

Diagnosing faults on marine mechanical equipment

Overview

This standard identifies the competences you need to carry out efficient and effective fault diagnosis on marine mechanical equipment, in accordance with approved procedures. You will be required to diagnose faults on a range of marine mechanical equipment, both at assembly and component level. This will include equipment such as gear boxes, stabilisers, pumps, propeller shafts (including controllable pitch propeller systems), steering and rudder arrangements, aircraft lifts, ballast arrangements, engines, liquid oxygen equipment, weapons equipment, sewage treatment, reverse osmosis and low pressure steam plant and other specific marine 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 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 with the tools and equipment used, that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of 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 to marine 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 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 be required to demonstrate safe working practices throughout and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace, both ashore and afloat.

Diagnosing faults on marine mechanical equipment

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

Diagnosing faults on marine mechanical equipment

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 diagnostic activities and the responsibility they place on you
2. how to recognise and deal with emergencies and the procedures to be followed (such as methods of safely evacuating and closing down of compartments in the case of fire or other major incident, first aid, fire fighting and resuscitation of personnel)
3. the specific safety precautions to be taken when carrying out fault diagnosis of the specific piece of equipment
4. the isolation and lock-off procedure or permit-to-work procedure that applies
5. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during fault diagnosis
6. hazards associated with carrying out fault diagnosis on marine mechanical equipment (moving machinery, handling oils and greases, stored pressure/force, misuse of tools, using practices that do not follow laid-down procedures) and how they can be minimised
7. how to obtain and interpret drawings, specifications, manufacturers' manuals and other documents needed in the fault diagnostic process
8. the procedure to be adopted to establish evidence of the background of the fault
9. how to evaluate the various types of information available for fault diagnosis (such as user reports, monitoring equipment, sensory input, machinery history records)
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 various items 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 defect
13. how to evaluate sensory conditions by sight, sound, smell, touch
14. the procedure to be followed to investigate the faults and how to deal with intermittent conditions
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 that the fault could have on health

Diagnosing faults on marine mechanical equipment

- and safety and on the overall process
- 18. how to prepare and produce a risk analysis report (where appropriate)
- 19. how to prepare a report or take follow-up action which satisfies the company policy on concluding fault diagnosis
- 20. the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

Diagnosing faults on marine mechanical equipment

Scope/range related to performance criteria

1. Carry out all of the following during the fault diagnosis activity:

- 1.1 plan the fault diagnosis so as to minimise disruption to normal working
- 1.2 use the correct issue of vessel/system drawings and maintenance documentation
- 1.3 adhere to risk assessment, COSHH and other relevant safety standards
- 1.4 ensure that any stored energy or substances are released safely and correctly
- 1.5 ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
- 1.6 provide safe access and working arrangements for the maintenance area
- 1.7 carry out the fault diagnostic activities, using approved procedures
- 1.8 identify the fault, and determine appropriate corrective action
- 1.9 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 five of the following types of marine mechanical equipment:

- 2.1 reciprocating engines
- 2.2 gas turbine engines
- 2.3 low pressure steam plant
- 2.4 gearboxes
- 2.5 clutches and couplings
- 2.6 ballast arrangements
- 2.7 compressors (high or low pressure)
- 2.8 weapons hoists
- 2.9 weapons launchers
- 2.10 liquid oxygen equipment
- 2.11 stern seals, stabilisers and shock mounts
- 2.12 control valves (such as reducing and ported)
- 2.13 pumps (such as centrifugal and positive displacement)
- 2.14 steering and rudder arrangements
- 2.15 processing plant (such as sewage and reverse osmosis)
- 2.16 drive mechanisms (such as belts, chains, couplings, levers and linkages)
- 2.17 propeller shafts and drives (such as Z, V and inline, plumber blocks)
- 2.18 lifting and handling equipment (such as replenishment-at-sea rigs, aircraft lifts, davit, windlass' and capstans)
- 2.19 mechanical structures (such as cranes, gantries and travellers)
- 2.20 other specific marine mechanical equipment

3. Collect evidence regarding the fault from three of the following sources:

- 3.1 the person or operator who reported the fault
- 3.2 monitoring equipment or gauges
- 3.3 recording devices
- 3.4 sensory (such as sight, sound, smell, touch)
- 3.5 plant/machinery records
- 3.6 condition of end product

4. Use a range of fault diagnostic techniques, to include:

- 4.1 half-split technique

plus one more from the following:

Diagnosing faults on marine mechanical equipment

- 4.2 emergent sequence
 - 4.3 input/output
 - 4.4 six point
 - 4.5 unit substitution
 - 4.6 function/performance testing
 - 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 algorithms
 - 5.3 probability charts/reports
 - 5.4 equipment self-diagnostics
 - 5.5 physical layout diagrams
 - 5.6 flow charts
 - 5.7 fault analysis charts (such as fault trees)
 - 5.8 troubleshooting 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, operation of levers and linkages)
7. Use two of the following types of test equipment to aid fault diagnosis:
- 7.1 measuring instruments/devices
 - 7.2 dial test indicators
 - 7.3 torque measuring devices
 - 7.4 thermal indicators
 - 7.5 audio test 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
 - 9.5 vibration analysis data sheet
 - 9.6 other specific documentation

Behaviours

Behaviours:

You will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as:

- strong work ethic
- positive attitude
- team player
- dependability
- responsibility
- honesty
- integrity
- motivation
- commitment

Diagnosing faults on marine mechanical equipment

Developed by	Enginuity
Version Number	3
Date Approved	28 Feb 2019
Indicative Review Date	28 Feb 2021
Validity	Current
Status	Original
Originating Organisation	Semta
Original URN	SEMME3097
Relevant Occupations	Marine Engineering Trades
Suite	Marine Engineering Suite 3
Keywords	engineering; marine; mechanical; diagnose; faults; equipment; gearbox; stabilisers; pumps; propeller shaft; steering; rudders