Overview

This standard identifies the competences you need to install mechanical equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install 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 structures like hoppers and large storage vessels.

This standard does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that require minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes and the alignment and connection to external units/equipment, such as power supplies, belt and chain drives, clutches and brakes, services and fluid power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water, steam or fuel supplies, as appropriate to the equipment being installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate tension or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or 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 installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.
You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must also be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying mechanical installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities safely and effectively, to identify and correct any faults, and to ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. 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. carry out a site check prior to installation activities
3. follow all relevant drawings and specifications for the installation being carried out
4. use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
5. install, position and secure the equipment and components in accordance with the specification, using the correct methods, techniques and procedures
6. ensure that all necessary connections to the equipment are complete
7. deal promptly and effectively with problems within your control and report those that cannot be solved
8. check that the installation is complete and that all components are free from damage
9. complete records of the handover 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 installing 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 installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. the health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. the hazards associated with installing mechanical equipment, and with the tools and equipment used, and how they can be minimised
5. the personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. the interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. how to carry out currency/issue checks of the specifications you are working with
8. the equipment to be installed, its operating procedures and function
9. methods of marking out the site for positioning of the equipment, and the tools and equipment used for this
10. methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
11. the various mechanical fasteners that will be used, and their method of installation (including threaded fasteners, special securing devices, masonry fixing devices)
12. the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
13. the procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
14. the types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crow bars, torque wrenches, engineer’s levels, alignment telescopes, laser devices)
15. the techniques used to position, align, level and adjust the equipment
16. methods of lifting, handling and supporting the equipment during the installation activities
17. methods of connecting to mechanical power transmission devices (such as belt and chain drives, couplings, clutches, brakes)
18. methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
19. why electrical bonding is critical, and why it must be both mechanically and electrically secure
20. the procedure for the safe disposal of waste materials
21. how to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy, and quality of the installation (including the fitting of guards to all moving parts, covers on electrical connections)
22. how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, contamination)
23. the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
24. the calibration/care and control procedures for tools and equipment
25. the problems that can occur with the installation operations, and how these can be overcome
26. the fault-finding techniques to be used when the equipment fails to operate correctly
27. the recording documentation to be completed for the activities undertaken
28. the extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve
Installing mechanical equipment

**Scope/range related to performance criteria**

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
   1. the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
   2. appropriate utilities are available (such as gas, water, air, electricity)
   3. any required installation consumables are available
   4. safety and environmental conditions can be met
   5. the installation activities have been planned, prior to beginning the work
   6. checks have been made to ensure currency of installation documentation (such as drawings, layouts, instructions, manufacturers' data, settings and other documentation)

2. Carry out **all** of the following activities during the installation:
   1. adhere to risk assessment, COSHH and other relevant safety standards
   2. obtain clearance to carry out the installation activities
   3. provide safe access and working arrangements for the installation area
   4. ensure safe isolation of services during the installation (such as mechanical, electricity, gas, air or fluids)
   5. dispose of waste items in a safe and environmentally acceptable manner
   6. leave the work area in a safe condition and free from foreign object debris

3. Install **one** of the following types of mechanical equipment:
   1. machine tools
   2. elevators
   3. lifting and handling equipment
   4. industrial compressors
   5. processing plant
   6. conveyors
   7. hoppers or large storage vessels
   8. engines
   9. turbines
   10. process control equipment (such as large valves and actuating mechanisms, pumps)
11. Other specific mechanical equipment

4. Apply installation methods and techniques, to include five of the following:
   1. Marking out of locating and securing positions
   2. Levelling equipment
   3. Drilling and hole preparation
   4. Shimming and packing
   5. Fitting inserts (such as rag or expanding bolts)
   6. Fitting anti-vibration mountings
   7. Positioning equipment
   8. Securing using mechanical fixings
   9. Aligning equipment
   10. Applying screw fastening locking devices

5. Move and position equipment, using two of the following:
   1. Slings
   2. Portable lifting devices
   3. Hoists
   4. Cranes
   5. Block and tackle
   6. Jacks
   7. Fork lift
   8. Rollers/skates
   9. Manual handling and moving loads

6. Use three of the following instruments during the installation activities:
   1. Straight edges and feeler gauges
   2. Plumb lines and taut wires
   3. Engineer's levels
   4. Alignment telescopes
   5. Dial test indicators
   6. Laser equipment
   7. Measuring instruments (such as electrical, mechanical, fluid power)
   8. Self-diagnosis equipment

7. Make two of the following connections to the installed equipment:
1. mechanical connections (such as re-assembly of transported sub-assemblies)
2. electrical wired connections (excluding simple `plug in' connections)
3. fluid power connections
4. utility service connections (such as gas, air, steam, water, oil)

8. Carry out checks and adjustments, appropriate to the equipment being installed, to include:
   1. testing that the equipment operates to the installation specification
   Plus six more of the following:
   2. setting working clearance
   3. making visual checks for completeness and freedom from damage
   4. tensioning
   5. making sensory checks (sight, sound, smell, touch)
   6. topping up fluid/oil reservoirs
   7. ensuring that moving parts are guarded and clear of obstruction
   8. making `off-load' checks
   9. checking torque settings of fasteners
   10. checking level and alignment
   11. ensuring locking devices are fitted to fasteners (where appropriate)
   12. pressurising the system

9. Deal with two of the following conditions during the installation process:
   1. installations with no faults
   2. partial equipment malfunction
   3. complete malfunction of equipment

10. Use two of the following fault finding techniques during the checking and testing activities:
   1. six point
   2. input-to-output
   3. equipment self-diagnostics
   4. injection and sampling
   5. half-split
   6. function testing
   7. emergent problem sequence
   8. unit substitution
11. Produce installations which comply with **two** of the following standards:
   1. equipment manufacturer’s operation specification/range
   2. BS and/or ISO standards
   3. customer (contractual) standards and requirements
   4. company standards and procedures

12. Complete the relevant records/paperwork, to include **one** of the following, and pass to the appropriate people:
   1. installation records
   2. company specific documentation
   3. job card
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