Unit 5: Developing Skills in Assembling Mechanical Components

Unit reference number: H/600/9142

QCF level: 1

Credit value: 3

Guided learning hours: 30

Unit aim

This unit will enable learners to develop manual skills when working with basic assembly tools, so that they can apply them to assembling a product from a small number of mechanical components. This unit provides some of the knowledge, understanding and skills for the Level 1 Performing Engineering Operations NOS Unit 5: Assembling Mechanical Components.

Unit introduction

In this unit learners will be introduced to the practical skills needed to assemble components in an engineering workshop. They will explore why they need to understand what they are going to carry out and prepare the work area correctly. Using basic hand tools and measuring equipment, which they have selected, learners will assemble components into finished products which meet given specifications.

Learners will consider the importance of working safely in an engineering workshop and the need to check that tools and equipment are in a safe and useable condition at all times. They will also understand the requirement to check that components are the correct type and in good condition before starting work. Selection of the correct fastening devices and special tools, such as a torque wrench, is also covered in this unit. As assembly processes may involve the use of cleaning substances and lubricants, learners will need guidance on the precautions to take when using them.

Cleaning down work areas on completion of activities and the return of tools and equipment into safe storage are considered in the context of good housekeeping and efficient working.

This unit will help learners to appreciate the importance of following given instructions carrying out activities and to recognise the problems which may occur when assembling mechanical components.

Essential resources

It would be extremely useful if learners had access to a range of equipment commonly used in engineering. It may be possible to arrange a visit to an engineering company to extend learner awareness of the range of resources used in engineering.

A typical centre engineering workshop should be equipped with the basic requirements of this unit including a range of mechanical fastening devices, tools and equipment for assembly operations. All supporting auxiliary equipment should also be available together with appropriate safety equipment.

Workshops should be staffed appropriately to ensure health and safety requirements are met. Technician support may be required during practical work.

Learning outcomes, assessment criteria and unit amplification

To pass this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

Learning outcomes		Assessment criteria		Unit amplification
1	Be able to prepare a work area in readiness for assembly operations	1.1	Confirm with a supervisor what has to be done before assembly operations are carried out safely	□ *Before starting work*: understand the task eg what needs to be carried out, order of operations, tools and equipment, quality checks; personal protection eg eye protection, hair protection, footwear, use of barrier cream, removal of loose clothing and jewellery; regulations and safety procedures; maintenance of access eg clear walkways, emergency exits; understand the need for good housekeeping eg cleanliness of work area, removal of waste materials; understand what might go wrong eg damaged components, shortage of fastening devices, finished assembly not to standard; confirm proposed actions with a supervisor
		1.2	Prepare a work area ready for the assembly of components	□ *Work area preparation*: bench preparation eg tidy up, plan layout of components; consumables eg oil, grease, sealant, gasket; services eg electrical, compressed air; obtain components to be assembled; obtain instructional materials eg assembly drawing, parts list, assembly instructions; obtain appropriate fastening devices; select tools and equipment; obtain correct personal protective equipment eg eye protection, hair protection, overalls, safety footwear
		1.3	Check components are correct and that tools and equipment are safe to use	□ *Check that components are correct and equipment safe to use*: check components eg correct quantity, screw threads undamaged, free from contamination, defects, burrs, sharp edges; condition of tools eg screwdrivers, pliers, feeler gauges, mallets, spanners, keys, alignment devices, punches, measuring equipment, lifting equipment

Learning outcomes		Assessment criteria		Unit amplification
2	Be able to carry out assembly operations using mechanical components	2.1	Use appropriate tools to assemble components	□ *Assembling components*: assembly procedures eg positioning, alignment, shim adjustment, securing, torque tightening; fastening/securing devices eg screws, nuts, bolts, machine screws, washers, rivets, tab washers, wire locks, locking nuts, circlips, pins, dowels, keys, rivets; minimum of six components eg pulley mechanism, simple crank mechanism, simple gearbox assembly, bearings, seals, shafts, chains, sprockets, cams and followers, springs, belts, gaskets
		2.2	Check that the finished assembly conforms to specified limits of accuracy	□ *Check assembly meets required standard*: checking for operation eg correct movement of sliding and rotating parts, correct torque applied to critical fastenings, end float of shafts, operating clearances on valves or actuators; visual inspection eg correctness of fit at critical stages during assembly, correct orientation of cover plates
		2.3	Clean down work area and return tools and equipment to storage.	□ *Cleaning down and putting away*: tools and equipment eg cleaning cloth, tool case, toolbox; return to storage eg tools, equipment, surplus fastenings; close down services eg electrical, compressed air eg inspection of work area eg visual, sign off

Information for tutors

Delivery

This unit is essentially practical and learners would benefit from practising their skills before being assessed. Learners should think about the processes needed and actions to be taken to prepare their workplace and then assemble components into a basic assembly. Learners should have opportunities to talk about what they are going to do and how they propose to overcome any problems which may occur while they are assembling components. It is important that they understand the safety aspects of using hand and powered assembly tools and the measures which must be taken in order to minimise risk. They should also be fully aware of what to do in the case of an emergency.

Outline learning plan

The outline learning plan has been included in this unit as guidance.

Topic and suggested assignments/activities
Confirm with a supervisor what has to be done before assembly operations are carried out safely. Tutor-led unit introduction covering content, method of working and assessment. Tutor-led overview of the hand assembly skills learners will develop. Whole-class, tutor-led discussion about how engineers plan the assembly of engineering products. Using one or two simple products as examples – tutor presents drawing(s)/sketch(es), list of tools, components, fastening, sequence of operations, quality checks. Tutor-led discussion about PPE, where and when it is necessary and how it works. Tutor-led discussion about the need to confirm proposed activities with a supervisor. Small-group activity to plan the assembly of a single given product.
Prepare a work area ready for the assembly of components. Whole-class, tutor-led discussion about the need to prepare work areas – present examples of poor and good preparation. Paired activity to identify hazards/bad practices in workshops – presented as images with a checklist to complete.
Check components are correct and that tools and equipment are safe to use. Whole-class, tutor-led discussion about why components, tools and equipment should be checked before being used. Tutor presents an example which shows the consequences of working with assembly tools that are not fit for purpose. Small-group activity to identify, from images, problems which can occur when assembling components. Tutor-led discussion about special precautions to take when working with lubricants, cleaning substances, hydraulic oil and compressed air.

Topic and suggested assignments/activities
Use appropriate tools to assemble components. Tutor demonstration of assembly techniques followed by assembly of a product. Individual activities to develop basic assembly skills using hand tools. Individual and paired activities to assemble products from given components referring to parts schedules, drawings and manuals.
Check that the finished assembly conforms to specified limits of accuracy. Whole-class, tutor-led discussion about why assembled components should be checked against the specification. Individual activity to check an assembled product against its specification – dimensional and operational features.
Clean down work area and return tools and equipment to storage. Tutor-led discussion about the need for 'good housekeeping' in engineering workshops and the correct storage of tools and equipment.
Assessment activity – prepare a work area and assemble components using hand tools. Individual activity to assemble components using tools and procedures which address the unit content and six assessment criteria.
Seek and respond to guidance from the tutor. Tutors should encourage learners to have a dialogue with them. This could be prompted by the tutor asking learners to explain what they are doing, why they are doing it and how they are able to work safely. This does not require a formal allocation of time and should occur during delivery and assessment of the unit.

Assessment

The centre will devise and mark the assessment for this unit.

Learners must meet all assessment criteria to pass the unit.

Learners will benefit from access to range of assessment opportunities. Examples might include observed practice, recorded explanations, checklists and annotated photographic records. Entries within a logbook and a finished assembly inspection report, both validated by the tutor, are also appropriate methods for recording achievement. Competence in practical activities should be evidenced through witness testimonies or observation records signed by the tutor.

Suggested resources

Textbooks

Boyce et al – *Engineering Level 1 Foundation Diploma* (Edexcel/Pearson, 2008) ISBN 9780435756253

Salmon D – *NVQ Engineering Level 2 Mandatory Units* (Longman, 1997) ISBN 9780582302983

Salmon D – *NVQ Engineering Level 2 Mechanical Units* (Longman, 2002) ISBN 9780750654067

Other publications

SEMTA – Trainees Book, Training Module for Maintaining Mechanical Devices and Systems (Training Publications Ltd 2001)

SEMTA – Instructors Manual, Training Module for Maintaining Mechanical Devices and Systems (Training Publications Ltd 2001)

Tutor resource disks

Boyce et al – *Engineering Level 1 Foundation Diploma* (Edexcel/Pearson, 2008) ISBN 9780435756260

Websites

www.hse.gov.uk