SEMEM3-05
Carrying out fault diagnosis on mechanical equipment

Overview

This unit 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 evidence 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:

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 fault diagnosis of the specific piece of equipment
K3 the isolation and lock-off procedure or permit-to-work procedure that applies
K4 the importance of wearing protective clothing and other appropriate safety equipment during the fault diagnosis activities
K5 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
K6 where to obtain, and how to interpret, drawings, specifications, manufacturers' manuals and other documents needed in the fault diagnosis process
K7 the procedure to be adopted to establish the background of the fault
K8 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)
K9 the various fault finding techniques that can be used, and how they are applied (such as half-split, input/out put, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques, and equipment self diagnostics)
K10 how to use a range of fault diagnostic equipment to investigate the problem (such as measuring devices, torque and run-out devices)
K11 how to use various items of test equipment, and how to calibrate it and check that it is free from damage and defects
K12 how to evaluate sensory information (sight, sound, smell, touch)
K13 the procedure(s) to be followed for investigating the faults, and how to deal with intermittent faults
K14 how to analyse and evaluate possible characteristics and causes of specific faults/problems
K15 how to relate previous reports/records of similar fault conditions
K16 how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on health and safety, and on the overall process or system
K17 how to prepare and produce a risk analysis report (where appropriate)
K18 how to prepare a report and take follow-up action which satisfies the company policy on concluding fault diagnosis

K19 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 activity:
   - 1.1 plan the fault diagnosis prior to beginning the work
   - 1.2 obtain and use the correct issue of company and/or manufacturer's 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 identify the fault and determine appropriate corrective action
   - 1.8 dispose of waste items in a safe and environmentally acceptable manner, and leave work area in a safe condition
2. carry out fault diagnosis on **three** of the following types of equipment:
   - 2.1 gearboxes
   - 2.2 process control valves
   - 2.3 machine tools
   - 2.4 compressors
   - 2.5 lifting and handling equipment
   - 2.6 workholding devices
   - 2.7 processing plant
   - 2.8 transfer equipment
   - 2.9 engines
   - 2.10 mechanical structures
   - 2.11 pumps
   - 2.12 company-specific equipment
3. collect evidence regarding the fault from **four** of the following sources:
   - 3.1 person or operator who reported the fault
   - 3.2 sensory input (such as sight, sound, smell, touch)
   - 3.3 monitoring equipment or gauges
   - 3.4 plant/machinery records
   - 3.5 recording devices
   - 3.6 condition of end product
4. use a range of fault diagnostic techniques, to include **two** of the following:
   - 4.1 half-split technique
   - 4.2 emergent sequence
   - 4.3 unit substitution
   - 4.4 input/output

4.5 function/performance testing
4.6 six point technique
4.7 injection and sampling
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 physical layout 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 trouble shooting guides
6. apply **two** of the following monitoring or testing procedures to help in the fault diagnosis:
   6.1 alignment checks
   6.2 force/pressure checks (such as spring pressure, hydraulic or pneumatic pressures)
   6.3 leakage
   6.4 vibration
   6.5 thermal checks (such as bearings, friction surfaces)
   6.6 movement checks (such as travel, clearance, levers and links)
7. use **two** of the following types of test equipment to aid fault diagnosis:
   7.1 measuring instruments/devices
   7.2 thermal indicators
   7.3 dial test indicators
   7.4 audio test devices
   7.5 torque measuring devices
   7.6 self-diagnostic equipment
   7.7 other specific test equipment
8. find faults that have resulted in **two** of the following breakdown categories:
   8.1 intermittent problem
   8.2 partial failure/out-of-specification output
   8.3 complete breakdowns
9. provide a record of the outcome of fault diagnosis, using **one** of the following:
   9.1 step-by-step analytical report
   9.2 preventative maintenance log/report
   9.3 corrective action report
   9.4 company-specific reporting procedure

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