Unit 10: Maintaining Process Control Systems

Level: 3

Guided learning hours: 700

Unit overview

This unit of competence has been developed by employers in the Advanced Manufacturing and Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector.

This unit identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out corrective maintenance activities to process controller equipment, in accordance with approved procedures. They will be required to maintain a range of process controller equipment, such as fixed I/O, rack mount and modular systems. This will involve dismantling, removing and replacing faulty peripheral components, process controller units and components, down to unit and board level. They will also need to be able to load and download process controller programs, check them for errors, make alterations to programs, and create and maintain back-up copies of completed programs.

Their responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities, process control system, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with minimal supervision, taking personal responsibility for their actions, and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying maintenance procedures to process controller systems. They will understand the maintenance methods and procedures used, and their application, and will know about the various process controller units and peripheral components, their functions and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and ensuring that the equipment operates to the required specification and remains compliant with all standards and regulations. They will also know about the interaction of the other associated integrated technologies, and will have sufficient knowledge to carry out the dismantling and reassembly of the process controller system, safely and effectively.

They will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate occupational behaviours required in the workplace to meet the job profile and overall company objectives, including logical approach, problem solving orientation, quality focus, personal responsibility and resilience, clear communicator, team player, applies lean manufacturing principles, adaptability, self-motivation, willingness to learn and commitment.

Assessment requirements

The assessment requirements for this unit are in the Advanced Manufacturing Engineering Assessment Strategy and can be found in *Annexe A* of the associated qualification specification. These requirements have been developed by employers for Advanced Manufacturing Engineering.

Additional information

Although all of the content and assessment requirements must be met in full, employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored training programme whilst meeting their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Performance requirements

The apprentice must be able to:

P1 Work safely at all times, complying with health and safety and other relevant regulations and guidelines

P2 Demonstrate the required occupational behaviours in line with the job role and company objectives

P3 Follow the relevant maintenance schedules to carry out the required work

P4 Carry out the maintenance activities within the limits of their personal authority

P5 Carry out the maintenance activities in the specified sequence and in an agreed timescale

P6 Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

P7 Complete relevant maintenance records accurately and pass them on to the appropriate person

P8 Dispose of waste materials in accordance with safe working practices and approved procedures

Skills

The apprentice must be able to:

S1 Carry out **all** of the following during the maintenance activities:

- 1.1 plan and communicate the maintenance activities to cause minimal disruption to normal working
- 1.2 obtain and use the correct issue of company and/or manufacturers' drawings and maintenance documentation
- 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work including the electricity at work regulations
- 1.4 ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
- 1.5 provide and maintain safe access and working arrangements for the maintenance area
- 1.6 carry out the maintenance activities using appropriate techniques and procedures
- 1.7 re-connect and return the system to service on completion of the maintenance activities
- 1.8 dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition

Skills

The apprentice must be able to:

S2 Carry out maintenance activities on **one** of the following types of process control equipment:

- 2.1 modular
- 2.2 rack mount

S3 Carry out **all** of the following program maintenance activities on the process control system:

- 3.1 select and use appropriate programming devices (such as terminals, hand-held programmers and personal computers)
- 3.2 use ladder logic or system flowcharts
- 3.3 carry out online monitoring of programs
- 3.4 produce back-ups of completed programs
- 3.5 use 'on' and 'off-line' programming
- 3.6 edit, enter and remove contacts from lines of logic
- 3.7 load, read and save programs
- 3.8 alter counter and timer settings
- 3.9 force contacts on and off

S4 Carry out **all** of the following during the maintenance activities:

- 4.1 take electrostatic precautions when handling components and circuit boards
- 4.2 proof marking or labelling of removed wires and components
- 4.3 replace peripherals (such as sensors, actuators, relays, switches)
- 4.4 inspect components for serviceability
- 4.5 use run mode of operation
- 4.6 check back-up batteries and replace where applicable
- 4.7 change or add circuit boards (where applicable)
- 4.8 replace process controller units
- 4.9 functionally test the system
- 4.10 replace power supplies (where applicable)

S5 Maintain process control equipment in compliance with **two** of the following:

- 5.1 BS7671-IET wiring regulations
- 5.2 organisational guidelines and codes of practice
- 5.3 BS, ISO and/or BSEN standards
- 5.4 equipment manufacturer's operation range

S6 Complete the relevant documentation from **one** of the following in line with company procedure:

- 6.1 job cards
- 6.2 permits to work/formal risk assessment and/or sign-on/off procedures

Skills

The apprentice must be able to:

6.3 maintenance log or report

6.4 company-specific documentation

Knowledge and understanding

The apprentice must:

K1 Describe the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility they place on them

K2 Describe the isolation and lock-off procedure or permit-to-work procedure that applies to the process control system being worked on

K3 Describe the specific health and safety precautions to be applied during the maintenance activity, and their effects on others

K4 Explain how to recognise and deal with victims of electric shock (to include methods of safely removing the victim from the power source, isolating the power source), including the difference between AC and DC electrical shock and how this affects the victim

K5 Describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities, and where this can be obtained

K6 Describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)

K7 Describe the hazards associated with carrying out maintenance activities on process control systems (such as handling fluids, stored pressure/force, electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise them to reduce any risks

K8 Describe the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

K9 Explain how to obtain and interpret drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, symbols used on process controller documents and other documents needed in the maintenance process

K10 Describe the basic principles of how the system being maintained functions, its operation sequence, the working purpose of individual units/components and how they interact

K11 Describe the devices and systems for storing programs

K12 Describe procedures to be applied to the storage, location and method of backing up programs

Knowledge and understanding *The apprentice must:*
K13 Describe the different types of interface cards and their application
K14 Describe the procedures and application of design and development' computer-based authoring software
K15 Describe the numbering system and codes used for identification of inputs and outputs
K16 Explain how to search the user program within the process controller for specific elements
K17 Describe programming techniques and codes used (such as interlocking, timers, counters, subroutines)
K18 Describe the techniques involved in editing, entering and removing contacts from lines of logic and, where applicable, the procedure to be followed for 'on' and 'off-line' programming
K19 Describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance process
K20 Describe company policy on the repair/replacement of components during the maintenance process
K21 Describe the techniques used to dismantle/assemble integrated equipment (such as release of pressures/force, proofmarking to aid assembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)
K22 Describe methods of attaching identification marks/labels to removed components or cables, to assist with reassembly
K23 Describe methods of checking that components are fit for purpose, and the need to replace batteries, boards and other failed items
K24 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 their intended purpose
K25 Describe the importance of making 'off-load' checks before proving the equipment with the electrical supply on
K26 Describe the generation of maintenance documentation and/or reports following the maintenance activity
K27 Describe the equipment operating and control procedures to be applied during the maintenance activity
K28 Explain how to use lifting and handling equipment correctly and safely in the maintenance activity
K29 Describe the problems that can occur during the maintenance of the process control system, and how they can be overcome

Knowledge and understanding *The apprentice must:*
K30 Describe the organisational procedure to be adopted for the safe disposal of waste of all types of material K31 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve