

SEMMME3-104 - SQA Unit Code H2AM 04

Restoring mechanical components to usable condition by repair



Overview

This unit identifies the competences you need to restore mechanical components to usable condition by repair, in accordance with approved procedures. You will be required to restore a range of mechanical components and equipment to operational condition, by repairing assemblies/sub-assemblies and components, by reforming, reworking the surface, replacing threads or the replacement of worn parts. You will also be required to select the appropriate equipment to use, based on the nature of the repair required, the operations that will need to be carried out and the accuracy required.

In producing the components, you will be expected to use a range of hand tools, machine tools, portable power tools, and shaping and fitting techniques, appropriate to the type of material and repair being performed. These activities will include such things as sawing (hand, band), drilling, reaming, grinding (hand or machine), filing, scraping or lapping, threading internal, threading external, turning, milling and thermal processes. Materials to be used may include ferrous, non-ferrous, non-metallic and composites, which may be in sheet form, bar sections (such as square/rectangular, round, angle), and part-machined components.

Your responsibilities will require you to comply with organisational policy and procedures for the repairing activities undertaken, and to report any problems with these activities or with the tools, equipment or materials used that you cannot personally resolve, or that are outside your permitted authority, to the relevant people. 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.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying repair procedures to mechanical components. You will understand the function and operating conditions of the components being repaired, in sufficient depth to determine a suitable repair sequence and to ensure that the repairs carried out are safe and practical in operation. You will also understand the organisational policy on repairing components, and its application.

You will understand the safety precautions required when carrying out the repair activities, especially those for isolating 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 the workplace.

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Performance criteria

You must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations and guidelines
- P2 follow the relevant specifications for the component to be repaired
- P3 prepare the component for repair
- P4 carry out the repairs within agreed timescales, using approved materials and components and methods and procedures
- P5 ensure that the repaired component meets the specified operating conditions
- P6 produce accurate and complete records of all repair work carried out

Knowledge and understanding

You need to know and understand:

- K1 the health and safety requirements of the area in which the repairing activity is to take place, and the responsibility they place on you
- K2 the isolation procedures or permit-to-work procedure that applies
- K3 the specific health and safety precautions to be applied during the repairing procedure, and their effects on others
- K4 the importance of wearing protective clothing and other appropriate safety equipment during the repair process
- K5 the hazards associated with the operations being carried out (such as sawing: hand, band; drilling; reaming; grinding: hand or machine; filing; scraping or lapping; threading internal; threading external; turning; milling; and thermal processes), and how to minimise them and reduce any risks
- K6 where to obtain, and how to interpret, drawings, specifications, manufacturers' manuals, maintenance schedules and other documents identifying parameters of the equipment being repaired
- K7 how to carry out currency/issue checks on the specifications you are working with
- K8 the methods and techniques to be followed for repairing mechanical equipment, in compliance with company procedures
- K9 the types of repair that can be made to components in order to prolong their useful life (such as bushing worn holes, fitting thread inserts, building up surfaces by thermal process or metal spraying, making stepped keys, cutting new keyways, making stepped/oversize dowels or studs)
- K10 the factors to be taken into account when deciding if a repair is practical and possible (such as replacement component availability, cost of replacing, safety of repair, age and condition of equipment)
- K11 the need to liaise with other departments in order to have specialised operations carried out on the components (such as thermal processes, metal spraying)
- K12 how to use filing, scraping and lapping to achieve the required surface finish (such as various types of files/scrapers, ensuring that file/scrapper handles are in good condition, selection and use of lapping mediums)
- K13 how to cut internal and external threads (such as by using hand dies and taps, machine cutting)
- K14 how to produce a sliding or mating fit, and the techniques to be adopted
- K15 how to select saw blades for different materials and different operations
- K16 the types and application of portable power tools that can be used for the repair operations
- K17 how to check that portable power tools and extension cables are in a safe usable condition

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- K18 how to use hand power tools and specialist equipment (such as electrical, pneumatic, lifting equipment) correctly
- K19 the operating requirements of the machine tools and accessories being used (such as guards, workholding devices, taper turning attachments, steadies, dividing heads, specific statutory regulations, abrasive wheels regulations)
- K20 the various shapes and types of tooling that can be used (such as solid, high-speed tooling, brazed-tip tooling, interchangeable-tipped tooling)
- K21 how to handle and store tools and equipment, safely and correctly
- K22 factors which affect the selection of cutting feeds and speeds, and the depth of cut that can be taken (such as workpiece rigidity, machine condition, type of tooling being used, material type, finish and tolerance required)
- K23 the application of cutting fluids with regard to a range of different materials and processes
- K24 the clamping of a workpiece in a chuck/workholding device (including safely secured for the process, not causing distortion in the finished components)
- K25 how to recognise machining faults, and how to identify when tools need re-sharpening/dressing
- K26 the operating requirements of the thermal processes and accessories being used (including any statutory regulations and quality standards to be observed, guards, workholding devices, fume extraction, gas storage)
- K27 the company recording procedures to be used following a repair, and how to apply them
- K28 the procedure for the safe disposal of waste materials
- K29 the types of problem associated with repairs, and how to resolve them
- K30 the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

Additional Information

Scope/range related to performance criteria

You must be able to:

1. Carry out **all** of the following during the repair activity:
 - 1.1 obtain and use the correct issue of company and/or manufacturer's drawings and overhaul documentation
 - 1.2 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
 - 1.3 provide and maintain safe access and working arrangements for the work area
 - 1.4 follow good practice/approved repair procedures at all times
 - 1.5 record the repair in the appropriate documentation
 - 1.6 dispose of waste items in a safe and environmentally acceptable manner
 - 1.7 leave the work area and tools in a safe and appropriate condition on completion of the activities

2. Use appropriate techniques to carry out **six** of the following types of repair:
 - 2.1 reforming the component surface by adding metal
 - 2.2 replacement of internal thread (thread inserts)
 - 2.3 recondition a unit by replacement of worn components
 - 2.4 reworking the fit (shimming)
 - 2.5 sleeving worn components
 - 2.6 replacement/reworking of worn keys/keyways
 - 2.7 making stepped dowels, keys or studs
 - 2.8 replacing damaged or missing gear teeth
 - 2.9 cutting new keyways
 - 2.10 plugging holes
 - 2.11 making a temporary fix
 - 2.12 stopping cracks running, and filling them
 - 2.13 bushing worn holes
 - 2.14 other specific repair procedure
 - 2.15 reworking the surface finish (using techniques such as filing, scraping, lapping, grinding)

3. Use a range of methods and techniques to repair components, to include **six** of the following:
 - 3.1 sawing (hand, band)
 - 3.2 filing
 - 3.3 turning
 - 3.4 drilling
 - 3.5 scraping or lapping

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- 3.6 milling
 - 3.7 reaming
 - 3.8 threading external
 - 3.9 thermal processes
 - 3.10 grinding (hand or machine)
 - 3.11 threading internal
4. Repair components made from different types of material, to include **two** from the following:
- 4.1 low carbon steel
 - 4.2 aluminium
 - 4.3 plastic/synthetic
 - 4.4 high carbon steel
 - 4.5 brass/bronze
 - 4.6 composite
 - 4.7 cast iron
 - 4.8 stainless steel
5. Carry out repairs to mechanical equipment in compliance with **one** of the following:
- 5.1 BS, ISO or BSEN standards and procedures
 - 5.2 other accepted international standards
 - 5.3 customer (contractual) standards and requirements
 - 5.4 company standards and procedures

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