
Overview

This standard identifies the competences you need to carry out efficient and effective fault diagnosis on electronic equipment/circuits, in accordance with approved procedures. You will be required to diagnose faults on a range of electronic equipment, such as power supply systems, motor control systems, sensors and actuators, digital circuits and systems, analogue circuits and systems, and hybrid circuits and systems, both at assembly and component level. You will be expected to use a variety of fault diagnosis methods and techniques, and to utilise a number 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 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 produce.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying fault diagnosis procedures on electronic equipment and circuits. You will understand the various fault diagnosis methods and techniques used, and their application. You will also know how to interpret and apply 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 diagnosis activities, especially those for isolating the equipment. You will also understand your responsibilities for safety and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety 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 evidence gained to draw valid conclusions about the nature and probable cause of the fault
8. 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 the fault diagnosis activity is to take place, and the responsibility these requirements place on you
2. the isolation and lock-off procedure or permit-to-work procedure that applies
3. what constitutes a hazardous voltage and how to recognise victims of electric shock
4. how to reduce the risks of a phase to earth shock (such as insulated tools, rubber mating and isolating transformers)
5. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the fault diagnosis activities
6. hazards associated with carrying out fault diagnosis on electronic equipment (such as mains electricity, stored capacitive/inductive/electrostatic energy, misuse of tools), and how to minimise these and reduce any risks
7. the procedure to be adopted to establish the background of the fault
8. how to evaluate the various types of information available for fault diagnosis
9. how to use the various aids and reports available for fault diagnosis
10. how to use various types of fault diagnostic equipment needed to investigate the problem
11. digital circuits and their operation (including logic truth tables and Boolean algebra for AND, OR, NAND, NOR, NOT and EXCLUSIVE-OR gates)
12. the various fault finding techniques that can be used, and how they are applied (such as half-split, input-to-output, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques, and equipment self-diagnostics)
13. how to evaluate sensory conditions (by sight, sound, smell, touch)
14. how to analyse evidence and evaluate possible characteristics and causes of specific faults/problems
15. how to relate previous reports/records of similar fault conditions
16. the care, handling and application of electronic test instruments (such as multimeters, logic probes, oscilloscopes, signal tracers, signal generators)
17. how to calibrate electronic test instruments and check that they are free from damage and defects
18. the precautions (such as use of wrist straps, special packaging and handling areas) to be taken to prevent electrostatic discharge (ESD) damage to electronic circuits and components
19. how to obtain and interpret drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance

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- reports, graphical electronic/electrical symbols, wiring regulations, and other documents needed in the fault diagnosis activities
20. the basic principles of how the circuit functions, its operating sequence, the function/purpose of individual units/components, and how they interact
 21. the different types of cabling (such as multicore, single core, ribbon, screened cables), fittings/connectors (including insulation displacement), and their application
 22. the different types of control systems and components, and their operation
 23. the functions of different types of electronic components (analogue and digital), and their operation
 24. how to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall system or process
 25. how to prepare and produce a risk analysis report, where appropriate
 26. how to prepare a report, or take follow-up action, on conclusion of the fault diagnosis, in accordance with company policy
 27. the extent of your own authority and to whom you should report if you have problems that you cannot resolve

Scope/range related to performance criteria

1. Carry out **all** of the following during the fault diagnostic activity:
 1. plan the fault diagnosis using available information about the fault
 2. obtain and use the correct issue of company and/or manufacturers' drawings and maintenance documentation
 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
 4. ensure the safe isolation of equipment
 5. provide and maintain safe access and working arrangements for the fault finding/maintenance area
 6. use grounded wrist straps and other electrostatic discharge (ESD) precautions, as appropriate
 7. carry out the fault diagnostic activities using appropriate procedures
 8. collect equipment fault diagnostic evidence from 'live' and isolated circuits
 9. disconnect or isolate components, or parts of circuits when appropriate, to confirm the diagnosis
 10. identify the fault and determine the appropriate corrective action
 11. 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 **four** of the following types of equipment:
 1. power supply systems (such as switched mode, series regulation, shunt regulation)
 2. motor control systems (such as closed-loop servo/proportional, inverter control)
 3. sensors and actuators (such as linear, rotational, temperature, level, photo-optic, pressure, flow)
 4. digital circuits and systems (such as programmable controller, microprocessor, ROM/RAM, logic gates)
 5. analogue circuits and systems (such as frequency modulation/demodulation, amplifiers, filters, oscillators)
 6. hybrid circuits and systems (such as analogue to digital convertors (ADC), d-to-a convertors (DAC))
3. Collect fault diagnosis evidence from **four** of the following sources:
 1. the person or operator who reported the fault
 2. equipment self-diagnosis
 3. test instrument measurements (such as multimeter, oscilloscope, logic probe, signal tracer, signal generator)

4. recording devices
5. sensory input (sight, sound, smell, touch)
6. plant/equipment records
7. circuit meters (such as voltmeter, power factor meter, ammeter)
8. equipment outputs
4. Use a range of fault diagnostic techniques to include **two** of the following:
 1. half-split technique
 2. input/output technique
 3. injection and sampling
 4. six point technique
 5. emergent sequence
 6. unit substitution
 7. function/performance testing
 8. equipment self-diagnostics
5. Use a variety of diagnostic aids, to include **two** of the following:
 1. logic diagrams
 2. fault analysis charts (such as fault trees)
 3. flow charts or algorithms
 4. manufacturers' manuals
 5. probability charts/reports
 6. troubleshooting guides
 7. computer-aided test equipment
 8. electronic aids
6. Use **all** of the following fault diagnostic procedures:
 1. inspection (such as breakages, wear/deterioration, signs of overheating, missing parts, loose fittings)
 2. operation (such as manual switching off and on, automatic switching/timing/sequencing, outputs)
 3. measurement (such as voltage, current, continuity, logic state, noise, frequency, signal shape and level)
7. Use **four** of the following types of test equipment to aid fault diagnosis:
 1. oscilloscope
 2. multimeter
 3. logic probe
 4. signal tracer
 5. signal generator
 6. other specific test equipment
8. Find faults that have resulted in **two** of the following breakdown categories:
 1. intermittent action or circuit failure
 2. partial failure or reduced performance
 3. complete breakdown
9. Provide a record of the outcome of the fault diagnosis, using **one** of the following:
 1. step-by-step analytical report

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2. preventative maintenance log/report
 3. corrective action report
 4. company-specific reporting procedure

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Carrying out fault diagnosis on electronic equipment and circuits
LEGACY



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