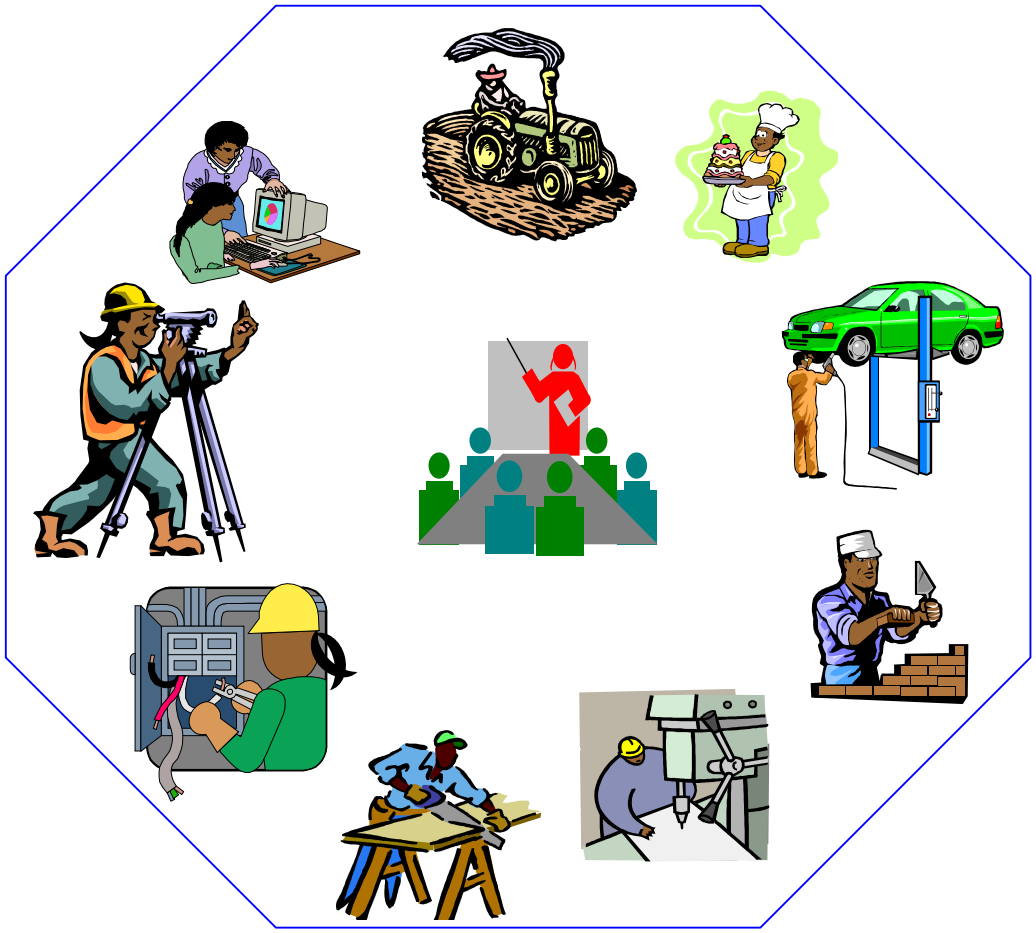
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

METAL MANUFACTURING MANAGEMENT

NTQF Level V



Ministry of Education

Feburary 2017

INTRODUCTION

Within the policies and strategies of the Ethiopian Government, TVET is given an important role with regard to technology transformation by using international standards and international best practices as the basis, and adapting and verifying them in to the Ethiopian context. The new paradigm in the outcome-based TVET system is the orientation at the current and anticipated future demand of the economy and the labour market.

The Ethiopian National TVET Strategy is a road map for the development of the Ethiopian Occupational Standards (EOS) within the context of the National TVET Qualification Framework (NTQF). Ethiopian Occupational Standards are national workplace standards, which define the occupational requirements and expected outcome related to a specific occupation without taking TVET delivery into account.

The Occupational Standard Development process has the following objectives:

- to identify and group the tasks performed by skilled workers in particular occupations/industries;
- to develop instruments for use as national standards : Assessments and Curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of Ethiopian skilled workers in industries nation-wide and international and;
- to supply employers and employees, and their associations, industries, training institutions and governments with analyses of the tasks performed in particular occupations.

The whole Package occupational standard document for the occupation is an integrated set of nationally endorsed Unit of Competences subdivided in to different levels built one upon the other to make full occupational profile and used as basis for outcome based training and competence assessment.

The occupational standard for this Level has basically technical, technological, Entrepreneurial, Kaizen and generic competences. It is made up of mandatory components; the unit of competence, the element, performance criteria, required knowledge, skill, and attitude as well as the resources required for assessment and, methods and contexts of assessment to collect evidences to prove the competence of the assessee.

This occupational Standard is for Metal Manufacturing Management at level V:

- provides a consistent and reliable set of components for training, recognising and assessing people knowledge, skills and attitudes for the level,
- informs what nationally recognised qualifications are awarded by using unit competences embodied in the occupational level,
- encourages the development and delivery of flexible training, which suits individual and industry requirements

- encourages training and assessment in a work-related environment which leads to verifiable workplace outcomes.

Each unit of competence identifies a discrete workplace requirement and includes the knowledge and skills that underpin competence as well as language, literacy and numeracy; and occupational health and safety requirements.

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

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

- description of an occupation
- modification history
- chart with an overview of all Units of Competence for the respective level including the Unit Titles and Unit Codes indicating sequential flow of unit of competences and training modules
- contents of each Unit of Competence (competence standard)
- Occupational map

Occupational standards and Unit of Competence Titles

There are agreed titling for Occupational standard and unit of competences. Always use the correct titles, ***exactly*** as they appear in the occupational standard, and with the code placed with the title.

Each unit of competence has a unique thirteen digits (for example, IND MMM5 01 0217) code assigned when the Occupational Standard is endorsed. The first *three* characters signify the sector acronym. e.g., Industry. *Four* characters in the second group signify the acronym of the occupational title expressed as a work function and qualification level written in numerical form shows the unit and the level it belongs. e.g. Metal Manufacturing Management V. Third group with ***two*** numbers signify the numerical order of the specific unit in the occupational level. Fourth group of ***four*** characters signify the month and year of development e.g. 0217(December 2017).

MODIFICATION HISTORY

Occupational Standards are not static documents because they are amended periodically to reflect the latest industry practices and are version controlled. It is essential that the latest version is always used stating the date they are released nationally by the Federal technical and Vocational Training and Education Agency (FTVETA).

Version Number Conventions

When an Occupational Standard is reviewed it is considered to be a new occupational standard for the purposes of version control; sometimes the version number is changed and not, depending on the extent of the change. Code of unit of competences may or may not change as the occupational standard is reviewed and explanation is given on the changes made.

The development/revision, release and review date is:

This Occupational standard is Version 3. Those who are responsible to undertake competence assessment and provide training should check for the version's review, release and future proposed revision dates to confirm the latest version number before developing assessment tools and commence training respectively. Users are also advised to contact the agency for any doubts they have on the documents or may refer to our website.

The *development/revision date* is the time the document is prepared and validated by relevant industry experts and approved by relevant sector leading organization/ authority. The *release date* is the time the document has been dispatched nationally by FTA for implementation. It indicates the effective date to use the document for training and assessment purposes and termination of use of the previous version for any purposes.

The *review date* (shown in bottom, right side of the cover page and footer of each page) indicates when the occupational standard is expected to be reviewed in the light of changes such as changing technologies and circumstances. The review date is not an expiry date for the use of the occupational standard unless notified or replaced by FTA. Endorsed occupational standards and their components remain current until they are reviewed or replaced.

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

Previous Occupational level Name:.....Version.....

Modified Occupational level Name:..... Version.....

Date of Review....February 2017.....

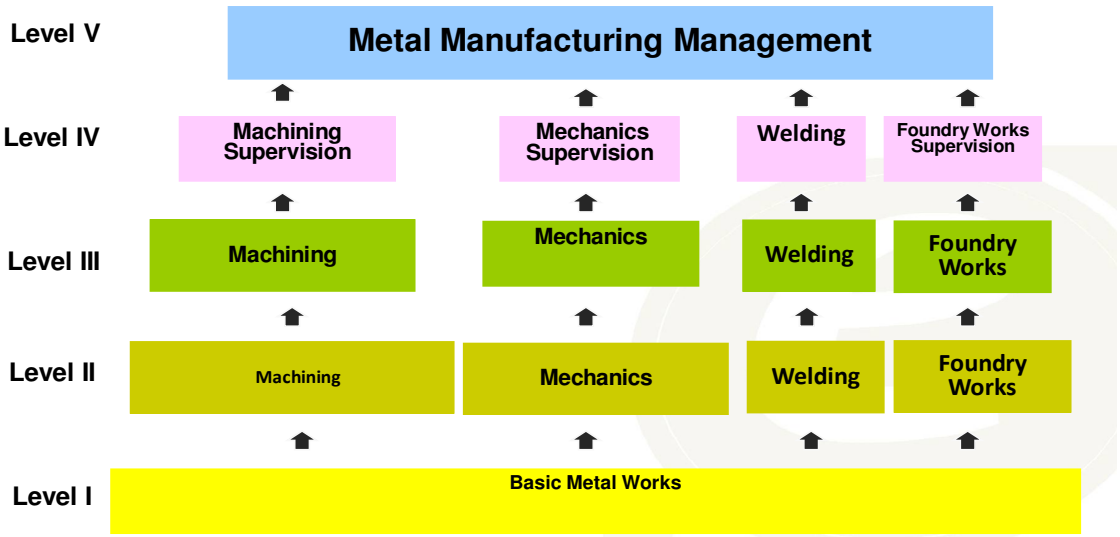
Date and Version	Occupational Level	Changes on the units	Justification/Remark
May 2011, Version 2	V	**Endorsed changes** • Manage Technical Processes • Develop and Document Specifications and Procedures • Facilitate Development of New Product • Analyze and Perform Control Requirement Solutions • Plan and Calculate Required Mechanical Systems Job • Develop a proactive maintenance strategy • Manage Project Quality • Facilitate and Capitalize on Change and Innovation	No changes made on the contents except changes on unit codes due to sequential arrangements
		• Addition of new units • Maintain the workplace OHS management system • Manage Safety and Environmental Protection • Undertake value analysis of product or process costs in terms of customer requirement s • Manage installation and commissioning of equipment and systems	• Newly added • Moved from Level IV to its appropriate level • Replaced " Manage Value Chain" • Newly added
		Merged Units	**None**
		Replaced Units • Develop and Refine Systems for Continuous Improvement in Operations	*Replaced by* Unit of Competence: *Manage Continuous Improvement Process (Kaizen)*
		.Removed Units • Manage Competitive Manufacturing Processes • Manage Value Chain • Develop Communication Strategies to Support Production • Introduce Competitive Manufacturing to Small and Medium Enterprise	• Removed from the standard as the competences belong to the upper level

Date and Version	Occupational Level	Changes on the units	Justification/Remark
		• Interpret Product Cost in Terms of Customer Requirements	• Removed from the standard as the competence belongs to level II

The occupational Map

The following occupational map indicates structure and organization of occupations in a given sector/sub sector. It also shows titles of occupations, vertical pathways and the level of qualifications that are possible with this occupational standard. The occupational Map is followed by "Unit of Competence Chart."

METALS MANUFACTURING



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

UNIT OF COMPETENCE CHART

Occupational Standard: Metal Manufacturing Management

Occupational Code: IND MMM

NTQF Level V

IND MMM5 01 0217 Maintain Workplace OHS Management System	**IND MMM5 02 0217** Develop Proactive Maintenance Strategy	**IND MMM5 03 0217** Plan and Calculate Basic Mechanical Systems Job
IND MMM5 04 0217 Determine Appropriate Measuring System for Specific Process	**IND MMM5 05 0217** Develop and Document Technical Specifications and Procedures	**IND MTM5 06 0217** Manage Technical Processes
IND MMM5 07 0217 Facilitate the Development of New Product	**IND MMM5 08 0217** Perform Advanced Statistical Quality Control	**IND MMM5 09 0217** Analyze and Perform Control Requirements Solutions
IND MMM5 10 0217 Manage the Installation and Commissioning of Equipment and Systems	**IND MMM5 11 0217** Manage Safety and Environmental Protection	**IND MMM5 12 0217** Undertake Value Analysis of Product Costs
IND MMM5 13 0217 Practice Career Professionalism	**IND MMM5 14 0217** Manage Project Quality	**IND MMM5 15 0217** Facilitate and Capitalize on Change and Innovation
IND MMM5 16 0217 Manage Continuous Improvement Process (Kaizen)		

Occupational Standard: Metal Manufacturing Management Level V	
Unit Title	**Maintain Workplace OHS Management System**
Unit Code	**IND MMM5 01 0217**
Unit Descriptor	This competency covers the ongoing maintenance of the Occupational Health Safety Management System (OHSMS) within the area of managerial responsibility, in order to ensure that the workplace is, so far as is practicable, consistently safe and without risks to the health and safety of employees. It assumes that the OHSMS has been developed by persons with the relevant specialist knowledge and skills.

Elements	Performance Criteria
1. Manage OHS information in the workplace	1.1. Action is taken to ensure that requirements for OHS record keeping and reporting implemented according to workplace ***procedures*** and legislative requirements. 1.2. Sources of OHS information are accessed and evaluated for the application in to workplace. 1.3. Data and information are collected and collated to provide information to managers and stakeholders on OHS requirements, trends and risk controls.
2. Support implementation of OHSMS	2.1. OHS priorities are determined in consultation with appropriate managers and stakeholders. 2.2. OHS training needs are identified for implementation and maintenance of the OHSMS. 2.3. Action plans are developed by taking account of priorities and training needs. 2.4. Achievement of action plans is monitored and plans are updated accordingly.
3. Support OHS participative arrangements	3.1. OHS information and documentation are ensured to be understandable and accessible to all. 3.2. OHS issues that may arise within area of authority are promptly addressed or referred to appropriate person. 3.3. Information about the outcomes of OHS is provided in consultation in a manner that is accessible to all.
4. Collect data to evaluate currency of OHSMS.	4.1. Expert advisors, internal data and information that provides relevant and reliable information on the performance of the OHSMS are identified in consultation with stakeholders and, as required. 4.2. Workplace inspections are conducted on a regular basis. 4.3. Workplace OHS implications of any changes are identified to legislation.

	4.4. Any OHS implications to proposed changes are identified to the workplace. 4.5. Action is taken to arrange an OHSMS audit.
5. Analyse data and information to identify areas for improvement	5.1. Compliance of OHSMS with OHS legislation is assessed. 5.2. Information collected is analysed to identify areas for improvement. 5.3. Stakeholders, key personnel and, as required, OHS advisors are consulted with. 5.4. Outcomes of analysis are documented and communicated to key personnel and stakeholders in an easily understood format. 5.5. Limits of own expertise are recognised and appropriate advice is sought.
6. Initiate and maintain improvements.	6.1. Priorities for OHS are determined in consultation with stakeholder. 6.2. An OHS plan is developed with responsibilities and time frames in consultation with stakeholders. 6.3. Resources required for implementation of plan are identified and sourced. 6.4. Achievement is monitored against plan. 6.5. Effectiveness of modifications to OHSMS is monitored in consultation with stakeholders on an ongoing basis.

Variable	**Range**
Procedures	All operations are performed in accordance with procedures. Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.
Hazards	May include, but not limited to: • Handling chemicals and hazardous materials • Chemical and or hazardous materials spillage • Gases and liquids under pressure • Moving machinery • Materials handling • Working at heights, in restricted or confined spaces, or environments subjected to heat, noise, dusts or vapours • Fire and explosion.
OHS Information Sources	may be external and include: • OHS legislation, codes of practice, Ethiopian and International standards, policies and procedures • Internet sites, journals and newsletters • Manufacturer manuals

	• Risk assessments, JSAs, workplace inspections • MSDSs and registers • Hazard and incident reports.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Interact with the workforce to maintain the process that comprise the OHSMS • Access and analyse information to identify areas for improvement • Develop appropriate improvement strategies • Apply a quality improvement process to implement and monitor change
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • OHS record keeping and reporting as required under: • Hazardous substances and dangerous goods legislation • OHS legislative requirements to report serious incidents and injuries and keep records of risk assessments • Creation and management of other record such as: • Hazard and incident reports, investigation reports • Completed workplace inspection checklists and reports • External or internal reports • Minutes of meetings. • OHS responsibilities of all levels in the workplace • The consultation processes, either general/specific to OHS • Hazard identification and risk assessment • Implementation of risk control measures by applying the hierarchy of control • New and relevant OHS information • OHS record keeping • OHS issue resolution legislative requirements for consultation prior to the implementation of change • Sources and types if information that provide realistic information on the performance of the OHSMS • Techniques for analysing OHS data, including simple statistical analysis and graphing of trends • Types of internal and external change that may impact on OHS
Underpinning Skills	Demonstrate skills to: • Maintain an OHSMS already defined and established • Identify types of data and information that will provide information on the effectiveness of the OHSMS in minimising risk • Analyse the data to identify areas for improvement in elements of the OHSMS, including communication and consultation, reporting and hazard identification, risk assessment and risk control,

	• Develop strategies for improvement in the OHSMS • Apply the hierarchy of control to recommend actions to minimise risk • Writing is required to the level of writing the required reports and documents. • Numeracy is required to interpret and manipulate the necessary data.
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: Metal Manufacturing Management Level V	
Unit Title	**Develop Proactive Maintenance Strategy**
Unit Code	**IND MMM5 02 0217**
Unit Descriptor	This unit of competency covers the skills and knowledge required to develop and implement a proactive maintenance strategy for an organisation. The unit recognises that there are a number of predictive or proactive maintenance strategies, such as Total Productive Maintenance (TPM) and Reliability Centred Maintenance (RCM).

Elements	Performance Criteria
1.Determine appropriate analytical techniques	1.1. Key stakeholders are liaised with to determine objectives of maintenance strategy 1.2. Current maintenance situation is examined to determine major areas requiring improvement 1.3. Possible strategies, techniques and tools are compared against organisation needs 1.4. Possible strategies, techniques and tools are selected 1.5. Selected strategies, techniques and tools are confirmed with key stakeholders
2.Develop reliability strategies	2.1. Preferred maintenance strategy is selected 2.2. Strategy is examined and adapted to organisation needs and priorities 2.3. Techniques and tools required to implement strategy are examined and adapted 2.4. Key stakeholders are liaised with to develop an implementation plan 2.5. Key information and performance indicators required are identified
3.Implement strategies	3.1. Data collection required is identified 3.2. Hardware and other resources required are identified 3.3. Skill needs required are identified in consultation with key stakeholders 3.4. All resources/training are ensured to implement strategy available
4.Monitor the implementation of strategy	4.1. Information/performance indicators are compared with desired levels 4.2. Key stakeholders are liaised with regarding strategy issu 4.3. Areas requiring adjustment are identified

	4.4. Required adjustments are made

Variable	Range
Competitive systems and practices	May include, but are not limited to: • Lean operations • Agile operations • Preventative and predictive maintenance approaches • Monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems • Statistical process control systems, including six sigma and three sigma • Just in Time (JIT), kanban and other pull-related operations control systems • Supply, value, and demand chain monitoring and analysis • 5S • Continuous improvement (kaizen) • Breakthrough improvement (kaizen blitz) • Cause/effect diagrams • Overall Equipment Effectiveness (OEE) • TAKT time • Process mapping • Problem solving • Run charts • Standard procedures • Current reality tree Competitive systems and practices should be interpreted so as to take into account: • The stage of implementation of competitive systems and practices • The size of the enterprise • The work organisation, culture, regulatory environment and the industry sector
OEE	May include, but are not limited to: • OEE is the combination of the main factors causing loss of productive capacity from equipment/plant and is: • *OEE = availability x performance x quality rate* where: ➢ availability takes into account losses due to breakdown, set-up and adjustments ➢ performance takes into account losses due to minor stoppages, reduced speed and idling ➢ quality rate takes into account losses due to rejects, reworks and start-up waste
MTBF	Is one key measure of the effectiveness of a

	maintenance procedure, and is an indicator as to whether root causes are being found and resolved. If MTBF is reducing, then it is an indicator that the maintenance regime is failing. There are many possible causes of any problem. Eliminating some will have no impact, others will ameliorate the problem. However, elimination of the root cause will eliminate the problem. There should only be one root cause for any problem and so the analysis should continue until this one cause is found. Elimination of the root cause permanently eliminates the problem. Depending on the equipment, operations and procedures of the organisation, alternative statistical records of maintenance and maintenance-related events may be substituted for MTBF providing they relate strategies for improving OEE.
FMEA	Is a systematic approach that identifies potential failure modes in a system, product, or operations/assembly operation caused by either design or operations/assembly process deficiencies. It also identifies critical or significant design or process characteristics that require special controls to prevent or detect failure modes. FMEA is a tool used to prevent problems from occurring. Some industry sectors have highly adapted forms of FMEA and may practice traditional FMEA in say their routine maintenance while using another technique, such as Hazard and Operability Studies (HAZOP) for design and modification. HAZOP is a form of FMEA which has been practiced by the process industries for over 30 years and examines the implications of changes in process conditions to process stability.
Condition monitoring	Is used to describe the process of analysing the implications of condition monitoring data for proactive maintenance whether it be obtained from Non Destructive Testing (NDT) reports, visual assessment by experts, diagnostic reports obtained from SCADA or other enterprise or equipment software and product or process quality analyses. It does not require the actual undertaking of the NDT or condition monitoring assessment or test. If this is required appropriate units from other Training Packages will be required.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Consider a variety of proactive maintenance strategies for suitability to an organisation • Consult operators, maintenance, management and other stakeholders in decisions on proactive

	maintenance strategies • Implement selected strategies • Monitor performance to selected indicators and make improvements to selected proactive maintenance strategies.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Characteristics and strengths of different types of strategies, techniques and tools, such as: ➢ TPM ➢ RCM ➢ Mean Time Between Failure (MBTF) ➢ Failure Mode Effects Analysis (FMEA) ➢ Condition monitoring ➢ Root Cause Analysis (RCA) • Holistic costs of different strategies combining cost of maintenance with costs of lost production, sales, and so on, as relevant to the organisation • Business goals sufficient to match the strategy to the business needs • Strategic thinking and its application to proactive maintenance • Principles of process equipment and how to improve its reliability • Resources required and how to obtain them
Underpinning Skills	Demonstrate skills in: • Communicating with others using a variety of media and techniques • Adapting personal communication strategy to different levels of literacy and numeracy in target individuals and groups • Working in a team • Analysing quantitative and qualitative information to determine proactive maintenance strategy options • Solving problems to root cause • Applying basic arithmetic and statistical techniques • Planning complex strategies, including consideration of timelines, resources, benefit/cost, implementation requirements, and monitoring and adjustment considerations • Reading and interpreting engineering specifications, drawings and charts • Using information system terminals and computers • Prioritising options, including reasons and recommendations • Recording data
Resources Implication	The following resources must be provided: • Workplace or fully equipped assessment location with necessary tools, equipment and consumable material

	• Workplace procedures and plans relevant to work area • Specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee • Documentation and information in relation to production, waste, overheads and hazard control/management • Reports from supervisors/managers • Case studies and scenarios to assess responses to contingencies.
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: Metal Manufacturing Management Level V	
Unit Title	**Plan and Calculate Basic Mechanical Systems Job**
Unit Code	**IND MMM5 03 0217**
Unit Descriptor	This unit covers knowledge, skills and attitudes in planning and calculating basic mechanical system job, and selecting the components and mechanical features required in performing simple functions.

Elements	Performance Criteria
1. Research equipment function and operational requirements	1.1. All relevant drawings, specifications, manuals and documentation are obtained in accordance with workplace procedures. 1.2. Appropriate personnel are consulted to determine requirements. 1.3. Information collected is interpreted and draft functional and operational requirements are prepared and verified with supervisor or design team.
2. Calculate construction and processing data	2.1. All relevant data for the process are collected and calculated. 2.2. Data is translated for use in sketch/drawing and specifications
3. Prepare a preliminary sketch/drawing/ specifications	3.1. Appropriate ***basic components, assemblies and fasteners*** are selected to perform the required function. 3.2. Where required, components and/or materials are selected from supplier/manufacturer catalogues. 3.3. Appropriate and relevant codes are applied to the sketch/drawing/specification in accordance with workplace procedures. 3.4. The preliminary sketch/drawing/specification is approved in accordance with policy and procedures.
4. Plan the mechanical system	4.1. Parts of the mechanical system are identified, according to the sketch and the collected data 4.2. The parts are composed to a mechanical system. 4.3. Necessary programming of NC and CNC machines are made 4.4. The function will be simulated and evaluated where possible optimizations will be done

Variable	Range
Basic components, assemblies and fasteners	May include, but not limited to: • Shafts • Seals

	• Bearings • Fasteners • Splines • Cam • Lifting systems • Pneumatic circuits • Hydraulic circuits • Piping systems

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Researched equipment function and operational requirements • Calculated construction and processing data • Prepared a preliminary sketch/drawing/specifications • Selected appropriate components, assemblies and fasteners to perform required functions • Planned mechanical system • Performed programming of NC and CNC machines
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Relevant codes and standards • Basic mechanical components: ➢ Shafts ➢ Bearings ➢ Seals ➢ Fasteners, thread systems ➢ Splines ➢ Cams • Drive components: ➢ Electric motors ➢ IC engines ➢ Brakes ➢ Clutches ➢ Belts and pulleys ➢ Chains and sprockets ➢ Gears ➢ Couplings ➢ Universal joints • Lifting systems: ➢ lifting jacks ➢ hoists ➢ winch equipment • Machine tool: ➢ NC ➢ CNC
Underpinning Skills	Demonstrate skills of: • Coordinating with concerned personnel on determining operational requirements

	• Interpreting and verifying collected data and relevant codes • Calculating construction and processing data • Drawing and sketching • Programming PLC • Operating NC and CNC machines
Resource Implications	The following resources must be provided: • Workplace or fully equipped assessment location with necessary tools and equipment as well as consumable materials • Personal protective equipment
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: Metal Manufacturing Management Level V	
Unit Title	**Determine Appropriate Measuring System for Specific Process**
Unit Code	**IND MMM5 04 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes in managing a number of processes to ensure adequate resources, programming and maintenance for operations. This unit includes checking measuring equipment for correct operation, and validating/calibrating precision measuring equipment in accordance with predetermined procedures.

Elements	Performance Criteria
1. Check equipment for correct operation	1.1. Appropriate checks are made of components, for wear, loose connections or other faults. 1.2. Appropriate checks are made for integrated operations of equipment.
2. Validate/Calibrate precision measuring equipment	2.1. ***Calibration*** of precision measuring equipment is assessed based on manufacturers' specifications and/or standard operating procedures. 2.2. Equipment is calibrated against appropriate ***physical standards*** using correct ***calibration devices***, ***equipment***, ***techniques*** and using predetermined procedures. 2.3. Equipment is ***re-commissioned*** in accordance with standard operating procedures.
3. Monitor and manage o going technical processes/ operations	3.1. A range of on-going technical processes/operations and their related interaction are ***monitored*** and analyzed 3.2. Required measuring equipment and measuring process are determined to ensure sufficient precision 3.3. On-going technical processes are adequately documented
4. Develop work program and schedules and tax the costs of precision	4.1. Required ***human resources*** and physical resources are identified for the ongoing process 4.2. Maintenance and system review activities are scheduled 4.3. Purchasing and renewal requirements are scheduled 4.4. ***Costs*** of increasing precision are taxed 4.5. Precision that most fits the economy as well as the quality is set
5. Monitor the condition o plant and resources	5.1. Condition of plant and resources are monitored and documented according to the measured data 5.2. Performance problems are diagnosed

	5.3. An energy and resource minimization plan is developed
6. Plan corrective action a required to improve specific parts of the process	6.1. Critical areas are identified for performance improvement 6.2. The process/system is altered to ensure that variation is controlled and faults are rectified. 6.3. Feedback on the effectiveness of the process improvements is sought from concerned people 6.4. Changes/alterations on the process are documented and communicated to customers/stakeholders.
7. Monitor environmental performance	7.1. Regular environmental audits of processes and systems are conducted 7.2. Result of environmental audits is analyzed and communicated to stakeholders.

Variable	**Range**
Calibration	• To standardize the quantities of a measuring instrument
Physical standards	• Reference standards of mass length, time, temperature, pressure, volume, process characteristics etc.
Calibration devices, equipment	May include but not limited to the following: • Micrometer • Vernier caliper • Voltmeter • Oscilloscope • All types of comparators, jigs and fixtures, templates and patterns
Techniques	• In standard operating procedures, manufacturers' manuals
Re-commissioning	May include the following: • Sealing • Tagging • Identification or storage
Monitoring	May at times include: • Taking corrective actions to maintain or enhance performance • May also require continual monitoring to ensure that correct operations are performed and that all equipment is functioning to the required standards
Human resources	Refer to people employed through: • Awards • Contracts • Subcontracts • May include professionals, para-professionals, trade and non-qualified
Costs	Refer to: • On-going costs within the business and to the managemer of cost within a specific engineering project.

	• Cost estimation and control are essential areas of business management that will require an application of engineering expertise.

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Checked equipment for correct operation • Validated /calibrated precision measuring equipment • Monitored and managed on-going technical processes and selected the fit system for the process • Developed work programs and schedules and identified required human resources • Monitored the condition of plant and resources • Planned corrective action to improve specific parts of the process • Monitored environmental performance
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • The procedures for measuring process performance • The impact of variations in process performance on the achievement of the organization's objectives • Issues relating to waste management, recycling and the environment • The interaction of the technical process with other related processes • The recording and reporting requirements associated with the technical process • Procedures for documenting and communicating variations to the technical process • The resource requirements of the process in terms of the process requirements • Process for review of maintenance procedures and scheduling • Maintenance strategies • Procedures for reviewing system performance • Opportunities to improve system performance through revised maintenance schedules/activities • Process of preparing and maintaining plant and equipment procurement schedules • The life expectancy of existing plant and equipment • The costs and benefits of repair/maintenance versus replacement • The procedures for procuring new/replacement plant and equipment • The authority responsible for approving the procurement of new/replacement plant and equipment
Underpinning Skills	Demonstrate skills in: • Calibrating equipment • Managing engineering operations

	• Determining an appropriate external standard in accordanc with standard operating procedures • Using electronic setting equipment • Preparing and maintaining plant and equipment procurement schedules • Preparing and maintaining plant and equipment procurement schedules • Developing work programs and schedules for provision of resources, • Instigating performance improvement related to cost, process variations, documentation and environmental effects • Reviewing process element compatibility • Determining specifications of the plant, resources and process output • Checking process performance against specification • Monitoring type(s) of plant condition associated with the process • Selecting monitoring methods and recording monitoring results • Preparing analysis of monitoring results • Preparing proposals on improvements to plant, equipment and/or maintenance strategies/schedules • impacts of the process, procedures and The delegated authority responsible for approving remedial action • Identifying faults in the process and/or variations outside specification and the action(s) to be taken to overcome faults/ variations • Documenting alterations to the process • Communicating details of alterations to customers and stakeholders • Analyzing the environmental systems with respect to: ➢ Energy usage ➢ Waste management ➢ Water conservation ➢ Materials conservation ➢ Workplace environmental conditions and risks ➢ Reporting environmental requirements and structures • Measuring equipment specifications, operation, wearing parts, connections and components • Checking measuring equipment, tools and equipment and identifying common fault(s) that may be found in the measuring equipment • Analyzing effects of faults on the performance/accuracy of the measuring equipment • Observing standards, legislative or regulatory requirements applicable to the measuring equipment and/or its calibration

	• Observing standard operating procedures for calibrating the measuring equipment, tools and equipment • Observing standard operating procedures for commissioni the measuring equipment • Preparing calibration records to be kept/maintained in accordance with standard operating procedures
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Metal Manufacturing Management Level V	
Unit Title	**Develop and Document Technical Specifications and Procedures**
Unit Code	**IND MMM5 05 0217**
Unit Descriptor	This unit covers the competence to analyze requirements and to develop and document technical specifications and procedures providing concise and unambiguous direction and guidance for workplace activities.

Element	Performance Criteria
1. Identify requirements	1.1. Information required for technical specifications and procedures is identified and assembled 1.2. ***Specifications and procedures*** requirements and formats are established and confirmed, where necessary 1.3. Requirements for information entry, storage, output and quality of document production are identified in accordance with enterprise procedures 1.4. Specifications and procedures document design are made appropriate for efficient entry of information and satisfy appearance and presentation requirements for the purpose of the document 1.5. Range of functions incorporated in the document design are made to reflect the nominated requirements
2. Prepare specifications	2.1. Technical information is collected for use in the specification; tested and validated or confirmed before use 2.2. Authoritative sources and references are identified and used in the preparation and presentation of the specification 2.3. Specifications are written in a format to ensure requirements can be met 2.4. Specifications are written in a manner that is clear and understood in the workplace 2.5. Specification documentation is made to satisfy enterprise and industry standards
3. Prepare technical procedures	3.1. Activities and tasks are identified, analyzed and documented 3.2. Activities and tasks are sequenced and logically grouped 3.3. Procedures are documented to enterprise and industry standards

Variables	Range
Specifications	Technical criteria for an object, item, system or sub-system describing the components, materials, construction, circuitry and associated legal, regulatory or intellectual property issues
Procedures	Contain detailed descriptions of the tasks, activities, sequences, materials, tooling, rules and safety requirements, leading or guiding an individual through an authorized work practice.
OHS requirements	Include legislation, vehicle industry • Regulations, safety management systems, hazardous substances and dangerous goods code and safe operating procedures • Personal protective equipment is to include as prescribed under legislation, regulations and enterprise policies and practices

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Locate, interpret and apply information • Apply safety requirements throughout the work sequence, including the use of personal protective clothing and equipment • Identify and itemize steps and stages in procedures • Complete a significant operational procedure, incorporating safety obligations, and covering: ➢ a full analysis of the topic area ➢ a step-by-step operational procedure ➢ supporting documents to the procedure ➢ complete or review and update a specification for a significant system or sub-system covering: ✓ system/sub-system description ✓ components ✓ materials ✓ construction ✓ circuitry ✓ related information sources ✓ legal, regulatory or intellectual property law requirements • Modify products to cater for variations in workplace cultures and environment • Work effectively with others
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Technical writing and presentation techniques • Enterprise (or equivalent) technical procedure formats, • content rules, preparation and management techniques
Underpinning Skills	Demonstrate skills to: • Plan and organize to avoid backtracking, workflow interruptions or wastage

	• Use mathematical ideas and techniques to incorporate measurements, calibration and test requirements into specifications and procedures • Establish processes which anticipate and allow for risks, cater for both direct and indirect causes, avoid or minimize reworking and avoid wastage in the preparation and conten of procedures • Use the workplace technology related to document preparation, including calculators and measuring devices, computing systems and information management systems
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: Metal Manufacturing Management Level V	
Unit Title	**Manage Technical Processes**
Unit Code	**IND MTM5 06 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to manage technical processes in the preparation of resource, monitoring production stages and measuring specified process parameters.

Elements	Performance Criteria
1. Coordinate resource us	1.1. Technical process requirements are interpreted in terms of resources and procedures 1.2. Schedules and technical resources are confirmed with relevant personnel 1.3. ***Process and Occupational Health and Safety (OHS) requirements*** are clarified, where necessary
2. Manage the process	2.1. Roles and responsibilities are allocated, as required 2.2. Technical process is monitored and guidance provided, where required 2.3. ***Process parameters*** are monitored to ensure conformance to requirements 2.4. Safety associated with the process including chemical handling is monitored
3. Facilitate process problem resolution	3.1. Methods to solve process problems are identified through facilitation of meetings or discussions 3.2. Knowledge of process improvement and technical systems are used to assist in the systematic identification and resolution of process problems 3.3. Preferred option is recommended and documented to resolve the problem 3.4. Implementation of the recommended problem resolution option is facilitated
4. Monitor process improvements and variations	4.1. Improvements and variations to process are monitored to ensure outcome meets specifications, production schedule and workplace requirements 4.2. Data is collated and analyzed to evaluate the effectiveness of process improvements or variations

Variable	Range
OHS requirements	May Include, but not limited to: • Manual handling techniques • Standard operating procedures

	• Personal protective equipment • Safe materials handling • Taking of rest breaks • Ergonomic arrangement of workplaces • Following marked walkways • Safe storage of equipment • Housekeeping • Reporting accidents and incidents • Other OHS practices relevant to the job and enterprise
Process parameters	May Include, but not limited to: • Speed • RH% • Efficiency • Machine utilization • Production • Production capacity of machines • Temperature • Pressure • Chemical values • Time • Volume • Quantities • Ph (be) • Concentration and Viscosity

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Coordinated the use of resources • Allocated tasks and roles to relevant personnel • Managed technical process • Solved problems and monitor process improvements • Monitored process improvements and variations
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Industry and product and technical processes and equipment and resources • Technical and specified process parameters • Characteristics or raw materials and their properties • Processing, measurement, matches • Monitoring processes and procedures • Quality standards and manual handling procedures • Safety and environmental aspects of relevant processes, including use of chemicals • Workplace procedures and reporting and documentation processes and procedures • Chemical processes relating to production • OHS practices, including hazard identification and control measures

	• Recording and reporting practices
Underpinning skills	Demonstrates skills to: • Interpret requirements • Determine schedules and resources • Match personnel to tasks and roles • Facilitate problem solving associated with process variations • Analyze process parameters • Monitor process requirements • Communicate effectively within the workplace • Document, assess and transfer information • Read, interpret and follow information on work specifications, standard operating procedures and work instructions and other reference material • Maintain accurate records • Sequence operations • Meet specifications • Clarify and check task-related information • Carry out work according to OHS practices
Resource Implications	Access is required to real or appropriately simulated situations, including: • Work areas • Materials and equipment • Information on workplace 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: Metal Manufacturing Management Level V	
Unit Title	**Facilitate the Development of New Product**
Unit Code	**IND MMM5 07 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required develop a new/evolutionary product within an existing range products and encompass design for manufacture and t facilitation of its initial production.

Elements	Performance Criteria
1. Confirm design brief of new product in consultation with releva people	1.1. Technical specification, aesthetic requirements, timelines, cost and other market requirements are communicated and agreed upon with customer and other key stakeholders. 1.2. Regulatory/industry code/intellectual property requirements for product are determined. 1.3. Possible tooling/process/equipment needs are identified. 1.4. Design brief, including relevant drawings are developed to meet needs 1.5. 'Sign off' on total design brief is obtained from all relevant persons
2. Determine material requirements for produc	2.1. Appropriate materials/combination of materials/ components are selected in liaison with key stakeholders 2.2. Material/component testing and evaluation regime required to meet product end user requirements, including regulatory/industry code requirements are determined 2.3. Testing and evaluation of trial materials/components are arranged 2.4. Trial process of materials is monitored and material trial result interpreted 2.5. Final materials/components specifications and details of value chain are determined
3. Determine process requirements for produc	3.1. Appropriate process is selected to make product in liaison with key stakeholders and based on ***relevant factors*** 3.2. Any special process/equipment requirements for this product is/are determined 3.3. Other concerns and/or training or other needs are communicated with production personnel 3.4. The design is adjusted as required to satisfy customer and production needs

4. Monitor process needs for the new product	4.1. Equipment design and other needs are coordinated with procurement personnel 4.2. Hardware specifications are interpreted to ensure they are appropriate for the job required 4.3. Appropriate draft procedures for the new product are coordinated with process personnel to ensure its compliance with the job required. 4.4. Product cost and design are validated to meet objectives
5. Trial new product throug the process	5.1. Trialing procedure is designed to deliver required information 5.2. Trialing of the new product is coordinated with relevant stakeholders 5.3. Product trial process results are interpreted to ensure product is Health Safety and Environment (HSE requirements) strictly observed 5.4. Process is tuned to optimize production of new product
6. Determine process capability	6.1. Appropriate statistical process control charts are plotted 6.2. Confidence limits are determined 6.3. Confidence limits are compared with product specificatio
7. Coordinate product trial	7.1. Product testing and required evaluation regime are determined to meet end user requirements, including regulatory/industry code requirements 7.2. Testing and evaluation of trial product/prototype are arranged 7.3. Product trial results are interpreted and product trial process is guided 7.4. Final product specification is determined in liaison with key stakeholders 7.5. Required changes are carried out to materials, process and equipment
8. Implement standard procedures for new product	8.1. Initial production is monitored and, in liaison with appropriate team members, process, conditions and materials are adjusted to ensure the product and process outcomes conform to requirements 8.2. Process specifications are updated to ensure that optimized operation developed are reflected 8.3. Standard operating procedures are implemented to ensure conformity for the new product 8.4. Equipment and other hardware records are updated to ensure that additions/changes are reflected

	8.5. Project records are prepared to ensure that all required reports have been completed and submitted 8.6. Records are archived according to company procedures

Variable	Range
Relevant factors	May Include, but not limited to: • Type of material • Dimensional precision of product • Length of run/number of products • Required aesthetics • Size and complexity of product • Available capital funding • Process equipment available • Health Safety and Environment (HSE) requirements
Processes and policies	May Include, but not limited to: • This competence unit is for the design of a new product 'from scratch'. • It assumes an understanding of the operation of all relevant equipment and processes but does not necessarily require them to be used personally. • The competence assumes a working knowledge of all main processes and materials so that an informed choice can be made between them. • All operations are performed in accordance with standard procedures and policies.
Tools and equipment	May Include, but not limited to: • Understanding of the use of all standard processing equipment • Relevant Personal Protective Equipment (PPE)
Typical regulatory requirements	May Include, but not limited to: • **Occupational Health and Safety (OHS)** • Environmental regulations • Structural codes • Product/industry specific requirements
Typical problems	May Include, but not limited to: • Defining product end user requirements in terms meaningful to the product design and manufacture • Matching suitable materials and processes to the product needs and company expertise and facilities • Matching (and improving) process capability to product tolerances

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate has the ability to: • Apply a thorough understanding of materials and components, their grades and properties and the effects

	of processing to a new situation and use this understanding to predict likely solutions to the new product design specification challenge. • Understand material /component and process interactions that is to be applied in interpreting data and to make adjustments to materials/components and process to achieve the desired outcomes.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • The specifications and uses of the materials, equipment • Process sufficient to choose an appropriate combination of materials and process to achieve the end use function of the product. • The enterprise's procedures and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards.
Underpinning Skills	Demonstrate skills in: • Observing safe working practices which include compliance on accepted policies, standard, strategies legislative and enterprise requirements. • Recognizing hazards commonly occurring at the workplace and follow health and safety instructions and procedures in the workplace. • Implementing and monitoring defined OHS policies and procedures for a work group or area, within their scope of responsibilities.
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: Metal Manufacturing Management Level V	
Unit Title	**Perform Advanced Statistical Quality Control**
Unit Code	**IND MMM5 08 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes in working within a quality improvement system, either individually or in a team situation and taking samples or applying a statistical process to monitor production.

Elements	Performance Criteria
1. Work within a quality system	1.1. Instructions and procedures are followed and duties are performed in accordance with requirements of ***quality improvement system***. 1.2. Conformance to specifications is ensured. 1.3. Defects are detected and reported according to standard operating procedures. 1.4. Performance of operation or quality of product or service is monitored to ensure ***customer*** satisfaction.
2. Engage in quality improvement	2.1. Current performance is assessed. 2.2. Established performance measures are identified. 2.3. Specifications and standard operating procedures are identified. 2.4. Defects are detected and reported according to standard operating procedures. 2.5. Process improvement procedures are participated in the improvement of internal/external customer/supplier relationships is participated in. 2.6. Performance of operation or quality of product or service is monitored to ensure customer satisfaction
3. Take samples	3.1. Difference between population and sample is understood and various ***sampling schemes*** are applied in accordance with standard operating procedures. 3.2. Sample is taken according to the procedure.
4. Apply statistical proces to monitor production	4.1. Concept of variation is understood in terms of average an spread. 4.2. Data is used to produce ***relevant statistical information***. 4.3. Data is interpreted accurately and information is presented to appropriate authority according to standard operating procedures.

Variable	Range
Quality improvement system	It is a system comprising some or all of the following elements • Quality assurance • Quality control • Quality inspection • Quality improvement • Total quality control
Customer	The next person or organization receiving the production or service
Sampling schemes	• Agreed customer plans • Acceptable Quality Level (AQL) • Average Outgoing Quality Level (AOQL) plans
Relevant statistical information	Refers to : • Average range and process control data and • Plotting of charts such as line graphs, run charts, tally charts, histograms, control charts, random and assignable causes etc.

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Worked within a quality system • Engaged in quality improvement • Applied sampling schemes • Applied statistical process to monitor production
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Quality system terminology and concepts e.g. ➢ quality assurance – planning to meet customers' requirements ➢ quality control – checks and procedures to ensure customer requirements are met ➢ quality inspection – inspecting and testing products and services ➢ total quality control – a company-wide approach that combines both quality assurance and quality control so that the customer is always satisfied • Commonly accepted meaning/s of the terms quality and quality system • The reasons for following requirements of the quality improvement system may include: ➢ Strategies and approaches for working within a quality system ➢ Procedures to be followed in undertaking the work ➢ Specifications to which the individual's work is to comply ➢ Reasons for ensuring work conforms to specification • Benefits of good quality: ➢ Quality products ➢ Reduced costs ➢ Customer confidence, satisfaction and loyalty

	➢ Good reputation ➢ Job satisfaction ➢ Solving problems ➢ Increased competitiveness ➢ Keeping up with technology • Costs and consequences of poor quality e.g. ➢ Lost customers ➢ Accidents ➢ Wastage ➢ Lost time ➢ Low morale ➢ Conflict • Procedures for reporting defects • Examples of common defects • Quality improvement procedures • Four steps of the quality cycle: plan, do, check, act • Reasons for following process improvement procedures • Examples of ways in which customer/supplier relationships can be improved • Benefits of good customer/supplier relationship • Hazards and control measures associated with applying quality procedures, including housekeeping • Safe work practices and procedures • Numerical operations and statistical calculations/formulae within the scope of this unit • Statistical process control procedures, which may include si sigma etc. And the sampling procedures to be followed • The types of charts that can be produced to assist monitorir of products including run charts, tally charts, histograms, control charts • Use and application of personal protective equipment
Underpinning skills	Demonstrates skills to: • Interpret requirements • Statistical computation • Implement safe work practices and procedures • Observe and apply quality procedures in housekeeping • Monitor process requirements • Communicate effectively within the workplace • Document, assess and transfer information • Implement PDCA • Maintain accurate records • Meet specifications • Clarify and check task-related information
Resource Implications	Access is required to real or appropriately simulated situation including : • Work areas • Charts and instruments • Materials and tools relevant to the activities

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: Metal Manufacturing Management Level V	
Unit Title	**Analyze and Perform Control Requirements Solutions**
Unit Code	**IND MMM5 09 0217**
Unit Descriptor	This unit covers the knowledge, skills, and attitudes required for solution and operation of important requirements by controller.

Elements	Performance Criteria
1. Determine system requirements	1.1. Instructions regarding system requirements are obtained, understood and clarified as necessary. 1.2. Available drawings are interpreted correctly using standard symbols.
2. Analyze control requirements	2.1. Requirements are analyzed based on demand 2.2. Basic parts of hydraulic, pneumatic and electric control system are detected. 2.3. Electro-pneumatic/hydraulic control systems are used as development of traditional ones.
3. Select control system components	3.1. Suitable components and alternatives are detected with different systems developed. 3.2. Components are selected for ***hydraulic***, pneumatic and electric circuits 3.3. Functions of the control systems are modified according to the requirements and ***safety procedures***
4. Solve control requirements	4.1. Hardware programmed logic controller and ***PLC*** are used for solutions 4.2. Solutions are integrated into the working process
5. Verify component selection	5.1. Circuits are set- up and operated on laboratory benches. 5.2. Operation is analyzed and outcomes are verified against system requirements.

Variable	Range
Hydraulic circuits	May include, but not limited to: • Linear actuators, motors, control valves
Safety procedures	May include, but not limited to: • Selecting a suitable fire resistant fluid for a system, given its operating conditions; • Following required precautions when changing a system from one fluid to another
PLC	Refers to Programmable Logic Controller

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

	• Determined system requirements • Analyzed control requirements • Selected components for simple hydraulic, pneumatic, electric and combined circuits • Solved control requirements by integrating these solutions into the working system • Verified component selection • Used and programmed PLC
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Fluid power: ➢ Definition of the term fluid power ➢ Differences between pneumatic and hydraulic systems ➢ Advantages and disadvantages of fluid power compare with mechanical and electric power systems ➢ Safety procedures when working with fluid power equipment ➢ Basic properties of fluids ➢ Selection and suitability for different applications ➢ Basic properties and units – mass, volume, density, specific volume, relative density, force and weight, pressure (absolute, atmospheric and gauge), temperature (celsius and kelvin), viscosity, surface tension ➢ Introduction to temperature and pressure effects on the basic properties and applications ➢ Precautions to be taken when changing type of fluid in system • Awareness of different components including: ➢ Pipes (rigid and flexible) ➢ Valves, types and functions ➢ Filters and strainers for liquids ➢ Gauges and instruments – pressure/temperature gauges, liquid level gauges, thermometers, thermocouples, manometers, piezometers ➢ Pipe fittings – elbows/bends, enlargement/contractions coupler/unions, tees ➢ Tanks and vessels – storage tanks, pressure vessels, header and surge tanks, weirs/dams/reservoirs ➢ Flow measurement instruments – venturi and orifice meters ➢ Pumps, motors/turbines • Linear actuators: ➢ Types, selection and functions ➢ Methods of supporting linear actuators ➢ Introduction to calculations related to linear actuators • Control valves (hydraulic and pneumatic): ➢ Directional controls and functions ➢ Pressure controls and functions ➢ Flow controls and functions

Underpinning Skills	Demonstrate skills in: • Observing and analyzing performance of linear actuators in laboratory circuits • Checking valves and functions • Recognizing and drawing standard symbols for control valves • Drawing and analysis of typical circuits containing control valves • Observing and analyzing performance of valves in basic circuits • Proper use of fluids • Proper storing and handling of chemical fluids • Proper disposal of waste • Using PLC • Programming PLC • Drawing and analysis of circuit diagrams containing basic components • Setting- up and operating circuits on pneumatic and hydraulic benches in a fluid power laboratory
Resource Implication	The following resources must be provided. • Workplace or fully equipped assessment location with necessary tools, equipment and consumable materials • Simulation boards • Personal protective equipment
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: Metal Manufacturing Management Level V	
Unit Title	**Manage the Installation and Commissioning of Equipment and Systems**
Unit Code	**IND MMM5 10 0217**
Unit Descriptor	This unit covers the skills and knowledge required to manage the installation and commissioning of equipment and systems.

Elements	Performance Criteria
1 Prepare work plan and specification document	1.1 Items to be included in work plan and specification document are identified and confirmed 1.2 Work plan for installation and commissioning of ***equipment and systems*** is drawn up, including management and reporting procedures 1.3 Specification document is prepared according to workplace and/or manufacturer procedures
2 Coordinate and monitor contract arrangements	2.1 Contract arrangements for the installation and commissioning of equipment/systems, including all legal, insurance and safety requirements, are coordinated in accordance with workplace and/or legislative procedures 2.2 Contract arrangements are monitored to ensure compliance with requirements and variations dealt with according to agreed strategy
3 Manage schedules and budgets	3.1 Information is gathered to establish adherence to schedule and budget forecasts 3.2 Deviation from performance targets is monitored and corrective action taken, if and where necessary 3.3 Scheduling and budgeting processes are assessed to determine whether variations or alternative plans are indicated
4 Administer legal, environmental and OHS requirements	4.1 Legal, environmental and OHS requirements related to installation and commissioning of equipment/systems are defined 4.2 Monitoring of the process is assessed to ensure compliance
5 Assess and report on work completion	5.1 Completed work is assessed to confirm all specifications have been incorporated 5.2 Report on work completed is prepared in accordance with ***workplace practices***
6 Maintain records	6.1 Records are maintained of installation and commissioning activities in accordance with workplace practices

Variable	Range
Equipment and systems	May Include, but not limited to: • Microprocessor or computer control • Production and facility equipment used within the enterprise
Workplace practices	May Include, but not limited to: • Workplace practices relating to managing installation and commissioning of equipment and systems • Conditions of service, legislation and industrial agreements including workplace agreements and awards and federal legislation • Standard work practices • Reporting verbally or in writing • Oral, written or visual communication • Being responsible for the maintenance of own work quality and contributing to the quality improvement of team or section output, where necessary • Safety, environmental, housekeeping and quality practices as specified by machine and equipment manufacturers, regulatory authorities and the organisation
Legislative/ regulatory requirements	All work must comply with relevant Federal legislative or regulatory requirements, organisation insurance requirements, OHS legislation, manual handling procedures and relevant health regulations.
Workplace OHS practices	May Include, but not limited to: • Use of personal protective wear and equipment • Safe materials handling practices • Taking of rest breaks • Ergonomic arrangement of workplaces • Following marked walkways • Storage of equipment • Workstation housekeeping • Cleaning of equipment • Workers' compensation legislation

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Develop and prepare work plan and specification documents • Organise and monitor contract arrangements • Assess scheduling and budgeting procedures • Implement legal, environmental and OHS obligations/requirements • Ensure completed work meets specifications • Maintain accurate records Apply underpinning knowledge and skills when: • Organising work

	• Managing activities and personnel • Completing tasks • Identifying improvements • Applying safety precautions relevant to the task • Assessing operational capability of specified equipment used and work processes • Shows evidence of application of relevant workplace practices including: • Hazard policies and procedures including codes of practice
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Appropriate installation and commissioning procedures • OHS considerations and environmental factors • Contract requirements • Safety and environmental aspects of relevant enterprise activities • Workplace practices and reporting/recording processes • Relevant regulatory requirements and codes of practice • Relevant OHS legislation, regulatory requirements and codes of practice • Carry out work in accordance with OHS practices • Hazard identification and control measures associated with managing installation and commissioning of equipment and systems
Underpinning Skills	Demonstrate skills in: • Monitor contract arrangements, scheduling and budgets • Manage the application of technical skills by other personnel • Communicate effectively within the workplace, including liaising with other departments • Establish or interpret procedures, where required • Determine report requirements and present information in appropriate formats • Read, interpret and follow information on job instructions, specifications, standard operating procedures, patterns, charts, tickets, order forms and other applicable reference material • Sequence operations • Clarify and check task related 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: Metal Manufacturing Management Level IV	
Unit Title	**Manage Safety and Environmental Protection**
Unit Code	**IND MMM5 11 0217**
Unit Descriptor	This unit specifies the outcomes required to conduct an Occupational Health and Safety (OHS) risk analysis, including the inspection of workplaces for hazards. The development and implementation of appropriate responses to reduce risks are also addressed, including responses required by government legislation and regulation for environmental protection in production/manufacturing workplaces

Elements	Performance Criteria
1. Determine areas of potential risk in the production/ manufacturing workplace	1.1. ***Specific risks*** for the range of occupations in the workplace are identified and prioritized. 1.2. Safety is evaluated and hazards and potential risk areas are identified in accordance with ***legislative requirements for OHS*** and company policies. 1.3. Hazards are identified and prioritized and required approaches to remediation are documented.
1. Inspect and report on areas of specific risk	2.1. Inspection of the workplace is conducted to identify specific risks for the range of identified jobs/activities. 2.2. Expert advice and advice from workplace personnel is sought as appropriate. 2.3. ***An inspection report*** is completed in accordance with best practice and statutory obligations.
3. Advise on implementation of control measures at the workplace	3.1. Recommendations are made from findings of inspection report. 3.2. ***Relevant parties*** are consulted regarding compliance issues relating to statutory requirements. 3.3. Agreed control measures are implemented in conjunction with relevant ***workplace personnel***. 3.4. Effectiveness of control measures is monitored and reviewed.
4. Establish and review communications and educational programs	4.1. Effective strategies for communicating occupational health and safety policy and practice are determined in consultation with appropriate personnel. 4.2. ***Communication strategies*** and ***educational programs*** specific to the industry are established in accordance with statutory requirements and best practice. 4.3. The effectiveness of the communication and educational programs is reviewed.

Variables	Range
Specific risks	May include, but are not limited to: • Fall protection and access equipment • Cranes, hoists and lifting gear • Pressure equipment • Welding, cutting and gouging processes in the manufacturing industry in particular, oxy-acetylene, commonly used high risk equipment, etc. • Production equipment/machineries • Metal / steel construction • Protruding objects • Stacking and storing materials • exposure to Ultra Violet Light (UVL) • environmental conditions • electrical works
Legislative requirements for OHS	Must be adhered to in all planning and implementation stages, noting that: • OHS requirements are to be in accordance with Federal or regional legislation and regulations and may Include, but not limited to: ➢ Protective clothing and equipment ➢ Use of tools and equipment ➢ Workplace environment and safety ➢ Handling of materials ➢ Use of firefighting equipment ➢ Use of first aid equipment ➢ Hazard control and hazardous materials and substances • Personal protective equipment may include that prescribed under legislation, regulation and workplace policies and practices • Safe operating procedures may include but are not limited to: ➢ Recognizing and preventing hazards associated with the use of tools and equipment ➢ Trip hazards ➢ Underground services ➢ Surrounding structure and facilities ➢ Hazardous materials ➢ Other machines ➢ Working in proximity to others ➢ Workplace visitors/the public ➢ Working in confined spaces • Environmental requirements to cover water quality management must address waste management, storm-water protection and clean-up protection

	• Legislative requirements may require the development and use of site safety plans and safe work methods statements
An inspection report	May include, but are not limited to: • Prescribed self-assessment tools identified by a relevant regional authority (relevant legislation must be applied) • Check lists, hazard sheet • Company safety procedure forms
Relevant parties : 	May include, but are not limited to: • Designers • Manufacturers and importers • Suppliers of plant • Principal contractors • Employers • Self-employed persons/subcontractors • Workers • Persons in control of workplaces • Members of workplace safety committees
Workplace personnel	May include, but are not limited to: • Principal contractors • Employers • Self-employed persons/subcontractors • Workers • Persons in control of workplaces • Members of workplace safety committees
Communication strategies	May include, but are not limited to: • Verbal communications • Issued specific instructions and signage • Written communications including memos and emails
Educational programs	May include, but are not limited to: • General and workplace specific induction training - noting that occupational health and safety induction training provided must meet the requirements of the jurisdiction in which the work is undertaken • Other forms of specialist and targeted training

Evidence Guide	
Critical Aspects of Competence	A person must be able to demonstrate: • Ability to identify daily work requirements and allocate work appropriately • Ability to interpret financial documents in accordance with legal requirements
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Current workplace/Occupational Health and Safety (OHS) legislation and advisory standards • Manufacturing Workplace Advisory Standard • Manual Handling in the Metal Manufacturing Industry

	• Advisory Standard • Pollution Advisory Standards • Noise Advisory Standard • Application of industry contracts • Environmental hazards and related regulation • Other relevant manufacturing codes, standards and government regulations
Underpinning Skills	Demonstrate skill of: • Application of regulatory requirements, including safe work method statements and plans such as site safety plans • Appropriate literacy and numeracy skills • Communication skills • Initiative and investigation skills to be able to inspect the workplace and identify risks and hazards • Inspection skills • Interpretation and application skills • Interviewing skills • Maintaining of records and documents • Negotiation/conflict resolution skills • OHS auditing skills • Report writing skills • Research skills • Self-management skills to be able to monitor and evaluate the effectiveness of educational programs developed • Teamwork skills to ensure effective collaboration with relevant stakeholders • Technical skills in production processes relevant to the workplace • Technological skills to be able to effectively use office software and equipment
Resource Implications	Resource implications for assessment include: • Current copy of relevant federal/regional OHS legislation, Act/regulation and advisory standards for first aid • Samples of workplace incident data and incident reports • Other relevant codes, standards, government regulations • Office equipment, including calculators, photocopiers and telephone systems • Computers with appropriate software
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: Metal Manufacturing Management Level V	
Unit Title	**Undertake Value Analysis of Product Costs**
Unit Code	**IND MMM5 12 0217**
Unit Descriptor	This unit covers the knowledge and skills required by an employee who is required to analyse products and processes to determine the factors that most impact on meeting customer requirements. The analysis is in terms of cost factors and include options for improving cost efficiency. The unit also includes implementing identified changes that increase cost efficiency. The unit may be applied individually or in a team environment.

Elements	Performance Criteria
1. Analyse customer benefits and determine waste	1.1. Features/Benefits perceived by customer are determined in product 1.2. Cost components are analysed and those which deliver customer features/benefits and those which don't determined 1.3. ***Waste*** cost components are analysed 1.4. Alternative ways of reducing waste costs are determined 1.5. Actions which maximise customer benefits and minimise costs are selected
2. Analyse production performance variance	2.1. Required ***performance*** is analysed to meet customer ***pull*** 2.2. Actual ***cycle time*** and variability of cycle time are determined 2.3. Cause of waste in throughput is analysed 2.4. Costs are analysed and methods of reducing costs/waste determined 2.5. Actions required is taken to achieve cost/waste reduction/s

Variable	Range
Waste	Is any activity which does not contribute to customer benefit/features in the product. Within manufacturing, categories of waste include: • Excess production and early production • Delays • Movement and transport • Poor process design • Inventory • Inefficient performance of a process

	• Making defective items. Waste for this unit may include activities which do not yield any benefit to the organisation or any benefit to the organisations customers.
Performance	May be thought of as the rate of output of the plant compared to the rate required to meet demand.
Pull	Is the concept of producing to demand, rather than for stock or some forecast.
Cycle time	Is the normal time to complete an operation on a product.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills competence to: • Select a product/range of products to analyse and determine waste in terms of any cost which does not contribute directly to an identified customer benefit/feature and then proceed to determine and implement methods of reducing this waste. • Can consistently perform the unit as a whole, as defined by the elements, performance criteria, skills and knowledge.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Customer benefits from products • Performance and cycle times for products made • Major costs which are controllable (and how to control them) • Types of waste (MUDA) • Methods of reducing waste (MUDA) • Methods of reducing cycle time • Desirability of improving performance and methods of reducing cycle time
Underpinning Skills	Demonstrate skills in: • Calculation • Communication • Problem solving • Analysis • Numeracy • Literacy • Planning and organising
Resources Implication	The following resources must be provided: • On an appropriate, industrial plant/site • In a situation allowing the generation of evidence of the ability to respond to problems • By using a suitable simulation and/or a range of case studies/scenarios • Through a combination of these techniques.
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: Metal Manufacturing Management Level V	
Unit Title	**Practice Career Professionalism**
Unit Code	**IND MMM5 13 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes in promoting career growth and advancement.

Elements	Performance Criteria
1. Integrate personal objectives with organizational goals	1.1. Personal growth and work plans are pursued towards improving the qualifications set for the profession 1.2. Intra- and interpersonal relationships are maintained in the course of managing oneself based on performance ***evaluation*** 1.3. Commitment to the organization and its goal is demonstrated in the performance of duties
2. Set and meet work priorities	2.1. Competing demands are prioritized to achieve personal, team and organizational goals and objectives. 2.2. ***Resources*** are utilized efficiently and effectively to manage work priorities and commitments 2.3. Practices along economic use and maintenance of equipment and facilities are followed as per established procedures
3. Maintain professional growth and development	3.1. ***Trainings and career opportunities*** are identified and availed of based on job requirements 3.2. ***Recognitions*** are sought/received and demonstrated as proof of career advancement 3.3. ***Licenses and/or certifications*** relevant to job and caree are obtained and renewed

Variables	Range
Evaluation	May include, but are not limited to: • Performance Appraisal • Psychological Profile • Aptitude Tests
Resources	May include, but are not limited to: • Human • Financial • Technology includes: ➢ Hardware ➢ Software
Trainings and career opportunities	May include, but are not limited to: • Participation in training programs include: ➢ Technical, Supervisory, Managerial ➢ Continuing Education

	• Serving as Resource Persons in conferences and workshops
Recognitions	May include, but are not limited to: • Recommendations • Citations • Certificate of appreciations • Commendations • Awards and tangible and intangible rewards
Licenses and/or certifications	May include, but are not limited to: • NTQF Certificates (NC) • Competence Certificates (CC) • Support Level Licenses such as Professional Licenses

Evidence Guide	
Critical Aspects of Competence	Assessment requires evidence that the candidate: • Attained job targets within Key Result Areas (KRAS) • Maintained intra - and interpersonal relationship in the course of managing oneself based on performance evaluation • Completed trainings and career opportunities which are based on the requirements of the industries • Acquired and maintained licenses and/or certifications according to the requirement of the qualification
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Work values and ethics (Code of Conduct, Code of Ethics, etc.) • Company policies, company operations, procedures and standards • Fundamental rights at work including gender sensitivity • Personal hygiene practices
Underpinning Skills	Demonstrate skills of: • Appropriate practice of personal hygiene skills • Intra and Interpersonal skills • Communication skills
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: Metal Manufacturing Management Level V	
Unit Title	**Manage Project Quality**
Unit Code	**IND MMM5 13 0217**
Unit Descriptor	This unit specifies the outcomes required to manage quality within projects. It covers determining quality requirements, implementing quality assurance processes, and using review and evaluation to make quality improvements in current and future projects.

Elements	Performance Criteria
1. Determine quality requirements	1.1. ***Quality objectives***, standards and levels are determined, with input from stakeholders and guidance of a higher project authority, to establish the basis for quality outcomes and a ***quality management plan***. 1.2. Established ***quality management methods***, ***techniques and tools*** are selected and used to determine preferred mix of quality, capability, cost and time. 1.3. Quality criteria are identified, agreed with a higher project authority and communicated to stakeholders to ensure clarity of understanding and achievement of quality and overall project objectives. 1.4. Agreed quality requirements are included in the project plan and implemented as basis for performance measurement.
2. Implement quality assurance	2.1. Results of project activities and product performance are measured and documented throughout the project life cycle to determine compliance with agreed quality standards. 2.2. Causes of unsatisfactory results are identified, in consultation with the client, and appropriate actions are recommended to a higher project authority to enable continuous improvement in quality outcomes. 2.3. Inspections of quality processes and ***quality control*** results are conducted to determine compliance of quality standards to overall quality objectives. 2.4. A quality management system is maintained to enable effective recording and communication of quality issues and outcomes to a higher project authority and stakeholders.
3. Implement project quality improvements	3.1. Processes are reviewed and agreed changes implemented continually throughout the project life cycle to ensure continuous improvement to quality. 3.2. Project outcomes are reviewed against performance criteria to determine the effectiveness of quality management processes and procedures.

	3.3. Lessons learned and recommended ***improvements*** are identified, documented and passed to a higher project authority for application in future projects.

Variable	**Range**
Quality objectives	May include, but not limited to: • Requirements from the client and other stakeholders • Requirements from a higher project authority • Negotiated trade-offs between cost, schedule and performance • Those quality aspects which may impact on customer satisfaction
Quality management plan	May include, but not limited to: • Established processes • Authorizations and responsibilities for quality control • Quality assurance and continuous improvement
Quality management methods, techniques and tools	May include, but not limited to: • Brainstorming • Benchmarking • Charting processes • Ranking candidates • Defining control • Undertaking benefit/cost analysis • Processes that limit and/or indicate variation • Control charts • Flowcharts • Histograms • Pareto charts • Scatter gram and run charts
Quality control	May include, but not limited to: • Monitoring conformance with specifications • Recommending ways to eliminate causes of unsatisfactory • Performance of products or processes • Monitoring of regular inspections by internal or external agents
Improvements	May include, but not limited to: • Formal practices, such as total quality management or continuous improvement • Improvement by less formal processes which enhance both the product quality and processes of the project, for example client surveys to determine client satisfaction with project team performance

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • Lists of quality objectives, standards, levels and measurement criteria

	• Records of inspections, recommended rectification actions and quality outcomes • Management of quality management system and quality management plans • Application of quality control, quality assurance and continuous improvement processes • Records of quality reviews • Lists of lessons learned and recommended improvements • How quality requirements and outcomes were determined for projects • How quality tools were selected for use in projects • How team members were managed throughout projects with respect to quality within the project • How quality was managed throughout projects • How problems and issues with respect to quality and arising during projects were identified and addressed • How projects were reviewed with respect to quality management • How improvements to quality management of projects have been acted upon
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • The principles of project quality management and their application • Acceptance of responsibilities for project quality management • Use of quality management systems and standards • The place of quality management in the context of the project life cycle • Appropriate project quality management methodologies; and their capabilities, limitations, applicability and contribution to project outcomes • Attributes: ➢ Analytical ➢ Attention to detail ➢ Able to maintain an overview ➢ Communicative and positive leadership
Underpinning Skills	Demonstrate skills of: • Ability to relate to people from a range of social, cultural and ethnic backgrounds, and physical and mental abilities • Project and quality management • Planning and organizing • Communication and negotiation • Problem-solving • Leadership and personnel management • Monitoring and review skills

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: Metal Manufacturing Management Level V	
Unit Title	**Facilitate and Capitalize on Change and Innovation**
Unit Code	**IND MMM5 15 0217**
Unit Descriptor	This unit specifies the outcomes required to plan and manage the introduction and facilitation of change; particular emphasis is on the development of creative and flexible approaches, and on managing emerging opportunities and challenges.

Elements	Performance Criteria
1. Participate in planning the introduction and facilitation of change	1.1. Concept, nature importance and objective of change are understood. 1.2. Steps tools and approaches of changes are planned and made in consultation with ***appropriate stakeholders***. 1.3. The relationship among innovation, quality, change and cost is understood. 1.4. Environments that facilitate the expedition of change are understood. 1.5. ***Change resistance reducing techniques*** are identified and implemented.
2. Manage growth and transition of business	2.1. ***Needs for growth*** are identified. 2.2. ***Growth strategies*** are identified. 2.3. Selected growth strategies are implemented.
2 Develop creative and flexible approaches and solutions	3.1. Concepts, types and nature of problem are understood. 3.2. Variety of problem solving techniques and approaches are identified and analyzed to manage workplace issues. 3.3. ***Risks*** are identified and assessed, and action initiated to manage these to achieve a recognized benefit or advantage to the organization. 3.4. Workplace is managed in a way which promotes the development of innovative approaches and outcomes. 3.5. Creative and responsive approaches to resource management are used to improve productivity and services, and/or reduce costs.
3 Manage emerging challenges and opportunities	3.1. Future challenges and opportunities are identified in reference to global business situation 3.2. The role of technology and its value additions are explained. 3.3. Technology and innovation based system is introduced and implemented

	3.4. Individuals and teams are supported to respond effectively and efficiently to changes in the organization's goals, plans and priorities. 3.5. Coaching and mentoring are made to assist individuals and teams to develop competencies to handle change efficiently and effectively. 3.6. Opportunities are identified and taken as appropriate to make adjustments and respond to the changing needs of customers and the organization. 3.7. ***Information needs*** of individuals and teams are anticipated and facilitated as part of change implementation and management. 3.8. Recommendations are identified, evaluated and negotiated for improving the methods to manage change with appropriate individuals and groups.

Variables	**Range**
Appropriate stakeholders	May include, but not limited to: • Organization directors and other relevant managers • Teams and individual employees who are both directly and indirectly involved in the proposed change • Union/employee representatives or groups • OHS committees • Other people with specialist responsibilities • External stakeholders where appropriate - such as clients, suppliers, industry associations, regulatory and licensing agencies
Change resistance reducing techniques	May include, but not limited to: • Education and communication • Participation and involvement • Facilitation and support • Negotiation and agreement • Manipulation and cooptation • Explicit and implicit coercion
Needs for growth	May include, but not limited to: • Survival • Economies of scale • Expansion of market • Owners mandate • Technology • Government policy and Self sufficiency
Growth Strategies	May include, but not limited to: • Franchising • Outsourcing • Sub-contracting and Merging
Risks	May include financial and non-financial risks

Information needs	May include, but not limited to: • New and emerging workplace issues • Implications for current work roles and practices including training and development • Changes relative to workplace legislation, such as OHS, workplace data such as productivity, inputs/outputs and future projections • Planning documents • Reports • Market trend data • Scenario plans and customer/competitor data

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Participate in planning the introduction and facilitation of change • Manage growth and transition of business • Develop creative and flexible approaches and solutions • Manage emerging challenges and opportunities
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Relevant legislation from all levels of government that affects business operation, especially in regard to occupational health and safety and environmental issues, equal opportunity, industrial relations and anti-discrimination • Growth strategies • The principles and techniques involved in: ➢ Change and innovation management ➢ Development of strategies and procedures to implement and facilitate change and innovation • Use of risk management strategies: ➢ Identifying hazards, ➢ Assessing risks and implementing risk control measures ➢ Problem identification and resolution ➢ Leadership and mentoring techniques ➢ Management of quality customer service delivery ➢ Consultation and communication techniques ➢ Record keeping and management methods ➢ The sources of change and how they impact ➢ Factors which lead/cause resistance to change ➢ Approaches to managing workplace issues
Underpinning Skills	Demonstrate skills on: • Communication, planning, managing and team works
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: Metal Manufacturing Management Level V	
Unit Title	**Manage Continuous Improvement Process (Kaizen)**
Unit Code	**IND MMM5 16 0217**
Unit Descriptor	This unit describes the performance, outcomes, knowledge, attitude and skills required to sustain and develop an environment in which continuous improvement, innovation and learning are promoted, rewarded and managed.

Elements	Performance Criteria
1. Diagnose the current status.	1.1. ***Parameters*** used for study current situation are obtained. 1.2. Internal and external environment is analyzed. 1.3. Problems related to targeted environment is recognized and identified. 1.4. Problems regarding to current situation are analyzed. 1.5. Alternatives are generated. 1.6. Best alternatives are selected.
2. Design an effective continuous improvement process (kaizen).	2.1. The values, mission and goals of kaizen management system are clarified. 2.2. The ***kaizen management template*** and a visual management logo full of purpose and meaning are developed. 2.3. A clear action strategy (master and detailed plans) is defined. 2.4. The most effective and proven ***kaizen tools*** are chosen and applied. 2.5. A practical way is identified to involve all employees in ***Gemba activities*** (top, middle and bottom).
3. Develop change capability.	3. 1. Kaizen Promotion Team Structure is developed. 3. 2. The Kaizen Training Plan is defined and started. 3. 3. Supervisors' kaizen capability and habits are developed. 3. 4. Key people are developed in terms of ***individual leadership capability***.
4. Implement improved processes.	4.1. ***Sustainability/continuous improvement*** are promoted as an essential part of doing business. 4.2. Impacts of change and consequences are addressed for people, and transition plans implemented. 4.3. Objectives, time frames, measures and communication plans are ensured in place to manage implementation. 4.4. Contingency plans are implemented in the event of non-performance.

	4.5. Failure is followed-up by prompt investigation and analysis of causes. 4.6. Emerging challenges and opportunities are managed effectively. 4.7. Continuous improvement systems and processes are evaluated regularly. 4.8. Improvements are communicated to all relevant groups and individuals. 4.9. Opportunities are explored for further development of value stream improvement processes.
5. Establish direction and control.	5.1. A ***system audit tool*** is defined and implemented. 5.2. The kaizen management system is deployed across all company levels and functions. 5.3. Results are checked and corrections made. 5.4. ***Standard operating procedures*** are developed and maintained. 5.5. The recruit, training and evaluation systems are improved and ***HR practices*** compensated.

Variables	**Range**
Parameters	May include, but not limited to: • Working condition • Resources May Include, but not limited to: ➢ Human ➢ Material and Machine • Kaizen elements
Kaizen management template	May include, but not limited to: • Visual management board for: ➢ Displaying characteristic figures, data and graphics ➢ Depicting and controlling processes ➢ Identifying and marking sources of risks, setting and standards ➢ Displaying company's values and goals of kaizen
Kaizen tools	May include, but not limited to: • 5S (a visual workplace management) • 7 QC tools(Cause and Effect Diagram, Check Sheet , Pareto Diagram , Histogram, Scatter Diagram, Control Chart and Flow Chart) • Brainstorming • Basic Industrial Engineering (IE) tools such as time study, motion study, line balancing, work sampling • JIT (JUST IN TIME) principles • MUDA identification and elimination tools • Kanban • Poka-yoke and Takt- time

Gemba activities	May include, but not limited to: • Value-adding activities to satisfy the customer • Employee autonomous operations (participating in team to identify nonconformity, propose solutions and implement them autonomously)
Individual leadership capability	May include, but not limited to: • Personal and interpersonal skills • Courage • Honour and integrity • Energy and drive • Strategic skills • Operating and Organizational positioning skills
Sustainability/continuous improvement	May include, but not limited to: • Improvements made by following PDCA (Plan, Do, Check and Act) cycle for: ➢ Improvements in one's own work ➢ Saving in energy, material and other resources ➢ Improvements in the working environment ➢ Improvements in machines and processes ➢ Improvements in jigs and tools ➢ Improvement in office work ➢ Improvements in product quality ➢ Ideas for new products ➢ Customers services and customer relations
System audit tool	May include, but not limited to: • 5S audit • Patrol system • Kaizen board • 5M check lists and Key Performance Indicators (KPIs)
Standard operating procedure	May include, but not limited to: • Administrative standards for: ➢ Managing the business ➢ Administration ➢ Personnel Guidelines ➢ Job Descriptions ➢ Guidelines for preparing cost information • Operation standards for: ➢ Describing the way a job is done. ➢ Help realising Quality, cost, delivery. ➢ Addressing the need to satisfy customers. ➢ Using the process that's the best. ➢ Producing work in the most cost effective manner. ➢ Assuring total quality for the customer.
HR practices	May include, but not limited to: • Resources May Include, but not limited to: ➢ Recruit and retain high quality people with innovative skills and a good track, record in innovation • HR development is used for:

	➢ strategic capability and provide encouragement and facilities for enhancing innovating skills and enhancing the intellectual capital of the organization • Reward will: ➢ Provide financial incentives and rewards and recognition for successful innovation

Evidence Guide	
Critical Aspects of Assessment	Demonstrates skills and knowledge competencies to: • Establish policy and cross-functional goals for kaizen • Deploy and implement goals as directed through policy deployment and cross-functional management. • Realize goals through deployment and audits. • Build systems, procedures, and structures conducive to kaizen. • Use kaizen in functional capabilities. • Introduce Kaizen as a corporate strategy • Provide support and direction between allocating resources • Establish, maintain and upgrade standards. • Make employees conscious through training programs. • Assist employees develop skills and tools for problem solving.
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • Quality management and continuous improvement theories • Creativity/innovation theories/concepts • Competitive systems and practices tools, including: ➢ 5S ➢ JUST IN Time (JIT) ➢ Mistake proofing ➢ Process mapping ➢ Establishing customer pull ➢ Setting of KPIs/metrics ➢ SOP ➢ Kaizen elements/targets. ➢ Identification and elimination of waste/MUDA ➢ Continuous improvement processes including implementation, monitoring and evaluation strategies for a whole organization and its value stream ➢ Difference between breakthrough improvement and continuous improvement ➢ Organizational goals, processes and structure ➢ Approval processes within organization ➢ Methods of determining the impact of a change ➢ Customer perception of value ➢ Define, Measure, Analyze, Improve and Control (DMAIC) to sustain process

Underpinning Skills	Demonstrates Skills to: • Use leadership skills to foster a commitment to quality and openness to improvement. • Analyze training needs and implementing training programs • Prepare and maintain quality and audit documentation • Undertake self-directed problem solving and decision-making on issues of a broad and/or highly specialized nature and in highly varied and/or highly specialized contexts • Communicate at all levels in the organization and to audiences of different levels of literacy and numeracy • Analyze current state/situation of the organization. • Analyze individually and collectively the implementation of competitive systems and practices tools in the organization and determining strategies for improved implementation • Solve highly varied and highly specialized problems related to competitive systems and practices implementation and continuous improvement to root cause • Negotiate with stakeholders, where required, to obtain information required for implementation and refinement of continuous improvements, including management, unions, employees and members of the community. • Review relevant metrics, including all those measures which might be used to determine the performance of the improvement system, including: ➢ Key Performance Indicators (KPIs) for existing processes ➢ Quality statistics ➢ Delivery timing and quantity statistics ➢ Process/equipment reliability (‘uptime’)
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.

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