

Maintaining industrial refrigeration equipment

Overview

This standard identifies the competences you need to carry out corrective maintenance activities on industrial refrigeration equipment, in accordance with approved procedures. This will involve dismantling, removing and maintaining faulty or damaged components, such as motors, compressors, evaporative condensers, evaporators, safety control devices, valves, refrigerant metering devices, sensors, switches, thermostats, meters, thermocouples, timers, interlocks, electrical components and wiring, electronic boards and components, controller units, computer systems and peripheral devices.

You will be expected to apply a range of dismantling and assembly methods and techniques, to include marking/labelling of components to aid the assembly, dismantling components by unplugging, de-soldering removal of screwed, clamped and crimped connections, and aligning and adjusting components. You will also be expected to purge the system with the designated gases, to charge the system with the specified refrigerant and lubricant, and to bring the system back on line following the recognised and safe procedures.

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 a good understanding of your work, and will provide an informed approach to applying maintenance procedures on refrigeration systems and equipment. You will understand the dismantling and reassembly methods and procedures used, and their application. You will know how the equipment functions, the purpose of the individual components 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 also have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating, charging and purging the equipment. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in

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the workplace.

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Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation and other relevant regulations, directives and guidelines
2. follow the relevant maintenance schedules to carry out the required work
3. carry out the 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 and store all relevant maintenance documentation in accordance with organisational requirements
7. dispose of waste materials in accordance with safe working practices and approved procedures and leave the work area in a safe condition

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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
2. the isolation and lock-off procedures or permit-to-work procedure that applies to the refrigeration equipment being maintained
3. the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. hazards associated with carrying out maintenance activities on refrigeration equipment/systems (such as stored pressure/force, lack of good ventilation, live electrical connections, handling liquid or vapour refrigerants, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise them to reduce any risks
5. handling and storing of gas cylinders and equipment; the safe handling, storing and disposal of refrigerants; methods of determining contents in cylinders to allow complete charging
6. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the maintenance process
7. how to obtain and interpret drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process
8. the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
9. organisational policy on the repair/replacement of components during the maintenance process
10. the sequence to be adopted for the dismantling/reassembly of various types of assembly
11. the methods and techniques used to dismantle/assemble refrigeration equipment (such as unplugging, de-soldering removal of screwed, clamped and crimped connections, removing bolted components and assemblies)
12. methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as batteries, lamps, seals and gaskets)
13. how to make adjustments to components/assemblies to ensure they function correctly
14. the basic principles of how compression type refrigeration systems function, their operation sequence, the working purpose of individual units/components and how they interact
15. types of compressor, condenser, expansion valves and evaporators, and methods of stopping compressor prime movers
16. the system operating pressures and temperatures, and the relationship between refrigerant gas pressures and temperatures
17. methods of removing and replacing components and units without

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- damaging the system and infrastructure
- 18. methods of testing equipment and systems for leaks (such as liquid bubble testing, treated paper, halide torch, sulphur candles, electronic instruments or automatic detection equipment), and the tools and equipment that can be used
- 19. types and application of primary and secondary refrigerants, and methods of purging and charging the system using liquid and vapour refrigerants
- 20. the use of vacuum pumps, pressure gauges, compound gauges, flow gauges and indicators
- 21. 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
- 22. the generation of maintenance documentation and/or reports following the maintenance activity
- 23. the equipment operating and control procedures to be applied during the maintenance activity
- 24. how to use lifting and handling equipment correctly and safely in the maintenance activity
- 25. the problems associated with the maintenance activity, and how they can be overcome
- 26. the organisational procedure to be adopted for the safe disposal of waste of all types of material
- 27. 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/range

1. Carry out all of the following during the maintenance activity:
 1. plan and communicate the maintenance activities to cause minimal disruption to normal working
 2. obtain and use the correct issue of organisational and/or manufacturers' drawings and maintenance documentation
 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
 4. ensure the safe isolation of equipment (such as mechanical, electricity, refrigerants)
 5. provide and maintain safe access/egress and working arrangements for the maintenance area
 6. carry out the maintenance activities using appropriate techniques and procedures
 7. re-connect and return the system to service on completion of the maintenance activities
 8. record the results of the maintenance activity and report any defects found
 9. dispose of waste materials in accordance with safe working practices and approved procedures and leave the work area in a safe condition
2. Carry out maintenance activities on two of the following types of refrigeration equipment:
 1. compression types using air cooled condensers
 2. compression types using water cooled condensers
 3. compression types using secondary refrigerants
 4. air conditioning cooling plant
3. Carry out all of the following maintenance techniques, as appropriate to the equipment being maintained:
 1. testing the system for leaks
 2. setting, aligning and adjusting replaced components
 3. dismantling equipment to unit/sub-assembly level
 4. dismantling units to component level
 5. checking correct operation of all safety devices
 6. marking/labelling of components
 7. checking operation of all valves
 8. checking components for serviceability
 9. tightening fasteners to the required torque

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10. replacing 'lived' items (such as lamps, seals, gaskets)
 11. functionally testing the completed system
 12. replacing damaged/defective components
4. Maintain and/or replace a range of refrigeration equipment components, to include ten of the following:
1. motors
 2. thermocouples
 3. gauges (temperature, humidity, pressure)
 4. evaporative condensers
 5. vents/diffusers
 6. transformers
 7. evaporators
 8. electrical cables
 9. uninterrupted power supplies
 10. compressors
 11. overload protection devices
 12. interlocks
 13. relays
 14. circuit boards
 15. modems
 16. sensors
 17. safety devices
 18. printers
 19. switches
 20. electronic components
 21. PC peripheral devices
 22. thermostats
 23. pressure relief valves
 24. monitoring software
 25. belt drives
5. Carry out charging/evacuation procedures on refrigeration equipment, to include five of the following, as applicable to the equipment being maintained:
1. purging equipment of all air (such as dry nitrogen)
 2. pumping down a system
 3. using flushing lines and equipment
 4. setting pressure cut-outs
 5. liquid charging of a system
 6. setting expansion valves
 7. vapour charging of a system
 8. setting thermostats and controls
 9. adding refrigeration lubricants
6. Carry out pressure leak testing of the completed system, using two

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of the following methods:

1. bubble testing
2. halide torch
3. treated papers
4. sulphur candles
5. electronic instruments
6. automatic detection
7. other suitable method

7. Maintain refrigeration equipment/systems in compliance with one of the following:

1. organisational guidelines and codes of practice
2. equipment manufacturer's operation range.
3. BS7671/EEE wiring regulations
4. BS, ISO and/or BSEN standards

8. Complete and store all relevant maintenance documentation in accordance with organisational requirements, using one of the following:

1. job cards
2. permits to work/formal risk assessment and/or sign-on/off procedures
3. maintenance log or report
4. organisational-specific documentation
5. electronic reports

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