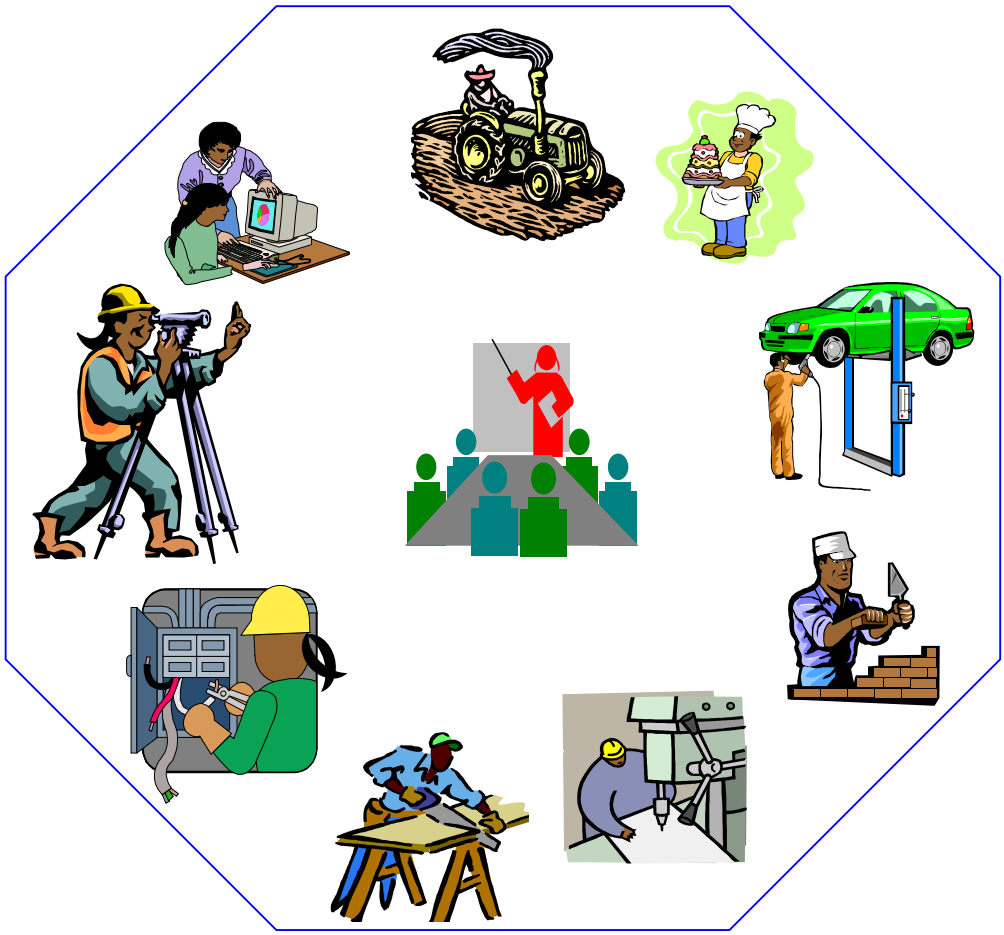
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

WELDING

NTQF Level II-IV



Ministry of Education
February 2017

Introduction

Ethiopia has embarked on a process of reforming its Technical and Vocational Education and Training (TVET) System. Within the policies and strategies of the Ethiopian Government, technology transformation by using current 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 Standard (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 Ethiopian standards, which define the current and future occupational requirements and expected outcome related to a specific occupation using distinct Unit of Competences without taking TVET delivery into account.

The whole Package EOS document for an occupation is an integrated set of nationally endorsed core generic Unit of Competences organized in to different qualification levels built one upon the other below or side wise to make full occupational profile.

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 and NTQF level
- Unit title
- Unit code
- Unit descriptor
- Elements and Performance criteria
- Range and Variables
- Evidence guide

Together all the parts of a Unit of Competence guide the assessor/curriculum developer in determining the candidate training and assessment.

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

- Chart with an overview of all Units of Competence with their Unit Codes and Titles
- Detail contents of each Unit of Competence
- Occupational map providing the TVET providers with information and important requirements to consider when designing training programs using this standards and show a career path

Modification History

Occupational Titling

This occupational Standard is set for Welding ranging from Level 2-4:

Unit Coding

There are agreed conventions for the unit codes used for unit of competences organized for any specific occupational standard. Codes are given by considering international and national benchmarks.

Unit Title: Welding
Unit Code: **IND WLD2 01/02/... 0217**
Unit Coding is Described Here Under:

Character	**What it stands for:**
IND	First three characters signify *the priority/major industry/sector* acronym. E.g. ***Industry Development***
WLD2	Four characters in the second group signify the acronym of the occupational title expressed as a work function and qualification level written in numerical form shows the unit belongs. **E.g. *Welding Level II...***
01	Third group with two numbers signify the numerical order of the specific unit
0217	Fourth group of four characters signify the month and year of development. **E.g. February 2017**

Version Change

The version number is either changed or not, depending on the extent of the change. This Occupational standard is organized in three levels with the same title "Welding." Those who are responsible to undertake competence assessment and provide training should check for the version review of the document to confirm the latest version number before developing assessment tools and commence training respectively. Users are also advised to contact the agency for any doubts they have on the document or may refer to our website.

The development date is the time the document is prepared and validated by relevant industry experts and approved by relevant sector leading the industry. It indicates the effective date to use the document for training and assessment purposes and termination of use of the previous version for any purposes.

The endorsed occupational standards and their components remain current until they are reviewed or replaced.

Users of this occupational standard are advised strictly to read and understand the table below for the changes made on the occupational standard during revision process.

Name: Welding

Previous Occupational Level: II-III

Version: 1

Date of Development: March 2011

Modified Occupational level Name: Welding

New Occupational Level: II-IV

Version: Level II and III: 2 and Level IV: 1

Date of Review: February 2017

Occupational Level	Changes on the units	Justification/Remark
II	***Endorsed Units:*** • Perform Mensuration and Calculations • Maintain Tools and Equipment • Weld Using Gas Metal Arc Welding Process (GMAW) • Weld Using Shielded Metal Arc Welding Process (SMAW) • Participate in Workplace Communication • Work in Team Environment • Develop Business Practice	By making Some changes on the contents, including updating unit codes
	• Perform Thermal Cutting (with no Manual Heating) • Repair Weld (by inspecting)	With some concept changes from the title to the detail
	New units Added: • Perform Fillet Tungsten Inert Gas (TIG) Welding	Moved to appropriate Level II
	Merged Units:	**None**
	Replaced Units: • Apply Continuous Improvement Processes (Kaizen)	**Replaced by:** "Standardize and Sustain 3S"
	Removed Units:	**None**
III	***Endorsed Units:*** • Perform Advanced Engineering Detail Drafting • Perform Special Welding Processes	With some concept changes from the title to the detail

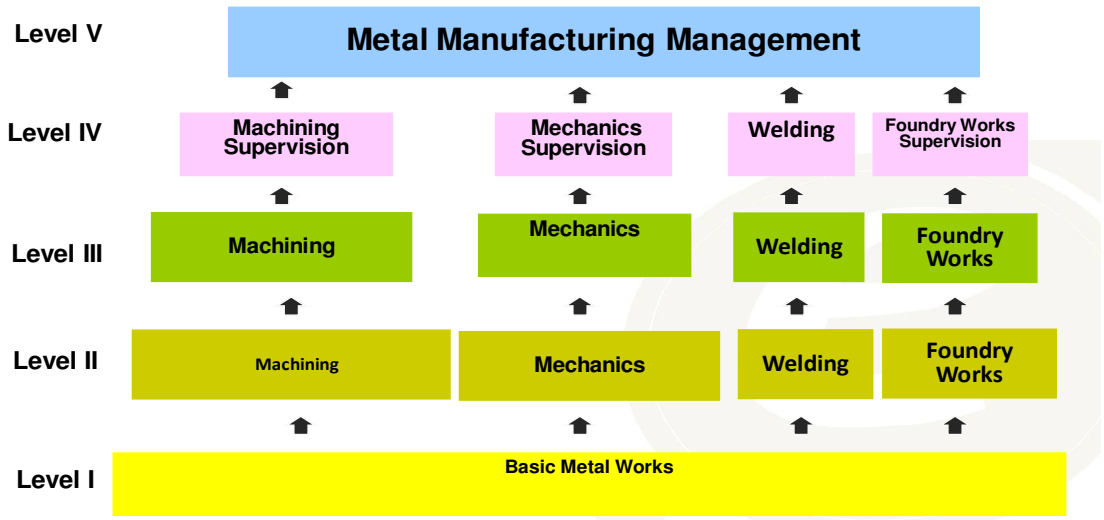
Occupational Level	Changes on the units	Justification/Remark
	• Monitor Implementation of Work Plan/Activities • Lead Small Team • Improve Business Practice • Lead Workplace Communication • Apply Quality Control	
	New units Added: • Perform Plate and Tube Welding Using Gas Tungsten Arc Welding (GTAW) • Perform Plate and Tube Welding using Shielded Metal Arc Welding (SMAW) • Perform Plate and Tube Welding Using Gas Metal Arc Welding (GMAW)	Newly added by growing from level 2
	• Determine Welding Materials	Newly added
	Merged Units:	**None**
	Replaced Units: • Maintain Quality System and Continuous Improvement Processes (Kaizen)	**Replaced by:** **"** Prevent and Eliminate MUDA"
	Removed Units:	**None**
IV	***Endorsed Units:*** • Plan and Organize Work • Develop Team and Individuals • Migrate to New Technology • Utilize Specialized Communication Skills • Establish Quality Standards	**None**
	New units Added: • Supervise and Guide CIM Production Operations • Develop Models • Manage Product Cost Estimation and Bill of Materials • Perform Process Planning and Scheduling • Perform High Reliability Soldering and De-soldering • Perform Brazing and Silver Soldering • Apply and Supervise Metallurgy Principles • Apply and Supervise Welding	Newly added as distinct unit of competences

Occupational Level	Changes on the units	Justification/Remark
	Codes and Principles • Implement and Monitor Environmentally Sustainable Work Practices	
	Merged Units:	**None**
	Replaced Units: • Manage Continuous Improvement System • Manage and Maintain Small/Medium Business Operations	**Replaced by**: " Apply Problem Solving Techniques and Tools" and "Manage Micro, Small and Medium Enterprises (MSMEs)" respectively
	Removed Units:	**None**

Occupational Map

The following occupational map indicates occupational structure in this sector recently. It also shows titles of occupations, vertical pathways and the level of qualifications.

METALS MANUFACTURING



***This version unit of competence chart is presented in the Chart below*:**

UNIT OF COMPETENCE CHART

Occupational Standard: Welding		
Occupational Code: IND WLD2		
NTQF Level II		
IND WLD2 01 0217 Prepare Basic (2D) Engineering Drawing Using CAD	**IND WLD2 02 0217** Perform Mensuration and Calculation	**IND WLD2 03 0217** Perform Fillet Gas Metal Arc Welding (GMAW)
IND WLD2 04 0217 Perform Fillet Shielded Metal Arc Welding (SMAW)	**IND WLD2 05 0217** Perform Fillet Tungsten Inert Gas (TIG) Welding	**IND WLD2 06 0217** Perform Thermal Cutting
IND WLD2 07 0217 Inspect and Repair Welding Pieces	**IND WLD2 08 0217** Maintain Tools and Equipment	**IND WLD2 09 0217** Participate in Workplace Communication
IND WLD2 10 0217 Work in Team Environment	**IND WLD2 11 0217** Develop Business Practice	**IND WLD2 12 0217** Standardize and Sustain 3S

NTQF Level III

IND WLD3 01 0217 Perform Advanced Engineering Detail Drafting	**IND WLD3 02 0217** Determine Welding Materials	**IND WLD3 03 0217** Perform Oxyacetylene Gas Welding
IND WLD3 04 0217 Perform Plate and Tube Welding using Shielded Metal Arc Welding (SMAW)	**IND WLD3 05 0217** Perform Plate and Tube Welding Using Gas Tungsten Arc Welding (GTAW)	**IND WLD3 06 0217** Perform Plate and Tube Welding Using Gas Metal Arc Welding (GMAW)
IND WLD3 07 0217 Perform Special Welding	**IND WLD3 08 0217** Monitor Implementation of Work Plan/Activities	**IND WLD3 09 0217** Apply Quality Control
IND WLD3 10 0217 Lead Workplace Communication	**IND WLD3 11 0217** Lead Small Teams	**IND WLD3 12 0217** Improve Business Practice
IND WLD3 13 0217 Prevent and Eliminate MUDA		

NTQF Level IV

IND WLD4 01 0217 Supervise and Guide CIM Production Operations	**IND WLD4 02 0217** Develop Models	**IND WLD4 03 0217** Manage Product Cost Estimation and Bill of Materials
IND WLD4 04 0217 Perform Process Planning and Scheduling	**IND WLD4 05 0217** Perform High Reliability Soldering and De-soldering	**IND WLD4 06 0217** Perform Brazing and Silver Soldering
IND WLD4 07 0217 Apply and Supervise Metallurgy Principles	**IND WLD4 08 0217** Apply and Supervise Welding Codes and Principles	**IND WLD4 09 0217** Implement and Monitor Environmentally Sustainable Work Practices
IND WLD4 10 0217 Plan and Organize Work	**IND WLD4 11 0217** Migrate to New Technology	**IND WLD4 12 0217** Establish Quality Standards
IND WLD4 13 0217 Develop Individuals and Team	**IND WLD4 14 0217** Utilize Specialized Communication Skills	**IND WLD4 15 0217** Manage Micro, Small and Medium Enterprises (MSMEs)
IND WLD4 16 02 17 Apply Problem Solving Techniques and Tools		

NTQF Level II

Occupational Standard: Welding Level II	
Unit Title	**Prepare Basic (2D) Engineering Drawing Using CAD**
Unit Code	**IND WLD2 01 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to perform manual drafting and computer aided drafting to produce simple Two Dimensional (2D) metal engineering drawings, part and material lists.

Elements	Performance Criteria
1. Analyze drawing requirements	1.1. Specifications and other data are determined from work order and specification, actual sample or relevant documents 1.2. All data to produce the drawing are identified and collected based on applied standards 1.3. Drawing requirements are verified by ***relevant personnel*** and timeframes for completion are established in accordance with standard operating procedures
2. Prepare drawing or make changes to existing drawing	2.1. ***Drafting principles*** are applied to produce a drawing in consistence 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
3. Prepare engineering parts list	3.1. Component parts are identified and organized by component type and/or in accordance with company/customer requirements 3.2. Drawings and/or parts lists ***records*** are completed in accordance with standard operating procedures
4. Issue approved drawing	4.1. Approved drawing and/or parts lists are copied and ***issued*** to relevant personnel in accordance with standard operating procedures. 4.2. Approved drawings and/or parts lists are stored and catalogued in accordance with standard operating procedures

Variable	Range
Relevant personnel	Involve include: • Supervisor • Technical personnel • Manufacturers • Suppliers

	• Contractors • Customers
Drafting principles	Are prepared in accordance with: • Local standards • International standards
Records	May include, but not limited to: • Cataloguing • Issuing security classifications • Filing • Preparing distribution lists
Issued	Are in the form of: • Hard copy • Photographic • 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 • Used drafting equipment and measuring instruments
Underpinning Knowledge and Attitude	Demonstrate knowledge and attitude 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 • 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: Welding Level II	
Unit Title	**Perform Mensuration and Calculation**
Unit Code	**IND WLD2 02 0217**
Unit Descriptor	This unit covers competence required in carrying out mensuration and calculation at workplace.

Elements	Performance Criteria
1. Select measuring instruments	1.1. Object or component to be measured is identified, classified and interpreted according to the appropriate regular ***geometric shape*** and drawing standard 1.2. Measuring tools are selected/identified as per object to be ***measured*** or work requirements 1.3. Alternative measuring tools are used without sacrificing cost and quality of work
2. Carry-out measurements and calculations	2.1. Accurate measurements are obtained according to work requirements/ISO standard 2.2. Calculation needed, including trigonometric functions, algebraic computations are performed to complete work tasks using the ***four fundamental operations***/ ***basic arithmetic*** 2.3. Numerical computation is self-checked and corrected for accuracy 2.4. Where appropriate, formulae are constructed to enable problems to be solved based on applied calculations 2.5. ***Instruments*** are read to the limit of accuracy of the tool
3. Perform calculations on algebraic expressions	3.1. Transposition of formulae are carried out to isolate the variable required, involving the four fundamental operations. 3.2. Equations involving one unknown are solved correctly 3.3. Percentages are computed using appropriate formula. 3.4. Ratio and proportion are computed using appropriate formula

Variable	Range
Geometric shape	May include, but is not limited to: • Round • Square • Rectangular • Triangle • Sphere • Conical • Semi-circle and Other irregular shapes

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

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Perform calculation: ➢ Using four fundamental operations ➢ Involving fractions and mixed numbers ➢ Involving fractions and decimals ➢ On algebraic expressions ➢ Involving ratio and proportion

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

Occupational Standard: Welding Level II	
Unit Title	**Perform Fillet Gas Metal Arc Welding (GMAW)**
Unit Code	**IND WLD2 03 0217**
Unit Descriptor	This unit covers the competence required in carrying out Fillet Weld using Gas Metal Arc Welding (GMAW) in fabrication and assembly of metal works

Elements	Performance Criteria
1. Prepare equipment and materials for Fillet Weld using Gas Metal Arc Welding (GMAW)	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 1.5. Welding machine and its accessories are identified
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 according to requirements
3. Set-up pre heating tools/ equipment	3.1. Pre-heating equipment, appropriate to the job requirement and specifications is set-up 3.2. Equipment is operated in conformance with the manufacturer's instructions
4. Perform tack welding	4.1. Joints are made free from rust, paints, grease and other foreign materials prior to fit up or tacking based on Welding Procedure Specification (WPS) 4.2. Root gap is performed in accordance with the requirements of WPS

	4.3. Alignment is checked within the range of acceptability of code and standard. 4.4. Backing plate, stiffener and running plate are installed as required. 4.5. Tack welding is performed in accordance with the requirements of WPS and client's specifications 4.6. Tack weld is dimensionally acceptable and is made visually free from stresses
6. Perform GMAW welds	6.1. Root pass is performed in accordance with specifications and enterprise/industry standards and safety procedures 6.2. Root pass is cleaned in accordance with procedures 6.3. Subsequent filling passes are performed in accordance with procedures 6.4. Capping is performed in accordance with specifications and procedures 6.5. Defects are removed with minimum loss of sound metal using correct and appropriate techniques and tools. 6.6. Weld deposit is ensured to be within specifications. 6.7. Materials are welded using GMAW process in accordance with specification 6.8. Joints are cleaned and freed from discontinuities.
7. Assure weld quality conformance	7.1. Welded parts are made free from weld defects or porosity according to WPS 7.2. Weld joints are visually inspected for conformance to specifications. 7.3. Weld records and completion details are completed and maintained correctly as required. 7.4. OHS procedures are observed throughout this unit

Variable	**Range**
Prepared Materials	Flame cut and ground or machined; preheating, setting up of jigs, fixtures, clamps, etc. Carbon/manganese steel, low alloy steel and on plate, pipe and rolled steel sections
Routine maintenance	Ensuring gun, liner, contact tip etc. are in serviceable condition
OHS requirements	May include, but not limited to: • Protective clothing and equipment (include that prescribed under legislation, regulation and workplace policies and practices)

	• Use of tools and equipment, • Workplace environment and safety, handling of materials • Use of fire- fighting 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 • GMAW machine and accessories
Fillet weld	Plate to plate and plate to pipe weld types

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Produced welds to quality • Applied safe welding practices • Used personal protective equipment for GMAW • Observed relevant standards or codes • Prepared plate and pipe for code standard welding • Applied pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard • Maintained weld records to code standard • Practiced hazard control measures associated with welding, including housekeeping
Underpinning Knowledge	Demonstrates knowledge of: • Requirements to produce welds to quality • Relevant standards or codes • Methods for preparing plate and pipe for code standard welding • Pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard • Requirements for maintaining weld records to code standard • Hazard and control measures associated with welding, including housekeeping
Underpinning skills	Demonstrates skills of: • Safe welding practices • Producing welds to quality specifications • Use and application of personal protective equipment for GMAW
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: Welding Level II	
Unit Title	**Perform Fillet Shielded Metal Arc Welding (SMAW)**
Unit Code	**IND WLD2 04 0217**
Unit Descriptor	This unit covers the competence required in carrying out Shielded Metal Arc Welding (SMAW) in fabrication and assembly of metal works.

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 fine-tuned or adjusted consistent with work requirements to produce acceptable weld 2.4. Braces, stiffeners, rails and other jigs are provided and in conformity with requirements. 2.5. Appropriate distortion prevention measures are selected for weld and material type in according to requirements
3. Set-up pre heating tools/ equipment	3.1. Pre-heating equipment is set-up appropriate to the job requirement and specifications 3.2. Equipment is operated in conformance with the manufacturer's instructions
4. Perform tack welding	4.1. Joints are made free from rust, paints, grease and other foreign materials prior to fit up or tacking based on Welding Procedure Specification (WPS) 4.2. ***Root gap*** is performed in accordance with the requirements of WPS 4.3. ***Alignment*** is checked within the range of acceptability of code and standard.

	4.4. Backing plate, stiffener and running plate are installed as required. 4.5. ***Tack welding*** is performed in accordance with the requirements of WPS and client's specifications 4.6. Tack weld is dimensionally acceptable and is made visually free from stresses
5. Perform SMAW welds	6.1. Root pass is performed in accordance with specifications and enterprise / industry standards and safety procedures 6.2. Root pass is cleaned in accordance with procedures 6.3. Subsequent filling passes are performed in accordance with procedures 6.4. ***Capping*** is performed in accordance with specifications and procedures 6.5. Defects are removed with minimum loss of sound metal using correct and appropriate techniques and tools. 6.6. Weld deposit is ensured to be within specifications. 6.7. Materials are welded using SMAW process in accordance with specifications 6.8. Joints are cleaned and freed from discontinuities.
6. Quality assure weld conformance	7.1. Welded parts are made free from ***weld defects*** or porosity according to WPS 7.2. Weld joints are visually inspected for conformance to specifications. 7.3. Weld records and completion details are completed and maintained correctly as required. 7.4. OHS procedures are observed throughout this unit

Variables	**Range**
Root gap	May include, but not limited to: • Welding Procedure and Specification (WPS) requirements • Client requirements
Alignment	May include, but not limited to: • Codes and specifications • Client requirements
Tack welding	May include, but not limited to: • Bridge tacking • Permanent tacking • Temporary tacking
Capping	The final cover pass in a welding joint

Weld defects	May include, but not limited to: • Porosity • Undercut • Arc Strike • Spatters • Slag inclusion • Concavity/convexity • Degree of reinforcement • Burn through • Crater cracks • Cracks • Lack of Fusion • Pinholes • Blowholes • Under Fill • Overlap • Misalignment • Distortion
Visually and dimensionally acceptable	May include, but not limited to: • Fully fused to the base metal • Free from defects and discontinuities • Evenly distributed
Backing materials	May include, but not limited to: • Stiffeners • Backing plate and Strong back
WPS requirements	May include, but not limited to: • Welding positions include1F, 2F, 3F,4F • Material thickness may be 1.6mm – unlimited • Carbon or mild steel • Type and size of mild steel electrode • Travel speed • Angel of electrode • Manipulation of electrode • Current setting (polarity, amperage, voltage) • Arc length • Preheating/Post Weld Heating Treatment (PWHT) • Joint preparation
Occupational Health and Safety (OHS) requirements	are to be in accordance with 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

Evidence Guide

Critical Aspects of Competence	Assessment requires evidence that the candidate: • weld carbon steel plates in 1F, 2F, 3F,4F positions to acceptable standards and approved WPS • Prepare materials for SMAW welding process • Set-up welding machine / equipment, accessories and fixtures • Check gap and alignment • Ensure weld conformance • Applied safe welding practices for SMAW • Applied pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard • Maintained weld records to code standard • Practiced hazard control measures associated with welding, including housekeeping
Underpinning knowledge and Attitudes	Demonstrates knowledge of: • Welding codes and standards • Materials and consumables • Basic mathematics and measurements • Plan/drawing interpretation • Electrode classification • Welding and heating techniques • Welding jigs • Weld testing techniques • Material preparation • Joint preparation • Filler materials and 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, electrode and material • Types of electrodes, current settings, high frequency voltage • Fabrication and assembly techniques • Materials and their various profiles • Basic electricity • Welding and heating equipment and its basic maintenance • Welding symbols • Communication Principles • Safe Welding practices and measures
Underpinning Skills	Demonstrates skills of: • Selecting correct welding machine, electrodes and materials • Preparing material and joint

	• Identifying and rectifying weld defects • Applying techniques for distortion prevention and rectification • Cleaning welds • Handling welding tools, equipment and consumable materials • Reading and interpreting information on written job instructions, specifications, standard operating procedures and drawings • Utilizing jigs and templates • Recording routine information in to proforma and standard workplace forms • Maintaining welding and heating equipment • Applying safe welding practices
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: Welding Level II	
Unit Title	**Perform Fillet Tungsten Inert Gas (TIG) Welding**
Unit Code	**IND WLD2 05 0217**
Unit Descriptor	This unit covers the competence required in carrying out Tungsten Inert Gas (TIG) welding, visually inspecting welds and correcting defects in fabrication and assembly of metal works.

Elements	Performance Criteria
1. Prepare equipment and materials for Tungsten Inert Gas (TIG) welding	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 fine-tuned or adjusted consistent with work requirements to produce acceptable weld 2.4. Braces, stiffeners, rails and other jigs are provided and in conformity with requirements 2.5. Appropriate distortion prevention measures are selected for weld and material type in according to requirements
3. Set-up pre heating tools/ equipment	3.1. Pre-heating equipment is set-up appropriate to the job requirement and specifications 3.2. Equipment is operated in conformance with the manufacturer's instructions
4. Perform tack welding	4.1. Joints are made free from rust, paints, grease and other foreign materials prior to fit up or tacking based on Welding Procedure Specification (WPS) 4.2. ***Root gap*** is performed in accordance with the requirements of WPS 4.3. ***Alignment*** is checked within the range of acceptability of code and standard.

	4.4. Backing plate, stiffener and running plate are installed as required. 4.5. ***Tack welding*** is performed in accordance with the requirements of WPS and client's specifications 4.6. Tack weld is dimensionally acceptable and is made visually free from stresses
5. Weld to job specification using TIG	5.1. Root pass is performed in accordance with specifications and enterprise / industry standards and safety procedures 5.2. Root pass is cleaned in accordance with procedure 5.3. Subsequent filling passes are performed in accordance with procedures 5.4. ***Capping*** is performed in accordance with specifications and procedures 5.5. Weld deposit is ensured to be within specifications. 5.6. Materials are welded using TIG process in accordance with specification
6. Assure quality weld conformance	6.1. Welded parts are made free from ***weld defects*** or porosity according to WPS 6.2. Weld joints are visually inspected for conformance to specifications. 6.3. Weld records and completion details are completed and maintained correctly as required. 6.4. OHS procedures are observed throughout this unit

Variable	**Range**
Prepared Materials	May include, but not limited to: • Flame cut and ground or machined; preheating, setting up of jigs, fixtures, clamps, etc. • Carbon/manganese steel, low alloy steel and aluminum materials, etc. on plate, pipe and rolled steel sections
Root gap	May include, but not limited to: • Welding Procedure and Specification (WPS) requirements • Client requirements
Alignment	May include, but not limited to: • Codes and specifications • Client requirements
Tack welding	May include, but not limited to: • Bridge tacking • Permanent tacking • Temporary tacking
Capping	Is the final/cover pass in a welding joint

Weld defects	May include, but not limited to: • Porosity • Undercut • Spatters • Slag inclusion • Concavity/Convexity • Degree of reinforcement • Burn through • Crater cracks
Routine maintenance	Ensuring gun, liner, contact tip etc. are in serviceable condition
OHS requirements	May include, but not limited to: • Protective clothing and equipment (include that prescribed under legislation, regulation and workplace policies and practices) • Use of tools and equipment, • Workplace environment and safety, handling of materials • Use of fire- fighting 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 • TIG machine and accessories
Visually and dimensionally acceptable	May include, but not limited to: • Fully fused to the base metal • Free from defects and discontinuities • Evenly distributed
Backing materials	May include, but not limited to: • Stiffeners • Backing plate and Strong back
WPS requirements	May include, but not limited to: • Welding positions include1F, 2F, 3F,4F • Material thickness may be1.6 mm – unlimited • Carbon or mild steel • Type and size of mild steel electrode • Travel speed • Current setting (polarity, amperage, voltage) • Joint preparation

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Prepare equipment and materials for Tungsten Inert Gas (TIG) welding • Set-up welding machine/equipment, accessories and fixtures

	• Minimize and rectify distortion • Check gap and alignment • Weld to job specification using TIG • Maintain weld records as required
Underpinning knowledge and Attitudes	Demonstrates knowledge of: • Requirements to produce welds to quality • Relevant standards or codes • Methods for preparing plate and pipe for code standard welding • Requirements for maintaining weld records to standard code • Hazard and control measures associated with welding, including housekeeping • Welding codes and standards • Materials and consumables • Basic mathematics and measurements • Plan/drawing interpretation • Rod classification • Welding and heating techniques • Welding jigs, fixture and clamps • Weld testing techniques • Material preparation • Joint preparation • Filler materials and 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 rod and material • Types of electrodes, current settings, high frequency voltage • Fabrication and assembly techniques • Materials and their various profiles • Basic electricity • Welding and heating equipment and its basic maintenance • Welding symbols • Communication principles • Safe welding practices and measures
Underpinning Skills	Demonstrates skills of: • Producing welds to quality specifications • Using and applying personal protective equipment for TIG • Selecting correct welding machine, wire rods and materials • Preparing material and joint

	• Identifying and rectifying weld defects • Applying techniques for distortion prevention and rectification • Cleaning welds • Handling welding tools and equipment • Handling materials and consumables • Reading and interpreting information on written job instructions, specifications, standard operating procedures and drawings • Utilizing jigs, fixture and clamps • Recording routine information in a standard workplace forms • Maintaining welding and heating equipment • Applying safe welding practices
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: Welding Level II	
Unit Title	**Perform Thermal Cutting**
Unit Code	**IND WLD2 06 0217**
Unit Descriptor	This unit covers the competence in performing thermal cutting and gouging including the assembly and disassembly and operation of a variety of equipment on a range of materials (ferrous, non-ferrous and non-metallic).

Elements	Performance Criteria
1. Identify and prepare tools, equipment and accessories for work	1.1. Appropriate tools and equipment are selected in accordance with work requirements and specifications 1.2. Accessories and equipment are selected and assembled for manual heating and thermal cutting works following standard procedures and safety regulations
2. Operate thermal cutting and gouging equipment	2.1. Appropriate ***cutting process*** for material are/is selected according to availability and standards 2.2. ***Equipment*** start-up and adjustment procedures are followed correctly to standard operating procedures. 2.3. Appropriate cutting allowances are determined and ***material*** is used in the most economical way. 2.4. Defects are identified and corrective action undertaken following standard operating procedures. 2.5. Material is heated, cut or ***gouged*** to specification. 2.6. All safety procedures and measures are applied with accordance to regulations
3. Assure quality and clean up	3.1. Shape/size/length is measured with acceptable standards 3.2. Work area is cleared and unnecessary materials are properly 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

Variable	Range
Cutting process	Use of hand held and self-propelled straight line cutters May use fuel gas, oxy fuel gas and air fuel gas
Equipment	Oxy acetylene, oxy hydrogen, plasma, air carbon arc, laser beam etc.
Material	Various thicknesses and types including ferrous, non-ferrous and non-metallic

Gouging	Is the removal of materials by electrical, mechanical and manual for the formation of groove.

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Select and prepare appropriate heating & cutting equipment, tools and accessories in accordance with job requirements • perform heating and cutting according to job requirements/ ISO standard • Assure quality and perform clean up following workplace procedures
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Cutting processes appropriate to various materials • Heating and cutting specifications • Procedures for heating and cutting • The tools, equipment and techniques for heating and cutting • Assembling procedures for equipment and accessories • Hazards and control measures associated with manual heating and thermal cutting • Use and application of personal protective clothing and equipment • Equipment pre-checks and operation • Procedures for adjusting heating and cutting equipment • Cutting allowances and reasons for applying them • Procedures for minimizing waste material • Reasons for minimizing waste material • Cutting defects and their causes • Procedures for correcting cutting defects • Tools, equipment and techniques required to correct cutting defects
Underpinning Skills	Demonstrate skills of: • Performing pre-start checks • Starting equipment safely • Following standard operating procedures • Adjusting equipment to operating specifications • Making cutting allowances • Economizing material and minimizing wastage • Identifying cutting defects and taking corrective actions • Heating and cutting materials to specifications • Performing measurements needed to meet the requirements of this unit • Reading and interpreting routine information on written job instructions, specifications, standard operating procedures and drawings • Following oral instructions

	• Entering routine and familiar information onto proformas and standard workplace forms
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: Welding Level II	
Unit Title	**Inspect and Repair Welding Pieces**
Unit Code	**IND WLD2 07 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in inspecting, testing and repairing welds.

Elements	Performance criteria
1. Prepare for work	1.1. ***Weld defects*** are located and marked following standard procedures and practice 1.2. ***Tools and equipment*** are prepared appropriate to the work requirements 1.3. Tasks are performed in accordance with company / industry requirements and safety procedures 1.4. Work area is ensured to be safe for standardized welding processes
2. Remove defects	2.1. Weld defects are removed in accordance with approved industry procedures or client requirements. 2.2. ***Removal of non-defective welds*** is minimized and cleaned due to requirements. 2.3. Visual test is performed to verify the extent of removal of defects, where applicable based on comparable standards 2.4. The extent of defect removal is to be verified by informed welding inspector 2.5. Welding tasks are performed in accordance with company/ industry requirement and safety procedures
3. Perform re-welding	3.1. Re-welding is performed in accordance with approved repair safety procedure. 3.2. Weld is visually checked after re-welding for acceptability

Variable	Range
Weld defects	May include, but not limited to: • Porosity • Root undercut • Solid material inclusion • Concavity/convexity • Degree of reinforcement • Burn Through • Crater cracks • Cracks • Lack of Fusion (tie-in) • Pinholes/Blowholes

	• Under Fill • Excess/incomplete penetration • Slag/tungsten inclusion • Overlap • Misalignment • Distortion
Tools and equipment	May include, but not limited to: • Welding machine and accessories • Gouging outfit and accessories • Portable grinder • Chipping hammer • Files • Extension cord and lightings • Barriers • Portable oven
Removal of non-defective welds	May include, but not limited to: • Grinding • Arc/air gouging • Cutting (mechanical, gas) • Plasma gouging
WPS	Welding Procedure and Standard

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Inspect and test defects • Remove defects • Perform re-welding/ repairing weld defects following procedures
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Destructive and non-Destructive method • Interpretation of weld repair procedures and WPS • Causes and identification of weld defects • Materials and consumables • Welding equipment and tools • Welding codes and symbols • Repair techniques • Selection and use of PPE
Underpinning Skills	Demonstrates skills in: • Applying weld defect removal tools and equipment • Applying correct re-weld techniques • Measuring skills • Communication skills • Rectifying weld defects • Handling welding tools, equipment, and consumables materials • Identifying weld defects

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: Welding Level II	
Unit Title	**Maintain Tools and Equipment**
Unit Code	**IND WLD2 08 0217**
Unit Descriptor	This unit covers competence required in carrying out routine programmed safety and maintenance checks on machines, equipment and tools.

Elements	Performance Criteria
1. Undertake programmed safety and maintenance checks	1.1. ***Machines/equipment*** are inspected according to workplace routine 1.2. Minor machine repairs are performed according to manufacturer's instruction or workplace procedures 1.3. Machine moving parts are adjusted to manufacturer's specifications 1.4. Removal/ replacement of ***consumable components*** is undertaken to prescribed procedure and instructions 1.5. Fluids and lubricants are replaced and / or topped up to prescribed schedule and according to manufacturer's instructions. 1.6. ***Checks*** are undertaken safely and to prescribed procedures. 1.7. Status report is recorded on pro-forma and reported
2. Perform preventive maintenance	2.1. ***Tools*** and equipment are regularly checked for defects /functionality according to standards 2.2. Defective hand tools and equipment are reported for repair or replacement in compliance with regulations 2.3. Tools and equipment are cleaned, lubricated and stored according to prescribed procedure 2.4. Necessary reports are accomplished in accordance with workplace procedures
3. Store tools and equipment	3.1. Inventory of tools and equipment is conducted and documented/recorded in accordance with workplace policy and procedures 3.2. Tools and equipment are stored safely in appropriate locations in accordance with manufacturer's instructions

Variable	Range
Machines/equipment	• Manual, semi-automatic and automatic machines of a stand-alone continuous production or process nature
Consumable components	• Air filters, oil wipers, grease containers, tool tips, indicator globes, fluids and lubricants, guides and limit switch actuators

Checks	• 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
Tools	May include, but not limited to: • Cutting tools: hacksaw, crosscut saw, rip saw • Boring tools: auger, brace, grinlet, hand drill • Holding tools: vise grip, C-clamp, bench vise • Threading tools: die and stock, taps
Cleaning materials	• Rust remover, lubricants, rugs, etc.

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Perform operational maintenance of machines/equipment and tools • Select and use appropriate processes, tools and equipment to carry out task • Identify functional and non-functional tools and equipment • Check, lubricate and calibrate tools, equipment and instruments according to manufacturer's specifications • Replace defective tools, equipment and their accessories • Observe and apply safe handling of tools and equipment and safety work practices • Prepare and submit inventory report, where applicable • Maintain workplace in accordance with OHS regulations • Store tools and equipment safely in appropriate locations and in accordance with company practices
Underpinning Knowledge and Attitudes	Demonstrates 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 • Safe work practices and procedures • Hazards and control measures associated with operational maintenance of machines/equipment • Good housekeeping
Underpinning Skills	Demonstrates skills in: • 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 • 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: Welding Level II	
Unit Title	**Participate in Workplace Communication**
Unit Code	**IND WLD2 09 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

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

	3.5. Reporting requirements to supervisor are completed according to organizational guidelines.

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

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

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

Occupational Standard: Welding Level II	
Unit Title	**Work in Team Environment**
Unit Code	**IND WLD2 10 0217**
Unit Descriptor	This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

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

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

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

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

Occupational Standard: Welding Level II	
Unit Title	**Develop Business Practice**
Unit Code	**IND WLD2 11 0217**
Unit Descriptor	This unit covers knowledge, skills and attitude required to establish a business operation from a planned concept. It includes researching the feasibility of establishing a business operation, planning the setting up of the business, implementing the plan and reviewing operations once commenced, customer handling, developing and maintaining business relationships.

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

3. Implement Business Development Plan	3.1. Physical and human resources are obtained to implement business operation. 3.2. ***Operational unit*** is established to support and coordinate business operation. 3.3. Simulations on the development plan are well discussed and understood. 3.4. Implementation manual is discussed and understood. 3.5. Marketing the business operation is undertaken. 3.6. Monitoring process is developed and implemented for managing operation. 3.7. ***Legal documents*** are carefully maintained and relevant records kept and updated to ensure validity and accessibility. 3.8. Contractual procurement rights for goods and services including ***contracts with relevant people*** are negotiated and secured as required in accordance with the business plan. 3.9. Options for leasing/ownership of business premises are identified and contractual arrangements completed in accordance with the business plan.
4. Review implementation process and take corrective measures	4.1. Review process is developed and implemented for implementation of business operation. 4.2. Improvements in business operation and associated management process are identified. 4.3. Identified improvements are implemented and monitored for effectiveness.
5. Establish contact with customers and clarify needs of customer	5.1. Persuasion strategies are developed and discussed. 5.2. Welcoming customer environment is maintained and Customer is greeted warmly according to enterprise policies and procedures. 5.3. Information is provided to satisfy customer needs. 5.4. Information on customers and service history is gathered for analysis. 5.5. Customer data is maintained to ensure database relevance and currency. 5.6. Customer needs are accurately assessed against the products/services of the enterprise. 5.7. Customer details are documented clearly and accurately in required format. 5.8. Negotiations are conducted in a business-like and professional manner.

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

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

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

	whom the business has, or seeks to have, a performance-based relationship
Negotiation techniques	May include, but is not limited to: • Identification of goals, limits • Clarification of needs of all parties • Listening and questioning • Non-verbal communication techniques • Appropriate language and situation • Bargaining • Developing options • Appropriate cultural behavior • Confirming agreements
Opportunities to maintain regular contact	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 • Enterprise policies and procedures in regard to: ➢ Customer service ➢ Dealing with difficult customers ➢ Maintenance of customer databases ➢ Allocated duties/responsibilities ➢ 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: Welding Level II	
Unit Title	**Standardize and Sustain 3S**
Unit Code	**IND WLD2 12 0217**
Unit Descriptor	This unit of competence covers the knowledge, skills and attitudes required by worker to standardize and sustain 3S to his/her workplace. It covers responsibility for the day- to-day operations of the workplace and ensuring that continuous improvements of Kaizen elements are initiated and institutionalized.

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

	3.6. Improvements are recommended to lift the level of compliance in the workplace. 3.7. Checklists are followed to sustain activities and report to relevant personnel. 3.8. Problems are avoided by sustaining activities.

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

	• Standardization level checklist • 5S checklist • The five Whys and one How approach(5W1H) • Suspension • Incorporation and Use Elimination
Relevant procedures	May include, but is not limited to: • Assign 3S responsibilities • Integrate 3S duties into regular work duties • Check on 3S maintenance level • OHS measures such as signage, symbols / coding and labeling of workplace and equipment • Creating conditions to sustain your plans • Roles in implementation
Reporting	May include, but is not limited to: • Verbal responses • Data entry into enterprise database • Brief written reports using enterprise report formats
Relevant personnel	May include, but is not limited to: • Supervisors, managers and quality managers • Administrative, laboratory and production personnel • Internal/external contractors, customers and suppliers
Tools and techniques	May include, but is not limited to: • 5S slogans • 5S posters • 5S photo exhibits and storyboards • 5S newsletter • 5S maps • 5S pocket manuals • 5S department/benchmarking tours • 5S months • 5S audit • Awarding system • Big cleaning day • Patrolling system May include, 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	Demonstrates knowledge of:

Knowledge and Attitudes	• 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: Welding Level III	
Unit Title	**Perform Advanced Engineering Detail Drafting**
Unit Code	**IND WLD3 01 0217**
Unit Descriptor	This unit covers competence in producing drawings components to complete with surface texture and dimensions using manual drafting and CAD system. Drawing components may include assembly, layout and complete 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 due to standard 2.5. Correct convention of parts is shown based on ***ISO standard*** 2.6. Drawing, including auxiliary views, sections and assemblies in third angle projection are produced in accordance with standard 2.7. All drawings are produced in an acceptable ISO standard 2.8. Components, material and/or assemblies are selected from data sheets or manufacturers' catalogues to meet specifications.
3. Quality assure drawing	3.1. Drawings are checked to ensure compliance with specifications. 3.2. Drawings are checked to ensure that assembly/fabrication is possible due to standards 3.3. Drawings are issued, filed and stored according to workplace system and procedures.

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

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Prepare assembly, lay-out and detail drawing complete with surface texture, tolerances and dimensions • Produce drawings in third angle projection including auxiliary views, sections and assemblies • Produce 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 square-ness) • 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 CAD system
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: Welding Level III	
Unit Title	**Determine Welding Materials**
Unit Code	**IND WLD3 02 0217**
Unit Descriptor	This unit covers the skills and knowledge required in determining the property of weld materials for all welding processes by understanding most common materials used in metal engineering works.

Elements	Performance Criteria
1. Determine common engineering materials	1.1. ***Common engineering materials*** are determined according to standards. 1.2. General metallurgical principles and properties of ferrous and non-ferrous metal are ascertained and understood in compliance with standards 1.3. The effects of different types of bonding in materials are identified and understood with references to standards 1.4. The effects of mechanical and thermal processes on the principal properties of materials are analyzed
2. Identify classes of materials based on properties	2.1. Classes , codes and calibrating requirements of materials, based on properties required for particular mechanical and manufacturing engineering applications are identified with references to standard 2.2. Common characteristics, faults or flaws in materials and components or product in particular engineering applications are identified and understood with references to standard 2.3. Test methods for materials and components or product in particular engineering applications are identified by standards 2.4. Appropriate sources of information on properties materials, ***materials tests***, test calibration, test certificates, regulations and standards are identified and used 2.5. Appropriate sources of information on Materials Safety Data Sheets (MSDS) are selected due to applicable standards
3. Prepare materials and equipment for testing	3.1. Materials are selected for use in given mechanical/ manufacturing engineering applications based on relevant test information 3.2. Identified materials for testing are classified based on relevant test information 3.3. Materials and ***equipment*** are prepared based on to be conducted standardized test

4. Assure quality results of material tests	4.1. Materials tests results are recorded and reported due to industry practice 4.2. Appropriate material calibration and traceability are ensured based on regulations 4.3. Appropriate Materials Safety Data Sheets (MSDS) for applications are recorded and reported in accordance with organizational procedures, codes and regulations. 4.4. OHS measures are observed throughout the process within the regulations

Variable	**Range**
Common engineering materials	May include, but not limited to: • Ferrous metals: cast irons, carbon and alloy steels, stainless steels, coated steels, • Non-ferrous metals: aluminum and its alloys, copper and its alloys, nickel alloys, zinc, titanium, magnesium,
Tests of materials	• Tensile, compression, impact, hardness, corrosion, spark
Equipment	May include, but is not limited to: • Hardness tester – Rockwell, brinell, shore sheleroscope • Spark testing – grinder (portable, bench) • Tensile tester • Impact testing equipment (charpy test) • Spectrometer
Classes of materials based on properties	May include, but not limited to: • Classes of materials: ➢ Non-ferrous metals and alloys - Copper, aluminum, zinc, lead, tin and their alloys; ➢ ferrous metals - Carbon steels, alloy steels, cast irons; bearing materials; lubricants; • Properties of materials: ➢ Strength, elasticity, plasticity, malleability, toughness, brittleness, fatigue endurance, mouldability, weldability, machinability, formability, resistance to creep and stress relaxation, resistance to degradation (e.g. use of plastic fillers to enhance UV resistance), adhesion ➢ electrical, magnetic, thermal, chemical and optical; material structure and effect on properties • Other related factors: ➢ Corrosion and corrosion protection methods. ➢ The effect of manufacturing processes on material properties. ➢ The effect of property enhancement on design (e.g. adhesives plus sintering replacing some forging and machining of gears on shafts)

Material Properties	May include, but not limited to: • Mechanical properties includes tensile strength, yield strength and hardness • Physical properties include electrical conductivity, thermal conductivity, thermal expansion and vibration dampening capacity • Required properties include tensile strength, compression, shear characteristics, torsion, hardness, impact resistance, fatigue resistance, creep resistance, visual appearance and color, magnetic properties, corrosion resistance

Evidence Guide	
Critical Aspects of Competence	Assessment requires knowledge and skills in • Identify common engineering materials • Identify classes of materials based on properties • Identify and use sources of information on engineering materials • Prepare materials and equipment use for testing • Record and report results of material tests
Underpinning Knowledge and Attitudes	Look for evidence that confirms knowledge of: • Classification of materials: ➢ Metals and non-metals ➢ Ferrous and non-ferrous metals ➢ Polymers (thermoplastics, thermosetting and elastomers) ➢ Ceramics ➢ Composite materials • Physical properties of materials: ➢ Electrical conductivity/resistivity ➢ Specific gravity/density ➢ Thermal conductivity/expansion ➢ Specific heat ➢ Melting/boiling points • Magnetic properties • Optical properties • Mechanical properties: ➢ Strength – yield, tensile, compressive ➢ Stress/strain data ➢ Hardness ➢ Toughness (impact and slow strain) ➢ Elasticity, plasticity ➢ Ductility ➢ Malleability ➢ Fatigue, creep • Engineering materials • Engineering applications of ferrous metals: ➢ Cast irons

	➢ Carbon and alloy steels ➢ Stainless steels • Engineering applications of non-ferrous metals: ➢ Aluminum and its alloys ➢ Copper, brass and bronze ➢ Nickel alloys, zinc, titanium ➢ Magnesium ➢ Refractory metals • Effects of mechanical and thermal processes on the properties of materials: ➢ Casting, forging, rolling and extrusion ➢ Cold forming ➢ Powder processes ➢ Heat treatment ➢ Joining – fasteners ➢ Soldering and brazing ➢ Welding ➢ Adhesives ➢ Finishing – coatings, metallic and non-metallic • Effect of material properties on production • Effect of characteristics, faults or flaws in materials on product and processes • Test methods for materials and components, specific industrial test standards, regulations and authorities related to particular engineering applications • Test methods for faults or flaws in materials and components or product • Test procedures and typical applications for tests • Identification of test for an application based on an understanding of its ability to measure specific material or product properties, significance of test sheets / certificates to applications • Identification of materials for an application based on comparison of properties of materials • Significance of test reports and documentation to applications • Significance of materials tests and test sheets/certificates, test calibration and traceability • Hazards and control measure associated with selecting and understanding common engineering materials, including housekeeping
Underpinning Skills	Demonstrates skills in: • Reading, interpreting and following information on materials • Selecting class of materials for an application based on comparison of properties for a significant range of materials classes • Identifying characteristics, faults or flaws in materials or

	product • Identifying test methods for materials and components or product • Implementing tests correctly for materials • Reporting, recording and filing test reports and documentation
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: General Metal Fabrication and Assembly Level II	
Unit Title	**Perform Oxyacetylene Gas Welding**
Unit Code	**IND WLD3 03 0217**
Unit Descriptor	This unit covers competence carrying out oxyacetylene welding. It focuses on fillet, plate and tube welding processes in fabrication and assembly of metals.

Elements	Performance Criteria
1. Select welding equipment and consumables	1.1. Correct welding equipment are selected according to work load 1.2. Correct welding consumables are selected based on applied standard procedures 1.3. Welding Procedure and Specifications (WPS)are followed according to standard
2. Prepare and assemble welding materials and equipment	2.1. Welding ***equipment and consumables*** are prepared in accordance with standard operating procedures 2.2. ***Materials are prepared*** to achieve required ***weld*** specification.
3. Perform weld joints	3.1. Materials are welded in all positions in accordance with WPS 3.2. Instructions, symbols, specifications are interpreted correctly including bead size, bead placement, reinforcement etc. and in accordance with weld procedure sheet
4. Correct faults	4.1. Weld defects are identified in accordance with standard 4.2. Defects are removed with minimum loss of sound metal using correct and appropriate techniques and tools due to regulations
5. Assure quality weld record handling	5.1. Welding joints are inspected against specifications using destructive and non- destructive testing methods based on operational standards 5.2. Weld records are filled up in accordance with specifications and standard operating procedures 5.3. Weld records are maintained in accordance with specifications and standard operating procedures.

Variable	Range
Equipment and consumables	Consumables may include, but not limited to: • Fuel gases including oxyacetylene, hydrogen, liquid range of filler rods, fluxes, Liquefied Petroleum Gas (LPG), etc., Equipment may include, but not limited to:

	• Oxyacetylene generator, cylinders, regulators, hoses, torches, tips
Materials	May include, but not limited to: • Plate, pipe, round bar, etc. • Ferrous (Low and high carbon steel/alloy steel) • Non-ferrous (copper, brass, aluminum,)
Preparation of materials	May include, but not limited to: • Preheating, setting up of jigs, fixtures, clamps, etc. • Joint preparation e.g. beveling
Weld	Plate, fillet, butt in flat, horizontal, vertical and overhead positions
Occupational Health and Safety (OHS)	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
Tools, equipment and materials	May include, but not limited to: • Hand and power tools, • Measuring equipment, • Guillotines, • Oxyacetylene and accessories

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Safe welding practices and operating procedures • Select welding equipment and consumables following preparatory requirements • Appropriate settings for the given task and the selected equipment/consumables • Pre-heating of the weld materials as per property requirements • Prepare and assemble welding materials and equipment • Perform weld joints using standard operating procedures • Correct defects using standard operating techniques • Assure quality weld record handling following procedures
Underpinning knowledge	Demonstrates knowledge of: • Preparatory requirements

	• Purpose and examples of pre-welding and post welding • Appropriate settings for the given task and the selected equipment/consumables • The 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 competency
Underpinning skills	Demonstrates skills of • Applying safe welding practices • Performing weld joints using standard operating procedures • Using standard operating techniques • Utilizing heating for weld materials • Using methods of weld defect removal and their application • Using and applying personal protective equipment for oxy acetylene 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: Welding Level III	
Unit Title	**Perform Plate and Tube Shielded Metal Arc Welding (SMAW)**
Unit code	**IND WLD3 04 0217**
Unit Descriptor	This unit covers the competence required in carrying out advanced Plate and Tube Shielded Metal Arc Welding (SMAW). The unit applies to welds associated with a range of structural sections, plate and pipe for general fabrication using steel materials.

Elements	Performance Criteria
1. Prepare welding materials	1.1. Weld requirements are identified from specifications and/or drawings. 1.2. Correct size, type and quantity of ***materials***/ components are determined, obtained and prepared for compliance with the job specifications 1.3. Materials are assembled/ aligned to specification, where required.
2. Set-up welding machine / equipment, accessories and fixtures	2.1. Welding machine is positioned and set to the polarity indicated in the welding procedures/ specifications or as recommended by the filler rod/electrode manufacturer 2.2. Current and voltage are fine-tuned/adjusted consistent with job requirements based on instruction material 2.3. Braces, stiffeners, rails and other jigs are provided in conformity with job requirements. 2.4. Appropriate distortion prevention measures are selected for weld and material type in according to requirements 2.5. Electrode and oven/heaters are installed on needed requirements
3. Perform tack welding	3.1. Joints are made free from rust, paints, grease and other foreign materials prior to fit up or tacking based on ***Welding Procedure Specification (WPS) requirements*** 3.2. Root gap is performed in accordance with the requirements of WPS 3.3. Alignment is checked within the range of acceptability of code and standard. 3.4. Backing plate, stiffener and running plate are installed as required. 3.5. ***Tack welding*** is performed in accordance with the requirements of WPS

	3.6. Tack weld is dimensionally acceptable and is made visually free from stresses
4. Perform root pass	4.1. Root pass is performed in accordance with WPS and/or client specifications. 4.2. Task is performed in accordance with company or industry requirement and safety procedure. 4.3. Weld is visually made acceptable in accordance with applicable codes and standards 4.4. Root pass is cleaned and made free from ***defects*** and discontinuities 4.5. Task is performed in accordance with the required standard
5. Weld subsequent/ filling passes	5.1. Subsequent/filling passes are performed in accordance with approved WPS 5.2. Weld is visually made acceptable in accordance with applicable codes and standards 5.3. Fill pass is cleaned and made free from defects and discontinuities
6. Perform capping	6.1. ***Capping*** is performed in accordance with WPS and/or client specifications 6.2. Weld is visually acceptable in accordance with applicable codes and standards
7. Assure quality weld conformance	7.1. Weld is visually checked for defects and repaired, as required 7.2. Weld records and completion details are completed and maintained correctly as required. 7.3. ***OHS procedures and measures*** for performing SMAW process are observed throughout this unit

Variable	**Range**
Materials	• welding carbon steel plates and pipes and/or mild steel
WPS requirements	• Carbon steel plate/mild steel 1F,2F,3F,4F, 2G and 3G positions • Carbon steel pipe 2G,3G,5G and 6G position • Consumables • Arc length • Electrode manipulation • Travel speed • Current setting (polarity, amperage, voltage) • Welding accessories • Joint preparation
Tack welding	May include, but not limited to:

	• Bridge tacking • Permanent tacking • Temporary tacking
Defects	May include, but not limited to: • Porosity • Undercut • Arc Strike • Elongated intrusion • Concavity/convexity • Degree of reinforcement • Burn Through • Crater cracks • Cracks • Lack of Fusion • Pinholes/Blowholes • Under Fill • Overlap • Misalignment • Distortion
Capping	Is the final/cover pass of the weld process
OHS procedures and measures	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

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Welded carbon steel pipes in 1F,2F,3F,4F, 2G and carbon steel pipe in 2G,3G,5G and 6G position to acceptable standard following the approved WPS • Prepare welding materials • Assemble and set up welding equipment • Set-up welding accessories and fixtures • Perform tack welding • Check gap and alignment • Perform root pass • Perform Weld subsequent/filling passes and capping
Underpinning knowledge and Attitudes	Demonstrates knowledge of: • The properties and characteristics of a materials and consumables (electrodes, base metal, etc.) • Requirements to conform to standard and specifications • Weld codes, procedures and requirements • Drawing interpretation • Weld defects

	• Basic mathematics • Safe welding practices • Basic electricity (AC and DC) and polarity • Manufacturer's specifications • Use and application of personal protective equipment for SMAW
Underpinning Skills	Demonstrates skills in: • Welding to conform to standard, codes and specifications • Performing safe welding practices • Using and applying personal protective equipment for SMAW • Interpreting weld requirements and specifications • Interpreting technical drawings relating to advanced SMAW • Using hand and power tools to prepare and weld material using SMAW • Applying weld techniques • Using measurement and numeracy skills relating to advanced SMAW and preparation requirements • Selecting and handling equipment, materials and consumables appropriate to the task • Using visual identification of faults/defects • Rectifying weld defects • 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: Welding Level III	
Unit Title	**Perform Plate and Tube Welding Using Gas Tungsten Arc Welding (GTAW)**
Unit Code	**IND WLD3 05 0217**
Unit Descriptor	This unit covers the competence required in carrying out advanced Gas Tungsten Arc Welding (GTAW). The unit applies to welds associated to plate and pipe for general fabrication using steel materials.

Elements	Performance Criteria
1. Prepare welding materials for gas tungsten welding	1.1. Weld requirements are identified from specifications and/or drawings. 1.2. Correct size, type and quantity of materials/ components are determined, obtained and ***prepared*** for compliance with the job specifications 1.3. Materials are assembled/ aligned to specification, where required.
2. Set-up welding machine / equipment, accessories and fixtures	2.1. ***Welding machine*** is positioned and wired up or set to the polarity indicated in the welding procedures / specifications or as recommended by the filler wire manufacturer 2.2. Current and voltage are fine-tuned/adjusted consistent with job requirements based on instruction material 2.3. Braces, stiffeners, rails and other jigs are provided in conformity with job requirements 2.1. Welding machines and ***accessories*** are made ***routine maintenance*** as per client requirements 2.4. Appropriate distortion prevention measures are selected for weld and material type in according to requirements
3. Perform tack welding	3.1. Joints are made free from rust, paints, grease and other foreign materials prior to fit up or tacking based on Welding Procedure Specification (WPS) 3.2. ***Root gap*** is performed in accordance with the requirements of WPS 3.3. Alignment is checked within the range of acceptability of code and standard. 3.4. Backing plate, stiffener and running plate are installed as required. 3.5. ***Tack welding*** is performed in accordance with the requirements of WPS

	3.6. Tack weld is made dimensionally acceptable and visually free from stresses
4..Perform root pass	4.1. Root pass is performed in accordance with WPS and/or client specifications. 4.2. Task is performed in accordance with company or industry requirement and safety procedure. 4.3. Weld is made visually acceptable in accordance with applicable codes and standards 4.4. Root pass is cleaned and free from ***defects*** and discontinuities 4.5. Task is performed in accordance with the required standard
5. Weld subsequent / filling passes	5.1. Subsequent/filling passes are performed in accordance with approved WPS 5.2. Weld is made visually acceptable in accordance with applicable codes and standards
6. Perform capping	6.1. Capping is performed in accordance with WPS and/or client specifications 6.2. Weld is made visually acceptable in accordance with applicable codes and standards
7. Quality assure weld conformance	7.1. Weld is visually checked for defects and repaired, as required 7.2. Weld records and completion details are completed and maintained correctly as required. 7.3. OHS procedures and measures for performing GTAW process are observed throughout this unit

Variables	**Range**
Prepared	Preheating, setting up of jigs, fixtures, clamps, etc., joint preparation, beveling
Welding machine	AC or DC welding machines
Accessories	May include, but not limited to: • TIG torces short and long back caps • Regulators and flow meters • Gas hoses and adaptors • Gas cylinders • Ceramic caps • Collet and collet bodies
Routine maintenance	ensuring gun, tungsten rod, etc. are in serviceable condition
Root gap	May include, but not limited to: • WPS requirements • Client requirements

Tack welding	May include, but not limited to: • Bridge tacking • Permanent tacking • Temporary tacking
Defects	May include, but not limited to: • Porosity • Undercut • Arc Strike • Elongated intrusion • Tungsten inclusion • Concavity/convexity • Degree of reinforcement • Burn Through • Crater cracks • Cracks • Lack of Fusion • Pinholes/Blowholes • Under Fill • Overlap • Misalignment and Distortion
Materials and consumables	May include, but not limited to: • Cabon steel or stainless steel, aluminum • Filler rod, tungsten rod, shielding gas, base metal
WPS requirements	May include, but not limited to: • Welding positions May include, but not limited to: ➢ 1F – 4F ➢ 1G – 4G • Wall thickness May include, but not limited to: ➢ 1.6 mm and above • Type of material May include, but not limited to: ➢ Carbon or mild steel • Consumables May include, but not limited to: ➢ Filler metal ➢ Tungsten rod (type and size) ➢ Shielding gas (argon or other available inert gas) • Travel speed • Current setting (polarity, amperage, voltage) • Shielding gas flow rate • Welding accessories and Joint preparation
Visually and dimensionally acceptable	May include, but not limited to: • Fully fused to the base metal • Free from defects and discontinuities • Evenly distributed

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Prepare welding materials for gas tungsten welding

	• Set-up welding machine / equipment, accessories and fixtures • Perform tack welding, • Weld carbon steel plates and pipe using GTAW in 1F – 5F and 1G – 6G welding positions • Perform root pass, filling passes and capping as per WPS • Quality assure weld conformance
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Drawing/plan/WPS interpretation • The properties and characteristics materials and consumables • Requirements to conform to standards, codes and WPS • Welding machine and tools, leads and hand pieces • Material preparation and joint preparations • 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 • Classification and types of electrodes, current settings, high frequency voltage • Filler materials and consumables • Safe welding practices and use of personal protective equipment
Underpinning Skills	Demonstrates skills of: • Welding to conform to standards, codes and WPS • Identifying and interpreting appropriate standards • Selecting, handling and using appropriate tools and equipment • Using a variety of welding machines and electrodes • Identifying and rectifying weld defects • Applying techniques for distortion prevention and rectification • Cleaning welds • Reading and interpreting information on written job instructions, specifications, standard operating procedures and drawings • Recording routine information related to GTAW onto proformas and standard workplace forms • Following oral instructions • Measurement skills relating to joint preparation and GTAW
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: Welding Level III	
Unit Title	**Perform Plate and Tube Welding Using Gas Metal Arc Welding (GMAW)**
Unit Code	**IND WLD3 06 0217**
Unit Descriptor	This unit covers the competence required in carrying out advanced Gas Metal Arc Welding (GMAW). The unit applies to welds associated with a range of structural sections, plate and pipe for general fabrication.

Elements	Performance Criteria
1. Prepare equipment and materials for Gas Metal Arc Welding (GMAW)	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 1.5. Welding machine and its accessories are identified
2. Set-up welding machin equipment, accessorie and fixtures	2.2. Welding machine settings, accessories and consumables are identified and selected based on standards 2.3. 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 2.4. Current, voltage and wire feed setting are fine-tuned or adjusted in consistent with work requirements to produce acceptable weld 2.5. Braces, stiffeners, rails and other jigs are provided in conformity with requirements 2.6. Welding machines and accessories are made ***routine maintenance*** as per client requirements 2.7. Appropriate distortion prevention measures are selected for weld and material type in according to requirements
3. Perform tack welding	3.1. ***Plate and pipe Joints*** are made free from rust, paints, grease and other foreign materials prior to fit up or tacking based on Welding Procedure Specification (WPS) 3.2. ***Root gap*** is performed in accordance with the requirements of WPS

	3.3. Alignment is checked within the range of acceptability of code and standard. 3.4. Backing plate, stiffener and running plate are installed as required. 3.5. ***Tack welding*** is performed in accordance with the requirements of WPS 3.6. Tack weld is made dimensionally acceptable and visually free from stresses
4. Perform root pass	4.1. Root pass is performed in accordance with WPS and/or client specifications. 4.2. Task is performed in accordance with company or industry requirement and safety procedure. 4.3. Weld is made visually acceptable in accordance with applicable codes and standards 4.4. Root pass is cleaned and free from ***defects*** and discontinuities 4.5. Task is performed in accordance with the required standard
5. Weld subsequent/ filling passes	5.1. Subsequent/filling passes are performed in accordance with approved WPS 5.2. Weld is made visually acceptable in accordance with applicable codes and standards
6. Perform capping	6.1. Capping is performed in accordance with WPS and/or client specifications 6.2. Weld is made visually acceptable in accordance with applicable codes and standards
7. Quality assure weld conformance	7.1. Weld joints are inspected using destructive and non-destructive testing methods for conformance to specifications 7.2. Weld records and completion details are completed and maintained correctly, as required. 7.3. Documentation are accomplished and documents kept/filed in accordance with organization standards procedures 7.4. OHS procedures are observed throughout this unit

Variable	**Range**
Prepared Materials	May include, but not limited to: • Flame cut and ground or machined; preheating, setting up of jigs, fixtures, clamps, etc. • Carbon/manganese steel, stainless steel, high alloy steel and aluminum materials, etc. on plate, pipe and rolled steel sections

Plate and tube weld	• Single bevel butt weld, T-joint, tube to tube butt weld, plate to plate butt weld in different welding positions
Routine maintenance	Ensuring gun, liner, contact tip etc. are in serviceable condition
Occupational Health and Safety (OHS)requirements	May include, but not limited to: • Protective clothing and equipment (include that prescribed under legislation, regulation and workplace policies and practices) • Use of tools and equipment, • Workplace environment and safety, handling of materials • Use of fire- fighting equipment, use of first aid equipment • Hazard control and hazardous materials and substances
Tools and equipment	May include, but not limited to: • Hand and power tools • Measuring equipment • GMAW machine and accessories

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Produce welds to quality • Apply safe welding practices • Use personal protective equipment for GMAW • Observe relevant standards or codes and symbols • Prepare plate and pipe for code standard welding • Apply pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard • Maintain weld records to code standard • Practice hazard control measures associated with welding, including housekeeping
Underpinning Knowledge	Demonstrates knowledge of: • Requirements to produce welds to quality • Relevant standards or codes and symbols • Methods for preparing plate and pipe for code standard welding • Pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard • Requirements for maintaining weld records to code standard • Hazard and control measures associated with welding, including housekeeping
Underpinning skills	Demonstrates skills of: • Welding by following general safety practices • Producing welds to quality specifications • Using and applying personal protective equipment for GMAW

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: Welding Level III	
Unit Title	**Perform Special Welding**
Unit code	**IND WLD3 07 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed in performing Submerged Arc Welding (SAW), Flux Cored Arc Welding (FCAW), Resistance Welding, and Exothermic welding.

Elements	Performance Criteria
1. Determine job requirements	1.1. Drawings are interpreted to produce component to ***specifications***. 1.2. Sequence of operation is determined to produce component to specifications. 1.3. Work is prepared using appropriate tools and techniques 1.4. Appropriate spray welding equipment and consumables are selected for materials and work requirements.
2. Set up welding machine	2.1. Requirements for welding are determined from job requirements, welding procedures and specifications and/or technical drawings. 2.2. Welding machine is set up in accordance with job requirements, welding procedures and specifications, technical drawings and manufacturer's instructions. 2.3. Welding machine should be 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. 2.4. Current, voltage, and wire feed settings are fine-tuned or adjusted consistent with job requirements to produce acceptable weld. 2.5. Task is completed without causing damage to the tools, equipment and materials and injury to self and others. 2.6. Gas setting on spray welding equipment is adjusted to task requirements 2.7. Replaceable moulds for exothermic weld is prepared and set up according to task requirements
3. Set up welding accessories	3.1. Welding machine accessories and consumables are identified from job requirements, welding procedures and specifications. 3.2. Welding machine accessories and consumables are set up in accordance with job requirements, welding procedures and specifications and/or manufacturer's instructions.

	3.3. Spools are firmly locked to holder, rollers adjusted to correct tension. 3.4. Flux recovery equipment and flux oven /heaters are installed, where needed. 3.5. Aluminum powder and metal oxide compositions are obtained for exothermic welding according to requirements
4. Perform tack welding	4.1. Joints are free from rust, paints, grease and other foreign materials prior to fit up or tacking. 4.2. Root gap is performed in accordance with the requirements of WPS 4.3. ***Tack welding*** is performed if necessary in accordance with the requirements of WPS and client's specifications. 4.4. Tack welding is performed visually and dimensionally acceptable. 4.5. Backing plate, stiffener, running plate are installed as required.
5. Perform special welds	5.1. Root pass is performed in accordance with WPS and/or client specifications. 5.2. Subsequent/filling passes are performed in accordance with approved WPS 5.3. Capping is performed in accordance with WPS and/or client specifications 5.4. Exothermic welding is performed in accordance with WPS and/or client specifications 5.5. Task is performed in accordance with approved WPS
6. Assure quality and clean up	6.1. Weld is visually checked for ***defects*** and repaired, as required 6.2. Weld is visually made acceptable in accordance with applicable codes and standards 6.3. ***OHS procedures*** are observed throughout this unit

Variable	**Range**
Specifications	May include, but not limited to: • Welding codes may include, but not limited to: ➢ ISO ➢ CEN ➢ DIN ➢ API ➢ ASME / AWS ➢ AS codes

	➢ CSA ➢ BS • Reference Industry standards • Client specification
Tack welding	May include, but not limited to: • Bridge tacking • Permanent tacking • Temporary tacking
Defects	May include, but not limited to: • Porosity • Undercut • Arc Strike • Spatters • Wire and solid material inclusion • Concavity/convexity • Degree of reinforcement • Burn Through • Crater cracks • Cracks • Lack of Fusion (tie-in) • Pinholes/Blowholes • Under Fill • Overlap • Misalignment • Distortion
OHS procedures	May include, but not limited to: • Wearing of required PPE • Securing oxy-acetylene tanks before, during and after use • Checking oxy-acetylene hose for gas leaks
Materials and consumables	May include, but not limited to: • Mild steel • Carbon steel • Grinding/cutting discs • Flux-cored electrode • SAW powder • Shielding gases • Filler powder • Hose, tips • Exothermic aluminum powder
Equipment and accessories	May include, but not limited to: • Generator set • Rectifier • Wire feeder • Flux hopper • Run-on/run-off plates • Flux recovery

	• Motor and rail • Control panel • Portable grinder • Replaceable welding moulds
WPS requirements	May include, but not limited to: • Welding positions • 1F – 4F • 1G – 3G • Thickness: 1.6 mm and above • Type of material: Carbon or mild steel • Type and size of electrode wire • Travel speed • Current setting (polarity, amperage, voltage) • Backing material (weld metal, backing plate and ceramics) • Joint preparation • Codes and specifications and Client requirements
Visually and dimensionally acceptable	May include, but not limited to: • Fully fused to the base metal • Free from defects and discontinuities • Evenly distributed

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Set up and operated automatic welding equipment used in welding carbon steel plates using SAW in 1F and 1G positions; and using FCAW in 2G and 3G positions to acceptable standard and following approved WPS
Underpinning knowledge and Attitudes	Demonstrates knowledge of: • Drawing/plan/WPS interpretation • Materials and consumables (electrodes wire, base metal, flux) • SAW,FCAW and Exothermic equipment and tools • Basic mathematics (MDAS) • Welding codes and symbols • Identification of weld defects
Underpinning Skills	Demonstrates skills of: • Measuring skills • Communication skills • Rectifying weld defects • Setting weld plates and arc length • Setting up and operating SAW, FCAW, powder spray machine equipment and accessories • Setting welding parameters (current, voltage and travel speed) • Setting electrode wire feeder • Flux recovery techniques

	• Handling welding tools and equipment • Handling welding materials and consumables
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: Welding Level III	
Unit Title	**Monitor Implementation of Work Plan/Activities**
Unit Code	**IND WLD3 08 0217**
Unit Descriptor	This unit covers competence required to oversee and monitor the quality of work operations within an enterprise. This unit may be carried out by team leaders or supervisors.

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

	4.4. Where problem is raised by a team member, they are encouraged to participate in solving the problem. 4.5. Follow up action is taken to monitor the effectiveness of solutions in the workplace.

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

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

Occupational Standard: Welding Level III	
Unit Title	**Apply Quality Control**
Unit Code	**IND WLD3 09 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in applying quality control in the workplace.

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

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

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

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

Occupational Standard: Welding Level III	
Unit Title	**Lead Workplace Communication**
Unit Code	**IND WLD3 10 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to lead in the dissemination and discussion of information and issues in the workplace.

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

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

	• Using Internet • Cell phone

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

Occupational Standard: Welding Level III	
Unit Title	**Lead Small Teams**
Unit Code	**IND WLD3 11 0217**
Unit Descriptor	This unit covers the skills, knowledge and attitudes required to determine individual and team development needs and facilitate the development of the work group.

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

4. Develop team commitment and cooperation	4.1. Open communication processes are used by team to obtain and share information. 4.2. Decisions are reached by the team in accordance with its agreed roles and responsibilities. 4.3. Mutual concern and camaraderie are developed in the team.
5. Facilitate accomplishment of organizational goals	5.1. Team members are made actively participatory in team activities and communication processes. 5.2. Individual and joint responsibility has been developed teams members for their actions. 5.3. Collaborative efforts are sustained to attain organizational goals.

Variable	**Range**
Learning and development needs	May include, but is not limited to: • Coaching, mentoring and/or supervision • Formal/informal learning program • Internal/external training provision • Work experience/exchange/opportunities • Personal study • Career planning/development • Performance appraisals • Workplace skills assessment & Recognition of prior learning
Organizational requirements	May include, but is not limited to: • Quality assurance and/or procedures manuals • Goals, objectives, plans, systems and processes • Legal and organizational policy/guidelines and requirements • Safety policies, procedures and programs • Confidentiality and security requirements • Business and performance plans • Ethical standards • Quality and continuous improvement processes and standards
Feedback on performance	May include, but is not limited to: • Formal/informal performance appraisals • Obtaining feedback from supervisors and colleagues • Obtaining feedback from clients • Personal and reflective behavior strategies • Routine and organizational methods for monitoring service delivery
Learning delivery methods May include, but is not limited to:	• 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: Welding Level III	
Unit Title	**Improve Business Practice**
Unit Code	**IND WLD3 12 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required in promoting, improving and growing business operations.

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

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

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

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

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

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

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

Occupational Standard: Welding Level III	
Unit Title	**Prevent and Eliminate MUDA**
Unit Code	**IND WLD3 13 0217**
Unit Descriptor	This unit of competence covers the knowledge, skills and attitude required by a worker to prevent and eliminate MUDA/wastes in his/her their workplace. It covers responsibility for the day-to-day operation of the work and ensures Kaizen elements are continuously improved and institutionalized.

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

4. Prevent occurrence of wastes/MUDA.	4.1. Plan of MUDA prevention is prepared and implemented. 4.2. Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement are discussed and prepared. 4.3. Occurrences of wastes/MUDA are prevented by using ***visual and auditory control methods***. 4.4. Waste-free workplace is created using ***5W and 1H***sheet. 4.5. The completion of required operation is done in accordance with standard procedures and practices. 4.6. The updating of standard procedures and practices is facilitated. 4.7. The capability of the work team that aligns with the requirements of the procedure is ensured.

Variable	**Range**
OHS requirements	May include, but is not limited to: • Are to be in accordance with legislation/ regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of firefighting equipment, enterprise first aid, hazard control and hazardous materials and substances. • Personal protective equipment is to include that prescribed under legislation/regulations/codes of practice and workplace policies and practices. • Safe operating procedures are to include, but are not limited to the conduct of operational risk assessment and treatments associated with workplace organization. • Emergency procedures related to this unit are to include but may not be limited to emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.
Safety equipment and tools	May include, but is not limited to: • Dust masks/goggles • Glove • Working cloth • First aid and safety shoes
Tools and techniques	May include, but is not limited to: • Plant Layout • Process flow • Other Analysis tools

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

	• When • Why • How

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Discuss why wastes occur in the workplace • Discuss causes and effects of wastes/MUDA in the workplace • Analyze the current situation of the workplace by using appropriate tools and techniques • Identify, measure, eliminate and prevent occurrence of wastes by using appropriate tools and techniques • Use 5W and 1H sheet to prevent
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Targets of customers and manufacturer/service provider • Traditional and kaizen thinking of price setting • Kaizen thinking in relation to targets of manufacturer/service provider and customer • value • The three categories of operations • the 3“MU” • waste/MUDA • wastes occur in the workplace • The 7 types of MUDA • The Benefits of identifying and eliminating waste • Causes and effects of 7 MUDA • Procedures to identify MUDA • Necessary attitude and the ten basic principles for improvement • Procedures to eliminate MUDA • Prevention of wastes • Methods of waste prevention • Definition and purpose of standardization • Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement • Methods of visual and auditory control • TPM concept and its pillars. • Relevant OHS and environment requirements • Plan and report • Method of communication
Underpinning Skills	Demonstrates skills to: • Draw & 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.

NTQF Level IV

Occupational Standard: Welding Level IV	
Unit Title	**Supervise and Guide CIM Production Operations**
Unit Code	**IND WLD4 01 0217**
Unit Descriptor	This unit covers the competency required of supervising and guiding production operations including control of machine and processes and the capture of manufacturing data through conventional or Computer-integrated Manufacturing (CIM) processes.

Elements	Performance Criteria
1. Interpret the design brief or scope of production including CIM system	1.1. Required features and extent of integration of the CIM system are established in consultation with the client based on applicable operational regulations 1.2. Technical, commercial and environmental parameters are established to the scope of work in accordance with organizational procedures 1.3. Technical managers and senior design engineers are consulted in determining a production process in compliance with engineering standards 1.4. OHS, regulatory requirements and enterprise procedures relevant to scope of work are considered 1.5. Preliminary advice on feasibility of manual or possible CIM project are collected and presented to client based on engineering environment
2. Prepare production process including possible CIM system	2.1. Investigations and measurements are performed based on scope of work and operational standards 2.2. Required modelling and calculations are carried out using ***appropriate software and validation techniques*** according to production specifications 2.3. A range of conventional and CIM production solutions are generated using appropriate innovative and creative engineering specifications 2.4. Feasibility and evaluate solutions are checked against design criteria ensuring conformity to ***standards and codes***, technical, economic and OHS requirements 2.5. Social and sustainability implications of solutions are determined according to organizational specifications 2.6. Concept proposals is reviewed with client and identify preferred solution according to operational procedures
3.Perform supervision of conventional and /or CIM supported production	3.1. Conventional production processes are planned in comparison to CIM design based on results of external feasibility study and organizational requirements

	3.2. Documentation, drawings, specifications and instructions are provided in accordance with industry standards 3.3. Client and stakeholders are consulted in accordance with company procedures 3.4. Approved drafted production process is prepared for implementation according to operational requirements and standards
4. Assure quality production process	4.1. Production standards are applied (preferable ISO 9001 and 14001…) during the manufacturing process according to industry requirements

Variable	Range
Appropriate software and validation techniques	May include, but not limited to: • Comparison of traditional solutions for simple design problems with software solutions to the same design problems • Review of previously implemented design challenges which were completed using the software
Standards and codes	Refer to all relevant international standards and codes applicable to a particular design task
Parameters of the brief or contract	May include, but not limited to: • Design cost and system capital cost • Maintainability and product life cycle cost • Durability, function, performance and aesthetics • Energy and environmental sustainability and social issues • Equipment availability and worksite restrictions • Other special features and limits in the design brief
Conventional manufacturing	Limited use of ICT's and the conventional part May include, but not limited to: • Analysis • Planning • Purchasing • Materials handling and management • Providing direct control • Supervision of operations.
CIM manufacturing	Using ICTs 'to control the entire production process. It May include, but not limited to: • Computer-aided Design/Computer-aided Manufacturing (CAD/CAM) • Computer-aided Process Planning (CAPP) • Computer Numerical Control (CNC) machine tools • Direct Numerical Control (DNC) machine tools • Flexible Machining Systems (FMS)

	• Automated Storage and Retrieval Systems (ASRS) • Automated Guided Vehicles (AGV) • use of robotics and automated conveyance • computerised scheduling • production and inventory control • a business system integrated by a common database
Range of solutions	for CIM systems May include, but not limited to: • Hardware options • Software options and systems
OHS, regulatory, sustainability and environmental issues	May include, but not limited to: • OHS Acts and regulations • Relevant standards • Industry codes of practice • Risk assessments • Registration requirements • Safe work practices • Minimising ecological and environmental footprint of process, plant and product • Maximising economic benefit of process plant and product to the organisation and the community • Minimising the negative OHS impact on employees, community and customer • State and territory regulatory requirements
Communications protocols	Refer to the set of standardised rules for data and signal syntax, checking and error detection. Hardware and software generated data in accordance with a protocol allows generators and receivers to understand or translate the data as information, control signals integrity and error checks.
Automation safety	Refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity. Standards apply to general plant design and use as well as the functional safety of safety-related electrical, electronic and programmable electronic control systems.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills to: • Interpret features of plant and equipment and parameters to the brief or contract • Advise client based on discipline knowledge and OHS and regulatory standards • Research sustainability implications and current industrial design techniques • Determine OHS, regulatory and risk management requirements • Investigate and measure • Model and calculate using appropriate software and validation techniques

	• Generate and evaluate a range of solutions for feasibility against design criteria • Sketch a conventional and CIM system solution • Communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design • Document design with drawings, specifications and instructions.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Current CIM design knowledge, skills and techniques, including mechanical, electrical, fluid, electronic and information technologies, sensor/transducers, controllers, interfacing and signal conditioning, networking, software, data sharing and control functions • Techniques for: ➢ continuous improvement ➢ problem solving and decision making • Root Cause Analysis (RCA) or Failure Mode and Effects Analysis (FMEA) or Design Review Based on Failure Mode (DRBFM), and Pareto analysis • Features and capability of plant, equipment, controllers, software, network and communication systems • OHS and regulatory requirements, codes of practice, standards, risk management and registration requirements • Contemporary engineering design methods • Software options for control and data sharing • Hardware options and capabilities to suit processes and products • Documentation, drawings, specifications, instructions required, process information and programming
Underpinning Skills	Demonstrate skills in: • Determining features of CIM system, including OHS, regulatory and risk management requirements • Interpreting parameters to the brief or contract • Investigating and presenting options • Investigating faults in existing designs and arriving at solutions • Selecting and using software and validation techniques • Creating design solutions to match client expectations of innovation as well as fitness for purpose • Supervising services, maintainability, cost, manufacturability and assembly, and ease of operation • Evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis • Communicating, negotiating and reviewing with

	stakeholders and client throughout process to obtain agreement on proposal and sign-off on design • Documenting design with drawings, specifications and instructions
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: • Interview/Written test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Welding Level IV	
Unit Title	**Develop Models**
Unit Code	**IND WLD4 02 0217**
Unit Descriptor	This unit specifies the competence required in laying-out, manufacturing and finishing models.

Elements	Performance Criteria
1. Determine work requirements	1.1. Requirements are identified from design program and brief. 1.2. Drawings, instructions and specifications are interpreted and understood based on standards 1.3. Appropriate ***materials*** are selected to meet ***specifications***. 1.4. Time schedule of specific work to be performed is prepared considering available resources based on the program requirements 1.5. Functional and formal relationships are studied with reference to the actual context and given specifications 1.6. Detail specifications are determined based on scope of work
2. Layout model	2.1. Finished model design is conceptualized and planned with reference to customer's specifications (written or verbal) for finish, quality and form, in accordance with operational procedures 2.2. Estimated cost calculation for ***models*** are accomplished in compliance with organizational processes 2.3. Contractions allowances, clearances, tapers etc. are calculated to establish model parameters due to standards applied 2.4. Datum boards, jigs and fixtures are designed and manufactured according to drawings
3. Manufacture model	3.1. Sequence of manufacture, including build-up on datum board, establishing datum's mark out of model and areas to be machined, are determined with reference to operational procedures 3.2. Appropriate machines and machining processes are selected to shape/produce model to specifications 3.3. A range of hand and hand held power tools are selected and used utilizing acceptable techniques and procedures to shape model to fine tolerances according to specifications.

	3.4. Appropriate measurement/calculations are undertaken to check specifications, including coordinate measuring and machine checking as required 3.5. All components are assembled according to drawings
4. Assure Quality	4.1. Functionality of model is tested in accordance with specifications and test procedures 4.2. Where necessary, all deviations or modifications to original tooling design, prints or plans, are recorded and reported consistent with standard operating procedures 4.3. Model documentation is compiled according to operational requirements

Variable	Range
Materials	May include, but not limited to: • Metal, timber, plastic, fiberglass, composites, etc.
Specifications	May include, but not limited to: • Technical or engineering drawing • Type of material • Work procedure • Unit of measurement • Cost estimation
Models	May include, but not limited to: • Machinery for food processing, • Agricultural equipment, • Jig and fixtures • Moulds and press dies • Production units • Packaging tools • Devices of all kind • Gearboxes and couplings • Valves and pumps • Hydraulic and pneumatic assembly devices • Steel structures and support elements • New technology application for equipment and devices
Engineering standards	May include, but not limited to: • Economic • Environmental • Sustainability • Manufacturability • Ethical • Health and Safety • Social and Political

Evidence Guide

Critical Aspects of Competence	Demonstrates skills and knowledge in: • Complying with accepted engineering standard • Applying conventional graphic quality • Implementing precision in manufacturing and fitting and accuracy in description • Preparing consistent style of presentation
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Consequences of selecting inappropriate materials • Various processes requiring models • Calculus, engineering calculations and formulae relating to developing and manufacturing models • Properties and uses of datum boards, datum holes or datum faces • Reasons for developing the sequence of manufacture • The range of machines and machining processes and their operations • The various checking procedures and devices including coordinate measuring and machine testing • Procedures for recording deviation or modification to original drawings or specifications • Hazards and control measures associated with developing and manufacturing precision models • Safe work practices and procedures
Underpinning Skills	Demonstrates skills in: • Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, drawings and other applicable reference documents • Selecting appropriate materials • Conceptualizing and determining type of model required to meet specifications • Performing calculations necessary for manufacture • Developing and manufacturing datum boards, datum holes or datum faces, jigs and fixtures etc. Required for accurate manufacture • Developing a planned sequence of manufacture • Identifying areas required to be accurately manufactured • Selecting and operating the appropriate range of machines and machining processes for manufacturing the model accurately to size, tolerance and specifications • Using required hand and hand held power tools • Measuring components to specified tolerances • Carrying out measurement and test procedures for accuracy and functionality • recording and writing reports

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 assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Welding Level IV	
Unit Title	**Manage Product Cost Estimation and Bill of Materials**
Unit Code	**IND WLD4 03 0217**
Unit Descriptor	This unit covers the competency required to manage the estimated manufacturing cost of products or projects and needed bill of materials.

Elements	Performance Criteria
1. Plan and prepare for work	1.1. The work to be performed and managed is identified and clarified according to work requirements and/or tender 1.2. Essential time scheduling , sequences of work and labour are prepared based on available resources and specifications 1.3. Format (take off sheet) and materials ***bill of quantities*** are prepared based on technical specifications 1.4. Cost centres of all required resources in all respect of fields are determined according to operational specifications 1.5. ***Information*** regarding remarks is supplied due to operational procedures
2. Develop estimated product / project costs	2.1. Appropriate labor rates and material costs are selected and applied based on operational specifications 2.2. Estimates of unit costs, as appropriate, are determined and applied based on company reference data 2.3. Costs to the project of work cover, environmental protection agency requirements, seeking approvals, waste management fees and other statutory or additional costs are identified and applied due to requirements 2.4. Overhead recovery and margins are applied according to company policy 2.5. Completed estimated ***project costs*** for inclusion in tender or bill are calculated based on organizational computer supported cost calculation formats
3.Measure and check correct quantities of work	3.1. Measurements are quantified item by item according to technical specifications 3.2. Computation of the work to prepare the bill of quantities is done based on company policies 3.3. Incorrect data and size of parameters are checked as per accepted standards

	3.4. Corrections and adjustment are made within standard formats 3.5. Bill of quantities is finalized and documented based on organizational requirements
4.Maintain administrative control over resource acquisition process	4.1. The administration system through which resources are procured and acquired is monitored for its effectiveness due to organizational regulations 4.2. Financial responsibility is exercised over the procurement and acquisition system and its maintenance based on the cooperate procedures 4.3. Procurement reports are evaluated in preparation for management team meetings due to requirements 4.4. Regular meetings are facilitated and conducted between team members and the client to report on progress based on organizational regulations
5.Supervise the provision and withdrawal of resources	5.1. A system for the effective supply and withdrawal of resources is established and maintained based on company procedures 5.2. Strategic information on the usage and movement of resources within the production area is managed and monitored based on company regulations 5.3. Communications principles and policies between on-site personnel and providers of physical resources are established and maintained according to policies 5.4. Feedback from the operators and production staff is obtained and monitored at commencement, during and on completion of the project based on organizational guidelines
6. Assure quality and verify all data	6.1. Completed estimated production or project costs for inclusion in a tender or bill are verified in compliance with a computer supported cost calculation format 6.2. Actual costs are compared with estimated cost to identify deviations according to operational regulations and standards 6.3. Deviations are motivated or rectified according to established organizational framework, procedures and routines. 6.4. Assistance/approval from management is obtained based on company policies

Variables	**Range**
Bill of quantities	Is an itemized list of materials required in constructing/ producing, maintaining or repairing a specific structure
Information	May include, but not limited to:

	• Estimate relates to a discrete product with a limited number of operations to manufacture • Verbal or written and graphical instructions, work schedules, plans/specifications, memos, maps, Material Safety Data Sheets (MSDS), diagrams or sketches and graphics, reference data • Regulatory /legislative requirements pertaining to operations and the environment • Relevant specifications and instructions • Organization work specifications and requirements • Instructions issued by authorized personnel
Project costs	May include, but not limited to: • Organizational and subcontract labor hours • Project administration costs • Overheads • Consumable and production materials • Cost of meeting statutory requirements • Waste removal fees • Utilities/resource consumption • Communications costs
Key requirements	May includ timing, budget, resources, overheads, production output, special conditions
Financial and business principles	May include, but not limited to: • Probity and honest dealing • Accurate and timely development and maintenance of • Financial records • Accountability and integrity • Transparency of financial processes • Compliance with all legal financial obligations
Administrative control over the procurement process	May include, but not limited to: • Agreements with subcontractors and materials suppliers • Generation of procurement documentation • Authorizing payment for services provided • Managing the raising of purchase orders

Evidence Guide	
Critical Aspects of Competence	The competence is observed through: • Identifying the materials required for a product/project • Gathering all information required to deliver the product/project • Interpreting measurements and calculating quantities and costs • Planning and allocating human resources • Identifying and costing other related costs such as those required to meet statutory and regulatory processes

	• Producing documentation which meets the timeframe sand quality standards established by the organization • Communicating effectively, both verbally and in writing
Required knowledge	Demonstrate knowledge of • Computation inclusive data organization and systematic analysis • Technical specification reading • Effective administration and monitoring of the procurement system and processes • Sequence of production operations • Types, scope and usage of labor through the employee and subcontractor systems • Operation and structure of organizational costing and contracting system • Ethiopian standards relevant to the industry sector • Government regulations/legislations and standards
Required skills	Demonstrate skills in: • Technological applications to facilitate use of the organization's software and office technology including appropriate procurement and costing software programs • Carry out numerical operations, geometry and calculations /formulae within the scope of this unit • Extrapolate labor and materials costs from written information • Read drawings and technical specifications • Plan and sequence operations • Overview the impact on cost estimates • Using proforma estimate sheets
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 assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Welding Level IV	
Unit Title	**Perform Process Planning and Scheduling**
Unit Code	**IND WLD4 04 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitude required to determine production sequence, identify production requirements and capacities, and prepare production schedules of component / part. It includes the review of process specifications and continuous production improvements.

Elements	Performance Criteria
1. Determine production sequence	1.1. Steps required for the process are identified and flow charts are produced where required in accordance with standard operating procedures 1.2. Material and parts lists are prepared manually or with CAD in accordance with standard operating procedures 1.3. Tooling and/or equipment requirements are documented in accordance with standard operating procedures. 1.4. Process steps are documented and clearly represented in accordance with standard operating procedures.
2. Identify and analyze production requirements and capacities	2.1. Engineering production data are identified and obtained in accordance with workplace procedures. 2.2. Inventory capacities and requirements are identified and obtained in accordance with workplace procedures. 2.3. Procurement and supply requirements and constraints are analyzed and carried out in accordance with workplace procedures. 2.4. Production capacity and constraints are analyzed and applied in accordance with workplace procedures. 2.5. Standard times are identified and obtained in accordance with workplace procedures. 2.6. Production requirements are obtained with the existing resources and strategies are evolved to fit with it based on technical specifications
3. Prepare schedule for production of a component/part	3.1. Production of component is scheduled in accordance with production, inventory, procurements, time constraints, supply and labour capacities according to operational requirements 3.2. Schedule is documented in accordance with accepted organization procedures and quality management.

4.Review process specifications	4.1. Supporting engineering and production data are analyzed and reviewed where required according to organizational procedures 4.2. The new ***production processes*** to be used are determined applying organizational guidelines 4.3. Specifications are obtained and examined in accordance with operational procedures
5. Assure quality workplace operations	5.1. Operations in the workplace support overall enterprise goals and quality assurance initiatives 5.2. Quality problems and issues are promptly identified and adjustments are made accordingly to company regulations 5.3. Procedures and systems are improved in consultation with colleagues to enhance constantly efficiency and effectiveness based on Kaizen 5.4. Input is provided to appropriate management regarding staffing needs according to labour laws 5.5. Workplace challenges are promptly identified and addressed accordingly to operational and customer service regulations 5.6. Follow up action is taken to monitor the effectiveness of solutions in the workplace based on company policies and standards

Variable	**Range**
Production processes	May include, but not limited to: • Work planned over a timeframe, • Available resources • Company data
Production management	These include *s*teps / activities, milestones, targets, KPI against which progress can be monitored and evaluated
Production meetings	May include, but not limited to: • Performance evaluation • Work inspection • Maintenance and repair scheduling • Register equipment maintenance • Location of potential hazards • Pre-tour safety meetings • Assist with supervision of teams
Statutory adherence	May include, but not limited to: • Occupational Health and Safety • Duty of care • Environment and • Codes of practice
Communications	May include, but not limited to:

	• Intranet data flow • Written instruction • Oral instruction • Circulars

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Determine production sequence • Identified production requirements and capacities • Prepared schedule for production of a component/part • Reviewed process specifications
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Production processes outside and within the organization • Tooling and/or equipment requirements for workplace processes • Safe workplace practices and procedures • Scheduling techniques • Production methods • Inventory policies • Procurement, supply requirements and constraints • General staffing levels, capabilities and application of standard times • Machine set-up, capability and application of standard times • Enterprise safety requirements and directives • Quality assurance requirements
Underpinning skills	Demonstrate skills to: • Determine schedules and resources • Match personnel to tasks and roles • Facilitate problem solving associated with process variations • Analyze process parameters • Monitor process requirements • Communicate effectively within the workplace • Document, assess and transfer information • Read, interpret and follow information on work specifications, standard operating procedures and work instructions and other reference material • Maintain accurate records • Implement sequence of operations • Clarify and check task-related information • Carry-out work according to OHS practices
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 assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Welding Level IV	
Unit Title	**Perform High Reliability Soldering and De-soldering**
Unit Code	**IND WLD4 05 0217**
Unit Descriptor	This unit covers competence required in advanced soldering/de-soldering for the installation and fabrication of electrical/electronic and metal components in metal production processes.

Elements	Performance Criteria
1. Determine work requirements	1.1. Work requirement is determined using data sheets, technical drawings based on specifications and consultation with technical experts 1.2. Correct and appropriate ***tools***, equipment and material are selected according to operational procedures
2. Prepare for soldering	2.1. Material/***device*** is cut, shaped and/or drilled to specification. 2.2. ***Materials***/devices are cleaned to specifications using correct and appropriate materials and procedures. 2.3. Correct and appropriate set-up and/ or mounting techniques are used due to requirements
3. Solder components	3.1. Material/device is mounted using correct and appropriate tools and techniques based on specifications 3.2. Soldering is applied with correct and appropriate techniques and appropriate use of flux according to operational standards 3.3. Necessary techniques are undertaken to protect materials/ devices from heat damage due to requirements 3.4. Printed circuit boards, assemblies and ***components*** are handled in such a way as to prevent electrostatic discharge or mechanical damage compliant to manufacturing procedures
4. Assure quality soldering process	4.1. Visual inspection is carried out to ensure compliance with specifications. 4.2. Where required, mechanical/electrical tests are undertaken using correct and appropriate techniques and equipment to ensure compliance with specifications 4.3 Rework/repair is carried out to ensure compliance with specifications. 4.4 Repair/rework is inspected and tested to specifications

Variable	Range
Tools	All types of irons, pliers, side cutters, brushes, files, soldering tips, solder syringes, holding devices etc.
Device	Medical/navigation equipment, military etc.
Materials	Solder (solid, resin cord and paste), flux (resin or powder) etc.
Test/inspection	Visual, mechanical or electrical techniques
Components	Metallic and electronic

Evidence Guide	
Critical Aspects of Competence	Demonstrate ability to: • Determine job specifications and operational procedures • Prepare and apply soldering materials, equipment and tools • Solder components • Test/inspect soldered joints • Rework/repair faulty joints including de-soldering
Underpinning Knowledge and Attitudes	Look for evidence that confirms knowledge of: • Cleaning solutions and properties and cleaning procedures • Methods of joint preparation • Properties of fluxes and their uses • Heat and damage protection procedures • Procedures for preventing electrostatic discharge damage • Soldered joint testing and inspection procedures • Reworking procedures and precautions • Safe work practices and procedures
Underpinning Skills	Look for evidence that confirms skills in: • Performing joint preparation • Performing high level soldering • Undertaking testing/inspecting • Performing reworking/repairing • Recording • Reading and interpreting routine information on written job instructions, specifications and standard operating procedures • Following oral instruction
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: Welding Level IV	
Unit Title	**Perform Brazing and Silver Soldering**
Unit Code	**IND WLD4 06 0217**
Unit Descriptor	This unit covers competence required to perform brazing and silver soldering. It includes the preparation of materials and equipment and the inspection of the completed work.

Element	Performance Criteria
1. Prepare materials and equipment	1.1. Scope of work is determined from specifications and/ or instructions 1.2. ***Materials*** are correctly prepared using appropriate tools and techniques 1.3. Materials are correctly assembled/aligned to meet specifications as required 1.4. Distortion prevention measures are identified and appropriate action is taken as required 1.5. ***Heating*** equipment is assembled and set up safely and correctly in accordance with standard operating procedures 1.6. Correct and appropriate ***consumables*** are selected and prepared due to operational procedures
2. Braze and/or silver solder	2.1. The correct ***process*** is selected to meet specifications. 2.2. Materials are preheated as required 2.3. Consumables are applied using correct techniques 2.4. Jointing material is applied correctly and in appropriate quantities to meet job/specifications 2.5. Material temperature is annealed using correct and appropriate techniques
3. Inspect joints	3.1. Excess jointing materials are removed using correct and appropriate techniques 3.2. Inspection of joints is undertaken to standard operating procedures 3.3. Inspection results are reported/recorded using standard operating procedures as required

Variables	Range
Materials	Ferrous and non-ferrous
Heating	Oxy acetylene and fuel gas, cylinders, connections, hoses, tips and nozzles
Consumables	Fluxes (resin or powder), all types of silver solder and brazing grades, tin lead alloy brass alloy, etc.

Process	Brazing, braze welding and silver soldering

Evidence Guide	
Critical Aspects of Competence	Demonstrates the skill and knowledge of: • Preparation of materials and equipment. • Performing brazing and silver soldering • Inspection of the welded joint
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • The reasons for selecting specific methods of assembly/alignment • The procedures for minimising distortion of the materials being brazed/braze welded/silver soldered • The procedures for assembling and setting up the specific heating equipment • The reasons for selecting specific heating equipment • The reasons for selecting specific consumables • The procedures and precautions for preheating the materials to be joined • The effects of the use of inappropriate techniques on the performance of the jointed materials • The effect of inappropriate quantities of jointing material on the performance of the jointed materials • The procedures for normalizing the temperature of jointed materials • The consequences of using inappropriate techniques to normalize the temperature of the joint • The procedures for removing excess jointing material • The procedures for inspecting brazed/braze welded/silver soldered joints • Use and application of personal protective equipment for silver soldering and brazing/braze welding • Safe work practices and procedures
Underpinning Skills	Demonstrate skills in: • Conducting test runs • Preparing materials • Performing brazing, braze welding, silver soldering • Undertaking visual inspection • Reading and interpreting routine information on written job instructions, specifications and standard operating procedures • Following oral instructions
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: Welding Level IV	
Unit Title	**Apply and Supervise Metallurgy Principles**
Unit Code	**IND WLD4 07 0217**
Unit Descriptor	This unit covers competency required in applying and supervising basic metallurgy principles related to selecting appropriate Non-destructive Testing (NDT) technique and interpreting the results of NDT tests for production processes

Elements	Performance Criteria
1. Interpret and apply basic metallurgy principles	1.1. Principles of solidification and crystal structures in metals and alloys are interpreted and applied in relation to ***NDT methods***
	1.2. Equilibrium diagram for metal or alloy is correctly sourced
	1.3. Equilibrium diagrams are correctly interpreted
2. Apply principles of metals and alloys to forming	2.1. ***Principles and methods for fusion welding of metals and alloys*** are applied to NDT test selection due to standard
	2.2. ***Defects in welding*** are identified and classified from NDT test results due to standard
	2.3. Principles and methods used to produce metal castings are applied to NDT test selection.
	2.4. ***Defects in metal and alloy castings*** are identified and classified from NDT test results
	2.5. ***Principles and methods used to produce steel forgings*** are applied to NDT test selection.
	2.6. Defects in steel forgings are identified and classified from NDT test results.
3. Apply heat treatment in relation to welds	3.1. Reasons for performing heat treatment are identified in compliance with regulations
	3.2. Processes such as pre-heat/post-heat treatment, stress relieving, normalizing and annealing are applied according to operational standards
4. Quality assure principles of mechanical testing	4.1. ***Principles of mechanical testing*** are applied to NDT test selection.
	4.2. Defects in metal product are identified and classified from NDT test results

Variable	Range
NDT methods	Ultra sonic inspection, magnetic particle, liquid penetrants, visual inspection, ADDY current testing, hardness testing,

	spectro method, digital and computerized radiography, universal testing, etc.
Principles and methods for fusion welding of metals and alloys	May include, but not limited to: • MMAW • SAW • GMAW • GTAW • FCAW
Defects in welding	• Cracks, lack of fusion, cavities, imperfect shape, solid inclusions, miscellaneous, slag inclusion, incomplete distortion, under cut, porosity, etc.
Defects in metal and alloy castings	• Shrinkage cavities, hot tears, hot spot, cold cracks, , gas holes/porosity (blow holes, pin holes), inclusion
Principles and methods used to produce steel forgings	• Deformations, strengthening mechanisms, annealing
Principles of mechanical testing	• Impact, tensile, hardness testing, etc.

Evidence Guide	
Critical Aspects of Competence	A person must be able to demonstrate: • Interpret and apply the principles of solidification and crystal structures in metals and alloys • Interpret equilibrium diagrams for metals and alloys • Interpret and apply the principles of fusion welding of metals and alloys • Interpret and apply the principles of the formation of castings • Interpret and apply the principles of steel forging • Interpret and apply the principles of mechanical testing • Apply appropriate pre and post-heat treatment processes for a range of welded materials
Underpinning Knowledge and Attitudes	Look for evidence that confirms knowledge of: • Principles of solidification and crystal structures in metal: ➢ Classification of materials ➢ Structure of atoms ➢ Process of solidification ➢ Crystal structures ➢ Defects formed during solidification ➢ Modification of crystal structure ➢ Heat treatment processes ➢ Defects formed during heat treatment • Meaning of equilibrium diagrams representative of a range of metals including aluminium, iron, steel and common non-ferrous alloys: ➢ Alloy systems ➢ Solid and liquid solubility

	➢ Basic equilibrium diagrams ➢ Equilibrium diagrams for common alloys • Principles of fusion welding in relation to NDT testing defects in fusion welding: ➢ Processing defects ➢ Grinding cracks ➢ Pickling cracks ➢ Heat treatment cracks ➢ Service defects ➢ Fatigue cracks ➢ Corrosion and stress corrosion cracks • Principles of the formation of castings • Defects in castings • Principles of steel forging • Defects in steel forging • Principles of mechanical testing: ➢ Tensile testing ➢ Impact testing ➢ Hardness testing ➢ Fatigue testing ➢ Torque testing ➢ Other tests • Heat treatment processes • Effect of heat treatment on metal
Underpinning Skills	Look for evidence that confirms skills in: • Researching • Applying metallurgy principles • Selecting NDT test appropriate to metal or alloy and manufacturing process • Applying heat treatment processes
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: Welding Level IV	
Unit Title	**Apply and Supervise Welding Codes and Principles**
Unit Code	**IND WLD4 08 0217**
Unit Descriptor	This unit covers competency required in supervising and applying welding codes and principles in metal production to meet the statutory and regulatory requirements for welding procedures applicable in Ethiopia and international.

Elements	Performance Criteria
1. Apply all statutory and regulatory requirements	1.1. ***Statutory and safety requirements*** are applied according to industry required ***welding*** codes 1.2. Welding terms and symbols are correctly interpreted and applied to welding due to standard
2. Apply heat treatment in relation to welds	2.1. Reasons for performing heat treatment are identified in compliance with regulations 2.2. Processes such as pre-heat/post-heat treatment, stress relieving, normalizing and annealing are applied according to operational standards
3. Plan the logical sequence of welding operations	3.1. Principles of planning and setting up welding process are supervised and applied based on operational specifications 3.2. Where specified, welds are prepared for external testing based on applicable welding code , and safety and reliability regulations

Variable	Range
Statutory and safety requirements	International and national welding codes applied but not limited to: • ISO • CEN • DIN • API • ASME / AWS • AS codes • CSA • BS
Welding	To international standard using any of the following processes: • Flux core arc welding • Gas metal arc welding • Gas tungsten arc welding • Manual metal arc welding

Evidence Guide	
Critical Aspects of Competence	Critical aspects of assessment and evidence include: • Applying and supervising welding statutory and safety requirements (welding codes) to different welding jobs and environments • Interpreting welding codes and symbols including symbols for type of weld, weld size, processing and finishing operations etc • Applying appropriate pre and post-heat treatment processes for a range of welded materials • Setting up weld sequence and preparing materials in a logical manner for welding job.
Underpinning Knowledge and Attitudes	Required knowledge includes: • Any applicable industry standards, national/Australian standards, NOHSC guidelines, state/territory regulatory codes of practice/standards for the applicable welding processes • Safe work practices and procedures • Hazards related to welding • Safety equipment and procedures related to welding activities • Welding terminology • Welding codes and symbols • Logical sequence for welding processes • Tools, equipment, techniques used in welding • Heat treatment processes • Effect of heat treatment on metal
Underpinning Skills	Required skills include: • Interpreting welding specifications including terms, codes and symbols • Planning the sequence of welding operations
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Mechanics Supervision Level IV	
Unit Title	**Implement and Monitor Environmentally Sustainable Work Practices**
Unit Code	**IND WLD4 09 0217**
Unit Descriptor	This competency covers the outcomes required to effectively analyse the workplace in relation to environmentally sustainable work practices and to implement improvements and monitor their effectiveness.

Elements	Performance Criteria
1. Investigate current practices in relation to resource usage.	1.1. Environmental regulations applying to the enterprise are identified. 1.2. ***Procedures*** are assessed for assessing ***compliance*** with environmental regulations. 1.3. Information on environmental and resource efficiency systems and procedures are collected, and provided to the work group where appropriate. 1.4. Current resource usage is ***measured*** and recorded by members of the work group. 1.5. Current ***purchasing strategies*** are analysed and recorded. 1.6. Current work processes are analysed to access information and data and assisted in identifying areas for improvement.
2. Set targets for improvements.	2.1. Input is sought from ***stakeholders, key personnel and specialists***. 2.2. External sources of information and data are accessed, as required. 2.3. Alternative solutions are evaluated to workplace environmental issues. 2.4. Efficiency targets are set.
3. Implement performance improvement strategies.	3.1. ***Techniques and tools*** are sourced to assist in achieving targets. 3.2. Continuous improvement strategies are applied to own work area of responsibility and ideas and possible solutions communicated to the work group and management. 3.3. Environmental and resource efficiency improvement plans for own work group are integrated with other operational activities and implemented. 3.4. ***Suggestions*** and ideas about environmental and resource efficiency management are sought from stakeholders and act upon them where appropriate.

	3.5. Costing strategies are implemented to fully value environmental assets.
4. Monitor performance.	4.1. Outcomes are documented and reports on targets communicated to key personnel and stakeholders. 4.2. Strategies are evaluated. 4.3. New targets are set and new tools and strategies investigated and applied. 4.4. Successful strategies are promoted and participants rewarded, where possible.

Variables	**Range**
Procedures	May include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards. Where reference is made to industry codes of practice, and/or Ethiopian/international standards, the latest version must be used.
Compliance	May include meeting relevant federal, state and local government laws, by-laws, regulations and codes of practice.
Measurement	May include, but not limited to: • Material fed to/consumed by plant/equipment • Plant meters and gauges • Job cards including kanbans • Examination of invoices from suppliers • Measurements made under different conditions • Examination of relevant information and data • Others as appropriate to the specific industry contexts.
Purchasing strategies	May include, but not limited to: • Influencing suppliers to take up environmental sustainability • Selecting materials/components with a lower environmental profile.
Stakeholders**,** key personnel and specialists	May include, but not limited to: • Employees at all levels of the organisation • Customers • Suppliers • Other organisations • Key personnel within the organisation, and specialists outside it who may have particular technical expertise
Techniques and tools	May include, but not limited to: • Visual workplace concepts • Measurement, display and/or recording devices • Changed work practices/procedures • Competence development and awareness training • Process and equipment items

Suggestions	May include, but not limited to: • Prevent and minimise environmental risks and maximise opportunities • Reduce emissions of greenhouse gases • Reduce use of non-renewable resources • Make more efficient use of energy, water and other resources • Maximise opportunities to reuse and recycle materials • Identify strategies to offset or mitigate environmental impacts. E.g. Purchasing of carbon credits • Express purchasing power through the selection of suppliers with improved environmental performance. E.g. Purchasing renewable energy and materials with lower embedded carbon • Eliminate the use of hazardous and toxic materials increasing the reusability/recyclability of wastes/products.
Environmental and resource efficiency issues	May include, but not limited to: • Addressing environmental and resource sustainability initiatives such as Environmental Management Systems, action plans, surveys and audits • Reference to standards, guidelines and approaches such as: ➢ ISO 14001 Environmental Management Systems ➢ Life Cycle Analyses ➢ Cradle to cradle ➢ Global Reporting Initiative ➢ Ecological foot printing ➢ Triple Bottom Line reporting and Product Stewardship • Determining enterprise's most appropriate waste treatment including waste to landfill, recycling, re-use and wastewater treatment • Applying the waste management hierarchy in the workplace • Initiating and/or maintaining appropriate enterprise procedures for operational energy consumption, including stationary energy and non-stationary (transport) • Efficient use of water • Minimising greenhouse gas emissions • Use of controls to minimise the risk of environmental damage from hazardous substances
Incidents	May include, but not limited to: • Breaches or potential breaches of regulations • Occurrences outside of standard procedure which may lead to lower environmental performance

Evidence Guide	
Critical Aspects of Competence	A person must be able to demonstrate: • Provide evidence of the ability to implement and monitor integrated environmental and resource efficiency management policies and procedures within an organisation. • Monitor and investigate current resource usage • Develop plans to improve sustainability • Implement environmental improvements. Consistent performance should be demonstrated. For example, look to see that: • Environmental performance is routinely monitored and investigated • Areas for improvements are followed through and the implemented changes are in turn monitored and investigated.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • How to access and use relevant environmental and resource efficiency systems, tools and procedures • Understanding of best practice approaches relevant to own area of responsibility • Strategies to maximise opportunities and minimise impacts relevant to own work area • Relevant environmental and resource efficiency issues specific to industry practices • Methods for measuring and calculating resource usage
Underpinning Skills	Demonstrate skills of: • Using relevant environmental and resource efficiency systems, tools and procedures • Applying quality assurance systems relevant to own work area • Applying relevant supply chain procedures • Measurement and calculation techniques • Communication/consultation skills to ensure information is supplied to the work group • Reading and writing is required to comprehend documentation and interpret environmental and energy efficiency requirements and to document and maintain records • Numeracy is required to interpret numeric workplace information, readings and measurements, handle data as required and complete numeric components of workplace forms/reports.
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: Welding Level IV	
Unit Title	**Plan and Organize Work**
Unit Code	**IND WLD4 10 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitude required in planning and organizing work activities in a production application. It may be applied to a small independent operation or to a section of a large organization.

Elements	Performance Criteria
1. Set objectives	1.1. ***Objectives*** are planned consistent with and linked to work activities in accordance with organizational aims. 1.2. Objectives are stated as measurable targets with clear time frames. 1.3. Support and commitment of team members are reflected in the objectives. 1.4. Realistic and attainable objectives are identified.
2. Plan and schedule work activities	2.1. Tasks/work activities to be completed are identified and prioritized as directed. 2.2. Tasks/work activities are broken down into steps in accordance with set time frames and achievable components. 2.3. Task/work activities are assigned to appropriate team or individuals in accordance with agreed functions. 2.4. ***Resources*** are allocated as per requirements of the activity. 2.5. ***Schedule of work activities*** is coordinated with personnel concerned.
3. Implement work plans	3.1. ***Work methods and practices*** are identified in consultation with personnel concerned. 3.2. ***Work plans*** are implemented in accordance with set time frames, resources and ***standards***.
4. Monitor work activities	4.1. Work activities are monitored and compared with set objectives. 4.2. Work performance is monitored. 4.3. Deviations from work activities are reported and recommendations are coordinated with appropriate personnel and in accordance with set standards. 4.4. Reporting requirements are complied with in accordance with recommended format.

	4.5. Timeliness of report is observed. 4.6. Files are established and maintained in accordance with standard operating procedures.
5. Review and evaluate work plans and activities	5.1. Work plans, strategies and implementation are reviewed based on accurate, relevant and current information. 5.2. Review is done based on comprehensive consultation with appropriate personnel on outcomes of work plans and reliable feedback. 5.3. Results of review are provided to concerned parties and formed as the basis for adjustments/simplifications to be made to policies, processes and activities. 5.4. Performance appraisal is conducted in accordance with organization rules and regulations. 5.5. Performance appraisal report is prepared and documented regularly as per organization requirements. 5.6. Recommendations are prepared and presented to ***appropriate personnel/authorities***. 5.7. ***Feedback mechanisms*** are implemented in line with organization policies.

Variable	**Range**
Objectives	May include, but not limited to: • Specific • General
Resources	May include, but not limited to: • Personnel • Equipment and technology • Services • Supplies and materials • Sources for accessing specialist advice • Budget
Schedule of work activities	May include, but not limited to: • Daily • Work-based • Contractual and Regular
Work methods and practices	May include, but not limited to: • Legislated regulations and codes of practice • Industry regulations and codes of practice • Occupational health and safety practices
Work plans	May include, but not limited to: • Daily work plans

	• Project plans • Program plans • Resource plans • Skills development plans • Management strategies and objectives
Standards	May include, but not limited to: • Performance targets • Performance management and evaluation systems • Occupational standards • Employment contracts • Client contracts • Discipline procedures • Workplace assessment guidelines • Internal quality assurance • Internal and external accountability and auditing requirements • Training Regulation Standards and Safety Standards
Appropriate personnel/ authorities	May include, but not limited to: • Appropriate personnel include: • Management and Line Staff
Feedback mechanisms	May include, but not limited to: • Verbal feedback • Informal feedback • Formal feedback • Questionnaire • Survey and Group discussion

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Set objectives • Plan and schedule work activities • Implement work plans • Monitor work activities • Review and evaluate work plans and activities
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Organization's strategic plan, policies rules and regulations, laws and objectives for work unit activities and priorities • Organizations policies, strategic plans, guidelines related to the role of the work unit • Team work and consultation strategies
Underpinning Skills	Demonstrates skill to: • Plan • Lead • Organize • Coordinate • Communicate

	• Inter-and intra-person/motivation skills • Present
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: Welding Level IV	
Unit Title	**Migrate to New Technology**
Unit Code	**IND WLD4 11 0217**
Unit Descriptor	This unit defines the competence required to apply skills and knowledge in using new or upgraded technology. The rationale behind this unit emphasizes the importance of constantly reviewing work processes, skills and techniques in order to ensure that the quality of the entire business process is maintained at the highest level possible through the appropriate application of new technology. To this end, the person is typically engaged in on-going review and research in order to discover and apply new technology or techniques to improve aspects of the organization's activities.

Elements	Performance Criteria
1. Apply existing knowledge and techniques to technology and transfer	1.1. Situations are identified where existing knowledge can be used as the basis for developing new skills. 1.2. New or upgraded technology skills reacquired and used to enhance learning. 1.3. New or upgraded equipment are identified, classified and used where appropriate, for the benefit of the organization.
2. Apply functions of technology to assist in solving organizational problems	2.1. Testing of new or upgraded equipment is conducted according to the specification manual. 2.2. Features of new or upgraded equipment are applied within the organization. 2.3. Features and functions of new or upgraded equipment are used for solving organizational problems. 2.4. Sources of information relating to new or upgraded equipment are accessed and used.
3. Evaluate new or upgraded technology performance	3.1. New or upgraded equipment is evaluated for performance, usability and against OHS standards. 3.2. ***Environmental considerations*** are determined from new or upgraded equipment. 3.3. ***Feedback*** is sought from users where appropriate.

Variables	Range
Environmental Considerations	May include, but not limited to: • Recycling, safe disposal of packaging (e.g. Cardboard, polystyrene, paper, plastic) and correct disposal of waste materials by an authorized body
Feedback	May include, but not limited to: • Surveys,

	• Questionnaires, • interviews and meetings.

Evidence Guide	
Critical Aspects of Competence	Competence must confirm the ability to transfer the application of existing skills and knowledge to new technology
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Broad awareness of current technology trends and directions in the industry (e.g. systems/procedures, services, new developments, new protocols) • Vendor product directions • Ability to locate appropriate sources of information regarding metal manufacturing and new technologies • Current industry products/services, procedures and techniques with knowledge of general features • Information gathering techniques
Underpinning Skills	Demonstrate skills of: • Research skills for identifying broad features of new technologies • Ability to assist in the decision making process • Literacy skills in regard to interpretation of technical manuals • Ability to solve known problems in a variety of situations and locations • Evaluate and apply new technology to assist in solving organizational problems • General analytical skills in relation to known problems
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: Welding Level IV	
Unit Title	**Establish Quality Standards**
Unit Code	**IND WLD4 12 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to establish quality specifications for work outcomes and work performance. It includes monitoring and participation in maintaining and improving quality, identifying critical control points in the production of quality output and assisting in planning and implementing of quality assurance procedures.

Elements	Performance Criteria
1. Establish quality specifications for product	1.1. Market specifications are ***sourced*** and ***legislated requirements*** identified. 1.2. Quality specifications are developed and agreed upon. 1.3. Quality specifications are documented and introduced to organization staff / personnel in accordance with the organization policy. 1.4. Quality specifications are updated when necessary.
2. Identify hazards and critical control points	2.1. Critical control points impacting on quality are identified. 2.2. Degree of risk for each hazard is determined. 2.3. Necessary documentation is accomplished in accordance with organization quality procedures
3. Assist in planning of quality assurance procedures	3.1. Procedures for each identified control point are developed to ensure optimum quality. 3.2. Hazards and risks are minimized through application of appropriate controls. 3.3. Processes are developed to monitor the effectiveness of quality assurance procedures.
4. Implement quality assurance procedures	4.1. Responsibilities for carrying out procedures are allocated to staff and contractors. 4.2. Instructions are prepared in accordance with the enterprise's quality assurance program. 4.3. Staff and contractors are given induction training on the quality assurance policy. 4.4. Staff and contractors are given in-service training relevant to their allocated ***safety procedures***.
5. Monitor quality of work outcome	2.1. Quality requirements are identified. 2.2. Inputs are inspected to confirm capability to meet quality requirements. 2.3. Work is conducted to produce required outcomes.

	2.4. Work processes are monitored to confirm quality of output and/or service. 2.5. Processes are adjusted to maintain outputs within specification.
6. Participate in maintaining and improving quality at work	6.1. Work area, materials, processes and product are routinely monitored to ensure compliance with quality requirements. 6.2. Non-conformance in inputs, process, product and/or service is identified and reported according to workplace reporting requirements. 6.3. Corrective action is taken within level of responsibility, to maintain quality standards. 6.4. Quality issues are raised with designated personnel.
7. Report problems that affect quality	7.1. Potential or existing quality problems are recognized. 7.2. Instances of variation in quality are identified from specifications or work instructions. 7.3. Variation and potential problems are reported to supervisor/manager according to enterprise guidelines.

Variable	**Range**
Sourced	May include, but not limited to: • End-users • Customers or stakeholders
Legislated requirements	May include, but not limited to: • Verification of product quality as part of consumer legislation or specific legislation related to product content or composition.
Safety procedures.	May include, but not limited to: • Use of tools and equipment for fabrication/production/ manufacturing works • Workplace environment and handling of material safety, • Following occupational health and safety procedures designated for the task • Respect the policies, regulations, legislations, rule and procedures for manufacturing/production/fabrication works

Evidence Guide	
Critical Aspect of Competence	Demonstrates skills and knowledge to: • Monitor quality of work • Establish quality specifications for product • Participate in maintaining and improving quality at work • Identify hazards and critical control points in the production of quality product

	• Assist in planning of quality assurance procedures • Report problems that affect quality • Implement quality assurance procedures
Underpinning Knowledge	Demonstrates knowledge of: • Work and product quality specifications • Quality policies and procedures • Improving quality at work • Hazards and critical points of operation • Obtaining and using information • Applying federal and regional legislation within day-today work activities • Accessing and using management systems to keep and maintain accurate records • Requirements for correct preparation and operation • Technical writing
Underpinning Skills	Demonstrates skills to: • Monitor quality of work • Establish quality specifications for product • Participate in maintaining and improving quality at work • Identify hazards and critical control points in the production of quality product • Assist in planning of quality assurance procedures • Report problems that affect quality • Implement quality assurance 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: Welding Level IV	
Unit Title	**Develop Individuals and Team**
Unit Code	**IND WLD4 13 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to determine individual and team development needs and facilitate the development of the workgroup.

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 to meet individual and group training and developmental needs is collaboratively developed and implemented. 1.3. Individuals are encouraged to self-evaluate performance and identify areas 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 to obtain and share information is used by team. 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 actively participated in team activities and communication processes. 5.2. Individual and joint responsibility is developed by team's 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, monitoring and/or supervision • Formal/informal learning program • Internal/external training provision • Work experience/exchange/opportunities • Personal study • Career planning/development • Performance evaluation • 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 evaluation • 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: • On the job coaching or monitoring • Problem solving

	• Presentation/demonstration • Formal course participation • Work experience and involvement in professional networks • Conference and seminar attendance

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 plans to improve the effectiveness of learning • Prepare learning plans to match skill needs • Access and designate learning opportunities
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Coaching and monitoring 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 to obtain 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 a variety of texts, preparing general information and documents according to target audience; spell with accuracy; use grammar and punctuation effective relationships and conflict management • Communicate including receiving feedback and reporting, maintaining effective relationships and conflict management • Plan and organize required resources and equipment to meet learning needs • Coach and mentor skills to provide support to colleagues • Report to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes • Facilitate and conduct small group training sessions • Relate to people from a range of social, cultural, physical and mental backgrounds
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: Welding Level IV	
Unit Title	**Utilize Specialized Communication Skills**
Unit Code	**IND WLD4 14 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate group discussions, and contribute to the development of communication strategies.

Elements	Performance Criteria
1. Meet common and specific communication needs of clients and colleagues	1.1. Specific communication needs of clients and colleagues are identified and met. 1.2. Different approaches are used to meet communication needs of clients and colleagues. 1.3. Conflict is addressed promptly and in a timely way and in a manner which does not compromise the standing of the organization.
2. Contribute to the development of communication strategies	2.1. ***Strategies*** for internal and external dissemination of information are developed, promoted, implemented and reviewed as required. 2.2. Channels of communication are established and reviewed regularly. 2.3. Coaching in effective communication is provided 2.4. Work related network and relationship are maintained as necessary. 2.5. Negotiation and conflict resolution strategies are used where required. 2.6. Communication with clients and colleagues is made appropriate to individual needs and organizational objectives.
3. Represent the organization	3.1. When participating in internal or external fora, presentation is relevant, appropriately researched and presented in a manner to promote the organization. 3.2. Presentation is made clear and sequential and delivered within a predetermined time. 3.3. Appropriate media is utilized to enhance presentation. 3.4. Differences in views are respected. 3.5. Written communication is made consistent with organizational standards. 3.6. Inquiries are responded in a manner consistent with organizational standard.

4. Facilitate group discussion	4.1. Mechanisms which enhance ***effective group interaction*** are defined and implemented. 4.2. Strategies which encourage all group members to participate are used routinely. 4.3. Objectives and agenda are routinely set and followed for meetings and discussions. 4.4. Relevant information are provided to group to facilitate outcomes. 4.5. Evaluation of group communication strategies is undertaken to promote participation of all parties. 4.6. Specific communication needs of individuals are identified and addressed.
5. Conduct interview	5.1. A range of appropriate communication strategies are employed in ***interview situations***. 5.2. Different ***types of interview*** is conducted in accordance with the organizational procedures. 5.3. Records of interviews are made and maintained in accordance with organizational procedures. 5.4. Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated.

Variable	**Range**
Strategies	May include, but not limited to: • Recognizing own limitations • Utilizing techniques and aids • Providing written drafts • Verbal and non verbal communication
Effective group interaction	May include, but not limited to: • Identifying and evaluating what is occurring within an interaction in a non-judgmental way • Using active listening • Making decision about appropriate words, behavior • Putting together response which is culturally appropriate • Expressing an individual perspective • Expressing own philosophy, ideology and background and exploring impact with relevance to communication
Interview situations	May include, but not limited to: • Establish rapport • obtain facts and information • Facilitate resolution of issues • Develop action plans • Diffuse potentially difficult situation

Types of Interview	May include, but not limited to: • Related to staff issues • Routine • Confidential • Evidential • Non-disclosure • Disclosure

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Demonstrate effective communication skills with clients and work colleagues accessing service • Adopt relevant communication techniques and strategies to meet client particular needs and difficulties
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Communication process • Dynamics of groups and different styles of group leadership • Communication skills relevant to client groups
Underpinning Skills	Demonstrates skills to: • Full range of communication techniques including: ➢ active listening ➢ feedback ➢ interpretation ➢ role boundaries setting ➢ negotiation ➢ establishing empathy ➢ communication strategies • Communicate to fulfil job roles as specified by the organization
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: Welding Level IV	
Unit Title	**Manage Micro, Small and Medium Enterprises (MSMEs)**
Unit Code	**IND WLD4 15 0217**
Unit Descriptor	This unit covers knowledge, skills and attitude required in running Micro, Small and Medium enterprises. The strategies involve developing, monitoring and managing work activities and financial information, developing effective work habits, and adjusting work schedules as needed.

Elements	Performance Criteria
1. Develop and communicate Strategic work plan	1.1. The importance of planning is sensitized before acting and about the importance of plans to reduce risks and to inhibit impulsive actions and discussed. 1.2. The basics of planning and beginning with goal setting are communicated. 1.3. The achievement of measurable and realistic short-term business objective is addressed. 1.4. How to develop realistic activities plans and schedule is discussed. 1.5. ***Major components of work plan*** are introduced and understood. 1.6. The importance of constant reviewing their plans is understood by monitoring the results.
2. Identify daily work requirements and Develop effective work habits	2.1. Basic concept about effect working culture is discussed and understood. 2.2. Different approaches to work culture are developed and understood. 2.3. Work requirements are identified for a given time period by taking into consideration of ***resources*** and constraints. 2.4. Work activities are prioritized based on business needs, requirements and deadlines. 2.5. If appropriate, work is allocated to relevant staff or contractors to optimize efficiency. 2.6. Work and personal priorities are identified and a balance is achieved between competing priorities using appropriate ***time management strategies***. 2.7. Input is sought from ***internal and external sources*** and used to develop and refine new ideas and approaches.

	2.8. Business or inquiries is/are responded to promptly and effectively. 2.9. Information is presented in a format appropriate to the industry and audience.
3. Manage Marketing of MSMEs	3.1. Information on market and business needs is analyzed and market opportunities identified. 3.2. Marketing mix and components are evaluated. 3.3. Marketing mix for specific target market is determined. 3.4. Marketing mix is monitored and continual adjusted against marketing performance.
4. Manage Human Resources	4.1. ***Human resource rules, regulations law and procedures*** are identified and determined. 4.2. The existing human resource is audited, and gaps are identified. 4.3. Recruitment and selection are conducted based on the organizational requirements. 4.4. Selected candidates are oriented and placed for the appropriate position. 4.5. Appraisal of employees' performance is conducted. 4.6. Appraisal result is used for training and development, promotion, compensation, disciplinary measures and other purposes as required. 4.7. ***Employee relations*** are maintained.
5. Manage production and Operation	5.1. Production /operation plan is developed and implemented. 5.2. Required inputs are purchased and adequate inventories maintained. 5.3. Production /operation process is checked and controlled. 5.4. Quality control is applied and maintained.
6. Maintain financial records and use for decision making	6.1. The objective and benefits of financial records are discussed and understood. 6.2. Asset, liabilities and capital are identified and recorded. 6.3. Balance sheet and different journals are discussed. 6.4. Business transactions are discussed, analyzed, classified and recorded. 6.5. Daily financial records are maintained correctly in accordance with legal and accounting requirements.

	6.6. Invoices and payments are prepared and distributed in timely manner and in accordance with legal requirements. 6.7. Outstanding accounts are collected or followed-up. 6.8. Revenue, expense and costs are identified and discussed. 6.9. Different ledgers and subsidiary ledgers are discussed and maintained. 6.10. Profit and loss report is prepared. 6.11. Financial interpretation is conducted with assistant from the appropriate person. 6.12. Financial manual is prepared.
7. Monitor, Manage and Evaluate work performance	7.1. People, resources and/or equipment are coordinated to provide optimum results. 7.2. Staff, clients and/or contractors are communicated within a clear and regular manner, to monitor work in relation to ***business goals*** or timelines. 7.3. ***Problem solving techniques*** are applied to work situations to overcome difficulties and achieve positive outcomes. 7.4. Opportunities for improvements are monitored according to business demands. 7.5. Work schedules are adjusted to incorporate necessary modifications to existing work and routines or changing needs and requirements. 7.6. Proposed changes are clearly communicated and recorded to aid in future planning and evaluation. 7.7. Relevant codes of practice are used to guide an ethical approach to workplace practices and decisions.

Variable	**Range**
Major components of work plan	May include, but not limited to: • Objective • Responsibilities • Resources (human, materials, finance, time, etc) • Activities
Resources	May include, but not limited to: • Human resource • Money • Time • Machines • Equipment • Space

Time management strategies	May include, but not limited to: • Prioritizing and anticipating • Short term and long term planning and scheduling • Creating a positive and organized work environment • Clear timelines and goal setting that is regularly reviewed and adjusted as necessary • Breaking large tasks into smaller tasks • Getting additional support if identified and necessary
Internal and external sources	May include, but not limited to: • Staff and colleagues • Management, supervisors, advisors or head office • Relevant professionals such as lawyers, accountants, management consultants • Professional associations
Human resource rules , regulations law and procedures	May include, but not limited to: • Recruitment and selection • Orientation and placement • Training and development • Performance appraisal and reward system • Disciplinary procedures • Movement and separation • Industrial relation
Employee relations	May include, but not limited to: • Relationship within employees • Relationship among employees and management and labor union • Relationship between labor union and government
Business goals	May include, but not limited to: • Sales targets • Budgetary targets • Team and individual goals • Production targets • Reporting deadlines
Problem solving techniques	May include, but not limited to: • Brainstorming • Fish bone • Focus group discussion and Problem tree

Evidence Guide	
Critical Aspects of Competence	A person must be able to demonstrate: • Ability to identify daily work requirements and allocate work appropriately • Ability to interpret financial documents in accordance with legal requirements • The ability to prepare strategic plan • The ability to develop effective work habit • The ability to manage marketing of MSEs

	• The ability to manage human resources of MSEs • the ability to manage production/operation of MSEs • The ability to maintain financial records of MSEs • The ability to manage, monitor and evaluate work performance of MSMEs
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Strategic plan • Working culture • Time management strategy • Marketing Mix • Relevant marketing, operation/production, human resource and financial management • Human resource functions • Production/operation functions • Monitoring and evaluation • Problem solving techniques • Federal and Local Government legislative requirements affecting business operations, especially in regard to OHS, equal employment opportunity, industrial relations and anti-discrimination • Relevant industry code of practice • Planning techniques to establish realistic timelines and priorities • Identification of relevant performance measures • Quality assurance principles and methods
Underpinning Skills	Demonstrate skills to: • Technical or specialist skills relevant to the business operation • Interpret legal requirements, company policies and procedures and immediate, day-to-day demands • Strategic planning skills • Human relation skills • Communicate using questioning, clarifying, reporting, and giving and receiving constructive feedback • Numeracy skills for performance information, setting targets and interpreting financial documents and reports • Technical skills to interpret business document, reports and financial statements and projections • Relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities • Solve problem and develop contingency plans • Using computers and software packages to record and manage data and to produce reports • Evaluate using assessment work and outcomes • Observe for identifying appropriate people, resources and to monitor work

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: Welding Level IV	
Unit Title	**Apply Problem Solving Techniques and Tools**
Unit Code	**IND WLD4 16 02 17**
Unit Descriptor	This unit of competency covers the knowledge, skills and attitude required to apply scientific problem solving techniques and tools to enhance quality, productivity and other kaizen elements on continual basis.

Elements	Performance criteria
1. Identify and select theme/problem.	1.1. ***Safety requirements*** are followed in accordance with safety plans and procedures. 1.2. All possible problems related to the process /Kaizen elements are listed using ***statistical tools and techniques***. 1.3. All possible problems related to kaizen elements are identified and listed on Visual Management Board/Kaizen Board. 1.4. Problems are classified based on obviousness of cause and action. 1.5. Critical factors like the number of customers affected, Potentials for bottlenecks, and number of complaints etc… is selected. 1.6. Problems related to priorities of ***Kaizen Elements*** are given due emphasis and selected.
2. Grasp current status and set goal.	2.1. The extent of the problem is defined. 2.2. Appropriate and achievable goal is set.
3. Establish activity plan.	3.1. The problem is confirmed. 3.2. High priority problem is selected. 3.3. The extent of the problem is defined. 3.4. Activity plan is established as per ***5W1H***.
4. Analyze causes of a problem.	4.1. All possible causes of a problem are listed. 4.2. Cause relationships are analyzed using***4M1E***. 4.3. Causes of the problems are identified. 4.4. Root causes are selected. 4.5. The root cause which is most directly related to the problem is selected. 4.6. All possible ways are listed using ***creative idea generation*** to eliminate the most critical root cause. 4.7. The suggested solutions are carefully tested and evaluated for potential complications.

	4.8. Detailed summaries of the action plan are prepared to implement the suggested solution.
5. Examine countermeasures and their implementation.	5.1. Action plan is implemented by ***medium KPT*** members. 5.2. Implementation is monitored according to the agreed procedure and activities are checked with preset plan.
6. Assess effectiveness of the solution.	6.1. ***Tangible and intangible results*** are identified. 6.2. The results are verified over time. 6.3. Tangible results are compared with targets using ***various types of diagram***.
7. Standardize and sustain operation.	7.1. If the goal is achieved, the new procedures are standardized and made part of daily activities. 7.2. All employees are trained on the new ***Standard Operating Procedures (SOPs)***. 7.3. SOP is verified and followed by all employees. 7.4. The next problem is selected to be tackled by the team.

Variables	**Range**
Safety requirements	May include, but not limited to: • OHS requirements include legislation, material safety, managements system, hazardous substances and dangerous goods code and local safe operating procedures • Work is carried out in accordance with legislative obligations, environmental legislations, relevant health regulation, manual handling procedure and organization insurance requirements
Statistical tools and techniques	May include, but not limited to: • 7 QC tools may include: ➢ Stratification ➢ Pareto Diagram ➢ Cause and Effect Diagram ➢ Check Sheet ➢ Control Chart/Graph ➢ Histogram and Scatter Diagram • QC techniques may include: ➢ Brain storming ➢ Why analysis ➢ What if analysis and 5W1H
Kaizen Elements	May include, but not limited to: • Quality • Cost • Productivity

	• Delivery • Safety • Moral • Environment and Gender equality
5W1H	May include, but not limited to: • Who: person in charge • Why: objective • What: item to be implemented • Where: location • When: time frame • How: method
4M1E	May include, but not limited to: • Man • Machine • Method • Material and Environment
Creative idea generation	May include, but not limited to: • Brainstorming • Exploring and examining ideas in varied ways • Elaborating and extrapolating • Conceptualizing
Medium KPT	May include, but not limited to: • 5S • 4M (Machine, Method, Material and Man) • 4p (Policy, Procedures, People and Plant) • PDCA cycle • Basics of IE tools and techniques
Tangible and intangible results	May include, but not limited to: • Tangible result may include quantifiable data • Intangible result may include qualitative data
Various types of diagram	May include, but not limited to: • Line graph • Bar graph • Pie-chart • Scatter and Affinity diagrams
Standard Operating Procedures (SOPs)	May include, but not limited to: • The customer demand • The most efficient work routine (steps) • The cycle times required to complete work elements • All process quality checks required to minimize defects/errors • The exact amount of work in process required

Evidence Guide	
Critical Aspects of Assessment	Demonstrates skills and knowledge competencies to: • Apply all relevant procedures and regulatory requirements to ensure quality and productivity of an

	organization. • Detect non-conforming products/services in the work area • Apply effective problem solving approaches/strategies. • Implement and monitor improved practices and procedures • Apply statistical quality control tools and techniques.
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • QC story/PDCA cycle/ • QC story/ Problem solving steps • QCC techniques • 7 QC tools • Basic IE tools and techniques. • SOP • Quality requirements associated with the individual's job function and/or work area • Workplace procedures associated with the candidate's regular technical duties • Relevant health, safety and environment requirements • organizational structure of the enterprise • Lines of communication • Methods of making/recommending improvements. • Reporting procedures
Underpinning Skills	Demonstrates skills to: • Apply problem solving techniques and tools • Apply statistical analysis tools • Apply Visual Management Board/Kaizen Board. • Detect non-conforming products or services in the work area • Document and report information about quality, productivity and other kaizen elements. • Contribute effectively within a team to recognize and recommend improvements in quality, productivity and other kaizen elements. • Implement and monitor improved practices and procedures. • Organize and prioritize activities and items. • Read and interpret documents describing procedures • Record activities and results against templates and other prescribed 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.

Acknowledgement

We wish to extend thanks and appreciation to the many representatives of business, industry, academe and government agencies who donated their time and expertise to the development of this occupational standard.

We would like also to express our appreciation to the Experts of GIZ, Techtra Engineering, Steely RMI P.L.C., Walia Steel Industry, Akaki Metal Products Factory, Akaki Spare Parts, Holland Car P.L.C., B and C Aluminum P.L.C./Inter Africa Extrusion, Zukuala Steel Production Factory, Mesfin Industrial Engineering P.L.C., Kaliti Metal Production Factory, Metal Corporation, Metals Industry Development Institute, Ministry of Trade and Industry; and Federal Technical and Vocational Education and Training (TVET) who made the development of this occupational standard possible.

This occupational standard was developed on February 2017 at Addis Ababa, Ethiopia.