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## Overview

This standard identifies the competences you need to carry out fault diagnosis on engineering plant and equipment, in accordance with approved procedures. You will be required to diagnose faults on engineering plant and equipment such as engines and other rotating equipment, mechanical equipment, production machinery, process equipment, electrical and electronic equipment, fluid power, environmental and control equipment and other relevant engineering systems and equipment, at sub-assembly/component level. You will be expected to use a variety of fault diagnostic methods and techniques, and to utilise a wide range of diagnostic aids and equipment. From the evidence gained, you will be expected to identify the fault and its probable cause, and to suggest appropriate action to remedy the problem.

Your responsibilities will require you to comply with organisational policy and procedures for the fault diagnostic activities undertaken, and to report any problems with these activities, or with the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work and will provide an informed approach to applying fault diagnostic techniques and procedures to engineering plant and equipment. You will understand the various fault diagnostic methods and techniques used, and their application. You will know how to apply and interpret information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities and identifying faults or conditions that are outside the required specification.

You will understand the safety precautions required when carrying out the fault diagnostic activities, especially those for isolating the equipment. You will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace and will be required to demonstrate safe working practices throughout.

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## Performance criteria

*You must be able to:*

1. investigate and establish the most likely causes of the faults
2. select, use and apply diagnostic techniques, tools and aids to locate faults
3. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
4. determine the implications of the fault for other work and for safety considerations
5. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
6. record details on the extent and location of the faults in an appropriate format

## Knowledge and understanding

### *You need to know and understand:*

1. the health and safety requirements of the area in which you are carrying out the fault diagnosis activities, and the responsibility these requirements place on you
2. the specific safety precautions to be taken when carrying out the fault diagnosis on the relevant engineering plant and equipment
3. the isolation and lock-off procedures or permit-to-work procedure that applies
4. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the fault diagnostic activities; the type of safety equipment to be used, and where to obtain it
5. hazards associated with carrying out fault diagnosis on engineering plant and equipment (such as handling fluids, stored pressure/force, electrical contact, process controller interface, using faulty or damaged tools and equipment, using practices and procedures that do not follow laid-down procedures), and how to minimise them
6. where to obtain, and how to interpret drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed for the fault diagnostic activities
7. how the engineering plant or equipment functions, and the working purpose of the various integrated systems
8. the various fault-finding techniques that can be used, and how they are applied (such as half-split, input/output, emergent problem sequence, six-point technique, functional testing, unit substitution, injection and sampling techniques, and equipment self-diagnostics)
9. how to evaluate the various types of information available for fault diagnosis (such as operator reports, monitoring equipment, sensory inputs, machinery history records, and condition of the product)
10. how to evaluate sensory information from sight, sound, smell, touch
11. the procedures to be followed to investigate faults, and how to deal with intermittent conditions
12. how to use the various aids and reports available for fault diagnosis
13. the types of equipment that can be used to aid fault diagnosis (such as mechanical measuring instruments, electrical measuring instruments, test rigs, and pressure and flow devices), and how to check the equipment is calibrated or

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configured correctly for the intended use, and that it is free from damage and defects

14. the application of specific fault-finding methods and techniques that are best suited to the problem

15. how to analyse and evaluate possible characteristics and causes of specific faults/problems

16. how to make use of previous reports/records of similar fault conditions

17. how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on the overall process

18. how to prepare a report which complies with the organisational policy on fault diagnosis

19. the extent of your own authority, and whom you should report to if you have problems that you cannot resolve

## Scope/range

1.

Carry out all of the following during the fault diagnostic activities:

- 1.1 plan the fault diagnostic activities prior to beginning the work
- 1.2 use the correct issue of company and/or manufacturers' drawings and maintenance documentation
- 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
- 1.4 ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
- 1.5 provide safe access and working arrangements for the maintenance area
- 1.6 carry out the fault diagnostic activities, using approved procedures
- 1.7 collect equipment fault diagnostic evidence from live and isolated systems
- 1.8 disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
- 1.9 identify the fault, and determine appropriate corrective action
- 1.10 dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition

2.

Carry out fault diagnosis on two of the following types of engineering plant or equipment:

- 2.1 engines (such as piston or turbine)
- 2.2 rotating or reciprocating machinery (such as pumps, compressors)
- 2.3 mechanical equipment (such as cyclic and rotational devices, gearboxes, drives and linkages)
- 2.4 production machinery (such as machine tools, presses, transfer mechanisms)
- 2.5 process equipment (such as furnaces, chemical treatment equipment)
- 2.6 rotating electrical machinery (such as generators, motors)
- 2.7 stationary electrical equipment (such as transformers, switchgear)
- 2.8 stationary plant and equipment (such as air receivers, accumulators, tanks, piping)
- 2.9 emergency standby or alarm/warning systems and equipment
- 2.10 fluid power equipment (such as air receivers, pipework, valves, cylinders and actuators and pumps)
- 2.11 instrumentation and control equipment (such as temperature, pressure, level, flow, weight, speed)
- 2.12 process controller (such as program controller, robots, input/output interfacing, wiring/cabling, monitoring sensors)
- 2.13 electrical equipment (such as power supplies, switch gear and distribution panels, control systems)
- 2.14 electronic equipment (such as control units, visual display or indicating devices)

2.15 environmental systems (such as air conditioning, heating and ventilation, fume extraction)

3.

Collect information about the fault from four of the following sources:

- 3.1 the person or operator who reported the fault
- 3.2 monitoring equipment or gauges
- 3.3 recording devices
- 3.4 sensory (such as sight, sound, smell, touch)
- 3.5 plant or machinery records/history
- 3.6 condition of the product

4.

Use a range of fault diagnostic techniques, to include:

- 4.1 half-split technique

Plus one more from the following:

- 2. emergent problem sequence
- 3. functional testing
- 4. input/output
- 5. six-point technique
- 6. injection and sampling
- 7. unit substitution

1.

Use a variety of diagnostic aids and equipment, to include two of the following:

- 1.1 manufacturer's manual
- 1.2 logic diagrams
- 1.3 algorithms
- 1.4 flow charts
- 1.5 probability charts/reports
- 1.6 fault analysis charts (such as fault trees)
- 1.7 equipment self-diagnostics
- 1.8 troubleshooting guides
- 1.9 circuit diagrams/specifications

2.

Use two of the following types of test equipment to help in the fault diagnosis:

- 2.1 mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
- 2.2 electrical/electronic measuring instruments (such as multimeters, logic probes)
- 2.3 fluid power test equipment (such as test rigs, flow meters, pressure gauges)

3.

Find faults that have resulted in two of the following breakdown categories:

- 3.1 intermittent problem

3.2 partial failure or reduced performance/out of specification product

3.3 complete breakdown

4.

Carry out both of the following on completion of the fault diagnostic activities:

4.1 validation and evaluation of the fault diagnostic systems and procedures used

4.2 identification of improvements that could be made to the fault diagnostic systems and procedures

5.

Record details of the outcome of the fault diagnosis, using one of the following:

5.1 step-by-step analytical report

5.2 preventative maintenance log/report

5.3 corrective action report

5.4 company-specific reporting procedure

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Carrying out fault diagnosis on engineering plant and equipment



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