



National Unit Specification: general information

UNIT Power Drives (SCQF level 5)

CODE F5K3 11

SUMMARY

This Unit may form part of a National Qualification Group Award or may be offered on a free standing basis.

The Unit is designed to allow candidates to develop basic knowledge, understanding and skills of mechanical power transmission drives. During delivery of the Unit candidates will learn to identify power transmission drives and explain their essential features. They will also learn how to select power transmission products from manufacturers' data to match given technical requirements. Candidates will also develop the knowledge and skills to fit, align and adjust mechanical power transmission drives safely. They will also develop knowledge and understanding of methods used to lubricate mechanical power transmission drives and how ingress of contaminants can be prevented.

This Unit is suitable for candidates training to be mechanical, maintenance or multi-disciplinary engineering craft persons or technicians.

OUTCOMES

- 1 Identify mechanical power transmission drives and explain their essential features.
- 2 Select mechanical power transmission drives to match given power drive requirements.
- 3 Fit, align and adjust a power transmission drive safely to a given specification.
- 4 Describe appropriate lubrication methods in power drives.

Administrative Information

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National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

CREDIT VALUE

1 credit at SCQF level 5 (6 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

The Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- ◆ Problem Solving (SCQF level 5)
- ◆ Communication (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Identify mechanical power transmission drives and explain their essential features.

Performance Criteria

- 1 Identify correctly given types of mechanical power transmission drives
- 2 State correctly the purpose of given types of mechanical power transmission drives
- 3 Explain correctly how the essential features of given types of mechanical power transmission drives transmit torque and power.

OUTCOME 2

Select mechanical power transmission drives to match given power drive requirements.

Performance Criteria

- (a) Calculate correctly the speed ratio of a mechanical power transmission drive from given data.
- (b) Select mechanical power transmission drives correctly to suit the power drive criteria.
- (c) List the chosen power transmission products correctly using manufacturers' product codes and descriptions.

OUTCOME 3

Fit, align and adjust a power transmission drive safely to a given specification.

Performance Criteria

- (a) Fit, align and adjust a mechanical power transmission product to a given drive system.
- (b) Use tools and equipment correctly to complete practical tasks.
- (c) Carry out and record correctly static checks on the installed mechanical power drive.
- (d) Comply fully with operational and safety requirements, good housekeeping and appropriate tool/equipment storage while undertaking practical tasks.
- (e) Cooperate effectively with others in an engineering workshop environment.

OUTCOME 4

Describe appropriate lubrication methods in power drives.

Performance Criteria

- (a) Describe correctly methods of lubrication suitable for given types of mechanical power drive.
- (b) Describe correctly the purpose and application of static seals.
- (c) Describe correctly the purpose and application of dynamic seals.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Outcomes 1, 2 and 4

Written and/or recorded oral evidence should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria.

Outcomes 1, 2 and 4 may be assessed on an individual basis, as a combination of outcomes or as a single, holistic assessment covering all three Outcomes. Assessment(s) must be conducted under supervised, closed-book conditions in which candidates may use reference materials provided by the centre but are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment. Total assessment time for the three outcomes must not exceed 2 hours.

With regard to Outcome 1

- ◆ candidates must identify three types of power transmission drives from the following:
 - shaft coupling
 - clutch
 - brake
 - chain or belt or gears
 - bearing

- ◆ candidates must state the purpose of three of the following power transmission drives:
 - shaft coupling
 - clutch
 - brake
 - chain or belt or gears
 - bearing

- ◆ candidates must explain how torque and power is transmitted in each of the following:
 - shaft coupling
 - clutch
 - chain or belt or gears.

With regard to Outcome 2

- ◆ candidates must calculate the speed ratio for a single speed reduction mechanical power drive with given input and output speeds of rotation
- ◆ candidates must select the following mechanical power transmission drives:
 - two types of shaft coupling
 - two types of bearing (one plain; one rolling element)
 - either a belt drive, or chain drive, or gear drive

The requirements presented to candidates must be sufficient to allow selection from a manufacturer's product catalogue but must not involve any computation of design/operating factors.

National Unit Specification: statement of standards (cont)

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With regard to Outcome 4

- ◆ candidates must describe two different methods of lubrication used with power drives
- ◆ candidates must describe the purpose and application of two types of static seal
- ◆ candidates must describe the purpose and application of two types of dynamic seal

Outcome 3

Product and performance evidence supplemented with an assessor observation checklist(s) should be produced to demonstrate that a candidate has achieved the Outcome and Performance Criteria.

The mechanical power transmission drive used for assessment must be a single stage, speed reduction drive between parallel shafts using either a belt or chain drive with a tensioner fitted and adjusted correctly.

Assessment must be conducted under supervised conditions in which candidates may use reference materials provided by the centre.

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

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This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit forms part of the National Qualification Group Award in Maintenance Engineering at SCQF level 5, but may also be offered on a free standing basis.

The aim of this Unit is to allow candidates to develop basic knowledge, understanding and skills of mechanical power transmission drives. On successful completion of the Unit candidates will be able to identify power transmission drives and explain their essential features. They will also have learnt to select power transmission products from manufacturer's data to match given technical requirements. Candidates will also have the knowledge and skills to fit, align and adjust mechanical power transmission drives safely using the correct tools within a safe system of work. They will also have developed the knowledge and understanding to describe lubrication methods used with mechanical power transmission drives and methods of preventing the ingress of contaminants into drive systems.

The Outcomes and performance criteria for this Unit have been written in general terms to allow flexibility in the choice of types and sizes of mechanical power transmission drives. The range of mechanical power transmission products may include couplings, clutches, brakes, belts, chains, gears, bearings and seals. It is recommended that centres teach an appropriate balance of drives found in general engineering applications and those specific drives that satisfy local industrial needs.

The delivery of Outcome 1 should begin with a revision of power transmission terms such as input/output, torque, speed of rotation, power and nominal diameter. Candidates should then be introduced to a range of mechanical power transmission drives and taught that each drive is designed for a purpose, comes in numerous forms, have distinctive features, relative merits and a range of applications. They should also be encouraged to learn the technical terms used with power transmission drives. Candidates should be encouraged to handle various products and learn to distinguish between the different types of each product. They should also learn how torque and power are transmitted through mechanical power transmission drives. It may also be helpful to teach candidates how applied loads can be braked.

In Outcome 2 candidates should learn how to select suitable mechanical power transmission products from manufacturers' product literature or product database for given requirements. The given technical requirements will include the type of drive to be used, input power and speed, output speed and centre distance between shafts. Power transmission from input to output can be achieved by chain, belt or gears. The selected products may be listed in the form of a parts list stating quantity, description, manufacturers name and product codes for identification, sub-assembly and purchasing purposes. Such an approach will allow candidates to become familiar with technical information in product literature and the way in which requisition documentation is prepared.

National Unit Specification: support notes (cont)

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Outcome 3 is designed to build on the learning in Outcome 2. In this Outcome candidates will learn how to fit, align and adjust a given power drive in-line with the manufacturer's recommended practice to ensure correct operation of the drive. Before installing the power drive, candidates should be made aware of current legislation, regulations, procedures and safe working practices relevant to this type of work. The power drive may be a belt, chain or gear drive although one of the former two are likely to be the preferred option because no specialist equipment is required. Candidates should only undertake static checks on the installed drive.

In Outcome 4 candidates should be introduced to methods of lubrication used in power drives and the types of seals used to retain lubricants and prevent the ingress of contaminants. Methods of applying lubricating oil should include brush, dip, splash, spray and wick feed. Lubrication of porous, sintered plain bearings should also be considered. Candidates should also be taught about the purpose and use of shields and seals in bearings and the different types of seals used in housings. Candidates should also learn about the results of inadequate lubrication, contamination and incorrect assembly in terms of early in service failure and the consequences that follow.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the outcomes are presented in the National Unit Specification: statement of standards section of the Unit. This Unit may be delivered by a combination of lecturing, group discussions, practical activities, investigations and industrial visits. Most of the Unit can be delivered in a classroom with access to relevant product literature and examples of mechanical power transmission drives. However, it is recommended that practical exercises are delivered in an engineering workshop which may include suitable examples of process plant and motor vehicles to provide candidates with practical applications of the various types of mechanical power transmission products and mechanical power drive systems available.

Manufacturers' literature provides product information, technical data, exemplar applications, design procedure and selection guidelines for the user. Such information may be obtained in various media from the manufacturers' website, their distributors and representatives. The use of genuine product information allows the candidate to become familiar with the format and content of the literature and gives realism to the learning experience. In addition, some manufacturers of mechanical power transmission products provide product support literature, including case studies, to show both good and bad practice in the installation of power transmission drives and the outcomes of bad practices.

Industrial visits, particularly for candidates with little or no practical experience, can be of great benefit in allowing them to see different types of mechanical power drives in action and to discuss with engineers on site the problems associated with these drives.

National Unit Specification: support notes

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OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Problem Solving skills, that is, critical thinking, planning, organising, reviewing and evaluating will be developed as candidates will learn how to fit, align and adjust a given power drive in-line to ensure correct operation of the drive. Before installing the power drive, candidates should take manufacturer's instructions into account and consider current legislation, regulations, procedures and safe working practices relevant to this type of work. With assessor support candidates may evaluate their approaches to work as they undertake static checks on the installed drive.

The need to read and apply technical information provides opportunities to develop skills in written and/or oral communication. Written evidence produced should be to a level acceptable in the vocational area. Formative work could help to develop written and oral communication skills in an engineering environment.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Centres are encouraged to use formative assessment extensively as it plays a particularly important role in allowing candidates to develop a sound knowledge, understanding and skills in such areas as the identification, selection and correct installation of power transmission drives and in describing appropriate methods of applying and retaining lubricant and preventing the ingress of contaminants.

Outcome 1

- 1 Assessment of pc (a) may be by an observation exercise with a checklist to record candidate responses.
- 2 Assessment of pc (b) may comprise a series of short answer questions.
- 3 Assessment of pc (c) may comprise a balance of restricted response and structured questions.

DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements