parts are 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 not limited to: • Manual, semi-automatic and automatic machines of a stand-alone continuous production or process nature
Checks	May include, but 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 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 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
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: Mechanics Level II	
Unit of Title	**Weld Using Shielded Metal Arc Welding (SMAW)**
Unit Code	**IND MCS2 05 0217**
Unit Descriptor	This unit covers the competence in carrying out basic Shielded Metal Arc Welding (SMAW) in a range of metal work fabrication activities.

Elements	Performance Criteria
1. Prepare materials for SMAW welding process	1.1. Weld work is identified from order and/or drawings in accordance with industry standards 1.2. Correct size, type and quantity of materials/ components are determined, obtained and inspected for compliance with the job specifications 1.3. ***Materials are correctly prepared*** in accordance with job specifications 1.4. Materials are assembled/aligned to specification, where required
2. Set-up welding machine / equipment, accessories and fixtures	2.1. Welding machine settings, accessories and consumables are identified and selected based on standards 2.2. Welding machine is connected to an independent power supply and wired up or set to the polarity indicated in the welding procedures/specifications or as recommended by the manufacturer 2.3. Current and voltage are fine-tuned or adjusted consistent with work requirements to produce acceptable weld 2.4. Braces, stiffeners, rails and other jigs are provided in conformity with requirements. 2.5. Appropriate ***distortion prevention measures*** are selected for weld and material type in according to requirements
3. Perform SMAW welds	3.1. Root pass is performed in accordance with specifications and enterprise industry standards and safety procedures 3.2. Root pass is cleaned in accordance with procedures 3.3. Subsequent filling passes are performed in accordance with procedures 3.4. Capping is performed in accordance with specifications and procedures 3.5. Weld deposit is ensured to be within specifications. 3.6. Materials are welded using SMAW process in accordance with specifications 3.7. Joints are cleaned and freed from discontinuities.

4. Assure quality weld conformance	4.1. Welded parts are made free from weld ***defects*** or porosity according to ***WPS requirements***
	4.2. Weld joints are visually inspected in conformance with specifications.
	4.3. Weld records and completion details are completed and maintained correctly as required
	4.4. ***OHS procedures*** are followed throughout this unit by using Tools, equipment and materials.

Variable	**Range**
Prepared materials	May include, but not limited to: • Used would include carbon or stainless steel • Preparation of materials including preheating, setting up of jigs, fixtures, clamps, etc., joint preparation e.g. beveling AC or DC welding machines
Distortion prevention measures	May include, but not limited to: • Remedial action using thermal processes including oxy acetylene and air arc equipment • Grinding devices may also be used
Defects	May include, but not limited to: • Porosity, slag inclusions, discontinuities, lack of penetration, undercut
WPS requirements	May include, but not limited to: • Welding positions may include but not limited to ➢ 1F, 2F, 3F,4F ➢ 1G, 2G, 3G and 1.6mm – unlimited (plate) • Type and size of electrode • Travel speed • Current setting (polarity, amperage, voltage) • Arc length • Preheating/Post Weld Heating Treatment (PWHT) • Joint preparation
OHS procedures	May include, but not limited to: • Protective clothing and equipment (include that prescribed under legislation, regulation and workplace policies) • Use of tools and equipment, • Workplace environment and safety, handling of materials, • Use of firefighting equipment, use of first aid equipment, • Hazard control and hazardous materials and substances
Tools, equipment and materials	May include, but not limited to: • Hand and power tools, • Measuring equipment, • Relevant welding machines • Relevant welding electrode and materials • Gloves, shields and other protective (cloths and leather shoes) equipment • AC or DC welding machines and their accessories

Evidence Guide	
Critical Aspects of Competence	Demonstrate knowledge and skills: • Prepared materials for basic Shielded Metal Arc Welding (SMAW) • Assembled and setting up welding equipment • Welded to job specification using basic SMAW • Minimized and rectified distortion • Identified the properties and characteristics of a wide range of materials • Applied weld procedures, techniques and standards • Identified different welder systems such as numbering, bar coding, paint coding, letter stamps • Applied safety requirements and safe welding practices • Used personal protective equipment for SMAW
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • In-depth knowledge of the properties and characteristics of a wide range of materials • Different welder identification systems such as numbering, bar coding, paint coding, letter stamps • Safety requirements
Underpinning Skills	Must demonstrate skills of: • Weld procedures and requirements • Different welder identification systems such as numbering, bar coding, paint coding, letter stamps • Safe welding practices • use and application of personal protective equipment for SMAW
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: Mechanics Level II	
Unit Title	**Perform Oxyacetylene Welding**
Unit Code	**IND MCS2 06 0217**
Unit Descriptor	This unit covers competence in performing oxyacetylene welding, using a range of materials for general fabrication.

Elements	Performance Criteria tools
1. Prepare welding equipment and materials	1.1. Correct ***welding*** equipment are selected according to work requirement 1.2. Correct welding consumables are selected based on applied standard procedures 1.3. Welding Procedure and Specifications (WPS) and ***OHS procedures***/measures are followed/observed throughout the welding operation 1.4. Welding equipment, including cylinders, regulators, hoses, torches and tips are assembled and set up safely in accordance with standard operating procedures 1.5. ***Materials are prepared*** to achieve required weld specification
2. Perform weld joints	2.1. Welding equipment are adjusted correctly and safely. 2.2. ***Materials*** are welded to standard in all positions. 2.3. Instructions, symbols, specifications are interpreted correctly including bead size, bead placement, reinforcement etc. and in accordance with weld procedure sheet, if available, and standard operating procedures. 2.4. Welding Procedure and Specifications (WPS) and OHS procedures/measures are followed/observed throughout the welding operation
3. Correct faults	3.1. Welding joints are visually inspected against specifications 3.2. Defects are removed with minimum loss of sound metal using correct and appropriate techniques and ***tools***
4. Assure quality weld records	4.1. Welding joints are inspected against specifications using destructive and non- destructive testing methods based on operational standards 4.2. Weld records are filled up in accordance with specifications and standard operating procedures 4.3. Weld records are maintained in accordance with specifications and standard operating procedures.

Variable	Range
Welding	May include, but not limited to: • Fillet and butt in flat, horizontal, vertical and overhead positions
OHS procedures	May include, but not limited to: • Protective clothing and equipment, • Use of tools and equipment, • Workplace environment and safety, handling of materials, • Use of firefighting equipment, use of first aid equipment, • Hazard control and hazardous materials and substances • Personal protective equipment is to include that prescribed under legislation, regulation and workplace policies and practices
Prepared materials	May include, but not limited to: • Preheating, setting up of jigs, fixtures, clamps, etc., joint • Preparation e.g. beveling
Materials	May include, but not limited to: • Low carbon steel, plate, pipe, tube and round bar
Tools	May include, but not limited to: • Hand and power tools, • Measuring equipment, • Guillotines, soldering equipment, • Oxyacetylene and accessories

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Performed preparatory requirements • Explained purpose and examples of pre-welding and post welding; purpose of reinforcing areas to be welded; fuel gas properties and applications • Performed heating of the weld materials • Determined appropriate settings for the given task and the selected equipment/consumables • Performed methods of weld defect removal and their application • Identified material and consumable properties and characteristics • Performed post treatments • Observed recording procedures • Observed safe welding practices • Used personal protective equipment for oxy acetylene welding • Observed relevant hazards and control measures related to the competence
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Preparatory requirements • Purpose and examples of pre-welding and post welding

	• Appropriate settings for the given task and the • Selected equipment/consumables • Purpose of reinforcing areas to be welded • Material and consumable properties and characteristics • Fuel gas properties and applications • Post treatments • Recording procedures • Relevant hazards and control measures related to the unit
Underpinning Skills	Must demonstrate skills of: • Apply operational safety requirements • Access, interpret and apply technical information • Apply hand-eye coordination • Read sketches or basic drawings • Identify and select from a range of welding equipment and accessories • Identify and match equipment with specified tasks • Heating of weld materials • Comply with environmental requirements • Methods of weld defect removal and their application • Safe welding practices and use/application of personal protective equipment for oxyacetylene welding
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: Mechanics Level II	
Unit Title	**Carry out Heat Treatment**
Unit Code	**IND MCS2 07 0217**
Unit Descriptor	This unit covers the competence in performing heat treatment of ferrous and non-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 are 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*** is ***heat treated*** to achieve required result in accordance with standard operating procedures and customer requirements
3. Assure quality 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	include gas, oil fired and electric furnaces, such as: • Pit furnace • Box type furnace

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

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 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	The following resources must be provided: • Manuals/catalogues relative to heat treatment • Job order, requisitions slip for materials • Materials, tools and equipment relevant to the activity

Methods of Assessment	Competence may be accessed through: • Interview/ Written exam • Observation/ Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in simulated workplace environment.

Occupational Standard: Mechanics Level II	
Unit Title	**Perform Hammer Forging**
Unit Code	**IND MCS2 08 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in using hammer tools and formers, selecting material, and applying hammer forging techniques and operation in fabrication and assembly of metals.

Elements	Performance Criteria
1. Analyze and plan hand forging work	1.1. Drawing is interpreted for swaging, bending, upsetting, spreading, punching and drifting techniques is in compliance with specification. 1.2. ***Material calculations*** are made using volumes and weights that include provision for oxidization and shrinkage 1.3. Forging temperatures and heat specifications are applied to for various materials requirement 1.4. Work plan is drafted according to specifications
2. Prepare and select tools and material	2.1. ***Hammer tools and formers*** are made available according to operational procedures 2.2. Forging machine is set up in accordance with operational procedures 2.3. ***Material*** is correctly selected for use with specific tools and formers with compliance to standards 2.4. ***OHS*** measures are followed throughout the application of this unit based on requirements
3. Perform hammer forging techniques	3.1. Appropriate hammer forging technique is selected and applied according to standard 3.2. Annealing technique is applied with compliance to instructions 3.3. ***Defects*** are recognized and appropriate rectification action is taken based on operational procedures 3.4. Correct techniques are applied to the handling of hot metal with regard to balancing and pivoting due to operational instruction 3.5. Correct ***heating process*** is applied based on operational instructions
4. Assure quality work	4.1. Equipment is operated in a manner that minimizes oxidization in accordance with operational procedures 4.2. Heating process is controlled to specified areas as per instruction 4.3. Form and shape are measured applying standard devices 4.4. OHS measures and procedures are followed throughout the process

Variable	Range
Material calculations	May include, but not limited to: • Thermal expansion/contraction, material wastage
Hammer tools and formers	May include, but not limited to: • Flatters, set hammers, hot/cold sets, ball peen hammer, • swages, etc.
Material	May include, but not limited to: • Low/high carbon steels, alloys, stainless steel, lead, etc.
Occupational Health and Safety (OHS)	May include, but not limited to: • Protective clothing and equipment (include that prescribed under legislation, regulation and workplace policies) • Use of tools and equipment, • Workplace environment and safety, handling of materials, • Use of firefighting equipment, use of first aid equipment, • Hazard control and hazardous materials and substances
Defects	May include, but not limited to: • Galls, fins, shrinkage, oxidization, etc.
Heating process	May include, but not limited to: • Diesel, electric and gas furnaces; coke fires and gaseous • oxygen/fuel equipment

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Application of Hammer forging techniques • Application of annealing, hardening and tempering techniques • Set- up and operation of forging machines and techniques for handling hot metal • Application of hazards control measures associated with hammer • Performing forging, including housekeeping • Application of personal protective equipment, safe work practices and procedures
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Set up and operation of forging machines • Oxidization/shrinkage allowances • Numerical operations and formulae for determining the volume and weight of material • Hazards and control measures associated with hammer
Underpinning Skills	Must demonstrate skills of: • Using hammer forging techniques • Applying techniques for handling hot metal • Using material specifications • Forging, including housekeeping • Use and application of personal protective equipment • Safe work practices and 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: Mechanics Level II	
Unit Title	**Perform Manual Production Assembly**
Unit Code	**IND MCS2 09 0217**
Unit Descriptor	This unit covers competence in assembling and testing components manually.

Elements	Performance criteria
1. Prepare work order	1.1. Work requirements are determined from work sheet, instructions, drawings or visual inspection in accordance with operational specifications. 1.2. ***Assembly equipment*** are selected and prepared for use in standard operating procedures. 1.3. Required protective coating application equipment is identified according to job requirement. 1.4. ***Components/sub-assemblies*** are obtained and arranged for assembly due to operational procedures. 1.5. OHS is followed for assembling and coating applications according to standard operating procedures.
2 Assemble components	2.1. Appropriate techniques are applied for assembling and adjustment of components following correct sequence due to operational instructions 2.2. Standard fastening equipment and methods are used to ensure operational performance, quality and safety of the completed assembly with conformance to specifications 2.3. Correct lubrication is selected and applied correctly in conformance with specifications 2.4. Final component assembly is adjusted as necessary for compliance with operational specifications 2.5. Production data is recorded/input due to requirements
3.Assure quality and clean up	3.1. Assembly is ***tested/checked*** for compliance with work sheet requirements using standard operating procedures 3.2. Faulty equipment are recorded and reported to appropriate personnel in accordance with standard operating procedures 3.3. Components and/or assemblies are packed, sealed and stored safely in conformance with operational instructions 3.4. Work place is cleaned and secured in accordance with standard operating procedures. 3.5. ***Personal Protective Equipment (PPE)*** are maintained in accordance with standard operating procedures

Variable	Range
Assembly equipment	May include, but not limited to: • Hand tools • Power tools • Jigs & fixtures • Standard fixture components • Manually operated assembly lines
Components/sub-assemblies	May include, but not limited to parts that make up machinery, devices, equipment or sub-assembly products
Testing/checking	May include, but not limited to: • Given by specification of assembled product
PPE	May include, but not limited to: • Includes hand protection, full body protection, respirators, air fed hoods and foot protection. Noise and heat protection may also be necessary

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Assembled components and/or sub-assemblies in a production environment and tested the components and/or sub-assemblies to ensure compliance with specifications • Apply basic protective coatings
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Application and use of assembly tools and equipment • Sequence in which the assemblies are to be performed • Storage location and procedures of the component/sub-assemblies • Required tests and checks • Required action (reports)for non-conformance • Potential damage through the use of inappropriate handling and/or unsafe storage procedures • Use and application of personal protective equipment • Safe work practices and procedures • The requirements for completion and processing of maintenance reports • Requirements for completion and processing of inspection reports • Standard procedures and manufacturers' specifications for inspecting and maintaining personal protective equipment in the workplace
Underpinning Skills	Must demonstrate skills in: • Following job instructions, job sheets, specifications, relevant drawings and standard operating procedures • Selecting and using assembly tools, components and sub-assemblies • Entering routine and familiar information onto proformas and other standard workplace forms

	• Following oral instruction • Preparing site with due regard to OHS requirements including site safety, clear working space, other materials/structures/personnel in the vicinity, isolation of work site where required • Undertaking routine maintenance on plant and equipment in accordance with standard operating procedures • Assembling equipment in accordance with manufacturers' specifications and standard operating procedures • Identifying coating type and appropriate solvents and standard workplace procedures required for mixing processes, clean-up and safe handling • Using standard operating procedures to report on any damage or faulty parts and communicating with appropriate personnel • Following procedure for storage including any hazard reduction and/or protection of equipment and components • Undertaking comprehensive inspection as required by standard operating procedures • Preparing all required inspection records/reports and details communicated • Selecting and using appropriate personal protective equipment in workplace operations in accordance with standard procedures • Recording and reporting faulty items to appropriate personnel using standard 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: Mechanics Level II	
Unit Title	**Maintain and Repair Mechanical Drives and Transmission Assemblies**
Unit Code	**IND MCS2 10 0217**
Unit Descriptor	This unit covers competence of diagnosing faults and repairing and maintaining drives and transmission assemblies. It includes final adjustment and commissioning.

Elements	Performance Criteria
1. Undertake maintenance of mechanical drives and mechanical transmission components	1.1. Principles of ***mechanical drives and mechanical transmission*** components are understood in accordance with engineering standards. 1.2. Function of the main parts of the designated mechanical drive/transmission assembly is understood based on standard designs 1.3. Maintenance principles, techniques, tools and equipment are applied according to manual standards 1.4. Wear, distortion, tensions, misalignment, fatigue, lubrication, slackness, tooth wear, breakages and other related malfunctions are identified according to operational procedures 1.5. Assembly requiring of further diagnosis, repair or adjustment is identified and findings are documented to specification
2. Diagnose faults	2.1. Service reports are interpreted, and visual and ***sensory inspection*** is undertaken according to operational specifications 2.2. Diagnose faults inspection of the drive/ transmission assembly is undertaken based on operational procedures 2.3. Given manufacturers' specifications is tested using standard maintenance principles and procedures 2.4. Faults are localized at the component level and identified for adjustment, repair or replacement. 2.5. Causes of faults are analyzed, documented and acted by appropriate means to avoid re-occurrence according to preventive maintenance procedures
3. Adjust mechanical drives and transmission assemblies	3.1. Adjustment requirements are determined due to specifications 3.2. Appropriate maintenance principles, techniques, tools and equipment are used, and drives/transmission components are tensioned, aligned balanced or adjusted to manufacturers'/site specifications according to safe workshop practices.

	3.3. Drive/transmission assembly is tested after adjustment for correct operation or identified for further diagnosis or repair based on standard procedures 3.4. Service report is completed due to requirements
4. Repair mechanical drives/transmission assemblies	4.1. Task requirements are ascertained based on fault diagnosis report 4.2. Tools and equipment are selected according to service specifications 4.3. Mechanical drive/transmission assembly is dismantled according to maintenance principles, techniques, tools, equipment and safe workshop practices 4.4. Serviceable items are repaired according to manufacturers' specifications and standard workshop practices. 4.5. Standard replaceable items are selected and obtained based on manufacturers' catalogues, spare parts lists, engineering specifications 4.6. Component parts are refitted to mechanical drive/transmission assembly in accordance with manufacturers'/site specifications and maintenance standards
5. Assure quality final adjustment and commissioning	5.1. Drive/transmission components are tensioned, balanced, aligned or adjusted to fulfill quality and operational requirements 5.2. Drive/transmission assembly is tested to manufacturers' specifications 5.3. Assembly is ***commissioned*** in accordance with specifications 5.4. Service report is completed compliant to standard

Variable	**Range**
Mechanical drive and transmission	May include, but not limited to: • Worm and worm wheel, • Line shafts, • Plumber blocks, • Pulleys, • Sprockets, • Belts, • Taper bush assemblies, • Roller chains, • Chain drives, • Mechanical and hydraulic couplings, • Compression couplings, • Disc type flexible couplings,

	• Spider type, • Chain couplings, • Universal joints, • Bevel gearing, • Rack and pinion gearing, • Dog toothed clutches, • Cone type clutches, • Expanding shoe type clutches, • Friction/plate type clutches, • Centrifugal clutches, • Toggle action linkages, • Magnetic clutches, • Sprag clutches, • Band type brakes and other associated drive components
Inspection of sensory	May include, but not limited to: • Vibration, heat, smell, sound, sight
Commissioning	May include, but not limited to: • Confirming readiness for use or return to use

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills in: • Diagnostics and maintenance, repair, adjustment and commissioning of mechanical drives and mechanical transmission assemblies
Underpinning Knowledge and Attitudes	Must demonstrate knowledge in: • Uses and characteristics of lubricants • Principles of operation of a range of mechanical drives and transmissions • Techniques, tools and equipment to measure components • Common malfunctions in mechanical drives, transmissions and their components • Procedures for checking and adjusting mechanical drives, transmissions and their components • Preventative measures that can be undertaken to avoid recurrence of the fault/failure • Any applicable industry standards, OHS guidelines, regulatory codes of practice/standards • Safe work practices and procedures • Hazards and control measures associated with maintaining and repairing mechanical drives and mechanical transmission assemblies • job instructions, specifications, manufacturers' instructions, standard workshop manuals/procedures, drawings, charts, lists and other reference documentation
Underpinning Skills	Must demonstrate skills in: • Using personal protective equipment • Locating, reading and interpreting information on written

	• Checking and clarifying task-related information • Interpreting manufacturers' catalogues or engineering specifications • Undertaking diagnostic and testing • Analyzing operational performance • Planning and sequencing operations • Completing proformas, standard workplace forms and short reports using relevant terminology • Checking for conformance to specifications • Measuring components to specified tolerances • Undertaking calculations for determining cutting parameters and checking tolerances • Undertaking numerical operations and engineering calculations/formulae within the scope of this unit • Following verbal instructions • Orally reporting 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 accessed through: • Written test/ Oral questioning • Observation/ Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in simulated workplace setting.

Occupational Standard: Mechanics Level II	
Unit Title	**Perform Equipment/Machine Layout, Setting and Leveling**
Unit Code	**IND MCS2 11 0217**
Unit Descriptor	This unit covers the competence needed to prepare layout for equipment foundation, setting and undertaking leveling and alignment tasks of machines and equipment in industry application.

Elements	Performance Criteria
1. Plan and prepare work	1.1. Work instructions, including plans, specifications, quality requirements and operational details are obtained and correctly interpreted compliant to task 1.2. Safety ***Occupational Health and Safety (OHS) requirements*** are followed in accordance with safety plans and policies 1.3. Tools and equipment are selected to the need of particular job with compliance to operational procedures 1.4. Material quantity requirements are calculated in accordance with plans and/or ***specifications*** 1.5. Correct and appropriate leveling or alignment devices/ equipment are selected and set up to standard operating procedures 1.6. Electrical lightings, wirings/gadgets are identified for proper installation of equipment/machine in accordance with standards 1.7. Environmental protection requirements are identified and applied for the project in accordance with environmental plans and regulatory obligations
2. Perform layout	2.1. Shop area is inspected for proper placement of equipment / machine based on manuals 2.2. Flow of equipment, material or personnel is taken into consideration for safety reason and movability according to operational procedures 2.3. Layout of equipment is done in workshop taking into consideration of its load, vibration and other parameters based on machine specifications 2.4. Locations are marked for form works, anchor bolts, etc. based on plans and instructions 2.5. Work area is cleared and surface prepared for safe erection of formwork according to requirements
3. Perform setting and leveling and	3.1. Machine is set in accordance with defined procedures 3.2. Machine is adjusted to meet specifications and operational

alignment	requirements 3.3. Equipment are leveled to specifications using correct and appropriate techniques according to standard 3.4. Leveling and alignment task is completed to specifications.
4. Assure quality and Clean up	4.1. First-off samples are measured in compliance with specifications 4.2. All reports and documentation are prepared and completed correctly based on standard procedures and format. 4.3. Work area is cleared and materials are disposed of, reused or recycled in accordance with legislation/regulations/codes of practice 4.4. Plant, ***tools and equipment*** are checked, cleaned, oiled, maintained and stored in accordance with manufacturers' recommendations

Variable	**Range**
OHS requirements	• Are to be in accordance with State or Territory legislation and regulations, organizational safety policies and procedures, and project safety plan. This may include protective clothing and equipment, use of tools and equipment, workplace environment and safety, handling of materials, use of firefighting equipment, organizational first aid, hazard control and hazardous materials and substances • Use of personal protective equipment /devices • Factory/production safety regulations • Standard electrical safety
Specifications	May include, but not limited to: • From engineering drawings, • Data sheets • manufacturers' specifications
Tools and equipment	May include, but not limited to: • Hand tools, • Hand held power tools, • Measuring tapes, • spirit levels, line levels, optical levels, electronic levels, laser levels, • Dial indicators, special type dial indicator fixtures, • magnetic bases, • feeler gauges, • Bench centers, vee blocks, etc.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Blueprint reading • Bolt hole locations

	• Anchor plate location • Report outcomes • Leveling and aligning machines and engineering components
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Site and equipment safety requirements • Steel reinforcement characteristics • Concrete characteristics and properties • Concreting principles • Structural technology • Formworks • Sequences of machine setting operations • Techniques, tools and equipment to measure samples • Characteristics of machines/processes • Principles of leveling and alignment • Safe work practices and procedures • Applicable machine tooling and accessories • Symptoms of tool wear • Strategies for conveying routine instructions • Numerical operations, geometry and calculations/formulae for leveling and alignment • Effects on equipment performance and life of non-level or out of alignment components • Techniques, tools, equipment and procedures to carry out the leveling and/or alignment • Reasons for selecting tools, techniques and equipment • Hazards and control measures associated with leveling and alignment • Processes for interpreting engineering drawings • Equipment types, characteristics, technical capabilities and limitations • Operational, maintenance and basic diagnostic procedures • Site isolation procedures • Materials Safety Data Sheets and materials handling methods • Quality requirements • Safe work method statements
Underpinning Skills	Must demonstrate skills in: • Interpreting and following job/operation sheets, standard operating procedures, specifications, safe working procedures and other applicable reference documents • Planning and preparing concrete work • Leveling procedures • Bolting hole locations • Anchoring plate location • Identifying worn tools • Using hand tools for machine setting • Measuring to specified tolerances

	• Reading, interpreting and following information on standard operating procedures, manufacturer recommendations, drawings and other applicable reference documents • Performing leveling/alignment measurements and calculations • Setting up leveling/aligning equipment • Completing leveling and/or alignment tasks
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: • Written Test/ Oral questioning • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Mechanics Level II	
Unit Title	**Install and Maintain Fluid Power Pipes and Tubes**
Unit Code	**IND MCS2 12 0217**
Unit Descriptor	This unit covers competence required to perform fluid power pipes and tubes installation, maintenance and repair to pumps, equipment and machineries.

Elements	Performance Criteria
1. Identify and plan work	1.1. Work instructions, including plans, specifications, ***quality requirements*** and operational details relevant to the tasks are obtained, confirmed and applied based on operational procedures 1.2. The site safety plan and organizational requirements are applied based on the ***Occupational Health and Safety (OHS) standards*** 1.3. Quantity and type of components, ***tools and equipment*** required are identified from given drawings and in accordance with manufacturer specifications
2. prepare and set-up work	2.1. Faults are identified that will prevent the component operating as required due to operational procedures 2.2. Potential methods of repairing the fault are identified and applied to ensure compliance of the component with manufacturer specifications 2.3. Types of pipes and fittings identified are made appropriate to the required flow speed and pressure based on the required specifications 2.4. Appropriate tools and equipment are selected according to working procedures 2.5. Circuit functions and components are mapped out in suitable graphical diagrams according to standards
3. Install fluid power pipes and tubes	3.1. Pipes are lowered and placed in position to design specifications 3.2. Pipes are joined in accordance with manufacturers' specifications 3.3. Pipe system is installed in accordance with plans, specifications and standards 3.4. The repair is conducted in accordance with accepted timeframes and with minimum wastage
4. Assure quality and cleanup work	4.1. Components installed, repaired or maintained are flushed and pressure tested based on work specifications 4.2. Test reports are completed in accordance with ***environmental protection requirement***

	4.3. Work area, tools and equipment are cleared and ***materials and types*** are disposed of, reused or recycled in accordance with legislation/ regulations/codes of practice and job specification.

Variable	**Range**
Quality requirements	May include, but not limited to: • Dimensions, tolerances, standards of work and material • Standards as detailed in the project drawings • Specifications and project documentation to meet client • Applicable standard tests
OHS standards	May include, but not limited to: • Protective clothing and equipment, • Use of tools and equipment, workplace environment and safety, handling of materials, • Use of fire-fighting equipment, • Use of first aid equipment,
Tools and equipment	May Include but not be limited to: • Leveling equipment, • Hydraulic and pneumatic joints , fittings and seals • Pressure gauges • Leakage detector • Soldering and brazing tools • Pipe cutter • Pipe wrenches • Pipe threaded • Tapes • Flanges and bends
Environmental protection requirements	May Include but are not limited to: • Organizational/project, environmental management plan, waste management, water quality protection, noise, vibration, dust and clean-up management
Materials and types	May include, but not limited to: • Carbon steel • Stainless steel • Copper • Rubber flex piping • PVC • Galvanized • HDP

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Install and maintain fluid power pipes and tubes to machines. • Safe and effective operational use of tools and equipment • Communication and working effectively and safely with others • Identify types of pipes and fittings

Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Mains pipe systems and installation procedures • Processes for interpreting engineering drawings • Compliance with workshop safety plan, OHS regulations applicable to workplace operations • Cross connections • Project quality requirements
Underpinning Skills	Must demonstrate skills of: • Interpreting engineering drawings • Controlling valves and flow • Sizing of pipes • Installing pipe systems • Handling materials, safety data sheets and materials
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: Mechanics Level II	
Unit Title	**Participate in Workplace Communication**
Unit Code	**IND MCS2 13 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 not limited to: • Team members • Suppliers • Trade personnel • Local government and Industry bodies
Medium	May include, but not limited to: • Memorandum • Circular • Notice • Information discussion • Follow-up or verbal instructions & Face to face communication
Storage	May include manual filing and computer-based filing systems
Protocols	May include, but not limited to: • Observing meeting • Compliance with meeting decisions • Obeying meeting instructions
Workplace interactions	May include, but 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: Mechanics Level II	
Unit Title	**Work in Team Environment**
Unit Code	**IND MCS2 14 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 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 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 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: Mechanics Level II	
Unit Title	**Develop Business Practice**
Unit Code	**IND MCS2 15 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 not limited to: • Public holidays • Ceremonies • Natural disaster • Campaigns
Business opportunities	May include, but 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 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 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 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 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 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 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 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, but not limited to: • 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 • Establish 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: Mechanics Level II	
Unit Title	**Standardize and Sustain 3S**
Unit Code	**IND MCS2 16 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 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 not limited to: • Dust masks/goggles • Glove • Working cloth • First aid and safety shoes
Tools and equipment	May include, but not limited to: • Paint • Hook • Sticker • Signboard • Nails • Shelves • Chip wood • Sponge • Broom • Pencil • Shadow board/Tools board
Tools and techniques	May include, but 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 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 not limited to: • Verbal responses • Data entry into enterprise database • Brief written reports using enterprise report formats
Relevant personnel	May include, but 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 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, but not limited to: ➢ 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: Mechanics Level III	
Unit Title	**Perform Advanced Engineering Detail Drafting by using CAD**
Unit Code	**IND MCS3 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 or similar. 1.2. Required information is sourced from workshop manuals, customer specifications, product suppliers, and designers or similar. 1.3. Scope of drawing including layout, additional required information and resources are planned.
2. Prepare assembly, lay-out and detail drawing	2.1. Drawing details and specifications are determined. 2.2. Engineering calculations are undertaken to determine all dimensions including limits and fits, surface texture, datum references and geometric tolerances where appropriate to ensure functional operation and suitability 2.3. Dimensions and ***geometric tolerances*** of various components are inserted where required. 2.4. ***Appropriate symbols*** for ***limits and fits***, surface texture and geometric tolerances are included. 2.5. Correct convention of parts is shown. 2.6. Drawing is produced by using ***CAD*** in third angle projection, including auxiliary views, sections and assemblies 2.7. All drawings are produced in an accordance to manufacturers specifications 2.8. Components, material and/or assemblies are selected from data sheets or manufacturers' catalogues to meet specifications.
3. Check drawing	3.1. Drawings are checked to ensure compliance with specifications. 3.2. Drawings are checked to ensure that assembly/fabrication is possible. 3.3. Drawings are issued, filed and stored according to workplace system and procedures.

Variables	Range
Drawing	May include, but not limited to: • Assembly drawing • Lay-out drawing

	• Detail drawing • Component drawing
Geometric Tolerances	May include, but not limited to: • Parallelism • Perpendicularity, • Concentricity • Squareness • Run out • Flatness and circularity
Appropriate symbols	May include, but not limited to: • Perpendicular • Finish • Parallel and Diameter
Limits and fits	May include, but not limited to • Shaft basis system • Hole basis system
CAD	• Computer Aided Design

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 of fit • 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 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 • Reasons for checking the drawings to ensure that manufacturing/assembly is possible, efficient and cost effective • 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 of 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: Mechanics Level III	
Unit Title	**Perform Advanced Geometric Development**
Unit Code	**IND MCS3 02 0217**
Unit Descriptor	This unit covers competence required in marking out complex cylindrical/ rectangular, conical and transitions fabrications using advanced geometric development techniques. It reflects the advanced skills required to calculate cutting, bending lines and developments. Fabrications may include elliptical shapes, curves, spirals etc. Patterns may include complex and irregular shapes.

Elements	Performance Criteria
1. Mark off/out fabrications	1.1. Specifications and work requirements are determined using correct calculations appropriate to the task. 1.2. Development is carried out to specifications or standard operating procedures using tools and equipment appropriate to the task. 1.3. Datum points are correctly established and indicated. 1.4. ***Allowances*** are correctly determined and marked
2. Make templates as required	2.1. ***Template material*** is selected appropriate to the marking out requirements. 2.2. Templates are accurately produced. 2.3. Allowances are correctly determined and transferred. 2.4. Templates for rolling, bending, pressing, drilling and profiling are accurately produced following ***OHS*** procedures. 2.5. Correct storage procedures are followed including labeling and identification to standard operating procedures. 2.6. Appropriate tools and equipment are utilized throughout the process
3. Develop patterns as required	3.1. Most appropriate ***development method*** for the task is chosen and applied. 3.2. Allowances are correctly determined and transferred. 3.3. Relevant standards/codes and symbols are interpreted and applied to materials and processes 3.4. Developed patterns are ensured to comply with job specifications and work standards 3.5. Appropriate ***tools and equipment*** are utilized in the preparation of patterns
4. Estimate quantities of materials from detail drawings	4.1. Materials are correctly identified. 4.2. Quantities are estimated from drawings.

	4.3. Material use is optimized and wastage is minimized 4.4. Bill of materials is documented and reported/submitted to appropriate personnel following organization format and standards

Variables	**Range**
Allowances	May include, but not limited to Thickness, Bend, Pitch, Angle, Circumference, Perimeter, Contraction
Template material	May include, but not limited to Steel plate, Perspex, Timber, Cardboard, Paper etc.
OHS	Are to be in accordance with legislation and regulations and May include, but not limited to: • Protective clothing and equipment that prescribed under legislation, regulation and workplace policies and practices • Use of tools and equipment • Workplace environment and safety • Use of firefighting equipment and first aid equipment • Handling of materials and hazardous materials/substances • Safe operating procedures are to include but not be limited to recognizing and preventing hazards associated with the use of tools and equipment, trip hazards, underground services, surrounding structure and facilities and other machines • Working at heights, working in proximity to others, worksite visitors, the public and may include working in confined spaces
Development method	• Parallel line, radial line and triangulation
Tools and equipment	May include, but not limited to: • Set square and T- square • Templates and compass • Divider, cutter, sharpener, eraser • Hard (model) paper and bond paper (A4, A3, A2, A1) • Drawing table and paste/adhesive

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Identified the quality of materials • Carried out development to specifications or standard operating procedures using tools and equipment appropriate to the task • Determined and mark allowances • Accurately produced templates for rolling, bending, pressing, drilling and profiling • Chose and applied most appropriate development method for the task • Interpreted and applied requirements of standards/codes to materials and processes • Estimated quantities from drawings

Underpinning Knowledge and Attitudes	Demonstrates knowledge of:
	• Tools, equipment, techniques in template/patterns development
	• Datum points
	• Geometrical principles and formulae
	• Calculations of allowances:
	  ➢ Thickness, bend, pitch and angle
	  ➢ circumference and perimeter
	• Template/patterns materials and development
	• Manufacturers' allowances on materials
	• Procedures for making template/patterns
	• Template/patterns labeling, identification and storage
	• Fabrication and assembly allowances
	• Effects of material type/thickness on fabrication and assembly allowances
	• Sources of data on fabrication/assembly allowances
	• Relevant standards, codes, symbols
	• Fabrication materials
	• Optimizing material use and minimizing material wastage
	• Safe work practices and procedures
	• Codes and symbols
	• Template material uses, specification and storage
	• Linear measurements and calculations, volume and angles
	• Unit conversion from SI to British system or vise-versa
	• Report writing and documentation

Underpinning Skills	Demonstrates skills of: • Interpreting working drawing • Marking off/out fabrications • Preparing templates • Developing patters • Estimating bills of materials • Applying OHS procedures
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: Mechanics Level III	
Unit Title	**Perform Gas Metal Arc Welding (GMAW)**
Unit Code	**IND MCS3 03 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in preparing materials, selecting and setting up the welding equipment, carrying out the Gas Metal Arc Welding (GMAW) and inspecting and correcting defects in fabrication and assembly of metals.

Elements	Performance criteria
1. Prepare materials for Gas Metal Arc Welding (GMAW)	1.1. Weld requirements are identified from specifications and/or drawings. 1.2. ***Materials are correctly prepared*** in accordance with job specifications. 1.3. ***Materials*** are assembled /aligned to specification, where required.
2. Select and assemble welding machine / equipment	2.1. Necessary ***tools and equipment*** are selected and made ready for operational activity 2.2. Welding machine settings, accessories and consumables are identified. 2.3. Welding machine is positioned in proximity to work, does not pose as obstruction and is protected from damage due to dust, falling objects or rainfall. 2.4. Welding machine settings, accessories and consumables are selected. 2.5. Welding equipment is assembled and set-up to specifications. 2.6. Current, voltage, and wire feed settings are fine-tuned or adjusted consistent with job requirements to produce acceptable weld. 2.7. Welding machine is wired up or set to the polarity indicated in the welding procedures/specifications or as recommended by the filler wire manufacturer 2.8. Welding machine is connected to an independent power supply.
3. Minimize and rectify distortion	3.1. Appropriate ***distortion prevention measures*** are selected for weld and material type. 3.2. Distortion is rectified according to work procedures. 3.3. ***OHS*** procedures are observed throughout the process.
4. Weld to job specification using GMAW	4.1. Root pass is performed in accordance with specifications and enterprise/industry requirements and safety procedures

	4.2. Root pass is cleaned in accordance with procedures 4.3. Subsequent filling passes are performed in accordance with procedures 4.4. Capping is performed in accordance with specifications and procedures 4.5. Weld deposit is ensured to be within specifications. 4.6. Joints are cleaned and free from discontinuities. 4.7. Welded parts are free from ***weld defects*** or porosity.
5. Ensure weld conformance	5.1. Defects are removed with minimum loss of sound metal using techniques and tools appropriate to the defect, material and process. 5.2. Weld joints are visually inspected for conformance to specifications. 5.3. Weld records are completed and maintained correctly as required.

Variables	**Range**
Preparation of materials	May include, but not limited to: • Preheating, setting up of jigs, fixtures, clamps, etc., • Joint preparation e.g. beveling
Materials	May include, but not limited to: • Carbon steel or stainless steel, mild steel and aluminum • Consumables • GMAW/MIG wire (diameter) • Shielding gas (carbon, argon and other available inert gas)
Tools and equipment	Are to include: • Hand and power tools • Measuring equipment • relevant welding machines • AC or DC welding machines and welding accessories
Distortion prevention measures	• Pre-heating, setting up of jigs, fixtures, clamps, etc.
OHS	are Federal legislation and regulations and May include, but not limited to: • Protective clothing and equipment includes that prescribed under legislation, regulation and workplace policies and practices • Use of tools and equipment and handling of materials • Workplace environment and safety and hazard control • Use of firefighting and first aid equipment,
Weld defects	May include, but not limited to: • Crack, • Porosity, • Slug inclusion,

	• Discontinuities, • Lack of penetration and undercut • Elongated intrusion • Concavity/convexity • Degree of reinforcement • Burn through • Crater cracks • Lack of Fusion • Pinholes/Blowholes • Under fill • Overlap • Misalignment • Distortion

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Used correct welding machine and electrodes • Performed material joint preparation with correct electrode • Rectified welding defects • Selected and used different types of mig wire • Applied current settings, high frequency voltage • Applied safe welding practices Option for assessment: • Assessor may require the candidate to weld carbon steel pipes using MIG in 2G and 5G and/or 6G positions to acceptable standards following approved WPS.
Underpinning knowledge and Attitudes	Demonstrates knowledge of: • Welding codes • Basic mathematics and measurements • Plan/drawing interpretation • Material preparation • Joint preparation • Identification of consumables • Identification of weld • Causes of distortion for materials within the scope of this unit • Causes of defects and methods of rectification • The relationships between amperage, wire diameter and material • Types of gases and their uses • Current settings, high frequency voltage • Safe welding practices and measures
Underpinning Skills	Demonstrates skills of: • Selecting correct welding machine and wire • Material and joint preparation • Identifying and rectifying weld defects • Applying techniques for distortion prevention and rectification • Cleaning welds

	• Handling welding tools and equipment • Handling materials and consumables and checking purity of shielding gas • Reading and interpreting information on written job instructions, specifications, standard operating procedures and drawings • Recording routine information into proforma and standard workplace forms • Applying safe welding practices
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: Mechanics Level III	
Unit Title	**Perform Gas Tungsten Arc Welding (GTAW)**
Unit Code	**IND MCS3 04 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in preparing materials, selecting and setting up the welding equipment, carrying out the Gas Tungsten Arc Welding (GTAW) and inspecting and correcting defects in fabrication and assembly of metals.

Elements	Performance criteria
1. Prepare materials for Gas Tungsten Arc Welding (GTAW)	1.1. Weld requirements are identified from specifications and/or drawings. 1.2. ***Materials are correctly prepared*** in accordance with job specifications. 1.3. ***Materials*** are assembled/aligned to specification, where required.
2. Select and assemble welding machine / equipment	2.1. Welding ***tools and equipment***, electrodes, accessories and consumables appropriate to the material are identified and selected 2.2. Welding machine is positioned in proximity to work, does not pose as obstruction and is protected from damage due to dust, falling objects or rainfall. 2.3. Welding machine settings, accessories and consumables are selected. 2.4. Welding equipment are assembled and set-up to specifications. 2.5. A current and voltage settings are fine-tuned or adjusted consistent with job requirements to produce acceptable weld. 2.6. Welding machine is set to the polarity indicated in the welding procedures/specifications or as recommended by the filler wire manufacturer 2.7. Welding machine is connected to an independent power supply.
3. Minimize and rectify distortion	3.1. Appropriate ***distortion prevention measures*** are selected for weld and material type. 3.2. Distortion is rectified according to work procedures. 3.3. ***OHS*** procedures are observed throughout the process.
4. Weld to job specification using GTAW	4.1. Root pass is performed in accordance with specifications and enterprise/industry requirements and safety procedures 4.2. Root pass is cleaned in accordance with procedures

	4.3. Subsequent filling passes are performed in accordance with procedures 4.4. Capping is performed in accordance with specifications and procedures 4.5. Weld deposit is ensured to be within specifications. 4.6. Joints are cleaned and free from discontinuities. 4.7. Welded parts are free from ***weld defects*** or porosity.
5. Ensure weld conformance	5.1. Defects are removed with minimum loss of sound metal using techniques and tools appropriate to the defect, material and process. 5.2. Weld joints are visually inspected for conformance to specifications. 5.3. Weld records are completed and maintained correctly as required.

Variables	**Range**
Preparation of materials	May include, but not limited to: • Preheating, setting up of jigs, fixtures, clamps, etc., • Joint preparation e.g. beveling
Materials	May include, but not limited to: • Carbon steel or stainless steel, mild steel and aluminum • Consumables • Tungsten rod (type and design) • Shielding gas (argon and other available inert gas)
Tools and equipment	Are to include: • Hand and power tools • Measuring equipment • Relevant welding machines • AC or DC welding machines and • Welding accessories
Distortion prevention measures	• Pre-heating, setting up of jigs, fixtures, clamps, etc.
OHS	Are Federal legislation and regulations and May include, but not limited to: • Protective clothing and equipment includes that prescribed under legislation, regulation and workplace policies and practices • Use of tools and equipment and handling of materials • Workplace environment and safety and hazard control • Use of firefighting and first aid equipment,
Weld defects	May include, but not limited to: • Crack, porosity, slug inclusion, discontinuities, lack of penetration and undercut • Elongated intrusion • Tungsten inclusion

	• Concavity/convexity • Degree of reinforcement • Burn through • Crater cracks • Lack of Fusion • Pinholes/Blowholes • Under fill • Overlap • Misalignment • Distortion

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Used correct welding machine and electrodes • Performed material joint preparation with correct electrode • Rectified welding defects • Selected and used different types of electrodes • Applied current settings, high frequency voltage • Applied safe welding practices Option for assessment: • Assessor may require the candidate to weld carbon steel pipes using TIG in 2G and 5G and/or 6G positions to acceptable standards following approved WPS.
Underpinning knowledge and Attitudes	Demonstrates knowledge of: • Welding codes • Basic mathematics and measurements • Plan/drawing interpretation • Electrode classification • Material preparation • Joint preparation • Filler materials and consumables selection • Identification of weld • Causes of distortion for materials within the scope of this unit • Causes of defects and methods of rectification • The relationships between amperage, electrode and material • Types of gases and their uses • Types of electrodes, current settings, high frequency voltage • Safe welding practices and measures
Underpinning Skills	Demonstrates skills of: • Selecting correct welding machine and electrodes • Material and joint preparation • Identifying and rectifying weld defects • Applying techniques for distortion prevention and rectification • Cleaning welds • Handling welding tools and equipment • Handling materials and consumables and checking purity of inert gas

	• Reading and interpreting information on written job instructions, specifications, standard operating procedures and drawings • Recording routine information into proforma and standard workplace forms • Applying safe welding practices
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: Mechanics Level III	
Unit Title	**Perform Precision Assembly**
Unit code	**IND MCS3 05 0217**
Unit Descriptor	This unit covers competence in assembling and testing complex engineering components and mechanical assemblies in a production line.

Elements	Performance Criteria
1. Prepare for work	1.1. Work requirements are determined/interpreted correctly from work sheet or other instructions in accordance with standard operating procedures. 1.2. All ***components/sub-assemblies*** are checked against work sheet, assembly list or equivalent instructions 1.3. Fitting requirements and sequential assembly planning are carried according to operational procedures 1.4. ***Tools, equipment*** and components/sub-assemblies are selected to meet work requirements 1.5. ***OHS procedures*** are followed through the process in this unit.
2. Assemble engineering components	2.1. Components/sub components are correctly prepared for assembly according to standard operating procedure 2.2. ***Techniques*** and principles appropriate to the job requirements are applied according to operational standards 2.3. Components of assembly are fitted to ensure correct positioning and conformance with specifications. 2.4. Final ***adjustments*** are performed on assembly to ensure alignment with operational specifications. 2.5. Faulty assemblies are identified for rework or when the fault is outside the scope of the workstation, processed according to standard operating procedure.
3.Assure quality assembled items	3.1. ***Assembly is tested*** to ensure that components interface/ interact according to operational specifications 3.2. The assembly is correctly marked/tagged/identified due to specification 3.3. Components and/or assembly are handled and stored according to standard operating procedures and in a manner least likely to cause damage 3.4. Assembly results are recorded and reported in accordance with operational specifications

Variable	Range
Components/sub-assemblies	May include, but not limited to: • Parts/ components that make up machinery, devices, equipment or sub-assembly products
Tools and equipment	May include, but not limited to: • hand, power and portable tools, and equipment • measuring equipment
OHS procedures	May include, but not limited to: • Protective clothing and equipment (include that prescribed under legislation, regulation and workplace policies) • Safe use of tools and equipment and materials • Workplace environment and safety and hazard control • Use of firefighting and first aid equipment
Techniques	May include, but not limited to: • Assembly methods and correct use of hand and power tools
Adjustments	May include, but not limited to: • Clearances, mesh, tension, level, alignment etc.
Assembly testing	May include, but not limited to: • Depends on specification of assembled product • Testing and checking to specification of assembled product

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Perform sequential assembly planning and fitting requirements • Select tools, equipment and components/sub-assemblies based on job requirements • Test assembly to ensure that components are interface/interact according to operational specifications • Adjusted mechanical assemblies if required • Marked or tagged assembly without faults and stored in designated place
Underpinning knowledge and Attitudes	Demonstrates knowledge of: • Job sheet/instruction interpretation • Specifications and types of tools, equipment and materials • Criteria in selecting/determining components/sub-components • Principles and techniques in assembling components/sub-components • Fitting requirements • Sequence in which the tasks are to be performed • Required action for test and checks, and non-conformance • Sources of the component/sub-assemblies • Criteria in determining good component assemblies from defective component assemblies • Damage to components and/or assemblies through the use of inappropriate handling and/or unsafe storage procedures • Relevant record keeping requirements • Safe work practices and procedures

	• Hazards and control measures associated with precision assembly • Awareness of other site factors that could be affected by the work • Operation of plant and equipment using standard operating procedures • Manufacturing jigs and shields in accordance with specifications • Correctly calculating the operating parameters • Safe work practices and procedures
Underpinning Skills	Demonstrates skills of: • Operating relevant tools and equipment • Testing and checking assemblies • Preparing a sequential assembly plan • Selecting and sourcing appropriate tools, components and sub-assemblies • Using tools appropriately • Identifying faulty components • Following job and oral instructions • Performing relevant record keeping requirements • Storing assemblies without damage
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: Mechanics Level III	
Unit Title	**Perform Machine/Plant Installation**
Unit Code	**IND MCS3 06 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required installing machines and plants. It includes performing complex machine connection and setting, and instructing the operator on new installations or existing sites.

Elements	Performance Criteria
1. Prepare installation site	1.1. Design work is correctly interpreted according to specifications and manufacturers' manual 1.2. Location, foundation, power requirements, ventilation, work flow and ***waste*** disposal are inspected and analyzed due to operational regulations 1.3. Non-compliance with specification is reported to appropriate authority using a formal site report 1.4. Future capacity requirement is obtained in accordance with policy and procedures 1.5. Productivity improvement areas are established in accordance with organizational policy and procedures 1.6. Alteration/correction is undertaken with the approval of appropriate authority 1.7. Site report on preparation stage is logged with contractor
2. Install machine/ plant	2.1. Machine components are prepared for correct sequential installation procedures 2.2. ***Machine/plant*** is installed in accordance with manufacturers manual and site specifications according to contract 2.3. ***Routine modifications/alterations*** to equipment and supporting structures are undertaken based on standard operating procedures 2.4. Machine/plant is moved, positioned, leveled, aligned, coupled connected and any other parameter (excluding electrical connections) in accordance with ***specifications*** 2.5. All works are carried out safely and in accordance with workplace procedures and to the given standards 2.6. ***Machine set*** operator is instructed, if necessary, on sequence settings and any required ***OHS procedures***
3. Assure quality installation work	3.1. Test of process is carried-out in accordance with manufactures specifications 3.2. First-off samples are measured and inspected for compliance with specifications

	3.3. Trouble shooting and fault finding are performed based on manufacturers' manual 3.4. All clutters from the installation are cleared and workplace is left in safe state according to environmental legislation 3.5. All reports and documentation are prepared and completed correctly based on standard procedures and format.

Variable	Range
Waste	May include, but not limited to: • Waste reduction • Waste management • Recycling and up-cycling • Flow of material and waste
Machine/plant	May include, but not limited to: • Workshop equipment • Packaging equipment • From engineering drawings, • Data sheets • Manufacturers' specifications • Mills • Conveyor systems • Structural steel work • Pharmaceutical and hospital equipment • Horticulture equipment • Rotating equipment and machinery such as pumps, blowers, compressors, drive units, • Production equipment and plant • Process equipment • Lifting devices and cranes • Conveyers
Routine modifications/ alterations	May include, but not limited to: • Concrete fittings and jigs • Tapping and re-threading of holes on site and in factory • Fitting of spacers/shims • Relocation of brackets • Alignment of holes • Re-drilling of holes • Piping
Specifications	May include, but not limited to: • From engineering drawings, • Data sheets • manufacturers' specifications
Machine set	May include, but not limited to: • Gears • Cam, pin boards, trip dogs • Other timing mechanisms

OHS procedures	May include, but not limited to: • Standard references and guidelines, any relevant Directives and Regulations, information contained in manufacturers' manuals, standard operating procedures • Use of personal protective equipment/devices • Factory/Production safety regulations • standard electrical safety
Measuring instruments	May include, but not limited to: • Dial indicator • Micrometer caliper • Precision spirit level • Vernier caliper • Vibrometer
Materials	May include, but not limited to: • Brass shims (assorted thickness) • Mounting pad/plate • Anchor bolts

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Inspect installation site preparation • Mount work holding fixtures/devices • Install machine/plant • Set machine • Conduct pre-start checks • Test machine for faults/performance
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Occupational Health and Safety (OHS) • manufacturers manuals, operating manual, specification, symbols manual • Basic knowledge of workplace layout principles including at a basic level the degree to which workplace layout is affected by: ➢ Engineering processes and systems ➢ Materials flow patterns ➢ Types of production plant and machinery ➢ Materials handling methods ➢ Unit loads ➢ Types of production methods • Productivity: ➢ Definition and measures of productivity ➢ Factors affecting productivity ➢ Productivity, quality and value adding ➢ Internet ➢ Concrete tables ➢ Transportation clamps and securing devices ➢ Materials and components to be used in the installation of the machine/plant

	➢ Applicable codes and standards ➢ Health hazards and control measures associated with installing machine/plant ➢ Tooling, equipment and timing requirements of the machine operations ➢ Common machine defects and adjustments ➢ strategies / techniques of conveying routine instructions • Recording techniques: ➢ Flow charts and flow process charts ➢ Activity relationship charts ➢ Outline process charts ➢ Multipurpose charts and string diagrams ➢ Basic principle of ergonomics ➢ The concept of waste and its application to productivity improvement
Underpinning Skills	Demonstrates skill of: • Installation, and erection specification of the machine/plant • Following procedures if the location, dimensions and/or levels of the site do not comply with the specifications • Performing installation sequence • Methods to locate, fix/fasten machine/plant • Methods of lifting/moving machine/plant and components • Techniques, tools and equipment to measure site and machine/plant installation • Use and application of personal protective equipment • Restoring the work area including housekeeping work • Determining machine process sequence • Verbally conveying routine and familiar instructions • Measuring to specified tolerances • Communicating and documenting • Reviewing and analyzing • Applying principles of ergonomics • Applying productivity principles
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 accessed through: • Written Exam/Oral questioning • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in simulated workplace setting.

Occupational Standard: Mechanics Level III	
Unit Title	**Maintain and Repair Engineering Components**
Unit Code	**IND MCS3 07 0217**
Unit Descriptor	This unit covers competence to perform maintenance, fault finding and repair of mechanical engineering components and assemblies. It includes spare parts manufacturing, fitting, final adjustment and commissioning.

Elements	Performance Criteria
1.Determine scope of maintenance and/or repair	1.1. Test, maintenance and repair specifications for components, assemblies and machinery are interpreted and understood in accordance with ***manufacturers' manual***
	1.2. Correct measuring/test devices are obtained and set up in compliance with specification
	1.3. Measurements/readings are taken at appropriate points based on manufactures' instruction
	1.4. All variances from specifications are recorded based on standard operating procedures
	1.5. Causes of faults are detected using appropriate engineering principles, techniques, procedures, tools and equipment.
	1.6. Data list of maintenance, repair, replacement, adjustment or requirements are determined due to regulations
2.Maintenance and repair of components	2.1. ***Plant***/machine/ assemblies is/are serviced according to Maintenance Plan and Schedule (MPS)
	2.2. Belts and drives are inspected and replaced according to MPS
	2.3. Runners, rollers and transport systems of plant are serviced and/or replaced according to MPS
	2.4. Safety features of plant/machine are tested to ensure its workability according to planned maintenance schedule
	2.5. Electrical/Electronic systems are tested according to specification
	2.6. Hydraulic and Pneumatic systems are tested according to specifications by Appling ***OHS*** procedures.
	2.7. When applicable, replacement parts are selected from manufacturers' catalogues and assessed against specification
	2.8. Where applicable, appropriate method of repair is determined based on standard procedures
	2.9. Where applicable, faulty components are repaired or adjusted to conform with specifications

3.Manufacture spare parts/ components	3.1. Replacement components/spare parts specifications are determined from appropriate source according to manufacturers' standard 3.2. Replacement components/spare parts are produced using appropriate ***workshop practice*** compliant with genuine specifications 3.3. Completed components/Spare parts are tested in accordance with genuine specifications
4.Assure quality maintained or repaired components	4.1. Component/unit is tested under operational conditions using acceptable engineering principles for compliance to operational specifications 4.2. Out of specification modification/alterations are approved by appropriate authority and are recorded and documented to standard operating procedure 4.3. Final component assembly is commissioned and returned to service according to standard operating procedures 4.4. Spare parts are recorded and re –ordered as needed due to genuine specifications 4.5. Report/logs are produced on completed system/plant/ machinery/status/performance as required in accordance with company operating procedures

Variable	**Range**
Manufacturers' manual	• Any appropriate manufacturers' catalogues that contain replacement parts that conform with specifications and operational requirements
Plant	System refers to but not limited to: • Workshop equipment • Packaging equipment • Mills • Concrete crusher/mixer • Conveyor systems • Structural steel work • Pharmaceutical and hospital equipment • Rotating equipment and machinery • Production equipment • Plant and machinery • Process equipment • Machine tools
OHS	May include, but not limited to: • Factory/Production safety regulations • Personal Protective Equipment (PPE) • Standard electrical safety • Moving heavy loads safety • COSHH

Workshop practices	May include, but not limited to Drilling, Scraping, Filing, Reaming, Tapping, Threading, etc.
Fitting principles and techniques	May include, but not limited to: • Limits of tolerance • Allowances and clearances • Effects of wear, stress, temperature • Types of fits – clearance, transition, interference • Press fitting methods • Force fits • Keyed fits • Shrink and freeze (expansion) fits • Limits of tolerance techniques • Allowances and clearances • Effects of wear, stress, temperature • Types of fits – clearance transition interference • Press fitting methods

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Repair and fit engineering components • Plan maintenance procedures • Assess system maintenance requirements • Carry-out machine maintenance • Analyze machine performance after maintenance
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Tools and equipment to be used to dismantle the components • Consequences of having components that do not comply with operational specifications • The types of adjustment applicable to the components being repaired/fitted • Appropriate methods of repair • The features and/or dimensions upon which replacement parts are to be selected • The process of identifying replacement parts from third party suppliers' catalogues • The material properties required • Sequence of events in the planned maintenance of the machine/plant • Gaskets flanges and pipes • PLCs and Software • Environmental considerations regarding disposal of liquids and solids • Machine/plant manual • Operating tables • Maintenance schedule • The manufacturing operations to be used in the production of new components

	• The sequence of operations to be used in the production of new components • The fitting requirements for assembling components • The appropriate sequence of assembly tasks • The purpose of using gland packing, jointing or gasket materials • The reasons for selecting particular jointing or packing materials • The applications of different types of lubricants • The consequences of using inappropriate or no lubricant • The need to have approval for out of specification modifications • The reasons for documenting out of specification modifications • Return to service procedures • The consequences of not following work site return to service procedures • Hazard and control measures associated with repairing and fitting engineering components, including housekeeping • Safe work practices and procedures
Underpinning Skills	Demonstrate skills in: • Obtaining operational specifications for the component/s • Assessing operation against specification and identifying faults • Checking component/s visually and dimensionally against the operational specifications using work site procedures • Checking repaired components visually and dimensionally for conformance to specifications • Maintaining performance tests appropriate to the machine/plant • Using manufacturers manuals • Using measurements required to ensure conformance to specifications and correct points at which measurements are to be taken • Appropriate adjustments to bring the machine/plant inline operational • Adjusting components selecting replacement parts • Preparing and assembling components • Applying gland packing, jointing or gasket materials • Applying appropriate lubricants • Adjusting components • Recording any approved modifications/alterations to work site procedures • Inspecting the final assembly and checking • Returning the final assembly to service in accordance with work site procedures • Brazing and soldering, basic machining for turning for screws and bolts, spare parts drilling

	• Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents • Maintaining reporting requirements relevant to the machine/plant being
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 accessed through: • Written Exam/Oral questioning • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in simulated workplace setting.

Occupational Standard: Mechanics Level III	
Unit Title	**Undertake Commissioning of Plant and Equipment**
Unit Code	**IND MCS3 08 0217**
Unit Descriptor	This unit covers competence required in under tale commissioning work on internally or externally located plant and/or engineering equipment.

Elements	Performance Criteria
1. Plan commissioning procedure	1.1. Suppliers Manuals are consulted to determine the commissioning procedure according to set standards 1.2. Commissioning procedure is prepared and approval is obtained in accordance with contract operating procedures 1.3. Operational performance charts are developed/obtained based on plant specifications 1.4. Applicable software is made available for processing data specifications
2. Assess system performance	2.1. Test and performance criteria are obtained from the manufacturers' manual 2.2. Correct measuring/test devices are obtained and applied according to system specifications 2.3. All necessary measurements/readings are taken and documented at appropriate points due to standard 2.4. Control systems are tested and verified in compliance with regulations 2.5. Safety equipment are tested and verified in compliance with regulations 2.6. All variances from specifications are recorded based on standard operating procedures.
3. Adjust plant	3.1. ***Plant/system*** performance is adjusted utilizing appropriate and correct techniques in accordance with design and operational specifications 3.2. Technical difficulties are resolved in consultation with manuals and appropriate technical advisers 3.3. PLCs/Software is adjusted in accordance with the operation manual and specifications
4. Assure quality plant performance	4.1. Performance of plant is assessed against performance criteria 4.2. Report/logs are prepared based on completed system/plant/machinery/status/performance in accordance with standard operating procedures. 4.3. Necessary documentation and reporting are accomplished in accordance with workplace procedures and format

Variable	Range
Plant/system	May include, but not limited to: • workshop equipment • packaging equipment • mills • crusher /mixer • conveyor systems • structural steel work • pharmaceutical and hospital equipment • rotating equipment and machinery • production equipment • plant and machinery • process equipment • machine tools

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Planned commissioning procedure for plant/equipment • Assessed system performance • Adjusted plant according to manufacturers' specification • Analyzed performance of the machine after commissioning
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • OHS May include, but not limited to: ➢ workplace safety regulations ➢ Personal Protective Equipment (PPE) ➢ standard electrical safety regulations • The sequence of events in the commissioning of the machine/plant • Performance tests appropriate to the machine/plant to be commissioned • Measurements required to ensure conformance to specifications and correct points at which measurements are to be taken • Transportation clamps and securing devices • Appropriate adjustments to bring the machine/plant into line with operational specifications based on engineering • Principles or appropriate technical advice • PLCS and Software • Types of safety guards
Underpinning Skills	Demonstrates skills in: • Moving heavy loads safely • Using manufacturers manuals • Wearing personal protective equipment • Keeping Standard electrical safety • Reporting requirements relevant to the machine/plant being commissioned

	• Performing adjustments and tests to plant/equipment • Performing measurements to ensure conformity to specifications
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 accessed through: • Observation/Demonstration • Written exam/Oral questioning with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Mechanics Level III	
Unit Title	**Install and Maintain Basic Pneumatic and Hydraulic Systems**
Unit Code	**IND MCS3 09 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes necessary to install, test and maintain basic pneumatic and hydraulic systems.

Elements	Performance Criteria
1. Plan and Prepare work	1.1. Basic pneumatic circuit diagrams and related component symbols are read and interpreted according to standards 1.2. Basic hydraulic circuit diagrams and related component symbols are read and interpreted according to standards 1.3. Pneumatic and hydraulic ***components*** are identified and selected according to diagram and standard 1.4. Installation work is appropriately planned and sequenced in accordance with requirements 1.5. Correct tools and auxiliary equipment are selected and obtained according to specifications and task
2. Install basic pneumatic and hydraulic circuits	2.1. Pneumatic and hydraulic lines/piping are joined and terminated according to diagrams and standards 2.2. Appropriate personal protective equipment are worn in line with standard operating procedures. 2.3. ***OHS policies*** **and** ***procedures*** for installation are followed in line with the requirements. 2.4. Instrumentation and control standards are followed in line with the job requirements. 2.5. Basic pneumatic and hydraulic circuits are installed in accordance with specifications and operational procedures 2.6. Components and fittings are inspected on functionality and possible faults corrected according to specifications 2.7. Maintenance requirements on system are applied based on manufactures' specifications 2.8. Work safety practices for pneumatics and hydraulics are applied according to specification and standard
3. Test and repair components and circuits	3.1. Test equipment and test procedures are established based on work task and specifications 3.2. All components and lines are tested on functionality and leakages due to operational and test pressure requirements 3.3. Basic pneumatic and hydraulic circuits are tested on functionality in accordance with operational procedures 3.4. Faults are identified and reported timely to appropriate personnel in accordance with operational procedures

	3.5. Repair on components and circuit is performed following safety standards and manufactures' specifications 3.6. Test results are recorded in compliance with operational requirements
4. Assure quality and maintain work	4.1. Installation of pneumatic system is maintained to specification 4.2. Installation of hydraulic system is maintained to specification 4.3. Pneumatic and hydraulic safety is maintained to standard 4.4. Test equipment and procedures are documented according to regulations 4.5. Work site is cleaned and all debris are cleared of and left safe in accordance with the company requirements

Variable	Range
Components	May include, but not limited to: • Compressors • Pumps • Reservoirs • Pressure regulators • Instrumentation • Piping • Seals • Connectors • Valves • Manometers • Actuators • Cylinders • Relief valves • Drivers
OHS policies and procedures application	May include, but not limited to: • OHS guidelines • Ethiopia environmental standards • Standard personal protective equipment
Diagram and Circuits	Basic pneumatic and hydraulic systems include but not limited to: • Principles of pneumatics and hydraulics • Diagrams and related symbols • basic lifting circuits • basic motor circuits • basic pushing circuit
Equipment/testing devices	May include, but not limited to: • Pressure meter • Leakage detectors • Multi meters • Process switches

Evidence Guide	
Critical Aspects of Competence	Assessment require evidence that the candidate: • Interpret work instructions and select correct components • Install basic pneumatic and hydraulic circuits • Conduct inspection and tests accurately on the devices • Document the tasks undertaken • Select and use correct personal protective equipment
Underpinning Knowledge	Demonstrate knowledge of: • Occupational health and safety practices • Communication principles • Principles of fluid pressure • Pascal's pressure law • Requirements of pneumatic and hydraulic standards • Selection of correct tools and test equipment • Mathematical calculations • Diagrams and symbols in pneumatics and hydraulics • Function of pneumatic and hydraulic components • Basic pneumatic and hydraulic circuits • Principles of fault finding and leakage detection • Rules of safe and clean work place environment
Underpinning Skills	Demonstrate skills of: • Planning and preparing work procedures on pneumatic and hydraulic systems • Selecting and using appropriate tools & equipment • Installing pneumatic and hydraulic circuits with correct components • Solving faults in unplanned events • Repairing and testing pneumatic and hydraulic components • Testing functionality of pneumatic and hydraulic circuits • Recording test results • Maintaining safe and clean work place environment
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 accessed through: • Observation/Interview • Written exam/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Mechanics Level III	
Unit Title	**Install Electrical Measuring Instruments and Control Devices**
Unit Code	**IND MCS3 10 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes necessary to install instrumentation, industrial wiring and control devices.

Elements	Performance Criteria
1. Plan and Prepare Installation work	1.1. Work order and drawing are read and correct interpreted in compliance with work requirements 1.2. Installation and connection of electrical metering units or measuring instruments with their relative control devices is planned according to task instructions 1.3. ***Materials*** necessary to complete the work are obtained in accordance with work requirements.
2. Install instrumentation and control devices	2.1. OHS policies and procedures inclusive protective clothing for installation are applied in line with the regulations 2.2. Appropriate ***Personal Protective Equipment (PPE)*** are worn in line with standard operating procedures. 2.3. ***OHS policies*** **and** ***procedures*** for installation are followed in line with the requirements. 2.4. ***Instrumentation and control standards*** are followed in line with the job requirements. 2.5. Instrumentation and Control standards are followed in line with the work requirements. 2.6. Devices or ***tools*** are wired and connected in accordance with manufacturer's instructions, requirements, and without damage to the surrounding place or environment 2.7. Events or conditions are responded to in accordance with established procedure
3. Assure quality instrumentation and control devices	3.1. Devices are tested functionally in accordance with standard procedures 3.2. Relevant commissioning tests are done to ensure compliance of statutory requirements 3.3. Process of equipment installation and testing is documented according to company's procedures/policies
4. Clean-up	4.1. Work site is cleaned and cleared of all debris and left safe in accordance with the company requirements 4.2. Devices are cleaned in accordance with standard procedures

Variable	Range

Materials	May include, but not limited to: • Wires and cables • Pipes/tubes & fittings • Sealing materials • Fasteners
PPE	May include, but not limited to: • Compulsive working protections • Insulating mat • Lockout tags • Safety belt and ladder
OHS policies and procedures	May include, but not limited to: • OHS guidelines • Ethiopia environmental standards
Instrumentation and control standards	May include, but not limited to: • Sensors/transmitters/transducers • Indicators both analogue and digital • Controllers including plc controlled devices • Control valves • Actuators • Recorders • Annunciator associated with the installed devices • Process switches
Tools	May include, but not limited to: • Cutter • Drill • Threading tool(assorted) • Pliers (assorted) • Screw drivers (assorted) • Soldering iron/gun • Wrenches, hexagonal wrenches or Allen keys • Water level, tri-square • Measuring tapes • Calipers and gauges
Equipment/testing devices	May include, but not limited to: • Lifting equipment • Fastening equipment • Multi-meters • Insulation tester or (Megger) • Calibrators

Evidence Guide	
Critical Aspects of Competence	Assessment require evidence that the candidate: • Interpret work instructions correctly • Install instrumentation & control devices up to standard • Conduct inspection and tests for commissioning • Document tasks undertaken
Underpinning	Demonstrate knowledge of :

Knowledge	• Occupational health and safety standards • Control and regulation theory • Basic electrical and electronic theory • Instrumentation & control specifications and function • Choice of tools, test equipment and calibrators • Process control system (single-loop & multi-loop controllers, DCS, DAS, SCADA, etc) • Sensors, transmitters, transducers & converters • Programmable logic controllers • Control valves and final control elements
Underpinning Skills	Demonstrates skills to: • Read drawings and circuit diagrams • Process variable measurements (pressure, level, flow, temperature, analysis, etc.) • Use proper hand tool, power tools and equipment • Use of electrical test instruments. • Mount and wiring instrumentation units and measuring devices • Solve problems in unplanned events
Resource 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 accessed through: • Observation/ Interview • Written exam/ Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Mechanics Level III	
Unit Title	**Perform Maintenance and Repair on Industrial Electrical Machines and Drives**
Unit Code	**IND MCS3 11 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed in performing maintenance, fault-finding and repair works on industrial electrical machines and drives.

Elements	Performance Criteria
1. Plan, prepare and coordinate maintenance works	1.1. ***Maintenance work*** is prepared in accordance with machine or drive operating time schedule or condition 1.2. Sequential work plan is prepared according to manufactures' manual and established enterprise procedures 1.3. Required materials, tools, equipment, testing devices and ***Personal Protective Equipments (PPE)*** are identified and obtained in line with prepared work instructions 1.4. Potential hazards are identified for prevention and control measures are selected in accordance with the work plan and operational procedures 1.5. Safety permit/Hot work permit is secured in accordance with enterprise procedure 1.6. Responsible department/personnel are informed on the schedule of work according to standard operating procedure.
2. Maintain electrical drive system or components	2.1. Safety policies and procedures are followed in accordance with OHSand enterprise procedure 2.2. Availability of ***maintenance records*** are prepared in accordance with established procedure, or based on enterprise Quality Management System (QMS). 2.3. Circuit or equipment to be diagnosed is isolated (lockout/ tag-out) in accordance with established procedure or according to suitable accepted standard practices 2.4. AC and DC machine(s) are cleaned/lubricated and inspected according to work instructions and work site procedures 2.5. Readings of ***electrical test instruments*** are diagnosed and identified defective instruments are referred for calibration/replacement in accordance with enterprise procedure 2.6. Mechanical fasteners are inspected and regularly tightened according to tensile strength, sizes and torque requirements 2.7. Regular routine/visual/sensory ***mechanical inspection*** is monitored instrict compliance withoperational precedures and company policies

3. Fault finding and Repair Electrical Drive System or components	3.1. Safety policies and procedures are strictly followed 3.2. Circuit or equipment to be diagnosed is isolated (lockout/tag-out) in accordance with safety regulations and operatiopnal procedures 3.3. Indicators/Symptoms of fault or failure are identified based on manufatures' manual and specifications 3.4. Necessary electrical test on the system or equipment is performed in accordance with safety regulations and to manufacturers' guidelines 3.5. Scope of fault, including estimated time to accomplish the task and the spare parts needed, are determined according to extent of damage 3.6. Worn-out/malfunctioning ***electrical inspection*** machine drive system or equipment parts are replaced in accordance with manufacturer's requirements / enterprise standards 3.7. Other works associated with the fault are coordinated with other concerned groupaccording to operational procedures
4.Assure quality and cleanup work	4.1. Final ***electrical and performance tests*** are carried out and data captured in accordance with work requirements and safety regulations 4.2. Service/Fault finding report is compiled and submitted according to operational procedures 4.3. ***Tools, equipment,testing device*** and work area are cleaned up and made safe in accordance with OHS requirements and established procedures

Variable	**Range**
Maintenance work	May include, but not limited to: • Preventive/ Monitoring • Corrective/Breakdown • Routine • Predictive and Condition based
PPE	May include, but not limited to: • Compulsive working protections • Insulating mat • Lockout tags • Safety belt and ladder
Maintenance records	May include, but not limited to: • Electrical plans • Equipment electrical diagrams • Historical records • Log book
Electrical test instruments	May include, but not limited to: • Multi-meter (VOM/DMM)

	• Insulation resistance tester (Megger) • High potential tester • Low resistance tester • Phase sequence meter • Ammeter
Mechanical inspection	May include, but not limited to inspection of: • Check frame for cracks • Bearings • Couplings • Base mounting / bolts • Cooling fan / forced cooling • Cowling if applicable • Terminal box
Electrical inspection	May include, but not limited to inspection of: • Earthing according to ET standards • Terminations / hot connections • Brushes • Brush gear • Brush pressure • Commutator and Terminal marks
Electrical and performance test	May include, but not limited to: • Continuity test • Electrical insulation test • High potential test (as the need arises) • Earth resistance test • Phase sequence test • Load test • Winding resistance test • Free running test • Simulation Test/No Load Test • Phase sequence • Actual Operation and Temperature
Tools, equipment and testing devices	May include, but not limited to: • Electrical hand tools • Testing instruments/devices • Testing equipment

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Demonstrate understanding of safety regulations applicable to worksite operations • Performs maintenance and troubleshooting procedures • Demonstrate the use of electrical testing equipment • Performs general repair on electrical machinery and drives • Commissions repaired and maintained electrical machinery for production purposes

Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Fundamentals of electricity • Electro-mechanical principles and requirements • Maintaining and monitoring electro-mechanical plant and equipment • Maintenance and troubleshooting procedures • Energizing standard electrical system • Measuring electrical circuits and machinery • Potential hazards and safety practices
Underpinning Skills	Demonstrate skills in: • Maintenance procedures • Preparing/obtaining materials, PPE, tools, equipment and testing devices • Evaluating condition of damage • Estimating time required to accomplish repair • Selecting prevention and/or control measures • Proper handling of equipment, tools, materials and consumables • Coordinating and communicating Interpreting plan and details • Tracing circuits • Performing basic first-aid • Practicing safe working habits • Using test instruments effectively • Troubleshooting and fault finding
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 accessed through: • Observation/ Interview • Written exam/ Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Mechanics Level III	
Unit Title	**Monitor Implementation of Work Plan/Activities**
Unit Code	**IND MCS3 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 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: Mechanics Level III	
Unit Title	**Apply Quality Control**
Unit Code	**IND MCS3 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 not limited to: • Check against design / specifications • Visual and Physical inspection
Quality standards	May include, but not limited to: • Materials

	• Components • Process • Procedures
Quality parameters	May include, but 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: Mechanics Level III	
Unit Title	**Lead Workplace Communication**
Unit Code	**IND MCS3 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 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: Mechanics Level III	
Unit Title	**Lead Small Teams**
Unit Code	**IND MCS3 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 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 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 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 not limited to:	May include, but 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: Mechanics Level III	
Unit Title	**Improve Business Practice**
Unit Code	**IND MCS3 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 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 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 not limited to: • Quality • Pricing • Cost • Location • Technology • Delivery • Timeframe • Promotion • Niche marketing • Support from government
Key indicators	May include, but 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 not limited to: • Lines of authority and reporting relationship
Objectives	May include, but not limited to: • Market share growth • Revenue growth • Profitability • Productivity • Innovation
Market position	May include, but 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 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 not limited to: • Features as perceived by the client • Benefits as perceived by the client
Promotion tools	May include, but 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 not limited to: • Importance • Urgency • Technology • Resource availability
Relevant stockholders	May include, but 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: Mechanics Level III	
Unit Title	**Prevent and Eliminate MUDA**
Unit Code	**IND MCS3 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 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 not limited to: • Dust masks/goggles • Glove • Working cloth • First aid and safety shoes
Tools and techniques	May include, but 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

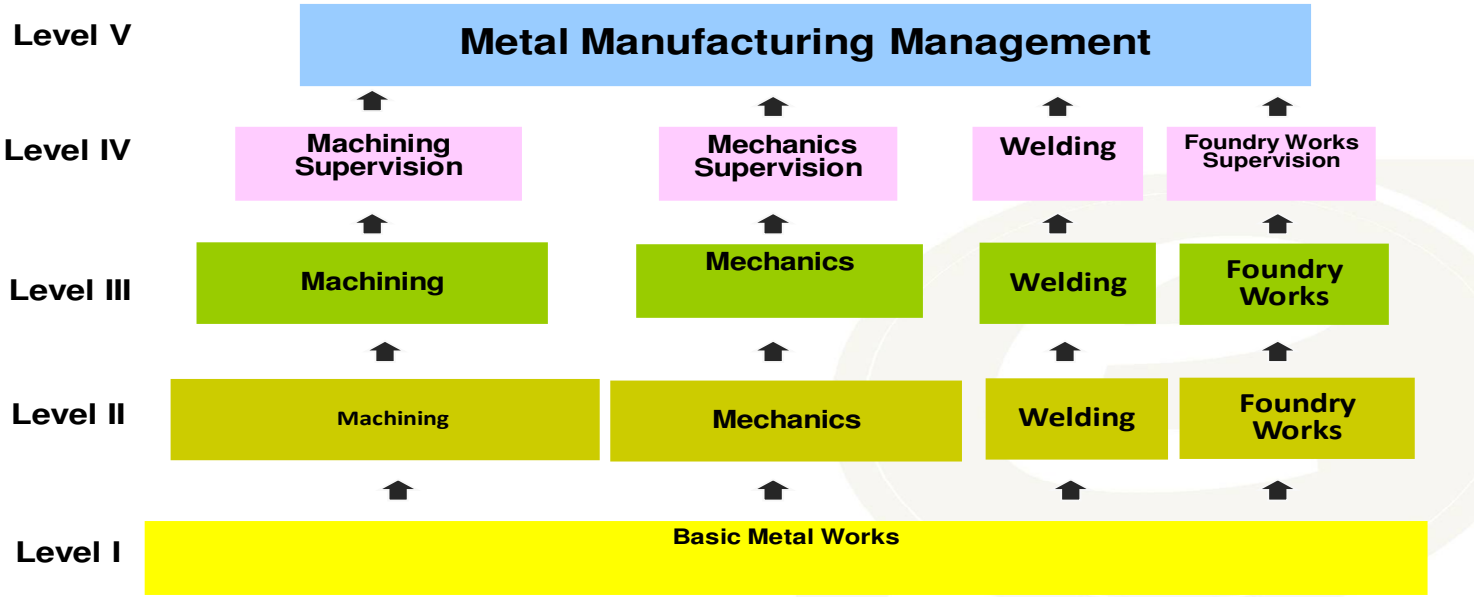
	• Brainstorming • Andon • U-line • In-lining • Unification • Multi-process handling & Multi-skilled operators • A.B. control (Two point control) • Cell production line • TPM (Total Productive Maintenance)
Relevant procedures	May include, but not limited to: • Make waste visible • Be conscious of the waste • Be accountable for the waste. • Measure the waste.
The ten basic principles for improvement	May include, but 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 not limited to: • Red Tagging • Sign boards • Outlining • Andons • Kanban, etc.
5W and 1H	May include, but not limited to: • Who • What • Where • When • Why and 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 & 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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