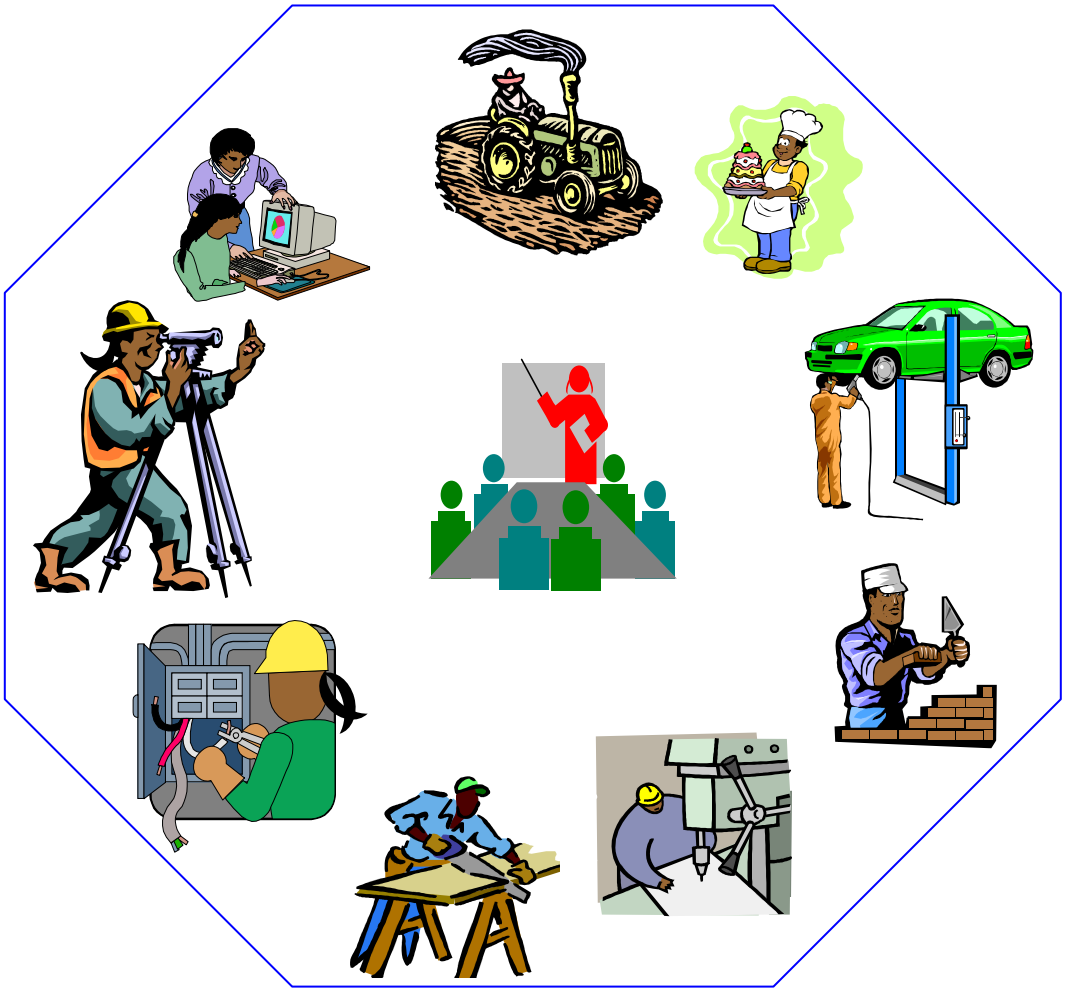
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

FOUNDRY WORKS

NTQF Level II-III



Ministry of Education
February 2017

Introduction

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

The Ethiopian Occupational 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 occupational requirements and expected outcome related to a specific occupation without taking TVET delivery into account.

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

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

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

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

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

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

UNIT OF COMPETENCE CHART

Occupational Standard: Foundry Work

Occupational Code: IND FDW2

NTQF Level II

IND FDW2 01 0217 Prepare Basic (2D) Engineering Drawing Using CAD	**IND FDW2 02 0217** Plan Casting Processes	**IND FDW2 03 0217** Prepare and Mix Sand for Moulding and Core Making
IND FDW2 04 0217 Produce Cores by Hand	**IND FDW2 05 0217** Produce Moulds by Hand	**IND FDW2 06 0217** Operate Non–electric Melting Furnace
IND FDW2 07 0217 Operate Sand Moulding and Core Making Machines	**IND FDW2 08 0217** Perform General Woodworking Machine Operations	**IND FDW2 09 0217** Carry out Heat Treatment
IND FDW2 10 0217 Participate in Workplace Communication	**IND FDW2 11 0217** Work in Team Environment	**IND FDW2 12 0217** Develop Business Practice
IND FDW2 13 0217 Standardize and Sustain 3S		

NTQF Level III

IND FDW3 01 0217 Perform Advanced Engineering Detail Drafting	**IND FDW3 02 0217** Use CAD/CAM Applications	**IND FDW3 03 0217** Develop and Manufacture Wood Pattern
IND FDW3 04 0217 Develop and Manufacture Production Patterns	**IND FDW3 05 0217** Develop and Manufacture Polystyrene Patterns	**IND FDW3 06 0217** Assemble Plated Patterns
IND FDW3 07 0217 Pour Molten Metal to Moulds	**IND FDW3 08 0217** Fettle and Trim Metal Castings	**IND FDW3 09 0217** Fabricate Gravity Die Casting Mould
IND FDW3 10 0217 Monitor Implementation of Work Plan/Activities	**IND FDW3 11 0217** Apply Quality Control	**IND FDW3 12 0217** Lead Workplace Communication
IND FDW3 13 0217 Lead Small Teams	**IND FDW3 14 0217** Improve Business Practice	**IND FDW3 15 0217** Prevent and Eliminate MUDA

NTQF Level II

Occupational Standard: Foundry Works Level II	
Unit Title	**Prepare Basic (2D) Engineering Drawing Using CAD**
Unit Code	**IND FDW2 01 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to perform manual drafting and computer aided drafting to produce simple Two Dimensional (2D) metal engineering drawings, part and material lists.

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

Variable	Range
Relevant personnel	May include, but not limited to:

	• supervisor • technical personnel • manufacturers • suppliers • contractors and customers
Drafting principles	May include, but not limited to: • local standards • international standards
Records	May include, but not limited to: • cataloguing • issuing security classifications • filing • preparing distribution lists
Issued	May include, but not limited to: • hard copy • photographic • soft copy • slide or transparency form including presentation as a single drawing and/or with other drawings • support documentation as a package

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • identified drawing requirements • prepared engineering .drawing or made changes to existing drawing • prepared engineering parts list • issued approved drawing
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Types and uses of drafting equipment and drawing instruments • Requirements and purpose of the engineering drawing and/or parts list • Sources of relevant data/information • Drafting principles to be applied in the preparation of drawing • Drawing symbols and standards • Isometric, orthographic and exploded view drafting • ISO Tolerances and fits • Shop mathematics (geometric principles and trigonometric functions • Types and forms of supply of engineering materials • Types and uses of measuring instruments (scale, steel rule,

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

Occupational Standard: Foundry Works Level II	
Unit Title	**Plan Casting Processes**
Unit Code	**IND FDW2 02 0217**
Unit Descriptor	This unit covers a person planning their own work where tasks involve one or more steps or functions and are carried out routinely on a regular basis. It includes the concepts of following routine instructions, specifications and requirements.

Elements	Performance Criteria
1. Identify work requirements	1.1. Instructions and procedures are obtained, understood and where necessary clarified based on operational standards. 1.2. Relevant specifications for work outcomes are obtained, understood and where necessary clarified based on operational standards 1.3. ***Task*** outcomes are identified following wok place procedures. 1.4. Task requirements such as completion time and quality measures are identified wok place procedures.
2. Plan steps required to complete task	2.1. ***Plan*** and sequence of activities are determined according to instructions and specifications provided
3. Review & assure work plan	3.1. Effectiveness of plan is reviewed against specifications and task requirements. 3.2. Plan is revised, if necessary, to better meet specifications and task requirements.

Variable	Range
Task	May include, but not limited to: • General requirements necessary to carry out routine work, such as: ➢ sand preparation, ➢ mold preparation, ➢ core making, ➢ melting, ➢ pouring and ➢ fettling operations • dedicated tools and equipment • materials and parts • work procedures • completion time • safety measures and equipment

	• Requirements and instructions are supplied verbally or on familiar standard forms, such as on job sheets. Instructions are carried out under supervision and in accordance with established procedures
Plan	May include, but not limited to: • preparing plans for tasks • sequencing activities • comparing planned steps against specifications and task requirements

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Identify work requirements • Plan steps required to complete task work • Review quality assurance work plan.
Underpinning Knowledge and Attitude	Look for evidence that confirms knowledge of: • work procedures • procedures for assessing frame/system, correct packing technique and assessing rubber/ master suitability/compatibility • requirements for the specific casting process. • working limitations of rubber • packing variations for a range of situations • correct selection of tools/procedures • sequence of procedures for release of master • the placement of mould/vent lines • hazards and control measures, including housekeeping • use and application of personal protective equipment • safe work practices and procedures • methods for establishing the appropriate time, temperature and pressure settings for the selected process • the stages in the process for mould curing, removal and cooling
Underpinning Skills	Look for evidence that confirms skills in: • following work procedures • selecting appropriate frame/system to suit master requirements • preparing/packing master, frame/system • selecting variables of time, temperature, and pressure • cutting rubber • selecting and using tools/methods for release of master • safely releasing master without damage • reading and interpreting routine information on written

	job instructions, specifications and standard operating procedures. May include drawings • using measurement skills needed to meet the requirements of this unit • entering routine and familiar information onto proformas and standard workplace forms • planning, sequencing 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: Foundry Works Level II	
Unit Title	**Prepare and Mix Sand for Moulding and Core Making**
Unit Code	**IND FDW2 03 0217**
Unit Descriptor	This unit covers the competence for loading up a mixer, mixing the sand, taking test samples and interpreting the results, discharging the sand and cleaning the mixer.

Elements	Performance Criteria
1. Load mixer (mill/Muller)	1.1. All pre start-up checks are performed safely and according to standard operating procedures. 1.2. Formula for sand mix is determined according to standard operating procedures. 1.3. ***Materials*** are measured and loaded according to formula specification.
2. Mix sand	2.1. Sand is mixed at the correct time and specifications 2.2. Performance of ***mixer*** and condition of the sand are monitored according to operational procedures 2.3. Material supply is regulated and maintained according to operations 2.4. ***Faults*** are reported following workplace procedures and format.
3. Test samples	3.1. Sample is properly and correctly extracted by observing safety measures 3.2. Test is applied in accordance with standard operating procedures 3.3. Test results are compared against specifications 3.4. Adjustments to formula/mix are made as required in accordance with standard operating procedures
4. Discharge mixture	4.1. Load is charged correctly and timely according to standard operating procedures 4.2. Unwanted treated sand is disposed of according to standard operating procedures and safety measures. 4.3. Appropriate documentation is completed per workplace procedures
5. Clean mixer	5.1. Housekeeping is performed per workplace standard 5.2. Mixer is cleaned according to workplace standard operating procedures. 5.3. Mixer is shut down following standard safety and operating procedures.

Variable	Range
Materials	May include, but not limited to: • Sand • Silica • Zircon • Chromate • Mixtures • Water
Mixer	May include, but not limited to: • Batch • Continuous mixers
Faults	May include, but not limited to: • Chemical ratios • Acid • Binder • Water

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • loaded the mixer • mixed sand • took and tested the samples • discharged the mixture • cleaned the mixer
Underpinning Knowledge and Attitudes	Look for evidence that confirms knowledge of: • Characteristics, safe handling procedure and mixture applications of sand and binding agent • Moulding requirements • Mixers, applications, loading, operating and unloading procedures • Volumes, quantities, ratios and percentages • Sampling, testing and acceptance criteria for mixed sand • Procedures for cleaning and shutting down mixer • Environmental requirements for the disposal of unwanted sand • Use and application of personal protective equipment • Safe work practices and procedures • Hazards and control measures related to preparing and mixing sand for metal moulding
Underpinning Skills	Look for evidence that confirms skills of: • Reading and following written instructions and standard operating procedures

	• Setting parameters for mixing • Loading mixers • Mixing sand and monitoring the process • Sampling and testing mixed sand • Discharging sand • Closing down and cleaning • Using measurement skills for preparing and mixing sand
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: Foundry Works Level II	
Unit Title	**Produce Cores by Hand**
Unit Code	**IND FDW2 04 0217**
Unit Descriptor	This unit covers competence in hand making of sand cores for metal casting.

Elements	Performance Criteria
1. Identify work requirements	1.1. Work requirements are correctly identified from drawings, instructions and specifications. 1.2. ***Materials*** are selected appropriate to work requirements. 1.3. Sequence of operation including work set-up is determined for maximum efficiency and to meet work specifications.
2. Select, inspect and prepare core box equipment	2.1. ***Core box*** is correctly identified from specifications to standard operating procedures. 2.2. Core box is assembled and damaged patterns are identified for repair or replacement to specification. 2.3. Core box is set up to specification according to standard operating procedures. 2.4. Core box is positioned with wires and gages are inserted as required. 2.5. Cavity is filled with mixed core sand according to standard operating procedures. 2.6. Core box is closed and checked for compliance to component specification 2.7. Appropriate core making equipment is selected and positioned according to standard operating procedures.
3. Make sand core	3.1. Appropriate ***core curing media*** is selected to produce core to specification. 3.2. Core is ***secured*** according to standard operating procedures. 3.3. Core curing media is used to produce core according to standard operating procedures. 3.4. ***Parting and stripping systems*** are utilized in accordance with standard operating procedures. 3.5. Core is finished by removing fins and protrusions, and then coated with refractory core wash.

	3.6. Core is secured and stored according to standard operating procedures.
4. Quality assure work and restore work area	4.1. All materials/debris are cleared and work site is cleaned and left in a safe state. 4.2. Unwanted treated sand is disposed of according to standard operating procedures and legislative and statutory requirements.

Variable	**Range**
Materials	May include, but not limited to: • Binders • Catalyst • Sand additives • Break down agents • Mould coatings
Core box	May include, but not limited to: • Full • Half • Segment core-box
Core curing media	May include, but not limited to: • Silica sand • Chromite sand • Shell sand • Sodium silicate • Breakdown agents • Chemically bonded media etc.
Secured	May include, but not limited to: • Weights • Clamps • Bolting
Parting and stripping systems	May include, but not limited to: • Dry • Wet

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • demonstrated the competence to produce jobbing moulds and cores by hand
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Metal casting process • Core box types, assembly techniques and their application • Selection of core box and ancillary components

	• Sand types and their bonding systems • Compaction processes • Parting and stripping systems • Mould requirements • Finishing and closing techniques • Core placement • Pouring requirements • Securing systems • Core box care and storage • Environmental requirements • Use and application of personal protective equipment • Safe work practices and procedures • Hazards and control measures associated with producing cores by hand (jobbing)
Underpinning Skills	Demonstrate skills of: • Interpreting written instruction sketches and drawings • Assembling and positioning core box • Positioning ancillary methoding components • Preparing core making media • Filling and compacting the core box assembly • Stripping, inspecting, finishing the core box • Following oral instruction • Entering routine and familiar information onto proforma 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: Foundry Works Level II	
Unit Title	**Produce Moulds by Hand**
Unit Code	**IND FDW2 05 0217**
Unit Descriptor	This unit covers knowledge, attitudes and skills needed in hand making of sand moulds and cores for metal casting.

Elements	Performance Criteria
1. Identify job requirements	1.1. Job requirements are correctly identified from drawings, instructions and specifications. 1.2. ***Materials*** appropriate to job requirements are selected. 1.3. Sequence of operation including job set-up are determined for maximum efficiency and to meet job specifications.
2. Select inspect and prepare pattern equipment	2.1. Pattern equipment is correctly identified from specifications to standard operating procedures. 2.2. ***Patterns*** are assembled; equipment is inspected to specifications, and damaged patterns are identified for repair or replacement to standard operating procedures to specification. 2.3. Pattern equipment is set up to specification according to standard operating procedures.
3. Make mould	3.1. Appropriate mould-making equipment is selected and positioned according to standard operating procedures. 3.2. Appropriate ***moulding media*** is selected to produce mould to specification. 3.3. Moulding media is used to produce mould according to standard operating procedures. 3.4. ***Moulds*** are rammed up with joints and drawbacks as required to standard operating procedures. 3.5. ***Parting and stripping systems*** are utilized in accordance with standard operating procedures. 3.6. Loose pieces, vents, risers and ***runners*** are positioned and ***secured*** as required to standard operating procedures. 3.7. Pattern and loose pieces are removed from mould and ***core*** box in a safe manner least likely to cause damage to the pattern and in accordance with standard operating procedures.

	3.8. Core is positioned in prints utilizing chaplets and chills as required and vented to specification according to standard operating procedures.
4. Check mould for compliance	4.1. Mould is closed and checked for compliance to component specification in accordance with standard operating procedures. 4.2. Mould is inspected and repaired as required. 4.3. Mould and core are cleaned and painted according to specification using standard operating procedures. 4.4. Mould is secured according to standard operating procedures. 4.5. ***Pouring basin*** is selected or manufactured to specification and positioned in accordance with standard operating procedures.
5. Quality assure and restore work area	5.1. All materials/debris are cleared and work site is cleaned and left in a safe state. 5.2. Unwanted treated sand is disposed of according to standard operating procedures and legislative and statutory requirements. 5.3. Tools and equipment are cleaned before storage 5.4. Excess materials are recycled/stored in accordance with workplace procedures

Variable	**Range**
Materials	May include, but not limited to: • Binders • Hardeners • Sand additives and Mould coatings
Patterns	May include, but not limited to: • Flat back • Uneven • Plated patterns • Multi-joint • Consumable • Split patterns • Loose piece patterns • Patterns requiring odd sides • Cored moulds • Drag and cope mould etc.
Moulding media	May include, but not limited to: • Green sand

	• Shell sand • Chemically bonded media etc.
Moulds	May include, but not limited to: • Flat back • Uneven jointed • Multi-part moulds
Parting and stripping systems	May include, but not limited to: • Dry • Wet
Runners	May include, but not limited to: • Hand-formed • Pattern-formed
Secured	May include, but not limited to: • Weights • Clamps • Bolting
Core	May include, but not limited to: • Full • Half • Segment cores
Pouring basin	May include, but not limited to: • Hand-formed • Pattern-formed

Evidence Guide	
Critical Aspects of Competence	Assessment required evidence that the candidate: • identified job requirements • determined sequence of operation • selected, inspected and prepared pattern equipment • made mould • cleaned and restored work area
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Metal casting process • Variety of pattern types and their application • Pattern assembly techniques • Selection of moulding box • How to select ancillary components • Sand types and their bonding systems • Compaction processes • Parting and stripping systems • Mould requirements • Finishing and closing techniques • Core placement • Pouring requirements

	• Securing systems • Pattern care and storage • Environmental requirements • Use and application of personal protective equipment • Safe work practices and procedures • Hazards and control measures associated with
Underpinning Skills	Demonstrate skills of: • Interpreting written instruction sketches and drawings • Assembling and positioning pattern in the moulding box • Positioning ancillary methoding components • Preparing moulding media • Filling and compacting the mould assembly • Stripping the pattern • Inspecting the mould • Finishing the mould • Positioning cores in prints • Closing moulds • Placing pouring basin • Securing mould • Following oral instruction • Entering routine and familiar information onto proforma 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: Foundry Works Level II	
Unit Title	**Operate Non–electric Melting Furnace**
Unit Code	**IND FDW2 06 0217**
Unit Descriptor	This unit covers the competence in operating a non-electric metal melting furnace.

Elements	Performance Criteria
1. Select materials	1.1. Requisitions for ***materials*** are completed as required according to standard operating procedures. 1.2. Charge analysis is undertaken in accordance with standard operating procedures. 1.3. The charge analysis is converted to ***furnace*** charge weight using standard operating procedures. 1.4. Charge is weighed according to standard operating procedures
2. Start-up furnace	2.1. Furnace is inspected for any defects or damage. 2.2. ***Routine operational maintenance*** of furnace is undertaken to standard operating procedures. 2.3. Furnace is started-up to standard operating procedures. 2.4. ***Faults*** are reported according to standard operating procedures
3. Charge furnace	3.1. ***Emergency/safety procedures*** are identified and followed as necessary. 3.2. Materials are pre-heated if required according to standard operating procedures. 3.3. Materials are charged into furnace using standard operating procedures. 3.4. Suitable areas for emergency unloading of molten metal are identified and kept available
4. Monitor furnace	4.1. Furnace is maintained at optimum operating condition to standard operating procedures. 4.2. Sample for chemical analysis is taken and remedial action is applied as required to correct composition using standard operating procedures. 4.3. Dross or slag is removed from furnace per standard operating procedures. 4.4. If necessary, metal in the furnace is de-gassed to standard operating procedures.

	4.5. Temperature of metal is checked and adjustment made if necessary according to operating procedures
5. Tap or unload the furnace	5.1. Quantity of the required metal is identified. 5.2. Tap rate is carried out to standard operating procedures. 5.3. Tapping or unloading is undertaken and completed safely according to standard operating procedures.
6. Shut down furnace	6.1. Shut-down of furnace is completed to standard operating procedures. 6.2. Routine operational maintenance of furnace is undertaken to standard operating procedures. 6.3. OHS procedures and measures are observed and applied throughout the process (from element 1 to 6)

Variable	**Range**
Materials	Type of alloy to be melted. • Aluminium • Bronze • Brass • Magnesium Alloy
Furnace	May include, but not limited to: • Singular • Multi-fuel • Oil fired • Gas fired
Routine operational maintenance	May include, but not limited to: • Routine lubrication • Cleaning • Routine repair • Repairing of refractory lining
Faults	May include, but not limited to: • Leaks in crucible • Clogged burner • Damage crucible
Emergency/safety procedures	May include, but not limited to: • Tapped out • Cleaning of burner • Repair

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • selected materials

	• started up furnace • charged furnace • monitored furnace • tapped or unloaded the furnace • shut down furnace
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Types of manuals used in the foundry industry • Identification of symbols used in the manuals forms • and standard operating procedures • Identification of units of measurements and unit of conversion • Sampling procedures for chemical analysis, carbon equivalent and chill wedge tests • Procedures for de-gassing as necessary using tablets or lance and other methods. • Procedures and principles of de-slagging or dross removal • Tapping temperature and procedure of the molten metal • Weighing procedures using different scale types • Correct order of loading of different charge materials • Thermocouple condition monitoring and adjustment mechanism for furnace, • Furnace close-down procedures • Applicable industry safety standards, OHS guides, codes of practice/standards, use and application of personal protective equipment safe work practices and procedures
Underpinning Skills	Demonstrate skills in: • Reading and interpreting routine information on written job instructions, specifications, standard operating procedures relevant test data sheets and other standard workplace forms including drawings for furnace operation • Following oral instruction and entering routine and familiar information onto pro forma and standard workplace forms. • Identifying faults and areas for routine repair of the furnace and performing routine maintenance as necessary. • Following procedures for starting and closing down furnace • Deciding on charge materials, weighing them and feeding the charge materials into the furnace. • Measuring and correcting metal temperature

	• Sampling for chemical analysis, carbon equivalent and chill wedge tests • De-gassing using tablets or lance and other methods • De-slagging or dross removal • Tapping temperature and procedure of the molten metal • Weighing procedures using different scale types • Correct order of loading of different charge materials
Resource implications	The following resources must be provided: • all manuals/catalogues relative to melting/casting • job order, requisitions slip for materials • materials, tools and equipment relevant to the activity • actual furnace
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: Foundry Works Level II	
Unit Title	**Operate Sand Moulding and Core Making Machines**
Unit Code	**IND FDW2 07 0217**
Unit Descriptor	This unit covers competence in operating automatic and semi-automatic sand moulding and core making machines

Elements	Performance Criteria
1. Conduct pre-operational checks	1.1. Instructions and specifications are interpreted correctly. 1.2. Pattern is selected and inspected to specifications and cleaned as required. 1.3. Damaged patterns/core boxes are identified for repair or replacement to standard operating procedures. 1.4. Pattern is set up in bolster and core box according to standard operating procedures.
2. Operate machine to produce mould/cores	2.1. Appropriate ***moulding media*** is selected to produce mould and core to specification. 2.2. Moulds are filled to specification according to standard operating procedures. 2.3. ***Machine*** is operated in accordance with standard operating procedures. 2.4. Machine is unloaded safely to standard operating procedures. 2.5. Moulds are stripped, inspected and painted as required according to standard operating procedures.
3. Assemble moulds/cores	3.1. Moulds are dried and vented as required to specification and closed in accordance with standard operating procedures. 3.2. Runner bush is set to specification as required.
4. Clean and restore work	4.1. All materials/debris are cleared and work site is cleaned and left in a safe state. 4.2. Tools and equipment are cleaned and properly stored 4.3. Necessary documentation is completed in accordance with workplace standard operating procedures

Variable	Range
Moulding media	may include the following or as appropriate for the

	particular machine: • Shell • Chemically bonded • Green sand
Machine	May include, but not limited to: • Automatic moulding machine • Semi-automatic moulding machine

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Determined job requirements • Conducted pre- operational checks • Operated machine to produce mould/cores • Assembled moulds/cores • Cleaned and restored work
Underpinning Knowledge	Demonstrate knowledge of: • Characteristics and applications of sand and binding agents • Machine operation, fault identification, analysis and • Rectification procedures • Core selection and loading procedures • Use and application of personal protective equipment • Safe work practices and procedures • Hazards and control measures associated with operating sand moulding machines.
Underpinning Skills	Demonstrate skills of: • Interpreting written instructions and specifications • Preparing and installing pattern • Programming operating parameters • Operating and monitoring moulding machines • Assembling moulds and Inserting cores (in moulding machines) • Inserting runner bushes • Maintaining integrity of mould • Maintaining integration of interrelated metal melting, • core making and sand mixing processes • Maintaining operational capability of moulding machines • 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: Foundry Works Level II	
Unit Title	**Perform General Woodworking Machine Operations**
Unit Code	**IND FDW2 08 0217**
Unit Descriptor	This unit covers the competence in setting up and operating wood working machines to produce patterns.

Elements	Performance Criteria
1. Determine work requirements	1.1. ***Work requirements***, instructions and specifications are interpreted and understood. 1.2. Appropriate ***wood working machines*** are selected to meet specifications 1.3. Materials including consumables are identified / selected and prepared following standard procedures
2. Set up woodworking machines	2.1. Tools/cutters are selected appropriate to task requirements. 2.2. ***Cutting tools*** are sharpened and/or shaped to specification. 2.3. Tools/cutters are correctly installed using standard operating procedures. 2.4. ***Guards/stops*** are set and adjusted as required. 2.5. Woodworking machines are set-up in accordance with company standard operating procedures and safety requirements
3. Operate woodworking machines	3.1. Material to be machined is positioned and secured effectively. 3.2. Materials are machined to specification using standard operating procedures. 3.3. Material use is optimized and waste is minimized.
4. Quality assure finished component	4.1. Machined component is evaluated against specifications and predetermined finish. 4.2. Necessary rectification is done to meet specifications or comply with predetermined finish. 4.3. Machine and tools are cleaned and maintained following workplace procedures and standards. 4.4. Housekeeping is performed in accordance with standard operating procedures.

Variable	Range
Work requirements	May include, but not limited to: • Sizing • Appearance in terms of figure, grain or surface finish • Allowance of imperfections such as twist, bow, bend, sloping grain, knots, shakes, gum veins etc.
Woodworking machines	May include, but not limited to: • Band saws • Buzzers • Thicknesses • Disk sander • Bobbin sander • Pattern mill • Wood lathe • Pedestal router and drill
Cutting tools	May include, but not limited to: • Blades • Router bits
Guards/stops	May include, but not limited to: • Fixed guards and stops • Variable guards and stops
Set up	May include, but not limited to: • Installation of the blades and cutters • Settings for the job • Adjustments for sizing and speed

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidences that the candidate: • Determined job requirements • Had set up woodworking machines • Operated woodworking machines • Checked finished component
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Application & use of general wood working machines • Procedure in interpreting instructions, drawings or sketches • Numerical operations and calculations within the scope of this unit • Consequences of selecting inappropriate materials • Various processes requiring models calculus, engineering calculations and formulae relating to developing and manufacturing precision models • Different machines and machining processes and their operations

	• Various checking procedures and devices including coordinate measuring and machine checking • Procedures for recording deviation or modification to original drawings or specifications • Hazards and control measures associated with developing and manufacturing precision models
Underpinning Skills	Demonstrate skills of: • Determining job requirements from job instructions, specifications, standard operating procedures and other applicable reference documents • Checking and clarifying task-related information • Selecting and setting machines • Setting guards and stops • Handling, machining and storing timber and wood • Measuring materials and components to specified sizes/tolerances • Checking for conformance to specifications
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be 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: Foundry Works Level II	
Unit Title	**Carry out Heat Treatment**
Unit Code	**IND FDW2 09 0217**
Unit Descriptor	This unit covers the competence in performing heat treatment of ferrous and non-ferrous metals, selecting the appropriate process to achieve the desired result using a variety of equipment.

Elements	Performance Criteria
1. Determine job requirements and select equipment	1.1. Work requirements are determined from engineering drawing, work sheet or verbal instruction from metallurgist and other concerned personnel. 1.2. ***Heating equipment*** are selected for the required ***heat treatment process***. 1.3. Equipment is selected according to standard operating procedures and/or manufacturer's instructions 1.4. Personal protective equipment/devices are used in accordance with Occupational Health and Safety (OHS) requirements
2. Load/ arrange materials	2.1. Material is piece- or batch-loaded and unloaded in accordance with standard operating procedures. 2.2. Fixtures are used to avoid /minimize damage to the material during handling and heating or cooling. 2.3. Handle material appropriate to the situation is applied according to standard operating procedure.
3. Operate and monitor heating equipment	3.1. Furnace start-up is performed as per standard operating procedures and safety requirements. 3.2. Information related with equipment and process are recorded as per standard procedures. 3.3. Required heating temperature, soaking time and cooling time are applied and maintained according to standard operating procedure. 3.4. Hazards are identified and control measures implemented to maintain a safe work environment. 3.5. Optimum furnace operation requirement is maintained as per standard operating procedures. 3.6. Furnace atmosphere is maintained as per standard operating procedures

	3.7. Temperature distribution inside the furnace is monitored and adjusted, if necessary, in accordance with standard operating procedures.
4. Heat treat materials	4.1. Quenching medium/tank is prepared as required by the process. 4.2. Air blast for air cooling is prepared, if required by the process. 4.3. Material is removed from the furnace as per standard operating procedures and safely requirements 4.4. ***Materials*** are heat treated to achieve required result in accordance with standard operating procedures and customer requirements
5. Shut down furnace	5.1. Furnace is shut down as per standard operating procedures 5.2. Routine maintenance is performed on thermo-couples and temperature meter as per standard operating procedures 5.3. Housekeeping is performed in accordance with workplace standard procedures

Variable	**Range**
Heating equipment	include gas, oil fired and electric furnaces, such as: • pit furnace • box type furnace • boggie (car type) furnace or • muffle furnace
Heat treatment process	May include, but not limited to: • Stress relieving • Annealing • Normalizing • Quenching (air, water, oil) • Tempering
Materials	May include, but not limited to: • Cast iron • Carbon steels • Alloy steels • Aluminium alloys.

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Determined job requirements • Set-up heat treatment equipment

	• Loaded/ arranged the materials • Operated and monitored heating equipment • Heat treated materials • Shut down furnace
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Metal chemical composition. • Different heat-treatment processes, equipment and application. • Heat-treatment faults and counter-measures. • Destructive and non-destructive testing of metals. • Mechanical / physical properties of metals. • Time, temperature diagram of metals. • Use of personal protective unit. • Safe work practices and procedures.
Underpinning Skills	Demonstrate skills of: • Selecting appropriate heat-treatment equipment and process. • Identifying and rectifying heat-treatment faults (equipment and process). • Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, manufacturers manual and instructions, chart, list, drawings and applicable reference documents. • Entering routine and familiar information into pro-forms and standard workplace form. • Performing standard metal hardness tests. • Checking and clarifying tasks selected information.
Resource implications	The following resources must be provided: • manuals/catalogues relative to heat treatment • job order, requisitions slip for materials • materials, tools and equipment relevant to the activity
Methods of Assessment	Competence may be 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: Foundry Work Level II	
Unit Title	**Participate in Workplace Communication**
Unit Code	**IND FDW2 10 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

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

	3.4. Errors in recording information on forms/ documents are identified and properly acted upon. 3.5. Reporting requirements to supervisor are completed according to organizational guidelines.

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

Evidence Guide	
Critical Aspects of Competency	Demonstrates skills and knowledge to: • Prepare written communication following standard format of the organization • Access information using communication equipment • Make use of relevant terms as an aid to transfer information effectively • Convey information effectively adopting the formal or informal communication

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

Occupational Standard: Foundry Work Level II	
Unit Title	**Work in Team Environment**
Unit Code	**IND FDW2 11 0217**
Unit Descriptor	This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

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

Variable	Range
Role and objective of team	May include, but not limited to: • Work activities in a team environment with enterprise or specific sector • Limited discretion, initiative and judgment maybe demonstrated on the job, either individually or in a team environment
Sources of information	May include, but not limited to:

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

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

Occupational Standard: Foundry Work Level II	
Unit Title	**Develop Business Practice**
Unit Code	**IND FDW2 12 0217**
Unit Descriptor	This unit covers knowledge, skills and attitude required to establish a business operation from a planned concept. It includes researching the feasibility of establishing a business operation, planning the setting up of the business, implementing the plan and reviewing operations once commenced, customer handling, developing and maintaining business relationships.

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

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

	5.7. Customer details are documented clearly and accurately in required format. 5.8. Negotiations are conducted in a business-like and professional manner. 5.9. Benefits for all parties are maximized in the ***negotiation through use of established techniques*** and in the context of establishing long term relationships. 5.10. The results of negotiations are communicated to appropriate colleagues and stakeholders within appropriate timeframes. 5.11. ***Opportunities to maintain regular contact*** with customers are identified and taken-up.
6. Develop and Maintain Business Relationship	6.1. Features and benefits of products/services provided by the enterprise are described/ recommended to meet customer needs. 6.2. Alternative sources of information/advice are discussed with the customer. 6.3. Information needed is pro-actively sought, reviewed and acted upon to maintain sound business relationships. 6.4. Agreements are honored within the scope of individual responsibility. 6.5. Adjustments to agreements are made in consultation with the customer and information shared with appropriate colleagues. 6.6. Relationships are nurtured through regular contact and use of effective interpersonal and communication styles.

Variable	**Range**
Unusual Business opportunities	May include, but not limited to: • Public holidays • Ceremonies • Natural disaster • Campaigns
Business opportunities	May include, but not limited to: • Expected financial viability • Skills of operator • Amount and types of finance available • Returns expected or required by owners

	• Likely return on investment • finance required • Lifestyle issues
Business skills and personal attributes	May include, but not limited to: • Technical and/ or specialist skills • Managerial skills • Entrepreneurial skills • Taking calculated risk skills • Willingness to take calculated risks • Willingness to work under pressure
Specialist and relevant parties	May include, but not limited to: • Chamber of commerce • Financial planners and financial institution representatives, business planning specialists and marketing specialists • Accountants • Lawyers and providers of legal advice • Government agencies • Industry/trade associations • Online gateways • Business brokers/business consultants
Business risks	May include, but not limited to: • Occupational health and safety • Environmental risks • Relevant legislative requirements • Security of investment • Market competition • Security of premises/location • Supply and demand • Resources available
Human and physical resources	May include, but not limited to: • Software and hardware • Office premises and equipment • Communications equipment • Specialist services through outsourcing, contracting and consultancy • Staff • Vehicles
Operational unit	May include but not limited to different departments, sections, teams, divisions, etc. staffed with required personnel and equipped to service and support business
Legal documents	May include, but not limited to: • Partnership agreements, constitution documents, statutory books for companies (register of members,

	register of directors and minute books), certificate of Incorporation, franchise agreements and financial documentation, appropriate software for financial records • Occupational Health and Safety (OHS) • Recordkeeping including personnel, financial, taxation, and environmental
Contracts with relevant people	May include, but not limited to: • business owners, suppliers, employees, agents, land owners, distributors, customers or any person with whom the business has, or seeks to have, a performance-based relationship
Negotiation techniques	May include, but not limited to: • Identification of goals, limits • Clarification of needs of all parties • Listening and questioning • Non-verbal communication techniques • Appropriate language and situation • Bargaining • Developing options • Appropriate cultural behavior • Confirming agreements
Opportunities to maintain regular contact	to maintain regular contact with customers may include: • Informal social occasions • Ceremonies • Exhibitions • Industry functions • Association membership • Co-operative promotions • Program of regular telephone contact

Evidence Guide	
Critical Aspects of Competence	Demonstrates knowledge and skills in: • that a business operation has been planned and implemented from initial research of feasibility of the business and completion of the plan, through implementing the plan and commencing operations • the ability to evaluate the results of research and assess the likely viability and practicability of a business opportunity, taking into account the current business/market climate and resources available • treating customers in a courteous and professional manner • building and maintaining relationships to achieve successful business outcomes

Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Paradigm shift • Unusual business opportunities • Feasibility study • Business structure • Federal and regional government legislative requirements affecting business operations, especially in regard to OHS, EEO, industrial relations and anti-discrimination • Procurement and recruitment strategy • Operational unit • Monitoring process • Business systems and operations • Relevant marketing, management, sales and financial concepts • Options for financing • Business premises and ownership • Lease • Methods for researching business opportunities • Methods of identifying relevant specialist services to complement the business • Advertising and promotion • Distribution and logistics • Terms and conditions in contractual agreement • Record keeping duties • Operational factors relating to the business (provision of professional services, products) • Customer need assessment • Source of information • Operational knowledge of enterprise policies and procedures in regard to: ➢ customer service ➢ dealing with difficult customers ➢ maintenance of customer databases ➢ allocated duties/responsibilities ➢ General knowledge of the range of enterprise merchandise and services, location of telephone extensions and departments/sections • Basic operational knowledge of industry/workplace codes of practice in relation to customer service • negotiation and communication techniques appropriate to negotiations that may be of significant commercial value
Underpinning Skills	Demonstrate skills of: • Hunting and exploiting unusual business opportunities

	• Interpreting legal requirements, company policies and procedures and immediate, day-to-day demands • Conducting feasibility study • Developing new behavior • Using technology • Marketing skills • Business planning skills • Entrepreneurial skills • Time management skills • Customer handling skills • Communication skills including questioning, clarifying, reporting, and giving and receiving constructive feedback • Technical and analytical skills to interpret business documents, reports and financial statements and projections • Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities • Problem solving skills to develop contingency plans • Using computers and software packages to record and manage data and to produce reports • Interpreting business information, numeracy skills for data analysis to aid research • Negotiation to conduct business activities • Research to identify a business opportunity and to conduct a feasibility study • Analytical skills to assess personal attributes and to identify business risks • Observation skills for identifying appropriate people, resources and to monitor work • Persuasion and networking skills • Welcoming customers • Information seeking skills to collect, organize and understand information related to collating and analyzing customer information to identify needs • Establish diagnostic processes which identify and recommend improvements to customer service
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning

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

Occupational Standard: Foundry Work Level II	
Unit Title	**Standardize and Sustain 3S**
Unit Code	**IND FDW2 13 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.

	3.4. Workplace is cleaned up after completion of job and before commencing next job or end of shift. 3.5. Situations are identified where compliance to standards is unlikely and actions specified in procedures are taken. 3.6. Improvements are recommended to lift the level of compliance in the workplace. 3.7. Checklists are followed to sustain activities and report to relevant personnel. 3.8. Problems are avoided by sustaining activities.

Variable	**Range**
OHS requirements	May include, but not limited to: • Are to be in accordance with legislation/ regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of fire fighting equipment, enterprise first aid, hazard control and hazardous materials and substances. • Personal protective equipment is to include that prescribed under legislation/regulations/codes of practice and workplace policies and practices. • Safe operating procedures are to include, but are not limited to the conduct of operational risk assessment and treatments associated with workplace organization. • Emergency procedures related to this unit are to include but may not be limited to emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.
Safety equipment and tools	May include, but not limited to: • dust masks/ goggles • glove • working cloth • first aid and safety shoes
Tools and equipment	May include, but not limited to: • paint • hook • sticker • signboard • nails

	• shelves • chip wood • sponge • broom • pencil • shadow board/ tools board
Tools and techniques	May include, but not limited to: • 5S Job Cycle Charts • Visual 5S • The Five Minute 5S • Standardization level checklist • 5S checklist • The five Whys and one How approach(5W1H) • Suspension • Incorporation and Use Elimination
Relevant procedures	May include, but not limited to: • Assign 3S responsibilities • Integrate 3S duties into regular work duties • Check on 3S maintenance level • OHS measures such as signage, symbols / coding and labeling of workplace and equipment • Creating conditions to sustain your plans • Roles in implementation
Reporting	May include, but not limited to: • verbal responses • data entry into enterprise database • brief written reports using enterprise report formats
Relevant personnel	May include, but not limited to: • supervisors, managers and quality managers • administrative, laboratory and production personnel • internal/external contractors, customers and suppliers
Tools and techniques	May include, but not limited to: • 5S slogans • 5S posters • 5S photo exhibits and storyboards • 5S newsletter • 5S maps • 5S pocket manuals • 5S department/benchmarking tours • 5S months • 5S audit • Awarding system • Big cleaning day • Patrolling system may include:

	➢ Top management Patrol ➢ 5S Committee members and Promotion office Patrol ➢ Mutual patrol ➢ Self-patrol ➢ Checklist and Camera patrols

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Discuss the relationship between Kaizen elements. • Standardize and sustain 3S activities by applying appropriate tools and techniques.
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Elements of Kaizen • Ways to improve Kaizen elements • Benefits of improving kaizen elements • Relationship between Kaizen elements • The fourth pillar of 5S • Benefits of standardizing and sustaining 3S • Procedures for standardizing and sustaining 3S activities • Tools and techniques to sustain 3S • Relevant Occupational Health and Safety (OHS) and environment requirements • Plan and report • Method of communication
Underpinning Skills	Demonstrates skills of: • improving Kaizen elements by applying 5S • standardizing and sustaining procedures and techniques to avoid problems • technical drawing • procedures to standardizing 3S activities • analyzing and preparing shop layout of the workplace • standardizing and sustaining checklists • preparing and implementing tools and techniques to sustain 3S • working with others • reading and interpreting documents • observing situations • solving problems by applying 5S • communication skills • preparing labels, slogans, etc. • gathering evidence by using different means • using Kaizen board properly in accordance the procedure

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

NTQF Level III

Occupational Standard: Foundry Works Level III	
Unit Title	**Perform Advanced Engineering Detail Drafting**
Unit Code	**IND FDW3 01 0217**
Unit Descriptor	This unit covers competence in producing drawings complete with surface texture and dimensions using manual drafting and CAD system. Drawing components may include assembly, layout and detail drawings.

Elements	Performance Criteria
1. Determine drawing requirements	1.1. Requirements and purpose of ***drawing*** are checked and interpreted from work order or similar. 1.2. Required information is sourced from workshop manuals, customer specifications, product suppliers, and designers or similar. 1.3. Scope of drawing including layout, additional required information and resources are planned.
2. Prepare assembly, lay-out and detail drawing	2.1. Drawing details and specifications are determined. 2.2. Engineering calculations are undertaken to determine all dimensions including limits and fits, surface texture, datum references and geometric tolerances where appropriate to ensure functional operation and suitability 2.3. Dimensions and ***geometric tolerances*** of various components are inserted where required. 2.4. ***Appropriate symbols*** for ***limits and fits***, surface texture and geometric tolerances are included. 2.5. Correct convention of parts is shown. 2.6. Drawing is produced in third angle projection, including auxiliary views, sections and assemblies 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. Check drawing	3.1. Drawings are checked to ensure compliance with specifications. 3.2. Drawings are checked to ensure that assembly/fabrication is possible. 3.3. Drawings are issued, filed and stored according to workplace system and procedures.

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

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • prepared assembly, lay-out and detail drawing complete with surface texture, tolerances and dimensions • produced drawings in third angle projection including auxiliary views, sections and assemblies • produced drawing using CAD system
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • standard engineering drawing symbols, references and terminology • projection and projection lines • arrangements and designs/lay-out • general tolerance, limits and fits • shaft and hole basis • extremes of fit • surface texture • geometric tolerances (no datum references, flatness, roundness etc. and with datum reference e.g. parallel square) • 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 • use of CAD system
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.

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

Occupational Standard: Foundry Works Level III	
Unit Title	**Use CAD/CAM Applications**
Unit Code	**IND FDW3 02 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to link designed CAD 3D parts with basic programmed CAM / CNC machining processes.

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

	4.5. Occupational health and safety procedures and environmental guidelines are observed throughout the operation
5. Comply with quality assurance	5.1. Program must be changed if errors are found and retested until program is effective 5.2. Designed part is checked and measured in conformance to specification and quality outcomes 5.3. Appropriate methods, measuring tools and equipment are utilized throughout the operation

Variables	**Range**
Specifications	May include, but not limited to: • Standard operating procedures • Safe working procedures
Drawing	May include, but not limited to: • detail drawing • component drawing • bill of material
Limits and fits	May include, but not limited to: • Shaft basis system • Hole basis system
Geometric tolerances	May include, but not limited to: • Parallelism • Perpendicularity, • Concentricity • Squareness • Run out • Flatness • Circularity
CAD and CAM	May include, but not limited to: • Combined Computer Aided Design and Computer • Aided Manufacturing Systems
Appropriate symbols	May include, but not limited to: • Perpendicular • surface Finish • Parallel and Diameter
ISO standard	• European and American standard or equivalent and its application
Machine	May include, but not limited to: • NC/CNC machines • 3 D printer/ plotter/ • Robots

Evidence Guide	
Critical Aspects of Competence	Assessment requires that the candidate: • Prepared detail drawing complete with surface texture, tolerances and dimensions • produced drawing using CAD system • conducted pre-start checks • set machine • Instructed the operator
Underpinning Knowledge	Demonstrates knowledge of: • CAD/CAM system and its application • Specifications and/or requirements of the part to be drawn • Effect of surface finish on the performance/operation of surfaces • Appropriate datum points • All appropriate linear, diametric and geometric tolerances • Procedures for determining tolerances including numerical operations, geometry and calculations/formulae within the scope of this unit • Requirements of ISO standards or equivalent for the drawing(s) to be produced • Drawing specifications • Methods of manufacture from the drawing • Work holding fixtures/devices/tools and preset tooling for different machining • Reasons for establishing tool offsets • The purpose of datum settings • Source(s) of information on tool offsets and datum settings • Procedures to program and load programs • Procedures for verifying loaded programs • Pre-start checks • Machine setting procedures • Machine operating procedures • Product or part specifications in relation to the machining process • Measuring devices for checking parts orproducts • Effects of worn or damaged tooling • Corrective action for worn or damaged tooling • Risks and control measures associated with numerical and computer controlled machines, including housekeeping • Safe work practices and procedures

	• Pre-start checks • Machine setting procedures • Machine operating procedures • Product or part specifications in relation to the machining process • Measuring devices for checking parts or products • Effects of worn or damaged tooling • Corrective action for worn or damaged tooling • Risks and control measures associated with numerical and computer controlled machines, including housekeeping • Safe work practices and procedures
Underpinning Skills	Demonstrates skill in: • Reading, interpreting and following information on written job instructions, specifications, standard operating procedures • Producing drawings in accordance with acceptable standard and required specifications by using cad/cam system • Planning and sequencing operations • Checking and clarifying task related information • Loading and verifying programs • Conducting pre-start checks • Following and checking safety features and safety equipment for correct operation • Performing numerical operations and calculations/formulae within the scope of this unit • Setting and adjusting machines • Measuring and verifying first-off samples • Instructing machine operators on the sequence of operations • Identifying worn or damaged tooling and taking appropriate corrective action
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Foundry Works Level III	
Unit Title	**Develop and Manufacture Wood Pattern**
Unit Code	**IND FDW3 03 0217**
Unit Descriptor	This unit covers competence required in developing and manufacturing wood patterns, both regular shaped and split patterns, based on casting and moulding principles.

Elements	Performance Criteria
1. Determine job requirements	1.1. Job instructions and specifications are interpreted correctly. 1.2. Type of wood pattern required is determined through application of ***moulding/casting techniques*** and foundry processes. 1.3. Appropriate ***timber/timber composites*** are selected to meet specification.
2. Develop and lay out wood patterns	2.1. Pattern parameters are ***calculated*** to specification e.g. angles, tapers, clearances, contractions etc. 2.2. Pattern is laid out showing tapers, machining allowances, core prints and method of construction to specification. 2.3. Jigs and fixtures are developed and manufactured to aid wood pattern manufacture as required.
3. Manufacture wood patterns	3.1. Materials are marked out and construction is developed to meet specification. 3.2. Pattern or pattern component parts are produced to size and shape and checked for conformance to specifications using acceptable wood pattern making techniques and procedures and utilizing ***appropriate machines for wood proceeding***. 3.3. Pattern is correctly marked, color-coded or tagged according to specifications and standard operating procedures. 3.4. OHS procedures and measures are observed throughout the process 3.5. Housekeeping procedures are performed in accordance with workplace standard procedures

Variable	Range
Moulding/casting techniques	• The variety of sand moulding techniques and sand mediums

Timber/timber composites	May include, but not limited to: • Hardwood • Softwood • Laminates • Plywood • Veneers and bonded fiber board
Calculation	include the determination of: • Contraction rates, • General engineering calculations
Appropriate machines for wood proceeding	• Lathes, milling machines, grinders, pedestal drills, pantographs and other machines as needed, like CNC, lathe and milling machines
Joining and fixing	May include, but not limited to: • Glued • Screwed • Nailed • Stapled

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • determined job requirements • developed and lay out wood patterns • manufactured wood patterns
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Kinds of timber products including features, characteristics and applications • Moulding and casting techniques • Tools required for casting/moulding • Jigs and fixtures methods of construction • Formulas and mathematical techniques required for necessary manufacturing of patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc. • Identification of coding and numbering • Pattern checking techniques • Mould ability (i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc.) • Types of personal protective equipment • Safe work practices and procedures
Underpinning Skills	Demonstrate skills of: • Reading/interpreting/following information on written • job instructions, specifications, standard operating • procedures, charts, lists, drawings and other documents

	• Performing computation on different numerical operations, geometry and formulas within the scope of this unit • Selecting appropriate timber to suit the moulding/ casting techniques and foundry process • Laying out the pattern/core boxes • Constructing patterns/core boxes • Joining and fixing component parts
Resource Implications	The following resources must be provided: • all manuals/catalogues relative to work activity • tools and equipment as well as consumable materials
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: Foundry Works Level III	
Unit Title	**Develop and Manufacture Production Patterns**
Unit Code	**IND FDW3 04 0217**
Unit Descriptor	This unit covers the competence required in developing pattern and manufacturing metal production patterns and core boxes.

Elements	Performance Criteria
1. Determine scope of work	1.1. Drawings, instructions and specifications are interpreted and understood. 1.2. Pattern type and design are conceptualised and planned with reference to customer's specification (written or verbal) for number, layout, runner system and core box design. 1.3. Pattern design is interpreted and visualised from drawings, prints or plans and checked against customer requirements. 1.4. A plan is developed for sequence of manufacture for either a high or low volume foundry production pattern.
2. Develop and prepare pattern equipment	2.1. ***Appropriate materials*** are selected and obtained to meet requirements of strength, durability and component finish etc. 2.2. ***Calculations*** appropriate to establishing pattern parameters, including angles, tapers, contraction, etc. are performed, where applicable.
3. Manufacture production patterns and core boxes	3.1. ***Appropriate machines*** and machining process are selected to shape/produce production patterns and core boxes to specification. 3.2. A range of hand and hand held power tools are selected to fashion/manufacture production patterns and core boxes to specification. 3.3. Production patterns and core boxes are checked to specification and surface finish and are checked for mould ability.

Variables	Range
Appropriate materials	May include, but not limited to A range of ferrous, non-ferrous and alloy materials, polymers, epoxy resins, urethane

Calculations	May include, but not limited to the determination of contraction rates as well as general engineering calculations
Appropriate machines	May include but not limited to lathes, milling machines, grinders, pedestal drills, pantographs and other machines as needed, like CNC, lathe and milling machines

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Determine job requirements • Develop pattern equipment • Manufacture production patterns and core boxes
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • characteristics of metals and alloys and their application in the development/manufacture of production patterns • tolerances and contraction rates typically used in the manufacture of production patterns • production moulding and casting techniques • tooling required for casting/moulding • methoding techniques • the use and application of jigs and fixtures • methods of construction including machining provision and clamping arrangements • appropriate techniques, tools and equipment to measure, mark out and produce production patterns • the formulae and mathematical techniques required for manufacturing production patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc. • identification coding and numbering • pattern checking techniques • mould ability i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc. • use and application of personal protective equipment • safe work practices and procedures • hazards and control measures associated with developing and manufacturing production patterns
Underpinning Skills	Demonstrate skills of: • determining job requirements from written instructions, sketches and drawings • planning and sequencing manufacturing operations • checking and clarifying task-related information • selecting appropriate metals to suit the moulding/casting techniques and foundry process • laying out/constructing production pattern/core boxes

	• joining and. fixing component parts • checking pattern for conformance to specifications • measuring components to specified tolerances • calculating shrinkage, draft, machine allowances
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: Foundry Works Level III	
Unit Title	**Develop and Manufacture Polystyrene Patterns**
Unit Code	**IND FDW3 05 0217**
Unit Descriptor	This unit covers all patterns developing and manufacturing polystyrene patterns, including patterns for the lost foam process and for those areas on a wood pattern and core box where polystyrene is required.

Elements	Performance Criteria
1. Determine job requirements	1.1. Drawings, instructions and specifications are interpreted and understood. 1.2. The appropriate ***grade/type*** of polystyrene is selected to meet specifications.
2. Mark out pattern	2.1. Calculations are performed to determine contraction allowance etc. 2.2. Pattern/pattern components are marked out to specifications.
3. Manufacture pattern	3.1. Pattern components are correctly jointed and secured using ***adhesives*** appropriate to the task. 3.2. Appropriate ***tools*** are selected and techniques are used to manufacture polystyrene patterns to specification. 3.3. Pattern is checked for conformance to specifications and correctly marked for identification.
4. Protect pattern from damage	4.1. Patterns are handled and stored in a safe manner least likely to cause damage using standard operating procedures.

Variable	Range
Grade/type	May include, but not limited to: • Size and density of bead
Adhesives	May include, but not limited to: • PVA, 'hot glue'
Tools	May include, but not limited to: • Hot wire, knives, saws

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Determine job requirements • Mark out pattern • Manufacture pattern

	• Protect pattern from damage
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • types and applications of polystyrene for pattern making • the formulae and mathematical techniques required for manufacturing patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc. • marking out techniques for polystyrene patterns • undercuts and holes • types and applications of adhesives • tools and their uses in the manufacture of polystyrene patterns • pattern checking techniques • handling and storage techniques • use and application of personal protective equipment • safe work practices and procedures • hazards and control measures associated with developing and manufacturing polystyrene patterns
Underpinning Skills	Demonstrate skills in: • determining job requirements from written instructions, sketches and drawings • planning and sequencing tasks/operations • checking and clarifying task-related information • selecting polystyrene appropriate for pattern or foundry process • marking out in relation to polystyrene patterns • selecting and applying adhesives • manufacturing polystyrene patterns • checking patterns for compliance • handling finished polystyrene products • using calculations to determine contraction allowances
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: Foundry Works Level III	
Unit Title	**Assemble Plated Patterns**
Unit Code	**IND FDW3 06 0217**
Unit Descriptor	This unit covers the competence required in assembling plated patterns.

Elements	Performance Criteria
1. Determine job requirement	1.1. Job instructions and specifications are interpreted correctly. 1.2. Type of pattern required is determined through job specifications 1.3. Appropriate ***materials*** are selected to meet specification.
2. Inspect and layout patterns	2.1. Pattern(s) is/are inspected to ensure dimensions and surface finish conforms to specifications. 2.2. Pattern and runner system is laid out to specifications from drawings, sketches or verbal instructions. 2.3. Pattern(s) ***alignment*** is correctly laid-out.
3. Mount pattern on plates	3.1. Cope and drag patterns/double-sided ***match plate*** patterns are attached to pattern plate/s according to specification. 3.2. Cope and drag patterns/double-sided match plate patterns are inspected for security and alignment. 3.3. Safety measures are observed throughout the process.
4. Mount runner system	4.1. Volume of runner system is conformed to specification. 4.2. All calculations are performed without error. 4.3. Runner components are attached to pattern plates using appropriate fixing and joining techniques using dowels and other fixing attachments to specification. 4.4. OHS procedures are followed in the process
5.Quality assure plated pattern assembly	5.1. Surface and mould ability of plated pattern assembly are inspected and measured for compliance with specification 5.2. Appropriate techniques and procedures are followed in checking/inspecting conformance of plated pattern assembly 5.3. Housekeeping procedures are performed after the operation.

Variable	Range
Materials	May include, but not limited to: • Metal • Wood
Alignment	May include, but not limited to: • Measurement (X Y Plane) • Dowels
Match Plate	May include, but not limited to: • Plane • Offset

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Determined job requirements. • Inspected and laid-out patterns • Mounted pattern on plates • Mounted runner system • Inspected plated pattern assembly
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Determining job requirements from written instructions, specifications, sketches and drawings • Planning and sequencing tasks • Checking and clarifying task-related information • Performing relevant calculations • Following verbal instructions • Applying surface finishes for the moulding process • Laying out patterns and runner systems • Attaching pattern and runner components • Locating and aligning patterns • Types of pattern plates • Techniques for avoiding cross jointing or mismatch of the pattern and their relationship to the pin-centre • Methoding systems • Mould ability of materials i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc. • Moulding and casting techniques • Kinds, use and application of personal protective equipment • Safe work practices and procedures • Hazards and control measures associated with assembling plated patterns
Underpinning Skills	Demonstrate skills of: • Checking patterns for compliance

	• Performing measurement, numerical operations and calculations associated with assembling plated patterns • Fixing and drilling techniques • Following safety, quality, communication, materials handling techniques • Recording and reporting associated with assembling plated patterns or other units requiring the exercise of the skills and knowledge covered by this unit.
Resource implications	The following resources must be provided: • All manuals/catalogues and related job order, requisitions • Materials, tools, equipment and facilities relevant to the unit
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: Foundry Works Level III	
Unit Title	**Pour Molten Metal to Moulds**
Unit Code	**IND FDW3 07 0217**
Unit Descriptor	This unit covers the competence required in manually pouring molten metal to moulds.

Elements	Performance Criteria
1. Prepare for pouring molten metal	1.1. The condition of the mould is checked according to standard operating procedures. 1.2. The temperature of molten metal is checked for conformance to specification, and pouring method is sequenced to standard operating procedures. 1.3. The capacity of the required pour is identified against specification according to standard operating procedures. 1.4. ***Ladle*** is preheated/prepared and transferred to receive molten metal. 1.5. ***Additives*** are determined from specification and added to molten metal as required.
2. Maintain quality of metal as required	2.1. Slag/dross is removed where necessary according to standard operational procedures. 2.2. The temperature is monitored as required. 2.3. Chemical analysis is undertaken and remedial action applied as required and in accordance with standard operating procedures.
3. Pour molten metal	3.1 Pouring environment is secured in accordance with standard operating procedures. 3.2 Metal is poured at an appropriate and continuous rate in accordance with standard operating procedures. 3.3 Metal is poured at an appropriate and continuous rate. 3.4 A test bar is poured as required and in accordance with standard operating procedures. 3.5 The ladle is emptied of excess metal and cleaned according to standard operating procedures. 3.6 Ladle is maintained and returned to appropriate location based on regulations.

Variable	Range
Ladle	May include, but not limited to:

	• Lip pour • Tea pot • Bottom pour • Barrel • Bull ladles of varying capacity
Additives	May include, but not limited to: • Alloys • Inoculants • Spheroidisers • Coagulants

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Prepared for pouring molten metal • Preheated or prepared ladle • Transferred ladle to furnace • Poured molten metal and maintained quality of metal as required
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Types and pouring characteristics of metals • Types and characteristics of ladles • Procedures for maintaining condition and integrity of ladle • Procedure on safe handling and transfer of molten metal • Metal treatments procedures for making additions to molten metal • Slag and dross removing procedures • Techniques for sampling/testing molten metal pouring • Metal identification and tagging procedures • Use and application of personal protective equipment • Safe work practices and procedures • Hazards and control measures on pouring molten metal
Underpinning Skills	Demonstrate skills of: • Reading and following written instructions, standard operating procedures, specifications and standard test • Data sheets • Selecting and checking ladle • Preparing ladle for pouring • Treating metal • Removing slag and dross • Sampling and testing molten metal • Pouring molten metal into moulds and pigs

	• Tagging pig metal
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: Foundry Works Level III	
Unit Title	**Fettle and Trim Metal Castings**
Unit Code	**IND FDW3 08 0217**
Unit Descriptor	This unit covers the competence required in fettling and trimming metal castings and assessing the quality of the casting.

Elements	Performance Criteria
1. Determine job requirements	1.1. Job requirements are correctly determined from instructions and specifications. 1.2. Correct mouldings and/or castings are located and arranged for efficient processing.
2. Observe safety requirements	2.1. ***Personal protective equipment*** are selected and used correctly. 2.1 Manual or mechanical handling methods are applied appropriate to the work requirements 2.2. Castings/forgings are stored or positioned in a safe manner
3. Identify excess material for removal	3.1. Casting is removed from mould and/or sand media is removed from casting as required. 3.2. Castings are visually checked as suitable for further processing, and excess metal is correctly identified according to standard operating procedures
4. Select correct tools and equipment	4.1. Cleaning method is selected appropriate to casting and job requirements. 4.2. Rumbling/shot blast/sand blast equipment is set to specification and used in accordance with standard operating procedures as required. 4.3. Appropriate ***hand tools*** are selected and used for the given task. 4.4. Appropriate ***power tools and accessories*** are selected and used for the given task.
5. Remove excess material	5.1. Excess metal (e.g. runners, risers and flashing) is removed using methods and equipment appropriate to the task and to standard operating procedures. 5.2. Excess metal suitable for recycling is identified according to standard operating procedures. 5.3. Excess metallic materials are identified from specifications and isolated as required according to standard operating procedures.

6. Quality assess castings/forging	6.1. Castings are visually checked for conformance with specifications to standard operating procedures. 6.2. Non-conforming castings are rejected or set aside and identified for further consideration or remedial action according to standard operating procedures. 6.3. Faults are reported/recorded as required according to standard operating procedures.

Variable	**Range**
Personal protective equipment	May include, but not limited to: • Safety goggles • Apron • Gloves and Safety shoes
Hand tools	May include, but not limited to: • Files • Chisels • Hammers, etc.
Power tools and accessories	May include, but not limited to: • Saws • Croppers • Grinding disks/belts (including grades) • Swing grinder • Pedestal grinders etc. • Hanger type blast machine • Shot thumb blast machine • Table type shot blasting machine

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Performed fettling and trimming metal castings. • Operated grinding machines and cutting equipment. • Operated shot blasting machines.
Underpinning Knowledge	Demonstrate knowledge of: • Characteristic of quality fettling standards for metal casting/forging • Fettling requirements • Different fettling tools and their usage • Handling procedure and storage requirements of materials tools and equipment • Use and application of personal protective equipment • Safe work practices and procedures • Hazards and control measures associated with fettling and trimming metal castings

Underpinning Skills	Demonstrate skills of: • Interpreting written instruction sketches and drawings • Identifying castings • Visually inspecting castings • Fettling and trimming metal castings • Conducting a final inspection • Recording and reporting associated with fettling and trimming metal castings • Handling materials, tools and equipment
Resource Implications	The following resources must be provided: • all manuals/catalogues relative to coreless induction furnace, job order, requisitions slip of materials • tools, equipment and consumable materials • actual furnace and operations
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: Foundry Works Level III	
Unit Title	**Fabricate Gravity Die Casting Mould**
Unit Code	**IND FDW3 09 0217**
Unit Descriptor	This unit covers the competence required in fabricating a gravity die casting mould (permanent/semi-permanent).

Elements	Performance Criteria
1. Identify job requirement	1.1. Product drawings, instruction and specifications are interpreted and fully understand. 1.2. Appropriate ***mould materials*** are selected as per method of moulding and specifications. 1.3. Mould fabrication technique, moulding of components, casting technique and foundry process are identified to determine the ***type of mould*** required.
2. Prepare mould construction plan	2.1. ***Planning of mould***, fabrication of components, casting technique are applied as required. 2.2. Moulding process is selected as per mould plan and standard operating procedures. 2.3. Casting parameters is laid-out as per standard operating procedures. 2.4. Pouring system, ***mould cooling system,*** riser size are calculated as per standard operating procedures.
3. Fabricate mould	3.1. Mould materials are identified and secured/ procured according to standard operating procedures. 3.2. Mould and component parts are produced to size and shape and checked for compliance with specifications using acceptable machining techniques, procedures and utilizing appropriate hand and hand-help power tools. 3.3. Mould component parts are joined or fixed as required according to specification and acceptable mould making techniques and procedures. 3.4. Mould cooling system is checked for compliance with specification. 3.5. Clay moulding of casting is produced from the mould to check configuration and surface finish of the mould as per standard operating procedures.
4. Conduct trial casting	4.1. Samples for aesthetic inspection are produced and dimensional inspection is performed as per specification requirement.

	4.2. Mould is prepared for application of appropriate ***mould coating*** as per standard operating procedures. 4.3. Mould is mounted and secured to casting machine as per standard operating procedures. 4.4. Mould/ machine is prepared for pouring of molten metal as per standard operating procedures. 4.5. Task is completed using personal protective equipment in accordance with safe work practices and procedures.
5. Inspect mould	5.1. Mould is inspected for related defects as per standard operating procedures. 5.2. Dimensions are checked and mould is rectified, if needed, as per standard operating procedures. 5.3. Section thickness is measured and checked for compliance with specification. 5.4. Conformance report is submitted as per company/shop requirement and standard operating procedures.

Variable	**Range**
Mould material	May include, but not limited to: • Gray cast iron for the halves or quadrants • Tool steel for bottom mould • Gray cast iron for centre mould
Type of mould	Types of mould includes but not limited to: • centre pouring mould • side pouring mould • semi-permanent mould with sand core • with loose piece
Planning of mould	The following should be considered in planning: • quantity of casting to be produced • type of metal to be cast • casting cycle time • complexity of the casting • casting machine loading
Mould cooling system	May include, but not limited to: • Water cooling • Air cooling
Mould coating	May include, but not limited to: • Preheating of mould (110° – 150°C) • Coating application/ technique (spraying)

	• Coating type • Insulating type • Lubricating type

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Identified job requirement • Prepared mould construction plan • Fabricated mould • Conducted trial casting • Inspection mould
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Casting process of non-ferrous alloys • Metal, resin, and composite product knowledge including characteristics and application • Moulding and casting techniques for ferrous metal • Machining and tool / die making process • Principles of permanent mould coating and application • Patterns and tooling required to fabricate metal mould • Method and technique of permanent mould fabrication • Use of jig / fixture • Bench work for metal mould • Mould checking technique • Casting inspection technique • Casting defect, cause and countermeasure • Use and application of personal protective equipments • Safe work practice and procedures • Hazards and control measures associated with developing and manufacturing permanent mould • Safe work practice and procedures • Observant/Attentive to details • Patience • Honesty
Underpinning Skills	Demonstrate skills of: • Determining job requirements from written instructions, standard operating procedures, sketches, drawings and other applicable reference documents • Planning and sequencing operations • Checking and clarifying task related information • Selecting appropriate materials to suit the moulding/casting techniques and foundry process • Laying out the pattern/core boxes and mould • Constructing patterns/core boxes and mould • Joining and fixing component parts

	• Checking patterns and moulds • Calculating contraction rates/pitch/proportions/profiles • Calculating mould cooling water (H2O) volume • Calculating gating/riser system • Preparation of mould coating • Application of mould coating • Pre-heating of mould
Resource implications	The following resources must be provided: • Manuals/catalogues relative to mould making • Job order, requisitions slip for materials • Materials, tools and equipment relevant to the activity • Incoming material receiving effort • Quality handbook procedure for melting
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: Foundry Works Level III	
Unit Title	**Monitor Implementation of Work Plan/Activities**
Unit Code	**IND FDW3 10 0217**
Unit Descriptor	This unit covers competence required to oversee and monitor the quality of work operations within an enterprise. This unit may be carried out by team leaders or supervisors.

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

	4.3. Problems are analysed for any long term impact and potential solutions assessed and actioned in consultation with relevant colleagues. 4.4. Where problem is raised by a team member, they are encouraged to participate in solving the problem. 4.5. Follow up action is taken to monitor the effectiveness of solutions in the workplace.

Variables	**Range**
Problems	May include, but not limited to: • difficult customer service situations • equipment breakdown/technical failure • delays and time difficulties • competence
Workplace records	May include but is not limited to: • staff records and regular performance reports

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • ability to effectively monitor and respond to a range of common operational and service issues in the workplace • the role of staff involved in workplace monitoring • quality assurance, principles of workflow planning, delegation and problem solving
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • roles and responsibilities in monitoring work operations • overview of leadership & 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: Foundry Works Level III	
Unit Title	**Apply Quality Control**
Unit Code	**IND FDW3 11 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in applying quality control in the workplace.

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

Variable	Range
Quality check	May include, but not limited to: • Check against design / specifications • Visual and Physical inspection
Quality standards	May include, but not limited to: • Materials • Components • Process • Procedures
Quality parameters	May include, but not limited to: • Standard Design / Specifications • Material Specification

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

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

Occupational Standard: Foundry Works Level III	
Unit Title	**Lead Workplace Communication**
Unit Code	**IND FDW3 12 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to lead in the dissemination and discussion of information and issues in the workplace.

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

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

	• Speaking to groups • Using telephone • Written • Using Internet • Cell phone

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

Occupational Standard: Foundry Works Level III	
Unit Title	**Lead Small Teams**
Unit Code	**IND FDW3 13 0217**
Unit Descriptor	This unit covers the skills, knowledge and attitudes required to determine individual and team development needs and facilitate the development of the work group.

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

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

Variable	**Range**
Learning and development needs	May include, but not limited to: • Coaching, mentoring and/or supervision • Formal/informal learning program • Internal/external training provision • Work experience/exchange/opportunities • Personal study • Career planning/development • Performance appraisals • Workplace skills assessment & Recognition of prior learning
Organizational requirements	May include, but not limited to: • Quality assurance and/or procedures manuals • Goals, objectives, plans, systems and processes • Legal and organizational policy/guidelines and requirements • Safety policies, procedures and programs • Confidentiality and security requirements • Business and performance plans • Ethical standards • Quality and continuous improvement processes and standards
Feedback on performance	May include, but not limited to: • Formal/informal performance appraisals • Obtaining feedback from supervisors and colleagues • Obtaining feedback from clients • Personal and reflective behavior strategies

	• Routine and organizational methods for monitoring service delivery
Learning delivery methods May include, but not limited to:	May include, but not limited to: • On the job coaching or mentoring • Problem solving • Presentation/demonstration • Formal course participation • Work experience and Involvement in professional networks • Conference/seminar attendance and induction

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Identify and implement learning opportunities for others • Give and receive feedback constructively • Facilitate participation of individuals in the work of the team • Negotiate learning plans to improve the effectiveness of learning • Prepare learning plans to match skill needs • Access and designate learning opportunities
Underpinning Knowledge and Attitude and Attitude	Demonstrates knowledge of: • Coaching and mentoring principles • How to work effectively with team members who have diverse work styles, aspirations, cultures and perspective • How to facilitate team development and improvement • Methods and techniques for eliciting and interpreting feedback • Methods for identifying and prioritizing personal development opportunities and options • Career paths and competence standards in the industry
Underpinning Skills	Demonstrates skills to: • Read and understand a variety of texts, prepare general information and documents according to target audience; spell with accuracy; use grammar and punctuation effective relationships and conflict management • Receive feedback and report, maintain effective relationships and conflict management • Organize required resources and equipment to meet learning needs • Provide support to colleagues • Organize information; assess information for relevance and accuracy;

	• Identify and elaborate on learning outcomes • 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: Foundry Works Level III	
Unit Title	**Improve Business Practice**
Unit Code	**IND FDW3 14 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required in promoting, improving and growing business operations.

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

	4.4. Target markets are identified/ refined. 4.5. ***Market position*** is developed/ reviewed. 4.6. ***Practice brand*** is developed. 4.7. ***Benefits*** of products or services are identified. 4.8. ***Promotion tools*** are selected and developed.
5. Develop business growth plans	5.1. Plans are developed to increase profitability 5.2. Proposed plans are ***ranked*** according to agreed criteria. 5.3. An action plan is developed and agreed to implement the top ranked plans. 5.4. Business work practices are reviewed to ensure they support growth plans.
6. Implement and monitor plans	6.1. Implementation plan is developed in consultation with all ***relevant stakeholders***. 6.2. Success indicators of the plan are agreed. 6.3. Implementation is monitored against agreed indicators. 6.4. Implementation is adjusted as required.

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

	• Demographic factors • Technological impacts • Political/legislative/regulative impacts • Competitors, competitor pricing and response to pricing • Competitor marketing/branding • Competitor products
SWOT analysis	May include, but not limited to: • Internal strengths such as staff capability, recognized quality • Internal weaknesses such as poor morale, under-capitalization, poor technology • External opportunities such as changing market and economic conditions • External threats such as industry fee structures, strategic alliances, competitor marketing
Competitive advantage	May include, but not limited to: • Quality • Pricing • Cost • Location • Technology • Delivery • Timeframe • Promotion • Niche marketing • Support from government
Key indicators	May include, but not limited to: • Staffing • Cost and expenses • Personnel productivity (particularly of principals) • Goodwill • Profitability • Price structure • Customers base • Productivity • Quality • System
Organizational structures	May include, but not limited to: • Lines of authority and reporting relationship
Objectives	May include, but not limited to: • Market share growth • Revenue growth • Profitability • Productivity and Innovation

Market position	May include, but not limited to: • The goods or service provided • Product mix • The core product - what is bought • The tangible product - what is perceived • The augmented product - total package of consumer • Features/benefits • Product differentiation from competitive products • New/changed products • Price and pricing strategies (cost plus, supply/demand, ability to pay, etc.) • Pricing objectives (profit, market penetration, etc.) • Cost components • Market position • Distribution strategies • Marketing channels • Promotion • Target audience • Communication
Practice brand	May include, but not limited to: • Practice image • Practice logo/letterhead/signage • Phone answering protocol • Facility decor • Slogans • Templates for communication/invoicing • Style guide • Writing style • AIDA (Attention, Interest, Desire and Action)
Benefits	May include, but not limited to: • Features and Benefits as perceived by the client
Promotion tools	May include, but not limited to: • Networking and referrals • Seminars • Sales promotion • Advertising • Personal selling • Press releases • Publicity and sponsorship • Brochures • Newsletters (print and/or electronic) • Websites • Direct mail • Telemarketing/cold calling

Ranking	May include, but not limited to: • Importance • Urgency • Technology • Resource availability
Relevant stockholders	May include, but not limited to: • Micro and Small Enterprises development • Non-Government Organizations (NGOs) • Finance institutions • Capital goods leasing enterprise

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

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

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

Occupational Standard: Foundry Works Level III	
Unit Title	**Prevent and Eliminate MUDA**
Unit Code	**IND FDW3 15 0217**
Unit Descriptor	This unit of competence covers the knowledge, skills and attitude required by a worker to prevent and eliminate MUDA/wastes in his/her their workplace. It covers responsibility for the day-to-day operation of the work and ensures Kaizen elements are continuously improved and institutionalized.

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

	requirements. 3. 5. Improvements gained by elimination of waste/MUDA are reported to relevant bodies.
4. Prevent occurrence of wastes/MUDA.	4.1. Plan of MUDA prevention is prepared and implemented. 4.2. Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement are discussed and prepared. 4.3. Occurrences of wastes/MUDA are prevented by using ***visual and auditory control methods***. 4.4. Waste-free workplace is created using ***5W and 1H***sheet. 4.5. The completion of required operation is done in accordance with standard procedures and practices. 4.6. The updating of standard procedures and practices is facilitated. 4.7. The capability of the work team that aligns with the requirements of the procedure is ensured.

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

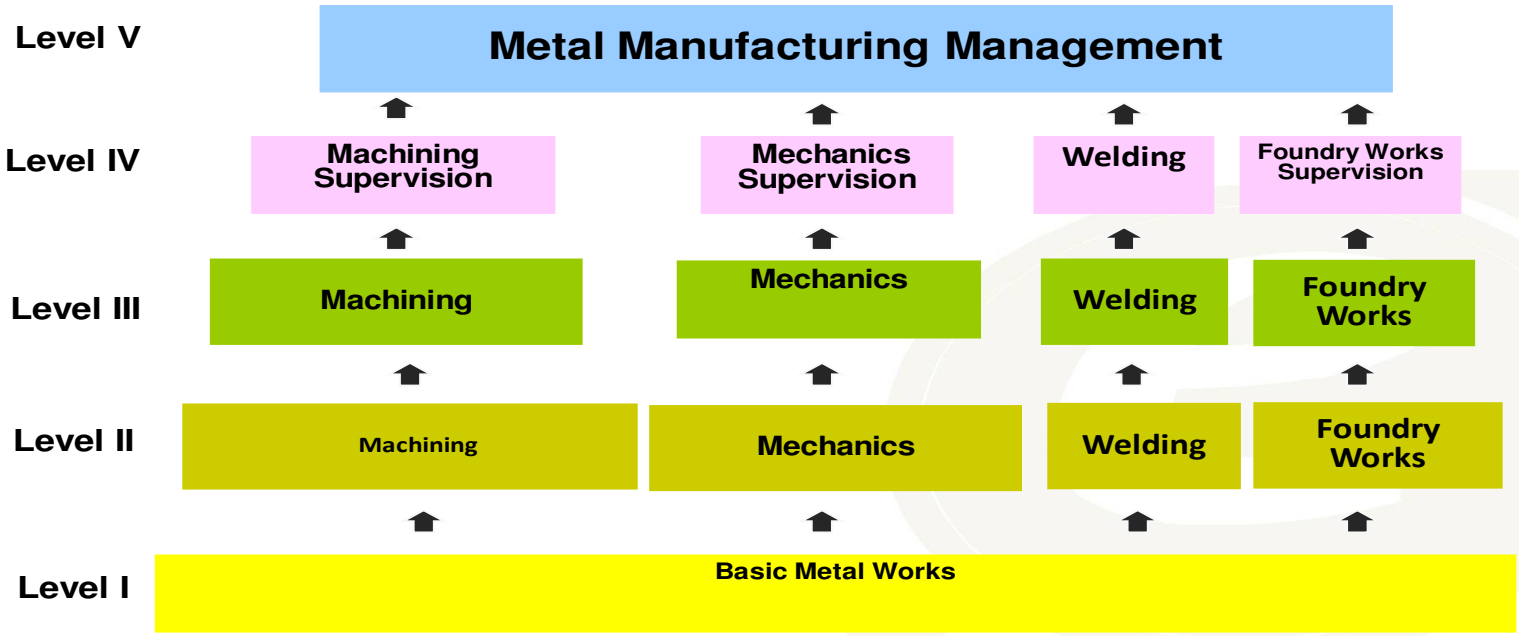
	• Working cloth • First aid and safety shoes
Tools and techniques	May include, but not limited to: • Plant Layout • Process flow • Other Analysis tools • Do time study by work element • Measure Travel distance • Take a photo of workplace • Measure Total steps • Make list of items/products, who produces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

Visual and auditory control methods	May include, but not limited to: • Red Tagging • Sign boards • Outlining • Andons • Kanban, etc.
5W and 1H	May include, but not limited to: • Who • What • Where • When • Why • How

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Discuss why wastes occur in the workplace • Discuss causes and effects of wastes/muda in the workplace • Analyze the current situation of the workplace by using appropriate tools and techniques • Identify, measure, eliminate and prevent occurrence of wastes by using appropriate tools and techniques • Use 5w and 1h sheet to prevent
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Targets of customers and manufacturer/service provider • Traditional and kaizen thinking of price setting • Kaizen thinking in relation to targets of manufacturer/service provider and customer • value • The three categories of operations • the 3“MU” • waste/MUDA • wastes occur in the workplace • The 7 types of MUDA • The Benefits of identifying and eliminating waste • Causes and effects of 7 MUDA • Procedures to identify MUDA • Necessary attitude and the ten basic principles for improvement • Procedures to eliminate MUDA • Prevention of wastes • Methods of waste prevention

	• Definition and purpose of standardization • Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement • Methods of visual and auditory control • TPM concept and its pillars. • Relevant OHS and environment requirements • Plan and report • Method of communication
Underpinning Skills	Demonstrates skills to: • Draw and analyze current situation of the work place • Use measurement apparatus (stop watch, tape, etc.) • Calculate volume and area • Use and follow checklists to identify, measure and eliminate wastes/MUDA • Identify and measure wastes/MUDA in accordance with OHS and procedures • Use tools and techniques to eliminate wastes/MUDA in accordance with OHS procedure • Apply 5w and 1h sheet • Update and use standard procedures for completion of required operation • Work with others • Read and interpret documents • Observe situations • Solve problems • Communicate • Gather evidence by using different means • Report activities and results using report formats
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

METALS MANUFACTURING



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.