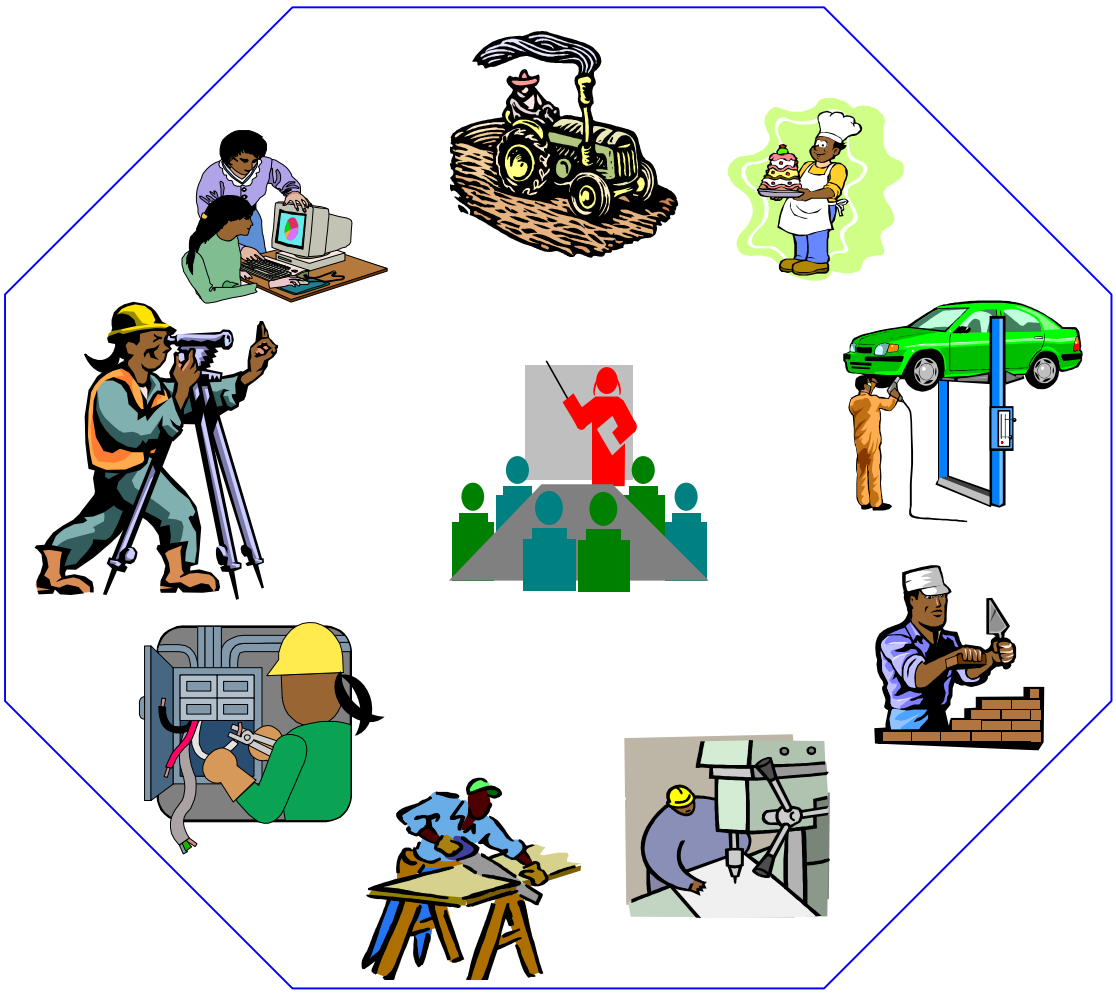
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

POWER GENERATION AND SUBSTATION INSTALLATION AND MAINTENANCE-MECHANICAL

NTQF Level III



Ministry of Education

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Introduction

Ethiopia has embarked on a process of reforming its TVET-System. Within the policies and strategies of the Ethiopian Government, technology transformation – by using international standards and international best practices as the basis, and, adopting, adapting and verifying them in the Ethiopian context – is a pivotal element. TVET is given an important role with regard to technology transfer. The new paradigm in the outcome-based TVET system is the orientation at the current and anticipated future demand of the economy and the labor market.

The Ethiopia Occupational Standards (EOS) is the core element of the Ethiopian National TVET-Strategy and an important factor within the context of the National TVET-Qualification Framework (NTQF). They are national Ethiopian standards, which define the occupational requirements and expected outcome related to a specific occupation without taking TVET delivery into account.

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

A Unit of Competence describes a distinct work activity. It is documented in a standard format that comprises:

- Occupational title and NTQF level
- Unit title
- Unit code
- Unit descriptor
- Elements and Performance criteria
- Variables and Range statement
- Evidence guide

Together all the parts of a Unit of Competence guide the assessor in determining whether the candidate is competent.

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

- chart with an overview of all Units of Competence for the respective level (Unit of Competence Chart) including the Unit Codes and the Unit titles
- contents of each Unit of Competence (competence standard)
- occupational map providing the technical and vocational education and training (TVET) providers with information and important requirements to consider when designing training programs for this standards and for the individual, a career path

UNIT OF COMPETENCE CHART

Occupational Standard: Power Generation and Substation Installation and Maintenance - Mechanical

Occupational Code: EIS IMM

NTQF Level III

EIS IMM3 01 0612 Install and Maintain Hydraulic/Pneumatic Components	EIS IMM3 02 0612 Install and Maintain Industrial Pipe Works	EIS IMM3 03 0612 Install and Maintain Mechanical Valves
EIS IMM3 04 0612 Install and Maintain Mechanical Pumps	EIS IMM3 05 0612 Install and Maintain Industrial Fans	EIS IMM3 06 0612 Install and Maintain Industrial Screens, Strainers and Filters
EIS IMM3 07 0612 Install and Maintain Fuel Transport Equipment	EIS IMM3 08 0612 Install and Maintain Industrial Pressure Vessels	EIS IMM3 09 0612 Install and Maintain Internal Combustion Engines
EIS IMM3 10 0612 Repair/Replace/Modify Metal Structures and Components	EIS IMM3 11 0612 Inspect and Repair/ Replace Faults in Mechanical Components	EIS IMM3 12 0612 Diagnose and Repair Faults in Mechanical Equipment
EIS IMM3 13 0612 Conduct Generator Mechanical Maintenance	EIS IMM3 14 0612 Maintain and Test Fixed Fire Protection Systems	EIS IMM3 15 0612 Install and Maintain Hydro Turbines
EIS IMM3 16 0612 Maintain Wind Turbines	EIS IMM3 17 0612 Install and Maintain Steam Turbine	EIS IMM3 18 0612 Install and Maintain Turbine (Steam/Gas)
EIS IMM3 19 0612 Perform Sheet Metal Works	EIS IMM3 20 0612 Weld Using Manual Metal Arc Welding Process (MMAW)	EIS IMM3 21 0612 Fabricate Metal Structures and Components
EIS IMM3 22 0612 Perform Advanced Scaffolding	EIS IMM3 23 0612 Perform Advanced Rigging Works	EIS IMM3 24 0612 Install and Maintain Industrial Transmissions
EIS IMM3 25 0612 Apply Quality Control	EIS IMM3 26 0612 Monitor Implementation of Work Plan/ Activities	EIS IMM3 27 0612 Lead Workplace Communication
EIS IMM3 28 0612 Lead Small Teams	EIS IMM3 29 0612 Improve Business Practice	EIS IMM3 30 1012 Maintain Quality System and Continuous Improvement Processes (Kaizen)

Occupational Standard: Power Generation and Substation Installation and Maintenance-Mechanical Level III	
Unit Title	**Install and Maintain Hydraulic/Pneumatic Components**
Unit Code	**EIS IMM3 01 0612**
Unit Descriptor	This unit refers to the installation, repair and/or maintenance of fluid power components on stationary/mobile equipment.

Elements	Performance Criteria
1. Plan and prepare for the work	1.1 Work requirements are identified from request/work orders or equivalent and clarified/confirmed with appropriate parties or by site inspection 1.2 Occupational health and safety standards, statutory requirements, relevant Ethiopian standards, codes of practice, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure 1.3 Resources required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications 1.4 Relevant plans, drawings and texts are selected and interpreted in accordance with the work plan 1.5 Correct size, type and quantity of materials/components are determined, obtained and inspected for compliance with the job specifications 1.6 Work is planned in detail including sequencing and prioritizing and considerations made, where appropriate, for the maintenance of plant security and capacity in accordance with system/site requirements 1.7 Co-ordination requirements, including requests for isolations where appropriate, are resolved with others involved, affected or required by the work 1.8 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures 1.9 Work area is prepared in accordance with work requirements and site procedures
2. Remove hydraulic/ pneumatic components	2.1 Required ***isolations*** are confirmed, where appropriate, in accordance with site requirements. 2.2 Fluid power components are disconnected in accordance with the work plan 2.3 Components are removed in a manner which will assist in replacement in accordance with site requirements 2.4 Components are inspected for abnormalities in accordance

	with the work plan
3. Maintain fluid power components	3.1 Components are identified and prepared for maintenance in accordance with the work plan 3.2 Visual inspections and testing are carried out applying ***hydraulic and pneumatic principles*** in accordance with the work plan 3.3 ***Maintenance*** is performed in accordance with manufacturer's specifications and site requirements 3.4 Components are dismantled, cleaned and examined to verify tolerances using appropriate techniques and procedures to determine replacement, overhaul, or repair in accordance with the work plan 3.5 Dimensional inspection is performed with precision measuring devices to ensure compliance with specifications and results recorded in accordance with the work plan 3.6 Faulty items are identified, repaired/overhauled using appropriate techniques and standards in accordance with the work plan 3.7 Replacement items are selected, inspected and prepared for installation in accordance with manufacturer's specifications and the work plan 3.8 Components are refitted in accordance with manufacturer's specifications and the work plan
4. Replace components	4.1 Site is prepared for fluid power component replacement in accordance with the work plan 4.2 Fluid power components are replaced in accordance with the work plan and manufacturer's specifications 4.3 Fluid power components are aligned and connected in accordance with the work plan 4.4 All connections are leak/pressure tested in accordance with manufacturer's specifications and site requirements 4.5 Machinery/plant and components are tested and adjusted as required in accordance with manufacturer's specifications and site requirements
5. Complete the work	5.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements 5.2 ***Work area*** is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures 5.3 Plant, ***tools*** and equipment are maintained and stored in accordance with site/enterprise procedures 5.4 ***Work completion*** details are finalized in accordance with site/enterprise procedures

Variable	Range
Hydraulic components	• may include rams, actuators, relays, hydraulic operated tools, motors, governors and relays
Pneumatic components	• may include actuators, relays, rams, tools and compressors
Hydraulic and pneumatic principles	May include but not limited to: • may include both small signal control and power operating mediums
Measuring tools	• may include micrometers; dial test indicators; slip gauges; surface plate; depth gauge; vernier
Details of maintenance	• may be clarified by diagnosis; work place inspection; consultation with other parties/operators
Maintenance	• may include repair; inspection and modification; overhaul; lubrication; servicing; test running
Work completion details	• may include plant and maintenance records; job cards; check sheets; on device labeling updates; reporting and/or documenting equipment defects
Work site environment	• may be affected by nearby plant or processes, e.g. chemical, heat, dust, noise, gas and oil
Isolations	can refer to: • electrical/mechanical or other associated processes

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • relevant sections of occupational, health and safety legislation, statutory legislation, enterprise/site safety procedures and enterprise/site emergency procedures • preparation and planning of work • removal techniques • maintenance techniques and procedures • installation techniques and procedures • completion of work procedures
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • occupational health and safety • hydraulic/pneumatic equipment • properties of liquids and gases • precision measuring equipment • seals and gaskets • valves and porting principles • hydraulic/pneumatic principles • specialized tools and jigs; bearings • relevant materials and components • technical drawings and data • data recording techniques

	• hand and portable power tools • diagnostic and testing techniques • plant and systems • design and construction of pipe work
Underpinning Skills	Demonstrates skills to: • apply occupation health and safety standards • identify and use precision measuring equipment • identify and select tools and materials • identify and use relevant test equipment • manufacture and install seals and gaskets • select and use specialized tools and jigs • use technical drawings and data • use hand and portable power tools • apply testing techniques • apply hydraulic and pneumatic principles • dismantle and assemble components to specified tolerances • communicate effectively
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting

Occupational Standard: Power Generation and Substation Installation and Maintenance-Mechanical Level III	
Unit Title	**Install and Maintain Industrial Pipe Works**
Unit Code	**EIS IMM3 02 0612**
Unit Descriptor	This unit refers to all work associated with the installation, maintenance, and fabrication of industrial pipe work and may involve fault finding and repairs.

Elements	Performance Criteria
1. Plan and prepare for the work	1.1 Work requirements are identified from request/work orders or equivalent and clarified/confirmed with appropriate parties or by site inspection 1.2 Occupational health and safety standards, statutory requirements, relevant Ethiopian standards, codes of practice, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure 1.3 Resources required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications 1.4 Relevant plans, drawings and texts are selected and interpreted in accordance with the work plan 1.5 Correct size, type and quantity of materials/components are determined, obtained and inspected for compliance with the job specifications 1.6 Work is planned in detail including sequencing and prioritizing and considerations made, where appropriate, for the maintenance of plant security and capacity in accordance with system/site requirements 1.7 Co-ordination requirements, including requests for isolations where appropriate, are resolved with others involved, affected or required by the work 1.8 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures 1.9 Work area is prepared in accordance with work requirements and site procedures 1.10 Where appropriate, the teams and individuals roles and responsibilities within the team are identified, and where required, assist in the provision of on-the-job training
2. Fabricate and install pipe work	2.1 Required isolations are confirmed, where appropriate, in accordance with site requirements. 2.2 Pipe runs are identified, calculations performed and sketches made of the planned installation in accordance with the work plan 2.3 ***Pipe work*** is fabricated using appropriate techniques and equipment in accordance with the work plan 2.4 Pipe work is leveled and aligned and installed/coupled in accordance with the work plan

3. Maintain industrial pipe work	3.1 Pipe work found to be faulty is repaired/replaced to conform to site requirements or manufacturer's specifications 3.2 Pipe work modifications/alterations are undertaken in accordance with site requirements and manufacturers specifications 3.3 Machinery/plant returned to service and pipe work monitored and adjusted in accordance with the work plan
4. Complete the work	4.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements 4.2 Work area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures 4.3 Plant, ***tools and equipment*** are maintained and stored in accordance with site/enterprise procedures 4.4 Work completion details are finalized in accordance with site/enterprise procedures

Variable	**Range**
Pipe work	May be fabricated from diverse material including, ABS, PVC, polyurethane, copper, stainless steel, galvanized steel, black steel, copper/nickel, concrete and mineral fiber
Tools and equipment	May include: stocks, dyes, threading machine, hydraulic benders, hand benders, hand and power cutters, welders, plastic heat gun, spirit level, grinders, jigs and lifting devices
Fittings/ components	May include: Couplings, screw fittings and flanges Pipes may contain or have contained water, gas, air or chemicals of a hazardous nature. Pipe work may be protected by protective coatings
Details of maintenance	May be: clarified by diagnosis and work place inspection
Maintenance	May include but not limited to: • repair, inspection, modification and overhaul
Work completion details	May include but not limited to: • plant and maintenance records, job cards, check sheets, on device labeling updates and reporting and/or documenting equipment defects
Work site environment	May be affected by: • nearby plant or processes, e.g. chemical, heat, dust, noise, gas and oil
Isolations	can refer to: • electrical/mechanical or other associated processes

Evidence Guide

Critical Aspects of Competence	Demonstrates skills and knowledge in: • The knowledge and application of relevant sections of occupational, health and safety • legislation, statutory legislation, enterprise/site safety procedures and • enterprise/site emergency procedures, preparation and planning of work • pipe work fabrication techniques and procedures • maintenance techniques and procedures • installation techniques and procedures • completion of work procedures
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Occupational health and safety • pipe work materials and their applications • precision measuring equipment; seals and gaskets • quality assurance/quality control • specialized tools and jigs • leveling and alignment • rigging and lifting • relevant materials and components • technical drawings and data • data recording techniques • hand and portable power tools • testing techniques • relevant plant and systems • isolation procedures • communication principles • principles of fluid power • protective coatings
Underpinning Skills	Demonstrates skills to: • Apply occupational health and safety standards • identify and use measuring equipment • apply pipe work fabrication and installation techniques • manufacture and install seals and gaskets • apply leveling and alignment techniques • use technical drawings and data • identify and select materials and components • apply data analysis techniques • use hand and portable power tools • apply relevant testing techniques • apply dismantling and reassembling techniques • apply relevant maintenance procedures • recognize worn/damaged • components • communicate effectively • apply relevant tools and jigs • apply fluid power principle

Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting

Occupational Standard: Power Generation and Substation Installation and Maintenance-Mechanical Level III	
Unit Title	**Install and Maintain Mechanical Valves**
Unit Code	**EIS IMM3 03 0612**
Unit Descriptor	This unit refers to the fault finding, diagnosis, repair and/or overhaul of mechanical valves, but excluding any associated servo or actuating.

Elements	Performance Criteria
1. Plan and prepare for the work	1.1 Work requirements are identified from request/work orders or equivalent and clarified/confirmed with appropriate parties or by site inspection 1.2 Occupational health and safety standards, statutory requirements, relevant Ethiopian standards, codes of practice, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure 1.3 Resources required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications 1.4 Relevant plans, drawings and texts are selected and interpreted in accordance with the work plan 1.5 Correct size, type and quantity of materials/ components are determined, obtained and inspected for compliance with the job specifications 1.6 Work is planned in detail including sequencing and prioritizing and considerations made where appropriate for the maintenance of plant security and capacity in accordance with system/site requirements 1.7 Co-ordination requirements, including requests for isolations where appropriate, are resolved with others involved, affected or required by the work 1.8 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures 1.9 Work area is prepared in accordance with work requirements and site procedures 1.10 Where appropriate, the teams and individuals roles and responsibilities within the team are identified and, where required, assist in the provision of on-the-job training
2. Remove valves for maintenance	2.1 Required ***isolations*** are confirmed where appropriate in accordance with site requirements 2.2 ***Valve*** is disconnected in accordance with the work plan

	2.3 Valve is removed in a manner which will assist in replacement in accordance with the work plan 2.4 Valve is inspected for abnormalities in accordance with the work plan.
3. Perform valve maintenance	3.1 ***Maintenance*** is performed in accordance with manufacturers specifications and the work plan 3.2 Valve is dismantled, clearly marked for identification and relevant sketches drawn in accordance with the work plan 3.3 Components are correlated in preparation for re-assembly in accordance with manufacturer's drawings/manuals 3.4 New components are inspected to ensure compliance with manufacturer's specifications 3.5 Dimensional inspection is performed with ***precision measuring devices*** to ensure compliance with manufacturer's specifications and site requirements 3.6 Components are reassembled for testing in accordance with manufacturer's specifications and site requirements 3.7 Modifications/alterations are undertaken in accordance with manufacturer's specifications and site requirements 3.8 Components are leveled , aligned, coupled and connected in accordance with manufacturer's specifications and site requirements 3.9 Valves are pressure tested, monitored and adjusted if required in accordance with manufacturer's specifications and the work plan
4. Replace/install valves	4.1 Site is prepared for valve replacement in accordance with the work plan 4.2 Valve is replaced in accordance with the work plan and manufacturer's specifications 4.3 Valve is connected in accordance with the work plan and manufacturer's specifications 4.4 Final job inspection is completed and any permits relinquished in accordance with the work plan
5. Complete the work	5.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements 5.2 ***Work*** area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures 5.3 Plant, tools and equipment are maintained and stored in accordance with site/enterprise procedures 5.4 ***Work completion details*** are finalized in accordance with site/enterprise procedures

Variable	Range
Valves	May include: • high and low pressure and temperature valves that are flanged and bolted; dampers and hydro regulating valves; gate; globe; wafer; uni-flow; plug; ball; knife; rotary; piston (ported); diaphragm; non-return; pinch; pressure relief; regulating; isolating; slide dampers; isolating and regulating blade dampers; gas regulating or isolating dampers; hydro turbine guide vanes; and shutters
Precision measuring devices	• May include: inside/outside micrometers, vernier, engineer's rule, dial gauges, depth gauges and feeler gauges
Testing	May include: • pressure testing (hydraulic and vacuum), blue check
Valve control solutions	May include: • gases; solids; and fluids and chemicals such as caustic soda, chlorine, ammonia, sulphuric acid, sodium hypochlorite, hydrazine, diethylamine, citric acid, hydrofluoric acid, ammonium molydate, trisodium phosphate, hydrogen, nitrogen, carbon dioxide, water, flyash, slurry, compressed air, brine, oil, steam (superheated and saturated), hydrogen, propane and carbon dioxide
Details of maintenance	May include but not limited to: • may be clarified by: diagnosis and workplace inspection
Maintenance	May include: • repair, inspection, modification, overhaul, lubrication, servicing, test running, sealing, machining, identifying and replacing defective components and valve packing
Valve drives	may include: • electrical, mechanical, pneumatic, hydraulic or manual
Isolations	can refer to: • electrical/mechanical or other associated processes
Work completion details	may include: • plant and maintenance records, job cards, check sheets, on device labeling updates and reporting and/or documenting equipment defects
Work site environment	• may be affected by: nearby plant or processes, e.g. chemical, heat, dust, noise, gas and oil

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • occupational, health and safety legislation • statutory legislation • enterprise/site safety procedures and enterprise/site

	emergency procedures • preparation and planning of work • removal techniques • maintenance techniques and procedures • installation techniques and procedures • completion of work procedures
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Valve operating and seating arrangements; hydraulic and pneumatic principles • measuring equipment • glands, seals and gaskets; bearings • occupational health and safety standards; quality assurance/quality control • specialized tools and jigs • leveling and aligning; rigging and lifting equipment; valve materials and components • technical drawings and data • data recording techniques • hand and portable power tools • diagnostic and testing techniques • protective coatings • plant and systems • communication principles
Underpinning Skills	Demonstrates skills to: • Identify and use precision measuring equipment • manufacture and install seals and gaskets • apply dismantling and assembly techniques • select, manufacture and use specialized tools and jigs • level and align; use and update technical drawings and data • identify and select materials and components • use hand and portable power tools • apply diagnostic and testing techniques and rectify faults • interpret and apply valve operational techniques • apply occupational health and safety procedures • recognize worn/damaged components and part • apply effective maintenance procedures; • apply data analysis techniques and tools • communicate effectively
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting

Occupational Standard: Power Generation and Substation Installation and Maintenance-Mechanical Level III	
Unit Title	**Install and Maintain Mechanical Pumps**
Unit Code	**EIS IMM3 04 0612**
Unit Descriptor	This unit refers to the installation and maintenance of all pumps, compressors and blowers and the installation of which requires no more than basic alignment.

Elements	Performance Criteria
1. Plan and prepare for work	1.1 Work requirements are identified from request/work orders or equivalent and clarified/confirmed with appropriate parties or by site inspection 1.2 Occupational health and safety standards, statutory requirements, relevant Ethiopian standards, codes of practice, manufacturer's specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure. 1.3 Resources required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications 1.4 Relevant plans, drawings and texts are selected and interpreted in accordance with the work plan 1.5 Correct size, type and quantity of materials/ components are determined, obtained and inspected for compliance with the job specifications 1.6 Work is planned in detail including sequencing and prioritizing and considerations made, where appropriate, for the maintenance of plant security and capacity in accordance with system/site requirements 1.7 Co-ordination requirements, including requests for isolations where appropriate, are resolved with others involved, affected or required by the work 1.8 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures 1.9 Work area is prepared in accordance with work requirements and site procedures 1.10 Where appropriate, the teams and individuals roles and responsibilities within the team are identified and, where required, assist in the provision of on-the-job training
2. Remove pumps for maintenance	2.1 Required ***isolations*** are confirmed where appropriate in accordance with site requirements 2.2 Pump is disconnected in accordance with the work plan 2.3 Pump is removed in a manner which will assist in

	replacement in accordance with the work plan 2.4 Pump is inspected for abnormalities in accordance with the work plan
3. Maintain pumps	3.1 ***Maintenance*** is performed in accordance with manufacturer's specifications and site procedures 3.2 Pump is dismantled for maintenance in accordance with manufacturer's specifications and site procedures 3.3 Sketches are made, data noted and components marked for identification and/or re-assembly in accordance with job requirements and site procedures 3.4 New components are obtained and inspected for compliance with manufacturer's specifications 3.5 Dimensional inspection is performed with precision measuring devices to ensure compliance with specifications and results recorded in accordance with job requirements and site procedures 3.6 ***Pump*** is reassembled applying appropriate principles and techniques in accordance with manufacturer's specifications and site requirements 3.7 Modifications/alterations are undertaken in accordance with site requirements
4. Replace/install pumps	4.1 Site is prepared for pump replacement in accordance with the work plan 4.2 Pump is replaced in accordance with the work plan and manufacturer's specifications 4.3 Pump is leveled , aligned, coupled and connected in accordance with the work plan 4.4 All fastenings are torque in accordance with manufacturer's specifications and site requirements 4.5 Machinery/plant and pump are test run, monitored and adjusted as required in accordance with manufacturer's specifications and site requirements
5. Complete the work	5.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements 5.2 ***Work area*** is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures 5.3 Plant, ***tools*** and ***equipment*** are maintained and stored in accordance with site/enterprise procedures 5.4 ***Work completion details*** are finalized in accordance with site/enterprise procedures
Variable	**Range**
Isolations	can refer to: • electrical/mechanical or other associated processes

Pumps	• May include single stage, centrifugal, screw and gear, positive, non-positive, partial and variable displacement, vane, diaphragm, roots and pistons
Pump drives	• May include: electrical, internal combustion, hydraulic, pneumatic or steam
Details of maintenance	may be: • clarified by diagnosis and workplace inspection
Maintenance	• can include: • repair, inspection, modification, lubrication, servicing, test running, identifying and replacing defective components
Work site environment	may be affected by: • nearby plant or processes e.g. chemical, heat, dust, noise and oil
Tools	May include: • micrometers, vernier, dial test indicators, slip gauges, hand tools, hydraulic spanners, customized mandrels, digital height gauges, internal micrometers, depth gauges, air grinders, jigs and fixtures, customized spanners, thermal blankets, induction heaters, thermal crayons, digital thermometers, oxyacetylene gear and appropriate lifting devices
Plant and equipment	May include but not limited to: • jigs for dismantling and oxyacetylene heating equipment
Work completion details	May include but not limited to: • plant and maintenance records, job cards, check sheets, on device labeling updates and reporting and/or documenting equipment defects

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • Occupational, health and • safety legislation; Statutory legislation; Enterprise/site safety procedures; • Enterprise/site emergency procedures • Preparation and planning of work • Removal techniques • Maintenance techniques and procedures • Installation techniques and procedures • Completion of work procedures
Underpinning Knowledge and	Demonstrates knowledge of: • Pumps and compressors

Attitudes	• Measuring equipment • Seals and gaskets; Bearings • Occupational health and safety standards; • Quality assurance/quality control • Specialized tools and jigs • Leveling and alignment; Rigging and lifting equipment; • Materials and components of pumps • Fluid dynamics • Torque techniques • Technical drawings and data • Data recording techniques • Hand and portable power tools • Diagnostic and testing techniques • Protective coatings • Heating techniques • Defined tolerances and fits • Balancing techniques • Isolation procedures • Communication principles
Underpinning Skills	Demonstrates skills to: • Identify and use precision measuring equipment • Manufacture and install seals and gaskets • Apply fluid dynamics principles • Install bearings • Use specialized tools and jigs; Level and align • Use technical drawings and data • Identify and select materials and components • Apply data analysis techniques and tools • Use hand and portable power tools • Apply diagnostic and testing techniques • Use heat application equipment • Apply dismantling and reassembling techniques • Work to defined tolerances • Apply occupational health and safety procedures • Recognize worn/damaged components • Apply effective maintenance procedures • Communicate effectively
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting

Occupational Standard: Power Generation and Substation Installation and Maintenance-Mechanical Level III	
Unit Title	**Install and Maintain Industrial Fans**
Unit Code	**EIS IMM3 05 0612**
Unit Descriptor	This unit refers to all work required to maintain/overhaul industrial fans and may involve fault finding, diagnosis, repair and could require the removal and replacement of rotating elements with modulating controls.

Elements	Performance Criteria
1. Plan and prepare for the work	1.1 Work requirements are identified from request/work orders or equivalent and clarified/confirmed with appropriate parties or by site inspection 1.2 Occupational health and safety standards, statutory requirements, relevant Ethiopian standards, codes of practice, manufacturer's specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure 1.3 Resources required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications 1.4 Relevant plans, drawings and texts are selected and interpreted in accordance with the work plan 1.5 Correct size, type and quantity of materials/components are determined, obtained and inspected for compliance with the job specifications 1.6 Work is planned in detail including sequencing and prioritizing and considerations made, where appropriate, for the maintenance of plant security and capacity in accordance with system/site requirements 1.7 Co-ordination requirements, including requests for isolations where appropriate, are resolved with others involved, affected or required by the work 1.8 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures 1.9 Work area is prepared in accordance with work requirements and site procedures 1.10 Where appropriate, the teams and individuals roles and responsibilities within the team are identified and where required, assist in the provision of on-the-job training
2. Remove fan for maintenance	2.1 Required ***isolations*** are confirmed, where appropriate, in accordance with site requirements

	2.2 ***Fans*** are disconnected in accordance with the work plan 2.3 Fans are removed in a manner which will assist in replacement in accordance with the work plan 2.4 Fans are inspected for abnormalities in accordance with the work plan
3. Maintain fans	3.1 ***Maintenance*** is performed in accordance with manufacturer's specification and site procedures 3.2 Components are disassembled/assembled and preliminary balance of the equipment is obtained, maintained and adjusted by assembling components of an appropriate weight in accordance with manufacturer's/site specifications 3.3 Sketches are made, data noted and components marked for identification and/or re-assembly in accordance with job requirements and site procedures 3.4 New components are obtained and inspected for compliance with manufacturer's specifications 3.4 Dimensional inspection is performed with precision measuring devices to ensure compliance with specifications and results recorded in accordance with job requirements and site procedures 3.5 Fans are reassembled applying appropriate principles and techniques in accordance with manufacturer's specifications and site requirements 3.6 Modifications/alterations are undertaken in accordance with site requirements
4. Replace/install fans	4.1 Site is prepared for fans replacement in accordance with the work plan 4.2 Fans are replaced in accordance with the work plan and manufacturer's specifications 4.3 Fans are leveled , aligned, coupled and connected in accordance with the work plan 4.4 All fastenings are torque in accordance with manufacturer's specifications and site requirements 4.5 Machinery/plant and fans are test run, monitored and adjusted as required in accordance with manufacturer's specifications and site requirements
5. Complete the work	5.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements 5.2 ***Work*** area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures 5.3 Plant, ***tools*** and equipment are maintained and stored in accordance with site/enterprise procedures

	5.4 ***Work completion details*** are finalized in accordance with site/enterprise procedures

Variable	**Range**
Isolations	• can refer to electrical/mechanical or other associated processes
Fans may include:	• Induced draft, forced draft, cooling and exhaust. Modulating controls may be to guide vanes and impellor blades
Maintenance may include:	• repair, inspection, modification, balancing, overhaul, lubrication, servicing, test running and identifying and replacing defective components
Tools may include:	• micrometers, verniers, dial test indicators, slip gauges, hand tools, hydraulic spanners, customized mandrels, digital height gauges, internal micrometers, depth gauges, air grinders, jigs and fixtures, customized spanners, thermal blankets, induction heaters, thermal crayons, digital thermometers, oxyacetylene gear and appropriate lifting devices
Work completion details may include:	• plant and maintenance records, job cards, check sheets, on device labeling updates and reporting and/or documenting equipment defects
Work site environment may be affected:	• by nearby plant or processes, e.g. chemical, heat, dust, noise, gas and oil

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • Occupational, health and safety legislation • Statutory legislation • Enterprise/site safety procedures • Enterprise/site emergency procedures • Preparation and planning of work • Removal techniques • Maintenance techniques and procedures • Installation techniques and procedures • Completion of work procedures
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Precision measuring equipment • Seals and gaskets; Bearings (anti-friction and plain) • Bearings (white metal and tilting pad) • Occupational health and safety standards • Quality assurance/quality control • Specialized tools and jigs • Leveling and alignment • Rigging and lifting

	• Materials and components • Torque techniques • Technical drawings and data • Data recording techniques • Hand and power tools; • Diagnostic and testing techniques • Protective coatings • Plant and systems; • Heating and heat treatment techniques • Defined tolerances and fits • Balancing techniques • Isolation procedures • Communication principles
Underpinning Skills	Demonstrates skills to: • Identify and use measuring equipment • Manufacture and install seals and gaskets • Install bearings (anti-friction and plain) • Install bearings (white metal and/or tilting pad) • Apply leveling and aligning techniques • Use technical drawings and data • Identify and select materials and components • Apply data analysis techniques • Identify and apply correct torque techniques • Use hand and portable power tools • Apply diagnostic and testing techniques • Use heat application equipment • Work to defined tolerances • Dismantle and assemble component • Apply balancing procedures • Apply maintenance and installation procedures • Apply occupational health and safety procedures • Recognize worn/damaged components • Communicate effectively
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting

Occupational Standard: Power Generation and Substation Installation and Maintenance-Mechanical Level III	
Unit Title	**Install and Maintain Industrial Screens, Strainers and Filters**
Unit Code	**EIS IMM3 06 0612**
Unit Descriptor	This unit refers to the fault finding diagnosis, repair and/or overhaul of industrial screens, strainers and filters.

Elements	Performance Criteria
1. Plan and prepare for the work	1.1 Work requirements are identified from request/work orders or equivalent and clarified/confirmed with appropriate parties or by site inspection 1.2 Occupational health and safety standards, statutory requirements, relevant Ethiopian standards, codes of practice, manufacturer's specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure 1.3 Resources required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications 1.4 Relevant plans, drawings and texts are selected and interpreted in accordance with the work plan 1.5 Correct size, type and quantity of materials/ components are determined, obtained and inspected for compliance with the job specifications 1.6 Work is planned in detail including sequencing and prioritizing and considerations made, where appropriate, for the ***maintenance*** of plant security and capacity in accordance with system/site requirements 1.7 Co-ordination requirements, including requests for ***isolations*** where appropriate, are resolved with others involved, affected or required by the work. plan 1.8 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures 1.9 Work area is prepared in accordance with work requirements and site procedures Generation Industry Training 1.10 Where appropriate, the teams and individuals roles and responsibilities within the team are identified and, where required, assist in the provision of on-the-job training
2. Remove plant/	2.1 Required isolations are confirmed where appropriate in accordance with site requirements

equipment for maintenance	2.2 ***Screens***, ***strainers*** and ***filters*** are disconnected in accordance with the work plan 2.3 Screens, strainers and filters are removed in a manner which will assist in replacement in accordance with the work plan 2.4 Screens, strainers and filters are inspected for abnormalities in accordance with the work plan
3. Maintain plant/ equipment	3.1 Equipment isolation and de-pressurization is confirmed visually and manually, as required in accordance with the job plan and site requirements 3.2 ***Plant***/equipment components, assemblies or sub-assemblies are identified and prepared for maintenance in accordance with the work plan. 3.3 Equipment is removed, cleaned and marked for identification in accordance with the job plan and site requirements 3.4 Faulty items are repaired/overhauled, using appropriate principles, techniques and standards in accordance with the job plan and site requirements 3.5 Replacement items for installation are selected and inspected in accordance with manufacturer's specifications 3.6 Out of specification modifications/alterations approved by appropriate authority and in accordance with requirements 3.7 Component failures are identified and probable causes reported using appropriate techniques and equipment in accordance with the job plan 3.8 Components or sub-assemblies are refitted in accordance with manufacturer's specifications and site requirements 3.9 All fastenings are torque in accordance with manufacturer's specifications and site requirements
4. Replace/install screens, strainers and filters	4.1 Site is prepared for screens, strainers and filters replacement in accordance with the work plan 4.2 Out of specification modifications/alterations approved by appropriate authority and in accordance with requirements 4.3 Screens, strainers and filters are replaced in accordance with the work plan and manufacturer's specifications 4.4 Screens, strainers and filters are leveled, aligned and coupled in accordance with the work plan 4.5 All fastenings are torque in accordance with manufacturer's specifications and site requirements 4.6 Machinery/plant is test run, monitored and adjusted as required in accordance with manufacturer's specifications

	and site requirements with site/enterprise procedures
5. Complete the work	5.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements 5.2 ***Work*** area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures 5.3 ***Plant***, tools and equipment are maintained and stored in accordance with site/enterprise procedures 5.4 ***Work completion details*** are finalized in accordance

Variable	**Range**
Screens	may include: • vibratory, rotary, fixed and basket
Strainers	may include: • Basket, rotary and element processes
Filters	may include: • water trap, lube oil filters, cartridge, element, oil purifiers, paper, resin and sand
Plant	may include: • electrostatic precipitators • economize hopper; air conditioner; water coolers
Details of maintenance	may be: • clarified by diagnosis and work place inspection
Maintenance	may include: • repair, inspection, modification, overhaul, lubrication, servicing and test running
Work completion details	may include: • plant and maintenance records, job cards, check sheets, on device labeling updates and reporting, documenting equipment defects
Work site environment	may be affected: • by nearby plant or processes e.g. chemical, heat, dust, noise, gas and oil
Isolations	can refer to: • electrical/mechanical or other associated

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • occupational health and safety legislation • statutory legislation • enterprise/site safety procedures • enterprise/site emergency procedures • preparation and planning of work • removal techniques • maintenance techniques and procedures • installation techniques and procedures

	• completion of work procedures
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Occupational health and safety • filters and filtration system • measuring equipment • screen and filter types and materials • quality assurance/quality • control; technical drawings and data • data recording techniques • hand and portable power tools • specialized tools and jigs • anode and cathode protection • alignment procedures • rigging and lifting techniques • relevant materials and components • fault finding and diagnostic techniques • appropriate test procedures • plant and system • balancing procedures • communication principles
Underpinning Skills	Demonstrates skills to: • apply occupational health and safety standards • identify and use measuring equipment • use hand portable power tools • use technical drawings and data • apply data analysis techniques • install and remove bearings • dismantle and assemble components • apply installation and maintenance procedures • communicate effectively
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting