



SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

In accordance with regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Standards Generating Body (SGB) for

Secondary Agriculture

Registered by NSB 01, Agriculture and Nature Conservation, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web site at www.saqa.org.za. Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, Hatfield Forum, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the unit standards should reach SAQA at the address ***below and no later than 13 March 2004***. All correspondence should be marked **Standards Setting – SGB for Secondary Agriculture** and addressed to

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National Certificate in Sugar Manufacturing and Refining Technical Maintenance – NQF Level 3

Field: Agriculture and Nature Conservation

Sub-field: Secondary Agriculture

NQF level: 3

Credits: This qualification consists of 164 credits taken from 40 Fundamental, 103 Core and 21 Elective. At least 143 credits are at level 3.

Rationale for the qualification

The current emphasis in the industry is on multi-skilling as it is believed to enhance the employability of the individual. This qualification will enable the learner to acquire recognised competencies relevant to the various aspects of the Sugar Refining and Manufacturing industry.

The qualifying learner will operate in areas of activities such as routine maintenance of electrical and mechanical machinery in the sugar refining manufacturing processes. The learner will engage in activities such as the installation and repairs of basic electrical and mechanical machinery.

This is the second qualification in a series for learners who want to follow a career in the field of Sugar Industry Technical Maintenance. It also provides learners who have gained relevant experiences in the workplace with an opportunity to obtain credits through an RPL process.

The qualification also forms the basis for further learning in the field of Sugar Manufacturing Technical Maintenance where learners will engage in more complex maintenance and repair activities.

Because of the emphasis on multi-skilling across a wide cross-section of skills, the learner will be able to enter a broader spectrum of career paths and would be

employable in other sectors as well. Other sectors could include manufacturing and processing sectors.

The learner will have demonstrated an ability to make decisions and consider a range of options after completion of the following unit standards in three specified areas:

Fundamental Learning:

MATHS LITERACY AND NUMERACY

- Describe, apply, analyse and calculate shape and motion in 2-3 dimension space in different contexts (ID 9013)
- Demonstrate an understanding of the use of different numbers and number bases and measurement units & an awareness of error in the context of relevant calculations (ID 9010)
- Work with a wide range of patterns and basic functions and solve related problems. (ID 7457)
- Instrument Drawings
- Use mathematics to investigate & monitor the financial aspects of personal & business issues (ID12415)

COMMUNICATIONS

- Use communication skills to handle conflict in the workplace (ID 9533)
- Lead a team, plan, allocate and assess their work no. (ID 9527)
- Interpret and use information from texts (ID 8969)
- Write texts for a range of communicative contexts (ID 8970)
- Manage work time effectively (ID 9530)
- Show understanding of diversity in the workplace (ID 9531)

Core Learning:

MANUFACTURING

- Maintain conveyer system
- Maintain bearings in machines & equipment
- Maintain pumps
- Maintain direct drives
- Maintain indirect drives

- **FABRICATION**
- Form and shape sheet plate, pipe and structural sections using powered machinery
- Weld work pieces with oxyacetylene in all positions (ID 12480)
- **ELECTRICAL**
- Wire and commission industrial circuits. (ID 10266)
- Fault find, repair and maintain industrial electrical circuits (ID 10259)
- Maintain and repair three phase AC machines. (ID10262)
- Select install connect and commission three phase AC machines (ID 10264)

Elective Learning:

- Explain Sugar Cane Processing Value Chain
- Fault finding and repair temperature measuring equipment
- Fault finding and repair level measuring equipment
- Fault finding and repair flow measuring equipment
- Fault finding and repair pressure measuring equipment
- Maintain fluid power/pneumatic systems
- Operate and monitor a lathe to produce simple components
- Operate and monitor a milling machine to produce simple components
- Maintain dynamic seals in machines/equipment

Rules of Combination:

To obtain this qualification, all fundamental and core unit standards are compulsory. In addition, the learner must select and complete a minimum of 21 credits from the elective unit standards.

Access to the qualification

Proven competence against the qualification, "National Certificate in Sugar Industry Technical Maintenance; NQF level 2" or equivalent is assumed to be in place.

Purpose of the qualification

A learner assessed as competent against this qualification, will be able to fault find, dismantle and repair and maintain work in a **wide cross-section** of skills specific to the sub-field of Secondary Agriculture e.g. Sugar Manufacturing and Refining industry. The learner will obtain a formally recognised qualification on level 3 on the NQF in the Field of Agriculture and Nature Conservation.

The learner will also have a thorough understanding of the process of manufacturing and refining sugar. In addition they will have enhanced communication skills as it pertains to the individual. All of these will contribute to the operational efficiency of the Sugar Refining Factories.

In addition the learner will be well positioned to extend their learning and practice into other areas of manufacturing process, or to strive towards welding, electrical, instrumentation and manufacturing unit standards and practice at higher levels.

Learning assumed to be in place

It is assumed that a learner attempting this qualification will have competence against the qualification: "National Certificate in Sugar Industry Technical Maintenance; NQF level 2" or equivalent.

Exit level outcomes

Qualifying learners can:

Exit level outcome 1:

- Demonstrate an understanding of and an ability to fault find, dismantle, maintain, assemble and install a variety of electrical and instrument assemblies and make close tolerance adjustments to equipment and process, meeting output requirements and working safely with due care for fellow workers and the environment.

Associated Assessment Criteria:

- Conditioning of equipment and machinery is monitored
- Faults in equipment and machinery are diagnosed
- Equipment and machinery are maintained to required standards and overhauled at required intervals
- Dismantling sequence of assemblies meets specifications
- Assemblies and installations meet specifications
- Safe working practices are adhered to

Exit level outcome 2:

- Select appropriate procedures to solve familiar problems within engineering environment and operate within clearly defined contexts, with some scope for personal decision-making and responsibility.

Associated Assessment Criteria:

- Appropriate procedures are selected to solve problems in an efficient and effective manner
- Unfamiliar problems are accurately reported to appropriate personnel
- Can respond to questions and discuss issues related to familiar problems in mechanical engineering (fitting)

Exit level outcome 3:

- Communicate with peers, production personnel and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format.

Associated Assessment Criteria:

- Information is gathered from a range of sources and accurately summarised into a prescribed format.
- Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- Relationships with peers, production personnel and members of supervisory/management levels are established and functioning.

Exit level outcome 4:

- Demonstrate an understanding of options for further learning in this or a related fields of learning and preparation requirements for such learning.

Associated Assessment Criteria:

- Options are explained.
- Preparation requirements are explained.
- Learning plan is developed.

Criteria for internal and external assessors

Assessors need experience in the following areas:

- Interpersonal skills, subject matter and assessment.
- The assessor needs to be competent in the planning and conducting assessment of learning outcomes and design and develop assessments as described in the relevant unit standards. The subject matter experience must be well developed within the field of technical maintenance in the sugar manufacturing and refining industry.
- The subject matter experience of the assessor can be established by recognition of prior learning.
- Assessors need to be registered with the relevant ETQA.

Critical cross field outcomes

The following reflect the relevance of the critical cross-field outcomes applicable to this qualification. Examples where these critical cross-field outcomes apply in the unit standards, as well as the manner in which they are reflected.

Identifying and solving problems in which responses display that responsible decisions using critical and creative thinking have been made.

- Maintain Pumps.

Identifying and solving problems in which responses display that responsible decisions using critical and creative thinking have been made through recognising and responding to non-conforming parts.

Working effectively with others as a team.

- Maintain direct drives.

Working effectively with others as a team through interacting with colleagues and team members in order to acquire required consumables, lubricants and cleaning agents.

Organising and managing oneself and one's activities responsibly and effectively.

- Maintain indirect drives.

Organising and managing oneself and one's activities responsibly and effectively when applying correct procedures and techniques for performing indirect drive maintenance.

Communicating effectively using visual, mathematical and/or language skills in the modes of oral and/or written persuasion.

- Form and shape sheet, plate, pipe and structural sections using powered machinery.

Communicating effectively using visual, mathematical and/or language skills in the modes of oral and/or written persuasion when reporting on and recording information on work performed.

Collecting, analysing, organising and critically evaluating information.

- Maintain fluid/power pneumatic systems.

Collecting, analysing, organising and critically evaluating information when interpreting information off job instructions to maintain correct system.

Demonstrating an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.

- Maintain indirect drives.

Demonstrating an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation through understanding and explaining the purpose of indirect drive maintenance in the manufacturing process.

International comparability

This qualification is comparable to equivalent qualifications in Scotland and Ireland. In particular the Scottish qualification: "National Certificate/SVQ Foundation (Level 3) in Engineering, Fabrication and Welding" are based on the same general principles and skills outcomes.

Integrated Assessment Criteria:

Learners will produce evidence of the following:

- Verbal and written explanations of reasons for adhering to operational and work site procedures as well as statutory requirements, adhering to specific sequence of operations, identifying deviations, taking corrective actions and recording relevant data, and reporting deviations outside the jobholder's responsibility.
- Demonstrations of a range of operational actions relating to applying quality control and applying general safety in the workplace.
- Learners will demonstrate an understanding of the Sugar Manufacturing and Refining industry.
- Oral or written questioning regarding the reflexive competencies within the qualification:

If the identifying and solving of problems, team work, organising oneself, the using of applied science, the implication of actions and reactions in the world as a set of related systems are not clear from the observation, a method of oral questioning or a case study should be applied to determine the whole person development and integration of applied knowledge and skills.

- A portfolio of evidence is required to prove the practical, foundational and reflexive competencies of the learner, which may include production and quality statistics.
- Assessors and moderators should develop and conduct their own integrated assessment by making use of a range of formative and summative assessment methods. Assessors should assess and give credit for the evidence of learning that has already been acquired through formal, informal and non-formal learning and work experience.
- Unit standards in the qualification must be used to assess specific and critical cross-field outcomes. During integrated assessments the assessor should make use of formative and summative assessment methods and should assess combinations of practical, foundational and reflexive competencies.

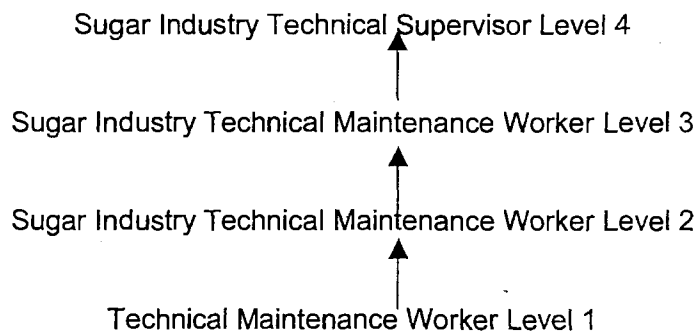
Recognition of Prior Learning

This qualification may be achieved in part or completely through the recognition of prior learning, which includes formal, informal and non-formal learning and work experience. The learner should be thoroughly briefed of the mechanism to be used and support and guidance should be provided. Care should be taken that the mechanism used provides the learner with an opportunity to demonstrate

competence and is not too onerous as to prevent learners from taking up the RP: option towards gaining a qualification.

Articulation Possibilities

The qualification has been designed and structured in such a way that it facilitates learner movement from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their context and structure top-up learning appropriately. This qualification forms a basis for entry into a wide cross section of industries in South Africa. This will be achieved through the multi-skilling of the learner.



Moderation Options

Anyone assessing a learner against these unit standards must be registered as an assessor with the relevant ETQA.

Any institution offering learning that will enable achievement of these unit standards or will assess these unit standards must be accredited as a provider with the relevant ETQA. Moderation of assessment will be overseen by the relevant ETQA according to the moderation guidelines in the relevant qualification and the agreed ETQA procedures.

Therefore anyone wishing to be assessed against these unit standards may apply to be assessed by any assessment agency, assessor or provider institution, which is accredited by the relevant ETQA.

QUALIFICATION MATRIX: NATIONAL CERTIFICATE: SUGAR MANUFACTURING AND REFINING TECHNICAL MAINTENANCE NQF LEVEL 3

FUNDAMENTAL		Level	Credits	CORE		Level	Credits	ELECTIVE		Level	Credits
MATHEMATICAL LITERACY AND NUMERACY				MANUFACTURING							
Describe apply, analyse and calculate shape and motion in 2-3 dimension space in different contents (ID 9013)	3	4		Maintain conveyer system	3	6		Explain Sugar Cane Processing Value Chain	4	2	
Demonstrate an understanding of the use of different numbers and number bases and measurement units & an awareness of error in the context of relevant calculations (ID 9010)	3	2		Maintain bearings in machines & equipment	3	8		Fault finding and repair temperature measuring equipment	3	5	
Work with a wide range of patterns and basic functions and solve related problems. (ID 7457)	3	3		Maintain pumps	3	24		Fault finding and repair level measuring equipment	3	6	
Instrument Drawings	3	3		Maintain direct drives	3	6		Fault finding and repair flow measuring equipment	3	8	
Use mathematics to investigate & monitor the financial aspects of personal & business issues (ID12415)	3	5		Maintain indirect drives	2	6		Fault finding and repair pressure measuring equipment	3	8	
COMMUNICATIONS				FABRICATION				Maintain fluid power/pneumatic systems		4	16
Use communication skills to handle conflict in the workplace (ID 9533)	3	3		Form and shape sheet plate, pipe and structural sections using powered machinery	3	15		Operate and monitor a lathe to produce simple components	2	12	
Lead a team, plan, allocate and assess their work no. (ID 9527)	3	4		Weld work pieces with oxyacetylene in all positions (ID 12480)	3	8		Operate and monitor a milling machine to produce simple components	2	12	
Interpret and use information from texts (ID 8969)	3	5		ELECTRICAL				Maintain dynamic seals in machines/equipment		3	8
Write texts for a range of communicative contexts (ID 8970)	3	5		Wire and commission industrial circuits. (ID 10266)	3	8					
Manage work time effectively (ID 9530)	3	3		Fault find, repair and maintain industrial electrical circuits (ID 10259)	3	8					
Show understanding of diversity in the workplace (ID 9531)	3	3		Maintain and repair three phase AC machines. (ID10262)	3	8					
				Select install connect and commission three phase AC machines (ID 10264)	3	6					
TOTAL		40		TOTAL		103		TOTAL		21	

TITLE: Maintain conveyor systems

LEVEL ON NQF: 3

CREDITS: 6

FIELD: Manufacturing, Engineering and Technology

SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Mechanical Engineering Fitting (NQF level 3) and related qualifications. Qualifying learners are able to identify a range of conveyor systems and their application and are able to inspect conveyor systems, determine faults, assess requirements for repair, and remove, replace and set up conveyor systems.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as part of a progression. It is one of a series of unit standards for machine and equipment maintenance in the engineering area.

The credits allocated to this unit standard assume that a learner has already learned to

- Maintain direct drives, bearings and brakes and clutches

SPECIFIC OUTCOMES

1. Plan and prepare for conveyor system maintenance

Range:

Conveyor systems may include belt-, chain-, pipe- and bucket conveyor

Planning and preparation includes breakdown scheduling, job cards, running inspection

2. Prepare site and equipment

Range:

Preparation includes ensuring system is safe

Making system safe includes isolation and applying protective equipment

Isolation includes electrical and mechanical energy (a loaded conveyor may have potential energy as well)

3. Inspect and assess conveyor system

Range:

Inspection includes components such as: pulleys, sprockets, links, flights, buckets, scrapers, idlers, skirting, liners, guides, chutes, bearing housings, drives

4. Maintain conveyor system

- Identify problems and take corrective action

Range:

Conveyor characteristics include usage and operating range / temperature, control of friction and interaction of moving surfaces

Problems include non-conforming components, belt specification, alignment and lubrication

5. Check conveyor system for compliance with operational requirements

Range:

Operational requirements include load capacity and training of belt, tension

Check includes alignment, belt specifications

6. Care for and store system maintenance tools and equipment

Range:

Tools and equipment include absorbent material, hand tools and cleaning equipment and fluids

7. Record information on work done

8. Discuss and explain incidents and problems related to conveyor system maintenance

9. Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

ASSESSMENT CRITERIA

Results achieved

1. Site and equipment are prepared for conveyor system maintenance
2. Conveyor system is maintained and restored to a safe and serviceable condition
3. Conveyor system is checked for compliance

Indicators

1. System is confirmed to be isolated
2. Conveyor system is inspected and non-conformances identified
3. Conveyor maintenance requirements are determined
4. System maintenance consumables, parts and / or components are selected, fitted and adjusted to meet operational requirements
5. Non-conforming consumables, damaged or sub-standard components and equipment are timeously identified and appropriate corrective action taken
6. Conveyor system records are completed and processed
7. Work is carried out in a safe manner in accordance with schedules and manufacturer specifications
8. Maintenance process cycle time meets workplace requirements
9. A clean and tidy work environment is maintained
10. No delays are caused as a result of poor planning for conveyor belt splicing process and identifying problems
11. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions covering:
 - Conveyor systems, belting types, characteristics
 - The maintenance process – sequence, procedures and techniques
 - Tools and equipment used
 - Quality awareness: implications of system maintenance that do not comply with operational requirements
 - Applicable conveyor system maintenance theory
 - Safety
 - Reporting and documentation requirements

2. Explain and discuss the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

My assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. My assessor will (at the very least) be accredited and have a technical qualification in this learning area.

I can be assessed in the language of my choice although if I have to report incidents or conditions to someone else, I will be assessed on my ability to report in the language commonly used in my working environment.

I will be assessed in the workplace but I can submit documents, projects, test results and assignments that were not produced in the workplace.

I can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

The learner should be able to work autonomously with minimal supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

Work is generally, but not exclusively, carried out in a team environment.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:
 - Conveyor system and components
 - Tools and equipment used in the conveyor system maintenance process
 - Quality terminology and concepts
2. Attributes, descriptions, characteristics & properties:
 - Typical conveyor system faults and defects
 - End users of conveyor system

3. Sensory cues:
 - Sensory cues (what I see, hear, smell, feel) utilised for identifying conveyor system related defects and non-conformances and the causes thereof

4. Purpose of:
 - Preparing site and equipment for maintenance process
 - Maintaining conveyor systems
 - Quality checks and procedures
 - Reporting problems

5. Processes, events, causes and effects, implications:
 - Implications of non-conformance
 - Causes and responses to common problems
 - Maintenance sequence and process
 - Implications and consequences of situations such as, e.g. using damaged or faulty tools equipment in the maintenance process, delaying reports about problems in work area

6. Procedures and techniques:
 - Identifying component defects
 - Maintaining conveyor system components
 - Conveyor belt splicing, training, aligning and tensioning
 - Preparing consumables, replacement components / parts for maintenance
 - Quality checks and procedures
 - Reporting procedures

7. Regulations, legislation, agreements, policies, standards:
 - Applicable safety, health and environmental protection legislation and standards
 - Applicable company policies and procedures

8. Theory: rules, principles, laws:
 - Applicable mechanical theory covering the maintenance of conveyor systems, e.g. tensions, tension ratios, torque, power, contact angles, pulley diameters, rev.minutes, applicable formulae

- Applicable mathematical concepts including diameters, ratios, formulae
9. Relationships, systems:
- The relationship of the conveyor system maintenance process to the production process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems
 - Recognise and respond to non-conforming components / parts
2. Work effectively with others as a member of a team
 - Interact with colleagues and team members in order to maintain conveyor system
3. Organise and manage my activities and myself
 - According to procedures, following regular, consistent methodical work patterns
 - Manage resources and my time
4. Collect, analyse, organise and critically evaluate information
 - Collect sensory and numeric information from the conveyor maintenance process
 - Classify the information and identify deviations from the norm
5. Communicate effectively
 - Record outputs and incidents
6. Use science and technology effectively and critically
 - Understand and explain mechanical theory relevant to the conveyor maintenance process
7. Demonstrate an understanding of the world as a set of related systems
 - Understand and explain the purpose of conveyor system maintenance to the production process
 - Justify my actions as appropriate

SUPPLEMENTARY INFORMATION

TITLE: Maintain fluid power / pneumatic systems

LEVEL ON NQF: 4

CREDITS: 16

FIELD: Manufacturing, Engineering and Technology

SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Engineering Fitting (NQF level 4) and related qualifications.

Qualifying learners can perform routine maintenance on a fluid power system to ensure operational integrity. They will understand the importance of maintenance in fluid power work and how it is achieved. This will include a basic knowledge of filtration, fluid conditioning techniques and the use of hand tools to maintain fluid power systems.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as part of a progression. It is one of a series of unit standards for maintaining and caring for equipment in the engineering skills area.

The credits allocated to this unit standard assume that a learner has already learned to maintain pipe systems.

SPECIFIC OUTCOMES

1. Plan and prepare for fluid power / pneumatic system maintenance

Range:

Plan and prepare includes obtaining documentation, interpreting engineering drawings, maintenance schedules and procedures and selecting appropriate tools and equipment

Making system safe includes isolation, depressurisation and using protective equipment

2. Prepare site and equipment for maintenance activity

Range:

Hazardous areas include confined spaces, fluid handling, explosion hazards and ventilation

3. Maintain fluid power / pneumatic system

- Identify problems and take corrective action

Range:

Maintain includes identifying defects, repairing and or replacing components, checking of filters, breathers, traps, drains, lubricators, lubricants, tubing and piping

Hydraulic system components include fixed displacement pumps, fluid conditioning equipment, pressure relief valves, directional control valves, flow control valves, actuators, fluid conductors and gauges

Pneumatic system components include supply manifolds, air preparation equipment, pressure regulators, flow control valves, directional control valves, actuators and gauges

Problems include severe leaks, strange noises and reversed connections

4. Apply quality checks on completed work

Range:

Quality checks include commissioning system and inspecting for leaks, lubricant and coolant levels and also inspecting for accuracy, neatness and compliance with design fundamentals

5. Conduct post-repair activities

Range:

Post repair activities include cleaning up, processing documentation and reporting system maintenance activities to responsible persons

6. Care for and store system maintenance tools and equipment

Range:

Tools and equipment include containers, blanking flanges, plates and plugs, absorbent material, hand tools and cleaning equipment and fluids

7. Report on system condition

8. Discuss and explain incidents and problems related to system maintenance

9. Work safely with due care for self, fellow workers, equipment, materials and the environment

ASSESSMENT CRITERIA

Results achieved

1. System is ensured to be safe
2. System non-conformances are identified
3. System maintenance activities are performed
4. Plant care checks are undertaken
5. System is returned to service

Indicators

1. Applicable system for closing down is identified and confirmed
2. Fluid power system is isolated in accordance with manufacturer specifications
3. System is depressurised following manufacturer specifications
4. Provisions for working in a hazardous location are implemented to regulatory and worksite procedures
5. Applicable consumables, lubricants and cleaning agents are acquired in the required quantities
6. Components requiring service are identified and removed without damage to the system or component
7. Removed components are serviced using appropriate tools and equipment
8. Maintained components are replaced without damage to the component or system
9. Completion of maintenance / service is confirmed and verified
10. Fluids and levels in the system are checked to meet operational requirements
11. Accumulator pre-charge pressures are visually checked
12. Visual plant care inspection is carried out to manufacturer specifications
13. System is timeously re-energised
14. System performance is confirmed to meet operational requirements
15. Work is carried out in a safe manner in accordance with schedules and manufacturer specifications
16. Problems are timeously reported to appropriate personnel
17. A clean and tidy work environment is maintained

18. No delays are caused as a result of poor planning for performing routine maintenance and identifying problems
19. System and equipment condition report is accurate and clear
20. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions related to:
 - Fluid power and pneumatic systems
 - The selection of components and why
 - Consequences of non-conforming design
 - The importance of continuously checking the quality of work against the requirements of the job
 - The health, safety and environmental issues pertaining to making the system safe
 - Consequences of not checking system fluid levels
 - What tools and equipment to use and why
 - What consumables, lubricants and cleaning agents are used and why
 - Consequences of not topping up low lubricant levels
 - The importance of caring for and storing system maintenance tools and equipment
 - Difference(s) between hydrostatic and hydrodynamics
 - Function and importance of filters in the system
 - Purpose and importance of pressure relief valves (hydraulics) and pressure regulators (pneumatics)
 - The importance of using components with suitable pressure rating
2. Discuss the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

The assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. The assessor will (at the very least) be accredited and have a technical qualification in this learning area.

The learner can be assessed in the language of his/her choice although s/he has to report incidents or conditions to someone else. The learner will be assessed on his/her ability to report in the language commonly used in his/her working environment.

The learner will be assessed in the workplace but s/he can submit documents, projects, test results and assignments that were not produced in the workplace.

The learner can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

The learner should be able to work autonomously with minimal supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:
 - Consumables, lubricants, cleaning agents used
 - Equipment on which maintenance is performed
 - Hydraulic and pneumatic components
 - Systems
2. Attributes, descriptions, characteristics & properties:
 - System defects
 - End users of system design
 - Pressure hazards
 - Working fluids
3. Sensory cues:
 - Sensory cues (what I see, hear, smell, feel) utilised for identifying problems during system maintenance
4. Purpose of:
 - Making system safe
 - Performing system maintenance
 - Following maintenance schedules
 - Designing simple systems
 - Interpreting instruction

- Adhering to system design principles
- Adhering to safety, health and environmental legislation
- Pressure relief valves or pressure regulators
- Processes, events, causes and effects, implications:
- Implications of overlooking system maintenance
- Acquiring required lubricants, consumables and cleaning agents
- Performing system maintenance
- System design
- Implications of overlooking design fundamentals
- Implications of not adhering to safety, health and environmental legislation
- Making fluid power system safe

5. Procedures and techniques:

- Making system safe
- Re-energising system
- Servicing components
- Performing visual inspections
- Checking lubricant levels
- Topping up lubricants
- For minimising wastage
- Identifying problems
- Identify and select required components
- Designing system
- Reporting on system operation
- Handling and storage of components
- Isolation technique and procedure
- Ensuring it is safe to re-energise system
- Re-energising system
- Checking lubricant levels

6. Regulations, legislation, agreements, policies, standards:

- Applicable safety, health and environmental protection legislation
- Applicable company policies and procedures

7. Theory: rules, principles, laws:

- Hazards of pressure
- Fluid power
- Working fluids
- Applicable quality assurance fundamentals
- Pressure

8. Relationships, systems:

- Relationship between maintained system and the production process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems

- Related to the maintenance of system

2. Work effectively with others as a member of a team

- Interact with colleagues and team members in order to acquire required consumables, lubricants and cleaning agents

3. Organise and manage my activities and myself

- Apply the correct procedures and techniques for performing system maintenance
- Manage resources and my time

4. Collect, analyse, organise and critically evaluate information

- Interpret information off job instructions to maintain correct system
- Make decisions based on that information

5. Communicate effectively

- Report condition of system

6. Demonstrate an understanding of the world as a set of related systems

- Understand and explain the purpose of system maintenance to the production process
- Justify my actions as appropriate

SUPPLEMENTARY INFORMATION

TITLE: Maintain bearings in machines and equipment

LEVEL ON NQF: 3

CREDITS: 8

FIELD: Manufacturing, Engineering and Technology

SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Engineering Fitting (NQF level 3) and related qualifications.

Qualifying learners are able to identify a range of bearings and their application in machinery and equipment and are able to check bearings, determine faults, assess requirements for repair, and remove and replace bearings.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as part of a progression. It is one of a series of unit standards for machine installation in the engineering area.

The credits allocated to this unit standard assume that a learner has already learned to perform routine maintenance.

SPECIFIC OUTCOMES

1. Plan and prepare for bearing replacement

Range:

Planning and preparation includes obtaining documentation, interpreting engineering drawings, maintenance schedules and procedures and selecting appropriate tools and equipment.

Bearings include anti-friction and plain types

Anti-friction bearings include ball (single and double thrust) and roller (needle, spherical, taper) types

Plain bearings include plain, wrapped, flanged, split and thrust types in brass, bronze, white metal, phosphor bronze, aluminium and synthetics

2. Prepare site and equipment for bearing replacement

Range:

Site and equipment preparation includes isolating equipment electrically, mechanically and from other energy sources

3. Check bearings in situ

Range:

Bearing loading includes axial, radial and combinations of these

In situ check includes inspection while machine is in operation and static

Application includes loading: axial, radial and a combination of these

4. Remove and inspect bearings

- Identify problems and take corrective action

Range:

Inspection includes security, alignment, sign of wear / deterioration and leakage

Cleaning includes ultrasonic cleaning

Bearing removal / installation includes, cold, warm dismantling, heater and mechanical means

Problems include incorrect internal clearance, excessive noise, alignment, vibration, undue movement, high temperatures, lack of or excessive lubrication

5. Install bearings to machines and equipment

Range:

Installation includes clearance, alignment, pre-loading and lubrication. For white metal bearings installation includes scraping surfaces to obtain required fit

6. Check installation for compliance with operational requirements

Range:

Operational requirements include using of bearing catalogue, radial internal clearance, load, speed and temperature and appropriate lubrication

7. Record information on work done
8. Discuss and explain incidents and problems related to bearing replacement
9. Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

ASSESSMENT CRITERIA

Results achieved

1. Site and equipment are prepared for bearing replacement
2. Bearing serviceability is determined in situ
3. Bearings are removed and inspected
4. Bearings are installed

Indicators

1. Bearing application and the forces involved are determined for the bearing types
2. Bearings are identified from manufacturer markings and parts publications
3. Bearing assemblies are inspected for conformance to manufacturer's specifications
4. Bearing lubrication and cooling devices and / or system are checked for operation against manufacturer specifications
5. Bearing diagnostic equipment is used to establish bearing condition
6. Machine / equipment records are completed in accordance with work site procedures
7. Bearings and / or assemblies are removed
8. Bearings and / or assemblies are stripped and parts are identified
9. Bearings and associated parts are cleaned
10. Bearings and associated parts are inspected for damage and measured for wear in accordance with manufacturer specifications
11. Bearings and associated parts not conforming to specifications are replaced
12. Bearing parts and fitting equipment are selected to match bearing type and fitting procedure
13. Bearing and / or assemblies are installed in accordance with manufacturer specifications
14. Locking devices, if any, are secured in accordance with machine requirements
15. Replacement parts and / or assemblies are functionally checked and / or tested

16. Work is carried out in a safe manner in accordance with schedules and manufacturer specifications
17. Bearing replacement process cycle time meets workplace requirements
18. A clean and tidy work environment is maintained
19. No delays are caused as a result of poor planning for replacing bearings and identifying problems
20. Bearing replacement report is accurate and clear
21. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions covering:
 - Bearing types
 - The maintenance process – sequence, procedures and techniques
 - Mechanical aids used
 - Quality awareness: implications of bearing replacements that do not comply with operational requirements
 - Applicable replacement theory
 - Safety
 - Lubrication
 - Internal clearances
 - Reporting and documentation requirements
2. Explain and discuss the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

My assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. My assessor will (at the very least) be accredited and have a technical qualification in this learning area.

I can be assessed in the language of my choice although if I have to report incidents or conditions to someone else, I will be assessed on my ability to report in the language commonly used in my working environment.

I will be assessed in the workplace but I can submit documents, projects, test results and assignments that were not produced in the workplace.

It can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

The learner should be able to work autonomously with minimal supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

Work is generally, but not exclusively, carried out in a team environment.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:
 - Bearings and bearing assemblies
 - Tools and equipment used in replacement process
 - Engineering drawings
 - Quality terminology and concepts
2. Attributes, descriptions, characteristics & properties:
 - Bearing types
 - Typical bearing defects
 - End users of machine / equipment
3. Sensory cues:
 - Sensory cues (what I see, hear, smell, feel) utilised for identifying bearing related problems
4. Purpose of:
 - Preparing site and equipment for replacement
 - Pre-loading bearings
 - Testing bearing assemblies
 - Range of bearing installation / removal methods
 - Lubrication

- Quality checks and procedures
 - Reporting problems
 - Bearing clearances
5. Processes, events, causes and effects, implications:
- Implications of non-conformance
 - Causes and responses to common problems
 - Replacement sequence and process
 - Implications and consequences of situations such as, e.g. poor quality, using damaged or faulty tools equipment, using poor quality, damaged or faulty equipment in the replacement process, delaying reports about problems in work area
 - Too much or too little lubrication
6. Procedures and techniques:
- Identifying bearings and bearing assemblies
 - Removing bearings and bearing assemblies
 - Preparing bearing assembly for installation
 - Bearing pre-loading techniques
 - Bearing installation techniques
 - Applying locking devices
 - Quality checks and procedures
 - Reporting procedures
7. Regulations, legislation, agreements, policies, standards:
- Applicable safety, health and environmental protection legislation and standards
 - Applicable company policies and procedures
8. Theory: rules, principles, laws:
- Applicable mechanical theory covering the replacement of bearings and bearing assemblies
 - Applicable mathematical concepts
 - Applicable fits and tolerance principles
9. Relationships, systems:
- The relationship of the replaced bearing / bearing assembly to the production process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems
 - Recognise and respond to non-conforming bearings
2. Work effectively with others as a member of a team
 - Interact with colleagues and team members in order to replace bearings
3. Organise and manage my activities and myself
 - According to procedures, following regular, consistent methodical work patterns
 - Manage resources and my time
4. Collect, analyse, organise and critically evaluate information
 - Collect sensory and numeric information from the bearing replacement process
 - Classify the information and identify deviations from the norm
5. Communicate effectively
 - Record outputs and incidents
6. Use science and technology effectively and critically
 - Understand and explain mechanical theory relevant to the bearing replacement process
7. Demonstrate an understanding of the world as a set of related systems
 - Understand and explain the purpose of replacing bearings to the production process
 - Justify my actions as appropriate

SUPPLEMENTARY INFORMATION

TITLE: Operate and monitor a lathe to produce simple components

LEVEL ON NQF: 2
CREDITS: 12
FIELD: Manufacturing, Engineering and Technology
SUB FIELD: Manufacturing and Assembly

PURPOSE:

The skills, values and knowledge reflected in this unit standard are required by people in the field of engineering machining.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Engineering Machining (NQF level 2) and related qualifications.

Qualifying learners can carry out lathe operations to produce simple components using a range of standard machine tools to predetermined specifications.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as the start of a progression. It is one of a series of unit standards for turning in the engineering machining skills area.

The credits allocated to this unit standard assume that a learner has already learned to:

- Select, use and care for engineering hand tools
- Select, use and care for engineering power tools
- Select, use and care for engineering measuring equipment
- Read, interpret and produce basic engineering drawings
- Maintain a safe and productive work area

SPECIFIC OUTCOMES

1. Prepare for work activity
 - Interpret drawings and job instructions and determine sequence of operations
 - Prepare machine for operation including lubrication, routine maintenance and pre-operational checks
 - Check materials and tools required are at workstation

2. Set lathe

- Select and install required accessories and work holding fixtures
- Select, prepare and install required tools
- Select and set cutting speeds and feeds

3. Perform turning operations

- Start up and shut down lathe
- Monitor lathe while in operation, making adjustments to speeds and feeds where required
- Remove machined component on completion of turning process
- Clean lathe

Range:

The range of *turning operations* covered in this standard *must* include facing off, drilling, parallel cutting, recessing, parting off, radius cutting, boring, tapping, knurling, chamfering and reaming

4. Apply quality checks on machined component

- Select and prepare appropriate measuring equipment
- Measure component
- Report non-conforming components to appropriate personnel
- Store machined component

5. Recognise and report problems, changes and/or malfunctions while operating

6. Record information on work done

- Document conformance of component to specifications

7. Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

Range:

Safe working practices include the use of guards, correct coolants and appropriate personal protective equipment

ASSESSMENT CRITERIA

Results achieved

1. Machined component meets specifications

Indicators

1. Machine is set up to accept work safely and without damage to work piece or machine
2. Accessories and work holding fixtures selected are appropriate to task
3. Tools selected are appropriate to material type and safety requirements
4. Cutting speeds and feeds selected are appropriate to machine, material and tooling
5. Materials are prepared and correctly marked out if required
6. Machine operating instructions and worksite procedures are adhered to
7. Adjustments during turning process are made quickly and appropriately
8. Safe working practices are adhered to
9. Components are measured and conformance to specification documented
10. Problems are reported timeously to appropriate personnel
11. A clean and tidy work environment is maintained

Understanding confirmed

1. Respond to 'what if' and 'why' questions covering:
 - The process of turning – procedures and techniques
 - Machine functions, parts, accessories and set up
 - Component specifications and defects
 - Applicable theory
 - Materials
 - Safety
 - Reporting and documentation requirements
2. Explain the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

My assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. My assessor will (at the very least) be accredited and have a technical qualification in this learning area.

I can be assessed in the language of my choice although if I have to report incidents or conditions to someone else, I will be assessed on my ability to report in the language commonly used in my working environment.

I will be assessed in the workplace but I can submit documents, projects, test results and assignments that were not produced in the workplace.

I can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The scope and level of this unit standard is determined by the ranges as indicated under the specific outcomes.

All work is performed under supervision.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:

- Main parts and functions of lathe
- Machine controls
- Accessories
- Work holding fixtures
- Tools (geometry and composition)
- Measuring equipment
- Personal protective equipment
- Common defects

2. Attributes, descriptions, characteristics & properties:

- Material types
- Coolant types

3. Purpose of:
 - Turning
 - Material preparation
 - Safety checks

4. Processes, events, causes and effects, implications:
 - Implications of selecting inappropriate accessories, work holding fixtures, tools, cutting speeds and feeds
 - Implications of incorrect installation of accessories, work holding fixtures and tools
 - Implications of component not meeting specifications, e.g. poor finishes, uneven surface textures, incorrect size
 - Implications and consequences of situations such as, e.g. damaged or faulty equipment, allowing faulty processes to continue, delaying reports about changing conditions

5. Procedures and techniques:
 - Set up procedures for lathe
 - Turning operations and procedures covered by this unit standard
 - Measuring procedures
 - Machine cleaning procedures
 - Machine safety procedures
 - Recording and reporting procedures

6. Regulations, legislation, agreements, policies, standards:
 - Applicable safety, health and environmental protection legislation and standards

7. Theory: rules, principles, laws:
 - Applicable basic machining theory covering speeds and feeds, material properties and the underlying principles of turning
 - Applicable mathematical concepts including geometry, trigonometry and algebra
 - Applicable underlying scientific concepts

8. Relationships, systems:
 - The relationship of the drawing to the machined component

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems
 - Recognise problems while machining components and respond appropriately
2. Organise and manage myself and my activities
 - Plan sequence of operations based on job requirements and set up machine appropriately
3. Collect, analyse, organise and critically evaluate information
 - Collect sensory and numeric information from the process and the machined component
 - Classify the information and identify deviations from the norm
4. Communicate effectively
 - Record outputs, incidents, measurements
 - Report incidents and conditions
 - Respond to questions or requests for more details
5. Use science and technology effectively and critically
 - Understand and explain machining theory and mathematical and scientific concepts underpinning the machining operation
6. Demonstrate an understanding of the world as a set of related systems
 - The relationship of the drawing to the final machined component
 - The manufacturing purpose of the machined component

SUPPLEMENTARY INFORMATION

TITLE: Maintain pumps

LEVEL ON NQF: 3
CREDITS: 24
FIELD: Manufacturing, Engineering and Technology
SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Mechanical Engineering Fitting (NQF level 3) and related qualifications. Qualifying learners are able to identify a range of pumps and their application and are able to inspect pumps, determine faults, assess requirements for repair, and remove, replace and bleed pumps in order to ensure operational integrity of the equipment.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as part of a progression. It is one of a series of unit standards for machine and equipment maintenance in the engineering area.

The credits allocated to this unit standard assume that a learner has already learned to perform routine maintenance.

SPECIFIC OUTCOMES

1. Plan and prepare for pump maintenance

Range:

Planning and preparation includes obtaining documentation and selecting appropriate tools, reading and interpreting engineering drawings and task instructions, identification of the appropriate pump as per task instruction, obtaining appropriate maintenance schedules, manufacturer's specifications and worksite procedures

2. Prepare site and equipment

Range:

Preparation includes ensuring system is safe

Making system safe includes isolation, depressurisation and applying protective equipment

Isolation includes electrical and mechanical energy

Equipment preparation includes decontamination of equipment

3. Inspect and assess pump condition

- Identify problems and take corrective action

Range:

Problems include non-conforming components, low pressure, excessive heat, vibration and non-conforming pump priming

4. Maintain pump

Range:

Pumps include positive displacement and centrifugal types

Positive displacement pumps include gear, rotary and reciprocating pumps

Centrifugal types include single and multi-stage centrifugal pumps

Maintenance includes inspection for damage and wear, removal, shaft run out repair and fitment of pump components and assemblies

Inspection includes measuring of components to verify compliance with manufacturer's specifications

Damage includes signs and evidence of cavitation

Consumables include mechanical seals, static seals and gaskets

5. Check pump for compliance with operational requirements

Range:

Check includes visual inspection and performing associated tests

Operational requirements include flow and pressure

Characteristics include usage and operating specifications

6. Care for and store system maintenance tools and equipment

Range:

Tools and equipment include absorbent material, hand tools and cleaning equipment and fluids

7. Record information on work done

8. Discuss and explain incidents and problems related to pump maintenance
9. Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

ASSESSMENT CRITERIA

Results achieved

1. Site and equipment are prepared for pump maintenance
2. Pump is maintained to specifications
3. Pump is checked for compliance with operational requirements
4. Pump condition is recorded and reported

Indicators

1. System is confirmed to be isolated
2. Pump is inspected and non-conformances identified
3. Pump maintenance requirements are determined
4. System maintenance consumables, parts and / or components are selected, fitted and adjusted to meet operational requirements and manufacturer's specifications
5. Maintained pump is checked for conformance with manufacturer specifications
6. Non-conforming consumables, damaged or sub-standard components and equipment are timeously identified and appropriate corrective action taken
7. Pump records are completed and processed
8. Work is carried out in a safe manner in accordance with schedules and manufacturer specifications
9. Maintenance process cycle time meets workplace requirements
10. A clean and tidy work environment is maintained
11. No delays are caused as a result of poor planning for pump maintenance process and identifying problems
12. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions covering:
 - Pumps and their characteristics

- The maintenance process – sequence, procedures and techniques
 - Tools and equipment used
 - Quality awareness: implications of system maintenance that do not comply with operational requirements
 - Applicable pump maintenance theory
 - Priming procedures
 - Safety
 - Reporting and documentation requirements
2. Explain and discuss the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

The assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. The assessor will (at the very least) be accredited and have a technical qualification in this learning area.

The learner can be assessed in the language of his/her choice although s/he has to report incidents or conditions to someone else. The learner will be assessed on his/her ability to report in the language commonly used in his/her working environment.

The learner will be assessed in the workplace but s/he can submit documents, projects, test results and assignments that were not produced in the workplace.

The learner can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

The learner should be able to work autonomously with minimal supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

Work is generally, but not exclusively, carried out in a team environment.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:
 - Pump and components
 - Tools and equipment used in the pump maintenance process
 - Quality terminology and concepts

2. Attributes, descriptions, characteristics & properties:
 - Typical pump faults and defects
 - End users of pump

3. Sensory cues:
 - Sensory cues (what I see, hear, smell, feel) utilised for identifying pump related defects and non-conformances and the causes thereof

4. Purpose of:
 - Preparing site and equipment for maintenance process
 - Maintaining pumps
 - Quality checks and procedures
 - Reporting problems
 - Priming pumps
 - Starting pump systems in specific sequence
 - Pump decontamination
 - Pressure testing

5. Processes, events, causes and effects, implications:
 - Implications of non-conformance
 - Causes and responses to common problems
 - Maintenance sequence and process
 - Causes of cavitation

- Implications and consequences of situations such as, e.g. using poor quality, damaged or faulty equipment in the maintenance process, delaying reports about problems in work area

6. Procedures and techniques:

- Identifying component defects
- Maintaining pump components
- Pump priming
- Starting up
- Draining and purging
- Decontamination
- Preparing consumables, replacement components / parts for maintenance
- Pressure testing
- Quality checks and procedures
- Reporting procedures

7. Regulations, legislation, agreements, policies, standards:

- Applicable safety, health and environmental protection legislation and standards
- Applicable company policies and procedures

8. Theory: rules, principles, laws:

- Applicable mechanical theory covering the maintenance of pumps, e.g. pressure, flow rate and area in a system
- Applicable mathematical concepts

9. Relationships, systems:

- The relationship of the pump maintenance process to the production process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems

- Recognise and respond to non-conforming components / parts

2. Work effectively with others as a member of a team

- Interact with colleagues and team members in order to maintain pump

3. Organise and manage my activities and myself
 - According to procedures, following regular, consistent methodical work patterns
 - Manage resources and my time

4. Collect, analyse, organise and critically evaluate information
 - Collect sensory and numeric information from the pump maintenance process
 - Classify the information and identify deviations from the norm

5. Communicate effectively
 - Record outputs and incidents

6. Use science and technology effectively and critically
 - Understand and explain mechanical theory relevant to the pump maintenance process

7. Demonstrate an understanding of the world as a set of related systems
 - Understand and explain the purpose of pump maintenance to the production process
 - Justify my actions as appropriate

SUPPLEMENTARY INFORMATION

TITLE: Maintain indirect drives

LEVEL ON NQF: 2
CREDITS: 6
FIELD: Manufacturing, Engineering and Technology
SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Mechanical Engineering Fitting (NQF level 2) and related qualifications.

Qualifying learners can perform maintenance on indirect drives to ensure operational integrity.

They will understand the importance of maintenance of indirect drives and how it is achieved. This will include a basic knowledge of drive systems, repairing indirect drive components, alignment of the drive and the use of tools and equipment to maintain indirect drives.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as the start of a progression. It is one of a series of unit standards for maintaining and caring for equipment in the engineering skills area.

The credits allocated to this unit standard assume that a learner has already learned to perform routine maintenance.

SPECIFIC OUTCOMES

1. Plan and prepare for indirect drive maintenance

Range:

Plan and prepare includes reading and interpreting task instruction

Preparing includes ensuring system is safe

Making system safe includes isolation and applying protective equipment

Isolation includes electrical and mechanical

2. Prepare site and equipment for indirect drive maintenance

3. Maintain indirect drive

- Identify problems and take corrective action

Range:

Maintain includes identify, inspect, remove and replace components

Indirect drives include belt and chain drives

Components include pulleys, sprockets, belts, chains and tensioners

Problems include lack of tension, belt or chain whipping, tension, misalignment, worn pulleys and sprockets, worn belts and chains, wear, damage and defective components

4. Align indirect drives

Range:

Drive alignment tools include taper and feeler gauge, straight edge and belt tension

5. Apply quality checks on completed work

Range:

Quality checks include tension setting / adjustment, horizontal / vertical alignment, alignment and tension

6. Conduct post-maintenance activities

Range:

Post maintenance activities include cleaning up, processing documentation and reporting maintenance activities to responsible persons

Documentation includes inspection registers and maintenance schedules

7. Care for and store indirect drive maintenance tools and equipment

Range:

Tools and equipment include absorbent material, hand tools and cleaning equipment and fluids

8. Explain and discuss incidents and problems related to indirect drive maintenance

9. Work safely with due care for self, fellow workers, equipment, materials and the environment

Range:

Hazardous areas include moving or rotating machinery or components

ASSESSMENT CRITERIA

Results achieved

1. System is made safe before starting intended task
2. Indirect drive maintenance activities are carried out and drive is operational
3. Documents and reports are complete Predictions are formulated

Indicators

1. Applicable indirect drive is identified for shutting down and confirmed
2. Appropriate indirect drive is isolated in accordance with worksite procedures
3. Provisions for working in a hazardous location are implemented to regulatory and worksite procedures
4. Working principles of components are accurately explained
5. Applicable consumables, lubricants and cleaning agents are acquired in the required quantities
6. Components requiring service are identified and removed without damage to the rest of the drive system
7. Removed components are serviced using appropriate tools and equipment
8. Maintained components are replaced without damage to the component or drive system
9. Indirect drive alignment is within manufacturer specified tolerance
10. Completion of maintenance / service is confirmed and verified
11. Visual indirect drive inspection is carried out to manufacturer specifications
12. Drive tension is confirmed in accordance with worksite procedures
13. Protective guards and systems are in place and functional
14. Indirect drive performance is confirmed to meet operational requirements
15. Maintenance is carried out in a safe manner in accordance with schedules and manufacturer specifications
16. No delays are caused as a result of poor planning for conducting inspections and identifying non-conformances
17. Problems are timeously reported to appropriate personnel
18. Work environment is clean, tidy and safe
19. Indirect drive and equipment condition report is accurate, clear and timeously processed
20. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions related to:
 - The basic principle and maintenance of indirect drives
 - The basic principle of fault finding and repair of indirect drives
 - Reasons for protective guards and systems
 - The implications of not following safe working procedures
 - Indirect drives lubrication techniques
 - The selection of components and why
 - The importance of continuously checking the quality of work against the requirements of the job
 - The health, safety and environmental issues pertaining to indirect drive maintenance
 - What tools and equipment to use and why
 - Steps to take to limit waste
 - What consumables, lubricants and cleaning agents are used and why
 - The importance of caring for and storing indirect drive maintenance tools and equipment
 - The reasons for proper storage techniques
 - The implications of not following safe working procedures
2. Explain the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

The assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. The assessor will (at the very least) be accredited and have a technical qualification in this learning area.

The learner can be assessed in the language of his/her choice although s/he has to report incidents or conditions to someone else. The learner will be assessed on his/her ability to report in the language commonly used in his/her working environment.

The learner will be assessed in the workplace but s/he can submit documents, projects, test results and assignments that were not produced in the workplace.

The learner can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

All work is performed under supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:
 - Consumables, lubricants, cleaning agents used
 - Equipment on which maintenance is performed
 - Typical indirect drive non-conformances
 - Associated tools and equipment
 - Indirect drives and components
 - Task instruction

2. Attributes, descriptions, characteristics & properties:
 - End users of indirect drive
 - Thickness and hardness of materials
 - Associated non-conformances / faults
 - Characteristics of indirect drives

3. Sensory cues:
 - Sensory cues (what I see, hear, smell, feel) utilised for identifying problems during indirect drive maintenance

4. Purpose of:
 - Individual components in the indirect drive system
 - Making drive system safe
 - Performing indirect drive system maintenance
 - Following maintenance schedules
 - Interpreting instructions

- Adhering to indirect drive system maintenance principles
 - Following safety, health and environmental procedures
 - Adhering to safety, health and environmental legislation
 - Signing off the task instruction
 - Reporting non-conformances, incidents and problems
 - Indirect drives
 - Reporting non-conformances, incidents and problems
5. Processes, events, causes and effects, implications:
- Acquiring required lubricants, consumables and cleaning agents
 - Performing indirect drive maintenance
 - Implications of not adhering to safety, health and environmental legislation
 - Making indirect drive safe
 - Causes and responses to common problems
 - Implications of non-conformance
 - Implications and consequences of situations such as e.g. poor quality, damaged or faulty components
6. Procedures and techniques:
- Making indirect drive safe
 - Maintaining components
 - Performing visual inspections
 - Drive tensioning procedure
 - For minimising wastage
 - Identifying problems
 - Identify and select required components
 - Reporting on indirect drive operation
 - Handling and storage of components
 - Isolation technique and procedure
 - Posture during hand tool usage
 - Hand tool grip
 - Applying pressure
 - Communication procedures
 - Applicable recording and reporting procedures

- Applicable safe working procedures
 - Applicable quality assurance procedures
 - Removing and replacing defective components such as sprockets or pulleys
 - Indirect drive fault finding
 - Recording and reporting procedures
 - Indirect drive alignment procedures
 - Fastener tensioning methods and procedures
7. Regulations, legislation, agreements, policies, standards:
- Applicable safety, health and environmental protection legislation
 - Applicable company policies and procedures
8. Theory: rules, principles, laws:
- Equipment operating principles
 - Equipment working principles
 - Equipment maintenance fundamentals
 - Associated engineering principles
 - Applicable quality assurance fundamentals
 - Force and torque
 - Applying pressure
 - Component inspection and fault finding
 - Belt, chain stretch
 - Indirect drive alignment and methods of alignment
 - Tensioning and methods of tensioning
9. Relationships, systems:
- Relationship between the maintained system and the manufacturing process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems
 - Related to the maintenance of an indirect drive
2. Work effectively with others as a member of a team

- Interact with colleagues and team members in order to acquire required consumables, lubricants and cleaning agents
3. Organise and manage my activities and myself
 - Apply the correct procedures and techniques for performing indirect drive maintenance
 - Manage resources and my time
 4. Collect, analyse, organise and critically evaluate information
 - Interpret information off job instructions to maintain correct indirect drive
 - Make decisions based on that information
 5. Communicate effectively
 - Report condition of indirect drive
 6. Demonstrate an understanding of the world as a set of related systems
 - Understand and explain the purpose of indirect drive maintenance in the manufacturing process
 - Justify my actions as appropriate

SUPPLEMENTARY INFORMATION

TITLE: Maintain direct drives

LEVEL ON NQF: 3

CREDITS: 6

FIELD: Manufacturing, Engineering and Technology

SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Engineering Fitting (NQF level 3) and related qualifications.

Qualifying learners can perform routine maintenance on direct drives to ensure operational integrity. This will include monitoring, repairing and alignment of direct drives. They will understand the importance of maintaining direct drives and how this is achieved.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as part of a progression. It is one of a series of unit standards for maintaining and caring for equipment in the engineering skills area.

The credits allocated to this unit standard assume that a learner has already learned to maintain indirect drives.

SPECIFIC OUTCOMES

1. Plan and prepare for direct drive maintenance

Range:

Plan and prepare includes reading and interpreting engineering drawings and task instructions

Preparing includes ensuring system is safe

Making system safe includes isolation and applying protective equipment

Isolation includes electrical and mechanical

2. Prepare site and equipment for direct drive maintenance

3. Maintain direct drive

- Identify problems and take corrective action

Range:

Maintain includes identifying, inspect, removing and replacing drive components, keys and locking devices

Direct drives include couplings and fluid drive types

Problems include noise, non-power transmission, vibration, low fluid levels, lubrication and excessive wear and damage

4. Align direct drives

Range:

Drive alignment tools include dial gauges / dial test indicators (DTI) and taper gauges

Determine rock, shaft or coupling hub run-out, shim thickness and size meets specifications

5. Apply quality checks on completed work

Range:

Quality checks include inspection for leaks, lubricant and coolant levels

Operational requirements include drive, no vibration and the fitting of safety guards

6. Conduct post-maintenance activities

Range:

Post maintenance activities include cleaning up, processing documentation and reporting maintenance activities to responsible persons

Documentation includes inspection registers and maintenance schedules

7. Care for and store direct drive maintenance tools and equipment

Range:

Tools and equipment include absorbent material, hand tools and cleaning equipment and fluids

8. Report on system condition

9. Discuss and explain incidents and problems related to direct drive maintenance

10. Work safely with due care for self, fellow workers, equipment, materials and the environment

Range:

Hazardous areas include confined spaces, fluid handling, explosion hazards and revolving machinery

ASSESSMENT CRITERIA

Results achieved

1. System is made safe before starting intended task
2. Site and equipment are prepared for installation
3. Direct drive maintenance activities are carried out and drive is operational and meets specifications

Indicators

1. Applicable direct drive is identified for shutting down and confirmed
2. Appropriate direct drive is isolated in accordance with worksite procedures
3. Provisions for working in a hazardous location are implemented to regulatory and worksite procedures
4. Working principles of components are accurately explained
5. Applicable consumables, lubricants and cleaning agents are acquired in the required quantities
6. Components requiring service are identified and removed without damage to the rest of the drive system
7. Removed components are serviced / lubricated using appropriate tools and equipment
8. Maintained components are replaced without damage to the component or drive system
9. Direct drive gap, axial and radial alignment is within manufacturer specified tolerance
10. Completion of maintenance / service is confirmed and verified
11. Visual direct drive inspection is carried out to manufacturer specifications
12. Protective guards and systems are in place and functional
13. Direct drive performance is confirmed to meet operational requirements
14. Maintenance is carried out in a safe manner in accordance with schedules and manufacturer specifications

15. No delays are caused as a result of poor planning for performing maintenance and identifying problems
16. Maintenance activities meet with customer requirements / specifications
17. Problems are timeously reported to appropriate personnel
18. Work environment is clean, tidy and safe
19. Direct drive and equipment condition report is accurate, clear and timeously processed
20. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions related to:
 - Direct drives and their characteristics
 - Consumables, lubricants and cleaning agents
 - Consequences of not topping up low lubricant levels
 - Operational requirements of different drives
 - Tools and equipment used
 - Steps to take to limit waste
 - Checking the quality of work against the requirements of the job
 - Caring for and storing maintenance tools and equipment
 - Protective guards
 - Installation of taper-lock bushes
 - Importance of fits and tolerances
2. Explain and discuss the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

My assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. My assessor will (at the very least) be accredited and have a technical qualification in this learning area.

I can be assessed in the language of my choice although if I have to report incidents or conditions to someone else, I will be assessed on my ability to report in the language commonly used in my working environment.

I will be assessed in the workplace but I can submit documents, projects, test results and assignments that were not produced in the workplace.

It can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

All work is performed under supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:

- Consumables, lubricants, cleaning agents used
- Types of couplings
- Equipment on which maintenance is performed
- Direct drives and drive assemblies
- Tools and equipment used in direct drive maintenance process
- Engineering drawings
- Quality terminology and concepts

2. Attributes, descriptions, characteristics & properties:

- Typical defects and their remedies
- Properties of drive lubricants
- Characteristics of drive types

3. Sensory cues:

- Sensory cues (what I see, hear, smell, feel) utilised for identifying problems during direct drive maintenance

4. Purpose of:

- Performing assembly maintenance
- Following maintenance schedules
- Direct drives
- Fitting safety guards

-
- Taperlocks and keys
 - Safety checks
 - Reporting non-conformances and problems
5. Processes, events, causes and effects, implications:
- Implications of overlooking direct drive non-conformances
 - Acquiring required lubricants, consumables and cleaning agents
 - Performing direct drive maintenance
 - Incorrect fluid levels
 - Implications of applying heat to remove / replace direct drives
 - Implications of poor alignment results
 - Causes and responses to common problems
 - Replacement sequence and process
 - Implications and consequences of situations such as, e.g. poor quality, using damaged or faulty tools equipment, using poor quality, damaged or faulty equipment in the replacement process, delaying reports about problems in work area
6. Procedures and techniques:
- Making direct drive safe
 - Checking that direct drive is safe
 - Maintaining components
 - Performing visual inspections
 - Performing routine maintenance
 - For minimising wastage
 - Identifying problems
 - Identify and select required components
 - Reporting on direct drive operation
 - Handling and storage of components
 - Removing and installing direct drives
 - Isolation technique and procedure
 - Posture during hand tool usage
 - Hand tool grip
 - Applying pressure
 - Communication procedures

- Applicable recording and reporting procedures
 - Applicable safe working procedures
 - Applicable quality assurance procedures
 - Removing and replacing defective components
 - Direct drive fault finding
 - Recording and reporting procedures
 - Direct drive alignment procedures
7. Regulations, legislation, agreements, policies, standards:
- Applicable safety, health and environmental protection legislation
 - Applicable company policies and procedures
8. Theory: rules, principles, laws:
- Equipment maintenance fundamentals
 - Associated engineering principles
 - Applicable fits and tolerances
 - Applicable quality assurance fundamentals
 - Force and torque
 - Applying pressure
 - Component inspection and fault finding
 - Direct drive alignment and methods of alignment
9. Relationships, systems:
- Relationship between the maintained direct drive and the production process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems
 - Related to the maintenance of a direct drive
2. Work effectively with others as a member of a team
 - Interact with colleagues and team members in order to acquire required consumables, lubricants and cleaning agents
3. Organise and manage my activities and myself

- Apply the correct procedures and techniques for performing direct drive maintenance
 - Manage resources and my time
4. Collect, analyse, organise and critically evaluate information
 - Interpret information off job instructions to maintain correct direct drive
 - Make decisions based on that information
 5. Communicate effectively
 - Report condition of direct drive
 6. Demonstrate an understanding of the world as a set of related systems
 - Understand and explain the purpose of direct drive maintenance to the production process
 - Justify my actions as appropriate

SUPPLEMENTARY INFORMATION

TITLE: Maintain direct drives

LEVEL ON NQF: 3

CREDITS: 6

FIELD: Manufacturing, Engineering and Technology

SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Engineering Fitting (NQF level 3) and related qualifications.

Qualifying learners can perform routine maintenance on direct drives to ensure operational integrity. This will include monitoring, repairing and alignment of direct drives. They will understand the importance of maintaining direct drives and how this is achieved.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as part of a progression. It is one of a series of unit standards for maintaining and caring for equipment in the engineering skills area.

The credits allocated to this unit standard assume that a learner has already learned to maintain indirect drives.

SPECIFIC OUTCOMES

1. Plan and prepare for direct drive maintenance

Range:

Plan and prepare includes reading and interpreting engineering drawings and task instructions

Preparing includes ensuring system is safe

Making system safe includes isolation and applying protective equipment

Isolation includes electrical and mechanical

2. Prepare site and equipment for direct drive maintenance

3. Maintain direct drive

- Identify problems and take corrective action

Range:

Maintain includes identifying, inspect, removing and replacing drive components, keys and locking devices

Direct drives include couplings and fluid drive types

Problems include noise, non-power transmission, vibration, low fluid levels, lubrication and excessive wear and damage

4. Align direct drives

Range:

Drive alignment tools include dial gauges / dial test indicators (DTI) and taper gauges

Determine rock, shaft or coupling hub run-out, shim thickness and size meets specifications

5. Apply quality checks on completed work

Range:

Quality checks include inspection for leaks, lubricant and coolant levels

Operational requirements include drive, no vibration and the fitting of safety guards

6. Conduct post-maintenance activities

Range:

Post maintenance activities include cleaning up, processing documentation and reporting maintenance activities to responsible persons

Documentation includes inspection registers and maintenance schedules

7. Care for and store direct drive maintenance tools and equipment

Range:

Tools and equipment include absorbent material, hand tools and cleaning equipment and fluids

8. Report on system condition

9. Discuss and explain incidents and problems related to direct drive maintenance

10. Work safely with due care for self, fellow workers, equipment, materials and the environment

Range:

Hazardous areas include confined spaces, fluid handling, explosion hazards and revolving machinery

ASSESSMENT CRITERIA

Results achieved

1. System is made safe before starting intended task
2. Site and equipment are prepared for installation
3. Direct drive maintenance activities are carried out and drive is operational and meets specifications

Indicators

1. Applicable direct drive is identified for shutting down and confirmed
2. Appropriate direct drive is isolated in accordance with worksite procedures
3. Provisions for working in a hazardous location are implemented to regulatory and worksite procedures
4. Working principles of components are accurately explained
5. Applicable consumables, lubricants and cleaning agents are acquired in the required quantities
6. Components requiring service are identified and removed without damage to the rest of the drive system
7. Removed components are serviced / lubricated using appropriate tools and equipment
8. Maintained components are replaced without damage to the component or drive system
9. Direct drive gap, axial and radial alignment is within manufacturer specified tolerance
10. Completion of maintenance / service is confirmed and verified
11. Visual direct drive inspection is carried out to manufacturer specifications
12. Protective guards and systems are in place and functional
13. Direct drive performance is confirmed to meet operational requirements
14. Maintenance is carried out in a safe manner in accordance with schedules and manufacturer specifications

15. No delays are caused as a result of poor planning for performing maintenance and identifying problems
16. Maintenance activities meet with customer requirements / specifications
17. Problems are timeously reported to appropriate personnel
18. Work environment is clean, tidy and safe
19. Direct drive and equipment condition report is accurate, clear and timeously processed
20. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions related to:
 - Direct drives and their characteristics
 - Consumables, lubricants and cleaning agents
 - Consequences of not topping up low lubricant levels
 - Operational requirements of different drives
 - Tools and equipment used
 - Steps to take to limit waste
 - Checking the quality of work against the requirements of the job
 - Caring for and storing maintenance tools and equipment
 - Protective guards
 - Installation of taper-lock bushes
 - Importance of fits and tolerances
2. Explain and discuss the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

My assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. My assessor will (at the very least) be accredited and have a technical qualification in this learning area.

I can be assessed in the language of my choice although if I have to report incidents or conditions to someone else, I will be assessed on my ability to report in the language commonly used in my working environment.

I will be assessed in the workplace but I can submit documents, projects, test results and assignments that were not produced in the workplace.

It can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

All work is performed under supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

NOTES:**Essential Embedded Knowledge**

1. Names & functions of:
 - Consumables, lubricants, cleaning agents used
 - Types of couplings
 - Equipment on which maintenance is performed
 - Direct drives and drive assemblies
 - Tools and equipment used in direct drive maintenance process
 - Engineering drawings
 - Quality terminology and concepts

2. Attributes, descriptions, characteristics & properties:
 - Typical defects and their remedies
 - Properties of drive lubricants
 - Characteristics of drive types

3. Sensory cues:
 - Sensory cues (what I see, hear, smell, feel) utilised for identifying problems during direct drive maintenance

4. Purpose of:
 - Performing assembly maintenance
 - Following maintenance schedules
 - Direct drives
 - Fitting safety guards

- Taperlocks and keys
 - Safety checks
 - Reporting non-conformances and problems
5. Processes, events, causes and effects, implications:
- Implications of overlooking direct drive non-conformances
 - Acquiring required lubricants, consumables and cleaning agents
 - Performing direct drive maintenance
 - Incorrect fluid levels
 - Implications of applying heat to remove / replace direct drives
 - Implications of poor alignment results
 - Causes and responses to common problems
 - Replacement sequence and process
 - Implications and consequences of situations such as, e.g. poor quality, using damaged or faulty tools equipment, using poor quality, damaged or faulty equipment in the replacement process, delaying reports about problems in work area
6. Procedures and techniques:
- Making direct drive safe
 - Checking that direct drive is safe
 - Maintaining components
 - Performing visual inspections
 - Performing routine maintenance
 - For minimising wastage
 - Identifying problems
 - Identify and select required components
 - Reporting on direct drive operation
 - Handling and storage of components
 - Removing and installing direct drives
 - Isolation technique and procedure
 - Posture during hand tool usage
 - Hand tool grip
 - Applying pressure
 - Communication procedures

- Applicable recording and reporting procedures
- Applicable safe working procedures
- Applicable quality assurance procedures
- Removing and replacing defective components
- Direct drive fault finding
- Recording and reporting procedures
- Direct drive alignment procedures

7. Regulations, legislation, agreements, policies, standards:

- Applicable safety, health and environmental protection legislation
- Applicable company policies and procedures

8. Theory: rules, principles, laws:

- Equipment maintenance fundamentals
- Associated engineering principles
- Applicable fits and tolerances
- Applicable quality assurance fundamentals
- Force and torque
- Applying pressure
- Component inspection and fault finding
- Direct drive alignment and methods of alignment

9. Relationships, systems:

- Relationship between the maintained direct drive and the production process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems

- Related to the maintenance of a direct drive

2. Work effectively with others as a member of a team

- Interact with colleagues and team members in order to acquire required consumables, lubricants and cleaning agents

3. Organise and manage my activities and myself

- Apply the correct procedures and techniques for performing direct drive maintenance
 - Manage resources and my time
4. Collect, analyse, organise and critically evaluate information
- Interpret information off job instructions to maintain correct direct drive
 - Make decisions based on that information
5. Communicate effectively
- Report condition of direct drive
6. Demonstrate an understanding of the world as a set of related systems
- Understand and explain the purpose of direct drive maintenance to the production process
 - Justify my actions as appropriate

SUPPLEMENTARY INFORMATION

TITLE: Maintain dynamic seals in machines and / or equipment

LEVEL ON NQF: 3
CREDITS: 3
FIELD: Manufacturing, Engineering and Technology
SUB FIELD: Manufacturing and Assembly

PURPOSE:

Learners in the field of engineering require the skills, values and knowledge reflected in this unit standard.

The learning outcomes in this unit standard also contribute to the exit level outcomes required for the National Certificate in Engineering Fitting (NQF level 3) and related qualifications.

Qualifying learners are able to identify types of dynamic seals, select for specific use, install and test dynamic seals used in machines and equipment.

LEARNING ASSUMED TO BE IN PLACE:

This unit standard has been designed as part of a progression. It is one of a series of unit standards for machine maintenance in the engineering area.

The credits allocated to this unit standard assume that a learner has already learned to:

- Maintain static seals and bearings in machines and equipment.

SPECIFIC OUTCOMES

1. Plan and prepare for seal replacement

Range:

Planning and preparation includes obtaining documentation, interpreting engineering drawings, maintenance schedules and procedures and selecting appropriate tools and equipment.

2. Prepare site and equipment for seal replacement

Range:

Preparation includes ensuring system is safe

Making system safe includes isolation, depressurisation and using protective equipment

Isolation includes electrical and mechanical energy

Equipment preparation includes decontamination of equipment

3. Maintain dynamic seals

- Identify problems and take corrective action

Range:

Seal types include balanced and unbalanced mechanical seals

Maintenance includes checking / measuring shaft run-out, shaft float, sharp edges, shaft finish, stuffing box sealing surfaces and condition of studs

Maintenance includes seal setting where applicable

Problems include vibration, low cooling / sealing fluid volumes, excessive wear, leaks and overheating

4. Check equipment for compliance with operational requirements

Range:

Operational requirements include no leaks and adequate sealing / cooling medium

5. Care for and store system maintenance tools and equipment

Range:

Tools and equipment include absorbent material, hand tools and cleaning equipment and fluids

6. Record information on work done

7. Discuss and explain incidents and problems related to replacing dynamic seals

8. Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

ASSESSMENT CRITERIA

Results achieved

1. Site and equipment are prepared for installation
2. Dynamic seal is maintained
3. Installation site is restored to a safe and serviceable condition
4. Appropriate personal protective equipment is worn and used

Indicators

1. System is confirmed to be isolated
2. System is depressurised
3. Seal types are accurately identified and seal assembly inspected according to manufacturer specifications
4. Appropriate tools and correct replacement method is determined relevant to seal assembly
5. Seal assemblies are correctly removed from machine / equipment and component parts inspected for conformance with manufacturer specifications
6. Appropriate seals and replacement parts required are selected and obtained
7. Seal and seal assemblies are prepared for installation in accordance with manufacturer requirements
8. Equipment is prepared and inspected for installation
9. Seals are handled and installed with due care
10. Seals and seal assemblies are correctly fitted to machines and / or equipment
11. Seal assemblies are tested for conformance with specifications
12. Appropriate lubrication is applied where necessary to manufacturer specifications
13. No leaks visible or overheating experienced
14. Work is carried out in a safe manner in accordance with schedules and manufacturer specifications
15. Maintenance process cycle time meets workplace requirements
16. A clean and tidy work environment is maintained
17. No delays are caused as a result of poor planning for replacing seals and identifying problems
18. Seal replacement report is accurate and clear
19. Applicable health, safety and environmental procedures are adhered to

Understanding confirmed

1. Respond to 'what if' and 'why' questions covering:
 - Dynamic seals and their characteristics
 - The installation process – sequence, procedures and techniques
 - Mechanical aids used
 - Quality awareness: implications of dynamic seal replacements that do not comply with operational requirements

- Applicable dynamic seal theory
 - Safety
 - Reporting and documentation requirements
 - Handling and care of dynamic seals
 - Costs regarding seals and seal replacement
 - Use of sealing medium
 - Purpose of cooling medium (where applied)
 - Purpose of decontaminating equipment
2. Explain and discuss the implications of not adhering to the sequence of activities and operations as described in the specific outcomes and making decisions inappropriate to the task

ACCREDITATION AND MODERATION:

My assessment will be governed by the policies and guidelines of the MERSETA Education and Training Quality Assuror who has jurisdiction over this field of learning. My assessor will (at the very least) be accredited and have a technical qualification in this learning area.

I can be assessed in the language of my choice although if I have to report incidents or conditions to someone else, I will be assessed on my ability to report in the language commonly used in my working environment.

I will be assessed in the workplace but I can submit documents, projects, test results and assignments that were not produced in the workplace.

I can be assessed against this unit standard to obtain credits or as part of an integrated assessment for a qualification.

RANGE STATEMENT:

The ranges as indicated under the specific outcomes determine the scope and level of this unit standard.

Work is generally, but not exclusively, carried out in a team environment.

All work is performed under supervision and according to worksite and manufacturer specifications and occupational safety, health and environmental legislation.

NOTES:

Essential Embedded Knowledge

1. Names & functions of:
 - Dynamic seals and seal assemblies
 - Tools and equipment used in replacement and fitting process
 - Engineering drawings
 - Quality terminology and concepts

2. Attributes, descriptions, characteristics & properties:
 - End users of machine / equipment
 - Typical dynamic seal defects
 - Properties of sealing face material and their application

3. Sensory cues:
 - Sensory cues (what I see, hear, smell, feel) utilised for identifying dynamic seal related problems

4. Purpose of:
 - Preparing site and equipment for maintenance
 - Testing seal assemblies
 - Quality checks and procedures
 - Reporting problems
 - Cooling medium
 - Sealing medium
 - Ensuring system is safe

5. Processes, events, causes and effects, implications:
 - Implications of non-conformance
 - Causes and responses to common problems
 - Replacement sequence and process
 - Implications and consequences of situations such as, e.g. using poor quality, damaged or faulty equipment in the maintenance process, delaying reports about problems in work area
 - Cost implication of dynamic seal abuse

6. Procedures and techniques:
 - Identifying seals and seal assemblies
 - Removing seal / seal assembly
 - Preparing seal assembly for installation
 - Seal installation techniques
 - Quality checks and procedures
 - Reporting procedures
 - Dynamic seal handling and installation

7. Regulations, legislation, agreements, policies, standards:
 - Applicable safety, health and environmental protection legislation and standards
 - Applicable company policies and procedures

8. Theory: rules, principles, laws:
 - Applicable mechanical theory relating to dynamic seals and their assemblies, e.g. pressure, friction, heat, properties of polymers
 - Applicable mathematical concepts

9. Relationships, systems:
 - The relationship of the maintained seal to the production process

Critical Cross-Field Education & Training Outcomes

1. Identify and solve problems
 - Recognise and respond to non-conforming dynamic seals

2. Work effectively with others as a member of a team
 - Interact with colleagues and team members in order to replace dynamic seals

3. Organise and manage my activities and myself
 - According to procedures, following regular, consistent methodical work patterns
 - Manage resources and my time

4. Collect, analyse, organise and critically evaluate information

- Collect sensory and numeric information from the dynamic seal replacement process
 - Classify the information and identify deviations from the norm
5. Communicate effectively
- Record outputs and incidents
6. Use science and technology effectively and critically
- Understand and explain mechanical theory relevant to the dynamic seal replacement process
7. Demonstrate an understanding of the world as a set of related systems
- Understand and explain the purpose of replacing dynamic seals to the production process
 - Justify my actions as appropriate

SUPPLEMENTARY INFORMATION