Unit 835 Assembling, wiring and testing electrical panels/components mounted in enclosures

UAN:	R/600/5913
Level:	Level 2
Credit value:	14
GLH:	64
Relationship to NOS:	This unit has been derived from national occupational standard Performing Engineering Operations Unit No. 35: Assembling, wiring and testing electrical panels/components mounted in enclosures (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to assemble, wire and test electrical panels and components mounted in enclosures. It will prepare the learner 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. 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, earthing bonding, and sub-assemblies such as power supplies, card racks, and process controller units. This will involve using a range of tools and equipment along with soldering techniques and anti-static protection techniques. The assembly activities will also include making all necessary checks and adjustments to ensure that components are free from damage, correctly positioned and secured, are terminated correctly and pass the

required insulation and resistance checks.

The learner's responsibilities will require them to comply with health and safety requirements and organisational policy and procedures for the electrical component assembly and wiring activities undertaken. The learner will need to take account of any potential difficulties or problems that may arise with the assembly and wiring activities, or with the tools and equipment used, and to seek appropriate help and advice in determining and implementing a suitable solution. The learner will work under a high level of supervision, whilst taking responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide an understanding of their work, and will enable them to apply appropriate electrical assembly, wiring and testing procedures and techniques safely. The learner will understand the assembly methods and procedures used, and their application, and will know about the various components used, to the required depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when mounting electrical components in enclosures, and with using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Assemble, wire and test electrical panels/components mounted in enclosures
Assessment criteria
The learner can: 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 mounting of the electrical components: • adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment (PPE) and other relevant safety regulations

- follow job instructions, assembly drawings and test procedures at all times
- ensure that the components are free from damage, foreign objects, dirt or other contamination
- check that the tools and test instruments are within calibration date and are in a safe and usable condition
- prepare the electrical components and enclosures for the assembly operations
- use safe and approved techniques to mount the electrical components in the enclosures
- where appropriate, apply procedures and precautions to eliminate Electrostatic Discharge (ESD) hazards (such as the use of grounded wrist straps)
- return all tools and equipment to the correct location on completion of the assembly activities

1.3 Plan the electrical assembly, wiring and testing activities before they start them

1.4 Use appropriate sources to obtain the required specifications, circuit diagrams, components, assembly and test information

1.5 Obtain the correct tools and equipment for the assembly and test operations, and check that they are in a safe and usable condition

1.6 Use the appropriate methods and techniques to assemble the components in their correct positions

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

- enclosure partitions
- component mounting plates
- component marking
- trunking
- conduit
- contactors
- overload and other relays
- transformers/chokes
- circuit breakers/fuses
- panel meters (voltage, current)
- terminal blocks/junction boxes
- safety interlocks
- isolators
- bases for plug-in devices
- switches (push button, toggle)
- capacitors
- resistors
- rectifiers
- timers
- power supplies
- circuit boards
- thermistors/thermocouples
- indicators (lamps, LEDs)

- thermostats
- busbars
- soft starters
- variable speed drives
- limit switches
- sensors
- programmable controllers
- plugs/sockets
- grommets/grommet strip
- lighting fixtures
- batteries
- connector rails
- solenoids
- other specific components

1.8 Use ten of the following methods and techniques (and the appropriate tools) during the wiring activities:

- cable forming/bending
- cable supporting/tying
- cable/wire clamping
- cable protection (such as sleeving, grommets)
- cable/wire crimping
- insulation stripping
- making screwed connections
- soldering (where appropriate)
- cable routeing
- connecting pre-formed looms
- wire marking/colour coding

1.9 Carry out eight of the following activities during the mounting of the electrical components:

- setting working clearance
- drilling
- filing
- riveting
- sawing/cutting
- forming
- aligning components
- torque setting fasteners
- earth bonding
- securing using mechanical fasteners/threaded devices
- punching
- applying sealants/adhesives
- clamping
- crimping
- component marking
- making screw connections
- measuring

1.10 Wire up electrical components on panels or in enclosures, using two of the following cable/wire types:

- single core cable
- multicore cable
- laminated copper
- data/communication cable
- Mineral Insulated cable
- screened cable
- fibre-optic
- braided copper
- twisted pair/ribbon cable
- other specialist cable

1.11 Secure the components, using the specified connectors and securing devices

1.12 Wire and terminate cables to the appropriate connections on the components

1.13 Use appropriate test methods and equipment to check that the completed assembly is safe and meets all aspects of the specification

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

- positional accuracy of all components
- correct orientation
- correct alignment
- component security
- security of all terminations
- correct termination of all wires to components
- completeness
- ensuring enclosure is free of debris (such as cable offcuts/insulation, enclosure/trunking breakouts)
- ensuring freedom from damage

Plus all of the following electrical checks:

- continuity of cable/wiring connections (such as battery and lamp checks)
- earth continuity
- polarity
- protective conductor resistance values
- insulation resistance

1.15 Assemble electrical components on panels or in enclosures, in accordance with one or more of the following standards:

- BS7671/IEE wiring regulations
- other BS or ISO standards and procedures
- company standards and procedures

1.16 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

1.17 Leave the work area in a safe and tidy condition on completion of the electrical assembly and testing activities

Learning outcome
The learner will: 2. Know how to assemble, wire and test electrical panels/components mounted in enclosures
Assessment criteria
The learner can: 2.1 Describe the specific safety practices and procedures that they need to observe when assembling, wiring and testing electrical components mounted in enclosures (including any specific legislation, regulations or codes of practice for the activities, equipment or materials) 2.2 Describe the hazards associated with assembling, wiring and testing electrical panels (such as using sharp instruments for stripping cable insulation, use of soldering irons, carrying out insulation tests), and how they can be minimised 2.3 Describe the importance of wearing appropriate protective clothing and equipment, and keeping the work area safe and tidy 2.4 Describe 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) 2.5 Explain how to obtain and interpret drawings, circuit and physical layouts, charts, specifications, graphical electrical symbols, BS and ISO wiring regulations, and other documents needed for the electrical component mounting, wiring and testing activities 2.6 Describe the basic principle of operation of the equipment/circuits being assembled and wired, and the purpose of individual components within the circuit 2.7 Describe 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) 2.8 Describe the type 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) 2.9 Describe the preparations to be undertaken on the components and enclosure, prior to the mounting activities 2.10 Explain how the components are to be aligned and positioned prior to securing, and the tools and equipment that are used 2.11 Explain how to identify any orientation requirements, values or polarity for the components used in the electrical wiring activities 2.12 Describe the methods of attaching identification markers/labels during electrical assembly activities 2.13 Describe the different types of cabling, and their application (such as multicore cables, single core cables, single insulated, double insulated, Steel Wire Armoured (SWA), Mineral Insulated (MI), screened cables) 2.14 Describe the use of BS7671/IEE wiring, and other regulations, when selecting wires and cables and when carrying out tests on electrical circuits 2.15 Explain 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, electrical checks for electrical continuity and earth continuity, insulation resistance and polarity checks)
2.16	Explain how to check that tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose
2.17	Explain when to act on their own initiative and when to seek help and advice from others
2.18	Describe 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 hand tools and test equipment to the designated locations, cleaning the work area, removing and disposing of waste)