SEMPEO120

Wiring electrical equipment and circuits

Overview

This standard covers a range of basic competences that you need to wire up electrical equipment and circuits. It will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or it will provide a basis for the development of additional skills and occupational competences in the working environment.

You will be expected to prepare for the electrical wiring activities by obtaining all the necessary job instructions, components, tools, equipment and any documentation that may be required. You will be required to use the appropriate tools and equipment, based on the operations to be performed and the components to be connected.

In carrying out the electrical wiring operations, you will be required to work to instructions for the wiring of the various electrical components and connectors that make up the electrical system/circuit being produced. The wiring activities will also include making all necessary checks and adjustments to the circuit, including visual checks for security of components, freedom from damage to components or cables, and simple continuity checks. On completion of the electrical wiring activities, you will be expected to return all tools and equipment to the correct location, and to leave the work area in a safe and tidy condition.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for the electrical wiring activities undertaken. You will need to report any difficulties or problems that may arise with the wiring activities, and to carry out any agreed actions. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide an understanding of your work, and will enable you to apply appropriate electrical wiring and termination techniques and procedures safely. You will understand the electrical wiring process, and its application, and will know about the various cables and components used to produce the circuits, to the required 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 wiring and testing activities, especially those for ensuring the safe isolation of the equipment and

circuits produced. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

Specific Standard Requirements

At least one of the circuits produced must include a combination of components and assembly techniques and procedures, for example: by producing a simple lighting circuit with a mains isolation unit, switches and luminaires, or by producing a control circuit where a number of functions are turned on in a set sequence or perform some other defined function.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines
2. obtain the correct tools and equipment for the wiring and testing operations, and check that they are in a safe and usable condition
3. mount and secure the electrical components safely and correctly to meet specification requirements
4. install and terminate the cables to the appropriate connections on the components
5. produce wired up electrical circuits
6. check the completed circuit to ensure that all operations have been completed, and that the finished circuit meets the required specification
7. report any difficulties or problems that may arise with the electrical wiring activities, and carry out any agreed actions
8. leave the work area in a safe and tidy condition on completion of the electrical wiring activities

Knowledge and understanding

You need to know and understand:

1. the specific safety practices and procedures that you need to observe when wiring electrical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. the hazards associated with wiring electrical equipment, and with the tools and equipment used, (such as using sharp instruments for stripping cable insulation, using soldering irons), and how they can be minimised
3. the importance of wearing appropriate protective clothing and equipment (PPE), and keeping the work area safe and tidy
4. what constitutes a hazardous voltage and how to recognise victims of electric shock
5. how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
6. the interpretation of circuit diagrams, wiring diagrams, and other relevant specifications (including BS and ISO schematics, wiring regulations, symbols and terminology)
7. the types of cabling used for wiring up the equipment/circuits (such as multicore cables, single core cables, solid and multi-stranded cables, screened cables)
8. the application and use of a range of electrical components (such as switches, sockets, lighting and fittings, junction boxes, consumer units, relays, solenoids, transformers, sensors and actuators, circuit protection equipment)
9. how to check that components meet the required specification/operating conditions (such as values, tolerance, current carrying capacity, voltage rating, power rating, working temperature range)
10. methods of mounting and securing electrical equipment/components to various surfaces (such as the use of nuts and bolts, screws and masonry fixing devices)
11. the specific electrical termination methods and devices to be used (such as plugs and sockets, soldering, screwed, clamped and crimped connections)
12. the use of BS7671/IET wiring regulations when selecting wires and cables
13. how to prepare the cables for terminating (such as cutting them to the correct length, removing correct length of outer and inner insulation without damaging insulation or conductors)
14. methods of attaching markers/labels to components or cables to assist with identification (such as colour coding conductors, using coded tabs)

15. the tools and equipment used in the wiring and testing activities (including the use of cable stripping tools, crimping tools, soldering irons)
16. the importance of conducting inspections and checks on the completed circuit (such as visual examination for loose or exposed conductors, excessive solder or solder spikes which may allow short circuits to occur, strain on terminations, insufficient slack cable at terminations, continuity checks)
17. the importance of earthing procedures for electrical installations, and why the earth bonding must be both mechanically and electrically secure
18. problems that can occur with the wiring operations, and how these can be overcome
19. when to act on your own initiative and when to seek help and advice from others
20. the importance of leaving the work area in a safe and clean condition on completion of the wiring (such as returning hand tools and test equipment to the designated location, cleaning the work area, and removing and disposing of waste)

Scope/range related to performance criteria

1.

Carry out **all** of the following during the wiring and testing activities:

1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
1.2 ensure the safe isolation of services during the wiring and testing activities
1.3 follow job instructions, circuit drawings and test procedures at all times
1.4 check that tools and test instruments to be used are in a safe, tested, calibrated and usable condition
1.5 ensure that the electrical system is kept free from foreign objects, dirt or other contamination
1.6 where appropriate, apply procedures and precautions to eliminate electrostatic discharge (ESD) hazards
1.7 return all tools and equipment to the correct location on completion of the wiring and testing activities

2.

Produce circuits using **one** of the following types of cable:

2.1 single core
2.2 data/communication
2.3 ribbon cables
2.4 multicore
2.5 fibre-optics
2.6 wiring loom/harness
2.7 PVC twin and earth
2.8 screened/coaxial
2.9 flexible (such as cotton or rubber covered)

3.

Wire up **one** of the following types of electrical circuit:

3.1 domestic lighting circuits
3.2 air conditioning control circuits
3.3 domestic power circuits
3.4 refrigeration control circuits
3.5 motor start and control
3.6 heating/boiler control circuits
3.7 vehicle heating or ventilating
3.8 aircraft lighting circuits
3.9 vehicle lighting
3.10 power generation and control circuits
3.11 vehicle starting and ignition
3.12 avionic circuits and systems
3.13 instrumentation and control circuits
3.14 emergency lighting systems

3.15 alarm systems (such as fire, intruder, process control)
3.16 communication systems
3.17 electro-pneumatic or electro-hydraulic control circuits
3.18 computer systems
3.19 other control circuits (such as pumps, fans, blowers, extractors) lighting
3.20 other specific electrical circuits

4.

Wire up and terminate **four** of the following electrical modules/components to produce the circuits:

4.1 isolators
4.2 lamp holders
4.3 fuses/circuit breakers
4.4 switches
4.5 panel lamps
4.6 sensors
4.7 sockets
4.8 luminaires
4.9 actuators
4.10 relays/contactors
4.11 ballast chokes
4.12 junction boxes/terminal blocks
4.13 alarm devices
4.14 consumer units
4.15 panels or sub-assemblies
4.16 motors and starters
4.17 residual current device (RCD)
4.18 pumps
4.19 instruments
4.20 heaters
4.21 transformers
4.22 blowers
4.23 other specific electrical components

5.

Carry out **all** of the following wiring and termination activities:

5.1 positioning and securing of equipment and components
5.2 determining the current rating and lengths of cables required
5.3 stripping outer coating without damage to conductor insulation
5.4 stripping cable conductor insulation/protection
5.5 making mechanical/screwed/clamped connections
5.6 crimping (such as spade end, loops, tags and pins)
5.7 soldering and de-soldering
5.8 secure wires and cables (such as glands, clamps, clips, plastic strapping, lacing, harnessing)

6.

Carry out checks to the equipment and circuits being wired, to include **all** of the

following:

6.1 making visual checks (such as completeness, signs of damage, incorrect termination)
6.2 movement checks (such as loose fittings and connections)
6.3 continuity

7.

Produce electrical circuits, in compliance with **one** of the following standards:

7.1 BS 7671/IET wiring regulations
7.2 other BS and/or ISO standards
7.3 company standards and procedures
7.4 component manufacturers standards

Behaviours

Additional Information

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

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