SEMIC320

Commissioning mechanical equipment and systems

Overview

This standard identifies the competences you need to carry out commissioning activities on mechanical equipment and systems, in accordance with approved procedures. You will be required to commission a range of mechanical equipment, such as machine tools, process control equipment, rotating mechanical equipment, engines and turbines, conveyors and elevators, lifting and handling equipment, processing plant and storage vessels that have mechanical systems connected to them.

This standard does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as bench drills, pedestal grinders, small compressors or pumps.

You will be expected to check that the equipment has been installed correctly to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level and alignment, adjusting and setting equipment operating parameters, making `off-load' checks before starting up the equipment, operating the equipment at reduced loads/speeds to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to electrical, fluid power, programmable logic controllers (PLC's), services and external units/equipment, such as belt and chain drives, clutches and brakes.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another standard.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning

procedures for mechanical equipment. You will understand the commissioning methods, techniques and procedures used and their application. You will know how the equipment functions, the purpose of the individual units/components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities, correcting or reporting faults and solving functional problems, ensuring that the equipment performs to the required specification.
You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. 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. follow all relevant setting up and operating specifications for the products or assets being configured
3. follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
4. gather all the information required to undertake the commissioning
5. plan and carry out the commissioning activities in accordance with approved methods, techniques and procedures, using appropriate instruments/devices
6. deal promptly and effectively with problems and conditions within your control and report those that cannot be solved
7. check that the configuration is complete and that the equipment operates to specification
8. complete relevant documentation in accordance with organisational requirements

Knowledge and understanding

You need to know and understand:

1. the specific safety practices and procedures that you need to observe when commissioning mechanical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. hazards associated with carrying out mechanical commissioning activities (such as handling oils, greases, stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. how to obtain and interpret drawings, specifications, manufacturers' manuals, instructions and other documentation needed in the commissioning process
7. how to carry out currency/issue checks for the specifications you are working with
8. the equipment to be commissioned, its operating procedures and function
9. the checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. the procedures to be applied during the commissioning activity
11. the importance of making `off-load' checks before running the equipment under power
12. the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
13. how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, setting backlash in gears, adjusting and tensioning belt and chain drives, preloading bearings)
14. the fault diagnostic techniques that can be used to help identify problems with the equipment
15. the uses of measuring equipment, such as micrometers, verniers, run-out

devices and other measuring devices

16. the calibration/care and control procedures for the tools and equipment used during commissioning
17. the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
18. the methods and techniques used to dismantle mechanical equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)
19. how to re-assemble the removed components, and how to adjust them to meet the operating specification
20. the recording and/or reporting documentation to be completed for the activities undertaken
21. the types of problem associated with the commissioning activity, and how they can be overcome
22. the organisational procedures to be adopted for the safe disposal of waste of all types of materials
23. the extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Scope/range related to performance criteria

1. Carry out **all** of the following during the commissioning activities:
1. plan the commissioning activities so as to minimise disruption to normal working
2. ensure the currency of all documentation used in the commissioning activities
3. adhere to risk assessment, COSHH and other relevant safety standards
4. ensure that all tools and equipment used are within current calibration dates
5. ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air or fluids)
6. obtain clearance to carry out the commissioning activities
7. provide safe access and working arrangements for the commissioning area
8. dispose of any waste items in a safe and environmentally acceptable manner
9. leave the work area in a safe condition and free from foreign object debris

2. Gather all the information required to undertake the commissioning, to include **six** of the following:
1. client requirements
2. regulations and guidelines
3. commissioning procedures
4. equipment specifications
5. environmental requirements
6. product/process specifications
7. manufacturers' manuals/settings
8. installation reports
9. resources necessary to carry out commissioning (such as personnel, supplies, time constraints)

3. Carry out commissioning on **one** of the following types of mechanical equipment/systems:
1. machine tools
2. turbines
3. lifting and handling equipment
4. industrial compressors

5. elevators
6. engines
7. conveyors
8. processing plant
9. hoppers or large storage vessels (having mechanical systems connected to them)
10. process control equipment (such as large valves and actuating mechanisms, pumps)
11. other specific mechanical equipment

4. Prior to initial start-up, carry out **all** of the following checks:

1. the site is free from obstructions/hazards, and safety/environmental conditions have been met
2. check for damage to equipment following the installation
3. the equipment has been installed and secured/torqued in position, according to specification
4. all utilities are connected and operative
5. all connections have been made correctly (mechanical, electrical, fluid power, PLC)
6. all fluids, lubricants and grease are at the appropriate level for start-up
7. all moving parts are clear of obstructions
8. all labels, safety and warning signs are attached in the correct locations
9. all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning methods, techniques and procedures:

1. carry out start-up procedures, and confirm that the equipment/system meets specifications
2. run equipment at the recommended initial settings (such as reduced power/speed/flow)
3. check for leaks during operations
4. make sensory checks (sight, sound, smell, touch)
5. run through the operating sequence, and check for correct functioning
6. load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, feeds, pressures, flow, timing, sequence)
7. conduct a trial run of the equipment at full power/speed/flow

8. confirm that the final product/process outcomes meet specifications
9. monitor and record measurements and observations
10. shut down/isolate the equipment/installation to a safe condition

6. Use **three** of the following instruments/devices during the commissioning activities:

1. alignment devices
2. multimeter
3. flow testing devices
4. levelling devices
5. continuity tester
6. specific diagnostic aids
7. linear measuring instruments
8. bleeding equipment
9. PLC/PC equipment
10. speed measuring devices
11. pressure testing devices
12. other specific instruments/devices

7. Deal with **two** of the following conditions during the commissioning process:

1. installations with no faults
2. partial equipment malfunction
3. complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

1. checks and tests undertaken
2. where the installation fails to meet the specification requirements
3. probable causes/sources of the defect
4. recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

5. identifying the source of the fault, using appropriate fault finding

techniques and/or diagnostic aids
6. isolating and dismantling the equipment to unit, sub-assembly or component level
7. replacing damaged or defective items
8. re-running the commissioning checks to confirm that correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** of the following standards:
1. equipment manufacturer's operating spec/range
2. health, safety and environmental requirements
3. wiring regulations
4. customer standards and requirements
5. BS and/or ISO standards
6. company standards and procedures

10. Complete the relevant documentation, to include **one** from the following, and pass it to the appropriate people:
1. commissioning log/report
2. corrective action report
3. job sheet
4. customer specific documentation
5. handover report

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