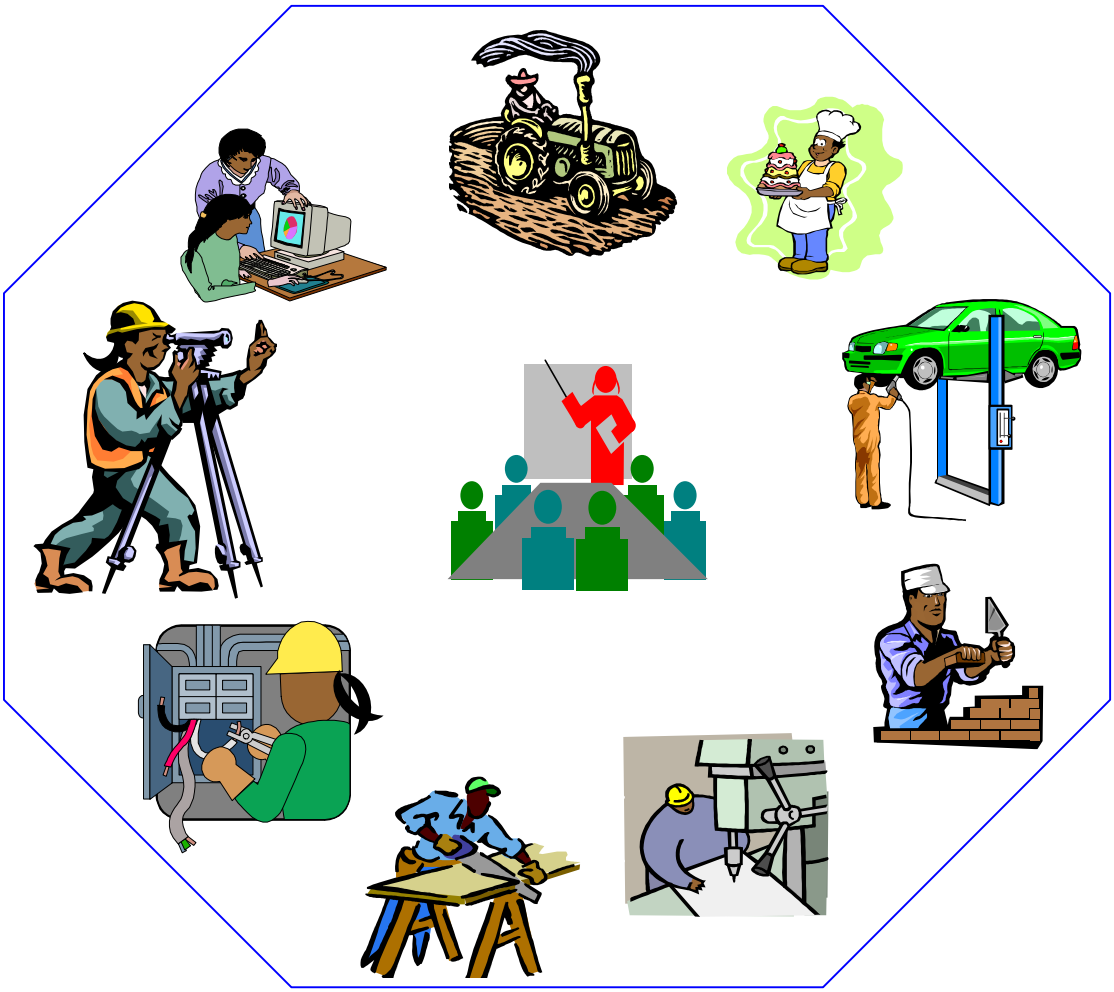
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

POWER GENERATION OPERATION

NTQF Level III and IV



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 Operation

Occupational Code: EIS PGO

NTQF Level III

EIS PGO3 01 0612 Conduct Single Energy Source Isolation Procedures for Permit to Work	EIS PGO3 02 0612 Operate and Monitor Air Conditioning Equipment and Ventilation System	EIS PGO3 03 0612 Operate and Monitor Fuel Supply
EIS PGO3 04 0612 Operate and Monitor Fuel Firing Plant (Gas or Oil)	EIS PGO3 05 0612 Operate and Monitor Fixed Fire Protection System	EIS PGO3 06 0612 Operate and Monitor Compressed Air System
EIS PGO3 07 0612 Operate and Monitor Oil System	EIS PGO3 08 0612 Operate and Monitor Heat Exchangers	EIS PGO3 09 0612 Operate Hydro Generator/Synchronous Condenser/Pump Unit
EIS PGO3 10 0612 Operate and Monitor Wind Generator	EIS PGO3 11 0612 Operate and Monitor Condensing and Cooling Water Systems	EIS PGO3 12 0612 Operate and Monitor Dual Fuel Firing Plant
EIS PGO3 13 0612 Operate and Monitor Water Treatment Plant	EIS PGO3 14 0612 Interpret and Analyze Single Operation Protection Devices	EIS PGO3 15 0612 Operate Hydro-Electric Generating Plant and Auxiliary Equipment
EIS PGO3 16 0612 Conduct Water Conveyance and Control	EIS PGO3 17 0612 Conduct Non-Routine Operational Testing	EIS PGO3 18 0612 Operate and Monitor Supervisory, Control and Data Acquisition Systems
EIS PGO3 19 0612 Operate HV Condition Changing Apparatus	EIS PGO3 20 0612 Operate HV Primary Switchgear	EIS PGO3 21 0612 Operate HV Secondary Switchgear
EIS PGO3 22 0612 Respond to Critical Incidents	EIS PGO3 23 0612 Conduct Operational Checks on In-Service Electrical Plant	EIS PGO3 24 0612 Conduct Operational Checks on In-Service Mechanical Plant

EIS PGO3 25 0612 Operate and Monitor Auxiliary Steam System	EIS PGO3 26 0612 Operate and Monitor Water System (Condensate and Feed-Water)	EIS PGO3 27 0612 Operate and Monitor Condensing and Cooling Water Systems
EIS PGO3 28 0612 Operate and Monitor Boiler Unit	EIS PGO3 29 0612 Operate and Monitor Steam Turbine	EIS PGO3 30 0612 Shut Down Steam Turbine
EIS PGO3 31 0612 Apply Environmental and Sustainable Energy Procedures	EIS PGO3 32 0612 Organize Personal Work Priorities and Development	EIS PGO3 33 0612 Support Innovation and Change
EIS PGO3 34 0612 Apply Quality Control	EIS PGO3 35 0612 Monitor Implementation of Work Plan/ Activities	EIS PGO3 36 0612 Lead Workplace Communication
EIS PGO3 37 0612 Lead Small Teams	EIS PGO3 38 0612 Improve Business Practice	EIS PGO3 39 1012 Maintain Quality System and Continuous Improvement Processes (Kaizen)

NTQF Level IV

EIS PGO4 01 0612 Monitor Compliance with OHS Policy and Procedures	EIS PGO4 02 0612 Conduct Multiple Energy Source Isolation Procedures	EIS PGO4 03 0612 Coordinate and Direct Switching Program
EIS PGO4 04 0612 Coordinate First Response Team Operation	EIS PGO4 05 0612 Operate and Monitor DC Electrical System	EIS PGO4 06 0612 Operate and Monitor AC Electrical System
EIS PGO4 07 0612 Undertake Commissioning/ Decommissioning	EIS PGO4 08 0612 Co-ordinate Operational Strategies for Power Production	EIS PGO4 09 0612 Perform Risk Analysis of Generation Plant
EIS PGO4 10 0612 Monitor Implementation of Enterprise Production/ Maintenance Quality Control Procedures	EIS PGO4 11 0612 Monitor and Implement Environmental Plans and Procedures	EIS PGO4 12 0612 Produce Maintenance Plans for Generation Production Plant

EIS PGO4 13 0612 Coordinate Local HV Networks	EIS PGO4 14 0612 Manage Critical Incidents	EIS PGO4 15 0612 Schedule Generation
EIS PGO4 16 0612 Plan Scheduled Outage	EIS PGO4 17 0612 Deliver and Review Training	EIS PGO4 18 0612 Coordinate Permit to Work System
EIS PGO4 19 0612 Interpret and Analyze Multi-Operation Protection Devices	EIS PGO4 20 0612 Manage System Re-start	EIS PGO4 21 0612 Coordinate Electrical Energy Production
EIS PGO4 22 0612 Perform Cost Estimations	EIS PGO4 23 0612 Control Permit to Work Operations	EIS PGO4 24 0612 Operate and Monitor Dual Fuel Firing Plant
EIS PGO4 25 0612 Coordinate the Network/System	EIS PGO4 26 0612 Interpret and Analyze LV and Mechanical Protection Devices	EIS PGO4 27 0612 Develop HV Switching Programs
EIS PGO4 28 0612 Operate and Monitor System Equipment	EIS PGO4 29 0612 Control Hydro Generation / Pumping	EIS PGO4 30 0612 Write Programs for Control Systems
EIS PGO4 31 0612 Conduct Technical Inspection of Process Plant and Equipment	EIS PGO4 32 0612 Coordinate Team Activities	EIS PGO4 33 0612 Plan and Organize Work
EIS PGO4 34 0612 Establish Quality Standards	EIS PGO4 35 0612 Migrate to New Technology	EIS PGO4 36 0612 Develop Individuals and Team
EIS PGO4 37 0612 Utilize Specialized Communication Skills	EIS PGO4 38 0612 Manage and Maintain Small/Medium Business Operation	EIS PGO4 39 1012 Manage Continuous Improvement System

NTQF Level III

Occupational Standard: Power Generation Operation Level III	
Unit Title	**Conduct Single Energy Source Isolation Procedures for Permit to Work**
Unit Code	**EIS PGO3 01 0612**
Unit Descriptor	This unit deals with the skills and knowledge required to apply single energy source isolation procedures of the permit to work procedures at the isolating level. Job requirements including permits are coordinated with other personnel involved in, or affected by, the isolation in accordance with enterprise/site requirements.

Elements	Performance Criteria
1. Plan and prepare for isolation, de-isolation and restoration	1.1 Work requirements are identified from request/work orders or equivalent and clarified/confirmed with the appropriate parties or by site inspection 1.2 Safety issues are identified to comply with statutory, enterprise and site requirements 1.3 Materials, equipment and resources required to satisfy the job plan are identified, requisitioned, obtained and inspected for compliance with job specifications 1.4 Work is planned in detail with the responsible issuing officer, including sequencing and prioritizing of work, and the maintenance of plant security and capacity in accordance with permit/site requirements 1.5 Job requirements including permits are coordinated with ***other personnel involved*** in, or affected by, the isolation in accordance with enterprise/site requirements 1.6 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. Perform isolation	2.1 Plant to be isolated is correctly identified 2.2 Isolation is performed in accordance with enterprise/site ***permit*** to work procedures 2.3 Isolations are confirmed with others involved in, or affected by, the work in accordance with enterprise/site procedures
3. Perform de-isolation and restoration	3.1 De-isolation and restoration of plant is performed in accordance with permit to work procedures 3.2 De-isolations are confirmed with others involved in, or affected by, the work in accordance with enterprise/site procedures 3.3 ***Work completion details*** are finalized in accordance with enterprise/site procedures

Variable	Range
Other personnel involved	May include but not limited to: • Issuing officer, isolating officers, recipient in charge and testing officer or their equivalent.
Permits	May include but not limited to: • Any documentation/forms approved for use by the enterprise safety rules and permit to work procedures.
Work completion details	May include but not limited to: • log books, computer input

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • Knowledge and application of relevant sections of: Occupational Health and Safety legislation; Statutory legislation; Enterprise/site safety procedures; Enterprise/site emergency procedures • Dealing with an unplanned event by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the underpinning knowledge and skills
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Relevant Occupational Health and Safety regulations • Relevant statutory legislation • Relevant enterprise/site safety procedures • Enterprise/site emergency procedures and techniques • Environmental legislation • Plant status • Relevant plant and equipment its location and operating parameters; • Enterprise recording procedures • Isolating procedures • Communication principles and procedures • Computers and software • Introduction to power production plant • Typical arrangement of power production plant • Thermodynamics • Properties of matter • Power plant cycle • General responsibilities for power production plant operations • Electrical principles • Transformers • Switchgear • Electrical protection • Schematic diagrams • Auxiliary supply systems

	• High voltage systems • High voltage switching procedures • Safe operating principles
Underpinning Skills	Demonstrates skills to: • Apply relevant Occupational Health and Safety regulations • Apply relevant statutory legislation • Apply relevant enterprise/site safety procedures • Apply enterprise/site emergency procedures and techniques • Apply enterprise recording procedures • Locate and/or identify relevant plant and equipment • Operate plant within design parameters • Identify plant status • Prepare plant/equipment for operation • Communicate effectively • Apply isolating procedures • Plan and prioritize work • Use drawings, diagrams and symbols • Apply data analysis techniques and tools.
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 Operation Level III	
Unit Title	**Operate and Monitor Air Conditioning Equipment and Ventilation System**
Unit Code	**EIS PGO3 02 0612**
Unit Descriptor	This unit deals with the skills and knowledge required to diagnose and repair faults in air conditioning equipment / ventilation systems, and associated accessories and wiring systems.

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 the on-the-job training
2. Verify the fault	2.1 Normal performance and function of the equipment is ascertained by consulting appropriate reference sources

	in accordance with the work plan 2.2 ***Fault indicators*** and appropriate technical information/diagnostic techniques are used to verify reported symptoms/faults in accordance with the work plan 2.3 Symptoms are reproduced and monitored if possible, whilst due regard for personnel safety and plant security is observed in accordance with the work plan
3. Find the fault	3.1 Required ***isolations*** are confirmed where appropriate in accordance with site requirements 3.2 Fault finding is carried out in conjunction with others involved in, or affected by, the work in accordance with enterprise/job requirements 3.3 ***Equipment*** components, wires, cables, terminations and support fixings are inspected for obvious faults in accordance with the work plan 3.4 All appropriate ***fault finding/diagnostic techniques*** are identified, selected and used to determine the fault in accordance with the work plan 3.5 All appropriate ***components*** are disconnected to enable accurate test measurements of suspected faulty components without the concern of "back-feed" readings in accordance with the work plan 3.6 ***Test and measurement instruments*** are used in accordance with manufacturer instructions and job requirements
4. Determine cause of fault	4.1 All appropriate personnel are consulted in order to obtain as many details relating to the faulty equipment as possible in accordance with the work plan 4.2 Appropriate use is made of any information from fault indicators and maintenance records in accordance with the work plan 4.3 Valid conclusions about the nature and cause of the fault are reached from analysis of available evidence in accordance with the work plan
5. Repair or rectify the fault	5.1 Required isolations are confirmed where appropriate in accordance with site requirements 5.2 Appropriate repair procedures are undertaken in conjunction with others involved in, or affected by, the work in accordance with the work plan 5.3 Faulty, worn, damaged or unsecured components are replaced, repaired or secured in accordance with the work plan 5.4 Parts and components are selected and replaced as

	required in accordance with appropriate specifications and the work plan 5.5 Components disconnected for testing are reconnected having been proven free of faults and all terminations are then checked to ensure they are electrically and mechanically sound in accordance with the work plan 5.6 All faults are repaired or rectified in accordance with the work plan 5.7 Final job inspection is performed and permits are relinquished as required in accordance with the work plan
6. Complete the work	6.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements 6.2 ***Work area*** is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures 6.3 Plant, tools and equipment are maintained and stored in accordance with site/enterprise procedures 6.4 ***Work completion details*** are finalised in accordance with site/enterprise procedures

Variable	**Range**
Equipment	May include but not limited to: • Air conditioning (refrigerated and evaporative), water coolers, packaged air conditioners and refrigerators.
Materials	May include but not limited to: • Solvents, insulation tape, contact cleaners, heat shrink, vacuum pumps, gas recovery units and gas bottles.
Components	May include but not limited to: • Fuses/circuit breakers, overloads, indicator lamps, plugs, residual current devices, earth leakage circuit breakers and light emitting/power diodes.
Test and measurement instruments	May include but not limited to: • Manifold gauges, thermometers, insulation testers, voltmeters, ammeters and refrigerant detectors.
Fault finding and diagnostic techniques	May include but not limited to: • Linear approach, half split rule, sensory detection and insulation/continuity tests.
Tests and operational checks	May include but not limited to: • May include correct air circulation, drainage, vibration, correct temperature, noise, pressure checks and leak detection.
Isolations	• Can refer to electrical/mechanical or other associated processes.
Work site environment	May include but not limited to: • Affected by nearby plant or processes, e.g. heat, noise, dust, oil, water and chemical.

Work completion details	May include but not limited to: • Plant and maintenance records, job cards, check sheets and on device labeling updates. Work may be performed with equipment on line.

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • Knowledge and application of relevant sections of: Occupational Health and Safety legislation; • Statutory legislation; Enterprise/site safety procedures; Enterprise/site emergency procedures • Preparation and planning of work • Verification techniques • Diagnostic and fault finding techniques and procedures • Repair techniques and procedures • Dealing with an unplanned event by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Occupational health and safety standards • Relevant statutory requirements and codes of practice • Relevant Ethiopian standards • Equipment and material required to perform the work • Isolation procedures • Layout of plant/work site and operation of its equipment • Fault finding and diagnostic techniques • Repair techniques • Air conditioning and refrigeration equipment • Environmental legislation • Regulatory procedures • Electrical principles • Test and measurement instruments • Circuit plan appreciation • Engineering and workshop practice • Communication principles • Refrigerant gases
Underpinning Skills	Demonstrates skills to: • Apply occupational health and safety standards • Follow relevant statutory regulations and codes of practice • Apply relevant Ethiopian standards • Use plans, drawings and texts • Use test and measurement instruments • Use fault finding and diagnostic techniques • Determine the cause of faults • Repair faults • Recover refrigerant gases

	• Select materials for the job • Apply regulatory procedures • Apply electrical principles • Communicate effectively • Apply data analysis techniques and tools.
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 Operation Level III	
Unit Title	**Operate and Monitor Fuel Supply**
Unit Code	**EIS PGO3 03 0612**
Unit Descriptor	This unit deals with the skills and knowledge required to operate, inspect and monitor fuel supply from source to recipient unit storage.

Elements	Performance Criteria
1. Plan and prepare	1.1 ***Safety issues*** are identified to comply with enterprise and site requirements 1.2 Work requirements are identified from relevant personnel and documentation 1.3 ***Documentation*** to determine plant status is assessed and evaluated 1.4 Localized plant inspection and field preparation for service are carried out in accordance with manufacturer and enterprise procedures 1.5 ***Plant*** operational prerequisites are established in accordance with manufacturer and enterprise procedures 1.6 Sequence for re-commissioning of plant is determined to suit existing circumstances in accordance with enterprise requirements 1.7 Where appropriate, the teams and individuals roles and responsibilities within the team are identified and, where required, assist in the provision of the on-the-job training
2. Operate fuel plant	2.1 Plant is operated in accordance with enterprise/site and manufacturer operating procedures 2.2 Plant is monitored and observed to detect deviations from normal operating conditions 2.3 Corrective actions are taken to rectify abnormalities in accordance with manufacturer and enterprise procedures
3. Test plant operation	3.1 ***Tests*** are performed in accordance with defined procedures applicable to the operational test 3.2 Plant is observed for correct operational response 3.3 Corrective action is taken when response is not in accordance with documentation, plant integrity or personnel safety requirements 3.4 Plant is returned to required operational status upon completion of test
4. Analyze plant faults	4.1 Causes of ***abnormal plant operating conditions*** are identified by analyzing the ***technical and operational***

	information in a logical and sequential manner 4.2 Corrective action taken is in accordance with enterprise procedures 4.3 Plant integrity and personnel safety are maintained through consultation with appropriate personnel, and with reference to plant, technical and operational documentation
5. Monitor and inspect plant	5.1 Plant to be monitored/inspected is physically identified 5.2 Plant is monitored/inspected for normal operation or to detect deviations 5.3 Corrective action taken is in accordance with enterprise procedures 5.4 ***Appropriate personnel*** are notified when defects are detected 5.5 Documentation is updated and plant problems, movements, abnormalities and status are reported and logged in accordance with enterprise/site procedures

Variable	**Range**
Safety standards	May include but not limited to: • Relevant sections of Occupational Health and Safety legislation, enterprise safety rules, relevant state and federal legislation, national standards for plant and environmental legislation.
Systems, plant and/or equipment	May include but not limited to: • electrical supply switchboard; supervisory, alarm, protection and control equipment; gas supply; gas delivery; fire protection systems; compressors and pumps; electric motors; valves, actuators and dampers (electric, hydraulic, pneumatic and manual); filters and strainers heaters (electrical/steam), oil recirculation systems, attemporators and gas or oil storage systems or biomas systems.
Information and documentation sources	May include but not limited to: • verbal or written communications; enterprise/site safety rules; equipment and alarm manuals; dedicated computer equipment; enterprise/site standing and operating instructions; enterprise/site log books; manufacturer operation and maintenance manuals; and specialist's reports.
Technical and operational indicators	May include but not limited to: • Stimuli (audio, smell, touch, visual), local indicators and recorders, alarms (visible and or audible) and basic fault finding equipment.
Communications	May include but not limited to: • Telephone, two way radio, pager public address system, computer (electronic mail) and operating log (written or verbal).