MANUFACTURING AND ENGINEERING TECHNOLOGY

Prototype Modelling

WorldSkills Occupational Standards

 WSC2022_WSOS45_Prototype_Modelling

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WorldSkills Occupational Standards (WSOS)

Occupation description and WSOS

The name of the occupation is

Prototype Modelling

Description of the associated work role(s) or occupation(s)

The prototype modelling practitioner is involved with the design, creation, testing, and modification of prototypes. In many fields, there is great uncertainty as to whether a new design will actually do what is desired. New designs often have unexpected problems. A prototype is often used as part of the product design process to give engineers and designers the ability to explore design alternatives, test theories, and confirm performance prior to starting production of a new product.

Prototype modelling practitioners use their experience to tailor prototypes according to the specific unknowns still present in the intended designs. For example, some prototypes are used to confirm and verify consumer interest in a proposed design, whereas other prototypes will attempt to verify the performance or suitability of a specific design approach.

In general, an iterative series of prototypes will be designed, constructed, and tested as the final design emerges and is prepared for production. In most cases, multiple iterations of prototypes are used progressively to refine the design. It is common to design, test, evaluate, and then modify the design based on analysis of the prototype.

In many product development organizations, prototyping specialists are employed. These are individuals with specialized training and skills in general fabrication techniques that can help bridge theoretical designs and fabrication of prototypes. For a company engaged in rapid prototyping and manufacturing or functional testing, prototype models are crucial for troubleshooting potential problems in the design process.

A team with excellent interpersonal and communication skills will provide clients with confidence that the specialist advice and guidance resulting from prototyping fully supports their production plans. The prototyping engineering technician will require a range of skills including 3D CAD systems, CAM systems such as milling, printing, and other CAM machining, vacuum casting, prototype model making by hand tools and machines, and spray painting and finishing.

General notes on the WSOS

The WSOS specifies the knowledge, understanding, and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, and to the extent that it is able to. The Standard is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the "weighting". The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills that are set out in the Standards Specification. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, provided that this does not distort the weightings assigned by the Standards.

WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	5

The individual needs to know and understand:

- Principles and applications of safe working generally and as applied to prototype modelling
- The purposes, uses, care, and maintenance of all equipment and materials, together with their safety implications
- Environmental and safety principles and their application to good housekeeping in the work environment
- Principles and methods for work organization, control, and management
- Principles of communication and collaboration
- The scope and limits of one's own and others' roles, responsibilities,
- and duties individually and collectively
- The parameters within which activities need to be scheduled
- Principles and techniques for time management

The individual shall be able to:

- Prepare and maintain safe, tidy, and efficient work areas
- Prepare self for the tasks in hand, including full regard to health and safety
- Schedule work to maximize efficiency and minimize disruption
- Select and use all equipment and materials safely and in compliance
- with manufacturers' instructions
- Apply or exceed the health and safety standards applying to the environment, equipment, and materials
- Restore work areas to appropriate states and conditions
- Contribute to team and organizational performance both broadly and specifically
- Give and take feedback and support

2	**Design prototypes**	5

The individual needs to know and understand:

- The proposed function of the final production model of the prototype
- Design principles
- The importance of effective collaboration with other professionals
- Principles and methods of formal and informal communication

Section		Relative importance (%)
	The individual shall be able to: • Grasp and visualize complex and abstract ideas • Convert descriptive text, either written or verbal, into design • Discuss design concepts with clients and colleagues • Interpret complex technical drawings and convert them into designs • Provide expert advice and guidance on limitations and opportunities to clients and colleagues • Engage with product designers and engineers to support design and test parts • Provide innovative solutions to challenges and problems	
3	**Technical drawings**	**10**
	The individual needs to know and understand: • Features from the available CAD systems • Technical terminology and symbols used in technical drawings and specifications	
	The individual shall be able to: • Prepare accurate 2D technical drawings providing clear and unambiguous information to future users • Prepare and dimension 2D technical drawings from 3D CAD data • Clearly label drawings • Accurately measure dimensions and transcribe to drawings and technical specifications	
4	**Computer Aided Design 3D - CAD**	**15**
	The individual needs to know and understand: • Benefits, limitations, and advantages of various CAD software systems • Reverse Engineering and its uses in Industry.	
	The individual shall be able to: • Work effectively and creatively with internationally known and recognized 3D CAD systems • Create 3D CAD Data of complete prototypes and exploded parts • Apply clear and accurate dimensioning • Use reverse engineering techniques	

Section		Relative importance (%)
5	**Computer Aided Manufacturing - CAM**	5

The individual needs to know and understand:

- The benefits, limitations, and advantages of various CAM software systems
- Machine and Machining Parameters
- Tools suitable for CNC machining
- Programming as the creation of logical process plans
- Different methods and techniques to generate a program
- (CAM/CAD or manual)
- CAM system programming
- Skill related software

The individual shall be able to:

- Use CAM software and milling machines to produce accurate models, production prototypes, and engineering components
- Use 3D CAD data to generate cutter paths using specialist machining software
- Select the best methods according to production type and part specification
- Effectively use skill specific software and related hardware
- Generate programmes using CAD/CAM systems and taking into account the format of the initial data

6	**Manufacturing prototype models**	50

The individual needs to know and understand:

- Types and characteristics of materials used in prototype model making
- Methods of model production
- Importance of accuracy in detail and dimension
- Methods of finishing prototype models
- Use and care of tools and equipment used in prototype model making

Section		Relative importance (%)
	The individual shall be able to: • Manufacture prototype models according to design criteria, specified materials and specifications • Transfer and manufacture copies of parts • Tailor prototypes according to the specific unknowns still present in intended designs • Use hand tools and conventional machines to produce prototype models • Use CNC machines to produce prototype models • Finish prototype models' surfaces • Use measuring equipment • Produce models from standard plastic materials; PU-Chemical Wood, casting resin, celcoat, laminating resin, acryl glass, polyurethane, aluminium, composites, PVC, etc. • Use polyurethane and fast cast resin to produce parts through to accurate multiple components for pre-production assemblies • Use different resins to produce parts that can be clear, heat resistant, flame retardant and flexible • Adapt resins to be tinted or pigmented, add glass filler to stiffen parts and be over moulded • Apply production tasks – cutting, sanding, gluing • Apply negative and positive mouldings • Modify minor product details • Create and assemble parts • Modify prototypes based on feedback from engineers and potential users	
7	**Paint and decorate prototype models**	**10**
	The individual needs to know and understand: • Types of paints and paint finishes required for prototype models • The purposes for labels and stickers The safe usage of paints and polishes	
	The individual shall be able to: • Finish prototype model surfaces • Paint prototype models using spray cans • Polish painted models • Decorate prototype models with appropriate stickers • Innovate and test new paints and finishes to satisfy clients' needs • Assemble given parts from customers such as LED, batteries, motors, wheels switches, etc. to manufacture products.	
	Total	**100**

References for industry consultation

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.**oneto**nline.org/)

This WSOS (Section 2) appears most closely to relate to *Model Maker: Metals and Plastic*:
https://www.onetonline.org/link/summary/51-4061.00

and *Model Maker:*
http://data.europa.eu/esco/occupation/3cbbdb83-7c36-4ae5-8c45-6c284186f477

Adjacent occupations can also be explored through these links.

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2022.

ORGANIZATION	CONTACT NAME
A. Stebler AG (Austria, Germany, Switzerland)	Stephan Rey, Senior Production Manager
HM Habich & Martin GmbH, Modell und Formenbau (Germany)	Peter Habich, CEO
LLC STC – CYBERCAD (Belarus, Kazakhstan,	Egor Vladimirovich Kulaev, CEO