

## Overview

This standard identifies the competences you need to carry out fault diagnosis on services, and service equipment and systems, in accordance with approved procedures. You will be required to diagnose faults on a range of service equipment and systems, such as fresh and foul water, environmental control, emergency power generation, heating and ventilation, gas distribution including medical gas pipelines, process control, instrumentation control, refrigeration, and medical decontamination at sub-assembly and/or component level, as applicable to the equipment. You will be expected to use a variety of fault diagnostic methods and techniques, and to utilise a number of diagnostic aids and equipment. From the information 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 that are outside your permitted authority, to the relevant people. You will be expected to work with minimal 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 procedures to services equipment and systems. 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 for 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 be required to demonstrate safe working practices throughout and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

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## Performance criteria

*You must be able to:*

1. work safely at all times, complying with health and safety legislation and other relevant regulations, directives and guidelines
2. review and use all relevant information on the symptoms and problems associated with the products or assets
3. investigate and establish the most likely causes of the faults
4. select, use and apply diagnostic techniques, tools and aids to locate faults
5. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
6. determine the implications of the fault for other work and for safety considerations
7. use the information gained to draw valid conclusions about the nature and probable cause of the fault
8. complete and store all relevant documentation of the fault diagnosis in accordance with organisational requirements
9. dispose of waste materials in accordance with safe working practices and approved procedures and leave the work area in a safe condition

## 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 diagnostic activities, and the responsibility these requirements place on you
2. the specific safety precautions to be taken when carrying out the fault diagnosis of the particular service system
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 diagnosis process, the type of equipment to be used, and where to obtain it
5. hazards associated with carrying out fault diagnosis on service equipment and systems (such as handling fluids, stored pressure/force, electrical contact, process controller interface, using faulty or damaged tools and equipment, using practices that do not follow laid-down procedures), and how to minimise them and reduce any risks
6. what constitutes a hazardous voltage and how to recognise victims of electric shock
7. how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
8. where to obtain, and how to interpret, drawings, service and circuit diagrams, specifications, manufacturers' manuals and other documents needed in the fault diagnostic activities
9. the basic principles of how the system functions, and the working purpose of the various units within it
10. 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, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)
11. 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 end product)
12. how to evaluate sensory information (such as sight, sound, smell, touch)
13. the procedures to be followed to investigate faults, and how to deal with intermittent conditions

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14. how to use the various aids and reports available for fault diagnosis
15. the 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 that it is calibrated or configured correctly for the intended use, and that it is free from damage and defects
16. the application of specific fault finding methods and techniques best suited to the problem
17. how to analyse and evaluate possible characteristics and causes of specific faults/problems
18. how to relate previous reports/records of similar fault conditions
19. 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
20. how to prepare a report which complies with the organisational policy on fault diagnosis
21. the extent of your own responsibility and to whom you should report 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 diagnosis so as to minimise disruption to normal working
- 1.2 obtain and use the correct issue of organisational 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 and procedures to realise a safe system of work
- 1.4 ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
- 1.5 provide and maintain 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 information 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 materials in accordance with safe working practices and approved procedures and leave the work area in a safe condition

2.

Carry out fault diagnosis on two of the following types of services equipment, to sub-assembly or component level, as applicable:

- 2.1 fresh water
- 2.2 emergency power generation
- 2.3 process control
- 2.4 foul water
- 2.5 gas distribution
- 2.6 medical gas pipelines
- 2.7 compressed air
- 2.8 instrumentation and control
- 2.9 decontamination equipment (such as medical)
- 2.10 refrigeration
- 2.11 heating and ventilating
- 2.12 environmental control
- 2.13 air conditioning and ventilating

3.

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

- 3.1 the person or operator who reported the fault
- 3.2 sensory input (such as sight, sound, smell, touch)
- 3.3 monitoring equipment or gauges

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- 3.4 plant or machinery records/history
- 3.5 recording devices
- 3.6 condition of the end product

4.

Use a range of fault diagnostic techniques, to include two of the following:

- 4.1 half-split technique
- 4.2 emergent problem sequence
- 4.3 function/performance testing
- 4.4 input/output technique
- 4.5 six point technique
- 4.6 injection and sampling
- 4.7 unit substitution
- 4.8 equipment self diagnostics

5.

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

- 5.1 manufacturer's manual
- 5.2 logic diagrams
- 5.3 algorithms
- 5.4 flow charts
- 5.5 probability charts/reports
- 5.6 fault analysis charts (such as fault trees)
- 5.7 equipment self-diagnostics
- 5.8 troubleshooting guides
- 5.9 circuit diagrams/specifications
- 5.10 performance charts/readings

6.

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

- 6.1 mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
- 6.2 electrical/electronic measuring instruments (such as multimeters, logic probes, temperature meters)
- 6.3 fluid power test equipment (such as test rigs, flow meters, pressure gauges)

7.

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

- 7.1 intermittent problem
- 7.2 partial failure or reduced performance/out-of-specification product
- 7.3 complete breakdown

8.

Complete and store all relevant documentation of the fault diagnosis in accordance with organisational requirements, using one of the following:

- 8.1 step-by-step analytical report
- 8.2 preventative maintenance log/report
- 8.3 corrective action report
- 8.4 organisational-specific reporting procedure

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8.5 electronic reports

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