Unit 8: Developing Skills in Wiring Electrical Circuits and Components

Unit reference number: L/601/0124

QCF level: 1

Credit value: 3

Guided learning hours: 30

Unit aim

This unit introduces learners to the skills required to carry out the wiring and terminating of electrical circuits and components. It will give them the opportunity to think about the necessary precautions and safety requirements when preparing for wiring activities by learning about components, cables, tools and equipment when using appropriate terminations. This unit provides some of the knowledge, understanding and skills for the Level 1 Performing Engineering Operations NOS Unit 21: Wiring Electrical Equipment and Circuits.

Unit introduction

In this unit learners will explore the activities involved in wiring simple electrical circuits and components. When preparing for electrical wiring activities they will learn about the necessary safety requirements, components, cables, tools, equipment, and any documentation that may be required.

Learners will be involved in the practical activities associated with wiring a simple electrical assembly. They will be able to demonstrate that they can prepare for the activity and also take the necessary precautions to ensure the assembly is carried out safely and correctly. Learners will have an opportunity to check a range of components, cables, tools and equipment before the wiring is carried out. Having completed an electrical wiring activity learners will show that they can leave the work area in a safe and tidy condition and that they have produced an assembly to a reasonable standard.

Essential resources

A typical centre engineering workshop should be equipped with the basic requirements of this unit including a range of electrical wiring equipment and components, cables, tools and equipment for assembly operations. All supporting auxiliary equipment should also be available together with appropriate safety equipment.

Workshops should be staffed appropriately to ensure health and safety requirements are met. Technician support may be required during practical work.

Learning outcomes, assessment criteria and unit amplification

To pass this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

Learning outcomes		Assessment criteria		Unit amplification
1	Be able to prepare for and carry out an electrical wiring activity	1.1	Take precautions ready to carry out an electrical wiring activity	□ *Preparation activities*: precautions eg tidy bench and floor area, planning assembly area layout, checking availability of services such as electrical or air supplies, putting tools and equipment into safe storage after use; preparation eg correct components and cables and how they fit into the assembly, how to use tools and equipment eg electrician's screwdriver (parallel slotted and Phillips head), adjustable wrench, craft knife, pliers with insulated handles, wire strippers, junior hacksaw, digital multimeter, tape measure; checking eg damaged housing, broken insulation, missing terminal screws, quantity of components; preparation for termination activities eg determining the sizes and lengths of required cables
		1.2	Prepare components, cables, tools and equipment ready for an electrical wiring activity	□ *Wiring electrical activity*: wiring a circuit eg lighting, power, control, domestic lighting circuits, domestic power circuits, motor start and control, vehicle heating or ventilating, vehicle lighting, vehicle starting and ignition, instrumentation and control circuits, alarm systems (such as fire, intruder, process control), electro-pneumatic or electro-hydraulic control circuits, other control circuits (such as pumps, fans, blowers, extractors), lighting, air conditioning control circuits, refrigeration control circuits, heating/boiler control circuits, aircraft lighting circuits, power generation and control circuits, avionic circuits and systems, emergency lighting systems, communication systems, computer systems including earthing procedures and circuit protection; wiring circuit or assembly to contain cabling; simple test to ensure wiring meets the standard eg continuity test, insulation resistance test; making visual checks eg positioning of components, for damaged sleeving, loose and exposed conductors, strain on terminations, insufficient slack cable at sockets
		1.3	Check components and cables before they are used in an electrical wiring activity	

Learning outcomes		Assessment criteria		Unit amplification
2	Be able to wire and terminate electrical components correctly and safely	2.1	List the safety aspects for an electrical wiring activity	□ *Electrical circuit or assembly*: circuit containing four components eg isolators, switches, sockets, lamp holders, junction boxes/terminal blocks, panel lamps, circuit breakers/fuses, relays/contactors, alarm devices, motors/starters, pumps, heaters, blowers, luminaries, ballast chokes, consumer unit, residual current device (RSD), instruments, transformer, panel/sub-assembly, sensor, actuator, solenoids; positioning and securing of equipment and components; cables eg PVC, flexible, single core, multiway, data/communications, fibre optics, screened/coaxial, ribbon cables, wiring loom/harness; preparing cables eg stripping outer coating without damage to conductor insulation, stripping cable conductor insulation/protection; securing cables eg clips, plastic strapping, lacing, harnessing, clips, protective sleeving, coded tabs; crimping eg spade end, loops, tags, pins; making mechanical/screwed/ clamped connections; soldering and de-soldering; installation eg fixed, as on a wall, portable, as on a bench exercise board or special fixture
		2.2	Wire up electrical components correctly and safely	□ *Safety*: personal protection eg wearing protective clothing, removal of loose clothing and jewellery, use of barrier cream, eye protection, safety footwear; preparation of assembly area; good housekeeping eg cleanliness of work area, removal of waste materials, storage of materials and tools; maintenance of access eg clear walkways, emergency exits; using cable stripping and terminating tools safely and correctly; adhering to safety procedures or systems eg risk assessment, COSHH

Information for tutors

Delivery

This unit is about preparing for and carrying out an electrical wiring activity correctly and safely. It therefore lends itself to be delivered in a holistic way and by learners practising in the workshop and reflecting on the experiences gained relating to safety and the correct use of components, cables, tools and equipment when carrying out these activities.

A key part of delivery is therefore likely to be demonstration and practice although some awareness raising may be needed in a safe environment such as a classroom. Although both learning outcomes are practical in nature, some underpinning knowledge will need to be established before learners are allowed access to the practical activities. Checking of this may be best achieved through question and answer sessions. Other activities such as 'card games' or 'word searches' etc may also be appropriate and helpful.

Outline learning plan

The outline learning plan has been included in this unit as guidance.

Topic and suggested assignments/activities
Be able to prepare for and carry out an electrical wiring activity Whole-class, tutor-led discussions about the importance of good preparation. Whole-class, tutor-led demonstration of good practice and preparation in the electrical workshop. Individual activity: learners visit a poorly laid out wiring or assembly area and establish all points of bad practice, set this up as a competition. Individual activity: learners devise and play each others' crossword games about the precautions to take and the checking of components and cables. Assessment of this part of the unit is likely to be achieved within activities to meet the requirements of the second learning outcome.
Be able to wire up electrical components correctly and safely Individual activity completing 'gapped handouts' about safety aspects etc. Whole-class, tutor-led demonstration of electrical wiring activities. Individual activity: learners practise producing electrical wiring assemblies, with formative checks until learners show a reasonable level of competence and safety. Individual summative assessment activity. This will take a large proportion of the time for this part of the unit.

Assessment

The centre will devise and mark the assessment for this unit.

Learners must meet all assessment criteria to pass the unit.

Due to the nature of the assessment requirements of this unit it is likely that summative assessment will take a large proportion of the 30 hours assigned to the unit. Learners should only be the assessed once the tutor is comfortable with their level of competence developed during the formative stages of the practical activities.

A single assignment could be developed to address all the assessment criteria. It should be based on the practical activity of assembling electrical components and cables correctly and safely. This does mean that most of the evidence will be in the form of witness statements/observation records supported by annotated photographs of what learners carried out, and work area layout, along with component and cable listings etc. 2.1 will however require either a written list of safety aspects produced by learners or a list written by the tutor and extracted from the learner, and authenticated as such.

The wiring assembly given to each learner must include a range of opportunities for them to take appropriate precautions before they prepare for and start the assembly activity in a correct and safe manner. The electrical wiring assembly must include four different components and have a cable type from those listed in the unit content. Whilst the circuit does not need to contain all those listed it should have a simple function. Typical circuits are given in the unit content under learning outcome 1. This would add relevance to this activity. When designing the circuit to be assembled, and the components and cables to be carried out used care must be taken to ensure a protection device is included, and that learners have opportunities to show that the assembly is carried out correctly and checked using simple tests and visual checks. It would also be sensible to include some components or cables that are not 'fit for purpose' for example broken insulation, so that learners can demonstrate they have checked components and cables before assembling and requested an exchange. The opportunity to check the wiring for correct function is also important and part of the requirements of 2.2.

Suggested resources

Books

Linsley R – *Basic Electrical Installation Work* (Butterworth-Heinemann, 1998) ISBN 978-0340705742

Meredith B – *Ortho – Wiring Basics* (Ortho Books, 2000) ISBN 978-0897214407

Magazines

Engineering – (The Engineering Magazine) ISSN 0013-7782

Engineering & Technology Magazine

Websites

www.rapidonline.com

www.maplin.co.uk/

http://uk.rs-online.com/web/