

# SEMEM3-23

## J1HD 04 -Carrying out fault diagnosis on engineered systems



### Overview

This unit identifies the competences you need to carry out fault diagnosis on engineered systems, in accordance with approved procedures. You will be required to diagnose faults on an engineered system involving two or more of the following interactive technologies: mechanical, electrical, fluid power or process controller, at sub-assembly/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 carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying fault diagnosis procedures within an integrated system. You will understand the various fault diagnosis 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 know about the interaction of the other associated integrated technologies, and will have sufficient knowledge to carry out effective fault diagnosis of the Integrated system.

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

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#### Performance criteria

*You must be able to:*

- P1 work safely at all times, complying with health and safety and other relevant regulations and guidelines
- P2 review and use all relevant information on the symptoms and problems associated with the products or assets
- P3 investigate and establish the most likely causes of the faults
- P4 select, use and apply diagnostic techniques, tools and aids to locate faults
- P5 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
- P6 determine the implications of the fault for other work and for safety considerations
- P7 use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
- P8 record details on the extent and location of the faults in an appropriate format

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#### Knowledge and understanding

*You need to know and understand:*

- K1 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
- K2 the specific safety precautions to be taken when carrying out the fault diagnosis of the particular engineered system
- K3 the isolation and lock-off procedures or permit-to-work procedure that applies
- K4 the importance of wearing protective clothing and other appropriate safety equipment during the fault diagnosis activities, the type of safety equipment to be used and where to obtain it
- K5 hazards associated with carrying out fault diagnosis on engineered systems (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 these and reduce any risks
- K6 how to recognise and deal with victims of electric shock (to include methods of safely removing the victim from the power source, isolating the power source, and methods of first aid resuscitation)
- K7 where to obtain, and how to interpret, drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed for the fault diagnosis activities
- K8 the basic principles of how the system functions, and the working purpose of the various integrated systems
- K9 the various fault finding techniques that can be used, and how they are applied (such as half-split, input/output put, emergent problem sequence, six point technique, functional testing, unit substitution, injection and sampling techniques, and equipment self-diagnostics)
- K10 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)
- K11 how to evaluate sensory information from sight, sound, smell, touch
- K12 the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K13 how to use the various aids and reports available for fault diagnosis
- K14 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 configured correctly for the intended use, and that it is free from damage and defects
- K15 the application of specific fault finding methods and techniques that are best suited to the problem

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- K16 how to analyse and evaluate possible characteristics and causes of specific faults/problems
- K17 how to make use of previous reports/records of similar fault conditions
- K18 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
- K19 how to prepare a report which complies with the company policy on fault diagnosis
- K20 the extent of your own authority and to whom you should report if you have problems that you cannot resolve

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### Additional Information

#### Scope/range related to performance criteria

*You must be able to:*

1. carry out **all** of the following during the fault diagnostic activities:
  - 1.1 plan the fault diagnosis activities prior to beginning the work
  - 1.2 obtain and 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 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 diagnosis evidence from live and isolated systems
  - 1.8 disconnect or isolate components or parts of the system, when appropriate, to confirm diagnosis
  - 1.9 identify the fault and determine appropriate corrective action
  - 1.10 dispose of waste items in 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 interactive technologies, to sub-assembly or component level:
  - 2.1 mechanical
  - 2.2 electrical
  - 2.3 fluid power
  - 2.4 process controller
3. collect information about the fault from **four** of the following sources:
  - 3.1 the person or operator who reported the fault
  - 3.2 sensory (such as sight, sound, smell, touch)
  - 3.3 monitoring equipment or gauges
  - 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 functional/performance testing
  - 4.4 input/output
  - 4.5 six point technique
  - 4.6 injection and sampling
  - 4.7 unit substitution

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- 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
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)
  - 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. provide a record of the outcome of the fault diagnosis, 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 company-specific reporting procedure

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