SEMEMI215

# Carrying out repairs to electronic equipment

## Overview

This standard identifies the competences you need to carry out repairs on electronic equipment, in accordance with approved procedures. You will be required to carry out repairs on a range of electronic equipment, such as power supplies, motor control systems, alarm and protection circuits, sensors and actuator circuits, digital circuits and systems, analogue circuits and systems, and hybrid circuits and systems. This will involve dismantling, removing and replacing faulty items at board and component level, on a variety of different types of electronic assemblies and sub-assemblies.

You will be expected to apply a range of dismantling and reassembly methods and techniques, such as soldering, de- soldering, crimping, harnessing, and securing cables and components. You will be expected to take care that you do not cause further damage to the equipment/circuit during the repair activities and, therefore, the application of electrostatic discharge (ESD) procedures will be a critical part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for carrying out the repair activities, 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions, and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying electronic repair procedures. You will have an understanding of the function and operating conditions of the electronic equipment being repaired, and will know about the tools and techniques to be used, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the repair activities, especially those for isolating the equipment, and for taking the necessary safeguards to protect yourself, and others, 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:*

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
P2 follow the relevant maintenance/repair schedules to carry out the required work
P3 carry out the repair activities within the limits of your personal authority
P4 carry out the repair activities in the specified sequence and in an agreed timescale
P5 repair and/or replace a range of electronic components
P6 use the appropriate joining/connecting techniques
P7 deal with problems within your control and report those that cannot be solved
P8 complete and store all relevant documentation in accordance with organisational requirements
P9 dispose of waste materials in line with organisational and environmentally safe procedures

## Knowledge and understanding

*You need to know and understand:*

K1 how to work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
K2 the importance of wearing the appropriate personal protective equipment (PPE), and of keeping the work area clean and tidy
K3 how the repair activities may affect the work of others, and the procedure for informing them of the work to be carried out
K4 the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards
K5 how to obtain and extract information from job instructions, drawings and data
K6 the basic principles of how the electronic circuit functions, and its operating sequence
K7 how to check that the replacement components meet the required specification/operating conditions
K8 methods of removing and replacing the faulty components from the equipment
K9 the importance of removing faulty components without causing damage to other components, wiring or the surrounding structure
K10 methods of attaching identification marks/labels to removed components or connections, in order to assist with re-assembly
K11 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)
K12 how to check that tools and equipment are free from damage or defects, that they are in a safe and usable condition, and that they are configured correctly for the intended purpose
K13 the sequence for reconnecting the equipment, and the checks to be made prior to restoring power
K14 the importance of making `off-load' checks before proving the equipment with the electrical supply on
K15 how to make adjustments to components/assemblies to ensure that they function correctly
K16 the documentation and/or reports to be completed following the repair activity, and the importance of ensuring that these reports are completed accurately and legibly

K17 the issues that can occur with the repair activity, and how they can be overcome

K18 the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

## Scope/range related to performance criteria

1. Carry out all of the following during the repair activities:
1.1. confirm the type and level of repair to be carried out
1.2. undertake the repair activities to cause minimal disruption to normal working
1.3. use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
1.4. adhere to procedures or systems in place for risk assessment, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
1.5. ensure the safe isolation of equipment
1.6. ensure that safe access and working arrangements have been provided in the work area
1.7. take electrostatic discharge (ESD) precautions when handling sensitive components and circuit boards
1.8. leave the work area in a safe and tidy condition

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

3. Carry out all of the following maintenance techniques and procedures during the repair activities:
3.1. removing excessive dirt and grime
3.2. dismantling/disconnecting equipment to the required level
3.3. checking the condition/deterioration of components
3.4. making adjustments to components and/or connections
3.5. re-assembling of units or sub-assemblies

3.6. reviewing and checking the equipment operation and/or performance
3.7. reporting or actioning any other defects that require immediate attention

4. Repair and/or replace a range of electronic components, to include six of the following:
4.1. cables and connectors
4.2. printed circuit boards
4.3. transformers
4.4. fixed resistors
4.5. variable resistors
4.6. capacitors
4.7. rectifiers
4.8. thermistors
4.9. transistors
4.10. diodes
4.11. sensors
4.12. heat sinks
4.13. protection devices
4.14. decoders
4.15. regulators
4.16. encoders or resolvers
4.17. inverters or servo controllers
4.18. analogue or digital integrated circuits
4.19. other specific components

5. Use the correct joining/connecting techniques to deal with three of the following types of connection:
5.1. push-fit connectors
5.2. soldering or desoldering
5.3. clip assemblies
5.4. threaded connections
5.5. crimped connections
5.6. zero insertion force (ZIF) connectors
5.7. adhesive joints/assemblies
5.8. edge connectors

6. Carry out repairs to electronic equipment, in accordance with one of the following:

6.1. organisational guidelines and codes of practice
6.2. equipment manufacturer's operation range
6.3. BS, ISO and/or BSEN standards
6.4. current wiring regulations

7. Complete one of the following records, and pass it to the appropriate person:
7.1. job cards
7.2. permits to work/formal risk assessment and/or sign on/off procedures
7.3. repair log or report
7.4. organisational-specific documentation
7.5. electronic reports

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