

## Carrying out fault diagnosis on mechanical equipment

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### Overview

This standard identifies the competences you need to carry out efficient and effective fault diagnosis on mechanical equipment, in accordance with approved procedures. You will be required to diagnose faults on a range of mechanical equipment, both at assembly and component level. This will include equipment such as machine tools, gearboxes, processing plant, engines, pumps, process control valves, compressors, transfer equipment, lifting and handling equipment, mechanical structures and other company-specific equipment. 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 information gained, you will be expected to identify the fault and its probable cause, and to suggest 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 full 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 on mechanical equipment. You will understand the various fault diagnosis methods and techniques used, and their application. You will also 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 maintenance 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.

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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 equipment
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 outcome 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

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### 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 fault diagnosis of the specific piece of equipment
3. the isolation and lock-off procedure or permit-to-work procedure that applies
4. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the fault diagnosis activities, the type of safety equipment to be used and where to obtain it
5. hazards associated with carrying out fault diagnosis on mechanical equipment (such as moving machinery, handling oils and greases, stored pressure/force, misuse of tools, using practices or procedures that do not follow laid-down procedures), and how to minimise these and reduce any risks
6. 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) including the difference of AC and DC electrical shock and how this affects the victim
7. where to obtain, and how to interpret, drawings, specifications, manufacturers' manuals and other documents needed in the fault diagnosis process
8. the procedure to be adopted to establish the background of the fault
9. how to evaluate various types of information available for fault diagnosis (such as operator reports, monitoring equipment, sensory information, machinery history records and condition of end product)
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 use a range of fault diagnostic equipment to investigate the problem (such as measuring devices, torque and run-out devices)
12. how to use various items of test equipment, and how to calibrate it and check that it is free from damage and defects
13. how to evaluate sensory information (sight, sound, smell, touch)
14. the procedure(s) to be followed for investigating the faults, and how to deal with intermittent faults
15. how to analyse and evaluate possible characteristics and causes of specific faults/problems
16. how to relate 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 health and

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safety, and on the overall process or system

18. how to prepare a risk analysis report and take follow-up action which satisfies the organisational policy on concluding fault diagnosis
19. the extent of your own authority and to whom you should report if you have problems that you cannot resolve

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## Scope/range

1. Carry out all of the following during the fault diagnostic activity:
  1. plan the fault diagnosis prior to beginning the work
  2. obtain and use the correct issue of organisational and/or manufacturer's 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 including the electricity at work regulations
  4. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids) and safe release of stored energy
  5. provide and maintain safe access and working arrangements for the maintenance area
  6. carry out the fault diagnostic activities using approved procedures
  7. collect equipment fault diagnosis information from live and isolated systems
  8. disconnect or isolate components or parts of the system, when appropriate, to confirm diagnosis
  9. identify the fault and determine appropriate corrective action
  10. dispose of waste materials in accordance with safe working practices and approved procedures and leave work area in a safe condition
  
2. Carry out fault diagnosis on three of the following types of equipment:
  1. gearboxes
  2. process control valves
  3. machine tools
  4. compressors
  5. lifting and handling equipment
  6. workholding devices
  7. processing plant
  8. transfer equipment
  9. engines
  10. mechanical structures
  11. pumps
  12. company-specific equipment
  
3. Collect information regarding the fault from four of the following sources:
  1. person or operator who reported the fault

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2. sensory input (such as sight, sound, smell, touch)
  3. monitoring equipment or gauges
  4. plant/machinery records
  5. recording devices
  6. condition of end product
  7. electronic report
  8. equipment/machine self diagnostics
4. Use a range of fault diagnostic techniques, to include three of the following:
1. half-split technique
  2. emergent problem sequence
  3. unit substitution
  4. input/output
  5. function/performance testing
  6. six point technique
  7. injection and sampling
  8. equipment self diagnostics
5. Use a variety of diagnostic aids and equipment, to include two of the following:
1. manufacturer's manual
  2. physical layout diagrams
  3. algorithms
  4. flow charts
  5. probability charts/reports
  6. fault analysis charts (such as fault trees)
  7. equipment self diagnostics
  8. trouble shooting guides
  9. circuit diagrams/specifications
6. Apply two of the following monitoring or testing procedures to help in the fault diagnosis:
1. alignment checks
  2. force/pressure checks (such as spring pressure, hydraulic or pneumatic pressures)
  3. leakage
  4. vibration
  5. thermal checks (such as bearings, friction surfaces)
  6. movement checks (such as travel, clearance, levers and links)
7. Use two of the following types of test equipment to aid fault diagnosis:
1. measuring instruments/devices
  2. thermal indicators

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3. dial test indicators
  4. audio test devices
  5. torque measuring devices
  6. self-diagnostic equipment
  7. other specific test equipment
8. Find faults that have resulted in two of the following breakdown categories:
1. intermittent problem
  2. partial failure/ reduced performance/ out-of-specification output
  3. complete breakdowns
9. Complete and store all relevant documentation of the outcome of the fault diagnosis in accordance with organisational requirements, using one of the following:
1. step-by-step analytical report
  2. preventative maintenance log/report
  3. corrective action report
  4. company-specific reporting procedure
  5. electronic reports

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