



National Unit Specification: general information

UNIT Power Drives (SCQF level 6)

CODE F5JC 12

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 their knowledge and understanding in mechanical power transmission drives. During delivery of the Unit candidates will develop the knowledge and understanding to explain the features and terms associated with power transmission drives. They will also learn to evaluate power transmission products and match such products to given applications. Candidates will also develop the knowledge and understanding to design a mechanical power drive and create a parts list to realise their design. They will also develop the knowledge and understanding of methods used to check installed mechanical power drives for installation and developed faults.

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

OUTCOMES

- 1 Explain features and terms associated with a range of mechanical power transmission drives.
- 2 Analyse different types of mechanical power transmission drives.
- 3 Design a mechanical power transmission drive.
- 4 Describe methods of checking mechanical power transmission drives.

Administrative Information

Superclass: XS

Publication date: March 2009

Source: Scottish Qualifications Authority

Version: 01

© Scottish Qualifications Authority 2009

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

Additional copies of this Unit Specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre, telephone 0845 279 1000.

National Unit Specification: general information (cont)

UNIT Power Drives (SCQF level 6)

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:

- ◆ Power Drives at SCQF level 5
- ◆ Standard Grade Technological Studies at credit level

CREDIT VALUE

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

**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 6)
- ◆ Communication (SCQF level 6)
- ◆ Numeracy (SCQF level 6)

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

National Unit Specification: statement of standards

UNIT Power Drives (SCQF level 6)

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

Explain features and terms associated with a range of mechanical power transmission drives.

Performance Criteria

- (a) State correctly the relationship between power, torque and speed of rotation in terms of quantities, symbols and units.
- (b) Define correctly the term speed ratio for a given speed reduction power drive.
- (c) Explain correctly how torque is transmitted by a range of power transmission drives.
- (d) Explain correctly what is meant by a positive drive and a non-positive drive and state an example of each.

OUTCOME 2

Analyse different types of mechanical power transmission drives.

Performance Criteria

- (a) Explain correctly the capability and limitations of mechanical power transmission drives.
- (b) State correctly the capacity of mechanical power transmission drives.
- (c) Identify correctly the lubrication requirements of mechanical power transmission drives.
- (d) Match correctly mechanical power transmission drives to given applications.

OUTCOME 3

Design a mechanical power transmission drive.

Performance Criteria

- (a) Interpret correctly the given design parameters for the power transmission drive.
- (b) Use correctly manufacturers' design guidelines.
- (c) Undertake correctly any analysis associated with the design task.
- (d) Identify and list correctly the mechanical power transmission products required for the design using manufacturer's product codes.

National Unit Specification: statement of standards (cont)

UNIT Power Drives (SCQF level 6)

OUTCOME 4

Describe methods of checking mechanical power transmission drives.

Performance Criteria

- (a) State correctly indicators of faults.
- (b) Describe correctly causes of faults.
- (c) Describe correctly corrective actions to resolve faults.
- (d) Describe completely and accurately checks for noise and vibration.

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 explain how torque is transmitted in the following power transmission drives:
 - shaft coupling
 - clutch
 - brake
 - chain or belt or gears

With regard to Outcome 2

- ◆ candidates must explain the capabilities, limitations, capacities and lubrication requirements of the following range of mechanical power transmission drives:
 - two different types of shaft coupling
 - two different types of clutch
 - two different types of chain
 - two different types of belt
 - two different types of gears

National Unit Specification: statement of standards (cont)

UNIT Power Drives (SCQF level 6)

- ◆ candidates must match three different drives to given applications. Each application must require the candidate to choose a different drive. Lubrication and seals must be considered in the chosen drives.

With regard to Outcome 4

- ◆ candidates must state one indicator of an installation fault and two indicators of developed faults
- ◆ candidates must describe two causes of developed faults
- ◆ candidates must describe one action to resolve an installation fault and two actions to resolve developed faults
- ◆ candidates must describe one check for noise and one check for vibration

Outcome 3

Product evidence is required to demonstrate that a candidate has achieved the Outcome and Performance Criteria. This Outcome must be assessed by a single assessment comprising a single stage reduction mechanical power drive using belt or chain to connect parallel shafts.

Assessment must be conducted under supervised conditions in which candidates should 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

UNIT Power Drives (SCQF level 6)

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 Mechanical Engineering at SCQF level 6, but may also be offered on a free standing basis.

The aim of this Unit is to allow candidates to develop their knowledge and understanding in mechanical power transmission drives. On successful completion of the Unit candidates will have developed the knowledge and understanding to explain the features and terms associated with power transmission drives. They will also have learnt how to evaluate power transmission drives matching such drives to given applications. Candidates will also have developed the knowledge and understanding to design a mechanical power drive and create a parts list to realise their design. They will also be able to describe methods used to check installed mechanical power drives for installation and developed faults.

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 drives 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 definitions, symbols and units associated with power transmission 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. Candidates should be encouraged to handle various drives and learn to distinguish between the different types of each drive. 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 addition candidates should learn what is meant by a positive and a non-positive drive, the merits and applications of each and how they can be realised.

Outcome 2 is designed to build upon the learning in Outcome 1. In this Outcome candidates should learn about the limitations, capacity, capability and lubrication requirements of the range of mechanical power transmission drives considered in Outcome 1. The lubrication requirements should include both static and dynamic seals. Candidates should also learn to match power transmission drives to given applications, selecting products from given manufacturers' product literature.

In Outcome 3 candidates should examine how mechanical power transmission drives are designed from given information. Candidates should learn how to use the design guidelines provided by product manufacturers and produce a parts list of power transmission products for their design. The parts list should state the quantity, description, manufacturers name and product codes for identification, sub-assembly and purchasing purposes.

National Unit Specification: support notes (cont)

UNIT Power Drives (SCQF level 6)

Such an approach will allow candidates to become familiar with technical information in product literature and the way in which requisition documentation is prepared.

In Outcome 4 candidates should examine faults in mechanical power drives. Candidates should learn how to check power drives for possible incorrect installation and how to identify probable causes of developed faults. They should learn to identify different types of fault, describe possible causes and outline corrective actions to resolve such faults. Incorrect installation may include: incorrect parts installed, parts installed incorrectly, incorrect centre distance, mis-alignment of parts (eg parallel, angular and axial misalignments) and incorrect initial tension. Developed faults may include: excessive noise, excessive wear, vibration and early failure of one or more components.

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 drives systems available.

Manufacturers' literature provides product information, technical data, exemplar applications, design procedures 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.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill of *Problem Solving*, that is, Critical Thinking, Planning and Organising, will be developed as candidates design a mechanical power transmission drive. They have to analyse requirements and evaluate different types of mechanical power transmission products in terms of their capability, capacity and suitability for given applications. Assessor support could encourage candidates to review and evaluate approaches taken to the design process.

The need to evaluate and summarise complex technical information and data on mechanical power transmission products provides opportunities to develop skills in written and/or oral communication. Written evidence produced should be formally presented to industry standards and could be exemplified by industrial documents or technical presentations. Discussion of design issues during formative work could help to develop oral communication skills in an engineering environment.

National Unit Specification: support notes (cont)

UNIT Power Drives (SCQF level 6)

Numeracy will be naturally developed with an emphasis on the application of skills in workplace situations. Reading engineering drawings from manufacturers' technical literature and presenting sketches, candidates will learn to interpret, calculate and translate numerical and graphical data in a working context.

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 and understanding in such areas as mechanical power transmission drive operation and terminology, the capabilities, limitations and capacities of different power transmission products, the design of mechanical power transmission drives and methods of checking power transmission drives for installation and developed faults.

Outcomes 1, 2 and 4

Regardless of whether assessment of the 3 Outcomes is carried out on an individual basis, as a combination of Outcomes or on a single, holistic basis any assessment paper(s) used may comprise a suitable balance of short answer, restricted response and structured questions.

Outcome 3

Assessment of this Outcome should be in the form of a design assignment with candidates being provided with task instruction sheets and manufacturers product literature. Sketches and a structured parts list should be produced, identifying the selected products using product codes, descriptions, quantities and manufacturers name. Centres may choose to limit the time candidates have to complete this assessment to 1 hour and 30 minutes.

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