SEMEM442

Carrying out maintenance activities on electrical equipment

Overview

This standard identifies the competences you need to lead maintenance activities by carrying out corrective maintenance activities on electrical equipment, in accordance with approved procedures. As part of the team you will be required to maintain a range of electrical equipment. You will be required to maintain a range of electrical equipment, such as single, three-phase and direct current power supplies and control systems, motors and starters, switchgear and distribution panels, control systems, electrical equipment, wiring enclosures and luminaires. This will involve dismantling, removing and replacing faulty equipment, at component or unit level, on a variety of different types of electrical assemblies and sub-assemblies. You will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely.

You will be expected to apply a range of dismantling and reassembly methods and techniques, such as soldering, crimping, harnessing and securing cables and components.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken and to report any problems with the maintenance activities or the tools and equipment used, that you cannot personally resolve or that are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment, and materials used in the maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. 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 an in depth understanding of your work and will provide an informed approach to applying electrical maintenance procedures. You will understand the dismantling and reassembly methods and procedures, and their application. You will know about the electrical equipment worked on, component properties, functions and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and ensuring that the repaired equipment functions to the required specification and remains compliant with all standards and regulations.

You will understand the safety precautions required when carrying out the maintenance 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.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. produce and update relevant maintenance schedules and plans
3. lead maintenance activities within the limits of your personal authority
4. carry out the maintenance activities in the specified sequence and in an agreed timescale
5. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
6. complete relevant maintenance documentation accurately
7. dispose of waste materials in accordance with safe working practices and approved procedures
8. identify and lead on making improvements to maintenance processes and procedures
9. update management information and systems to support the activities of the maintenance department

Knowledge and understanding

You need to know and understand:

1. the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on you
2. how to prioritise your own and your team's workload to ensure that targets are met
3. how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
4. the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards
5. how to complete a skills audit of team members
6. how maintenance teams can access the appropriate training and development programmes once a need training need has been identified
7. the isolation and lock-off procedure or permit-to-work procedure that applies to maintenance activities (such as electrical isolation, locking off switchgear, removal of fuses, placing of maintenance warning notices, proving the isolation has been achieved and secured)
8. how to recognise and deal with victims of electric shock
9. hazards associated with carrying out electrical maintenance activities (such as contact with live electrical components, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise these and reduce any risk
10. the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
11. how to obtain and interpret drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, wiring regulations, and other documents needed for the maintenance activities
12. the procedure to be adopted to establish the background of the fault
13. how to evaluate the various types of information available for fault diagnosis
14. how to use the various aids and reports available for fault diagnosis
15. how to use various items of fault diagnostic equipment to investigate the problem
16. 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)
17. how to evaluate sensory information (sight, sound, smell, touch)
18. how to analyse evidence and evaluate possible characteristics and causes of specific faults/problems

19. how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on health and safety, and on the overall process or system
20. how to relate previous reports/records of similar fault conditions
21. the care, handling and application of electrical test instruments (such as multimeters, insulation resistance testers)
22. how to calibrate electrical test instruments and check that they are free from damage and defects
23. the purpose of the components which have been replaced/maintained
24. the different types of cabling and their application (such as multicore cables, single core cables, steel wire armoured (SWA), mineral insulated (MI), screened cables)
25. the application and use of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)
26. the different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)
27. the care, handling and application of ohmmeters, multimeters and other electrical measuring instruments
28. company policy on the repair/replacement of components, and the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
29. how to check that the replacement components meet the required specification/operating conditions (such as values, tolerance, current carrying capacity, voltage rating, power rating, working temperature range, frequency)
30. the techniques used to dismantle/assemble electrical equipment (such as unplugging, de-soldering, removal of screwed, clamped and crimped connections)
31. methods of removing and replacing cables and wires in wiring enclosures without causing damage to existing cables
32. the use of wiring regulations, and other, regulations when selecting wires and cables and when carrying out tests on systems
33. methods of attaching identification markers/labels to removed components or cables to assist with re-assembly
34. the tools and equipment used in the maintenance activities (including the use of cable stripping tools, crimping tools, soldering irons and torches, gland connecting tools)
35. methods of checking that components are fit for purpose, and the need to replace `lifed' items (such as motor brushes, seals and gaskets overload protection devices)
36. how to make adjustments to components/assemblies to ensure they function correctly
37. how to check tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose
38. the importance of making `off-load' checks before proving the

equipment with the electrical supply on

39. the generation of maintenance documentation and/or reports following the maintenance activity
40. the equipment operating and control procedures to be applied during the maintenance activity
41. how to use appropriate lifting and handling equipment in the maintenance activity
42. the problems that can occur during the electrical maintenance activity, and how they can be overcome
43. the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
44. how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
45. how to evaluate improvement ideas in order to select those that are to be pursued
46. how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
47. how to create or update Standard Operating Procedures (SOP's) maintenance schedules and plans.
48. the techniques required to communicate information using visual control systems (such as, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
49. the extent of your own authority and to whom you should report if you have a problem that you cannot resolve

Scope/range related to performance criteria

1. Lead a maintenance team by carrying out all the following:

    1. communicate the maintenance activities to the team
    2. involve the team in planning how the maintenance activities will be undertaken
    3. allocate specific maintenance activities to each team member
    4. involve the team in identifying improvements that could be made to the maintenance process and/or procedures
    5. encourage the team and/or individuals to take the lead where appropriate

2. Review and update maintenance procedures and plans to include three of the following:

    1. preventive maintenance (routine inspections, and adjustments)
    2. corrective maintenance (activities identified from preventative maintenance activities)
    3. predictive maintenance (analysis of the equipment's condition)
    4. reactive maintenance (unexpected equipment/component failure)
    5. maintenance prevention (equipment/component design and development)

plus supporting documentation associated with two **of the following
6. equipment performance
7. equipment downtime/failure
8. overall equipment effectiveness (OEE)
9. maintenance costs
10. health and safety
11. staff development and training
12. maintenance procedures/instructions
13. operator manuals/working instructions
14. regulatory compliance

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

    1. the person or operator who reported the fault
    2. recording devices
    3. test instrument measurements (such as watt meters, multimeter, earth-loop impedance testers)
    4. sensory input (sight, sound, smell, touch)
    5. plant/equipment records
    6. circuit meters (such as voltmeter, power factor meter,

ammeter)
7. condition of end product
8. equipment self-diagnostics

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

    1. half-split technique
    2. input/output technique
    3. emergent sequence
    4. injection and sampling
    5. unit substitution
    6. six point technique
    7. function/performance testing
    8. equipment self-diagnostics

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

    1. logic diagrams
    2. equipment self-diagnosis
    3. trouble shooting guides
    4. flow charts or algorithms
    5. fault analysis charts (such as fault trees)
    6. electronic aids
    7. manufacturers' manuals

6. Use all of the following fault diagnosis procedures:

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

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

    1. multimeter
    2. watt meter
    3. voltmeter
    4. ammeter
    5. earth-loop impedance tester
    6. insulation resistance tester
    7. portable appliance tester
    8. light meter
    9. other specific test equipment

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

    1. intermittent problem
    2. partial failure/out-of-specification output
    3. complete breakdowns

9. Carry out all of the following during the maintenance activity:

    1. obtain and use the correct issue of company and/or manufacturer's drawings and maintenance documentation
    2. 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
    3. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
    4. provide and maintain safe access and working arrangements for the maintenance area
    5. carry out the maintenance activities using appropriate techniques and procedures
    6. re-connect and return the system to service on completion of activities
    7. dispose of waste items in a safe and environmentally acceptable manner and leave the work area in a safe condition

10. Carry out maintenance activities on six **of the following types of electrical equipment:

    1. single-phase power supplies
    2. control systems and components
    3. three-phase power supplies
    4. electrical plant
    5. direct current power supplies
    6. wiring enclosures
    7. motors and starters
    8. luminaires
    9. switchgear and distribution panels
    10. other specific electrical equipment

11. Carry out eight **of the following maintenance activities as applicable to the equipment being maintained:

    1. isolating and locking-off equipment
    2. removing and replacing damaged wires and cables
    3. disconnecting and reconnecting wires and cables
    4. attaching suitable cable identification markers

5. removing and replacing wiring enclosures
6. removing electrical units/components
7. setting and adjusting replaced components
8. checking components for serviceability
9. making `off-load' checks before powering up
10. replacing damaged/defective components
11. functionally testing the completed system

12. Replace/refit a range of electrical components, to include ten of the following groups of components:

    1. cables and connectors
    2. capacitors
    3. lighting fixtures
    4. contactors
    5. rectifiers
    6. batteries
    7. relay components
    8. encoders or resolvers
    9. switches and sensors
    10. overload protection devices
    11. inverter and servo controllers
    12. solenoids
    13. locking and retaining devices (cable ties, clips, proprietary fasteners)
    14. circuit boards
    15. transformers
    16. thermistors or thermocouples
    17. other specific components

13. Maintain electrical equipment which complies with one of the following:

    1. organisational guidelines and procedures
    2. equipment manufacturer's operating specification/range
    3. British, European or International standards or directives
    4. recognised compliance agency/body standards or directives
    5. health, safety and environmental requirements
    6. customer standards and requirements

14. Complete the relevant maintenance documentation to include one from the following:

    1. job cards
    2. permit to work/formal risk assessment and/or sign-on/off procedures
    3. maintenance log or report
    4. company-specific recording system

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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