SEMPEO122

Assembling and wiring electrical panels

Overview

This standard covers a range of basic competences that you need to assemble and wire electrical panels or components mounted in enclosures. 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 assembly of the electrical panels by obtaining all the necessary job instructions, components, tools, equipment and any documentation that may be required.

The activities will include the assembly of a range of electrical components such as component panels, isolator switches, fuses and circuit breakers, contactors and relays, bases for plug-in devices, rail-mounted terminal blocks, trunking, earth bonding, and sub-assemblies such as power supplies and card racks. This will involve using a range of tools and equipment along with soldering techniques and anti-static protection techniques. On completion of the assembly 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 assembly of the electrical panels. You will need to report any difficulties or problems that may arise with the assembly 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 assembly techniques and procedures safely for electrical panels. You will understand the assembly methods and procedures used, and their application, and will know about the various components used to produce the panels, 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 mounting electrical components on panels or in enclosures, and with using the associated tools and equipment. 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 electrical panel assemblies produced must include a combination of components and assembly techniques and procedures, for example: by assembling and wiring a control panel that has a main isolator switch, a series of contactors, an overload protection device and a panel door interlock/microswitch.

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 assembly and test operations, and check that they are in a safe and usable condition
3. use the appropriate methods and techniques to assemble the components in their correct positions
4. secure the components, using the specified connectors and securing devices
5. wire and terminate cables to the appropriate connections on the components
6. produce assembled and wired up electrical panels
7. check the completed panel assembly to ensure that all operations have been completed, and that the finished assembly is secure and meets the required specification
8. report any difficulties or problems that may arise with the electrical assembly and wiring activities, and carry out any agreed actions
9. leave the work area in a safe and tidy condition on completion of the electrical panel assembly activities

Knowledge and understanding

You need to know and understand:

1. the specific safety practices and procedures that you need to observe when assembling and wiring electrical components mounted on panels or in enclosures (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. the hazards associated with assembling and wiring electrical panels (such as using sharp instruments for stripping cable insulation, use of soldering equipment), 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 precautions to be taken to prevent electrostatic discharge (ESD) damage to circuits and sensitive components (such as use of earthed wrist straps, anti-static mats, special packaging and handling areas)
7. how to interpret drawings, circuit and physical layouts, charts, specifications, graphical electrical symbols, BS and ISO wiring regulations, and other documents needed for the electrical activities
8. the types of components and sub-assemblies that are used in the assembly activities (such as contactors, relays, circuit breakers/fuses, solenoids, switches, transformers, ballast chokes, terminal blocks, sub-assemblies)
9. preparations to be undertaken on the components and enclosure, prior to the mounting activities
10. how the components are to be aligned and positioned prior to securing, and the tools and equipment that are used
11. how to identify any orientation requirements, values or polarity for the components used in the electrical assembly and wiring activities
12. the types of cabling to be used in the assembly and wiring of the panels or enclosures (such as multicore cables, single core cables, single insulated, double insulated, screened cables)
13. why electrical bonding/earthing is critical, and why it must be both mechanically and electrically secure

14. the use of BS7671/IET wiring, and other, regulations when selecting wires and cables
15. the assembly methods and techniques to be used when wiring electrical panels or components mounted in enclosures (such as cable stripping, soldering, crimping, securing cables using cable ties, lacing/strapping of wires)
16. the different types, applications, and methods of attaching identification markers/labels during the electrical wiring activities
17. how to conduct any necessary checks to ensure the accuracy and quality of the assembly produced (such as visual checks for completeness and freedom from damage to conductors or components, mechanical checks for security of components and connections, checks for electrical continuity and earth continuity)
18. how to check that tools and equipment are free from damage or defects, are in a safe, tested, calibrated and usable condition
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 electrical assembly and wiring activities (such as returning tools and equipment to the designated location, cleaning the work area, removing and disposing of waste)

Scope/range related to performance criteria

1.

Carry out **all** of the following during the mounting and wiring of the electrical components to electrical panels:

1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
1.2 follow job instructions, assembly drawings and procedures at all times
1.3 ensure that the components are free from damage, foreign objects, dirt or other contamination
1.4 check that tools and equipment to be used are in a safe, tested, calibrated and usable condition
1.5 prepare the electrical components and panels/enclosures for the assembly operations
1.6 use safe and approved techniques to mount the electrical components on the panels or in the enclosures
1.7 where appropriate, apply procedures and precautions to eliminate electrostatic discharge (ESD) hazards (such as the use of grounded wrist straps and mats)
1.8 return all tools and equipment to the correct location on completion of the assembly activities

2.

Mount electrical components on panels or into enclosures, to include **six** of the following items:

2.1 enclosure partitions
2.2 bases for plug-in devices
2.3 limit switches
2.4 component mounting plates
2.5 switches (such as push button, toggle)
2.6 sensors
2.7 contactors
2.8 capacitors
2.9 plugs/sockets
2.10 overload and other relays
2.11 resistors
2.12 grommets/grommet strip
2.13 transformers/chokes
2.14 rectifiers
2.15 batteries
2.16 circuit breakers/fuses
2.17 power supplies
2.18 connector rails
2.19 panel meters (such as voltage, current)

2.20 circuit boards
2.21 solenoids
2.22 terminal blocks/junction boxes
2.23 thermistors/thermocouples
2.24 isolators
2.25 safety interlocks
2.26 indicators (such as lamps, LEDs)
2.27 other specific components

3.

Use **one** of the following types of cable in the wiring up of the electrical components:

3.1 single core cable
3.2 screened cable
3.3 twisted pair/ribbon cable
3.4 multicore cable
3.5 fibre-optic
3.6 data/communication cable
3.7 laminated copper
3.8 braided copper
3.9 other specialist cable

4.

Use **six** of the following methods and techniques (and the appropriate tools) during the wiring activities:

4.1 insulation stripping
4.2 securing wires and cables (such as cable ties, clips, plastic strapping, lacing, harnessing)
4.3 cable routeing
4.4 cable forming/bending
4.5 adding cable protection (such as sleeves or grommets)
4.6 making screwed/clamped connections
4.7 installing and terminating pre-formed looms
4.8 making crimped connections (such as spade end, loops, tags and pins)
4.9 marking or colour coding wires/cables
4.10 applying sealants/adhesives
4.11 making soldered connections

5.

Carry out quality checks, to include **all** of the following:

5.1 positional accuracy of all components
5.2 correct termination of all wires to components
5.3 correct orientation
5.4 security of all terminations
5.5 correct alignment
5.6 completeness
5.7 component security
5.8 ensuring freedom from damage

5.9 ensuring that the enclosure is free of debris (such as cable offcuts/insulation, enclosure/trunking breakouts)
5.10 continuity of cable/wiring connections (such as battery and lamp checks)

6.

Assemble electrical components on panels or in enclosures, in compliance with **one** of the following

6.1 BS7671/IET wiring regulations
6.2 other BS or ISO standards and procedures
6.3 company standards and procedures
6.4 component manufactures 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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