

Testing communication-electronic systems

Overview

This standard identifies the competences you need to carry out inspections and tests on communication - electronic systems, in accordance with approved procedures. You will be required to carry out tests on a range of communication - electronic systems, sub-systems or assemblies to line replacement unit (LRU) level, to establish and ensure that they are functioning at optimal level and to specification. You will be required to carry out inspections, measurements and tests, which will include voltage and current levels, resistance values, waveform, clock/timer switching, pulse width/rise time, open/short circuit, logic state, frequency modulation/demodulation and signal noise/interference levels, as applicable to the equipment you are working on.

Your responsibilities will require you to comply with organisational policy and procedures for carrying out the testing activities and to report any problems with these activities 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 the procedures used for carrying out the required inspections and tests, and will provide an informed approach to applying the necessary testing procedures. You will understand the equipment being worked on, the test equipment being used, and the various test procedures and their application, in adequate depth to provide a sound basis for carrying out the activities correcting faults, and ensuring that the equipment operates safely and correctly to the required specification and remains compliant with all standards and regulations. In addition, you will be expected to review the outcome of the tests, compare the results with appropriate specifications, determine the action required, and record/report the results in the appropriate format.

You will understand the safety precautions required when carrying out the inspection and testing 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.

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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. follow the appropriate procedures for use of tools and equipment to carry out the required tests
3. set up and carry out the tests using the correct procedures and within agreed timescales
4. complete and store all relevant documentation of the test outcome in accordance with organisational requirements
5. review the results and carry out further tests if necessary
6. 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 the testing activity is to take place, and the responsibility they place on you
2. your responsibilities under regulations relevant to the communication - electronic testing activities being undertaken
3. the isolation and lock-off procedure, or permit-to-work procedure that applies to the testing activities (electrical isolation, locking off switch gear, removal of fuses, placing maintenance warning notices, proving that isolation has been achieved and secured)
4. isolation procedures that are unique to communication - electronic systems
5. the specific safety precautions to be taken when carrying out formal inspection and testing of communication - electronic equipment
6. the hazards associated with testing communication - electronic systems and with the equipment that is used, and how to minimise them and reduce any risks
7. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the testing activities
8. what constitutes a hazardous voltage and how to recognise victims of electric shock
9. how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting, isolating transformers)
10. the importance of keeping the work area clean and tidy, and free from waste and surplus materials
11. how the testing activities may affect the work of others, and the procedure for informing them of the work to be carried out
12. the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
13. how to obtain and interpret drawings, boolean algebra, truth tables, logic symbols, circuit diagram specifications, manufacturers' manuals, test procedures and other documents needed to carry out the test
14. the principles of how communication-electronic or associated systems function and interact
15. how subsystems and assemblies function within a system
16. how to determine suitable test points within a system, subsystem or assembly
17. how to set up and apply the appropriate test equipment
18. how to determine the calibration state of the equipment, and the actions to be taken if equipment is out of calibration,
19. how to ensure that the test equipment is free from damage or defect
20. how to check that tools and equipment are free from damage or defect, are in a safe and useable condition and are configured

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- correctly for their intended purpose
- 21. the various testing methods and procedures, and how to apply them to different operating conditions
- 22. how to analyse test results, and how to use comparison and sequential techniques
- 23. the environmental control and organisational operating procedure relating to functional testing
- 24. the documentation required, and the procedures to be followed at the conclusion of the test
- 25. the extent of your authority and to whom you should report to if you have problems that you cannot resolve

Scope/range

1. Carry out all of the following during the testing activities:
 1. plan the inspection and testing activities to cause minimal disruption to normal working
 2. obtain and use the correct issue of organisational and/or manufacturers' 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 maintenance area
 6. carry out the inspection and testing activities using appropriate techniques and procedures
 7. take electrostatic precautions when handling components and circuit boards
 8. re-connect and return the equipment to service on completion of the testing activities
 9. 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 inspections and tests on four communication - electronic systems, subsystems 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)

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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/portable 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. Carry out tests using a range of tools and test equipment, to include four of the following:

1. oscilloscope
2. temperature testing devices
3. ammeter
4. power meters
5. logic analyser
6. valve tester
7. Q meter
8. spectrum analyser
9. current tracer
10. time domain reflectometer
11. signal generator
12. frequency counter
13. multimeter
14. protocol analyser
15. computer-aided diagnostic equipment
16. breakout box
17. special-purpose testing equipment
18. automatic test equipment
19. other specific test equipment

4. Carry out all of the following tests or measurements, as applicable to the equipment being tested:

1. logic states
2. resistance
3. DC voltage/current levels
4. heat dissipation
5. AC voltage/current levels

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6. frequency modulation/demodulation
 7. clock/timer switching
 8. performance of system, sub-system or assembly
 9. pulse width/rise time
 10. conditions of assemblies and components
 11. open/short circuit
 12. signal noise/interference levels
5. Carry out all the following checks to ensure the accuracy and quality of the tests carried out:
1. test equipment is correctly calibrated
 2. test equipment used is appropriate for the tests being carried out
 3. test equipment is operated within its specification range
 4. test procedures used are up to date
6. Complete and store all relevant documentation of the test outcome in accordance with organisational requirements, using one of the following:
1. preventative maintenance log/report
 2. organisational-specific reporting procedure
 3. inspection schedule
 4. specific test report
 5. electronic reports

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