**Unit Title**  |  Maintaining Electronic Equipment/Systems  
---|---  
**Ofqual unit reference number (code)**  |  F/508/5098  
**Organisation Reference**  |  QU051702  
**Unit Level**  |  Level 2  
**Unit Sub Level**  |  None  
**GLH**  |  68  
**Unit Credit Value**  |  15  
**Sector Subject Areas**  |  • 4.1 Engineering  
**Unit Grading Structure**  |  Pass  
**Availability**  |  Restricted  
**Restricted Organisations**  |  N/A  
**Assessment Guidance**  |  This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from Semta's website or requested via customerservices@semta.org.uk  
Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's PEO NVQ QCF unit assessment strategy which can be downloaded from Semta's website or requested via customerservices@semta.org.uk  
Unit specific additional assessment requirements: In order to prove their ability to combine different electronic maintenance operations, at least one of the electronic maintenance activities carried out must be of a significant nature, and must cover a minimum of seven of the activities listed in assessment criteria 1.10 plus the removal and replacement of three of the components identified in assessment criteria 1.11.  

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<tr>
<th>LEARNING OUTCOMES</th>
<th>ASSESSMENT CRITERIA</th>
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<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
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<tr>
<td>1. Maintain electronic equipment/systems.</td>
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1.1. Work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines.

1.2. Carry out all of the following during the maintenance activities:
- adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
- ensure the safe isolation of equipment (where appropriate)
- follow job instructions, maintenance drawings and procedures
- take electrostatic discharge (ESD) precautions when handling sensitive components and circuit boards
- check that the tools and test instruments are within calibration date and are in a safe, PAT tested and usable condition
- ensure that the system is kept free from foreign objects, dirt or other contamination
- return all tools and equipment to the correct location on completion of the maintenance activities
- leave the work area in a safe and tidy condition.

1.3. Carry out maintenance/repair activities on three of the following types of electronic equipment:
- power supplies (such as switched mode, series regulation, shunt regulation)
- motor control systems (such as closed loop servo/proportional control, inverter control)
- sensor/actuator circuit (such as linear, rotational, temperature, photo-optic, flow, level, pressure)
- digital circuit (such as process control, microprocessor, logic devices, display devices)
- signal processing circuit (such as frequency modulating/demodulating, amplifiers, filters)
- alarms and protection circuits
- ADC and DAC hybrid circuits.

1.4. Plan the maintenance activities before they start them.
1.5. Obtain all the information they need for the safe removal and replacement of the equipment/system components.

1.6. Obtain and prepare the appropriate tools and equipment.

1.7. Apply appropriate maintenance diagnostic techniques and procedures.

1.8. Use four of the following maintenance diagnostic techniques, tools and aids:
   - fault finding techniques (such as six point, input/output, half-split, unit substitution)
   - diagnostic aids (such as manuals, flow charts, troubleshooting guides, maintenance records)
   - information gathered from the person who reported the fault
   - visual checks (such as signs of damage, overheating, missing parts, wear/deterioration)
   - movement checks (such as loose fittings and connections)
   - monitoring equipment or gauges
   - test instrumentation measurement (such as voltage, resistance, current, waveform).

1.9. Use the appropriate methods and techniques to remove and replace the required components.

1.10. Carry out all of the following maintenance techniques and procedures during the repair activities:
   - removing excessive dirt and grime
   - dismantling/disconnecting equipment to the required level
   - disconnecting and reconnecting wires and cables
   - checking the condition/deterioration of components
   - soldering and de-soldering
   - repairing circuit board tracks
   - removing and replacing electronic units/circuit boards
   - removing and replacing electronic components
   - making adjustments to components and/or connections
   - re-assembling of units or sub-assemblies.
1.11. Replace/refit a range of electronic components, to include twelve of the following:
- cables and connectors
- printed circuit boards
- fixed resistors
- variable resistors
- potentiometers
- light dependent resistor (LDR)
- fixed capacitors
- variable capacitors
- electrolytic capacitors
- mini transformers
- rectifiers
- thermistors
- thyristors
- transistors
- diodes
- Zener diodes
- light emitting diodes (LEDs)
- sensors
- heat sinks.

1.12. 1.11 continued:
- protection devices
- surface mount packages
- integrated circuits
- decoders
- regulators
- encoders or resolvers
- inverters or servo controllers
- analogue or digital integrated circuits
- edge connectors
- switches
- wiring pins/tags/wire links
- opto-electronics/optical fibre components
- relays
- relays
- inductors.

1.13. Use the correct joining/connecting techniques to deal with three of the following types of connection:
- push-fit connectors
- soldering or de-soldering
- clip assemblies
- threaded connections
- crimped connections
- zero insertion force (zif) connectors
- adhesive joints/assemblies
- edge connectors.
1.14. Carry out tests on the maintained equipment, in accordance with the test schedule/defined test procedures.

1.15. Carry out checks and tests on the maintained equipment, to include both of the following:
- visual checks (such as for solder bridges, dry joints, incorrect value components, signs of damage, missing components)
- movement checks (such as loose wires and connections, incorrectly seated devices/packages)

Plus three more from the following:
- logic states
- dc voltage/current levels
- ac voltage/current levels
- clock/timer switching
- oscillations
- attenuation
- pulse width/rise time
- open/short circuit
- resistance
- capacitance
- waveform analysis
- inductance
- frequency modulation/demodulation
- amplification
- signal noise/interference levels.

1.16. Use five of the following types of test equipment:
- multimeter
- oscilloscope
- logic probe/clip
- logic analyser
- pulse sequencing analyser
- counter-timers
- signature analysers
- protocol analyser
- signal generator
- signal tracer
- stabilised power supplies
- measuring bridges
- software diagnostic programs
- data communications test set
- bus exerciser/analyser.

1.17. Carry out maintenance activities on electronic equipment, in accordance with one or more of the following:
- organisational guidelines and codes of practice
### 1.18. Deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve.

### 1.19. Leave the work area in a safe and tidy condition on completion of the maintenance activities.

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<thead>
<tr>
<th>2. Know how to maintain electronic equipment/systems.</th>
<th>2.1. Describe the health and safety requirements, and safe working practices and procedures required for the electronic maintenance activities undertaken.</th>
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<td>2.2. Describe the isolation and lock-off procedure or permit-to-work procedure that applies to the electronic repair activities and the electronic equipment or circuits being worked on (such as electrical isolation, locking off switchgear, removal of fuses, placing maintenance warning notices, proving that isolation has been achieved and secured).</td>
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<td>2.3. Describe the hazards associated with maintaining electronic equipment, and with the tools and equipment that are used (such as live electrical components, capacitor discharge, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how these can be minimised.</td>
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<td>2.4. Explain what constitutes a hazardous voltage and 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, and how to obtain first aid assistance).</td>
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<td>2.5. Describe the importance of wearing appropriate protective clothing/equipment (PPE), and of keeping the work area safe and tidy.</td>
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<td>2.6. Describe the procedure for obtaining drawings, job instructions, related specifications, replacement parts, materials</td>
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and other consumables necessary for the maintenance activities.

2.7. Explain how to extract information from job instructions, drawings and data (such as circuit diagrams, specifications, manufacturers’ manuals, test procedures and other documents needed to carry out repairs).

2.8. Describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards.

2.9. Describe the basic principles of how the electronic circuit functions, and the working purpose of individual units/components.

2.10. Describe the various maintenance diagnostic techniques and aids that can be used (such as fault reports, visual checks, measuring, movement and alignment checks, testing; fault location using techniques such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics).

2.11. Describe the care, handling and application of electronic measuring instruments/fault diagnostic equipment to investigate the problem (such as multimeter, oscilloscope, signal generators, logic probes/analyzers, measuring bridges).

2.12. Explain how to check that test equipment is safe to use (such as condition of power cables, using suitably fused test probes, clips and leads); how to check that equipment is within current calibration approval dates and PAT tested; checking that the test equipment is suitable for the tests they are to carry out and can cover the range and values they are to measure.

2.13. Explain how to connect to an approved power supply and, where appropriate, signal source; identifying correct test points in the circuit; how to position test instruments into circuits without damaging circuit components (such as using test probes, ensuring correct polarity, taking antistatic precautions); setting instrument zero readings; obtaining instrument readings and comparing them with expected results.
2.14. Describe the application of Ohm’s Law and relevant calculations (including units of electronic measurement and their multiples and sub-multiples).

2.15. Describe the use of calculations and other regulations, when selecting wires and cables and when carrying out tests on electronic circuits.

2.16. Explain how to make adjustments to circuit components; making decisions on circuit performance and faulty components; removal and replacement of faulty components.

2.17. Explain how to check that the replacement components meet the required specification/operating conditions (such as values, tolerance, current-carrying capacity, ambient temperatures, connection orientation).

2.18. Describe the methods of removing and replacing the faulty components from the equipment (such as unplugging, de-soldering, removal of screwed, clamped, edge connected, zero insertion force, and crimped connections) without causing damage to other components, wiring, circuit boards or the surrounding structure.

2.19. Describe the tools and equipment used in the repair activities (including the use of wire-stripping tools, crimping tools, soldering irons, insertion devices and connecting tools); how to check that they are in a safe and usable condition.

2.20. Describe the sequence for reconnecting the equipment, and the checks to be made prior to restoring power (such as checking components for correct polarity, ensuring that there are no exposed conductors, cable insulation is not damaged, all connections are mechanically and electrically secure, casings are free from loose screws, there are no wire ends or solder blobs/spikes that could cause short circuits, and all fuses/protection devices are installed).
2.21. Describe the importance of making de-energised checks before proving the equipment with the electrical supply on.

2.22. Explain how to make adjustments to components/assemblies to ensure that they function correctly.

2.23. Describe the documentation and/or reports to be completed following the maintenance activity, and the importance of ensuring that these reports are completed accurately and legibly.

2.24. Describe the problems that can occur with the electronic equipment maintenance activity, and how they can be overcome.

2.25. Explain when to act on their own initiative and when to seek help and advice from others.

2.26. Describe the importance of leaving the work area in a safe and clean condition on completion of the maintenance activities (such as returning hand tools and test equipment to is designated location, cleaning the work area, removing and disposing of waste).

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<th>Equivalences</th>
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