MANUFACTURING AND ENGINEERING TECHNOLOGY

Prototype Modelling

Technical Description

 TD45 v8.0 WSC2021

worldskills

WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders, and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

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1 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

Prototyping Modelling

1.1.2 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.

1.1.3 Number of Competitors per team

Prototype Modelling is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 22 years in the year of the Competition.

1.2 The relevance and significance of this document

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

Since this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI – Code of Ethics and Conduct
- WSI – Competition Rules
- WSI – WorldSkills Occupational Standards framework
- WSI – WorldSkills Assessment Strategy
- WSI online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations.

2 The WorldSkills Occupational Standards (WSOS)

2.1 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.

2.2 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**

3 The Assessment Strategy and Specification

3.1 General guidance

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: measurement and judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, in order to demonstrate their quality and conformity with the Standards.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

4 The Marking Scheme

4.1 General guidance

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more independent people with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance. Please see the Rules for further details.

Experts and Independent Assessors are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition. Skill Advisors actively facilitate this process.

4.2 Assessment Criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). *The Assessment Criteria, the allocation of marks, and the assessment methods, should not be set out within this Technical Description. This is because the Criteria, allocation of marks, and assessment methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published.*

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

4.3 Sub Criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by measurement or judgement, or both measurement and judgement.

Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

4.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by measurement or by judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

		CRITERIA								TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE
		A	B	C	D	E	F	G	H			
STANDARDS SPECIFICATION SECTION	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		9.50	10.00	0.50
	3								11.00	11.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS		5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by judgement, measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

4.6 Assessment and marking using judgement

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts or separate guidance notes)
- the 0-3 scale to indicate:
  - 0: performance below industry standard
  - 1: performance meets industry standard
  - 2: performance meets and, in specific respects, exceeds industry standard
  - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

4.7 Assessment and marking using measurement

Normally three Experts will be used to assess each aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

4.8 The use of measurement and judgement

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

4.9 Skill assessment strategy

WorldSkills is committed to continuous improvement. This particularly applies to assessment. The SMT is expected to learn from past and alternative practice and build on the validity and quality of assessment and marking.

Measurement Marking

NOTE: Marks are calculated by CIS 'Ranged Score' calculations. Mark deductions are as a percentage of maximum mark

Lengths

- Tolerance of +/- 0.1 mm, deduct 0%
- Tolerance of +/- 0.15 mm, deduct 20%
- Tolerance of +/- 0.2 mm, deduct 40%
- Tolerance of +/- 0.25 mm, deduct 60%
- Tolerance of +/- 0.3 mm, deduct 80%
- Tolerance greater than +/- 0.3 mm, deduct 100%

Angles

- Tolerance +/- 0.5°, deduct 0%
- Tolerance +/- 1.0°, deduct 50%
- Tolerance greater than +/- 1.0°, deduct 100%

Plastic fillets and radii

- Tolerance +/- 0.5 mm, deduct 0%
- Tolerance +/- 1.0 mm, deduct 40%
- Tolerance +/- 1.5 mm, deduct 70%
- Tolerance greater than +/- 1.5 mm, deduct 100% Minimum one fillet, radii, and angle must be measured.

4.10 Skill assessment procedures

Assessment and marking are an intense process that depends upon skilful leadership, management, and scrutiny.

- Items to be assessed and the allocation of marks are decided by Experts at the Competition;
- A Summary Marking Form is provided to each Competitor to ensure transparency;
- The Chief Expert or Deputy Chief Expert divides all Experts into several marking teams. In such cases, WorldSkills experience at a previous Competition is taken into consideration as well as culture, language, and continent;
- If Experts have the possibility to measure the dimensions for Measurement Marking by a digital measuring machine, the Experts can decide and organize it at the Competition. In this case, the measurement is done by a professional assistant who is familiar with it;
- When the Judgment Marking and Measurement Marking are performed on a module, the Judgment Marking should be performed first (every marking day);
- Progressive marking is used for each completed module.

5 The Test Project

5.1 General notes

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS.

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Standards will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Standards, or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work. The Test Project will not assess knowledge of WorldSkills rules and regulations.

Most Test Projects (and Marking Schemes) are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Developer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

Please refer to the current version of the Competition Rules for further details.

5.2 Format/structure of the Test Project

The Test Project is a single Test Project assessed in stages.

5.3 Test Project design requirements

Competitors are given 2D drawings and instruction document to execute the requirement as per WorldSkills Occupational Standards. The Test Project can have minor product details for a modification.

The drawings of the Test Project need to include at least 50 specified dimensions or points for measurement.

5.4 Test Project development

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Who develops the Test Project or modules

The Test Project/modules are developed by an Independent Test Project Designer in collaboration with the Skill Competition Manager.

5.4.2 When is the Test Project developed

The Test Project/modules are developed according to the following timeline:

Time	Activity
Prior to the Competition	The Test Project/modules are developed.
No later than one (1) month prior to the Competition	The Test Project documents are sent to the WorldSkills International Skills Competitions Administration Manager.
At the Competition on C-3	The Test Project/modules are presented to Experts.
At the Competition on C-2	The Test/Project modules are presented to Competitors.

5.5 Test Project initial review and verification

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations,

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer is expected to identify one or more independent, expert, and trusted individuals initially to review the Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

5.6 Test Project validation

The Skill Competition Manager coordinates the validation and will ensure that the Test Project/modules can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project selection

The Test Project/modules are selected by the Independent Test Project Designer in collaboration with the Skill Competition Manager.

5.8 Test Project circulation

If applicable, the Test Project is circulated via the website as follows:

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Experts on C-3 and to Competitors on C-2.

5.9 Test Project coordination (preparation for Competition)

Coordination of the Test Project/modules is undertaken by the Skill Competition Manager.

5.10 Test Project change

There is no 30% change required to be made to the Test Project/modules at the Competition. Exceptions are amendments to technical errors in the Test Project documents and to infrastructure limitations.

5.11 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These such items may include those for fault finding modules or modules not circulated.

The Competition Organizer informs Experts of material specifications required for the Test Project through the Infrastructure List.

6 Skill management and communication

6.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the skill specific Discussion Forum (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be the moderator for this Forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

6.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

This information includes:

- Competition Rules
- Technical Descriptions
- Mark Summary Form (where applicable)
- Test Projects (where applicable)
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 Test Projects [and Marking Schemes]

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 Day-to-day management

The day-to-day management of the skill during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Skill Competition Manager. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalized at the Competition by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

6.5 General best practice procedures

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

Topic/task	Best practice procedure
Equipment failure	• If equipment or tools which are brought by the Competitor fail, no extra time will be allowed.
Supply of equipment, tools, instruments, etc. to competitors	• In the case that a Competitor has forgotten to bring a tool in their toolbox the SCM, CE, and DCE can decide if this item can be delivered to the Competitor by the Team Leader.
Photographic records by the marking groups	• To record any good practices or practices that are not so good during the competition that can support Judgement Marking, the marking team can take pictures. For example unsafe acts, dirty and disorganized workstation, attitudes that can cause accidents, etc.
Given parts for Test Project	• The SCM is responsible for preparing and organizing all the given parts to complete the Test Project such as stickers, motor, LEDs, batteries, wire, power cable, etc
Measurement plan - digital measurement	• The SCM is responsible for organizing and coordinating the programme for digital measurement by the company responsible for this during the Competition.

7 Skill-specific safety requirements

Refer to WorldSkills Health, Safety, and Environment Policy and Regulations for Host country or region regulations.

Task	Safety glasses with side protection	Hearing protection	Painting mask	Dust mask	Nitrile gloves	Safety shoes with closed toe and heel	Tight fitting work clothes (long trousers)	Hairnet/hat a lot of and Long Hair
General PPE for safe areas						√		
Area within the workstation	√	√				√	√	√
Milling machine	√	√		√		√	√	√
Turning lathe	√	√		√		√	√	√
CNC milling machine	√	√		√		√	√	√
Drilling machine	√	√		√		√	√	√
Disc sanding machine, band sanding machine, bobbin sanding machine	√	√		√		√	√	√
Frizzi machine	√	√		√		√	√	√

Task	Safety glasses with side protection	Hearing protection	Painting mask	Dust mask	Nitrile gloves	Safety shoes with closed toe and heel	Tight fitting work clothes (long trousers)	Hairnet/hat a lot of and Long Hair
Band saw	√	√		√		√	√	√
Paint booth	√		√		√	√	√	
Work with liquid resin	√		√		√	√	√	

8 Materials and equipment

8.1 Infrastructure List

The Infrastructure List details all equipment, materials, and facilities provided by the Competition Organizer.

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These such items may include those for fault finding modules or modules not circulated.

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

8.2 Competitors toolbox

Competitors may bring one toolbox with the total external volume not exceeding 0.5 m³.

(Volume = Length x Height x Width, or V = L x H x W).

Volume measurement does not include a packing crate, other protective packing material, palette for transportation, wheels, etc.

8.3 Materials, equipment, and tools supplied by Competitors

The following items are allowed to be carried in the toolbox:

Item	Type	Quantity	Picture
Space mouse and keyboard: *Required software to be installed by the CAD assistant	Un	01	
Hand tools for processing			
Wood Chisels	Set	01	
Wood Planes	Set	01	
Cutting tools such as Stiletto and Scissors	Un	02	
Files	Set	01	
Electric tools for processing (allowed only with dust extractor), if this item is not in the Infrastructure List.	Un	01	
Scale rule – 150 mm and 300 mm	Un	01	
Vernier calliper – 150 mm and 300 mm	Un	02	

Item	Type	Quantity	Picture
Depth gage – 150 mm	Un	01	
Micrometer – 0 mm to 25 mm; 25 mm to 50 mm and 50 mm to 75 mm	Un	03	
Gage blocks rectangular – Steel - 56 pc	Set	01	
Dial indicator – 10 mm; 0.01 mm	Un	01	
Compass of steel (Spring Divider) – 150 mm	Un	01	
Radius gage – 1mm to 7 mm; 7.5 mm to 15 mm and 15.5 mm to 25 mm	Un	03	
Universal Bevel Protractor – 360°	Un	01	
Spatulas	Set	01	
Masking tape *if this item is not in the Infrastructure List	Un	01	
A gas mask that conforms to the Health, Safety, and Environment standard * if this item is not in the Infrastructure List	Set	01	

Competitors are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

8.4 Materials, equipment, and tools supplied by Experts

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

8.5 Materials and equipment prohibited in the skill area

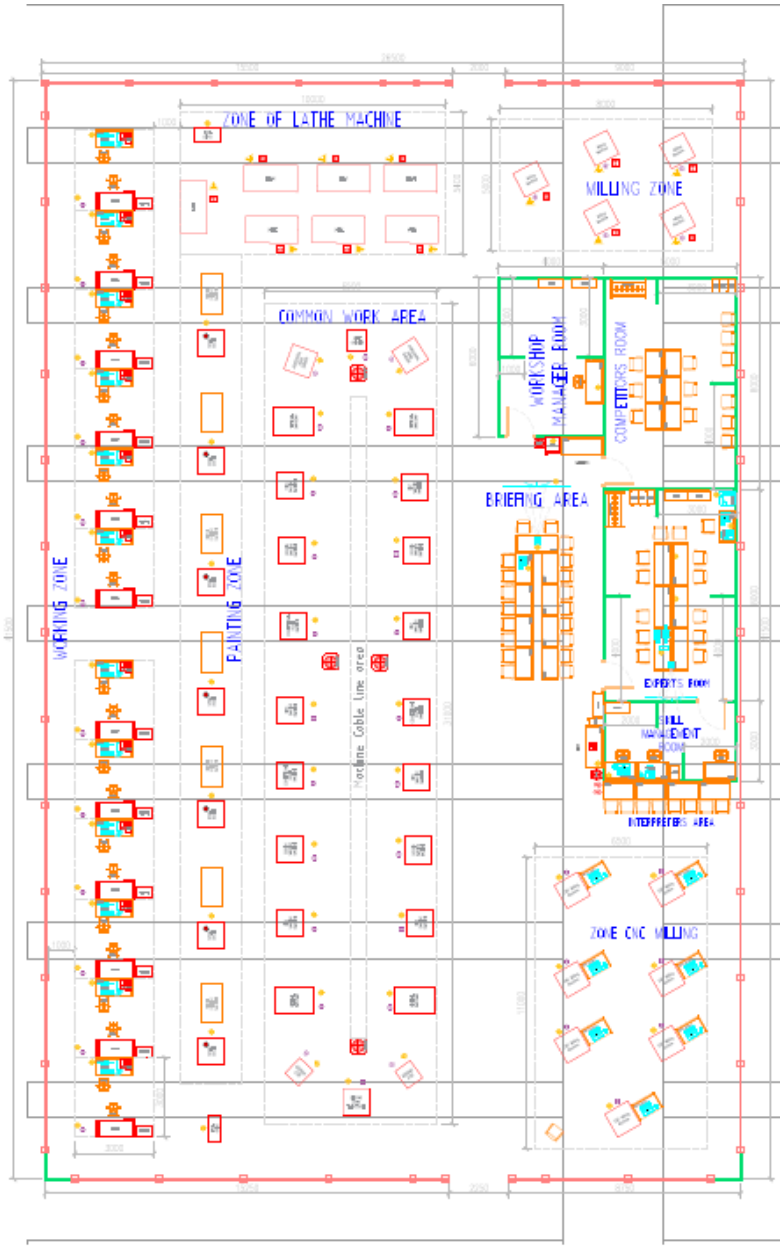
CAD systems and software other than those provided at the Competition. Computerized machines and tools other than those provided at the Competition.

Already prepared parts and tools cannot be used for the Test Project to manufacture the Test Project.

8.6 Proposed workshop and workstation layouts

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout



9 Skill-specific rules

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

Topic/task	Skill-specific rule
Use of technology – USB, memory sticks	• Competitors, Experts, and Interpreters are not allowed to bring memory sticks into the workshop. The SCM, Chief and Deputy Chief Expert are exempt from this rule. • If Competitors, Chief Expert, Deputy Chief Expert, Experts, and interpreters bring electronic data storage devices such as flash drive, HD, USB device, etc., these must remain stored in a locker and will be returned only at the end of C4. Experts may use these devices only if authorized by SCM. • The SCM is exempt from this rule.
Use of technology – personal laptops, tablets and mobile phones	• Competitors, Experts, and Interpreters are not allowed to bring personal laptops, tablets, personal photo and video taking devices, and mobile phones into the workshop. The SCM, Chief and Deputy Chief Expert is exempt from this rule for both Personal phones and competition phones. • If these items are brought into the workshop they must remain stored in your locker and will be returned only at the end of C4. Experts may use these devices only if authorized by SCM or CE. Mobile phones can be retrieved at lunch time and at the end of the competition day. • The Skill Competition Manager, Chief Expert, and Deputy Chief Expert is exempt from this rule.
Use of technology – personal photo and video taking devices	• Competitors, Experts, SCM, CE, DCE and Interpreters are allowed to use personal photo and video taking devices in the workshop from C1 until C+1.
Templates, aids, etc.	• Competitors are not permitted to bring or use their own templates or aids at any time. • These cannot be fabricated during Familiarization Day or the competition days.
Drawings, recording information	• Competitors, Chief Expert, Deputy Chief Expert, Experts and Interpreters are not permitted to bring drawings or prepared information into the workshop from C-4 until C+1. The SCM is exempt from this rule.

Topic/task	Skill-specific rule
Test Project and Assessment	• Competitors, Chief Expert, Deputy Chief Expert, Experts, and Interpreters are not permitted to take Test Project drawings or Marking Scheme out of the workshop from C-4 until the conclusion of the Competition on C4. The SCM is exempt from this rule.
Books, catalogues, notes, drafts or any other personal/technical information	• Competitors may bring these items (books, notes, catalogues, etc.) for consultation during the C-2 familiarization. However, all of these must remain in the workshop, preferably in the locker, throughout the competition - C-2 until C4. It is not allowed to use during lunchtime or any other time outside the workshop.

10 Visitor and media engagement

Following is a list of possible ways to maximize visitor and media engagement:

- Try-a-Skill;
- Display screens;
- Test Project descriptions;
- Career opportunities;
- Daily reporting of competition status;
- Live demonstration while machining;
- 3D Print technology demonstration;
- Digital measuring demonstration by supplier.

11 Sustainability

This skill competition will focus on the sustainable practices below:

- Recycling;
- Use of "green" materials.

12 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 WorldSkills Occupational Standards on a two-yearly cycle.

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 2021.

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, Russia)	Egor Vladimirovich Kulaev, CEO