



Higher National Unit specification

General information for centres

Unit title: CAD: Sheet Metal

Unit code: F21A 35

Unit purpose: This Unit is designed to provide candidates with knowledge and skills in the use of Computer Aided Design (CAD) within the design and manufacture of sheet metal components. Candidates will be introduced to a variety of materials and material properties used in the manufacture of sheet metal components. On completion of the Unit the candidate will be able to be able to:

- 1 Explain the manufacturing processes used in the design and manufacture of sheet metal components.
- 2 Design and produce sheet metal components for manufacture using a 3D CAD system.
- 3 Produce an assembly of sheet metal components using a 3D CAD system.

Credit points and level: 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**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.*

Recommended prior knowledge and skills: Candidates should possess a basic knowledge and understanding of design. This may be evidenced by the possession of HN Units in:

DW1E 34	<i>CAD: 2D I</i>
DW13 34	<i>CAD: 3D Modelling</i>
DW19 34	<i>CAD: Feature Based Modelling 1</i>
DW17 34	<i>Design Methodology</i> or any equivalent of study Unit

Core Skills: There are opportunities to develop the Core Skills of Communication, Problem Solving and Information Technology, all to SCQF level 6, and the Core Skill of Numeracy to SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

General information for centres (cont)

Assessment: All assessments for this Unit are undertaken as open-book in a supervised environment. All assessment could be by standalone tasks if required, however a design brief specification (brief) would be an ideal assessment task to provide the necessary opportunities for candidates to develop the required evidence and would allow integration of assessment for all Outcomes.

Higher National Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Explain the manufacturing processes used in the design and manufacture of sheet metal components

Knowledge and/or Skills

- ◆ Material
- ◆ Sheet Metal Forming
- ◆ Sheet Metal Joining

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can explain the manufacturing processes for a range of sheet metal materials appropriate to a sheet metal design.

In response to a design brief specification, the candidate must choose and explain their choice of two sheet metal materials for the manufacturing process. The candidate must provide the finish and gauge detail and explain where a minimum of two sheet metal forming processes and two joining techniques will be required.

Assessment Guidelines

Each assessment for each Outcome could be undertaken as individual events. However if a design brief specification (brief) were to be utilised, all three assessments could be combined into one holistic assessment which could be undertaken either as an open or closed-book event/s. As an open-book assessment, sufficient time should be allocated for the candidate to prepare and present all the required evidence and submit this by an agreed deadline.

It is recommended that centres develop assessment checklists to support the recording of Evidence Requirements for each of the Knowledge and/or Skills items.

Higher National Unit specification: statement of standards (cont)

Unit title: CAD: Sheet Metal

Outcome 2

Design and produce sheet metal components for manufacture using a 3D CAD system

Knowledge and/or Skills

- ◆ Design factors influencing sheet metal pattern development
- ◆ 3D sheet metal part creation
- ◆ 3D sheet metal pattern development
- ◆ Manufacturing drawings
- ◆ Annotation

Evidence Requirements

In response to a given design brief specification, candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ justify design choices for sheet pattern to meet design brief specification. (to include: material gauge, edge design, bend allowance, bend relief, economical design and tolerances)
- ◆ produce a minimum of four 3D computerised sheet metal component parts to fulfil the given brief requirements
- ◆ produce hardcopy folded and flat pattern drawings for manufacture of the four required 3D sheet metal components, with manufacturing details annotated

Assessment Guidelines

Each assessment for each Outcome could be undertaken as individual events. However if a design brief specification were to be utilised, all three assessments could be combined into one holistic assessment which could be undertaken either as an open or closed-book event/s. As an open-book assessment, sufficient time should be allocated for the candidate to prepare and present all the required evidence and submit this by an agreed deadline. The recommended time allocation for the assessment is four hours.

It is recommended that centres develop assessment checklists to support the recording of Evidence Requirements for each of the Knowledge and/or Skills items.

Outcome 3

Produce an assembly of sheet metal components using a 3D CAD system

Knowledge and/or Skills

- ◆ Part retrieval for assembly modelling
- ◆ 3D constraints (relevant to the software used)
- ◆ Functional testing
- ◆ Assembly drawings
- ◆ Exploded assembly drawings
- ◆ Parts list
- ◆ Annotation and assembly details

Higher National Unit specification: statement of standards (cont)

Unit title: CAD: Sheet Metal

Evidence Requirements

In response to a given design brief specification, candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ use part retrieval techniques to create a fully constrained 3D assembly of a minimum of four sheet metal components and perform required checks for functionality (to include interference and collision detection)
- ◆ produce hardcopy and exploded assembly drawing with assembly details, appropriate annotation and a parts list

Assessment Guidelines

Each assessment for each Outcome could be undertaken as individual events. However if a design brief specification (brief) were to be utilised, all three assessments could be combined into one holistic assessment which could be undertaken either as an open or closed-book event/s. As an open-book assessment, sufficient time should be allocated for the candidate to prepare and present all the required evidence and submit this by an agreed deadline. The recommended time allocation for the assessment is a maximum of three hours.

It is recommended that centres develop assessment checklists to support the recording of Evidence Requirements for each of the Knowledge and/or Skills items.

Administrative Information

Unit code:	F21A 35
Unit title:	CAD: Sheet Metal
Superclass category:	XD
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History of changes:

Version	Description of change	Date
02	Superclass changed from VF to XD.	26/06/13

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Higher National Unit specification: support notes

Unit title: CAD: Sheet Metal

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 was developed for the HNC/HND Computer Aided Draughting and Design Group Awards. The Unit has been designed to allow candidates to develop knowledge, understanding and skills in sheet metal materials and manufacturing processes, design of sheet metal components for manufacture using 3D CAD systems and production of sheet metal components using a 3D CAD system. A recommended list of topics for each of the Outcomes has been provided to assist with planning learning episodes.

In Outcome 1 the candidate should be able to identify and explain the properties of materials and manufacturing processes used in the design and manufacture of sheet metal components. Range (mild steel, stainless steels, aluminium, other emerging materials), finish (chequered, brushed, dimpled and other emerging finishes) and gauge (foil, sheet [metric and imperial], plate) details of materials and the potential use of sheet metal for cladding, food industry, aircraft, automotive use and other emerging uses should be discussed. Forming (bending, laser cutting, punching) and sheet metal joining techniques (thermal types, mechanical [threads, rivets] seams, snap lock) for different materials could be experimented with to understand the interrelationship of all these manufacturing requirements.

In Outcome 2 the candidate is required to design and produce sheet metal components for manufacture using a 3D CAD system in response to a given brief. The candidate should be able to produce 3D CAD details and detailed manufacturing drawings (folded and flat pattern). Each candidate should have an understanding of how design factors such as material gauge, edge design — hems, open, closed/safety, tear drop, rolled, bend allowance, bend relief, economical design (nesting, weld versus bend) and tolerances influence sheet metal pattern development for the manufacturing process. 3D sheet metal part creation and manufacturing drawings and related annotation, are also covered by this Outcome.

In Outcome 3 candidates will produce an assembly of sheet metal components using a 3D CAD system. They should be able to retrieve and use the parts created for Outcome 2 and fully develop an assembly of 3D sheet metal components and apply appropriate 3D constraints. Candidates should use CAD system tools to check the fit of the assembled components, ensuring there is no interference between adjacent parts. Collision detection should also be utilised where the CAD system supports this function and moving parts are within the assembly.

Candidates should also demonstrate their ability to produce assembly/exploded assembly drawings with appropriate annotation and parts list.

Higher National Unit specification: support notes (cont)

Unit title: CAD: Sheet Metal

Guidance on the delivery and assessment of this Unit

It is intended that this Unit be presented using the specialist application CAD software available at the centre, with appropriate technical and support material available to the candidate. This Unit is at SCQF level 8 and has been devised as an Optional Unit within the new HND Computer Aided Draughting and Design award.

In delivery of this Unit, candidates should be provided with the opportunity to gain as much practical experience as possible. Each candidate will need access to a PC with CAD software installed.

Unit Assessment

Outcome 1	Written or oral recorded	2 hours
Outcome 2	Practical	4 hours
Outcome 3	Practical	3 hours

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of Communication, Problem Solving and Information Technology, all to SCQF level 6, and the Core Skill of Numeracy to SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Communication may be developed principally during the first two Outcomes in which candidates will produce designs and further develop these in relation to the given brief. Candidates will be required to explain their designs and must justify each choice in relation to technical criteria such as material gauge, edge design, bend allowance, bend relief, economical design and tolerances.

Candidates will use IT systems and specific applications throughout the whole of the Unit, from the planning/design stages, through the development stages and during the manufacturing process itself.

There are opportunities to develop the Core Skill of Numeracy provided by the design aspects of the Unit, which will require a number of calculations and extensive use of graphical information, including use and production of annotated technical drawings.

There is wide scope for candidates to utilise and develop the Core Skill of Problem Solving throughout the Unit, as there are critical thinking, planning and evaluation aspects inherent in the design, production and testing of sheet metal components.

Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. The candidate would require access to a PC with the appropriate CAD software installed. With regard to assessment, planning would be required by the centre to ensure the sufficiency and authenticity of candidate evidence. Arrangements would also need to be made to ensure that the candidate could demonstrate that the practical assessment evidence is their own work. This could involve the candidate attending the centre, utilising video conferencing or alternatively, special arrangements could be made for the candidate to demonstrate the practical assessments to a designated, responsible person, local to the candidate.

Higher National Unit specification: support notes (cont)

Unit title: CAD: Sheet Metal

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

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This Unit is designed to provide you with knowledge and skills in the use of Computer Aided Design (CAD) for the design and manufacture of sheet metal components. You will also gain knowledge of a variety of materials and material properties used in the manufacture of sheet metal components. On completion of the Unit you will be able to explain the manufacturing processes for a range of sheet metal materials, design and produce sheet metal components for manufacture using a 3D CAD system in response to a given brief and produce an assembly of sheet metal components using a 3D CAD system.

This Unit will help you to develop practical skills that will enable you to create part and assembly drawings and produce 3D CAD details and detailed manufacturing drawings (folded and flat pattern). By the end of the Unit, as well as having gained practical skills, you will have an understanding of the design factors influencing sheet metal component for manufacture.

In Outcome 1 you will identify the properties of sheet metal materials and the most appropriate manufacturing processes for the production of sheet metal components and assemblies. In Outcome 2 you will move on to designing sheet metal components using a 3D CAD system and in Outcome 3 you will produce an assembly of sheet metal components using a 3D CAD system.

All assessments for this Unit are undertaken as open-book in a supervised environment. Your assessment may be by standalone tasks or by an integrated assessment for all Outcomes.

During the course of the Unit there may be opportunities for you to develop the Core Skills of Communication, Problem Solving and Information Technology, and the components using number and using graphical information of the Core Skill of Numeracy to SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.