

## Overview

This standard covers a broad range of basic mechanical maintenance competences that will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or that will provide a basis for the development of additional skills and occupational competences in the working environment.

You will be expected to prepare for the maintenance activities by obtaining all necessary information, documentation, tools and equipment required, and to plan how you intend to carry out the required maintenance activities and the sequence of operations you intend to use.

You will be required to select the appropriate equipment to use, based on the maintenance operations to be carried out and the type of mechanical equipment being maintained. This will include equipment such as gearboxes, pumps, machine tools, conveyor systems, workholding arrangements, engines, processing plant and equipment, and other organisation-specific equipment. You will be expected to use a variety of maintenance diagnostic techniques and procedures, such as gathering information from fault reports, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment.

You will then be expected to dismantle, remove and replace or repair any faulty units or components, on a variety of mechanical assemblies and sub-assemblies. This will include components such as shafts, bearings, couplings, gears, pulleys, clutches, brakes, levers and linkages, cams and followers, and other specific mechanical components. You will be expected to cover a range of maintenance activities, such as draining and removing fluids, releasing stored energy, labelling/proof marking to aid reassembly, dismantling components to the required level, dismantling components requiring pressure or expansion/contraction techniques, checking components for serviceability, replacing faulty components and 'lived' items, setting, aligning and adjusting components, tightening fasteners to the required torque and making 'off-load' checks of the maintained equipment.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for the mechanical maintenance activities undertaken. You will need to take account of any potential difficulties or problems that may arise with the maintenance activities, and to seek appropriate help and advice in determining and implementing a suitable solution. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide an understanding of your work, and

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will enable you to apply appropriate mechanical maintenance techniques and procedures safely. You will understand the maintenance process, and its application, and will know about the mechanical equipment being maintained, the equipment components, tools and consumables used, to the required depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the maintenance activities, and when using maintenance tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

#### **Specific Standard Requirements**

In order to prove your ability to combine different maintenance operations, at least one of the maintenance activities must be of a significant nature, and must cover at least **seven** of the activities listed in scope 4 plus the removal and replacement of a minimum of **five** of the components listed in scope 5.

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### Performance criteria

- You must be able to:*
- P1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
  - P2 plan the maintenance activities before you start them
  - P3 obtain all the information you need for the safe removal and replacement of the equipment components
  - P4 obtain and prepare the appropriate tools and equipment
  - P5 apply appropriate maintenance diagnostic techniques and procedures
  - P6 use appropriate methods and techniques to remove and replace the required components
  - P7 carry out tests on the maintained equipment, in accordance with the test schedule/defined test procedures
  - P8 deal promptly and effectively with problems within your control and seek help and guidance from the relevant people if you have problems that you cannot resolve
  - P9 leave the work area in a safe and tidy condition on completion of the maintenance activities

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### Knowledge and understanding

*You need to know and understand:*

- K1 the health and safety requirements, and safe working practices and procedures required for the mechanical maintenance activities undertaken
- K2 the importance of wearing appropriate protective clothing and equipment (PPE), and of keeping the work area safe and tidy
- K3 hazards associated with carrying out mechanical maintenance activities (such as handling oils, greases, stored energy/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise them
- K4 the system isolation procedures or permit-to-work procedure that applies
- K5 how to obtain and interpret drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process
- K6 the procedure for obtaining drawings, job instructions, related specifications, replacement parts, materials and other consumables necessary for the maintenance activities
- K7 the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
- K8 the various maintenance diagnostic techniques and aids that can be used (such as fault reports, visual checks, measuring, movement and alignment checks, testing)
- K9 the various fault location techniques that can be used, and how they are applied (such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics)
- K10 how to evaluate sensory information (sight, sound, smell, touch)
- K11 the sequence to be adopted for the dismantling/re-assembly of various types of assemblies
- K12 the methods and techniques used to dismantle/assemble mechanical equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment)
- K13 methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
- K14 the identification, application, fitting and removal of different types of bearings (such as roller, ring, thrust)
- K15 methods and techniques of fitting keys and splines
- K16 identification, application, fitting and removal of different types of gears
- K17 how to correctly tension belts and chains
- K18 the identification and application of different types of locking device
- K19 methods of checking that removed components are fit for purpose, and the need to replace 'lived' items (such as seals and gaskets)
- K20 The uses of measuring equipment (such as micrometers, verniers, run-

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- out devices and other measuring devices)
- K21 how to check that tools and equipment are free from damage or defect, are in a safe and usable condition, are within calibration, and are configured correctly for the intended purpose
- K22 how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, setting backlash in gears, preloading bearings)
- K23 the importance of making `off-load' checks before running the equipment under power
- K24 the importance of completing maintenance documentation and/or reports following the maintenance activity
- K25 how to use lifting and handling equipment in the maintenance activity
- K26 the problems associated with the mechanical maintenance activity, and how they can be overcome
- K27 when to act on your own initiative and when to seek help and advice from others
- K28 the importance of leaving the work area and equipment in a safe and clean condition on completion of the maintenance activities (such as returning hand tools and test equipment to the designated locations, cleaning the work area, and removing and disposing of waste)

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### Additional Information

#### Scope/range related to performance criteria

*You must be able to:*

1. Carry out **all** of the following during the maintenance activity:
  - 1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
  - 1.2 ensure the safe isolation of equipment (such as mechanical, electrical, gas, air or fluids), where appropriate
  - 1.3 follow job instructions, maintenance drawings and procedures
  - 1.4 check that the tools and test instruments are within calibration date, and are in a safe and usable condition
  - 1.5 ensure that the system is kept free from foreign objects, dirt or other contamination
  - 1.6 return all tools and equipment to the correct location on completion of the maintenance activities
  
2. Carry out maintenance activities on **two** of the following types of mechanical equipment:
  - 2.1 gearboxes
  - 2.2 machine tools
  - 2.3 engines
  - 2.4 pumps
  - 2.5 compressors
  - 2.6 processing plant
  - 2.7 transfer equipment
  - 2.8 workholding devices
  - 2.9 process control valves
  - 2.10 mechanical structures
  - 2.11 lifting and handling equipment
  - 2.12 company-specific equipment
  
3. Use **four** of the following maintenance diagnostic techniques, tools and aids:
  - 3.1 fault finding techniques (such as half-split, input/output, unit substitution)
  - 3.2 diagnostic aids (such as manuals, flowcharts, troubleshooting guides, maintenance records)
  - 3.3 information gathered from fault reports
  - 3.4 visual checks (such as signs of leakage, damage, missing parts,

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- wear/deterioration)
  - 3.5 alignment checks
  - 3.6 movement checks (such as excessive movement or clearance, loose fittings and connections)
  - 3.7 force/pressure checks (such as spring pressure, belt or chain tension)
  - 3.8 overheating checks (such as bearings, friction surfaces)
  - 3.9 sensory input (such as sight, sound, smell, touch)
  - 3.10 information from monitoring equipment or gauges
  - 3.11 operating (such as manual operation, timing and sequencing)
  - 3.12 test instrumentation measurement (such as pressure, flow, timing, sequence, movement)
  - 3.13 measuring instruments (such as dial test indicators, torque measuring devices, feeler gauges)
4. Carry out **all** of the following maintenance activities, as applicable to the equipment being maintained:
- 4.1 dismantling equipment to unit/sub-assembly level
  - 4.2 setting, aligning and adjusting replaced components
  - 4.3 dismantling units to component level
  - 4.4 proof marking/labelling of components
  - 4.5 tightening fastenings to the required torque
  - 4.6 checking components for serviceability
  - 4.7 making 'off-load' checks before starting up
  - 4.8 replacing all 'lived' items (such as seals, bearings, gaskets)
  - 4.9 replenishing oils and greases
  - 4.10 replacing damaged/defective components
5. Remove and refit a range of mechanical components, to include **eight** of the following:
- 5.1 shafts
  - 5.2 bearing and seals
  - 5.3 slides
  - 5.4 couplings
  - 5.5 fitting keys
  - 5.6 rollers
  - 5.7 gears
  - 5.8 springs
  - 5.9 housings
  - 5.10 clutches
  - 5.11 diaphragms
  - 5.12 actuating mechanisms
  - 5.13 valves and seats
  - 5.14 cams and followers
  - 5.15 structural components
  - 5.16 pistons

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- 5.17 chains and sprockets
  - 5.18 locking and retaining devices (such as circlips, pins)
  - 5.19 brakes
  - 5.20 pulleys and belts
  - 5.21 splines
  - 5.22 levers and links
  - 5.23 other specific components
6. Carry out checks on the maintained equipment, to include **three** of the following:
- 6.1 correct operation of moving parts
  - 6.2 correct working clearance of parts
  - 6.3 backlash in gears
  - 6.4 belt/chain tension
  - 6.5 bearing loading
  - 6.6 torque loading of fasteners
  - 6.7 operational performance
  - 6.8 functionally test the system
7. Maintain mechanical equipment in compliance with **one** or more of the following:
- 7.1 organisational guidelines and codes of practice
  - 7.2 equipment manufacturers' operation range
  - 7.3 BS and/or ISO standards



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