Industrial Design Technology

Technical Description

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

Industrial Design Technology

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

Industrial design technology is the creation of a product designed for mass consumption. It must succeed in both form (appearance) and function, and promote efficient manufacture. It must be technically feasible to produce, and meet a genuine need in the marketplace, at an acceptable price.

To fulfil the role of an industrial design technician, knowledge, skills, and qualities are required in each of the following broad areas:

- market research, graphic and wider communication skills
- design and development processes
- engineering practice, product analysis, and materials science/engineering

In modern, successful economies, industrial design follows a thinking process, which can be summarized as follows:

- Inspiration: understand; observe; perspective/orientation
- ideation: develop ideas; prototype; test
- implementation: "story telling" (create value proposition); pilot; create the business model.

In start-ups and small companies, industrial design technicians may themselves cover all steps in this process. In larger organizations, they may support and contribute to either each phase of the process, or one or two phases only. For industrial design in larger organizations, teamwork is advantageous, to capitalize on a range of perspectives, attitudes, knowledge and skills.

Industrial design technology combines two disciplines: design, and engineering, in order to innovate, with success as measured by the customer's response and the producer's viability and profit. It is essentially disruptive to current ways of doing and making things. This means that the industrial designer must stay constantly alert to new materials, technologies, markets, and consumer demand and benefit.

In summary: the sequence of steps, starting with market research, ideas development, and design, before physically making and testing, often many times, distinguishes industrial design from craft-based design. This is a very important difference to the process of the craft-based designer, whose creativity is embedded in the act of making. Good industrial design technicians respect the importance of inspiration and ideation as a separate set of activities, before testing, improvement and manufacture.

1.1.3 Number of Competitors per team

Industrial Design Technology is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 25 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:

- The role and responsibilities of the industrial design technician, and how it differs from craft-based design, creativity, and production
- Principles and practices for safe working practice across different work settings
- Principles and methods for
- organizing own time efficiently and effectively
- setting and reaching goals for self and own areas of responsibility
- scheduling and organizing work assignments
- establishing priorities and rescheduling
- Good practice in generating and maintaining records
- Ethical principles for safeguarding and maintaining clients' and organizations' security and proper business advantage
- The norms and expectations for best practice in one's role.

The individual shall be able to:

- Apply safe working methods personally and for others
- Select and keep to efficient and effective work methods and habits
- Estimate time requirements for each phase of the design process, and create timelines
- Select and use appropriate planning and management tools
- Maintain orderly and secure work areas
- Maintain work records as required and helpful
- Minimize distractions that impact on own effectiveness and efficiency
- Respond positively to formal and informal opportunities to learn and update knowledge and expertise.

Section	Relative importance (%)
2 **Market research and ideas formation**	**15**

The individual needs to know and understand:

- Their organization's
  - brand
  - position in the market
  - range and nature of products and services
  - business strategies and plans

- The sources of design commissions and requirements
- Principles and methods for researching
  - Customer satisfaction
  - Market opportunities

- Principles, methods and ethics for obtaining information by
  - Observation
  - Feedback
  - Surveys
  - Analysis
  - Secondary (indirect) sources

- Principles and techniques for drawing conclusions from data and inputs:
  - Inductive reasoning (combining information in order to generalize)
  - Deductive reasoning (applying general rules to situations).

The individual shall be able to

- Receive and mentally process information and requests
- Participate in new market research and product planning
- Review the relationship of potential new products to the organization's product range and plans
- Review and select alternative methods for obtaining market intelligence
- Investigate the potential need and benefit of new products and product lines using suitable research methods
- Draw conclusions from the market research
- Maintain records of the market research and thinking process.

Section	Relative importance (%)
3 **The design process**	**15**

The individual needs to know and understand:

- Design as a process for creating and developing concepts and specifications, through strategic problem-solving
- Principles of design
- Design processes and steps for mass consumption products and services
- Constraints and opportunities as they relate to the client and organization
- Principles for visual and physical realisation
- The available techniques, methods, tools, and aids to support design and development
- The impacts of innovation on design and the design process for mass consumption.

The individual shall be able to:

- Conduct research into trends in design
- Conceive or receive a design idea
- Through market research and consultation, create, realize, and evaluate design concepts for manufacturing
- Evaluate the feasibility of design ideas, relative to
  - Appearance
  - Safety
  - Function,
  - Serviceability
  - Budget
  - Production methods and costs
  - Market characteristics
- Modify and refine design ideas, based on the above factors
- Complete the design process within the parameters of the business or commission.

Section	Relative importance (%)
4 Drawing, illustration, and graphics	**20**

The individual needs to know and understand:

- The essential characteristics of visualization for industrial design, including colour, visual materials' properties, composition, and typography
- Principles, purposes, and techniques for sketching within the industrial design process
- The range of equipment and tools used to support sketching
- The creative process for industrial design
- The range of graphics equipment and tools that support the representation of the design idea
- Principles and methods for generating desired impressions and impact on viewers
- The range and sequence of information required for design documentation for mass consumption
- The relationship of design documentation to the whole development process
- The available choices for IT hardware and software
- International design documentation systems.

The individual shall be able to:

- Explore ways of articulating design ideas visually
- Prepare sketches, iteratively, exploring options and results
- implement decisions regarding colour, visual materials' properties, and composition
- Create
  - detailed drawings
  - illustrations
  - artwork or blueprints
- use drafting instruments and tools
- use CAD software
- draft, lay out, and specify technical devices, plants and equipment
- update sketches, drawings, and documentation as development proceeds
- maintain document control throughout the design process.

Section	Relative importance (%)
5 **Materials science and engineering**	**15**

The individual needs to know and understand:

- The practical application of engineering science and technology
- The principles, techniques, procedures and equipment relevant to design and production
- Machines and tools, including their design, uses, repair, and maintenance
- Raw materials
- Production processes, quality control, and costs
- Circuit boards, processors, chips, electronic equipment, hardware and software
- Applied mathematics
- Physical principles, properties, laws, interrelationships, and applications for
  - Fluids
  - Materials,
  - Atmospheric dynamics
  - Mechanics
  - Electrics
- Atomic and sub-atomic structures and processes
- Properties of materials
- Trends in materials and their applications
- Methods for identifying, testing, and selecting materials
- Developments in the digitalizing of industrial processes.

The individual shall be able to:

- Consult with engineers and/or other knowledge sources to plan tests and prototypes
- Select and specify machines and tools for prototyping
- Identify and apply relevant procedures and regulations to the testing and prototyping process
- Determine the purposes, range and scope of tests and prototypes
- Put in place measures to ensure the validity of information and data collected
- Conduct tests and prototyping
- Collect planned information and data for analysis
- Review the implications of the analysis for
  - The manufacturing process, and outcomes, and
  - the selection and use of materials.

Section	Relative importance (%)
6 The development process	**20**

The individual needs to know and understand:

- The technical standards governing the design idea and purpose
- Ergonomics for the purpose of fitting users' needs and characteristics
- Manufacturing processes and available options for given items
- The impacts of manufacturing and assembly on the function and appearance of given items
- The impact of materials and manufacture on the mass and weight of given items
- Principles, methods and techniques for collecting test data
- The options for use of testing and analytical products, methods, techniques and tools.

The individual shall be able to:

- Research production specifications, costs, production materials, and manufacturing methods
- Provide cost estimates and itemized production requirements
- Build models, patterns, or templates
- Fabricate models or samples in a range of materials, using hand and power tools
- Monitor processes, materials, and surroundings to detect or assess problems
- Collect and process information by compiling, categorizing, calculating, and verifying information and data
- Select and use suitable and robust testing equipment, tools, methods, and techniques
- Analyse and evaluate information to determine compliance with standards
- Estimate or quantify sizes, numbers, or amounts, of items relevant to production
- Determine time, costs, resources, or materials needed for production
- Present designs and reports to clients or managers for approval
- Raise and discuss the needs for and benefits of modification
- Techniques for optimizing manufacture and distribution
- Review, adapt, and provide documentation, detailed instructions/specifications, or drawings, for fabrication, construction, assembly, modification, maintenance and use.

Section	Relative importance (%)
7 **Implementation**	**10**

The individual needs to know and understand:

- Principles and methods for showing, promoting, and selling products or services
- The organization's
- Marketing strategy and tactics
- Product demonstration
- Sales techniques
- Sales control systems.

The individual shall be able to:

- Develop industrial standards and regulatory guidelines
- Check the relationship of the product to the organization's business strategy and plan
- Develop promotional strategies or plans for the product
- Develop artistic or design concepts for decoration, exhibition, or commercial purposes
- Design graphic material for use as ornamentation, illustration, advertising, and packaging
- Present evaluation reports, including
  - Handling and safety
  - Market appeal
  - Production efficiency
  - Distribution.
  - Use
  - Maintenance.

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.

The final understanding on Measurement and Judgement Marking is available when the Marking Scheme and the Test Project are approved.

The table contains approximate information and is used to develop the Marking Scheme and the Test Project.

	Criteria	Judgement	Measurement	Total
A	Research and analytics of market situation	20	5	25
B	Sketch concept of the Ideas	10	10	20
C	CAD Modelling and engineering process	10	20	30
D	Project development and presentation	20	5	25
Total		60	40	100

4.10 Skill assessment procedures

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

Three groups of Experts award marks according to two criteria in aspects for each module. Competitors are provided with necessary materials prior to the beginning of each stage of the competition. The Competitor shall independently check the availability of all materials and tasks, previously checked and signed by two Experts.

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/modules is a series of four (4) modules.

Module	Description	Module completion time
1	Module 1 – Hot point 1: Research and analytics of market situation	5 hours
2	Module 2 – Hot point 2: Sketch concept of the Ideas	4 hours
3	Module 3 – Hot point 3: CAD Modelling and engineering process	8 hours
4	Module 4 – Hot point 4: Project development and presentation	6 hours

5.3 **Test Project design requirements**

Module 1 – Hot point 1: Research and analytics of market situation

In this module, the participant must conduct research and analysis of the current situation regarding the proposed area of product development. Provide statistical data and analytical offers of the modern supply and demand market, describe the average consumer of a product, his desires. Describe the problems of the production process of the product, isolate the positive and negative, analyze the use of materials and production technologies, identify the engineering faulty and collapsible units of the product and the necessary input data for the development of one's own idea for the product.

Module 2 – Hot point 2: Sketch concept of the Ideas

The Competitor should develop the concept of the object for the first briefing and present it using the sketches. The task contains only the technology that one would like to implement in the future in everyday life. The participant should analyse the information received and draw conclusions about the nature and possibility of using this technology in the future object, choose the segment of consumers for which they will design, choose the materials for the object and the colour palette, and determine the functionality.

The input data table is filled in at any time prior to the end of the module at the Competitor's discretion and attached to the magnetic board. Once the participant has understood his or her design task, they may begin sketching. Through the sketches in the first format, the Competitor establishes the shape of the future object and its colour scheme. Once the Competitor is happy with the shape of the future object, they draw a demo sketch. The demo sketch is distinguished by a more detailed drawing and the image size. For the sketch to be even more informative, one section is selected and "set apart", so that the thickness of the product and the internal space can be seen. The demonstration sketch also indicates the dimensions of the product.

For a better understanding of the functionality of the object, scenario sketches of the proposed functions are made in the second format. The scenario sketch should demonstrate the moment of interaction or action of the object, for the purpose of which the Competitor may draw a person (individual parts) in the script or indicate the movement with arrows (twisting, moving upwards, etc.). Additional text explanation is also allowed in the scenarios (but not instead of the scenario image itself).

An exploded-view drawing should be made for explanations on the selected material and design of the product in the second format. This exploded diagram is carried out along the coordinates inscribed along the axes in three directions (x, y, z). The parts and fixtures are spread out, however, the object does not lose its visual integrity. An explosion along a single axis, partial separation of parts or a loss of overall visual integrity cannot be considered an exploded view.

The parts should be accompanied with proper explanations for the selected material; the material should be named in an unambiguous manner (not "plastic" or "metal", but for example "polyurethane" or "steel"), and there should be proper explanations of why this exact material has been chosen (for example the cost, abrasion resistance, increased strength, tactile sensations, elasticity, ability to take a new form or return to the initial one, etc.). The explanations (in the case of a glue or weld joint, explanations should be close to the joint lines) about the reasons for choosing this particular method of connection (increased strength, complex configuration of parts, etc.) should be present on the exploded view next to the possible fasteners on the designed object (coupling elements, all kinds of fixing surfaces and their parts and accessories).

It is important to remember that there is no clear task regarding the aesthetic decoration of the sheets; it is assessed (judged) in terms of the Competitor's ability to present their ideas and in terms of their level of artistic skills. The list of sketches specified in the task is minimal, and the presence of all items on the list according to the task is assessed objectively. However, in order to more greatly describe the

project and the artistic idea, it is allowed to draw more sketches or compile a sheet. The sheets are also evaluated in terms of the accuracy of the work. The sheets are attached to the magnetic board after execution. The initial idea of the project is judged within the same module.

The Competitor's ability to immediately determine the required parameters of the future object, choose the optimal design option for production and the selected price category. The operability of the object, safety of its use by a human, maintainability, and the potential for long- term operation is assessed on the basis of the materials and design of the object.

Module 3 – Hot point 3: CAD Modelling and engineering process

The Competitor's task is to refine the project to produce a final version which is presented to the customer. The module will take 10 hours to complete. The first thing that the Competitor does when starting the module is to divide up his or her working time. Participants are handed out the time sheets.

The participant fills the time sheet out independently, describing the expected stages of work and the time for their implementation. After filling in the table, the Competitor puts it onto the magnetic board as well. The more detailed the table is, the greater the understanding of the workflow by the Competitor and the easier it is for the Experts to assess the rationality of the participant's time distribution, speed of his or her work, and correspondence of his or her real work process to the intended one.

In this module, the Competitor's actions are recorded from the working screen facilitate the work of the Experts, and once the module has been completed, these are reviewed by the responsible experts for compliance with the work plans. The Competitors' sketches from the first module are also handed over to the Experts, who make three comments (one from each member of the marking team) regarding the project, which should be eliminated (or not eliminated, at the discretion of the Competitor) in the future. Initial comments recorded relate to the design and materials, then to maintainability and safety of operation; the following comments relate to functionality; the last comments relate to aesthetics of form and colour.

According to the terms of the competition, the comments should be made for each project; however, the nature of the comments is assessed separately by the experts. In the project presentation, it is necessary to say what the comments on the project were and how they were eliminated by the Competitor. During the performance of the module, it is possible to change the project an unlimited number of times and to apply the seal for restart. However, this will affect the Expert's assessment (judgement) of the work performance.

The project may be corrected not only in terms of the comments made by the Experts, but also at the request of the Competitor. This will also affect the Expert assessment. The already corrected project is made in Fusion 360 when working with the three-dimensional model; when modelling, it is necessary to take into account the settings of the programmes and the modelling process specified in the task.

When modelling, one should clearly monitor the accuracy of assignment of the selected material to the parts, as this will affect the calculation of mass and loads. The three-dimensional model should also consist of parts, not a single monolith (unless this has been requested by the customer), which will help the experts to assess the possibility of manufacturing this product.

Once the project is ready, the Competitor either sends it for printing, or checks against loads, or begins to develop the design documentation at his or her discretion. When sending to print, the Competitor should choose the optimal printing mode in terms of time and accuracy of production. Arrange the parts for printing on the table in a logical manner, be economical.

When printing, it is considered whether the printing was stopped and for what reason. When checking the object against loads, it is considered what type of loads the Competitor has chosen and to which points they were applied. Whether the Competitor's choice reflects the actual future

workloads and whether he or she has taken the data from the calculation into account in the design, whether there have been any corrections made to the project.

When checking the weight of the product, one can determine not only the total weight, but also its stability at certain points. Design documentation is required to check the configuration of the parts and to select the material for them in the final project.

The stamp and frame are selected at the discretion of the task developer and filled in by the

Competitor, which also applies to the specification table. Documentation and loads are printed. During prototype modelling, the Competitor should focus on the final appearance of the product, its shape and colour composition.

The more detailed the prototype, the better. The prototype is made to scale. Execution of working elements (operating on/off button, opening door, etc.) is possible in the task. The prototype should be neat and maintain its shape for a long time (the presentation takes place the next day).

Module 4 – Hot point 4: Project development and presentation

The task in this module is to make a report and a presentation of one's project.

The participant is given 6 hours to complete this module. The presentation should include materials from the previous modules: sketches, data from the calculation of the product mass, and data of the object pertaining to its sustained loads, and a 3D model. The Competitor must take images of the object with the flying camera (at least 2 different trajectories using additional light sources), assembly/disassembly of the object, video showing the launch of loads to the object, and motion features of the object.

When developing a presentation, the participant can use the music provided to him or from his music folder, formed by him prior to the start of the competition. Slides in the presentation should change automatically. The structure of the project presentation is determined by the participant himself.

An environment and/or a human figure can be further embedded into the video when the materials are agreed upon before the presentation commences. The presentation should also contain text explanations about the processes shown on the screen and explanations (annotation) about the project itself.

The artistic aspects of the presentation are at the discretion of the Competitor. The objective of the presentation is to draw attention to one's project and to be remembered. Reading text off a sheet of paper is not permitted. Test Project has been improved in relation to its original version, and whether the project actually meets the customer requirements and consumer profile.

The participant must also prepare a report on the work done in the form of a book consisting of products developed by him during the entire competition, for example, sketches, product drawings, calculations, analytics and market research and issues.

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.
At the Competition on C-4	The Test Project/modules are presented to the Experts without any technical information.
At the Competition on C1	The full Test Project/modules are presented to the 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-4 and to Competitors every morning of each Competition day.

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.

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
Use technology – local software for translation	• From C1-C4 Competitors are allowed to use the local software, according to the Infrastructure List, to translate the signs/labels on the sketches and any text in the presentation according the instructions in the Test Project.
Use of technology – 3D printing process	• Competitors are allowed to leave the 3D printing in the prototyping process during the lunchtime however they will take full responsibility and have to deal with any after effects. If the process goes wrong the Workshop Manager is allowed to stop the 3D printer but the Competitor's time is not extended.

7 Skill-specific safety requirements

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

Task	Sturdy shoes with closed toe and heel	Safety shoes
General PPE for safe areas	√	
Competitor workstations		√

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 are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

8.3 Materials, equipment, and tools supplied by Competitors

It is not applicable for the Optoelectronic Technology skill competition for Competitors to bring materials, equipment, and tools to the Competition.

However, 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 not allowed to bring materials, equipment, or tools. All is supplied by the Competition Organizer.

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.
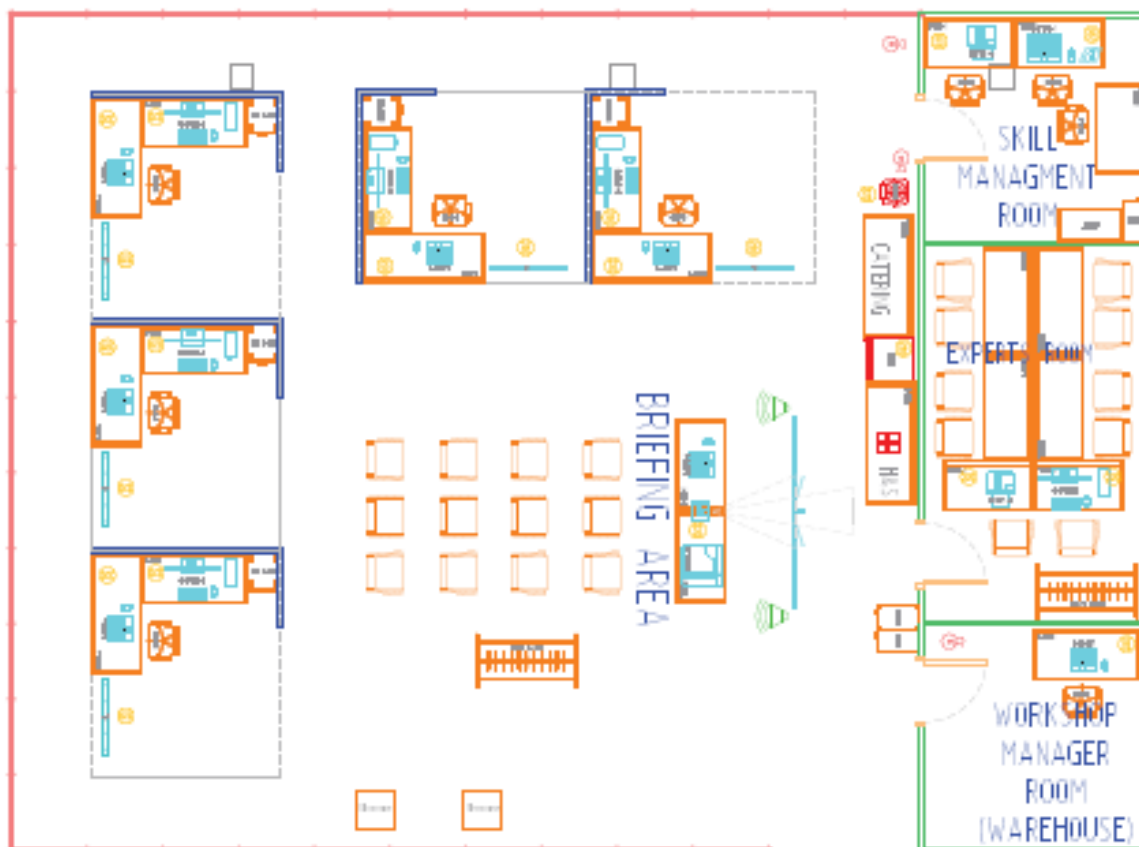
8.5 Materials and equipment prohibited in the skill area

Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4.

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	Best practice procedure
Use of technology – USB, memory sticks	• No external memory devices are to be connected to the competition computer unless under the supervision of the Chief Expert and Deputy Chief Expert. • Competitors are not allowed to load any digital data to their competition computers. If needed, it must be approved first by the Chief Expert. The Chief Expert will nominate an Expert or group of Experts to execute the necessary installations. • Skill Competition Manager, Chief Expert, Deputy Chief Expert, Experts, Competitors, and Interpreters are not allowed to bring and use personal memory sticks into the workshop.
Use of technology – personal laptops, tablets, and mobile phones	• From C-4 to C1 Chief Expert, Deputy Chief Expert, Experts and Interpreters are allowed to use personal laptops, tablets, and mobile phones in the Expert room only. Exceptions are possible with the Skill Competition Manager approval. • The Skill Competition Manager is allowed to use his laptop, tablet and mobile phone at all times. • Competitors are not allowed to bring personal laptops, mobile phones, and tablets into the workshop. If these items are brought into the workshop, then they must be locked in the personal locker and only removed at the end of day. • Wireless headphones and smartwatches are not allowed for the Competitors. If these items are brought into the workshop, then they must be locked in the personal locker and only removed at the end of day.
Use of technology – personal photo and video taking devices	• The use of personal photo and video taking devices is forbidden in the workshop until the last break on each competition day.
Communication and contact between compatriot Expert and Competitor	• No communication during breaks or lunch time between Expert, Interpreter and Competitor from C1 to C4. • Competitor and compatriot Expert/Interpreter cannot be outside the competition area at same time unless is approved by the Chief Expert.
Use of technology – personal tools for sketching and prototyping	• From C1 to C4 Competitors are allowed to check and use tools from their toolbox to do the tasks from Test Project relating to sketching and prototyping.

10 Visitor and media engagement

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

- Offer to try oneself in the profession: a site where visitors and representatives of the press can try themselves in computer modelling
- The displays showing the process of work and the information about the competitors which advertise the career prospects
- Test project text description: public display of test projects
- Demonstration of completed modules: The result of each modules can be published after the assessment is finished.

11 Sustainability

This skill competition will focus on the sustainable practices below:

- recycling;
- use of environmentally friendly materials;
- use of completed projects in practice;
- minimization of printing;
- use of pdf-files and electronic documents in the maximum number of cases;
- reduce the number of programs that need to be installed on computers of competitors.

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.**onet**online.org/)

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.

There were no responses to the requests for feedback this cycle