

# National Added Value Unit Specification



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**Unit title:** Design and Manufacture Assignment (National 4)

**SCQF:** level 4 (6 SCQF credit points)

**Unit code:** to be advised

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## Unit outline

This is the Added Value Unit in the Design and Manufacture (National 4) Course. The general aim of this Unit is to enable the learner to provide evidence of added value for the Design and Manufacture (National 4) Course through the successful completion of an assignment which will allow the learner to demonstrate challenge and application.

Learners who complete this Unit will be able to:

- 1 Design and manufacture a product in response to a brief

This Unit is a mandatory Unit of the Design and Manufacture (National 4) Course and is also available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Course Support Notes*, which provide advice and guidance on delivery and assessment approaches. Exemplification of the assessment in this Unit is given in the *National Assessment Resource*.

## Recommended entry

Entry to this Unit is at the discretion of the centre. It is recommended that the learner should be in the process of completing, or have completed, the Units of the Design and Manufacture (National 4) Course:

- ◆ Design and Manufacture: Design (National 4)
- ◆ Design and Manufacture: Materials and Manufacturing (National 4)

## Equality and inclusion

This Unit Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information please refer to the *Course Support Notes*.

# Standards

## Outcomes and assessment standards

### Outcome 1

The learner will:

- 1 Design and manufacture a product in response to a brief by:**
  - 1.1 Researching and confirming the design brief
  - 1.2 Developing design ideas in response to the brief
  - 1.3 Manufacturing a prototype based on the design ideas
  - 1.4 Evaluating the design ideas and craft skills in the manufactured prototype

### Evidence Requirements for the Unit

Evidence for this Unit will be generated through an assignment in which learners will produce a design folio and a finished prototype in response to a design opportunity. Learners will develop and confirm a design brief as required. They will carry out research and use idea generation techniques to develop and resolve their proposals. They will investigate materials and manufacturing practicalities, plan a manufacturing strategy and implement it.

This Added Value Unit is assessed internally by the teacher/lecturer.

The assignment requires learners to use skills and apply knowledge related to design and practical manufacturing skills (as defined in the 'Further mandatory information on Course coverage' section of this document). It includes building and testing models.

The brief will be sufficiently open and flexible to allow for personalisation and choice. It will allow learners to demonstrate creativity. All learners should be provided with a clear outline of the assessment, including when and how they will be assessed. The teacher/lecturer should offer the learner guidance on an appropriate choice of topic, including questions/tasks/prompts which will lead learners through the assignment in clear stages. This should involve advice on possible headings or other advice which assists the learner to describe and explain the key features of their topic.

While the learner should choose the topic to be researched, it would be reasonable for the choice the learner makes to be one where the teacher/lecturer has some expertise and has resources available to enable the learner to more successfully meet the assessment standards. The assignment should be carried out under supervised open book conditions.

Learners will provide evidence of having identified a design opportunity that exists within an existing product or a situation. They will use a minimum of three research techniques to gather, refine and present information in order to develop a clear design brief based on the design opportunity. Learners must negotiate, develop and confirm the requirements of the brief in terms of product opportunity and target market.

Evidence is required of the learner having carried out research in response to the requirements of the brief in order to present a clear design specification. The research must cover at least six of the following factors: aesthetics; function; human interface; safety; location of use; sustainability; impact on the environment; manufacturing costs; materials.

Learners will produce design ideas from initial concepts to firm final proposals using a range of idea generation techniques (minimum of four and to include physical modelling) and at key stages of the design process. Learners will research and justify choice of materials by matching aesthetics, function and performance to the properties of the materials selected.

Learners must retain details of ongoing evaluation of design ideas and additional research throughout design activity. This may take the form of annotations or other competent evidence that records the learner's thought processes with regard to ideas that are adopted and those that are rejected — with reasons.

Learners must provide evidence in the way of final design proposals. These must be in graphic and modelling forms and must include working drawings to an appropriate scale. An outline specification is also required.

For the manufacturing process, evidence must be provided of the learner having selected correctly the various tools, equipment, fixings and materials appropriate for the task of manufacturing the prototype. In addition, evidence is required of planning of the sequence of manufacturing activities.

Learners must manufacture their design ideas from the working drawings and to the specification, providing evidence of using skill in the safe use of tools and equipment. Evidence is also required of the manufacturing of the prototype to a standard that is functionally sound, generally free from significant faults, and finished to a competent standard.

Evidence of evaluation of the design and the prototype is required. The evaluation of the design must consider the effectiveness of the design idea against the brief. The evaluation of the prototype must cover aspects of quality in terms of craftsmanship. In its totality the evaluation of design and the prototype must cover at least five of the following aspects as applicable:

- ◆ function and performance
- ◆ aesthetics
- ◆ ergonomics
- ◆ safety
- ◆ manufacture and assembly
- ◆ durability
- ◆ maintenance

Further information is provided in the exemplification of assessment in the *National Assessment Resource*. Advice and guidance on possible approaches to assessment is provided in the *Course Support Notes*.

## **Development of skills for learning, skills for life and skills for work**

Please refer to the Course Specification for information about skills for learning, skills for life and skills for work.

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## Further mandatory information on Course coverage for the Design and Manufacture (National 4) Course

The following gives details of mandatory skills, knowledge and understanding for the Design and Manufacture (National 4) Course. Assessment of this Added Value Unit will involve selecting appropriate skills, knowledge and understanding from those listed below, in line with the Evidence Requirements above. This list of skills, knowledge and understanding also provides the basis for the assessment of all the Units in the Course:

### Design and Manufacture: Design

#### The design team in industry

The design process: the design brief, specification, recognising simple design factors, simple evaluation against a specification

Situation analysis: identification of problems and needs

Research techniques: use of search engines, measuring and recording, asking questions

Product evaluation techniques: surveys, user trials

The concept of function and fitness for purpose

Performance requirements including ease of maintenance

Aesthetics: shape, proportion, size, colour

Ergonomics: establishing critical sizes, basic understanding of how humans interact with products

Economic and market considerations: target market, maintenance requirements and repairs, value for money, consumer demand, sustainability and environmental issues

Environmental issues: sustainability, recycling, upcycling

Idea generation techniques: morphological analysis, thought showering, modelling, mind mapping, sketching, model making, prototyping, reflecting (on previous work), expert opinion

Modelling materials including: woods, metals, plastics, paper, card, manufactured boards, wire and pipe cleaners, foam and expanded foams, clay and moulding compound

Modelling techniques: scale models, fully crafted prototypes, computer-generated models

The role of modelling in the design process

The properties and uses of materials: softwoods, hardwoods, metals, thermo- and thermosetting plastics, manufactured boards

Graphic techniques — manual and/or CADD: sketching for early idea generation, working drawings, annotated sketches, perspective sketches

Presentation techniques: colour, shade and shadow, text, backgrounds

Computer-aided manufacturing (CAM): benefits (unit cost for mass production, quality assurance, globalisation, clean manufacturing), drawbacks (breakdown, setup cost)

Basic sustainability issues: ease of repair, reducing energy consumption, reducing amount of materials used, material selection

Factors that influence design: safety, construction, size, durability, cost, ergonomics, aesthetics, material selection

Design briefs: writing a simple design brief to define a problem or need

Design specification: writing a basic design specification that outlines the main requirements of a product

Knowledge of manufacturing in the workshop and in industry: wood turning; drilling wood, metal and plastic; using the belt and disc sander; moulding metals; metal turning; forge work; moulding plastics

Impact of design technologies on the world of work and society

Safe working practices and systems applicable to Design and Manufacture workshops generally and individual activities as required

## **Design and Manufacture: Materials and Manufacture**

Planning of manufacturing operations including materials lists, cutting lists and basic sequencing of manufacturing operations

Reading of working drawings and diagrams including an appreciation of orthographic projection

Manufacturing processes in industry — uses and applications: wood, metals, manufactured boards, plastics

Knowledge and use of common tools and equipment for: measuring and marking out; cramping, clamping and gripping; cutting, shearing, shaping, filing, bending and twisting; turning; drilling; sanding; fitting and fixing; surface finishing; testing and checking against standards

Fixing and joining to include, as applicable: standard joint types for woodworking, thermal joining techniques for metals, cementing of plastics, other mechanical joining techniques and use of proprietary adhesives as applicable and appropriate (pop riveting, nuts and bolts, spot welding)

Woodworking skills such as flat-frame and carcass construction to cover basic joint types (housing joint, dowel joint, mortise and tenon joint, cross halving joint, butt joint, screws and glue)

Skills in metalworking such as: turning (parallel and step turning), drilling, knurling

Surface finishing skills including: sanding, polishing, varnishing, staining

Skills in the use of hand tools, power tools and equipment as applicable and appropriate (tenon saw, coping saw, hacksaw, various types and sizes of file, hand vice, bench vice, engineer's vice, try square, sliding bevel, engineer's square, mallet, pin hammer, marking gauge, steel rule, scribe, dividers, odd-leg callipers, bevel edge chisel, hand drill, sander, screwdriver, smoothing plane, centre punch)

Heat treatments of metals: annealing, hardening, tempering

Properties and uses of common materials: softwoods, hardwoods, metals, plastics, manufactured boards and veneers

Impact of manufacturing technologies on the world of work and society: reduction in workforce, skilled workforce, cost of equipment, impact on environment (energy and pollution)

Safe working practices and systems applicable to Design and Manufacture workshops generally and individual activities as required

## Administrative information



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**Published:** August 2011 (draft version 1.0)

**Superclass:** to be advised

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### History of changes

| Version | Description of change | Authorised by | Date |
|---------|-----------------------|---------------|------|
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Note: readers are advised to check SQA's website: [www.sqa.org.uk](http://www.sqa.org.uk) to ensure they are using the most up-to-date version of the Unit Specification.