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REPUBLIC OF SOUTH AFRICA



NATIONAL OCCUPATIONAL CURRICULUM  
CONTENT FOR APPRENTICES OF THE 21<sup>st</sup>  
CENTURY  
(NOCC-A21)

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## Millwright

**CURRICULUM CODE: 671202000**  
**SAQA ID: 97585**

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# INTRODUCTION

## Overview

The NOCC-A21 for Millwright comprises of four training years and is constructed in a way which will result in apprentices spending **58%** their time in the workplace and **42%** of their time at the skills development provider over a training period of 4 years.

Years	Skills Development Provider (SDP) Time in working days <sup>1</sup>	Workplace Time in working days
Year 1	144 (62%)	88 (38%)
Year 2	101 (44%)	129 (56%)
Year 3	87 (38%)	143 (62%)
Year 4	58 (25%)	172 (75%)
Total Training Time	388	532
<b>Total percentage split</b>	<b>58%</b>	<b>42%</b>

As stipulated above, apprentices in **Year 1** still spend a significant amount of their time at the training provider (**62%**) in order to gain the important foundations in the trade. The time spent at the training provider then reduces considerably over the remaining three years (**Year 2: 44%**, **Year 3: 38%** and **Year 4: 25%**) in order to ensure as much productive time in the workplace as possible.

The entire set-up of NOCC-A21 is work-driven and practical, and thus conceptualised around real life work situations in the relevant trade. The NOCC-A21 is made up of broad **learning areas**, which are then sub-divided into smaller **work situations**.

**Learning areas (LA)** are overarching themes of learning derived from a common work area e.g. 'Perform work activities on drives and gear boxes'. Each learning area is made up of a number of work situations.

**Work situations (WS)** are the next smaller unit of learning, i.e. the work-related situations that an apprentice would typically find him/herself in. For example, 'Perform routine maintenance, fault finding, repair and alignment on gearboxes'. Work situations are the underlying work activities that will help the apprentice to develop the required proficiency of the learning area.

Both learning areas and work situations are included in a **NOCC-A21 Profile**, which demonstrates the learning, which needs to be covered over the course of the training programme. Please see the NOCC-A21 profile for your specific trade on the next page

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<sup>1</sup> A working day is calculated as being 8 hours. Total maximum working days per year are assumed to be 230 days.

## Millwright NOCC-A21 Profile

Learning areas		Work situations					
<b>A</b>	<b>Practice the occupation and behave responsibly and professionally in the workplace</b>	<b>A1</b> Receive an induction and orientation to the occupation & the training programme (incl. Apprentice contracts)  (Fitter & Turner / Mechanical Fitter A1)	<b>A2</b> Behave ethically and communicate professionally in the workplace (incl. attitude/motivation)  (Fitter & Turner / Mechanical Fitter A2)	<b>A3</b> Manage personal finances (living within ones means, budgeting, saving, dealing with family pressures)  (Fitter & Turner / Mechanical Fitter A3)	<b>A4</b> Plan for work activities and manage time effectively  (Fitter & Turner / Mechanical Fitter A4)	<b>A5</b> Use personal computer systems incl. standard office software for trade-related tasks and smart devices  (Fitter & Turner / Mechanical Fitter A5)	<b>A6</b> Prepare for job search, CV writing and job interviews  (Fitter & Turner / Mechanical Fitter A6)
<b>B</b>	<b>Comply with health and safety practices</b>	<b>B1</b> Adhere to OHS and perform risk assessment (incl. toolbox talks) and lock-out and tag out procedures  (Fitter & Turner / Mechanical Fitter C1)	<b>B2</b> Perform First aid & Firefighting  (Fitter & Turner / Mechanical Fitter C2)	<b>B3</b> Work safely and correctly with basic hoisting & lifting equipment (up > 2.5/5Tons)  (Fitter & Turner / Mechanical Fitter C3)	<b>B4</b> Work safely at heights (incl. ladders & scaffolds) and in confined spaces as well as in & near excavations  (Fitter & Turner / Mechanical Fitter C4)	<b>B5</b> Perform housekeeping, resource efficient & environmentally friendly waste removal (incl. storage of hazardous materials)  (Fitter & Turner / Mechanical Fitter C5)	
<b>C</b>	<b>Conduct preparatory &amp; quality assurance activities</b>	<b>C1</b> Read, interpret and produce freehand as well as accurate basic 2 and 3 dimensional engineering drawings of mechanical components	<b>C2</b> Identify, read and interpret Electrical switchgear and related drawings, symbols and sketches (incl. creating and modifying simple electrical sketches)	<b>C3</b> Apply trade calculations in job tasks  (Fitter & Turner / Mechanical Fitter B3)	<b>C4</b> Understand and apply basic mechanical theory  (Fitter & Turner / Mechanical Fitter B4)	<b>C5</b> Understand and apply fundamentals of electricity  (Fitter & Turner / Mechanical Fitter None)	<b>C6</b> Adhere to company and industry quality standards  (Fitter & Turner / Mechanical Fitter B5)



		(Fitter & Turner / Mechanical Fitter B1)	(Fitter & Turner / Mechanical Fitter None)				
<b>D</b>	<b>Handle and care for occupation-specific tools, equipment and materials</b>	<b>D1</b> Handle, care for basic hand tools  (Fitter & Turner / Mechanical Fitter D1)	<b>D2</b> Select and care for engineering power tools (portable and fixed)  (Fitter & Turner / Mechanical Fitter D2)	<b>D3</b> Identify and care for marking and mechanical measuring equipment  (Fitter & Turner / Mechanical Fitter D3)	<b>D4</b> Identify, care for and use electrical measuring, instruments (fixed and portable)  (Fitter & Turner / Mechanical Fitter None)	<b>D5</b> Identify, handle and store relevant engineering materials  (Fitter & Turner / Mechanical Fitter B2)	
<b>E</b>	<b>Fabricate a range of simple mechanical components or work pieces</b>	<b>E1</b> Mark-off, saw and file various simple components and materials  (Fitter & Turner / Mechanical Fitter E1)	<b>E2</b> Sharpen drill bits as per application and drill material to specifications using a portable and fixed drilling machine  (Fitter & Turner / Mechanical Fitter E2)	<b>E3</b> Saw material to specification using a power saw  (Fitter & Turner / Mechanical Fitter E3)	<b>E4</b> Grind material to specifications using a pedestal grinder  (Fitter & Turner / Mechanical Fitter E4)	<b>E5</b> Cut threads with stocks, dies and taps and ream parallel and tapered holes  (Fitter & Turner / Mechanical Fitter E5)	
<b>F</b>	<b>Fabricate complex mechanical components or work pieces</b>	<b>F1</b> Fabricate and fit gaskets  (Fitter & Turner / Mechanical Fitter F1)	<b>F2</b> Fabricate and fit keys and locking devices  (Fitter & Turner / Mechanical Fitter F2)	<b>F3</b> Fabricate a flange and other suitable components  (Fitter & Turner / Mechanical Fitter F3)	<b>F4 – ELECTIVE</b> Construct pipe systems and pressure test (metal/steel and Slurry pipelines)  (Fitter & Turner / Mechanical Fitter None)		

<b>G</b>	<b>Perform basic welding, cutting, brazing on engineering materials</b>	<b>G1</b> Gas cut metal to specification  (Fitter & Turner / Mechanical Fitter G1)	<b>G2</b> Arc weld metal to specification  (Fitter & Turner / Mechanical Fitter G2)	<b>G3</b> Gas weld, silver solder and braze metal to specification  (Fitter & Turner / Mechanical Fitter G3)			
<b>H</b>	<b>Identify and care for Electrical Equipment and components</b>	<b>H1</b> Identify and maintain Distribution Boards	<b>H2</b> Identify and maintain Protective devices	<b>H3</b> Identify and maintain Contactors, Timers, Isolators and Limit Switches etc.			
<b>I</b>	<b>Work with electronic components applicable to the occupational context</b>	<b>I1</b> Identify and use electronic measuring instruments	<b>I2</b> Gain an overview, identify and test electronic components	<b>I3</b> Identify, read and interpret electronic circuit drawings and specifications	<b>I4</b> Construct electronic circuits using soldering	<b>I5</b> Troubleshoot electronic circuits	
<b>J</b>	<b>Install, connect and programme programmable logic controllers (PLCs) and VSDs</b>	<b>J1</b> Understand, interpret and design relay panels	<b>J2</b> Interpret instructions and design a PLC programme	<b>J3</b> Install, connect and programme PLC components as per instruction	<b>J4</b> Install, connect and programme variable speed drives		
<b>K</b>	<b>Install and connect electrical equipment, switch- and control gear</b>  <b>Specific SANS in each work situation</b>	<b>K1</b> Install wireways	<b>K2</b> Identify and install Conductors and Cables	<b>K3</b> Install and connect main and control circuits, and switchgear	<b>K4</b> Install, connect and test batteries	<b>K5</b> Install and connect luminaires	<b>K6</b> Install and connect fixed measuring instruments (incl. CTs and VTs)
<b>L</b>	<b>Test, Install and connect</b>	<b>L1</b> Design electrical	<b>L2</b> Install, test and	<b>L3</b>	<b>L4</b>		

	<b>Electrical Machines (Transformers, Single and three Phase and DC Motors)</b>	circuits and perform fault-finding and repair	protect transformers (small and medium)	Test, Install and connect single- and 3-phase AC/DC motors and control gear	Maintain (disassemble and reassemble) electrical motors, generators & alternators		
<b>M</b>	<b>Perform work activities on hydraulic &amp; pneumatic systems</b>	<b>M1</b> Build and test basic hydraulic flow circuits  (Fitter & Turner / Mechanical Fitter L1)	<b>M2</b> Build and test basic pneumatic circuits  (Fitter & Turner / Mechanical Fitter M1)	<b>M3</b> Perform routine maintenance, fault finding, repair and reassembly activities on hydraulic systems  (Fitter & Turner / Mechanical Fitter L2)	<b>M4</b> Perform routine maintenance, fault finding, repair and reassembly activities on pneumatic systems  (Fitter & Turner / Mechanical Fitter M2)	<b>M5</b> Perform installation and commissioning activities on hydraulic systems  (Fitter & Turner / Mechanical Fitter L3)	<b>M6</b> Perform installation and commissioning activities on pneumatic systems  (Fitter & Turner / Mechanical Fitter M3)
<b>N</b>	<b>Perform work activities on gearboxes and drives</b>	<b>N1</b> Perform routine maintenance, fault finding, repair and alignment on gearboxes  (Fitter & Turner / Mechanical Fitter H1)	<b>N2</b> Perform routine maintenance, fault finding, repair and alignment on drives  (Fitter & Turner / Mechanical Fitter H2)	<b>N3</b> Install, align and commission gearbox to specifications  (Fitter & Turner / Mechanical Fitter H3)	<b>N4</b> Install, align and commission drives to specification  (Fitter & Turner / Mechanical Fitter H4)	<b>N5 ELECTIVE:</b> Perform laser alignment on drives and gearboxes  (Fitter & Turner / Mechanical Fitter H5)	
<b>O</b>	<b>Perform work activities on pumps for water systems and water related valves</b>	<b>O1</b> Perform routine maintenance fault finding, repair and reassembly activities on pumps for water systems  (Fitter & Turner / Mechanical Fitter	<b>O2</b> Perform routine maintenance fault finding, repair and reassembly activities on water related valves  (Fitter & Turner / Mechanical Fitter	<b>O3</b> Install, align and commission pumps for water systems and water related valves  (Fitter & Turner / Mechanical Fitter I3)			

<b>P</b>	<b>Perform work activities on brakes and clutches</b>	<b>I1)</b> <b>P1</b> Perform routine maintenance, fault finding, repair, reassembly and alignment activities on brakes and clutches  (Fitter & Turner / Mechanical Fitter J1)	<b>I2)</b> <b>P2</b> Perform installation and commissioning activities on brakes and clutches  (Fitter & Turner / Mechanical Fitter J2)					
	<b>Perform work activities on bearings and lubrication systems</b>	<b>Q1</b> Perform routine maintenance, fault find, repair and align bearings  (Fitter & Turner / Mechanical Fitter K1)	<b>Q2</b> Perform routine maintenance, fault find, repair and align lubrication systems  (Fitter & Turner / Mechanical Fitter K2)	<b>Q3</b> Perform installation and commissioning activities on lubrication systems  (Fitter & Turner / Mechanical Fitter K3)	<b>Q4</b> Perform installation and commissioning activities on bearings  (Fitter & Turner / Mechanical Fitter K4)			
	<b>Inspect, maintain and fault find on conveyor systems</b>	<b>R1</b> Inspect, maintain conveyor systems (incl. rolling elements, structure and belts) and inspect safety guards and shout  (Fitter & Turner / Mechanical Fitter N1)	<b>R2</b> Track conveyor belts  (Fitter & Turner / Mechanical Fitter N2)	<b>R3</b> <b>ELECTIVE</b> Remove and replace conveyor belts / splicing (excluding vulcanization & fusing)  (Fitter & Turner / Mechanical Fitter N3)				
	<b>Understand the basics for Diesel</b>	<b>S1 Elective (Basic)</b> Understand diesel	<b>S2 Elective (Basic)</b> Understand auto					

	<b>Mechanics and Auto Electrical fault identification (Basic) ELECTIVE</b>	engine components and how to fault find	electrical components and how to fault find				
<b>T</b>	<b>Understand the basics of air-conditioning ELECTIVE</b>	<b>T1 Elective</b> Understand the function of components and operation of air-conditioning systems	<b>T2 Elective</b> Perform basic fault-finding and repair on air-conditioning systems				

Please note that the NOCC-A21 for the Millwright, Fitter&Turner and Mechanical Fitter have been aligned in order to allow for joint implementation of the programmes.

The details of the actual learning content for each **Work situation** are defined in a **Learning Package**. The learning package includes a number of components as can be seen in the template in the box below.

**Component A** is a **work scenario** which locates the learning in everyday workplace activities. The work scenario for each work situation brings the curriculum alive by showing how the learning in that situation links to real work. The work scenario also supports a teaching methodology that ensures that industry work processes are integrated into the classroom.

**Component B** is the **integrated learning content**. This defines the practical skills, underpinning knowledge and the work experience (with relevant QCTO codes) required to perform the tasks contained within a work situation and links the NOCC-A21 back to the QCTO curriculum framework.

Each learning package also includes **Component C** on **internal assessment** to be performed (based on the assessment criteria contained), which can support the facilitator in designing the assessment for each learning package. **Component D** identifies the **learning resources** that can be used to teach the learning package. In addition, in **Component E** the **Tools, Equipment and Materials** required for each Learning package are listed. A consolidated tools and equipment list with a toolbox list is included towards the end of the document.

Also included in each learning package is a list of other learning package(s) which need to have been covered before the current learning package can be taught (**pre-requisite learning**), **Component F**.

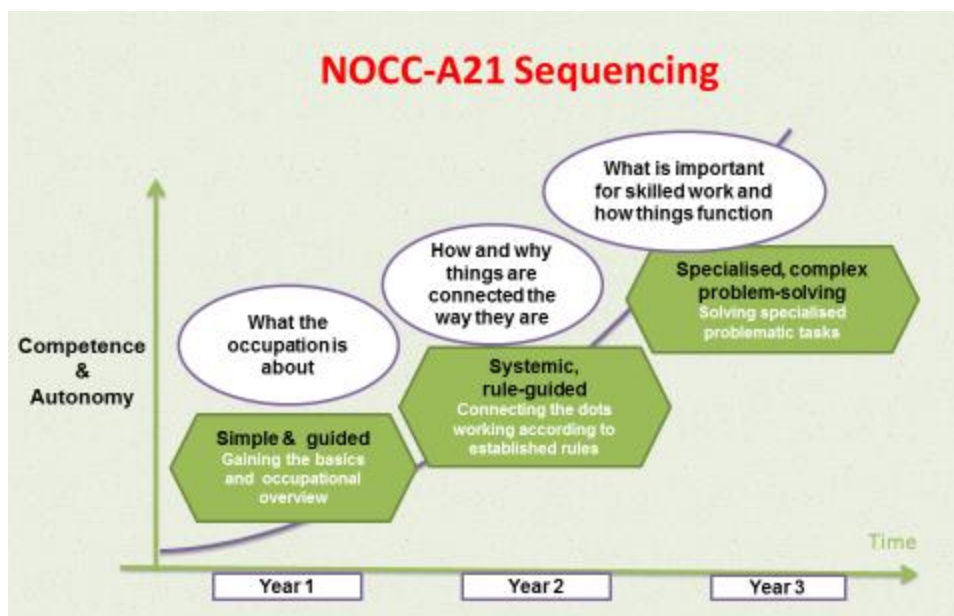
## Integration, scaffolding and sequencing of learning

An important design principle of the NOCC-A21 is that it incorporates practical skills, underpinning knowledge and workplace experience in a single, integrated learning programme. These three elements are included in each learning package instead of being separated into consecutive phases as theory and practice previously were in apprenticeships.

The work situations that make up the curriculum are designed to be taught in an integrated rather than linear fashion. While each work situation has a distinct focus, there is an overlap between them as some work situations develop foundational knowledge and skills for others. This means that some foundational knowledge and skills might be introduced in one work situation, but reinforced and further developed in another (e.g. OHS, Professional communication and work ethics, Housekeeping, Company and quality standards, etc.).

NOCC-A21 Learning Package			
<b>Occupation/trade title:</b>	<b>SAQA ID:</b>		
	<b>Curriculum code:</b>		
<b>Learning area title:</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>
<b>Work situation title:</b>	<b>Total hours</b>		
<b>COMPONENT A: Work scenario:</b>			
<b>COMPONENT F: Prerequisite learning:</b>			
<b>COMPONENT B: INTEGRATED LEARNING CONTENT</b>			
<b>Practical skills modules (PM)</b>	<b>Knowledge modules (KM)</b>	<b>Work experience modules (WM)</b>	
<b>The apprentice must be able to:</b>	<b>Knowledge of:</b>	<b>The apprentice will be expected to engage in the following work activities:</b>	
<b>ASSESSMENT CRITERIA</b>			
<b>Component C: Internal Assessment to be performed:</b>			
<b>Component D: Learning resources for teaching</b>			
<b>Component E: Tools, Equipment and Materials</b>			

Scaffolding is another design feature of the NOCC-A21. This informs the sequencing and teaching of the curriculum. A scaffolded approach is one that lays down foundational knowledge and skills, and progressively moves learners to more complex understanding and practice. Strong support and guidance are initially provided but are slowly removed as the learner becomes more competent and independent. This is like physical scaffolding in construction, which is incrementally removed as it is no longer needed. In the teaching of the NOCC-A21, the activities that students engage in should move from simple and guided in the first year, to systematic rule-guided in the second year, and finally to complex and problem solving in the third year.



### Suggested sequencing

The tables that follow provide a suggested sequencing of the work situations over the entire training programme. The suggested sequencing is not cast in stone and may be adapted as per the needs of each training provider. However, two principles need to be adhered to, when adapting the suggested sequence:

- 1) The **pre-requisite learning** for each learning package (Component F) must be in place before a learning package can be taught.
- 2) **At the end of each training year** all identified work situations need to be covered in order to ensure the same learning outcome for all apprentices.

CC – Cross cutting. This set of skills needs to be pursued throughout the learning programme. Even though this learning package has not been allocated specific hours in the workplace, please spend a minimum of 1 hour discussing this to make the apprentice conscious on the importance of these skills in the workplace.

Please view the NOCC-A21 Sequencing of the Millwright on the next page.

YEAR 1					YEAR 2					YEAR 3					YEAR 4				
LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite
A1	Receive an induction and orientation to the occupation & the training programme	16	16	none	K1	Install wireways	24	80	Year 1	I1	Identify and use electronic measuring instruments	24	40	Year 2	S1 – Elective	Understand diesel engine components and how to fault find (Basic)	80	80	Year 3
B1	Adhere to OHS and perform risk assessment (incl. toolbox talks) and lock-out and tag out procedures	24	24	A1	K2	Identify and install Conductors and Cables	16	80	Year 1	I2	Gain an overview, identify and test electronic components	40	40	I1	S2 – Elective	Understand auto electrical components and how to fault find (Basic)	40	80	S1
B2	Perform First aid & Firefighting	24	24	B1	K3	Install and connect main and control circuits, and switchgear	40	80	K2	I3	Identify, read and interpret electronic circuit drawings and specifications	40	40	I2	T1 – Elective	Understand the function of components and operation of air-conditioning systems	40	80	Year 3
A2	Behave ethically and communicate professionally in the workplace (incl. attitude/motivation)	16	CC	A1	K4	Install, connect and test batteries	24	72	Year 1	I4	Construct electronic circuits using soldering	40	64	I3	T2 – Elective	Perform basic fault-finding and repair on air-conditioning systems	40	80	T1
A3	Manage personal finances (living within ones means, budgeting, saving, dealing with family pressures)	8	CC	A1,A2	K5	Install and connect luminaires	40	40	Year 1	I5	Troubleshoot electronic circuits	40	80	I4	A6	Prepare for Job search skills, CV writing and job interviews	24	CC	All
A4	Plan for work activities and manage time effectively	16	CC	A1,A2	K6	Install and connect fixed measuring instruments (incl. CTs and VTs)	16	40	Year 1	J1	Understand, interpret and design relay panels	40	80	Year 2	Trade test	Revision for Trade test and Trade test	240	1056	All



YEAR 1					YEAR 2					YEAR 3					YEAR 4				
LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite
A5	Use personal computer systems incl. standard office software for trade-related tasks and smart devices	40	CC	A1,A2	N1	Perform routine maintenance, fault finding, repair and alignment on gearboxes	40	40	Year 1	J2	Interpret instructions and design a PLC programme	40	80	J1					
C1	Read, interpret and produce freehand as well as accurate basic 2 and 3 dimensional engineering drawings of mechanical components	24	CC	A1	O1	Perform routine maintenance fault finding, repair and reassembly activities on pumps for water systems	40	40	Year 1	J3	Install, connect and programme PLC components as per instruction	40	80	J2					
D1	Handle and care for basic hand tools	16	16	A1, A2, B1, B2, C1	P1	Perform routine maintenance, fault finding, repair, reassembly and alignment activities on brakes and clutches	40	40	Year 1	J4	Install, connect and programme variable speed drives	40	80	Year 2					
D2	Select and care for engineering power tools (portable and fixed)	16	16	A1, A2, B1, B2, C1	N2	Perform routine maintenance, fault finding, repair and alignment on drives	80	80	Year 1	L1	Design electrical circuits and perform faultfinding and repair	80	80	Year 2					

YEAR 1					YEAR 2					YEAR 3					YEAR 4				
LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite
D3	Identify, care and use marking and mechanical measuring equipment	24	16	A1, A2, B1, B2, C1	O2	Perform routine maintenance fault finding, repair and reassembly activities on water related valves	32	32	Year 1	L2	Install, test and protect transformers (small and medium)	40	80	Year 2					
D5	Identify, handle and store relevant engineering materials	8	8	A1, A2, B1, B2, C1	N3	Install, align and commission gearbox to specifications	24	24	N1	L3	Test, install and connect single/ 3-phase AC/DC motors and control gear	80	80	Year 2					
B4	Work safely at heights (incl. ladders & scaffolds) and in confined spaces as well as in & near excavations	40	24	A1, A2, B1, B2	N4	Install, align and commission drives to specification	40	40	N2	L4	Maintain (disassemble and reassemble) electrical motors, generators & alternators)	40	80	Year 2					
B5	Perform housekeeping, resource efficient & environmentally friendly waste removal (incl. storage of hazardous materials)	8	CC	A1, B1, B2	O3	Install, align and commission pumps for water systems and water related valves	40	40	O2	R1	Inspect, maintain conveyer systems (incl. rolling elements, structure and belts) and inspect safety guards and shout	40	80	Year 2					
C3	Apply trade calculations in job tasks	16	CC	A1, D5, C1	P2	Perform installation and commissioning	16	16	P1	R2	Track conveyer belts	8	80	R1					

YEAR 1					YEAR 2					YEAR 3					YEAR 4				
LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite
						activities on brakes and clutches													
C4	Understand and apply basic mechanical theory	40	CC	C3	Q3	Perform installation and commissioning activities on lubrication systems	8	8	Year 1	R3	ELECTIVE: Remove and replace conveyor belts / splicing (excluding vulcanization (vusing))	24	40	R2					
C6	Adhere to company and industry quality standards	24	CC	A1, C3, D5	Q4	Perform installation and commissioning activities on bearings	16	16	Year 1	N5	ELECTIVE: Perform laser alignment on drives and gearboxes	40	40	Year 2					
E1	Mark-off, saw and file various simple components and materials	72	40	D1	M1	Build and test basic hydraulic flow circuits	80	80	Year 1										
E2	Sharpen drill bits as per application and drill material to specifications using a portable and fixed drilling machine	16	24	D2	M2	Build and test basic pneumatic circuits	64	56	Year 1										
E3	Saw material to specification using a power saw	8	8	D2,D3	M3	Perform routine maintenance, fault finding, repair and reassembly	40	40	M1										

YEAR 1					YEAR 2					YEAR 3					YEAR 4				
LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite
						activities on hydraulic systems													
E4	Grind material to specifications using a pedestal grinder	24	16	D2,D3	M4	Perform routine maintenance, fault finding, repair and reassembly activities on pneumatic systems	40	40	M2										
E5	Cut threads with stocks, dies and taps and ream parallel and tapered holes	40	32	D1-D3	M5	Perform installation and commissioning activities on hydraulic systems	24	24	M3										
F1	Fabricate and fit gaskets	16	24	E	M6	Perform installation and commissioning activities on pneumatic systems	24	24	M4										
F2	Fabricate and fit keys and locking devices	80	40	E															
F3	Fabricate a flange & other suitable components	80	40	E															

YEAR 1					YEAR 2					YEAR 3					YEAR 4				
LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite
F4	ELECTIVE: Construct pipe systems and pressure test (metal/steel and Slurry pipelines)	24	CC	E															
G1	Gas cut metal to specification	16	40	A1, B1-B2 & C1															
G2	Arc weld metal to specification	40	40	G1															
G3	Gas weld, silver solder and braze metal to specification	24	40	G2															
Q1	Perform routine maintenance, fault find, repair and align bearings	24	40	A1, B1-B2, C1, C3, C4, C6, D1-D3, D5															
Q2	Perform routine maintenance, fault find, repair and align lubrication systems	32	40	A1, B1-B2, C1, C3, C4, C6, D1-D3, D5															
B3	Work safely and correctly with basic hoisting & lifting equipment (up to 2.5/5 tons)	40	CC	A1, B1-B2															
C5	Understand and apply fundamentals of electricity	40	CC	A1, B1-B2															

YEAR 1					YEAR 2					YEAR 3					YEAR 4				
LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite	LA/WS	Work situation title	SDP	WP	Pre-requisite
D4	Identify, care for and use electrical measuring instruments (fixed and portable)	40	8	C5															
C2	Identify, read and interpret Electrical switchgear and related drawings, symbols and sketches (incl. creating and modifying simple electrical sketches)	40	8	C5, D4															
H1	Identify and maintain Distribution Boards	40	40	C2															
H2	Identify and maintain Protective devices	40	40	H1															
H3	Identify and maintain Contactors, Timers, Isolators and Limit Switches etc.	40	40	H2															
<b>TOTALS</b>		<b>1136</b>	<b>704</b>			<b>TOTALS</b>	<b>808</b>	<b>1032</b>			<b>TOTALS</b>	<b>696</b>	<b>1144</b>			<b>TOTALS</b>	<b>464</b>	<b>1376</b>	

## **Development of correct attitudes and attributes**

Practicing apprentices need a set of core attitudes and attributes to competently perform their trade in a workplace. These cut across and need to be built into the teaching of each work situation. The core attitudes and attributes are:

- Follow instructions correctly
- Pay attention to detail and work accurately
- Be quality conscious
- Work tidily
- Be time conscious and work under pressure
- Ensure safety
- Perform as a team player
- Demonstrate customer orientation
- Be aware of the need to work in a manner that protects the environment
- Adhere to company rules and standards
- Work independently within the requirements of the job
- Take responsibility for ones work

## **Rotation between the SDP and the workplace**

The apprentice is expected to spend 30% to 40% of the time at the SDP and 60% to 70% of the time at the workplace, over the three years. At the SDP the apprentice should spend at least 50% of the time in the workshop applying the theory that has been learnt. The rotation between the SDP and the workplace should occur in a series of blocks which may be between 8-12 weeks long, in the first year, but by third year the blocks will reduce to 4-8 weeks at the SDP and increase to 12-16 weeks at the workplace. The logbook will detail the suggested rotation schedule and workplace activities.

## **Entry requirement**

The entry requirement for this trade is: Grade 9 (NQF Level 1)

## **Learning and teaching materials**

The materials developed to deliver the respective learning programme will include:

- An apprentice guide that includes material that supports the learning of each learning package
- A training provider guide that supports the teaching of the theory and practical components of the programme
- An employer guide that supports the delivery of the workplace experience component of the programme
- An apprentice logbook for guiding and signing off the workplace experience
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## **Link to QCTO curriculum document**

The NOCC-A21 has been developed to enable the implementation of the QCTO occupational qualification for the relevant trade.

To facilitate alignment with the QCTO curriculum for the trade, the knowledge, practical skills and work experience included in learning packages derives from this. In some cases the content included from the QCTO curriculum has been supplemented to create a full learning package for a work situation that includes knowledge, practical skills and work experience. A few learning packages also contain content that is additional to the QCTO curriculum. The work situations addressed by these learning packages were added to address gaps identified by the industry experts, who assisted with the development of the NOCC-A21. Content in learning packages that comes from the QCTO curriculum can be identified by the curriculum codes. Content that is supplementary has no code and is included in red.

A full cross referencing between the QCTO curriculum and the NOCC-A21 is provided in the cross referencing table as a separate document.

In addition to working with the NOCC-A21, training providers also need to familiarise themselves with the QCTO qualification and curriculum documents for the trade.

## Assessment

NOCC-A21 assessment should be geared towards developing competent apprentices. Competent apprentices have relevant trade-related practical skills and sound knowledge underpinning their skill-sets. This enables them to understand what they are doing and why, and to make appropriate decisions and solve problems. Both their knowledge and skills thus need to be assessed. The learning package for each work situation includes assessment criteria for the knowledge and skills developed in that situation. Guidelines have been provided in each learning packages for the internal knowledge and practical assessment.

The assessment of the occupational programme includes internal and external assessment activities. Training providers are responsible for internal continuous assessment, which should be carried out throughout out each year of the programme.

It is recommended that the internal continuous assessments are planned in **at the end of each training week**. Each Friday the content of the specific week would be assessed. This allows both apprentices and facilitators to determine the current level of comprehension, and whether any remedial work is required. If the week has covered several learning packages, the content of the assessment would cover the different learning packages. If only one learning package was covered, the assessment would focus on this specific package.

The final external assessment to be completed is the trade test. Six to eight weeks trade test preparation has been included in the NOCC, wherein the facilitator and mentor can support the apprentice to prepare for this final external assessment. As per the QCTO assessment specifications, the apprentice should be competent in:

- Fit, adjust and maintain industrial machinery.
- Diagnose, find and repair faults in industrial machinery.
- Install, test and commission industrial machinery.

When an apprentice has completed the occupational programme and is considered competent, s/he need to pass the trade test at a registered trade testing centre to be awarded their qualification.



## Human Resources

The human resources required for each of the components, practical, knowledge and workplace experience is noted below.

### **Human Resource Requirement for Practical skills modules:**

- Trade tested in the related trade
- 3-5 years post trade test relevant work experience and knowledge and experience on the topic to be covered
- Trainer/ apprentice ratio 1:15
- Facilitators must be suitably qualified in facilitation and assessment of trade qualifications.  
OR Must have qualified in DHET preparatory programme for delivery of occupational programmes (facilitation and assessment)

### **Human Resource Requirement for Knowledge modules:**

- Facilitator must be trade tested in the related trade
- Facilitator must have relevant industry experience and knowledge and experience on the topic to be covered
- Facilitators must be suitably qualified in facilitation and assessment of trade qualifications.  
OR Must have qualified in DHET preparatory programme for delivery of occupational programmes (facilitation and assessment)
- Facilitator/ learner ratio 1:30

### **Human Resource Requirement for Work experience modules:**

- Mentor must be trade tested in the related trade
- Mentors must be suitably qualified in mentoring and be able to support the apprentices in trade test preparation.
- 3-5 years post trade test relevant work experience
- Mentor/ apprentice ratio 1:2

## List of acronyms

<b>NOCC</b>	National Occupational Curriculum Content
<b>OHS</b>	Occupational Health and Safety
<b>PPE</b>	Personal Protective Equipment
<b>QCTO</b>	Quality Council for Trades and Occupations
<b>SABS</b>	South African Bureau of Standards
<b>SANS</b>	South African National Standards
<b>SAQA</b>	South African Qualifications Authority

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>A1</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Practice the occupation and behave responsibly and professionally in the workplace</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		120	16	
<b>Work situation title: Receive an induction and orientation to the occupation &amp; the training programme (incl. Apprentice contracts)</b>	<b>Total hours</b>	16	16	
<b>Work scenario:</b> Thembi is starting as a new apprentice in the Millwright trade. It is her first day in the training programme. She does not yet have a full understanding of what lies ahead of her over the next 4 years and wants to understand the contracts that she must sign, how the rotation plan will work and how to complete the logbook.				
<b>Prerequisite learning:</b> None				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	40%	<b>Knowledge modules (KM)</b>	60%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><i>Given learnership agreement, QCTO qualification (source access), NOCC-A21, the rotation scheme and logbook</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Explain the purpose of their training and how it will unfold</li> <li>• Demonstrate the use of the logbook by filling in sections.</li> </ul> <p><i>Given apprenticeship contracts, relevant legislation and code of conduct, case studies demonstrating the contravening of contracts/legislation/regulations</i></p>		<p>Knowledge of:</p> <p><b>KM-02-KT01: Introduction to the Millwright Trade (20%)</b></p> <ul style="list-style-type: none"> <li>• KT0101 The millwright's world of work</li> <li>• KT0102 Career opportunities for qualified millwrights</li> <li>• KT0103 Occupational profile of a millwright</li> <li>• KT0104 Legislation relating to apprentices in the millwright trade</li> <li>• KT0105 The role of South African National Standards (SANS)</li> <li>• KT0106 Trade test requirements</li> </ul> <p><b>KM-01-KT05: Types and structure of employer organisations and the impact of the external environment (11%)</b></p>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>• Attend medical assessment (pre-placement) and physical assessment</li> <li>• Induct apprentice to company-vision/mission, specific structures and procedures</li> <li>• Introduce apprentice to the team</li> <li>• Explain to apprentices and co-workers the aims of the training programme</li> <li>• Provide an overview of on-the-job experience programme (rotation scheme)</li> <li>• Induction to general work place policies, procedures and standards (e.g. SANS) which will need to be</li> </ul>

<p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Complete and sign an apprenticeship contract</li> <li>• Explain the contractual roles and responsibilities of the different role players in the training, and particularly their own</li> <li>• Read and obtain an overview of employment legislation relevant to their contracts</li> <li>• Demonstrate an understanding of the process to be followed in terms of laying a grievance</li> <li>• Demonstrate an understanding of the processes that need to be followed in the event of disciplinary procedures</li> <li>• Explain the importance of a code of conduct and the need to comply with the ethics and value of the company</li> </ul> <p><i>Given case study with non-compliance scenarios at employer and/or training provider.</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Correctly identify non-compliance and explain remedial action</li> </ul> <p><i>Given promotional image videos showing Millwrights in the workplace, Career pathway charts, Career stories of successful Millwrights</i></p> <p><b>The apprentice must be able to:</b></p>	<ul style="list-style-type: none"> <li>• KT0501 Types of employer organisations, including public, private and non-profit entities</li> <li>• KT0502 Company as legal persona, stakeholders, responsibilities</li> <li>• KT0503 Differences between micro, small, medium and large organisations</li> <li>• KT0504 Organisational hierarchies</li> <li>• KT0505 Organisational culture, structures, systems</li> <li>• KT0506 Departments, services and inter-departmental relationships</li> <li>• KT0507 Organisational strategies, business plans and related processes, including budgeting and reporting</li> <li>• KT0508 Typical organisational stakeholders</li> <li>• KT0509 The economy, markets, customers, competition, service delivery</li> <li>• KT0510 Resources, including materials, people, finance, technology</li> <li>• KT0511 Legislation, regulations and standards, including SANS</li> <li>• KT0512 Organisations and the natural environment</li> <li>• KT0513 Global influences on local conditions and the economy</li> </ul> <p><b>KM-01-KT01: Employment (12%)</b></p> <ul style="list-style-type: none"> <li>• KT0101 An employee's legal rights</li> <li>• KT0102 Legislation which governs workplaces</li> <li>• KT0103 Employer roles and responsibilities</li> </ul>	<p>adhered to</p> <ul style="list-style-type: none"> <li>• Clarify apprentices role and responsibilities in the company</li> <li>• Provide an overview of core work areas of the company</li> <li>• Introduce the allocated supervisors/mentors and clarify reporting structures</li> <li>• Structured discussion on contractual obligations for apprentice and employer by going through the relevant contracts and company policies and procedures</li> <li>• Feedback session with the apprentice reflecting on adherence to contractual obligations at the end of company phase</li> </ul>
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<ul style="list-style-type: none"> <li>• Identify the world of work of a Millwright</li> <li>• Understand the importance of Millwrights for society &amp; industry</li> <li>• Acknowledge the physical work environment of a Millwright (locations, hazards, discomforts, working hours) and the importance of SANS</li> </ul>	<ul style="list-style-type: none"> <li>• KT0104 Employee role and responsibilities</li> <li>• KT0105 Role of organised labour in business</li> <li>• KT0106 Union organisation, structures and processes</li> <li>• KT0107 Labour relations</li> <li>• KT0108 Employment relations in small and micro enterprises</li> <li>• KT0109 Role of the Department of Labour, the CCMA and the Labour Court</li> </ul> <p><b>KM-01-KT03: Employer-Employee relationships (11%)</b></p> <ul style="list-style-type: none"> <li>• KT0301 Employment contracts including learning contracts such as learnerships, apprenticeships and internships</li> <li>• KT0302 Mandates, vision, mission, policies and procedures</li> <li>• KT0303 Rules, codes of conduct and ethics</li> <li>• KT0304 Organisational values, common and specific</li> <li>• KT0305 Labour relations processes, including discipline, grievance, strikes, lock outs, negotiation, conciliation, mediation and arbitration</li> </ul> <p><b>KM-01-KT08: Current trends influencing work (11%)</b></p> <ul style="list-style-type: none"> <li>• KT0801 Employment equity</li> <li>• KT0802 Broad-Based Black Economic</li> </ul>	
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	<p>Empowerment</p> <ul style="list-style-type: none"> <li>• KT0803 Sustainability</li> <li>• KT0804 Diversity</li> <li>• KT0805 Work-life balance</li> <li>• KT0806 Working smart</li> </ul> <ul style="list-style-type: none"> <li>• Learnership agreements (apprenticeship contracts which includes the contractual obligations of apprentices, employers and skills development providers)</li> <li>• Need for contracts, legislations and regulations</li> <li>• Employment legislation (Workman's Compensation Act; Basic Conditions of Employment Act; Labour Relations Act; Collective Bargaining agreements; Employment Equity Act; Broad-Based-Black Economic Empowerment Act).</li> <li>• Unemployment Insurance Fund (UIF) and Pay As You Earn (PAYE) tax</li> <li>• The purpose and importance of the logbook</li> <li>• The rotation schedule</li> <li>• Unfair labour practices</li> <li>• Determination of wages for apprentices</li> <li>• Consequences of breaching contractual obligations</li> <li>• Company-specific processes/procedures related to legislative requirements</li> <li>• The importance of adhering to the company code of conduct/ethics</li> <li>• The importance of a Millwright in society</li> <li>• Work roles of Millwrights in different industry sectors (job descriptions incl.</li> </ul>	
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	<p>work locations)</p> <ul style="list-style-type: none"> <li>• Different areas of specialisation for Millwrights (occupational titles)</li> <li>• The importance of occupational pride</li> <li>• Typical work schedules in industry (part-time, full time, overtime, shift-work, job-sharing etc.)</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p>Case study with non-compliance scenarios of employer, training provider. Apprentice to correctly identify non-compliance and explain remedial action</p>	<p><b>KM-02-KT01:</b></p> <ul style="list-style-type: none"> <li>• IAC0101 The job environment and workplace roles of a millwright are accurately described and explained</li> <li>• IAC0102 The profile of a millwright is described with respect to industry description, career path progression and requirements</li> <li>• IAC0103 The applicable legislation relating to millwright apprentices is described</li> <li>• IAC0104 Legal aspects pertaining to apprentices are explained</li> <li>• IAC0105 Trade test methodology, requirements and assessment procedure leading up to the trade assessment are explained</li> </ul> <p><b>KM-01-KT05:</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Describe the various kinds of organisations which are employers and explain the differences between them</li> <li>• IAC0502 Describe, with the aid of sketches where relevant, how organisations are structured and explain</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Proof of induction session and related documents including rotation scheme and allocated mentors</li> <li>• Proof of structured conversation on contractual obligations</li> <li>• Proof of feedback session with the apprentice reflecting on adherence to contractual obligations at the end of company phase</li> </ul>

	<p>the relationships between elements of the structure</p> <ul style="list-style-type: none"> <li>• IAC0503 Describe how organisations fulfil their mandate or mission</li> <li>• IAC0504 Describe typical stakeholders of various types of organisation</li> <li>• IAC0505 Discuss the impact of these factors on an employer and an employee</li> <li>• IAC0506 Describe the processes which employer organisations have to apply because of the external environment</li> </ul> <ul style="list-style-type: none"> <li>• IAC0101 Define and describe the concepts which underpin employment and employment related legislation and systems</li> <li>• IAC0102 Discuss the impact of these concepts on an employer and an employee</li> <li>• IAC0103 Describe the processes which govern employment, disputes and other labour relations issues</li> <li>• IAC0301 Define and describe the concepts which define employer and employee relationships</li> <li>• IAC0302 Discuss the impact of these concepts on an employer and an employee</li> <li>• IAC0303 Describe the processes which govern employer-employee relation</li> <li>• IAC0801 Describe and explain the current trends affecting organisations and employees</li> </ul>	
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	IAC0802 Discuss the impact of these factors on an employer and an employee	
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**Internal Assessment to be performed:**

- Internal multiple choice knowledge test on compliant/non-compliant case scenarios, remedial action procedures
- The competency will be at 100%
- Signed off attendance register for induction

**Learning resources for teaching**

- Textbooks on defined Knowledge Modules
- Learnership agreements
- QCTO qualification (source access), NOCC-A21, the rotation scheme, logbook format
- Promotional image videos showing Millwrights in the workplace
- Charts and diagrams of the structure of the sector
- Samples of company codes of conduct
- Samples of company policies, rules and regulations

**Tools, Equipment and Materials**

Personal Protective Equipment; Overalls; Safety Boots

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>A2</h1>
		<b>Curriculum code:</b> 671202000		
<b>Learning area title:</b> Practice the occupation and behave responsibly and professionally in the workplace	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		120	16	
<b>Work situation title:</b> Behave ethically and communicate professionally in the workplace (incl. attitude/motivation)	<b>Total hours</b>	16	CC	
<b>Work scenario:</b> Kagiso is a Millwright apprentice fresh from school and is not familiar on how to behave professionally in a workplace. The rules and systems seem so different to anything she has encountered either in her school or her private life. She receives an induction into the workplace on how to behave and communicate professionally, the expected work ethics and how to display the right attitude and motivation.				
<b>Prerequisite learning:</b> A1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><i>Given various ethical, communication and conflict scenarios/tasks with various stakeholder groups (internal and external, on different hierarchical levels)</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Identify appropriate and inappropriate ethical behaviour and the consequences thereof for the business</li> </ul> <p><b>Identify appropriate communication procedures</b></p> <ul style="list-style-type: none"> <li>Identify appropriate ways of communication with colleagues and managers</li> </ul>		<p>Knowledge of:</p> <p><b>KM-01-KT02: Organisation of work (11%)</b></p> <ul style="list-style-type: none"> <li>KT0201 What work is, including products and services, paid and unpaid</li> <li>KT0202 Work as sets of value-adding processes</li> <li>KT0203 Customers in the value chain, internal and external</li> <li>KT0204 Work as collaboration - the role of teams in work processes</li> <li>KT0205 How teams function</li> <li>KT0206 Team organisation, team roles, meetings and information flow</li> <li>KT0207 Meeting protocols for a variety of meeting types, including formal meetings and informal "stand-up" meetings</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Identify and clarify the work ethics applicable to the company</li> <li>Identify and clarify organisational requirements and workplace procedures related to internal and external communication</li> <li>Answer telephone calls and take messages (if possible)</li> <li>Participate in a feedback session on work ethics and professional behaviour demonstrated during the training period at the end of the company block (incl. displayed attitude and motivation)</li> </ul>

<ul style="list-style-type: none"> <li>• Identify appropriate ways of communication with external stakeholders</li> </ul> <p><b>Communicate positively in the workplace and with clients</b></p> <ul style="list-style-type: none"> <li>• Use effective questioning, active listening and conversational skills to gather and convey information</li> <li>• React appropriately to given instructions (verbally and in writing)</li> <li>• Encourage, acknowledge and act upon constructive feedback</li> <li>• Use appropriate non-verbal behaviour</li> <li>• Demonstrate work site etiquette from arrival to departure (blocking driveways, movement inside work site, respecting other people’s space, cleaning after work etc.)</li> </ul> <p><b>Communicate via phone/smartphones and email in a business context:</b></p> <ul style="list-style-type: none"> <li>• Take telephonic messages and handle basic client inquiries</li> <li>• Leave concise voicemails to communicate information</li> <li>• Write business emails and respond to email inquiries</li> <li>• Demonstrate acceptable usage and communication through smartphone technologies/applications (e.g. whatsapp) – incl. time of day</li> </ul>	<ul style="list-style-type: none"> <li>• KT0208 Organisational hierarchies in medium and large organisations</li> </ul> <p><b>KM-01-KT07: Ethics at work (11%)</b></p> <ul style="list-style-type: none"> <li>• KT0701 Definition of ethical behaviour</li> <li>• KT0702 Components of ethical behaviour, including integrity, honesty, fair dealing, respecting diversity</li> <li>• KT0703 Unwritten but expected behaviours including reliability, accountability, time keeping, respect for others</li> <li>• KT0704 Lapses in ethical behaviour, including sexual harassment, racism, bullying, theft and abuse of company property, rules, time and sick leave</li> <li>• KT0705 Conflicts of interest, including primary and secondary interests, the impact on individuals and organisations, and the link to corruption</li> <li>• KT0706 The need for ethical behaviour and the impact or consequences of lapses in ethical behaviour</li> </ul> <p><b>Professional Communication techniques including:</b></p> <ul style="list-style-type: none"> <li>• Recognition of different personal communication styles appropriate to individual, social and cultural backgrounds</li> <li>• Giving and receiving constructive feedback</li> <li>• Verbal and non-verbal communication:</li> <li>• Use of positive and confident language</li> <li>• Body language</li> </ul>	
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	<ul style="list-style-type: none"> <li>• Use of communication media in business:</li> <li>• Telephones (including smartphones)</li> <li>• Communication on social media</li> <li>• Email</li> <li>• Characteristics of professional and positive communication</li> <li>• Methods of recording and communicating information (toolbox talk, job cards link back to A2)</li> <li>• Sender and receiver problem</li> </ul> <p><b>Types of internal and external clients including:</b></p> <ul style="list-style-type: none"> <li>• Clients from different backgrounds (e.g. social, cultural, religion, etc.)</li> <li>• Outside contractors</li> <li>• Suppliers</li> <li>• Supervisors/Manager</li> <li>• Colleagues</li> </ul> <p><b>Team work and professional behaviour in a team:</b></p> <ul style="list-style-type: none"> <li>• The importance of team work and the different role of team members</li> <li>• How to work successfully in a team</li> <li>• Productive and counterproductive team behaviour</li> </ul> <p><b>Attitude and Motivation:</b></p> <ul style="list-style-type: none"> <li>• How your attitude influences your motivation</li> <li>• Goal setting and drivers for success</li> </ul>	
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	<ul style="list-style-type: none"> <li>Inhibitors/challenges on the way to success and how to deal with them (how one sabotages oneself)</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>Communicating with colleagues and superiors in a manner suitable to the work environment (role play exercise)</li> </ul>	<p><b>KM-01-KT02: Organisation of work (11%)</b></p> <ul style="list-style-type: none"> <li>IAC0201 Define and describe the concepts which underpin work, working and working relationships</li> <li>IAC0202 Discuss the impact of these concepts on an employee and co-workers</li> <li>IAC0203 Describe the processes which govern the work in the workplace</li> </ul> <p><b>KM-01-KT07: Ethics at work (11%)</b></p> <ul style="list-style-type: none"> <li>IAC0701 Define and describe the concepts, issues and examples of ethical and unethical conduct</li> <li>IAC0702 Discuss the impact of these factors on an employer and an employee</li> <li>IAC0703 Describe the impact of lapses in ethical behaviour on the organisation and individuals in the organisation</li> <li>IAC0704 Describe the processes which employer organisations use to support ethical conduct in the workplace</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>SE01: Proof of feedback session with the apprentice reflecting on work ethics and overall professional behaviour at the end of company phase</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test with ethical/communication scenarios and they have to identify correct behaviour and the competency will be at 80%</li> </ul>		

- Practical exercise with role play: Interact with team and supervisor – demonstrate professional behaviour, Level of competence required: 80%

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Role-plays for communication techniques
- Communication Scenarios/Case studies

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>A3</h1>
		<b>Curriculum code:</b> 671202000		
<b>Learning area title:</b> Practice the occupation and behave responsibly and professionally in the workplace	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		120	16	
<b>Work situation title:</b> Manage personal finances (living within one's means, budgeting, saving, dealing with family pressures)	<b>Total hours</b>	8	CC	
<b>Work scenario:</b> Managing one's personal finances can be quite challenging, when starting your first job. Julius has been handed his first salary slip and is now trying to understand how he will manage his personal finances well over the next four years and also how to deal with the family pressures that will be put upon him to assist others.				
<b>Prerequisite learning:</b> A1, A2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><i>Legislation related to TAX (Personal/ Income/ UIF) – Mock Bank statements and mock salary advice, Calculator</i> <i>Real salary slips of apprentices, if available</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Understand the importance of managing own finances</li> <li>Understand the difference between income and expenses</li> <li>Evaluate personal spending and saving habits</li> <li>Evaluate own debt situation</li> <li>Draw up a personal monthly budget</li> <li>Recognise the importance of saving for future goals and contingent costs</li> </ul>		<p><i>QCTO none</i></p> <p>Knowledge of:</p> <ul style="list-style-type: none"> <li>Personal Monthly Income</li> <li>Monthly expenses (fixed and flexible)</li> <li>Indirect expenses (bank charges, interest, etc.)</li> <li>Types of accounts</li> <li>Types of saving vehicles</li> <li>Debt and how to avoid it</li> <li>Legislation related to Tax</li> <li>Dealing with spending pressures resulting from family obligations</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>None</li> </ul>

<ul style="list-style-type: none"> <li>Deal with spending pressures resulting from family obligations</li> <li>Review own budget at the end of each month (actual spending compared to budgeted spending)</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>Correct explanation of what expenses can be avoided or can be regarded as flexible</li> <li>Own financial plan and explanation of how this plan was drawn up/what was considered</li> <li>Personal monthly budget, based on the wage that apprentices receive</li> </ul>		<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>Signed-off Logbook/PoE</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Practical exercise with drawing up a budget based on mock salary slip and sample expenses. (1 hour testing time)</li> <li>Level of competence required: 80%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>Learning Material on defined Knowledge and Practical Skills Modules</li> <li>Legislation related to TAX (Personal/ Income/ UIF)</li> <li>Mock Bank statements and mock salary advice</li> <li>Calculator, Real salary slips of apprentices if available</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>Personal Protective Equipment: Overalls; Safety Boots;</li> </ul>		



<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>A4</h1>	
		<b>Curriculum code:</b> 671202000			
<b>Learning area title:</b> Practice the occupation and behave responsibly and professionally in the workplace	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>		
		120	16		
<b>Work situation title:</b> Plan for work activities and manage time effectively	<b>Total hours</b>	16	CC		
<b>Work scenario:</b> Kwena is working in the maintenance department. When he arrives at work he clocks in and obtains his job card from his supervisor. His job card specifies the tasks he must complete as well as the tools and materials to be used. Kwena reads his job card very carefully so he is clear about what the job requires. He knows that he has to plan his time carefully and work efficiently if he is going to complete everything before the end of the day.					
<b>Prerequisite learning:</b> A1, A2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>	
<p><i>QCTO none</i></p> <p><b><u>Read job cards, plan work activities and manage time effectively</u></b></p> <p><i>Given samples of jobs cards and timesheets and work scenarios</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Explain the use and importance of job cards and timesheets in the work context</li> <li>• Fill in sample job cards and timesheets as per given work scenario</li> </ul>		<p><b>Knowledge of:</b></p> <p><b>KM-01-KT04: Concepts related to the performance of work (22%)</b></p> <ul style="list-style-type: none"> <li>• KT0401 Planning, organising and control</li> <li>• KT0402 Work flow</li> <li>• KT0403 Cost, waste</li> <li>• KT0404 Productivity, efficiency</li> <li>• KT0405 Housekeeping</li> <li>• KT0406 Risk, health, safety, environment and related systems</li> <li>• KT0407 Quality and quality systems</li> <li>• KT0408 Continual improvement</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <p><b><u>Plan work activities and manage time effectively</u></b></p> <ul style="list-style-type: none"> <li>• Plan work activities based on job cards provided</li> <li>• Complete timesheets</li> <li>• Participate in planning meetings</li> </ul>	

<ul style="list-style-type: none"> <li>• Identify the most important tasks and develop a plan for prioritisation</li> <li>• Develop a time schedule for the day</li> <li>• Identify potential areas for delay/challenges and how to counter them</li> <li>• Describe typical time thieves in a common work day</li> </ul>	<p><b>Planning work activities</b></p> <ul style="list-style-type: none"> <li>• Planning of own daily work activities as per priority schedules</li> <li>• Coordination of work activities within and also across disciplines</li> <li>• Communication channels in the workplace and reporting procedures</li> </ul> <p><b><u>Job cards and timesheets</u></b></p> <ul style="list-style-type: none"> <li>• Job cards and timesheets, their importance and correct uses</li> </ul> <p><b><u>Time management</u></b></p> <ul style="list-style-type: none"> <li>• Effective time management</li> <li>• The importance of effective time management (risks to business)</li> <li>• How to plan for tasks and manage arising delays/challenges</li> <li>• Organisation of self and workspace for peak efficiency</li> <li>• Understand the importance of, and the most useful techniques for, setting and achieving goals.</li> <li>• Identification of the right things to focus work activities on and how to develop plans for prioritisation</li> <li>• Identification of typical time thieves</li> <li>• Correlation between stress, ownership and time management</li> </ul>	<ul style="list-style-type: none"> <li>• Obtain feedback on level of time management perceived by company, including areas for further improvement</li> </ul>
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<b>ASSESSMENT CRITERIA</b>		
<p><b><u>Read job cards, plan work activities and manage time effectively</u></b></p> <ul style="list-style-type: none"> <li>• Task requirements from job cards correctly identified</li> <li>• Tasks are adequately prioritised and planned</li> <li>• Potential areas for delay/challenges identified and corrective action explained</li> <li>• Job cards and timesheets completed</li> </ul>	<p><b>KM-01-KT04: Concepts related to the performance of work (22%)</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Define and describe the concepts related to the performance of work</li> <li>• IAC0402 Discuss the impact of these concepts on the individual employee</li> <li>• IAC0403 Describe the processes which govern the performance of work</li> </ul> <p><b>Planning work activities</b></p> <ul style="list-style-type: none"> <li>• Plan and coordinate work activities in accordance with operational sequences.</li> <li>• Liaise with other relevant trade disciplines and departments and coordinate work activities.</li> </ul> <p><b><u>Job cards and time management</u></b></p> <ul style="list-style-type: none"> <li>• The purpose and use of job cards and timesheets explained</li> <li>• Time management techniques relevant to a pipe fitting context are explained</li> <li>• Key time thieves in a pipe fitting context are identified</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Job cards completed for work performed</li> <li>• Completed timesheets</li> <li>• Signed off logbook/PoE</li> </ul>
<p><b>Internal Assessment to be performed</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test with multiple choice question 30 minutes and the competency will be at 80%</li> </ul>		

- Practical exercise to identify task requirements from a sample job card, plan a schedule of activities in order of priority and complete a timesheet
  - Standard time of 1 hour
  - Level of competence required: 80%

**Learning resources for teaching**

- Learning material and assessments for defined knowledge and practical modules
- Sample job cards and time schedules
- Samples of reporting procedures
- Videos on planning and time management in a Millwright environment

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots;

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>A5</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Practice the occupation and behave responsibly and professionally in the workplace</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		120	16	
<b>Work situation title: Use personal computer systems incl. standard office software for trade-related tasks and smart devices</b>	<b>Total hours</b>	40	CC	
<b>Work scenario:</b> Marato is requested to operate a computer at his workplace for the everyday tasks of office communication. He does not yet fully know how to operate all applications and requests an introduction. He also wants to know what smart devices are used in the context of a Millwrights daily work.				
<b>Prerequisite learning:</b> A1, A2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>
<p><b>PM-01-PS05: Perform basic computer operations</b></p> <p><i>Given a personal computer and document, spreadsheet and communication applications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0501 Start up and shut down computer and use basic input and output devices</li> <li>PA0502 Create, open and save files, folders, documents and emails</li> <li>PA0503 Compile simple reports</li> <li>PA0504 Compile spreadsheets including basic arithmetic functions</li> <li>PA0505 Retrieve, access, read and print documents</li> </ul>		<p>Knowledge of:</p> <p><b>KM-01-KT06: Information and communication technology at work</b></p> <ul style="list-style-type: none"> <li>KT0601 Computers, software and systems</li> <li>KT0602 Telephones, internet and intranet</li> <li>KT0603 The use of ICT to support business processes</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-01-PS05</b></p> <ul style="list-style-type: none"> <li>AK0501 Input and output devices</li> <li>AK0502 Features and use of the application functions</li> <li>AK0503 Formatting of text, paragraphs and cells</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li><b>Conduct an induction to the company's computer system, its main applications and usage related policies</b></li> </ul>

<ul style="list-style-type: none"> <li>• PA0506 Send and receive electronic communication</li> </ul>	<ul style="list-style-type: none"> <li>• AK0504 Inserting, moving, copying and deleting text</li> <li>• AK0505 Basic spreadsheet formulas</li> <li>• Basic ergonomics of computer use</li> <li>• Main types and parts of computers, and basic features of different operating systems</li> <li>• Range and functions of peripheral devices that can be used with a personal computer</li> <li>• Starting and shut-down procedures as well as ejecting/removing external devices</li> <li>• Basic typing techniques and strategies</li> <li>• Navigation and manipulation procedures of the desktop environment within the range of assigned workplace tasks</li> <li>• Organisational requirements for simple document filing conventions</li> <li>• Dangers of computer viruses, malware programs and illegal internet downloads</li> <li>• Appropriate use of internet search engines</li> <li>• User instructions for basic computer and network security software</li> <li>• Types of printing and storage devices</li> <li>• User instructions for printers and storage devices</li> <li>• Basic troubleshooting techniques for printers</li> <li>• Email etiquette and procedures to follow</li> <li>• Procedures for data security and regular backups</li> <li>• Computer shutdown procedure</li> <li>• Smart devices in the Millwrights context of work</li> </ul>	
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<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-01-PS05</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Computer and related devices are cared for and used correctly</li> <li>• IAC0502 Document and file names are easily identified in terms of their purpose and content</li> <li>• IAC0503 The application functions are described and used appropriately</li> <li>• IAC0504 Computer files are named consistently and saved in an appropriate way</li> <li>• IAC0505 Reports are produced as required</li> <li>• IAC0506 Spreadsheets are produced as required</li> <li>• IAC0507 Text is checked for spelling and grammar and corrected</li> <li>• IAC0508 Electronic communication is managed and used appropriately</li> </ul>	<p><b>KM-01-KT06</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Define and describe the concepts, tools and equipment related to information and communication technology</li> <li>• IAC0602 Describe and explain, with the aid of sketches where relevant, how organisations use information and communications technology to support business processes</li> <li>• IAC0603 Discuss the impact of these concepts, tools and equipment on the workplace</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off induction session</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Practical exercise of 60 min length covering all key functions of the PC</li> <li>• Level of competence required: 80%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> <li>• Personal Computers with standard office software and access to the internet</li> <li>• Office furniture and equipment</li> <li>• MS Office package (Word, Excel, Powerpoint)</li> <li>• Email application</li> <li>• Access to the internet</li> </ul>		

- Printer
- Storage, backup software and devices
- Antivirus programmes
- Data security and backup procedures

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 94022</b>		<h1>A6</h1>	
		<b>Curriculum code: 641502000</b>			
<b>Learning area title: Practice the occupation and behave responsibly and professionally in the workplace</b>		<b>Total hours</b>	<b>SDP</b> 120		
<b>Work situation title: Prepare for job search, CV writing and job interviews</b>		<b>Total hours</b>	24	CC	
<b>Work scenario:</b> Thembi is in the final year of her apprenticeship and is becoming increasingly anxious about whether her company will offer her a job on completion of the apprenticeship. She needs to know how she can find and apply for a job, should she not be placed with her company. She also needs to update her CV and practise job interview skills to ensure her success in securing a new job.					
<b>Prerequisite learning:</b> All					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>	
<p><i>QCTO none</i> <i>Given samples of current job advertisements for Millwrights (electronic and print)</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Research possible career and employment opportunities for Millwrights</li> <li>Demonstrate the steps that must be taken in order to search for and apply for a suitable job</li> <li>Revise and update own CV</li> <li>Formulate and submit applications for actual jobs</li> <li>Obtain an overview of applicable salary systems and average payment scale of Millwrights upon qualification</li> </ul>		<p><i>QCTO none</i> Knowledge of:</p> <ul style="list-style-type: none"> <li>How to source the right job advertisements for qualifying Millwrights and apply for a job (including developing a CV, submitting applications and correct dress code and preparation for job interviews)</li> <li>The average salary scales and basis for decisions regarding salary scales</li> <li>Career opportunities and progression paths available for Millwrights</li> <li>Interviewing techniques and questions</li> <li>Preparing for an interview (do's and don'ts)</li> <li>Relevant professional associations and their purpose</li> </ul>		<p><i>QCTO none</i> The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Structured discussion with supervisor about employment opportunities within the company</li> </ul>	

<p><i>Given brochures and information about preparing for an interview as well as access to the internet</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Answer anticipated interview questions</li> <li>• Ask relevant questions in an interview</li> <li>• Dress appropriately for an interview</li> <li>• Demonstrate that he/she has prepared well for an interview (how to arrive on time; behave professionally; knows something about the company he/she applied with)</li> </ul> <p><i>Given access to the internet</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Research whether professional bodies exist for Millwrights and explain what the purpose of professional associations are</li> <li>• Explain the need for registration, licensing and certification with professional associations</li> </ul>	<ul style="list-style-type: none"> <li>• The licensing, certification and registration requirements for Millwrights</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• Curriculum vitae updated</li> <li>• Applications for carpentry jobs submitted</li> <li>• Successful (winning) roleplays and interview techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss the career opportunities that exist for Millwrights.</li> <li>• Lists anticipated interview questions and associated responses to each question</li> <li>• List the professional associations which exist for Millwrights</li> <li>• Explain the purpose of professional associations</li> <li>• Describe the typical roles and responsibilities of a Millwright</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed logbook/PoE</li> </ul>
<p><b>Internal assessment to be performed:</b></p>		

- Practical exercise whereby the apprentice updates his/her CV and submits application(s) for a job.
- Competency to be at 100% (CV fully up-to-date and no spelling or grammatical mistakes on the CV or job application letter)

**Learning resources for teaching**

- Job advertisements for Millwrights
- Materials and videos on how to develop a winning CV, write applications, job interview preparation and dress code
- Information from the websites of professional bodies

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>B1</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Comply with health and safety practices</b>		<b>Total hours</b>	<b>SDP</b> 136		
<b>Work situation title: Adhere to OHS and perform risk assessments (incl. toolbox talks) and lock-out and tag out procedures</b>		<b>Total hours</b>	24	24	
<b>Work scenario:</b> Adherence to safe working procedures is of paramount importance to every Millwright. Before Thembi has her first day at work she is introduced to all important OHS rules and regulations. She learns how to perform risk assessments, attend and take notes in toolbox talks, and the importance of lock-out and tag out procedures					
<b>Prerequisite learning:</b> A1					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>	
<p><b>OHS regulations</b></p> <p><i>Given applicable site specific OHS policies, procedures, rules and regulations</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Demonstrate understanding of National Safety Legislation (OHS Act &amp; Construction Regulations applicable to the working environment.</li> <li>PA0102 Demonstrate understanding of general workshop safety in compliance with standard worksite practices.</li> <li>Identify hazards and risks associated with unsafe acts and conditions within the work environment (perform risk assessments)</li> <li>Identify relevant safety and Personal Protective Equipment (PPE), and describe the correct applications and limitations of each.</li> </ul>		<p>Knowledge of:</p> <p><b>KM-02-KT02: Safety, health, environment, risk and quality principles in the workplace (80%)</b></p> <ul style="list-style-type: none"> <li>KT0201 Occupational health and safety legislation</li> <li>KT0202 Legislation and regulations for workplace safety within electricity</li> <li>KT0203 General workshop safety rules, safety precautions and safe practices for working within industry</li> <li>KT0204 Personal protective equipment</li> <li>KT0205 Safety symbols and colour coding</li> <li>KT0206 Hazard identification and risk assessment principles</li> <li>KT0207 Fundamentals of isolating and locking out equipment and circuits</li> <li>KT0208 Fundamentals of securing worksites</li> <li>KT0209 Protection devices</li> <li>KT0214 Environmental protection and pollution</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Participate in prescribed OHS arrangements in the workplace</li> <li>Participate in toolbox talks, meetings and informal discussions and take notes</li> <li>Report on work results in next morning's toolbox talk</li> <li>Evaluate safety risks in relation to given work tasks and adopt preventative measures</li> <li>Perform an OHS evaluation of the workplace and provide a report to mentor/superior on identified risks and potential preventative measures</li> <li>Secure a work area with the applicable safety signage</li> <li>Perform basic isolation, lock out and tag out</li> </ul>	

<p><b>PM-01-PS03: Read and respond to safety signage</b></p> <p><i>Given a range of general, prohibitive, fire safety and exits, warning, mandatory, vehicle and overhead crane signage, etc.</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0301 Identify and describe the purpose of various types of safety signage</li> <li>• PA0302 Explain the precautions or actions that have to be taken in response to each safety sign</li> <li>• PA0303 Explain the implications and consequences of not responding correctly to safety signage</li> </ul> <p><b>Participate in toolbox talk and take basic notes</b></p> <ul style="list-style-type: none"> <li>• Identify and follow correct process for toolbox talk</li> <li>• Seek information and provide responses to others in the group</li> <li>• Take notes and communicate plans/agreed outcomes of toolbox talk</li> </ul> <p><b>Perform basic isolation, lock out and tag out procedures as per applicable industry standards</b></p> <p><i>Given different work scenarios, which require lock/tag out for safe working procedure</i></p> <p><b>The apprentice must be able to</b></p> <ul style="list-style-type: none"> <li>• Correctly identify all kinds of different</li> </ul>	<p>concepts</p> <ul style="list-style-type: none"> <li>• The importance of toolbox talks and their function in the workplace</li> <li>• Taking basic notes in a toolbox talk and how to report back the following day</li> <li>• The importance of lock-out and tag out</li> <li>• Industry policy and procedure for lock-out and tag-out</li> <li>• Different forms of energy (potential, pressure, steam, electrical, gravity, kinetic, mechanical)</li> <li>• How to test for ZERO energy</li> <li>• Different forms of tag and lock out procedures and their application as well as associated risks</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-01-PS03:</b></p> <ul style="list-style-type: none"> <li>• AK0301 Purpose of warning, mandatory, statutory and informative signs</li> <li>• AK0302 Workplace safety, health and environmental principles and procedures</li> <li>• AK0303 Specified requirements pertaining to employers' and employees' duties concerning occupational safety and health</li> <li>• AK0304 Consequences of not obeying safety signage</li> </ul>	<p>procedures as per applicable industry standards</p>
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<p>energy's (potential, pressure, steam, electrical, gravity, kinetic, mechanical) and how to de-energise them</p> <ul style="list-style-type: none"> <li>• Test for ZERO energy</li> <li>• Use different kinds of isolation lockout systems e.g. Gang lock vs. ball valve lock</li> <li>• Perform basic isolation, lock out and tag out procedures as per applicable industry standards</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-01-PS03:</b></p> <ul style="list-style-type: none"> <li>• IAC0301 All signs are correctly and immediately recognised and their purpose explained</li> <li>• IAC0302 The correct relevant actions or precautions in response to safety signs are described and explained</li> <li>• IAC0303 The implications and consequences of not responding to safety signage are described</li> <li>• Basic isolation, lock out and tag out procedures are performed as per applicable industry standards</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0201 The difference between acts and regulations, the responsibilities of the various role players and the application of the relevant health and safety regulations in the workplace are described and explained</li> <li>• IAC0202 The application of legislation for working with electrical installations, equipment and appliances are described and explained</li> <li>• IAC0203 General safe work practices are correctly described and explained</li> <li>• IAC0204 Various types of personal protective equipment are identified and their uses are explained</li> <li>• IAC0205 Safety signs are recognised and described in terms of associated risk and safe conduct</li> <li>• IAC0206 Basic risk assessment and hazard identification procedures are described</li> <li>• IAC0207 The inter-relationship between workplace safety and a productive work environment is explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE01: Proof of toolbox talks</li> <li>• SE02: OHS evaluation of the workplace and issued report to mentor/superior</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test with multiple choice question 30 minutes and the competency will be at 80%</li> <li>• Practical observation in which apprentice is requested to identify hazards, unsafe acts and conditions, explain safety signage and prescribe remedial action (45 minutes per candidate, can be done at same time), competency at 80%</li> </ul>		

- Level of competency of 100% (critical) required for: lock out and tag procedures

**Learning resources for teaching**

- Learning material covering defined Knowledge and Practical Skills Modules
- Different work scenarios which require the assessment of risks in the workplace

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots;
- Safety signage
- Tag out board, Lock, different lockout mechanisms

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>B2</h1>		
		<b>Curriculum code: 671202000</b>				
<b>Learning area title: Comply with health and safety practices</b>		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
			136			72
<b>Work situation title: Perform First aid &amp; Firefighting</b>		<b>Total hours</b>	24	24		
<b>Work scenario:</b> Knowing what to do in case of an accident or a fire cannot be underestimated. Before Thembi has her first day at work she is introduced to all important First aid & Fire fighting principles.						
<b>Prerequisite learning:</b> B1						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>		
<b>PM-01-PS01: Perform basic first aid</b>  <i>Given basic first aid kits</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0101 Identify the nature of injuries or medical emergencies</li> <li>PA0102 Select appropriate treatment or equipment</li> <li>PA0103 Apply relevant treatments</li> <li>PA0104 Monitor condition of injured person</li> <li>PA0105 Report orally and in writing on the nature of the injury, the treatment and the condition of the injured person</li> </ul> <b>PM-01-PS02: Perform basic fire fighting</b>  <i>Given a range of basic fire-fighting</i>		Knowledge of:  <b>KM-02-KT02: Safety, health, environment, risk and quality principles in the workplace (80%)</b> <ul style="list-style-type: none"> <li>KT0210 Causes, prevention and control of fires</li> <li>KT0211 Basic first aid</li> <li>KT0212 Incident reporting</li> <li>KT0213 Evacuation procedures</li> </ul> <u>Applied Knowledge</u>  <b>PM-01-PS01: Perform basic first aid</b> <ul style="list-style-type: none"> <li>AK0101 Types of injury and medical emergency</li> <li>AK0102 Purpose, methods, procedures and techniques of basic first aid</li> </ul>		<i>QCTO none</i>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision: <ul style="list-style-type: none"> <li><b>Exercise fire fighting measures in a mock exercise (if applicable)</b></li> <li><b>Be appointed as a temporary first aider and fire fighter at the workplace</b></li> </ul>		



<p><i>equipment and relevant personal protective equipment</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0201 Identify various types of fire and assess their context</li> <li>• PA0202 Select appropriate fire-fighting and safety equipment for each type of fire</li> <li>• PA0203 Contain or extinguish various types of fire</li> <li>• PA0204 Retreat from fires where required</li> </ul>	<ul style="list-style-type: none"> <li>• AK0103 Typical contexts in which injuries occur</li> <li>• AK0104 Implications of incorrect identification, poor treatment or lack of prioritisation of injuries or medical emergencies</li> <li>• AK0105 First aid reporting procedures and techniques</li> <li>• AK0106 Applicable safety, health and environmental legislation and regulations</li> <li>• AK0107 Role of first aid practitioner in relation to medical or para-medical personnel</li> </ul> <p><b>PM-01-PS02:</b></p> <ul style="list-style-type: none"> <li>• AK0201 Types, purpose and function of fire fighting equipment</li> <li>• AK0202 Symbols on fire fighting equipment</li> <li>• AK0203 Characteristics of various types of fire</li> <li>• AK0204 Fire fighting and retreat methods and procedures</li> <li>• AK0205 Relevant safety, health and environmental regulations</li> <li>• AK0206 Fire chemistry, combustion triangle, fire transmission, spread and elimination</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-01-PS01:</b></p> <ul style="list-style-type: none"> <li>• IAC0101 The nature of injuries and medical emergencies are identified and prioritised, and appropriate treatment and equipment is selected</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0208 Regulations for the prevention and control of fires and the causes, effects and implication of fires are described</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE01: First aider appointment</li> <li>• SE02: Mock exercise in fire fighting</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0102 Appropriate treatments are applied according to procedures</li> <li>• IAC0103 Condition of the injured person is monitored until appropriate medical personnel arrives</li> <li>• IAC0104 Reporting is concise, accurate and clear</li> <li>• IAC0105 Implications of incorrect identification, poor treatment or lack of prioritisation of injuries or medical emergencies are described and explained</li> </ul> <p><b>PM-01-PS02:</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Various types of fire are identified and the context assessed correctly</li> <li>• IAC0202 The correct equipment is selected and used to extinguish or contain each type of fire</li> <li>• IAC0203 The correct procedure is followed to retreat from fires</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0209 The attributes, characteristics, descriptions and properties of different types of fires are explained</li> <li>• IAC0210 Basic first aid procedures are described for the attributes, characteristics and properties of various injuries</li> <li>• IAC0211 The implication of injuries, their causes and effects are explained</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <p><b>OHS</b></p> <ul style="list-style-type: none"> <li>• Practical test as per provider requirements on first aid and fire fighting, competency at 80% - critical outcomes 100%.</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning Material on defined Knowledge and Practical Skills Modules</li> <li>• Basic first aid kits</li> <li>• A range of basic fire-fighting equipment and relevant personal protective equipment</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots;</li> </ul>		

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>B3</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Comply with health and safety practices</b>		<b>Total hours</b>	<b>SDP</b> 136		
<b>Work situation title: Work safely and correctly with basic hoisting &amp; lifting equipment (up to 2.5 tons)</b>		<b>Total hours</b>	40	CC	
<b>Work scenario:</b> Manini is requested to fit a 200 mm pipe assembly to a construction. The assembly must be lifted and mounted to complete a section of construction. She has to identify the lifting equipment by considering the mass and diameter of the pipe. She must also inspect the work area for hazards. The safety of her and all present is her responsibility.					
<b>Prerequisite learning:</b> A1, B1-B2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>	
<p><b>PM-01-PS04: Identify, use and care for lifting and support equipment</b></p> <p><i>Given lifting and support equipment applicable to the trade including lifting and coffin hoists, jib cranes, <del>overhead remote control cranes</del>, manual jacks, hydraulic jacks, chain blocks, steel rope and nylon slings, shackles, air hoists, eye bolts, tackle, various kinds of support equipment, cleaning and lubricating materials, task instructions, a range of typical items for lifting and relevant personal protective equipment etc, the apprentice must be able to:</i></p> <ul style="list-style-type: none"> <li>PA0401 Identify potential hazards and risks related to the use of the lifting and</li> </ul>		<p>Knowledge of:</p> <p><b>KM-03-KT04: Basic lifting concepts</b></p> <ul style="list-style-type: none"> <li>KT0401 Rigging (slings, block and tackle, chain block, steel ropes)</li> <li>KT0402 Rigging concepts</li> <li>KT0403 Load selection and limitations</li> <li>KT0404 Safety precautions (incl. correct PPE)</li> </ul> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>AK0401 Safety and housekeeping standards related to lifting and support equipment</li> <li>AK0402 Techniques for using and maintaining lifting and support equipment</li> <li>AK0403 Safety procedures and legal requirements</li> </ul>		<p>QCTO none</p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Select the correct lifting and hoisting equipment for the work task at hand</li> <li>Perform risk assessment on lifting and hoisting task in the respective environment</li> <li>Move equipment/materials (up to 2500kg) as per company specific requirements</li> <li>Inspect equipment and check registers</li> <li>Move equipment/materials on the work site with hoisting and lifting equipment (under various stages of supervision)</li> </ul>	

<p>support equipment and list appropriate responses</p> <ul style="list-style-type: none"> <li>• PA0402 Identify the correct lifting equipment for a variety of lifting tasks and describe their functions</li> <li>• PA0403 Describe and explain the requirements and standards for inspecting lifting equipment</li> <li>• PA0404 Identify the correct weight carrying capacity of lifting and support equipment for a variety of tasks</li> <li>• PA0405 Inspect lifting equipment for valid certification, and identify and report defects</li> <li>• PA0406 Select and use a range of different lifting and support equipment for appropriate tasks according to the equipment's size and weight</li> <li>• PA0407 Select and use appropriate personal protective equipment</li> <li>• PA0408 Clean, maintain and store lifting and support equipment after use, and clean the work area</li> </ul>	<ul style="list-style-type: none"> <li>• AK0404 Safe operating procedures for lifting equipment</li> <li>• AK0405 Manufacturers' procedures and specifications related to lifting and support equipment</li> <li>• AK0406 Correct and safe application of lifting and support equipment</li> <li>• AK0407 Typical hazards and risks associated with lifting and support equipment</li> <li>• AK0408 Environmental requirements and practices</li> <li>• AK0409 Criteria and requirements for inspecting and reporting on condition of lifting and support equipment</li> <li>• AK0410 ISO standards for slings, hooks, shackles and eye bolts</li> <li>• AK0411 Storing of lifting and support equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Store hoisting and lifting equipment, record and report any defects</li> <li>• Maintain hoisting and lifting equipment</li> <li>• Apply safety and housekeeping standards related to lifting and hoisting</li> <li>• Provide work documentation, verbal and written reports as required by the company</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• IAC0401 Items are lifted and, where applicable, supported using the correct lifting and support equipment</li> <li>• IAC0402 All potential hazards are identified and appropriate steps, including the use of personal protective equipment, are taken to reduce the risk according to the specific requirements for each task</li> <li>• IAC0403 Lifting and support equipment are identified and their functions and</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0401 Types of rigging are identified and described</li> <li>• IAC0402 Rigging concepts are discussed</li> <li>• IAC0403 Loads are calculated and selected</li> <li>• IAC0404 Safety precautions pertaining to rigging are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off PoE/logbook</li> </ul>

<p>relevant safety standards are correctly described and explained</p> <ul style="list-style-type: none"> <li>• IAC0404 Lifting and support equipment is examined for damage and all defects are identified and reported</li> <li>• IAC0405 Maximum lifting capacities and limits are observed</li> <li>• IAC0406 Lifting equipment is not damaged during or after use</li> <li>• IAC0407 Lifting equipment work area is cleaned and maintained in accordance with requirements</li> <li>• IAC0408 Lifting and support equipment is stored according to the requirements</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test (30 min) about identification of equipment, maintenance and storage the competency will be at 80%.</li> <li>• Practical exercise identification, inspection and safe lifting techniques <ul style="list-style-type: none"> <li>○ #Standard time 1 hour</li> </ul> </li> <li>• Level of competence required: 80%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> <li>• Practical tasks to move equipment/materials (up to 2500kg)</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots; Hard hats, safety glasses, safety gloves, etc.</li> <li>• Lifting and hoisting equipment: Lifting and coffin hoists, manual jacks, hydraulic jacks, chain blocks, steel rope and nylon slings, shackles, eye bolts, tackle, chain slings, tirror</li> </ul>		

Materials:

- Electrical motors, gearboxes, pallets to be lifted, any type of load not exceeding 2.5 ton
- Cleaning and lubricating materials

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>B4</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Comply with health and safety practices</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		136	72	
<b>Work situation title: Work safely at heights (incl. ladders &amp; scaffolds) and in confined spaces as well as in &amp; near excavations (if applicable)</b>		<b>Total hours</b>	40	24
<b>Work scenario:</b> Manini is requested to work in different contexts: At height, in a confined space as well as in/near excavations. Before she performs the actual work, she needs to access the specific risks involved when working in such areas.				
<b>Prerequisite learning:</b> A1, A2, B1, B2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	<b>70%</b>	<b>Knowledge modules (KM)</b>	<b>30%</b>	<b>Work experience modules (WM)</b>
<p>QCTO none</p> <p><i>Given various types of ladders and different work scenarios, which require the use of ladders:</i></p> <p><b>The apprentice must be able to:</b></p> <p><b>Use of Ladders</b></p> <ul style="list-style-type: none"> <li>Select the correct type of ladder for use according to the specific work requirements</li> <li>Confirm certification of ladder for purpose and identify associated work tasks</li> <li>Ensure area for ladder placement is free of obstructions</li> <li>Place and position ladder on suitable, clean and level surface (top &amp; bottom)</li> <li>Check if ladder is placed at appropriate angle and has the correct height in accordance with given limits (up to 9m)</li> <li>Secure and tie ladders (top or bottom) and/or obtain assistance to prevent slipping, where required</li> </ul>		<p>QCTO none</p> <p><b>Working at heights</b></p> <ul style="list-style-type: none"> <li>Legislative requirements for working at heights.</li> <li>General hazards and risks related to working at heights.</li> <li>Ladder safety</li> <li>Scaffold safety</li> <li>Fall arresting systems and procedures.</li> </ul> <p><b>Working in confined spaces</b></p> <ul style="list-style-type: none"> <li>General hazards and risks related to working in confined spaces.</li> <li>Adequate ventilation</li> </ul> <p><b>Working in or near excavations</b></p> <ul style="list-style-type: none"> <li>Working in or near excavations and trenches.</li> <li>Excavation design hazards and safety procedure requirements.</li> <li>Properties and classification of soil types,</li> </ul>		<p>QCTO none</p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Participate in the application and adherence to working at heights procedures whilst performing work at elevated positions.</li> <li>Participate in the application and adherence to working in confined space procedures whilst working in constricted areas.</li> <li>Participate in the application and adherence to working in or near excavations in accordance to worksite standards</li> <li>Carry out risk assessments prior to climbing ladders and select the appropriate PPE for use prior to climbing ladders</li> <li>Select the correct type of ladder for use according to the specific work requirements</li> <li>Check ladders for compliance and reject non-compliant ladders and initiate</li> </ul>

<ul style="list-style-type: none"> <li>• Safe use of ladders for given work assignment according to OHSA requirements</li> <li>• Observe special safety measures when working close to electrical circuits</li> <li>• Isolate and barricade work area to ensure safe dismantling/taking down of scaffoldings and ladders after work completion</li> <li>• Securely dismantle/take down ladders</li> <li>• Complete ladder register prior to storing</li> <li>• Securely store ladders in designated area</li> </ul> <p><b>Use of Scaffolding (for awareness only)</b></p> <ul style="list-style-type: none"> <li>• Select the appropriate PPE for use prior for erecting scaffolding</li> <li>• Select the correct type of ladder for use according to the specific work requirements</li> <li>• Select the correct type of scaffolding for use according to the specific work requirements</li> <li>• Check scaffolding for compliance</li> <li>• Reject, and label damaged scaffolding components and initiate repair/replacement process</li> <li>• Erect scaffolding and install components correctly for the stabilisation of the scaffolding up to 2m</li> </ul>	<p>sloping requirements, excavation support systems and back filling requirements.</p> <p><u>Safe use of ladders:</u></p> <ul style="list-style-type: none"> <li>• Types of ladders (e.g. extension ladder, a-frame ladder, wooden ladder, etc.)</li> <li>• Purpose of ladders and where different types are used</li> <li>• Safe erection methods for ladders</li> <li>• Safety precautions concerning ladders (incl. overreach, overload, etc.)</li> <li>• Correct positioning and demarcation of areas before climbing of ladders</li> <li>• Risk assessment methods before climbing ladders</li> <li>• Methods of inspection of ladders (visual and mechanical)</li> <li>• Angles and fastening of ladders when extended</li> <li>• Methods of checking rungs on ladders</li> <li>• Types of Non-skid devices for ladders</li> <li>• Methods of checking the spreader brace devices for ladders</li> <li>• Maximum heights of ladders</li> <li>• Different types of PPE used when climbing ladders</li> <li>• Ladder register (purpose of and completion)</li> <li>• Standard operating procedures with regards to ladders</li> </ul> <p><u>Safe use of scaffolding:</u></p> <ul style="list-style-type: none"> <li>• Types of visual inspection of scaffolding</li> <li>• Types of scaffolding</li> <li>• Purpose of scaffolding and where different types are used</li> <li>• The different components used in erecting of</li> </ul>	<p>repair/replacement process</p> <ul style="list-style-type: none"> <li>• Use ladders on inside/outside structures for applicable work</li> <li>• Complete ladder register prior to storing of the ladders.</li> <li>• Store ladders in accordance with the manufactures specification or organisational specifications</li> <li>• Erect scaffolding and install components correctly for the stabilisation of the scaffolding to install inside and outside of structures up to 2m</li> <li>• Erect scaffoldings in various work environments and for various work scenarios</li> <li>• Complete scaffolding register prior to storing of scaffold</li> <li>• Store scaffolding in accordance with the manufactures specification or organisational specifications</li> </ul>
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	<p>scaffolding</p> <ul style="list-style-type: none"> <li>• Safe methods of erecting scaffolding</li> <li>• Establishment of footings</li> <li>• Safe work methods to determine the bearing capacity of ground or working surfaces</li> <li>• Techniques for using ropes</li> <li>• Types of scaffolding accessories</li> <li>• Lifting devices include cantilevered hoists and gin wheels</li> <li>• Rules and regulations associated with scaffolding</li> <li>• Different types of PPE for use when erecting scaffolding</li> <li>• Purpose and completion of the scaffolding register</li> <li>• Types of platforms for use on scaffolding</li> <li>• Support structures for scaffolding</li> <li>• Permissible alterations and repairs due to work damage, accidents, misuse and other changes</li> <li>• Standard operating procedures with regards to scaffoldings</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• Understanding of National Safety Legislation (OHS Act &amp; Construction Regulations applicable to the working environment is demonstrated.</li> <li>• Application of general workshop safety in accordance with standard worksite practices.</li> <li>• Adherence to working at heights procedures whilst performing work at elevated positions.</li> <li>• Adherence to working in confined space procedures whilst working in constricted areas.</li> <li>• Adherence to working in or near excavations in accordance to worksite standards.</li> </ul>	<p><b>Working at heights</b></p> <ul style="list-style-type: none"> <li>• Explain conditions/ requirements that compels conformance to work on height procedures.</li> <li>• Identify general hazards and risks related to working at heights.</li> <li>• Explain mandatory requirements with regard to the use of step ladders.</li> <li>• Explain mandatory requirements with regard to the use of scaffolding.</li> </ul> <p><b>Working in confined spaces</b></p> <ul style="list-style-type: none"> <li>• Explain the definition of a confined space as</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off PoE/logbook</li> <li>• Completed ladder and scaffold registers</li> </ul>

<ul style="list-style-type: none"> <li>• Selecting suitable ladders and scaffolds for loads and the environment in which they are to be erected</li> <li>• Safe erecting/assembling of ladders/scaffolds in different structures</li> <li>• Adequate use of support accessories/equipment</li> <li>• Compliance with legislation and standard operating procedures when using ladders</li> <li>• Correct storage of ladders</li> </ul>	<p>per relevant legislation.</p> <ul style="list-style-type: none"> <li>• Explain conditions/ requirements that compels conformance to working in confined spaces.</li> <li>• Explain mandatory requirements and procedures with regard to working in confined spaces.</li> <li>• Identify general hazards and risks related to working in confined spaces.</li> </ul> <p><b>Working in or near excavations</b></p> <ul style="list-style-type: none"> <li>• Explain the definition of a trench / excavation as per the OHS Act and Construction Regulations.</li> <li>• Explain the hazardous nature of working in and around excavations.</li> <li>• Explain the safety requirements that need to be adhered to when working in or near trenches and excavations.</li> <li>• Explain sloping requirements for different types of soil.</li> <li>• Identify and explain the use of shoring materials.</li> <li>• Identify and explain the use of pre-manufactured support systems.</li> <li>• Explain the calculations for the grade and elevation of a trench.</li> <li>• Explain backfilling procedures.</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test (30 min) about identification of equipment, maintenance and storage the competency will be at 80%.</li> <li>• Practical exercise identification, inspection and working techniques (ladders, scaffolds), confined spaces &amp; in and near excavations <ul style="list-style-type: none"> <li>○ #Standard time 2 hours</li> </ul> </li> <li>• Level of competence required: 100%</li> </ul>		

### **Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Practical tasks

### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety gloves; Hard hat; Safety jacket
- High visibility reflective vest with suitable personal identification details
- Body harness, anchorage, lifeline
- Ropes, chains, fasteners, fixing devices
- Spanners/ wrenches
- Screw drivers
- Hammers
- Gin wheels
- Shovels
  
- Ladders up to 9 meters
- Modular and prefabricated scaffolds up to 2 meters
- Steel tubing
- Prefabricated scaffolding components
- Supporting accessories and equipment (e.g. secured by nylon ropes, wheels, chains, couplings etc.)
- Transport trolleys

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>B5</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Comply with health and safety practices</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		136	72	
<b>Work situation title: Perform housekeeping, resource efficient &amp; environmentally friendly waste removal (incl. storage of hazardous materials)</b>	<b>Total hours</b>	8	CC	
<b>Work scenario:</b> Tom has completed his drilling task on the pedestal drilling machine. He is requested to perform all required housekeeping tasks as per industry standards and dispose of all waste materials in environmentally friendly manner. This includes handling and storing all hazardous material safely.				
<b>Prerequisite learning:</b> A1, B1-B2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><b>Perform housekeeping activities as per industry standards</b></p> <p><i>Given an untidy workshop after a full day of work</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Identify all areas required to clean in order to perform housekeeping as per industry standard</li> <li>Clean all relevant areas as per prescribed standard</li> <li>Collect tools, review tools for any defects</li> <li>Clean and store all tools appropriately</li> </ul>		<p>Knowledge of:</p> <p><b>KM-01-KT04: Concepts related to the performance of work(22%)</b></p> <ul style="list-style-type: none"> <li>KT0403 Cost, waste</li> <li>KT0404 Productivity, efficiency</li> <li>KT0405 Housekeeping</li> <li>KT0406 Risk, health, safety, environment and related systems</li> </ul> <p><u>Housekeeping</u></p> <ul style="list-style-type: none"> <li>The importance of housekeeping and reasons therefore – also related to OHS</li> <li>Safety and housekeeping standards applicable to the specific industry</li> <li>Techniques for inspecting, cleaning and storing tools</li> </ul>		<p><i>QCTO none</i></p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Perform regular housekeeping activities and receive feedback on standards performed</li> <li>Conduct toolbox checks, clean tools and safely store as per industry standard</li> <li>Select and use correct PPE</li> <li>Lift, carry and handle hazardous substances</li> <li>Store hazardous substances following safety procedures</li> </ul>

<ul style="list-style-type: none"> <li>• Collect all waste materials and store OR dispose of in an environmentally friendly manner</li> </ul> <p><b>Handling and storage of hazardous materials</b></p> <p><i>Given various types of hazardous materials and work scenarios, which require the handling and storage thereof</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Select and use correct PPE</li> <li>• Identify hazardous materials and explain their respective risks</li> <li>• Lift, carry and handle hazardous substances in a safe manner</li> <li>• Safely store the substances</li> </ul>	<ul style="list-style-type: none"> <li>• Correct handling, storage and disposal of common waste materials applicable to the industry</li> </ul> <p><u>Hazardous materials</u></p> <ul style="list-style-type: none"> <li>• Select and use correct PPE</li> <li>• Hazardous materials and their respective risks to health and the environment</li> <li>• Safe handling and storage of hazardous materials</li> <li>• The impact of incorrectly disposing of waste</li> <li>• Environmental regulations for the disposal of relevant hazardous waste</li> <li>• Interpretation of Material Safety Data Sheets (MSDS)</li> </ul> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>• Safety and housekeeping standards related to the industry</li> <li>• Techniques for inspecting, cleaning and storing tools</li> <li>• Environmentally friendly waste material disposal</li> <li>• Handling, storage and disposal of hazardous materials</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• Housekeeping procedures are performed to industry standard</li> <li>• Tools are inspected, cleaned and stored as per prescribed standard</li> </ul>	<p><b>Housekeeping</b></p> <ul style="list-style-type: none"> <li>• Selection and use correct PPE is explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off Logbook/PoE</li> </ul>

<ul style="list-style-type: none"> <li>• Waste materials are either stored or disposed of in environmentally friendly manner</li> <li>• Material Safety Data sheets are correctly interpreted</li> <li>• Hazardous substances are lifted, carried stored following the applicable safety procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Correct housekeeping procedures are identified and the reasons for them explained</li> <li>• Techniques for inspecting, cleaning and storing of tools are adequately described</li> <li>• The types of hazardous waste are identified and the impact of incorrectly disposing of waste is described</li> <li>• Environmental regulations for the disposal of relevant hazardous waste are correctly explained</li> <li>• Material Safety Data sheets are correctly interpreted</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test (30 min) with various housekeeping scenarios. Apprentice to identify and explain correct housekeeping procedures and propose remedial action for inappropriate housekeeping measures. Competency must be at 80%.</li> <li>• Practical exercise of performing regular housekeeping activities and safely handling and storing hazardous materials <ul style="list-style-type: none"> <li>○ #Standard time 1 hour</li> </ul> </li> <li>• Level of competence required: 80%, hazardous materials: 100%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge Modules</li> <li>• Practical tasks</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots; Hard hats, safety glasses, safety gloves, etc.</li> <li>• Hazardous Materials for storage (oils, thinners, paints, safety solvents, acids)</li> <li>• Material Safety Data Sheets (MSDS) for respective materials</li> </ul>		

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>C1</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Conduct preparatory and quality assurance activities</b>		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>184</td> <td>8</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
184	8						
<b>Work situation title: Read, interpret and produce freehand as well as accurate basic 2 and 3 dimensional engineering drawings of mechanical components</b>		<b>Total hours</b>	<table border="1"> <tr> <td>24</td> <td>CC</td> </tr> </table>	24	CC		
24	CC						
<b>Work scenario:</b> Manini is requested to view some mechanical drawings. She will need to interpret them for the respective work scenario. She also has to produce a drawing for the machine shop to machine a new shaft for the shaker using a free hand sketching method including symbols and abbreviations and all dimensions.							
<b>Prerequisite learning:</b> A1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	NONE		
<p><b>PM-02-PS04: Read, interpret and produce basic engineering drawings</b></p> <p><i>Given engineering drawings and practical drawing assignments,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0401 Identify and interpret symbols, abbreviations and tolerances on engineering drawings</li> <li>PA0402 Identify types of fits</li> <li>PA0403 Identify surface textures</li> <li>PA0404 Draw free hand sketches</li> <li>PA0405 Draw isometric and orthographic drawings</li> <li>Housekeeping performed as per industry standard</li> </ul> <p><i>Given work scenarios and instructions to</i></p>		<p>Knowledge of:</p> <p><b>KM-03-KT01: Engineering drawings (15%)</b></p> <ul style="list-style-type: none"> <li>KT0101 Freehand drawing</li> <li>KT0102 Code of practice for engineering drawing (symbols and abbreviations)</li> <li>KT0103 Drawing instruments and equipment</li> <li>KT0104 Dimensioning methods</li> <li>KT0105 read and interpreted Isometric drawings</li> <li>KT0106 Assembly and detailed drawings</li> <li>Surface textures tolerances</li> <li>Draw a orthographic projections first and third angle</li> <li>Draw isometric drawing including eclipse/circle</li> </ul>		<p>QCTO none</p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Access, select and view engineering drawings related to a specific work scenario</li> <li>Interpret basic engineering drawings to determine scope of work.</li> <li>Discuss appropriateness/correctness of engineering drawing with supervisor</li> <li>Identify and interpret component requirements</li> <li>Interpret dimensions, instructions, symbols and conventions</li> <li>Extract dimensions from engineering drawings for work to be undertaken</li> <li>Modify drawings by hand where necessary</li> <li>Use drawings to explain and communicate</li> </ul>			

<p><i>produce a freehand sketch/modification of a drawing for an engineering component</i></p> <p><b>The apprentice must be able to:</b></p> <p><b>Produce basic sketches and modifications of engineering components</b></p> <ul style="list-style-type: none"> <li>• Select principal axes and angles</li> <li>• Sketch isometric and non-isometric lines</li> <li>• Construct pictorial circles and arcs</li> <li>• Sketch isometric, oblique and perspective views</li> <li>• Conduct calculations, as required, to ensure correct dimensions and proportions</li> <li>• Construct and use scales for sketch</li> <li>• Apply engineering specific terminology and symbols, and include specifications, as required, to convey required information</li> <li>• Complete border and title blocks and confirm sketch is an accurate representation of component</li> <li>• Check correct application of standard drawing conventions</li> <li>• Obtain verification of completed sketches of basic engineering components by facilitator</li> </ul>	<p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>• AK0401 Terms and definitions pertaining to engineering drawings</li> <li>• AK0403 Allowances, tolerances and fits</li> <li>• AK0404 Engineering drawing conventions</li> </ul>	<p>the information content</p> <ul style="list-style-type: none"> <li>• Draw a freehand sketch of a component</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-02-PS04: Read, interpret and produce basic engineering drawings</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Details and information on engineering drawings are interpreted and explained accurately</li> <li>• IAC0402 Engineering drawings are produced according to specifications</li> <li>• Housekeeping performed as per industry</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0101 Freehand drawings demonstrate accurate resemblance to original object in terms of dimensions, shape and size</li> <li>• IAC0102 Accurate drawings indicate instruments are used correctly</li> <li>• IAC0103 First and third angle orthographic projections are read and interpreted accurately</li> <li>• IAC0104 Isometric drawings are read and</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>



<p>standard</p>	<p>interpreted accurately</p> <ul style="list-style-type: none"> <li>• IAC0105 Assemblies, sectional drawings and detailed drawings are read and interpreted accurately</li> <li>• Orthographic projections first and third angle according to specifications</li> <li>• Isometric drawing including eclipse/circle</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 50 marks (45min) and the competency will be at 80%</li> <li>• Practical exercise of 60min standard time covering all above-mentioned items</li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>• Accurately resemblance to original object</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All other components of assessment</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots;</li> <li>• Engineering drawings and drawing</li> </ul> <p><b>Measuring instruments incl.:</b></p> <ul style="list-style-type: none"> <li>• Steel ruler</li> <li>• Steel square</li> <li>• Vernier calliper</li> <li>• Micrometer</li> <li>• Acrylic Rulers</li> <li>• Geometry set squares</li> <li>• Reduction scale rulers (Architect's scale)</li> </ul>		

Materials:

- A3 drawing board with small drawing head or double lock mechanism
- Set of pen and pencil
- Set square with protractors and scale ruler
- Compass set with pen adaptor
- Drafting templates/stencils (architect, lettering, electrician, engineering)

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>C2</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Conduct preparatory and quality assurance activities</b>		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>184</td> <td>8</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
184	8						
<b>Work situation title: Identify, read and interpret Electrical switchgear and related drawings, symbols and sketches (incl. creating and modifying simple electrical sketches)</b>		<b>Total hours</b>	<table border="1"> <tr> <td>40</td> <td>8</td> </tr> </table>	40	8		
40	8						
<b>Work scenario:</b> Manfred is requested to view some electrical switchgear drawings. He needs to relate symbols with the electrical components, interpret the role of each component and explain the function of the circuit. He then has to produce a given circuit applying all the above.							
<b>Prerequisite learning:</b> C5, D4							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>			
<b>PM-05-PS01: Read and interpret electrical diagrams</b>  <i>Given a variety of typical electrical diagrams for various systems (i.e. distribution, motor control), lists of symbols and abbreviations and relevant information on reading diagrams,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0101 Identify and explain symbols</li> <li>PA0102 Identify and explain abbreviations</li> <li>PA0103 Determine and explain the electrical current flow as shown in the circuit diagram</li> </ul>		Knowledge of:  <b>KM-07-KT02: Wiring of installations (35%)</b> <ul style="list-style-type: none"> <li>KT0201 Regulations and statutory requirements for wiring of premises</li> <li>KT0202 Electrical diagrams and symbols</li> <li>KT0203 Electrical components and their applications</li> </ul> <u>Applied Knowledge:</u>  <b>PM-05-PS01: Read and interpret electrical diagrams</b>		<i>QCTO none</i>  <b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b> <ul style="list-style-type: none"> <li>Read and interpret electrical diagrams relating to various work scenarios</li> <li>Extract and use information from drawings to define scope of work</li> <li>Discuss appropriateness/correctness of electrical drawing specifications with supervisor</li> <li>Create and modify simple electrical sketches</li> <li>Modify electrical diagrams as per required work scenario</li> </ul>			

<ul style="list-style-type: none"> <li>PA0104 Locate the relevant portions of the diagram with respect to the whole using the given references</li> <li>PA0105 Locate the relevant position of components using the given references</li> </ul> <p><b>Create and modify simple electrical sketches</b></p> <p><i>Given work scenarios which require electrical sketches/diagrams for various systems</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Create simple electrical sketches to describe the work scenario accurately</li> <li>Modify electrical diagram as per requirement of work scenario</li> </ul>	<ul style="list-style-type: none"> <li>AK0101 International Electro-technical Commission Standards</li> <li>AK0102 Systematic approach for reading diagrams</li> <li>AK0103 Techniques for interpreting diagrams</li> </ul> <ul style="list-style-type: none"> <li>Industry standards and conventions for the creation of simple electrical diagrams</li> <li>Accepted techniques to modify existing electrical diagrams</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-05-PS01: Read and interpret electrical diagrams</b></p> <ul style="list-style-type: none"> <li>IAC0101 Abbreviations are correctly identified and explained according to International Electro-Technical Commission specifications</li> <li>IAC0102 Electrical current flow as shown in the circuit diagram is correctly determined and explained</li> <li>IAC0103 Relevant portions of the diagram are correctly located with</li> </ul>	<p><b>KM-07-KT02: Wiring of installations</b></p> <ul style="list-style-type: none"> <li>IAC0201 List, identify and explain the meaning of all standard International Electrotechnical Commission (IEC) wiring symbols given on work drawings</li> <li>IAC0202 Identify electrical components and draw schematic diagrams of installations</li> <li>IAC0203 State and explain the safety purpose of earthing, fuse, circuit breakers and earth leakage protection</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>Signed off logbook/PoE</li> </ul>

<p>respect to the whole according to the given references</p> <ul style="list-style-type: none"> <li>IAC0104 Relevant positions of components are located correctly according to the given references</li> </ul>	<p>unit</p> <ul style="list-style-type: none"> <li>IAC0204 Describe the principles of operation of various control systems</li> <li>IAC0205 Describe the principles of operation of single and three phase circuit breakers and core balance earth leakage relays (wound primaries and straight primaries with tripping relay)</li> <li>IAC0206 Describe the purpose of load distribution, lightning arrestors and energy control units</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test of a minimum of 50 marks (60 min) and the competency will be at 80%</li> <li>Practical exercise of 45min standard time covering all the above-mentioned items</li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>Produced drawing must be functional</li> <li>All symbols must be correct</li> <li>All safety procedures and principles adhere to</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>All other assessment items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>Learning material covering Knowledge and Practical Skills Modules</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>Personal Protective Equipment; Overalls; Safety Boots;</li> <li>Electrical drawings and components</li> <li>Pens and pencils</li> <li>Drawing area</li> </ul>		

<ul style="list-style-type: none"> <li>• Ruler</li> <li>• Electrical stencil</li> <li>• Eraser</li> </ul>							
<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>C3</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Conduct preparatory and quality assurance activities</b>		<b>Total hours</b>				<b>SDP</b>	<b>WP</b>
						184	8
<b>Work situation title: Apply trade calculations in job tasks</b>		<b>Total hours</b>		16	CC		
<b>Work scenario:</b> Xolani must fabricate and install some mechanical components. He studies the drawing and technical specifications for the job carefully to ensure that he understands what to do. He checks some of the calculations of the dimensions and then starts calculating and measuring out the material he will be using.							
<b>Prerequisite learning:</b> A1, C1, D5							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>		80%	<b>Knowledge modules (KM)</b>		20%		
					<b>Work experience modules (WM)</b>		
QCTO none		QCTO none		QCTO none			
<b>Perform basic trade calculations</b>  <i>Given drawings and work scenarios,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>• Apply calculations and related theoretical principles to determine fabrication parameters</li> <li>• Calculate quantities of materials required for specified job</li> <li>• Use equivalent and conversion tables</li> <li>• Calculate area, volume and circumference</li> </ul>		<b>Knowledge of:</b> <ul style="list-style-type: none"> <li>• Basic trade calculations incl.: <ul style="list-style-type: none"> <li>○ Mathematical calculations, linear measurement, areas, volumes, ratios</li> </ul> </li> <li>• Basic calculations for quantities of materials</li> <li>• The use of equivalent and conversion tables</li> <li>• The use of tables of weights and measurements</li> <li>• Ratios and proportions</li> <li>• Calculation of area, volume and circumference</li> </ul>		<b>The apprentice will be expected to engage in the following work activities:</b> <ul style="list-style-type: none"> <li>• Calculate relevant production parameters utilising trade calculations for various jobs</li> <li>• Give the apprentices various work scenarios in which he/she needs to measure and calculate: <ul style="list-style-type: none"> <li>○ Length</li> <li>○ Area</li> <li>○ Volume</li> <li>○ Diameter</li> </ul> </li> </ul>			

<ul style="list-style-type: none"> <li>• Explain the principle of Pythagorean theorem</li> </ul>	<ul style="list-style-type: none"> <li>• The principle of performing right angle trigonometry</li> <li>• The principle of Pythagorean theorem</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• Calculations and related theoretical principles are correctly applied to determine fabrication parameters</li> </ul>	<ul style="list-style-type: none"> <li>• Explain and apply the use of equivalents and conversion tables.</li> <li>• Explain and apply the use of tables of weights and measurements</li> <li>• Explain and apply ratios and proportions.</li> <li>• Explain and illustrate the calculation of area, volume and circumference.</li> <li>• Explain and demonstrate the principle of performing right angle trigonometry.</li> <li>• Explain and apply the principle of Pythagorean theorem.</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>
<p><b>Internal Assessment to be performed</b></p> <ul style="list-style-type: none"> <li>• Internal test, in which mathematical concepts and principles are applied to calculate fabrication and installation requirements. The length will be 1 hour and the competency will be at 80%. <ul style="list-style-type: none"> <li>○ All calculation steps to be shown</li> <li>○ Calculations to be correct</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material and assessments for defined knowledge and practical modules</li> <li>• Samples (and charts) of trade calculations and formulas</li> <li>• Different work scenarios for which calculations must be done;</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment: Overalls, safety boots, etc.</li> </ul>		

- Scientific Calculator
- Zues book/ Engineering black book

**Occupation/trade title:** Millwright

**SAQA ID:** 97585

**Curriculum code:** 671202000

**Learning area title:** Conduct preparatory and quality assurance activities

**Total hours**

**SDP**

**WP**

184

8

**Work situation title:** Understand and apply basic mechanical theory

**Total hours**

40

CC

**C4**

**Work scenario:** Thandu is requested to attend Basic Mechanical class. He is to build an understanding of mechanical theory as is required to practise as a Millwright - to the extent that he can apply it in fault finding and repair. He must master the function of an array of mechanical components and subassemblies.

**Prerequisite learning:** C3

**INTEGRATED LEARNING CONTENT**

Practical skills modules (PM)	80%	Knowledge modules (KM)	20%	Work experience modules (WM)
<p><i>QCTO none</i></p> <p><i>Given different mechanical work scenarios, which demonstrate fundamental mechanical principles</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Determine the different forms of mechanical energy</li> <li>• Explain the difference between linier and rotary movement and the applying principles</li> <li>• Perform fundamental numerical calculations to solve routine mechanical problems</li> <li>• Calculate missing values from a given technical drawing</li> </ul>		<p><b>Mechanical Theory</b></p> <ul style="list-style-type: none"> <li>• Engineering components, mechanical systems and their working principles</li> <li>• The definitions of components and subassemblies</li> <li>• The types and functions of components and subassemblies</li> <li>• The applications of different components, subassemblies and systems</li> <li>• Safety precautions pertaining to mechanical work</li> <li>• Numerical calculations for routine mechanical problems</li> <li>• Linear and rotary movement</li> <li>• Forms of mechanical energy</li> </ul> <p><b>KM-03-KT05: Types and applications of screw</b></p>		<p><i>QCTO none</i></p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <p>None</p>



	<p><b>threads</b></p> <ul style="list-style-type: none"> <li>• KT0501 Terminology related to screw threads (pitch, root diameter, nominal diameter, lead, flank, internal and external threads, helix angle, included angle)</li> <li>• KT0502 Screw threads (v-thread, acme and square threads)</li> <li>• KT0503 Application of screw threads</li> <li>• KT0504 Thread calculations</li> </ul> <p><b>KM-03-KT06: Types and functions of locking devices and fasteners</b></p> <ul style="list-style-type: none"> <li>• KT0601 Fasteners and locking devices (machine screws, set screws, cap screws, grub screw, studs, locking nuts and bolts, washers, circlips, pins, keys)</li> <li>• KT0602 Application of fasteners and locking devices</li> <li>• KT0603 Drawings of fasteners and locking devices</li> </ul> <p><b>Hoses and fittings</b></p> <ul style="list-style-type: none"> <li>• Types of hoses</li> <li>• Types of fittings</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p>Display a comprehensive understanding of:</p> <ul style="list-style-type: none"> <li>• The different forms of mechanical energy</li> <li>• The difference between linier and rotary movement and the applying principles</li> <li>• Fundamental numerical calculations to</li> </ul>	<p><b>Mechanical theory</b></p> <ul style="list-style-type: none"> <li>• Engineering components, mechanical systems and their working principles are identified and explained</li> <li>• The definitions of components and</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• None</li> </ul>

<p>solve routine mechanical problems</p> <ul style="list-style-type: none"> <li>• Calculating missing values from a given technical drawing</li> <li>• Basic trade calculations incl.:</li> <li>• Mathematical calculations, linear measurement, areas, volumes, ratios</li> <li>• Basic engineering principles incl.:</li> <li>• Basic physical quantities, concepts, principles, S.I. units, mass, velocity, acceleration, force, weight, density, angles, energy/work/power, moments/torque, centre of gravity, mechanical advantage, levers, etc.</li> </ul>	<p>subassemblies are discussed</p> <ul style="list-style-type: none"> <li>• The types and functions of components and subassemblies are discussed</li> <li>• The applications of different components, subassemblies and systems are explained</li> <li>• Safety precautions pertaining to mechanical work is explained</li> </ul> <p><b>KM-03-KT05: Types and applications of screw threads</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Types of screw threads are read and identified</li> <li>• IAC0502 Thread terminology is explained and the profile of a thread is drawn</li> <li>• IAC0503 Freehand drawings of threads are produced with accurate resemblance to original object in terms of dimensions, shape and size</li> <li>• IAC0504 Application of screw threads is discussed</li> <li>• IAC0505 The depth of different threads is calculated</li> </ul> <p><b>KM-03-KT06: Types and functions of locking devices and fasteners</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Types of fasteners and locking devices are identified and discussed</li> <li>• IAC0602 Application of fasteners and locking devices is explained</li> <li>• IAC0603 Fasteners and locking devices are read and interpreted from drawings</li> <li>• IAC0604 Freehand drawings of different types of fasteners and locking devices are produced</li> </ul>	
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	<ul style="list-style-type: none"> <li>IAC0605 Safety precautions pertaining to fasteners and locking devices are explained</li> </ul> <p><b>Hoses and fittings</b></p> <ul style="list-style-type: none"> <li>Types of hoses are identified</li> <li>Types of fittings are identified</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test of a minimum of 30 marks (30min) and the competency will be at 80%</li> <li>Practical exercise of 45min covering all above-mentioned items</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>All assessment items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>Lecture, presentations,</li> <li>Applicable videos</li> <li>Practical demonstration,</li> <li>Practical group work</li> <li>Individual practice sessions under supervision</li> <li>Print materials, electronic files, software applications incl.:</li> <li>Textbooks (Basic Mechanical theory)</li> <li>Teaching and learning manuals incl. multimedia applications</li> <li>Learning material covering Knowledge and Practical Skills Modules</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>Personal Protective Equipment; Overalls; Safety Boots;</li> <li>Mechanical components</li> <li>Fastener examples</li> <li>Types and applications of screw threads</li> <li>Thread gauge</li> <li>Hoses and fittings</li> <li>Vernier</li> <li>Micro meter</li> <li>Thread file</li> <li>Circlip pliers</li> </ul>		

<ul style="list-style-type: none"> <li>• Combination pliers</li> <li>• Set of spanners</li> <li>• Torque wrench</li> </ul>							
<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>C5</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Conduct preparatory and quality assurance activities</b>		<b>Total hours</b>				<b>SDP</b>	<b>WP</b>
						184	8
<b>Work situation title: Understand and apply fundamentals of electricity</b>		<b>Total hours</b>		40	CC		
<p><b>Work scenario:</b> Thando is requested to attend a class for Electrical apprentices. She is to build an understanding of the theory of electricity required to practise as a Millwright to the extent that she can apply it in solving problems and designing circuits. She must master the function of an array of electrical components and interpret the role of each component in a circuit.</p>							
<p><b>Prerequisite learning:</b> A1, B1-B2</p>							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>			
<p>QCTO none</p> <p><i>Given different work scenarios and drawings; different electrical components in an electrical circuit</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Determine the different forms of energy</li> <li>• Explain the difference between alternating and direct current and the underlying principles</li> <li>• Explain the basic transformer principle</li> <li>• Explain the concepts of magnetism,</li> </ul>		<p>Knowledge of:</p> <p><b>KM-06-KT01: Fundamentals of electricity</b></p> <ul style="list-style-type: none"> <li>• KT0101 Principles and fundamental concepts of electricity</li> <li>• KT0102 Definitions, types, properties and applications of conductors, insulators and semi-conductors</li> <li>• KT0103 Concepts, theories and principles of electrical circuits</li> <li>• KT0104 Calculations on basic electrical circuits (resistance, voltage and current) and power</li> </ul>		<p>QCTO none</p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <p>None</p>			

<p>resistance, current and voltage</p> <ul style="list-style-type: none"> <li>• Perform fundamental numerical calculations to solve routine electro-technological (incl. Ohm's law and Kirchhoff's law) and electro-mechanical problems</li> <li>• Calculate missing values from a given electro technical drawing</li> <li>• Identify appropriate conductors and insulators and the relevant properties of relate materials</li> <li>• Explain basic electrical principles</li> </ul>	<ul style="list-style-type: none"> <li>• KT0105 Basic principles and calculation of magnetism</li> </ul> <p><b>KM-09-KT01: Concepts, theory and principles of supply systems (20%)</b></p> <ul style="list-style-type: none"> <li>• KT0101 Theory and concepts of alternating current</li> <li>• KT0102 Fundamental principles of alternating current</li> <li>• KT0103 Alternating current generation (distribution systems theory)</li> <li>• KT0104 Characteristics and calculations from alternating current waveforms</li> <li>• KT0105 Theory, concepts and principles of direct current sources</li> <li>• KT0106 Sources of direct current</li> <li>• KT0107 Calculations of direct and alternating current circuits</li> <li>• KT0108 Construction and operating principles of direct current generators</li> <li>• KT0109 Characteristics, sources and generation of renewable energy</li> <li>• KT0110 Relevant legislative requirements</li> </ul> <ul style="list-style-type: none"> <li>• Basic transformer principle</li> <li>• Ohms law (Resistive circuits only)</li> <li>• Kirchhoff's laws</li> <li>• Alternating current theory (incl. generation of electricity)</li> <li>• Direct current theory</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		

<p>Display a comprehensive understanding of:</p> <ul style="list-style-type: none"> <li>• Principles and fundamental concepts of electricity</li> <li>• Concepts and production of electricity</li> <li>• Magnetism</li> <li>• Basic transformer principle</li> <li>• Understanding resistance, current and voltage</li> <li>• Conductors and insulators</li> <li>• Ohms law (Resistive circuits only)</li> <li>• Kirchhoff's laws</li> <li>• Alternating current theory (incl. generation of electricity)</li> <li>• Direct current theory</li> <li>• Definitions, types, properties and applications of conductors, insulators and semi-conductors</li> <li>• Concepts, theories and principles of Electrical Circuits</li> <li>• Basic trade calculations incl.:</li> </ul>	<p><b>KM-06-KT01: Fundamentals of electricity</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Describe, calculate and interpret fundamental concepts of electricity (electro motive force, potential difference, resistance) using the correct units of measurement and definitions</li> <li>• IAC0102 List types of materials used for conductors, insulators and semi-conductors and describe their mechanical and electrical properties and applications</li> <li>• IAC0103 Describe the factors that influences the resistance of a material</li> <li>• IAC0104 Define and explain, using the correct units of measurement, Ohm's law of electricity</li> <li>• IAC0105 Define and explain, using the correct units of measurement, Kirchhoff's law of electricity</li> <li>• IAC0106 Manipulate formula to calculate voltage, current and resistance in series/parallel circuits</li> <li>• IAC0107 Name, describe and explain the different types of magnets and their properties</li> <li>• IAC0108 Explain fundamental magnetic concepts by naming the five characteristics of magnetic lines of force and explaining the relationship between flux and flux density</li> <li>• IAC0109 Describe, with the aid of a</li> </ul>	<p><b>Supporting Evidence:</b></p>
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	<p>drawing, the application of the right-hand grip rule and show how a magnetic field is established when an electrical current flows through a conductor, by using formula, calculate the force on a current carrying conductor.</p> <ul style="list-style-type: none"> <li>• IAC0110 Describe, with the aid of drawings, the effect on the magnetic field around a current carrying conductor when placed in a uniform magnetic field. Fleming's left-hand rule must be demonstrated.</li> <li>• IAC0111 Describe and explain the various forces or methods that can be used to alter magnetic fields, and describe the changes that take place</li> </ul> <p><b>KM-09-KT01: Concepts, theory and principles</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Explain the principles of generation by using Fleming's right hand rule and Faraday's laws</li> <li>• IAC0102 Explain the generation and differences between single and three phase alternating current by using wave forms and vector diagrams.</li> <li>• IAC0103 Explain the load balancing principles in a three phase supply system</li> <li>• IAC0104 Explain by drawing wave form diagrams, the differences between line and phase values.</li> <li>• IAC0105 Calculate line and phase</li> </ul>	
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	<p>voltages, line and phase currents, power and power factor taking inductance, capacitance and impedance into account</p> <ul style="list-style-type: none"> <li>• IAC0106 Explain the generation principles of direct current</li> <li>• IAC0107 Calculate power and energy in direct and alternating current circuits</li> <li>• IAC0108 Explain the various methods of producing renewable energy and list the advantages and disadvantages of the different renewable energy generation methods</li> <li>• IAC0109 Describe with the aid of drawings the components of direct current generators and their functions</li> <li>• IAC0110 Explain with the aid of drawings the operating principles of direct current generators</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 100 marks (90 min) and the competency will be at 80%</li> <li>• Practical exercise of 60min covering all above-mentioned items</li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>• Application of Ohms Law</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All other assessment items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Lecture, presentations,</li> <li>• Related videos</li> <li>• Practical demonstration,</li> <li>• Practical group work,</li> </ul>		



- Individual practice sessions under supervision
- Print materials, electronic files, software applications incl.:
- Textbooks (electro technology, physics, mathematics etc.)
- Teaching and learning manuals incl. multimedia applications
- Learning material covering Knowledge Modules

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;
- Electrical drawings and components
- Multi meter
- Calculator
- Training Circuit boards(Bread board)
- Conductor samples
- Insulator samples

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>C6</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Conduct preparatory and quality assurance activities</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		184	8	
<b>Work situation title: Adhere to company and industry quality standards</b>	<b>Total hours</b>	24	CC	
<b>Work scenario:</b> Florence is responsible for manufacturing a mechanical component. During and after manufacturing she has to ensure that her work adheres to all relevant quality standards. She uses the relevant standards as well as the specific drawings to check for tolerances and finishing specifications.				
<b>Prerequisite learning:</b> A1, C3, D5				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	50%	<b>Knowledge modules (PM)</b>	50%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><b>Interpret legislation and quality assurance specifications</b></p> <p><i>Given legislation, work instructions and specifications, and quality assurance directives</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Access relevant legislative and quality assurance documentation</li> <li>Interpret and adhere to mandatory legislation and quality assurance directives</li> </ul> <p><b><u>Identify codes and standards applicable to specific work scenarios</u></b></p>		<p><b>Knowledge of:</b></p> <p><b>KM-01-KT04: Concepts related to the performance of work (22%)</b></p> <ul style="list-style-type: none"> <li>KT0401 Planning, organising and control</li> <li>KT0402 Work flow</li> <li>KT0403 Cost, waste</li> <li>KT0404 Productivity, efficiency</li> <li>KT0405 Housekeeping</li> <li>KT0406 Risk, health, safety, environment and related systems</li> <li>KT0407 Quality and quality systems</li> <li>KT0408 Continual improvement</li> </ul> <p><b>Understand quality assurance and control concepts and processes</b></p>		<p><i>QCTO none</i></p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Identify codes and standards applicable to materials, systems and components and work tasks</li> <li>Adhere to SOP and quality standards whilst executing work assignments</li> <li>Explain reasons for necessity of adhering to quality standards and potential negative consequences in case of non-compliance</li> </ul>

<p><i>Given SOPs, standards, SABS handbooks and specifications, technical drawings including tolerances and finishing specifications as well as finished work samples</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Identify quality process, standards and requirements in the workplace</li> <li>• Identify appropriate systems of inspection / quality control in given scenarios</li> <li>• Identify applicable codes and standards for given examples / scenarios in respective handbooks</li> <li>• Explain the reasons for the applicable quality codes and standards</li> <li>• Identify instruments and gauges to use to check quality in given examples</li> <li>• Check the samples for adherence to the applicable quality standards</li> <li>• Identify and report on deviations from quality standards in the provided samples</li> <li>• Identify and complete quality assurance documentation for given examples</li> </ul>	<ul style="list-style-type: none"> <li>• The importance of standards for companies and industry</li> <li>• Standard regulating bodies applicable to the Millwright trade in South Africa and internationally</li> <li>• Codes and standards that are applicable to Millwrights</li> <li>• Tolerances and finishing specifications</li> <li>• Consequences of not adhering to set standards, tolerances and finishing specifications</li> <li>• Instruments and gauges to check quality</li> <li>• Methods of identifying quality assurance standards from technical drawings and other documentation such as SABS handbooks</li> <li>• Methods of ensuring adherence to quality standards during and after completion of work</li> <li>• Standard Operating Procedure (SOP) and its importance in ensuring efficiency, quality output and uniformity of performance</li> <li>• Quality assurance documentation in the workplace</li> </ul>	<ul style="list-style-type: none"> <li>• Check completed work for adherence to applicable standards, tolerances and specifications and report back</li> <li>• Propose remedial action in the case of non-compliance</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b><u>Examine work samples for conformance to quality standards</u></b></p>	<p><b>KM-01-KT04: Concepts related to the performance of work (22%)</b></p>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed-off logbook/PoE</li> </ul>

<ul style="list-style-type: none"> <li>• Applicable quality standards are identified from the respective handbooks and listed in full as well as the reasons therefore explained</li> <li>• Methods for inspecting and testing samples for conformance explained</li> <li>• Suitable non-destructive examination methods identified for given examples</li> <li>• Given samples examined for deviation from quality standards and deviations are correctly identified</li> <li>• All quality deviations are correctly identified in quality report</li> <li>• Negative consequences of non-compliance are adequately explained</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0401 Define and describe the concepts related to the performance of work</li> <li>• IAC0402 Discuss the impact of these concepts on the individual employee</li> <li>• IAC0403 Describe the processes which govern the performance of work</li> <li>• Applicable standards and the reasons therefore are adequately explained</li> <li>• Methods for identifying adherence to quality standards are correctly described</li> <li>• Negative consequences of non-conformance are adequately explained</li> </ul>	
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**Internal Assessment to be performed**

- Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%
- Practical exercise with 2 given work samples, quality standards, drawings (incl. tolerances and finishing specifications) for identification of adherence to quality standards and provision of quality report.
  - Standard time of 30min
  - All safety procedures and principles adhered to
  - Level of competence required: 80%.

**Learning resources for teaching**

- Learning material and assessments for defined knowledge and practical modules
- Codes and standards applicable to the work (SABS handbooks and others)
- Samples, comparison chart and ISO chart
- Chart of standard setting bodies

- Drawings and specifications which include quality requirements
- Charts on non-destructive examination techniques
- Standard Operating Procedure and Safe Working Procedure
- Audio-visual materials on quality standards and control

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: overalls; safety boots; hard hats, safety glasses, safety gloves, ear protection, etc.
- Measuring equipment: equipment for checking tolerances and specifications
- Work samples for demonstrating and practising quality control

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>D1</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Handle and care for occupation-specific tools, equipment and materials</b>		<b>Total hours</b>				<b>SDP</b>	<b>WP</b>
						104	64
<b>Work situation title: Handle and care for basic hand tools</b>		<b>Total hours</b>		16	16		
<b>Work scenario:</b> Morris is requested to identify the hand tools in a Millwright toolbox. She must explain the use and care of each item as well as describe the possible hazards. The safety of her and all present is her responsibility.							
<b>Prerequisite learning:</b> A1, A2, B1, B2, C1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>		<b>Knowledge modules (KM)</b>		<b>Work experience modules (WM)</b>			
70%		30%					
<p><b>PM-02-PS02: Select and care for engineering hand tools</b></p> <p><i>Given an assignment to select specific tools for specific applications and range of hand tools,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0201 Identify and select the tools required</li> <li>PA0202 Demonstrate the use of the tools</li> <li>PA0203 Demonstrate cleaning and storing practices for the various tools</li> <li>PA0204 Identify potential hazards and risks related to the use of the tools and list appropriate responses</li> </ul> <p><i>Given tools as reflected in complete Millwright Toolbox, pictures of badly and correctly maintained hand tools, real examples of defective hand tools</i></p>		<p>Knowledge of:</p> <p><b>KM-03-KT03: Engineering tools and equipment (22%)</b></p> <ul style="list-style-type: none"> <li>KT0301 Hand tools to hold, assemble or disassemble components</li> <li>KT0302 Hand-held cutting tools (saws, blades, files, scrapers, chisels, taps and dies, hand reamers, hand broaching tools, hammers centre punch)</li> </ul> <p><b>KM-05-KT01: Hand tools and power tools (50%)</b></p> <ul style="list-style-type: none"> <li>KT0101 Types, uses and care of hand tools</li> </ul> <ul style="list-style-type: none"> <li>Standard Millwright's tools and their correct use</li> <li>OHS risks related to the use of the tools</li> <li>Specific dangers involved in use of power tools i.e. grinder</li> </ul>		<p><i>QCTO none</i></p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Be assigned to assist with toolbox checks, the care and maintenance of available hand tools</li> <li>Care for own toolbox and tools</li> <li>Assist with the use of hand tools on basic work tasks</li> </ul>			

<p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Identify tools and their correct use</li> <li>• Identify OHS risks associated with the use of handtools</li> <li>• Identify correct care and storage of supplied hand tools</li> <li>• Plan and prepare for repairs to hand tools:</li> <li>• Identify the correct method of correcting defects noted on examples and effect small common repairs</li> <li>• Perform basic applications of the majority of handtools for the apprentice to experience their correct use and handling</li> <li>• Apprentice to give a step-by-step list how he/she would go about affecting the repairs needed on the illustrated examples of broken handtools supplied</li> </ul>	<ul style="list-style-type: none"> <li>• Regular care and maintenance of basic hand- and power tools</li> <li>• Common wear and tear and defects on handtools</li> <li>• Correct repair of faulty hand tools</li> <li>• OHS risks associated with maintenance and repair of hand tools</li> </ul> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>• AK0201 Identification, function, use and care of hand tools</li> <li>• AK0202 Practices related to quality, health, safety and protection of the environment when using hand tools</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• IAC0201 Hand tools are identified and selected for specific applications</li> <li>• IAC0202 The safe and proper use of hand tools is demonstrated</li> <li>• IAC0203 Hand tools are cleaned and stored correctly</li> </ul>	<p><b>KM-03-KT03: Engineering tools and equipment (22%)</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>• IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>• IAC0303 The selection of tools for a variety of tasks is explained</li> <li>• IAC0307 Safety precautions pertaining to tools are explained</li> </ul> <p><b>KM-05-KT01: Hand tools and power tools (50%)</b></p>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off PoE/logbook</li> </ul>

- |  |   |  |
|--|---|--|
|  | <ul style="list-style-type: none"><li>• IAC0101 Identify hand tools and describe their uses</li></ul> |  |
|--|---|--|

**Internal Assessment to be performed:**

- Internal knowledge test of 45 minutes and the competency will be at 100%
- Practical exercise of provided step-by-step list how he/she would go about affecting the repairs needed on the illustrated examples of broken handtools supplied

**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Pictures of badly and correctly maintained hand tools,
- Real examples of defective hand tools

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots
- Millwright standard toolbox (see list supplied by NAMB)
- Also show: Multimeter, but sensitise apprentices to not use, until they have been trained on electricity.



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>D2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Select and care for occupation-specific tools, equipment and materials</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		104	64	
<b>Work situation title: Select and care for engineering power tools (portable and fixed)</b>	<b>Total hours</b>	16	16	
<b>Work scenario:</b> Morris is requested to identify the portable and fixed power tools relevant to the Millwright trade. She must explain the use and care of each item as well as describe the possible hazards. The safety of her and all present is her responsibility.				
<b>Prerequisite learning:</b> A1, A2, B1, B2, C1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>
<p><b>PM-03-PS02: Select and care for engineering power tools</b></p> <p><i>Given an assignment to select specific power tools for specific applications and a range of power tools and equipment, the apprentice must be able to:</i></p> <ul style="list-style-type: none"> <li>PA0201 Identify and select the different power tools</li> <li>PA0202 Demonstrate the start-up and shut down procedures of the different tools</li> <li>PA0203 Demonstrate cleaning procedures and storage of the different tools</li> <li>PA0204 Identify potential hazards and risks related to the use of the tools and list appropriate response</li> </ul> <p><i>Given tools as reflected in complete Millwright Toolbox, pictures of badly and correctly maintained power tools, real examples of</i></p>		<p>Knowledge of:</p> <p><b>KM-03-KT03: Engineering tools and equipment (22%)</b></p> <ul style="list-style-type: none"> <li>KT0303 Hand-held power tools (angle grinder, drills, drill bits and reamers)</li> </ul> <p><b>KM-05-KT01: Hand tools and power tools (50%)</b></p> <ul style="list-style-type: none"> <li>KT0102 Types, uses and care of portable power tools</li> <li>KT0103 Types, uses and care of fixed power tools</li> </ul> <ul style="list-style-type: none"> <li>Standard Millwright's tools and their correct use</li> <li>OHS risks related to the use of the tools</li> <li>Specific dangers involved in use of power tools i.e. grinder</li> <li>Regular care and maintenance of power tools</li> <li>Common wear and tear and defects on</li> </ul>		<p><i>QCTO none</i></p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Be assigned to assist with toolbox checks, the care and maintenance of available power tools</li> <li>Care for own toolbox and tools</li> <li>Assist with the use of power tools on basic work tasks</li> <li>Perform housekeeping activities</li> </ul>

<p><i>defective power tools</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Identify tools and their correct use</li> <li>Identify OHS risks associated with the use of power tools</li> <li>Identify correct care and storage of power tools</li> <li>Plan and prepare for repairs to power tools:</li> <li>Identify the correct method of correcting defects noted on examples. Small repairs to power tools (e.g. change the plug or extension cord, covers, etc.)</li> <li>Perform basic applications of the majority of power tools for the apprentice to experience their correct use and handling</li> <li>Apprentice to give a step-by-step list how he/she would go about affecting the repairs needed on the illustrated examples of broken power tools supplied</li> </ul>	<p>powertools</p> <ul style="list-style-type: none"> <li>Correct repair of faulty powertools</li> <li>How to correctly replace electrical cords and the legal limitations of what is allowed</li> <li>OHS risks associated with maintenance and repair of hand- and power tools</li> </ul> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>AK0201 Identification, function, use and care of power tools</li> <li>AK0202 Practices related to quality, health, safety and protection of the environment when using power tools</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>IAC0201 Power tools and equipment are identified and selected accurately</li> <li>IAC0202 Power tools and equipment are started and shut down safely and correctly</li> <li>IAC0203 Power tools and equipment are cleaned and stored correctly</li> </ul>	<p><b>KM-03-KT03: Engineering tools and equipment (22%)</b></p> <ul style="list-style-type: none"> <li>IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>IAC0303 The selection of tools for a variety of tasks is explained</li> <li>IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>Signed off logbook</li> </ul>

	<p><b>KM-05-KT01: Hand tools and power tools (50%)</b></p> <ul style="list-style-type: none"> <li>• IAC0102 Identify portable power tools and describe their uses</li> <li>• IAC0103 Identify fixed power tools and describe their uses</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of 45 minutes and the competency will be at 100%</li> <li>• Practical exercise of provided step-by-step list how apprentice would go about affecting the repairs needed on the illustrated examples of broken power tools supplied</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> <li>• Pictures of badly and correctly maintained power tools,</li> <li>• Real examples of defective power tools</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots</li> <li>• Portable and fixed power tools standard to Millwrights (see list supplied by NAMB)</li> <li>• Portable power tools: Hand drill, angle grinder</li> <li>• Fixed power tools: Pedestal grinder, pedestal drill, power saw</li> </ul>		

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>D3</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Handle and care for occupation-specific tools, equipment and materials</b>		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>104</td> <td>64</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
104	64						
<b>Work situation title: Identify, care and use marking and mechanical measuring equipment</b>		<b>Total hours</b>	<table border="1"> <tr> <td>24</td> <td>16</td> </tr> </table>	24	16		
24	16						
<b>Work scenario:</b> Mpho is requested to identify, care and use mechanical marking and measuring instruments. The safety of her and all present is her responsibility.							
<b>Prerequisite learning:</b> A1, A2, B1, B2, C1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>			
<p><b>PM-02-PS03: Select and care for engineering measuring instruments</b></p> <p><i>Given an assignment to select specific measuring tools for specific applications and a range of measuring instruments, the learner must be able to:</i></p> <ul style="list-style-type: none"> <li>PA0301 Identify and select the measuring instruments required</li> <li>PA0302 Demonstrate the use of the measuring instruments</li> <li>PA0303 Clean and store the measuring instruments</li> <li>PA0304 Check and calibrate measuring instruments</li> <li>PA0305 Identify potential hazards and risks related to the use of the measuring instruments and list appropriate responses</li> </ul> <p><i>Given a range of work scenarios which require</i></p>		<p><b>KM-03-KT03: Engineering tools and equipment (22%)</b></p> <ul style="list-style-type: none"> <li>KT0304 Measurement tools and equipment (basic measurement tools, precision measuring tools, angular measuring tools, inspection gauges)</li> <li>KT0305 Marking-off tools and equipment (punches, scribes, combination sets, protractors, calipers (inside and outside), jenny caliper, engineering square, angle plates, marking-off table, dividers)</li> <li>Measuring instruments used in a Millwright setting, their use and care</li> <li>Mechanical marking instruments, their use and care</li> <li>Precautions when marking off and marking off techniques</li> <li>Precautions when measuring and correct application of measuring instruments</li> <li>Scrapers for cleaning surfaces</li> <li>Calculations of different measuring units</li> <li>Thread gauge metric and imperial</li> </ul>		<p><i>QCTO none</i></p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Indicate the range and type of measuring the instruments are designed for</li> <li>Perform a variety of tasks using measuring and marking off instruments</li> <li>Maintain and care measuring and marking off instruments</li> <li>Report on any defects and store them safely and correctly</li> <li>Perform housekeeping duties</li> </ul>			

<p><i>measuring and marking off, instruments listed the necessary engineering tools and equipment applicable to the scenarios, the apprentice must be able to:</i></p> <ul style="list-style-type: none"> <li>Identify the correct marking off equipment</li> <li>Measure correctly as per work instruction</li> <li>State the purpose, use and care for the Tool or equipment</li> </ul> <p><i>Given various shapes (flanges, millwright block) on various materials (steel, perspex, paper, galvanised plate)</i></p> <ul style="list-style-type: none"> <li>Identify the correct marking off equipment</li> <li>State the purpose, use and care for the respective tools</li> </ul>	<ul style="list-style-type: none"> <li>Radius gauge</li> <li>Surface comparison chart/gauge</li> </ul> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>AK0301 Identification, reading, calibration, use and care of measuring instruments</li> <li>AK0302 Safety procedures</li> <li>AK0303 Procedures for cleaning and storing different measuring instruments</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>IAC0301 Measuring instruments are identified and selected for specific applications</li> <li>IAC0302 Measuring instruments are used and read correctly</li> <li>IAC0303 Measuring instruments are cleaned and stored correctly</li> <li>IAC0304 Measuring instruments are checked for accuracy and calibrated correctly</li> </ul>	<p><b>KM-03-KT03: Engineering tools and equipment (22%)</b></p> <ul style="list-style-type: none"> <li>IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>IAC0303 The selection of tools for a variety of tasks is explained</li> <li>IAC0304 Measurement calculations are performed correctly and accurately</li> <li>IAC0305 Measurements from measuring tools are read and interpreted correctly</li> <li>IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>Signed off Logbook/PoE</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Constant evaluation throughout in terms of appropriate use</li> </ul>		

- Practical final exercise with set up jigs to demonstrate measuring with different measuring instruments and marking off
  - #Standard time 2 hours
- Level of competence required: 80%

#### **Learning resources for teaching**

- Learning material as per defined Knowledge and Practical Skills Modules

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;
- Millwright standard toolbox for each apprentice
- Measuring equipment: Tape measure, steel ruler, manual vernier, vernier height gauge, telescopic gauges, inside and outside calipers, inside and outside micrometres (non electronic), depth micrometer (on electronic), line of cord, combination square, engineering square, thread gauge, taper gauge, feeler gauge
- Marking off equipment: Scribes, prick punch, centre punch, dividers, jenny caliper,
- Mark off table

#### Materials:

- Marking blue
- Steel plate

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>D4</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Handle and care for occupation-specific tools, equipment and materials</b>		<b>Total hours</b>	<b>SDP</b> 104		
<b>Work situation title: Identify, care for and use electrical measuring instruments (fixed and portable)</b>		<b>Total hours</b>	40	8	
<b>Work scenario:</b> Mpho is requested to identify, care for and use electrical measuring instruments on low voltage single phase and three phase. The safety of her and all present is her responsibility.					
<b>Prerequisite learning:</b> C5					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>	
<b>PM-05-PS03: Identify and use portable testing and measuring instruments</b>  <i>Given a variety of testing and measuring instruments (including voltage tester, multimeter, insulation tester, earth leakage polarity tester, phase rotation tester, clamp on meter, earth leakage tester), equipment to be tested and measured, personal protective equipment, manufacturers' specifications and work instructions, the apprentice must be able to:</i> <ul style="list-style-type: none"> <li>PA0301 Review the work instructions, determine the scope of work and plan the operation</li> <li>PA0302 Collect all required instruments and relevant personal protective</li> </ul>		<b>KM-05-KT02: Measuring and testing instruments</b> <ul style="list-style-type: none"> <li>KT0201 Portable electrical measuring instruments</li> <li>KT0202 Types of electrical measuring and testing instruments</li> <li>KT0203 Safe use of measuring and testing instruments</li> <li>KT0204 Construction and operating principles of measuring and testing instruments</li> <li>KT0205 Methods of connecting measuring and testing instruments in circuits</li> <li>KT0206 Applications and methods of using electrical measuring and testing instruments</li> <li>KT0207 Care and maintenance of single and three phase measuring and testing</li> </ul>		<i>QCTO none</i>  <b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b> <ul style="list-style-type: none"> <li>Indicate the range and type of measuring the instruments are designed for</li> <li>Perform a variety of measuring tasks using the measuring instruments and log the results</li> <li>Maintain and care for measuring instruments used</li> <li>Report on any defects and safely store measuring instruments</li> </ul>	

<p>equipment, prepare the work space and complete a risk assessment</p> <ul style="list-style-type: none"> <li>• PA0303 Identify and respond to hazards and risks</li> <li>• PA0304 Identify a range of testing and measuring instruments</li> <li>• PA0305 Identify and describe the features and functions of each instrument</li> <li>• PA0306 Explain the applications of the various instruments</li> <li>• PA0307 Inspect instruments and identify and report defects</li> <li>• PA0308 Use the instruments to test and measure various values on equipment</li> <li>• PA0309 Describe and explain the requirements for handling and storing portable testing and measuring instruments</li> </ul> <p><b>PM-05-PS04: Identify and use fixed measuring instruments</b></p> <p><i>Given a variety of measuring instruments (including volt meter, amp meter, power factor meter, energy meter), equipment to be measured, personal protective equipment, manufacturers' specifications and work instructions, the apprentice must be able to</i></p> <ul style="list-style-type: none"> <li>• PA0401 Review the work instructions, determine the scope of work and plan the operation</li> </ul>	<ul style="list-style-type: none"> <li>• KT0209 Types and functions of panel mounted electrical measuring and testing instruments</li> <li>• KT0210 Safe use of panel mounted measuring and test instruments</li> <li>• KT0211 Protection of measuring instruments when connected in a circuit</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-05-PS03:</b></p> <ul style="list-style-type: none"> <li>• AK0301 Safe work procedures</li> <li>• AK0302 Standard operating procedures</li> <li>• AK0303 Manufacturers' specifications</li> <li>• AK0304 Value reading on the correct scale</li> <li>• AK0305 Hazard identification and risk assessment practices</li> <li>• AK0306 Methods of identifying defects on instruments</li> <li>• AK0307 Functions and applications of testing and measuring instruments</li> <li>• AK0308 Safe use, handling and care of testing and measuring instruments</li> </ul> <p><b>PM-05-PS04:</b></p> <ul style="list-style-type: none"> <li>• AK0401 Safe work procedures</li> <li>• AK0402 Standard operating procedures</li> <li>• AK0403 Manufacturers' specifications</li> <li>• AK0404 Value reading on the correct scale</li> </ul>	
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<ul style="list-style-type: none"> <li>• PA0402 Collect all required instruments and relevant personal protective equipment, prepare the work space and complete a risk assessment</li> <li>• PA0403 Identify and respond to hazards and risks</li> <li>• PA0404 Identify the various instruments</li> <li>• PA0405 Explain the functions and applications of the instruments</li> <li>• PA0406 Inspect instruments and identify and report defects</li> <li>• PA0407 Use the instruments to measure various values on equipment</li> <li>• PA0408 Describe and explain the requirements for handling fixed measuring instruments</li> </ul>	<ul style="list-style-type: none"> <li>• AK0405 Methods of identifying defects on instruments</li> <li>• AK0406 Hazard identification and risk assessment practices</li> <li>• AK0407 Functions and applications of testing and measuring instruments</li> <li>• AK0408 Safe use, handling and care of measuring instruments</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-05-PS03:</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0302 All instruments are identified correctly</li> <li>• IAC0303 The features and functions of the instruments are correctly identified and described</li> <li>• IAC0304 The applications of the instruments are correctly explained</li> <li>• IAC0305 All defective instruments are identified and reported</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0201 Identify different types of electrical measuring instruments including fixed and portable and state the purpose</li> <li>• IAC0202 Identify the basic components of various measuring and test instruments and describe the basic principle of operation</li> <li>• IAC0204 Describe the applications and methods of using electrical measuring and testing instruments in direct and alternating current circuits</li> <li>• IAC0205 Describe safety and functionality checks to be performed on measuring and testing instruments before use</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off PoE/logbook</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0306 Instruments are used correctly according to work instructions and manufacturers' specifications to test and measure applicable values on equipment</li> <li>• IAC0307 The values are tested and measured correctly</li> <li>• IAC0308 Correct handling and storage requirements are described and explained</li> </ul> <p><b>PM-05-PS04:</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0402 All instruments are identified correctly</li> <li>• IAC0403 The functions and applications of the instruments are correctly explained</li> <li>• IAC0404 All defective instruments are identified and reported</li> <li>• IAC0405 Instruments are used correctly according to work instructions and manufacturers' specifications to measure applicable values on equipment</li> <li>• IAC0406 The values are measured correctly</li> <li>• IAC0407 Correct handling of fixed measuring instruments is described and explained</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0206 Describe correct methods of handling and storing measuring and testing instruments</li> <li>• IAC0207 Describe, with the aid of drawings, the connection of measuring instruments to single phase and three phase circuits</li> <li>• IAC0208 Explain the function of the wattmeter (electrodynamometer type), kilowatt-hour meter, frequency meter, power factor meter and maximum demand meter</li> <li>• IAC0209 Illustrate, by means of circuit diagrams, how the wattmeter (electrodynamometer type), kilowatt-hour meter, frequency meter, power factor meter and maximum demand meter are connected in single and three phase circuits</li> <li>• IAC0210 Describe the various methods of protection when connecting measuring instruments in circuits</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Knowledge test (multiple choice and open question format)</li> <li>• Practical exercise to demonstrate physical use of measuring instruments</li> </ul>		

○ #Standard time: 1 ½ hours

- Level of competence required: 80%, critical outcomes on use: 100%

### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules

### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;
- Portable electrical measuring instruments: Voltage tester, multimeter (digital and analog), insulation resistance tester (megger), earth leakage polarity tester, phase rotation tester, clamp on meter, earth leakage tester, loop impedance tester
- Fixed electrical measuring instruments: Volt meter, amp meter, power factor meter, energy meter, kilowatt-hour meter, frequency meter, power factor meter and maximum demand meter, watt meter

### Materials:

- Electrical installations
- Resistance boxes
- Electrical cables

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>D5</h1>		
		<b>Curriculum code:</b> 671202000				
<b>Learning area title:</b> Handle and care for occupation-specific tools, equipment and materials		<b>Total hours</b>	<b>SDP</b> 104			<b>WP</b> 64
<b>Work situation title:</b> Identify, handle and store relevant engineering materials		<b>Total hours</b>	8			8
<b>Work scenario:</b> Joseph is requested to sort out the workshop store. He has to identify, handle and store relevant engineering (conductive and non-conductive) materials and components. He has to categorise all materials and components. The safety of all present is his responsibility.						
<b>Prerequisite learning:</b> A1, A2, B1, B2, C1						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b> None	50%	<b>Knowledge modules (KM)</b>	50%	<b>Work experience modules (WM)</b>		
<p><b>PM-02-PS05: Identify engineering materials, their characteristics and applications</b></p> <p><i>Given a variety of engineering materials, the apprentice must be able to:</i></p> <ul style="list-style-type: none"> <li>PA0501 Identify the types of engineering materials</li> <li>PA0502 List the characteristics of the engineering materials</li> <li>PA0503 List the applications of the engineering materials</li> <li>Recall the terms, definitions and use of materials pertaining to the trade</li> <li>Recall the physical properties and characteristics of metal.</li> <li>Identify ferrous and non-ferrous metals.</li> <li>Colour coding of materials</li> </ul>		<p><b>KM-03-KT02: Engineering materials</b></p> <ul style="list-style-type: none"> <li>KT0201 Basic metallurgy and heat concepts</li> <li>KT0202 Properties of base metals, alloys and synthetic materials</li> <li>KT0203 Non-ferrous metals and ferrous materials</li> <li>KT0204 Metal specifications and testing</li> <li>Different uses for the materials</li> <li>Safety precautions related to the different materials</li> <li>Safe stacking and storing of mechanical materials</li> </ul> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>AK0501 Types and applications of engineering materials</li> </ul>		<p><i>QCTO none</i></p> <p><b>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</b></p> <ul style="list-style-type: none"> <li>Identify relevant engineering materials</li> <li>Handle relevant engineering materials</li> <li>Safely store relevant engineering materials</li> <li>Report on any defects</li> </ul>		
<b>ASSESSMENT CRITERIA</b>						
• IAC0501 Engineering materials are identified		• IAC0201 Basic metallurgy and heat concepts		<b>Supporting Evidence:</b>		

<p>and their application explained</p> <ul style="list-style-type: none"> <li>• IAC0502 Engineering materials are selected for specific applications</li> </ul>	<p>are explained</p> <ul style="list-style-type: none"> <li>• IAC0202 Properties of base metals, alloys, and synthetic materials are described</li> <li>• IAC0203 Metal specifications and testing are discussed</li> <li>• IAC0204 Ferrous and non-ferrous are differentiated and synthetic materials described</li> </ul>	<ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of 20 questions (30 min.) and the competency will be at 80%.</li> <li>• Practical exercise of 30min length covering <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> </ul> </li> <li>• All materials identified correctly with their advantages and disadvantages stated</li> <li>• Level of competence required: 80%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment: Overalls; Safety Boots;</li> <li>• Samples (and charts) of different materials</li> <li>• Hardness tester</li> </ul> <p><u>Materials:</u></p> <ul style="list-style-type: none"> <li>• Samples of ferrous and non-ferrous materials: Copper, zinc, galvanised plating, brass, stainless steel, mild steel, cast iron, aluminium, bakelite, nylon, teflon, phosphor bronze, etc.</li> </ul>		

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1 style="color: red;">E1</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Fabricate a range of simple mechanical mechanical components and work pieces</b>		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>160</td> <td>120</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
160	120						
<b>Work situation title: Mark-off, saw and file various simple components and materials</b>		<b>Total hours</b>	<table border="1"> <tr> <td>72</td> <td>40</td> </tr> </table>	72	40		
72	40						
<b>Work scenario:</b> Happiness is requested to mark off a work-piece that must be welded to a pipe that is designed as part of a construction. She has to identify the material by referring to a drawing and considering the size and tensile strength. She must select the tools and inspect the work area. She then has to measure, saw and mark off the material to specification. The safety of all present is her responsibility.							
<b>Prerequisite learning:</b> D1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>			
<b>PM-02-PS01: Plan and prepare for fabrication of components</b>  <i>Given practical assignments on fabrication of a range of components, drawings, applicable charts, a list of tools, materials and equipment,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0101 List the quality criteria required</li> <li>PA0102 List component specifications including tolerances and sizes from the assignment</li> <li>PA0103 List material, tool and equipment requirements</li> <li>PA0104 Describe the sequence of work to fabricate the different components</li> <li>PA0105 Identify and list potential hazards and risks related to the assignments</li> </ul>		<b>KM-03-KT03: Engineering tools and equipment</b> <ul style="list-style-type: none"> <li>KT0301 Hand tools to hold, assemble or disassemble components</li> <li>KT0302 Hand-held cutting tools (saws, blades, files, scrapers, chisels, taps and dies, hand reamers, hand broaching tools, hammers centre punch)</li> <li>KT0303 Hand-held power tools (angle grinder, drills, drill bits and reamers)</li> <li>KT0304 Measurement tools and equipment (basic measurement tools, precision measuring tools, angular measuring tools, inspection gauges)</li> <li>KT0305 Marking-off tools and equipment (punches, scribes, combination sets, protractors, calipers (inside and outside), jenny caliper, engineering square, angle plates, marking-off table, dividers)</li> </ul>		<b>WM-02, Fabrication of mechanical components</b>  <b>The apprentice will be expected to engage in the following work activities:</b> <ul style="list-style-type: none"> <li>WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>WA0103 Fabricate a variety of mechanical components to requirements using hand and power tools</li> <li>WA0104 Test or fit fabricated components</li> <li>WA0105 Restore the work area and dispose of waste materials</li> <li>WA0106 Interact with production personnel, where applicable</li> <li>WA0107 Complete all relevant documentation</li> </ul>			
<b>PM-02-PS06: Mark-off various simple</b>		Applied Knowledge					

<p><b>components</b></p> <p><i>Given engineering drawings, hand tools, measuring instruments and materials,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0601 Mark-off a workpiece</li> <li>• PA0602 Check measurements and marking-off for accuracy</li> <li>• PA0603 Demonstrate adherence to safe and environmentally responsible practices during all the stages of the assignment</li> </ul> <p><b>PM-02-PS08: File workpieces</b></p> <p><i>Given workpiece specifications, a range of materials and hand tools,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0801 List the quality criteria and specifications required</li> <li>• PA0802 Select the material, tools and equipment required for the assignment</li> <li>• PA0803 Describe the sequence of work to file the workpiece</li> <li>• PA0804 Identify and list potential hazards and risks related to the assignments</li> <li>• PA0805 Mark-off the workpiece</li> <li>• PA0806 Cut material to size with a hacksaw</li> <li>• PA0807 File the workpiece</li> <li>• PA0808 Debur and finish off the workpiece</li> <li>• PA0809 Demonstrate adherence to safe and environmentally responsible practices during</li> </ul>	<p><b>PM-02-PS01: Plan and prepare for fabrication of components</b></p> <ul style="list-style-type: none"> <li>• AK0101 Procedures to plan and prepare for fabrication of components</li> <li>• AK0102 Material identification, types and profiles</li> <li>• AK0103 Practices related to quality, health, safety, and protection of the environment</li> </ul> <p><b>PM-02-PS06: Mark-off various simple components</b></p> <ul style="list-style-type: none"> <li>• AK0601 Identification, function, use and care of hand tools</li> <li>• AK0602 Identification, reading, calibration, use and care of measuring equipment or instruments</li> <li>• AK0603 Terms and definitions of engineering drawings</li> <li>• AK0604 Symbols and abbreviations used in drawings</li> <li>• AK0605 Allowances, tolerances and fits</li> <li>• AK0606 Material identification, types and profiles</li> <li>• AK0607 Types and applications of engineering materials</li> <li>• AK0608 Procedures, methods and techniques for marking-off</li> <li>• AK0609 Practices related to quality, health, safety, and protection of the environment when marking off components</li> </ul> <p><b>PM-02-PS08: File workpieces</b></p> <ul style="list-style-type: none"> <li>• AK0801 Procedures to plan and prepare for filing of components</li> <li>• AK0802 Identification, function, use and care</li> </ul>	<ul style="list-style-type: none"> <li>• WA0108 Communicate with relevant parties</li> </ul>
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<p>all the stages of the assignment</p> <p><b>PM-02-PS09: Saw workpieces</b></p> <p><i>Given workpiece specifications, a range of materials and hand tools,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0901 List the quality criteria and specifications required</li> <li>• PA0902 Select the material, tools and equipment required for the assignment</li> <li>• PA0903 Describe the sequence of work to saw the workpiece</li> <li>• PA0904 Identify and list potential hazards and risks related to the assignment</li> <li>• PA0905 Mark-off the workpiece</li> <li>• PA0906 Saw the workpiece with a hacksaw</li> <li>• PA0907 Debur and finish off the workpiece</li> <li>• PA0908 Demonstrate adherence to safe and environmentally responsible practices during all the stages of the assignment</li> </ul>	<p>of hand tools used in cutting and filing</p> <ul style="list-style-type: none"> <li>• AK0803 Identification, reading, calibration, use and care of measuring equipment and instruments</li> <li>• AK0804 Allowances, tolerances and fits</li> <li>• AK0805 Types and applications of engineering materials</li> <li>• AK0806 Procedures to file workpieces</li> <li>• AK0807 Practices related to quality, health, safety, and protection of the environment when filing workpieces</li> </ul> <p><b>PM-02-PS09: Saw workpieces</b></p> <ul style="list-style-type: none"> <li>• AK0901 Procedures to plan and prepare for sawing of components</li> <li>• AK0902 Identification, function, use and care of hand tools</li> <li>• AK0903 Identification, reading, calibration, use and care of measuring equipment and instruments</li> <li>• AK0904 Allowances, tolerances and fits</li> <li>• AK0905 Types and applications of engineering materials</li> <li>• AK0906 Procedures to saw workpieces</li> <li>• AK0907 Practices related to quality, health, safety, and protection of the environment when sawing workpieces</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-02-PS01: Plan and prepare for fabrication of components</b></p> <ul style="list-style-type: none"> <li>• IAC0101 The fabrication of the components is planned according to accepted sequences</li> <li>• IAC0102 Specifications and quality criteria that must be met are clearly linked to the specific instruction</li> </ul>	<p><b>Internal Assessment Criteria</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>• IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>• IAC0303 The selection of tools for a variety of</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> </ul>



<ul style="list-style-type: none"> <li>• IAC0103 Tools, equipment and materials required are identified correctly</li> <li>• IAC0104 Risks and hazards are correctly identified and listed</li> <li>• IAC0105 Consequences of mistakes in the planning and preparation of the manufacturing task are described correctly</li> </ul> <p><b>PM-02-PS06: Mark-off various simple components</b></p> <ul style="list-style-type: none"> <li>• IAC0601 The importance of accurate marking-off is explained</li> <li>• IAC0602 The workpiece is marked off accurately</li> </ul> <p><b>PM-02-PS08: File workpieces</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Hand tools required for filing workpieces are identified and used</li> <li>• IAC0802 Workpieces are marked-off</li> <li>• IAC0803 Workpieces are cut to specific size specifications</li> <li>• IAC0804 Workpieces are filed correctly to specifications</li> <li>• IAC0805 Safety and environmental protection practices are adhered to</li> </ul> <p><b>PM-02-PS09: Saw workpieces</b></p> <ul style="list-style-type: none"> <li>• IAC0901 Hand tools required for sawing workpieces are identified and used</li> <li>• IAC0902 Workpieces are sawn correctly to specifications</li> <li>• IAC0903 Safety and environmental protection practices are adhered to</li> </ul>	<p>tasks is explained</p> <ul style="list-style-type: none"> <li>• IAC0304 Measurement calculations are performed correctly and accurately</li> <li>• IAC0305 Measurements from measuring tools are read and interpreted correctly</li> <li>• IAC0306 Speeds, feeds and cutting tools are described correctly</li> <li>• IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	<ul style="list-style-type: none"> <li>• SE0103 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Constant evaluation throughout entire period</li> </ul>		

- Practical exercise of fabrication
  - #Standard time 2 hours
  - #Tolerance: 0.05mm
- Level of competence required: 80%

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;
- Hacksaw, scribe, measuring instruments, files

#### Materials:

- Marking blue
- 8mmx50mmx100mm mild steel plate

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<b>E2</b>				
		<b>Curriculum code:</b> 671202000						
<b>Learning area title:</b> Fabricate a range of simple mechanical components and work pieces		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>160</td> <td>120</td> </tr> </table>		<b>SDP</b>	<b>WP</b>	160	120
<b>SDP</b>	<b>WP</b>							
160	120							
<b>Work situation title:</b> Sharpen drill bits as per application and drill material to specifications using a portable and fixed drilling machine		<b>Total hours</b>	<table border="1"> <tr> <td>16</td> <td>24</td> </tr> </table>	16	24			
16	24							
<b>Work scenario:</b> Joseph is requested to identify and drill relevant steel to a prescribed design. He also is asked to sharpen drill bits. The safety of all present is his responsibility.								
<b>Prerequisite learning:</b> D2								
<b>INTEGRATED LEARNING CONTENT</b>								
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>				
<p><b>PM-03-PS05: Drill material to specifications using a portable drilling machine</b></p> <p><i>Given workpiece specifications, material, portable drills and drill bits,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0501 Plan and prepare to drill holes using a portable drilling machine</li> <li>PA0502 Interpret workpiece specifications</li> <li>PA0503 Select, prepare and handle material</li> <li>PA0504 Select and use lubricants and coolants</li> <li>PA0505 Mark-off workpiece</li> <li>PA0506 Select, inspect and sharpen drill bits</li> <li>PA0507 Set-up portable drilling machine and workpiece</li> <li>PA0508 Drill and deburr holes</li> <li>PA0509 Clean and store</li> </ul>		<p><b>KM-03-KT03: Engineering tools and equipment (22%)</b></p> <ul style="list-style-type: none"> <li>KT0301 Hand tools to hold, assemble or disassemble components</li> <li>KT0302 Hand-held cutting tools (saws, blades, files, scrapers, chisels, taps and dies, hand reamers, hand broaching tools, hammers centre punch)</li> <li>KT0303 Hand-held power tools (angle grinder, drills, drill bits and reamers)</li> <li>KT0304 Measurement tools and equipment (basic measurement tools, precision measuring tools, angular measuring tools, inspection gauges)</li> <li>KT0305 Marking-off tools and equipment (punches, scribes, combination sets, protractors, calipers (inside and outside), jenny caliper, engineering square, angle plates, marking-off table, dividers)</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <ul style="list-style-type: none"> <li>Gather the necessary information, plan the process,</li> <li>Check fixed tools for correctness</li> <li>Conduct risk assessments and prepare work site for processes</li> <li>Perform the task using the prescribed power tools</li> <li>Test/compare fabricated components to the prescribed standard</li> <li>Restore the work area and dispose of waste materials</li> <li>Interact with production personnel, where applicable</li> <li>Complete all relevant documentation</li> <li>Communicate with relevant parties.</li> </ul>				

<ul style="list-style-type: none"> <li>PA0510 Use a portable drilling machine in a safe and responsible manner</li> </ul> <p><b>PM-03-PS06: Drill material to specifications using a fixed drilling machine</b></p> <p><i>Given workpiece specifications, material, a fixed drilling machine and tools,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0601 Plan and prepare to drill holes using a fixed drilling machine</li> <li>PA0602 Identify hazards and risks and use fixed drilling machines in a safe and responsible manner</li> <li>PA0603 Interpret workpiece specifications</li> <li>PA0604 Select, prepare and handle material</li> <li>PA0605 Select and use lubricants and coolants</li> <li>PA0606 Mark-off workpiece</li> <li>PA0607 Select, inspect and sharpen drill bits</li> <li>PA0608 Set-up fixed drilling machine and workpiece</li> <li>PA0609 Calculate and set speeds and feeds</li> <li>PA0610 Drill and debur holes</li> <li>PA0611 Lock out, clean the drill and remove and store all attachments</li> <li>PA0612 Use a fixed drilling machine in a safe and responsible manner and coolants specifications</li> </ul>	<p><u>Applied Knowledge</u></p> <p><b>PM-03-PS05: Drill material to specifications using a portable drilling machine</b></p> <ul style="list-style-type: none"> <li>AK0501 Identification, function, use and care of portable drilling machines</li> <li>AK0502 Procedures to drill holes using a portable drilling machine</li> <li>AK0503 Methods to sharpen drill bits</li> <li>AK0504 Drill speeds, lubricants and coolants</li> <li>AK0505 Practices related to quality, health, safety and protection of the environment when using a portable drill</li> </ul> <p><b>PM-03-PS06: Drill material to specifications using a fixed drilling machine</b></p> <ul style="list-style-type: none"> <li>AK0601 Identification, function, use and care of fixed drilling machines</li> <li>AK0602 Procedures to drill holes using a fixed drilling machine</li> <li>AK0603 Methods to sharpen drill and tool bits</li> <li>AK0604 Drill speeds, lubricants</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-03-PS05: Drill material to specifications using a portable drilling machine</b></p> <ul style="list-style-type: none"> <li>IAC0501 The use of portable drilling machines is explained and demonstrated</li> </ul>	<ul style="list-style-type: none"> <li>IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>Signed off logbook/PoE</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0502 The workpieces are drilled according to procedures and specifications</li> <li>• IAC0503 Drill bits are sharpened to specifications</li> <li>• IAC0504 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0505 Lubricants and coolants are used according to manufacturer's specifications</li> </ul> <p><b>PM-03-PS06: Drill material to specifications using a fixed drilling machine</b></p> <ul style="list-style-type: none"> <li>• IAC0601 The use of fixed drilling machines is explained and demonstrated</li> <li>• IAC0602 The workpiece is drilled according to procedure and specifications</li> <li>• IAC0603 Drill bits are sharpened to specifications</li> <li>• IAC0604 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0605 Lubricants and coolants are used according to manufacturer's</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0303 The selection of tools for a variety of tasks is explained</li> <li>• IAC0304 Measurement calculations are performed correctly and accurately</li> <li>• IAC0305 Measurements from measuring tools are read and interpreted correctly</li> <li>• IAC0306 Speeds, feeds and cutting tools are described correctly</li> <li>• IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Ongoing observation during drilling exercises.</li> <li>• Final practical assessment 1 hour with check sheet: <ul style="list-style-type: none"> <li>○ #Correct drill speeds</li> <li>○ #Drilling stance</li> <li>○ #Drill Angle for drilling different type of material</li> <li>○ #Securing and setting up of workpiece on table</li> <li>○ #Alignment of workpiece with drill bit</li> <li>○ #Pilot holes</li> <li>○ #Correct use of centre drill</li> <li>○ #Drilling pressure</li> <li>○ #Correct selection of drilling lubricant and drill bit</li> <li>○ #Secure drill bit in chuck</li> </ul> </li> </ul>		

- #Correct use of drift
- Practical assessment sharpening drill bits
  - #Drill angle
  - #Face of the drill bit (cutting edge higher than face of the drill bit)
  - #Finishing of the drill bit
  - #Cutting edge should only reach half the diameter of the drill bit
  - #Drill bit face not discoloured

**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots; Safety glasses
- Portable drill
- Fixed drill
- Drill bits (suitable to the drilling machine)
- Deburring tool
- Engineering square

Materials:

- Off cuts: Mild steel – pipes, plates, sheets
- Drilling lubricants

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>E3</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Fabricate a range of simple mechanical components and work pieces</b>		<b>Total hours</b>	<b>SDP</b> 160		
<b>Work situation title: Saw material to specification using a power saw</b>		<b>Total hours</b>	8	8	
<b>Work scenario:</b> Joseph is requested to cut steel segments for a shelf. He has to identify, handle and saw relevant steel to the prescribed length. The safety of all present is his responsibility.					
<b>Prerequisite learning: D2+D3</b>					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>	
<b>PM-03-PS07: Saw material to specification using a power saw</b>  <i>Given workpiece specifications, material and a power saw,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0701 Interpret workpiece specifications, material and blade types</li> <li>PA0702 Mark-off and secure the workpiece</li> <li>PA0703 Set-up power saw, speeds and feeds</li> <li>PA0704 Use a power saw in a safe and responsible manner</li> <li>PA0705 Lock-out, clean, remove and store materials</li> </ul>		<b>Knowledge of:</b>  <b>KM-03-KT03: Engineering tools and equipment</b> <ul style="list-style-type: none"> <li>KT0301 Hand tools to hold, assemble or disassemble components</li> <li>KT0302 Hand-held cutting tools (saws, blades, files, scrapers, chisels, taps and dies, hand reamers, hand broaching tools, hammers centre punch)</li> <li>KT0303 Hand-held power tools (angle grinder, drills, drill bits and reamers)</li> <li>KT0304 Measurement tools and equipment (basic measurement tools, precision measuring tools, angular measuring tools, inspection gauges)</li> <li>KT0305 Marking-off tools and equipment (punches, scribes, combination sets, protractors, calipers (inside and outside), jenny caliper, engineering square, angle plates, marking-off table, dividers)</li> </ul>		<i>QCTO none</i>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <ul style="list-style-type: none"> <li><b>Gather the necessary information, plan the process,</b></li> <li><b>Check fixed tools for correctness</b></li> <li><b>Conduct risk assessments and prepare work site for processes</b></li> <li><b>Perform the task using the prescribed power tools</b></li> <li><b>Test/compare fabricated components to the prescribed standard</b></li> <li><b>Restore the work area and dispose of waste materials</b></li> <li><b>Interact with production personnel, where applicable</b></li> <li><b>Complete all relevant documentation</b></li> <li><b>Communicate with relevant parties</b></li> </ul>	

	<p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>• AK0701 Identification, function, use and care of power saws</li> <li>• AK0702 Procedures to saw workpieces using power saws</li> <li>• AK0703 Methods to saw workpieces</li> <li>• AK0704 Sawing safety precautions</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-03-PS07: Saw material to specification using a power saw</b></p> <ul style="list-style-type: none"> <li>• IAC0701 The use of power saws is explained and demonstrated</li> <li>• IAC0702 The workpiece is sawn according to procedure and specifications</li> <li>• IAC0703 Risks and hazards are identified and responded to in a responsible manner</li> </ul>	<p><b>KM-03-KT03: Engineering tools and equipment</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>• IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>• IAC0303 The selection of tools for a variety of tasks is explained</li> <li>• IAC0304 Measurement calculations are performed correctly and accurately</li> <li>• IAC0305 Measurements from measuring tools are read and interpreted correctly</li> <li>• IAC0306 Speeds, feeds and cutting tools are described correctly</li> <li>• IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off Logbook/PoE</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Ongoing observation with checklist</li> </ul>		



**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots; Safety glasses, Gloves
- Power saw

**Materials:**

- Mild steel various shapes and sizes

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>E4</b>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Fabricate a range of simple mechanical components and work pieces</b>	<b>Total hours</b>	<b>SDP</b> 160	<b>WP</b> 120	
<b>Work situation title: Grind material to specifications using a pedestal grinder</b>	<b>Total hours</b>	24	16	
<b>Work scenario:</b> Joseph is requested to remove the burr from a chisel, punch, scribe and face a flat screwdriver. He has to identify, handle and grind relevant items to the prescribed standard. The safety of all present is his responsibility.				
<b>Prerequisite learning:</b> D2+D3				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>
<b>PM-03-PS04: Grind material to specifications using a pedestal grinder</b> <i>Given workpiece specifications, a pedestal grinder, grinding wheels, drill bits and chisels,</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0401 Plan and prepare to grind workpieces</li> <li>PA0402 Select grinding wheel to match grinding assignment</li> <li>PA0403 Remove and replace grinding wheels</li> <li>PA0404 Dress grinding wheels</li> <li>PA0405 Set-up pedestal grinder and set tool rest</li> <li>PA0406 Grind drill bits, high speed steel tool bits and chisels</li> <li>PA0407 Use a pedestal grinder in a safe and responsible manner</li> </ul>		<b>Knowledge of:</b> <b>KM-03-KT03: Engineering tools and equipment</b> <ul style="list-style-type: none"> <li>KT0301 Hand tools to hold, assemble or disassemble components</li> <li>KT0302 Hand-held cutting tools (saws, blades, files, scrapers, chisels, taps and dies, hand reamers, hand broaching tools, hammers centre punch)</li> <li>KT0303 Hand-held power tools (angle grinder, drills, drill bits and reamers)</li> <li>KT0304 Measurement tools and equipment (basic measurement tools, precision measuring tools, angular measuring tools, inspection gauges)</li> <li>KT0305 Marking-off tools and equipment (punches, scribes, combination sets, protractors, calipers (inside and outside),</li> </ul>		<i>QCTO none</i>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <ul style="list-style-type: none"> <li>Identify relevant Tools and Equipment</li> <li>Handle relevant Tools and Equipment</li> <li>Gather the necessary information, plan the process,</li> <li>Check fixed tools for correctness</li> <li>Conduct risk assessments and prepare work site for processes</li> <li>Perform the task using the prescribed power tools</li> <li>Test/compare fabricated components to the prescribed standard</li> <li>Restore the work area and dispose of waste materials</li> </ul>

	<p>jenny caliper, engineering square, angle plates, marking-off table, dividers)</p> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>• AK0401 Identification, function, use and care of grinding power tools and machines</li> <li>• AK0402 Procedures to grind workpieces using a grinding power tools and machines</li> <li>• AK0403 Methods to dress grinding wheels</li> <li>• AK0404 Grinding safety precautions</li> </ul>	<ul style="list-style-type: none"> <li>• Interact with production personnel, where applicable</li> <li>• Complete all relevant documentation</li> <li>• Communicate with relevant parties.</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-03-PS04: Grind material to specifications using a pedestal grinder</b></p> <ul style="list-style-type: none"> <li>• IAC0401 The uses of fixed grinding power tools and machines are explained and demonstrated</li> <li>• IAC0402 The workpiece is ground according to procedure and specifications</li> <li>• IAC0403 Grinding wheels are dressed correctly</li> <li>• IAC0404 Risks and hazards are identified and responded to in a responsible manner</li> </ul>	<p><b>KM-03-KT03: Engineering tools and equipment</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>• IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>• IAC0303 The selection of tools for a variety of tasks is explained</li> <li>• IAC0304 Measurement calculations are performed correctly and accurately</li> <li>• IAC0305 Measurements from measuring tools are read and interpreted correctly</li> <li>• IAC0306 Speeds, feeds and cutting tools are described correctly</li> <li>• IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off Logbook/PoE</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Use of pedestal grinding machine</li> </ul>		

- The uses of fixed grinding power tools and machines are explained and demonstrated
- The workpiece is ground according to procedure and specifications
- Grinding wheels are dressed correctly
- Risks and hazards are identified and responded to in a responsible manner
- Distance between wheel and tool rest not more than 2mm
- Tool rest set at correct attack angle
- Practical assessment sharpening chisel
  - #Chisel cutting angle 60 degrees
  - #Straightness of cutting edge
  - #No discolouration of cutting edge
  - #Removal of mushroom head
- Practical assessment sharpening of prick/centre punch
  - #Prick punch cutting angle 45 degrees
  - #Centre punch cutting angle 60 degrees
  - #No discolouration of tip
  - #No oval grinding
- Practical assessment sharpening of scribe
  - #Scribe cutting angle as specified by facilitator
  - #No discolouration of scribing edge
- Practical assessment sharpening of flat screwdriver
  - #Straightness and thickness of driving edge
  - #No discolouration of driving edge
  - #In line with angle
- Level of competence required: 80%

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots, Safety shield;

<ul style="list-style-type: none"> <li>• Pedestal grinder</li> <li>• Drill bits, chisel, punch, scribes and screwdriver</li> </ul>						
<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1 style="color: red;">E5</h1>		
		<b>Curriculum code: 671202000</b>				
<b>Learning area title: Fabricate a range of simple mechanical components and work pieces</b>		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
			160			120
<b>Work situation title: Cut threads with stocks, dies and taps (Ream parallel and tapered holes)</b>		<b>Total hours</b>	40	32		
<b>Work scenario:</b> Happiness is presented with a cover for a flange and requested to thread the holes. She has to identify the material by referring to a drawing and considering the size and tensile strength. She must select the tools and inspect the work area. She then has to measure, saw, mark off and drill material to specification. The safety of all present is her responsibility.						
<b>Prerequisite learning:</b> D1-D3						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>		
<b>PM-02-PS11: Cut threads with stocks, dies and taps</b>  <i>Given specifications, a range of materials, stocks, dies and taps, and hand tools,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>• PA1101 Interpret workpiece specifications</li> <li>• PA1102 Interpret tap and drill charts</li> <li>• PA1103 Select hand tools, equipment and lubrication</li> <li>• PA1104 Cut threads using stocks and dies</li> <li>• PA1105 Tap holes</li> <li>• PA1106 Conduct post fabrication activities</li> <li>• PA1107 Demonstrate adherence to safe and environmentally responsible practices during all the stages of the</li> </ul>		<b>KM-03-KT03: Engineering tools and equipment</b> <ul style="list-style-type: none"> <li>• KT0301 Hand tools to hold, assemble or disassemble components</li> <li>• KT0302 Hand-held cutting tools (saws, blades, files, scrapers, chisels, taps and dies, hand reamers, hand broaching tools, hammers centre punch)</li> <li>• KT0303 Hand-held power tools (angle grinder, drills, drill bits and reamers)</li> <li>• KT0304 Measurement tools and equipment (basic measurement tools, precision measuring tools, angular measuring tools, inspection gauges)</li> <li>• KT0305 Marking-off tools and equipment (punches, scribes, combination sets,</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:  <b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least 80 hours</b> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>• WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>• WA0103 Fabricate a variety of mechanical components to requirements using hand</li> </ul>		

<p>assignment</p> <p><b>PM-02-PS12: Ream parallel and tapered holes</b></p> <p><i>Given specifications, a range of materials, reamers and hand tools,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA1201 Interpret workpiece specifications</li> <li>• PA1202 Interpret reaming charts</li> <li>• PA1203 Select hand tools, equipment and lubrication</li> <li>• PA1204 Ream holes</li> <li>• PA1205 Conduct post fabrication activities</li> <li>• PA1206 Demonstrate adherence to safe and environmentally responsible practices during all the stages of the assignment</li> </ul>	<p>protractors, calipers (inside and outside), jenny caliper, engineering square, angle plates, marking-off table, dividers)</p> <p><u>Applied Knowledge</u></p> <p><b>PM-02-PS11: Cut threads with stocks, dies and taps</b></p> <ul style="list-style-type: none"> <li>• AK1101 Procedures to plan and prepare for cutting threads and tapping and reaming holes</li> <li>• AK1102 Identification, function, use and care of hand tools</li> <li>• AK1103 Identification, reading, calibration, use and care of measuring equipment and instruments</li> <li>• AK1104 Allowances, tolerances and fits</li> <li>• AK1105 Types and applications of reamers, stocks and dies, and lubricants</li> <li>• AK1106 Procedures to cut threads using stocks and dies</li> <li>• AK1107 Procedures to ream holes</li> <li>• AK1108 Procedures to tap holes</li> <li>• AK1109 Practices related to quality, health, safety and protection of the environment when cutting threads and tapping and reaming holes</li> </ul> <p><b>PM-02-PS12: Ream parallel and tapered holes</b></p> <ul style="list-style-type: none"> <li>• AK1201 Procedures to plan and prepare for reaming holes</li> <li>• AK1202 Identification, function, use and care of hand tools</li> <li>• AK1203 Identification, reading, calibration, use and care of measuring equipment and instruments</li> <li>• AK1204 Allowances, tolerances and fits</li> </ul>	<p>and power tools</p> <ul style="list-style-type: none"> <li>• WA0104 Test or fit fabricated components</li> <li>• WA0105 Restore the work area and dispose of waste materials</li> <li>• WA0106 Interact with production personnel, where applicable</li> <li>• WA0107 Complete all relevant documentation</li> <li>• WA0108 Communicate with relevant parties</li> </ul>
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	<ul style="list-style-type: none"> <li>• AK1205 Types and applications of reamers, stocks and dies, and lubricants</li> <li>• AK1206 Procedures to ream holes using reamers</li> <li>• AK1207 Practices related to quality, health, safety and protection of the environment when cutting threads and tapping and reaming holes</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-02-PS11: Cut threads with stocks, dies and taps</b></p> <ul style="list-style-type: none"> <li>• IAC1101 Hand tools, equipment and lubrication requirements for cutting threads and reaming and tapping holes are explained</li> <li>• IAC1102 Threads are cut according to procedures and specifications</li> <li>• IAC1103 Holes are reamed according to procedures and specifications</li> <li>• IAC1104 Holes are tapped according to procedures and specifications</li> <li>• IAC1105 Safety and environmental protection practices are adhered to</li> <li>• IAC1201 Hand tools, equipment and lubrication requirements for cutting threads and reaming and tapping holes are explained</li> </ul> <p><b>PM-02-PS12: Ream parallel and tapered holes</b></p> <ul style="list-style-type: none"> <li>• IAC1202 Threads are cut according to procedures and specifications</li> <li>• IAC1203 Holes are reamed according to procedure and specifications</li> <li>• IAC1204 Holes are tapped according to</li> </ul>	<p><b>KM-03-KT03: Engineering tools and equipment</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>• IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>• IAC0303 The selection of tools for a variety of tasks is explained</li> <li>• IAC0304 Measurement calculations are performed correctly and accurately</li> <li>• IAC0305 Measurements from measuring tools are read and interpreted correctly</li> <li>• IAC0306 Speeds, feeds and cutting tools are described correctly</li> <li>• IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>

procedure and specifications • IAC1205 Safety and environmental protection practices are adhered to		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions and the competency will be at 80%</li> <li>• Practical exercise of 1Hour length covering above             <ul style="list-style-type: none"> <li>○ Holes taped square</li> <li>○ Tools and equipment may not be damaged</li> <li>○ Tools used, must be clean and neat at all times</li> <li>○ All safety aspects adhered to according to company policies</li> <li>○ No injury</li> <li>○ Manufacture work piece according to notes and tolerances on drawing</li> <li>○ Reaming charts interpreted correctly</li> <li>○ Lubrication spillage cleaned correctly</li> <li>○ Tapping must be done free hand</li> </ul> </li> <li>• Level of competence required: 80%</li> <li>• Level of safety aspects must be: 100%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering defined Knowledge and Practical Skills Modules</li> <li>• Samples (and charts) of tapping and all the dangers</li> <li>• Samples (and charts) of different taps and pitches</li> <li>• Safe Operating Procedure and Safe Working Procedure for tapping and reaming</li> <li>• Charts of risk assessment procedure and safety measures</li> <li>• Videos of tapping and reaming will be an added advantage</li> <li>• Material Safety Data Sheets for reference</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment: Overalls; Safety Boots, leather gloves</li> <li>• Material to work on</li> <li>• Hand Tools: Stocks, Taps, Dies, Drills, Engineering square, Hammer, Punch, venier, scriber and reamer.</li> </ul>		



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>F1</b>		
		<b>Curriculum code: 671202000</b>				
<b>Learning area title: Fabricate complex mechanical components and work pieces</b>		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
		200	104			
<b>Work situation title: Fabricate and fit gaskets</b>		<b>Total hours</b>	16	24		
<b>Work scenario:</b> Lesego is requested to replace a seal on a water system that has a leak. She is required to use the flanges of the installation as a template She has to identify the material by considering the thickness, the liquid being transferred and pressure in the installation. She must select the tools and work area. The safety of her and all present is her responsibility						
<b>Prerequisite learning:</b> E						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>		
<p><b>PM-03-PS01: Plan and prepare for fabrication of complex components</b></p> <p><i>Given practical assignments on fabrication of a range of components, drawings, applicable charts, a list of tools, materials and equipment,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0101 List the quality criteria required</li> <li>PA0102 List component specifications including tolerances and sizes from the assignment</li> <li>PA0103 List material, tool and equipment requirements</li> <li>PA0104 Describe the sequence of work to fabricate the different components</li> <li>PA0105 Identify and list potential hazards and risks related to the assignments</li> </ul> <p><b>PM-02-PS07: Fabricate and fit gaskets</b></p>		<p>Knowledge of:</p> <p><b>KM-04-KT01: Static and dynamic seals and gaskets (8%)</b></p> <ul style="list-style-type: none"> <li>KT0101 Seals and gaskets</li> <li>KT0102 The stuffing box and gland (packings)</li> <li>KT0103 Lagging pipelines</li> <li>KT0104 O-rings</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-03-PS01: Plan and prepare for fabrication of complex components</b></p> <ul style="list-style-type: none"> <li>AK0101 Procedures to plan and prepare for fabrication of components</li> <li>AK0102 Material Identification, types and profiles</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least 80 hours</b></p> <ul style="list-style-type: none"> <li>WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>WA0103 Fabricate a variety of mechanical components to requirements using hand and power tools</li> <li>WA0104 Test or fit fabricated components</li> </ul>		

<p><i>Given gasket specifications or samples, materials and hand tools</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0701 List the quality criteria and specifications required</li> <li>• PA0702 Select the material, tools and equipment required for the assignment</li> <li>• PA0703 Describe the sequence of work to fabricate the gasket</li> <li>• PA0704 Identify and list potential hazards and risks related to the assignments</li> <li>• PA0705 Mark-off, fabricate and fit the gaskets</li> <li>• PA0706 Demonstrate adherence to safe and environmentally responsible practices during all the stages of the assignment</li> </ul>	<ul style="list-style-type: none"> <li>• AK0103 Practices related to quality, health, safety and protection of the environment</li> </ul> <p><b>PM-02-PS07: Fabricate and fit gaskets</b></p> <ul style="list-style-type: none"> <li>• AK0701 Procedures to plan and prepare for fabrication of gaskets</li> <li>• AK0702 Identification, function, use and care of hand tools for gasket fabrication</li> <li>• AK0703 Identification, reading, calibration, use and care of measuring equipment and instruments</li> <li>• AK0704 Allowances, tolerances and fits</li> <li>• AK0705 Types and applications of engineering materials</li> <li>• AK0706 Types and applications of gaskets</li> <li>• AK0707 Torques prescribed for tightening gaskets</li> <li>• AK0708 Practices related to quality, health, safety and protection of the environment when fabricating and fitting gaskets</li> </ul> <p>Any amendments or additions to QCTO qualification must be typed in red</p>	<ul style="list-style-type: none"> <li>• WA0105 Restore the work area and dispose of waste materials</li> <li>• WA0106 Interact with production personnel, where applicable</li> <li>• WA0107 Complete all relevant documentation</li> <li>• WA0108 Communicate with relevant parties</li> </ul>
<p><b>ASSESSMENT CRITERIA</b></p>		
<p><b>PM-03-PS01: Plan and prepare for fabrication of complex components</b></p> <ul style="list-style-type: none"> <li>• IAC0101 The fabrication of the components is planned according to accepted sequences</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0101 The definitions of seals and gaskets are discussed</li> <li>• IAC0102 The types and functions of packings, seals, gaskets and glands are discussed</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 Signed-off job cards</li> <li>• SE0102 Non-conformance reports</li> <li>• SE0103 Workplace logbook or portfolio</li> <li>• SE0104 Equipment downtime records</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0102 Specifications and quality criteria that must be met are clearly linked to the specific instruction</li> <li>• IAC0103 Tools, equipment and materials required are identified correctly</li> <li>• IAC0104 Risks and hazards are correctly identified and listed</li> <li>• IAC0105 Consequences of mistakes in the planning and preparation of the manufacturing task are described correctly</li> </ul> <p><b>PM-02-PS07: Fabricate and fit gaskets</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Gasket material requirements are explained for different applications</li> <li>• IAC0702 Gaskets are fabricated correctly to specifications</li> <li>• IAC0703 Gaskets are fitted correctly to specification</li> <li>• IAC0704 Safety and environmental protection practices are adhered to</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0103 The applications of different gaskets for air, steam, liquids, chemicals and gases are explained</li> <li>• IAC0104 The method of packing a stuffing box is described</li> <li>• IAC0105 Safety precautions pertaining to static and dynamic seals and gaskets are explained</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions and the competency will be at 80%</li> <li>• Practical exercise of 1hr 30min length covering <ul style="list-style-type: none"> <li>o Standard time 1 hour 30 min</li> <li>o Apparatus may not be damaged</li> <li>o Bearing surface to carry 60% of key length</li> <li>o No burs allowed</li> <li>o Tools must be clean and neat</li> <li>o No injury or unsafe act had occurred</li> <li>o Sides of key must be parallel (0,05)</li> <li>o Finishing (N7 standard)</li> </ul> </li> <li>• Level of competence required: 80%</li> </ul>		

**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of different seals used in the field
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots
- Millwright standard toolbox (see list supplied by NAMB)
- Mechanical Flanges to fit a gasket
- Gasket Material

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>F2</b>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Fabricate complex mechanical components and work pieces</b>		<b>Total hours</b>	<table border="1" style="width: 100%; text-align: center;"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>200</td> <td>104</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
200	104						
<b>Work situation title: Fabricate and fit keys and locking devices</b>		<b>Total hours</b>	80	40			
<b>Work scenario:</b> Manini is requested to replace a key on a belt and pulley system that drives a water pump. She has to identify the material by considering the size and tensile strength. She must select the tools and work area. She then has to cut, file and fit the key to the prescribed standard. The safety of her and all present is her responsibility.							
<b>Prerequisite learning:</b> E							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>		70%	<b>Knowledge modules (KM)</b>		30%		
			<b>Work experience modules (WM)</b>				
<b>PM-02-PS10: Fabricate and fit keys</b> <i>Given specifications of a range of keys, a range of materials and hand tools the learner must be able to:</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>• PA1001 List the quality criteria and specifications required</li> <li>• PA1002 Select the material, tools and equipment required for the assignment</li> <li>• PA1003 Describe the sequence of work to fabricate and fit the key</li> <li>• PA1004 Identify and list potential hazards and risks related to the assignments</li> <li>• PA1005 Mark-off, fabricate and fit the key</li> <li>• PA1006 Conduct post fabrication and fitting activities</li> <li>• PA1007 Demonstrate adherence to safe and environmentally responsible</li> </ul>			Knowledge of: <b>KM-03-KT06: Types and functions of locking devices and fasteners</b> <ul style="list-style-type: none"> <li>• KT0601 Fasteners and locking devices (machine screws, set screws, cap screws, grub screw, studs, locking nuts and bolts, washers, circlips, pins, keys)</li> <li>• KT0602 Application of fasteners and locking devices</li> <li>• KT0603 Drawings of fasteners and locking devices</li> </ul> <u>Applied Knowledge</u> <ul style="list-style-type: none"> <li>• AK1001 Procedures to plan and prepare for fabricating and fitting keys</li> <li>• AK1002 Identification, function, use and care of hand tools</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:  <b>WM-02, Fabrication of mechanical components</b> <ul style="list-style-type: none"> <li>• <b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least 80 hours</b></li> <li>• <b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least</b></li> </ul>		

<p>practices during all the stages of the assignment</p> <p><b>Fabricate and fit locking devices</b></p> <p><i>Given specifications of a range of keys, a range of materials and hand tools the learner must be able to:</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• List the quality criteria and specifications required</li> <li>• Select the material, tools and equipment required for the assignment</li> <li>• Describe the sequence of work to fabricate and fit locking devices</li> <li>• Identify and list potential hazards and risks related to the assignments</li> <li>• Mark-off, fabricate and fit the key</li> <li>• Conduct post fabrication and fitting activities</li> <li>• Demonstrate adherence to safe and environmentally responsible practices during all the stages of the assignment</li> </ul> <ul style="list-style-type: none"> <li>• Manufacture a gib-head, parallel, taper and feather key</li> <li>• Fit a gib-head, parallel, taper, feather key.</li> <li>• Install the following locking devices - lock-nuts, dowels, lock-plates, split pins, taper pins and wire method.</li> <li>• Remove a gib-head, parallel, taper and feather key</li> </ul>	<ul style="list-style-type: none"> <li>• AK1003 Identification, reading, calibration, use and care or measuring equipment and instruments</li> <li>• AK1004 Allowances, tolerances and fits</li> <li>• AK1005 Types and applications of keys</li> <li>• AK1006 Procedures to fabricate and fit keys</li> <li>• AK1007 Practices related to quality, health, safety, and protection of the environment when fabricating and fitting keys</li> </ul>	<p><b>80 hours</b></p> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>• WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>• WA0103 Fabricate a variety of mechanical components to requirements using hand and power tools</li> <li>• WA0104 Test or fit fabricated components</li> <li>• WA0105 Restore the work area and dispose of waste materials</li> <li>• WA0106 Interact with production personnel, where applicable</li> <li>• WA0107 Complete all relevant documentation</li> <li>• WA0108 Communicate with relevant parties</li> </ul>
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<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• IAC1001 Hand tools required for fabricating keys are identified and used</li> <li>• IAC1002 Keys/<b>locking devices</b> are fabricated correctly to specifications</li> <li>• IAC1003 Keys/<b>locking devices</b> are fitted correctly to specifications</li> <li>• IAC1004 Safety and environmental protection practices are adhered to</li>   <li>• <b>Different locking devices fitted and removed according to standards</b></li> <li>• <b>Manufacture a gib-head, parallel, taper and feather key correctly</b></li> <li>• <b>Fit a gib-head, parallel, taper, feather key correctly</b></li> <li>• <b>Install the following locking devices: lock-nuts, dowels, lock-plates, split pins, taper pins and wire method correctly</b></li> <li>• <b>Remove a gib-head, parallel, taper and feather key correctly</b></li> <li>• <b>Identify nuts and bolts correctly</b></li> <li>• <b>Tighten nuts and bolts correctly</b></li> </ul>	<ul style="list-style-type: none"> <li>• IAC0601 Types of fasteners and locking devices are identified and discussed</li> <li>• IAC0602 Application of fasteners and locking devices is explained</li> <li>• IAC0603 Fasteners and locking devices are read and interpreted from drawings</li> <li>• IAC0604 Freehand drawings of different types of fasteners and locking devices are produced</li> <li>• IAC0605 Safety precautions pertaining to fasteners and locking devices are explained</li>   <li>• <b>Identify the following types of keys - gib-head, parallel, taper, feather, woodruff and tangential, with their advantages and disadvantages</b></li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions and the competency will be at 80% <ul style="list-style-type: none"> <li>○ Practical exercise of 1hr 30min length</li> <li>○ Apparatus may not be damaged</li> <li>○ Bearing surface to carry 60% of key length</li> <li>○ No burs allowed</li> <li>○ Tools must be clean and neat</li> <li>○ No injury or unsafe act had occurred</li> <li>○ Sides of key must be parallel (0,05)</li> </ul> </li> </ul>		

- Finishing (N7 standard)

- Level of competence required: 80% Learning resources for teaching

**Learning resources for teaching:**

- Learning material on defined Knowledge and Practical Skills Modules

**Tools, Equipment and Material:**

- Personal Protective Equipment; Overalls; Safety Boots; Safety
- Taper key hub and bush, Key Steel
- Measuring equipment; Venier; telescopic gauges; inside callipers; Micrometres; steel ruler;
- Hand Tools: Bustard File; Second Cut File; smooth file; file brush; paint brush; marking blue past; hacksaw and blade; scriber; engineering square; small hammer;



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>F3</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Fabricate complex mechanical components and work pieces</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		200	104	
<b>Work situation title: Fabricate a flange &amp; other suitable components</b>	<b>Total hours</b>	80	40	
<b>Work scenario:</b> Manini is requested to manufacture a flange that must be welded to a pipe that is fit as part of a construction. The assembly will then be mounted to complete the section. She has to identify the material by considering the size and tensile strength. She must select the tools and inspect the work area. She then has to measure, saw, mark off and drill material to specification and weld the workpiece. The safety of her and all present is her responsibility.				
<b>Prerequisite learning:</b> E				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>
<b>PM-03 Fabricate components or workpieces using power tools and machinery</b> <i>Given specifications or samples, materials and hand tools</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0102 List component specifications including tolerances and sizes from the assignment</li> <li>PA0103 List material, tool and equipment requirements</li> <li>PA0104 Describe the sequence of work to fabricate the different components</li> <li>PA0105 Identify and list potential hazards and risks related to the assignments</li> </ul>		Knowledge of: <b>KM-03-KT03: Engineering tools and equipment</b> <ul style="list-style-type: none"> <li>KT0301 Hand tools to hold, assemble or disassemble components</li> <li>KT0302 Hand-held cutting tools (saws, blades, files, scrapers, chisels, taps and dies, hand reamers, hand broaching tools, hammers centre punch)</li> <li>KT0303 Hand-held power tools (angle grinder, drills, drill bits and reamers)</li> <li>KT0304 Measurement tools and equipment (basic measurement tools, precision measuring tools, angular measuring tools, inspection gauges)</li> <li>KT0305 Marking-off tools and equipment (punches, scribes, combination sets, protractors, calipers (inside and outside), jenny caliper, engineering square, angle</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least 80 hours</b> <ul style="list-style-type: none"> <li>WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>WA0103 Fabricate a variety of mechanical components to requirements using hand and power tools</li> <li>WA0104 Test or fit fabricated components</li> <li>WA0105 Restore the work area and</li> </ul>

	<p>plates, marking-off table, dividers)</p> <p><u>Applied Knowledge</u></p> <ul style="list-style-type: none"> <li>• AK0101 Procedures to plan and prepare for fabrication of components</li> <li>• AK0102 Material identification, types and profiles</li> <li>• AK0103 Practices related to quality, health, safety, and protection of the environment</li> </ul>	<p>dispose of waste materials</p> <ul style="list-style-type: none"> <li>• WA0106 Interact with production personnel, where applicable</li> <li>• WA0107 Complete all relevant documentation</li> <li>• WA0108 Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• IAC0101 The fabrication of the components is planned according to accepted sequences</li> <li>• IAC0102 Specifications and quality criteria that must be met are clearly linked to the specific instruction</li> <li>• IAC0103 Tools, equipment and materials required are identified correctly</li> <li>• IAC0104 Risks and hazards are correctly identified and listed</li> <li>• IAC0105 Consequences of mistakes in the planning and preparation of the manufacturing task are described correctly</li> <li>• IAC0601 The use of fixed drilling machines is explained and demonstrated</li> <li>• IAC0602 The workpiece is drilled according to procedure and specifications</li> <li>• IAC0603 Drill bits are sharpened to specifications</li> <li>• IAC0604 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0605 Lubricants and coolants are used according to manufacturer's specifications</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0301 Different tools (hand, cutting, power, measuring, marking off) are listed and identified</li> <li>• IAC0302 Safe care, correct use and storage of tools and equipment are explained</li> <li>• IAC0303 The selection of tools for a variety of tasks is explained</li> <li>• IAC0304 Measurement calculations are performed correctly and accurately</li> <li>• IAC0305 Measurements from measuring tools are read and interpreted correctly</li> <li>• IAC0306 Speeds, feeds and cutting tools are described correctly</li> <li>• IAC0307 Safety precautions pertaining to tools are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 questions and the competency will be at 80% <ul style="list-style-type: none"> <li>○ Practical exercise: Standard time 1 hour 30 min</li> <li>○ Apparatus may not be damaged</li> </ul> </li> </ul>		

- The flange is marked off and drilled as specified on the drawing
- The centre lines within 0.5mm from the centre of the material.
- The diameters of the holes may not be more than 0.1mm bigger than the drill diameter.
- Distances between the drilled holes may not vary by more than 0.5mm.
- PCD Tolerance:  $\pm 0.5\text{mm}$
- Holes must be drilled at 90 deg to surface of the flange
- No burs allowed
- Tools must be clean and neat
- No injury or unsafe act had occurred
- Finishing (N7 standard)
- Level of competence required: 80%

#### **Learning resources for teaching**

- Learning material covering defined Knowledge and Practical Skills Modules
- Samples (and charts) of different flanges
- Safe Operating Procedure and Safe Working Procedure for manufacturing a flange
- Charts of risk assessment procedure and safety measures for manufacturing a flange
- CDs and videos of for manufacturing a flange/other suitable components will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots; Safety
- Flat Mild steel
- Measuring equipment; Vernier; inside callipers; Micrometres; steel ruler;
- Hand Tools: smooth file; file brush; paint brush; marking blue past; scriber; engineering square; small hammer; pin punch

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>F4</b>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Fabricate complex mechanical components and work pieces</b>	<b>Total hours</b>	<b>SDP</b> 200	<b>WP</b> 104		
<b>Work situation title: Construct pipe systems and pressure test (metal/steel and HDPE lines) - Elective</b>	<b>Total hours</b>	24	CC		
<b>Work scenario:</b> Manini is requested to construct a pre-designed pipe system. She has to identify the different pipes and valves considering the size and function and application. She must select the tools and work area. She then has to assemble the components to the prescribed drawing. The safety of her and all present is her responsibility.					
<b>Prerequisite learning: E</b>					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	<b>80%</b>	<b>Knowledge modules (KM)</b>	<b>20%</b>	<b>Work experience modules (WM)</b>	
<p><i>QCTO none</i></p> <p><i>Given equipment specifications and materials and hand tools</i></p> <p><b>The apprentice must be able to:</b></p> <p><b>Install, maintain, test and repair Flow systems made up of Galvanised steel and/or HDPE Pipes</b></p> <ul style="list-style-type: none"> <li>Different materials, pipes and relevant equipment are identified and selected according to job requirements and instructions received</li> <li>Different materials, pipes and relevant equipment are handled, transported and carefully stored to prevent damage</li> <li>The site is prepared according to the work instruction and drawings where</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT03: Types and application of valves</b></p> <ul style="list-style-type: none"> <li>KT0301 Classification and types of valves (Classification includes linear motion, rotary motion and quarter turn valves; types include gate, non-return, relief, ball shut-off valves; also included are pipe systems.)</li> <li>KT0302 Terminology of valves</li> <li>KT0303 Function and working principles of valves</li> <li>KT0304 Removal and installation of valves</li> </ul> <p><u>Applied Knowledge</u></p>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <ul style="list-style-type: none"> <li><b>None as elective</b></li> </ul>	

<p>pipes and equipment are to be positioned.</p> <ul style="list-style-type: none"> <li>• Access equipment is acquired and prepared at the worksite in accordance with regulatory requirements for safe working practice.</li> <li>• Relevant materials, components and tools are procured using specific processes and procedures</li> <li>• High-density polyethylene plastic (HDPE) pipes and fittings are joined using the different approved methods and in accordance with the relevant SANS Codes</li> <li>• Polymer pipes and fittings are joined in accordance with the relevant SANS Codes and meeting SHEQ requirements</li> <li>• Galvanised mild steel (GMS) pipes and fittings are joined and sealed in accordance with the relevant SANS Codes and meeting SHEQ requirements</li> <li>• Completed system is pressure tested to detect any possible leaks or defects in accordance with the relevant SANS Codes and meeting SHEQ requirements</li> </ul>	<p><b>KM-04-KT03: Types and application of valves</b></p> <ul style="list-style-type: none"> <li>• Procedures to plan and prepare work area</li> <li>• Identification of different valves and pipes</li> <li>• Assembly and testing procedures</li> <li>• Component info related to quality, health, safety, and protection of the environment</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>Build and test basic pipe systems</b></p> <ul style="list-style-type: none"> <li>• Identify different materials, pipes, fittings and relevant equipment used in pipe systems</li> <li>• Methods applied to handle transport, and store different materials, pipes, fittings and relevant equipment</li> <li>• Site preparation according to the work instruction and drawings where pipes and equipment are to be positioned.</li> <li>• Safe working practices to acquire access equipment and prepare the worksite in accordance with regulatory requirements</li> <li>• Specific processes and procedures to procure relevant materials, components and tools</li> <li>• Different approved methods to join High-density polyethylene plastic</li> </ul>	
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	<p>(HDPE) pipes and fittings in accordance with the relevant SANS Codes</p> <ul style="list-style-type: none"> <li>• Methods used to join Polymer pipes and fittings in accordance with the relevant SANS Codes and meeting SHEQ requirements</li> <li>• Methods used to join and seal galvanised mild steel (GMS) pipes and fittings in accordance with the relevant SANS Codes and meeting SHEQ requirements</li> <li>• Procedure to pressure test completed system to detect any possible leaks or defects in accordance with the relevant SANS Codes and meeting SHEQ requirements</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p>Demonstrate knowledge and understanding to install, maintain, test and repair pipe systems</p>	<p><b>KM-04-KT03: Types and application of valves</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Classification and types of valves are identified and discussed</li> <li>• IAC0302 Application of valves is discussed</li> <li>• IAC0303 Components of valves and pipe systems are identified and discussed</li> <li>• IAC0304 Functions and working principles of valves are described</li> <li>• IAC0305 Removal and installation procedures for valves are described</li> <li>• IAC0306 Safety precautions pertaining to valves are explained</li> </ul> <p><b>Build and test basic pipe systems</b></p>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>

	<ul style="list-style-type: none"><li>• Different materials, pipes, fittings and relevant equipment used in pipe systems are discussed.</li><li>• Methods applied to handle transport, and store different materials, pipes, fittings and relevant equipment are discussed.</li><li>• Site preparation according to the work instruction and drawings where pipes and equipment are to be positioned are discussed</li><li>• Safe working practices to acquire access equipment and prepare the worksite in accordance with regulatory requirements are demonstrated.</li><li>• Specific processes and procedures to procure relevant materials, components and tools are discussed.</li><li>• Different approved methods to join High-density polyethylene plastic (HDPE) pipes and fittings in accordance with the relevant SANS Codes are demonstrated.</li><li>• Methods used to join Polymer pipes and fittings in accordance with the relevant SANS Codes and meeting SHEQ requirements are demonstrated.</li><li>• Methods used to join and seal galvanised mild steel (GMS) pipes and fittings in accordance with the relevant SANS Codes and meeting SHEQ requirements are demonstrated.</li></ul>	
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	<ul style="list-style-type: none"> <li>• Procedure to pressure test completed system to detect any possible leaks or defects in accordance with the relevant SANS Codes and meeting SHEQ requirements are demonstrated.</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 10 questions and the competency will be at 80%</li> <li>• Practical exercise of 180 min length covering all items mentioned above. <ul style="list-style-type: none"> <li>○ Tools must be clean, neat and not damaged</li> <li>○ No injury or unsafe act had occurred</li> <li>○ No Burrs</li> </ul> </li> </ul> <p><b>Learning resources for teaching:</b></p> <ul style="list-style-type: none"> <li>• Learning material</li> <li>• Samples (and charts) of pipes, valves and fittings</li> <li>• Manufacturer's operating instructions (or SOP) for pipes, valves and fittings</li> <li>• Applicable SANS standards for plumbing</li> <li>• Charts of risk assessment procedure and safety measures.</li> <li>• CDs and videos of plumbing will be an advantage</li> </ul> <p><b>Tools, Equipment and Material:</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots; Safety</li> <li>• Valves and Pipes</li> <li>• Ringset spanners and Pipe wrench</li> <li>• Flowmeters and pressure gauges</li> <li>• Pipe cutters</li> <li>• Stocks and dies.</li> <li>• Deburring tool</li> <li>• Smooth half-round file</li> <li>• Measuring tape</li> <li>• Hacksaw</li> </ul>		



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1 style="color: red;">G1</h1>		
		<b>Curriculum code: 671202000</b>				
<b>Learning area title: Perform basic welding, cutting, brazing on engineering materials</b>		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
			80			120
<b>Work situation title: Gas cut metal to specification</b>		<b>Total hours</b>	16	40		
<b>Work scenario:</b> Jenna is working at the holding furnace. She has to replace the inlet spout as per the maintenance schedule. The bolts retaining the inlet spout are damage to the extent that a spanner or wrench can no longer be used to loosen them. Jenna must use Oxyacetylene equipment to cut the bolts in order to remove them. The safety of her and her fellow employees are her responsibility.						
<b>Prerequisite learning:</b> A1, B1-B2 & C1						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>		
<b>PM-03-PS10: Gas cut metal to specification</b> <i>Given workpiece specifications, materials, tools and gas cutting equipment,</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>• PA1001 Mark-off workpieces</li> <li>• PA1002 Set-up gas cutting equipment and workpieces</li> <li>• PA1003 Cut material to specification</li> <li>• PA1004 Conduct post gas cutting activities</li> <li>• <b>Apply pre-assessment on gas cutting equipment</b></li> <li>• <b>Detect gas leaks</b></li> <li>• <b>Perform Shut down procedures</b></li> <li>• <b>Performance assessment report for completion of work situation</b></li> </ul>		Knowledge of:  <b>KM-03-KT07: Principles, equipment and methods of arc welding, gas welding, cutting, brazing and silver soldering</b> <ul style="list-style-type: none"> <li>• KT0701 Arc welding and gas welding and cutting equipment and consumables</li> <li>• KT0702 Arc welding and gas welding and cutting techniques and principles</li> <li>• KT0703 Material selection</li> <li>• KT0704 Cutting and welding defects</li> <li>• KT0705 Safe handling of gas cylinders</li> <li>• KT0706 Health and safety risks and protective equipment and measures</li> </ul> <u>Applied Knowledge</u>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least 80 hours</b> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>• WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>• WA0103 Fabricate a variety of mechanical components to requirements using hand and power</li> </ul>		

	<ul style="list-style-type: none"> <li>• AK1001 Identification, function, use and care of gas cutting equipment</li> <li>• AK1002 Procedures to gas cut workpieces using gas cutting equipment</li> <li>• AK1003 Gas cutting methods</li> <li>• AK1004 Gas cutting safety precautions</li> </ul>	<p>tools</p> <ul style="list-style-type: none"> <li>• WA0104 Test or fit fabricated components</li> <li>• WA0105 Restore the work area and dispose of waste materials</li> <li>• WA0106 Interact with production personnel, where applicable</li> <li>• WA0107 Complete all relevant documentation</li> <li>• WA0108 Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• The use of gas cutting equipment is explained and demonstrated</li> <li>• The work piece is gas cut according to procedure and specifications</li> <li>• Risks and hazards are identified and responded to in a responsible manner</li> <li>• Safety precautions are met</li> </ul>	<ul style="list-style-type: none"> <li>• IAC1001 The use of gas cutting equipment is explained and demonstrated</li> <li>• IAC1002 The workpieces are gas cut according to procedure and specifications</li> <li>• IAC1003 Risks and hazards are identified and responded to in a responsible manner</li> <li>• Cutting defects are described</li> <li>• Safety precautions pertaining to gas cutting are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 questions and the competency will be at 80%</li> <li>• Practical exercise of 30min length <ul style="list-style-type: none"> <li>○ All safety aspects adhered to</li> <li>○ No injury</li> <li>○ Start up and shut down of the Gas cutting correctly done</li> <li>○ Pre inspection correctly done and all parts identified</li> <li>○ No damage to equipment</li> <li>○ Nozzles cleaned correctly</li> <li>○ Level of Safety aspects must be 100%</li> </ul> </li> </ul>		


- Level of competence required: 80%

**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of gas and all the dangers
- Safe Operating Procedure and Safe Working Procedure for Gas Cutting
- Charts of risk assessment procedure and safety measures for Gas Cutting
- CDs and videos of Gas Cutting will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Gas welding goggles or face shield, spats, apron, yoke, leather gloves
- Material to cut
- Hand Tools, Gas cutting equipment (Oxygen and acetylene cylinders, flashback arresters, pipe, cutting torch, different nozzles)


<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>					
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Perform basic welding, cutting, brazing on engineering materials</b>		<b>Total hours</b>				<b>SDP</b>	<b>WP</b>
						80	120
<b>Work situation title: Arc weld metal to specification</b>		<b>Total hours</b>		40	40		
<b>Work scenario:</b> Cameron is tasked to install a new water line. He is required to manufacture brackets on which the pipeline will be mounted. The manufacturing is according to a given drawing. He must weld the cut steel in order to make the brackets.							
<b>Prerequisite learning:</b> G1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>		70%	<b>Knowledge modules (KM)</b>		30%		
			<b>Work experience modules (WM)</b>				
<b>PM-03-PS08: Arc weld metal to specification</b> <i>Given gasket specifications or samples, materials and hand tools:</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0801 Select welding rods required</li> <li>PA0802 Set-up arc welding machine and workpieces</li> <li>PA0803 Perform a fillet weld in the flat position (1F), including fitting and tacking</li> <li>PA0804 Perform a fillet weld in the horizontal position (2F), including fitting and tacking</li> <li>PA0805 Perform a fillet weld in the vertical up position (3F), including fitting and tacking</li> <li>PA0806 Use an arc-welding machine in a safe and responsible manner</li> <li>PA0807 Conduct post welding activities</li> </ul>		Knowledge of: <b>KM-03-KT07: Principles, equipment and methods of arc welding, gas welding, cutting, brazing and silver soldering</b> <ul style="list-style-type: none"> <li>KT0701 Arc welding and gas welding and cutting equipment and consumables</li> <li>KT0702 Arc welding and gas welding and cutting techniques and principles</li> <li>KT0703 Material selection</li> <li>KT0704 Cutting and welding defects</li> <li>KT0705 Safe handling of gas cylinders</li> <li>KT0706 Health and safety risks and protective equipment and measures</li> </ul> <u>Applied Knowledge</u> <b>PM-03-PS08: Arc weld metal to specification</b> <ul style="list-style-type: none"> <li>AK0801 Identification, function, use and</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least 80 hours</b> <ul style="list-style-type: none"> <li>WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>WA0103 Fabricate a variety of mechanical components to requirements using hand and power tools</li> <li>WA0104 Test or fit fabricated components</li> </ul>			

<ul style="list-style-type: none"> <li>• Performance assessment report for completion of work situation</li> <li>• Perform good house keeping</li> </ul>	<ul style="list-style-type: none"> <li>• care of arc welding equipment</li> <li>• AK0802 Procedures to arc weld workpieces using an arc-welding machine</li> <li>• AK0803 Methods and different arc welding positions</li> <li>• AK0804 Arc welding safety colour markings and symbols</li> <li>• AK0805 Arc welding safety precautions</li> <li>• AK0806 Fitting and tack welding techniques and practices</li> </ul>	<ul style="list-style-type: none"> <li>• WA0105 Restore the work area and dispose of waste materials</li> <li>• WA0106 Interact with production personnel, where applicable</li> <li>• WA0107 Complete all relevant documentation</li> <li>• WA0108 Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• IAC0801 The uses of arc welding machines are explained and demonstrated</li> <li>• IAC0802 The workpiece is arc welded according to procedure and specifications</li> <li>• IAC0803 Risks and hazards are identified and responded to in a responsible manner</li> </ul>	<ul style="list-style-type: none"> <li>• Arc welding equipment is described</li> <li>• Arc welding techniques and principles are discussed</li> <li>• Material is identified and selected according to applications</li> <li>• Welding defects are described</li> <li>• Safety precautions pertaining to arc welding and gas cutting are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 questions and the competency will be at 80%</li> <li>• Practical exercise of 1hr length covering <ul style="list-style-type: none"> <li>○ All safety aspects adhered to</li> <li>○ No Injuries</li> <li>○ No damage to equipment</li> <li>○ All welding joint 80% correct</li> </ul> </li> <li>• Level of competence required: 80%</li> </ul> <p><b>Learning resources for teaching</b></p>		

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of different welding joints
- Safe Operating Procedure and Safe Working Procedure for Arc Welding
- Charts of risk assessment procedure and safety measures for Arc Welding
- CDs and videos of Arc Welding will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Welding gloves, Safety Goggles, spats, apron, welding helmet
- Material and consumables
- Measuring equipment; Hand Tools; welding equipment, Arc welding machine, Power tools

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>			
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Perform basic welding, cutting, brazing on engineering materials</b>		<b>Total hours</b>	<b>SDP</b> 80		
<b>Work situation title: Gas weld, silver solder and braze metal to specification</b>		<b>Total hours</b>	24	40	
<b>Work scenario:</b> Mario is requested to join a steel section with the use of Gas weld, silver solder and braze metal to specification. He has to identify, handle measure and weld relevant section to the prescribed standard. The safety of all present is his responsibility.					
<b>Prerequisite learning: G2</b>					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>	
<b>PM-03-PS09: Gas weld, silver solder and braze metal to specification</b>  <i>Given workpiece specifications, materials, tools and gas welding equipment,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>• PA0901 Set-up gas welding equipment and workpiece</li> <li>• PA0902 Use gas welding equipment in a safe and responsible manner</li> <li>• PA0903 Adjust the flame and pressure settings</li> <li>• PA0904 Perform gas welds, silver soldering and brazing</li> <li>• PA0905 Conduct post gas welding activities</li> </ul>		Knowledge of:  <b>KM-03-KT07: Principles, equipment and methods of arc welding, gas welding, cutting, brazing and silver soldering</b> <ul style="list-style-type: none"> <li>• KT0701 Arc welding and gas welding and cutting equipment and consumables</li> <li>• KT0702 Arc welding and gas welding and cutting techniques and principles</li> <li>• KT0703 Material selection</li> <li>• KT0704 Cutting and welding defects</li> <li>• KT0705 Safe handling of gas cylinders</li> <li>• KT0706 Health and safety risks and protective equipment and measures</li> </ul> <u>Applied Knowledge</u> <ul style="list-style-type: none"> <li>• AK0901 Identification, function, use and care of gas welding equipment</li> <li>• AK0902 Procedures to gas weld workpieces using gas-welding equipment</li> <li>• AK0903 Gas welding safety colour markings</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:  <b>WM-02-WE01: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to fabricate mechanical components for least 80 hours</b> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary information, plan the fabrication process, compile the materials list and draw the materials</li> <li>• WA0102 Conduct risk assessments and prepare work site for fabrication processes</li> <li>• WA0103 Fabricate a variety of mechanical components to requirements using hand and power tools</li> <li>• WA0104 Test or fit fabricated components</li> <li>• WA0105 Restore the work area and dispose of waste materials</li> <li>• WA0106 Interact with production personnel, where applicable</li> </ul>	

	and symbols • AK0904 Gas welding methods • AK0905 Gas welding safety precautions	• WA0107 Complete all relevant documentation • WA0108 Communicate with relevant parties
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• IAC0901 The uses of gas welding equipment are explained and demonstrated</li> <li>• IAC0902 Equipment is set up correctly</li> <li>• IAC0903 The workpieces are gas welded according to procedure and specifications</li> <li>• IAC0904 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0905 Safety precautions are adhered to</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0901 The uses of gas welding equipment are explained and demonstrated</li> <li>• IAC0902 Equipment is set up correctly</li> <li>• IAC0903 The workpieces are gas welded according to procedure and specifications</li> <li>• IAC0904 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0905 Safety precautions are adhered to</li> </ul>	<b>Supporting Evidence:</b> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of components fabricated, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions and the competency will be at 80%</li> <li>• Practical exercise:             <ul style="list-style-type: none"> <li>○ Standard time 1 hour 30 min</li> </ul> </li> <li>• Level of competence required: 80%             <ul style="list-style-type: none"> <li>○ No injury</li> <li>○ Start up and shut down of the Gas welding correctly done</li> <li>○ Pre inspection correctly done and all parts identified</li> <li>○ No damage to equipment</li> <li>○ Nozzles cleaned correctly</li> <li>○ Level of Safety aspects must be 100%</li> </ul> </li> <li>• Level of competence required: 80%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> <li>• Samples (and charts) of gas and all the dangers</li> <li>• Safe Operating Procedure and Safe Working Procedure for Gas welding</li> <li>• Charts of risk assessment procedure and safety measures for Gas welding</li> <li>• CDs and videos of for Gas welding will be an added advantage</li> </ul>		



**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Gas welding goggles or face shield, spats, apron, yoke, leather gloves.
- Material to cut
- Hand Tools, Gas cutting equipment (Oxygen and acetylene cylinders, flashback arresters, pipe, cutting torch, different nozzles)

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>H1</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Identify and care for Electrical Equipment and components</b>		<b>Total hours</b>	<b>SDP</b> 120		
<b>Work situation title: Identify and maintain Distribution Boards</b>		<b>Total hours</b>	40	40	
<b>Work scenario:</b> Ronelda is requested to maintain a Main Distribution Board. She will need to locate, inspect and maintain the DB to the prescribed standard. Safety is premium and therefore isolation and lockout must be completed correctly and components must be replaced according to OEM specifications					
<b>Prerequisite learning:</b> C2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	60%	<b>Knowledge modules (KM)</b>	40%	<b>Work experience modules (WM)</b>	
<p><b>PM-05-PS02: Identify and care for electrical equipment</b></p> <p><i>Given a variety of electrical equipment including typical motor control gear such as control panels, distribution boards, contractors, timers, isolators and limit switches, and manufacturers' specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0201 Identify and respond to hazards and risks</li> <li>PA0202 Identify the electrical equipment</li> <li>PA0203 Describe and explain the functions and applications of the electrical equipment</li> <li>PA0204 Describe and explain the requirements for handling and storing</li> </ul>		<ul style="list-style-type: none"> <li>Types, functions and applications of electrical equipment</li> <li>Hazard identification and risk assessment practices related to Distribution Board</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-05-PS02: Identify and care for electrical equipment</b></p> <ul style="list-style-type: none"> <li>AK0201 Safety procedures and techniques</li> <li>AK0202 Standard operating procedures</li> <li>AK0203 Manufacturers' specifications</li> <li>AK0204 Hazard identification and risk assessment practices</li> <li>AK0205 Types, functions and</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>Maintain Distribution Boards under the direct supervision of a qualified millwright, electrician for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> </ul>	

<p>motor control gear</p> <ul style="list-style-type: none"> <li>• Use correct PPE</li> <li>• Isolate, lockout and test for zero potential</li> <li>• All connections are inspected for proper insertion and secureness (hot connections) (infra-red)</li> <li>• All components operation is within standard and limits</li> <li>• All components are secured correctly</li> <li>• All components and DB clean and dust free</li> <li>• Use correct (oil free) cleaning solvents</li> </ul>	<p>applications of electrical equipment</p> <ul style="list-style-type: none"> <li>• AK0206 Safe use, handling and care of electrical equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct pre-maintenance inspections and identify and report any deviations</li> <li>• Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on Distribution Boards</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete maintenance reports</li> <li>• Communicate with relevant parties</li> <li>• Identify all elements of DB boards in various work scenarios correctly and explain their functionality/importance</li> <li>• Inspect DB boards and provide report on required maintenance/repairs</li> <li>• Attend to DB Board maintenance as per industry standard</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-05-PS02: Identify and care for electrical equipment</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0202 Types of electrical equipment and their functions and applications are correctly identified, described and explained</li> <li>• IAC0203 Correct handling and</li> </ul>	<ul style="list-style-type: none"> <li>• Safety procedures and techniques are adhered to</li> <li>• Standard operating procedures are discussed</li> <li>• Manufacturers' specifications are discussed</li> <li>• Hazard identification and risk assessment practices are applied</li> <li>• Types, functions and applications of electrical equipment are discussed</li> <li>• Safe use, handling and care of electrical equipment are done</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>

<p>storage requirements are described and explained</p> <ul style="list-style-type: none"> <li>• Correct PPE used</li> <li>• Isolate, lockout and test for zero potential</li> <li>• All connections are inspected for proper insertion and secureness (hot connections) (infra-red)</li> <li>• All components operation is checked to be within standard and limits</li> <li>• All components secureness checked correctly</li> <li>• All components and DB cleaned and dust free</li> <li>• Use correct (oil free) cleaning solvents</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (45min) and the competency will be at 80%</li> <li>• Practical exercise of 60min covering all the above-mentioned items</li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>• Safety (Isolate, lockout and test for zero potential)</li> <li>• Use of correct PPE.</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All the other assessment items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots;</li> </ul>		

- Engineering drawings and drawing
- Set of insulated screwdrivers
- Fuse pullers (optional)
- Infra-red camera (Optional)
- Multi meter
- Electrical cleaning solvent
- Waste/Rags
- Panel key
- Lockout equipment

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>H2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Identify and care for Electrical Equipment and components</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		120	120	
<b>Work situation title: Identify and maintain Protective devices</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Patricia is requested to maintain the protective devices on a plant. She will need to locate, inspect and maintain all the items on the list to the prescribed standard. Safety is premium, therefore isolation and lockout must be completed correctly and components must be replaced according to OEM specifications.				
<b>Prerequisite learning: H1</b>				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	<b>80%</b>	<b>Knowledge modules (KM)</b>	<b>20%</b>	<b>Work experience modules (WM)</b>
<b>PM-05-PS05: Identify and care for protective devices</b>  <i>Given a variety of protective devices such as overloads, relays, circuit breakers, fuse holders and lighting systems, SANS standards and manufacturers' specifications,</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0501 Identify and respond to hazards and risks</li> <li>PA0502 Identify the protective devices</li> <li>PA0503 Describe and explain the functions and applications of the protective devices</li> <li>PA0504 Describe and explain the requirements for handling and storing protective devices</li> </ul>		Knowledge of:  <b>KM-10-KT01: Low voltage protection</b> <ul style="list-style-type: none"> <li>KT0101 Purpose and application of low voltage protection</li> <li>KT0102 Types of low voltage protection</li> <li>KT0103 Low voltage protection parameters and statutory requirements</li> </ul> <u>Applied Knowledge:</u>  <b>PM-05-PS05: Identify and care for protective devices</b> <ul style="list-style-type: none"> <li>AK0501 Safety procedures and techniques</li> <li>AK0502 Standard operating procedures</li> </ul>		<i>QCTO none</i>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <b>Maintain protective devices under the direct supervision of a qualified millwright or electrician for at least 120 hours</b> <ul style="list-style-type: none"> <li>Identify correct protective devices for various work scenarios</li> <li>Gather the necessary maintenance information, plan the maintenance process, compile component list and draw the parts and materials</li> <li>Conduct risk assessments, perform the lock-out and tag out procedures</li> </ul>

	<ul style="list-style-type: none"> <li>• AK0503 Manufacturers' specifications</li> <li>• AK0504 Hazard identification and risk assessment practices</li> <li>• AK0505 Types, functions and applications of protective devices</li> <li>• AK0506 Safe use, handling and care of protective devices</li> </ul>	<p>where applicable and prepare the work sites</p> <ul style="list-style-type: none"> <li>• Conduct pre-maintenance inspections and identify and report any deviations</li> <li>• Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on protective devices</li> <li>• Conduct post-maintenance inspection and functionality tests and commission the repaired/replaced protective devices</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete maintenance reports</li> <li>• Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-05-PS05: Identify and care for protective devices</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0502 Types of protective devices and their functions and applications are correctly identified, described and explained</li> <li>• IAC0503 Correct handling and storage</li> </ul>	<p><b>KM-10-KT01: Low voltage protection</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Name and describe the types of low voltage protective devices</li> <li>• IAC0102 Describe the operation and functions of different types of low voltage protective devices including overload relays, fuses, circuit breakers and earth leakage protection devices</li> <li>• IAC0103 Explain, with the aid of circuit diagrams, how single-and three phase electrical installations</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>

<p>requirements are described and explained</p>	<p>are protected</p> <ul style="list-style-type: none"> <li>• IAC0104 Describe the effect of adverse conditions on the operational characteristics of protective devices</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (60min) and the competency will be at 80%</li> <li>• Practical exercise of 60min covering all above-mentioned items</li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>• Safety Isolate, Lockout and test for zero potential</li> <li>• Correct Installation of protective device</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All other assessment items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; Overalls; Safety Boots;</li> <li>• Electrical components</li> <li>• Set of spanners</li> <li>• Insulated Screwdrivers</li> <li>• Multi meter</li> <li>• Panel key</li> </ul>		



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>H3</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Identify and care for Electrical Equipment and components</b>		<b>Total hours</b>	<b>SDP</b> 120		
<b>Work situation title: Identify and maintain Contactors, Timers, Isolators and Limit Switches, etc</b>		<b>Total hours</b>	40	40	
<b>Work scenario:</b> Patricia is requested to maintain the all Contactors, Timers, Isolators and Switches on a Plant. She will need to locate, inspect and maintain all the items on the list to the prescribed standard. Safety is premium therefore isolation and lockout must be completed correctly. Components must be replaced according to OEM specifications.					
<b>Prerequisite learning:</b> H2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	<b>80%</b>	<b>Knowledge modules (KM)</b>	<b>20%</b>	<b>Work experience modules (WM)</b>	
<p><i>QCTO none</i></p> <p><b>Identify and care for electrical control components</b></p> <p><i>Given a variety of electrical components including typical motor control gear such as control panels, contractors, timers, isolators and limit switches, and manufacturers' specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Identify and respond to hazards and risks</li> <li>Identify the electrical components</li> <li>Describe and explain the functions and applications of the electrical components</li> <li>Describe and explain the requirements for handling and storing motor control gear</li> </ul>		<p>Knowledge of:</p> <p><b>KM-09-KT05: Switchgear and control gear</b></p> <ul style="list-style-type: none"> <li>KT0501 Principles of operation of switchgear and control gear</li> <li>KT0502 Components of switchgear and control gear systems and the application thereof</li> <li>KT0503 Electrical drawings</li> </ul> <p><u>Applied Knowledge:</u></p> <p><b>Identify and care for electrical control Components</b></p> <ul style="list-style-type: none"> <li>Safety procedures and techniques</li> <li>Standard operating procedures</li> <li>Manufacturers' specifications</li> <li>Hazard identification and risk assessment practices</li> <li>Types, functions and applications of electrical control components</li> <li>Safe use, handling and care of electrical</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>Maintain electrical control components under the direct supervision of a qualified millwright or electrician for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>Identify electrical control components for various work scenarios</li> <li>Gather the necessary maintenance information, plan the maintenance process, compile component list and draw the parts and materials</li> <li>Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>Conduct pre-maintenance inspections and</li> </ul>	

	control components	identify and report any deviations <ul style="list-style-type: none"> <li>• Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on electrical control components</li> <li>• Conduct post-maintenance inspection and functionality tests and commission the repaired/replaced electrical control components</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete maintenance reports</li> <li>• Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<b>Identify and care for electrical control components</b> <ul style="list-style-type: none"> <li>• Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• Types of electrical components and their functions and applications are correctly identified, described and explained</li> <li>• Correct handling and storage requirements are described and explained</li> </ul>	<b>KM-09-KT05: Switchgear and control gear</b> <ul style="list-style-type: none"> <li>• IAC0501 Describe disconnectors, relays, timers and contactors in terms of construction and operating principles with reference to the contacts, operating coils (where applicable) and operating mechanisms</li> <li>• IAC0502 Describe, with the aid of labelled drawings, the principle of operation of the over current and earth leakage protection relays</li> <li>• IAC0503 Describe the following terminology in terms of low voltage circuit breakers: moulded cases, positive indication, trip position, factory sealed, thermal magnetic tripping, quick make, quick break, trip free mechanism,</li> </ul>	<b>Supporting Evidence:</b> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>

	interpole barriers.	
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**Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 30 marks (60min) and the competency will be at 80%
- Practical exercise of 60min covering all above-mentioned items.

Level of competency of 100% (critical) required for:

- Safety (isolate, lockout and test for zero potential)

Level of competency of 80% required for:

- All other assessment items

**Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;
- Electrical components
- Set of spanners
- Insulated Screwdrivers
- Multi meter
- Panel key
- Lockout equipment

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>11</b>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Work with electronic components applicable to the occupational context</b>		<b>Total hours</b>	<b>SDP</b> 184		
<b>Work situation title: Identify, use and care for electronic measuring instruments</b>		<b>Total hours</b>	24	40	
<b>Work scenario:</b> Johnny is requested to design and build an electronic control circuit. He must identify and use electronic measuring instruments during the task. The circuit must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.					
<b>Prerequisite learning:</b> Year 2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	
<b>PM-07-PS02: Identify and use electronic measuring instruments</b>  <i>Given electronic measuring instruments including an oscilloscope and multimeter, equipment to be measured (function generator, power supply and circuits), personal protective equipment, manufacturers' specifications and work instructions,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0201 Review the work instructions, determine the scope of work and plan the operation</li> <li>PA0202 Collect all required instruments and relevant personal protective equipment, prepare the work space and complete a risk assessment</li> </ul>		<i>QCTO none</i>  Knowledge of: <ul style="list-style-type: none"> <li>Electronic measuring instruments their uses and applications</li> <li>Correct care and maintenance of electronic measuring instruments</li> </ul> <b>Electronic testing</b> <ul style="list-style-type: none"> <li>Testing principles for electronic circuits</li> <li>Testing techniques for electronic circuits</li> <li>Safety during Testing</li> <li>Electrical circuit design</li> </ul> <u>Applied knowledge:</u> <b>PM-07-PS02: Identify and use electronic measuring instruments</b>		<i>QCTO none</i>  <b>If the workplace allows for this exposure:</b>  The apprentice will be expected to gain practical experience and engage in the following work activities: <ul style="list-style-type: none"> <li>Given a work scenario identify the correct electronic measuring instruments to be used</li> <li>Explain the use of the different measuring instruments and precautions to be taken</li> <li>Care for and store electronic measuring instruments</li> <li>Report defects on electronic measuring instruments</li> </ul>	

<ul style="list-style-type: none"> <li>• PA0203 Identify and respond to hazards and risks</li> <li>• PA0204 Identify the features and functions on the electronic measuring instruments</li> <li>• PA0205 Explain the applications of the features and functions of the electronic measuring instruments</li> <li>• PA0206 Inspect instruments and identify and report defects</li> <li>• PA0207 Use the electronic measuring instruments to measure the applicable values on the equipment</li> <li>• <b>Care and storage of Electronic measuring instruments</b></li> </ul>	<ul style="list-style-type: none"> <li>• AK0201 Safe work procedures</li> <li>• AK0202 Standard operating procedures</li> <li>• AK0203 Manufacturers' specifications</li> <li>• AK0204 Value reading on the correct scale</li> <li>• AK0205 Hazard identification and risk assessment practices</li> <li>• AK0206 Methods of identifying defects on instruments</li> <li>• AK0207 Functions and applications of testing and measuring instruments</li> <li>• AK0208 Safe use, handling and care of testing and measuring instruments</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-07-PS02: Identify and use electronic measuring instruments</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0202 All features and functions on the electronic measuring instruments are correctly identified</li> <li>• IAC0203 The applications of all the features and functions are correctly described and explained</li> <li>• IAC0204 All defective instruments are identified and reported</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Electronic measuring instruments their uses and applications are explained</b></li> <li>• <b>Correct care and maintenance of electronic measuring instruments are described.</b></li> </ul> <p><b>Electronic testing</b></p> <ul style="list-style-type: none"> <li>• <b>Testing principles for electronic circuits are explained</b></li> <li>• <b>Testing techniques for electronic circuits are described</b></li> <li>• <b>Safety during Testing is explained</b></li> <li>• <b>Electrical circuit design is explained</b></li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0205 The instruments are used correctly to measure the values on the equipment</li> <li>• IAC0206 The values are measured correctly</li> <li>• The instruments are cared for and stored correctly</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 60min including all items mentioned above:</li> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>• Reading values</li> <li>• Selecting correct scale</li> </ul> </li> <li>• Level of competency of 80% required for: <ul style="list-style-type: none"> <li>• On all the above-mentioned items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> <li>• Samples (and charts)</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> <li>• Charts of risk assessment procedure and safety measures</li> <li>• Tutorial videos</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles</li> <li>• Multi meter</li> <li>• Oscilloscope</li> <li>• Function generator</li> <li>• Power supply</li> </ul>		

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		12
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Work with electronic components applicable to the occupational context</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		184	264	
<b>Work situation title: Gain an overview, identify and test electronic components</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Elvis is requested to design and build a Battery charger. He must identify and test all components for use in the circuit. The circuit must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.				
<b>Prerequisite learning:</b> Year 2, I1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<b>PM-07-PS03: Identify and test electronic components</b>  <i>Given electronic components including a range of different types of diodes, resistors, transistors, thyristors, capacitors and inductors, applicable tools, applicable test instruments, applicable personal protective equipment, manufacturers' specifications and work instructions,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0301 Identify and respond to hazards and risks</li> <li>PA0302 Identify a range of electronic components</li> <li>PA0303 Test diodes using instruments</li> <li>PA0304 Test resistors using instruments</li> </ul>		Knowledge of:  <b>KM-06-KT02: Electronics (30%)</b> <ul style="list-style-type: none"> <li>KT0201 International Electrotechnical Commission (IEC) symbols for electronic components</li> <li>KT0202 Principles, safety precautions, identification and basic function of electronic components</li> <li>KT0203 Basic electronic circuits</li> <li>KT0204 Principles of rectification, single phase and 3-phase</li> </ul> <ul style="list-style-type: none"> <li>Theory of conductors, semi-conductors, resistor, capacitor, inductors, diodes</li> <li>Function of electronic components</li> <li>Electronic symbols</li> <li>Value calculations</li> <li>Use of the colour chart</li> </ul>		QCTO none  <i>If the workplace allows for this exposure:</i>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <ul style="list-style-type: none"> <li>Identify Electronic components</li> <li>Describe the function/use of the components</li> <li>Determine the values of the components</li> <li>Test electronic components (where applicable)</li> </ul>

<ul style="list-style-type: none"> <li>• PA0305 Test transistors using instruments</li> <li>• PA0306 Test thyristors using instruments</li> <li>• PA0307 Test capacitors using instruments</li> <li>• PA0308 Test inductors using instruments</li> <li>• PA0309 Test (<b>Determine Value</b>) resistors using standard colour and numerical codes</li> <li>• PA0310 Determine capacitor values using numerical codes</li> <li>• PA0311 Verify electronic components against the manufacturers' specifications</li> <li>• <b>Determine circuit layout of IC's</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Use of data sheets</b></li> </ul> <p><b>Electronic component testing</b></p> <ul style="list-style-type: none"> <li>• <b>Testing principles for electronic components</b></li> <li>• <b>Testing techniques for electronic components</b></li> <li>• <b>Safety during testing</b></li> </ul> <p><u>Applied knowledge:</u></p> <p><b>PM-07-PS03: Identify and test electronic components</b></p> <ul style="list-style-type: none"> <li>• AK0301 Safe work procedures</li> <li>• AK0302 Standard operating procedures</li> <li>• AK0303 Manufacturers' specifications</li> <li>• AK0304 Applicable SANS standards</li> <li>• AK0305 Hazard identification and risk assessment practices</li> <li>• AK0306 Colour and numerical codes for resistors</li> <li>• AK0307 Numerical codes for capacitors</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-07-PS03: Identify and test electronic components</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> </ul>	<p><b>KM-06-KT02: Electronics (30%)</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Describe the various capacitors used and typical applications</li> <li>• IAC0202 Determine the value of capacitors using charts and calculate the value of capacitance of</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>



<ul style="list-style-type: none"> <li>• IAC0302 Electronic components are identified correctly</li> <li>• IAC0303 Electronic components are tested correctly, using the applicable measuring instruments on the correct scale</li> <li>• IAC0304 Standard colour and numerical codes are applied correctly to identify the value of resistors</li> <li>• IAC0305 Standard numerical codes are applied correctly to determine capacitor values</li> <li>• IAC0306 Electronic component specifications are correctly determined according to the manufacturers' specifications</li> <li>• IAC0307 Critical issues relating to testing electronic components are described and explained</li> </ul>	<p>capacitors in series and parallel</p> <ul style="list-style-type: none"> <li>• IAC0203 Determine the value of resistors utilizing colour coding charts</li> <li>• IAC0204 Describe the various inductors used and typical applications</li> <li>• IAC0205 Describe the construction and uses of various semiconductor devices</li> <li>• IAC0206 Draw basic electronic circuits using International Electrotechnical Commission (IEC) symbols <b>(This is required to create a more comprehensive approach to the foundation for Electronics)</b></li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 60 min including all items mentioned above</li> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>• Electronic components are identified correctly</li> <li>• Electronic symbols</li> </ul> </li> <li>• Level of competency of 80% required for: <ul style="list-style-type: none"> <li>• All the above-mentioned items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p>		

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Tutorial videos if available

### **Tools, Equipment and Materials**

- Calculator
- Stationary
- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Measuring instruments
- Boards with electronic components
- Resistor
- Thyristors
- Capacitor
- Inductors
- IC's
- Semi-conductor devices
- Diodes
- Colour chart

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>I3</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Work with electronic components applicable to the occupational context</b>		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>184</td> <td>264</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
184	264						
<b>Work situation title: Identify, read and interpret electronic circuit drawings and specifications</b>		<b>Total hours</b>	40	40			
<b>Work scenario:</b> Tommy is given a number electronic circuits to identify. He must read and interpret the function of each component within the design parameters. He must discuss the function of each component within the drawing.							
<b>Prerequisite learning:</b> Year 2 plus I2							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>			
<b>PM-07-PS01: Read and interpret electronic diagrams</b>  <i>Given a variety of electronic diagrams, lists of symbols and abbreviations and relevant information on reading diagrams,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0101 Identify and explain symbols</li> <li>PA0102 Identify and explain abbreviations</li> <li>PA0103 Determine and explain the electrical current flow as shown in a circuit diagram</li> <li>PA0104 Locate the relevant portions of the diagram with respect to the whole, using the given references</li> </ul>		<b>KM-06-KT02: Electronics</b> <ul style="list-style-type: none"> <li>KT0201 International Electrotechnical Commission (IEC) symbols for electronic components</li> <li>KT0202 Principles, safety precautions, identification and basic function of electronic components</li> <li>KT0203 Basic electronic circuits</li> <li>KT0204 Principles of rectification, single phase and 3-phase</li> </ul> <ul style="list-style-type: none"> <li>Purpose of circuit diagrams in the electronics industry</li> <li>Conventions used in and the features of electronic circuit diagrams</li> <li>Common symbols used in electronic circuit diagram (South African Drawing Standard)</li> </ul>		<i>QCTO none</i> <b>If the workplace allows for this exposure:</b> The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <ul style="list-style-type: none"> <li><b>Read and interpret electronic circuit drawings and specifications</b></li> </ul>			

<ul style="list-style-type: none"> <li>PA0105 Locate the relevant position of components using the given references</li> </ul>	<ul style="list-style-type: none"> <li>Electronic component parameters and component identification methods</li> <li>Types and designs of PCBs and their usage</li> <li>Basic types and usage of analogue and digital instruments</li> </ul> <p><u>Applied knowledge:</u></p> <p><b>PM-07-PS01: Read and interpret electronic diagrams</b></p> <ul style="list-style-type: none"> <li>AK0101 International Electro-technical Commission Standards</li> <li>AK0102 Systematic approach for reading diagrams</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-07-PS01: Read and interpret electronic diagrams</b></p> <ul style="list-style-type: none"> <li>IAC0101 Abbreviations are correctly identified and explained according to International Electro-technical Commission specifications</li> <li>IAC0102 Electrical current flow is correctly determined and explained</li> <li>IAC0103 Relevant portions of the diagram are correctly located with respect to the whole</li> <li>IAC0104 Relevant positions of components are located correctly</li> </ul>	<p><b>KM-06-KT02: Electronics</b></p> <ul style="list-style-type: none"> <li>IAC0201 Describe the various capacitors used and typical applications</li> <li>IAC0202 Determine the value of capacitors using charts and calculate the value of capacitance of capacitors in series and parallel</li> <li>IAC0203 Determine the value of resistors utilizing colour coding charts</li> <li>IAC0204 Describe the various inductors used and typical applications</li> <li>IAC0205 Describe the construction and uses of various semiconductor devices</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>Signed off logbook</li> </ul>

<b>Internal Assessment to be performed:</b>		

- Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%
- Practical exercise of 60min including all items mentioned above
  
- Level of competency of 100% (critical) required for:
  - Abbreviations are correctly identified and explained
  
- Level of competency of 80% required for:
  - All above-mentioned items

**Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Tutorial videos if available

**Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Array of electronic drawings

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>14</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Work with electronic components applicable to the occupational context</b>		<b>Total hours</b>	<b>SDP</b> 184		
<b>Work situation title: Construct electronic circuits using soldering</b>		<b>Total hours</b>	40	64	
<b>Work scenario:</b> Elvis is given a voltage rectifier circuit to build. He must read and interpret the function within the design parameters. He must construct the circuit according to the drawing. All components used must be covered in the discussion of the design.					
<b>Prerequisite learning:</b> Year 2 plus I3					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	
<b>PM-07-PS04: Construct electronic circuits using soldering</b>  <i>Given work instructions, electronic components, Vero boards, soldering equipment and materials, applicable tools, applicable testing instruments and circuit diagrams, standard operating procedures, statutory requirements, and PPE,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0401 Identify and respond to hazards and risks and use all relevant personal protective equipment</li> <li>PA0402 Read and interpret circuit diagrams</li> <li>PA0403 Solder various wire joints</li> <li>PA0404 Solder components on a PC or Vero board</li> <li>PA0405 De-solder components</li> </ul>		<i>QCTO none</i> <ul style="list-style-type: none"> <li>Planning of the layout of a veroboard</li> <li>Sensitivity of electronic components (static)</li> <li>Soldering techniques on veroboards</li> <li>Use of oscilloscope</li> <li>Use of signal generator</li> <li>Safety precautions when working with electronic circuits</li> <li>Statutory requirements as per work conducted</li> </ul> <u>Applied knowledge:</u>  <b>PM-07-PS04: Construct electronic circuits using soldering</b> <ul style="list-style-type: none"> <li>AK0401 Safe work procedures</li> <li>AK0402 Standard operating procedures</li> <li>AK0403 Manufacturers' specifications</li> </ul>		<i>QCTO none</i>  <i>If the workplace allows for this exposure</i>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision: <ul style="list-style-type: none"> <li>Identify Electronic components</li> <li>Solder electronic components (where applicable)</li> <li>Perform final functionality assessment</li> </ul>	

<ul style="list-style-type: none"> <li>• PA0406 Select the components needed for electronic circuits</li> <li>• PA0407 Construct electronic circuits</li> <li>• PA0408 Solder the circuits</li> <li>• PA0409 Test the functioning of the electronic circuits</li> <li>• Document test results and calculate where necessary</li> <li>• Clean work area after completion of task in accordance with work site procedures and housekeeping standards</li> </ul>	<ul style="list-style-type: none"> <li>• AK0404 Applicable SANS standards</li> <li>• AK0405 Hazard identification and risk assessment practices</li> <li>• AK0406 Soldering techniques and applications</li> <li>• AK0407 Types of testing instruments and their use</li> <li>• AK0408 Techniques for installing components</li> <li>• AK0409 De-soldering methods</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-07-PS04: Construct electronic circuits using soldering</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0402 Circuit diagrams are correctly interpreted</li> <li>• IAC0403 The correct soldering equipment and material was selected as per task requirements</li> <li>• IAC0404 The correct components are selected according to the circuit diagrams</li> <li>• IAC0405 Electronic circuits are constructed according to the circuit diagrams</li> <li>• IAC0406 Sufficient solder is applied in the appropriate shape</li> </ul>	<p><b>Soldering principles</b></p> <ul style="list-style-type: none"> <li>• Explain principles and techniques of soldering electronic circuits</li> <li>• Explain principles and techniques of de-soldering electronic components circuits</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0407 All dirt and oxidation on the connections were cleaned appropriately</li> <li>• IAC0408 Tinning of wire and connections was done according to manufacturers' specifications</li> <li>• IAC0409 Connections were soldered according to set specifications and techniques</li> <li>• IAC0410 The Vero board tracks are undamaged</li> <li>• IAC0411 Tests are conducted using applicable instruments on the correct scale to confirm correct functioning of electronic circuits</li> <li>• IAC0412 Critical issues relating to constructing electronic circuits using soldering are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (xx min) and the competency will be at 80%</li> <li>• Practical exercise of 60min including all items mentioned above</li> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>○ Soldering techniques</li> <li>○ Selection of components</li> <li>○ Placement of components</li> </ul> </li> <li>• Level of competency of 80% required for:</li> <li>• All above-mentioned items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> <li>• Samples (and charts)</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> <li>• Charts of risk assessment procedure and safety measures</li> </ul>		



- CDs and videos will be an added advantage

### **Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Soldering station
- Solder sucker
- Helping hands
- Magnifying glass
- Oscilloscope
- Signal generator/power supply
- Measuring instruments
- Standard electronic tools
- Anti-static mat
- Longnose set
- Side cutter

### Materials:

- Veroboards
- Resin/solder
- Electronic components:
  - Resistor
  - Capacitor
  - Inductors
  - Semi-conductor devices
  - Diodes
- Colour chart

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>15</b>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Work with electronic components applicable to the occupational context</b>		<b>Total hours</b>	<b>SDP</b>		<b>WP</b>
			184		264
<b>Work situation title: Troubleshoot electronic circuits</b>		<b>Total hours</b>	40	80	
<b>Work scenario:</b> Tim is given a pulse generator. He must read and interpret the function within the design parameters. He must determine the deviation in function and report accordingly. He then needs to repair the Pulse generator according to OEM standards.					
<b>Prerequisite learning:</b> Year 2 plus I4					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	
<p><b>PM-12-PS03: Find faults on electronic circuits</b></p> <p><i>Given a variety of faulty equipment, circuit diagrams, electrical and electronic test instruments and relevant documentation,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0301 Review the documentation, determine the scope of work and plan a logical fault-finding process</li> <li>PA0302 Collect all required tools, select testing equipment, personal protective equipment, prepare the workspace and complete a risk assessment</li> <li>PA0303 Identify the panel and applicable electronic diagrams</li> <li>PA0304 Collect information and evidence on faults</li> <li>PA0305 Select test instruments to determine faults</li> <li>PA0306 Use test instruments to determine</li> </ul>		<p>Knowledge of:</p> <ul style="list-style-type: none"> <li>Common faults on electronic circuits</li> <li>Trouble shooting techniques</li> <li>Statutory requirements as per work conducted</li> </ul> <p><u>Applied knowledge:</u></p> <p><b>PM-12-PS03: Find faults on electronic circuits</b></p> <ul style="list-style-type: none"> <li>AK0301 Safe work procedures</li> <li>AK0302 Standard operating procedures</li> <li>AK0303 Manufacturers' specifications</li> <li>AK0304 Systematic application of fault finding techniques</li> <li>AK0305 Sensory cues related to fault finding</li> <li>AK0306 Hazard identification and risk assessment practices</li> </ul> <p><b>PM-12-PS04: Replace defective electronic components</b></p> <ul style="list-style-type: none"> <li>AK0401 Safe work procedures</li> </ul>		<p>QCTO none</p> <p><i>If the workplace allows for this exposure</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Identify faults on electronic circuits</li> <li>Troubleshoot and repair electronic circuits</li> </ul>	

<p>fault area</p> <ul style="list-style-type: none"> <li>• PA0307 Identify and report faults</li> <li>• PA0308 Explain the reasons for decisions on fault identification</li> </ul> <p><b>PM-12-PS04: Replace defective electronic components</b></p> <p><i>Given a variety of faulty equipment with identified faults, replacement components, circuit diagrams and electrical and electronic test instruments, applicable tools and soldering equipment,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0401 Review the documentation, determine the scope of work and plan the replacement operation</li> <li>• PA0402 Collect all required tools, select testing and personal protective equipment, prepare the workspace and complete a risk assessment</li> <li>• PA0403 Select components for replacement</li> <li>• PA0404 Remove and replace faulty components</li> <li>• PA0405 Test the circuit</li> <li>• PA0406 Apply sufficient solder in the appropriate shape</li> <li>• PA0407 Clean the work area and dispose of used materials</li> </ul>	<ul style="list-style-type: none"> <li>• AK0402 Standard operating procedures</li> <li>• AK0403 Manufacturers' specifications</li> <li>• AK0404 Systematic application of fault finding techniques</li> <li>• AK0405 Sensory cues</li> <li>• AK0406 Applicable SANS standards</li> <li>• AK0407 Hazard identification and risk assessment practices</li> <li>• AK0408 Soldering techniques</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-12-PS03: Find faults on electronic circuits</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Hazards and risks are identified</li> </ul>	<ul style="list-style-type: none"> <li>• Describe all safe work procedures</li> <li>• Discuss all standard operating procedures</li> <li>• Discuss hazard identification and risk assessment practices</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>

<p>and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</p> <ul style="list-style-type: none"> <li>• IAC0302 The relevant panel is located and applicable electronic diagrams are identified</li> <li>• IAC0303 All relevant information and evidence on faults is collected</li> <li>• IAC0304 Applicable test instruments are selected according to the requirements of the various types of equipment</li> <li>• IAC0305 Test instruments are used correctly to determine fault areas</li> <li>• IAC0306 The logical process for fault finding is followed systematically</li> <li>• IAC0307 All faults are identified and reported according to requirements</li> <li>• IAC0308 Critical issues relating to fault finding processes and the correct operation of equipment are described and explained</li> </ul> <p><b>PM-12-PS04: Replace defective electronic components</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0402 The applicable matching components are selected</li> <li>• IAC0403 The correct procedures are followed to remove and replace faulty components</li> <li>• IAC0404 Applicable test instruments are used to test the circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss Manufacturers' specifications</li> <li>• Explain systematic application of fault finding techniques</li> <li>• Explain sensory cues related to fault finding</li> </ul>	
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<ul style="list-style-type: none"> <li>• IAC0405 The applicable solder is applied in the appropriate shape</li> <li>• IAC0406 The tracks are undamaged</li> <li>• IAC0407 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 60 min including all items mentioned above</li> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>• The faulty component/s must be identified</li> <li>• Circuit must function correctly</li> </ul> </li> <li>• Level of competency of 80% required for: <ul style="list-style-type: none"> <li>• All the above-mentioned items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> <li>• Samples (and charts)</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> <li>• Charts of risk assessment procedure and safety measures</li> <li>• CDs and videos will be an added advantage</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles</li> <li>• Soldering station</li> <li>• Solder sucker</li> <li>• Helping hands</li> <li>• Magnifying glass</li> <li>• Oscilloscope</li> <li>• Signal generator/power supply</li> <li>• Measuring instruments</li> </ul>		

- Standard electronic tools
- Long nose set
- Side cutter
- Cleaning brush
- Anti-static mat

Materials:

- Existing electronic circuits with simulated faults / faulty components
- Resin/solder
- Colour chart

Electronic component spares:

- Resistor
- Capacitor
- Inductors
- Semi-conductor

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>J1</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title</b> Install, connect and programme programmable logic controllers (PLCs) and VSDs		<b>Total hours</b>	<b>SDP</b> 160		
<b>Work situation title: Understand, interpret and design relay panels</b>		<b>Total hours</b>	40	80	
<b>Work scenario:</b> Jerry is instructed to design a Relay Panel. The circuit must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.					
<b>Prerequisite learning:</b> Year 2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	
<b>PM-07-PS01: Read and interpret electronic diagrams</b>  <i>Given a variety of electronic diagrams, lists of symbols and abbreviations and relevant information on reading diagrams,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0101 Identify and explain symbols</li> <li>PA0102 Identify and explain abbreviations</li> <li>PA0103 Determine and explain the electrical current flow as shown in a circuit diagram</li> <li>PA0104 Locate the relevant portions of the diagram with respect to the whole, using the given references</li> <li>PA0105 Locate the relevant position of</li> </ul>		<i>QCTO none</i>  Knowledge of: <ul style="list-style-type: none"> <li>Theory and function of relays</li> <li>Input and output devices</li> <li>Programming languages</li> <li>Designing circuits using programming languages</li> <li>Specific safety procedures</li> <li>Statutory requirements as per work conducted</li> <li>Wiring of circuits</li> <li>Common faults on Logic Relays</li> <li>Fault finding procedures for Logic relays</li> <li>Maintenance and troubleshooting</li> <li>Reading wiring diagrams and understanding electrical symbols</li> <li>Interpret Single Line Diagram (SLD)   EEP</li> </ul>		<i>QCTO none</i>  <b><i>If workplace allows for this exposure:</i></b>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision: <ul style="list-style-type: none"> <li>Identify common faults on Logic Relays</li> <li>Perform fault finding procedures on logic relays</li> <li>Perform maintenance and troubleshooting on logic relays</li> <li>Explain function of the relay</li> <li>Interpret Single Line Diagram (SLD)   EEP</li> <li>Explain Basic Control Panel Design</li> <li>Recall operation of Electromechanical Relay Logic   Digital Circuits Worksheets</li> </ul>	

<p>components using the given references</p> <ul style="list-style-type: none"> <li>• Wire electronic circuits (part of design)</li> </ul>	<ul style="list-style-type: none"> <li>• Basic Control Panel Design</li> <li>• Electromechanical Relay Logic   Digital Circuits Worksheets</li> <li>• Relay Interlocking Systems</li> </ul> <p><b>PM-07-PS01: Read and interpret electronic diagrams</b></p> <ul style="list-style-type: none"> <li>• AK0101 International Electro-technical Commission Standards</li> <li>• AK0102 Systematic approach for reading diagrams</li> </ul>	<ul style="list-style-type: none"> <li>• Explain operation of Relay Interlocking Systems</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-07-PS01: Read and interpret electronic diagrams</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Abbreviations are correctly identified and explained according to International Electro-technical Commission specifications</li> <li>• IAC0102 Electrical current flow is correctly determined and explained</li> <li>• IAC0103 Relevant portions of the diagram are correctly located with respect to the whole</li> <li>• IAC0104 Relevant positions of components are located correctly</li> <li>• Wire electronic circuits (part of design)</li> </ul>	<ul style="list-style-type: none"> <li>• Theory and function of Logic relays is understood</li> <li>• Common faults on Logic Relays are identified</li> <li>• Fault finding procedures are explained</li> <li>• Statutory requirements as per work conducted are correctly identified</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off PoE/Logbook</li> </ul>



**Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 30 marks (45 min) and the competency will be at 80%
- Practical exercise of all above items. Standard time: 60min

**Level of competency of 100% (critical) required for practical exercise:**

- Abbreviations are correctly identified
- Operation of circuit

**Level of competency of 80% (critical) required for practical exercise:**

- All above-mentioned items

**Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Tutorial videos if available

**Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Screw driver set
- Wire stripper
- Side cutter
- Multi-meter
- Array of relays
- Timers
- Buzzers
- Switches
- Indication lights
- Array of conductors

<ul style="list-style-type: none"> <li>• Spanner set</li> </ul>						
<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		J2		
		<b>Curriculum code:</b> 671202000				
<b>Learning area title</b> Install, connect and programme programmable logic controllers (PLCs) and VSDs		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
			160			320
<b>Work situation title:</b> Interpret instructions and design a PLC programme		<b>Total hours</b>	40	80		
<b>Work scenario:</b> Jerry is instructed to design a PLC Programme. The circuit must adhere to all safety regulations and function within the design parameters.						
<b>Prerequisite learning:</b> Year 2 plus J1						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>		
<p>QCTO none</p> <p><i>Given a work scenario which requires a PLC programme such as a traffic light, motor control, materials and equipment</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Read and interpret the scenario given</li> <li>• Perform a risk assessment on the task</li> <li>• Design circuit to given scenario using programme language</li> <li>• Plan wiring as per diagram</li> <li>• Test programmed PLC in simulation</li> <li>• Rectify programme if not functioning correctly</li> <li>• Test programmed PLC again</li> <li>• Document test results</li> </ul>		<p>QCTO none</p> <p><u>Knowledge of:</u></p> <ul style="list-style-type: none"> <li>• Theory and function of PLCs</li> <li>• Input and output devices</li> <li>• Programming languages in connection with PLCs</li> <li>• Designing circuits using programming languages</li> <li>• Specific safety procedures related to PLCs</li> <li>• Statutory requirements as per work conducted</li> <li>• Circuit layout</li> <li>• Common faults on Logic Relays</li> <li>• Fault finding procedures</li> <li>• Maintenance and troubleshooting</li> </ul>		<p>QCTO none</p> <p><b><i>If workplace allows for this exposure:</i></b></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>• Read and interpret programmes in PLCs (in a variety of contexts)</li> <li>• Have structured discussion on programming of PLCs for specific scenarios</li> </ul>		

<ul style="list-style-type: none"> <li>• Check drawing and programme for correctness</li> <li>• Clean work area after completion of task in accordance with work site procedures and housekeeping standards</li> </ul> <p>Explain the principle of operation and uses of the Programmable Logic Controller</p> <ul style="list-style-type: none"> <li>• Specific safety procedures</li> <li>• Isolation procedure</li> <li>• Using correct testing instruments.</li> <li>• Power supply wiring.</li> <li>• Input or output wiring.</li> <li>• What is Programmable Logic Control</li> <li>• Batch process</li> <li>• Ladder logic</li> <li>• PLC systems</li> <li>• Installing the PLC</li> <li>• Cabling.</li> <li>• Grounding.</li> <li>• Conduit.</li> <li>• BUZZ WORDS</li> <li>• Input Interface</li> <li>• Output Interface</li> <li>• Memory types</li> <li>• CPU (Central Processing Unit)</li> <li>• Hand programming panel</li> <li>• Buffer relays</li> <li>• Instructions</li> <li>• Timers</li> <li>• Decimal</li> <li>• Binary</li> <li>• Hexadecimal</li> </ul>	<ul style="list-style-type: none"> <li>• Function of the relays within the PLC</li> <li>• Relay operation within the PLC</li> <li>• Reading diagrams and understanding electrical symbols</li> <li>• Ladder Logic</li> <li>• Interlocking Systems</li> </ul>	
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<ul style="list-style-type: none"> <li>• A bit</li> <li>• A Byte</li> <li>• A Word</li> <li>• An Address</li> <li>• Counters</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>Sketch and describe the block diagram of a PLC</b></p> <ul style="list-style-type: none"> <li>• In-depth explanation - Timers</li> <li>• In-depth explanation - Counters</li> <li>• Explanation – Load Instruction (LD)</li> <li>• Explanation – AND Instruction</li> <li>• Explanation – OUT Instruction</li> <li>• Explanation – LDI Instruction</li> <li>• Explanation – ANI Instruction</li> <li>• Explanation – OR Instruction</li> <li>• Explanation – ORI Instruction</li> <li>• Explanation – IF Instruction</li> <li>• Sink and Source</li> <li>• Buffering</li> <li>• Troubleshooting</li> <li>• Input / Output Unit</li> <li>• SYMBOLS</li> </ul> <ul style="list-style-type: none"> <li>• Correct interpretation of scenario</li> <li>• Circuit design</li> <li>• Functionality of programme</li> <li>• Clean worksite after completion of task and equipment returned safely to store</li> </ul>	<p><b>Be able to explain the following:</b></p> <ul style="list-style-type: none"> <li>• Theory and function of Logic relays</li> <li>• Input and output devices</li> <li>• Programming languages in connection</li> <li>• Designing circuits using programming languages</li> <li>• Specific safety procedures</li> <li>• Statutory requirements as per work conducted</li> <li>• Wiring of circuits</li> <li>• Common faults on Logic Relays within PLC</li> <li>• Fault finding procedures</li> <li>• Maintenance and troubleshooting</li> <li>• Statutory requirements as per work conducted</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off PoE/logbook</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (45 min) and the competency will be at 80%</li> </ul>		

- Practical exercise of all the above-mentioned items. Standard time: 60 min
- **Level of competency of 100% (critical) required for practical exercise:**
- Programming must be correct.
- **Level of competency of 80% required for practical exercise:**
- All the above-mentioned items

#### **Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Tutorial Videos if available

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- PLC
- Input and Output Devices
- Computer or handheld programmer
- Wire stripper
- Screw driver
- Multi-meter

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>J3</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title</b> Install, connect and programme programmable logic controllers (PLCs) and VSDs	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		160	320	
<b>Work situation title: Install, connect and programme PLC components as per instruction</b>	<b>Total hours</b>	40	80	
<b>Work scenario:</b> Sam is instructed to design, install and programme a PLC. The circuit must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.				
<b>Prerequisite learning:</b> Year 2 plus J2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<b>PM-07-PS05: Install, connect and programme programmable logic controllers</b>  <i>Given a variety of circuit diagrams, programmable logic controllers, computers or programmers, manufacturers' specifications, IEC standards, applicable tools and instruments, applicable personal protective equipment and task instructions,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0501 Review the task instructions, determine the scope of work and plan the connection and programming processes</li> <li>PA0502 Collect all required tools, select installation, testing and personal protective equipment, prepare the workspace and</li> </ul>		<u>Knowledge of:</u>  <b>KM-09-KT05: Switchgear and control gear</b> <ul style="list-style-type: none"> <li>KT0501 Principles of operation of switchgear and control gear</li> <li>KT0502 Components of switchgear and control gear systems and the application thereof</li> <li>KT0503 Electrical drawings</li> <li><b>KT0504 Introduction to programmable logic controllers (PLC's)</b></li> <li>KT0505 Introduction to soft starters</li> <li>KT0506 Introduction to variable speed drives</li> </ul> <b>Programmable Logic Controller Operating Principles.</b> <ul style="list-style-type: none"> <li>Principle of operation and uses of the Programmable Logic Controller.</li> </ul>		<i>QCTO none</i>  <b>If workplace allows for this exposure:</b>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision: <ul style="list-style-type: none"> <li>Read and interpret programmes in PLCs (in a variety of contexts)</li> <li>Have structured discussion on programming of PLCs for specific scenarios</li> <li>Read and interpret diagrams of PLCs (in a variety of contexts)</li> <li>Mount and wire PLCs and input and output devices</li> <li>Troubleshoot PLCs and input/output devices (in a variety of contexts)</li> <li>Replace faulty components on input/output devices</li> </ul>

<p>complete a risk assessment</p> <ul style="list-style-type: none"> <li>• PA0503 Interpret the instructions and design the programme</li> <li>• PA0504 Install and wire PLC components and the circuit as required</li> <li>• PA0505 Programme the PLC to function as per the instructions</li> <li>• PA0506 Test the programme for correct operation and rectify any faults identified</li> <li>• PA0507 Clean the work area and dispose of used materials</li> </ul>	<ul style="list-style-type: none"> <li>• Installation site conditions</li> <li>• Panel / cabinet installation</li> <li>• Installing the PLC</li> <li>• Orientation</li> <li>• Installation</li> <li>• General precautions for wiring</li> <li>• Power supply wiring</li> <li>• Input wiring</li> <li>• Output wiring</li> <li>• Programming Language and buzz words</li> <li>• Theory and function of PLCs</li> <li>• Input and output devices</li> <li>• Designing circuits using programming languages</li> <li>• Specific safety procedures related to PLCs</li> <li>• Statutory requirements as per work conducted</li> <li>• Wiring diagrams and symbols</li> <li>• Wiring of circuits</li> <li>• Common faults on PLCs and input/output devices</li> <li>• Fault finding procedures</li> <li>• Specific safety procedures related to PLCs and Input/ Output device including maintenance and troubleshooting</li> </ul> <p><b>PM-07-PS05: Install, connect and programme programmable logic controllers</b></p> <ul style="list-style-type: none"> <li>• AK0501 Safe work procedures</li> </ul>	
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	<ul style="list-style-type: none"> <li>• AK0502 Standard operating procedures</li> <li>• AK0503 Manufacturers' specifications</li> <li>• AK0504 Applicable SANS standards</li> <li>• AK0505 Hazard identification and risk assessment practices</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-07-PS05: Install, connect and programme programmable logic controllers</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0502 The design of the PLC programme meets the specifications</li> <li>• IAC0503 Circuits are wired according to the design and manufacturers' specifications</li> <li>• IAC0504 Circuits are correctly tested to confirm that they are safe and operate according to design requirements</li> <li>• IAC0505 The PLC operates according to the design requirements</li> <li>• IAC0506 All work is done according to the work instruction</li> <li>• IAC0507 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> </ul>	<p><b>KM-09-KT05: Switchgear and control gear</b></p> <ul style="list-style-type: none"> <li>• IAC0504 Describe the basic principles of operation for programmable logic controllers</li> </ul> <p><b>Be able to explain and describe the following:</b></p> <ul style="list-style-type: none"> <li>• Theory and function of PLCs</li> <li>• Input and output devices</li> <li>• Programming languages in connection with PLCs</li> <li>• Designing circuits using programming languages</li> <li>• Specific safety procedures related to PLCs</li> <li>• Statutory requirements as per work conducted</li> <li>• Wiring of circuits</li> <li>• Specific safety procedures related to PLCs and Input/ Output devices including maintenance and troubleshooting</li> <li>• Common faults on PLCs and input/output devices</li> <li>• Fault finding procedures</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>



<ul style="list-style-type: none"> <li>IAC0508 Critical issues relating to installing, connecting and programming PLCs are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test of a minimum of 30 marks (45 min) and the competency will be at 80%</li> <li>Practical exercise of all the above. Standard time: 60min.</li> <li><b>Level of competency of 100% (critical) required for practical exercise:</b> <ul style="list-style-type: none"> <li>Programming correctly executed</li> <li>Lockout and isolation</li> </ul> </li> <li><b>Level of competency of 80% required for practical exercise:</b> <ul style="list-style-type: none"> <li>All the above-mentioned items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>Learning material covering Knowledge and Practical Skills Modules</li> <li>Samples (and charts)</li> <li>Safe Operating Procedure and Safe Working Procedure</li> <li>Charts of risk assessment procedure and safety measures</li> <li>Tutorial videos will be an added advantage</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles</li> <li>PLC</li> <li>Input and Output Devices</li> <li>Computer or handheld programmer</li> <li>Wire stripper</li> <li>Screw driver</li> <li>Multi-meter</li> </ul>		

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>J4</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title</b> Install, connect and programme programmable logic controllers (PLCs) and VSDs		<b>Total hours</b>	<b>SDP</b> 160		
<b>Work situation title: Install, connect and programme variable speed drives</b>		<b>Total hours</b>	40	80	
<b>Work scenario:</b> Marlene is instructed to design, install and programme a VSD. The circuit must adhere to all safety regulations and function within the design parameters. All components used must be according to OEM specifications.					
<b>Prerequisite learning:</b> Year 2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	
<b>PM-07-PS06: Install, connect and programme variable speed drives</b>  <i>Given a variety of circuit diagrams, programmable logic controllers, computers or programmers, manufacturers' specifications, IEC standards, applicable tools and instruments, applicable personal protective equipment and task instructions,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0601 Review the task instructions, determine the scope of work and plan the connection and programming processes</li> <li>PA0602 Collect all required tools, select installation, testing and personal protective equipment, prepare the workspace and complete a risk assessment</li> </ul>		<u>Knowledge of:</u>  <b>KM-09-KT05: Switchgear and control gear</b> <ul style="list-style-type: none"> <li>KT0501 Principles of operation of switchgear and control gear</li> <li>KT0502 Components of switchgear and control gear systems and the application thereof</li> <li>KT0503 Electrical drawings</li> <li>KT0504 Introduction to programmable logic controllers (PLC's)</li> <li>KT0505 Introduction to soft starters</li> <li><b>KT0506 Introduction to Variable Speed Drives</b></li> </ul> <b>Variable Speed Drives Operating Principles.</b>		<i>QCTO none</i>  <b>If workplace allows for this exposure:</b>  The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision: <ul style="list-style-type: none"> <li>Read and interpret programmes in VSDs (in a variety of contexts)</li> <li>Have structured discussion on programming of VSDs for specific scenarios</li> <li>Read and interpret diagrams of VSDs (in a variety of contexts)</li> <li>Mount and wire VSDs and input and output devices</li> <li>Troubleshoot VSDs and input/output devices (in a variety of contexts)</li> </ul>	

<ul style="list-style-type: none"> <li>• PA0603 Interpret the instructions, design the circuits and wire the inputs and outputs</li> <li>• PA0604 Install variable speed drives</li> <li>• PA0605 Programme variable speed drives to function as per the instructions</li> <li>• PA0606 Test the circuit and programme for correct operation and rectify any faults identified</li> <li>• PA0607 Clean the work area and dispose of used materials</li> </ul> <p><b>PM-15-PS04: Test and verify conformance of control systems</b></p> <p><i>Given a variety of control systems (including variable speed drives, soft starters, hoisting equipment and traction equipment), manufacturers' specifications and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0401 Review the work instructions, determine the scope of work and plan the testing and verification processes</li> <li>• PA0402 Collect all required tools and personal protective equipment, select the correct testing and measuring instruments, prepare the workspace and complete a risk assessment</li> <li>• PA0403 Verify the parameters (including volts, rpm, frequency, current, watts, ramp up, ramp down) in each system</li> </ul>	<ul style="list-style-type: none"> <li>• Principle of operation and uses of the Variable Speed Drives.</li> <li>• Installation site conditions</li> <li>• Panel / cabinet installation</li> <li>• Installing the VSD</li> <li>• Orientation</li> <li>• Installation</li> <li>• General precautions for wiring</li> <li>• Power supply wiring</li> <li>• Input wiring</li> <li>• Output wiring</li> <li>• Write a programme for the given VSD.</li> <li>• Language and buzz words</li> <li>• Theory and function of VSDs</li> <li>• Input and output devices</li> <li>• Programming languages in connection with VSDs</li> <li>• Designing circuits using programming languages</li> <li>• Specific safety procedures related to VSDs and Input/ Output device including maintenance and troubleshooting</li> <li>• Common faults on VSDs and input/output devices</li> <li>• Statutory requirements as per work conducted</li> <li>• Wiring diagrams and symbols</li> <li>• Wiring of circuits</li> <li>• Fault finding procedures</li> </ul> <p><u>Applied Knowledge:</u></p>	<ul style="list-style-type: none"> <li>• Replace faulty components on input/output devices</li> <li>• Inspect and maintain VSD's</li> </ul>
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<p>conform to motor and manufacturers' specifications</p> <ul style="list-style-type: none"> <li>• PA0404 Test run the control systems and determine conformance according to manufacturers' specifications</li> <li>• PA0405 Rectify defects identified during testing</li> <li>• PA0406 Record test results</li> </ul>	<p><b>PM-07-PS06: Install, connect and programme variable speed drives</b></p> <ul style="list-style-type: none"> <li>• AK0601 Safe work procedures</li> <li>• AK0602 Standard operating procedures</li> <li>• AK0603 Manufacturers' specifications</li> <li>• AK0604 Applicable SANS standards</li> <li>• AK0605 Hazard identification and risk assessment practices</li> </ul> <p><b>PM-15-PS04: Test and verify conformance of control systems</b></p> <ul style="list-style-type: none"> <li>• AK0401 Safe work procedures</li> <li>• AK0402 Standard operating procedures</li> <li>• AK0403 Manufacturers' specifications</li> <li>• AK0404 Testing techniques</li> <li>• AK0405 Hazard identification and risk assessment practices</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-07-PS06: Install, connect and programme variable speed drives</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0602 Variable speed drives are programmed according to requirements</li> <li>• IAC0603 Inputs and outputs are wired according to the design and manufacturers' specifications</li> </ul>	<p><b>KM-09-KT05: Switchgear and control gear</b></p> <ul style="list-style-type: none"> <li>• IAC0506 Describe the basic principles of operation for Variable Speed Drives</li> </ul> <p><b>Describe the following:</b></p> <ul style="list-style-type: none"> <li>• Theory and function of VSDs</li> <li>• Input and output devices</li> <li>• Programming languages in connection with VSDs</li> <li>• Designing circuits using programming languages</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Completed Job-cards</li> <li>• Signed off logbook/PoE</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0604 Circuits operate according to design requirements and manufacturers' specifications</li> <li>• IAC0605 Circuits meet applicable SANS standards</li> <li>• IAC0606 Circuits are correctly tested to confirm that they are safe and operate according to design requirements</li> <li>• IAC0607 All work is done according to the work instruction</li> <li>• IAC0608 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> <li>• IAC0609 Critical issues relating to installing, connecting and programming variable speed drives are described and explained</li> </ul> <p><b>PM-15-PS04: Test and verify conformance of control systems</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0402 The parameters (volts, rpm, frequency, current, watts, ramp up, ramp down) in each system are verified according to motor and manufacturers' specifications</li> </ul>	<ul style="list-style-type: none"> <li>• Specific safety procedures related to VSDs and Input/ Output device including maintenance and troubleshooting</li> <li>• Statutory requirements as per work conducted</li> <li>• Wiring of circuits</li> <li>• Common faults on VSDs and input/output devices</li> <li>• Fault finding procedures</li> </ul>	
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<ul style="list-style-type: none"> <li>• IAC0403 The test run is conducted according to manufacturers' specifications</li> <li>• IAC0404 Test results are recorded correctly</li> <li>• IAC0405 All identified faults are rectified and meet SANS standards</li> <li>• IAC0406 Critical issues relating to testing and verifying conformance of control systems are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%</li> <li>• Practical exercise of all items above. Standard time: 60 min</li> <li>• <b>Level of competency of 100% (critical) required for practical exercise:</b> <ul style="list-style-type: none"> <li>• Programming correctly executed</li> <li>• Isolation and lockout safely performed</li> </ul> </li> <li>• <b>Level of competency of 80% required for practical exercise:</b> <ul style="list-style-type: none"> <li>• All the above-mentioned items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> <li>• Samples (and charts)</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> <li>• Charts of risk assessment procedure and safety measures</li> <li>• Tutorial videos if available</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles</li> <li>• VSD</li> <li>• Input and Output Devices</li> <li>• Computer or handheld programmer</li> <li>• Wire stripper</li> <li>• Screw driver</li> <li>• Multi-meter</li> </ul>		

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<b>K1</b>				
		<b>Curriculum code:</b> 671202000						
<b>Learning area title:</b> Install and connect electrical equipment, switch- and control gear		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>160</td> <td>392</td> </tr> </table>		<b>SDP</b>	<b>WP</b>	160	392
<b>SDP</b>	<b>WP</b>							
160	392							
<b>Work situation title:</b> Install wireways		<b>Total hours</b>	<table border="1"> <tr> <td>24</td> <td>80</td> </tr> </table>	24	80			
24	80							
<b>Work scenario:</b> Johnny is requested to mount a wireway to an existing wall. He must identify and select all the tools and equipment for the task. The wireway must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.								
<b>Prerequisite learning:</b> Year 1								
<b>INTEGRATED LEARNING CONTENT</b>								
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>				
<p><b>PM-06-PS09: Install wireways</b></p> <p><i>Given a variety of typical trunking, conduit and wire types (e.g. surfex, flat twin and earth, GP wire) of different types and sizes, applicable tools, relevant SANS standards, work instructions and personal protective equipment,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0901 Review the work instructions, determine the scope of work and plan the installation processes</li> <li>PA0902 Identify the various types and sizes of trunking and their applications</li> <li>PA0903 Identify and interpret the applicable SANS standards</li> </ul>		<p><b>KM-07-KT01: Wireways</b></p> <ul style="list-style-type: none"> <li>KT0101 Definition, types, purpose and applications of wireways</li> <li>KT0102 General provisions for wireways as prescribed in the SANS 10142-1</li> </ul> <p><b>KM-07-KT02: Wiring of installations</b></p> <ul style="list-style-type: none"> <li>KT0201 Regulations and statutory requirements for wiring of premises</li> <li>KT0202 Electrical diagrams and symbols</li> <li>KT0203 Electrical components and their applications</li> </ul> <p><b>KM-07-KT03: Earthing and bonding</b></p> <ul style="list-style-type: none"> <li>KT0301 Principles of earthing and bonding</li> <li>KT0302 Methods of earthing and bonding</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work</li> </ul>				

<ul style="list-style-type: none"> <li>• PA0904 Collect all required tools, select correct components, conductors and personal protective equipment, prepare the workspace and complete a risk assessment</li> <li>• PA0905 Select and prepare trunking, conduit and wire for installation</li> <li>• PA0906 Install trunking, conduit and wire</li> <li>• PA0907 Clean the work area and dispose of used materials</li> </ul>	<p>on low voltage overhead lines, equipment and cables</p> <ul style="list-style-type: none"> <li>• KT0303 Regulatory and statutory requirements related to earthing and bonding</li> <li>• Different types of wireways and their uses e.g. PVC and Bosal conduits, cable trays, Unistrat, PVC/metal trunking</li> <li>• Wire way installation methods and techniques</li> <li>• Tools for wireway installations</li> <li>• Earthing and Bonding methods</li> <li>• Safety precautions regarding wireway installations</li> <li>• PPE for the installation of wireways</li> <li>• Manufacturer specifications for different wireways</li> <li>• OHS Act</li> <li>• SANS codes and standards - 10142-1</li> <li>• Work procedures and work documents related to design and installing of wireways</li> <li>• Different types of enclosures associated accessories and their uses</li> <li>• Enclosure installation methods and techniques</li> <li>• Safety precautions regarding enclosure installation</li> <li>• Specialised PPE in the use of enclosures</li> <li>• How to complete a risk assessment on enclosures</li> <li>• Work procedures and work documents related to design and installing</li> </ul>	<p>sites</p> <ul style="list-style-type: none"> <li>• WA0203 Conduct pre-maintenance inspections and identify and report any problems</li> <li>• WA0204 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least five different pieces of industrial machinery</li> <li>• WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0206 Restore the work area and dispose of waste materials</li> <li>• WA0207 Interact with production personnel, where applicable</li> <li>• WA0208 Complete maintenance reports</li> <li>• WA0209 Communicate with relevant parties</li> <li>• Perform risk assessments for installing wireways and enclosures</li> <li>• Select the correct wireways and enclosures for the work task at hand</li> <li>• Install wire ways and enclosures</li> <li>• Record and report any defects on wireways and enclosures</li> <li>• Conduct final inspections of installation</li> <li>• Conduct housekeeping activities related to installation of wireways and</li> </ul>
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	<p>enclosures</p> <ul style="list-style-type: none"> <li>• Tools for wire way installations</li> <li>• Manufacturer specifications for different wire ways</li> <li>• Earthing and Bonding methods</li> </ul> <p><b>Types of wireways may include:</b></p> <ul style="list-style-type: none"> <li>• PVC conduit</li> <li>• Steel conduit</li> <li>• Flexible conduit</li> <li>• Trunking</li> <li>• Busbar trunking</li> <li>• Unistrut</li> <li>• Power skirting</li> <li>• Cable trays</li> <li>• Cable ladders</li> </ul> <p><b>Types of PVC and Steel Conduit bends incl.:</b></p> <ul style="list-style-type: none"> <li>• 90deg Bend</li> <li>• 45deg Bend</li> <li>• Off Sets</li> <li>• Double Offset</li> <li>• Over obstruction</li> </ul> <p><b>Types of accessories for PVC and Steel conduit incl.:</b></p> <ul style="list-style-type: none"> <li>• Couplings, Adaptors, Round Boxes, inspection Boxes etc.</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-06-PS09: Install wireways</b></p>	<p>enclosures</p> <ul style="list-style-type: none"> <li>• Participate in work processes to design and install wireways for industrial buildings</li> <li>• Perform risk assessments before planning to install wireways</li> <li>• Inspect tools and equipment and check installation documents</li> <li>• Select the correct wire ways work tasks at hand</li> <li>• Assemble and install selected wireways</li> <li>• Chase walls for steel and PVC wireways to be concealed in walls</li> <li>• Move electrical equipment/materials on industrial work sites</li> <li>• Conduct final inspection of wireway installations in industrial buildings and premises</li> <li>• Record and report any work problems and rectified defects</li> <li>• Store tools and equipment</li> <li>• Record and report any defects on tools and equipment</li> <li>• Conduct regular housekeeping activities</li> </ul>
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	<ul style="list-style-type: none"> <li>• AK0901 Safe work procedures</li> <li>• AK0902 Standard operating procedures</li> <li>• AK0903 Manufacturers' specifications</li> <li>• AK0904 Installation techniques</li> <li>• AK0905 Applicable SANS standards</li> <li>• AK0906 Hazard and risk assessment and mitigation procedures</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-06-PS09: Install wireways</b></p> <ul style="list-style-type: none"> <li>• IAC0901 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0902 Types and sizes of trunking, conduit and wire and their applications are identified correctly according to SANS standards</li> <li>• IAC0903 The applicable trunking, conduit and wire is selected and correctly prepared according to requirements</li> <li>• IAC0904 Installation of trunking, conduit and wire conforms to SANS standards</li> <li>• IAC0905 All work is performed according to the work instructions</li> <li>• IAC0906 Work area is cleaned according to standards and materials disposed of in an environmentally acceptable manner</li> <li>• IAC0907 Critical issues relating to the installation of wireways are described and explained</li> </ul>	<p><b>KM-07-KT01: Wireways</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Define the term wireway as given in the SANS 10142-1 Code of Practice</li> <li>• IAC0102 Describe different types of wireways and their applications</li> <li>• IAC0103 Describe and explain the provisions in the SANS 10142-1 Code of Practice for the correct and safe installation and use of the various types of wireways</li> <li>• IAC0104 Describe factors that influences the selection of wireways</li> </ul> <p><b>KM-07-KT02: Wiring of installations</b></p> <ul style="list-style-type: none"> <li>• IAC0201 List, identify and explain the meaning of all standard International Electrotechnical Commission (IEC) wiring symbols given on work drawings</li> <li>• IAC0202 Identify electrical components and draw schematic diagrams of installations</li> </ul>	<p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• SE0203 Applicable job cards</li> </ul>

	<ul style="list-style-type: none"> <li>• IAC0203 State and explain the safety purpose of earthing, fuse, circuit breakers and earth leakage protection unit</li> <li>• IAC0204 Describe the principles of operation of various control systems</li> <li>• IAC0205 Describe the principles of operation of single and three phase circuit breakers and core balance earth leakage relays (wound primaries and straight primaries with tripping relay)</li> <li>• IAC0206 Describe the purpose of load distribution, lightning arrestors and energy control units</li> </ul> <p><b>KM-07-KT03: Earthing and bonding (30%)</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Define earthing and bonding and explain the purpose thereof</li> <li>• IAC0302 Explain the regulatory requirements for earthing and bonding</li> <li>• IAC0303 Explain the regulatory requirements for the earthing of neutral conductors on both the supplier and consumer side of an installation</li> <li>• IAC0304 Explain the term 'systems earthing'</li> <li>• IAC0305 Describe the earthing systems relevant to SANS 10142-1.</li> <li>• IAC0306 Describe how a common earth electrode is used in reticulation circuits</li> <li>• IAC0307 Describe the provision of earthing for underground cables and overhead lines</li> <li>• IAC0308 Explain the various processes of measuring, testing and calculating</li> </ul>	
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	earthing and bonding system values.	
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**Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 20 marks (30min) and the competency will be at 80%
- Practical exercise of 60 min including all items mentioned above
  
- Level of competency of 100% (critical) required for practical exercise:
  - Earthing and bonding
- Level of competency of 80% required for practical exercise:
  - All above-mentioned items

**Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Tutorial videos if available

**Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Conduit benders
- Pipe cutter
- Hacksaw
- Holesaw
- Chassis punch
- Hammers
- Set of chisels
- Chalk line
- Screw drivers

- Spanners
- Electrical drilling machine/hammer with set of drill bits and chisels
- Electrical grinder
- Electrical wall chaser

**PPE incl:**

- Hand gloves
- Protective goggles and face shields
- Hearing protection
- Safety clothing
- Safety boots
- Dust mask

**Measuring and testing instruments incl.:**

- Measuring tape
- Steel ruler
- Steel square
- Combination square
- Spirit level

**Training workshop incl.:**

- Installation wall/cubicles/panels (i.e. potentially covering wall, ceiling and under floor installations)
- Set of reusable concealed and surface mounted standard enclosures incl. distribution boards, switch boards, panels, junction boxes and related accessories
- Set of consumables consisting of various types of enclosures and fittings e.g. PVC and metal conduits, cable trays, PVC/metal trunking and ducts, Pipe tube and conduit clamps, power skirting, box connectors, couplings etc.

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>K2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Install and connect electrical equipment, switch- and control gear</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		160	392	
<b>Work situation title: Identify and install conductors and cables</b>	<b>Total hours</b>	16	80	
<b>Work scenario:</b> Jordan is requested to prepare the wiring for a motor from the switchgear. He must identify and select the conductors and cables according to the task parameters. The cables and conductors must adhere to all safety regulations and design function. All components used must be according to OEM specifications.				
<b>Prerequisite learning:</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-06-PS05: Identify and differentiate conductors and cables</b></p> <p><i>Given a variety of typical low voltage conductors and cables, applicable tools, applicable personal protective equipment, work instructions, manufacturers' specifications and applicable SANS standards,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0501 Identify and respond to hazards and risks</li> <li>PA0502 Calculate ratings of cables by current, voltage and temperature and identify the size of cables required for different applications</li> </ul>		<p><b>KM-07-KT02: Wiring of installations</b></p> <ul style="list-style-type: none"> <li>KT0201 Regulations and statutory requirements for wiring of premises</li> <li>KT0202 Electrical diagrams and symbols</li> <li>KT0203 Electrical components and their applications</li> </ul> <p><b>KM-07-KT03: Earthing and bonding</b></p> <ul style="list-style-type: none"> <li>KT0301 Principles of earthing and bonding</li> <li>KT0302 Methods of earthing and bonding on low voltage overhead lines, equipment and cables</li> <li>KT0303 Regulatory and statutory requirements related to earthing and bonding</li> </ul> <p><b>KM-09-KT04: Types of cables and applications</b></p>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>WA0203 Conduct pre-maintenance</li> </ul>

<ul style="list-style-type: none"> <li>• PA0503 Identify a variety of types of conductors and cables</li> <li>• PA0504 Describe and explain the different applications of the various types of conductors and cables</li> </ul> <p><b>PM-06-PS06: Joint and terminate conductors and cables</b></p> <p><i>Given a variety of low voltage conductors and cables, jointing kits, termination kits, accessories, applicable tools, applicable personal protective equipment, work instructions, manufacturers' specifications and applicable SANS standards</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0601 Review the task instructions, determine the scope of work and plan the jointing, termination and installation processes</li> <li>• PA0602 Identify and interpret the applicable SANS standards</li> <li>• PA0603 Collect all required tools, select jointing, termination, testing and personal protective equipment, prepare the workspace and complete a risk assessment</li> <li>• PA0604 Select, prepare and joint cables</li> <li>• PA0605 Select, prepare and terminate cables</li> <li>• PA0606 Select, install and connect</li> </ul>	<ul style="list-style-type: none"> <li>• KT0401 Types of cable construction including armoured and un-armoured, insulated and un-insulated, single- and multi-core cables</li> <li>• KT0402 Cable materials and their functions and characteristics</li> <li>• KT0403 Identification of cable characteristics and properties</li> <li>• KT0404 Applications of various types of cable</li> <li>• KT0405 Installation methods and safe use of cables</li> <li>• KT0406 Safe transport and storage of cables</li> </ul> <p><b>Terminal lug types:</b></p> <ul style="list-style-type: none"> <li>• Crimp and compression</li> <li>• Soldering</li> <li>• Solder-less</li> </ul> <p><u>Applied Knowledge:</u></p> <p><b>PM-06-PS05: Identify and differentiate conductors and cables</b></p> <ul style="list-style-type: none"> <li>• AK0501 Safe work procedures</li> <li>• AK0502 Standard operating procedures</li> <li>• AK0503 Manufacturers' specifications</li> <li>• AK0504 Applicable SANS standards</li> <li>• AK0505 Hazard identification and risk assessment practices</li> <li>• AK0506 Methods of calculating cable ratings and size requirements</li> <li>• AK0507 Characteristics of various types of conductors and cables</li> </ul>	<p>inspections and identify and report any problems</p> <ul style="list-style-type: none"> <li>• WA0204 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least five different pieces of industrial machinery</li> <li>• WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0206 Restore the work area and dispose of waste materials</li> <li>• WA0207 Interact with production personnel, where applicable</li> <li>• WA0208 Complete maintenance reports</li> <li>• WA0209 Communicate with relevant parties</li> </ul> <ul style="list-style-type: none"> <li>• Inspect tools and equipment and check installation documents</li> <li>• Select the correct cables and conductor to be installed</li> <li>• Draw in cables and conductors</li> <li>• Secure conductors and cables</li> <li>• Perform continuity and installation resistance tests on existing installations</li> <li>• Report results of testing to supervisor and discuss</li> <li>• Move cables and conductors on the work site</li> </ul>
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<p>cables</p> <ul style="list-style-type: none"> <li>• PA0607 Test insulation and continuity of conductors and cables and rectify any faults identified</li> <li>• PA0608 Clean the work area and dispose of used materials</li> </ul>	<p><b>PM-06-PS06: Joint and terminate conductors and cables</b></p> <ul style="list-style-type: none"> <li>• AK0601 Safe work procedures</li> <li>• AK0602 Standard operating procedures</li> <li>• AK0603 Manufacturers' specifications</li> <li>• AK0604 Applicable SANS standards</li> <li>• AK0605 Hazard identification and risk assessment practices</li> <li>• AK0606 Methods of calculating cable ratings and size requirements</li> <li>• AK0607 Characteristics of various types of conductors and cables</li> <li>• AK0608 Methods of preparing, jointing, terminating, installing and connecting conductors and cables</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in regular housekeeping activities, tool and equipment maintenance</li> </ul>
<p><b>ASSESSMENT CRITERIA</b></p>		
<p><b>PM-06-PS05: Identify and differentiate conductors and cables</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0502 Ratings are correctly calculated and cables are identified according to SANS standards</li> <li>• IAC0503 Conductors and cables are correctly categorised into different types and the various types are</li> </ul>	<p><b>KM-07-KT02: Wiring of installations (35%)</b></p> <ul style="list-style-type: none"> <li>• IAC0201 List, identify and explain the meaning of all standard International Electrotechnical Commission (IEC) wiring symbols given on work drawings</li> <li>• IAC0202 Identify electrical components and draw schematic diagrams of installations</li> <li>• IAC0203 State and explain the safety purpose of earthing, fuse, circuit breakers and earth leakage protection unit</li> <li>• IAC0204 Describe the principles of operation of various control systems</li> </ul>	<p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed</li> </ul>



<p>identified</p> <ul style="list-style-type: none"> <li>IAC0504 The correct applications of the various types of conductors and cables are described and explained</li> </ul> <p><b>PM-06-PS06: Joint and terminate conductors and cables</b></p> <ul style="list-style-type: none"> <li>IAC0601 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>IAC0602 Conductors and cables are correctly selected according to the applicable requirements</li> <li>IAC0603 Conductors and cables are correctly prepared, jointed, terminated and connected</li> <li>IAC0604 Jointed, terminated and connected conductors and cables meet manufacturers' specifications</li> <li>IAC0605 Tests are conducted correctly to confirm that insulation and continuity of conductors and cables meet design requirements</li> <li>IAC0606 All work is performed in accordance with applicable SANS standards and the work instruction</li> <li>IAC0607 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable</li> </ul>	<ul style="list-style-type: none"> <li>IAC0205 Describe the principles of operation of single and three phase circuit breakers and core balance earth leakage relays (wound primaries and straight primaries with tripping relay)</li> <li>IAC0206 Describe the purpose of load distribution, lightning arrestors and energy control units</li> </ul> <p><b>KM-07-KT03: Earthing and bonding (30%)</b></p> <ul style="list-style-type: none"> <li>IAC0301 Define earthing and bonding and explain the purpose thereof</li> <li>IAC0302 Explain the regulatory requirements for earthing and bonding</li> <li>IAC0303 Explain the regulatory requirements for the earthing of neutral conductors on both the supplier and consumer side of an installation</li> <li>IAC0304 Explain the term 'systems earthing'</li> <li>IAC0305 Describe the earthing systems relevant to SANS 10142-1.</li> <li>IAC0306 Describe how a common earth electrode is used in reticulation circuits</li> <li>IAC0307 Describe the provision of earthing for underground cables and overhead lines</li> <li>IAC0308 Explain the various processes of measuring, testing and calculating earthing and bonding system values.</li> </ul> <p><b>KM-09-KT04: Types of cables and applications (20%)</b></p> <ul style="list-style-type: none"> <li>IAC0401 Describe, with the aid of</li> </ul>	<ul style="list-style-type: none"> <li>off by the supervising artisan</li> <li>SE0203 Applicable job cards</li> </ul>
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<p>manner</p> <ul style="list-style-type: none"> <li>IAC0608 Critical issues relating to jointing and terminating cables and conductors are described and explained</li> </ul>	<p>sketches, the different types of cable and their construction, and explain the function of the various materials used</p> <ul style="list-style-type: none"> <li>IAC0402 Describe the characteristics and applications of the various types of cable and compare their advantages and disadvantages</li> <li>IAC0403 Describe the factors effecting the efficiency of cables</li> <li>IAC0404 Describe and explain the provisions in the SANS 10142-1 Code of Practice for the correct and safe installation and use of the various types of cables</li> <li>IAC0405 Describe the precautions required when transporting and storing cables</li> </ul> <p><b>The apprentice must display knowledge of cables and conductors:</b></p> <ul style="list-style-type: none"> <li>Safe work procedures</li> <li>Standard operating procedures</li> <li>Manufacturers' specifications</li> <li>Applicable SANS standards</li> <li>Hazard identification and risk assessment practices</li> <li>Methods of calculating cable ratings and size requirements</li> <li>Characteristics of various types of conductors and cables</li> <li>Methods of preparing, jointing, terminating, installing and connecting conductors and cables</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p>		

- Internal knowledge test of a minimum of 20 marks (30min) and the competency will be at 80%
- Practical exercise of 60min including all items mentioned above
- Level of competency of 100% (critical) required for:
  - Isolate and lockout
- Level of competency of 80% required for:
  - All the above-mentioned items

### **Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Tutorial videos

### **Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Wire and cable strippers
- Cable/wire cutters
- Crimp tools
- Soldering iron
- Cable/wire pulling tools, fish tape
- Cable/wire dispenser
- Utility/cable knife
- Hacksaw
- Screw drivers
- Pliers
- Hammer
- Spanner set

### **Measuring and testing instruments incl.:**

- Tape measure

- Insulation resistance tester
- Continuity tester

**Training workshop and laboratory equipment incl.:**

- Ladders and Scaffolds
- Installation cabins/ cubicles with solid brick walls or interchangeable plaster-/chip board walls or punched hole grid panels (potentially covering wall, ceiling and under floor installations)
- Set of reusable concealed and surface mounted standard enclosures incl. distribution boards, switch boards, panels, junction boxes and related accessories
- Set of consumables consisting of various standard types of wire enclosures and fittings e.g. PVC and metal conduits, (RMC/GRC/IMC/EMT) cable trays, metal and fibreglass framing channels, PVC/metal trunking and ducts, ceiling support grids, arc floor trunking, Pipe tube and conduit clamps, box connectors, couplings etc.
- Set of consumables consisting of various standard types and sizes of connectors, lugs and glands  
Set of consumables consisting of various reels/drums of standard types and sizes of cables and conductors

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>K3</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Install and connect electrical equipment, switch- and control gear</b>		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>160</td> <td>392</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
160	392						
<b>Work situation title Install and connect main and control circuits, and switchgear</b>		<b>Total hours</b>	<table border="1"> <tr> <td>40</td> <td>80</td> </tr> </table>	40	80		
40	80						
<b>Work scenario:</b> Johnny is tasked to install and connect a control circuit. He must identify and use the correct components and switchgear for the task. The installation must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.							
<b>Prerequisite learning:</b> K2							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>			
<p><b>PM-06-PS01: Install and connect main and control circuits, and switchgear</b></p> <p><i>Given a variety of main and control circuits, including, panels, starters, motors, motor control gear, electrical distribution systems, protective systems, lighting systems, conductors and accessories, applicable tools and instruments, personal protective equipment, task instructions and relevant manufacturers' specifications, SANS and IEC standards,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0101 Review the task instructions, determine the scope of work and plan the installation processes</li> <li>PA0102 Collect all required tools, select installation, testing and personal</li> </ul>		<p>Knowledge of:</p> <p><b>KM-09-KT05: Switchgear and control gear</b></p> <ul style="list-style-type: none"> <li>KT0501 Principles of operation of switchgear and control gear</li> <li>KT0502 Components of switchgear and control gear systems and the application thereof</li> <li>KT0503 Electrical drawings</li> </ul> <p><u>Applied Knowledge:</u></p> <p><b>PM-06-PS01: Install and connect main and control circuits, and switchgear</b></p> <ul style="list-style-type: none"> <li>AK0101 Safe work procedures</li> <li>AK0102 Standard operating procedures</li> <li>AK0103 Manufacturers' specifications</li> <li>AK0104 Applicable SANS standards</li> <li>AK0105 Hazard identification and risk</li> </ul>		<p>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</p> <p><b>WM-03-WE05: Fault-find and repair electrical and mechanical sub-assemblies and machines under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b></p> <p>The person will be expected to engage in the following work activities:</p> <ul style="list-style-type: none"> <li>WA0501 Gather the necessary technical information and plan the fault-finding process</li> <li>WA0502 Conduct risk assessments, perform the lock-out and tag out procedures where</li> </ul>			

<p>protective equipment, prepare the workspace and complete a risk assessment</p> <ul style="list-style-type: none"> <li>• PA0103 Identify SANS standards applicable to each task</li> <li>• PA0104 Analyse the requirements and design and wire the circuits</li> <li>• PA0105 Identify the types of switch- and control gear</li> <li>• PA0106 Install and wire the switch- and control gear</li> <li>• PA0107 Connect switch- and control gear to specification</li> <li>• PA0108 Test the circuits with applicable instruments for correct operation and rectify any faults identified</li> <li>• PA0109 Clean the work area and dispose of used materials</li> </ul> <p><b>PM-15-PS04: Test and verify conformance of control systems</b></p> <p><i>Given a variety of control systems (including variable speed drives, soft starters, hoisting equipment and traction equipment), manufacturers' specifications and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0401 Review the work instructions, determine the scope of work and plan the testing and verification processes</li> <li>• PA0402 Collect all required tools and personal protective equipment, select the</li> </ul>	<p>assessment practices</p> <p><b>PM-15-PS04: Test and verify conformance of control systems</b></p> <ul style="list-style-type: none"> <li>• AK0401 Safe work procedures</li> <li>• AK0402 Standard operating procedures</li> <li>• AK0403 Manufacturers' specifications</li> <li>• AK0404 Testing techniques</li> <li>• AK0405 Hazard identification and risk assessment practices</li> </ul>	<p>applicable and prepare the work sites</p> <ul style="list-style-type: none"> <li>• WA0503 Fault find a variety of electrical and mechanical sub-assemblies and machines to manufacturers' and workplace specifications</li> <li>• WA0504 Compile parts list and draw parts, where applicable</li> <li>• WA0505 Repair a variety of electrical and mechanical sub-assemblies and machines to manufacturers' and workplace specifications</li> <li>• WA0506 Conduct functionality tests and commission the machines</li> <li>• WA0507 Restore the work area and dispose of waste materials</li> <li>• WA0508 Interact with production personnel, where applicable</li> <li>• WA0509 Complete all relevant documentation</li> <li>• WA0510 Communicate with relevant parties</li> <li>• <b>Install and wire switch- and control gear</b></li> <li>• <b>Connect switch- and control gear to specification</b></li> <li>• <b>Test the circuits with applicable instruments for correct operation and rectify any faults identified</b></li> <li>• <b>Label and tag circuits and place notices on the enclosure as required</b></li> <li>• <b>Engage in regular housekeeping activities, tool and equipment</b></li> </ul>
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<p>correct testing and measuring instruments, prepare the workspace and complete a risk assessment</p> <ul style="list-style-type: none"> <li>• PA0403 Verify the parameters (including volts, rpm, frequency, current, watts, ramp up, ramp down) in each system conform to motor and manufacturers' specifications</li> <li>• PA0404 Test run the control systems and determine conformance according to manufacturers' specifications</li> <li>• PA0405 Rectify defects identified during testing</li> <li>• PA0406 Record test results</li> </ul>		<p><b>maintenance</b></p> <ul style="list-style-type: none"> <li>• Store tools and equipment, record and report any defects on tools</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-06-PS01: Install and connect main and control circuits, and switchgear</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0102 Circuits operate according to design requirements</li> <li>• IAC0103 Circuit design and wiring meets the specifications</li> <li>• IAC0104 Circuits meet applicable SANS standards</li> <li>• IAC0105 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0106 All work is performed in</li> </ul>	<p><b>KM-09-KT05: Switchgear and control gear</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Describe disconnectors, relays, timers and contactors in terms of construction and operating principles with reference to the contacts, operating coils (where applicable) and operating mechanisms</li> <li>• IAC0502 Describe, with the aid of labelled drawings, the principle of operation of the over current and earth leakage protection relays</li> <li>• IAC0503 Describe the following terminology in terms of low voltage circuit breakers: moulded cases, positive indication, trip position, factory sealed, thermal magnetic tripping, quick make, quick break, trip free mechanism,</li> </ul>	<p><b>WM-03-WE05: Fault-find and repair electrical and mechanical sub-assemblies and machines under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b></p> <ul style="list-style-type: none"> <li>• SE0501 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0502 Completed workplace logbook, including list of equipment repaired, signed off by the supervising artisan</li> <li>• SE0503 Applicable job cards</li> </ul>

<p>accordance with applicable SANS standards</p> <ul style="list-style-type: none"> <li>• IAC0107 All work is done according to the work instruction</li> <li>• IAC0108 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> <li>• IAC0109 Critical issues relating to installing and connecting switch- and control gear are described and explained</li> </ul> <p><b>PM-15-PS04: Test and verify conformance of control systems</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0402 The parameters (volts, rpm, frequency, current, watts, ramp up, ramp down) in each system are verified according to motor and manufacturers' specifications</li> <li>• IAC0403 The test run is conducted according to manufacturers' specifications</li> <li>• IAC0404 Test results are recorded correctly</li> <li>• IAC0405 All identified faults are rectified and meet SANS standards</li> <li>• IAC0406 Critical issues relating to testing and verifying conformance of control systems are described and explained</li> </ul>	<p>interpole barriers.</p> <ul style="list-style-type: none"> <li>• Describe the De-iron arcing extinguisher</li> </ul> <p><b>The apprentice must display knowledge of main, control circuits, and switchgear:</b></p> <ul style="list-style-type: none"> <li>• Safe work procedures</li> <li>• Standard operating procedures</li> <li>• Manufacturers' specifications</li> <li>• Applicable SANS standards</li> <li>• Hazard identification and risk assessment practices</li> <li>• Critical issues relating to installing and connecting switch- and control gear</li> <li>• Methods of preparing area before installing and connecting switch- and control gear</li> </ul>	
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<ul style="list-style-type: none"> <li>• Distribution board selected is in accordance with manufacturer's specifications and complies with SANS-10142-1</li> <li>• Protection and control devices selected, installed and connected according to manufacturer's specifications and complies with SANS-10142-1</li> <li>• Circuits correctly connected, mechanically tight and neatly loomed to protection and control devices</li> <li>• Relevant tools and equipment were used according to job specifications and statutory requirements</li> <li>• All devices correctly labelled</li> <li>• Housekeeping must adhere to industry standards</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (45 min) and the competency will be at 80%</li> <li>• Practical exercise of 60 min including all items mentioned above</li> </ul> <ul style="list-style-type: none"> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>• Isolate and lockout</li> <li>• Circuits meet applicable SANS standards (Colour coding and earthing)</li> </ul> </li> <li>• Level of competency of 80% required for: <ul style="list-style-type: none"> <li>• All items above</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> <li>• Samples (and charts)</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> </ul>		

- Charts of risk assessment procedure and safety measures
- Tutorial videos

**Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Wire and cable strippers
- Cable/wire cutters
- Crimp tools
- Cable/wire dispenser
- Utility/cable knife
- Screw drivers
- Round nose Pliers
- Pliers
- Side cutter
- Tube Spanner set
- Continuity tester

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1 style="color: red;">K4</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Install and connect electrical equipment, switch- and control gear</b>		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>160</td> <td>392</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
160	392						
<b>Work situation title: Install, connect and test batteries</b>		<b>Total hours</b>	<table border="1"> <tr> <td>24</td> <td>72</td> </tr> </table>	24	72		
24	72						
<b>Work scenario:</b> Themba is tasked to install a battery bank. He must identify the equipment and use the correct methods of transporting, wiring and testing. The batteries must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.							
<b>Prerequisite learning:</b> Year 1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>			
<p><b>PM-06-PS02: Install, connect and test batteries</b></p> <p><i>Given a range of typical batteries, including, lead acid, nickel cadmium, primary and secondary batteries, conductors, applicable tools, applicable personal protective equipment, manufacturers' specifications, SANS standards and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0201 Review the maintenance information, determine the scope of work and plan the operation</li> <li>PA0202 Identify the type of batteries and record the data</li> <li>PA0203 Collect all required tools, select correct components, conductors and personal protective equipment, prepare the work space and complete a risk assessment</li> </ul>		<p>Knowledge of:</p> <p><b>KM-09-KT02: Batteries</b></p> <ul style="list-style-type: none"> <li>KT0201 Fundamentals of battery operation</li> <li>KT0202 Types and classification of batteries</li> <li>KT0203 Safety precautions of batteries</li> <li>KT0204 Care and maintenance of batteries</li> <li>KT0205 Battery components and construction</li> <li>KT0206 Disposal of batteries</li> </ul> <p><u>Applied Knowledge:</u></p> <p><b>PM-06-PS02: Install, connect and test batteries</b></p> <ul style="list-style-type: none"> <li>AK0201 Safe work procedures</li> <li>AK0202 Standard operating procedures</li> <li>AK0203 Manufacturers' specifications</li> <li>AK0204 Applicable SANS standards</li> <li>AK0205 Hazard identification and risk assessment practices</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</p> <p><b>WM-03-WE02: Fault-find and repair electrical and mechanical installations and control systems under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b></p> <p>The person will be expected to engage in the following work activities:</p> <ul style="list-style-type: none"> <li>WA0201 Gather the necessary technical information and plan the fault-finding process</li> <li>WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>WA0203 Fault find a variety of electrical and mechanical installations and control systems to manufacturers' and workplace</li> </ul>			

<ul style="list-style-type: none"> <li>• PA0204 Install the batteries</li> <li>• PA0205 Connect the batteries to specification</li> <li>• PA0206 Test the battery installation and complete documentation</li> <li>• PA0207 Clean the work area and dispose of used materials</li> </ul>		<p>specifications</p> <ul style="list-style-type: none"> <li>• WA0204 Compile parts list and draw parts, where applicable</li> <li>• WA0205 Repair a variety of electrical and mechanical installations and control systems to manufacturers' and workplace specifications</li> <li>• WA0206 Conduct functionality tests and commission the installations</li> <li>• WA0207 Restore the work area and dispose of waste materials</li> <li>• WA0208 Interact with production personnel, where applicable</li> <li>• WA0209 Complete all relevant documentation</li> <li>• WA0210 Communicate with relevant parties</li> <li>• Install the batteries</li> <li>• Connect the batteries to specification</li> <li>• Test the battery installation and complete documentation</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-06-PS02: Install, connect and test batteries</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0202 Batteries are correctly identified and the data is recorded accurately</li> <li>• IAC0203 Conductor sizes are correctly selected according to manufacturers' specifications</li> </ul>	<p><b>KM-09-KT02: Batteries</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Explain the terms potential difference, electromotive force, relative density and capacity</li> <li>• IAC0202 Describe, with the aid of a diagram, the fundamentals of battery construction</li> <li>• IAC0203 Describe and explain the various types of batteries and cells</li> <li>• IAC0204 Describe the advantages and disadvantages of primary and secondary cells for particular applications</li> <li>• IAC0205 Describe and explain the correct</li> </ul>	<p><b>WM-03-WE02: Fault-find and repair electrical and mechanical installations and control systems under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment repaired, signed</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0204 Batteries are installed and connected according to specification</li> <li>• IAC0205 All work is performed in accordance with applicable SANS standards and the work instruction</li> <li>• IAC0206 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> <li>• IAC0207 Critical issues relating to installing, connecting and testing batteries are described and explained</li> </ul>	<p>procedures to care, maintain, store and dispose of batteries and the hazards and safety precautions associated with batteries and battery rooms</p> <ul style="list-style-type: none"> <li>• IAC0206 Name the instruments used for testing batteries, describe how they are used and explain the purpose of each test</li> <li>• IAC0207 Explain, with the aid of drawings, the discharging and charging action of lead-acid cells</li> </ul> <p><b>The Learner must display knowledge of battery installation and testing:</b></p> <ul style="list-style-type: none"> <li>• Safe work procedures</li> <li>• Standard operating procedures</li> <li>• Manufacturers' specifications</li> <li>• Applicable SANS standards</li> <li>• Hazard identification and risk assessment practices</li> <li>• Selecting conductor sizes according to OEM specifics</li> <li>• Methods of preparing area for installation</li> <li>• Critical issues relating to installing, connecting and testing batteries</li> </ul>	<p>off by the supervising artisan</p> <ul style="list-style-type: none"> <li>• SE0203 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 marks (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 60 min including all items mentioned above</li> <li>• Level of competency of 100% (critical) required for practical exercise: <ul style="list-style-type: none"> <li>• Isolate and lockout</li> <li>• Termination and connections</li> </ul> </li> <li>• Level of competency of 80% required for practical exercise: <ul style="list-style-type: none"> <li>• All above items</li> </ul> </li> </ul>		

**Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Tutorial videos

**Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Wire and cable strippers
- Cable/wire cutters
- Crimp tools
- Cable/wire dispenser
- Utility/cable knife
- Screw drivers
- Pliers
- Side cutter
- Spanner set
- Multi meter
- Battery tester
- Hydrometer

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>K5</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Install and connect electrical equipment, switch- and control gear</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		160	392	
<b>Work situation title: Install and connect luminaires</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Japie is requested to install and connect additional lighting system in a workshop. He must identify the luminaires to be used, install and connect them. The circuit must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.				
<b>Prerequisite learning:</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-06-PS03: Install and connect luminaires</b></p> <p><i>Given a range of typical low voltage incandescent, fluorescent, sodium vapour, LED, CFL, blended mercury vapour, halogen lighting, conductors, applicable tools, applicable personal protective equipment, manufacturers' specifications, SANS standards and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0301 Review the maintenance information, determine the scope of work and plan the operation</li> <li>PA0302 Identify the types of luminaires</li> <li>PA0303 Identify and interpret the applicable SANS standards</li> <li>PA0304 Collect all required tools, select correct components, conductors</li> </ul>		<p><b>KM-09-KT06: Lighting systems</b></p> <ul style="list-style-type: none"> <li>KT0601 Principles of Illumination</li> <li>KT0602 Types of luminaires and lighting systems</li> </ul> <ul style="list-style-type: none"> <li>General safety rules and procedures connected to lighting installations</li> <li>Energy consumption of lighting systems</li> <li>Dimensioning, type and characteristics of lighting installation components</li> <li>Common lighting terms</li> <li>Types of materials, tools and equipment used for lighting installations</li> <li>Installation standards</li> <li>Basic installation circuits</li> <li>Installation zones and routes</li> <li>Testing of the electrical installation (Visual inspection, continuity test)</li> </ul> <p><u>Applied Knowledge:</u></p> <p><b>PM-06-PS03: Install and connect luminaires</b></p>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Analyse schematic drawings and documentations for lighting system installations</li> <li>Undertake all preparatory installation activities with assistance and regular supervision</li> <li>Practice general safety rules and safe work procedures related to light systems</li> <li>Test and repair lighting systems under close supervision until work can be done on a more autonomous basis</li> <li>Engage in regular housekeeping activities, tool and equipment maintenance</li> <li>Provide work documentation, verbal and written reports as required by the company</li> </ul>

<p>and personal protective equipment, prepare the work space and complete a risk assessment</p> <ul style="list-style-type: none"> <li>• PA0305 Install the luminaires</li> <li>• PA0306 Connect luminaires to specification and in accordance with SANS standards</li> <li>• PA0307 Test the luminaire installation and complete documentation</li> <li>• PA0308 Clean the work area and dispose of used luminaires and materials</li> </ul>	<ul style="list-style-type: none"> <li>• AK0301 Safe work procedures</li> <li>• AK0302 Standard operating procedures</li> <li>• AK0303 Manufacturers' specifications</li> <li>• AK0304 Applicable SANS standards</li> <li>• AK0305 Hazard identification and risk assessment practices</li> <li>• AK0306 Environmental requirements for luminaires</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-06-PS03: Install and connect luminaires</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0302 Luminaires are correctly identified</li> <li>• IAC0303 Conductor sizes are correctly selected according to manufacturers' specifications</li> <li>• IAC0304 Luminaires are installed and connected according to specification</li> <li>• IAC0305 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0306 All work is performed in accordance with applicable SANS standards and the work instruction</li> <li>• IAC0307 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable</li> </ul>	<p><b>KM-09-KT06: Lighting systems</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Explain illumination and luminaire circuits</li> <li>• IAC0602 Describe light intensity, lux, lumens, colour rendering and stroboscopic effect</li> <li>• IAC0603 Explain the controlling of lighting circuits</li> <li>• IAC0604 Explain different type of lamps and their principles of operation</li> <li>• IAC0605 Explain the safe disposal of lamps</li> </ul> <p><b>The apprentice must display knowledge of Luminaire installation and testing:</b></p> <ul style="list-style-type: none"> <li>• Safe work procedures</li> <li>• Standard operating procedures</li> <li>• Manufacturers' specifications</li> <li>• Applicable SANS standards</li> <li>• Hazard identification and risk assessment practices</li> <li>• Selecting conductor sizes according to OEM specifics</li> <li>• Methods of preparing area for installation</li> <li>• Critical issues relating to installing, connecting and testing luminaires</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>



<p>manner</p> <ul style="list-style-type: none"> <li>IAC0308 Critical issues relating to installing and connecting luminaires are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%</li> <li>Practical exercise of 60 min including all items mentioned above</li> <li>Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>Isolation and lockout</li> <li>Earthing and bonding</li> </ul> </li> <li>Level of competency of 80% required for: <ul style="list-style-type: none"> <li>All above items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>Learning material covering Knowledge and Practical Skills Modules</li> <li>Samples (and charts)</li> <li>Safe Operating Procedure and Safe Working Procedure</li> <li>Charts of risk assessment procedure and safety measures</li> <li>Tutorial videos</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles</li> <li>Wire and cable strippers</li> <li>Cable/wire cutters</li> <li>Crimp tools</li> <li>Cable/wire dispenser</li> <li>Utility/cable knife</li> <li>Screw drivers</li> <li>Pliers</li> <li>Side cutter</li> <li>Spanner set</li> </ul>		

- Multi meter
- Drilling machine
- Ladder
- Fish tape
- Glands
- Assortment of fasteners

**Hand- & power tools incl.:**

- Electrical **Measuring and testing instruments incl.:**
- Measuring tape
- Continuity tester

**Training workshop incl.:**

- Installation cabins/ cubicles
- Various types and sizes of reusable lighting fixtures for ceiling/wall, indoor/outdoor, socket types and IP ratings
- Various types of lighting control devices and switches
- Various types of lamps including CF, fluorescent, incandescent, halogen LED

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>K6</h1>			
		<b>Curriculum code:</b> 671202000					
<b>Learning area title:</b> Install and connect electrical equipment, switch- and control gear		<b>Total hours</b>	<table border="1"> <tr> <td><b>SDP</b></td> <td><b>WP</b></td> </tr> <tr> <td>160</td> <td>392</td> </tr> </table>			<b>SDP</b>	<b>WP</b>
<b>SDP</b>	<b>WP</b>						
160	392						
<b>Work situation title:</b> Install and connect fixed measuring instruments (incl. CTs and VTs)		<b>Total hours</b>	<table border="1"> <tr> <td>16</td> <td>40</td> </tr> </table>	16	40		
16	40						
<b>Work scenario:</b> Juleen is requested to install and connect fixed measuring instruments into a circuit. She must identify and select measuring instruments for the task. The circuit must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.							
<b>Prerequisite learning:</b> Year 1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>			
<p><b>PM-05-PS04: Identify and use fixed measuring instruments</b></p> <p><i>Given a variety of measuring instruments (including volt meter, amp meter, power factor meter, energy meter), equipment to be measured, personal protective equipment, manufacturers' specifications and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0401 Review the work instructions, determine the scope of work and plan the operation</li> <li>PA0402 Collect all required instruments and relevant personal protective equipment, prepare the work space and complete a risk assessment</li> </ul>		<p>QCTO none</p> <p>Knowledge of:</p> <ul style="list-style-type: none"> <li>Fixed measuring instruments their uses and applications</li> <li>Correct care and maintenance of fixed measuring instruments</li> </ul> <p><b>Testing /Measuring Circuit</b></p> <ul style="list-style-type: none"> <li>Testing principles for measuring circuits</li> <li>Testing techniques for measuring circuits</li> <li>Safety during Testing</li> <li>Electrical circuit design</li> </ul> <p><u>Applied Knowledge</u></p>		<p>QCTO none</p> <p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Given a work scenario identify the correct fixed measuring instruments to be used</li> <li>Explain the use of the different fixed measuring instruments and precautions to be taken</li> <li>Care for and store fixed measuring instruments</li> <li>Report defects on fixed measuring instruments</li> </ul>			

<ul style="list-style-type: none"> <li>• PA0403 Identify and respond to hazards and risks</li> <li>• PA0404 Identify the various instruments</li> <li>• PA0405 Explain the functions and applications of the instruments</li> <li>• PA0406 Inspect instruments and identify and report defects</li> <li>• PA0407 Use the instruments to measure various values on equipment</li> <li>• PA0408 Describe and explain the requirements for handling fixed measuring instruments</li> </ul> <p><b>PM-06-PS04: Install and connect fixed measuring instruments</b></p> <p><i>Given a range of low voltage fixed AC and DC measuring instruments including analogue and digital, ammeters, DC shunts, voltmeters, power factor meters, energy meters, conductors, applicable tools, applicable personal protective equipment, manufacturers' specifications, SANS standards and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <p>PA0401 Review the maintenance information, determine the scope of work and plan the operation</p> <p>PA0402 Identify the types of fixed measuring instruments</p> <p>PA0403 Identify and interpret the applicable SANS standards</p>	<p><b>PM-05-PS04: Identify and use fixed measuring instruments</b></p> <ul style="list-style-type: none"> <li>• AK0401 Safe work procedures</li> <li>• AK0402 Standard operating procedures</li> <li>• AK0403 Manufacturers' specifications</li> <li>• AK0404 Value reading on the correct scale</li> <li>• AK0405 Methods of identifying defects on instruments</li> <li>• AK0406 Hazard identification and risk assessment practices</li> <li>• AK0407 Functions and applications of testing and measuring instruments</li> <li>• AK0408 Safe use, handling and care of measuring instruments</li> <li>• Zero meter before energising</li> <li>• Cautious of parallax error. (Analogue meters)</li> </ul> <p><b>PM-06-PS04: Install and connect fixed measuring instruments</b></p> <ul style="list-style-type: none"> <li>• AK0401 Safe work procedures</li> <li>• AK0402 Standard operating procedures</li> <li>• AK0403 Manufacturers' specifications</li> <li>• AK0404 Applicable SANS standards</li> <li>• AK0405 Hazard identification and risk assessment practices</li> <li>• AK0406 Environmental requirements for fixed measuring instruments</li> </ul>	
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<p>PA0404 Collect all required tools, select correct components, conductors and personal protective equipment, prepare the work space and complete a risk assessment</p> <p>PA0405 Install the fixed measuring instruments</p> <p>PA0406 Connect fixed measuring instruments to specification and in accordance with SANS standards</p> <p>PA0407 Test the installation and complete documentation</p> <p>PA0408 Clean the work area and dispose of waste materials</p>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-05-PS04: Identify and use fixed measuring instruments</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0402 All instruments are identified correctly</li> <li>• IAC0403 The functions and applications of the instruments are correctly explained</li> <li>• IAC0404 All defective instruments are identified and reported</li> <li>• IAC0405 Instruments are used correctly according to work instructions and manufacturers' specifications to measure applicable values on equipment</li> </ul>	<p><b>The apprentice must display knowledge of Fixed Measuring Instruments their installation and testing:</b></p> <ul style="list-style-type: none"> <li>• Safe work procedures</li> <li>• Standard operating procedures</li> <li>• Manufacturers' specifications</li> <li>• Applicable SANS standards</li> <li>• Hazard identification and risk assessment practices</li> <li>• Selecting according to size and OEM specifics</li> <li>• Methods of preparing area for installation</li> <li>• Critical issues relating to installing, connecting and testing Fixed Measuring Instruments</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>• Signed off Logbook/PoE</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0406 The values are measured correctly</li> <li>• IAC0407 Correct handling of fixed measuring instruments is described and explained</li> </ul> <p><b>PM-06-PS04: Install and connect fixed measuring instruments</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0402 Fixed measuring instruments are correctly identified</li> <li>• IAC0403 Conductor sizes are correctly selected according to manufacturers' specifications</li> <li>• IAC0404 Fixed measuring instruments are installed and connected according to specification</li> <li>• IAC0405 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0406 All work is performed in accordance with applicable SANS standards and the work instruction</li> <li>• IAC0407 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> </ul>		
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<ul style="list-style-type: none"> <li>• IAC0408 Critical issues relating to installing and connecting fixed measuring instruments are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 60 min including all items mentioned above</li> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>• Isolate and lockout</li> <li>• Correct fixed measuring instrument for application</li> <li>• Secure and correct connections</li> </ul> </li> <li>• Level of competency of 80% required for: <ul style="list-style-type: none"> <li>• All the above items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material covering Knowledge and Practical Skills Modules</li> <li>• Samples (and charts)</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> <li>• Charts of risk assessment procedure and safety measures</li> <li>• Tutorial videos</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles</li> <li>• Wire and cable strippers</li> <li>• Cable/wire cutters</li> <li>• Crimp tools</li> <li>• Soldering iron</li> <li>• Utility/cable knife</li> <li>• Hacksaw</li> <li>• Screw drivers</li> </ul>		

- Pliers
- Hammer
- Spanner set
- Insulation resistance tester
- Continuity tester
- Ammeters
- DC shunts
- Voltmeters
- Power factor meters
- Energy meters
- Conductors



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>L1</b>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Test, install and connect electrical machines (Transformers, Single and three Phase and DC Motors)</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		240	320	
<b>Work situation title: Design electrical circuits and perform fault-finding and repair</b>	<b>Total hours</b>	80	80	
<b>Work scenario:</b> Jomo is requested to design and build an electrical circuit to control the forward and reverse action of a delivery table. The circuit must adhere to all safety regulations and function within the design parameters. All components must be used according to OEM specifications.				
<b>Prerequisite learning:</b> Year 2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>
<b>PM-16-PS01: Design and construct electrical circuits</b>  <i>Given the relevant tools, relevant SANS standards, manufacturers' specifications and a variety of typical work instructions,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0101 Review the work instructions, determine the scope of work and plan the work</li> <li>PA0102 Collect all required tools, select testing and personal protective equipment, prepare the workspace and complete a risk assessment</li> <li>PA0103 Design the electrical circuits to achieve the work instruction requirements</li> <li>PA0104 Develop schematic and block diagrams of the circuit to be built</li> </ul>		Knowledge of:  <b>KM-06-KT03: Electrical appliances (35%)</b> <ul style="list-style-type: none"> <li>KT0301 Types of electrical appliances</li> <li>KT0302 Classification of appliances according to SANS 10142-1</li> <li>KT0303 Regulatory requirements of appliances according to SANS 10142-1</li> </ul> <b>KM-10-KT01: Low voltage protection (100%)</b> <ul style="list-style-type: none"> <li>KT0101 Purpose and application of low voltage protection</li> <li>KT0102 Types of low voltage protection</li> <li>KT0103 Low voltage protection parameters and statutory requirements</li> </ul> <b>KM-11-KT01: Fault finding (100%)</b>		<i>QCTO none</i>  The apprentice will be expected to gain <b>practical experience</b> and engage in the following work activities under supervision  <b>Design and construct electrical circuits under supervision</b> <ul style="list-style-type: none"> <li>Design electrical circuits for various work scenarios</li> <li>Perform fault-finding and repair on electrical circuits</li> </ul>

<ul style="list-style-type: none"> <li>• PA0105 Select components required to achieve the purpose of the work instructions</li> <li>• PA0106 Check and verify conformance of component ratings to SANS standards and manufacturers' specifications</li> <li>• PA0107 Construct and test the circuits and rectify any faults</li> </ul> <p><b>PM-16-PS02: Modify electrical circuits</b></p> <ul style="list-style-type: none"> <li>• PA0201 Review the work instructions determine the scope of work and plan the work</li> <li>• PA0202 Interpret diagrams and identify changes required</li> <li>• PA0203 Update existing diagrams to include modifications</li> <li>• PA0204 Collect all required tools, select testing and personal protective equipment, prepare the workspace and complete a risk assessment</li> <li>• PA0205 Check and verify conformance of component ratings to SANS standards and manufacturers' specifications</li> <li>• PA0206 Modify the circuits, test the modified circuits and rectify any faults</li> </ul> <p><b>PM-12-PS01: Find faults on electrical</b></p>	<ul style="list-style-type: none"> <li>• KT0101 Faultfinding principles for electrical circuits</li> <li>• KT0102 Faultfinding techniques for electrical circuits</li> <li>• KT0103 Safety during faultfinding</li> <li>• <b>Electrical circuit design</b></li> </ul> <p><u>Applied knowledge:</u></p> <p><b>PM-16-PS01: Design and construct electrical circuits</b></p> <ul style="list-style-type: none"> <li>• AK0801 Safe work procedures</li> <li>• AK0802 Standard operating procedures</li> <li>• AK0803 Manufacturers' specifications</li> <li>• AK0804 Applicable SANS standards</li> <li>• AK0805 Hazard and risk assessment and mitigation procedures</li> <li>• AK0806 Application of design principles</li> </ul> <p><b>PM-16-PS02: Modify electrical circuits</b></p> <ul style="list-style-type: none"> <li>• AK0901 Safe work procedures</li> <li>• AK0902 Standard operating procedures</li> <li>• AK0903 Manufacturers' specifications</li> <li>• AK0904 Applicable SANS standards</li> <li>• AK0905 Hazard and risk assessment and mitigation procedures</li> <li>• AK0906 Application of design principles</li> </ul> <p><b>PM-12-PS01: Find faults on electrical circuits, live and dead</b></p>	
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<p><b>circuits, live and dead</b></p> <ul style="list-style-type: none"> <li>• PA0101 Review the documentation, determine the scope of work and plan a logical process for the fault-finding operation</li> <li>• PA0102 Collect all required relevant tools, select testing equipment, personal protective equipment, prepare the workspace and complete a risk assessment</li> <li>• PA0103 Identify the panel and applicable electrical diagrams</li> <li>• PA0104 Collect information and evidence on faults</li> <li>• PA0105 Select test instruments to determine faults</li> <li>• PA0106 Use test instruments to determine fault area</li> <li>• PA0107 Identify and report faults</li> <li>• PA0108 Explain the reasons for decisions on fault identification</li> </ul> <p><b>PM-12-PS02: Replace or repair defective electrical components</b></p> <ul style="list-style-type: none"> <li>• PA0201 Review the documentation, determine the scope of work and plan the replacement or repair operation</li> <li>• PA0202 Collect all required tools, select testing equipment, personal protective equipment, prepare the workspace and</li> </ul>	<ul style="list-style-type: none"> <li>• AK0101 Safe work procedures</li> <li>• AK0102 Standard operating procedures</li> <li>• AK0103 Manufacturers' specifications</li> <li>• AK0104 Systematic application of fault finding techniques</li> <li>• AK0105 Sensory cues related to fault finding</li> <li>• AK0106 Hazard identification and risk assessment practices</li> </ul> <p><b>PM-12-PS02: Replace or repair defective electrical components</b></p> <ul style="list-style-type: none"> <li>• AK0201 Safe work procedures</li> <li>• AK0202 Standard operating procedures</li> <li>• AK0203 Manufacturers' specifications</li> <li>• AK0204 Techniques for removing and replacing components</li> <li>• AK0205 Hazard and risk assessment and mitigation procedures</li> </ul>	
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<ul style="list-style-type: none"> <li>complete a risk assessment</li> <li>PA0203 Determine requirements for repairing identified faults and select components for replacement</li> <li>PA0204 Remove faulty components and replace with selected components</li> <li>PA0205 Test the circuits</li> <li>PA0206 Clean the work area and dispose of used materials</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-16-PS01: Design and construct electrical circuits</b></p> <ul style="list-style-type: none"> <li>IAC0801 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>IAC0802 Correct components are selected</li> <li>IAC0803 All equipment functions according to the applicable rating</li> <li>IAC0804 Diagrams conform to the instructions</li> <li>IAC0805 The electrical circuits are correctly constructed</li> <li>IAC0806 Critical issues relating to designing and constructing electrical circuits are described and explained</li> </ul> <p><b>PM-16-PS02: Modify electrical circuits</b></p> <ul style="list-style-type: none"> <li>IAC0901 Hazards and risks are</li> </ul>	<p><b>KM-06-KT03: Electrical appliances (35%)</b></p> <ul style="list-style-type: none"> <li>IAC0301 Define fixed, portable and stationary appliances</li> <li>IAC0302 Explain the classification of appliances</li> <li>IAC0303 Explain the regulations relevant to appliances</li> </ul> <p><b>KM-10-KT01: Low voltage protection (100%)</b></p> <ul style="list-style-type: none"> <li>IAC0101 Name and describe the types of low voltage protective devices</li> <li>IAC0102 Describe the operation and functions of different types of low voltage protective devices including overload relays, fuses, circuit breakers and earth leakage protection devices</li> <li>IAC0103 Explain, with the aid of circuit diagrams, how single-and three phase electrical installations are protected</li> <li>IAC0104 Describe the effect of adverse conditions on the operational characteristics</li> </ul>	<p><b>Supporting Evidence</b></p> <ul style="list-style-type: none"> <li>Signed off logbook/PoE</li> </ul>

<p>identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</p> <ul style="list-style-type: none"> <li>• IAC0902 The modified drawing meets the requirements of the work instruction</li> <li>• IAC0903 All equipment functions according to the instructions</li> <li>• IAC0904 The circuit functions according to the modification on the diagram</li> <li>• IAC0905 The required functionality and safety considerations are retained after modification</li> <li>• IAC0906 Critical issues relating to modifying electrical circuits are described and explained</li> </ul> <p><b>PM-12-PS01: Find faults on electrical circuits, live and dead</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0102 The relevant panel is located and applicable electrical diagrams are identified</li> <li>• IAC0103 All relevant information and evidence on faults is collected</li> <li>• IAC0104 Applicable test instruments</li> </ul>	<p>of protective devices</p> <p><b>KM-11-KT01: Fault finding (100%)</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Explain fault finding principles and techniques for alternating and direct current main supply circuits</li> <li>• IAC0102 Explain fault finding principles and techniques for alternating and direct current control circuits</li> </ul>	
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<p>are selected according to the requirements of the various types of equipment</p> <ul style="list-style-type: none"> <li>• IAC0105 Test instruments are used correctly to determine fault areas</li> <li>• IAC0106 The logical process for fault finding is applied systematically</li> <li>• IAC0107 All faults are identified and reported according to requirements</li> <li>• IAC0108 Critical issues relating to fault finding processes and the correct operation of equipment are described and explained</li> </ul> <p><b>PM-12-PS02: Replace or repair defective electrical components</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0202 The applicable components are selected</li> <li>• IAC0203 The correct procedures are followed to remove and replace faulty components</li> <li>• IAC0204 Applicable test instruments are used to test the safety and correct functioning of the circuits</li> </ul>		
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<ul style="list-style-type: none"> <li>IAC0205 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test of a minimum of 30 marks (45 min) and the competency will be at 80%</li> <li>Practical exercise of 90min covering all the above-mentioned items.</li> <li>Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>Safety isolate, lockout and test for zero potential.</li> <li>Circuit design.</li> <li>Earthing connection</li> </ul> </li> <li>Level of competency of 80% required for: <ul style="list-style-type: none"> <li>All other assessment items</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>Learning material</li> <li>Samples (and charts)</li> <li>Safe Operating Procedure and Safe Working Procedure</li> <li>Charts of risk assessment procedure and safety measures</li> <li>CDs and videos will be an added advantage</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles</li> <li>Electrical components related to the task</li> <li>Side cutter</li> <li>Wire stripper</li> <li>Multimeter</li> <li>Tube spanner</li> <li>Insulated screwdriver set</li> </ul>		

- round nose pliers
- Belt knife
- Combination pliers
- Lockout equipment



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>L2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Test, install and connect electrical machines (Transformers, Single and three Phase and DC Motors)</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		240	320	
<b>Work situation title: Install, test and protect transformers (small and medium)</b>	<b>Total hours</b>	40	80	
<b>Work scenario:</b> Dhudhu is tasked with the replacement of a transformer working in the boom for a stacker. The installation of the new transformer is required as the boom swing motor has been upgraded. He has to set the tappings and trip alarms according to the OEM specification. Safety is premium, therefore isolation and lockout is not negotiable.				
<b>Prerequisite learning:</b> Year 2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-06-PS07: Install and connect transformers</b></p> <p><i>Given a range of typical low voltage, single phase, three phase, auto, current, potential and power transformers, conductors, applicable tools, applicable personal protective equipment, manufacturers' specifications, SANS standards and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0701 Review the maintenance information, determine the scope of work and plan the operation</li> <li>PA0702 Identify the types of transformers</li> <li>PA0703 Identify and interpret the applicable SANS standards</li> <li>PA0704 Collect all required tools, select correct components, conductors and</li> </ul>		<p>Knowledge of:</p> <p><b>KM-09-KT03: Transformers</b></p> <ul style="list-style-type: none"> <li>KT0301 Theory of single phase wound transformers</li> <li>KT0302 Types of single phase transformers including single wound, double wound and auto- transformers and their applications.</li> <li>KT0303 Fundamentals of transformer construction</li> <li>KT0304 Transformer cooling systems</li> <li>KT0305 Principles of single phase transformer operation</li> <li>KT0306 Principles of single phase auto-transformer operation</li> <li>KT0307 Transformer losses</li> <li>KT0308 Formulas and calculations on input and output of transformers</li> <li>KT0309 Maintenance requirements of</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to gain <b>practical experience</b> and engage in the following work activities under supervision</p> <ul style="list-style-type: none"> <li><b>Install, connect and test new transformers (small and medium)</b></li> <li><b>Test and protect existing transformers</b></li> </ul>

<p>personal protective equipment, prepare the work space and complete a risk assessment</p> <ul style="list-style-type: none"> <li>• PA0705 Identify and test primary and secondary windings, where applicable</li> <li>• PA0706 Install the transformers</li> <li>• PA0707 Connect transformers to specification</li> <li>• PA0708 Test the transformer installation and complete documentation</li> <li>• PA0709 Clean the work area and dispose of used materials</li> <li>• Isolate, lockout and test for zero potential before work commences.</li> </ul> <p><b>PM-15-PS05: Test and verify conformance of single phase installations</b></p> <p><i>Given a complete single phase installation, testing and measuring instruments, relevant SANS standards and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0501 Review the work instructions, determine the scope of work and plan the testing and verification processes</li> <li>• PA0502 Collect all required tools and personal protective equipment, select the correct testing and measuring instruments, prepare the workspace and complete a risk assessment</li> <li>• PA0503 Identify and interpret applicable SANS standards</li> <li>• PA0504 Test polarity of installation for</li> </ul>	<p>transformers</p> <ul style="list-style-type: none"> <li>• KT0310 Types of three phase transformers and their applications</li> <li>• KT0311 Construction of three phase transformers including open core, closed core and shell or divided core</li> <li>• KT0312 Principles of 3 phase transformer operation and configuration</li> <li>• KT0313 Principles of 3 phase auto transformer operation and configuration</li> <li>• KT0314 Transformer protection and phasing</li> </ul> <p><u>Applied Knowledge:</u></p> <p><b>PM-06-PS07: Install and connect transformers</b></p> <ul style="list-style-type: none"> <li>• AK0701 Safe work procedures</li> <li>• AK0702 Standard operating procedures</li> <li>• AK0703 Manufacturers' specifications</li> <li>• AK0704 Applicable SANS standards</li> <li>• AK0705 Hazard identification and risk assessment practices</li> </ul> <p><b>PM-15-PS05: Test and verify conformance of single phase installations</b></p> <ul style="list-style-type: none"> <li>• AK0501 Safe work procedures</li> <li>• AK0502 Standard operating procedures</li> <li>• AK0503 Manufacturers' specifications</li> <li>• AK0504 Testing techniques</li> <li>• AK0505 Inspection techniques</li> </ul>	
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<p>conformance to SANS standards</p> <ul style="list-style-type: none"> <li>• PA0505 Test continuity of components for conformance to SANS standards</li> <li>• PA0506 Test insulation resistance for conformance to SANS standards</li> <li>• PA0507 Check and verify that ratings of components conform to SANS standards</li> <li>• PA0508 Test earth leakage unit for conformance to SANS standards</li> <li>• PA0509 Inspect mechanical aspects of the installation</li> <li>• PA0510 Write a report on electrical and mechanical findings</li> </ul> <p><b>PM-15-PS06: Test and verify conformance of three phase installations</b></p> <p>Given a complete three phase installation, testing and measuring instruments, relevant SANS standards and work instructions,</p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0601 Review the work instructions, determine the scope of work and plan the testing and verification processes</li> <li>• PA0602 Collect all required tools and personal protective equipment, select the correct testing and measuring instruments, prepare the workspace and complete a risk assessment</li> <li>• PA0603 Identify and interpret applicable SANS standards</li> <li>• PA0604 Test continuity of components for conformance to SANS standards</li> </ul>	<ul style="list-style-type: none"> <li>• AK0506 Applicable SANS standards</li> <li>• AK0507 Hazard identification and risk assessment practice</li> </ul> <p><b>PM-15-PS06: Test and verify conformance of three phase installations</b></p> <ul style="list-style-type: none"> <li>• AK0601 Safe work procedures</li> <li>• AK0602 Standard operating procedures</li> <li>• AK0603 Manufacturers' specifications</li> <li>• AK0604 Testing techniques</li> <li>• AK0605 Inspection techniques</li> <li>• AK0606 Applicable SANS standards</li> <li>• AK0607 Hazard identification and risk assessment practices</li> </ul>	
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<ul style="list-style-type: none"> <li>• PA0605 Test insulation resistance for conformance to SANS standards</li> <li>• PA0606 Check and verify that ratings of components conform to SANS standards</li> <li>• PA0607 Test earth leakage unit for conformance to SANS standards</li> <li>• PA0608 Inspect mechanical aspects of the installation</li> <li>• PA0609 Write a report on electrical and mechanical findings</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-06-PS07: Install and connect transformers</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0702 Transformers are correctly identified</li> <li>• IAC0703 Primary and secondary windings are correctly identified and tested using appropriate instruments</li> <li>• IAC0704 Conductor sizes are correctly selected according to manufacturers' specifications</li> <li>• IAC0705 Transformers are connected according to required input and output voltages</li> <li>• IAC0706 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0707 All work is performed in</li> </ul>	<p><b>KM-09-KT03: Transformers</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Name and describe the types of single phase transformers</li> <li>• IAC0302 Describe, with the aid of drawings, the construction of single phase transformers</li> <li>• IAC0303 Describe and explain the cooling systems used on transformers</li> <li>• IAC0304 Describe, with the aid of drawings, the principle of operation of single phase transformers in terms of mutual inductance and the henry as the unit of inductance</li> <li>• IAC0305 Explain, with the aid of drawings, the principle of operation of single phase auto- transformers</li> <li>• IAC0306 Describe types of transformer losses and explain their causes and effects</li> <li>• IAC0307 Calculate the terminal voltage, turns and current ratios for a single phase transformer.</li> <li>• IAC0308 Describe and explain the</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed-off logbook/PoE</li> </ul>

<p>accordance with applicable SANS standards and the work instruction</p> <ul style="list-style-type: none"> <li>• IAC0708 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> <li>• IAC0709 Critical issues relating to the installation of transformers are described and explained</li> </ul> <p><b>PM-15-PS05: Test and verify conformance of single phase installations</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0502 Test and measuring instruments are correctly selected</li> <li>• IAC0503 The relevant SANS standards are correctly identified and interpreted</li> <li>• IAC0504 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0505 The report conforms to the requirements and records the findings accurately</li> <li>• IAC0506 Critical issues relating to testing and verifying conformance of single phase installations are described and explained</li> </ul> <p><b>PM-15-PS06: Test and verify conformance of three phase installations</b></p>	<p>maintenance requirements for single/three phase transformers</p> <ul style="list-style-type: none"> <li>• IAC0309 Describe, with the aid of diagrams, the construction of three phase transformers</li> <li>• IAC0310 Describe the various types of construction of three phase transformers - open core, closed core, and shell or divided core</li> <li>• IAC0311 Describe the basic transformer maintenance procedures</li> <li>• IAC0312 Calculate the relationship of the voltage, current, turns ratio's and power including true power, apparent power and power factor</li> <li>• IAC0313 Describe and explain how inductance causes a phase angle between voltage and current and its relationship with the concept 'power factor'</li> <li>• IAC0314 Describe, with the aid of diagrams, three phase transformer connections</li> <li>• IAC0315 Calculate the line and phase voltages and currents relating to three-phase transformer connections</li> <li>• IAC0316 Explain the concept of, and need for, transformer tappings</li> <li>• IAC0317 Explain transformer protection and phasing</li> </ul>	
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<ul style="list-style-type: none"> <li>• IAC0601 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0602 Components of the three phase installation are correctly identified</li> <li>• IAC0603 Test and measuring instruments are correctly selected</li> <li>• IAC0604 The relevant SANS standards are correctly identified and interpreted</li> <li>• IAC0605 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0606 The report conforms to the requirements and records the findings accurately</li> <li>• IAC0607 Critical issues relating to testing and verifying conformance of three phase installations are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (60 min) and the competency will be at 80%</li> <li>• Practical exercise of 180min in length covering all items mentioned above. <ul style="list-style-type: none"> <li>○ Planning and calculations for task</li> <li>○ Interpretation of electrical calculations and diagram</li> <li>○ Identification of risks</li> <li>○ Correct selection, positioning and operation of transformer</li> <li>○ Transformer wired as per given diagram and labelled accordingly</li> <li>○ Use of appropriate equipment and tools</li> <li>○ Clean worksite after completion of task and equipment returned safely to store</li> <li>○ Correct PPE</li> </ul> </li> </ul>		

- Level of competency at 80% for all the above mentioned items
- Level of competency of 100% (critical) required for:
  - Safety Isolate, lockout and test for zero potential
  - Correct conductor sizes
  - Connecting of conductors correctly

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts)
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Hand Tools and measuring equipment
- Transformer
- Cable of sufficient length
- Set of Spanners and sockets
- Rubber Mallet
- Insulated Screwdrivers
- Allen key set
- Torque Wrench
- Crimping tool

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>L3</h1>			
		<b>Curriculum code:</b> 671202000					
<b>Learning area title:</b> Test, Install and connect electrical machines (Transformers, Single and three Phase and DC Motors)		<b>Total hours</b>				<b>SDP</b>	<b>WP</b>
						240	320
<b>Work situation title:</b> Test, install and connect single/ 3-phase AC/DC motors and control gear		<b>Total hours</b>		80	80		
<b>Work scenario:</b> Sakkie is tasked with the replacement of an array of motors used in a loading station. The installation of the motors is due to an upgrade on the load-units and vary between single and three phase motors. He has to identify the correct motor for each installation and install it according to the OEM Specification. Safety is premium, therefore isolation and lockout are non-negotiable.							
<b>Prerequisite learning:</b> Year 2							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	<b>Weeks/days:</b> QCTO NOCC		
<p><b>PM-06-PS08: Install and connect DC and single- and 3-phase AC motors</b></p> <p><i>Given a variety of low voltage, DC and single- and three phase AC motors, generators and alternators, conductors, applicable tools, applicable personal protective equipment, manufacturers' specifications, SANS standards and work instructions,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0801 Review the maintenance information, determine the scope of work and plan the operation</li> <li>PA0802 Identify the type of rotating machine and record the data</li> <li>PA0803 Identify and interpret the applicable SANS standards</li> <li>PA0804 Collect all required tools, select correct components, conductors and personal protective equipment, prepare the work space and complete a risk assessment</li> </ul>		<p>Knowledge of:</p> <p><b>KM-08-KT01: Rotating electrical machinery - AC motors</b></p> <ul style="list-style-type: none"> <li>KT0101 Construction of alternating current motors</li> <li>KT0102 Principle of operation of alternating current motors</li> <li>KT0103 Configuration of motor connections</li> <li>KT0104 Types of single phase and three phase alternating current motors</li> <li>KT0105 Application of alternating current motors</li> <li>KT0106 Testing principles of single phase and three phase alternating current motors</li> <li>KT0107 Protection of motors</li> <li>KT0108 Calculation of motor properties</li> </ul> <p><b>AC Motor control components</b></p> <ul style="list-style-type: none"> <li>Contactor (coil, main contacts, auxiliary contacts, voltages)</li> </ul>		<p>QCTO none</p> <p>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Perform risk assessments and lock out procedures for motor installation</li> <li>Install a starter or controller for an electric motor</li> <li>Install limit switches, stop buttons, overloads, over-current protection</li> <li>Test a control circuit</li> <li>Commission a control circuit</li> <li>Install a starter or controller for an electric motor</li> <li>Install cable from the supply to the motor starter</li> <li>Install limit switches, stop/start buttons, overloads, over-current protection, no volt relay</li> <li>Perform motor test</li> <li>Commission the system</li> </ul>			



<ul style="list-style-type: none"> <li>• PA0805 Install the rotating machinery</li> <li>• PA0806 Connect rotating machinery to specification and in accordance with SANS standards</li> <li>• PA0807 Test the rotating machinery installation and complete documentation</li> <li>• PA0808 Clean the work area and dispose of used materials</li> </ul> <p><b>PM-15-PS01: Test and verify conformance of single phase motors</b></p> <ul style="list-style-type: none"> <li>• PA0101 Review the work instructions, determine the scope of work and plan the testing and verification processes</li> <li>• PA0102 Collect all required tools and personal protective equipment, select the correct testing and measuring instruments, prepare the workspace and complete a risk assessment</li> <li>• PA0103 Identify and interpret applicable SANS standards</li> <li>• PA0104 Test continuity of components for conformance to SANS standards</li> <li>• PA0105 Test insulation resistance for conformance to SANS standards</li> <li>• PA0106 Inspect mechanical components</li> <li>• PA0107 Write a report on electrical and mechanical findings</li> </ul> <p><b>PM-15-PS02: Test and verify conformance of three phase motors</b></p> <ul style="list-style-type: none"> <li>• PA0201 Review the work instructions, determine the scope of work and plan the testing and verification processes</li> <li>• PA0202 Collect all required tools and personal protective equipment, select the correct</li> </ul>	<ul style="list-style-type: none"> <li>• Overload relays (magnetic, thermal)</li> <li>• current-devices (circuit breakers, fuses)</li> <li>• Time relays and time switches (electronic, electromagnetic, on-delay, off-delay, electro - pneumatic)</li> <li>• Limit switches (proxies, light sensors, mechanical, pressure)</li> <li>• Stop start push buttons</li> <li>• Emergency stop button</li> <li>• Symbols used in wiring diagrams</li> <li>• Rotary switches- single and 3-phase</li> <li>• Variable frequency drives</li> <li>• Reading and interpreting wiring diagram</li> <li>• Applicable SANS 10142</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-06-PS08: Install and connect DC and single- and 3-phase AC motors</b></p> <ul style="list-style-type: none"> <li>• AK0801 Safe work procedures</li> <li>• AK0802 Standard operating procedures</li> <li>• AK0803 Manufacturers' specifications</li> <li>• AK0804 Applicable SANS standards</li> <li>• AK0805 Hazard identification and risk assessment practices</li> </ul> <p><b>PM-15-PS01: Test and verify conformance of single phase motors</b></p> <ul style="list-style-type: none"> <li>• AK0101 Safe work procedures</li> <li>• AK0102 Standard operating procedures</li> <li>• AK0103 Manufacturers' specifications</li> <li>• AK0104 Testing techniques</li> <li>• AK0105 Applicable SANS standards</li> <li>• AK0106 Inspection techniques</li> <li>• AK0107 Hazard identification and risk assessment practices</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure that test instruments are in working condition</li> <li>• Conduct testing / measurement in circuits and equipment</li> <li>• Interpret results of testing/measuring and report findings</li> <li>• Store test and measuring equipment, record and report any defects</li> </ul>
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<p>testing and measuring instruments, prepare the workspace and complete a risk assessment</p> <ul style="list-style-type: none"> <li>• PA0203 Identify and interpret applicable SANS standards</li> <li>• PA0204 Test continuity of components for conformance to SANS standards</li> <li>• PA0205 Test insulation resistance for conformance to SANS standards</li> <li>• PA0206 Inspect mechanical components</li> <li>• PA0207 Write a report on electrical and mechanical findings</li> </ul> <p><b>PM-15-PS03: Test and verify conformance of direct current motors and generators</b></p> <p>Given a variety of direct current motors and generators, applicable testing and measuring instruments and SANS standards,</p> <ul style="list-style-type: none"> <li>• PA0301 Review the work instructions, determine the scope of work and plan the testing and verification processes</li> <li>• PA0302 Collect all required tools and personal protective equipment, select the correct testing and measuring instruments, prepare the workspace and complete a risk assessment</li> <li>• PA0303 Identify and interpret applicable SANS standards</li> <li>• PA0304 Test continuity of components for conformance to SANS standards</li> <li>• PA0305 Test insulation resistance for conformance to SANS standards</li> <li>• PA0306 Inspect mechanical components</li> <li>• PA0307 Write a report on electrical and</li> </ul>	<p><b>PM-15-PS02: Test and verify conformance of three phase motors</b></p> <ul style="list-style-type: none"> <li>• AK0201 Safe work procedures</li> <li>• AK0202 Standard operating procedures</li> <li>• AK0203 Manufacturers' specifications</li> <li>• AK0204 Testing techniques</li> <li>• AK0205 Applicable SANS standards</li> <li>• AK0206 Inspection techniques</li> <li>• AK0207 Hazard identification and risk assessment practices</li> </ul> <p><b>KM-08-KT02: Rotating electrical machinery - DC motors</b></p> <ul style="list-style-type: none"> <li>• KT0201 Construction of direct current motors</li> <li>• KT0202 Principles of operation for direct current motors</li> <li>• KT0203 Configuration of direct current motor connections</li> <li>• KT0204 Types and application of direct current motors</li> <li>• KT0205 Testing principles of direct current motors</li> <li>• KT0206 Protection of direct current motors</li> <li>• KT0207 Calculation of direct current motor properties</li> </ul> <p><b>DC Motor control components</b></p> <ul style="list-style-type: none"> <li>• Contactor (coil, DC contacts, auxiliary contacts, voltages)</li> <li>• Overload relays (magnetic, thermal)</li> <li>• current-devices (circuit breakers, fuses)</li> <li>• Time relays and time switches (electronic, electromagnetic, on-delay, off-delay, electro - pneumatic)</li> <li>• Limit switches (proxies, light sensors, mechanical, pressure)</li> <li>• Stop start push buttons</li> </ul>	
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<p>mechanical findings</p>	<ul style="list-style-type: none"> <li>• Emergency stop button</li> <li>• Symbols used in wiring diagrams</li> <li>• Reading and interpreting wiring diagram</li> <li>• Applicable SANS 10142</li> </ul> <p><b>Install and wire direct current (DC) motors</b></p> <ul style="list-style-type: none"> <li>• The operating/working principles of DC motors. <b>Range:</b> includes but not limited to series motor, shunt motor and compound motor</li> <li>• Components of DC motor. <b>Range:</b> stator, rotor, brush gear, frame, fan, shaft key.</li> <li>• Wiring diagrams of DC motors</li> <li>• Changing the direction of rotation of a DC motor using a rotary switch and contactors</li> <li>• Motor test to be performed on DC motors. <b>Range:</b> continuity test, insulation resistance between components, insulation resistance between conductors and mechanical examination.</li> <li>• Advantages and disadvantages of DC motors</li> <li>• Reading and interpreting circuit drawings</li> </ul> <p><b>Testing DC circuits</b></p> <ul style="list-style-type: none"> <li>• Different types of testing and measuring instruments and their uses</li> <li>• Common faults (e.g. open circuit, short circuit,, continuity, voltage supply)</li> <li>• Basic techniques of fault finding</li> <li>• Various electrical tests to be carried out on DC Circuits</li> <li>• PPE in the use of testing and measuring equipment</li> </ul> <p><b>PM-15-PS03: Test and verify conformance of direct current motors and generators</b></p> <ul style="list-style-type: none"> <li>• AK0301 Safe work procedures</li> </ul>	
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	<ul style="list-style-type: none"> <li>• AK0302 Standard operating procedures</li> <li>• AK0303 Manufacturers' specifications</li> <li>• AK0304 Testing techniques</li> <li>• AK0305 Applicable SANS standards</li> <li>• AK0306 Inspection techniques</li> <li>• AK0307 Hazard identification and risk assessment practices</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-06-PS08: Install and connect DC and single- and 3-phase AC motors</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0802 Rotating machinery is correctly identified and the data is recorded accurately</li> <li>• IAC0803 Conductor sizes are correctly selected according to manufacturers' specifications</li> <li>• IAC0804 Rotating machinery is installed and connected according to specification</li> <li>• IAC0805 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0806 All work is performed in accordance with applicable SANS standards and the work instruction</li> <li>• IAC0807 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> <li>• IAC0808 Critical issues relating to the installation of rotating machinery are described and explained</li> </ul>	<p><b>KM-08-KT01: Rotating electrical machinery - AC motors</b></p> <ul style="list-style-type: none"> <li>• IAC0101 List the different types of alternating current motors and describe their construction</li> <li>• IAC0102 Explain the principle of operation of alternating current motors</li> <li>• IAC0103 Characteristics of single phase and three phase motors</li> <li>• IAC0104 Describe and explain how tests are conducted on alternating current motors</li> <li>• IAC0105 Describe with the aid of diagrams, the configuration of motor connections</li> <li>• IAC0106 Describe and explain protection devices used for alternating current motors</li> <li>• IAC0107 Explain how time delay and current rating of overload protection devices influence their use in protecting motors from damage in case of locked rotors, overload during operation and short circuits</li> <li>• IAC0108 Compare the advantages and disadvantages of single- and three-phase motors</li> <li>• IAC0109 Calculate alternating current motor properties</li> </ul> <p><b>KM-08-KT02: Rotating electrical machinery - DC motors</b></p>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> </ul>

<p><b>PM-15-PS01: Test and verify conformance of single phase motors</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0102 Test and measuring instruments are correctly selected for the type of motor</li> <li>• IAC0103 The relevant SANS standards are correctly identified and interpreted</li> <li>• IAC0104 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0105 The report records all readings accurately, as well as any mechanical damage to the motor</li> <li>• IAC0106 Critical issues relating to testing and verifying conformance of single phase motors are described and explained</li> </ul> <p><b>PM-15-PS02: Test and verify conformance of three phase motors</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0202 Test and measuring instruments are correctly selected for each type of motor</li> <li>• IAC0203 The relevant SANS standards are correctly identified and interpreted</li> <li>• IAC0204 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0205 The report records all readings accurately, as well as any mechanical damage to the motor</li> <li>• IAC0206 Critical issues relating to testing and</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0201 List the different types of direct current motors and describe their construction</li> <li>• IAC0202 Explain the principle of operation of direct current motors</li> <li>• IAC0203 Describe the applications of different types of direct current motors</li> <li>• IAC0204 Describe and explain how various tests are conducted on direct current motors</li> <li>• IAC0205 Describe with the aid of diagrams, the configuration of motor connections, power circuits and control circuits.</li> <li>• IAC0206 Describe and explain protection devices used for direct current motors</li> <li>• IAC0207 Explain how time delay and current rating of overload protection devices influence their use in protecting motors from damage in case of locked rotors, overload during operation, short circuits</li> <li>• IAC0208 Compare the advantages and disadvantages of different types of direct current motors</li> <li>• IAC0209 Calculate direct current motor properties</li> </ul>	
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<p>verifying conformance of three phase motors are described and explained</p> <p><b>PM-15-PS03: Test and verify conformance of direct current motors and generators</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0302 Test and measuring instruments are correctly selected for the type of motor</li> <li>• IAC0303 The relevant SANS standards are correctly identified and interpreted</li> <li>• IAC0304 All electrical tests are conducted correctly according to SANS standards</li> <li>• IAC0305 The report records all readings accurately, as well as any mechanical damage to the motor</li> <li>• IAC0306 Critical issues relating to testing and verifying conformance of DC motors and generators are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 60 marks (90min) and the competency will be at 80%</li> <li>• Practical exercise of 180min in length covering all items mentioned above. Level of competency 80%.</li> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>○ Safety- isolate, lockout and test for zero potential</li> <li>○ Earth connection done correctly</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> <li>• Print materials, electronic files, software applications</li> <li>• Training manuals for trainers and apprentices incl. multimedia software</li> <li>• Set of presentation aids (videos, slides) for overhead or LED/LCD projectors</li> </ul>		

### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Set of spanners
- Allen key set
- Socket set
- Multi-meter
- Insulation resistance tester
- Crimping tool
- Cable strapping tool
- Training panel
- Conductors
- Contactors relays
- Overloads
- Over-current devices
- Stop/start buttons
- Limit switches
- Various starters
- Rotary switches
- Timers
- Controls for motors
- Direct-on-line starter;
- Automatic star/delta starter;
- Forward reverse using contactors,
- Sequence starters (various)
- Oscillating panel (limit switches);
- Rotary switch (forward reverse and two speed);
- Variable frequency drive
- Two speed motor using contactors

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>L4</b>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Test, install and connect electrical machines (Transformers, Single and three Phase and DC Motors)</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		240	320	
<b>Work situation title: Maintain (disassemble and reassemble) electrical motors, generators &amp; alternators</b>	<b>Total hours</b>	40	80	
<b>Work scenario:</b> Sally is tasked with the repair of an array of alternators, generators and motors. The items will be used as emergency stock at the crushers. All repairs must be done according to the OEM Specification. Safety is premium therefore PPE is a non-negotiable.				
<b>Prerequisite learning:</b> Year 2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	<b>80%</b>	<b>Knowledge modules (KM)</b>	<b>20%</b>	<b>Work experience modules (WM)</b>
<b>PM-13-PS01: Dismantle and test DC and AC motors, generators, alternators and transformers</b>  <i>Given a range of single and three phase AC and DC motors, alternators, generators, and transformers, relevant tools, materials and equipment and manufacturers' specifications,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0101 Review the maintenance information, determine the scope of work and plan the operation</li> <li>PA0102 Collect all required tools and personal protective equipment, prepare the work space and complete a risk assessment</li> <li>PA0103 Strip and unpack the motors, generators, alternators and transformers, remove bearings where required and inspect and record any</li> </ul>		Knowledge of:  <u>Applied Knowledge</u>  <b>PM-13-PS01: Dismantle and test DC and AC motors, generators, alternators and transformers</b> <ul style="list-style-type: none"> <li>AK0101 Safe work procedures</li> <li>AK0102 Construction of motors and assembly sequences</li> <li>AK0103 Hazard identification and risk assessment practices</li> <li>AK0104 Purposes, methods and techniques of marking components</li> <li>AK0105 Environmentally methods of disposal for various materials</li> <li>AK0106 Common electrical, mechanical faults and bearing faults and defects</li> <li>AK0107 Test equipment, procedures, measurements and records</li> <li>AK0108 Methods and techniques for compiling technical reports</li> <li>AK0109 Methods and techniques of</li> </ul>		<b>WM-04-WE02: Overhaul electrical and mechanical sub-assemblies and machines under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b> <ul style="list-style-type: none"> <li>Gather the necessary technical information, maintenance history and plan the overhauling process</li> <li>Conduct risk assessments, perform lock-out and tag out procedures where applicable and prepare work site</li> <li>Dismantle, measure, test and identify faults and determine the serviceability of components</li> <li>Compile reports, and parts and materials lists and draw parts and materials</li> <li>Repair, replace or modify components as required</li> <li>Assemble, test and adjust parts and components</li> <li>Commission machinery</li> <li>Restore the work area and dispose of</li> </ul>



<p>mechanical defects</p> <ul style="list-style-type: none"> <li>• PA0104 Mark components as required</li> <li>• PA0105 Test, identify and record faulty electrical components</li> <li>• PA0106 Clean and store all components</li> <li>• PA0107 Compile technical reports</li> <li>• PA0108 Clean the work area and dispose of used materials</li> </ul> <p><b>PM-13-PS02: Re-assemble DC and AC motors, generators, alternators and transformers</b></p> <ul style="list-style-type: none"> <li>• PA0201 Review the maintenance information, determine the scope of work and plan the operation</li> <li>• PA0202 Collect all required tools and personal protective equipment, prepare the work space and complete a risk assessment</li> <li>• PA0203 Fit bearings and seals as required</li> <li>• PA0204 Re-assemble the motors, generators, alternators and transformers using orientation and alignment markings</li> <li>• PA0205 Inspect, check and test reassembled motors, generators, alternators and transformers</li> <li>• PA0206 Conduct in-process and functionality tests</li> <li>• PA0207 Clean the work area and dispose of used materials</li> </ul>	<p>diagnosing typical faults and defects</p> <ul style="list-style-type: none"> <li>• AK0110 Methods and techniques of applying temporary electrical power</li> </ul> <p><b>PM-13-PS02: Re-assemble DC and AC motors, generators, alternators and transformers</b></p> <ul style="list-style-type: none"> <li>• AK0201 Safe work procedures</li> <li>• AK0202 Hazard identification and risk assessment practices</li> <li>• AK0203 Standard operating procedures</li> <li>• AK0204 Motor assembly methods and techniques</li> <li>• AK0205 Common motor faults</li> </ul>	<p>waste materials</p> <ul style="list-style-type: none"> <li>• Interact with production personnel, where applicable</li> <li>• Complete all relevant documentation</li> <li>• Communicate with relevant parties</li> <li>• <b>Disassemble, inspect/maintain and reassemble DC and AC motors, generators, alternators and transformers as per required standards</b></li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<b>PM-13-PS01: Dismantle and test DC and AC</b>	<b>Supporting Evidence:</b>	

<p><b>motors, generators, alternators and transformers</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Hazards and risks are identified and responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</li> <li>• IAC0102 All disassembly work is carried out safely and correctly</li> <li>• IAC0103 All mechanical and electrical faults are identified and recorded correctly</li> <li>• IAC0104 The correct stripping sequence is followed</li> <li>• IAC0105 The correct tools and equipment are used for each operation</li> <li>• IAC0106 All components are marked to maintain orientation and alignment of components</li> <li>• IAC0107 There is no damage to tools, equipment or components</li> <li>• IAC0108 Components are cleaned and stored correctly</li> <li>• IAC0109 All work is done according to the work instruction</li> <li>• IAC0110 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> <li>• IAC0111 Critical issues relating to dismantling and testing AC and DC motors, alternators, generators, and transformers are described and explained</li> </ul> <p><b>PM-13-PS02: Re-assemble DC and AC motors, generators, alternators and transformers</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Hazards and risks are identified and</li> </ul>		<p><b>WM-04, Overhauling of electrical and mechanical sub-assemblies and machines</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>
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<p>responded to in a responsible manner in accordance with accepted hazard identification and risk assessment practices</p> <ul style="list-style-type: none"> <li>• IAC0202 All assembly and testing work is carried out safely and correctly</li> <li>• IAC0203 The correct assembly sequences are followed</li> <li>• IAC0204 The correct tools and equipment are used for each operation</li> <li>• IAC0205 All components are assembled and aligned according to their markings</li> <li>• IAC0206 There is no damage to tools, equipment or components</li> <li>• IAC0207 Correct in-process and functionality tests are carried out</li> <li>• IAC0208 All work is done according to the work instruction</li> <li>• IAC0209 Work area is cleaned according to standards and materials are disposed of in an environmentally acceptable manner</li> <li>• IAC0210 Critical issues relating to reassembling AC and DC motors, alternators, generators, and transformers are described and explained</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (45min) and the competency will be at 80%</li> <li>• Practical exercise of 60min covering all above-mentioned items</li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>• Use of PPE</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All other assessment items</li> </ul> <p><b>Learning resources for teaching</b></p>		

- Learning material on Knowledge and Practical Skills Modules.
- Print materials, electronic files, software applications
- Set of presentation aids (videos, slides) for overhead or LED/LCD projectors

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Multi-meter
- Insulation resistance tester
- Training panel
- Set of Spanners
- Socket set
- Bearing pullers
- Bearing heaters
- Allen key set
- Tube spanners
- Rubber mallet
- Temperature measuring devices
- Bearing drifter set
- Set of screwdrivers
- Torx wrench set

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>M1</h1>			
		<b>Curriculum code: 671202000</b>					
<b>Learning area title: Perform work activities on hydraulic and pneumatic systems</b>		<b>Total hours</b>				<b>SDP</b>	<b>WP</b>
						272	264
<b>Work situation title: Build and test basic hydraulic flow circuits</b>		<b>Total hours</b>		80	80		
<b>Work scenario:</b> Bona is tasked to build a Hydraulic System to operate a lifting platform. The Hydraulic system must conform to the parameters stipulated by the design team. The system must adhere to all safety standards and tested to perform optimally before the system is declared operable.							
<b>Prerequisite learning:</b> Year 1							
<b>INTEGRATED LEARNING CONTENT</b>							
<b>Practical skills modules (PM)</b>		<b>Knowledge modules (KM)</b>		<b>Work experience modules (WM)</b>			
80%		20%					
<p><b>PM-04-PS01: Build and test basic hydraulic circuits</b></p> <p><i>Given work instructions for a range of basic hydraulic circuits, related components including sensors and actuators, drawings, schematics and relevant tools,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0101 Read and interpret symbols, diagrams and schematics and identify the related components</li> <li>PA0102 Describe the role and function of each component within the circuit</li> <li>PA0103 Interpret work instructions, select the relevant tools, equipment, components and personal protective equipment for each task, prepare the work area and conduct a risk assessment</li> <li>PA0104 Use all relevant personal protective equipment and apply all relevant health, safety and environmental precautions</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT10: Mechanical working principles, types and applications of hydraulic systems</b></p> <ul style="list-style-type: none"> <li>KT1001 Hydraulic systems</li> <li>KT1002 Units of measurement in hydraulic systems (pressure, flow rate, area)</li> <li>KT1003 Hydraulic symbols and circuits</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-04-PS01: Build and test basic hydraulic circuits</b></p> <ul style="list-style-type: none"> <li>AK0101 Hydraulic components and related symbols</li> <li>AK0102 Drawing and schematic conventions</li> <li>AK0103 Measurement and testing methods and techniques</li> <li>AK0104 Typical hydraulic faults</li> <li>AK0105 Removal and replacement techniques</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities under supervision:</p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>WA0203 Conduct pre-maintenance inspections and identify and report any problems</li> <li>WA0204 Perform maintenance in accordance with the manufacturers'</li> </ul>			

<ul style="list-style-type: none"> <li>• PA0105 Build and test basic hydraulic circuits</li> <li>• PA0106 Remove, test and replace hydraulic components</li> <li>• PA0107 Identify typical hydraulic faults</li> <li>• PA0108 Care for tools and equipment and clean and restore the work area</li> </ul>	<ul style="list-style-type: none"> <li>• AK0106 Typical hazards and safety, health and environment related risks</li> <li>• AK0107 Applicable safety, health and environmental requirements and practices</li> </ul>	<p>maintenance schedule and specifications on at least five different pieces of industrial machinery</p> <ul style="list-style-type: none"> <li>• WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0206 Restore the work area and dispose of waste materials</li> <li>• WA0207 Interact with production personnel, where applicable</li> <li>• WA0208 Complete maintenance reports</li> <li>• WA0209 Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-04-PS01: Build and test basic hydraulic circuits</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Circuits are assembled correctly and meet specifications</li> <li>• IAC0102 All faults are identified and corrected</li> <li>• IAC0103 All components and symbols are identified correctly and their role and function correctly described</li> <li>• IAC0104 All tools and equipment are correctly and safely used and cared for</li> <li>• IAC0105 Safe working practices are applied</li> <li>• IAC0106 Components are correctly handled and tested</li> </ul>	<p><b>KM-04-KT10: Mechanical working principles, types and applications of hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• IAC1001 Components and functions of hydraulic systems are identified and described</li> <li>• IAC1002 Units of measurement in hydraulic systems are calculated</li> <li>• IAC1003 Hydraulic symbols and circuits are read and interpreted</li> <li>• IAC1004 Safety precautions pertaining to hydraulic systems are explained</li> </ul>	<p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• SE0203 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> </ul>		

- Practical exercise of 60min length covering all associated tasks and procedures.
  - No injury or unsafe act had occurred
  - Interpret symbols and abbreviations.
  - Interpret elementary hydraulic circuit diagrams.
  - Identify the following hydraulic fluids:
    - petroleum based
    - emulsion based
  - Install and maintain the following filters:
    - suction
    - pressure
    - return
  - Install and maintain hydraulic tubing and fittings.
  - Install and maintain flexible hydraulic hoses and fittings.
  - All safety aspects adhered to according company policies
  - No damage to equipment
  - Take readings off pressure and flow meters

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of Hydraulic Fluids, Valves and power packs
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment;: Overalls; Safety Boots; Safety Goggles
- Hydraulic basic Simulation stand and equipment
- Tools include but not limited to: Spanner set, Allen key set, screw drivers, Flow and Pressure Gauges,

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>M2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on hydraulic &amp; pneumatic systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		272	264	
<b>Work situation title: Build and test basic pneumatic circuits</b>	<b>Total hours</b>	64	56	
<b>Work scenario:</b> Jona is tasked to build a pneumatic system to operate a Transfer chute. The Pneumatic system must conform to the parameters stipulated by the design team. The system must adhere to all safety standards and tested to perform optimally before the system is declared operable.				
<b>Prerequisite learning:</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<b>PM-04-PS02: Build and test basic pneumatic circuits</b>  <i>Given work instructions for a range of basic pneumatic circuits, related components, drawings, schematics, relevant tools and equipment,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0201 Read and interpret symbols, diagrams and schematics and identify the related components</li> <li>PA0202 Describe the role and function of each component within the circuit</li> <li>PA0203 Interpret work instructions, select the relevant tools, equipment, components and personal protective equipment for each task, prepare the work area and conduct a risk assessment</li> <li>PA0204 Use all relevant personal protective equipment and apply all relevant health, safety and</li> </ul>		Knowledge of:  <b>KM-04-KT11: Mechanical working principles, types and applications of pneumatic systems</b> <ul style="list-style-type: none"> <li>KT1101 Pneumatic systems</li> <li>KT1102 Units of measurement in pneumatic systems (pressure, flow rate, area)</li> <li>KT1103 Pneumatic symbols and circuits</li> <li>KT1104 Safety precautions pertaining to pneumatic systems are explained</li> </ul> <u>Applied Knowledge</u>  <b>PM-04-PS02: Build and test basic pneumatic circuits</b> <ul style="list-style-type: none"> <li>AK0201 Pneumatic components and related symbols</li> <li>AK0202 Drawing and schematic conventions</li> <li>AK0203 Measurement and testing methods and techniques</li> <li>AK0204 Typical pneumatic faults</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:  <b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b> <ul style="list-style-type: none"> <li>WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>WA0203 Conduct pre-maintenance inspections and identify and report any problems</li> <li>WA0204 Perform maintenance in accordance with the manufacturers'</li> </ul>



<p>environmental precautions</p> <ul style="list-style-type: none"> <li>PA0205 Build and test basic pneumatic circuits</li> <li>PA0206 Identify and correct faults</li> <li>PA0207 Remove, test and replace pneumatic components</li> <li>PA0208 Care for tools and equipment and clean and restore the work area</li> </ul>	<ul style="list-style-type: none"> <li>AK0205 Removal and replacement techniques</li> <li>AK0206 Typical hazards and safety, health and environment related risks</li> <li>AK0207 Applicable safety, health and environmental requirements and practices</li> </ul>	<p>maintenance schedule and specifications on at least five different pieces of industrial machinery</p> <ul style="list-style-type: none"> <li>WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>WA0206 Restore the work area and dispose of waste materials</li> <li>WA0207 Interact with production personnel, where applicable</li> <li>WA0208 Complete maintenance reports</li> <li>WA0209 Communicate with relevant parties</li> <li>Perform housekeeping as per industry standards</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-04-PS02: Build and test basic pneumatic circuits</b></p> <ul style="list-style-type: none"> <li>IAC0201 Circuits are assembled correctly and meet specifications</li> <li>IAC0202 All components and symbols are identified correctly and their role and function correctly described</li> <li>IAC0203 All faults identified and corrected</li> <li>IAC0204 All tools and equipment are correctly and safely used and cared for</li> <li>IAC0205 Safe working practices are applied</li> <li>IAC0206 Components are correctly handled and tested</li> </ul>	<p><b>KM-04-KT11: Mechanical working principles, types and applications of pneumatic systems</b></p> <ul style="list-style-type: none"> <li>IAC1101 Components and functions of pneumatic systems are identified and described</li> <li>IAC1102 Units of measurement in pneumatic systems are described</li> <li>IAC1103 Pneumatic symbols and circuits are read and interpreted</li> <li>IAC1104 Safety precautions pertaining to pneumatic systems are explained</li> </ul>	<p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>SE0202 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>SE0203 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> <li>Practical exercise of 45min length covering all associated tasks and procedures.</li> </ul>		

- No injury or unsafe act had occurred
- Interpret symbols and abbreviations.
- Interpret elementary Pneumatic circuit diagrams.
- Install and maintain Pneumatic tubing and fittings.
- Install and maintain flexible hoses and fittings.
- All safety aspects adhered to according company policies
- Damage to equipment

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of Pneumatic Valves and power packs
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Pneumatic basic Simulation stand and equipment
- Spanners set
- Allen key set
- Screw driver
- Pipe wrench
- Pipe cutter
- Hacksaw
- Valves and fittings
- Tape measure
- Smooth half round file

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>M3</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on hydraulic &amp; pneumatic systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		272	264	
<b>Work situation title: Perform routine maintenance, fault finding, repair and reassembly activities on hydraulic systems</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Mona is tasked with routine maintenance on a beneficiation plant. The Hydraulic system forms part of the weekly schedule which need to be inspected to ensure optimal performance for the shift. She has a list of hydraulic components that require replacing. The system must conform to OEM standard after he has completed replacing all the items on the list and the system is declared operable.				
<b>Prerequisite learning:</b> M1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-08-PS09: Clean and inspect hydraulic systems</b></p> <p><i>Given a selection of simple hydraulic systems including the power pack, relevant drawings, tools, personal protective equipment, specifications, cleaning materials and solvents,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0901 Plan and prepare for cleaning and inspecting a hydraulic system</li> <li>PA0902 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>PA0903 Read and interpret hydraulic</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT10: Mechanical working principles, types and applications of hydraulic systems</b></p> <ul style="list-style-type: none"> <li>KT1001 Hydraulic systems</li> <li>KT1002 Units of measurement in hydraulic systems (pressure, flow rate, area)</li> <li>KT1003 Hydraulic symbols and circuits</li> <li>Cleaning of system</li> <li>Heat detection</li> <li>Power-pack systems</li> <li>Baffle-plate</li> <li>Breather</li> </ul> <p><u>Applied Knowledge</u></p>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>WM-01-WE01: Observe and assist a qualified millwright, electrician or fitter in the maintenance of equipment, control systems and installations for at least 40 hours</b></p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <p><b>WM-01-WE03: Undertake all</b></p>

<p>diagrams</p> <ul style="list-style-type: none"> <li>• PA0904 Select tools and cleaning materials</li> <li>• PA0905 Clean a hydraulic system</li> <li>• PA0906 Visually inspect a hydraulic system for leaks, wear, damage, defects, and failures according to Original Equipment Manufacturer specifications</li> <li>• PA0907 Conduct post-cleaning and inspecting activities</li> <li>• <b>Housekeeping executed according to Industry standards</b></li> </ul> <p><b>PM-10-PS08: Do fault-finding on hydraulic systems</b></p> <p><i>Given practical assignments, hydraulic systems including the power pack, tools, diagnostic equipment, hydraulic circuit diagrams, personal protective equipment and specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0801 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0802 Visually inspect or assess hydraulic system condition</li> <li>• PA0803 Identify possible faults</li> <li>• PA0804 Determine corrective actions</li> </ul>	<p><b>PM-08-PS09: Clean and inspect hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• AK0901 Procedures to clean and inspect hydraulic systems</li> <li>• AK0902 Original Equipment Manufacturer specifications for a hydraulic system</li> <li>• AK0903 Components of a hydraulic system</li> <li>• AK0904 Signs and causes of leaks, wear, damage, failure and defects</li> <li>• AK0905 Types and applications of hydraulic systems</li> </ul> <p><b>PM-10-PS08: Do fault-finding on hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• AK0801 Procedures to diagnose hydraulic system problems</li> <li>• AK0802 Procedures to do fault-finding on a hydraulic system</li> <li>• AK0803 Original Equipment Manufacturer specifications for a hydraulic system</li> <li>• AK0804 Signs, symptoms and causes of faults on hydraulic systems</li> <li>• AK0805 Types of hydraulic system faults</li> <li>• AK0806 Possible corrective actions and options to repair faults</li> </ul> <p><b>PM-11-PS07: Repair hydraulic systems</b></p>	<p><b>activities without assistance, but under supervision of a qualified millwright, electrician or fitter, in maintenance processes for equipment, control systems and installations for at least 320 hours</b></p> <ul style="list-style-type: none"> <li>• WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>• WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• WA0203 Conduct pre-maintenance inspections and identify and report any problems</li> <li>• WA0204 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least five different pieces of industrial machinery</li> <li>• WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0206 Restore the work area and dispose of waste materials</li> </ul>
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<p>and options for dealing with identified faults</p> <ul style="list-style-type: none"> <li>• PA0805 Report faults or defects on a hydraulic system</li> <li>• PA0806 Conduct post-diagnosis and fault-finding activities</li> </ul> <p><b>PM-11-PS07: Repair hydraulic systems</b></p> <p><i>Given a faulty hydraulic system including the power pack, replacement components, lubricants, diagnostic information, sequence of work, specifications, tools and personal protective equipment,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0701 Read and interpret the practical assignments on specific repairs required</li> <li>• PA0702 Read and interpret the standard repair specifications and quality requirements from the manufacturer</li> <li>• PA0703 Identify components, parts, seals, lubricants and specifications of these that must be available for repair</li> <li>• PA0704 Plan the sequence of work to repair the hydraulic system</li> <li>• PA0705 Identify potential hazards and risks related to the job and list the</li> </ul>	<ul style="list-style-type: none"> <li>• AK0701 Procedures for repairing hydraulic systems</li> <li>• AK0702 Safety practices and procedures</li> <li>• AK0703 Hydraulic system disassembly and assembly procedures</li> <li>• AK0704 Hydraulic system component replacement procedures</li> <li>• AK0705 Lubricants, seals and parts specifications and part numbers</li> <li>• AK0706 Use and care of tools and equipment</li> <li>• AK0707 Post repair activities</li> </ul> <p><b>PM-09-PS08: Replace hydraulic components and assemble hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• AK0801 Procedures to replace hydraulic system components</li> <li>• AK0802 Procedures to assemble a hydraulic system</li> <li>• AK0803 Applications of hydraulic systems and specifications</li> <li>• AK0804 Hydraulic system components and applications</li> <li>• AK0805 Types and applications of hydraulic fluids</li> </ul> <p><b>Overhaul a mechanical machine that incorporates a hydraulic and pneumatic system</b></p> <ul style="list-style-type: none"> <li>• Manufacture specifications</li> <li>• Overhauling procedures</li> </ul>	<ul style="list-style-type: none"> <li>• WA0207 Interact with production personnel, where applicable</li> <li>• WA0208 Complete maintenance reports</li> <li>• WA0209 Communicate with relevant parties</li> </ul>
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<p>appropriate responses</p> <ul style="list-style-type: none"> <li>• PA0706 Identify, select and use the required hand tools, power tools and equipment</li> <li>• PA0707 Disassemble the hydraulic system following the specified procedure</li> <li>• PA0708 Inspect components and parts and confirm required repairs</li> <li>• PA0709 Replace components or parts following the specified procedure</li> <li>• PA0710 Check and fill hydraulic fluids if required</li> <li>• PA0711 Check and confirm that repairs have resolved the problem or fault</li> <li>• PA0712 Conduct post-repair activities</li> </ul> <p><b>PM-09-PS08: Replace hydraulic components and assemble hydraulic systems</b></p> <p><i>Given a selection of various hydraulic systems and components including the power pack, relevant tools, hydraulic circuit diagrams, personal protective equipment, specifications and material,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0801 Plan and prepare for replacing hydraulic system components and</li> </ul>		
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<p>assembling a hydraulic system</p> <ul style="list-style-type: none"> <li>• PA0802 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0803 Select tools, materials, equipment and hydraulic fluids</li> <li>• PA0804 Replace worn, damaged or defective components and parts</li> <li>• PA0805 Assemble, set and record hydraulic component or part numbers and specifications</li> <li>• PA0806 Check and fill hydraulic fluids</li> <li>• PA0807 Conduct post-assembly activities</li> <li>• <b>Housekeeping executed according to Industry standards</b></li> </ul> <p><b>Overhaul a mechanical machine that incorporates a hydraulic and pneumatic system</b></p> <p><i>Given used machines that incorporates a hydraulic and pneumatic system, worn components, tools, access to everything needed to overhaul the machine, personal protective equipment, specifications</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Identify and select specific tools, equipment and materials required for the overhaul process</li> <li>• Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• Disassemble the machine and prepare the components for inspection</li> </ul>		
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<ul style="list-style-type: none"> <li>• Inspect the components and draw up a material and replacement parts list</li> <li>• Replace all worn parts to specification</li> <li>• Assemble and restore the machine to conform to the service tolerances specified in the manufacturer specifications</li> <li>• Perform post overhauling activities</li> <li>• Perform Housekeeping as per industry standards</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-08-PS09: Clean and inspect hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• IAC0901 Procedures to clean and inspect a hydraulic system are explained</li> <li>• IAC0902 A hydraulic system is cleaned and inspected according to procedure</li> <li>• IAC0903 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0904 Leaks, wear, damage, defects and failures on a hydraulic system are identified and explained correctly</li> <li>• IAC0905 Hydraulic system types and Original Equipment Manufacturer specifications are explained</li> </ul> <p><b>PM-10-PS08: Do fault-finding on hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Defects or faults on a hydraulic system are identified correctly</li> </ul>	<p><b>KM-04-KT10: Mechanical working principles, types and applications of hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• IAC1001 Components and functions of hydraulic systems are identified and described</li> <li>• IAC1002 Units of measurement in hydraulic systems are calculated</li> <li>• IAC1003 Hydraulic symbols and circuits are read and interpreted</li> <li>• IAC1004 Safety precautions pertaining to hydraulic systems are explained</li> </ul>	<p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• SE0203 Applicable job cards</li> </ul>



<ul style="list-style-type: none"> <li>• IAC0802 Corrective actions and options are explained correctly and motivated</li> <li>• IAC0803 A systematic fault-finding process is followed</li> <li>• IAC0804 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-11-PS07: Repair hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Instructions and repair specifications are interpreted correctly</li> <li>• IAC0702 Hydraulic system components and specifications are identified correctly</li> <li>• IAC0703 The hydraulic system is disassembled and reassembled correctly</li> <li>• IAC0704 Faulty components are identified and replaced correctly</li> <li>• IAC0705 Sequences to repair the hydraulic system are followed correctly</li> <li>• IAC0706 Tools and equipment are identified and used correctly</li> <li>• IAC0707 Post repair activities are performed correctly</li> <li>• IAC0708 Safety requirements are met</li> </ul> <p><b>PM-09-PS08: Replace hydraulic components and assemble hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Procedures to replace hydraulic system components and assemble a hydraulic system are explained</li> <li>• IAC0802 Hydraulic components are</li> </ul>		
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<p>replaced according to procedures and specifications</p> <ul style="list-style-type: none"> <li>• IAC0803 A hydraulic system is assembled according to procedures and Original Equipment Manufacturer specifications</li> <li>• IAC0804 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>Overhaul a mechanical machine that incorporates a hydraulic and pneumatic system</b></p> <ul style="list-style-type: none"> <li>• Safety requirements are met</li> <li>• <input type="checkbox"/> Overhauling specifications and quality requirements are explained accurately</li> <li>• Tools, equipment, materials and parts are identified and described correctly</li> <li>• The sequence of activities to overhaul the machine is adhered to</li> <li>• The final product meets service tolerances specified in the manufacturer specifications</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 60min length covering all associated tasks and procedures. <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ Interpret symbols and abbreviations.</li> <li>○ Interpret elementary hydraulic circuit diagrams.</li> <li>○ Identify the following hydraulic fluids:</li> </ul> </li> </ul>		

- petroleum based
- emulsion based
- Install and maintain the following filters:
  - suction
  - pressure
  - return
- Install and maintain hydraulic tubing and fittings.
- Install and maintain flexible hydraulic hoses and fittings.
- Identify the following hydraulic pumps - vane, gear, piston.
- Install and maintain hydraulic pumps.
- Service procedures of reservoir.
- Install and maintain directional control, pressure and flow control valves.
- Install and maintain hydraulic cylinders.
- Identify and install accumulators.
- Diagnose faults in basic hydraulic systems.
- No damage to equipment

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of Hydraulic Fluids, Valves and power packs
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Hydraulic basic Simulation stand and equipment
- Tools include but not limited to: Spanner set, Allen key set, screw drivers, Flow and Pressure Gauges

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>M4</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on hydraulic &amp; pneumatic systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		272	264	
<b>Work situation title: Perform routine maintenance, fault finding, repair and reassembly activities on pneumatic systems</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Daniel is tasked with routine maintenance on a transfer plant. The pneumatic system forms part of the daily inspection schedule to ensure optimal performance for the shift. He is also tasked with the necessary repairs. After disassembly he inspects the barrel for any scorch marks and the piston shaft for any damage. The piston seals and the neck seals on the pneumatic cylinder are replaced. After reassembly he performs the necessary tests. The system must conform to OEM standard and all prescribed tasks must be executed before the system is declared operable				
<b>Prerequisite learning:</b> M2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-08-PS10: Clean and inspect pneumatic systems</b></p> <p><i>Given a selection of simple pneumatic systems, relevant drawings, tools, personal protective equipment, specifications, cleaning materials and solvents,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA1001 Plan and prepare for cleaning and inspecting a pneumatic system</li> <li>PA1002 Identify potential hazards and risks related to the job and list the appropriate responses</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT11: Mechanical working principles, types and applications of pneumatic systems</b></p> <ul style="list-style-type: none"> <li>KT1101 Pneumatic systems</li> <li>KT1102 Units of measurement in pneumatic systems (pressure, flow rate, area)</li> <li>KT1103 Pneumatic symbols and circuits</li> <li>KT1104 Safety precautions pertaining to pneumatic systems are explained</li> </ul> <p><b>KM-04-KT13: Diagnostic techniques</b></p> <ul style="list-style-type: none"> <li>KT1301 Diagnostic equipment</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>WA0202 Conduct risk assessments, perform the lock-out</li> </ul>

<ul style="list-style-type: none"> <li>• PA1003 Read and interpret pneumatic diagrams</li> <li>• PA1004 Select tools and cleaning materials</li> <li>• PA1005 Clean a pneumatic system</li> <li>• PA1006 Visually inspect a pneumatic system for leaks, wear, damage, defects, and failures according to Original Equipment Manufacturer specifications</li> <li>• PA1007 Conduct post-cleaning and inspecting activities</li> <li>• <b>Housekeeping executed according to industry standard</b></li> </ul> <p><b>PM-10-PS09: Do fault-finding on pneumatic systems</b></p> <p><i>Given a practical assignment, pneumatic system, tools, diagnostic equipment, pneumatic circuit diagrams, personal protective equipment and specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0901 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0902 Visually inspect or assess pneumatic system condition</li> <li>• PA0903 Identify possible faults</li> <li>• PA0904 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0905 Report faults or defects on pneumatic system</li> </ul>	<ul style="list-style-type: none"> <li>• KT1302 Diagnostic techniques</li> <li>• KT1303 Diagnostic testing</li> <li>• <b>Basic knowledge of compressor</b></li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-08-PS10: Clean and inspect pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• AK1001 Procedures to clean and inspect pneumatic systems</li> <li>• AK1002 Original Equipment Manufacturer specifications for a pneumatic system</li> <li>• AK1003 Components of a pneumatic system</li> <li>• AK1004 Signs and causes of leaks, wear, damage, failure and defects</li> <li>• AK1005 Types and applications of pneumatic systems</li> </ul> <p><b>PM-10-PS09: Do fault-finding on pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• AK0901 Procedures to diagnose pneumatic system problems</li> <li>• AK0902 Procedures to do fault-finding on a pneumatic system</li> <li>• AK0903 Original Equipment Manufacturer specifications for a pneumatic system</li> <li>• AK0904 Signs, symptoms and causes of faults on pneumatic systems</li> </ul>	<p>and tag out procedures where applicable and prepare the work sites</p> <ul style="list-style-type: none"> <li>• WA0203 Conduct pre-maintenance inspections and identify and report any problems</li> <li>• WA0204 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least five different pieces of industrial machinery</li> <li>• WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0206 Restore the work area and dispose of waste materials</li> <li>• WA0207 Interact with production personnel, where applicable</li> <li>• WA0208 Complete maintenance reports</li> <li>• WA0209 Communicate with relevant parties</li> </ul>
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<ul style="list-style-type: none"> <li>• PA0906 Conduct post-diagnosis and fault-finding activities</li> </ul> <p><b>PM-11-PS08: Repair pneumatic systems</b></p> <p>Given a faulty pneumatic system, replacement components, lubricants, diagnostic information, sequence of work, specifications, tools and personal protective equipment,</p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0801 Read and interpret the practical assignments on specific repairs required</li> <li>• PA0802 Read and interpret the standard repair specifications and quality requirements from the manufacturer</li> <li>• PA0803 Identify components, parts, seals, lubricants and specifications of these that must be available for repair</li> <li>• PA0804 Plan the sequence of work to repair the pneumatic system</li> <li>• PA0805 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0806 Identify, select and use the required hand tools, power tools and equipment</li> <li>• PA0807 Disassemble the pneumatic system following the specified procedure</li> <li>• PA0808 Inspect components and parts and confirm required repairs</li> <li>• PA0809 Replace components or parts</li> </ul>	<ul style="list-style-type: none"> <li>• AK0905 Types of pneumatic system faults</li> <li>• AK0906 Possible corrective actions and options to repair faults</li> </ul> <p><b>PM-11-PS08: Repair pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• AK0801 Procedures for repairing pneumatic systems</li> <li>• AK0802 Safety practices and procedures</li> <li>• AK0803 Pneumatic system disassembly and assembly procedures</li> <li>• AK0804 Pneumatic system component replacement procedures</li> <li>• AK0805 Lubricants, seals and parts specifications and part numbers</li> <li>• AK0806 Use and care of tools and equipment</li> <li>• AK0807 Post repair activities</li> </ul> <p><b>PM-09-PS09: Replace pneumatic components and assemble pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• AK0901 Procedures to replace pneumatic system components</li> <li>• AK0902 Procedures to assemble a pneumatic system</li> <li>• AK0903 Types and applications of pneumatic systems and specifications</li> <li>• AK0904 Pneumatic system components and application</li> </ul> <p><b>Overhaul a mechanical machine that</b></p>	
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<p>following the specified procedure</p> <ul style="list-style-type: none"> <li>• PA0810 Reassemble the pneumatic system following the specified procedure</li> <li>• PA0811 Check and confirm that repairs have resolved the problem or fault</li> </ul> <p>PA0812 Conduct post-repair activities</p> <p><b>PM-09-PS09: Replace pneumatic components and assemble pneumatic systems</b></p> <p><i>Given a selection of various pneumatic systems and components, relevant tools, pneumatic circuit diagrams, personal protective equipment, specifications and materials,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0901 Plan and prepare for replacing components of a pneumatic system and for assembling a pneumatic system</li> <li>• PA0902 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0903 Select tools, materials and equipment</li> <li>• PA0904 Replace worn, damaged or defective components and parts</li> <li>• PA0905 Assemble, set and record pneumatic component or part numbers and specifications</li> <li>• PA0906 Conduct post assembly activities</li> <li>• <b>Housekeeping executed according to</b></li> </ul>	<p><b>incorporates a hydraulic and pneumatic system</b></p> <ul style="list-style-type: none"> <li>• <b>Manufacture specifications</b></li> <li>• <b>Overhauling procedures</b></li> </ul>	
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<p>industry standard</p> <p><b>Overhaul a mechanical machine that incorporates a hydraulic and pneumatic system</b></p> <p><i>Given used machines that incorporates a hydraulic and pneumatic system, worn components, tools, access to everything needed to overhaul the machine, personal protective equipment, specifications</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Identify and select specific tools, equipment and materials required for the overhaul process</li> <li>• Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• Disassemble the machine and prepare the components for inspection</li> <li>• Inspect the components and draw up a material and replacement parts list</li> <li>• Replace all worn parts to specification</li> <li>• Assemble and restore the machine to conform to the service tolerances specified in the manufacturer specifications</li> <li>• Perform post overhauling activities</li> <li>• Perform housekeeping as per industry standards</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<b>PM-08-PS10: Clean and inspect pneumatic systems</b>	<b>KM-04-KT11: Mechanical working principles, types and applications of pneumatic systems</b>	<b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified</b>



<ul style="list-style-type: none"> <li>• IAC1001 Procedures to clean and inspect a pneumatic system are explained</li> <li>• IAC1002 A pneumatic system is cleaned and inspected according to procedure</li> <li>• IAC1003 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC1004 Leaks, wear, damage, defects and failures on a pneumatic system are identified and explained correctly</li> <li>• IAC1005 Pneumatic system types and Original Equipment Manufacturer specifications are explained</li> </ul> <p><b>PM-10-PS09: Do fault-finding on pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• IAC0901 Defects or faults on a pneumatic system are identified correctly</li> <li>• IAC0902 Corrective action options are explained correctly</li> <li>• IAC0903 A systematic fault-finding process is followed</li> <li>• IAC0904 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-11-PS08: Repair pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Instructions and repair</li> </ul>	<ul style="list-style-type: none"> <li>• IAC1101 Components and functions of pneumatic systems are identified and described</li> <li>• IAC1102 Units of measurement in pneumatic systems are described</li> <li>• IAC1103 Pneumatic symbols and circuits are read and interpreted</li> <li>• IAC1104 Safety precautions pertaining to pneumatic systems are explained</li> </ul> <p><b>KM-04-KT13: Diagnostic techniques</b></p> <ul style="list-style-type: none"> <li>• IAC1301 Types of diagnostic equipment are identified and described</li> <li>• IAC1302 The various types of diagnostic techniques are described</li> <li>• IAC1303 The sequence involved in a diagnostic procedure or technique is explained</li> <li>• IAC1304 Safety precautions pertaining to diagnostic equipment are explained</li> </ul>	<p><b>millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• SE0203 Applicable job cards</li> </ul>
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<p>specifications are interpreted correctly</p> <ul style="list-style-type: none"> <li>• IAC0802 Pneumatic system components and specifications are identified correctly</li> <li>• IAC0803 The pneumatic system is disassembled and reassembled correctly</li> <li>• IAC0804 Faulty components are identified and replaced correctly</li> <li>• IAC0805 Sequences to repair the pneumatic system are followed correctly</li> <li>• IAC0806 Tools and equipment are identified and used correctly</li> <li>• IAC0807 Post repair or overhaul activities are performed correctly</li> <li>• IAC0808 Safety requirements are met</li> </ul> <p><b>PM-09-PS09: Replace pneumatic components and assemble pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• IAC0901 Procedures to replace pneumatic system components and assemble a pneumatic system are explained</li> <li>• IAC0902 Pneumatic components are replaced according to procedures and specifications</li> <li>• IAC0903 A pneumatic system is assembled according to procedures and Original Equipment Manufacturer specifications</li> <li>• IAC0904 Risks and hazards are identified and responded to in a responsible manner</li> </ul>		
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<p><b>Overhaul a mechanical machine that incorporates a hydraulic and pneumatic system</b></p> <ul style="list-style-type: none"> <li>• Safety requirements are met</li> <li>• Overhauling specifications and quality requirements are explained accurately</li> <li>• Tools, equipment, materials and parts are identified and described correctly</li> <li>• The sequence of activities to overhaul the machine is adhered to</li> <li>• The final product meets service tolerances specified in the manufacturer specifications</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>○ Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> <li>○ Practical exercise of 45min length covering all associated tasks and procedures.</li> <li>○ No injury or unsafe act had occurred</li> <li>○ Interpret symbols and abbreviations.</li> <li>○ Interpret elementary Pneumatic circuit diagrams</li> <li>○ Identify compressed air pipelines</li> <li>○ Maintain air service units</li> <li>○ Maintain directional control, flow control and pressure valves</li> <li>○ Complete the symbol test according</li> <li>○ Set service unit pressure</li> <li>○ Install and maintain Pneumatic tubing and fittings.</li> <li>○ Install and maintain flexible hoses and fittings</li> <li>○ Install and maintain air service units.</li> <li>○ Install and maintain cylinders.</li> <li>○ Install and maintain directional control, flow control and pressure valves.</li> <li>○ Testing of set safety valves.</li> </ul>		

- Recall the service procedure for air receivers
- Diagnose faults in pneumatic systems.
- Complete the symbol test
- Set service unit pressure
- All safety aspects adhered to according company policies
- No damage to equipment

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of Pneumatic Valves and power packs
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- Videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Pneumatic basic simulation stand and equipment
- Spanners set
- Allen key set
- Screw driver
- Pipe wrench
- Pipe cutter
- Hacksaw
- Valves and fittings
- Tape measure
- Smooth half round file

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>M5</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on hydraulic &amp; pneumatic systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		272	264	
<b>Work situation title Perform installation and commissioning activities on hydraulic systems</b>	<b>Total hours</b>	24	24	
<b>Work scenario:</b> Phumi is tasked with the new installation of the power pack that will be driving the furnace hydraulics. She has to connect the pipes according to the hydraulic diagram, fill up the system and bleed the air out. After the installation she has to test the system and ensure that there is no leaks and everything is working according to sequence.				
<b>Prerequisite learning:</b> M3				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>
<p><b>PM-14-PS07: Install hydraulic system components and commission hydraulic systems</b></p> <p><i>Given practical assignments, a repaired hydraulic system component, tools, personal protective equipment, specifications</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0701 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>• PA0702 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> <li>• PA0703 Plan the sequences for installation and commissioning</li> <li>• PA0704 Identify potential hazards and risks related to the job and list the appropriate responses</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT10: Mechanical working principles, types and applications of hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• KT1001 Hydraulic systems</li> <li>• KT1002 Units of measurement in hydraulic systems (pressure, flow rate, area)</li> <li>• KT1003 Hydraulic symbols and circuits</li> <li>• <b>Ensuring no cavitation</b></li> <li>• <b>Adjusting the relief valve</b></li> <li>• <b>Accumulator</b></li> <li>• <b>Time delays</b></li> <li>• <b>Farrell's/olives</b></li> </ul> <p><u>Applied Knowledge</u></p>		<p>The apprentice will be expected to <b>gain practical experience</b> (engage) in the following work activities:</p> <p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission</b></p>

<ul style="list-style-type: none"> <li>• PA0705 Prepare the work area for installation of the hydraulic system</li> <li>• PA0706 Install the lubrication system to specifications</li> <li>• PA0707 Use tools and equipment correctly</li> <li>• PA0708 Follow the correct installation procedures and sequence</li> <li>• PA0709 Check the hydraulic system installation by performing a systematic inspection of all the critical control points</li> <li>• PA0711 Perform post installation and commissioning activities</li> <li>• Use correct Hydraulic fitting fittings</li> <li>• Install steel pipes</li> <li>• Perform Housekeeping as per industry standards</li> </ul>	<p><b>PM-14-PS07: Install hydraulic system components and commission hydraulic systems</b></p> <ul style="list-style-type: none"> <li>• AK0701 Installation of hydraulic system components</li> <li>• AK0702 Operation of hydraulic system</li> <li>• AK0703 Commissioning of hydraulic system</li> <li>• AK0704 Use of and care for tools and equipment</li> </ul>	<p><b>mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• WA0501 Gather the necessary technical information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• WA0502 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• WA0503 Install and align a variety of mechanical sub-assemblies and machines to manufacturers' and workplace specifications, including at least gearboxes, pumps, brakes and hydraulic systems</li> <li>• WA0504 Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• WA0505 Restore the work area and dispose of waste materials</li> <li>• WA0506 Interact with production personnel, where applicable</li> <li>• WA0507 Complete all relevant documentation</li> <li>• <input type="checkbox"/>WA0508 Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-14-PS07: Install hydraulic system components and commission hydraulic systems</b></p>	<p><b>KM-04-KT10: Mechanical working principles, types and applications of hydraulic systems</b></p>	<p><b>Supporting Evidence:</b></p> <p><b>WM-05-WE04: Observe and assist a</b></p>

<ul style="list-style-type: none"> <li>Hydraulic system components are correctly installed in terms of procedure, sequence and specifications</li> <li>Hydraulic system operation is checked and adjusted if necessary</li> <li>Hydraulic system is commissioned as per procedure</li> <li>Quality requirements are met</li> <li>Safety requirements are met</li> </ul>	<ul style="list-style-type: none"> <li>Components and functions of hydraulic systems are identified and described</li> <li>Units of measurement in hydraulic systems are calculated</li> <li>Hydraulic symbols and circuits are read and interpreted</li> <li>Safety precautions pertaining to hydraulic systems are explained</li> </ul>	<p><b>qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission</b></p> <ul style="list-style-type: none"> <li>SE0501 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>SE0502 Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>SE0503 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>Internal knowledge test of a minimum of 10 questions (30 min) and the competency will be at 80%</li> <li>Practical exercise of 45 min length <ul style="list-style-type: none"> <li>No injury or unsafe act had occurred</li> <li>No Injuries to self/co-worker and the environment or damage to equipment</li> <li>Interpret symbols and abbreviations.</li> <li>Interpret elementary hydraulic circuit diagrams.</li> <li>Identify the following hydraulic fluids: <ul style="list-style-type: none"> <li>petroleum based</li> <li>emulsion based</li> </ul> </li> <li>Install and maintain the following filters:</li> </ul> </li> </ul>		

- suction
- pressure
- return
- Install and maintain hydraulic tubing and fittings.
- Install and maintain flexible hydraulic hoses and fittings.
- Identify the following hydraulic pumps - vane, gear, piston.
- Install and maintain hydraulic pumps.
- Service procedures of reservoir.
- Install and maintain directional control, pressure and flow control valves.
- Install and maintain hydraulic cylinders.
- Identify and install accumulators.
- Diagnose faults in basic hydraulic systems.
- Construct the circuit shown on hydraulic diagram to adjust the relief valve
- Systematically test the circuit with pressure gauges and flow meters to detect the fault introduced by the assessor after he has checked the circuit.
- Comply with all safety standards
- The relief valves must be adjusted so that the circuit will operated at the required pressures within the limit of specification
- The fluid flow must be tested at the point/s indicated on the diagram and recorded correctly within the limits of specified litre per minute
- The sequence valves must be adjusted that the system operates at the required sequence.
- All safety aspects adhered to according company policies

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of hydraulic valves and equipment and diagrams
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Intermediate hydraulic simulation with valves, pipes and cylinders



<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>M6</h1>
		<b>Curriculum code:</b> 671202000		
<b>Learning area title:</b> Perform work activities on hydraulic & pneumatic systems	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		272	264	
<b>Work situation title:</b> Perform installation and commissioning activities on pneumatic systems	<b>Total hours</b>	24	24	
<b>Work scenario:</b> Mandla has to install a new pneumatic system for the door on the furnace. He first starts with the new installation for the pneumatic pipeline according to the diagram given. After this he installs the valves and the cylinders. The Electricians connect the new system to their PLC room. Mandla can now test the system and ensures that it works according to the diagram given and according to the correct sequencing.				
<b>Prerequisite learning:</b> M4				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-14-PS08 Install pneumatic system components and commission pneumatic systems</b></p> <p><i>Given practical assignments, a repaired pneumatic system component, tools, personal protective equipment, specifications:</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0801 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>PA0802 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT11: Mechanical working principles, types and applications of pneumatic systems</b></p> <ul style="list-style-type: none"> <li>KT1101 Pneumatic systems</li> <li>KT1102 Units of measurement in pneumatic systems (pressure, flow rate, area)</li> <li>KT1103 Pneumatic symbols and circuits</li> <li>Valve components</li> <li>The functions and use of valves</li> <li>Cylinder components</li> <li>Static and non-static seals</li> <li>FLR knowledge</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> (engage) in the following work activities:</p> <p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-</b></p>

<ul style="list-style-type: none"> <li>• PA0803 Plan the sequences for installation and commissioning</li> <li>• PA0804 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0805 Prepare the work area for installation of the pneumatic system</li> <li>• PA0806 Install the pneumatic system to specifications</li> <li>• PA0807 Use tools and equipment correctly</li> <li>• PA0808 Follow the correct installation procedures and sequence</li> <li>• PA0809 Check the pneumatic system installation by performing a systematic inspection of all the critical control points</li> <li>• PA0810 Commission the pneumatic system by performing a final inspection and performance test</li> <li>• PA0811 Perform post installation and commissioning activities</li> <li>• Risk-assessment should be in place when working on test bench</li> <li>• Safe operating procedures to be followed correctly</li> <li>• Test for zero energy/potential test correctly</li> <li>• Perform housekeeping as per industry standards</li> </ul>	<p><u>Applied Knowledge</u></p> <p><b>PM-14-PS08 Install pneumatic system components and commission pneumatic systems</b></p> <ul style="list-style-type: none"> <li>• AK0801 Installation of pneumatic system components</li> <li>• AK0802 Operation of pneumatic system</li> <li>• AK0803 Commissioning of pneumatic system</li> <li>• AK0804 Use of and care for tools and equipment</li> </ul>	<p><b>assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary technical information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• <input type="checkbox"/>WA0102 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• WA0103 Install, wire and connect electrical equipment and control systems to manufacturers' and workplace specifications</li> <li>• WA0104 Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• <input type="checkbox"/>WA0105 Restore the work area and dispose of waste materials</li> <li>• <input type="checkbox"/>WA0106 Interact with production personnel, where applicable</li> <li>• <input type="checkbox"/>WA0107 Complete all relevant documentation</li> <li>• <input type="checkbox"/>WA0108 Communicate with relevant parties</li> <li>• Perform housekeeping as per industry standards</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-14-PS08 Install pneumatic system components and commission pneumatic systems</b></p>	<p><b>KM-04-KT11: Mechanical working principles, types and applications of pneumatic systems</b></p>	<p><b>Supporting Evidence:</b></p> <p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and</b></p>

<ul style="list-style-type: none"> <li>• Pneumatic system components are correctly installed in terms of procedure, sequence and specifications</li> <li>• Pneumatic system operation is checked and adjusted if necessary</li> <li>• Pneumatic system is commissioned as per procedure</li> <li>• Quality requirements are met</li> <li>• Safety requirements are met</li> <li>• <b>Job observation to be performed before working on test bench</b></li> </ul>	<ul style="list-style-type: none"> <li>• Components and functions of pneumatic systems are identified and described</li> <li>• Units of measurement in pneumatic systems are described</li> <li>• Pneumatic symbols and circuits are read and interpreted</li> <li>• Safety precautions pertaining to pneumatic systems are explained</li> </ul>	<p><b>commission mechanical sub-assemblies and machines for at least 20 hours</b>  <b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b>  <b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• <input type="checkbox"/>SE0102 Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>• <input type="checkbox"/>SE0103 Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 questions and the competency will be at 80%</li> <li>• Practical exercise of 45min length <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No Injuries to self/co-worker and the environment or damage to equipment</li> <li>○ Interpret symbols and abbreviations.</li> <li>○ Interpret pneumatic circuit diagrams.</li> <li>○ Identify compressed air pipelines.</li> <li>○ Install and maintain compressed air pipelines.</li> <li>○ Install and maintain air service units.</li> <li>○ Install and maintain cylinders.</li> <li>○ Install and maintain directional control, flow control and pressure valves.</li> <li>○ Testing of set safety valves.(Standard pressure set at 6 Bar)</li> </ul> </li> </ul>		

- Recall the service procedure for air receivers.
- Diagnose faults in pneumatic systems.
- Complete the symbol test according
- Set service unit pressure
- Construct the circuit shown on pneumatic diagram
- The circuit must operate in sequence
- The assessor will ensure that you have all the necessary material and equipment to perform the task.
- You must stop working immediately as soon as the allocated time for the task has expired.
- Service unit pressure must be adjusted to specified pressure.
- There must be no damage to the equipment.
- All safety aspects adhered to according company policies
- No injury or damage to equipment

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of Pneumatic Diagrams, pneumatic valves and cylinders
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Intermediate Pneumatic Simulation station with different valves, Cylinders and pipes
- Additional Pneumatic valves, Cylinders and pipes

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>N1</b>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on gearboxes and drives</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		224	224	
<b>Work situation title: Perform routine maintenance, fault finding, repair and alignment on gearboxes</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Dingane is called to a breakdown on a crusher. On arrival he determines that the electrical motor is turning, but the crusher has stopped. He has to determine the cause and repair the breakdown and put the crusher back in service.				
<b>Prerequisite learning:</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<b>PM-08-PS02: Disassemble, clean and inspect gearboxes</b>  <i>Given a selection of gearboxes, relevant tools, personal protective equipment, specifications, cleaning materials and solvents</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0201 Plan and prepare workplace for disassembling gearbox</li> <li>PA0202 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>PA0203 Select tools and cleaning materials</li> <li>PA0204 Drain and visually inspect condition of oil</li> <li>PA0205 Disassemble and record gearbox component or part numbers and</li> </ul>		Knowledge of: <b>KM-04-KT06: Mechanical working principles, types and applications of reduction gearboxes</b> <ul style="list-style-type: none"> <li>KT0601 Gearboxes (single reduction, double reduction, variable speed)</li> <li>KT0602 Terminology of gearboxes</li> <li>KT0603 Functions and working principles of gearboxes</li> <li>KT0604 Removal and installation procedures for gearboxes</li> </ul> <b>KM-04-KT13: Diagnostic techniques</b> <ul style="list-style-type: none"> <li>KT1301 Diagnostic equipment</li> <li>KT1302 Diagnostic techniques</li> <li>KT1303 Diagnostic testing</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:  <b>WM-03-WE01: Observe and assist a qualified millwright, electrician or fitter in fault-finding and repairing electrical and mechanical installations and control systems for at least 20 hours</b> <ul style="list-style-type: none"> <li>WA0101 Gather the necessary technical information and plan the fault-finding process</li> <li>WA0102 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work</li> </ul>

<p>specifications (including floats)</p> <ul style="list-style-type: none"> <li>• PA0206 Clean gearbox components</li> <li>• PA0207 Visually inspect component condition (wear, damage, defect, failure) according to Original Equipment Manufacturer (OEM) specifications</li> <li>• PA0208 Conduct post-disassembling activities</li> </ul> <p><b>PM-09-PS01: Replace gearbox components and assemble gearboxes</b></p> <p><i>Given a selection of various types of gearbox, relevant tools, personal protective equipment and specifications</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0101 Plan and prepare for replacement of gearbox components and assembly of a gearbox</li> <li>• PA0102 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0103 Select tools, materials, equipment and lubricants</li> <li>• PA0104 Replace worn, damaged or defective components and parts</li> <li>• PA0105 Assemble, set and record gearbox component or part numbers and specifications (including floats)</li> <li>• PA0106 Lubricate components</li> <li>• PA0107 Conduct post-assembly activities</li> </ul> <p><b>PM-10-PS01: Do fault-finding on gearboxes</b></p>	<p><u>Applied Knowledge</u></p> <p><b>PM-08-PS02: Disassemble, clean and inspect gearboxes</b></p> <ul style="list-style-type: none"> <li>• AK0201 Procedures to disassemble, clean and inspect gearboxes</li> <li>• AK0202 Original Equipment Manufacturer gearbox specifications</li> <li>• AK0203 Lubricants, gasket material</li> <li>• AK0204 Gearbox components and component numbers</li> <li>• AK0205 Signs and causes of wear, damage, failure and defects in components</li> <li>• AK0206 Safe handling and storage of components</li> </ul> <p><b>PM-09-PS01: Replace gearbox components and assemble gearboxes</b></p> <ul style="list-style-type: none"> <li>• AK0101 Procedures to replace and assemble a gearbox</li> <li>• AK0102 Original Equipment Manufacturer gearbox specifications</li> <li>• AK0103 Types and applications of gearboxes</li> <li>• AK0104 Types and applications of lubricants</li> <li>• AK0105 Gearbox lubrication procedures</li> <li>• AK0106 Safe handling and storage of components</li> </ul>	<p>sites</p> <ul style="list-style-type: none"> <li>• WA0103 Fault find a variety of electrical and mechanical installations and control systems to manufacturers' and workplace specifications</li> <li>• WA0104 Compile parts list and draw parts, where applicable</li> <li>• WA0105 Repair a variety of electrical and mechanical installations and control systems to manufacturers' and workplace specifications</li> <li>• WA0106 Conduct functionality tests and commission the installations</li> <li>• WA0107 Restore the work area and dispose of waste materials</li> <li>• WA0108 Interact with production personnel, where applicable</li> <li>• WA0109 Complete all relevant documentation</li> <li>• WA0110 Communicate with relevant parties</li> <li>• Perform housekeeping as per industry standards</li> <li>• Complete a report referencing remedial action to completion of tasks</li> </ul>
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<p><i>Given a scenario or a simulated faulty gearbox installation, practical assignment, tools, diagnostic equipment, personal protective equipment and specification</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0101 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0102 Inspect or assess gearbox condition using senses</li> <li>• PA0103 Inspect or assess gearbox condition using diagnostic equipment</li> <li>• PA0104 Identify possible faults</li> <li>• PA0105 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0106 Report gearbox faults or defects</li> <li>• PA0107 Conduct post-fault-finding activities</li> <li>• Perform housekeeping as per industry standards</li> <li>• Complete a report referencing remedial action to completion of tasks</li> </ul> <p><b>PM-11-PS01: Repair gearboxes</b></p> <p><i>Given faulty gearboxes, replacement components, parts and lubricants, diagnostic information, sequence of work, specifications, tools and personal protective equipment</i></p>	<p><b>PM-10-PS01 Do fault-finding on a gearbox</b></p> <ul style="list-style-type: none"> <li>• AK0101 Procedures to do fault-finding on a gearbox</li> <li>• AK0102 Gearbox Original Equipment Manufacturer (OEM) specifications</li> <li>• AK0103 Signs, symptoms and causes of gearbox faults</li> <li>• AK0104 Types of gearbox faults</li> <li>• AK0105 Possible corrective actions and options to repair gearbox faults</li> </ul> <p><b>PM-11-PS01: Repair gearboxes</b></p> <ul style="list-style-type: none"> <li>• AK0101 Procedures for repairing gearboxes</li> <li>• AK0102 Safety practices and procedures</li> <li>• AK0103 Gearbox disassembly and assembly procedures</li> <li>• AK0104 Gearbox component replacement procedures</li> <li>• AK0105 Lubricants, seals and parts specifications and part numbers</li> <li>• AK0106 Use and care of tools and equipment</li> <li>• AK0107 Post repair activities</li> </ul> <p><b>Overhaul a gearbox</b></p> <ul style="list-style-type: none"> <li>• AK080101 Manufacture specifications</li> <li>• AK080102 Overhauling procedures</li> </ul>	
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**The apprentice must be able to:**

- PA0101 Read and interpret the practical assignments on specific repairs required
- PA0102 Read and interpret the standard repair specifications and quality requirements from the manufacturer
- PA0103 Identify gearbox components, parts, seals, lubricants and specifications of these that must be available for repair
- PA0104 Plan the sequence of work to repair the gearbox
- PA0105 Identify potential hazards and risks related to the job and list the appropriate responses
- PA0106 Identify, select and use the required hand tools, power tools and equipment
- PA0107 Disassemble the gearbox following the specified procedure
- PA0108 Inspect components and parts and confirm required repairs
- PA0109 Replace components or parts following the specified procedure
- PA0110 Reassemble the gearbox following the specified procedure
- PA0111 Check and confirm that repairs have resolved the problem or fault
- PA0112 Conduct post repair activities

**Overhaul a gearbox**

*Given a used gearbox with worn components, tools, access to everything need to overhaul a gearbox, personal*



<p><i>protective equipment, specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Identify and select specific tools, equipment and materials required for the overhaul process</li> <li>• Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• Disassemble the gearbox and prepare the components for inspection</li> <li>• Inspect the components and draw up a material and replacement parts list</li> <li>• Replace all worn parts to specification</li> <li>• Assemble and restore the gearbox to conform to with the service tolerances specified in the manufacturer specifications</li> <li>• Perform post overhauling activities</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-08-PS02: Disassemble, clean and inspect gearboxes</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Procedures to disassemble, clean and inspect a gearbox are explained</li> <li>• IAC0202 A gearbox is disassembled, cleaned and inspected according to procedure</li> <li>• IAC0203 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0204 Gearbox component or part numbers are recorded correctly before</li> </ul>	<p><b>KM-04-KT06: Mechanical working principles, types and applications of reduction gearboxes</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Types of gearboxes are identified and described</li> <li>• IAC0602 Components of gearboxes are identified and described</li> <li>• IAC0603 Functions and working principles of gearboxes are described</li> <li>• IAC0604 Removal and installation procedures for gearboxes are described</li> <li>• IAC0605 Safety precautions pertaining to gearboxes are explained</li> </ul>	<p><b>Supporting Evidence:</b>  <b>WM-03-WE01: Observe and assist a qualified millwright, electrician or fitter in fault-finding and repairing electrical and mechanical installations and control systems for at least 20 hours</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> </ul>

<p>and during disassembly</p> <ul style="list-style-type: none"> <li>• IAC0205 All worn, damaged and defective components are identified correctly</li> <li>• IAC0206 Gearbox types and Original Equipment Manufacturer specifications are explained</li> <li>• IAC0207 Signs and causes of worn, damaged and defective components are explained</li> </ul> <p><b>PM-09-PS01: Replace gearbox components and assemble gearboxes</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Procedures to replace gearbox components and assemble a gearbox are explained</li> <li>• IAC0102 Gearbox components are replaced according to procedures</li> <li>• IAC0103 A gearbox is assembled according to procedure and Original Equipment Manufacturer specifications</li> <li>• IAC0104 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-10-PS01 Do fault-finding on a gearbox</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Defects or faults on gearboxes are identified correctly</li> <li>• IAC0102 Corrective actions and options are explained correctly and motivated</li> <li>• IAC0103 A systematic fault-finding</li> </ul>	<p><b>KM-04-KT13: Diagnostic techniques</b></p> <ul style="list-style-type: none"> <li>• IAC1301 Types of diagnostic equipment are identified and described</li> <li>• IAC1302 The various types of diagnostic techniques are described</li> <li>• IAC1303 The sequence involved in a diagnostic procedure or technique is explained</li> <li>• IAC1304 Safety precautions pertaining to diagnostic equipment are explained</li> </ul>	<ul style="list-style-type: none"> <li>• SE0102 Completed workplace logbook, including list of equipment repaired, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>
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<p>process is followed</p> <ul style="list-style-type: none"> <li>• IAC0104 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-11-PS01: Repair gearboxes</b></p> <ul style="list-style-type: none"> <li>• IAC0101 Instructions and repair specifications are interpreted correctly</li> <li>• IAC0102 Gearbox components and specifications are identified correctly</li> <li>• IAC0103 Gearbox is disassembled and reassembled correctly</li> <li>• IAC0104 Faulty components are identified and replaced correctly</li> <li>• IAC0105 Sequences to repair gearbox are followed correctly</li> <li>• IAC0106 Tools and equipment are identified and used correctly</li> <li>• IAC0107 Post repair activities are performed correctly</li> <li>• IAC0108 Safety requirements are met</li> </ul> <p><b>Overhaul a gearbox</b></p> <ul style="list-style-type: none"> <li>• Safety requirements are met</li> <li>• Overhauling specifications and quality requirements are explained accurately</li> <li>• Tools, equipment, materials and parts are identified and described correctly</li> <li>• The sequence of activities to overhaul the gearbox is adhered to</li> <li>• The final product meets service tolerances specified in the manufacturer</li> </ul>		
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**Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%
- Practical exercise of 180min covering all items mentioned above
  - No injury or unsafe act had occurred
  - Shims neat and square to the base
  - Base bolts torque to specifications
  - Adjusting bolts must be loose
  - Dismantle a worm-wheel type reduction gearbox.
  - Assemble a worm-wheel type gearbox.
  - Identify the following types of fits on shafts and hole basis - clearance, transition, interference.
  - Fit seal and packing to mechanical components gearboxes, etc.
  - The damage and/or wear to the parts must be correctly inspected. The gearbox inspection sheet completed, all damaged and/or worn parts recorded
  - The worm wheel must be adjusted so that the tooth contact area conforms to the recommended pattern (Contact must be between 65% and 70%)
  - The oil scraper on the worm wheel must have a clearance of between 0.25mm and 0.38mm or to specifications and set at 60°
  - Oil seals must be removed and fitted in the bearing covers without damaging them
  - The end play on the shafts must be measured, recorded and set according to manufacturer's specifications
  - The worm wheel must turn freely when rotating the worm shaft by hand at the input side
  - There must be no damage to equipment
  - Measure run-out
  - Inspect bearings and record all findings
  - The damage and/or wear to the parts must be correctly inspected. The gearbox inspection sheet completed, all damaged and/or worn parts recorded
  - Oil seals must be removed and fitted in the bearing covers without damaging them
  - All safety aspects adhered to
  - No damage to equipment
- Level of competence required: 80%
- Safety aspects: 100%

**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of tolerance and Fits, lubrications, torque settings and bearing index sheet and gearboxes
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos procedures will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Reduction Gearboxes,
- Tools including but not limited to: torque wrench, Socket set, Spanner set, bearing replacement equipment, shims, feeler gauge, Mallet, DTI and lifting equipment

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>N2</b>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on gearboxes and drives</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		224	224	
<b>Work situation title: Perform routine maintenance, fault finding, repair and alignment on drives</b>	<b>Total hours</b>	80	80	
<b>Work scenario:</b> Dudu is called to a breakdown on a settling dam. On arrival he sees that the electrical motor is turning but the dam is overfull. He must determine, why the system failed to empty the dam and repair it				
<b>Prerequisite learning:</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-08-PS06: Disassemble, clean and inspect drives</b></p> <p><i>Given a selection of various types of direct and indirect drive, relevant tools, personal protective equipment, specifications, cleaning materials and solvents</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0601 Plan and prepare workplace for disassembling direct and indirect drives</li> <li>PA0602 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>PA0603 Select tools and cleaning materials</li> <li>PA0604 Disassemble and record direct and indirect drive components or parts' numbers and specifications</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT04: Types and application of drives</b></p> <ul style="list-style-type: none"> <li>KT0401 Drives (direct and indirect)</li> <li>KT0402 Terminology of drives</li> <li>KT0403 Functions and working principles of drives</li> </ul> <p><b>KM-04-KT13: Diagnostic techniques</b></p> <ul style="list-style-type: none"> <li>KT1301 Diagnostic equipment</li> <li>KT1302 Diagnostic techniques</li> <li>KT1303 Diagnostic testing</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-08-PS06: Disassemble, clean and inspect drives</b></p>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>WM-03-WE01: Observe and assist a qualified millwright, electrician or fitter in fault-finding and repairing electrical and mechanical installations and control systems for at least 20 hours</b></p> <ul style="list-style-type: none"> <li>WA0101 Gather the necessary technical information and plan the fault-finding process</li> <li>WA0102 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>WA0103 Fault find a variety</li> </ul>

<ul style="list-style-type: none"> <li>• PA0605 Clean components of direct and indirect drives</li> <li>• PA0606 Visually inspect component condition (wear, damage, defect, failure) according to Original Equipment Manufacturer specifications</li> <li>• PA0607 Conduct post-disassembling activities</li> <li>• Align drives to 0.05mm</li> <li>• Apply tension according to calculations</li> </ul> <p><b>PM-10-PS05: Do fault-finding on drives</b></p> <p><i>Given practical assignments, faulty direct and indirect drives, tools, diagnostic equipment, personal protective equipment and specifications</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0501 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0502 Visually inspect or assess condition of direct and indirect drives</li> <li>• PA0503 Identify possible faults</li> <li>• PA0504 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0505 Report faults or defects on direct and indirect drives</li> <li>• PA0506 Conduct post-diagnosis and fault-finding activities</li> <li>• Perform housekeeping as per prescribed industry standard</li> </ul>	<ul style="list-style-type: none"> <li>• AK0601 Procedures to disassemble, clean and inspect direct and indirect drives</li> <li>• AK0602 Original Equipment Manufacturer direct and indirect drive specifications</li> <li>• AK0603 Components of direct and indirect drives</li> <li>• AK0604 Signs and causes of wear, damage, failure and defects in components</li> <li>• AK0605 Safe handling and storage of components</li> </ul> <p><b>PM-10-PS05: Do fault-finding on drives</b></p> <ul style="list-style-type: none"> <li>• AK0501 Procedures to diagnose problems with direct and indirect drives</li> <li>• AK0502 Procedures to do fault-finding on direct and indirect drives</li> <li>• AK0503 Original Equipment Manufacturer specifications for direct and indirect drives</li> <li>• AK0504 Signs, symptoms and causes of faults on drives</li> <li>• AK0505 Types of drive faults</li> <li>• AK0506 Possible corrective actions and options to repair faults</li> </ul> <p><b>PM-09-PS05: Replace drive components and assemble drives</b></p> <ul style="list-style-type: none"> <li>• AK0501 Procedures to replace components of direct and indirect drives and assembly of direct and indirect drives</li> </ul>	<p>of electrical and mechanical installations and control systems to manufacturers' and workplace specifications</p> <ul style="list-style-type: none"> <li>• WA0104 Compile parts list and draw parts, where applicable</li> <li>• WA0105 Repair a variety of electrical and mechanical installations and control systems to manufacturers' and workplace specifications</li> <li>• WA0106 Conduct functionality tests and commission the installations</li> <li>• WA0107 Restore the work area and dispose of waste materials</li> <li>• WA0108 Interact with production personnel, where applicable</li> <li>• WA0109 Complete all relevant documentation</li> <li>• WA0110 Communicate with relevant parties</li> <li>• Ensure all safety guards are replaced</li> <li>• Listen to abnormal noise on gearboxes and drives and report findings</li> <li>• Feel for abnormal vibration</li> <li>• Monitor for excessive heat</li> <li>• Inspect for missing components</li> <li>• Perform housekeeping as per prescribed industry standard</li> </ul>
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**PM-09-PS05: Replace drive components and assemble drives**

*Given a selection of various types of direct and indirect drives, relevant tools, personal protective equipment, specifications and materials*

**The apprentice must be able to:**

- PA0501 Plan and prepare for replacement of direct and indirect drive components and assembly of direct and indirect drives
- PA0502 Identify potential hazards and risks related to the job and list the appropriate responses
- PA0503 Select tools, materials and equipment
- PA0504 Replace worn, damaged or defective components and parts
- PA0505 Assemble and record direct and indirect drive component or part numbers and specifications
- PA0506 Check and lubricate drives
- PA0507 Conduct post-assembly activities

**PM-11-PS05: Repair drives**

*Given faulty drives, replacement*

- AK0502 Direct and indirect drive Original Equipment Manufacturer specifications
- AK0503 Types and applications of direct and indirect drives

**PM-11-PS05: Repair drives**

- AK0501 Procedures for repairing drives
- AK0502 Safety practices and procedures
- AK0503 Drive disassembly and assembly procedures
- AK0504 Drive component replacement procedures
- AK0505 Lubricants, seals and parts specifications and part numbers
- AK0506 Use and care of tools and equipment
- AK0507 Post repair activities



*components, lubricants, diagnostic information, sequence of work, specifications, tools and personal protective equipment,*

**The apprentice must be able to:**

- PA0501 Read and interpret the practical assignments on specific repairs required
- PA0502 Read and interpret the standard repair specifications and quality requirements from the manufacturer
- PA0503 Identify components, parts, seals, lubricants and specifications of these that must be available for repair
- PA0504 Plan the sequence of work to repair the drive
- PA0505 Identify potential hazards and risks related to the job and list the appropriate responses
- PA0506 Identify, select and use the required hand tools, power tools and equipment
- PA0507 Disassemble the drive following the specified procedure
- PA0508 Inspect components and parts and confirm required repairs
- PA0509 Replace components or parts following the specified procedure
- PA0510 Reassemble the drive following the specified procedure
- PA0511 Check and confirm that repairs have resolved the problem or fault
- PA0512 Conduct post-repair activities

<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-08-PS06: Disassemble, clean and inspect drives</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Procedures to disassemble, clean and inspect direct and indirect drives are explained</li> <li>• IAC0602 Direct and indirect drives are disassembled, cleaned and inspected according to procedure</li> <li>• IAC0603 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0604 Components or parts numbers on direct and indirect drives are recorded correctly before and during disassembly</li> <li>• IAC0605 All worn, damaged and defective components are identified correctly</li> <li>• IAC0606 Direct and indirect drives types and Original Equipment Manufacturer specifications are explained</li> </ul> <p><b>PM-10-PS05: Do fault-finding on drives</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Defects or faults on direct and indirect drives are identified correctly</li> <li>• IAC0502 Corrective actions and options are explained correctly and motivated</li> <li>• IAC0503 A systematic fault-finding process is followed</li> </ul>	<p><b>KM-04-KT04: Types and application of drives</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Classification and types of drives are identified and discussed</li> <li>• IAC0402 Application of drives is discussed</li> <li>• IAC0403 Components of drives are identified and discussed</li> <li>• IAC0404 Functions and working principles of drives are described</li> <li>• IAC0405 Removal and installation procedures for drives are described</li> <li>• IAC0406 Safety precautions pertaining to drives are explained</li> </ul> <p><b>KM-04-KT13: Diagnostic techniques</b></p> <ul style="list-style-type: none"> <li>• IAC1301 Types of diagnostic equipment are identified and described</li> <li>• IAC1302 The various types of diagnostic techniques are described</li> <li>• IAC1303 The sequence involved in a diagnostic procedure or technique is explained</li> <li>• IAC1304 Safety precautions pertaining to diagnostic equipment are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of equipment repaired, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0504 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-09-PS05: Replace drive components and assemble drives</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Procedures to replace direct and indirect drive components and assemble direct and indirect drives are explained</li> <li>• IAC0502 Direct and indirect drive components are replaced according to procedures</li> <li>• IAC0503 Direct and indirect drives are assembled according to procedure and Original Equipment Manufacturer specifications</li> <li>• IAC0504 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-11-PS05: Repair drives</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Instructions and repair specifications are interpreted correctly</li> <li>• IAC0502 Drive components and specifications are identified correctly</li> <li>• IAC0503 The drive is disassembled and reassembled correctly</li> <li>• IAC0504 Faulty components are identified and replaced correctly</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 90min covering all items mentioned above (V-belt, Chain Drive, Couplings(Tyre)) <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> </ul> </li> </ul>		

- Identify the following types of drives - belt, gear, and chain.
- Identify A, B and C class V-belts.
- Maintain belt drives.
- Maintain gear drives.
- Maintain chain drives
- Tension and deflection according to chart or calculations
- 16mm per meter span (Use back of instruction sheet for calculations)
- Master link must be in the correct direction
- Chain tension adjusted correctly
- Lubrication of chain drives
- Horizontal and vertical alignment of driver and driven pulley within 0.5mm
- Chain Tension and deflection according to chart or calculations 16mm per meter span (Use back of instruction sheet for calculations)
- Shims neat and square to the base
- Base bolts torque to specifications
- Align driver to driven within  $\pm 0.1$ mm horizontally
- Align driver to driven within  $\pm 0.1$ mm vertically
- Align tension sprocket to main sprockets to within  $\pm 0.1$ mm
- Master link must be in the correct direction
- Adjusting bolts must be loose
- All safety aspects adhered to according company policies
- No damage to equipment

#### **Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts) of tolerance and Fits, lubrications, v-belts, chain drives, masterlink, gearboxes
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- V-belt alignment tools, belt tension gauge, hand tools, measuring equipment, straight edge, single v-belt simulation, double v-belt simulation, variety of shims, Pulley gauge
- Chain drives, hand tools, measuring equipment, straight edge, single chain simulation, double chain simulation, variety of shims,

tensioner pulley, variety of master links						
<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>N3</h1>		
		<b>Curriculum code:</b> 671202000				
<b>Learning area title:</b> Perform work activities on gearboxes and drives		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
			224			224
<b>Work situation title:</b> Install, align and commission gearboxes to specification		<b>Total hours</b>	24	24		
<b>Work scenario:</b> Lefa is tasked with the instalment of the new conveyer belt on the new plant. One of the tasks is the installation of the drives to the gearbox. He has to ensure the correct chain pulleys are used and also the tension of the chains. He also ensures that all the bolts are correctly torqued according to specifications						
<b>Prerequisite learning:</b> N1						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>		70%	<b>Knowledge modules (KM)</b>		30%	
			<b>Work experience modules (WM)</b>			
<b>PM-14-PS01 Install and commission gearboxes</b> <i>Given practical assignments, a repaired or overhauled gearbox, tools, personal protective equipment, specifications</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>• PA0101 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>• PA0102 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> <li>• PA0103 Plan the sequences for installation and commissioning</li> </ul>			Knowledge of: <b>KM-04-KT06 Mechanical working principles, types and applications of reduction gearboxes</b> <ul style="list-style-type: none"> <li>• KT0601 Gearboxes (single reduction, double reduction, variable speed)</li> <li>• KT0601 Terminology of gearboxes</li> <li>• KT0601 Functions and working principles of gearboxes</li> <li>• KT0601 Removal and installation procedures for gearboxes</li> </ul> <u>Applied Knowledge</u>		The apprentice will be expected to <b>gain practical experience</b> (engage) in the following work activities:  <b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b>  <b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b>  <b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-</b>	

<ul style="list-style-type: none"> <li>• PA0104 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0105 Prepare the work area for installation of the gearbox</li> <li>• PA0106 Install gearbox to specifications</li> <li>• PA0107 Use tools and equipment correctly</li> <li>• PA0108 Follow the correct installation procedures and sequence</li> <li>• PA0109 Check gearbox installation by performing a systematic inspection of all the critical control points</li> <li>• PA0110 Commission the gearbox by performing a final inspection and performance test</li> <li>• PA0111 Perform post installation and commissioning activities</li> <li>• Perform Housekeeping as per industry standards</li> <li>• Performance assessment report for completion of work situation</li> </ul>	<p><b>PM-14-PS01: Install and commission gearboxes</b></p> <ul style="list-style-type: none"> <li>• AK0101 Gearbox installation and commissioning procedures and specifications</li> <li>• AK0102 Use of and care for tools and equipment</li> </ul>	<p><b>assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• WA0401 Gather the necessary technical information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• WA0402 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• <input type="checkbox"/> WA0403 Install and align a variety of mechanical sub-assemblies and machines to manufacturers' and workplace specifications, including at least gearboxes, pumps, brakes and hydraulic systems</li> <li>• WA0404 Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• WA0405 Restore the work area and dispose of waste materials</li> <li>• WA0406 Interact with production personnel, where applicable</li> <li>• WA0407 Complete all relevant documentation</li> <li>• <input type="checkbox"/> WA0408 Communicate with relevant parties</li> <li>• Perform Housekeeping as per industry standards</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<b>PM-14-PS01: Install and commission</b>		<b>Supporting Evidence:</b>

<p><b>gearboxes</b></p> <ul style="list-style-type: none"> <li>• Installation is performed to requirements and specifications</li> <li>• Commissioning is performed to requirements</li> <li>• Quality requirements are met</li> <li>• Tools and equipment are used appropriately and correctly</li> <li>• Safety requirements are met</li> </ul>	<p><b>KM-04-KT06 Mechanical working principles, types and applications of reduction gearboxes</b></p> <ul style="list-style-type: none"> <li>• Types of gearboxes are identified and described</li> <li>• Components of gearboxes are identified and described</li> <li>• Functions and working principles of gearboxes are described</li> <li>• Removal and installation procedures for gearboxes are described</li> <li>• Safety precautions pertaining to gearboxes are explained</li> </ul>	<p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• Signed-off job cards</li> <li>• Non-conformance reports</li> <li>• Workplace logbook or portfolio</li> <li>• Equipment downtime records</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Practical exercise of 2 Hours length <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No Injuries to self/co-worker and the environment or damage to equipment</li> <li>○ Tension and deflection according to chart or calculations 16mm per meter span (Use back of instruction sheet for calculations)</li> <li>○ Shims neat and square to the base</li> <li>○ Adjusting bolts must be loose</li> <li>○ Base bolts torque to specifications</li> <li>○ Align driver to driven within <math>\pm 0.5\text{mm}</math> horizontally</li> <li>○ Align driver to driven within <math>\pm 0.5\text{mm}</math> vertically</li> <li>○ Align tension sprocket to main sprockets to within <math>\pm 0.1\text{mm}</math></li> <li>○ Master link must be in the correct direction</li> <li>○ Chain tension adjusted correctly</li> <li>○ Shims neat and square to the base</li> </ul> </li> </ul>		

- Adjusting bolts must be loose
- Identify the following types of fits on shafts and hole basis - clearance, transition, interference.
- Fit seal and packing to mechanical components gearboxes, etc.
- The damage and/or wear to the parts must be correctly inspected. The gearbox inspection sheet completed, all damaged and/or worn parts recorded
- Mark sheet requirements
- Level of competence required: 80%

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of tolerance and Fits, lubrications, masterlinks and gearboxes
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots; Safety Goggles
- Hand tools, measuring equipment, straight edge, single chain simulation, double chain simulation, variety of shims, tensioner pulley, variety of master links
- Gearboxes reduction, hand tools, measuring tools, spirit level



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>N4</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Perform work activities on gearboxes and drives</b>	<b>Total hours</b>	<b>SDP</b> 224	<b>WP</b> 224		
<b>Work situation title: Install, align and commission drives to specification</b>	<b>Total hours</b>	40	40		
<b>Work scenario:</b> Lefa is tasked with the instalment of the new conveyer belt on the new plant. One of the tasks is the installation of the drives to the gearbox. He has to ensure the correct chain pulleys are used and also the tension of the chains. He also ensures that all the bolts are correctly torqued according to specifications					
<b>Prerequisite learning: N2</b>					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>	
<p><b>PM-14-PS05: Install and commission drives</b></p> <p><i>Given practical assignments, repaired drives, tools, personal protective equipment and specifications</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0501 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>• PA0502 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> <li>• PA0503 Plan the sequences for installation and commissioning</li> <li>• PA0504 Identify potential hazards and risks related to the job and list the appropriate responses</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT04: Types and application of drives (8%)</b></p> <ul style="list-style-type: none"> <li>• KT0401 Drives (direct and indirect)</li> <li>• KT0402 Terminology of drives</li> <li>• KT0403 Functions and working principles of drives</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-14-PS05: Install and commission drives</b></p> <ul style="list-style-type: none"> <li>• AK0501 Drive installation, alignment and commissioning procedures and specifications</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> (engage) in the following work activities:</p> <p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-assemblies and machines for a period of least 480 hours</b></p>	

<ul style="list-style-type: none"> <li>• PA0505 Prepare the work area for installation of the drive</li> <li>• PA0506 Install and align the drive to specifications</li> <li>• PA0507 Use tools and equipment correctly</li> <li>• PA0508 Follow the correct installation procedures and sequence</li> <li>• PA0509 Check drive installation by performing a systematic inspection of all the critical control points</li> <li>• PA0510 Commission the drive by performing a final inspection and performance test</li> <li>• PA0511 Perform post installation and commissioning activities</li> <li>• Perform Housekeeping as per industry standards</li> </ul>	<ul style="list-style-type: none"> <li>• AK0502 Use and care of tools and equipment</li> </ul>	<ul style="list-style-type: none"> <li>• WA0401 Gather the necessary technical information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• WA0402 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• <input type="checkbox"/> WA0403 Install and align a variety of mechanical sub-assemblies and machines to manufacturers' and workplace specifications, including at least gearboxes, pumps, brakes and hydraulic systems</li> <li>• WA0404 Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• WA0405 Restore the work area and dispose of waste materials</li> <li>• WA0406 Interact with production personnel, where applicable</li> <li>• WA0407 Complete all relevant documentation</li> <li>• <input type="checkbox"/> WA0408 Communicate with relevant parties</li> <li>• Perform Housekeeping as per industry standards</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<b>PM-14-PS05: Install and commission drives</b>	<b>KM-04-KT04: Types and application of drives (8%)</b>	<b>Supporting Evidence:</b>  <b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and</b>

<ul style="list-style-type: none"> <li>• IAC0501 Installation and alignment is performed to requirements and specifications</li> <li>• IAC0502 Commissioning is performed to requirements</li> <li>• IAC0503 Quality requirements are met</li> <li>• IAC0504 Tools and equipment are used appropriately and correctly</li> <li>• IAC0505 Safety requirements are met</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0401 Classification and types of drives are identified and discussed</li> <li>• IAC0402 Application of drives is discussed</li> <li>• IAC0403 Components of drives are identified and discussed</li> <li>• IAC0404 Functions and working principles of drives are described</li> <li>• IAC0405 Removal and installation procedures for drives are described</li> <li>• IAC0406 Safety precautions pertaining to drives are explained</li> </ul>	<p><b>commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• Signed-off job cards</li> <li>• Non-conformance reports</li> <li>• Workplace logbook or portfolio</li> <li>• Equipment downtime records</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Practical exercise of 2 hours length <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No Injuries to self/co-worker and the environment or damage to equipment</li> <li>○ Identify the following types of drives - belt, gear, and chain.</li> <li>○ Identify A, B and C class V-belts.</li> <li>○ Install and align a single belt-drive.</li> <li>○ Install and align match-set belt drives.</li> <li>○ Install and align chain drives.</li> <li>○ Install jockey on V-belt and chain drive units.</li> <li>○ Horizontal and vertical alignment of driver and driven pulley within 0.5mm</li> <li>○ Tension and deflection according to chart or calculations 16mm per meter span (Use back of instruction sheet for calculations)</li> <li>○ Shims neat and square to the base</li> <li>○ Adjusting bolts must be loose</li> </ul> </li> </ul>		

- Base bolts torque to specifications
- Align driver to driven within  $\pm 0.5\text{mm}$  horizontally
- Align driver to driven within  $\pm 0.5\text{mm}$  vertically
- Align tension sprocket to main sprockets to within  $\pm 0.1\text{mm}$
- Master link must be in the correct direction
- Chain tension adjusted correctly
- Shims neat and square to the base
- Adjusting bolts must be loose
- Identify the following types of fits on shafts and hole basis - clearance, transition, interference.
- Fit seal and packing to mechanical components gearboxes, etc.
- The damage and/or wear to the parts must be correctly inspected. The gearbox inspection sheet completed, all damaged and/or worn parts recorded
- Mark sheet requirements
- Level of competence required: 80%

### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of tolerance and Fits, lubrications, v-belts, chain drives, masterlinks and gearboxes
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots; Safety Goggles
- V-belt alignment tools, fenner, hand tools, measuring equipment, straight edge, single v-belt simulation, double v-belt simulation, variety of shims
- Chain drives, hand tools, measuring equipment, straight edge, single chain simulation, double chain simulation, variety of shims, tensioner pulley, variety of master links
- Gearboxes reduction, hand tools, measuring tools, spirit level

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>N5</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on gearboxes and drives</b>	<b>Total hours</b>	<b>SDP</b> 224	<b>WP</b> 224	
<b>Work situation title: Perform laser alignment on drives and gearboxes (ELECTIVE)</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Ben has been requested to replace the V-belts on the cooling fan. He has to select a set and calculate and adjust the tension correctly. He must then realign the two pulleys using a laser alignment equipment.				
<b>Prerequisite learning:</b> Year 2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>		<b>Knowledge modules (KM)</b>		<b>Work experience modules (WM)</b>
<p>QCTO none</p> <p><i>Given various forms of drives &amp; gearboxes, materials and hand tools as well as laser alignment equipment,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Install and align a single belt-drive.</li> <li>• Install and align match-set belt drives.</li> <li>• Install and align chain drives</li> <li>• Install jockey on V-belt and chain drive units.</li> <li>• Horizontal and vertical alignment of driver and driven pulley within 0.1mm</li> <li>• Tension and deflection according to chart or calculations 16mm per meter span (Use back of instruction sheet for calculations)</li> <li>• Shims neat and square to the base</li> </ul>		<p>Knowledge of:</p> <p><b>KM-02-KT04 Types and application of drives</b></p> <ul style="list-style-type: none"> <li>• KT0401 Drives (direct and indirect)</li> <li>• KT0402 Terminology of drives</li> <li>• KT0403 Functions and working principle of drives</li> <li>• Calculations for the tension of drives e.g. v-belt and gearbox</li> </ul> <p><b>KM-02-KT06 Mechanical working principles, types and applications of reduction gearboxes</b></p> <ul style="list-style-type: none"> <li>• KT0601 Gearboxes (single reduction, double reduction, variable speed)</li> <li>• KT0601 Terminology of gearboxes</li> <li>• KT0601 Functions and working principles of gearboxes</li> </ul>		<p><b><i>If the workplace allows for this exposure</i></b></p> <p>The apprentice will be expected to <b>gain practical experience and</b> engage in the following work activities:</p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <ul style="list-style-type: none"> <li>• WA0501 Gather the necessary technical information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• WA0502 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and</li> </ul>

<ul style="list-style-type: none"> <li>• Adjusting bolts must be loose</li> <li>• Base bolts torque to specifications</li> <li>• Align driver to driven within <math>\pm 0.1</math>mm horizontally</li> <li>• Align driver to driven within <math>\pm 0.1</math>mm vertically</li> <li>• Align tension sprocket to main sprockets to within <math>\pm 0.1</math>mm</li> <li>• Master link must be in the correct direction</li> <li>• Chain tension adjusted correctly</li> <li>• Set up and use a laser alignment equipment correctly</li> <li>• Handling and storage correct</li> <li>• Safety procedure followed for the laser alignment</li> <li>• Ensuring the calibration is valid</li> <li>• Record and use the results of the laser reading correctly</li> <li>• Align a gearbox using couplings or drives</li> <li>• Alignment to be within 0.05mm on couplings (RPM related)</li> <li>• Perform Housekeeping as per industry standard</li> </ul>	<ul style="list-style-type: none"> <li>• KT0601 Removal and installation procedures for gearboxes</li> <li>• Laser alignment equipment</li> <li>• Procedure of using a laser alignment equipment</li> <li>• Techniques for laser aligning gearboxes and drives</li> <li>• Safety precautions when performing laser alignment</li> <li>• Tolerance chart</li> <li>• Transmitter and receiver</li> <li>• How to mount and set up and on which side the transmitter and receiver must be</li> </ul>	<p>prepare the work sites</p> <ul style="list-style-type: none"> <li>• WA0503 Install and align a variety of mechanical sub-assemblies and machines to manufacturers' and workplace specifications, including at least gearboxes, pumps, brakes and hydraulic systems</li> <li>• WA0504 Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• WA0505 Restore the work area and dispose of waste materials</li> <li>• WA0506 Interact with production personnel, where applicable</li> <li>• WA0507 Complete all relevant documentation</li> <li>• WA0508 Communicate with relevant parties</li> <li>• Install and align a single belt-drive.</li> <li>• Install and align match-set belt drives.</li> <li>• Install and align chain drives...</li> <li>• Install jockey on V-belt and chain drive units.</li> <li>• Horizontal and vertical alignment of driver and driven pulley within 0.1mm</li> <li>• Tension and deflection according to chart or calculations 16mm per meter span (Use back of instruction sheet for calculations)</li> <li>• Shims neat and square to the base</li> <li>• Adjusting bolts must be loose</li> <li>• Base bolts torque to specifications</li> <li>• Align driver to driven within <math>\pm 0.1</math>mm horizontally</li> <li>• Align driver to driven within <math>\pm 0.1</math>mm</li> </ul>
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		<p>vertically</p> <ul style="list-style-type: none"> <li>Align tension sprocket to main sprockets to within <math>\pm 0.1\text{mm}</math></li> <li>Master link must be in the correct direction</li> <li>Chain tension adjusted correctly</li> <li>Shims neat and square to the base</li> <li>Adjusting bolts must be loose</li> <li>Set up and use a laser alignment equipment correctly</li> <li>Handling and storage correct</li> <li>Safety procedure followed for the laser alignment</li> <li>Ensuring the calibration is valid</li> <li>Record and use the results of the laser reading correctly</li> <li>Align a gearbox using couplings or drives</li> <li>Alignment to be within <math>0.05\text{mm}</math> on couplings</li> <li>Perform housekeeping as per industry standards</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>Laser Alignment of mechanical drives</b></p> <ul style="list-style-type: none"> <li>Horizontal and vertical alignment of driver and driven pulley within <math>0.1\text{mm}</math></li> <li>Tension and deflection according to chart or calculations <math>16\text{mm}</math> per meter span (Use back of instruction sheet for calculations)</li> <li>Shims neat and square to the base</li> <li>Adjusting bolts must be loose</li> <li>Base bolts torque to specifications</li> </ul>	<p><b>KM-02-KT04 Types and application of drives</b></p> <ul style="list-style-type: none"> <li>Classification and types of drives are identified and discussed</li> <li>Application of drives is discussed</li> <li>Components of drives are identified and discussed</li> <li>Functions and working principles of drives are described</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>Applicable job cards</li> </ul>

<ul style="list-style-type: none"> <li>• Align tension sprocket to main sprockets to within <math>\pm 0.1\text{mm}</math></li> <li>• Master link must be in the correct direction</li> <li>• Chain tension adjusted correctly</li> <li>• Set up and use a laser alignment equipment correctly</li> <li>• Handling and storage correctly</li> <li>• Safety procedure followed for the laser alignment</li> <li>• Ensuring the calibration is valid</li> <li>• Record and use the results of the laser reading correctly</li> <li>• Alignment to be within <math>0.05\text{mm}</math> on couplings (in accordance to RPM requirements)</li> <li>• Proper Housekeeping</li> <li>• Performance assessment report for completion of work situation</li> </ul>	<ul style="list-style-type: none"> <li>• Removal and installation procedures for drives are described</li> <li>• Safety precautions pertaining to drives are explained</li> <li>• Calculation for the tension calculated correctly</li> </ul> <p><b>KM-02-KT06 Mechanical working principles, types and applications of reduction gearboxes</b></p> <ul style="list-style-type: none"> <li>• Types of gearboxes are identified and described</li> <li>• Components of gearboxes are identified and described</li> <li>• Functions and working principles of gearboxes are described</li> <li>• Removal and installation procedures for gearboxes are described</li> <li>• Safety precautions pertaining to gearboxes are explained</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 90min covering all above-mentioned items</li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>• Safety isolate, lockout and test for zero potential</li> <li>• Setup of laser equipment (settings)</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All assessment items <ul style="list-style-type: none"> <li>○ No Injuries to self/co-worker and the environment or damage to equipment</li> <li>○ Install and align a single belt-drive.</li> <li>○ Install and align match-set belt drives.</li> <li>○ Install and align chain drives...</li> </ul> </li> </ul>		



- Install jockey on V-belt and chain drive units.
- Horizontal and vertical alignment of driver and driven pulley within 0.1mm
- Tension and deflection according to chart or calculations 16mm per meter span (Use back of instruction sheet for calculations)
- Shims neat and square to the base
- Adjusting bolts must be loose
- Base bolts torque to specifications
- Align tension sprocket to main sprockets to within  $\pm 0.1$ mm
- Master link must be in the correct direction
- Chain tension adjusted correctly
- Set up and use a laser alignment equipment correctly
- Handling and storage correct
- Safety procedure followed for the laser alignment
- Ensuring the calibration is valid
- Record and use the results of the laser reading correctly
- Align a gearbox using couplings or drives
- Alignment to be within 0.05mm on couplings (Correct according to RPM chart)
- All safety aspects adhered to according company policies

#### **Learning resources for teaching**

- Learning material
- Samples (and charts) of laser equipment, tolerances
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- V-belt alignment tools,
- Belt tension gauge
- Straight edge
- Single v-belt simulation
- Double v-belt simulation
- Variety of shims

- Laser alignment equipment and mounting equipment
- Chain drives
- Measuring equipment
- Single chain simulation,
- Double chain simulation
- Tensioner pulley
- Verity of master links
- Gearboxes reduction
- Socket set
- Torque wrench
- Spanner set
- Allen Key set
- Tommy bar
- Engineering Square
- Tape measure
- Feeler gauge
- Rubber mallet
- Lockout equipment

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1 style="color: red;">01</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on pumps for water systems and water related valves</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		112	112	
<b>Work situation title: Perform routine maintenance fault finding, repair and reassembly activities on pumps for water systems</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Jane is responsible for maintaining the pumps on a plant. She has to ensure that the pumps are functional and adjusted to specification.				
<b>Prerequisite learning</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-08-PS03: Disassemble, clean, inspect and assemble pumps</b></p> <p><i>Given a selection of various types of pumps, relevant tools, personal protective equipment, specifications, cleaning materials and solvents,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0301 Plan and prepare workplace for disassembling a pump</li> <li>PA0302 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>PA0303 Select tools and cleaning materials</li> <li>PA0304 Disassemble and record pump component or part numbers and specifications</li> <li>PA0305 Clean pump components</li> <li>PA0306 Visually inspect component condition (wear, damage, defect, failure) according to Original</li> </ul>		<p><b>KM-04-KT05: Types and application of pumps</b></p> <ul style="list-style-type: none"> <li>KT0501 Classification of pumps</li> <li>KT0502 Terminology of pumps</li> <li>KT0503 Functions and working principles of pumps</li> <li>Knowledge of all seals used in pumps</li> <li>Lubrication that should be used on mechanical seals</li> <li>Cuttings of glands packing according to angles</li> <li>Material Safety data sheet (MSDS)</li> <li>Understanding a maintenance schedule</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-08-PS03: Disassemble, clean, inspect and assemble pumps</b></p> <ul style="list-style-type: none"> <li>AK0301 Procedures to disassemble, clean and inspect pumps</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities</p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>WA0203 Conduct pre-maintenance inspections and identify and report any problems</li> </ul>

<p>Equipment Manufacturer specifications</p> <ul style="list-style-type: none"> <li>• PA0307 Conduct post-disassembling activities</li> <li>• Assemble according to OEM specifications</li> </ul> <p><b>PM-10-PS02: Do fault-finding on pumps</b></p> <p><i>Given practical assignments, faulty pumps, tools, diagnostic equipment, personal protective equipment and specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0201 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0202 Visually inspect or assess pump condition</li> <li>• PA0203 Identify possible faults</li> <li>• PA0204 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0205 Report pump faults or defects</li> <li>• PA0206 Conduct post-diagnosis and fault-finding activities</li> </ul> <p><b>PM-09-PS02: Replace pump components and assemble pumps</b></p> <p><i>Given a selection of various types of pump, relevant tools, personal protective equipment and specifications,</i></p> <p><b>The apprentice must be able to:</b></p>	<ul style="list-style-type: none"> <li>• AK0302 Original Equipment Manufacturer pump specifications</li> <li>• AK0303 Pump components and component numbers</li> <li>• AK0304 Signs and causes of wear, damage, failure and defects in components</li> <li>• AK0305 Safe handling and storage of components</li> </ul> <p><b>PM-10-PS02: Do fault-finding on pumps</b></p> <ul style="list-style-type: none"> <li>• AK0201 Procedures to diagnose pump problems</li> <li>• AK0202 Procedures to do fault-finding on pumps</li> <li>• AK0203 Original Equipment Manufacturer (OEM) specifications for pumps</li> <li>• AK0204 Signs, symptoms and causes of faults</li> <li>• AK0205 Types of pump faults</li> <li>• AK0206 Possible corrective actions and options to repair faults</li> </ul> <p><b>PM-09-PS02: Replace pump components and assemble pumps</b></p> <ul style="list-style-type: none"> <li>• AK0201 Procedures to replace and assemble a pump</li> <li>• AK0202 Original Equipment Manufacturer pump specifications</li> <li>• AK0203 Types and applications of pumps</li> </ul>	<ul style="list-style-type: none"> <li>• WA0204 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least five different pieces of industrial machinery</li> <li>• WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0206 Restore the work area and dispose of waste materials</li> <li>• WA0207 Interact with production personnel, where applicable</li> <li>• WA0208 Complete maintenance reports</li> <li>• WA0209 Communicate with relevant parties</li> <li>• Conduct a range of routine maintenance tasks of varying complexity under supervision</li> <li>• The experience must include routine maintenance on pumps</li> <li>• Proper Housekeeping</li> </ul> <p><b>WM-04-WE01: Observe and assist a qualified millwright, electrician or fitter in overhauling a variety of electrical and mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-04-WE02: Overhaul electrical and mechanical sub-assemblies and machines under the direct supervision of a qualified millwright, electrician or</b></p>
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<ul style="list-style-type: none"> <li>• PA0201 Plan and prepare for replacement of pump components and assembly of a pump</li> <li>• PA0202 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0203 Select tools, materials, equipment and lubricants</li> <li>• PA0204 Replace worn, damaged or defective components and parts</li> <li>• PA0205 Assemble, set and record pump component or part numbers and specifications</li> <li>• PA0206 Check and lubricate a pump</li> <li>• PA0207 Conduct post-assembly activities</li> </ul> <p><b>PM-11-PS02: Repair pumps</b></p> <p><i>Given faulty pumps, replacement components, lubricants, diagnostic information, sequence of work, specifications, tools and personal protective equipment,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0201 Read and interpret the practical assignments on specific repairs required</li> <li>• PA0202 Read and interpret the standard repair specifications and quality requirements from the manufacturer</li> <li>• PA0203 Identify components, parts, seals, lubricants and specifications of these that must be available for repair</li> </ul>	<ul style="list-style-type: none"> <li>• AK0204 Types and applications of lubricants</li> <li>• AK0205 Pump lubrication procedures</li> <li>• AK0206 Pump components and applications</li> </ul> <p><b>PM-11-PS02: Repair pumps</b></p> <ul style="list-style-type: none"> <li>• AK0201 Procedures for repairing pumps</li> <li>• AK0202 Safety practices and procedures</li> <li>• AK0203 Pump disassembly and assembly procedures</li> <li>• AK0204 Pump component replacement procedures</li> <li>• AK0205 Lubricants, seals and parts specifications and part numbers</li> <li>• AK0206 Use and care of tools and equipment</li> <li>• AK0207 Post repair activities</li> </ul> <p><b>Overhaul a pump</b></p> <ul style="list-style-type: none"> <li>• <b>Manufacture specifications</b></li> <li>• <b>Overhauling procedures</b></li> </ul>	<p><b>fitter for at least 40 hours</b></p> <p><b>WM-04-WE03: Undertake all activities without assistance, but under supervision of a qualified millwright, electrician or fitter, to overhaul electrical and mechanical sub-assemblies and machines for at least 480 hours</b></p> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary technical information, maintenance history and plan the overhauling process</li> <li>• WA0102 Conduct risk assessments, perform lock-out and tag out procedures where applicable and prepare work site</li> <li>• WA0103 Dismantle, measure, test and identify faults and determine the serviceability of components</li> <li>• WA0104 Compile reports, and parts and materials lists and draw parts and materials</li> <li>• WA0105 Repair, replace or modify components as required</li> <li>• WA0106 Assemble, test and adjust parts and components</li> <li>• WA0107 Commission machinery</li> <li>• WA0108 Restore the work area and dispose of waste materials</li> <li>• <input type="checkbox"/> WA0109 Interact with production personnel, where applicable</li> <li>• WA0110 Complete all relevant documentation</li> </ul>
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<ul style="list-style-type: none"> <li>• PA0204 Plan the sequence of work to repair the pump</li> <li>• PA0205 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0206 Identify, select and use the required hand tools, power tools and equipment</li> <li>• PA0207 Disassemble the pump following the specified procedure</li> <li>• PA0208 Inspect components and parts and confirm required repairs</li> <li>• PA0209 Replace components or parts following the specified procedure</li> <li>• PA0210 Reassemble the pump following the specified procedure</li> <li>• PA0211 Check and confirm that repairs have resolved the problem or fault</li> <li>• PA0212 Conduct post-repair activities</li> </ul> <p><b>Overhaul a pump</b></p> <p><i>Given a used pump with worn components, tools, access to everything need to overhaul a pump, personal protective equipment, specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Identify and select specific tools, equipment and materials required for the overhaul process</li> </ul>		<ul style="list-style-type: none"> <li>• WA0111 Communicate with relevant parties</li> </ul>
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<ul style="list-style-type: none"> <li>• Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• Disassemble the pump and prepare the components for inspection</li> <li>• Inspect the components and draw up a material and replacement parts list</li> <li>• Replace all worn parts to specification</li> <li>• Assemble and restore the pump to conform to the service tolerances specified in the manufacturer specifications</li> <li>• Perform post overhauling activities</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-08-PS03: Disassemble, clean, inspect and assemble pumps</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Procedures to disassemble, clean and inspect a pump are explained</li> <li>• IAC0302 A pump is disassembled, cleaned and inspected according to procedure</li> <li>• IAC0303 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0304 Pump component or part numbers are recorded correctly before and during disassembly</li> <li>• IAC0305 All worn, damaged and defective components are identified correctly</li> <li>• IAC0306 Pump types and Original Equipment Manufacturer specifications are explained</li> </ul>	<p><b>KM-02-KT05 Types and application of pumps</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Classification and types of pumps are identified and discussed</li> <li>• IAC0502 Application of pumps is discussed</li> <li>• IAC0503 Components of pumps are identified and discussed</li> <li>• IAC0504 Functions and working principles of pumps are described</li> <li>• IAC0505 Removal and installation procedures for pumps are described</li> <li>• IAC0506 Safety precautions pertaining to pumps are explained</li> <li>•</li> </ul>	<p><b>Supporting Evidence:</b></p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• SE0203 Applicable job cards</li> </ul> <p><b>WM-04-WE01: Observe and assist a qualified millwright, electrician or fitter in overhauling a variety of electrical and</b></p>

<ul style="list-style-type: none"> <li>• IAC0307 Signs and causes of worn, damaged and defective components are explained</li> <li>• Perform housekeeping as per industry standards</li> </ul> <p><b>PM-10-PS02: Do fault-finding on pumps</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Defects or faults on pump are identified correctly</li> <li>• IAC0202 Corrective actions and options are explained correctly and motivated</li> <li>• IAC0203 A systematic fault-finding process is followed</li> <li>• IAC0204 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-09-PS02: Replace pump components and assemble pumps</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Procedures to replace pump components and assemble a pump are explained</li> <li>• IAC0202 Pump components are replaced according to procedures</li> <li>• IAC0203 A pump is assembled according to procedure and Original Equipment Manufacturer specifications</li> <li>• IAC0204 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-11-PS02: Repair pumps</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Instructions and repair specifications are interpreted correctly</li> </ul>		<p><b>mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-04-WE02: Overhaul electrical and mechanical sub-assemblies and machines under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b></p> <p><b>WM-04-WE03: Undertake all activities without assistance, but under supervision of a qualified millwright, electrician or fitter, to overhaul electrical and mechanical sub-assemblies and machines for at least 480 hours</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>
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<ul style="list-style-type: none"> <li>• IAC0202 Pump components and specifications are identified correctly</li> <li>• IAC0203 The pump is disassembled and reassembled correctly</li> <li>• IAC0204 Faulty components are identified and replaced correctly</li> <li>• IAC0205 Sequences to repair the pump are followed correctly</li> <li>• IAC0206 Tools and equipment are identified and used correctly</li> <li>• IAC0207 Post repair activities are performed correctly</li> <li>• IAC0208 Safety requirements are met</li> </ul> <p><b>Overhaul a pump</b></p> <ul style="list-style-type: none"> <li>• Safety requirements are met</li> <li>• Overhauling specifications and quality requirements are explained accurately</li> <li>• Tools, equipment, materials and parts are identified and described correctly</li> <li>• The sequence of activities to overhaul the pump is adhered to</li> <li>• The final product meets service tolerances specified in the manufacturer specifications</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 180min (SINGLE STAGE) covering all items mentioned above. <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ Dismantle pump correctly</li> <li>○ Inspect and record conditions of pump components as listed</li> <li>○ Pump must be assembled correctly</li> </ul> </li> </ul>		

- Axial float to instruction given
- Assessor to verify shaft run - out
- Pump must be assembled correctly
- Impeller to be adjusted central to 25% forward of the central position in the pump case and must not rub (Envirotech / Warman pump)
- The end play on the shafts must be measured, recorded and set according to manufacturer's specifications
- There must be no damage to equipment
- Identify the following types of pumps:
  - centrifugal
  - reciprocating
  - gear
- Define the terms positive and non-positive displacement.
- Install gland bush packing.
- Install a mechanical seal.
- Prime centrifugal, reciprocating and gear pumps.
- Diagnose faults on centrifugal, reciprocating and gear pumps.
- Interpret given flow diagrams and systems.
- All safety aspects adhered to according company policies
- No injury or damage to equipment

### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of tolerance and Fits, lubrications, pumps
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- KSB Pump
- Envirotech Pump
- Warman Pump
- Tool list including but not limited to: Pressure and flow meters Socket and spanner sets, Torque wrench, DTI, Steel ruler, Bearing replacement equipment, Mallet, Packing extractors and retractable blade Knife and V Blocks

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<b>Occupation/trade title:</b> Millwright	<b>SAQA ID:</b> 97585			02
	<b>Curriculum code:</b> 671202000			
<b>Learning area title:</b> Perform work activities on pumps for water systems and water related valves	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		112	112	
<b>Work situation title:</b> Perform routine maintenance, fault finding, repair and reassembly activities on water related valves	<b>Total hours</b>	32	32	

**Work scenario:** Chester is working on a water line. He closed the valve and tested for zero energy. He then discovers that there is still a lot of pressure in the pipeline. On further investigation he finds that the ball valve he closed is no longer sealing. He removes the faulty ball valve and replaces it. The replaced components must conform to OEM standards before returned to service.

**Prerequisite learning:** Year 1

INTEGRATED LEARNING CONTENT				
Practical skills modules (PM)	80%	Knowledge modules (KM)	20%	Work experience modules (WM)
<p><b>PM-08-PS11: Disassemble, clean and inspect valves</b></p> <p><i>Given a selection of various types of valve, relevant diagrams, tools, personal protective equipment, specifications, cleaning materials and solvents,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA1101 Procedures to disassemble, clean and inspect a valve are explained</li> <li>• PA1102 A valve is disassembled, cleaned and inspected according to procedure</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT03: Types and application of valves</b></p> <p>KT0301 Classification and types of valves (Classification includes linear motion, rotary motion and quarter turn valves; types include gate, diaphragm; non-return, relief, ball shut-off valves; also included are pipe systems.)</p> <p>KT0302 Terminology of valves</p> <p>KT0303 Function and working principles of valves</p>		<p>The apprentice will be expected to <b>gain practical experience and</b> engage in the following work activities:</p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>• WA0201 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> </ul>

<ul style="list-style-type: none"> <li>• PA1103 Risks and hazards are identified and responded to in a responsible manner</li> <li>• PA1104 Components and components' numbers of a valve are recorded correctly before and during disassembly</li> <li>• PA1105 All worn, damaged and defective components are identified correctly</li> <li>• PA1106 Valve types and Original Equipment Manufacturer specifications are explained</li> <li>• PA1107 Signs and causes of worn, damaged and defective components are explained</li> </ul> <p><b>Perform fault finding on valves</b></p> <ul style="list-style-type: none"> <li>• Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• Visually inspect or assess valves condition</li> <li>• Identify possible faults</li> <li>• Determine corrective actions and options for dealing with identified faults</li> <li>• Report valves faults or defects</li> <li>• Conduct post-diagnosis and fault-finding activities</li> <li>• Select care and post activity's regarding tools and equipment</li> <li>• Perform Housekeeping as per industry standards</li> </ul> <p><b>PM-09-PS10: Replace valve components</b></p>	<p>KT0304 Removal and installation of valves</p> <p><u>Applied Knowledge</u></p> <p><b>PM-08-PS11: Disassemble, clean and inspect valves</b></p> <ul style="list-style-type: none"> <li>• AK1101 Procedures to disassemble, clean and inspect valves</li> <li>• AK1102 Original Equipment Manufacturer valve specifications</li> <li>• AK1103 Types and applications of valves</li> <li>• AK1104 Valve components and component numbers</li> <li>• AK1105 Signs and causes of wear, damage, failure and defects in components</li> <li>• AK1106 Safe handling and storage of components</li> </ul> <p><b>PM-09-PS10: Replace valve components and assemble valves</b></p> <ul style="list-style-type: none"> <li>• AK1001 Procedures to replace and assemble a valve</li> <li>• AK1002 Original Equipment Manufacturer valve specifications</li> <li>• AK1003 Types and applications of valves</li> <li>• AK1004 Valve components and applications</li> </ul>	<ul style="list-style-type: none"> <li>• WA0202 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• WA0203 Conduct pre-maintenance inspections and identify and report any problems</li> <li>• WA0204 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least five different pieces of industrial machinery</li> <li>• WA0205 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0206 Restore the work area and dispose of waste materials</li> <li>• WA0207 Interact with production personnel, where applicable</li> <li>• WA0208 Complete maintenance reports</li> <li>• WA0209 Communicate with relevant parties</li> <li>• Perform Housekeeping as per industry standards</li> </ul>
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<p><b>and assemble valves</b></p> <p><i>Given a selection of various types of valve, relevant tools, personal protective equipment, specifications and material,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA1001 Plan and prepare for replacement of valve components and assembly of a valve</li> <li>• PA1002 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA1003 Select tools, materials and equipment</li> <li>• PA1004 Replace worn, damaged or defective components and parts</li> <li>• PA1005 Assemble, set and record valve component or part numbers and specifications</li> <li>• PA1006 Conduct post-assembly activities</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-08-PS11: Disassemble, clean and inspect valves</b></p> <ul style="list-style-type: none"> <li>• IAC1101 Procedures to disassemble, clean and inspect a valve are explained</li> <li>• IAC1102 A valve is disassembled, cleaned and inspected according to procedure</li> <li>• IAC1103 Risks and hazards are identified and responded to in a responsible manner</li> </ul>	<p><b>KM-04-KT03: Types and application of valves</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Classification and types of valves are identified and discussed</li> <li>• IAC0302 Application of valves is discussed</li> <li>• IAC0303 Components of valves and pipe systems are identified and discussed</li> <li>• IAC0304 Functions and working principles of valves are described</li> </ul>	<p><b>Supporting evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed</li> </ul>

<ul style="list-style-type: none"> <li>• IAC1104 Valve components and component numbers are recorded correctly before and during disassembly</li> <li>• IAC1105 All worn, damaged and defective components are identified correctly</li> <li>• IAC1106 Valve types and Original Equipment Manufacturer specifications are explained</li> <li>• IAC1107 Signs and causes of worn, damaged and defective components are explained</li> </ul> <p><b>Perform fault-finding on valves</b></p> <ul style="list-style-type: none"> <li>• Defects or faults on valves are identified correctly</li> <li>• Corrective actions and options are explained correctly and motivated</li> <li>• A systematic fault-finding process is followed</li> <li>• Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-09-PS10: Replace valve components and assemble valves</b></p> <ul style="list-style-type: none"> <li>• IAC1001 Procedures to replace valve components and assemble a valve are explained</li> <li>• IAC1002 Valve components are replaced according to procedures</li> <li>• IAC1003 A valve is assembled according to procedure and Original Equipment</li> </ul>	<ul style="list-style-type: none"> <li>• IAC0305 Removal and installation procedures for valves are described</li> <li>• IAC0306 Safety precautions pertaining to valves are explained</li> </ul>	<ul style="list-style-type: none"> <li>off by the supervising artisan</li> <li>• SE0203 Applicable job cards</li> </ul>
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<p>Manufacturer specifications</p> <ul style="list-style-type: none"> <li>• IAC1004 Risks and hazards are identified and responded to in a responsible manner</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> <li>• Practical exercise of 60min length covering all associated tasks and procedures. <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No damage to equipment</li> <li>○ Interpret symbols and abbreviations</li> <li>○ Classification and types of valves are identified and discussed</li> <li>○ Application of valves is discussed</li> <li>○ Components of valves are identified and discussed</li> <li>○ Functions and working principles of valves are described</li> <li>○ Removal and installation procedures for valves are described</li> <li>○ Glands replaced correctly</li> <li>○ Valve pressure tested to 200kpi</li> <li>○ Schore marks recorded correctly</li> <li>○ Stam straightness checked</li> <li>○ Glan packing cut 45" &amp; 120, Staggered</li> <li>○ Gate valve reseated</li> <li>○ Safety precautions pertaining to valves adhered to</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> <li>• Samples (and charts) of Valves</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> <li>• Charts of risk assessment procedure and safety measures</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles</li> <li>• Gate valve 75-100mm</li> </ul>		

<ul style="list-style-type: none"> <li>• Different gland sizes</li> <li>• Pressure test equipment for gate valves (including Gauges) s</li> <li>• Seating table for gate valve</li> <li>• Gaskets and flanges</li> <li>• Ringset spanners and Pipe wrench</li> <li>• Allen keys</li> <li>• Steel ruler</li> <li>• Knife (Retractable blade)</li> <li>• Hammer</li> </ul>						
<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>O3</h1>		
		<b>Curriculum code:</b> 671202000				
<b>Learning area title:</b> Perform work activities on pumps for water systems and water related valves		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
			112			112
<b>Work situation title:</b> Install, align and commission pumps for water systems and water related valves		<b>Total hours</b>	40	40		
<p><b>Work scenario:</b> Nkamo is tasked with the installation of a new cooling system pump on the furnace. She has to ensure that the pump installation, alignment and commissioning adhere to OEM specifications. After he installed the new pump and ensured the alignment is correct and the bolts are torqued to specifications, he can start priming the pump to test. Safety is a non-negotiable.</p>						
<p><b>Prerequisite learning:</b> O2</p>						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>		
<p><b>PM-14-PS02: Install and commission pumps</b></p> <p><i>Given practical assignments, repaired or overhauled pumps, tools, personal protective equipment and specifications,</i></p> <p><b>The apprentice must be able to:</b></p>		<p>Knowledge of:</p> <p><b>KM-04-KT05: Types and application of pumps</b></p> <ul style="list-style-type: none"> <li>• KT0501 Classification of pumps</li> <li>• KT0502 Terminology of pumps</li> <li>• KT0503 Functions and working principles of pumps</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <ul style="list-style-type: none"> <li>• Gather the necessary technical</li> </ul>		



<ul style="list-style-type: none"> <li>• PA0201 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>• PA0202 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> <li>• PA0203 Plan the sequences for installation and commissioning</li> <li>• PA0204 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0205 Prepare the work area for installation of the pump</li> <li>• PA0206 Install and align the pump to specifications</li> <li>• PA0207 Use tools and equipment correctly</li> <li>• PA0208 Follow the correct installation procedures and sequence</li> <li>• PA0209 Check the pump installation by performing a systematic inspection of all the critical control points</li> <li>• PA0210 Commission the pump by performing a final inspection and performance test</li> <li>• PA0211 Perform post installation and commissioning activities</li> <li>• <b>Alignment of the pump and the drive system</b></li> <li>• <b>Install a valve and ensure that there is no leaks and the flow is in the correct direction</b></li> <li>• <b>Bolts secured</b></li> <li>• <b>Select and fit correct gasket</b></li> </ul>	<p><b>KM-04-KT03: Types and application of valves</b></p> <ul style="list-style-type: none"> <li>• KT0301 Classification and types of valves (Classification includes linear motion, rotary motion and quarter turn valves; types include gate, non-return, relief, ball shut-off valves; also included are pipe systems.)</li> <li>• KT0302 Terminology of valves</li> <li>• KT0303 Function and working principles of valves</li> <li>• KT0304 Removal and installation of valves</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-14-PS02: Install and commission pumps</b></p> <ul style="list-style-type: none"> <li>• AK0201 Pump installation, alignment and commissioning procedures and specifications</li> <li>• AK0202 Use and care of tools and equipment</li> <li>• <b>Alignment of the pump and the drive system</b></li> </ul> <p><b>Install and commission valves</b></p> <ul style="list-style-type: none"> <li>• <b>Valves installation and commissioning procedures and specifications</b></li> <li>• <b>Use and care of tools and equipment</b></li> </ul>	<p>information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</p> <ul style="list-style-type: none"> <li>• Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• Install and align a variety of, pumps to manufacturers' and workplace specifications,</li> <li>• Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete all relevant documentation</li> <li>• Communicate with relevant parties</li> <li>• <b>Perform housekeeping according to industry standard</b></li> </ul>
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<ul style="list-style-type: none"> <li>• Operation of the opening and closing of the valve</li> <li>• Perform housekeeping as per industry standards</li> </ul>		
ASSESSMENT CRITERIA		
<p><b>PM-14-PS02: Install and commission pumps</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Installation and alignment is performed to requirements and specifications</li> <li>• IAC0202 Commissioning is performed to requirements</li> <li>• IAC0203 Quality requirements are met</li> <li>• IAC0204 Tools and equipment are used appropriately and correctly</li> <li>• IAC0205 Safety requirements are met</li> </ul> <p><b>Install and commission valves</b></p> <ul style="list-style-type: none"> <li>• Installation is performed to requirements and specifications</li> <li>• Commissioning is performed to requirements</li> <li>• Quality requirements are met</li> <li>• Tools and equipment are used appropriately and correctly</li> <li>• Safety requirements are met</li> </ul>	<p><b>KM-04-KT05: Types and application of pumps</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Classification and types of pumps are identified and discussed</li> <li>• IAC0502 Application of pumps is discussed</li> <li>• IAC0503 Components of pumps are identified and discussed</li> <li>• IAC0504 Functions and working principles of pumps are described</li> <li>• IAC0505 Removal and installation procedures for pumps are described</li> <li>• IAC0506 Safety precautions pertaining to pumps are explained</li> </ul> <p><b>KM-04-KT03: Types and application of valves</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Classification and types of valves are identified and discussed</li> <li>• <input type="checkbox"/> IAC0302 Application of valves is discussed</li> <li>• IAC0303 Components of valves and pipe systems are identified and discussed</li> <li>• IAC0304 Functions and working principles of valves are described</li> <li>• IAC0305 Removal and installation</li> </ul>	<p><b>Supporting Evidence</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>

	<p>procedures for valves are described</p> <ul style="list-style-type: none"> <li>• IAC0306 Safety precautions pertaining to valves are explained</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 questions (45 min) and the competency will be at 80%</li> <li>• Practical exercise of 120min length covering all items mentioned above <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No damage to equipment</li> <li>○ Dismantle pump correctly</li> <li>○ Pump must be assembled correctly</li> <li>○ No damage to equipment</li> <li>○ Inspect and record conditions of pump components as listed</li> <li>○ Impeller to be adjusted central to 25% forward of the central position in the pump case and must not rub (Envirotech / Warman pump)</li> <li>○ The damage and/or wear to the parts must be correctly inspected.</li> <li>○ Identify the following types of pumps: <ul style="list-style-type: none"> <li>▪ centrifugal</li> <li>▪ reciprocating</li> <li>▪ gear</li> </ul> </li> <li>○ Define the terms positive and non-positive displacement.</li> <li>○ Install gland bush packing.</li> <li>○ Prime centrifugal, reciprocating and gear pumps.</li> <li>○ Diagnose faults on centrifugal, reciprocating and gear pumps.</li> <li>○ Interpret given flow diagrams and systems.</li> <li>○ All safety aspects adhered to according company policies</li> <li>○ Glands replaced correctly</li> <li>○ Valve pressure tested to 200kpi 75 to 100 mm gate valve</li> </ul> </li> <li>• Level of competence required: 100%</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material</li> </ul>		

- Samples (and charts) of tolerance and Fits, lubrications, pumps and valves and seals
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Set of Spanners and Sockets
- Torque wrench
- Screwdrivers
- Rubber Mallet
- Allen keys
- Clock gauge
- Variety of shims
- Tape measure
- Vernier or Micrometre
- Tommy bar
- Gasket material
- Inside calliper
- Feeler gauge

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>P1</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on brakes and clutches</b>	<b>Total hours</b>	<b>SDP</b> 56	<b>WP</b> 56	
<b>Work situation title: Perform routine maintenance, fault finding, repair, reassembly and alignment activities on brakes and clutches</b>	<b>Total hours</b>	40	40	
<b>Work scenario:</b> Jimmy is called to a breakdown on a drive unit. The drive is connected to the output by means of a clutch. On inspection of the brake and clutch, he found it to be both excessively hot with the clutch totally disengaged under no load. This means that the clutch has failed and needs to be replaced. He must address the brake function as well, while the drive is isolated.				
<b>Prerequisite learning:</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-08-PS04: Disassemble, clean and inspect brakes</b></p> <p><i>Given a selection of various types of brake, relevant tools, personal protective equipment, specifications, cleaning materials and solvents,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>PA0401 Plan and prepare workplace for disassembling a brake</li> <li>PA0402 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>PA0403 Select tools and cleaning materials</li> <li>PA0404 Disassemble and record brake</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT07: Mechanical working principles, types and applications of clutches</b></p> <ul style="list-style-type: none"> <li>KT0701 Types of clutches</li> <li>KT0702 Terminology of clutches</li> <li>KT0703 Functions and working principles of clutches</li> <li>KT0704 Removal and installation procedure for clutches</li> </ul> <p><b>KM-04-KT08: Mechanical working principles, types and applications of brakes</b></p> <ul style="list-style-type: none"> <li>KT0801 Types of brakes</li> <li>KT0802 Terminology of brakes</li> <li>KT0803 Functions and working principles</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>WM-03-WE05: Fault-find and repair electrical and mechanical sub-assemblies and machines under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b></p> <ul style="list-style-type: none"> <li>WA0501 Gather the necessary technical information and plan the fault-finding process</li> <li>WA0502 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> </ul>

<p>component or part numbers and specifications</p> <ul style="list-style-type: none"> <li>• PA0405 Clean brake components</li> <li>• PA0406 Visually inspect component condition (wear, damage, defect, failure) according to Original Equipment Manufacturer specifications</li> <li>• PA0407 Conduct post-disassembling activities</li> </ul> <p><b>PM-10-PS04 Do fault-finding on a brake</b></p> <p><i>Given practical assignments, faulty brakes, tools, diagnostic equipment, personal protective equipment and specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0301 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0302 Visually inspect or assess brake condition</li> <li>• PA0303 Identify possible faults</li> <li>• PA0304 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0305 Report faults or defects on brake</li> <li>• PA0306 Conduct post-diagnosis and fault-finding activities</li> </ul> <p><b>PM-09-PS03: Replace brake components and assemble brakes</b></p> <p><i>Given a selection of various types of brake,</i></p>	<p>of brakes</p> <ul style="list-style-type: none"> <li>• KT0804 Removal and installation procedures for brakes</li> </ul> <p><b>KM-04-KT13: Diagnostic techniques</b></p> <ul style="list-style-type: none"> <li>• KT1301 Diagnostic equipment</li> <li>• KT1302 Diagnostic techniques</li> <li>• KT1303 Diagnostic testing</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-10-PS04 Do fault-finding on a brake</b></p> <ul style="list-style-type: none"> <li>• AK0301 Procedures to diagnose brake problems</li> <li>• AK0302 Procedures to do fault-finding on a brake</li> <li>• AK0303 Original Equipment Manufacturer (OEM) specifications for a brake</li> <li>• AK0304 Signs, symptoms and causes of faults</li> <li>• AK0305 Types of brake faults</li> <li>• AK0306 Possible corrective actions and options to repair faults</li> </ul> <p><b>PM-08-PS04: Disassemble, clean and inspect brakes</b></p> <ul style="list-style-type: none"> <li>• AK0401 Procedures to disassemble, clean and inspect brakes</li> <li>• AK0402 Original Equipment Manufacturer brake specifications</li> <li>• AK0403 Brake components and component numbers</li> <li>• AK0404 Signs and causes of wear,</li> </ul>	<ul style="list-style-type: none"> <li>• WA0503 Fault find a variety of electrical and mechanical sub-assemblies and machines to manufacturers' and workplace specifications</li> <li>• WA0504 Compile parts list and draw parts, where applicable</li> <li>• WA0505 Repair a variety of electrical and mechanical sub-assemblies and machines to manufacturers' and workplace specifications</li> <li>• WA0506 Conduct functionality tests and commission the machines</li> <li>• WA0507 Restore the work area and dispose of waste materials</li> <li>• WA0508 Interact with production personnel, where applicable</li> <li>• WA0509 Complete all relevant documentation</li> <li>• WA0510 Communicate with relevant parties</li> </ul>
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<p><i>relevant tools, personal protective equipment, specifications and material,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0301 Plan and prepare for replacement of brake components and assembly of a brake</li> <li>• PA0302 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0303 Select tools, materials and equipment</li> <li>• PA0304 Replace worn, damaged or defective components and parts</li> <li>• PA0305 Assemble, set and record brake component or part numbers and specifications</li> <li>• PA0306 Conduct post-assembly activities</li> </ul> <p><b>PM-11-PS03: Repair brakes</b></p> <p><i>Given a faulty brake, replacement components, lubricants, diagnostic information, sequence of work, specifications, tools and personal protective equipment</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0301 Read and interpret the practical assignments on specific repairs required</li> <li>• PA0302 Read and interpret the standard repair specifications and quality requirements from the manufacturer</li> </ul>	<p>damage, failure and defects in components</p> <ul style="list-style-type: none"> <li>• AK0405 Safe handling and storage of components</li> </ul> <p><b>PM-09-PS03: Replace brake components and assemble brakes</b></p> <ul style="list-style-type: none"> <li>• AK0301 Procedures to replace, assemble and set a brake</li> <li>• AK0302 Original Equipment Manufacturer brake specifications</li> <li>• AK0303 Types and applications of brakes</li> <li>• AK0304 Brake components and applications</li> </ul> <p><b>PM-11-PS03: Repair brakes</b></p> <ul style="list-style-type: none"> <li>• AK0301 Procedures for repairing a brake</li> <li>• AK0302 Safety practices and procedures</li> <li>• AK0303 brake disassembly and assembly procedures</li> <li>• AK0304 brake component replacement procedures</li> <li>• AK0305 Lubricants, seals and part specifications</li> <li>• AK0306 Use of and care for tools and equipment</li> </ul> <p><b>PM-10-PS04: Do fault-finding on clutches</b></p> <ul style="list-style-type: none"> <li>• AK0401 Procedures to diagnose clutch problems</li> <li>• AK0402 Procedures to do fault-finding on clutches</li> </ul>	
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<ul style="list-style-type: none"> <li>• PA0303 Identify components, parts, seals, lubricants and specifications of these that must be available for repair</li> <li>• PA0304 Plan the sequence of work to repair the brake</li> <li>• PA0305 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0306 Identify, select and use the required hand tools, power tools and equipment</li> <li>• PA0307 Disassemble the brake following the specified procedure</li> <li>• PA0308 Inspect components and parts and confirm required repairs</li> <li>• PA0309 Replace components or parts following the specified procedure</li> <li>• PA0310 Reassemble the brake following the specified procedure</li> <li>• PA0311 Check and confirm that repairs have resolved the problem or fault</li> <li>• PA0312 Conduct post-repair activities</li> </ul> <p><b>PM-08-PS05: Disassemble, clean and inspect clutches</b></p> <ul style="list-style-type: none"> <li>• PA0501 Plan and prepare workplace for disassembling a clutch</li> <li>• PA0502 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0503 Select tools and cleaning materials</li> <li>• PA0504 Disassemble and record clutch</li> </ul>	<ul style="list-style-type: none"> <li>• AK0403 Original Equipment Manufacturer specifications for a clutch</li> <li>• AK0404 Signs, symptoms and causes of faults</li> <li>• AK0405 Types of clutch faults</li> <li>• AK0406 Possible corrective actions and options to repair faults</li> </ul> <p><b>PM-08-PS05: Disassemble, clean and inspect clutches</b></p> <ul style="list-style-type: none"> <li>• AK0501 Procedures to disassemble, clean and inspect clutches</li> <li>• AK0502 Original Equipment Manufacturer clutch specifications</li> <li>• AK0503 Clutch components and component numbers</li> <li>• AK0504 Signs and causes of wear, damage, failure and defects in components</li> <li>• AK0505 Safe handling and storage of components</li> </ul> <p><b>PM-09-PS04: Replace clutch components and assemble clutches</b></p> <ul style="list-style-type: none"> <li>• AK0401 Procedures to replace, assemble and set a clutch</li> <li>• AK0402 Original Equipment Manufacturer clutch specifications</li> <li>• AK0403 Types and applications of clutch</li> <li>• AK0404 Clutch components and applications</li> </ul> <p><b>PM-11-PS04: Repair clutches</b></p> <ul style="list-style-type: none"> <li>• AK0401 Procedures for repairing a clutch</li> <li>• AK0402 Safety practices and procedures</li> </ul>	
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<p>component or part numbers and specifications</p> <ul style="list-style-type: none"> <li>• PA0505 Clean clutch components</li> <li>• PA0506 Visually inspect component condition (wear, damage, defect, failure) according to Original Equipment Manufacturer specifications</li> <li>• PA0507 Conduct post-disassembling activities</li> </ul> <p><b>PM-10-PS04: Do fault-finding on clutches</b></p> <p><i>Given practical assignments, faulty clutches, tools, diagnostic equipment, personal protective equipment and specifications,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0401 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0402 Visually inspect or assess clutch condition</li> <li>• PA0403 Identify possible faults</li> <li>• PA0404 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0405 Report faults or defects on a clutch</li> <li>• PA0406 Conduct post-diagnosis and fault-finding activities</li> </ul> <p><b>PM-09-PS04: Replace clutch components and assemble clutches</b></p>	<ul style="list-style-type: none"> <li>• AK0403 Clutch disassembly and assembly procedures</li> <li>• AK0404 Clutch component replacement procedures</li> <li>• AK0405 Lubricants, seals and part specifications and parts' numbers</li> <li>• AK0406 Use of and care for tools and equipment</li> <li>• AK0407 Post repair activities</li> </ul>	
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*Given a selection of various types of clutch, relevant tools, personal protective equipment, specifications and materials,*

**The apprentice must be able to:**

- PA0401 Plan and prepare for replacement of clutch components and assembly of a clutch
- PA0402 Identify potential hazards and risks related to the job and list the appropriate responses
- PA0403 Select tools, materials and equipment
- PA0404 Replace worn, damaged or defective components and parts
- PA0405 Assemble, set and record clutch component or part numbers and specifications
- PA0406 Conduct post-assembly activities
- Perform Housekeeping as per prescribed standard

**PM-11-PS04: Repair clutches**

*Given faulty clutches, replacement components, lubricants, diagnostic information, sequence of work, specifications, tools and personal protective equipment,*

**The apprentice must be able to:**

- PA0401 Read and interpret the practical assignments on specific repairs required

<ul style="list-style-type: none"> <li>• PA0402 Read and interpret the standard repair specifications and quality requirements from the manufacturer</li> <li>• PA0403 Identify components, parts, seals, lubricants and specifications of these that must be available for repair</li> <li>• PA0404 Plan the sequence of work to repair the clutch</li> <li>• PA0405 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0406 Identify, select and use the required hand tools, power tools and equipment</li> <li>• PA0407 Disassemble the clutch following the specified procedure</li> <li>• PA0408 Inspect components and parts and confirm required repairs</li> <li>• PA0409 Replace components or parts following the specified procedure</li> <li>• PA0410 Reassemble the clutch following the specified procedure</li> <li>• PA0411 Check and confirm that repairs have resolved the problem or fault</li> <li>• PA0412 Conduct post-repair activities</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-10-PS04: Do fault-finding on a brake</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Procedures to disassemble, clean and inspect a brake are explained</li> <li>• IAC0402 A brake is disassembled, cleaned and inspected according to procedure</li> <li>• IAC0403 Risks and hazards are identified and responded to in a responsible manner</li> </ul>	<p><b>KM-04-KT07: Mechanical working principles, types and applications of clutches</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Types of clutches are identified and described</li> <li>• IAC0702 Components of clutches are identified and discussed</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0501 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> </ul>

<ul style="list-style-type: none"> <li>• IAC0404 Brake component or part numbers are recorded correctly before and during disassembly</li> <li>• IAC0405 All worn, damaged and defective components are identified correctly</li> <li>• IAC0406 Brake types and Original Equipment Manufacturer specifications are explained</li> <li>• IAC0407 Signs and causes of worn, damaged and defective components are explained</li> </ul> <p><b>PM-08-PS04: Disassemble, clean and inspect brakes</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Procedures to disassemble, clean and inspect a brake are explained</li> <li>• IAC0402 A brake is disassembled, cleaned and inspected according to procedure</li> <li>• IAC0403 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0404 Brake component or part numbers are recorded correctly before and during disassembly</li> <li>• IAC0405 All worn, damaged and defective components are identified correctly</li> <li>• IAC0406 Brake types and Original Equipment Manufacturer specifications are explained</li> <li>• IAC0407 Signs and causes of worn, damaged and defective components are explained</li> </ul> <p><b>PM-09-PS03: Replace brake components and assemble brakes</b></p>	<ul style="list-style-type: none"> <li>• IAC0703 Functions and working principles of clutches are described</li> <li>• IAC0704 Removal and installation procedures for clutches are described</li> <li>• IAC0705 Safety precautions pertaining to clutches are explained</li> </ul> <p><b>KM-04-KT08: Mechanical working principles, types and applications of brakes</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Types of brakes are identified and described</li> <li>• IAC0802 Components of brakes are identified and discussed</li> <li>• IAC0803 Functions and working principles of brakes are described</li> <li>• IAC0804 Removal and installation procedures for brakes are described</li> <li>• IAC0805 Safety precautions pertaining to brakes are explained</li> </ul> <p><b>KM-04-KT13: Diagnostic techniques</b></p> <ul style="list-style-type: none"> <li>• IAC1301 Types of diagnostic equipment are identified and described</li> <li>• IAC1302 The various types of diagnostic techniques are described</li> <li>• IAC1303 The sequence involved in a diagnostic procedure or technique is explained</li> <li>• IAC1304 Safety precautions pertaining to diagnostic equipment are explained</li> </ul>	<ul style="list-style-type: none"> <li>• SE0502 Completed workplace logbook, including list of equipment repaired, signed off by the supervising artisan</li> <li>• SE0503 Applicable job cards</li> </ul>
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- IAC0301 Procedures to replace brake components and assemble a brake are explained
- IAC0302 Brake components are replaced according to procedures
- IAC0303 A brake is assembled according to procedure and Original Equipment Manufacturer specifications
- IAC0304 Risks and hazards are identified and responded to in a responsible manner

**PM-11-PS03: Repair a brake**

- Post repair activities
- Internal Assessment Criteria
- Instructions and repair specifications are interpreted correctly
- Brake components and specifications are identified correctly
- The brake is disassembled and reassembled correctly
- Faulty components are identified and replaced correctly
- Sequences to repair the brake are followed correctly
- Tools and equipment are identified and used correctly
- Post repair activities are performed correctly
- Safety requirements are met

**PM-10-PS05: Do fault-finding on a Clutch**

- IAC0501 Procedures to disassemble, clean and inspect a clutch are explained

<ul style="list-style-type: none"> <li>• IAC0502 A clutch is disassembled, cleaned and inspected according to procedure</li> <li>• IAC0503 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0504 Clutch component or part numbers are recorded correctly before and during disassembly</li> <li>• IAC0505 All worn, damaged and defective components are identified correctly</li> <li>• IAC0506 Clutch types and Original Equipment Manufacturer specifications are explained</li> <li>• IAC0507 Signs and causes of worn, damaged and defective components are explained</li> </ul> <p><b>PM-08-PS05: Disassemble, clean and inspect clutches</b></p> <ul style="list-style-type: none"> <li>• IAC0501 Procedures to disassemble, clean and inspect a clutch are explained</li> <li>• IAC0502 A clutch is disassembled, cleaned and inspected according to procedure</li> <li>• IAC0503 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0504 Clutch component or part numbers are recorded correctly before and during disassembly</li> <li>• IAC0505 All worn, damaged and defective components are identified correctly</li> <li>• IAC0506 Clutch types and Original Equipment Manufacturer specifications are explained</li> <li>• IAC0507 Signs and causes of worn, damaged and defective components are</li> </ul>		
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<p>explained</p> <p><b>PM-09-PS04: Replace clutch components and assemble clutches</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Procedures to replace clutch components and assemble a clutch are explained</li> <li>• IAC0402 Clutch components are replaced according to procedures</li> <li>• IAC0403 A clutch is assembled according to procedure and Original Equipment Manufacturer specifications</li> <li>• IAC0404 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-11-PS04 Repair clutches</b></p> <ul style="list-style-type: none"> <li>• Instructions and repair specifications are interpreted correctly</li> <li>• Clutch components and specifications are identified correctly</li> <li>• The clutch is disassembled and reassembled correctly</li> <li>• Faulty components are identified and replaced correctly</li> <li>• Sequences to repair the clutch are followed correctly</li> <li>• Tools and equipment are identified and used correctly</li> <li>• Post repair activities are performed correctly</li> <li>• Safety requirements are met</li> </ul>		
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### **Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 20 questions (40 min) and the competency will be at 80%
- Practical exercise of 120min covering all items mentioned above
  - No injury or unsafe act had occurred
  - Identify the following brake systems:
    - disc
    - thruster
    - electro-magnetic
  - Maintain disc brakes
  - Maintain thruster brakes - calliper type
  - Maintain electro-magnetic brakes
  - Identify centrifugal and multi-disc clutch systems
  - Maintain a multi-disc clutch
  - Air gap according to manufacturer's specifications
  - The torque is set at 100nm
  - The drum is in the centre of the brake shoe with a tolerance of 2mm
  - The centre height of drum is correct with a tolerance of 0.5mm
  - Time allowed 1.5 hours (per task).
  - Safety aspects must be adhered to.
  - All safety aspects adhered to according company policies
  - No injury or damage to equipment

### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of tolerance and fits, brake systems and clutches
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures

### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Tools including but not limited to: Feeler gauge, Socket and Spanner set, Torque wrench, Cir-clip pliers, lifting equipment,
- Thrust Brake (Hydraulic or Electro-pneumatic)
- Different brake systems



- Different clutch systems

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>P2</h1>		
		<b>Curriculum code: 671202000</b>				
<b>Learning area title: Perform work activities on brakes and clutches</b>		<b>Total hours</b>	<b>SDP</b>			<b>WP</b>
			56			56
<b>Work situation title: Perform installation and commissioning activities on brakes and clutches</b>		<b>Total hours</b>	16	16		
<b>Work scenario:</b> Doug is tasked with the installation of a new Thrust brake system that works with the long travel of an overhead crane. The installation of the brake system is situated between the drive and wheel. He has to set the brake according to the OEM Specification which requires the brake shoes placement be in the centre of the drum. The gap and all torque settings must be to specified limits. Safety is a non-negotiable.						
<b>Prerequisite learning:</b> P1						
<b>INTEGRATED LEARNING CONTENT</b>						
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>		
<b>PM-14-PS03: Install and commission brakes</b> <i>Given practical assignments, repaired brakes, tools, personal protective equipment and specifications,</i> <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>• PA0301 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>• PA0302 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> <li>• PA0303 Plan the sequences for installation and commissioning</li> <li>• PA0304 Identify potential hazards and risks related to the job and list the appropriate</li> </ul>		Knowledge of: <b>KM-04-KT07: Mechanical working principles, types and applications of clutches</b> <ul style="list-style-type: none"> <li>• KT0701 Types of clutches</li> <li>• KT0702 Terminology of clutches</li> <li>• KT0703 Functions and working principles of clutches</li> <li>• KT0704 Removal and installation procedure for clutches</li> </ul> <b>KM-04-KT08: Mechanical working principles, types and applications of brakes</b> <ul style="list-style-type: none"> <li>• KT0801 Types of brakes</li> <li>• KT0802 Terminology of brakes</li> </ul>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:  <b>Install and commission brakes and clutches under the direct supervision of a qualified millwright or fitter for at least 80 hours</b> <ul style="list-style-type: none"> <li>• Gather the necessary technical information, develop an installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• Conduct risk assessments, perform the lock-out and tag out procedures</li> </ul>		

<p>responses</p> <ul style="list-style-type: none"> <li>• PA0305 Prepare the work area for installation of the brake</li> <li>• PA0306 Install and align brakes to specifications</li> <li>• PA0307 Use tools and equipment correctly</li> <li>• PA0308 Follow the correct installation procedures and sequence</li> <li>• PA0309 Check the brake installation by executing a systematic inspection of all the critical control points</li> <li>• PA0310 Commission the brake by performing a final inspection and performance test</li> <li>• PA0311 Perform post installation and commissioning activities</li> </ul> <p><b>PM-14-PS04: Install and commission clutches</b></p> <ul style="list-style-type: none"> <li>• PA0401 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>• PA0402 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> <li>• PA0403 Plan the sequences for installation and commissioning</li> <li>• PA0404 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0405 Prepare the work area for installation of the clutch</li> <li>• PA0406 Install and align the clutch to specifications</li> <li>• PA0407 Use tools and equipment correctly</li> </ul>	<ul style="list-style-type: none"> <li>• KT0803 Functions and working principles of brakes</li> <li>• KT0804 Removal and installation procedures for brakes</li> </ul> <p><u>Applied Knowledge</u></p> <p><b>PM-14-PS03: Install and commission brakes</b></p> <ul style="list-style-type: none"> <li>• AK0301 Brake installation, alignment and commissioning procedures and specifications</li> <li>• AK0302 Use and care of tools and equipment</li> </ul> <p><b>PM-14-PS04: Install and commission clutches</b></p> <ul style="list-style-type: none"> <li>• AK0401 Clutch installation, alignment and commissioning procedures and specifications</li> <li>• AK0402 Use and care of tools and equipment</li> </ul>	<p>where applicable and prepare the work sites</p> <ul style="list-style-type: none"> <li>• Install and align brakes and clutches to manufacturers' and workplace specifications</li> <li>• Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete all relevant documentation</li> <li>• Communicate with relevant parties</li> </ul>
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<ul style="list-style-type: none"> <li>• PA0408 Follow the correct installation procedures and sequence</li> <li>• PA0409 Check clutch installation by performing a systematic inspection of all the critical control points</li> <li>• PA0410 Commission the clutch by performing a final inspection and performance test</li> <li>• PA0411 Perform post installation and commissioning activities</li> <li>• Perform housekeeping as per industry standards</li> <li>• Performance assessment report for completion of work situation</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-14-PS03: Install and commission brakes</b></p> <ul style="list-style-type: none"> <li>• IAC0301 Installation and alignment is performed to requirements and specifications</li> <li>• IAC0302 Commissioning is performed to requirements</li> <li>• IAC0303 Quality requirements are met</li> <li>• IAC0304 Tools and equipment are used appropriately and correctly</li> <li>• IAC0305 Safety requirements are met</li> </ul> <p><b>PM-14-PS04: Install and commission clutches</b></p> <ul style="list-style-type: none"> <li>• IAC0401 Installation and alignment is performed to requirements and specifications</li> <li>• IAC0402 Commissioning is performed to requirements</li> <li>• IAC0403 Quality requirements are met</li> <li>• IAC0404 Tools and equipment are used appropriately and correctly</li> <li>• IAC0405 Safety requirements are met</li> </ul>	<p><b>KM-04-KT08: Mechanical working principles, types and applications of brakes</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Types of brakes are identified and described</li> <li>• IAC0802 Components of brakes are identified and discussed</li> <li>• IAC0803 Functions and working principles of brakes are described</li> <li>• IAC0804 Removal and installation procedures for brakes are described</li> <li>• IAC0805 Safety precautions pertaining to brakes are explained</li> </ul> <p><b>KM-04-KT07: Mechanical working principles, types and applications of clutches</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Types of clutches are identified and described</li> <li>• IAC0702 Components of clutches are identified and discussed</li> </ul>	<p><b>Supporting Evidence</b></p> <p><b>Installation and commissioning of brakes and clutches</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>

	<ul style="list-style-type: none"> <li>• IAC0703 Functions and working principles of clutches are described</li> <li>• IAC0704 Removal and installation procedures for clutches are described</li> <li>• IAC0705 Safety precautions pertaining to clutches are explained</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (45 min) and the competency will be at 80%</li> <li>• Practical exercise of 90min in length covering all items mentioned above. <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No damage to equipment</li> <li>○ Identify the following brake systems: <ul style="list-style-type: none"> <li>▪ disc</li> <li>▪ thruster</li> <li>▪ electro-magnetic</li> </ul> </li> <li>○ The drum is in the centre of the brake shoe to specification</li> <li>○ The centre height of drum is correct with a tolerance of 0.5mm.</li> <li>○ Air gap according to manufacturer's specifications</li> <li>○ The torque is set to specification</li> <li>○ Identify centrifugal and multi-disc clutch systems</li> <li>○ All safety aspects adhered to according company policies</li> </ul> </li> <li>• Level of competency of 100% (critical) required for: <ul style="list-style-type: none"> <li>○ Safety- isolate, lockout and test for zero potential</li> </ul> </li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Learning material on defined Knowledge and Practical Skills Modules</li> <li>• Samples (and charts) of tolerance and Fits, Brakes systems and clutches</li> <li>• Safe Operating Procedure and Safe Working Procedure</li> <li>• Charts of risk assessment procedure and safety measures</li> <li>• CDs and videos will be an added advantage</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles</li> </ul>		

- Thrust Brake (Hydraulic or Electro-pneumatic)
- Different brake systems
- Different Clutch systems
- Set of Spanners and sockets
- Micrometres/Vernier
- Rubber Mallet
- Screwdriver
- Allen key set
- Torque Wrench
- Tape measure
- Feeler gauge
- Tommy bar

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>Q1</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on bearings and lubrication systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		80	104	
<b>Work situation title: Perform routine maintenance, fault find, repair and align bearings</b>	<b>Total hours</b>	24	40	
<b>Work scenario:</b> The maintenance department is tasked with a shutdown on a production line. Sonny's responsibility includes installing the bearings. He has to adhere to OEM specifications throughout the execution of the task. After installing the bearings, he has to start-up the line and ensure that the system works correctly.				
<b>Prerequisite learning:</b> A1, B1-B2, C1, C3, C4, C6, D1-D3, D5				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><b>PM-08-PS07: Remove and inspect bearings</b></p> <p><i>Given a selection of various types of bearing assembly, relevant tools, personal protective equipment, specifications, cleaning materials and solvents,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0701 Plan and prepare workplace for removing a bearing</li> <li>• PA0702 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0703 Select tools and cleaning materials</li> <li>• PA0704 Disassemble bearing unit or housing</li> <li>• PA0705 Remove bearing and record</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT02: Types and application of bearings</b></p> <ul style="list-style-type: none"> <li>• KT0201 Bearings (anti-friction and friction bearings)</li> <li>• KT0202 Application of bearings</li> <li>• KT0203 Maintenance of bearings</li> <li>• KT0204 Causes of failures in bearings</li> <li>• KT0205 Removal and installation of bearings</li> </ul> <p><u>Applied Knowledge:</u></p> <p><b>PM-08-PS07: Remove and inspect bearings</b></p>		<p>The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities:</p> <p><b>WM-03-WE05: Fault-find and repair electrical and mechanical sub-assemblies and machines under the direct supervision of a qualified millwright, electrician or fitter for at least 40 hours</b></p> <ul style="list-style-type: none"> <li>• WA0501 Gather the necessary technical information and plan the fault-finding process</li> <li>• WA0502 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> </ul>

<p>bearing part numbers and specifications</p> <ul style="list-style-type: none"> <li>• PA0706 Clean bearing components</li> <li>• PA0707 Visually inspect bearing condition (wear, damage, defect, failure) according to Original Equipment Manufacturer specifications</li> <li>• PA0708 Conduct post-removal and inspection activities</li> </ul> <p><b>PM-09-PS06: Replace bearings</b></p> <p><i>Given a selection of various types of bearings, relevant tools, personal protective equipment, specifications and material</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0601 Plan and prepare for replacing a bearing</li> <li>• PA0602 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0603 Select tools, materials and equipment</li> <li>• PA0604 Replace or mount and set a bearing according to specifications</li> <li>• PA0605 Lubricate a bearing</li> <li>• PA0606 Conduct post-assembly activities</li> </ul> <p><b>PM-10-PS06: Do fault-finding on bearings</b></p> <p><i>Given practical assignments, faulty bearing, tools, diagnostic equipment, personal protective equipment and specifications</i></p>	<ul style="list-style-type: none"> <li>• AK0701 Procedures to remove and inspect bearings</li> <li>• AK0702 Original Equipment Manufacturer bearing specifications</li> <li>• AK0703 Signs and causes of wear, damage, failure and defects in components</li> <li>• AK0704 Safe handling and storage of bearings</li> </ul> <p><b>PM-09-PS06: Replace bearings</b></p> <ul style="list-style-type: none"> <li>• AK0601 Procedures to replace a bearing</li> <li>• AK0602 Original Equipment Manufacturer bearing specifications</li> <li>• AK0603 Types and applications of bearings</li> <li>• AK0604 Bearing lubrication procedures</li> <li>• <b>Housekeeping standards for routine maintenance</b></li> <li>• <b>Material Safety Data Sheet</b></li> </ul> <p><b>PM-10-PS06: Do fault-finding on bearings</b></p> <ul style="list-style-type: none"> <li>• AK0601 Procedures to diagnose bearing problems</li> <li>• AK0602 Procedures to do fault-finding on bearings</li> <li>• AK0603 Original Equipment Manufacturer specifications for bearings</li> <li>• AK0604 Signs, symptoms and causes of faults on bearings</li> </ul>	<ul style="list-style-type: none"> <li>• WA0503 Fault find a variety of electrical and mechanical sub-assemblies and machines to manufacturers' and workplace specifications</li> <li>• WA0504 Compile parts list and draw parts, where applicable</li> <li>• WA0505 Repair a variety of electrical and mechanical sub-assemblies and machines to manufacturers' and workplace specifications</li> <li>• WA0506 Conduct functionality tests and commission the machines</li> <li>• WA0507 Restore the work area and dispose of waste materials</li> <li>• WA0508 Interact with production personnel, where applicable</li> <li>• WA0509 Complete all relevant documentation</li> <li>• WA0510 Communicate with relevant parties</li> <li>• <b>Perform housekeeping as per industry standards</b></li> </ul>
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<p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• PA0601 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0602 Visually inspect or assess bearing condition</li> <li>• PA0603 Identify possible faults</li> <li>• PA0604 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0605 Report faults or defects on bearings</li> <li>• PA0606 Conduct post-diagnosis and fault-finding activities</li> </ul>	<ul style="list-style-type: none"> <li>• AK0605 Types of bearing faults</li> <li>• AK0606 Possible corrective actions and options to repair faults</li> </ul>	
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-08-PS07: Remove and inspect bearings</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Procedures to remove and inspect a bearing are explained</li> <li>• IAC0702 Bearing unit or housing is disassembled correctly</li> <li>• IAC0703 A bearing is removed and inspected according to procedure</li> <li>• IAC0704 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0705 Bearing specifications and part numbers are recorded correctly</li> <li>• IAC0706 Worn, damaged and defective bearings are identified correctly</li> <li>• IAC0707 Bearing types and Original</li> </ul>	<p><b>KM-04-KT02 Types, and application of bearings</b></p> <ul style="list-style-type: none"> <li>• IAC0201 Types of bearings are differentiated</li> <li>• IAC0202 Components of bearings are identified and discussed</li> <li>• IAC0203 Applications for different bearings are discussed</li> <li>• IAC0204 The causes of bearing failure are described</li> <li>• IAC0205 Removal and installation procedures for bearings are described</li> <li>• IAC0206 Safety precautions pertaining to bearings are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• SE0501 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0502 Completed workplace logbook, including list of equipment repaired, signed off by the supervising artisan</li> <li>• SE0503 Applicable job cards</li> </ul>



<p>Equipment Manufacturer specifications are explained</p> <ul style="list-style-type: none"> <li>• IAC0708 Signs and causes of worn, damaged and defective components are explained</li> </ul> <p><b>PM-09-PS06: Replace bearings</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Procedures to replace a bearing are explained</li> <li>• IAC0602 A bearing is replaced or mounted and set according to procedures and specifications</li> <li>• IAC0603 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-10-PS06: Do fault-finding on bearings</b></p> <ul style="list-style-type: none"> <li>• IAC0601 Defects or faults on bearing are identified correctly</li> <li>• IAC0602 Corrective actions and options are explained correctly and motivated</li> <li>• IAC0603 A systematic fault-finding process is followed</li> <li>• IAC0604 Risks and hazards are identified and responded to in a responsible manner</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 15 questions (30 min) and the competency will be at 80%</li> </ul>		

- Practical exercise of 60min length, covering all items mentioned above:
  - No injuries to self/co-worker and the environment or damage to equipment
  - Correct use of induction heater, oil heater, press, puller and hydraulic jack
  - Bearing must be heated to correct temperature
  - Bearings must be removed correctly
  - Bearings must be mounted correctly
  - Bearings are mounted according to specifications (Clearance chart)
  - Correct lubrication used

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of different bearings, clearances and lubrication
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Tools include but not limited to: measuring equipment, hand tools, hand press, array of bearing heaters (induction, Oil bath), bearing pullers, infrared thermometer, Hand operated press
- Lubrication charts, Heat detection chalk (Heat Sticks)
- Bearings, bearing mounting sleeves

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>Q2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on bearings and lubrication systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		80	104	
<b>Work situation title: Perform routine maintenance, fault find, repair and align lubrication systems</b>	<b>Total hours</b>	32	40	
<b>Work scenario:</b> Hun's responsibilities at the production plant includes the maintenance of the lubrication systems. As these systems are extremely important to the smooth operation, a failure can cause lengthy downtime and costly repairs. All reservoirs must be checked and replenished daily. Any defects or irregularity must be reported and repaired with the utmost urgency. Safety is of utmost importance.				
<b>Prerequisite learning:</b> A1, B1-B2, C1, C3, C4, C6, D1-D3, D5				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<b>PM-08-PS08: Clean and inspect lubrication systems</b>  <i>Given a selection of various types of lubrication system, relevant drawings, tools, personal protective equipment, specifications, cleaning materials and solvents,</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0801 Plan and prepare for cleaning and inspecting a lubrication system</li> <li>PA0802 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>PA0803 Select tools and cleaning materials</li> </ul>		Knowledge of:  <b>KM-04-KT09: Mechanical working principles, types and applications of lubrication systems</b> <ul style="list-style-type: none"> <li>KT0901 Lubrication systems and devices</li> <li>KT0902 Properties of lubricants</li> <li>KT0903 Terminology of lubrication systems and devices</li> <li>KT0904 Working principles of lubrication systems and devices</li> </ul> <u>Applied Knowledge</u>  <b>PM-08-PS08: Clean and inspect lubrication systems</b>		The apprentice will be expected to <b>gain practical experience</b> and engage in the following work activities: <ul style="list-style-type: none"> <li><b>WM-01-WE01: Observe and assist a qualified millwright, electrician or fitter in the maintenance of equipment, control systems and installations for at least 40 hours</b></li> <li><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></li> <li><b>WM-01-WE03: Undertake all activities without assistance, but</b></li> </ul>

<ul style="list-style-type: none"> <li>• PA0804 Clean a lubrication system</li> <li>• PA0805 Visually inspect a lubrication system for leaks, wear, damage, defects, and failures according to Original Equipment Manufacturer specifications</li> <li>• PA0806 Conduct post-cleaning and inspecting activities</li> </ul> <p><b>PM-10-PS07: Do fault-finding on lubrication systems</b></p> <ul style="list-style-type: none"> <li>• PA0701 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0702 Visually inspect or assess lubrication system condition</li> <li>• PA0703 Identify possible faults</li> <li>• PA0704 Determine corrective actions and options for dealing with identified faults</li> <li>• PA0705 Report faults or defects on a lubrication system</li> <li>• PA0706 Conduct post-diagnosis and fault-finding activities</li> </ul> <p><b>PM-09-PS07: Replace lubrication components and assemble lubrication systems</b></p> <ul style="list-style-type: none"> <li>• PA0701 Plan and prepare for replacing components of a lubrication system and for</li> </ul>	<ul style="list-style-type: none"> <li>• AK0801 Procedures to clean and inspect lubrication systems</li> <li>• AK0802 Original Equipment Manufacturer specifications for a lubrication system</li> <li>• AK0803 Components of a lubrication system</li> <li>• AK0804 Signs and causes of leaks, wear, damage, failure and defects</li> <li>• AK0805 Types and applications of lubrication systems</li> </ul> <p><b>PM-10-PS07: Do fault-finding on lubrication systems</b></p> <ul style="list-style-type: none"> <li>• AK0701 Procedures to diagnose lubrication system problems</li> <li>• AK0702 Procedures to do fault-finding on a lubrication system</li> <li>• AK0703 Original Equipment Manufacturer specifications for a lubrication system</li> <li>• AK0704 Signs, symptoms and causes of faults on lubrication systems</li> <li>• AK0705 Types of lubrication system faults</li> <li>• AK0706 Possible corrective actions and options to repair faults</li> </ul> <p><b>PM-09-PS07: Replace lubrication components and assemble lubrication systems</b></p>	<p><b>under supervision of a qualified millwright, electrician or fitter, in maintenance processes for equipment, control systems and installations for at least 320 hours</b></p> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>• WA0102 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• WA0103 Conduct pre-maintenance inspections and identify and report any problems</li> <li>• WA0104 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least three different pieces of industrial machinery</li> <li>• WA0105 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0106 Restore the work area and dispose of waste materials</li> <li>• WA0107 Interact with production personnel, where applicable</li> <li>• WA0108 Complete maintenance reports</li> <li>• WA0109 Communicate with relevant parties</li> </ul>
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<p>assembling a lubrication system</p> <ul style="list-style-type: none"> <li>• PA0702 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0703 Select tools, materials, equipment and lubricants</li> <li>• PA0704 Replace worn, damaged or defective components and parts</li> <li>• PA0705 Assemble, set and record lubrication component or part numbers and specifications</li> <li>• PA0706 Check and fill lubricant</li> <li>• PA0707 Conduct post-assembly activities</li> </ul>	<ul style="list-style-type: none"> <li>• AK0701 Procedures to replace lubrication system components</li> <li>• AK0702 Procedures to assemble a lubrication system</li> <li>• AK0703 Types and applications of lubrication systems and specifications</li> <li>• AK0704 Lubrication system components and applications</li> <li>• AK0705 Types and applications of lubricants</li> <li>• AK0706 Environmental risks associated with lubricants</li> </ul>	
<p><b>PM-11-PS06: Repair lubrication systems</b></p> <ul style="list-style-type: none"> <li>• PA0601 Read and interpret the practical assignments on specific repairs required</li> <li>• PA0602 Read and interpret the standard repair specifications and quality requirements from the manufacturer</li> <li>• PA0603 Identify components, parts, seals, lubricants and specifications of these that must be available for repair</li> <li>• PA0604 Plan the sequence of work to repair the lubrication system</li> <li>• PA0605 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0606 Identify, select and use the required hand tools, power tools and</li> </ul>	<p><b>PM-11-PS06: Repair lubrication systems</b></p> <ul style="list-style-type: none"> <li>• AK0601 Procedures for repairing lubrication systems</li> <li>• AK0602 Safety practices and procedures</li> <li>• AK0603 Lubrication system disassembly and assembly procedures check</li> <li>• AK0604 Lubrication system component replacement procedures</li> <li>• AK0605 Lubricants, seals and parts specifications and part numbers</li> <li>• AK0606 Use and care of tools and equipment</li> <li>• AK0607 Post repair activities</li> </ul>	

<p>equipment</p> <ul style="list-style-type: none"> <li>• PA0607 Disassemble the lubrication system following the specified procedure</li> <li>• PA0608 Inspect components and parts and confirm required repairs</li> <li>• PA0609 Replace components or parts following the specified procedure</li> <li>• PA0610 Reassemble the lubrication system following the specified procedure</li> <li>• PA0611 Check and fill lubricant if required</li> <li>• PA0612 Check and confirm that repairs have resolved the problem or fault</li> <li>• PA0613 Conduct post-repair activities</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>PM-08-PS08: Clean and inspect lubrication systems</b></p> <ul style="list-style-type: none"> <li>• IAC0801 Procedures to clean and inspect a lubrication system are explained</li> <li>• IAC0802 A lubrication system is cleaned and inspected according to procedure</li> <li>• IAC0803 Risks and hazards are identified and responded to in a responsible manner</li> <li>• IAC0804 Leaks, wear, damage, defects and failures on a lubrication system are identified and explained correctly</li> <li>• IAC0805 Lubrication system types and Original Equipment Manufacturer specifications</li> </ul>	<p><b>KM-04-KT09: Mechanical working principles, types and applications of lubrication systems</b></p> <ul style="list-style-type: none"> <li>• IAC0901 Classification and types of lubrication systems and devices are described</li> <li>• IAC0902 Properties of lubricants are discussed</li> <li>• IAC0903 Components of lubrication systems and devices are discussed</li> <li>• IAC0904 Working principles of lubrications systems and devices are discussed</li> <li>• IAC0905 Safety precautions pertaining to lubrication systems are explained</li> </ul>	<p><b>Supporting Evidence:</b></p> <p><b>WM-01-WE01: Observe and assist a qualified millwright, electrician or fitter in the maintenance of equipment, control systems and installations for at least 40 hours</b></p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <p><b>WM-01-WE03: Undertake all activities without assistance, but under supervision of a qualified millwright, electrician or fitter, in maintenance processes for equipment, control</b></p>

<p>are explained</p> <p><b>PM-10-PS07: Do fault-finding on lubrication systems</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Defects or faults on a lubrication system are identified correctly</li> <li>• IAC0702 Corrective actions and options are explained correctly and motivated</li> <li>• IAC0703 A systematic fault-finding process is followed</li> <li>• IAC0704 Risks and hazards are identified and responded to in a responsible manner</li> </ul> <p><b>PM-09-PS07: Replace lubrication components and assemble lubrication systems</b></p> <ul style="list-style-type: none"> <li>• IAC0701 Procedures to replace lubrication system components and to assemble a lubrication system are explained</li> <li>• IAC0702 Lubrication components are replaced according to procedures and specifications</li> <li>• IAC0703 A lubrication system is assembled according to procedures and Original Equipment Manufacturer specifications</li> <li>• IAC0704 Risks and hazards are identified and responded to in a responsible manner</li> </ul>		<p><b>systems and installations for at least 320 hours</b></p> <ul style="list-style-type: none"> <li>• SE0101 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0102 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• SE0103 Applicable job cards</li> </ul>
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**PM-11-PS06: Repair lubrication systems**

- IAC0601 Instructions and repair specifications are interpreted correctly
- IAC0602 Lubrication system components and specifications are identified correctly
- IAC0603 The lubrication system is disassembled and reassembled correctly
- IAC0604 Faulty components are identified and replaced correctly
- IAC0605 Sequences to repair the lubrication system are followed correctly
- IAC0606 Tools and equipment are identified and used correctly
- IAC0607 Post repair activities are performed correctly
- IAC0608 Safety requirements are met

**PM-14-PS06: Install lubrication system components and commission lubrication systems**

- IAC0601 Lubrication system components are correctly installed in terms of procedure, sequence and specifications
- IAC0602 Lubrication system operation is checked and adjusted if necessary
- IAC0603 Lubrication system is commissioned as per procedure
- IAC0604 Quality requirements are met
- IAC0605 Safety requirements are met



**Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 30 marks (45min) and the competency will be at 80%
- Practical exercise of 60min covering all above mentioned items.

Level of competency of 100% (critical) required for:

- Safety isolate, lockout and test for zero potential.
- Use of PPE

Level of competency of 80% required for:

- All other assessment items

**Learning resources for teaching**

- Learning material on Knowledge and Practical Skills Modules
- Samples (and charts) of tolerance and Fits
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Hand Tools and measuring equipment
- Set of Spanners and sockets
- Rubber Mallet
- Screwdriver
- Allen key set
- Torque Wrench
- Torx wrench set
- Grease gun

<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<h1>Q3</h1>	
		<b>Curriculum code:</b> 671202000			
<b>Learning area title:</b> Perform work activities on bearings and lubrication systems	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>		
		80	104		
<b>Work situation title:</b> Perform installation and commissioning activities on lubrication systems	<b>Total hours</b>	8	8		
<b>Work scenario:</b> The maintenance department is busy with putting in a new production line. Sam is given the job card of putting in a new gravity feed lubrication system by the bearings. He has to perform a risk assessment and also prepare all his tools and equipment required. Sam takes the new lubrication system and installs it. After installing he has to start it up and ensure that the system works as required.					
<b>Prerequisite learning:</b> Year 1					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>	
<b>PM14-PS06 Install lubrication system components and commission lubrication systems</b>  <i>Given practical assignments, a repaired lubrication system component, tools, personal protective equipment, specifications</i>  <b>The apprentice must be able to:</b> <ul style="list-style-type: none"> <li>PA0601 Read and interpret the installation and commissioning specifications and quality requirements</li> <li>PA0602 Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> </ul>		<b>Knowledge of:</b>  <b>KM-04-KT09: Working principles, types and applications of lubrication systems</b> <ul style="list-style-type: none"> <li>KT0901 Lubrication systems and devices</li> <li>KT0902 Properties of lubricants</li> <li>KT0903 Terminology of lubrication systems and devices</li> <li>KT0904 Working principles of lubrication systems and devices</li> </ul> <u>Applied Knowledge</u>		The apprentice will be expected to <b>gain practical experience</b> (engage) in the following work activities:  <b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b>  <b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b>	

<ul style="list-style-type: none"> <li>• PA0603 Plan the sequences for installation and commissioning</li> <li>• PA0604 Identify potential hazards and risks related to the job and list the appropriate responses</li> <li>• PA0605 Prepare the work area for installation of the lubrication system</li> <li>• PA0606 Install the lubrication system to specifications</li> <li>• PA0607 Use tools and equipment correctly</li> <li>• PA0608 Follow the correct installation procedures and sequence</li> <li>• PA0609 Check the lubrication system installation by performing a systematic inspection of all the critical control points</li> <li>• PA0610 Commission the lubrication system by performing a final inspection and performance test performance test</li> <li>• PA070611 Perform post installation and commissioning activities</li> <li>• Perform housekeeping as per industry standards</li> </ul>	<p><b>PM14-PS06 Install lubrication system components and commission lubrication systems</b></p> <ul style="list-style-type: none"> <li>• AK0601 Lubrication system installation procedures and specifications</li> <li>• AK0602 Operation of lubrication system</li> <li>• AK0603 Commissioning of lubrication system</li> <li>• AK0604 Use of and care for tools and equipment</li> </ul>	<p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• Gather the necessary technical information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• Install, wire and connect electrical equipment and control systems to manufacturers' and workplace specifications</li> <li>• Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete all relevant documentation</li> <li>• Communicate with relevant parties</li> <li>• Perform housekeeping as per industry standards</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
	<p><b>KM-04-KT09 Mechanical working principles, types and applications of lubrication systems</b></p>	<p><b>Supporting Evidence:</b></p>

<p><b>PM14-PS06 Install lubrication system components and commission lubrication systems</b></p> <ul style="list-style-type: none"> <li>• Lubrication system components are correctly installed in terms of procedure, sequence and specifications</li> <li>• Lubrication system operation is checked and adjusted if necessary</li> <li>• Lubrication system is commissioned as per procedure</li> <li>• Quality requirements are met</li> <li>• Safety requirements are met</li> </ul>	<ul style="list-style-type: none"> <li>• Classification and types of lubrication systems and devices are described</li> <li>• Properties of lubricants are discussed</li> <li>• Components of lubrication systems and devices are discussed</li> <li>• Working principles of lubrications systems and devices are discussed</li> <li>• Safety precautions pertaining to lubrication systems are explained</li> </ul>	<p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 questions (15min) and the competency will be at 80%</li> <li>• Practical exercise of 45 min length <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ Correct lubrication used</li> <li>○ No damage to equipment</li> <li>○ Level of competence required: 100%</li> </ul> </li> </ul>		

**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of different bearings and lubrication fits and tolerance, Bearing catalogue
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Bearings, Measuring equipment, hand tools, hand press, bearing heater, bearing puller,
- Lubrication systems and components

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>Q4</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Perform work activities on bearings and lubrication systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		80	104	
<b>Work situation title: Perform installation and commissioning activities on bearings</b>	<b>Total hours</b>	16	16	
<b>Work scenario:</b> The maintenance department is busy with putting in a new production line. Manini is given the job card of putting in a new bearing component. He has to perform a risk assessment and also prepare all his tools and equipment required. Sam takes the new bearing component and installs it. After installing he has to start it up and ensure that the system works as per requirement.				
<b>Prerequisite learning:</b> Year 1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	70%	<b>Knowledge modules (KM)</b>	30%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><b>Install bearing components and commission</b></p> <p><i>Given practical assignments, a repaired bearing component, tools, personal protective equipment, specifications</i></p> <ul style="list-style-type: none"> <li>• Read and interpret the installation and commissioning specifications and quality requirements</li> <li>• Identify and select specific tools, equipment and materials required for the installation and commissioning process</li> <li>• Plan the sequences for installation and commissioning</li> <li>• Identify potential hazards and risks related to the job and list the appropriate responses</li> </ul>		<p><b>Knowledge of:</b></p> <p><b>KM-04-KT02: Types, and application of bearings</b></p> <ul style="list-style-type: none"> <li>• KS0201 Bearings (anti-friction and friction bearings)</li> <li>• KS0202 Application of bearing</li> <li>• KS0203 Maintenance of bearing</li> <li>• KS0204 Causes of failures in bearings</li> <li>• KS0205 Removal and installation of bearings</li> <li>• Tolerances off interference clearances</li> <li>• Bearing catalogues</li> <li>• Measuring equipment used and how to ensure that it is calibrated</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> (engage) in the following work activities:</p> <p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p> <p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission</b></p>

<ul style="list-style-type: none"> <li>• Prepare the work area for installation of the bearings</li> <li>• Install the bearings system to specifications</li> <li>• Use tools and equipment correctly</li> <li>• Follow the correct installation procedures and sequence</li> <li>• Check the bearing installation by performing a systematic inspection of all the critical control points</li> <li>• Commission the bearings by performing a final inspection and performance test</li> <li>• Perform post installation and commissioning activities</li> <li>• Clearances according to specification</li> <li>• Correct application for correct bearing</li> <li>• Correct bearing identified by the number</li> <li>• Bearing puller correct use</li> <li>• Bearing heater correct use</li> <li>• Hydraulic hand press correct use</li> <li>• Perform housekeeping as per industry standards</li> </ul>	<p><u>Applied Knowledge</u></p> <p><b>Install bearing components and commission</b></p> <ul style="list-style-type: none"> <li>• Bearing installation procedures and specifications</li> <li>• Operation of bearings</li> <li>• Commissioning of bearings</li> <li>• Use of and care for tools and equipment</li> </ul>	<p><b>mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• Gather the necessary technical information, develop and installation and commissioning plan, compile the parts and materials lists and draw the parts and materials</li> <li>• Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• Install, wire and connect electrical equipment and control systems to manufacturers' and workplace specifications</li> <li>• Conduct post-installation inspection and functionality tests and commission the installations</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete all relevant documentation</li> <li>• Communicate with relevant parties</li> <li>• Perform housekeeping as per industry standards</li> </ul>
<p><b>ASSESSMENT CRITERIA</b></p>		
<p><b>Install bearing components and commission</b></p> <ul style="list-style-type: none"> <li>• Bearing system components are correctly installed in terms of procedure, sequence and specifications</li> <li>• Bearing operation is checked and adjusted if necessary</li> </ul>	<p><b>KM-04-KT02: Types, and application of bearings</b></p> <ul style="list-style-type: none"> <li>• Types of bearings are differentiated</li> <li>• Components of bearings are identified and discussed</li> </ul>	<p><b>Supporting Evidence:</b></p> <p><b>WM-05-WE04: Observe and assist a qualified millwright or fitter to install and commission mechanical sub-assemblies and machines for at least 20 hours</b></p>

<ul style="list-style-type: none"> <li>• Bearing is commissioned as per procedure</li> <li>• Quality requirements are met</li> <li>• Safety requirements are met</li> </ul>	<ul style="list-style-type: none"> <li>• Applications for different bearings are discussed</li> <li>• The causes of bearing failure are described</li> <li>• Removal and installation procedures for bearings are described</li> <li>• Safety precautions pertaining to bearings are explained</li> </ul>	<p><b>WM-05-WE05: Install and commission mechanical sub-assemblies and machines under the direct supervision of a qualified millwright or fitter for at least 40 hours</b></p> <p><b>WM-05-WE06: Undertake all activities without assistance, but under supervision of a qualified millwright or fitter, to install and commission mechanical sub-assemblies and machines for a period of least 480 hours</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment installed, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 questions (60min) and the competency will be at 80%</li> <li>• Practical exercise of 45 min length covering <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No Injuries to self/co-worker and the environment or damage to equipment</li> <li>○ Correct use of heater, press, puller and hydraulic jack</li> <li>○ Bearing must be heated to correct temperature</li> <li>○ Bearings must be removed correctly</li> <li>○ Bearings must be mounted correctly</li> <li>○ Bearings are mounted according to specifications (Clearances)</li> <li>○ No damage to equipment</li> <li>○ Level of competence required: 100%</li> </ul> </li> </ul>		



**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of different bearings and lubrication fits and tolerance, Bearing catalogue
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Bearings, Measuring equipment, hand tools, hand press, bearing heater, bearing puller,

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>R1</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Inspect, maintain and fault find on conveyor systems</b>	<b>Total hours</b>	<b>SDP</b> 72	<b>WP</b> 200	
<b>Work situation title: Inspect, maintain conveyor systems (incl. rolling elements, structure and belts) and inspect safety guards and shout</b>	<b>Total hours</b>	40	80	
<b>Work scenario:</b> Adrian is responsible for inspecting the 3km conveyer belt in the mornings. She will need to locate, inspect and maintain all the components to the prescribed standard. Safety is premium, therefore isolation and lockout must be completed correctly before components are replaced according to OEM specifications.				
<b>Prerequisite learning:</b> Year 2				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b> NONE
<p>QCTO none</p> <p><i>Given a conveyor system (incl. rolling elements, structure and belts), which requires routine maintenance:</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Inspect, maintain conveyor systems (incl. rolling elements, structure and belts)</li> <li>Replace rolling components on different types of conveyors</li> <li>Fault find on conveyor systems</li> <li>Inspect safety installations on conveyor systems</li> <li>Remove and replace conveyor belts (Elective)</li> </ul>		<p>Knowledge of:</p> <p><b>KM-04-KT12: Types and functions of conveyors</b></p> <ul style="list-style-type: none"> <li>KT1201 Conveyors</li> <li>KT1202 Functions of conveyors</li> </ul> <ul style="list-style-type: none"> <li>The application of conveyor systems</li> <li>Basic principles of operation</li> <li>Classifications and types</li> <li>The applications and the distinct features and characteristics of various types of conveyor systems are explained</li> <li>The terminology used when explaining and discussing conveyor systems, in keeping with manufacturer and worksite norms and standards.</li> <li>Basic lifting equipment</li> </ul>		<p>QCTO none</p> <p>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</p> <p><b>Inspect, maintain conveyor systems</b> <b>Replace rolling components on different types of conveyors, fault find on conveyor systems and inspect safety installations on conveyor systems under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <ul style="list-style-type: none"> <li>Gather the necessary maintenance information, plan the maintenance process, compile the parts and</li> </ul>

*Given conveyor systems and work instructions:*

**The apprentice must be able to:**

- The classifications and types of conveyor systems are identified and discussed.
- The conveyor system/s are inspected and assessed for its work requirements in terms of maintenance, repair and/or removal
- The planning and preparation for the maintenance repair and/or removal of the conveyor system/s is explained, in accordance with work instructions
- Site and equipment are prepared for conveyor system maintenance
- Where required, handling space is cleared, potential obstructions are removed and personnel are notified, prior to the maintenance, repair and/or removal task.
- Respond to `what if` and `why` questions covering:
  - The maintenance process - sequence, procedures and techniques.
  - Tools and equipment used.
  - Quality awareness: implications of conveyor system maintenance that do not comply with operational requirements.
- Applicable conveyor system maintenance theory.

materials list and draw the parts and materials

- Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites
- Conduct pre-maintenance inspections and identify and report any problems
- Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least three different conveyors
- Conduct post-maintenance inspection and functionality tests and commission the industrial machinery
- Restore the work area and dispose of waste materials
- Interact with production personnel, where applicable
- Complete maintenance reports
- Communicate with relevant parties

<ul style="list-style-type: none"> <li>• Reporting and documentation requirements</li> <li>• Maintain conveyor system.</li> <li>• Maintenance includes identifying non-conforming components, removal, repair and installation of components and parts and confirming functionality.</li> <li>• Conveyor system is maintained in compliance with operational requirements.</li> <li>• The conveyor system is tested for conformance within operational requirements and according to manufacturer's specifications.</li> <li>• Operational requirements include correct function of the drive, braking unit and conveyor load carrying medium (bucket, screw).</li> <li>• Checks include the evaluation and adjustment of tolerances where required.</li> <li>• Checking for compliance may include commissioning procedures.</li> <li>• Work area is restored to a safe and serviceable condition.</li> <li>• All work is performed safely with due care for self, fellow workers, machines, equipment, materials and environment.</li> <li>• Conveyor system condition is recorded and reported.</li> <li>• System is confirmed to be isolated.</li> <li>• Conveyor system is inspected and non-conformances identified.</li> <li>• Conveyor system maintenance</li> </ul>		
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<ul style="list-style-type: none"> <li>• requirements are determined</li> <li>• Consumables, parts and/or components are selected, fitted and adjusted to meet operational requirements.</li> <li>• The conveyor system is checked for conformance with manufacturer specifications and safety standards.</li> <li>• Non-conforming or damaged components and equipment are identified and appropriate corrective action taken.</li> <li>• Conveyor system records are completed and processed.</li> <li>• Work is carried out in a safe manner in accordance with schedules and manufacturer specifications.</li> <li>• Maintenance process cycle time meets workplace requirements.</li> <li>• Applicable health, safety and environmental procedures are adhered to.</li> <li>• Proper Housekeeping</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• Hazards and risks are identified and responded to in a responsible manner &amp; in accordance with accepted hazard identification and risk assessment practices</li> <li>• Correct installation and handling of rolling elements are described and explained</li> <li>• Fault-finding is explained to cover most common deviations</li> <li>• Method of replacing conveyor belt correctly applied (when required)</li> </ul>	<p><b>KM-04-KT12: Types and functions of conveyors</b></p> <ul style="list-style-type: none"> <li>• IAC1201 Types of conveyors are identified and described</li> <li>• IAC1202 Functions of different types of conveyors are explained</li> <li>• IAC1203 Safety precautions pertaining to conveyors are explained</li> <li>• Describe the effect of adverse conditions (cleanliness and spillage) on the operational characteristics of a conveyor</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the apprentice, signed off by the supervising artisan</li> <li>• Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> </ul>

<ul style="list-style-type: none"> <li>• Conveyor system records are completed and processed</li> <li>• Work is carried out in a safe manner in accordance with schedules and manufacturer specifications.</li> <li>• Maintenance process cycle time meets workplace requirements.</li> <li>• A clean and tidy work environment is maintained</li> <li>• No delays are caused as a result of poor planning for conveyor system maintenance and identifying problems.</li> <li>• Applicable health, safety and environmental procedures are adhered to</li> <li>• Tools, equipment, lifting equipment and tackle is stored in accordance with manufacturer's specification and requirements.</li> <li>• Malfunctioning tools and equipment is reported and the necessary arrangements for the repair thereof is made according to accepted worksite practice.</li> <li>• Non-conforming or damaged tools and equipment are identified and appropriate corrective action taken.</li> <li>• The proper care and storage procedures of tools and equipment are explained in accordance with work site practices and specifications.</li> <li>• Work area is restored to a safe and serviceable condition.</li> </ul>	<p>belt</p>	<ul style="list-style-type: none"> <li>• Applicable job cards</li> </ul>
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**Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 50 marks (60min) and the competency will be at 80%
- Practical exercise of 90min Standard time covering all the above-mentioned items
  - No injury or unsafe act had occurred
  - No Injuries to self/co-worker and the environment or damage to equipment
  - Inspection of the conveyer carried out correctly and all evidence recorded correctly
  - Components replaced as per requirements
  - All bolts tightened according to specification
  - Adjustment bolts loose after tension is set
  - Faults correctly identified and corrected
  - All safety guards are in place and secured
  - All safety aspects adhered to according company policies

Level of competency of 100% (critical) required for:

- Safety and hazards

Level of competency of 80% required for:

- Types of conveyors
- Replacing of components
- Fault-finding and repair

**Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of different rollers, different conveyer systems
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

**Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots; Safety Goggles
- Functional conveyor belt
- Set of spanners
- Screwdrivers

- Coffin hoist and lifting tackle
- Crowbar
- Lockout mechanism
- Belt knife
- Combination pliers
- Hammer
- Spade and scraper
- Infra-red/Heat gauge
- Splicing equipment and associated tools
- Conveyer simulation with additional belts and rollers
- Safety guards on the conveyer simulator, Lifting equipment



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>R2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Inspect, maintain and fault find on conveyor systems</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		72	200	
<b>Work situation title: Track conveyor belts</b>	<b>Total hours</b>	8	80	
<b>Work scenario:</b> Lefa has to ensure that conveyer M3 is running correctly. On investigations he found that the conveyer is not running in the centre of the drive roller and the tension is too slack. Lefa has to tract the conveyer belt so that it runs in the centre and that the tension is correct. He adjusts and tests it when it is running. Once the conveyer belt is tracked and the tension is correct, he ensures that the bolts on the base are fully tightened. Safety is premium therefore isolation and lockout must be completed correctly components must be replaced according to OEM specifications.				
<b>Prerequisite learning:</b> R1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b> <b>NONE</b>
<p><i>QCTO none</i></p> <p><i>Given a conveyor system (incl. rolling elements, structure and belts), which requires tracking</i></p> <p><b>The apprentice must be able to:</b></p> <p><b>Track the conveyor belt</b></p> <ul style="list-style-type: none"> <li>• Pulleys and tracking</li> <li>• Explain Common belt conveyor problems</li> <li>• Identify probable causes and solutions</li> <li>• Determine sequence of tracking operations</li> </ul> <p><b>Rolling movement, the belt</b></p>		<p><i>QCTO none</i></p> <p>Knowledge of:</p> <p><b>Idlers and Frames</b></p> <ul style="list-style-type: none"> <li>• Design of idlers and frames</li> <li>• Troughing carrying idlers</li> <li>• Return idlers</li> <li>• Idler spacing</li> <li>• Conveyor frames</li> </ul> <p><b>Pulleys and counterweights</b></p> <ul style="list-style-type: none"> <li>• Conveyor take-ups</li> <li>• Pulley design and lagging</li> <li>• Counterweights</li> </ul>		<p><i>QCTO none</i></p> <p>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</p> <p><b>Inspect, maintain conveyor systems</b> <b>Replace rolling components on different types of conveyors, Track conveyor belts, Fault find on conveyor systems and inspect safety installations on conveyor systems under the direct supervision of a qualified millwright or fitter for at least 120 hours</b></p>

<ul style="list-style-type: none"> <li>• Observe run out without load</li> <li>• Perform tracking correction - starts at drive pulley and works down return towards tail pulley</li> <li>• Centre belt on the tail pulley by manipulation of return idlers and with the assistance of self-aligning return rolls</li> <li>• Ensure empty belt troughs well</li> <li>• Adjust snub pulley as a supplementary tracking means</li> <li>• Perform Troughing side alignment with and without load</li> <li>• Place self-aligning idlers</li> <li>• Perform housekeeping as per industry standards</li> </ul>	<p><b>Loading</b></p> <ul style="list-style-type: none"> <li>• Loading Chutes</li> <li>• Arrangement of Impact Belt at Loading Point</li> <li>• Loading on an Incline</li> <li>• Skirt boards</li> </ul>	<p>The apprentice will be expected to engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>• Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>• Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• Conduct pre-maintenance inspections and identify and report any problems</li> <li>• Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least three different conveyors</li> <li>• Conduct post-maintenance inspection and functionality tests and commission the conveyor</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with production personnel, where applicable</li> <li>• Complete maintenance reports</li> <li>• Communicate with relevant parties</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• Hazards and risks are identified and responded to in a responsible manner &amp; in accordance with accepted hazard identification and</li> </ul>	<p><b>Idlers and Frames</b></p> <ul style="list-style-type: none"> <li>• Design of idlers and frames are discussed</li> <li>• Installation of all types of idlers are</li> </ul>	<p><b>Supporting Evidence:</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key</li> </ul>

<p>risk assessment practices</p> <ul style="list-style-type: none"> <li>• Correct installation and handling of rolling elements are described and explained</li> <li>• Method of tracking conveyor belts are explained</li> <li>• Fault-finding is explained to cover most common deviations</li> </ul>	<p>explained</p> <ul style="list-style-type: none"> <li>• Idler spacing is discussed</li> <li>• Conveyor frames and the adjustment thereof is discussed</li> </ul> <p><b>Pulleys and counterweights</b></p> <ul style="list-style-type: none"> <li>• The operation of Conveyor take-ups and counterweights are discussed</li> <li>• Pulley design and lagging are explained</li> </ul> <p><b>Loading</b></p> <ul style="list-style-type: none"> <li>• Loading chutes are discussed</li> <li>• Impact Belt at Loading Point are discussed</li> <li>• Loading on an incline is explained</li> <li>• Reasons for Skirt boards are explained</li> </ul>	<p>points noted by the learner, signed off by the supervising artisan</p> <ul style="list-style-type: none"> <li>• Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• Applicable job cards</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 20 marks (30min) and the competency will be at 80%</li> <li>• Practical exercise of 20 min Standard time covering all the above-mentioned items <ul style="list-style-type: none"> <li>○ No injury or unsafe act had occurred</li> <li>○ No Injuries to self/co-worker and the environment or damage to equipment</li> <li>○ Inspection of the conveyer carried out correctly and all evidence recorded correctly</li> <li>○ Components replaced correctly</li> <li>○ The conveyer tracked correctly</li> <li>○ All bolts tighten according to specification</li> <li>○ Adjustment bolts loose</li> <li>○ Faults correctly identified and recorded according to industry practice</li> <li>○ All safety guards are in place and secured</li> </ul> </li> </ul> <p>Level of competency of 100% (critical) required for:</p> <ul style="list-style-type: none"> <li>• Safety and hazards</li> </ul>		

Level of competency of 80% required for:

- Types of conveyors
- Replacing of components
- Fault-finding and repair

#### **Learning resources for teaching**

- Learning material covering Knowledge and Practical Skills Modules
- Samples (and charts) of different rollers, different conveyer systems
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; Overalls; Safety Boots;
- Functional conveyor belt
- Set of spanners
- Screwdrivers
- Coffin hoist and lifting tackle
- Crowbar
- Lockout mechanism
- Belt knife
- Combination pliers
- Hammer
- Spade and scraper
- Conveyer simulation with additional belts and rollers
- Safety guards on the conveyer simulator

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>R3</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Inspect, maintain and fault find on conveyor systems</b>		<b>Total hours</b>	<b>SDP</b> 72		
<b>Work situation title: Remove and replace conveyor belts / splicing (excluding vulcanization (vusing) - (Elective)</b>		<b>Total hours</b>	24	40	
<b>Work scenario:</b> Mario is tasked with replacing the conveyor belt M6. He first starts with his risk assessment and isolation. After which he cleans the area and cuts the old conveyer and removes it. He then ensures all rollers are in good condition, before he puts in the new conveyer in. After the new conveyer is inserted he then starts joining the two ends with a mechanical splicing. When the splicing is completed Mario can start with the re-tensioning of the belt and the tracking of the conveyer belt.					
<b>Prerequisite learning:</b> R2					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	
<p><i>QCTO none</i></p> <p><i>Given conveyer simulation with additional belts and rollers, equipment for splicing, lifting equipment and Safety guards on the conveyer simulator</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>The classifications and types of conveyor systems are identified and discussed.</li> <li>Procedures include removal, replacement, routine servicing, strip and assembly, overhauling, fault finding.</li> <li>The planning and preparation for the maintenance, repair and/or removal of the conveyor system/s is explained, in accordance with work instructions.</li> <li>Site and equipment are prepared for conveyor system maintenance.</li> </ul>		<p><i>QCTO none</i></p> <p>Knowledge of:</p> <ul style="list-style-type: none"> <li>Identification of the equipment to be maintained, obtaining maintenance schedules and manufacturer specifications for specific equipment to be maintained.</li> <li>Different types of splicing for different kind of belt and the use</li> <li>Correct Tools required for splicing</li> <li>Basic knowledge of correct lifting equipment to be used</li> </ul>		<p>The apprentice will be expected to <b>gain practical experience</b> (engage) in the following work activities:</p> <p><b>WM-01-WE01: Observe and assist a qualified millwright, electrician or fitter in the maintenance of equipment, control systems and installations for at least 40 hours</b></p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <p><b>WM-01-WE03: Undertake all activities without assistance, but under supervision of a qualified millwright,</b></p>	

<ul style="list-style-type: none"> <li>• Where required, handling space is cleared, potential obstructions are removed and personnel are notified, prior to the maintenance, repair and/or removal task.</li> <li>• Quality awareness: implications of conveyor system maintenance that do not comply with operational requirements.</li> <li>• The conveyor system is tested for conformance within operational requirements and according to manufacturer's specifications.</li> <li>• Operational requirements include correct function of the drive, braking unit and conveyor load carrying medium (bucket, screw).</li> <li>• Safe and serviceable condition.</li> <li>• All work is performed safely with due care for self, fellow workers, machines, equipment, materials and environment.</li> <li>• System is confirmed to be isolated.</li> <li>• Mechanical splices are formed by using special components manufactured from steel .</li> <li>• There are two basic types, namely "Hinged and Fixed plate"</li> <li>• The hinged systems consist of two interlocking halves, which are connected and hinge around a central connecting shaft.</li> <li>• Perform Housekeeping as per industry standards</li> </ul>		<p><b>electrician or fitter, in maintenance processes for equipment, control systems and installations for at least 320 hours</b></p> <ul style="list-style-type: none"> <li>• WA0101 Gather the necessary maintenance information, plan the maintenance process, compile the parts and materials list and draw the parts and materials</li> <li>• WA0102 Conduct risk assessments, perform the lock-out and tag out procedures where applicable and prepare the work sites</li> <li>• WA0103 Conduct pre-maintenance inspections and identify and report any problems</li> <li>• WA0104 Perform maintenance in accordance with the manufacturers' maintenance schedule and specifications on at least three different pieces of industrial machinery</li> <li>• WA0105 Conduct post-maintenance inspection and functionality tests and commission the industrial machinery</li> <li>• WA0106 Restore the work area and dispose of waste materials</li> <li>• WA0107 Interact with production personnel, where applicable</li> <li>• WA0108 Complete maintenance reports</li> <li>• WA0109 Communicate with relevant parties</li> <li>• Perform housekeeping as per industry standards</li> </ul>
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<ul style="list-style-type: none"> <li>• Performance assessment report for completion of work situation</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<ul style="list-style-type: none"> <li>• Splicing procedures followed correctly</li> <li>• Conveyor system records are completed and processed</li> <li>• Work is carried out in a safe manner in accordance with schedules and manufacturer specifications.</li> <li>• A clean and tidy work environment is maintained.</li> <li>• Malfunctioning tools and equipment is reported and the necessary arrangements for the repair thereof is made according to accepted worksite practice.</li> <li>• Work area is restored to a safe and serviceable condition.</li> </ul>	<ul style="list-style-type: none"> <li>• Types of conveyors are identified and described</li> <li>• Functions of different types of conveyors are explained</li> <li>• Safety precautions pertaining to conveyors are explained</li> <li>• Correct splicing methods to be used</li> </ul>	<p><b>Supporting Evidence:</b></p> <p><b>WM-01-WE01: Observe and assist a qualified millwright, electrician or fitter in the maintenance of equipment, control systems and installations for at least 40 hours</b></p> <p><b>WM-01-WE02: Maintain equipment, control systems and installations under the direct supervision of a qualified millwright, electrician or fitter for at least 120 hours</b></p> <p><b>WM-01-WE03: Undertake all activities without assistance, but under supervision of a qualified millwright, electrician or fitter, in maintenance processes for equipment, control systems and installations for at least 320 hours</b></p> <ul style="list-style-type: none"> <li>• SE0201 A learning journal reflecting the job card number and the key points noted by the learner, signed off by the supervising artisan</li> <li>• SE0202 Completed workplace logbook, including list of equipment maintained, signed off by the supervising artisan</li> <li>• SE0203 Applicable job cards</li> </ul>
<b>Internal Assessment to be performed:</b>		

- Internal knowledge test of a minimum of 10 questions (20min) and the competency will be at 80%
- Practical exercise of 1H30 length covering
  - No injury or unsafe act had occurred
  - No Injuries to self/co-worker and the environment or damage to equipment
  - Inspection of the conveyer carried out correctly and all evidence recorded correctly
  - Components replaced correctly
  - The conveyer tracked correctly
  - Splicing done correctly
  - All bolts tightened according to specification
  - Adjustment bolts loose
  - Commissioning of the conveyer system
  - Correct lockout procedure followed
  - Faults correctly identified and corrected
  - All safety guards are in place and secured
  - All safety aspects adhered to according company policies
  - No injury or damage to equipment

#### **Learning resources for teaching**

- Learning material on defined Knowledge and Practical Skills Modules
- Samples (and charts) of different rollers, different splicing technics, different conveyer systems
- Safe Operating Procedure and Safe Working Procedure
- Charts of risk assessment procedure and safety measures
- CDs and videos will be an added advantage

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Conveyer simulation with additional belts and rollers
- Equipment for splicing, lifting equipment
- Safety guards on the conveyer simulator



<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>S1</h1>	
		<b>Curriculum code: 671202000</b>			
<b>Learning area title: Understand the fundamentals of Diesel Mechanics and Auto Electrical fault identification (Basic) ELECTIVE</b>		<b>Total hours</b>	<b>SDP</b> 120		
<b>Work situation title: Understand diesel engine components and how to fault find (Basic) Elective</b>		<b>Total hours</b>	80	80	
<b>Work scenario:</b> Harrold is called to a breakdown on a diesel vehicle. The vehicle is inoperative as it won't start. He has to determine the failure in the system and repair it to OEM standards. Safety is premium and his risk assessments are crucial.					
<b>Prerequisite learning:</b> Year 3					
<b>INTEGRATED LEARNING CONTENT</b>					
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>	
<p><i>QCTO none</i></p> <p><b>Prepare and service diesel engines and diesel-powered systems and unit subsystems</b></p> <p><i>Given a range of diesel engines and diesel-powered systems and unit sub-systems and the relevant tools, equipment, consumables, replacement parts, PPE and maintenance information,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Collect all required tools, materials and personal protective equipment for each task, prepare the work area and complete a risk assessment</li> <li>Use all relevant personal protective equipment and apply all relevant health, safety and environmental precautions</li> </ul>		<p><i>QCTO none</i></p> <p><b>Basic principles of internal combustion engines</b></p> <ul style="list-style-type: none"> <li>Construction and operating principles of petrol and diesel engines, including construction materials</li> <li>Basic operation of engines including 2- and 4-stroke petrol and diesel engines, rotary engines and combustion processes</li> <li>Comparison between petrol and diesel engines</li> <li>Classification of engines according to cylinder arrangement</li> <li>Identification, location and function of engine components and parts</li> <li>Construction and operating principles of various top ends</li> <li>Construction and operating principles of</li> </ul>		<p><i>QCTO none</i></p> <p><b>Observe and assist a competent artisan to remove and replace engine components and subsystems for a minimum of 120 hours</b></p> <p>The learner will be expected to gain practical experience and engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Gather the necessary technical information, plan the operation and collect relevant tools and equipment</li> <li>Conduct risk assessments and perform lock-out processes where applicable</li> <li>Conduct pre-removal inspections and identify and report any problems</li> </ul>	

<ul style="list-style-type: none"> <li>• Carry out visual inspections, pre-checks or tests as required by original equipment manufacturers' specifications</li> <li>• Identify and clean mechanical and electrical components</li> <li>• Collect required parts and remove and replace faulty system components or parts specified in the maintenance information Drain and replenish or check and top-up fluids</li> <li>• Remove and replace filters, inspect filters for foreign particles and explain the significance of the findings</li> <li>• Complete post-maintenance checks and tests</li> <li>• Clean and restore the diesel-powered system and the work area and dispose of all waste materials</li> <li>• Compile inspection report and record of maintenance done</li> </ul> <p><b>• Repair lubrication systems</b></p> <ul style="list-style-type: none"> <li>• Dismantle the lubrication system, marking parts to establish direction or alignment</li> <li>• Identify all components and parts, describe their purpose and their functions and explain how they operate</li> <li>• Clean, inspect, test and measure components and parts, identify wear or damage and report on the condition of the components and parts</li> </ul>	<p>various bottom ends</p> <ul style="list-style-type: none"> <li>• Construction and operating principles of various engine front and rear ends</li> <li>• Calculations related to bore and stroke, compression ratios, and torque and power</li> <li>• Identification and basic function of engine sub-systems, including lubrication, fuel, induction, exhaust and cooling systems</li> </ul> <p><b>Understand the maintenance of diesel engines and diesel-powered systems and unit subsystems</b></p> <ul style="list-style-type: none"> <li>• Inspection, testing, adjusting and cleaning methods and techniques for various system components</li> <li>• Name and function of the relevant components</li> <li>• Sensory cues related to tests, checks, inspections and adjustments</li> <li>• Sensory cues for damage or wear related to heavy equipment system components</li> <li>• Types of service schedules and completion of documentation</li> <li>• Typical hazards and safety, health and environment related risks</li> <li>• Applicable safety, health and environmental requirements and practices</li> <li>• Lifting and support requirements for diesel powered systems</li> <li>• Cleaning and restoring requirements</li> <li>• Terms and terminology for reporting component condition</li> </ul>	<ul style="list-style-type: none"> <li>• Disconnect and remove engine sub-systems (including batteries) using lifting equipment where required</li> <li>• Conduct relevant tests and compile condition reports</li> <li>• Prepare engine sub-systems for replacement and lift, position and replace engine subsystems</li> <li>• Connect engine sub-systems, conduct functionality tests, and adjust as required to meet specifications</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with personnel if applicable</li> <li>• Complete installation reports</li> </ul>
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<ul style="list-style-type: none"> <li>• Obtain replacement parts where required, reassemble lubrication system and carry out post-assembly quality checks and tests</li> <li>• Compile a record of all steps, checks, tests and procedures followed</li> <li>• Clean the work area and dispose of all waste materials</li> </ul> <p><b>Repair fuel systems</b></p> <ul style="list-style-type: none"> <li>• Carry out pre-checks or tests</li> <li>• Dismantle the fuel system, marking parts to establish direction or alignment</li> <li>• Identify all components and parts, describe their purpose and their functions and explain how they operate</li> <li>• Clean, inspect, test and measure components and parts, identify wear or damage and report on the condition of the components and parts</li> <li>• Obtain replacement parts where required, reassemble fuel system and carry out post assembly quality checks and tests</li> <li>• Compile a record of all steps, checks, tests and procedures followed</li> <li>• Clean the work area and dispose of all waste materials</li> </ul> <p><b>Repair cooling systems</b></p> <ul style="list-style-type: none"> <li>• Carry out pre-checks or tests</li> <li>• Dismantle the cooling system, marking parts to establish direction or alignment</li> </ul>	<ul style="list-style-type: none"> <li>• Correct application of tools and equipment</li> </ul> <p><b>Understand lubrication systems</b></p> <ul style="list-style-type: none"> <li>• Function of each component and part and operation of the components</li> <li>• Inspection, testing and cleaning methods and techniques for lubrication system components</li> <li>• Visual cues for damage or wear related to lubrication system components</li> <li>• Typical hazards and safety, health and environment related risks</li> <li>• Applicable safety, health and environmental requirements and practices</li> <li>• Terms and terminology for reporting component condition</li> <li>• Correct application of tools and equipment</li> </ul> <p><b>Understand fuel systems</b></p> <ul style="list-style-type: none"> <li>• Workshop manuals for fuel system components</li> <li>• Dismantling methods and techniques for fuel systems</li> <li>• Function and operation of each component</li> <li>• Inspection, testing and cleaning methods and techniques for fuel system components</li> <li>• Visual cues for damage or wear related to fuel system components</li> </ul>	
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<ul style="list-style-type: none"> <li>• Identify all components and parts, describe their purpose and their functions and explain how they operate</li> <li>• Clean, inspect, test and measure components and parts, identify wear or damage and report on the condition of the components and parts</li> <li>• Obtain replacement parts where required, reassemble cooling system and carry out post-assembly quality checks and tests</li> <li>• Compile a record of all steps, checks, tests and procedures followed</li> <li>• Clean the work area and dispose of all waste materials</li> </ul>	<ul style="list-style-type: none"> <li>• Typical hazards and safety, health and environment related risks</li> <li>• Applicable safety, health and environmental requirements and practices</li> <li>• Terms and terminology for reporting component condition</li> <li>• Correct application of tools and equipment</li> </ul> <p><b>Understand cooling systems</b></p> <ul style="list-style-type: none"> <li>• Procedures, steps and sequences for preparing, dismantling and reassembling cooling systems</li> <li>• Manufacturer's specifications for cooling system component re-usability</li> <li>• Workshop manuals for cooling system components</li> <li>• Dismantling methods and techniques for cooling systems</li> <li>• Function of parts and components and operation of the components</li> <li>• Inspection, testing and cleaning methods and techniques for cooling system components</li> <li>• Visual cues for damage or wear related to cooling system components</li> <li>• Typical hazards and safety, health and environment related risks</li> <li>• Applicable safety, health and environmental requirements and practices</li> <li>• Terms and terminology for reporting component condition</li> <li>• Correct application of tools and</li> </ul>	
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	equipment	
<b>ASSESSMENT CRITERIA</b>		
<p><b>Prepare and service diesel engines and diesel-powered systems and unit subsystems</b></p> <ul style="list-style-type: none"> <li>Inspect, clean and carry out visual inspections as required by original equipment manufacturers' specifications</li> <li>Identify and clean mechanical and electrical components</li> <li>All tools and equipment are selected and used appropriately and safely</li> <li>The inspection and service reports are legible and accurate, and all relevant documentation is completed correctly</li> <li>All work is done safely and the relevant personal protective equipment is used</li> <li>The work area is cleaned and all used or discarded materials and parts are disposed of correctly</li> </ul> <p>Descriptions and explanations of part functions are correct</p> <p><b>Repair lubrication systems</b></p> <ul style="list-style-type: none"> <li>Dismantling, inspection, cleaning, testing and reassembly processes are carried out in the correct sequence and following the manufacturer's procedures</li> <li>Measurements, clearances, tolerances and adjustments meet the manufacturer's specifications</li> <li>Dismantling, assessment and reassembly process is completed within the required</li> </ul>	<p><b>Understand maintenance</b></p> <ul style="list-style-type: none"> <li>Describe and explain the principles of servicing and preventative maintenance</li> <li>Describe and explain condition-based servicing</li> </ul> <p><b>Basic principles of internal combustion engines</b></p> <ul style="list-style-type: none"> <li>Describe and explain, with the aid of sketches where applicable and using the correct terms and terminology, the construction and operating principles of petrol and diesel engines</li> <li>Correctly explain how engines are classified</li> <li>Identify and describe engine components and parts, with the aid of sketches where applicable, and describe their location and function</li> <li>Explain common terms associated with engine design and performance</li> <li>Describe and explain, with the aid of sketches where applicable and using the correct terms and terminology, the construction and operating principles of various engine top, bottom, front and rear ends</li> <li>Correctly calculate problems related to bore and stroke, compression ratios, and torque and power</li> </ul>	<p><b>Observe and assist a competent artisan to remove and replace engine subsystems for a minimum of 120 hours</b></p> <ul style="list-style-type: none"> <li>A learning journal reflecting the job card number and the key points noted by the learner, signed off by the competent artisan</li> <li>Condition and installation reports</li> <li>Checklist completed by the competent artisan verifying task completion in accordance with all applicable organisational, safety, quality, environmental and administrative procedures and standards</li> <li>Time sheets reflecting time spent on activities</li> </ul>

<p>time</p> <ul style="list-style-type: none"> <li>• All tools and equipment are selected and used appropriately and safely</li> <li>• The parts condition report is accurate and all damaged or out-of-specification parts are identified, reported and replaced correctly</li> <li>• The process report is legible and accurate</li> <li>• All work is done safely and the relevant personal protective equipment is used</li> <li>• The work area is cleaned and all used or discarded materials and parts are disposed of correctly</li> <li>• Explanations of part functions and purpose and component operations are correct</li> </ul> <p><b>Repair fuel systems</b></p> <ul style="list-style-type: none"> <li>• Dismantling, inspection, cleaning, testing and reassembly processes are carried out in the correct sequence and following the manufacturer's procedures</li> <li>• Measurements, clearances, tolerances and adjustments meet the manufacturer's specifications</li> <li>• Dismantling, assessment and reassembly process is completed within the required time</li> <li>• All tools and equipment are selected and used appropriately and safely</li> <li>• The parts condition report is accurate and all damaged or out-of-specification parts are identified, reported and replaced</li> </ul>	<ul style="list-style-type: none"> <li>• Identify and describe engine sub-systems, with the aid of sketches where applicable, and describe their location and function</li> </ul>	
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<p>correctly</p> <ul style="list-style-type: none"> <li>• The process report is legible and accurate</li> <li>• All work is done safely and the relevant personal protective equipment is used</li> <li>• The work area is cleaned and all used or discarded materials and parts are disposed of correctly</li> <li>• Explanations of part functions and purpose and component operations are correct</li> </ul> <p><b>Repair cooling systems</b></p> <ul style="list-style-type: none"> <li>• Dismantling, inspection, cleaning, testing and reassembly processes are carried out in the correct sequence and following the manufacturer's procedures</li> <li>• Measurements, clearances, tolerances and adjustments meet the manufacturer's specifications</li> <li>• Dismantling, assessment and reassembly process is completed within the required time</li> <li>• All tools and equipment are selected and used appropriately and safely</li> <li>• The parts condition report is accurate and all damaged or out-of-specification parts are identified, reported and replaced correctly</li> <li>• The process report is legible and accurate</li> <li>• All work is done safely and the relevant personal protective equipment is used</li> <li>• The work area is cleaned and all used or discarded materials and parts are</li> </ul>		
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<p>disposed of correctly</p> <ul style="list-style-type: none"> <li>• Explanations of part functions and purpose and component operations are correct</li> </ul>		
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (30min) and the competency will be at 80%</li> <li>• Practical exercise of 45min covering all above-mentioned items</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All assessment items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Lecture, presentations,</li> <li>• Applicable videos</li> <li>• Practical demonstration and practical group work</li> <li>• Individual practice sessions under supervision</li> <li>• Print materials, electronic files, software applications incl.:</li> <li>• Textbooks (Basic Mechanical theory)</li> <li>• Teaching and learning manuals incl. multimedia applications</li> <li>• Learning material covering Knowledge and Practical Skills Modules</li> </ul> <p><b>Tools, Equipment and Materials</b></p> <ul style="list-style-type: none"> <li>• Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles</li> <li>• Spanners set</li> <li>• Allen key set</li> <li>• Screw driver</li> <li>• Pipe wrench</li> <li>• Hacksaw</li> <li>• Smooth file</li> <li>• Circlip pliers</li> <li>• Thread file</li> <li>• Filter Strap</li> <li>• Hammer</li> </ul>		



<b>Occupation/trade title:</b> Millwright		<b>SAQA ID:</b> 97585		<b>S2</b>
		<b>Curriculum code:</b> 671202000		
<b>Learning area title:</b> Understand the fundamentals of Diesel Mechanics and Auto Electrical fault identification (Basic) ELECTIVE	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		120	160	
<b>Work situation title:</b> Understand auto electrical components and how to fault find (Basic) Elective	<b>Total hours</b>	40	80	
<b>Work scenario:</b> Cathy is called to a breakdown on a vehicle. The vehicle is electrically inoperative. She has to determine the failure in the system and repair it to OEM standards. Safety is premium and her risk assessments are crucial.				
<b>Prerequisite learning:</b> Year 3 plus S1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><b>Removal, assess and replace engine electrical systems (including starting and charging systems)</b></p> <p><i>Given a range of engine electrical systems (including starting and charging systems), relevant tools and equipment, replacement parts, PPE and physical, electronic and on-line technical information,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Review the maintenance information, determine the scope of work and plan the operation</li> <li>Collect all required tools, materials and personal protective equipment for each</li> </ul>		<p><i>QCTO none</i></p> <p><b>Removal, assess and replace engine electrical systems (including starting and charging systems)</b></p> <ul style="list-style-type: none"> <li>Procedures, steps and sequences for preparing, removal and replacing engine electrical components</li> <li>Manufacturer's specifications for engine electrical component re-usability</li> <li>Workshop manuals for engine electrical components</li> <li>Removal methods and techniques for engine electrical components</li> <li>Function of the parts and components and operation of the components</li> <li>Inspection, testing and cleaning methods and techniques for engine electrical components</li> <li>Visual cues for damage or wear related</li> </ul>		<p><i>QCTO none</i></p> <p><b>Observe and assist a competent artisan to diagnose and repair electrical systems (charging and starting) in diesel powered systems for a minimum of 120 hours</b></p> <p>The learner will be expected to engage in the following work activities under supervision:</p> <ul style="list-style-type: none"> <li>Gather the job instruction and the necessary technical information, plan the operation and collect relevant tools and equipment</li> <li>Conduct risk assessments and select and use relevant personal protective equipment</li> </ul>

<p>task, prepare the work area and complete a risk assessment</p> <ul style="list-style-type: none"> <li>• Use all relevant personal protective equipment and apply all relevant health, safety and environmental precautions</li> <li>• Carry out pre-checks or tests</li> <li>• Remove components from the engine electrical system, marking parts to establish direction or alignment</li> <li>• Identify all components and parts, describe their purpose and their functions and explain how they operate</li> <li>• Clean, inspect, test and measure components and parts, identify wear or damage and report on the condition of the components and parts</li> <li>• Obtain replacement parts where required, replace engine electrical components and carry out post-assembly quality checks and tests</li> <li>• Compile a record of all steps, checks, tests and procedures followed</li> <li>• Clean the work area and dispose of all waste materials</li> </ul>	<p>to engine electrical components</p> <ul style="list-style-type: none"> <li>• Typical hazards and safety, health and environment related risks</li> <li>• Applicable safety, health and environmental requirements and practices</li> <li>• Terms and terminology for reporting component condition</li> <li>• Correct application of tools and equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct visual inspections and identify any problem areas or issues</li> <li>• Perform relevant tests and record readings</li> <li>• Access diesel powered system electronic control modules and download operational and parameter information</li> <li>• Compare diagnostic codes and test readings with the manufacturer's specifications and identify the root cause</li> <li>• Rectify the problem and restore system functionality to meet manufacturer's specifications</li> <li>• Conduct post-repair inspection and functionality tests and identify and report any problems</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with personnel where applicable</li> <li>• Complete repair reports</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
<p><b>Remove, assess and replace components from the engine electrical systems (including starting and charging systems)</b></p> <ul style="list-style-type: none"> <li>• Removal, inspection, cleaning, testing and replacement processes are carried out in the correct sequence and following the manufacturer's procedures</li> <li>• Measurements, clearances, tolerances</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss procedures, steps and sequences for preparing, removal and replacing engine electrical components</li> <li>• State manufacturer's specifications for engine electrical component re-usability</li> <li>• Consult workshop manuals to identify engine electrical components</li> <li>• Discuss removal methods and techniques for engine electrical</li> </ul>	<p><b>Supporting Evidence:</b></p> <p><b>Observe and assist a competent artisan to diagnose and repair electrical systems (charging and starting) in diesel powered systems for a minimum of 120 hours</b></p>

<p>and adjustments meet the manufacturer's specifications</p> <ul style="list-style-type: none"> <li>• Removal, assessment and replacement processes are completed within the required time</li> <li>• All tools and equipment are selected and used appropriately and safely</li> <li>• The parts condition report is accurate and all damaged or out-of-specification parts are identified, reported and replaced correctly</li> <li>• The process report is legible and accurate</li> <li>• All work is done safely and the relevant personal protective equipment is used</li> <li>• The work area is cleaned and all used or discarded materials and parts are disposed of correctly</li> </ul> <p>Explanations of part functions and purpose and component operations are correct</p>	<p>components</p> <ul style="list-style-type: none"> <li>• Describe the function of the parts and components and operation of the components</li> <li>• Explain inspection, testing and cleaning methods and techniques for engine electrical components</li> <li>• Describe visual cues for damage or wear related to engine electrical components</li> <li>• Discuss typical hazards and safety, health and environment related risks</li> <li>• Recall applicable safety, health and environmental requirements and practices</li> <li>• State terms and terminology for reporting component condition</li> <li>• Correct application of tools and equipment</li> </ul>	<ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the competent artisan</li> <li>• Repair reports</li> <li>• Checklist completed by the competent artisan verifying task completion in accordance with all applicable organisational, safety, quality, environmental and administrative procedures and standards</li> <li>• Time sheets reflecting time spent on activities</li> </ul>
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (45min) and the competency will be at 80%</li> <li>• Practical exercise of 45min covering all above-mentioned items</li> </ul> <p>Level of competency of 80% required for:</p> <ul style="list-style-type: none"> <li>• All assessment items</li> </ul> <p><b>Learning resources for teaching</b></p> <ul style="list-style-type: none"> <li>• Lecture, presentations,</li> <li>• Applicable videos</li> <li>• Practical demonstration,</li> </ul>		

- Practical group work,
- Individual practice sessions under supervision
- Print materials, electronic files, software applications incl.:
- Textbooks (Basic Mechanical theory)
- Teaching and learning manuals incl. multimedia applications
- Learning material covering Knowledge and Practical Skills Modules

#### **Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Spanners set
- Allen key set
- Screw driver
- Pipe wrench
- Hacksaw
- Smooth file
- Circlip pliers
- Thread file
- Filter Strap
- Hammer
- Smooth file
- Laptop (including applicable programmes)
- Multimeter
- Tong tester
- Set tube spanners

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<b>T1</b>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Understand the basics of air-conditioning ELECTIVE</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		80	160	
<b>Work situation title: Understand the function, components and operation of air-conditioning systems (Elective)</b>	<b>Total hours</b>	40	80	
<b>Work scenario:</b> Harriot is requested to repair an Air-conditioner. The unit is inoperative as it does not reduce the temperature. She has to determine the failure in the system and repair it to OEM standards. Safety is premium and her risk assessments are crucial.				
<b>Prerequisite learning:</b> Year 3				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p><i>QCTO none</i></p> <p><i>Given a functional air-conditioning system</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>• Explain the operation, functionality of an air-conditioning system</li> <li>• Identify the main components of the system and their functionality</li> <li>• Explain the theory of energy conservation and thermodynamics</li> </ul>		<p><i>QCTO none</i></p> <p>Knowledge of:</p> <p><b>Principles of thermodynamics</b></p> <ul style="list-style-type: none"> <li>• Fundamental of Kelvin's Law</li> </ul> <p><b>Basic vapour compression cycle</b></p> <ul style="list-style-type: none"> <li>• Principles of vapour compression cycle</li> </ul> <p><b>Principles of energy conservation</b></p> <ul style="list-style-type: none"> <li>• Theory of energy conservation</li> </ul> <p><b>Components and accessories of a refrigeration system</b></p> <ul style="list-style-type: none"> <li>• Types of compressors and application</li> <li>• Types of condensers and application</li> <li>• Types of cooling towers and application</li> </ul>		<p><i>QCTO none</i></p> <p>The learner will be expected to gain practical experience and engage in the following work activities under supervision:</p> <p><b>Observe and assist a competent artisan working on refrigeration systems for a minimum of 120 hours</b></p> <ul style="list-style-type: none"> <li>• Gather the necessary technical information, plan the operation and collect relevant tools and equipment</li> <li>• Conduct risk assessments and perform lock-out processes where applicable</li> <li>• Assist with pre-removal inspections and identify and report any problems</li> <li>• Observe artisan conduct relevant tests and compile condition reports</li> </ul>

	<ul style="list-style-type: none"> <li>• Types of evaporators and application</li> <li>• Types of expansion devices and application</li> <li>• Accessories and their application</li> </ul> <p><b>Refrigeration materials and piping</b></p> <ul style="list-style-type: none"> <li>• Materials associated with piping</li> <li>• Types of piping and their usage</li> <li>• Joints</li> <li>• Bending</li> <li>• Installation of pipe work</li> <li>• Pipe fitting and accessories</li> <li>• Insulation and vapour barrier</li> </ul> <p><b>Controls and safety devices</b></p> <ul style="list-style-type: none"> <li>• Identification of controls and safety devices {(types of control systems include but are not limited to: on-off controls, closed loop systems and open loop systems), [types of safety devices include but are not limited to: operational controls, safety controls and efficiency controls]; safety controls include but are not limited to: Overheating stats, humidity stats, pressure switches, flow switches, interlocks, time delays)}.</li> <li>• The operation of controls and safety devices</li> <li>• The application of controls and safety devices</li> </ul>	<ul style="list-style-type: none"> <li>• Identify components and accessories for replacement on refrigeration systems</li> <li>• Observe artisan conducting functionality tests, and adjust as required to meet specifications</li> <li>• Restore the work area and dispose of waste materials</li> <li>• Interact with personnel where applicable</li> <li>• Complete installation reports</li> </ul>
<b>ASSESSMENT CRITERIA</b>		
	<b>Principles of thermodynamics</b>	<b>Supporting Evidence</b>

	<ul style="list-style-type: none"> <li>• Define temperatures and heat transfer</li> <li>• Define latent and sensible heat</li> <li>• Calculate sensible and latent heat</li> <li>• Define the absolute pressure, barometric pressure, gauge pressure and vacuum pressure</li> <li>• Define and explain the term density, specific volume and mass flow</li> <li>• Explain Kelvin's Law in relation to thermo-dynamic</li> </ul> <p><b>Basic vapour compression cycle</b></p> <ul style="list-style-type: none"> <li>• Explain the operation of basic vapour compression cycle with the aid of a block diagram</li> <li>• Identify, name and locate the components, pipes and direction of refrigerant flow on a diagram</li> <li>• Discussion the relationship between pressure and temperature of the refrigerant in the diagram</li> <li>• Identify, name and locate the components, pipes and direction of refrigerant flow on an actual system</li> </ul> <p><b>Principles of energy conservation</b></p> <ul style="list-style-type: none"> <li>• Describe the important of maintenance, commissioning and the correct operation of the Refrigeration system with regard to energy conservation</li> <li>• Discuss factors that influence the efficient operation of the Refrigeration system</li> <li>• Possible scenarios: Dirty condensers,</li> </ul>	<p><b>Observe and assist a competent artisan work on refrigeration systems for a minimum of 120 hours</b></p> <ul style="list-style-type: none"> <li>• A learning journal reflecting the job card number and the key points noted by the learner, signed off by the competent artisan</li> <li>• Condition and installation reports</li> <li>• Checklist completed by the competent artisan verifying task completion in accordance with all applicable organisational, safety, quality, environmental and administrative procedures and standards</li> <li>• Time sheets reflecting time spent on activities</li> </ul>
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	<p>high ambient condition, incorrect installation, non- condensables, low air flow, etc</p> <p><b>Types of compressors and application</b></p> <ul style="list-style-type: none"> <li>• Identify and describe categories, types and the application of various compressors (including but not limited to: screw, scroll, rotary, reciprocating, centrifugal compressors)</li> <li>• Describe the function and operation of compressors</li> </ul> <p><b>Types of condensers and application</b></p> <ul style="list-style-type: none"> <li>• Identify and describe types of condensers and cooling towers and the application of various condensers (including but not limited to: air cooled, forced cooled, evaporated cooled, water cooled)</li> <li>• Describe the function and operation of condensers and cooling towers</li> <li>• Describe sub-cooling/ de-superheating and their relevancy and importance to the operation of the condenser</li> </ul> <p><b>Types of cooling towers and application</b></p> <ul style="list-style-type: none"> <li>• Identify and describe types of cooling towers and the application of various cooling towers (including but not limited to: open, type, induced draft towers, closed circuit)</li> <li>• Describe the function and operation of cooling towers</li> </ul>	
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	<p><b>Types of evaporators and application</b></p> <ul style="list-style-type: none"> <li>• Identify and describe categories, types and the application of various evaporators (including but not limited to: flooded, direct expansion, shell and tube, plate heat exchange, tube in tube)</li> <li>• Describe the function and operation of evaporators</li> </ul> <p><b>Types of expansion devices and application</b></p> <ul style="list-style-type: none"> <li>• Identify and describe categories, types and the application of various expansion devices (including but not limited to: thermostatic, electronic, fixed orifice, capillary)</li> <li>• Describe the function and operation of expansion devices</li> <li>• Describe super heat and its relevancy and importance to the operation of the evaporator</li> </ul> <p><b>Accessories and their application</b></p> <ul style="list-style-type: none"> <li>• Identify and describe, types and the application of various accessories (including but not limited to: suction/ liquid/ burnout driers, oil separators, sight glass, solenoid valve, suction accumulator, receivers, liquid receiver, vibration isolator, heat exchangers, service/shut off valve, muffler, schrader valve, crankcase heaters, crankcase/ evaporating pressure regulating valves, CPHE valves)</li> </ul>	
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	<ul style="list-style-type: none"> <li>• Describe the function and operation of accessories</li> </ul> <p><b>Materials associated with piping</b></p> <ul style="list-style-type: none"> <li>• Identify and describe types of materials used in refrigeration</li> <li>• Differentiate between the various types of piping materials in terms of application</li> </ul> <p><b>Types of piping and their usage</b></p> <ul style="list-style-type: none"> <li>• Identify and describe piping types and materials used in refrigeration (including but not limited to: copper, aluminium, stainless steel, scheduled piping, polyethylene composite piping, flexible hoses)</li> <li>• Differentiate between the various types of piping in terms of application to various refrigerants</li> <li>• Identify and describe piping used in secondary refrigeration circuits (e.g. water piping, glycol, eutectic solution)</li> <li>• Identify and describe piping types and materials used in condensate drainage piping (including but not limited to: PVC, galvanised, copper, steel)</li> </ul> <p><b>Controls and safety devices</b></p> <ul style="list-style-type: none"> <li>• Identify controls and safety devices</li> <li>• Describe the operation of controls and safety devices</li> <li>• Describe the application of controls and safety devices</li> </ul>	
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**Internal Assessment to be performed:**

- Internal knowledge test of a minimum of 30 marks (30min) and the competency will be at 80%
- Practical exercise of 45min covering all above-mentioned items

Level of competency of 80% required for:

- All assessment items

**Learning resources for teaching**

- Lecture, presentations,
- Applicable videos
- Practical demonstration,
- Practical group work,
- Individual practice sessions under supervision
- Print materials, electronic files, software applications incl.:
- Textbooks (Basic Mechanical theory)
- Teaching and learning manuals incl. multimedia applications
- Learning material covering Knowledge and Practical Skills Modules

**Tools, Equipment and Materials**

- Personal Protective Equipment; e.g. Overalls; Safety Boots; Safety Goggles
- Spanners set
- Allen key set
- Screw driver
- Pipe wrench
- Multimeter
- Circlip pliers
- Hammer

<b>Occupation/trade title: Millwright</b>		<b>SAQA ID: 97585</b>		<h1>T2</h1>
		<b>Curriculum code: 671202000</b>		
<b>Learning area title: Understand the basics of air-conditioning (ELECTIVE)</b>	<b>Total hours</b>	<b>SDP</b>	<b>WP</b>	
		80	160	
<b>Work situation title: Perform basic fault-finding and repair on air-conditioning systems (Elective)</b>	<b>Total hours</b>	40	80	
<b>Work scenario:</b> Donna is requested to repair a Refrigeration Plant. The unit is inoperative as it does not produce a reduced temperature. She has to determine the failure in the system and repair it to OEM standards. Safety is premium and her risk assessments are crucial.				
<b>Prerequisite learning:</b> Year 3 plus T1				
<b>INTEGRATED LEARNING CONTENT</b>				
<b>Practical skills modules (PM)</b>	80%	<b>Knowledge modules (KM)</b>	20%	<b>Work experience modules (WM)</b>
<p>QCTO none</p> <p><b>Prepare removal of components from an air conditioning refrigeration installation</b></p> <p><i>Given work instructions, tools, equipment; and consumables,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Determine and test functionality of equipment and correctly diagnose faults according to the scope of practical Skill</li> </ul> <p><i>Given work instructions, tools, equipment; and consumables,</i></p> <p><b>The apprentice must be able to:</b></p> <ul style="list-style-type: none"> <li>Verify the condition of the equipment for use</li> <li>Check calibration</li> </ul>		<p>QCTO none</p> <p>Knowledge of:</p> <p><b>Principles of fault finding</b></p> <ul style="list-style-type: none"> <li>The purpose of fault finding</li> <li>Fault finding methodologies and techniques</li> </ul> <p><b>Diagnosing operational faults</b></p> <ul style="list-style-type: none"> <li>Diagnostic methodologies and techniques used in fault finding</li> <li>The importance of utilising a logical sequence for fault finding</li> <li>The impact of making quick incorrect decisions</li> </ul> <p><b>Corrective action</b></p> <ul style="list-style-type: none"> <li>Reasons for corrective action</li> <li>Consequences of incorrect action taken</li> </ul>		<p>QCTO none</p> <p>The apprentice will be expected to gain practical experience and engage in the following work activities under supervision:</p> <p><b>Perform fault finding and repair activities on refrigeration systems at least three times over a period of not less than 120 hours</b></p> <ul style="list-style-type: none"> <li>Obtain the operating parameters of the system</li> <li>Diagnose operational faults through appropriate method(s).</li> <li>Report findings to the relevant personnel.</li> <li>Plan and prepare for repair procedures.</li> <li>Select tools and instruments, procure the necessary consumables and components</li> </ul>

<ul style="list-style-type: none"> <li>• Verify the performance deviation</li> <li>• Apply Health, safety and environmental (SHE) requirements</li> </ul> <p><b>Determine and test functionality of equipment</b></p> <ul style="list-style-type: none"> <li>• Establish health and safety requirements</li> <li>• Verify the condition of the equipment for use</li> <li>• Determine level of performance</li> <li>• Check drive mechanisms</li> <li>• Check radiators and fans</li> <li>• Determine water level and supply</li> <li>• Check equipment for leaks</li> </ul> <p><b>Remove components from air conditioning and refrigeration systems</b></p> <ul style="list-style-type: none"> <li>• Verify equipment to be removed</li> <li>• Follow the procedure to de-commission an air conditioning and/ or refrigeration system</li> <li>• Implement precautionary measures when working with possible contaminated refrigerant and oils</li> <li>• Follow the correct disposal techniques for contaminated refrigerant and oils</li> <li>• Follow the correct disposal procedure for used equipment</li> </ul> <p><b>Replace components on air conditioning and refrigeration systems</b></p>	<ul style="list-style-type: none"> <li>• The impact of temporary fixes (e.g. bridging out of safety devices)</li> </ul> <p><b>Determine and test functionality of equipment</b></p> <ul style="list-style-type: none"> <li>• Tools, equipment and consumables</li> <li>• Knowledge of recovery equipment</li> </ul> <p><b>Removal of components from air conditioning and refrigeration systems</b></p> <ul style="list-style-type: none"> <li>• Knowledge of equipment dismantling procedures</li> <li>• Knowledge of refrigerants handling procedures</li> </ul> <p><b>Replacing of components in air conditioning and refrigeration systems</b> Knowledge of equipment assembling procedures</p> <p><b>Re-commissioning the system</b></p> <ul style="list-style-type: none"> <li>• The importance of ensuring that the operating parameters are checked and recorded</li> <li>• The importance of ensuring that the operating parameters are compared with the original specifications (OEM's specifications)</li> </ul>	<ul style="list-style-type: none"> <li>• Under instruction, apply applicable method(s) to rectify the identified faulty condition.</li> <li>• Record faults and remedial actions taken to the relevant personnel.</li> <li>• Complete any documentation when necessary (documentation include but not limited to plant logbook).</li> </ul>
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<ul style="list-style-type: none"> <li>• Verify components to be replaced</li> <li>• Replace components on air conditioning and refrigeration systems following the recommended procedures and engineering drawings</li> <li>• Conduct post replacement activities (post activities include but are not limited to housekeeping, etc.)</li> </ul>		
<b>ASSESSMENT CRITERIA</b>		
<p><b>Prepare removal of components from an air conditioning refrigeration installation</b></p> <ul style="list-style-type: none"> <li>• Determination and test functionality of equipment and diagnose faults according to the Scope of Practical Skill completed correctly</li> <li>• Verify the condition of the equipment for use.</li> <li>• Calibration Checked correctly</li> <li>• the performance deviation verified correctly</li> <li>• Applied Health, safety and environmental (SHE) requirements</li> </ul> <p><b>Determine and test functionality of equipment</b></p> <ul style="list-style-type: none"> <li>• Establish health and safety requirements</li> <li>• Verify the condition of the equipment for use</li> <li>• Determine level of performance</li> <li>• Check drive mechanisms</li> <li>• Check radiators and fans</li> <li>• Determine water level and supply</li> </ul>	<p><b>Principles of fault finding</b></p> <ul style="list-style-type: none"> <li>• Explain the purpose of fault finding</li> <li>• Explain fault finding methodologies and techniques</li> </ul> <p><b>Operating parameters</b></p> <ul style="list-style-type: none"> <li>• Determine system specification and measure actual performance</li> <li>• Describe the importance and reasons of consultation with role players</li> </ul> <p><b>Diagnosing operational faults</b></p> <ul style="list-style-type: none"> <li>• Describe diagnostic methodologies and techniques used in fault finding</li> <li>• Explain the importance of utilising a logical sequence for fault finding</li> <li>• Explain the impact of making quick incorrect decisions</li> </ul> <p><b>Corrective action</b></p> <ul style="list-style-type: none"> <li>• Explain the reasons for corrective action</li> <li>• Explain the consequences of incorrect action taken</li> <li>• Explain the impact of temporary fixes</li> </ul>	<p><b>Supporting Evidence:</b></p> <p><b>Perform fault finding and repair activities at least three times over a period of not less than 120 hours</b></p> <ul style="list-style-type: none"> <li>• Signed off logbook/PoE</li> <li>• Job cards or site manager/ supervisor's report signed by both learner and supervisor</li> </ul>

<ul style="list-style-type: none"> <li>• Check equipment for leaks</li> </ul> <p><b>Remove components from air conditioning and refrigeration systems</b></p> <ul style="list-style-type: none"> <li>• Verify equipment to be removed</li> <li>• Follow the procedure to de-commission an air conditioning and/ or refrigeration system</li> <li>• Implement precautionary measures when working with possible contaminated refrigerant and oils</li> <li>• Follow the correct disposal techniques for contaminated refrigerant and oils</li> <li>• Follow the correct disposal procedure for used equipment</li> </ul> <p><b>Replace components on air conditioning and refrigeration systems</b></p> <ul style="list-style-type: none"> <li>• Verify components to be replaced</li> <li>• Replace components on air conditioning and refrigeration systems following the recommended procedures and engineering drawings</li> </ul> <p>Conduct post replacement activities (post activities include but are not limited to housekeeping, etc.)</p>	<p>(e.g. bridging out of safety devices)</p> <p><b>Re-commissioning the system</b></p> <ul style="list-style-type: none"> <li>• Describe the importance of ensuring that the operating parameters are checked and recorded</li> <li>• Explain the importance of ensuring that the operating parameters are compared with the original specifications</li> </ul>	
<p><b>Internal Assessment to be performed:</b></p> <ul style="list-style-type: none"> <li>• Internal knowledge test of a minimum of 30 marks (45min) and the competency will be at 80%</li> <li>• Practical exercise of 45min covering all above-mentioned items</li> </ul>		

Level of competency of 80% required for:

- Interpret symbols and abbreviations.
- Interpret elementary circuit diagrams.
- Install and maintain the following filters:
- Install and maintain tubing and fittings.
- Correct disposal techniques for contaminated refrigerant and oils.
- All safety aspects adhered to according company policies
- No damage to equipment

#### **Learning resources for teaching**

- Lecture, presentations,
- Applicable videos
- Practical demonstration,
- Practical group work,
- Individual practice sessions under supervision
- Print materials, electronic files, software applications incl.:
- Textbooks (Basic Mechanical theory)
- Teaching and learning manuals incl. multimedia applications
- Learning material covering Knowledge and Practical Skills Modules

#### **Tools, Equipment and Materials**

- Personal Protective Equipment: Overalls; Safety Boots; Safety Goggles
- Spanners set
- Allen key set
- Screw driver
- Pipe wrench
- Multimeter
- Circlip pliers
- Hammer



<b>MILLWRIGHT TOOLBOX, TOOLS AND EQUIPMENT LIST</b>			
Category	<b>TOOLBOX ITEMS (Handtools)</b>		
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>QTY</b>
1	Toolbox	Trunk Artisan 2-Tray no slot 660x370x235mm Toolbox	30
2	Padlock	Panel key	30
3	Set of Insulated electricians screw drivers	Personalised lock for lock out	30
4	Hack saw	Heavy Duty Tubular Professional Hacksaw 250-300mm with adjustable blade locators	30
5	Ball pein hammer	200g	30
6	Ball pein hammer	680-700g	30
7	Hammer	2kg	
8	Hammer Copper	2kg	
9	200MM Chisel	30mm edge 60° included angle Steel	30
10	Long nose pliers -(straight)	160mm Straight jaws; Half-round tapering serrated jaws; Dipcoated sure grip handles	30
11	Combination Pliers	200mm ; Profi-plus GS approved, Chrome Vanadium tool steel, Insulated grips	30
12	Side cutter pliers (diagonal)	180mm, Insulated, manufactured from high grade chrome vanadium tool steel to DIN 5238B specifications, to cut hard and soft wires	30
13	Long jaw round nose pliers	125mm, heavy duty, chrome vanadium, round jaw finish with smooth action single joints	30
14	180MM CIRCLIP PLIERS	I/S STR, O/S STR, I/S BNT & O/S BNT	30ea

15	250MM TIN SNIP	250mm Tungsten edged	30
16	1-13MM DRILL SET	Steel	30
17	250MM VICE GRIP	Chrome Vanadium tool steel	30
18	Nut Drivers(Socket screw driver/Tube Spanner)	8;10;13mm Socket head and shafts of chrome vanadium steel Contact drive heads with Kraft form handles	30
19	File brush	3-3/4" Brush Area Length	30
20	Scriber	Engineering scriber	30
21	Self-adjusting Wire cutter-stripper	Strips 0,5 to 8mm wire absolute safety insulated	30
22	Files ( Bastard,2 <sup>nd</sup> Cut, and Smooth Flat Files)	Combination set	30ea
23	Plastic Handles	Small, Medium and Large	30ea
24	Ratchet Crimping tool with release	terminal size : 1,25; 2 5,5 &8mm	30
25	Shifting spanner	200mm, Drop forged' Chrome-Vanadium steel, Gun metal finish, Hardened knurls	30
26	Shifting spanner	300mm, Drop forged' Chrome-Vanadium steel, Gun metal finish, Hardened knurls	30
27	Centre punch	heavy Duty 6mm x 150 mm	30
28	Prick Punch Set (7 piece)	60° included angle point to be used for marking metalssize 4 x 100mm	30
29	Set of Open/ring spanners (Set of 18)	Sizes: 6-24mm shaft in girder pattern; Chrome plated; Vanadium 31 CrV3 Mat. 1.2208	30
30	1/2" SOCKET SET	10-32mm Vanadium Chrome Including 50 & 150mm extention,Strong arm and ratchet	30

31	Allen Key set –Metric	Combination set (ball ends) set of 7 : 2,5 - 10mm	30
32	Allen Key set – Imperial	Combination set (ball ends) set of 1/16"-3/8"	30
33	Water pipe wrench	Stanley Fatmax 200mm Groove Joint	30
34	Junior saw	150mm	30
35	Engineering Square	100mm/300mm	30
36	Mallet	672 Grams	30
37	Tablet	(See attachment)	30
38	Bradwal	32mmX2.5mm Blade Moulded in	30
39	Deburring tool	Hardened Steel	30
30	Caliper Inside	Hardened tips	30
41	Caliper Jenny	Hardened tips	30
42	Caliper Outside	Hardened tips	30
43	Divider	Hardened tips	30
44	Engineering square	150mm	30
45	Feeler gauge	flexisteel	30
46	Flashlight	3volt	30
47	Measuring tape	5m	30
48	Micrometer	0-25mm	30
49	Multimeter	Volts, Ohms, Amps	30
50	Socket screw driver	10mm long reach	30
51	Steel rule set	(150mm , 300mm)	30
52	Taper gauge	0-10mm	30
53	Tommy bar	20mm x 450mm	30
54	Utility knife	Retractable blade	30
55	Toolbag	Leather workman type	30
56	Vernier	150mm	30
57	Geometry set squares	45 & 60 Deg	30

<b>WORKSHOP TOOLS</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>QTY</b>
58	Tap and Die-set (metric)	Tork Craft 44-Piece Tap And Die Set 3-12mm Hss In Metal Case (T9441)	12
59	Straight Edge	1m Magnetic	12
60	Bearing Puller	12-38mm	6
61	C-Spanner	combination set	5
62	Soldering Iron	220V 30W with stand	15
63	12v Power Supply	12V	15
64	Solder Sucker	nylon tip	15
65	Belt tension gauge	15-75 kgs	15
66	Clamp on meter	0 A to 100 A	15
67	Packing extractors	3 Piece set (small, medium & large)	15
68	PVC pipe cutter	0-42mm Cast aluminium alloy handle, enameled with stainless steel blade.	6
69	Rubber (insulated) gloves		15
70	Tap wrench	30/180/230/380/480mm Adjustable Tap Wrench M2-M24 Handle Tap Tapping Reamer Tool	5
71	Technical Pen Set	(refillable 0,18 - 0,70)	15

<b>Special Tools</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>QTY</b>
72	Bench Grinder	Bench Grinder (600w)	4
73	Hand Grinder (Small)	GWS 850 C Angle Grinder (850w)	10
74	Hand Grinder (Big)	2000 W 230 mm Angle Grinder Kit GWS 2000	10
75	Workbench and	1.2m L X 1.2B 1.1H 10mm top plate	15
76	Bench Vice	150mm	15
77	Hydraulic Training Unit with components	basic set with panel	2
78	Pneumatic Training Unit with components	basic set with panel	2
79	Shaft Alignment Unit	Built-in electronic 360° inclinometer. For shaft alignment. PSD 30 mm [1.18"]	8
80	Jigsaw	(500W)	5
81	Hydraulic press	20 Ton H Frame Press	3
82	Reduction scale rulers (Architect's scale)		5
83	Set square with protractors and scale ruler	combination set	5
84	Steel square	300x300	5
85	Earth leakage polarity tester		5
86	Earth leakage tester		5
87	meter Amp		5
88	meter Frequency		5
89	meter Kilowatt-hour		5
90	meter maximum demand		5
91	meter Power factor		5
92	meter Volt		5
93	meter Watt		5
94	Hydraulic Flowmeter	50l/s	5

95	Hydraulic Pressure gauges	150PSI	5
96	Insulation resistance tester (megger)	2megohm	5
97	Line of cord		5
98	Loop impedance tester		5
99	Phase rotation tester		5
<b>MEASURING EQUIPMENT</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>QTY</b>
100	Measuring Tape	10m/30m	30
101	Divider	standard	30
102	Multi-meter	Digital multimeter; LCD 3,75 digit (6000)	30
103	Oscilloscope	digital; Band: ≤50MHz; Channels:2; 4kpts/ch; Plug: EU	8
104	Clamp on meter	AC/DC digital clamp meter; Øcable:30mm; Sampling:3x/s; True RMS	15
105	Micrometer	4Pcs Outside Micrometer Set Ratchet Stop Type 0-100mm (0-25mm/25-50mm/50-75mm/75-100mm)	30ea
106	Vernier Height gauge	254MZ-300 Master	5
105	Venier	0 – 300 mm.	30
106	Torque Wrench	Adjustable torque wrench with 1/2" square drive. • Bi-directional tightening. • supplied with calibration certificate	8
107	Belt Tension gauge	Scale reads 30-180 lbs	15
108	Feeler gauge	0.02mm - 1mm [90mm] 17 Leaf	30
109	Thread Pitch Gauge	0.40mm - 7mm	30
110	Vernier height gauge	150mm	15

<b>EQUIPMENT(Classroom)</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>QTY</b>
111	White board (mobile)	1.2 X 1.8m	2
112	Data projector	( 3200 LM)	2
113	Storage Cabinet Unit 1 1000X600X2045	1000X600X2045	4
114	System Shelf	1915mm(H) x 914mm(W) x 305mm(D) 5 shelves	4
115	Swivel Chair Type 2 L - Cushioned comfort swivel chair with armrests, allowing for	Type 2 L - Cushioned comfort swivel	4
116	Table 1200x2400 with drawers	1200x2400	30
117	Student chairs (plastic)	(plastic)	30
118	Student desks 800x600mm	800x600mm	30
119	Laptop HP	2.4hz I7 1 TB	2
120	Storage Cabinet Unit 1 1000X600X1200	1000X600X1200	4
121	A3 drawing board	small drawing head or double lock mechanism	15
122	Marking off table	granite base	4
<b>MACHINERY</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>QTY</b>
123	Belt drives	double belt 16N small pully diamiter,big pully diamiter	5
124	Chain drives	double chain, small pully,big pully,tentioner self	5

125	Brakes		5
126	Taper key hub	Diameter d, Section b x h, Width Shaft & Hub b, Depth, Radius r. Shaft t1	9
127	Flange Jig		5
128	Pedestal Drill	40E Gearbox type	4
129	Induction Heater	Low ZVS 12-48V 20A 1000W High Frequency	4
130	Electrical Motor	1.5 HP Jet Motor	8
131	DC Motor	Electric motors 380V - 690V. 200kW - 20.000kW	8
132	Centrifugal pump	Tradepower Water Pump 1.5 HP Jet Moto	4
133	Pumps (Warman, KSB, Positive displacement and Multistage)	high-capacity models that deliver flow rates of up to 850 cubic metres per hour and delivered heads as high as 390 m	3
134	Bearings (Taper and Parallel)		2
135	Gearbox	gearbox/ radicon/ multi reduction	5
136	Coupling	20mm	5
137	Arc welding machine		5
138	Array of bearing heaters (induction, oil bath)		15
139	Bearing pullers		10
140	Bearing replacement equipment		10
141	Belt tension gauge		15
142	Chain simulation-Double		5
143	Chain simulation-Single		5
144	Flow and pressure gauges		5
145	Gas cutting equipment (Oxygen and acetylene cylinders, flashback arrestors, pipe, cutting torch, different nozzles)		4



146	Pneumatic basic simulation stand and equipment		4
147	Pressure and flow meters		4
148	Pressure test equipment (including gauges)		4
149	Pulley gauge		5
<b>EQUIPMENT (LONG TERM CONSUMABLES)</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>QTY</b>
150	<b>Electronics:</b>		
151	PLC	Upgradable to current specs	5
152	Bi-stable multi vibrator electronic circuit with a 555 timer ic, by using the circuit diagram, on the pc board.	Bi-stable multi vibrator electronic circuit with a 555 timer ic, by using the circuit diagram, on the pc board.	15
153	A triac speed control electronic circuit by using the circuit diagram, on the pc board supplied	A triac speed control electronic circuit by using the circuit diagram, on the pc board supplied	15
154	A-stable multi vibrator electronic circuit with a 555 timer ic,	A-stable multi vibrator electronic circuit with a 555 timer ic,	15
155	Mono stable multi vibrator electronic circuit with a 555 timer ic,	Mono stable multi vibrator electronic circuit with a 555 timer ic,	15
156	The circuit diagram, on the pc board		15
157	Forward reverse control panel for a 400 volt squirrel cage induction motor.	Forward reverse control panel for a 400 volt squirrel cage induction motor.	5

158	Two way control panel for a 230 volt capacitor start/capacitor start capacitor run motor with the aid of a selector switch.	Two way control panel for a 230 volt capacitor start/capacitor start capacitor run motor with the aid of a selector switch.	5
159	Two way control panel for a 230 volt single phase capacitor start/capacitor start capacitor run motor or capacitor run motor.	Two way control panel for a 230 volt single phase capacitor start/capacitor start capacitor run motor or capacitor run motor.	5
160	Forward and reverse oscillating panel, fitted with a three phase induction motor	Forward and reverse oscillating panel, fitted with a three phase induction motor	5
161	Forward reverse control panel for a 400 volt squirrel cage induction motor to start in star and automatically change over to delta.	Forward reverse control panel for a 400 volt squirrel cage induction motor to start in star and automatically change over to delta.	5
162	Sequence panel fitted with two three phase squirrel cage induction motors	380v	5
163	Sequence panel fitted with two three phase squirrel cage induction motors	380v	5
164	Plc controlled, slipring motor, plugging to neutral panel.	380v	5
165	Electrical dc compound motor	380v	5
166	Three phase slip-ring induction motor	380v	5
167	Single phase capacitor-start, capacitor-run induction motor.	220v	5
168	Three phase induction motor before commissioning	380v	5

169	Fault finding on a plugging to neutral hoist panel with a hand controller that controls the speed steps, by means of resistor banks, of a three phase slip-ring induction motor	380v	5
170	Plugging to neutral panel with a hand controller that controls the speed steps, by means of resistor banks, of a three phase slip ring induction motor	380v	5
171	Direct current panel with a hand controller that controls the speed steps, by means of resistor banks, of a direct current compound motor.	380v	5
172	Cutting and brazing sets	combination set	4
173	250 Amp Inverter Welder	250Amp	3
174	Electronics consumables kit	comination set	30
175	Lifting and coffin hoists	5ton	5
176	Manual jacks	10ton	5
177	Hydraulic jacks	5ton	5
178	Chain blocks	5ton	4
179	Nylon slings	5ton	6
180	Shackles	50mm	6
181	Eye bolts	50mm	6
182	Tackle	5ton	6
183	Chain slings	10ton	6
184	Tirfor	5ton	4
185	Wire rope slings:	20mm diameter	6

<b>Consumables</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>Ratio</b>
186	1way side entry boxes P.V.C	1way side entry boxes P.V.C	200
187	20mm inspection bend	20mm inspection bend	200
188	20mm T-bend	20mm T-bend	200
189	20mm P.V.C glands	20mm P.V.C glands	400
190	P.V.C inspection bend	20mm	200
191	One way P.V.C end box	1way	200
192	E/L samite clip tray	E/L samite clip tray	90
193	Isolator samite	6way	100
194	Double row neutral bar	Brass Double Row Earth and Neutral Ba	60
195	Samite clip tray	2 x 13 mm / 1 x 26 mm*	90
196	Ferrules kit	250pcs 2.5mm	60
197	1,5mm red wire	1,5mm red wire	30
198	1,5mm black wire	1,5mm black wire	30
199	2,5mm red wire	2,5mm red wire	30
200	2,5mm black wire	2,5mm black wire	30
201	2,5mm earth wire	2,5mm earth wire	15
202	Circuit breaker set (10-60 Amp)	Circuit breaker set (10-60 Amp)	20
203	60Amp Earth Leakage	60Amp Earth Leakage	30
204	2.5mm suffix (2+E) cable	2.5mm suffix (2+E) cable	30
205	4mm black wire	4mm black wire	15
206	Soldering wire	Soldering wire	60
207	Masking tape	Masking tape	90
208	Paint Brush	Paint Brush	60
209	Brass nuts (set)	270pcs Set Brass M2 3-25mm Male to Female	30

210	Brass flat washers (set)	M2 M2.5 M3 M4 M5 M6 M8 M10 M12 M14	30
211	Suffix cable clip 10mm	Suffix cable clip 10mm	30
212	2way (1-lever ) S/W (INDUSTRIAL)	2way (1-lever ) S/W (INDUSTRIAL)	30
213	3 pin top plug	4 pin top plug	60
214	Drill bits (Set)	Taper Shank combination set	60
215	Drill bits (Set)	Straight Shank Combination set	60
216	Taps (Set)	combination set	30
145	Lamp holder	E-Pride Bayonet Cap Nylon Batten Lamp Holder	90
217	10x50mmx6m flat bar	10X50mmX6mm	20
218	14x14mmx6m square bar/key fitting	14X14mmX6mm	20
219	8mmx100mmx6m flat bar (flange task)	8X100mmX6mm	30
220	0.5mm galvanised sheet marking off task	0.5mm	15
221	Hydraulic oil x 20l	20L	5
222	Hack saw blades	300mm	600
223	Marking blue / Marking pen	350ml	15
224	Engineering blue	350ml	60
225	Cutting paste / fluid	1L	60
226	Shim stock or shim plates	(various thicknesses)	30
227	Appropriate gland packing	12mm x 1m / 8mm x 1m / 6mm x 1m	60
228	Gasket material (4 types)	(4 types)	30
229	Grease x 20l	20L	5
230	Copper shaft - 30mmx1m	30mmX1m	15
231	Hydraulic Fittings	Assortment	20
232	Hydraulic Hoses	Assortment	20

233	Hydraulic Valves	Assortment	20
234	Pneumatic Fittings	Assortment	20
235	Pneumatic Hoses	Assortment	20
236	Pneumatic valves	Assortment	20
<b>SAFETY</b>			
<b>Item</b>	<b>Item Description</b>	<b>Specifications</b>	<b>Ratio</b>
237	Lock-out device	Current industry standard	30
238	First aid kit/box (check if updated)		2
239	Fire extinguishers (check expiry date)		8
240	Safety signage (colour coding, emergency and warning signs)		1
241	SANS regulation books		10