PROMT15
Carrying out fault diagnosis on electrical equipment and circuits

Overview

This unit identifies the competences you need to carry out efficient and effective fault diagnosis on electrical equipment and circuits, in accordance with approved procedures. You will be required to diagnose faults on a range of electrical equipment, such as single and three-phase power supplies, motors and starters, switchgear and distribution panels, electrical plant, control systems and equipment, and luminaires. You will be expected to use a variety of fault diagnosis methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, you will be expected to identify the fault and its probable cause, and to suggest action to remedy the problem.

Your responsibilities will require you to comply with organisational policy and procedures for the fault diagnostic activities undertaken, and to report any problems with these activities or the tools and equipment used that you cannot personally resolve, or that are outside your permitted authority, to the relevant people. You will be expected to work with minimal supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying fault diagnosis procedures on electrical equipment and circuits. You will understand the various fault diagnosis methods and techniques used, and their application. You will also know how to interpret and apply information obtained from the diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities and for identifying faults or conditions that are outside the required specification.

You will understand the safety precautions required when carrying out the fault diagnosis activities, especially those for isolating the equipment. You will also understand your responsibilities for safety and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

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Performance criteria

You must be able to:

P1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines
P2	Review and use all relevant information on the symptoms and problems associated with the products or assets
P3	Investigate and establish the most likely causes of the faults
P4	Select, use and apply diagnostic techniques, tools and aids to locate faults
P5	Complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
P6	Determine the implications of the fault for other work and for safety considerations
P7	Use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
P8	Record details on the extent and location of the faults in an appropriate format

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Knowledge and understanding

You need to know and understand:

K1	The health and safety requirements of the area in which the fault diagnosis activity is to take place, and the responsibility these requirements place on you
K2	The isolation and lock-off procedure or permit-to-work procedure that applies
K3	How to recognise and deal with victims of electric shock (to include methods of safely removing victim from power source, isolating the power source, and methods of first aid resuscitation)
K4	The importance of wearing protective clothing and other appropriate safety equipment during fault diagnosis activities
K5	Hazards associated with carrying out fault diagnosis on electrical equipment (such as live electrical components, stored energy, misuse of tools), and how to minimise these and reduce any risks
K6	The procedure to be adopted to establish the background of the fault
K7	How to evaluate the various types of information available for fault diagnosis
K8	How to use the various aids and reports available for fault diagnosis
K9	How to use various items of fault diagnostic equipment to investigate the problem
K10	The various fault finding techniques that can be used, and how they are applied (such as half-split, input-to-output, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)
K11	How to evaluate sensory information (sight, sound, smell, touch)
K12	How to analyse evidence and evaluate possible characteristics and causes of specific faults/problems
K13	How to relate previous reports/records of similar fault conditions
K14	The care, handling and application of electrical test instruments (such as multimeters, insulation resistance testers)
K15	How to calibrate electrical test instruments and check that they are free from damage and defects
K16	How to obtain and interpret drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, BS7671/IEE wiring regulations, and other documents needed in the maintenance process
K17	The basic principles of how the circuit functions, the operating sequence, the purpose of individual units/components and how they interact
K18	The different types of cabling (such as multi-core cables, single-core cables, SWA cables, MI cables, screened cables), their associated fittings, and their application
K19	The different types of motors and starters, and their operation
K20	The different types of control systems and components, and their

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Knowledge and understanding		operation
	K21	The different types of electrical components (such as plugs, switches, lighting and fittings, junction boxes, consumer units), and their operation
	K22	How to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process or system
	K23	How to prepare and produce a risk analysis report, where appropriate
	K24	How to prepare a report or take follow-up action which satisfies the company policy on concluding fault diagnosis
	K25	The extent of your own authority and to whom you should report if you have problems that you cannot resolve

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Scope related to performance criteria

1 Carry out all of the following during the fault diagnostic activity:

1.1 plan the fault diagnosis, based on the available information about the fault
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
1.4 ensure the safe isolation of equipment (such as electricity, mechanical, gas, air or fluids)
1.5 provide and maintain safe access and working arrangements for the fault finding/maintenance area
1.6 carry out the fault diagnostic activities using approved procedures
1.7 collect equipment fault diagnostic evidence from 'live' and isolated circuits
1.8 disconnect or isolate components or parts of circuits, when appropriate, to confirm diagnosis
1.9 identify the fault and determine appropriate corrective action
1.10 dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition

2 Carry out fault diagnosis on six of the following types of equipment:

2.1 single-phase power circuits
2.2 three-phase power circuits
2.3 direct current power circuits
2.4 switchgear and distribution panels
2.5 motors and starters
2.6 control systems and components
2.7 electrical plant
2.8 luminaires

3 Collect fault diagnostic evidence from four of the following sources:

3.1 the person or operator who reported the fault
3.2 test instrument measurements (e.g., watt meters, multimeter, earth-loop impedance testers)
3.3 circuit meters (such as voltmeter, power factor meter, ammeter) recording devices
3.4 sensory input (sight, sound, smell, touch)
3.5 plant/equipment records

Scope related to performance criteria

3.6 condition of end product
3.7 equipment self-diagnostics

4 Use a range of fault diagnostic techniques, to include two of the following:

4.1 half-split technique
4.2 input/output technique
4.3 injection and sampling
4.4 six point technique
4.5 equipment self-diagnostics
4.6 emergent sequence
4.7 unit substitution
4.8 function/performance testing

5 Use a variety of diagnostic aids and equipment to include two of the following:

5.1 logic diagrams
5.2 flow charts or algorithms
5.3 manufacturers' manuals
5.4 equipment self-diagnosis
5.5 fault analysis charts (such as fault trees)
5.6 trouble shooting guides
5.7 electronic aids

6 Use all of the following fault diagnosis procedures:

6.1 inspection (such as breakages, wear/deterioration, signs of overheating, missing parts, loose fittings)
6.2 operation (such as manual switching off and on, RCD test buttons, automatic switching/timing/sequencing, desired outputs)
6.3 measurement (such as voltage, current, continuity, power, temperature, luminescence)

7 Use three of the following types of test equipment to aid fault diagnosis:

7.1 multimeter
7.2 watt meter
7.3 voltmeter
7.4 ammeter
7.5 earth-loop impedance tester
7.6 insulation resistance tester

7.7 portable appliance tester
7.8 light meter
7.9 other specific test equipment

8 Find faults that have resulted in two of the following breakdown categories:

8.1 intermittent action or circuit failure
8.2 partial failure or reduced performance
8.3 complete breakdown

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