

## Unit 355

# Carrying out fault diagnosis on engineering plant and equipment

<b>UAN:</b>	D/600/5798
<b>Level:</b>	3
<b>Credit value:</b>	50
<b>GLH:</b>	60
<b>Relationship to NOS:</b>	This unit has been derived from National Occupational Standard engineering technical support Unit No 55: carrying out fault diagnosis on engineering plant and equipment (Suite 3).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>This unit covers the skills and knowledge needed to prove the competences required to carry out fault diagnosis on engineering plant and equipment, in accordance with approved procedures. The learner 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. The learner 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 evidence gained, the learner will be expected to identify the fault and its probable cause, and to suggest appropriate action to remedy the problem.</p>

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal

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responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying fault diagnostic techniques and procedures to engineering plant and equipment. The learner will understand the various fault diagnostic methods and techniques used, and their application. The learner 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.

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

<b>Learning outcome</b>
The learner will: 1. carry out fault diagnosis on engineering plant and equipment
<b>Assessment criteria</b>
The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 review and use all relevant information on the symptoms and problems associated with the products or assets 1.3 collect information about the fault from four of the following sources: <ul style="list-style-type: none"><li>• the person or operator who reported the fault</li><li>• monitoring equipment or gauges</li><li>• recording devices</li><li>• sensory (such as sight, sound, smell, touch)</li><li>• plant or machinery records/history</li><li>• condition of the end product</li></ul> 1.4 Investigate and establish the most likely causes of the faults 1.5 select, use and apply diagnostic techniques, tools and aids to locate faults 1.6 use a range of fault diagnostic techniques, to include: <ul style="list-style-type: none"><li>• half-split technique</li><li>• plus one more from the following:</li></ul>

- emergent problem sequence
  - six point technique
  - functional testing
  - injection and sampling
  - input/output
  - unit substitution
- 1.7 use a variety of diagnostic aids and equipment, to include two of the following:
- manufacturer's manual
  - algorithms
  - probability charts/reports
  - equipment self diagnostics
  - circuit diagrams/specifications
  - logic diagrams
  - flow charts
  - fault analysis charts (such as fault trees)
  - troubleshooting guides
- 1.8 use two of the following types of test equipment to help in the fault diagnosis:
- mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
  - electrical/electronic measuring instruments (such as multimeters, logic probes)
  - fluid power test equipment (such as test rigs, flow meters, pressure gauges)
- 1.9 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
- 1.10 carry out all of the following during the fault diagnostic activities:
- plan the fault diagnostic activities prior to beginning the work
  - use the correct issue of company and/or manufacturers' drawings and maintenance documentation
  - adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - provide safe access and working arrangements for the maintenance area
  - carry out the fault diagnostic activities, using approved procedures
  - collect equipment fault diagnostic evidence from live and isolated systems
  - disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
  - identify the fault, and determine appropriate corrective action
  - dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition
- 1.11 carry out fault diagnosis on two of the following types of engineering plant or equipment:

- emergent problem sequence
  - six point technique
  - functional testing
  - injection and sampling
  - input/output
  - unit substitution
- 1.7 use a variety of diagnostic aids and equipment, to include two of the following:
- manufacturer's manual
  - algorithms
  - probability charts/reports
  - equipment self diagnostics
  - circuit diagrams/specifications
  - logic diagrams
  - flow charts
  - fault analysis charts (such as fault trees)
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- 1.9 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
- 1.10 carry out all of the following during the fault diagnostic activities:
- plan the fault diagnostic activities prior to beginning the work
  - use the correct issue of company and/or manufacturers' drawings and maintenance documentation
  - adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - provide safe access and working arrangements for the maintenance area
  - carry out the fault diagnostic activities, using approved procedures
  - collect equipment fault diagnostic evidence from live and isolated systems
  - disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
  - identify the fault, and determine appropriate corrective action
  - dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition
- 1.11 carry out fault diagnosis on two of the following types of engineering plant or equipment:

- engines (such as piston or turbine)
  - rotating or reciprocating machinery (such as pumps, compressors)
  - mechanical equipment (such as cyclic and rotational devices, gearboxes, drives and linkages)
  - production machinery (such as machine tools, presses, transfer mechanisms)
  - process equipment (such as furnaces, chemical treatment equipment)
  - rotating electrical machinery (such as generators, motors)
  - stationary electrical equipment (such as transformers, switchgear)
  - stationary plant and equipment (such as air receivers, accumulators, tanks, piping)
  - emergency standby or alarm/warning systems and equipment
  - fluid power equipment (such as air receivers, pipework, valves, cylinders and actuators and pumps)
  - instrumentation and control equipment (such as temperature, pressure, level, flow, weight, speed)
  - process controller (such as program controller, robots, input/output interfacing, wiring/cabling, monitoring sensors)
  - electrical equipment (such as power supplies, switch gear and distribution panels, control systems)
  - electronic equipment (such as control units, visual display or indicating devices)
  - environmental systems (such as air conditioning, heating and ventilation, fume extraction)
- 1.12 determine the implications of the fault for other work and for safety considerations
- 1.13 carry out both of the following on completion of the fault diagnostic activities:
- validation and evaluation of the fault diagnostic systems and procedures used
  - identification of improvements that could be made to the fault diagnostic systems and procedures
- 1.14 use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
- 1.15 find faults that have resulted in two of the following breakdown categories:
- intermittent problem
  - partial failure or reduced performance/out of specification product
  - complete breakdown
- 1.16 record details on the extent and location of the faults in an appropriate format
- 1.17 provide a record of the outcome of the fault diagnosis, using one of the following:
- step-by-step analytical report
  - preventative maintenance log/report
  - corrective action report

- company-specific reporting procedure.

**Learning outcome**

The learner will:

2. know how to carry out fault diagnosis on engineering plant and equipment

**Assessment criteria**

The learner can:

- 2.1 describe the health and safety requirements of the area in which they are carrying out the fault diagnosis activities, and the responsibility these requirements place on them
- 2.2 describe the specific safety precautions to be taken when carrying out the fault diagnosis on the particular engineering plant and equipment
- 2.3 describe the isolation and lock-off procedures or permit-to-work procedure that applies
- 2.4 describe the importance of wearing protective clothing and other appropriate safety equipment during the fault diagnostic activities; the type of safety equipment to be used, and where to obtain it
- 2.5 describe the 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
- 2.6 explain where to obtain, and how to interpret drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed for the fault diagnostic activities
- 2.7 explain how the engineering plant or equipment functions, and the working purpose of the various integrated systems
- 2.8 describe 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)
- 2.9 explain 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)
- 2.10 explain how to evaluate sensory information from sight, sound, smell, touch
- 2.11 describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- 2.12 explain how to use the various aids and reports available for fault diagnosis
- 2.13 describe 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
- 2.14 describe the application of specific fault finding methods and techniques that are best suited to the problem

- 2.15 explain how to analyse and evaluate possible characteristics and causes of specific faults/problems
- 2.16 explain how to make use of previous reports/records of similar fault conditions
- 2.17 explain 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
- 2.18 explain how to prepare a report which complies with the company policy on fault diagnosis
- 2.19 describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve.