


Skills Programme Curriculum Document		
<b>Curriculum Code</b>	<b>Curriculum Title</b>	
900144-000-00-00	Hydrogen Fuel Cell System Practitioner	
<b>Quality Partner</b>	<b>Name</b>	<b>Logo</b>
	EWSETA	



## Table of content

SECTION 1: CURRICULUM SUMMARY .....	5
1. Occupational Information .....	5
1.1 Associated Occupation .....	5
1.2 Occupation or Specialisation Addressed by this Curriculum .....	5
1.3 Alternative Titles used by Industry .....	5
2. Curriculum Information.....	5
2.1 Curriculum Structure.....	5
2.2 Entry Requirements.....	6
3. Assessment Quality Partner Information.....	6
4. Part Qualification Curriculum Structure.....	6
SECTION 2: OCCUPATIONAL PROFILE.....	7
1. Occupational Purpose.....	7
2. Occupational Tasks .....	7
3. Occupational Task Details .....	7
3.1. Install, operate and monitor a hydrogen fuel cell system (NQF Level 5) .....	7
3.2. Maintain a hydrogen fuel cell system (NQF Level 5).....	7
SECTION 3: CURRICULUM COMPONENT SPECIFICATIONS.....	9
SECTION 3A: KNOWLEDGE MODULE SPECIFICATIONS.....	9
1. 900144-000-00-KM-01, Health and safety regarding hydrogen fuel cell systems, NQF Level 3, Credits 3 .....	10
1.2.1. KM-01-KT01: Covid 19 (20%) .....	10
1.2.2. KM-01-KT02: Health and safety in an organisation (20%).....	10
1.2.3. KM-01-KT03: Basic first aid (30%) .....	11
1.2.4. KM-01-KT04: Firefighting (30%).....	12
2. 900144-000-00-KM-02, Global Energy, CO <sub>2</sub> trends, and sustainable fuel alternatives, NQF Level 4, Credits 2 .....	14
2.2.1. KM-01-KT01: Global Energy, CO <sub>2</sub> trends and renewable sources (100%).....	14
3. 900144-000-00-KM-03, Basics of electricity, NQF Level 4, Credits 2 .....	16
3.2.1. KM-03-KT01: Fundamentals of electricity (65%) .....	16
3.2.2. KM-03-KT03: Wiring of installations (15%).....	16
3.2.3. KM-03-KT03: Low voltage protection (10%).....	17
3.2.4. KM-03-KT04: Earthing and bonding (10%).....	17
4. 900144-000-00-KM-04, Hydrogen fuel cell system technology, NQF Level 5, Credits 6.....	19
4.2.1. KM-04-KT01: Hydrogen fuel cell systems (70%).....	19

4.2.2. KM-04-KT02: System integration of a hydrogen fuel cell system (10%) .....	20
4.2.3. KM-04-KT03: Site inspection and load management/ deployment planning (20%).....	21
5. 900144-000-00-KM-05, Installation, operation and maintenance of hydrogen fuel cell systems, NQF Level 5, Credits 5.....	23
5.2.1. KM-05-KT01: Installation of hydrogen fuel cell systems (70%).....	23
5.2.2. KM-05-KT02: Operation of hydrogen fuel cell systems (25%) .....	23
5.2.3. KM-05-KT03: Monitoring and maintenance of hydrogen fuel cell systems (25%) .....	24
SECTION 3B: PRACTICAL SKILLS MODULE SPECIFICATIONS .....	26
1. 900144-000-00-PM-01, Perform basic first aid and fire-fighting, NQF Level 3, Credits 4.....	27
1.2.1. PM-01-PS01: Perform basic first aid .....	27
1.2.2. PM-01-PS02: Perform basic fire fighting .....	28
1.2.3. PM-01-PS03: Manage an emergency scene/situation.....	29
2. 900144-000-00-PM-02, Conduct 240V single phase electrical wiring activities on panels, NQF Level 4, Credits 2.....	32
2.2.1. PM-02-PS01: Conduct 240V single phase electrical wiring activities on panels .....	32
3. 900144-000-00-PM-03, Conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 2 .....	35
3.2.1. PM-03-PS01: Conduct site inspection for the installation of a hydrogen fuel cell system..	35
3.2.2. PM-03-PS02: Plan the deployment of a hydrogen fuel cell system .....	36
4. 900144-000-00-PM-04, Install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4 .....	39
4.2.1. PM-04-PS01: Install a hydrogen fuel cell system .....	39
4.2.2. PM-04-PS02: Operate and monitor a hydrogen fuel cell system .....	40
5. 900144-000-00-PM-05, Maintain a hydrogen fuel cell system, NQF Level 5, Credits 2 .....	42
5.2.1. PM-05-PS01: Perform troubleshooting and error checking .....	42
5.2.2. PM-05-PS02: Conduct tests on a hydrogen fuel cell system .....	43
5.2.3. PM-05-PS03: Change hydrogen fuel cell components .....	44
5.2.4. PM-05-PS04: Refuel hydrogen fuel cell .....	45
SECTION 3C: WORK EXPERIENCE MODULE SPECIFICATIONS .....	47
1. 900144-000-00-WM-01, Processes to conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 1 .....	48
1.2.1. WM-01-WE01: Conduct site inspection and plan the deployment of a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner .....	48
1.2.2. WM-01-WE02: Conduct site inspection and plan the deployment of a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner.....	49
2. 900144-000-00-WM-02, Processes to install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4.....	51

3. 900144-000-00-WM-03, Processes to maintain a hydrogen fuel cell systems, NQF Level 5,  
Credits 2 ..... 54

SECTION 4: STATEMENT OF WORK EXPERIENCE ..... 57

3. 900144-000-00-WM-03, Processes to maintain a hydrogen fuel cell systems, NQF Level 5,  
Credits 2 ..... 64

## **SECTION 1: CURRICULUM SUMMARY**

### **1. Occupational Information**

#### **1.1 Associated Occupation**

214401: Mechanical Engineer

#### **1.2 Occupation or Specialisation Addressed by this Curriculum**

Hydrogen Fuel Cell System Practitioner

#### **1.3 Alternative Titles used by Industry**

- Hydrogen Fuel Cell System Technician

### **2. Curriculum Information**

#### **2.1 Curriculum Structure**

This skills programme is made up of the following compulsory Knowledge and Application Modules:

Knowledge Modules:

- 900144-000-00-KM-01, Health and safety regarding hydrogen fuel cell systems, NQF Level 3, Credits 3
- 900144-000-00-KM-02, Global Energy, CO<sub>2</sub> trends, and sustainable fuel alternatives, NQF Level 4, Credits 2
- 900144-000-00-KM-03, Basics of electricity, NQF Level 4, Credits 2
- 900144-000-00-KM-04, Hydrogen fuel cell system technology, NQF Level 5, Credits 6,
- 900144-000-00-KM-05, Installation, operation and maintenance of hydrogen fuel cell systems, NQF Level 5, Credits 5

Total number of credits for Knowledge Modules: 18

Practical Skills Modules:

- 900144-000-00-PM-01, Perform basic first aid and fire-fighting, NQF Level 3, Credits 4
- 900144-000-00-PM-02, Conduct 240V single phase electrical wiring activities on panels, NQF Level 4, Credits 2
- 900144-000-00-PM-03, Conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 2

- 900144-000-00-PM-04, Install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4
- 900144-000-00-PM-05, Maintain a hydrogen fuel cell system, NQF Level 5, Credits 2

Total number of credits for Practical Skill Modules: 14

This skills programme also requires the following Work Experience Modules:

- 900144-000-00-WM-01, Processes to conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 1
- 900144-000-00-WM-02, Processes to install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4
- 900144-000-00-WM-03, Processes to maintain a hydrogen fuel cell system, NQF Level 5, Credits 2

Total number of credits for Work Experience Modules: 7

## **2.2 Entry Requirements**

NQF Level 4, with mechanical, electrical or chemical engineering competencies

## **3. Assessment Quality Partner Information**

Name of body: EWSETA

Address of body: 22 Wellington Road, Parktown, Johannesburg, South Africa

## **4. Part Qualification Curriculum Structure**

Not applicable

## **SECTION 2: OCCUPATIONAL PROFILE**

### **1. Occupational Purpose**

A Hydrogen Fuel Cell System Practitioner installs, operates and maintains hydrogen fuel cell systems.

### **2. Occupational Tasks**

- Install, operate and monitor a hydrogen fuel cell system (NQF Level 5)
- Maintain a hydrogen fuel cell system (NQF Level 5)

### **3. Occupational Task Details**

#### **3.1. Install, operate and monitor a hydrogen fuel cell system (NQF Level 5)**

##### **Unique Product or Service:**

Fully functional hydrogen fuel cell system that generates energy using new generation technology

##### **Occupational Responsibilities:**

- Install a hydrogen fuel cell system
- Operate and monitor a hydrogen fuel cell system

##### **Occupational Contexts:**

- Processes to install, operate and monitor a hydrogen fuel cell system

#### **3.2. Maintain a hydrogen fuel cell system (NQF Level 5)**

##### **Unique Product or Service:**

An efficient and reliable hydrogen fuel cell system that produces energy using new generation technology

##### **Occupational Responsibilities:**

- Perform troubleshooting and error checking
- Conduct tests on a hydrogen fuel cell system
- Change hydrogen fuel cell components
- Refuel hydrogen fuel cell

**Occupational Contexts:**

- Processes to maintain a hydrogen fuel cell system



## **SECTION 3: CURRICULUM COMPONENT SPECIFICATIONS**

### **SECTION 3A: KNOWLEDGE MODULE SPECIFICATIONS**

List of Knowledge Modules for which Specifications are included

- 900144-000-00-KM-01, Health and safety regarding hydrogen fuel cell systems, NQF Level 3, Credits 3
- 900144-000-00-KM-02, Global Energy, CO<sub>2</sub> trends, and sustainable fuel alternatives, NQF Level 4, Credits 2
- 900144-000-00-KM-03, Basics of electricity, NQF Level 4, Credits 2
- 900144-000-00-KM-04, Hydrogen fuel cell system technology, NQF Level 5, Credits 6,
- 900144-000-00-KM-05, Installation, operation and maintenance of hydrogen fuel cell systems, NQF Level 5, Credits 5

## **1. 900144-000-00-KM-01, Health and safety regarding hydrogen fuel cell systems, NQF Level 3, Credits 3**

### **1.1 Purpose of the Knowledge Module**

The main focus of the learning in this knowledge module is to build an understanding of Covid 19, health and safety in an organisation, basic first aid and basic fire-fighting.

The learning will enable learners to demonstrate an understanding of:

- KM-01-KT01: Covid 19 (20%)
- KM-01-KT02: Health and safety in an organisation (20%)
- KM-01-KT03: Basic first aid (30%)
- KM-01-KT04: Basic fire-fighting (30%)

### **1.2 Guidelines for Topics**

#### **1.2.1. KM-01-KT01: Covid 19 (20%)**

***Topic elements to be covered include:***

- KT0101 Corona viruses
- KT0102 Diseases associated with viruses (Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS)).
- KT0103 Covid 19 symptoms and mitigating measures

***Internal Assessment Criteria and Weight***

- IAC0101 Discuss, briefly, the origin spread and impact of the Covid 19 virus and its mutations
- IAC0102 Describe the diseases (including symptoms) associated with viruses, especially with the Corona virus
- IAC0103 Describe Covid 19 symptoms and the precautions to be taken to avoid spreading Covid 19
- IAC0104 Describe how best to respond when one is Covid positive

***(Weight 20%)***

#### **1.2.2. KM-01-KT02: Health and safety in an organisation (20%)**

***Topic elements to be covered include:***

- KT0201 Managing health and safety in an organisation

- KT0202 Chemical safety (training employees in handling and safety procedures; personal protection equipment such as respirators, gloves and goggles; procedures when working with chemicals; types of chemical hazards; injuries resulting from chemicals; chemical safety; chemical risk assessment (hazard identification, risk assessment, controlling exposure)
- KT0203 Electrical safety (injuries resulting from electrical currents; electrical safety; lock-out or tag-out; electrical hazards; working on or near live parts; PPE; OSHA requirements)
- KT0204 SANS 10142

***Internal Assessment Criteria and Weight***

- IAC0201 Describe ways of managing health and safety in an organisation
- IAC0202 Discuss aspects related to chemical safety
- IAC0203 Discuss aspects related to electrical safety
- IAC0204 Identify and discuss aspects from SANS 10142 relevant to the occupation of a Hydrogen Fuel Cell System Practitioner

***(Weight 20%)***

**1.2.3. KM-01-KT03: Basic first aid (30%)**

***Topic elements to be covered include:***

- KT0301 Primary and secondary emergency care
- KT0302 Primary emergency care/first aid kit
- KT0303 First aid principles and practice
- KT0303 An emergency scene
- KT0304 Managing shock

***Internal Assessment Criteria and Weight***

- IAC0201 Explain the aims of primary emergency care, use of appropriate PPE and the medico-legal implications of primary emergency care
- IAC0202 Describe the and the contents, maintenance and storage of the relevant primary emergency care/first aid kit
- IAC0203 Explain how to assess and manage an emergency scene in the workplace
- IAC0204 Explain how to identify and manage shock and how to conduct secondary assessment of the sick and/or injured person and provide appropriate primary emergency care within the workplace

***(Weight 30%)***

#### **1.2.4. KM-01-KT04: Firefighting (30%)**

***Topic elements to be covered include:***

- KT0401 Fire prevention
- KT0402 Principles of fire fighting
- KT0403 Fire-fighting techniques used for hydrogen fuel cell technology
- KT0404 Fire-fighting equipment

***Internal Assessment Criteria and Weight***

- IAC0401 Describe the basics of fire prevention in a hydrogen fuel cell context
- IAC0402: Discuss fire-fighting regulations, principles and practices in the workplace
- IAC0403 Describe fire-fighting techniques used for hydrogen fuel cell technology
- IAC0404 Describe the fire-fighting equipment used for fires related to hydrogen fuel cell technology

***(Weight 30%)***

#### **1.3 Provider Programme Accreditation Criteria**

***Physical Requirements:***

- Providers must have a training facility with all the resources to deliver the learning as set out in this module. Resources must include training manuals approved by the QCTO which cover the full spectrum of theory in this module, and other relevant documentation.
- Adequate and equipped training venue to accommodate the number of learners, as prescribed by the OHS Act
- Access to internet, computers, library and/or e-learning facilities
- Learning environment conducive to delivery of training
- Assessment documentation and standards approved by the AQP

***Human Resource Requirements:***

- Facilitators/lecturers must have acquired the relevant training in this module and must be registered for first aid and fire-fighting.
- Facilitators/lecturers must have experience with assessment and moderation in the subject matter of this module.
- Facilitator/learner ratio 1:20

***Legal Requirements:***

- Compliance with relevant legislation
- Accreditation with the appropriate quality assurance body

#### **1.4 Exemptions**

- None

## **2. 900144-000-00-KM-02, Global Energy, CO<sub>2</sub> trends, and sustainable fuel alternatives, NQF Level 4, Credits 2**

### **2.1 Purpose of the Knowledge Module**

The main focus of the learning in this knowledge module is to build an understanding of global energy systems, the impact of carbon emissions, sustainable fuel alternatives, and hydrogen fuel cell technology.

The learning will enable learners to demonstrate an understanding of:

- KM-02-KT01: Global Energy, CO<sub>2</sub> trends and renewable sources in South Africa (100%)

### **2.2 Guidelines for Topics**

#### **2.2.1. KM-01-KT01: Global Energy, CO<sub>2</sub> trends and renewable sources (100%)**

***Topic elements to be covered include:***

- KT0101 Energy for human wellbeing and economic development
- KT0102 Historical and current energy systems [fossils fuels (coal, oil, and gas)], carbon dioxide emissions and climate change
- KT0103 Unconventional energy sources [sustainable fuel alternatives (renewables)]
- KT0104 Hydrogen and energy production

#### ***Internal Assessment Criteria and Weight***

- IAC0101 Explain the importance of energy for human wellbeing and economic development
- IAC0102 Explain the concept of energy demand and identify the factors that influence it
- IAC0103 Elaborate on historical and current energy systems and explain their impact on global climate change
- IAC0104 Identify sustainable fuel alternatives and explain why there is a global urgency to develop and deploy them
- IAC0106 Describe the advantages of renewables
- IAC0107 Explain the benefits of using hydrogen as compared to fossil fuels
- IAC0108 Explain how hydrogen is used to mitigate the issue of fluctuation in renewable energy production

***(Weight 100 %)***

## 2.3 Provider Programme Accreditation Criteria

### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this module. Resources must include training manuals approved by the QCTO which cover the full spectrum of theory in this module, and other relevant documentation.
- Adequate and equipped training venue to accommodate the number of learners, as prescribed by the OHS Act
- Access to internet, computers, library and/or e-learning facilities
- Learning environment conducive to delivery of training
- Assessment documentation and standards approved by the AQP.

### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired a suitable degree or tertiary qualification in the electrical, electronic, automation or chemical engineering fields.
- Facilitators/lecturers must have experience with assessment and moderation in one of the engineering fields stated above.
- Facilitator/learner ratio 1:20

### *Legal Requirements:*

- Compliance with relevant legislation
- Accreditation with the appropriate quality assurance body.

## 2.4 Exemptions

None

### **3. 900144-000-00-KM-03, Basics of electricity, NQF Level 4, Credits 2**

#### **3.1 Purpose of the Knowledge Modules**

The main focus of the learning in this knowledge module is to build an understanding of the theory of electricity.

The learning will enable learners to demonstrate an understanding of:

- KM-03-KT01: Fundamentals of electricity (65%)
- KM-03-KT02: Wiring of installations (15%)
- KM-03-KT03: Low voltage protection (10%)
- KM-03-KT04: Earthing and bonding (10%)

#### **3.2 Guidelines for Topics**

##### **3.2.1. KM-03-KT01: Fundamentals of electricity (65%)**

***Topic elements to be covered include:***

- KT0101 Principles and fundamental concepts of electricity
- KT0102 Definitions, types, properties and applications of conductors, insulators and semi-conductors
- KT0103 Concepts, theories and principles of electrical circuits
- KT0104 Calculations on basic AC and DC electrical circuits (resistance, voltage and current and power)

***Internal Assessment Criteria and Weight***

- IAC0101 Describe, calculate and interpret fundamental concepts of electricity (electro motive force, potential difference, resistance) using the correct units of measurement and definitions
- IAC0102 List types of materials used for conductors, insulators and semi-conductors and describe their mechanical and electrical properties and applications
- IAC0103 Describe the factors that influence the resistance of a material
- IAC0104 Define and explain, using the correct units of measurement, Ohm's law of electricity
- IAC0105 Manipulate and use formulas to calculate voltage, current, resistance and power in AC and DC series/parallel circuits

***(Weight 65%)***

##### **3.2.2. KM-03-KT03: Wiring of installations (15%)**



***Topic elements to be covered include:***

- KT0201 Electrical diagrams and symbols
- KT0202 Electrical components and their applications

***Internal Assessment Criteria and Weight***

- IAC0201 List, identify and explain the meaning of all standard International Electrical Code (IEC) wiring symbols given on work drawings
- IAC0202 Identify electrical components and draw schematic diagrams of installations
- IAC0203 State and explain the safety purpose of earthing, fuses, circuit breakers and earth leakage protection unit

***(Weight 15%)***

**3.2.3. KM-03-KT03: Low voltage protection (10%)**

***Topic elements to be covered include:***

- KT0301 Purpose and application of low voltage protection
- KT0302 Types of low voltage protection

***Internal Assessment Criteria and Weight***

- IAC0301 Name and describe the types of low voltage protective devices
- IAC0302 Describe the operation and functions of low voltage protective devices including thermal overload relays (trips), overload relays with manual and automatic reset and various types of fuses and circuit breakers
- IAC0303 State and explain the safety purpose of earthing, fuses, circuit breakers and earth leakage protection unit

***(Weight 10%)***

**3.2.4. KM-03-KT04: Earthing and bonding (10%)**

***Topic elements to be covered include:***

- KT0401 Principles of earthing and bonding
- KT0402 Regulatory and statutory requirements related to earthing and bonding

### ***Internal Assessment Criteria and Weight***

- IAC0401 Define earthing and bonding and explain the purpose thereof
- IAC0402 Explain the regulatory requirements for earthing and bonding
- IAC0403 Explain the regulatory requirements for the earthing of neutral conductors on both the supplier and consumer side of an installation
- IAC0404 Explain the term 'systems earthing'

***(Weight 10%)***

### **3.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this module. Resources must include training manuals approved by the QCTO which covers the full spectrum of the theory in this module, and other relevant documentation.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space to carry out the application skills
- Access to internet, computers, library and/or e-learning facilities

#### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired a suitable qualification in the electrical field.
- Facilitators/lecturers must have experience with assessment and moderation in the field.
- Facilitator/learner ratio 1:20

#### *Legal Requirements:*

- Compliance with relevant legislation
- Accreditation with the appropriate quality assurance body.

### **3.4 Exemptions**

- None

## 4. 900144-000-00-KM-04, Hydrogen fuel cell system technology, NQF Level 5, Credits 6

### 4.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of hydrogen fuel cell system technology, the integration of the hydrogen fuel cell systems and site inspection and load management/ deployment planning.

The learning will enable learners to demonstrate an understanding of:

- KM-04-KT01: Hydrogen fuel cell systems (70%)
- KM-04-KT02: System integration of fuel cell systems (10%)
- KM-04-KT03: Site inspection and load management/ deployment planning (20%)

### 4.2 Guidelines for Topics

#### 4.2.1. KM-04-KT01: Hydrogen fuel cell systems (70%)

##### ***Topic elements to be covered include:***

- KT0101 Types of a hydrogen fuel cell systems [proton-exchange membrane or polymer-electrolyte membrane (PEM) fuel cell; alkaline fuel cells; phosphoric acid fuel cells (PAFC); Direct methanol fuel cells (DMFC)]
- KT0102 Single unit of fuel cell and fuel cell stack
- KT0103 Composition of a hydrogen fuel cell systems
- KT0104 Operation of a hydrogen fuel cell systems
- KT0105 Benefits/advantages of hydrogen fuel cell systems
- KT0106 Process flow of a hydrogen fuel cell system (starting from methanol water blend to finally obtain the end product of usable power)
- KT0107 Hydrogen-based economy

##### ***Internal Assessment Criteria and Weight***

- IAC0101 Explain the purpose of a hydrogen fuel cell
- IAC0102 Describe the types of hydrogen fuel cell systems and identify their similarities and differences
- IAC0103 Explain the different operations of hydrogen fuel cell systems
- IAC0104 Discuss, briefly, the single unit of fuel cell and a fuel cell stack and explain how many single units are combined to give a complete stack
- IAC0105 Describe the composition of a hydrogen fuel cell and state the functions and operations of each component

- IAC0106 Explain the basic electrochemical reactions happening inside a single PEM fuel cell unit
- IAC0107 Describe the advantages/benefits of hydrogen fuel cell systems
- IAC0108 Identify the manufacturers of these systems
- IAC0109 Explain the process flow of a hydrogen fuel cell system
- IAC0110 Explain what is meant by future hydrogen-based economy
- IAC0111 Discuss the advantages of hydrogen and of using hydrogen as a source of energy
- IAC0112 Explain how fuel cells play a vital role in bridging the gap between renewable energy and energy consumption

**(Weight 70%)**

#### **4.2.2. KM-04-KT02: System integration of a hydrogen fuel cell system (10%)**

***Topic elements to be covered include:***

- KT0201 Connecting the sub-systems of the hydrogen fuel cell system
- KT0202 Interaction between the different sub-systems
- KT0203 Hardware inspections and tests after integration
- KT0204 Buffer tank preparation (cleaning them to eliminate oxygen)

***Internal Assessment Criteria and Weight***

- IAC0201 Describe the method/s of physically connecting the sub-systems of the hydrogen fuel cell system
- IAC0202 Explain how the different sub-systems interact with each other and function together as a complete system
- IAC0203 Describe the hardware inspections and tests that are conducted after integration to ensure optimal system operation
- IAC0204 Explain the importance and function of a new buffer tank
- IAC0205 Describe the method of preparing (cleaning) a buffer tank

**(Weight 10%)**

#### **4.2.3. KM-04-KT03: Site inspection and load management/ deployment planning (20%)**

***Topic elements to be covered include:***

- KT0301 Purpose of site inspection
- KT0302 Aspects to be checked [include weather conditions; inclination of the ground; hazardous material (including open flames); sufficient space for delivery of equipment to site; type of transport that will be required, what is needed to deploy the system (principles of deployment location)]

***Internal Assessment Criteria and Weight***

- IAC0301 Explain the purpose of site inspection
- IAC0302 Explain the importance of ensuring that requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system are adhered to
- IAC0303 Identify the various aspects to be checked and provide reasons why these aspects are investigated

***(Weight 20%)***

#### **4.3 Provider Programme Accreditation Criteria**

***Physical Requirements:***

- Providers must have a training facility with all the resources to deliver the learning as set out in this document. Resources must include training manuals approved by the QCTO, which cover the full spectrum of practical activities in this module, and other relevant documentation.
- Providers must also have access to worksites where these activities are being carried out. Worksites must meet industry requirements.
- Providers must also have all the components that comprise a hydrogen fuel cell system and the equipment required to perform the activities described in this module.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space or site to carry out the practical skills
- Access to internet, computers, library and/or e-learning facilities

***Human Resource Requirements:***

- Facilitators/lecturers must have acquired a suitable degree or tertiary qualification in the electrical, electronic, automation or chemical engineering fields.
- Facilitators/lecturers must have experience with the installation of hydrogen fuel cell systems

- Facilitators/lecturers must have experience in assessment and moderation in one of the engineering fields stated above.
- Facilitator/learner ratio 1:20

*Legal Requirements:*

- Compliance to Safety Health Environmental Risk and Quality (SHERQ)
- Compliance to OHS Act and relevant labour legislation laws

#### **4.4 Exemptions**

None

## **5. 900144-000-00-KM-05, Installation, operation and maintenance of hydrogen fuel cell systems, NQF Level 5, Credits 5**

### **5.1 Purpose of the Knowledge Module**

The main focus of the learning in this knowledge module is to build an understanding of installation, operation and maintenance of hydrogen fuel cell systems.

The learning will enable learners to demonstrate an understanding of:

- KM-04-KT01: Installation of hydrogen fuel cell systems (50%)
- KM-04-KT02: Operation of hydrogen fuel cell systems (25%)
- KM-04-KT03: Maintenance of hydrogen fuel cell systems (25%)

### **5.2 Guidelines for Topics**

#### **5.2.1. KM-05-KT01: Installation of hydrogen fuel cell systems (70%)**

***Topic elements to be covered include:***

- KT0101 Preparation for installation
- KT0102 Handling equipment of hydrogen fuel cell systems
- KT0103 Installation procedures for hydrogen fuel cell systems (use of hooks, connecting the fuel cell system to the load, connecting the batteries and inverters to the fuel cell system)
- KT0104 Testing hydrogen fuel cell systems for operationality

***Internal Assessment Criteria and Weight***

- IAC0101 Describe the procedures involved in the preparation for installing
- IAC0102 Describe the safety procedures for handling equipment and systems
- IAC0103 Describe the installation procedures for hydrogen fuel cell systems
- IAC0104 Describe the procedures for testing the operationality of newly-installed hydrogen fuel cell systems

***(Weight 50%)***

#### **5.2.2. KM-05-KT02: Operation of hydrogen fuel cell systems (25%)**

***Topic elements to be covered include:***

- KT0201 Mode settings of the system (low voltage mode and manual mode)
- KT0102 Operations of the mode settings (such as power output, voltage, hydrogen pressure, etc.)

- KT0203 Interface of the system (LCD panel)
- KT0104 Recording operating parameters

***Internal Assessment Criteria and Weight***

- IAC0201 Explain the different mode settings of the hydrogen fuel cell system
- IAC0202 Explain the operations of the different mode settings
- IAC0203 Explain the process of setting the system to its appropriate mode of operation depending on the amount of load present, type of batteries and load profile
- IAC0204 Explain how to change mode settings
- IAC0205 Describe the method of using the interface of the system (LCD panel) to read system information and to set system parameters under each mode
- IAC0206 Explain the importance of recording key operating parameters

***(Weight 25%)***

**5.2.3. KM-05-KT03: Monitoring and maintenance of hydrogen fuel cell systems (25%)**

***Topic elements to be covered include:***

- KT0301 Method of connecting the system and reformer using a PC
- KT0302 Method of monitoring a hydrogen fuel cell systems
- KT0303 Parameters that are monitored (voltage, current and reformer temperature)
- KT0304 Methods to conduct tests (fuel test, methanol-water appearance test; methanol-water specific gravity test; methanol-water miscibility test, methanol-water boil down test)
- KT0305 Components that require changing (fuel filters, air intake filters, faulty components)
- KT0306 Error checking and troubleshooting.

***Internal Assessment Criteria and Weight***

- IAC0301 Describe the method of connecting the system and reformer using a PC
- IAC0302 Explain how to use a laptop to monitor basic parameters such as the voltage, current and reformer temperature through the system website.
- IAC0303 Explain the importance of system maintenance
- IAC0304 Describe the methods of conducting the fuel test, methanol-water appearance test; methanol-water specific gravity test; methanol-water miscibility test, methanol-water boil down test
- IAC0305 Describe the components that require maintenance and the procedures to replace them



- IAC0306 Explain the process for error checking and troubleshooting a hydrogen fuel cell systems

**(Weight 25%)**

### **5.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this document. Resources must include training manuals approved by the QCTO, which cover the full spectrum of practical activities in this module, and other relevant documentation.
- Providers must also have access to worksites where these activities are being carried out. Worksites must meet industry requirements.
- Providers must also have all the components that comprise a hydrogen fuel cell system and the equipment required to perform the activities described in this module.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space or site to carry out the practical skills
- Access to internet, computers, library and/or e-learning facilities

#### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired a suitable degree or tertiary qualification in the electrical, electronic, automation or chemical engineering fields.
- Facilitators/lecturers must have experience with the installation of hydrogen fuel cell systems
- Facilitators/lecturers must have experience in assessment and moderation in one of the engineering fields stated above.
- Facilitator/learner ratio 1:20

#### *Legal Requirements:*

- Compliance to Safety Health Environmental Risk and Quality (SHERQ)
- Compliance to OHS Act and relevant labour legislation laws

### **5.4 Exemptions**

- None

## **SECTION 3B: PRACTICAL SKILLS MODULE SPECIFICATIONS**

### List of Application Module Specifications

- 900144-000-00-PM-01, Perform basic first aid and fire-fighting, NQF Level 3, Credits 4
- 900144-000-00-PM-02, Conduct 240V single phase electrical wiring activities on panels, NQF Level 4, Credits 2
- 900144-000-00-PM-03, Conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 2
- 900144-000-00-PM-04, Install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4
- 900144-000-00-PM-05, Maintain a hydrogen fuel cell system, NQF Level 5, Credits 2

## **1. 900144-000-00-PM-01, Perform basic first aid and fire-fighting, NQF Level 3, Credits 4**

### **1.1 Purpose of the Practical Skills Module**

The focus of the learning in this module is on providing the learner an opportunity to perform basic first aid and fire-fighting. The module focuses on the training that will be acquired at the training provider's premises only. Considering the inherent danger in this occupation the practical skills in this module are important.

The learner will be required to:

- PM-01-PS01: Perform basic first aid
- PM-01-PS02: Perform basic fire fighting
- AM-01-PS03: Manage an emergency scene/situation

### **1.2 Guidelines for Practical Skills**

#### **1.2.1. PM-01-PS01: Perform basic first aid**

##### ***Scope of Practical Skill***

Given basic first aid kits, the learner must be able to:

- PA0101 Identify the nature of injuries
- PA0102 Select appropriate treatment or equipment
- PA0103 Apply relevant treatments
- PA0104 Monitor the condition of injured persons
- PA0105 Report orally and in writing on the nature of injuries, the treatment and the condition of injured persons

##### ***Applied Knowledge***

- AK0101 Types of injuries
- AK0102 Purpose, methods, procedures and techniques of basic first aid
- AK0103 Typical contexts in which injuries occur
- AK0104 Implications of incorrect identification, poor treatment or lack of prioritisation of injuries
- AK0105 First aid reporting procedures and techniques
- AK0106 Applicable safety, health and environmental legislation and regulations
- AK0107 Role of first aid practitioners in relation to medical or para-medical personnel

### ***Internal Assessment Criteria***

- IAC0101 Injuries are identified and prioritised, and appropriate treatment and equipment is selected
- IAC0102 Appropriate treatments are applied according to procedures
- IAC0103 The condition of the injured person is monitored until appropriate medical personnel arrive
- IAC0104 Reporting is concise, accurate and clear
- IAC0105 The implications of incorrect identification, poor treatment or lack of prioritisation of injuries are described and explained

### **1.2.2. PM-01-PS02: Perform basic fire fighting**

#### ***Scope of Practical Skill***

Given a range of basic fire-fighting equipment and personal protective equipment, the learner must be able to:

- PA0201 Identify various types of fires and assess their context
- PA0202 Select appropriate fire-fighting and safety equipment for each type of fire
- PA0203 Contain or extinguish various types of fires using appropriate fire-fighting equipment
- PA0204 Make safe any apparatus and material in use and shut off any electricity and other potentially dangerous services.
- PA0205 Evacuate the area using appropriate evacuation procedures

#### ***Applied Knowledge***

- AK0201 Types, purpose and function of fire-fighting equipment
- AK0202 Symbols on fire-fighting equipment
- AK0203 Characteristics of various types of fires
- AK0204 Fight fighting and retreat methods and procedures
- AK0205 Relevant safety health and environmental regulations
- AK0206 Fire chemistry, combustion triangle, fire transmission, spread and elimination

### ***Internal Assessment Criteria***

- IAC0201 Various types of fires are identified and the context assessed correctly
- IAC0202 The correct equipment is selected and used to extinguish or contain each type of fire
- IAC0203 The correct procedure is followed to retreat from fires

### **1.2.3. PM-01-PS03: Manage an emergency scene/situation**

#### ***Scope of Practical Skill***

Given a simulated emergency situation, a range of scenarios of possible illnesses, 'shocked' and 'injured' persons, appropriate protocols, standard operating procedures and statutory requirements, the learner should be able to:

PA0301 Assess and manage an emergency scene

PA0302 Implement triage (airways; breathing; circulation; internal and external injuries and/or medical conditions)

PA0303 Activate emergency services

PA0304 Use relevant risk based primary emergency care kit

PA0305 Use appropriate personal protective equipment

PA0306 Conduct secondary assessment according to relevant protocols

PA0307 Demonstrate Cardio-Pulmonary Resuscitation (CPR) with and without the use of barrier ventilation devices, according to accepted protocols

PA0308 Control bleeding according to protocols and using direct pressure/bandages or suitable materials.

PA0309 Treat bites using appropriate measures

PA0310 Immobilise fractures, dislocations and sprains in the position of most comfort to the affected person

PA0311 Manage shock (general shock, anaphylaxis)

PA0312 Manage wounds according to accepted protocols.

PA0313 Treat fractures according to accepted protocols

#### ***Applied Knowledge***

AK0301 PPE (includes surgical gloves, mouthpieces/respiration devices)

AK0302 Universal precautionary procedures for the safe management of body fluid spills

AK0303 Golden hour concept

AK0304 Triage procedures

AK0305 CPR procedures

AK0306 Bleeding control procedures

AK0307 Emergency rules (emergency services)

AK0308 Wounds (includes abrasions, lacerations, punctures, embedded objects, hand and eye wounds, rodent/animal/insect/reptile bites and stings; fractures, dislocations, sprains)

AK0309 Safety risks and specific workplace hazards

### **Internal Assessment Criteria**

IAC0301 Primary assessment is implemented

IAC0302 Triage is implemented according to assessment

IAC0303 CPR is performed according to first aid protocols

IAC0304 Emergency rules are implemented and services are activated according to protocols

IAC0305 Primary emergency care kit is used correctly

IAC0306 Appropriate PPE is used correctly

IAC0307 Illnesses, wounds and other medical conditions are monitored and managed according to the scope of the first aid practitioner

IAC0308 Shock is managed according to the scope of the first aid practitioner

IAC0308 Records are prepared according to protocols

### **1.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this document. Resources must include training manuals approved by the QCTO which cover the full spectrum of practical activities in this module, and other relevant documentation.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space to carry out the practical skills
- Access to internet, computers, library and/or e-learning facilities

#### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired suitable training in first aid and fire-fighting
- Facilitators/lecturers must have experience with assessment and moderation in these aspects.
- Facilitator/learner ratio 1:4 (maximum)

*Legal Requirements:*

- Compliance to Safety Health Environmental Risk and Quality (SHERQ)
- Compliance to OHS Act and relevant labour legislation laws

#### **1.4 Exemptions**

- None

## **2. 900144-000-00-PM-02, Conduct 240V single phase electrical wiring activities on panels, NQF Level 4, Credits 2**

### **2.1 Purpose of the Practical Skills Module**

The focus of the learning in this module is on providing the learner an opportunity to conduct 240V single phase electrical wiring activities on panels. The module focuses on the training that will be acquired both at the training provider's facility and at the worksite. The activity carried out at the worksite will serve to reinforce the theoretical and practical learning that took place at the service provider's training facility.

The learner will be required to:

- PM-02-PS01: Conduct 240V single phase electrical wiring activities on panels

### **2.2 Guidelines for Practical Skills**

#### **2.2.1. PM-02-PS01: Conduct 240V single phase electrical wiring activities on panels**

##### ***Scope of Practical Skill***

Given work instructions, drawings, panels, conductors/wires, tools, the learner must be able to:

- PA0101 Read and interpret electrical drawing
- PA0102 Plan the wiring according to electrical diagram and what is required
- PA0103 Identify and mitigate risks associated with the wiring activity
- PA0104 Install the components into the distribution board (DB)
- PA0105 Wire the components
- PA0106 Test and check the circuit without power supply (check continuity)
- PA0107 Connect installation to power supply and test using appropriate equipment
- PA0108 Perform all work safely

##### ***Applied Knowledge***

- AK0101 Interpretation of electrical drawing
- AK0102 Electrical components
- AK0103 Wiring procedures
- AK0104 Testing procedures
- AK0105 Testing equipment
- AK0106 Risk mitigation



- AK0107 Safety aspects

### ***Internal Assessment Criteria***

- IAC0101 Risks are identified and mitigated
- IAC0102 Electrical diagram are correctly interpreted, using schematics, wiring and layout representations
- IAC0103 Electrical components are installed on DB board
- IAC0104 The wiring of the panel is completed according to procedures
- IAC0105 The installation and wiring are tested, using appropriate equipment (without power supply) and problems are resolved
- IAC0104 The installation and wiring are tested using appropriate equipment (with power supply)
- IAC0104 Tools and equipment are used safely

## **2.3 Provider Programme Accreditation Criteria**

### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this module. Resources must include training manuals approved by the QCTO which covers the full spectrum of the theory in this module, and other relevant documentation.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space to carry out the application skills
- Access to internet, computers, library and/or e-learning facilities

### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired a suitable qualification in the electrical field.
- Facilitators/lecturers must have experience with assessment and moderation in the field.
- Facilitator/learner ratio 1:4 (maximum)

### *Legal Requirements:*

- Compliance with relevant legislation
- Accreditation with the appropriate quality assurance body.

## 2.4 Exemptions

- None

### **3. 900144-000-00-PM-03, Conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 2**

#### **3.1 Purpose of the Practical Skills Module**

The focus of the learning in this module is on providing the learner an opportunity to conduct site inspection and plan the deployment of a hydrogen fuel cell system. The learners will acquire the skill to perform these critical tasks which are a prelude to successful installation of a hydrogen fuel cell system. Learners will have the opportunity to perform these skills at the service provider's facility and such training could be accomplished through simulation if need be.

The learner will be required to:

- PM-03-PS01: Conduct site inspection for the installation of a hydrogen fuel cell system
- PM-03-PS02: Plan the deployment of a hydrogen fuel cell system

#### **3.2 Guidelines for Practical Skills**

##### **3.2.1. PM-03-PS01: Conduct site inspection for the installation of a hydrogen fuel cell system**

###### ***Scope of Practical Skill***

Given different sites with different conditions (ground inclination, hazards, etc.), or simulated situations, requirements, standards, and regulations relevant to hydrogen fuel cells, the learner must be able to:

- PA0101 Prepare for site inspection
- PA0102 Check ground conditions like inclination etc.
- PA0103 Check for any hazardous material or conditions on site
- PA0104 Analyse weather conditions (too windy, too hot etc.)
- PA0104 Check that requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system will be adhered to
- PA0105 Check if there is sufficient space for delivery of equipment to site
- PA0106 Identify the appropriate type of transport that will be required for the delivery

###### ***Applied Knowledge***

- AK0101 Aspects that influence the location and installation of hydrogen fuel cell system
- AK0102 Requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system
- AK0103 Types of transport for delivery of equipment

- AK0104 Types of hydrogen fuel cell system equipment

### ***Internal Assessment Criteria***

- IAC0101 Aspects that influence the location of a hydrogen fuel cell system are checked or inspected to facilitate planning for safe and optimal installation
- IAC0102 Use appropriate techniques to make a range of determinations regarding
- IAC0102 Requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system are considered and applied to the site
- IAC0103 The type of transport to deliver the hydrogen fuel cell system equipment is identified

### **3.2.2. PM-03-PS02: Plan the deployment of a hydrogen fuel cell system**

#### ***Scope of Application Skill***

Given different sites with different conditions, or simulated situations, the learner must be able to:

- PA0201 Plan how and where the hydrogen fuel cell system will be located
- PA0202 Determine the type of hydrogen fuel cell system that will be most suitable to be installed
- PA0203 Plan how the installation will be carried out
- PA0204 Identify and mitigate any potential risks that will impact on the installation
- PA0205 Make recommendations to enhance the safe and efficient installation of a hydrogen fuel cell system

#### ***Applied Knowledge***

- AK0201 Plan for installation of a hydrogen fuel cell system
- AK0202 Types of hydrogen fuel cell systems
- AK0203 Plan installation procedure
- AK0204 Risks to installation of hydrogen fuel cell systems
- AK0205 Mitigation measures for the risks
- AK0206 Recommendations for installation

### ***Internal Assessment Criteria***

- IAC0201 Planning for the installation of a hydrogen fuel cell system is completed according to standard procedures and site conditions
- IAC0202 Type of hydrogen fuel cell systems to be installed is identified
- IAC0203 Risks to the installation of identified hydrogen fuel cell system are identified and mitigated according to standard procedures
- IAC0204 Recommendations that will impact on the installation are made

### **3.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this document. Resources must include training manuals approved by the QCTO, which cover the full spectrum of practical activities in this module, and other relevant documentation.
- Providers must also have access to worksites where these activities are being carried out. Worksites must meet industry requirements.
- Providers must also have all the components that comprise a hydrogen fuel cell system and the equipment required to perform the activities described in this module.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space or site to carry out the practical skills
- Access to internet, computers, library and/or e-learning facilities

#### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired a suitable degree or tertiary qualification in the electrical, electronic, automation or chemical engineering fields.
- Facilitators/lecturers must have experience with the installation of hydrogen fuel cell systems
- Facilitators/lecturers must have experience in assessment and moderation in one of the engineering fields stated above.
- Facilitator/learner ratio 1:4 (maximum)

#### *Legal Requirements:*

- Compliance to Safety Health Environmental Risk and Quality (SHERQ)
- Compliance to OHS Act and relevant labour legislation laws

### 3.4 Exemptions

- None

## **4. 900144-000-00-PM-04, Install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4**

### **4.1 Purpose of the Practical Skills Module**

The focus of the learning in this module is on providing the learner an opportunity to install, operate and monitor hydrogen fuel cell systems. Special consideration must be given to safety aspects when working with hydrogen fuel cell systems. Learners will have the opportunity to perform these skills at the service provider's facility and such training could be accomplished through simulation if need be.

The learner will be required to:

- PM-04-PS01: Install a hydrogen fuel cell system
- PM-04-PS02: Operate and monitor a hydrogen fuel cell system

### **4.2 Guidelines for Practical Skills**

#### **4.2.1. PM-04-PS01: Install a hydrogen fuel cell system**

##### ***Scope of Practical Skill***

Given different hydrogen fuel cell systems deployment plan, requirements, standards, and regulations relevant to hydrogen fuel cells, safety requirements, the learner must be able to:

- PA0101 Prepare for hydrogen fuel cell system installation
- PA0102 Ensure that all components are available on site
- PA0103 Perform any hardware inspections and tests to ensure that all components are fully-operational prior to installation
- PA0104 Perform all electrical and physical connections using appropriate equipment
- PA0105 Test the installation for operability using the customer's load
- PA0106 Attend to any problems or deviations arising from the test
- PA0106 Conduct all activities safely and according to industry protocols

##### ***Applied Knowledge***

- AK0101 Types and components of hydrogen fuel cell systems
- AK0102 Installation procedures for these hydrogen fuel cell systems
- AK0103 Equipment to install hydrogen fuel cell system
- AK0104 Requirements, standards, and regulations pertaining to the installation of hydrogen fuel cell systems
- AK0105 Testing procedures for newly-installed hydrogen fuel cell systems

- AK0106 Safety procedures for hydrogen fuel cell system installations

### ***Internal Assessment Criteria***

- IAC0101 All preparation activities and checks to install hydrogen fuel cell system are performed according to industry standards
- IAC0102 Hydrogen fuel cell system is installed using appropriate equipment and industry procedures
- IAC0102 Requirements, standards, and regulations pertaining to the installation of a hydrogen fuel cell system are considered and applied
- IAC0103 Safety procedures and standards are adhered to

## **4.2.2. PM-04-PS02: Operate and monitor a hydrogen fuel cell system**

### ***Scope of Practical Skill***

Given newly-installed hydrogen fuel cell system, the learner must be able to:

- PA0201 Operate the mode settings of a hydrogen fuel cell system
- PA0202 Use the interface of the system (LCD panel) to read system information
- PA0203 Set system parameters under each mode and record key operating parameters
- PA0204 Use the system with a load

### ***Applied Knowledge***

- AK0201 Mode settings of the system
- AK0202 Interface of the system (LCD panel)
- AK0203 Operating parameters
- AK0204 System load

### ***Internal Assessment Criteria***

- IAC0201 The mode settings of a hydrogen fuel cell system are operated and changed, if required, according to system standards and specifications
- IAC0202 The interface of the system (LCD panel) is used according to system standards and specifications
- IAC0203 The operating parameters of each mode are set, recorded and monitored according to system standards and specifications and recorded as per company/system requirements



- IAC0204 The system is used with a load according to system standards and specifications

### **4.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this document. Resources must include training manuals approved by the QCTO, which cover the full spectrum of practical activities in this module, and other relevant documentation.
- Providers must also have access to worksites where these activities are being carried out. Worksites must meet industry requirements.
- Providers must also have all the components that comprise a hydrogen fuel cell system and the equipment required to perform the activities described in this module.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space or site to carry out the practical skills
- Access to internet, computers, library and/or e-learning facilities

#### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired a suitable degree or tertiary qualification in the electrical, electronic, automation or chemical engineering fields.
- Facilitators/lecturers must have experience with the installation of hydrogen fuel cell systems
- Facilitators/lecturers must have experience in assessment and moderation in one of the engineering fields stated above.
- Facilitator/learner ratio 1:4 (maximum)

#### *Legal Requirements:*

- Compliance to Safety Health Environmental Risk and Quality (SHERQ)
- Compliance to OHS Act and relevant labour legislation laws

### **4.4 Exemptions**

- None

## **5. 900144-000-00-PM-05, Maintain a hydrogen fuel cell system, NQF Level 5, Credits 2**

### **5.1 Purpose of the Practical Skills Module**

The focus of the learning in this module is on providing the learner an opportunity to maintain hydrogen fuel cell systems. Maintenance involves troubleshooting and error checking to ensure continuous and efficient operation of the system. Special consideration must be given to safety aspects when working with hydrogen fuel cell systems. Learners will have the opportunity to perform these skills at the service provider's facility and such training could be accomplished through simulation if need be. Learners will be taken to a site/s where an installation had been completed. The associated theory, processes, practical and technical aspects pertaining to maintaining a hydrogen fuel cell system will be discussed and demonstrated to deepen learner's understanding.

The learner will be required to:

- PM-05-PS01: Perform troubleshooting and error checking
- PM-05-PS02: Conduct tests on a hydrogen fuel cell system
- PM-05-PS03: Change hydrogen fuel cell components
- PM-05-PS04: Refuel hydrogen fuel cell

### **5.2 Guidelines for Practical Skills**

#### **5.2.1. PM-05-PS01: Perform troubleshooting and error checking**

##### ***Scope of Practical Skill***

Given a hydrogen fuel cell system that has malfunctions or errors or deviations, a PC connected to the system, manufacturer's specifications, the learner must be able to:

- PA0101 Connect the hydrogen fuel cell system to a laptop/PC
- PA0102 Monitor the parameters of a hydrogen fuel cell system
- PA0103 Analyse the data
- PA0104 Use appropriate methods and manufacturer's specifications for checking and investigating errors
- PA0105 Conduct troubleshooting according to manufacturer's specifications
- PA0106 Analyse deviations and implement corrective measures using manufacturer's specifications
- PA0107 Perform all tests according to safety requirements

##### ***Applied Knowledge***

- AK0101 System-PC connection
- AK0102 Operational parameters and ways of monitoring them

- AK0103 Techniques to analyse data
- AK0104 Methods for checking and investigating errors
- AK0105 Troubleshooting techniques
- AK0106 Types of deviations and their corrective measures
- AK0107 Manufacturer's specifications
- AK0108 Safety requirements

### ***Internal Assessment Criteria***

- IAC0101 Operational parameters of a hydrogen fuel cell system are monitored and data obtained is analysed using manufacturer's specifications
- IAC0102 Methods for checking and investigating errors are used
- IAC0103 Troubleshooting techniques specific to the hydrogen fuel cell system are implemented
- IAC0104 Deviations are analysed and corrective measures are implemented using manufacturer's specifications
- IAC0105 Safety requirements are adhered to during error checking and troubleshooting

## **5.2.2. PM-05-PS02: Conduct tests on a hydrogen fuel cell system**

### ***Scope of Practical Skill***

Given different hydrogen fuel cell systems, testing equipment and materials to conduct a range of tests, safety standards, the learner must be able to:

- PA0201 Prepare to conduct a range of tests
- PA0202 Ensure that all testing equipment is operational
- PA0203 Conduct the fuel test
- PA0204 Conduct the methanol-water appearance test
- PA0205 Conduct the methanol-water specific gravity test
- PA0206 Conduct the methanol-water miscibility test
- PA0207 Conduct the methanol-water boil down test
- PA0208 Perform all tests according to safety requirements

### ***Applied Knowledge***

- AK0201 Methods of conducting the fuel test methanol-water appearance test; methanol-water specific gravity test; methanol-water miscibility test and the methanol-water boil down test
- AK0202 Testing equipment to carry out the tests
- AK0203 Safety requirements

### ***Internal Assessment Criteria***

- IAC0201 All test preparation activities are performed according to industry standards
- IAC0202 Testing equipment is used as per industry procedures
- IAC0203 Tests are conducted as per industry procedures and safety requirements

## **5.2.3. PM-05-PS03: Change hydrogen fuel cell components**

### ***Scope of Practical Skill***

Given different hydrogen fuel cell systems, working and faulty components, the learner must be able to:

- PA0301 Prepare to change hydrogen fuel cell components
- PA0302 Ensure that all equipment required for these activities is available and operational
- PA0303 Change fuel filters according to system specifications
- PA0304 Change air intake filters according to system specifications
- PA0305 Change faulty components according to system specifications
- PA0306 Perform all tasks safely

### ***Applied Knowledge***

- AK0301 Hydrogen fuel cell systems
- AK0302 Faulty hydrogen fuel cell system components
- AK0303 Equipment used to change components
- AK0304 Methods of changing hydrogen fuel cell system components
- AK0305 Safety requirements

### ***Internal Assessment Criteria***

- IAC0301 All preparation activities to change hydrogen fuel cell system components are performed according to industry standards
- IAC0302 Equipment is used as per industry procedures
- IAC0303 Components are replaced according to replacement procedures for the specific hydrogen fuel cell systems
- IAC0304 All safety requirements are adhered to

### **5.2.4. PM-05-PS04: Refuel hydrogen fuel cell**

#### ***Scope of Practical Skill***

Given different hydrogen fuel cell systems, fuel for the hydrogen fuel cell, equipment, the learner must be able to:

- PA0401 Prepare to refuel hydrogen fuel cell
- PA0402 Ensure that all equipment required for this activity is available and operational
- PA0403 Refuel hydrogen fuel cell
- PA0404 Perform all tasks safely

#### ***Applied Knowledge***

- AK0401 Hydrogen fuel cell systems
- AK0402 Fuel for hydrogen fuel cell
- AK0403 Equipment used to refuel hydrogen fuel cell
- AK0404 Methods of replacing hydrogen fuel
- AK0405 Safety requirements

### ***Internal Assessment Criteria***

- IAC0401 All preparation activities to change hydrogen fuel cell system components are performed according to industry standards
- IAC0402 Equipment is used as per industry procedures
- IAC0403 Hydrogen fuel cell is fuelled according to procedure
- IAC0404 All safety requirements are adhered to

### 5.3 Provider Programme Accreditation Criteria

#### *Physical Requirements:*

- Providers must have a training facility with all the resources to deliver the learning as set out in this document. Resources must include training manuals approved by the QCTO, which cover the full spectrum of practical activities in this module, and other relevant documentation.
- Providers must also have access to worksites where these activities are being carried out. Worksites must meet industry requirements.
- Providers must also have a hydrogen fuel cell system and the equipment required to perform the activities described in this module.
- Adequate area to accommodate the number of learners, as prescribed by the OHS Act.
- Adequate area or space or site to carry out the practical skills
- Access to internet, computers, library and/or e-learning facilities

#### *Human Resource Requirements:*

- Facilitators/lecturers must have acquired a suitable degree or tertiary qualification in the electrical, electronic, automation or chemical engineering fields.
- Facilitators/lecturers must have experience with the installation of hydrogen fuel cell systems
- Facilitators/lecturers must have experience in assessment and moderation in one of the engineering fields stated above.
- Facilitator/learner ratio 1: 4 (maximum)

#### *Legal Requirements:*

- Compliance to Safety Health Environmental Risk and Quality (SHERQ)
- Compliance to OHS Act and relevant labour legislation laws

### 5.4 Exemptions

None

### **SECTION 3C: WORK EXPERIENCE MODULE SPECIFICATIONS**

#### List of Work Experience Module Specifications

- 900144-000-00-WM-01, Processes to conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 1
- 900144-000-00-WM-02, Processes to install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4
- 900144-000-00-WM-03, Processes to maintain a hydrogen fuel cell systems, NQF Level 5, Credits 2

## **1. 900144-000-00-WM-01, Processes to conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 1**

### **1.1 Purpose of the Work Experience Modules**

The focus of the work experience is on providing the learner an opportunity to gain exposure to conducting site inspection and planning the deployment of a hydrogen fuel cell system. The learner will be required to perform the related activities both under supervision and independently as many times as possible over the duration of the module. The work experience activities will be conducted at the service provider's facility through simulation. However, learners will be taken to a site where an installation had been completed. The associated theory, processes, practical and technical aspects pertaining to conducting site inspection and planning the deployment of a hydrogen fuel cell system will be discussed and demonstrated to deepen learners' understanding.

The learner will be required to:

- WM-01-WE01: Conduct site inspection and plan the deployment of a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner
- WM-01-WE02: Conduct site inspection and plan the deployment of a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner

### **1.2 Guidelines for Work Experiences**

#### **1.2.1. WM-01-WE01: Conduct site inspection and plan the deployment of a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner**

##### ***Scope of Work Experience***

The person will be expected to engage in the following work activities:

- WA0101 Conduct all the checks that are part of site inspection (ground conditions, inclination, hazardous material or conditions on site, sufficient space for delivery of equipment to site)
- WA0102 Analyse weather conditions (too windy, too hot etc.)
- WA0103 Apply the requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system
- WA0104 Identify the appropriate type of transport that will be required for delivery of the system
- WA0105 Plan how and where the hydrogen fuel cell system will be located and determine the type of hydrogen fuel cell system that will be most suitable for installation
- WA0106 Identify and mitigate any potential risks that will impact on the installation and make recommendations to enhance safe and efficient installation



### ***Supporting Evidence***

- SE0101 Signed-off logbook

### **1.2.2. WM-01-WE02: Conduct site inspection and plan the deployment of a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner**

#### ***Scope of Work Experience***

The person will be expected to engage in the following work activities:

- WA0201 Conduct all the checks that are part of site inspection (ground conditions, inclination, hazardous material or conditions on site, sufficient space for delivery of equipment to site)
- WA0202 Analyse weather conditions (too windy, too hot etc.)
- WA0203 Apply the requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system
- WA0204 Identify the appropriate type of transport that will be required for delivery of the system
- WA0205 Plan how and where the hydrogen fuel cell system will be located and determine the type of hydrogen fuel cell system that will be most suitable for installation
- WA0206 Identify and mitigate any potential risks that will impact on the installation and make recommendations to enhance safe and efficient installation

#### ***Supporting Evidence***

- SE0201 Signed-off logbook

### **1.3 Contextualised Workplace Knowledge**

- 1 Company specific standard operating procedures
- 2 Safety, health, environmental and quality requirements and procedures
- 3 Company specific quality management systems
- 4 Manufacturer specifications

### **1.4 Criteria for Workplace Approval**

*Physical Requirements:*

- Appropriate area for conducting the work experience activities
- All the equipment required for the activities

*Human Resource Requirements:*

- Person with either appropriate qualifications in hydrogen fuel cell systems or someone with at least three years' experience in the installation, operating, monitoring and maintaining of hydrogen fuel cell systems
- Mentor/learner ratio 1:4

*Legal Requirements:*

- Compliant with Safety, Health, Environmental, Risk and Quality (SHERQ) requirements
- Compliant with Compensation for Occupational Injuries and Diseases Act (COIDA) requirements

**1.5 Additional Assignments to be Assessed Externally**

- None

## **2. 900144-000-00-WM-02, Processes to install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4**

### **2.1 Purpose of the Work Experience Modules**

The focus of the work experience is on providing the learner an opportunity to gain exposure to installing, operating and monitoring of a hydrogen fuel cell system. The learner will be required to perform the related activities both under supervision and independently as many times as possible over the duration of the module.

The work experience activities will be conducted at the service provider's facility through simulation. However, learners will be taken to a site where an installation had been completed. The associated theory, processes, practical and technical aspects pertaining to installation, operation and monitoring of a hydrogen fuel cell system will be discussed and demonstrated to deepen learners' understanding.

The learner will be required to:

- WM-02-WE01: Install, operate and monitor a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner
- WM-02-WE02: Install, operate and monitor a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner

### **2.2 Guidelines for Work Experiences**

#### **2.2.1. WM-02-WE01: Install, operate and monitor a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner**

##### ***Scope of Work Experience***

The person will be expected to engage in the following work activities:

- WA0101 Ensure that all components are available on site and perform hardware inspections and tests to ensure that all components are fully-operational prior to installation
- WA0102 Install the hydrogen fuel cell system as per procedure
- WA0103 Test the installation for operability using the customer's load and address any problems or deviations arising from the test
- WA0104 Operate the mode settings of a hydrogen fuel cell system
- WA0105 Use the interface of the system (LCD panel) to read system information
- WA0106 Set system parameters under each mode and record key operating parameters
- WA0107 Use the system with a load
- WA0108 Conduct all activities safely and according to industry protocols

### ***Supporting Evidence***

- SE0101 Signed-off logbook

### **2.2.2. WM-02-WE02: Install, operate and monitor a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner**

#### ***Scope of Work Experience***

The person will be expected to engage in the following work activities:

- WA0201 Ensure that all components are available on site and perform hardware inspections and tests to ensure that all components are fully-operational prior to installation
- WA0202 Install the hydrogen fuel cell system as per procedure
- WA0203 Test the installation for operability using the customer's load and address any problems or deviations arising from the test
- WA0204 Operate the mode settings of a hydrogen fuel cell system
- WA0205 Use the interface of the system (LCD panel) to read system information
- WA0206 Set system parameters under each mode and record key operating parameters
- WA0207 Use the system with a load
- WA0206 Conduct all activities safely and according to industry protocols

### ***Supporting Evidence***

- SE0201 Signed-off logbook

### **2.3 Contextualised Workplace Knowledge**

- 1 Company specific standard operating procedures
- 2 Safety, health, environmental and quality requirements and procedures
- 3 Company specific quality management systems
- 4 Manufacturer specifications

### **2.4 Criteria for Workplace Approval**

#### ***Physical Requirements:***

- Appropriate area for conducting the work experience activities
- All the tools and equipment required for the activities

- A the components of a hydrogen fuel cell system

*Human Resource Requirements:*

- Person with either appropriate qualifications in hydrogen fuel cell systems or someone with at least three years' experience in the installation, operating, monitoring and maintaining of hydrogen fuel cell systems
- Mentor/learner ratio 1:4

*Legal Requirements:*

- Compliant with Safety, Health, Environmental, Risk and Quality (SHERQ) requirements
- Compliant with Compensation for Occupational Injuries and Diseases Act (COIDA) requirements

**2.5 Additional Assignments to be Assessed Externally**

- None

### **3. 900144-000-00-WM-03, Processes to maintain a hydrogen fuel cell systems, NQF Level 5, Credits 2**

#### **3.1 Purpose of the Work Experience Modules**

The focus of the work experience is on providing the learner an opportunity to gain exposure to maintaining a hydrogen fuel cell system. The learner will be required to perform the related activities both under supervision and independently as many times as possible over the duration of the module.

The work experience activities will be conducted at the service provider's facility through simulation. However, learners will be taken to a site where an installation had been completed. The associated theory, processes, practical and technical aspects pertaining to maintaining a hydrogen fuel cell system will be discussed and demonstrated to deepen learners' understanding.

The learner will be required to:

- WM-03-WE01: Maintain a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner
- WM-03-WE02: Maintain a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner

#### **3.2 Guidelines for Work Experiences**

##### **3.2.1. WM-03-WE01: Maintain a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner**

###### ***Scope of Work Experience***

The person will be expected to engage in the following work activities:

- WA0101 Monitor the parameters of a hydrogen fuel cell system and analyse the data
- WA0102 Use appropriate methods and manufacturer's specifications for checking and investigating errors, and conduct troubleshooting
- WA0103 Analyse deviations and implement corrective measures using manufacturer's specifications
- WA0104 Conduct a range of tests (methanol-water appearance test, methanol-water specific gravity test, methanol-water miscibility test, and methanol-water boil down test)
- WA0105 Change hydrogen fuel cell components (fuel filters, air intake filters, faulty components)
- WA0106 Refuel hydrogen fuel cell
- WA0107 Perform all tasks safely

###### ***Supporting Evidence***

- SE0101 Signed-off logbook

### **3.2.2. WM-03-WE02: Maintain a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner**

#### ***Scope of Work Experience***

The person will be expected to engage in the following work activities:

- WA0201 Monitor the parameters of a hydrogen fuel cell system and analyse the data
- WA0202 Use appropriate methods and manufacturer's specifications for checking and investigating errors, and conduct troubleshooting
- WA0203 Analyse deviations and implement corrective measures using manufacturer's specifications
- WA0204 Conduct a range of tests (methanol-water appearance test, methanol-water specific gravity test, methanol-water miscibility test, and methanol-water boil down test)
- WA0205 Change hydrogen fuel cell components (fuel filters, air intake filters, faulty components)
- WA0206 Refuel hydrogen fuel cell
- WA0207 Perform all tasks safely

#### ***Supporting Evidence***

- SE0201 Signed-off logbook

### **3.3 Contextualised Workplace Knowledge**

- 1 Company specific standard operating procedures
- 2 Safety, health, environmental and quality requirements and procedures
- 3 Company specific quality management systems
- 4 Manufacturer specifications

### **3.4 Criteria for Workplace Approval**

*Physical Requirements:*

- Appropriate area for conducting the work experience activities
- All the tools and equipment required for the activities
- A fully operational hydrogen fuel cell system

*Human Resource Requirements:*

- Person with either appropriate qualifications in hydrogen fuel cell systems or someone with at least three years' experience in the installation, operating, monitoring and maintaining of hydrogen fuel cell systems
- Mentor/learner ratio 1:4

*Legal Requirements:*

- Compliant with Safety, Health, Environmental, Risk and Quality (SHERQ) requirements
- Compliant with Compensation for Occupational Injuries and Diseases Act (COIDA) requirements

**3.5 Additional Assignments to be Assessed Externally**

- None



**SECTION 4: STATEMENT OF WORK EXPERIENCE**

<b>Curriculum Number:</b>	900144-000-00-00
<b>Curriculum Title:</b>	Hydrogen Fuel Cell Systems Practitioner

<b>Learner Details</b>	
<b>Name:</b>	
<b>ID Number:</b>	

<b>Employer Details</b>	
<b>Company Name:</b>	
<b>Address:</b>	
<b>Supervisor Name:</b>	
<b>Work Telephone:</b>	
<b>E-Mail:</b>	

**1. 900144-000-00-WM-01, Processes to conduct site inspection and plan the deployment of a hydrogen fuel cell system, NQF Level 5, Credits 1**

<b>WM-01-WE01</b>	<b>Conduct site inspection and plan the deployment of a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner</b>		
	<b>Scope Work Experience</b>	Date	Signature
WA0101	Conduct all the checks that are part of site inspection (ground conditions, inclination, hazardous material or conditions on site, sufficient space for delivery of equipment to site)		
WA0102	Analyse weather conditions (too windy, too hot etc.)		
WA0103	Apply the requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system		
WA0104	Identify the appropriate type of transport that will be required for delivery of the system		
WA0105	Plan how and where the hydrogen fuel cell system will be located and determine the type of hydrogen fuel cell system that will be most suitable for installation		
WA0106	Identify and mitigate any potential risks that will impact on the installation and make recommendations to enhance safe and efficient installation		
	<b>Supporting Evidence</b>	Date	Signature
SE0101	SE0101 Signed-off logbook		

<b>WM-01-WE02</b>	<b>Conduct site inspection and plan the deployment of a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner</b>		
	<b>Scope Work Experience</b>	Date	Signature
WA0201	Conduct all the checks that are part of site inspection (ground conditions, inclination, hazardous material or conditions on site, sufficient space for delivery of equipment to site)		
WA0202	Analyse weather conditions (too windy, too hot etc.)		
WA0203	Apply the requirements, standards, and regulations pertaining to the location and installation of a hydrogen fuel cell system		
WA0204	Identify the appropriate type of transport that will be required for delivery of the system		
WA0205	Plan how and where the hydrogen fuel cell system will be located and determine the type of hydrogen fuel cell system that will be most suitable for installation		
WA0206	Identify and mitigate any potential risks that will impact on the installation and make recommendations to enhance safe and efficient installation		
	<b>Supporting Evidence</b>	Date	Signature
SE0201	Signed-off logbook		

	<b>Contextualised Workplace Knowledge</b>	Date	Signature
1	Company specific standard operating procedures		

2	Safety, health, environmental and quality requirements and procedures		
3	Company specific quality management systems		
4	Manufacturer specifications		

	<b>Additional Assignments to be Assessed Externally</b>	Date	Signature
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**2. 900144-000-00-WM-02, Processes to install, operate and monitor a hydrogen fuel cell system, NQF Level 5, Credits 4**

<b>WM-02-WE01</b>	<b>Install, operate and monitor a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner</b>		
	<b>Scope Work Experience</b>	Date	Signature
WA0101	Ensure that all components are available on site and perform hardware inspections and tests to ensure that all components are fully-operational prior to installation		
WA0102	Install the hydrogen fuel cell system as per procedure		
WA0103	Test the installation for operationality using the customer's load and address any problems or deviations arising from the test		
WA0104	Operate the mode settings of a hydrogen fuel cell system		
WA0105	Use the interface of the system (LCD panel) to read system information		
WA0106	Set system parameters under each mode and record key operating parameters		
WA0107	Use the system with a load		
WA0108	Conduct all activities safely and according to industry protocols		
	<b>Supporting Evidence</b>	Date	Signature
SE0101	Signed-off logbook		

<b>WM-02-WE02</b>	<b>Install, operate and monitor a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner</b>		
	<b>Scope Work Experience</b>	Date	Signature
WA0201	Ensure that all components are available on site and perform hardware inspections and tests to ensure that all components are fully-operational prior to installation		
WA0202	Install the hydrogen fuel cell system as per procedure		
WA0203	Test the installation for operability using the customer's load and address any problems or deviations arising from the test		
WA0204	Operate the mode settings of a hydrogen fuel cell system		
WA0205	Use the interface of the system (LCD panel) to read system information		
WA0206	Set system parameters under each mode and record key operating parameters		
WA0207	Use the system with a load		
WA0208	Conduct all activities safely and according to industry protocols		
	<b>Supporting Evidence</b>	Date	Signature
SE0201	Signed-off logbook		

	<b>Contextualised Workplace Knowledge</b>	Date	Signature
1	Company specific standard operating procedures		

2	Safety, health, environmental and quality requirements and procedures		
3	Company specific quality management systems		
4	Manufacturer specifications		

	<b>Additional Assignments to be Assessed Externally</b>	Date	Signature
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**3. 900144-000-00-WM-03, Processes to maintain a hydrogen fuel cell system, NQF Level 5, Credits 2**

<b>WM-03-WE01</b>	<b>Maintain a hydrogen fuel cell system under the supervision of a qualified or experienced hydrogen fuel cell system practitioner</b>		
	<b>Scope Work Experience</b>	Date	Signature
WA0101	Monitor the parameters of a hydrogen fuel cell system and analyse the data		
WA0102	Use appropriate methods and manufacturer's specifications for checking and investigating errors, and conduct troubleshooting		
WA0103	Analyse deviations and implement corrective measures using manufacturer's specifications		
WA0104	Conduct a range of tests (methanol-water appearance test, methanol-water specific gravity test, methanol-water miscibility test, and methanol-water boil down test)		
WA0105	Change hydrogen fuel cell components (fuel filters, air intake filters, faulty components)		
WA0106	Refuel hydrogen fuel cell		
WA0107	Perform all tasks safely		
	<b>Supporting Evidence</b>	Date	Signature
SE0101	Signed-off logbook		
<b>WM-03-WE02</b>	<b>Maintain a hydrogen fuel cell system independently but subject to final check by a qualified or experienced hydrogen fuel cell system practitioner</b>		
	<b>Scope Work Experience</b>	Date	Signature
WA0201	Monitor the parameters of a hydrogen fuel cell system and analyse the data		



WA0202	Use appropriate methods and manufacturer's specifications for checking and investigating errors, and conduct troubleshooting		
WA0203	Analyse deviations and implement corrective measures using manufacturer's specifications		
WA0204	Conduct a range of tests (methanol-water appearance test, methanol-water specific gravity test, methanol-water miscibility test, and methanol-water boil down test)		
WA0205	Change hydrogen fuel cell components (fuel filters, air intake filters, faulty components)		
WA0206	Refuel hydrogen fuel cell		
WA0207	Perform all tasks safely		
	<b>Supporting Evidence</b>	Date	Signature
SE0201	Signed-off logbook		