worldskills

Technical Description

CNC Milling

Skill 07

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:

1 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

CNC Milling

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

CNC Machining has become one of the most important current machining processes in modern industry. Parts are made for household equipment, telecommunications, cars, ships, airplanes, oil rigs, bridges, aerospace etc. Customers come from virtually every sector. It covers a broad variety of machining processes, such as grinding, welding, electrical discharging, milling, and also turning or turn-milling. The CNC Machinist dictates the entire production process through the choice of setup, tools, and movements through their programming. Once correctly programmed and set up, these machines can produce almost any shape and can repeat the process infinitely. This offers great advantages for quality and efficiency.

CNC Milling machines use versatile manufacturing processes that create precise and complex parts from a variety of materials, using multi-axis and a variety of techniques (face, form, profile milling, ramping, contouring, jigs, and fixtures). CNC Mills can produce almost any shape and any part, especially with CNC mill-turn machines. These machines can perform both turning operations (rotating the workpiece against a cutting tool) and milling operations (rotating a cutting tool against a stationary or rotating workpiece) within a single setup.

Different requirements and demands are required for each customer application. Therefore, workpieces are made of different materials with different properties and different geometries, tolerances, and surface qualities. To provide the machinist with all the information they need, there is a technical drawing (finished part drawing) in digital or paper form for each workpiece. The digital data of the required part can be imported in software, which makes it a lot easier to achieve the desired geometry. However, the machinist must thoroughly check if and how the geometry can be achieved.

Machining starts with deciding how best to produce the part. There are many ways of doing this, like welding, milling, casting, and 3D Printing. One very important method is CNC Milling. A CNC mill is a very accurate computer-driven machine, where cutting tools, controlled by a program, are moved to cut away excess material to result in the expected workpiece. The CNC Milling machinist receives the technical drawing and uses the mill in many ways to find solutions to build the part. The CNC machines are able to achieve accuracy below ten microns, which is six to ten times thinner than a human hair.

The CNC Milling machinist uses a computer to communicate the toolpaths, including speed, depth of cut, and cutting particulars to achieve the desired shape. They must also set up the mill with all the necessary clamping devices, support devices, and cutting tools. These tools can cut almost every material (stainless steel, plastic, soft steel, aluminum, bronze, and so on). But the machinist must choose well to avoid temperature variations, tool wear, and vibration. Those factors influence the product and can result in poor quality.

When the machine starts cutting material, the machinist must ensure that all dimensions exactly fit the workpiece specifications. This may require some modifications, and very accurate inspection tools must be used. Once the machine is set up, the CNC Milling machinist also monitors and optimizes the processes to achieve even faster and better results for all the following parts. When making very complex parts, the CNC Machinist must read and understand drawings and transfer the data to the control of the machine.

Beyond this, CNC Milling represents one of the enabling technologies of Industry 4.0. CNC machines are essential elements of integration within the factory of the future, being fully connected to digital systems that allow real-time monitoring, adaptive control, and integration with production chains. Increasingly, these machines are combined with Artificial Intelligence (AI) to support the creation and optimization of their programming through CAD/CAM systems, enabling even greater automation, efficiency, and flexibility.

Problem-solving strategies, logical thinking, a high sense of precision, and the understanding of technical communication are the basic requirements for the CNC Mill Machinist.

1.1.3 Number of Competitors per team

CNC Milling 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
- WorldSkills Standards and Assessment Guide (skill-specific)

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

The WSOS specifies the knowledge, understanding, skills, and capabilities that underpin international best practice in technical and vocational performance. These are both specific to an occupational role and also transversal. Together they 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, to the extent that it can. 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 and capabilities that are set out in the WorldSkills Occupational Standards. 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, if this does not distort the weightings assigned by the Standards.

2.2 WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	**10**
	The individual needs to know and understand: • The CNC manufacturing process as an enabling technology of Industry 4.0 • The scope and limits of the workshop and the workspaces • Standards for the environment, safety, hygiene, and prevention of accidents • How and when to use safety equipment, such as first aid kits and fire extinguishers • Types of energy supplies for CNC milling machines and their sustainable management • Basic machine maintenance (coolant-maintenance, machine-lubrication, settings etc.)	

Section		Relative importance (%)
	• Methods for ensuring the maintenance of machinery to promote efficient and reliable working • Machine Accessories such as clamping devices, tailstock, and part-catching devices • The use and care of the available computer operating systems • Programming, setting, and operating of CNC milling machines with live tooling and multiple axes • CNC-programming systems (Din-ISO (G-Code), CAM software); • Principles of technical design and process planning • Properties of ferrous and nonferrous materials • Mathematics, especially calculations in trigonometry • Principles of cutting- and chip-removal technology • The importance of effective communications and teamwork • The use of machinery-handbooks, datasheets and manufacturers' operating instructions • The calibration, accuracy and use of measurement- and gauging tools.	
	The individual shall be able to: • Organize the workspace for optimal safety and performance • Check the condition and functionality of the workspace, equipment, tools and materials • Interpret and apply quality standards and regulations • Promote and apply health and safety regulations and best practice • Set up and operate CNC mills safely and environmentally well managed (e.g. in use of energy) • Use computer related professional software • Perform manual interventions to achieve excellence in manufactured components • Apply mathematical and geometrical principles for programming processes • Select and apply appropriate cutting technology for the material, equipment and cutting tools provided • Interpret and apply manufacturers' instructions • Find appropriate data in handbooks, tables, and charts • Develop creative solutions to complex design or technical challenges • Exchange information with technical and non-technical personnel and customers.	

Section		Relative importance (%)
2	**Interpret engineering drawings**	**10**
	The individual needs to know and understand: • ISO 1 and/or ISO 3 (European and American) drawing representations • Technical terms and symbols used in drawings and plans • Standards, standards symbols, and tables • Technical drawing legends.	
	The individual shall be able to: • Interpret engineering drawings and apply to specifications • Locate and identify dimensions of features • Locate and identify surface finish requirements • Locate and identify geometric specifications • Locate and identify assembly specifications of parts • Make 3D mental representations of the parts • Identify the materials that are to be used • Identify critical sequences (with a high possibility of damage or unsafe practice) and develop appropriate approaches.	
3	**Process planning**	**10**
	The individual needs to know and understand: • Types of machining tools used in CNC milling • The importance of good planning for reliable milling operations • The procedures and calculations required for scheduling time with software and machinery • Successful timing of selected sequences • Identification of critical sections • The behaviour of machines, clamping devices, materials, tools and machine accessories in different cutting processes • Methods and techniques for work holding • Methods to avoid crashes or collisions during set-up, tool proving, and operation for the selected sequences • Appropriate milling and measuring processes.	
	The individual shall be able to: • Find solutions using the capacities of the workshop environment, and according to the required work (size of batch, complexity) • Identify the appropriate milling and measuring processes • Identify and prepare the best work holding methods • Identify, prepare, and calibrate appropriate measuring tools • Identify and prepare appropriate cutting tools and inserts • Identify critical sections (with a high possibility of damage or unsafe practice) and identify alternatives or safe practice to avoid accidents or damage	

Section		Relative importance (%)
	• Find innovative ways of using the environment to solve technical issues • Explore and apply innovative tooling options • Weigh each solution and choose the best (considering context, speed, safety, price, and sustainability) • Plan the operations and sequences (milling strategy) based on specified data • Manage time so that activities are carried out as planned.	
4	**Programming**	**10**
	The individual needs to know and understand: • CNC Programming as the creation of a logical process plan • Different methods and techniques to generate programmes (manual, CAM etc.) • CAM system programming and the techniques of part- and tool-modelling • Cutting-effect (temperature, bending, force etc.) on: ◦ Geometry of the work piece design ◦ Work holding devices ◦ Tool holding devices ◦ Machine-accessories • The selection of cutting tools for required material and features • Mathematics (especially trigonometry) • Speeds and feeds for different materials and tools and work holding devices • The basis for choosing correct postprocessors • The generation of G-Code • Dialoguing with the CNC milling machine • The proper use of canned cycles to programme work piece features (classical features as well as driven-tool features).	
	The individual shall be able to: • Select the best methods according to the production type and part specifications • Use skill specific software and related hardware • Generate programs using CAD/CAM systems • Create or edit programmes directly on the machine-control • Edit running programmes in CAD/CAM and reload to the machine-control • Simulate machining strategies and perform optimizations.	
5	**Metrology**	**5**
	The individual needs to know and understand: • Chip removal behaviour of provided materials and tools • The temperature-related behaviour of provided materials, tools and machine-accessories	

Section		Relative importance (%)
	• The properties, uses, and handling of ferrous and non-ferrous materials • The effects of cutting force on material, clamping-devices, tools, and machine accessories • The range of tools and gauging instruments and their applications • The influence of temperature on measurements.	
	The individual shall be able to: • Identify and design the functional parameters for operating on the CNC milling machine • Select appropriate measuring or gauging instruments • Calibrate measuring tools • Use selected tools to make measurements on all features of the products • Use the measurement probe available on the CNC machine, correctly.	
6	**Set and operate CNC milling machines**	**50**
	The individual needs to know and understand: • The different steps that lead to the setup of the milling machine • The different modes of machine operation • The appropriate power up and Initializing sequence of CNC milling machines • The proper manipulating of CNC milling machines • Mounting tools and setting tool parameters • The modification of clamping devices, such as jaws, dual spindle etc. • The transfer of CNC programs to machine control, using provided software, memory devices, or wireless technology • The testing of programs (simulation, dry run etc.) • The correct, efficient and safe clamping of workpieces • Settings of work shift and tool shift offsets • The safe running of CNC procedures • Stopping and restarting cycles • Emergency stopping.	
	The individual shall be able to: • Identify and designate the different machining process on a CNC milling machine • Follow their selected process strategies • Appraise and follow a given process-strategy when using external CNC-programs • Upload generated CNC programs to CNC milling machines and perform test runs • Identify and designate the different machining processes on CNC milling machines	

Section		Relative importance (%)
	• Mount and align selected tools • Mount and align selected work holding devices • Mount and align selected accessories (Tailstock, Parts-catcher, etc.) • Set measures to avoid vibration in machining sequences and generate optimum milling • Perform a range of machining operations, including: ◦ Facing ◦ Roughing ◦ Drilling cycles ◦ Boring cycles ◦ Thread milling canned cycle ◦ 3D machining operations • Apply efficient burr-removal techniques on work pieces • Optimize machining strategies • Quickly react to problems and emergencies • Obtain dimensions, geometries, surface roughness etc. • Make all necessary corrections to get the final part to conform to the blueprint • Report health, safety, and environmental issues to the appropriate personnel • Report equipment failures to the appropriate personnel.	
7	**Finalize work pieces**	**5**
	The individual needs to know and understand: • Appropriate procedures with documentation • The importance of completing work pieces to the required standard within one's capabilities • The circumstances in which referral should be made to other appropriate personnel • Policies and good practice for the disposal of waste material.	
	The individual shall be able to: • Clean and deburr parts • Make final optical and measurement checks • Perform manual finishing operations and cleaning of the workpiece using hand tools • Deliver parts, drawings and digital memory devices to the appropriate locations and/or personnel as required by the organization • Dismount tools, clamping devices and machine accessories • Clean the machine and workplace • Dispose of waste material according to the policies in place and good practice • Set each environment to readiness for the next job • Document and save CNC Programs, work-holding and tooling information etc., following each organisation's process	

Section		Relative importance (%)
	• Complete and deliver reports as required, including concerns and recommendations for improvements and good practice.	
	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, 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 Assessment Design and Practice

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 Test Project Designer(s) 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 Competition Rules for further details.

Experts and Independent Test Project Designers 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
STANDARDS SPECIFICATION SECTION		A	B	C	D	E	F	G	H			
	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). This is documented in the Standards and Assessment Guide.
- 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 and procedures

WorldSkills is committed to continuous improvement including reviewing past limitations and building on good practice. The following skill assessment strategy and procedures for this skill competition take this into account and explain how the marking process will be managed.

A – Main dimensions

B – Secondary dimensions

C – Surface quality

D – Judgement

Judgement aspects are described in Standards and Assessment Guide.

Standards and Assessment Guide is to be provided.

The definitive Judgement and Measurement Marking Forms are finalized by the Independent Test Project Designer.

Makeup of the marking groups and use of data;

Measurement Marking - A, B, C, and E;

Coordinate measuring machine – CMM, measurement marking - A and B;

Judgement Marking - D

Three Experts for the evaluation

One spare Expert and minute keeping

For Judgement Marking the Experts are divided into three working groups.

Formation of Expert groups: The groups shall be nominated by the Chief Expert. The group must be a mix of experienced senior Experts and Experts who are new in their functions.

Each group is responsible for the complete assessment of one module realized by all Competitors.

CMM teamwork in the workshop; Experts can supervise their work.

A-Main dimensions and B-Secondary dimensions +/- 0.003 mm tolerance compensation.

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 Designer, 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 series of three (3) standalone modules.

5.3 Test Project design requirements

Test Projects should reflect the purposes, structures, processes, and outcomes of the occupational role they are based on. They should aim to be a small-scale version of that role. Before focusing on practicalities, SMTs should show how the Test Project design will provide full, balanced, and authentic opportunities for assessment and marking across the Standards, as set out in Section 5.1.

Details of module 1	
Initial data	• Material: Brass • Maximum raw size: 150 mm x 100 mm x 50mm • The minimum size for a finished part is not smaller than 50 mm x 50 mm x 30 mm • **Time allowed: 4.15 hr**

Details of module 1		
	• 2D finished drawing with a 3D shaded view (paper) or 3D step model (CAD) with 2D finished drawing (paper). • Work on two or three faces. • Possible two components with mating features.	
Machining process:	**The following features must be included:** Milling channels, figurative pocket, external contour, through hole boring, internal or external thread milling	**The following features may be included (optional):** circular pocket, rectangular pocket, drilling, Reaming, and tapping
Additional information	• The total of aspects for criterion A- main dimensions must be between 20 minimum - 23 maximum; • The total of aspects for criterion B - secondary dimensions must be between 17 minimum – 20 maximum (the remaining dimensions are assessed in criterion D - conformity to drawing). • The total aspects for criterion C- surface quality must be between 5 minimum – 8 maximum (must be possible to check all aspect with surface roughness tester similar to Mitutoyo - 178-954-3A)	
Tasks schedule	**Part programming and machining 4 hours 15 minutes**	
	Par CAM activity **Tool preparation** **Machining** Competitors can access both CAM and CNC machine at all times during the complete module.	
Details of module 2		
Initial data	• Material: Aluminium AlMG1SICU (6061-T6) HB90 • Maximum raw size: 150 mm x 100 mm x 50 mm; • The minimum size for a finished part is not smaller than 50 mm x 40 mm x 30 mm • **Time allowed: 6.15 hr** • 2D finished drawing with a 3D shaded view (paper) and 3D step model (CAD) with 2D finished drawing (paper). • Work on two faces • Possible two components with mating features. • For this module the Competitor will be challenged in a production run. The Competitor is authorized to make any design changes during module production. This production module will have a minimum of three and a maximum of five parts. The total production time, if necessary, will be extracted directly from the CNC Controller • With the 3D step file	

<table>
<tr><th colspan="3">Details of module 2</th></tr>
<tr><td>Machining process</td><td>The following features must be included:
Milling channels, figurative pocket, external contour, through hole boring, nose, circular pocket, internal thread milling (M30 x 1.5), reaming</td><td>The following features may be included (optional):
Rectangular pocket, drilling sample, island milling, tapping</td></tr>
<tr><td>Additional information</td><td colspan="2">• The total of aspects for criterion A- main dimensions must be between 3 minimum - 5 maximum (per workiece);
• The total of aspects for criterion B- secondary dimensions must be between 3 minimum - 5 maximum (per workiece), the remain dimensions are assessed in criterion D - conformity to drawing;
• The total aspects for criterion C - surface quality must be between 3 minimum – 5 maximum (per workiece, must be possible to check all aspect with surface roughness tester similar to Mitutoyo - 178-954-3A).</td></tr>
<tr><td rowspan="3">Tasks schedule</td><td>Part programming</td><td>Machining</td></tr>
<tr><td rowspan="2">CAM activity (2 hr)</td><td>Tool preparation (15 min)</td></tr>
<tr><td>Machining (4 hr)</td></tr>
<tr><th colspan="3">Details of module 3</th></tr>
<tr><td>Initial data</td><td colspan="2">• Material: Steel C45E 1.1191
• Maximum raw size: 150 mm x 100 mm x 50 mm
• The minimum size for a finished part is not smaller than 50 mm x 50 mm x
30 mm
• Time allowed: 7.00 hr
• 2D finished drawing with a 3D shaded view (paper) or 3D step model (CAD) with 2D finished drawing (paper).
• Work on three or four faces
• Possible two components with mating features.</td></tr>
<tr><td>Machining operations:</td><td>The following features must be included:
Drilling, blind hole boring, external contour, figurative pocket, island milling, external thread milling (M42 x 1.5), tapping, Ribs (**)</td><td>The following features may be included (optional):
Circular pocket, rectangular pocket, gudgeon</td></tr>
<tr><td>Additional Information</td><td colspan="2">• The total of aspects for criterion A - main dimensions must be between 30 minimum – 33 maximum
• The total of aspects for criterion B - secondary dimensions must be between
20 minimum - 23 maximum (the remain dimensions are assessed in criterion D - conformity to drawing)</td></tr>
</table>

Details of module 3		
	• The total aspects for criterion C - surface quality must be between 5 minimum – 8 maximum (must be possible to check all aspect with surface roughness tester similar to Mitutoyo - 178-954-3A) (**) Rib feature: Thickness = 6 mm – 8 mm; one or two ribs maximum	
Tasks schedule	**Part programming**	**Machining**
	CAM activity (2 hr 45 min)	Tool preparation (15 min)
		Machining (4 hr)

Additional details for the modules

- The Competitor is free to manufacture in 5 axes (3+2 system). It is not authorized to machine in 5 axes simultaneously;
- Of the three modules at least one module must use 2D finished drawing with a 3D shaded view (paper);
- Of the three modules at least one module must use 3D step model (CAD) with 2D finished drawing (paper);
- The following additional details must be included in the module: machine chamfers; 0.2 mm to 0.3 mm x 45 degrees;
- Every module must have a minimum of two geometric dimensioning tolerances criteria;
- It must be possible to complete the modules with the machining tools detailed in this Technical Description;
- It must be possible to check the modules with the measuring equipment and checking devices described in this Technical Description;
- Measurements of work pieces is performed on a coordinate measuring machine (CMM);
- The Competition Organizer will nominate a technician who is responsible for operating the coordinate measuring machine;
- The depth of the drilled or reamed hole will not be measured. The depth of the thread milling and tapped holes must be measured;
- For M6 and M10, core hole diameter 5.0 mm, 8.5 mm and the depth will not be measured;
- Tenons are not allowed under the machine vice. The Competitor must align the vice themselves. Machine stops on the vice are allowed;
- The Competition Organizer will try and supply the raw material + 0.15 mm/- 0, machined all six faces;
- Competitors can use Mastercam during the machining and tool preparation time;
- The Competitor is authorized to use of all machine options as supplied by the sponsor;

Tolerances

The following tolerances apply to the Modules:

- Main dimensions: range from 0.02 mm to 0.04 mm, IT>=7;
- Reamed bores IT7;
- Hollow out bores IT7;
- Surface quality N6 to N8/average = Ra 0.8 to 1.6;
- Depth of thread 0+2 mm;
- Form and positional tolerances as per DIN ISO 1101.

Customer change

Customer changes should come with a new 2D drawing or 3D model, the following changes can be made after the elapsed time;

- Features can be changed to cut more material away, such as a bore diameter being increased, or a boss diameter being reduced;
- Additional features machined into the original design, such as a pocket or drilled hole;
- Features must be “added” to the design, such as an additional bore where there was none before;
- The Test Project designer decide how many 3D model in step file be given and the minimum is one module

Mating features

Mating features are to be judged on the fit between the two components; this is an additional Judgement criterion.

There can also be measurement criteria for an overall length or dimension.

Production run

Competitors will receive all raw material blocks at the start of this Test Project. Competitors are free to choose their production strategy. If necessary, the production time can be consulted directly on the CNC controller. The consumption of electrical energy during the production of this module can also be extracted by an independent system. It stands out that the lower the consumption of energy consumed, the more sustainable the manufacturing cycle will be.

Tool preparation time (15 minutes)

- Competitors can set up tool holders;
- Competitors can change tools;
- Competitors can measure tool using CNC machine without cutting the material;
- Competitors can continue to work on Mastercam;
- Competitors **cannot** set up the vice.

Additional design requirements

The modules must meet the following requirements:

- Drawing ISO 1/E (First Angle Projection), Original Inventor model and Inventor drawing;
- Drawing ISO 3/A (Third Angle Projection), Original Inventor model and Inventor drawing;
- Drawing annotation to ISO 8015;
- A STEP file (3D surface model) supplied with minimum one module;
- Component model made from Aluminium (conform to drawing);
- Go to the Standard Institute to check the final drawing. Check them for all drawing standards according ISO 1101, ISO 8015 ISO 14401 and correct the drawing;
- CMM sponsor make the final CMM programme;
- Measurement report checked by hand so that the Competitors are able to check all assessed marks;
- Finalize the Excel-Marking Scheme for CIS, add the 0.003 mm tolerance as per formula in the A-main dimensions and B-secondary dimensions;
- Print drawings on the same size of paper as set in the CAD system to avoid any missing lines and/or showing wrong line thickness if the Host Country can supply the same size printer;
- Judgement and Measurement Marking Aspect descriptions should list both ISO 1/E and ISO 3/A dimensions, with ISO 3/A placed in brackets e.g. C6 (C4);
- The modules must be created with filename conventions (including filename extensions);
- Prior to the Competition, the modules must NOT be accessible to the Competitors;
- Independent Test Project Designer plans and prepares detailed drawings for CIS Marking and surface testing.

(*) The version is determined six (6) months prior to the Competition

Important note:

The list of tools and instruments described in section 8.3 is the reference for the development of the Test Project proposal; this means that it is of utmost importance that all project modules are made in strict accordance with the list of tools described. None of the project proposals submitted by the Expert may use different cutting tools and diameters than those defined in the Technical Description.

5.4 Test Project coordination and 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 Test Project coordination (preparation for Competition)

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

5.4.2 Who develops the Test Project/modules

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

5.4.3 When is the Test Project developed

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

Time	Action
Fifteen (15) months prior to the Competition	The ITPD is identified and a Confidentiality Agreement between WSI and the ITPD is organized.
Two (2) months prior to the Competition	Independent Test Project Designer completes the design of the Test Project and Marking Scheme. The final files and photos of the prototype are emailed to the WorldSkills International Skills Competitions Administration Manager.
At the Competition on C-4	The prototype of the Test Project/modules are presented to the Experts, without technical drawings or details.
At the Competition on C1	The complete 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 (ITPD) is expected to identify one or more independent

expert(s), and trusted individuals initially to review the Independent Test Project 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 of the Test Project/modules and will ensure that it can be completed within the material, equipment, knowledge, and time constraints of Competitors.

The Marking Scheme and Test Projects are developed by the Independent Test Project Designer and validated through WorldSkills processes. Detailed CMM procedures report and programme need to be provided. The CMM Programme is made by MiCAT Planner Software by CMM sponsor.

5.7 Test Project circulation

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 on C1.

5.8 Test Project change

Due to the Test Project being developed by an Independent Test Project Designer (ITPD), there is no 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 according to infrastructure limitations.

5.9 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 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 WorldSkills skill-specific Discussion Forum. (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the WorldSkills Discussion Forum. The Chief Expert (or an Expert Lead appointed by the Skill Management Team) will be the moderator for this Discussion Forum. Refer to the 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 competition during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and the Expert Leads. The Skill Management Plan is progressively developed in the six (6) months prior to the Competition and finalized at the Competition. 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
Release of Test Projects	• The Test Projects modules are released at C-4 with the Skill Competition Manager and Chief Expert and all Experts together and no one can take the notes in any way.
The translation for the Test Projects	• The Expert or Interpreter is allocated 10 minutes per module for translation or before the competition • A dictionary can be used.
Attend to the Competitor	• If the Competitor has problems during the competition, the Interpreter can accompany the technician or Skill Competition Manager and Chief Expert to solve their question. The compatriot Expert can attend only with permission from the Skill Competition Manager and Chief Expert.
Templates, aids, etc.	• The Competitor may bring one sheet (A4 size) with tool speeds and feeds for information only. • Blank paper can be provided at the competition.
Spy software	• Spyware may be used on the computers
Tools/ infrastructure	• Competitors must use the mouse and keyboard provided by the Competition Organizers. • Tenons are not allowed underneath the machine vice, the Competitor must align the machine vice manually. • Competitors are not allowed to bring their own linear height gauges. There are some supplied by the Competition Organizer which can be used during the competition. • The machine parameters must not be changed. • The post processor cannot be changed by the Competitor.
Equipment failure	• When a Competitor has an issue, their work must be checked for the correct process before looking for machine or software failure. • In the event of CNC machine failure, the Competitors are moved onto one of the spare CNC Machines • In the event of a computer failure, the Competitors may use one of the spare computers
Assessment	• The Competitors part is engraved with their Member ISO code, then it is covered and assigned a random number during assessment.

7 Skill-specific safety requirements

7.1 Personal Protective Equipment

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

Task	Safety glasses with side protection	Cut protection gloves (without breakage)	Sturdy shoes with closed toe and no heel	Safety shoes with protective cap	Tight fitting work clothes (long trousers)	Hearing protection
General PPE for safe areas			√		√	
Programming				√	√	
Machining	√			√	√	√ (optional)
Material handling	√	√		√	√	√ (optional)
Material deburring	√	√		√	√	√ (optional)
Using Compressed Air	√	√		√	√	√

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 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 for the upcoming WorldSkills 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 1.20 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	Description	Dimensions	EXAMPLE PHOTO
1	NC Centre Drills 90º	∅10.00	
2	Drills (DIN338/345)	∅5.00, ∅8.50, ∅9.80, ∅10.00, ∅11.80, ∅20.00	
3	Machine Reamer	∅10H7, ∅12H7	
4	Machine Tap (Blind Holes)	M6 x 1, M10 x 1.5	

Item	Description	Dimensions	EXAMPLE PHOTO
5	Machine Tap (Through Holes)	M6 x 1, M10 x 1.5	
6	End Mill (roughing) (DIN844)	∅6x13, ∅8x19, ∅10x22, ∅12x26, ∅16x32, ∅20x38	
7	End Mill (finishing) (DIN844)	∅6x13, ∅8x19, ∅10x22, ∅12x26, ∅16x32, ∅20x38	
8	Ball Nosed End Mills	∅12	
9	Chamfering cutters 90º	∅10	
10	Internal thread mill, pitch 1.5 mm	M30x1.5 (maximum length = 1.5 x ∅)	
11	External thread mill, pitch 1.5 mm	M42x1.5 (maximum length = 1.5 x ∅)	
12	Boring head	∅20 mm to 30 mm	
13	Surface Milling Head	∅63	
14	Spare reversible carbide tips		

Reference list for test and measurement instruments:

Item	Description	dimensions
1	Vernier calliper DIN 862	0-150 mm
2	Depth micrometre	0-75 mm
3	Depth Vernier calliper	0-15 mm
4	Outside micrometres DIN 863/1	0-25, 25-50, 50-75, 75-100, 100-125, 125-150 mm

Item	Description	dimensions
5	Inside micrometres	5-25, 25-50 mm
6	Disc micrometres	0-25, 25-50 mm
7	Three-point hole micrometres	5-25, 25-50 mm
8	(M30x1.5, M42x1.5)	
9	Thread plug gauges for good and rejected products	M6, M10, M30x1.5
10	Thread ring Gauges	M30 x 1.5, M42 x 1.5
10	Chamfering tester 45°	
11	Instrument for angular measurement, plain protractor	
12	Set of slip gauges	
13	Indicating micrometre with magnetic stand	
14	Dial indicator with magnetic stand	
15	Radius gauge R3-25 mm	
16	High-accuracy 90°angle, arm length 80 mm	
17	Straight edge 100 mm	

Important notes:

A) Please note that Competitors must bring their own tooling (tool holder, collet, cutting tools, test and measurement instruments) without the assemble together to the Competition. The Competition Organizer will not be providing these items for the Competitors. The same items described and available in Infrastructure List are only spares.

B) As mentioned in A) the Competitors must carry their own tool holders. Tool holders are limited to 20 and 1 for digital 3D probe per Competitor.

C) The Competition Organizer will supply pulls studs for the CNC machine at the competition. But Competitors can bring additional pull studs if they wish.

D) All tools must be dismounted from the toolholder for the familiarization time to begin. Tools must be outside the collets or hydraulic clamping systems;

E) In conclusion, it should be noted that this list of tools is a minimal list. It is an orientation so that the Test Project can be executed, that is, the three modules that form the Test Project need to be manufactured with the list of this TD.

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.

Experts are responsible that Interpreters bring their own PPE.

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.

The following IT-based information (e.g. data, programmes, etc.) and equipment allowing wireless contact outside the skill area (mobile-phones, laptops, etc.) are:

- Prohibited for Competitors;
- May be used by Experts in the workshop as defined by the Chief Expert prior to the Competition.

The use of any other PC than that provided during the Competition is strictly prohibited.

Competitors must only work with the software provided.

Only the keyboards supplied by the Competition Organizer can be used.

Important Information

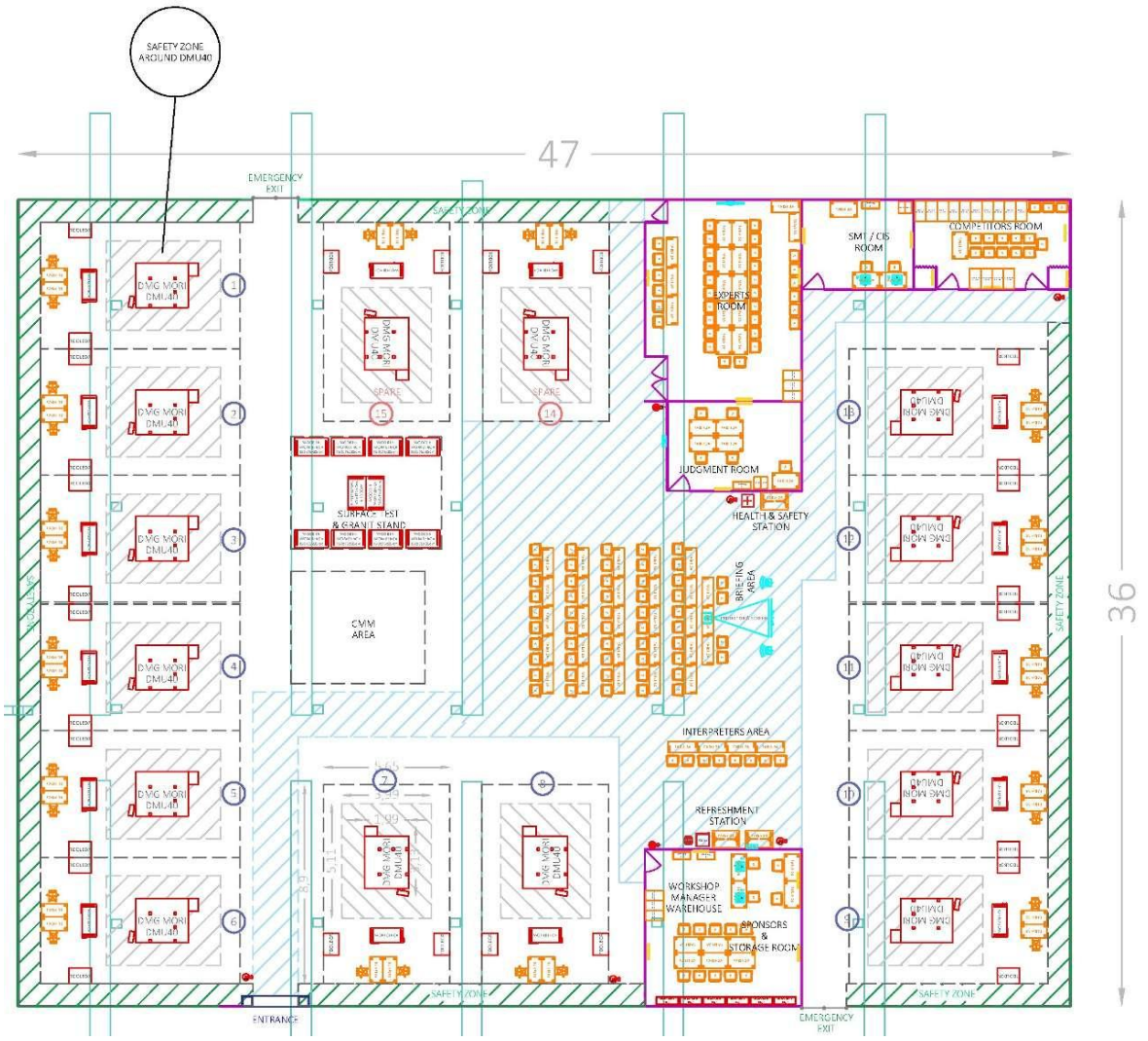
- The use of angular machine vices is NOT ALLOWED;
- The Competitors are only allowed to bring machine reamers for Dia.10H7 and Dia. 12H7;
- The Competitors are not allowed to bring their own linear height gauge or digital height gauges;

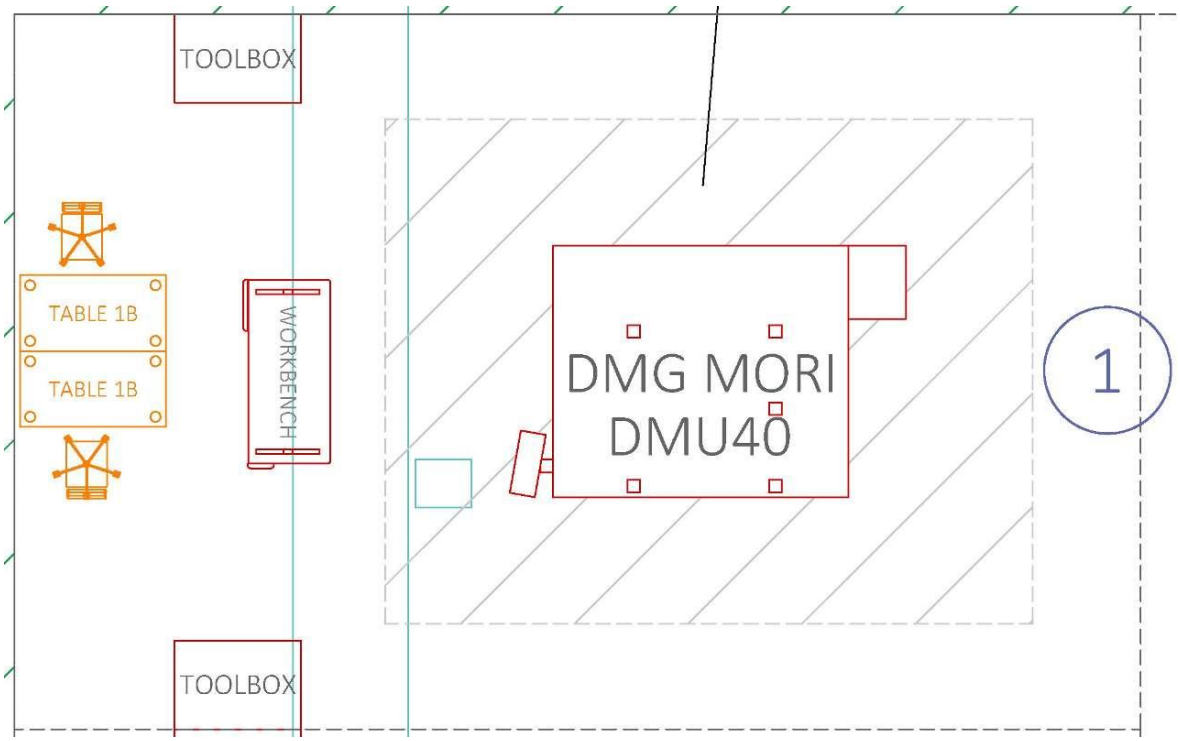
No external tool presetter is allowed in CNC Milling. The Competition Organizer does not provide this item and Competitors cannot bring external tool presetters.

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

9.1 General notes

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.

9.2 Skill-specific rules

Topic/task	Skill-specific rule
Use of technology – USB, memory sticks	• Competitors must only use memory sticks provided by the Competition Organizer. No other memory sticks are to be inserted into the Competitor computers except with permission from the Skill Competition Manager and Chief Expert. • Memory sticks or any other portable memory devices cannot be taken outside the workshop. • Memory sticks or other portable memory devices are to be submitted to the Chief Expert at the end of each day for safe keeping and must not be taken out of the workshop.
Use of technology – personal laptops, tablets and mobile phones	• Competitors, Experts, and Interpreters are not allowed to bring personal laptops, tablets or mobile phones into the workshop.
Use of technology – personal photo and video taking devices	• Competitors, Experts, and Interpreters are allowed to use personal photo and video taking devices in the workshop at the conclusion of the competition only.
Drawings, recording information	• No drawings or information regarding the Test Project can be taken out of the workshop. • The Competitor cannot bring their own drawings. During Familiarization, drawings are supplied.
External Tool Presetter	• Competitors cannot bring their external presetter machines The only authorized presetters are those manuals used mounted on the vise for use inside the CNC Machine.

Topic/task	Skill-specific rule
Extra Tolerance	• In all measurements performed on Coordinate Measuring Machines there will be an increase in measurement uncertainty; • The value will be defined by the SCM in accordance with the technical characteristics of the environment where the measurement will be carried out, generally in the order of +/- 0.003 mm.

10 Expert knowledge and experience

10.1 Requirements

Experts appointed for this skill competition must have the following knowledge and experience for the appropriate occupation or work role as documented in **section 1.1.2**.

This section is currently under development for WSC2026.

11 Visitor and media engagement

11.1 Engagement methods

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

- Display screens (video of CNC milling machining);
- A show spot with a complete Test Project (description, parts, and drawings) from past Competitions that make easy the understanding of Competitor activity;
- Competitor profiles - provide a sticker with the national flag, the name of the Competitor, and a brief description of their studies;
- Daily reporting of Competition status;
- A demonstration area for Competitors to interact with visitors to explain their skill;
- Demonstration videos provided by the machine and CAD/CAM sponsors showing parts machining which are of interests to visitors: aerospace, automotive, etc.;
- Small exhibits around the Event venue where various objects of everyday life such as a bottle; a mobile telephone; a toy; automotive part; aerospace part are exhibited with an explanation how it is produced and the role of CNC milling machines;
- A person who has detailed knowledge about CNC milling explains our skill competition with samples and videos. (Using former completed projects and technical drawings and a video showing a dry machining process of one module.);
- Terminals nearby the Competitors workplace showing the CAM activity;
- Live web cam in the machine with projection to a big screen. e.g. GoPro Cameras.

12 Sustainability

12.1 Sustainable practices

This skill competition will focus on the sustainable practices below:

- At the end of the Competition create several individual project sets (part, drawing and programmes) from the parts machined by the Competitors and donate them to vocational schools as teaching materials. (The programme is chosen from the highest scorer of each module);
- Demonstration parts;
- Each country/region is required to bring demonstration parts that the public can easily identify to be used during the demonstration time. (A geometric 3D file of the part is required as well.)

13 References for industry consultation

13.1 General notes

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.onetonline.org/)

13.2 References

The WSOS appears most closely to relate to: Milling and Planing Machine Setters, Operators and Tenders:
https://www.onetonline.org/link/summary/51-4035.00

or Milling Machine Operator:
http://data.europa.eu/esco/occupation/a1c9f8b7-c4ce-4b15-ac3c- 3378c300d8f2

These links also enable a review of adjacent occupations.

ILO 7223.

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 Lyon 2024.

Organization	Contact name
GBR Mechanico Pte Ltd	Davizon KK Yee, Director
Japan Organization for Employment of the Elderly, Persons with Disabilities and Job Seekers	Naomasa Ishii, Machining Training Instructor
MAN energy solutions	Matthias Wiedenmann, Team Leader Equipment Production
Robert Bosch	Fábio Silveira, Training Manager
RUAG AG	Raffael Widmer, BBV Polymechanics
SolidCAM Ltd.	Michal Ševčík, Global Education Manager
Tungsten Carbide Tool Factory Paul Horn GmbH	Jannik Biesinger, Instructor
Walter AG	

Organization	Contact name
	Michael Kaltenbach, R&D Manager Roundtools Milling

14 Appendix

14.1 Appendix information

Not applicable.