****

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**OIL PIPELINE MECHANICAL MAINTENACE**

**LEVEL 5**



TVET CDACC

P.O. BOX 15745-00100

NAIROBI

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FOREWORD

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with the Oil and Gas Pipeline Sector Skills Advisory Committee (SSAC) and the Kenya Pipeline Company (KPC), have developed this competency-based curriculum in oil and gas pipeline. This curriculum will allow the trainee to gain competency in oil pipeline equipment and facilities maintenance

The curriculum is designed and organized with clear outline of learning outcomes, specific learning outcomes, suggested delivery methods, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based, allowing for the trainee’s exit into the world of work and easy re- entry to the course.

I am grateful to the staff of TVET CDACC, council technical committee members, course panel members at KPC, Oil and Gas Pipeline SSAC members and all those who participated in the development and production of this curriculum.

**Prof CHARLES M.M. ONDIEKI, PhD, FIET(K), Con. EngTech.**

**CHAIRMAN TVET CDACC**

PREFACE

Kenya, through the Ministry of Education, chairs the human resource capacity building cluster of the Northern Corridor Integration Projects involving the partner states of Kenya, Uganda, South Sudan, Ethiopia and Rwanda. This cluster aims at building capacity for the railways, energy, petroleum and information and communication technology (ICT) sectors.

This curriculum has been developed as part of the effort to build human resource capacity for oil and gas pipelines for the Northern Corridor Integration Projects. The curriculum is competency- based and market-driven as it has been developed in collaboration with industry players through the Oil and Gas Pipeline Sector Skills Advisory Committee.

It is my conviction that the implementation of this curriculum will play a great role towards training of competent oil pipeline technicians needed not only for the implementation of Northern Corridor Integration Projects, but also for the oil and gas pipeline sector as a whole. TheTechnical and Vocational Education and Training Authority (TVETA) will quality assure programmes launched under this CBET curriculum.

**DIRECTOR, TECHNICAL TRAINING MINISTRY OF EDUCATION**

**ACKNOWLEDGEMENT**

In developing this curriculum, significant involvement and support was received from various persons and organisations to make it inclusive in terms of content for the benefit of all who will use it. The curriculum has been designed for competency- based training and has independent units of competence that allow the trainee flexibility in entry and exit.

I take this opportunity to acknowledge the Kenya Pipeline Company (KPC) board of directors and management for initiating and supporting the process of developing this curriculum.

The TVET CDCC recognizes with appreciation the role of the Oil and Gas Pipeline Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the curriculum. We also sincerely thank all stakeholders in the oil and gas sector for their valuable input and all those who participated in the process of developing this curriculum.

We are convinced that this curriculum will go a long way in ensuring that the workers in the oil and gas pipeline sector acquire competencies that will enable them perform their job more efficiently.

**Dr LAWRENCE GUANTAI M’ITONGA, PhD COUNCIL SECRETARY/CEO**

**TVET CDACC**

**ACRONYMS**

ERP Emergency Response Plan/Procedure

JSA Job Safety Analysis

OSHA Occupational Safety and Health Act

P&ID Piping & Instrumentation Diagrams

PPE Personal Protective Equipment

PTW Permit to Work

SCBA Self-contained Breathing Apparatus

SHE Safety, Health and Environment

CDACC Curriculum Development, Assessment and Certification Council

OG Oil and Gas

CU Curriculum

CR Core

MM Mechanical Maintenance

KEY TO UNIT CODE

OG/CU /MM/CR /01/5 / A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Version control

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**COURSE OVERVIEW**

The course will take a total of 1540 hours (52 weeks) to complete all the units of learning. The course is intended for technicians with a minimum of a certificate in mechanical engineering or related field such as agricultural engineering, mechatronics or manufacturing engineering. The course enables the trainee to work in the area of mechanical equipment and facilities maintenance in the oil and gas pipeline and related industries. There will be an introductory topic overview of oil and gas pipelines for every trainee taking any unit of learning.

.

This course consists of the following basic, common and core units of learning:

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| OG/CU/MM/BC/01/5/A | Communication skills | 25 | 2.5 |
| OG/CU/MM/BC/02/5/A | Numeracy skills | 40 | 4.0 |
| OG/CU/MM/BC/03/5/A | Digital literacy | 45 | 4.5 |
| OG/CU/MM/BC/04/5/A | Entrepreneurial skills | 70 | 7 |
| OG/CU/MM/BC/05/5/A | Employability skills | 50 | 5 |
| OG/CU/MM/BC/06/5/A | Environmental literacy | 25 | 2.5 |
| OG/CU/MM/BC/07/5/A | Occupational safety and health practices | 25 | 2.5 |
| **Total** | | **280** | **28.0** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours** | **Credit Factors** |
| OG/CU/MM/CR/01/5/A | Maintenance of Oil  Terminal Pumps | 80 | 8 |
| OG/CU/MM/CR/02/5/A | Maintenance of Oil Pipeline Mainline Pumps | 80 | 8 |
| OG/CU/MM/CR/03/5/A | Maintenance of Oil Pipeline Pump-set  Fluid Coupling | 140 | 14 |
| OG/CU/MM/CR/04/5/A | Alignment of Oil Pipeline Equipment  Shaft | 90 | 9 |
| OG/CU/MM/CR/05/5/A | Maintenance of Oil  Pipeline Valves | 80 | 8 |
| OG/CU/MM/CR/06/5/A | Maintenance of Oil  Pipeline Valve Actuators | 70 | 7 |
| OG/CU/MM/CR/07/5/A | Maintenance of Oil Pipeline Product  Meters | 120 | 12 |
| OG/CU/MM/CR/08/5/A | Maintenance of Oil  Product Tanks | 100 | 10 |
| OG/CU/MM/CR/09/5/A | Maintenance of Oil  Pipeline | 140 | 14 |
|  | Industrial attachment | 360 | 36 |
|  | Total | 1260 | 126 |
|  | Grand Total | 1540 | 154 |

The total duration of the course is 1540 hours including 360 hours’ industrial attachment.

**Entry Requirements**

A trainee entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE) D (Plain)

**Or**

1. Equivalent qualification as determined by Kenya National Qualifications Authority (KNQA)

**Provision for industrial attachment**

It is envisaged that the trainee will have unfettered access to a fire safety service as a pre-requisite for admission into this training course.

**Assessment**

The course will be assessed at two levels: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an internal accredited verifier, while external assessment is the responsibility of TVET CDACC.

**Certification**

On demonstration of competence in a unit of learning, a trainee will be awarded a Record of Achievement and on demonstration of competence in all units of learning, a trainee will be awarded a Certificate in Oil Pipeline Mechanical Maintenance. These certificates will be awarded by TVET CDACC in conjunction with training provider.

**BASIC UNITS OF LEARNING**

**COMMUNICATION SKILLS**

**UNIT CODE: OG/CU/MM/BC/01/5/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate communication skills

**Duration of Unit:** 25hours

**Unit Description**

This unit describes the competencies required to use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate discussion with groups and contribute to the development of communication strategies.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Contribute to the development of communication strategies
3. Conduct interviews
4. Facilitate group discussions
5. Represent the organization

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues | * Communication process * Modes of communication * Medium of communication * Effective communication * Barriers to communication * Flow of communication * Sources of information * Organizational policies * Organization requirements for written and electronic communication methods * Report writing * Effective questioning techniques (clarifying and probing) * Workplace etiquette * Ethical work practices in handling communication * Active listening * Feedback * Interpretation * Flexibility in communication | * Observation * Oral |
| 1. Contribute to the development of communication strategies | * Dynamics of groups * Styles of group leadership * Openness and flexibility in communication * Communication skills relevant to client groups | * Written * Observation |
| 1. Conduct interviews | * Types of interview * Establishing rapport * Facilitating resolution of issues * Developing action plans | * Written * Observation |
| 1. Facilitate group discussions | * Identification of communication needs * Dynamics of groups * Styles of group leadership * Presentation of information * Encouraging group members participation * Evaluating group communication strategies | * Written * Observation |
| 1. Represent the organization | * Presentation techniques * Development of a presentation * Multi-media utilization in presentation * Communication skills relevant to client groups | * Observation * Written |

**Suggested Delivery Methods**

* Interview
* Role playing
* Observation
* Viewing of related videos

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone

# NUMERACY SKILLS

**UNIT CODE:** **OG/CU/MM/BC/02/5/A**

**Relationship to Occupational Standards:**

This unit addresses the unit of competency: Demonstrate numeracy skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required to perform numerical functions. The person who is competent in this unit shall be able to: Calculate with whole numbers and familiar fractions, decimals and percentages for work; Estimate, measure, and calculate with routine metric measurements for work; Use routine maps and plans for work; Interpret, draw and construct 2D and 3D shapes for work; Interpret routine tables, graphs and charts for work; Collect data and construct routine tables and graphs for work; and Use basic functions of calculator

**Summary of Learning Outcomes**

1. Calculate with whole numbers and familiar fractions, decimals and percentages for work
2. Estimate, measure and calculate with routine metric measurements for work
3. Use routine maps and plans for work
4. Interpret, draw and construct 2D and 3D shapes for work
5. Interpret routine tables, graphs and charts for work
6. Collect data and construct routine tables and graphs for work
7. Use basic functions of calculator

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| Learning Outcome | Content | Suggested Assessment Methods |
| 1. Calculate with whole numbers and familiar fractions, decimals and percentages for work | * + Interpretation of whole numbers, fractions, decimals, percentages and rates   + Calculations involving several steps   + Calculation with whole numbers and routine or familiar fractions, decimals and percentages   + Conversion between equivalent forms of fractions, decimals and percentages   + Application of order of operations to solve multi-step calculations   + Application of problem solving strategies   + Making estimations to check reasonableness of problem solving process, outcome and its appropriateness to the context and task   + Use of formal and informal mathematical language and symbolism to communicate the result of a task | * Oral * Written * Practical test * Observation |
| 2. Estimate, measure and calculate with routine metric measurements for work | * Selection and interpretation of measurement information in workplace tasks and texts * Identification and selection of routine measuring equipment * Estimation and making measurements using correct units * Estimation and calculation using routine measurements * Performing conversions between routinely used metric units * Using problem solving processes to undertake tasks * Recording information using mathematical language and symbols | * Oral * Written * Practical test * Observation |
| 3. Use routine maps and plans for work | * Identification of features in routine maps and plans * Symbols and keys used in routine maps and plans * Identification and interpretation of orientation of map to North * Demonstrate understanding of direction and location * Apply simple scale to estimate length of objects, or distance to location or object * Give and receive directions using both formal and informal language | * Oral * Written * Practical test * Observation |
| 4. Interpret, draw and construct 2D and 3D shapes for work | * Identify two dimensional shapes and routine three dimensional shapes in everyday objects and in different orientations * Explain the use and application of shapes * Use formal and informal mathematical language and symbols to describe and compare the features of two dimensional shapes and routine three dimensional shapes * Identify common angles * Estimate common angles in everyday objects * Use formal and informal mathematical language to describe and compare common angles * Use common geometric instruments to draw two dimensional shapes * Construct routine three dimensional objects from given nets |  |
| 5. Interpret routine tables, graphs and charts for work | * Identify routine tables, graphs and charts in predominately familiar texts and contexts * Identify common types of graphs and their different uses * Identify features of tables, graphs and charts * Locate specific information * Perform calculations to interpret information * Explain how statistics can inform and persuade * Identify misleading statistical information * Discuss information relevant to the workplace | * Oral * Written * Practical test * Observation |
| 6. Collect data and construct routine tables and graphs for work | * Identify features of common tables and graphs * Identify uses of **different tables and graphs** * Determine data and variables to be collected * Determine audience * Select a method to collect data * Collect data * Collate information in a table * Determine suitable scale and axes * Draft and draw graph to present information * Check that data meets the expected results and context * Report or discuss information using formal and informal mathematical language | * Oral * Written * Practical test * Observation |
| 7. Use basic functions of calculator | * Identify and use keys for **basic functions on a calculator** * Calculate using whole numbers, money and routine decimals and percentages * Calculate with routine fractions and percentages * Apply order of operations to solve multi-step calculations * Interpret display and record result * Make estimations to check reasonableness of problem solving process, outcome and its appropriateness to the context and task * Use formal and informal mathematical language and appropriate symbolism and conventions to communicate the result of the task | * Oral * Written * Practical test * Observation |

**Suggested Delivery Methods**

**•** Interview

• Role playing

• Observation

• Viewing of related videos

**Recommended Resources**

**•** Desktop computers/laptops

• Internet connection

• Projectors

• Telephone

**DIGITAL LITERACY**

**UNIT CODE: OG/CU/MM/BC/03/5/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate digital literacy

**Duration of Unit:** 45 hours

**Unit Description**

This unit describes competencies required to use a computer and other digital devices for the purposes of communication, work performance and management at the workplace.

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Concepts of ICT * Functions of ICT * History of computers * Components of a computer * Classification of computers | * Written tests * Oral presentation * Observation |
| 1. Apply security measures to data, hardware and software | * Data security and control * Security threats and control measures * Types of computer crimes * Detection and protection against computer crimes * Laws governing protection of ICT | * Written tests * Oral presentation * Observation * Project |
| 1. Apply computer software in solving tasks | * Operating system * Word processing * Spread sheets * Data base design and manipulation * Data manipulation, storage and retrieval | * Oral questioning * Observation * Project |
| 1. Apply internet and email in communication at workplace | * Computer networks * Network configurations * Uses of internet * Electronic mail (e-mail) concept | * Oral questioning * Observation * Oral presentation * Written report |
| 1. Apply desktop publishing in official assignments | * Concept of desktop publishing * Opening publication window * Identifying different tools and tool bars * Determining page layout * Opening, saving and closing files * Drawing various shapes using DTP * Using colour pellets to enhance a document * Inserting text frames * Importing and exporting text * Object linking and embedding * Designing of various publications * Printing of various publications | * Oral questioning * Observation * Oral presentation * Written report * Project |
| 1. Prepare presentation packages | * Types of presentation packages * Procedure of creating slides * Formatting slides * Presentation of slides * Procedure for editing objects | * Oral questioning * Observation * Oral presentation * Written report * Project |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Project
* Group discussions

**Recommended Resources**

* Desk top computers
* Laptop computers
* Other digital devices
* Printers
* Storage devices
* Internet access
* Computer software

**ENTREPRENEURIAL SKILLS**

**UNIT CODE: OG/CU/MM/BC/04/5/A**

**Relationship to occupational standards**

This unit addresses the unit of competency: Demonstrate entrepreneurial skills

**Duration of unit:** 70 hours

**Unit description**

This unit describes the competencies critical to demonstration of entrepreneurial capabilities. It involves, enhancing the entrepreneur’s business skills, fostering a culture of continuous improvement at individual and organization level, implementing appropriate internal controls for profitability, improving employed capital base and undertaking regional/county business expansion.

**Summary of Learning Outcomes**

1. Develop one’s business skill
2. Develop individual workers and teams
3. Expand markets and customers
4. Expand employed capital
5. Undertake regional/county business expansion
6. Develop business Innovative strategies
7. Develop new products/ markets

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop one’s business skill | * Entrepreneurial skills development * Market trends * Monitoring and anticipating market trends * New technologies in entrepreneurship * Products and processes in entrepreneurship * Linkages with other entrepreneurs * Business conventions ad exhibitions * Personal improvement and growth | * Observation * Case studies * Individual/group assignments * Projects * Written * Oral |
| 1. Develop individual workers and teams | * Good staff/workers * Team building and team work * Staff development and enhancement * Culture of continuous improvement * Increasing products and services * Marketing improvement * Intrapreneurship | * Observation * Case studies * Individual/group assignments * projects * Written * Oral |
| 1. Expand markets and customers base | * Maintaining appropriate cash flow in the organization * Internal controls * Business break-even point * Business profitability determinants * Prudent purchases in an enterprise * Reducing business expenses * Good staff/workers and customer relations * Identifying and maintain new customers and markets * Product/ service promotions * Products / services diversification * SWOT / PESTEL analysis * Conducting a business survey * Market expansion * Small business records management * Book keeping and auditing for small businesses * Business support services * Small business resources mobilization and utilization * Basic business social responsibility * Management of small business * Word processing concepts in small business management * Computer application software * Monitoring and controlling business operations | * Oral * Observation * Case studies * Individual/group assignments * projects * Written |
| 1. Expand employed capital | * Employed capital in small businesses * Share holdings * Business expansion and diversification * Resources for growing small business * Small business Strategic Plan * Cooperate Social responsibility * Computer software in business development * ICT and business growth | * Observation * Case studies * Individual/group assignments * projects * Written |
| 1. Undertake county/regional business expansion | * Region identification process * Regional laws and regulation * Business regional expansion requirements | * Oral * Observation * Case studies * Individual/group assignments * projects * Written |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practice by trainee
* Role play
* Case study

**Recommended Resources**

* Case studies for small businesses
* Business plan templates
* Lap top/ desk top computer
* Internet

**EMPLOYABILITY SKILLS**

**UNIT CODE:** **OG/CU/MM/BC/05/5/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate employability skills

**Duration of Unit:** 50 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

**Summary of Learning Outcomes**

1. Conduct self-management

2. Demonstrate interpersonal communication

3. Demonstrate critical safe work habits

4. Lead small teams

5. Plan and organize work

6. Maintain professional growth and development

7. Demonstrate workplace learning

8. Demonstrate problem solving skills

9. Demonstrate workplace ethics

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management | * Self-awareness * Formulating personal vision, mission and goals * Strategies for overcoming life challenges * Emotional intelligence * Assertiveness versus aggressiveness * Expressing personal thoughts, feelings and beliefs * Developing and maintaining high self-esteem * Developing and maintaining positive self-image * Articulating ideas and aspirations * Accountability and responsibility * Good work habits * Self-awareness * Self-development * Financial literacy * Healthy lifestyle practices | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate interpersonal communication | * Meaning of interpersonal communication * Listening skills * Types of audience * Writing skills * Reading skills * Meaning of empathy * Understanding customers’ needs * Establishing communication networks * Sharing information | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate critical safe work habits | * Stress and stress management * Punctuality and time consciousness * Leisure * Integratingpersonal objectives into organizational objectives * Resources utilization * Setting work priorities * HIV and AIDS * Drug and substance abuse * Handling emerging issues | * Observation * Written * Oral interview * Third party report |
| 1. Lead a small team | * Leadership qualities * Team building * Determination of team roles and objectives * Team performance indicators * Responsibilities in a team * Forms of communication * Complementing team activities * Gender and gender mainstreaming * Human rights * Maintaining relationships * Conflicts and conflict resolution | * Observation * Oral interview * Written * Third party report |
| 1. Plan and organize work | * Functions of management * Planning * Organizing * Time management * Decision making process * Task allocation * Evaluating work activities * Resource utilization * Problem solving * Collecting and organising information | * Observation * Oral interview * Written * Third party report |
| 1. Maintain professional growth and development | * Opportunities for professional growth * Assessing training needs * Licenses and certifications for professional growth and development * Pursuing personal and organizational goals * Identifying work priorities * Recognizing career advancement | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate workplace learning | * Managing own learning * Contributing to the learning community at the workplace * Cultural aspects of work * Variety of learning context * Application of learning * Safe use of technology * Identifying opportunities * Generating new ideas * Workplace innovation * Performance improvement * Handling emerging issues * Future trends and concerns in learning | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate problem solving skills | * Problem identification * Problem solving * Application of problem-solving strategies * Resolving customer concerns | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate workplace ethics | * Meaning of ethics * Ethical perspectives * Principles of ethics * Values and beliefs * Ethical standards * Organization code of ethics * Common ethical dilemmas * Organization culture * Corruption, bribery and conflict of interest * Privacy and data protection * Diversity, harassment and mutual respect * Financial responsibility/accountability * Etiquette * Personal and professional integrity * Commitment to jurisdictional laws * Emerging issues in ethics | * Observation * Oral interview * Written * Third party report |

**Suggested Methods of Delivery**

* Instructor lead facilitation of theory
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors

# ENVIRONMENTAL LITERACY

**UNIT CODE:**  **OG/CU/MM/BC/06/5/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate environmental literacy

**Duration of Unit:** 25 hours

**Unit Description**

This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, identify environmental legislations/conventions for environmental concerns, implement specific environmental programs and monitor activities on environmental protection/programs.

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Control environmental hazard | * Purposes and content of Environmental Management and Coordination Act 1999 * Purposes and content of Solid Waste Act * Storage methods for environmentally hazardous materials * Disposal methods of hazardous wastes * Types and uses of PPE in line with environmental regulations * Occupational Safety and Health Standards (OSHS) | * Written questions * Oral questions * Observation of work procedures |
| 1. Control environmental Pollution control | * Types of pollution * Environmental pollution control measures * Types of solid wastes * Procedures for solid waste management * Different types of noise pollution * Methods for minimizing noise pollution | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Demonstrate sustainable resource use | * Types of resources * Techniques in measuring current usage of resources * Calculating current usage of resources * Methods for minimizing wastage * Waste management procedures * Principles of 3Rs (Reduce, Reuse, Recycle) * Methods for economizing or reducing resource consumption | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Evaluate current practices in relation to resource usage | * Collection of information on environmental and resource efficiency systems and procedures, * Measurement and recording of current resource usage * Analysis and recording of current purchasing strategies. * Analysis of current work processes to access information and data * Identification of areas for improvement | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Identify Environmental legislations/conventions for environmental concerns | * Environmental issues/concerns * Environmental legislations /conventions and local ordinances * Industrial standard /environmental practices * International Environmental Protocols (Montreal, Kyoto) * Features of an environmental strategy | * Written questions * Oral questions * Observation of work procedures |
| 1. Implement specific environmental programs | * Community needs and expectations * Resource availability * 5 s of good housekeeping * Identification of programs/Activities * Setting of individual roles /responsibilities * Resolving problems /constraints encountered * Consultation with stakeholders | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Monitor activities on Environmental protection/Programs | * Periodic monitoring and Evaluation of activities * Gathering feedback from stakeholders * Analysing data gathered * Documentation of recommendations and submission * Setting of management support systems to sustain and enhance the program * Monitoring and reporting of environmental incidents to concerned /proper authorities | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)
* ISO standards
* Ccompany environmental management systems (EMS)
* Montreal Protocol
* Kyoto Protocol

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:**  **OG/CU/MM/BC/07/5/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate occupational safety and health practices

**Duration of Unit:** 25 hours

**Unit Description**

This unit describes the competencies required to comply with regulatory and organizational requirements for occupational safety and health.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Identify and implement appropriate control measures to hazards and risks
3. Implement OSH programs, procedures and policies/guidelines

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace is conducted by * Authorized personnel or agency * Gathering of OHS issues and/or concerns raised | * Oral questions * Written tests * Observation of trainees identify hazards and risks |
| 1. Identify and implement appropriate control measure to hazards and risks | * Prevention and control measures, including use of PPE (personal protective equipment) for specific hazards are identified and implemented * Appropriate risk controls based on result of OSH hazard evaluation is recommended * Contingency measures, including emergency procedures during workplace incidents and emergencies are recognized and established in accordance with organization procedures | * Oral questions * Written tests * Practical test * Observation of implementation of control measures |
| 1. Implement OSH   programs, procedures  and policies/guidelines | * Providing information to work team about company OHS program, procedures and policies/guidelines * Participating in implementation of OSH procedures and policies/ guidelines * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE) e.g.
* Mask
* Face mask/shield
* Safety boots
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

**CORE UNITS OF LEARNING**

**MAINTENANCE OF OIL TERMINAL PUMPS**

**Unit Code: OG/CU/MM/CR/01/5/A**

**Relationship to Occupational Standards**

The unit addresses the unit standard: Maintain oil terminal pumps.

**Duration of Unit:** 80 hours

Unit Description

The unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely overhaul and service oil pipeline terminal pumps.

Summary of Learning Outcomes

* 1. Apply workplace safety
  2. Apply housekeeping principles to maintenance work area
  3. Prepare tools and equipment for pump maintenance
  4. Overhaul and service pump
  5. Test run serviced pump and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 1.1.Develop  safety plan for tank farm  operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2.Present  toolbox talk | * Meaning of toolbox talk * Safe working practices * How to conduct toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation |
| 1.4 Process  required permits to work and approvals | * Types of permit to work (PTW) * Importance of a permit to work (PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of incident/ accident report forms |

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| --- | --- | --- |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1 Clean tools and equipment  and stow | * Application of 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean  workplace before, during and after pump maintenance | * Cleaning tools, equipment and materials * Application of 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for pump  maintenance | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 3.1 Interpret PID drawings | * Piping and instrumentation diagrams (PID) * PID symbols and conventions * PID interpretation/ specifications * Equipment manufacturers requirements * Storage of drawings/specifications | * Observation * Written * Oral |

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| --- | --- | --- |
| 3.2 Prepare pump maintenance procedure | * Equipment manufacturers requirements * Application of workplace procedures * Maintenance procedure authorization process | * Observation * Inspection of records |
| 3.3 Obtain tools, equipment and materials | * Identification of tools equipment and materials * Application of 5S principles in work area | * Observation |
| **Learning Outcome 4:** Overhaul and service pump | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 4.1 Isolate the pump | * Pump driver isolation process * Pump product isolation process * Pump driver lockout/tag-out procedures | * Observation    |
| 4.2 Conduct pump overhaul and service | * Pump disassembly procedure * Pump inspection and wear measurements * Parts inspection procedures * Parts replacement/ refurbishment procedures * Pump reassembly procedure * Shafts alignment process | * Practical tests * Written * Observation * Demonstrati on |
| 4.3 Adhere to relevant safety aspects | * Safety regulations * Environmental regulations * Working safely |    * Observation    |

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| **Learning Outcome 5:** Test run and handover serviced pump | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 5.1 Carry out  pump service confirmatory tests | * Confirmation of pump reassembly process * Pump mounting procedures * Confirmation of pump/driver couplings alignment | * Observation    |
| 5.2 Test run  pump | * Notifying relevant sections * Power normalization process * Pump design and application parameters * Confirmation of required pump operating parameters * Recording maintenance data | * Written * Observation |
| 5.3 Handover  pump and closeout permits | * Equipment handover procedures * Equipment takeover procedures * Permit to work closeout procedure | * Written * Observation |
| 5.4 Write pump maintenance  report | * Analysing maintenance data * Structure and content of maintenance report | * Inspection of completed   report |

**Suggested Delivery Methods**

* + - Instructor-led facilitation of theory
    - Demonstration of task by trainer
    - Practice by trainee

Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Bearing puller, induction heater, bench grinder, hydraulic press,  lifting equipment, flange expander, shims, alignment toolkit, V- blocks, magnetic stand, computer, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **References:** |
| 1. Pump manufacturer maintenance and operation manual 2. **Practical Centrifugal Pump**, by Paresh Girdhar 3. **Troubleshooting Centrifugal Pumps and their Systems** by Ron Palgrave 4. [www.maintenancetechnology.com](http://www.osha.gov/) 5. [www.enggclopedia.com](http://www.skf.com/) 6. [www.plant-maintenance.com](http://www.plant-maintenance.com/) |

**MAINTENANCE OF PIPELINE MAINLINE PUMPS**

**Unit Code: OG/CU/MM/CR/02/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain oil pipeline mainline pumps.

**Duration of Unit:** 80 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely overhaul and service oil pipeline mainline pumps.

Summary of Learning Outcomes

1. Apply workplace safety
2. Apply housekeeping principles to maintenance work area
3. Prepare tools and equipment for mainline pump maintenance
4. Overhaul and service pump
5. Test run serviced pump and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1.Develop  safety plan for tank farm  operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2.Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * How to conduct toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Observation * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation |
| 1.4 Process  required permits to work and approvals | * Types of permit to work (PTW) * Importance of a permit to work (PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of Incident/ accident report forms |

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| --- | --- | --- |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning**  **Outcomes** | **Content** | * **Suggested Assessment**   **Methods** |
| 2.1 Clean tools and equipment  and stow | * Applying 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean  workplace before, during and after pump maintenance | * Cleaning tools, equipment and materials * Applying 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for pump  maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | * **Suggested Assessment**   **Methods** |
| 3.1 Interpret PID drawings | * PID symbols and conventions * PID interpretation   /specifications   * Equipment manufacturers requirements * Storage of drawings/ specifications | * Observation * Written * Oral |
| 3.2 Prepare pump maintenance procedure | * Equipment manufacturers requirements * Application of workplace procedures * Maintenance procedure authorization | * Observation * Inspection of completed procedure form |

|  |  |  |
| --- | --- | --- |
| 3.3 Obtain tools, equipment and materials | * Identification of tools equipment and materials   Application of 5S principles | * Observation |
| **Learning Outcome 4** Overhaul and service pump | | |
| **Specific**  **Learning Outcomes** | **Content** | * **Suggested**   **Assessment Methods** |
| 4.1 Isolate the pump | * Pump driver isolation process * Pump product isolation process   Pump driver lockout/tag- out procedures | * Observation |
| 4.2 Conduct pump overhaul and service | * Pump disassembly procedure * Pump inspection and wear measurements * Parts inspection procedures * Parts   replacement/refurbishm ent procedures   * Pump reassembly procedure   Shafts alignment process | * Practical tests * Written * Observation * Demonstration |
| 4.3 Adhere to relevant safety aspects | * Safety regulations * Environmental regulations * Working safely | * Observation |

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| --- | --- | --- |
| **Learning Outcome 5:** Test run and handover serviced pump | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 5.1 Carry out pump service confirmator y tests | * Confirmation of pump   reassembly process   * Pump mounting procedures * Confirmation of pump/driver couplings alignment | * Observation |
| 5.2 Test run pump | * Notifying relevant sections * Power normalization * Pump design and application parameters * Confirming required pump operating parameters * Recording maintenance data | * Written * Observation |
| 5.3 Handover pump and closeout permits | * Equipment handover   procedures   * Equipment takeover procedures * Permit to work closeout procedures | * Written * Observation |
| 5.4 Write maintenance report | * Analysing maintenance   data   * Structure and content of maintenance report | * Inspection of   completed report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Bearing puller, induction heater, bench grinder, hydraulic press, lifting equipment, flange expander, shims, alignment toolkit, V-  blocks, magnetic stand, computer, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **References:** |
| 1. **Handbook of Pumps and Pumping**, by Brian Nesbitt 2. [www.flowserve.com](http://www.cameron.com/) 3. [www.ebara.com](http://www.volmatic.com/) 4. Flowserve pump manual 5. Ebara pump manual |

**MAINTENANCE OF OIL PIPELINE PUMP-SET FLUID COUPLING**

**Unit Code: OG/CU/MM/CR/03/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain oil pipeline pump- set fluid coupling.

**Duration of Unit:**40 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely overhaul and service oil pipeline pump-set fluid coupling.

Summary of Learning Outcomes

1. Apply workplace Safety
2. Apply housekeeping principles to maintenance work area
3. Prepare tools and equipment for fluid coupling maintenance
4. Overhaul and service fluid coupling
5. Test run serviced fluid coupling and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.3.Develop  safety plan for tank farm operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.4.Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * Conducting toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation |
| 1.4 Process  required permits to work and approvals | * Types of permit to work (PTW) * Importance of a PTW * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of Incident/ accident report forms |

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| --- | --- | --- |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1 Clean tools and  Equipment and stow | * Applying 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean workplace before, during and  after fluid maintenance | * Cleaning tools, equipment and materials * Applying 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for fluid  coupling maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 3.1 Interpret PID drawings | * Piping &instrumentation diagrams (PID) * PID symbols and conventions * PID interpretation specifications * Equipment manufacturers’ requirements * Storage of drawings/ specifications | * Observation * Written * Oral |

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| --- | --- | --- |
| 3.4 Prepare fluid coupling maintenance procedure | * Equipment manufacturers requirements * Application of workplace procedure * Maintenance procedure authorization process | * Observation * Inspection of completed procedure form |
| 3.5 Obtain tools, equipment and  materials | * Identification of tools equipment and materials * Application of 5S principles | * Observation |
| **Learning Outcome 4:** Overhaul and service fluid coupling | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 4.1 Isolate the fluid coupling | * Fluid coupling driver isolation process * Fluid coupling product isolation process * Coupling driver lockout/tag-out procedures | * Observation |
| 4.2 Conduct fluid coupling overhaul and service | * Fluid coupling disassembly procedure * Fluid coupling inspection and wear measurements * Parts inspection procedures * Parts replacement/ refurbishment procedures * Fluid coupling reassembly procedure * Shafts alignment process | * Practical tests * Written * Observation * Demonstrat ion |
| 4.3 Adhere to relevant safety  aspects | * Safety regulations * Environmental regulations * Working safely | * Observation |

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| **Learning Outcome 5:** Test run and handover serviced fluid  coupling | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 5.1 Carry out fluid coupling service confirmator y tests | * Confirmation of fluid coupling reassembly process * Fluid coupling mounting procedures * Confirmation of fluid coupling/driver couplings alignment | * Observation |
| 5.2 Test run fluid coupling | * Notifying relevant sections * Power normalization * Fluid coupling operational parameters * Fluid coupling design and application parameters * Confirm required fluid coupling operating parameters * Recording maintenance data | * Written * Observation |
| 5.3 Hand over fluid coupling and closeout permits | * Equipment handover procedures * Equipment takeover procedures * Permit to work closeout procedures | * Written * Observation |
| 5.4 Write  coupling maintenance report | * Analysing maintenance data * Structure and content of maintenance report | * Inspection of completed   report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Bearing puller, induction heater, bench grinder, hydraulic press,  lifting equipment, flange expander, shims, alignment toolkit, V- blocks, magnetic stand, computer, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **References:** |
| 1. [www.voith.com](http://www.enggclopedia.com/) 2. [www.rexnord.com](http://www.rotork.com/) 3. [www.hitachi.fluidcoupling.com](http://www.hitachi.fluidcoupling.com/) 4. [www.premiumtransmission.com](http://www.wbdg.org/) 5. **Fluid Structure Interaction,** by John Wiley and Sons |

**ALIGNMENT OF OIL PIPELINE EQUIPMENT SHAFT**

**Unit Code: OG/CU/MM/CR/04/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Perform oil pipeline equipment shaft alignment.

**Duration of Unit:** 40 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely perform pipeline equipment shaft alignment.

Summary of Learning Outcomes

1. Apply workplace safety
2. Apply housekeeping principles to maintenance work area
3. Prepare tools and equipment for shaft alignment
4. Align equipment shafts
5. Test run aligned equipment and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1.Develop  safety plan for tank farm operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2.Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * How to conduct toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation |
| 1.4 Process  required permits to work and approvals | * Types of permit to work(PTW) * Importance of a permit to work (PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed   permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of incident/ accident report forms |

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| --- | --- | --- | --- |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** | |
| 2.1 Clean tools and  equipment and stow | * Applying 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation | |
| 2.2 Clean  workplace before, during and after equipment maintenance | * Cleaning tools, equipment and materials * Apply 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation | |
| **Learning Outcome 3:** Prepare tools and equipment for equipment  maintenance | | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** | |
| 3.1 Interpret PID drawings | * Piping and instrumentation diagrams * PID symbols and conventions * PID interpretation   /specifications   * Equipment manufacturers requirements * Storage of drawings/ specifications | * Observation * Written * Oral | |
| 3.2 Prepare | * Equipment | | * Observation |

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| alignment procedure | manufacturers’ requirements   * Application of workplace procedure * Alignment procedure authorization process | * Inspection of completed procedure form |
| 3.3 Obtain tools, equipment and materials | * Identification of tools equipment and materials * Application of 5S principles to work area | * Observation |
| **Learning Outcome 4:** Overhaul and service equipment | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 4.1 Isolate the equipment | * Equipment driver isolation process * Equipment product isolation process * Equipment driver   lockout/tag-out procedures | * Observation |
| 4.2 Conduct  equipment shaft alignment | * Equipment disassembly procedure * Equipment inspection and wear measurements * Parts inspection procedures * Parts replacement/ refurbishment procedures * Equipment reassembly procedure * Shafts alignment process | * Practical tests * Written * Observation * Demonstration |

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| 4.3 Adhere to relevant  safety aspects | * Safety regulations * Environmental regulations * Working safely | * Observation |
| **Learning Outcome 5:** Test run and handover serviced equipment | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 5.1 Carry out shaft alignment confirmato ry tests | * Confirmation of equipment reassembly process * Equipment mounting procedures * Confirmation of equipment/driver couplings integrity * Confirm holding down bolts tightness | * Observation |
| 5.2 Test run  equipment | * Notifying relevant sections * Power normalization * Equipment operational parameters * Equipment design and application parameters * Confirm required equipment operating parameters * Record maintenance data | * Written * Observation |
| 5.3 Handover equipment and closeout  permits | * Equipment handover procedures * Equipment takeover procedures * Permit to work closeout procedures | * Written * Observation |
| 5.4 Write  alignment report | * Analysing maintenance data * Structure and content of maintenance report | * Inspection of completed   report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Lifting equipment, flange expander, shims, alignment toolkit,  magnetic stand |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **REFERENCES:** |
| 1. **Shaft Alignment Handbook,** by John Piotrowski 2. **Couplings and Shaft Alignment,** by M Neale, R Hornell 3. [www.maintenancetechnology.com](http://www.rexnord.com/) 4. [www.ludeca.com](http://www.ludeca.com/) 5. [www.skf.com](http://www.emersonprocess.com/) |

**MAINTENANCE OF OIL PIPELINE VALVES**

**Unit Code: OG/CU/MM/CR/05/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain oil pipeline valves.

**Duration of Unit:** 80 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely overhaul and service oil pipeline valves.

Summary of Learning Outcomes

1. Apply workplace safety
2. Apply housekeeping principles to maintenance work area
3. Prepare tools and equipment for valve maintenance
4. Overhaul and service valve
5. Test run serviced valve and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1 Develop  safety plan for tank farm operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2 Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * How to conduct toolbox talk * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation |
| 1.4 Process  required permits to work and approvals | * Types of permit to work (PTW) * Importance of a permit to work (PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of Incident/accid ent report forms |

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| --- | --- | --- |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1 Clean tools and  equipment and stow | * Apply 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean  workplace before, during and after valve maintenance | * Cleaning tools, equipment and materials * Apply 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for valve  maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 1.1 Interpret PID drawings | * Piping and instrumentation diagrams * PID symbols and conventions * PID interpretation/ specifications * Equipment manufacturers’ requirements * Storage of drawings/ specifications | * Observation * Written * Oral |
| 1.2 Prepare valve maintenance procedure | * Equipment manufacturers’ requirements * Application of workplace procedure * Maintenance procedure authorization process | * Observation * Inspection of completed procedure form |

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| --- | --- | --- | --- |
| 1.3 Obtain tools, equipment  and materials | * Identification of tools, equipment and materials * Application of 5S principles to work area | | * Observation |
| **Learning Outcome 4:** Overhaul and service valve | | | |
| **Specific**  **Learning Outcomes** | **Content** | | **Suggested**  **Assessment Methods** |
| 4.1 Isolate  valve | * Valve driver isolation process * Valve product isolation process * Valve driver lockout/tag-out procedures | | * Observation |
| 4.2 Conduct valve overhaul and service | * Valve disassembly procedure * Valve inspection and wear measurements * Parts inspection procedures * Parts replacement/ refurbishment procedures * Valve reassembly procedure | | * Practical tests * Written * Observation * Demonstrati on |
| 4.3 Adhere to relevant safety  aspects | * Safety regulations * Environmental regulations * Working safely | | * Observation |
| **Learning Outcome 5:** Test run and handover serviced valve | | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** | |
| 5.1 Carry out valve service confirmator  y tests | * Confirmation of valve reassembly process * Valve mounting procedures * Confirmation of valve/actuator engagement | * Observation | |

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| --- | --- | --- |
| 5.2 Test run the valve | * Notifying relevant sections * Power normalization * Valve operational parameters * Valve design and application parameters * Confirm required valve operating parameters * Record maintenance data | * Written * Observation |
| 5.3 Handover valve and closeout permits | * Equipment handover procedures * Equipment takeover procedures * Permit to work closeout procedures | * Written * Observation |
| 5.4 Write valve  maintenance report | * Analysing maintenance data * Structure and content of maintenance report | * Inspection of   completed report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Bearing puller, induction heater, bench grinder, hydraulic press, lifting equipment, flange expander, shims, V-blocks, magnetic  stand, computer, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **REFERENCES:** |
| 1. [www.cameron.com](http://www.maintenancetechnology.com/) 2. Manufacturer maintenance and operation manual 3. **Maritime Engineering Reference Book**, by Antony F. Molland 4. **Handbook of Valves and Actuators,** by Brian Nesbitt 5. [www.rotork.com](http://www.voith.com/) 6. [www.emersonprocess.com](http://www.smithmeters.com/) 7. [www.volmatic.com.](http://www.volmatic.com/) |

**MAINTENANCE OF OIL PIPELINE VALVE ACTUATORS**

**Unit Code: OG/CU/MM/CR/06/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain oil pipeline valve actuators.

**Duration of Unit:** 40 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely overhaul and service oil pipeline valve actuators.

Summary of Learning Outcomes

1. Apply workplace safety
2. Apply housekeeping principles to maintenance work area
3. Prepare tools and equipment for actuator maintenance
4. Overhaul and service actuator
5. Test run serviced actuator and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1 Develop  safety plan for tank farm operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2 Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * How to conduct toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation |
| 1.4 Process  required permits to work and approvals | * Types of permit to work (PTW) * Importance of a permit to work(PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of Incident/acci dent report forms |

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| --- | --- | --- |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1 Clean tools and equipment and stow | * Apply 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean workplace before,  during and after actuator maintenance | * Cleaning tools, equipment and materials * Apply 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for actuator  maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 3.1 Interpret PID drawings | * Piping and instrumentation diagrams (PID) * PID symbols and conventions * PID interpretation/ specifications * Equipment manufacturers’ requirements * Storage of drawings/specifications | * Observation * Written * Oral |
| 3.2 Prepare  actuator maintenance procedure | * Equipment manufacturers’ requirements * Application of workplace procedure * Maintenance procedure authorization process | * Observation * Inspection of completed procedure form |

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| --- | --- | --- |
| 3.3 Obtain tools, equipment  and materials | * Identification of tools equipment and materials * Application of 5S principles to the work area | * Observation |
| **Learning Outcome 4:** Overhaul and service actuator | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 4.1 Isolate  actuator | * Actuator driver isolation process * Actuator product isolation process * Actuator lockout/tag-out procedures | * Observation |
| 4.2 Conduct  actuator overhaul and service | * Actuator disassembly procedure * Actuator inspection and wear measurements * Parts inspection procedures * Parts replacement/ refurbishment procedures * Actuator reassembly procedure | * Practical tests * Written * Observation * Demonstrat ion |
| 4.3 Adhere to relevant safety  aspects | * Safety regulations * Environmental regulations * Working safely | * Observation |

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| **Learning Outcome 5:** Test run and handover serviced actuator | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 5.1 Carry out actuator service confirmator y tests | * Confirmation of actuator reassembly process * Actuator mounting procedures * Confirmation of actuator/actuator   engagement | * Observation |
| 5.2 Test run  actuator | * Notifying relevant sections * Power normalization * Actuator operational parameters * Actuator design and application parameters * Confirm required   actuator operating parameters | * Written * Observation |
| 5.3 Handover actuator and closeout permits | * Equipment handover procedures * Equipment takeover procedures * Permit to work closeout procedures * Recording maintenance data | * Written * Observation |
| 5.4 Write maintenance report | * Analysing maintenance data * Structure and content of maintenance report | * Inspection of completed report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

List of Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Bearing puller, induction heater, bench grinder, hydraulic press,  lifting equipment, flange expander, shims, V-blocks, magnetic stand, computer, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **References:** |
| 1. Manufacturer maintenance and operation manual 2. **Maritime Engineering Reference Book**, by Antony F. Molland 3. **Handbook of Valves and Actuators**, by Brian Nesbitt 4. **Linear Electric Actuator**, by I. Boldea 5. [www.rotork.com](http://www.premiumtransmission.com/) 6. [www.emersonprocess.com](http://www.rotork.com/) 7. [www.volmatic.com](http://www.emersonprocess.com/). |

**MAINTENANCE OF OIL PIPELINE METERS**

**Unit Code: OG/CU/MM/CR/07/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain oil pipeline meters.

**Duration of Unit:** 40 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely overhaul and service oil pipeline meters.

Summary of Learning Outcomes

1. Apply workplace safety
2. Apply housekeeping principles to maintenance work area
3. Prepare tools and equipment for meter maintenance
4. Overhaul and service meter
5. Test run serviced meter and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1 Develop  safety plan for tank farm  operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2 Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * How to conduct toolbox talk * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation on correct identification of PPE |
| 1.4 Process  required permits to work and approvals | * Types of permit to work (PTW) * Importance of a permit to work (PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of Incident/acci dent report forms |

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| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1 Clean tools and equipment and stow | * Apply 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean workplace before,  during and after meter maintenance | * Cleaning tools, equipment and materials * Apply 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for meter  maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 3.1 Interpret PID drawings | * Piping and instrumentation diagrams * PID symbols, conventions * PID interpretation   /specifications   * Equipment manufacturers’ requirements * Storage of drawings/ specifications | * Observation * Written * Oral |
| 3.2 Prepare meter maintenance procedure | * Equipment manufacturers’ requirements * Application of workplace procedure * Maintenance procedure authorization process | * Observation * Inspection of completed procedure form |

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| 3.3 Obtain tools, equipment  and materials | * Identification of tools equipment and materials * Application of 5S principles | * Observation |
| **Learning Outcome 4:** Overhaul and service meter | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 4.1 Isolate  meter | * Meter driver isolation process * Meter product isolation process * Lockout/tag-out procedures | * Observation |
| 4.2 Conduct meter overhaul and service | * Meter disassembly procedure * Meter inspection and wear measurements * Parts inspection procedures * Parts   replacement/refurbishment procedures   * Meter reassembly procedure | * Practical tests * Written * Observation * Demonstrati on |
| 4.3 Adhere to relevant safety  aspects | * Safety regulations * Environmental regulations * Working safely | * Observation |
| **Learning Outcome 5:** Test run and handover serviced meter | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 5.1 Carry out meter service confirmatory tests | * Confirmation of meter reassembly process * Meter mounting procedures * Confirmation of meter/power system | * Observation |
| 5.2 Test run meter | * Notifying relevant sections * Power normalization * Meter operational parameters | * Written * Observation |

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|  | * Meter design and application parameters * Confirm required meter operating parameters * Record maintenance data |  |
| 5.3 Handover meter and  closeout permits | * Equipment handover procedures * Equipment takeover procedures * Permit to work closeout procedures | * Written * Observation |
| 5.4 Write meter maintenance report | * Analysing maintenance data * Structure and content of maintenance report | * Inspection of completed   report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

List of Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Bearing puller, induction heater, bench grinder, hydraulic press,  lifting equipment, flange expander, shims, computer, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **References:** |
| 1 Manufacturer maintenance and operation manual 2 Maintenance technology.com   1. Enggclopedia.com 2. Plant-maintenance.com 3. [www.smithmeters.com](http://www.triumvirate.com/) 4. Product meters manuals for all types of meters |

**MAINTENANCE OF OIL PRODUCT TANK**

**Unit Code: OG/CU/MM/CR/08/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain oil product tanks.

**Duration of Unit:** 80 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an oil pipeline mechanical technician in order to competently and safely maintain oil product tanks.

Summary of Learning Outcomes

1. Apply workplace safety
2. Apply housekeeping principles to maintenance work area
3. Prepare tools and equipment for tank maintenance
4. Clean and paint tank
5. Service tank accessories
6. Test and commission tank and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1 Develop  safety plan for tank farm operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2 Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * How to conduct toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Individual   toolbox talk presentation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE | * Observation on correct identificatio n of PPE |
| 1.4 Process  required permits  to work and approvals | * Types of permit to work (PTW) * Importance of a permit to work (PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed   permits |
| 1.5 Control  hazards associated with tank maintenance | * Types of hazards * Process of hazards identification * Hazard control measures | * Written assessment * Observation |

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| --- | --- | --- |
| 1.6 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of Incident/ accident report forms |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 2.1 Clean tools and equipment  and stow | * Apply 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean  workplace before, during and after tank  maintenance | * Cleaning tools, equipment and materials * Apply 5S principles to a work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for tank maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 3.1 Interpret Tank drawings | * Tank symbols and conventions * Tank PID interpretation   /specifications   * Tank manufacturers’ requirements * Storage of drawings/specifications | * Observation * Written * Oral |

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| --- | --- | --- |
| 3.2 Prepare tank maintenance procedure | * Tank design and application * Tank accessory equipment manufacturers’ requirements * Application of workplace procedure * Maintenance procedure authorization process | * Observation * Inspection of completed procedure form |
| 3.3 Obtain tools, equipment and  materials | * Identification of tools equipment and materials * Application of 5S principles | * Observation |
| **Learning Outcome 4:** Overhaul and service tank | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 4.1 Isolate the tank | * Tank decommissioning process * Tank product isolation process * Tank accessories lockout/tag-out procedures | * Observation |
| 4.2 Conduct tank cleaning and painting | * Tank cleaning process * Tank inspection and wear measurements * Tank painting requirements * Tank painting process * Paint inspection process * Parts replacement/ refurbishment procedures * Tank box-up procedure | * Practical tests * Written * Observation * Demonstrati on |
| 4.3 Conduct tank accessories  maintenance | * Equipment inspection procedure * Parts replacement/ refurbishment procedures | * Observation |

|  |  |  |
| --- | --- | --- |
|  | * Equipment reassembly   procedures |  |
| 4.4 Adhere to relevant safety aspects | * Safety regulations * Environmental regulations * Working safely * Environmental protection | * Observation |
| **Learning Outcome 5:** Test, commission and handover tank | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 5.1 Carry out tank service confirmator y tests | * Confirmation of tank box- up process * Confirm tank manholes cover tightness * Confirm tank-side valves’ integrity | * Observation |
| 5.2 Carry out tank functional tests and commission tank | * Notifying relevant sections * Equipment power normalization * Tank operational parameters * Tank design and application parameters * Confirm required tank operating parameters | * Written * Observation |
| 5.3 Handover tank and closeout  permits | * Tank handover procedures * Tank takeover procedures * Permit to work closeout procedures | * Written * Observation |
| 5.4 Write tank maintenance report | * Recording maintenance data * Analysing maintenance data * Structure and content of maintenance report | * Inspection of   completed report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

List of Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill, pneumatic wire brush, spray gun, |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper, grit, |
| **Materials** |
| Oils, greases, paints, paint solvents, water |
| **Equipment:** |
| Compressor, grit blasting equipment, lighting equipment, welding equipment, valve spades (various sizes), bearing puller, induction heater, bench grinder, hydraulic jack, lifting equipment, flange expander, exhauster fans, paint thickness gauge, sludge pump,  hoses, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat, respiratory protective equipment, face shield, clear goggles, noise protection  equipment, dust protection equipment, |
| **References:** |
| 1. Manufacturer maintenance and operation manual 2. [www.triumvirate.com](http://www.ebara.com/) 3. [www.wbdg.org](http://www.maintenancetechnology.com/) 4. [www.osha.gov](http://www.petrosleeve.com/) 5. **Tank Cleaning Safety Codes**, by Institute of Petroleum 6. **Tank Cleaning Guide**, by Verways |

**MAINTENANCE OF OIL PIPELINE – PIGGING, SLEEVING AND COATING**

**Unit Code: OG/CU/MM/CR/09/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain oil pipelines.

**Duration of Unit:** 40 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by a mechanical technician in order to competently and safely perform oil pipeline pigging, sleeving and coating.

Summary of Learning Outcomes

1. Apply workplace safety
2. Apply housekeeping principles to pipeline maintenance work area
3. Prepare tools and equipment for pipeline maintenance
4. Carry out pipeline pigging, sleeving and coating
5. Test run pipeline and handover to user

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1 Develop  safety plan for tank farm operations | * Elements of safety plan * How to develop the safety plan | * Written assessment * Observation |
| 1.2 Present  toolbox talk | * Meaning of toolbox talk * Safety working practices * How to conduct toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.3 Identify  correct PPEs for the task | * Meaning of PPE * Types of PPE * Purpose of PPE * Safe and correct handling,   use, maintenance, storage of different types of PPE | * Observation |
| 1.4 Process  required permits to work and approvals | * Types of permit to work (PTW) * Importance of a permit to work (PTW) * Requirements of a permit to work (PTW) system | * Written assessment * Inspection of completed permits |
| 1.5 Report any incidents and accidents | * Description of incident, accident * Incident/accident reporting process | * Written assessment * Inspection of Incident/ accident report forms |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 2:** Apply housekeeping principles to  maintenance work area | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1 Clean tools and  equipment and stow | * Apply 5S principles to work area * Purpose of cleaning and proper stowage | * Written assessment * Observation |
| 2.2 Clean  workplace before, during and after pipeline maintenance | * Cleaning tools, equipment and materials * Apply 5S principles to work area * Purpose of cleaning and storage | * Written assessment * Observation |
| **Learning Outcome 3:** Prepare tools and equipment for pipeline  maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 3.1 Interpret PID drawings | * Piping and instrumentation diagrams (P&ID) * PID symbols and conventions * PID interpretation   /specifications   * Equipment manufacturers requirements * Storage of drawings/ specifications | * Observation * Written * Oral |
| 3.2 Prepare  pipeline maintenance procedure | * Equipment manufacturers’ requirements * Application of workplace procedure * Maintenance procedure authorization process | * Observation * Inspection of completed procedure form |

|  |  |  |
| --- | --- | --- |
| 3.3 Obtain tools,  equipment and materials | * Identification of tools, equipment and materials * Application of 5S principles | * Observation |
| **Learning Outcome 4:** Overhaul and service pipeline | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 4.1 Perform  pipeline pigging | * Types and applications of pipeline pigs * Pigging process * Pig inspection and measurements * Pig launching and receiving * Sludge analysis * Pipeline inspection and wear measurements | * Observation |
| 4.2 Perform  pipeline sleeving | * Pipeline inspection and wear measurements * Pipeline defect identification * Types and applications of sleeves * Sleeving process * Types and applications of welding processes * Sleeve welding processes * Quality inspection of sleeving * Sleeving emergency procedures | * Practical tests * Written * Observation * Demonstrati on |
| 4.3 Perform  pipeline coating | * Purpose of pipeline coating * Types and applications of coatings * Pipeline coating process * Quality inspection of coating | * Practical tests * Written * Observation * Demonstrati on |

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| --- | --- | --- |
| 4.4 Adhere to relevant safety aspects | * Safety regulations * Environmental regulations * Working safely * Environmental protection | * Observation |
| **Learning Outcome 5:** Test, commission and handover tank | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 5.1 Carry out pipeline maintenance confirmatory tests | * Confirmation of tank box- up process * Confirm tank manholes cover tightness * Confirm tank-side valves integrity | * Observation |
| 5.2 Carry out pipeline functional tests | * Notifying relevant sections * Equipment power normalization * Tank operational parameters * Tank design and application parameters * Confirm required tank operating parameters | * Written * Observation |
| 5.3 Handover pipeline and closeout  permits | * Tank handover procedures * Tank takeover procedures * Permit to work closeout procedures | * Written * Observation |
| 5.4 Write  pipeline maintenance report | * Record maintenance data * Analyse maintenance data * Structure and content of maintenance report | * Inspection of completed   report |

**Suggested Delivery Methods**

* + Instructor-led facilitation of theory
  + Demonstration of task by trainer
  + Practice by trainee

List of Recommended Resources

|  |
| --- |
| **Hand Tools:** |
| Standard mechanical technician toolbox |
| **Power Tools:** |
| Angle grinder, hand drill |
| **Consumables:** |
| Cleaning materials, cleaning solvents, emery paper |
| **Materials** |
| Oils, greases |
| **Equipment:** |
| Bearing puller, induction heater, bench grinder, hydraulic press, lifting equipment, flange expander, shims, alignment toolkit, V-  blocks, magnetic stand, computer, |
| **PPE:** |
| Safety shoes, hand gloves, dust coat, helmet/hard hat |
| **References:** |
| Manufacturer maintenance and operation manual   1. **Practical Pigging Pipeline Open Data Standard** 2. Performing scheduled pipeline pigging [www.en.wikipedia.org/wiki/Pig](http://www.en.wikipedia.org/wiki/Pig) 3. Manufacturer maintenance and operation manual 4. Sleeve manufacturer’s manual 5. Engineering procedures planning (preventive) maintenance manual 6. [www.petrosleeve.com](http://www.flowserve.com/) |