
Overview

This standard identifies the competences you need to carry out efficient and effective fault diagnosis on communication - electronic systems, in accordance with approved procedures. You will be required to diagnose faults on a range of communication - electronic systems, sub-systems or assemblies at line replacement unit (LRU) 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 information 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 on communication - electronic systems. 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 and for taking the necessary safeguards to protect yourself against direct and indirect electric shock. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

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 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 information gained to draw valid conclusions about the nature and probable cause of the fault
8. complete and store all relevant documentation 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

Knowledge and understanding

You need to know and understand:

1. the health and safety requirements of the area in which the fault diagnosis activity is to take place, and the responsibility they place on you
2. the isolation and lock-off procedure or permit-to-work procedure that applies
3. what constitutes a hazardous voltage and how to recognise victims of electric shock
4. how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting, isolating transformers)
5. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the fault diagnostic process
6. hazards associated with carrying out fault diagnosis on communication - electronic systems (such as mains electricity, stored capacitive/inductive energy, misuse of tools), and how to minimise them and reduce any risks
7. the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards
8. the procedure to be adopted to establish background information of a fault
9. how to evaluate the various types of information available for fault diagnosis
10. how to use the various aids and reports available for fault diagnosis
11. how to use various items of fault diagnostic equipment to investigate the problem
12. the various fault-finding techniques that can be used, and how they are applied (such as half-split, input-to-output, emergent sequence, six point technique, function testing, unit substitution, injection and sampling techniques, equipment self diagnostics)
13. how to evaluate sensory conditions (sight, smell, sound or touch)
14. how to analyse information and evaluate possible characteristics and causes of specific faults or problems
15. how to relate previous reports/records of similar fault conditions
16. the care, handling and application of electronic test instruments (such as multimeters, logic probes, oscilloscopes,)
17. how to determine the calibration state of the equipment, and the actions to be taken if equipment is out of calibration
18. how to ensure that the equipment used is free from damage or defect
19. how to obtain and interpret drawings, circuit diagrams, physical layouts, charts, specification, manufacturers' manuals, history/maintenance reports, electronic/electrical symbols, other documentation needed in the maintenance process

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20. the principles of how communication - electronic or associated systems function and interact
 21. how sub-systems and assemblies function within the system
 22. the purpose of each LRU within a given system
 23. how to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process
 24. how to prepare and produce a risk analysis report, where appropriate
 25. how to complete the necessary paperwork or take follow-up action, which satisfies the organisational policy on concluding fault diagnosis
 26. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

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
 4. ensure the safe isolation of equipment
 5. provide and maintain safe access and working arrangements for the fault-finding/maintenance area
 6. carry out the fault diagnosis activities using appropriate procedures
 7. collect equipment fault diagnosis information from live and isolated circuits
 8. disconnect or isolate components or parts of circuits, 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 the work area in a safe condition
2. Carry out fault diagnosis on four communication - electronic systems, sub-systems or assemblies to LRU level, at least two of which must be selected from Group A:

Note Any of the items below can be identified as a system, sub-system or assembly in its own right.

Group A - communication electronics

1. transmitters (such as HF, VHF, UHF, microwave transmitters)
2. transceivers (such as HF, VHF, UHF, microwave)
3. receivers (such as HF, VHF, UHF, microwave receivers)
4. signal processing (analogue) (such as radar anti-clutter, comms audio and AGC stages)
5. signal processing (digital) (such as digital MTI, multiplexers, AGC)
6. aerial systems (such as phased arrays, long wire, and parabolic reflectors)
7. transmission lines (such as optical fibres, coaxial, baluns, twin wire, waveguide)
8. display systems (such as CRT, plasma, TFT, TV tab, LED)

9. man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
10. electro-optical systems (such as cameras, thermal imaging, targeting systems)
11. hydraulic-electrical systems (such as hydraulic motors, HSUs, and actuators)
12. cryptographic systems (such as data encryption and de-encryption)
13. built-in test equipment
14. data network systems (such as LANs, WANs)
15. data network interfaces (such as switch, router, bridging networks)
16. any other identifiable electronic system, sub-system or assemblies

Group B - associated equipment

17. environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
18. electromechanical systems (such as servos, motors, relays, complex switches)
19. power generation systems (such as fixed/transportable AC/DC generators, batteries)
20. power distribution systems (such as single phase/3-phase distribution panels)
21. power supply control systems (such as voltage/current series/shunt regulator/stabiliser)
22. hybrid systems (such as ADC, DAC)

3. Collect fault diagnosis information from four of the following sources:

1. person or operator who reported the fault
2. recording devices
3. test instrument measurements (such as wattmeters, multimeter, earth-loop impedance testers)
4. sensory (such as sight, sound, smell, touch)
5. plant/equipment records
6. circuit meters (such as voltmeter, power factor, ammeter)
7. condition of end product or output
8. equipment self-diagnostics

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

1. half-split
2. injection and sampling
3. emergent sequence
4. function/performance testing
5. six point technique
6. unit substitution
7. equipment self diagnostics

5. Use a variety of diagnostic aids, to include two of the following:
 1. logic diagrams
 2. fault analysis charts
 3. flow charts or algorithms
 4. manufacturers' manuals
 5. probability charts/reports
 6. troubleshooting guides
 7. computer-aided test equipment
 8. electronic aids
6. Use all of the following fault diagnostic procedures:
 1. inspection
 2. operation
 3. measurement
7. Use four of the following types of test equipment to aid fault diagnosis:
 1. oscilloscope
 2. multimeter
 3. current tracer
 4. logic probe
 5. signal generator
 6. other specific test equipment
8. Find faults that have resulted in two of the following breakdown categories:
 1. intermittent action/system failure
 2. complete breakdown
 3. partial failure or reduced performance
9. Complete and store all relevant documentation of the fault diagnosis in accordance with organisational requirements, using one of the following:
 1. step-by-step analytical report
 2. corrective action report
 3. preventative maintenance log/report
 4. organisational-specific reporting procedure
 5. electronic records

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Carrying out fault diagnosis on communication-electronic systems



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