

TECHNICAL DESCRIPTION

CNC MILLING



worldskills
international

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TD07 v4.0 – WSC2013

WorldSkills International, by a resolution of the Technical 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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Effective 11.10.11



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1. **INTRODUCTION**

1.1 **Name and description of skill**

1.1.1 The name of the skill is

CNC Milling

1.1.2 Description of skill

CNC technology has reached a stage of having become omnipresent. A lot of people can hardly imagine how important these technologies are in their lives: it is present in products and objects of everyday life as e.g. cars, airplanes, components of machines of all types, moulds for tools used for household machines, cell phones, toys, medicine prosthesis, etc.

CNC Technology includes machining tools such as lathes, multi-axis spindles, wire electrical discharge machines and milling machines, where the functions formerly performed by human operators are now performed by a computer-control module. The professionals associated to this skill use computer numerically controlled (CNC) machines to cut and shape precision products, as mentioned above. To form a finished part the cutting process can be started from a solid block, pre-machined parts or castings.

Thus the abbreviation (CNC) refers to a computer ("control") that reads instructions ("G-code") and drives the machine tool, a powered mechanical device ("milling machine"), used to fabricate components by the selective removal of material. A programme with "G-codes" is required and generated manually and/or automatically using CAD/CAM software followed by the necessary machining operations.

To achieve the finished part the CNC Milling professionals undertake a sequence of essential activities:

- Interpret engineering drawings and follow the specification.
- Generate a program (logical, process plan) with a CAD/CAM system and/or G-code.
- Set-up the tooling, work holding device, and work piece on the CNC machining centre.
- Manipulate cutting conditions, based on the properties of metal and tooling.
- Operate, inspect and maintain the accuracy of dimensions within the tolerances (between 0.02 – 0.04 mm).
- Optimise the process taking into account the production type: large quantities of one part, small batches or one-of-a-kind items.

Today a wide range of industries require CNC milling professionals to program, operate and keep sophisticated milling machines running in an efficient and reliable way. Large enterprises such as automobile, medium-sized enterprises, such as mould making and small enterprises on maintenance field are some of many examples where the CNC milling professional plays a key role to the success of metalwork industry.

1.2 **Scope of application**

1.2.1 Every Expert and Competitor must know this Technical Description.

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

1.3 Associated documents

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

- WSI - Competition Rules
- WSI - Online resources as indicated in this document
- Host Country - Health and Safety regulations

2. **COMPETENCY AND SCOPE OF WORK**

The Competition is a demonstration and assessment of the competencies associated with this skill. The Test Project consists of practical work only.

2.1 Competency specification

Using a Vertical Machining Centre, the Competitors will be required to produce metal parts covering different practical scenarios. The Competitor will work independently over the four days of competition and the associated tasks must be undertaken by using equipment and software known throughout the world such as Fanuc, Siemens and Heidenhain for the CNC controller and Mastercam for programming.

The Competitor must have an understanding of:

- Quality Standards
- Standards for the environment, safety, hygiene and prevention at work
- Computer operating systems

The Competitor must have knowledge of:

- Mathematics – calculation and geometry
- Metrology
- Properties and behaviour of materials

The Competitor must have advanced knowledge of:

- Technical design and process planning
- CNC equipment technology (Vertical Machining Centre) – programming and operating
- CAM system programming ability
- Cutting technology according to the cutting parameters, the material, and the equipment and cutting tools.

Taking into account the main activities to be undertaken the following are defined as execution skills.

Interpret engineering drawings and follow the specification

Competitors must know and understand:

- ISO E and/or ISO A drawing representation
- Standards, standards symbol and tables
- Drawing legend

Competitors must be able to:

- Identify main dimension and secondary dimension
- Identify ISO standard for surface finish
- Identify ISO standard for form and positional tolerances

Process Planning

Competitors must know and understand:

- The importance of good planning for the successful execution of programming and operation/machining
- How to plan, based on the type of operation and its sequence (machining strategy) of the data that must be specified

Competitors must be able to:

- Identify and set the different machining features and its executional sequences
- Correctly select the type of fixture system that best suits the operational requirements
- Adequate selection of the cutting tools, for machining the required material and operation
- Defining the cutting parameters as a function of the operation sequence, material type and type of operation

Programming

Competitors must know and understand:

- The different methods and techniques to generate a program

Competitors must be able to:

- Select the best methods according to the production type and part specification
- Create a program using G-Codes
- Create a program using a CAD/CAM system taking into account the format of the initial data:
 - Start with a drawing in paper format - creation of the geometry in wireframe and/or surface and/or solid
 - Start with a file in wireframe and/or surface and/or solid and import it to CAD/CAM system
- Using the parametric programming system

Machining

Competitors must know and understand:

- Select the appropriate measuring tools, gauging instruments and be able to correctly use them

Competitors must be able to:

- Use the stipulated processes for mounting the tools and accessories on the equipment.
- Identify and designate the different machining processes on CNC milling machine
- Identify and designate the functional parameters for operation on CNC milling machine
- Defining and adjusting of cutting parameters as a function of the operation sequence, material type, type of operation and CNC machine tool
- Use of the different programming techniques for CNC milling machine (CAM included)

2.2 Theoretical knowledge

2.2.1 Theoretical knowledge is required but not tested explicitly.

2.2.2 Knowledge of rules and regulations is not examined.

2.3 Practical work

The Test Projects for the Competition covers practical work to be done on one vertical machining centre using a commercial CAM system that is known throughout the world.

Work pieces shall be worked on two or three faces.

Programming shall be carried out with MASTERCAM.

The programming software of the machines (such as Fanuc, Siemens, Heidenhain) must be carried out on a commercially available CAM control system known throughout the world.

The Competitor must carry out the following work independently:

- Creation of the CNC programs based on drawings with the use of a CAM system
- Any optimisation work and program changes may also be made using the machine.
- Program data is transferred to the machine using the DNC of the CAM system.

The Experts decide at the Competition, whether none, one or all of the modules should be read into the programming system directly. All Competitors are bound by the same conditions.

Competitors must select and mount the tools for machining themselves. Tooling offset measurements are performed on the tool setter provided for this purpose during the time allowed for this work. All data of the machining tools must be entered manually into the tool carrier of the CNC machine (tool offset).

The program must be optimised and corrected by the Competitor independently.

3. THE TEST PROJECT

3.1 Format / structure of the Test Project

The Test Project will be comprised of three separately assessed modules.

3.2 Test Project design requirements

Details of Module 1 MILLING

Initial Data	<ul style="list-style-type: none"> • Material: Aluminium AlMgSi1 3.2315. • Raw Size: 100x100x50 • Time Allowed: 4.15 hrs • 2D Finished Drawing with a 3D Shaded view (paper) • Work on 2 (two) Faces 	
Machining Process	<p>The following features must be Included: Milling Channels, figurative pocket, external contour, through hole boring, internal or external thread milling</p>	<p>The following features may be Included (optional): Circular pocket, rectangular pocket, Drilling, Reaming & Tapping</p>
Additional Information	<ul style="list-style-type: none"> • The total of aspects for criterion <u>A-Main dimensions</u> must be between 20min.-23max. • The total of aspects for criterion <u>B-Secondary dimensions</u> must be between 17min.-20max. (the remain dimensions are assessed in criterion D - conformity to drawing) • The total aspects for criterion <u>C-surface quality</u> must be between 5min. - 8max. (must be possible to check all aspect with Surface roughness tester similar to Mitutoyo - 178-954-3A) 	
Tasks schedule	<p>Part Programming and Machining 4 hrs 15 mins</p> <p>CAM Activity Tool Preparation Machining</p> <p>Competitors can access both CAM and CNC machine at all times during the complete module</p>	

Details of Module 2 MILLING

Initial Data	<ul style="list-style-type: none"> • Material: Steel Ck 45 1.1191 • Raw Size: 100x150x50 • Time Allowed: 6.15 hrs • 2D Finished Drawing with a 3D Shaded view (paper) • Work on 2 (two) faces)
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Machining Process	The following features must be Included: Milling channels, figurative pocket, external contour, through hole boring, nose, circular pocket, internal thread milling, reaming	The following features may be Included (optional): Rectangular pocket, drilling sample, island milling, tapping
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Additional Information	<ul style="list-style-type: none"> The total of aspects for criterion <i>A-Main dimensions</i> must be between 25min.-28max. The total of aspects for criterion <i>B-Secondary dimensions</i> must be between 20min.-23max. (the remain dimensions are assessed in criterion D - conformity to drawing) The total aspects for criterion <i>C-surface quality</i> must be between 5min. - 8max. (must be possible to check all aspect with Surface roughness tester similar to Mitutoyo - 178-954-3A)
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Tasks schedule	Part Programming	Machining
	CAM Activity (2.30 h)	Tool Preparation (15 min) Machining (3.30 h)

Details of Module 3 MILLING

Initial Data	<ul style="list-style-type: none"> Material: Steel Ck 45 1.1191 Raw Size: 100x150x50 Time Allowed: 7.30 hrs 2D Finished Drawing with a 3D Shaded view (paper) Work on 3 (three) faces
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Machining Operations	The following features must be Included: Drilling, blind hole boring, external contour, figurative pocket, island milling, external thread milling, tapping, Ribs (**)	The following features may be Included (optional): Circular pocket, rectangular pocket, gudgeon.
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Additional Information	<ul style="list-style-type: none"> The total of aspects for criterion <i>A-Main dimensions</i> must be between 30min.-33max. The total of aspects for criterion <i>B-Secondary dimensions</i> must be between 20min.-23max. (the remain dimensions are assessed in criterion D - conformity to drawing) The total aspects for criterion <i>C-surface quality</i> must be between 5min. - 8max. (must be possible to check all aspect with Surface roughness tester similar to Mitutoyo - 178-954-3A) <p>(**) Rib feature: Thickness=<8mm; 1 or 2 ribs maximum</p>
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Tasks schedule	Part Programming	Machining
	CAM Activity (3 h)	Tool Preparation (15 min) Machining (4.15 h)

Additional details for the modules

- The following additional details must be included in the module: machine chamfers 0.2 to 0.3 mm x 45 degrees
- It must be possible to complete the modules with the machining tools detailed in the Technical Description.
- It must be possible to check the modules with the measuring equipment and checking devices described in the Technical Description.
- Measurements of work pieces will be performed on a coordinate measuring machine.
- The Competition Organiser will nominate a technician who will be responsible for operating the coordinate measuring machine.
- The depth of the drilled, reamed or tapped hole will not be measured.

Tolerances

The following tolerances apply to the Modules:

- Main dimensions: range from 0.02 to 0.04 mm, IT₇≥7
- Reamed bores IT₇
- Hollow out bores IT₇
- General tolerances +/- 0.1
- Surface quality N₆ to N₈ / root mean square average = Ra 0.8 to 3.2

- Depth of thread 0+2 mm
- Depth of bore 0+0.5 mm
- Form and positional tolerances as per DIN ISO 1101

3.3 Test Project development

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

Time	Activity
6 months before the Competition	The Chief Experts puts an example module on the Discussion Forum
6 months before the Competition	The Chief Expert organises the registered Members into Test Project development groups.
At the Competition	All Experts must bring one independently designed module to the Competition for consideration by all Experts. The proposal must be accompanied by a sample model. The eligible Experts select the modules to be used by a vote.

- 3.3.1 Who develops the Test Project / modules
The Test Project / modules are developed by:

Jointly by all Experts.

- 3.3.2 How and where is the Test Project / modules developed

The Test Project is developed independently by each Expert, 1 module as per the Chief Expert's decision.

Task for Experts

Each Expert must bring one complete module to the Competition. This module must meet the following requirements:

- Drawing ISO E, AutoCAD &/or Inventor
- Drawing ISO A, AutoCAD &/or Inventor
- ASTEP file (3D surface model)
- Component model made from Aluminium (conform to drawing)
- Measurement report, checked by hand so that the Competitors are able to check all assessed marks
- Subjective and Objective Marking Forms in the format MS Excel in one of the three official languages. Aspect description should list both ISO E and ISO A dimensions, with ISO A placed in brackets e.g. C6 (C4)
- 3 paper copies of the module (no copies and printouts can be printed at the Competition site)
- The modules must be created with filename conventions (including filename extensions) as module example sent by the Chief Expert 6 months before the Competition.
- All module drawing and paper files must be brought in on a CD/DVD or memory stick which must be labelled.
- Modules not meeting these requirements shall not be considered for the rest of the Competition.
- Experts who do not bring a module to the Competition will be excluded from further work on the modules. These Experts will assist the Chief Expert in different skill-related/organisational tasks that will be decided on the spot.
- Before the Competition, the modules must NOT be accessible to the Competitors.

() The version will be determined 6 months before the Competition*

Important Note:

The list of tools & instruments described in section 7.2 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.

- 3.3.3 When is the Test Project developed
The Test Project is developed:

Test Project module proposals are prepared by Experts before Competition and brought to the competition for selection:

- Six months before the Chief Expert will organise the countries/regions by groups (one group for each module) for the Test Project development. Each participating country/region will be asked to develop one module as described in this document.

3.4 Test Project marking scheme

Each Test Project must be accompanied by a marking scheme proposal based on the assessment criteria defined in Section 5.

- 3.4.1 The marking scheme proposal is developed by the person(s) developing the Test Project. The detailed and final marking scheme is developed and agreed by all Experts at the Competition.
- 3.4.2 Marking schemes should be entered into the CIS prior to the Competition.

3.5 Test Project validation

The Test Project module must comply with the project design requirements as is detailed in paragraphs 3.2 and 3.3. The Expert must also supply a component model made from the material to be used for the module when submitting the Test Project module proposal. These projects will be confirmed by a committee of Experts.

3.6 Test Project selection

The Test Project is selected as follows:

By vote of Experts at the current Competition.

Module presentation before the Competition

The modules brought by the Experts will be selected through a secret voting process. The country/region identification will be hidden on the drawings and then checked for completeness and for compliance with the project design criteria during the Experts' first working day. Modules that do not meet the design requirements under paragraph 3.2 and 3.3 will be excluded.

All Experts have 15 minutes to study the different proposals, followed by the secret vote. The project module/s with the most votes will be chosen.

In the event of a tie, the other projects are eliminated and a new vote between the tied projects takes place. If by any chance, there is still a tie between 2 or more projects, the final selection is made by ballot, which will then settle the vote.

Completion of the final modules by the Experts before the Competition

Modules will be developed on the basis of the design criteria in paragraph 3.2 and 3.3 with due consideration of machining criteria, the material quality, the methods of machining and the working time.

3.7 Test Project circulation

The Test Project is circulated via WorldSkills International website as follows:

The Test Project is not circulated prior to the Competition

3.8 Test Project coordination (preparation for Competition)

Coordination of the Test Project will be undertaken by:

The Chief Expert and Deputy Chief Expert.

3.9 Test Project change at the Competition

Not applicable

3.10 Material or manufacturer specifications

The Competition Organiser undertakes to provide information on the following equipment, twelve months before the Competition as per the Competition Rules:

- The machines
- The machine control systems
- The tool holders (e.g. Sk40 DIN 69871, BT 40)
- Release bolts for the tool holders
- Machine vice
- CAM programming station, software version, PC keyboard
- Machine control training software
- Possibility of practicing operating the machines intended for the Competition

4. SKILL MANAGEMENT AND COMMUNICATION

4.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration and decision making regarding the Competition must take place on the skill-specific Discussion Forum (<http://www.worldskills.org/forums>). All 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 moderator for this forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

4.2 Competitor information

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

This information includes:

- Competition Rules
- Technical Descriptions
- Test Projects
- Other Competition-related information

4.3 Test Projects

Circulated Test Projects will be available from [worldskills.org](http://www.worldskills.org) (<http://www.worldskills.org/testprojects>) and the Competitor Centre (<http://www.worldskills.org/competitorcentre>).

4.4 Day-to-day management

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

5. ASSESSMENT

This section describes how the Experts will assess the Test Project / modules. It also specifies the assessment specifications and procedures and requirements for marking.

5.1 Assessment criteria

This section defines the assessment criteria and the number of marks (subjective and objective) awarded. The total number of marks for all assessment criteria must be 100.

Section	Criterion	Marks		
		Subjective (if applicable)	Objective	Total
A	Main dimensions		54	54
B	Secondary dimensions		21	21
C	Surface quality		9	9
D	Conformity with drawing	10		10
E	No additional material used		6	6
Total =		10	90	100

5.2 Subjective marking

Scores are awarded on a scale of 1 to 10 – with 10 for the highest mark and 1 for the lowest.

5.3 Skill assessment specification

A – Main dimensions

Dimensions range from 0.02 to 0.04; Reamed bores: IT7; Hollow out bores: IT7; inside thread and outside thread: IT6

Form and positional tolerances as per DIN ISO 1101

B – Secondary dimensions

Dimensions with general tolerance +/- 0.1; depth of hole & thread: 0/+2mm; depth of bore: 0/+0.5mm; radius: +/- 0.2; angle: +/-0.5°

C – Surface quality

Surface quality N6 to N8 root means square average = Ra 0.8 to 3.2

D – Conformity with drawing

Point D is made up of the following elements		
	For project with 2 faces	For project with 3 faces
D1 Chamfering edges by machine	2 marks	2 marks
D2 Chamfering edges manual	1 mark	1 marks
D3 Contour damage	1 marks	1 marks
D4 Conformity with drawing – face 1	3 marks	2 marks
D5 Conformity with drawing – face 2	3 marks	2 marks
D6 Conformity with drawing – face 3	-	2 marks
Total	10 marks	10 marks

E – No additional material used

The use of extra material may occur and is assessed in the following way according to objective criteria: i.e. Competitors who use no extra material get the full marks; Competitors who use extra material are penalised and get 0 (zero) marks accordingly.

5.4 Skill assessment procedures

The definitive Subjective and Objective Marking Forms will be finalised by the Experts before the Competition.

Makeup of the marking groups and use of data

Objective marking - A, B, C and E

Coordinate measuring machine – CMM, objective marking

3 Experts for supervision and minute-keeping

Subjective marking - D

5 Experts for the evaluation

1 spare Expert and minute keeping

Working groups for subjective assessment: For subjective marking the Experts will be divided in 4 working groups.

Formation of Expert groups: The groups shall be nominated by the Chief Expert and the Deputy 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 realised by all Competitors.

6. SKILL-SPECIFIC SAFETY REQUIREMENTS

Refer to Host Country Health & Safety documentation for Host Country regulations.

- All Competitors must use safety glasses when using any hand, power or machine tools or equipment likely to cause or create chips or fragments that may injure the eyes.
- Experts will use the appropriate personal safety equipment when inspecting, checking or working with a Competitor's project.
- The documentation 'Safety and Fairness' will be prepared by the Experts.
- The Competitor must comply with the machine manufacturer's safety instructions.

7. MATERIALS & EQUIPMENT

7.1 Infrastructure List

The Infrastructure List details all equipment, materials and facilities provided by the Host Country.

The Infrastructure List is online (<http://www.worldskills.org/infrastructure/>).

The Infrastructure List specifies the items & quantities requested by the Experts for the next Competition. The Competition Organiser will progressively update the Infrastructure List specifying the actual quantity, type, brand/model of the items. Competition Organiser supplied items are shown in a separate column.

At each Competition, the Experts must review and update the Infrastructure List in preparation for the next Competition. Experts must advise the Technical Director 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.

7.2 Materials, equipment and tools supplied by Competitors in their toolbox

Reference list for [Tools](#) 

Item	Description	
1	NC Centre Drills 90°	Ø10.00
2	Drills (DIN338/345)	Ø5.00, Ø8.50, Ø9.80, Ø10.00, Ø11.80, Ø20.00
3	Machine Reamer	Ø10H7, Ø12H7
4	Machine Tap (Blind Holes)	M6, M10
5	Machine Tap (Through Holes)	M6, M10
6	End Mill (roughing) (DIN844)	Ø6x13, Ø8x19, Ø10x22, Ø12x26, Ø16x32, Ø20x38
7	End Mill (finishing) (DIN844)	Ø6x13, Ø8x19, Ø10x22, Ø12x26, Ø16x32, Ø20x38
8	Ball Nosed End Mills	Ø12
9	Chamfering cutters 90°	Ø10
10	Internal thread mill, pitch 1.5mm	M30x1.5 (max. length = 1.5 x Ø)
11	External thread mill, pitch 1.5mm	M42x1.5 (max. length = 1.5 x Ø)
12	Boring head	Ø20 to 40mm
13	Surface Milling Head	Ø63
14	Right-angle milling head	Ø20, Ø50
15	Spare reversible carbide tips.	

Reference list for Test & measurement instruments

Item	Description	
1	Vernier calliper DIN 862	0-150mm
2	Depth micrometer	0-75mm
3	Depth Vernier caliper	0-150mm
4	Outside micrometers DIN 863/1	0-25, 25-50, 50-75, 75-100, 100-25, 125-150mm
5	Inside Micrometers	5-25, 25-50 mm
6	Disc micrometers	0-25, 25-50 mm
7	Three-point hole Micrometers	5-25, 25-50 mm
8	Screw thread micrometer for pitch	1.5mm (M30x1.5, M42x1.5)
9	Thread plug gauges for good and rejected products	M6, M10, M30x1.5
10	Plug gauge	Ø10H7, Ø12H7
11	Thread Ring Plug Gauge go/no Go	M42x1.5
12	Chamfering tester 45°	
13	Instrument for angular measurement, plain protractor	
14	Set of slip gauges	
15	Indicating micrometer with magnetic stand	
16	Dial indicator with magnetic stand	
17	Radius gauge R3-25 mm	
18	High-accuracy 90° angle, arm length 80 mm	
19	Straight edge 100 mm.	

Important Notes:

A) Please note that Competitors must bring their own tooling (tool holder, cutting tools, test and measurement Instruments) to the Competition. The Competition Organiser will not be providing these infrastructure 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. However, these must be compatible with the clamping system of the machine (Specifications of the machine to be supplied are to be considered.)

C) The Competitors are allowed to bring additional tools in relation to the list described in TD (be aware of the maximum diameter permitted by the machine tool manufacturer). The quantities to bring is a decision of the participating country/region or Competitor only (must be careful to bring enough spares). Please see the paragraph 7.4 for particular restrictions.

D) The quantities and type of tool holders to bring is a decision of participating country/region or Competitor only. (The IL is a good source of inspiration.)

E) In relation to the Test 6 Measurement Instruments the Competitors only need to bring one of each but they are free to bring more and additional types

7.3 **Materials, equipment and tools supplied by Experts**

Not applicable

7.4 **Materials & equipment prohibited in the skill area**

IT-based information (e.g. data, programs 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 Skill Area as defined by the Chief Expert before 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.

Important Information

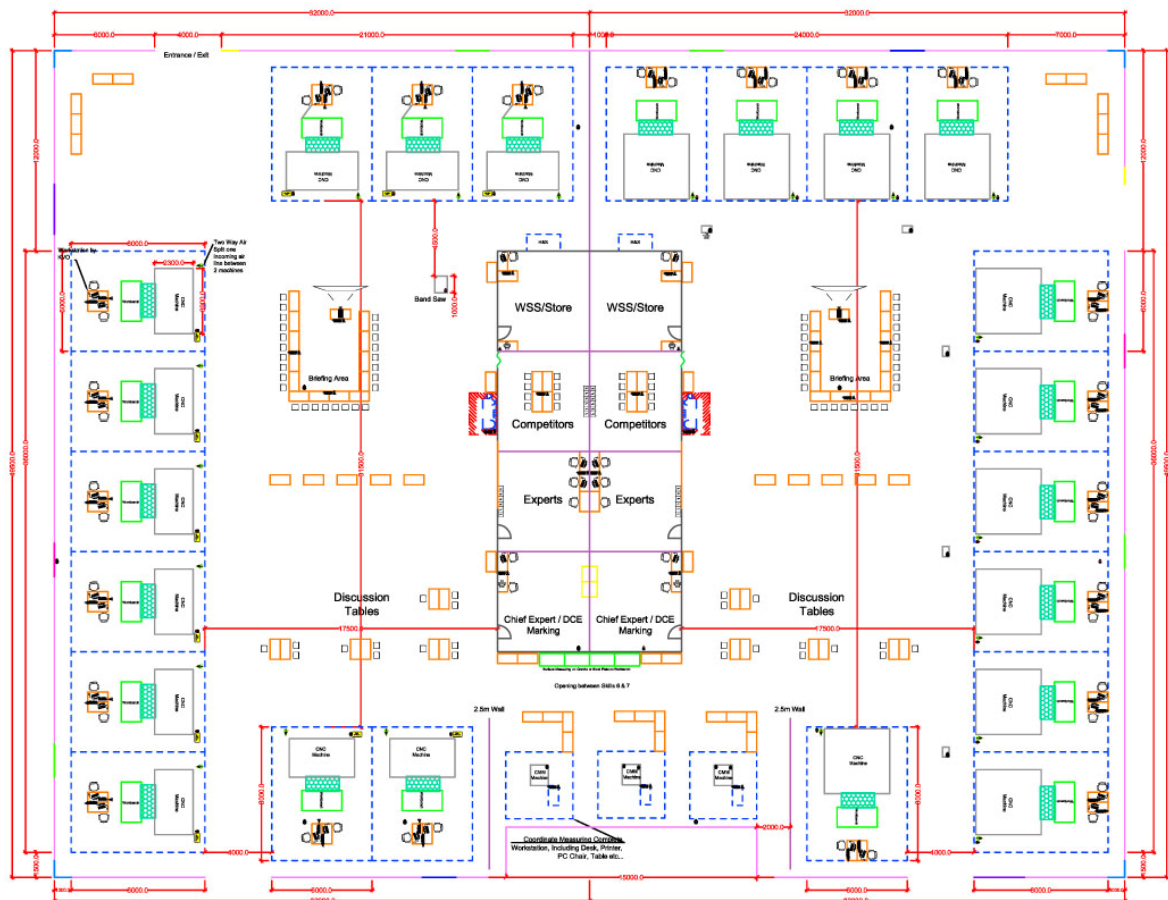
- The using of angular machine vices is NOT ALLOWED.
- The Competitors are only allowed to bring a machine reamers for Dia.10H7 & Dia12H7
- The Competition Organiser will provide Tool Presetting Machines thus the Competitors are not allowed to bring.

7.5 **Proposed workshop and workstation layouts**

Workshop layouts from London are available at:

http://www.worldskills.org/index.php?option=com_halls&Itemid=540

Workshop layout:



8. MARKETING THE SKILL TO VISITORS AND MEDIA

8.1 Maximising visitor and media engagement

The following ideas may be considered to maximise 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.
- A small expositors around the competition site 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 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 work place showing the CAM activity
- Live web cam in the machine with projection to a big screen

8.2 Sustainability

The following ideas may be considered:

- At the end of the Competition create several individual project sets (part, drawing and programs) from the parts machined by the Competitors and donate them to vocational schools as teaching materials. (The program 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.)