

TECHNICAL DESCRIPTION

MANUFACTURING TEAM CHALLENGE



worldskills
international

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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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1. **INTRODUCTION**

1.1 **Name and description of skill**

1.1.1 The name of the skill is

[Manufacturing Team Challenge](#)

1.1.2 Description of skill

- MTC is a team event.
- Teams need team identification (such as coloured shirts) or armbands that indicate your country/region (such as country/region flag).

Competitors may work in large manufacturing concerns such as automobile plants or be individuals in small or family businesses specialising in components of a design and manufacturing process.

MTC covers designing and manufacturing equipment assemblies. Each team is issued with a Test Project specification one year prior to the Competition. The teams will then design their individual assemblies in advance and build them during the Competition. At the beginning of the event, teams are given another surprise task. Comprehensive project documentation must also be produced.

1.1.3 Number of Competitors per team

[Manufacturing Team Challenge](#) is a team skill with 3 Competitors per team. Competitors are not to exceed 25 years of age in the year of the Competition.

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**

Design

Knowledge and understanding of design:

- Understand design processes such as selection of materials and meeting performance specifications required

Competitors shall be able to:

- Design a project that can be manufactured within the time limits of the Competition
- Design a project that best meets the Competition and performance specifications
- Design a project that can be built with the equipment provided or brought to the Competition by the team.

Drawing

Knowledge and understanding of drawing:

- Interpretation of drawings/setting-out according to ISO standards
- Understanding of 3D and 2D modelling software.
- Understanding of CAM software

Competitors shall be able to:

- Create workshop drawings to ISO standards. Drawing standard will be ISO-A or ISO-E depending on country/region involved.
- Create and modify 3D models
- Create CNC programs using a CAM package and a suitable postprocessor.
- Ability to interpret, construct and modify engineering CAD drawings, to work with 3D modelling, and to convert both to CAM.

Machining

Knowledge and understanding of machining:

- Understand and practice safe work procedures for all machine tools
- Understand Feeds and Speeds for different cutting tools and materials
- Be familiar with the set up, loading and running of a CNC machine
- A good knowledge of machining to drawings including the ability to modify that tool path manually to meet the specification of the finished product.
- It is expected that knowledge be required for machining steel (400-550 N/sq. mm.) or aluminium, plastics or whatever material it is made of.

Competitors shall be able to:

- Machine components to drawings on conventional machine tools and setting up, loading, and running CNC machines from a CAM generated tool path
- Safely Operate conventional machine tools e.g. Lathe, Mill, Drill press
- Safely Operate a CNC machining centre

Sheet Metal

Knowledge and understanding of sheet metal:

- Understand and practice safe work procedures for working with sheet metal
- Understand the process to be used to bend and cut sheet metal.

Competitors shall be able to:

- Bend and cut sheet metal components to drawings
- Fit sheet metal components to an assembly

Electronics

Knowledge and understanding of electronics:

- Understand and practice safe work with solder stations and electronic equipment
- Understand working with PCBs and able to solder PCBs
- Understand working with electronic software for programming electronic programs
- A sound knowledge of Mechatronics and robotics as required by the design of the project.

Competitors shall be able to:

- Assemble and commission electronics from a drawing
- Design control circuits

Welding

Knowledge and understanding of welding:

- Understand and practice safe work procedures for welding
- Understand the principles of different types of welding (e.g. TIG, MIG, OXY and Stick)

Competitors shall be able to:

- Weld materials as per drawing specifications
- Use safe work holding and welding techniques

Fitting

Knowledge and understanding of fitting:

- Understand the assembly of jigs and fixtures
- Understand project assembly and fastening methods

Competitors shall be able to:

- Design any jigs, fixtures or accessory needed to complete the project
- Create jigs, fixtures and accessories to drawing specifications.
- Assemble and commission project to competition specifications

Competition administration process

Knowledge and understanding of competition administration process

- Understand the rules of competing in WorldSkills
- Understand the timekeeping process for Competition
- Understand how to use basic Word and Excel computer programs

Competitors shall be able to:

- Follow the rules of the Competition
- Document costings, materials and other relevant items in the portfolio.

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

Note: The Test Project should be designed in the year preceding the Competition so that the team composition, selection and training may proceed and the major equipment list compiled.

The theoretical and practical training for the MTC should be defined 8 months prior to each WorldSkills Competition so that the composition of the teams is aligned to the proposed task(s).

General description of Test Project

- To carry out a CAD/CAM exercise in preparation for the manufacturing task
- To design and make any jigs, fixtures, adaptors, and attachments required for the task.
- To set up and machine all components required for the project.
- To carry out an assembly process required by the project.
- To work as a team in optimising the manufacturing process so that cycle times and costs are minimised. This would involve looking at design, tool paths, assembly procedures, as well as jigs, fixtures, and machining techniques.
- To run a full optimised cycle of at least 10 components.

3. THE TEST PROJECT

3.1 Format / structure of the Test Project

Main Test Project, a surprise project and a portfolio.

Main Test Project

The Main Test Project involves the manufacture of a team's solution to a manufacturing challenge and would include skill areas such as design, planning, manufacturing and documenting the manufacturing process.

The manufacturing challenge will detail the Test Project brief and the evaluation procedure and will be made freely available to MTC teams prior to the Competition.

Surprise project

The surprise project represents the 30% of change. See paragraph 3.9 *Test Project change at the Competition*. The surprise project must relate to the main project.

Portfolio

The portfolio will include the documentation involving the main project and will include 2D mechanical drawings, electronic solid model, electrical drawings, manufacturing plans, design calculations and manufacturing costs. Some sections of portfolio documentation may be done prior to the Competition.

3.2 Test Project design requirements

The total working time for the Test Project will be between 18 and 22 hours.

Design

The task is to have all design work including process parts, jigs, and fixtures carried out in accordance with the instructions, specifications, drawings, parts, and samples provided by the project designer(s).

The design of the Surprise Test Project must fit in the constraints of the following materials provided:

- 100 x 100 x 50mm aluminium – 2 per team
- 150 x 100 x 50mm aluminium – 2 per team
- 100 x 25mm aluminium flat – 300mm per team
- 100 x 10 aluminium flat – 250mm per team
- 50 dia aluminium round – 150mm per team
- 50 dia mild bright steel round – 150mm per team
- 25 dia mild bright steel round – 150mm per team
- 50 x 5 mild steel flat – 250mm per team
- 1.6mm thick flat MS sheet – 400 x 400mm per team

Program generation

Generate all programs required for the automated sections of the task including those for any CNC machines, robots, PCs and PLCs.

Manufacture

Make any parts nominated by the Experts as well as those needed for the working of those manufactured parts such as jigs, fixtures, adaptors, and process attachments to the required tolerances.

Assembly

Assemble the various components either manufactured previously or supplied as part of the task by outside sources using automated methods where nominated as part of the task.

Optimisation

Revise the manufacturing and assembly process to optimise cycle times and reduce the process cost.

Documentation

Document the process including header page, index, and descriptive overview of the task, hard copy of any programs, instructions for setting up and assembly, and any relevant drawings.

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
Before the previous Competition	Test Project proposals are developed by the Experts
1 month prior to the previous Competition	Test Project proposals are submitted on the Discussion Forum
At the previous Competition	The Test Project for is selected for the following Competition
3 months after the previous Competition	The complete specifications of the Test project are put on the Discussion Forum
4 months after the previous Competition	The Marking Scheme is developed
8 months after the previous Competition	The assessment procedures including assessment check lists and testing equipment is developed.
12 months before the Competition	Test Project Information Pack is supplied to the Technical Director and circulates it on the WorldSkills website
At the Competition	The Experts propose Surprise Test Projects. One is selected by vote of the Experts and given to the Competitors

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

Independently by each Expert.

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

- MTC has two projects. The Main Project is circulated prior to the Competition. The second project is the Surprise Project which represents the required 30% change, and is selected at the current competition and therefore is not circulated prior to the Competition.
- Main project proposals are prepared by Experts before the previous Competition where one selected is made, See 3.6 Test Project Selection.

Schedule for preparation and development of Main Test Project prior to the previous Competition

- Experts prepare at least one project proposal which will include an assessment scheme.
- 1 month prior to the previous Competition – all Main Test Project proposals are submitted on the MTC Discussion Forum.

At the previous Competition

The MTC Main Test Project is selected for the following Competition. See paragraph 3.6 *Test Project Selection*.

After the previous Competition

- Three (3) months after the previous Competition the complete specifications of project development is put on the MTC Discussion Forum. The CE or nominated Expert/s facilitates this.
- Four (4) months after the previous Competition the Marking Scheme is developed. The CE or nominated Expert/s facilitates this.
- Eight (8) months after the previous Competition the complete assessment procedures including assessment check lists and testing equipment is developed.

Before the Competition

- Twelve (12) months prior to the Competition the MTC Information Pack is compiled with discussion on the MTC Discussion Forum. This is submitted to the Technical Director who circulates it on the WSI website.

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

Prior to the current Competition.

The various Technical Delegates are to be advised of the team skills required and appropriate descriptive material is to be forwarded in advance for team preparation.

Main Project information including assessment weightings and assessment procedure to be included in current Competition MTC Information Pack

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 Projects are validated as follows:

- Main Project – specifications to be developed with performance outcomes – explanations and clarifications including assessment procedure to be available in current Competition MTC Information Pack – skills must be outlined in MTC Technical Description.
- Surprise Project – sample project to be supplied as well as all required documentation to be examined by Experts to conform to skills outlined in MTC Technical Description.

3.5.1 The detailed and final marking scheme is developed and agreed by all Experts using the MTC Discussion Forum.

3.6 Test Project selection

The Test Project is selected as follows:

- Before the previous Competition Test Project proposals submitted to the MTC Discussion Forum. The proposal should contain a proposed marking scheme with allocation of marks.
- The Main Test Project proposals will be presented by each Expert with discussion between Experts. The proposals should be in hard copy form with a copy for each Expert.
- Previous proposals that were not selected may also be considered for selection.
- The proposals will be checked for completeness and compliance with the project design criteria during selection of the Test Project.

- The Main Test Project will be considered on the basis of the design criteria in paragraph 3.2 with consideration of the MTC Infrastructure List and competition time.
- Proposals may be edited or altered by the Experts before the selection process.
- Several proposals may be combined to make up the Main Test Project to meet competition time requirements.
- Proposals that do not meet the design requirements under paragraph 3.2 will be excluded.
- The Main Test Project is then selected from the proposals by the standard WorldSkills ballot process.
- The selected Main Test Project or projects will then be prepared as a detailed set of specifications and assessment criteria and procedures and will be referred to as the MTC Information Pack.

3.7 Test Project circulation

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

- Twelve (12) months before the current Competition.

3.8 Test Project coordination (preparation for Competition)

Coordination of the Test Project will be undertaken by:

The Chief Expert

3.9 Test Project change at the Competition

The Surprise Project represents the 30% of change and the contents of this project will not be released to the teams prior to the start of the Competition.

Each Expert will present a Surprise Project proposal and a vote of these proposals at the pre-Competition meeting of Experts will determine the surprise project for that Competition. Editing of the surprise project is permitted and encouraged at this meeting of Experts to vary the content and evaluation procedure.

Selection of the Surprise Project

The Surprise Project must be complete and checked for accuracy before it can be considered for the ballot. The Surprise Project should be challenging and involve as many skills identified in the MTC Technical Description as possible. The duration of the Surprise Project should take 30% of competition time. Proposals not requiring this time will not be considered for the ballot.

Ideally, the Surprise Project should relate to the main Test Project.

3.10 Material or manufacturer specifications

All software including that required for CNC and Robotics must be available to each team at least 6 months prior to the Competition in the version in which it will be used at the Competition.
PIC software shall also be available at the same time.

4. **SKILL MANAGEMENT AND COMMUNICATION**

4.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration and decision making regarding the skill 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 project performance		50	50
B	Total manufacturing cost		15	15
C	Portfolio		5	5
D	Surprise project		30	30
Total =			100	100

5.2 Subjective marking

[Not applicable](#)

5.3 Skill assessment specification

Main Test Project

[Recording and calculation of all marks for the Main Project shall be done in the Competition Information System \(CIS\) however it must first be verified by the Marking Systems Advisor 3 months prior to the Competition. The Main Project marks will be calculated by comparing team's build cost and compliance to project specifications.](#)

Marking will be on the basis of product cost and will include such things as Competitors' time, materials used, parts used, any consulting fees, training required, and machine tool and tooling costs. Required tolerances must be met for a result to be valid.

Each team member must record the time they start and finish each shift and clearly indicate whether they are working on the Main Project, Surprise Project or the portfolio. Competitors not working must remain in a central position. Lunch time is an exception.

There may be other forms of assessment for sub-categories of the Main Project such as cycle time where applicable which may also translate to cost per product item made and inclusion of specific items of documentation.

Multiple awards may be made.

Main Project labour hours and machine usage hours will be costed at an hourly rate. This hourly rate will be in the currency of the Host Country. Typical hourly rates are:

- Each Competitor's work time @ €25.00/person/hour
- CNC machine @ €25.00/hour
- Consultant and training @ €40.00/hour

Portfolio

Sections of the portfolio must be done during the Competition and will be costed. All portfolios are to be in English.

The portfolio should contain:

- 2D drawings
- Design calculations
- Manufacturing plan
- Wiring diagrams
- 2D assembly
- Project documents (such as Maintenance manual).

5.4 Skill assessment procedures

Time-keeping system

- Machines are to be allocated in 15-minute increments. Working hours and actual machine usage hours to be calculated to the accuracy of the handwritten time-keeping system. The minimum increment for consultant is 15 minutes. Time keeping is handwritten by the Experts. The time keeping is done with 3-minute tolerances. Time sheets to be used during competition will be on the Discussion Forum 3 months prior the Competition.

For the Main Project, raw materials such as steel and aluminium in pipe, sheet and bar form will be costed on a price per kilogram rate. Rate to be decided by Experts prior to the Competition.

All extrusions and profile will be priced by length. Cost must be verified by Experts to reflect commercial cost.

All other components of the Main Project will require current catalogue prices – a printout of a current e-catalogue is acceptable as long as the printout has the website and date printed on it. The accuracy of these catalogues will be checked by Experts. Prices quoted must indicate whether or not they are inclusive of taxes.

Currency conversion rates will be set by Experts at the pre-Competition meeting.

Work schedule

- Teams will present a work schedule by the end of the first day of the Competition, showing a schedule of their planned activities, people and machines, for the duration of the Competition in progressive timelines on electronic project management software (such as MS Project). The schedule is to be updated daily.

Pre-competition coloured poster

The teams need to provide a pre-competition coloured poster (size: 600x1000) with:

- 3D drawing of the design
- Names and photographs of the Competitors
- Description of main project

Progressive marking for all sections of the Competition

Main project performance	C4 (Day 4 of Competition)
Main project cost	C4 (Day 4 of Competition)
Portfolio - section A	C1 (Day 1 of Competition)
Portfolio – Section B	C4 (Day 4 of Competition)
Surprise Project	C3 (Day 3 of Competition)

Portfolio:

Portfolio A is to be submitted during familiarisation before toolbox check.

During the toolbox check the material brought by the teams for manufacturing their Test Projects needs to be spread on the floor. A photo needs to be taken of all and put with the sketches that must be submitted for checking material.

Sketches must be available at toolbox check.

Sketches for the drawings to be made during competition need to be hand-drawn. Text can be computer generated.

The Surprise Project is to be released during Familiarisation Day (C-2)

Security

Each team's toolboxes will be checked prior to competition start. If any suspect items are identified during the toolbox check, the compatriot Expert is to be informed immediately. At no time should an Expert dismantle any components. The compatriot Expert and a team member must be present during this process.

Security – material size:

All material is to be cut in lengths at least 50mm larger than sketch size. To ensure this, five random parts will be measured during the toolbox check and compared with the sketch in the team's portfolio. Each piece must be 50mm larger than sketch size to be able to be used. A photocopy of this sketch is then taken and kept and will be compared throughout the competition to ensure same dimensions are used in the final drawings.

6. **SKILL-SPECIFIC SAFETY REQUIREMENTS**

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

Competitors must carefully familiarise themselves with the safety instructions concerning general electrical safety, machine safety, welding and hot work, machining and requirements for Personal Protective Equipment.

Chemical Substances

- Safe handling instructions must accompany all substances used. Familiarise yourself carefully with these instructions before using hazardous chemical substances. Wear the necessary protective equipment, for example gloves, eye protection and respirators.

Personal Protective Equipment (PPE)

- Protective clothing (long pants and a long-sleeved shirt) must be made of non-flammable materials. The long sleeved shirt must be firmly fastened at the wrist. Long pants must reach shoes/boots. Pants must be worn on waist.
- Wrist, finger and hand jewellery and any loose neck jewellery or clothing must be removed.
- Safety glasses to be worn at all times. Preferably a face shield should be worn when using machine tools, grinders and hand tools.
- Safety footwear with protective toe caps must be of approved safety standard.
- Hearing protection must be worn when using offhand grinding machines and angle grinders.
- Protective clothing, safety glasses and safety footwear must be worn at all times when in Competition area. This includes computer use as machine tools may be in adjacent area.

Working areas

- All offhand grinding must be done in the welding bays with the shields closed.
- Welding gloves and welding helmet must also be worn when welding in the welding bay. (Note: welding helmet and gloves not required for grinding.)
- When welding, the welding bay shields must be fully closed.
- All people in the welding bay must be fully equipped with welding gloves and welding helmet for welding. (If grinding suitable Personal Protective Equipment (PPE) should be worn.)
- Persons not properly equipped may enter the workshop but must move directly to and must remain within Expert's room and will not be permitted to enter the competition area.

Machine Safety

- When using a grinding machine or machine tool any sparks or swarf must not endanger other people.
- Machines must be cleaned after use.
- Clean up any coolant or oil or liquid spilt on floor.

Housekeeping

- When working in your own competition area, make sure that no working material interferes with the adjacent Competitor's area, and that your actions do not hinder his or her work.
- When sharing machines, leave ample space for the person working on the machine.
- Floor and passages must be kept free of unnecessary clutter, wires and trash.

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.

PIC software is to be provided by the Competition Organiser. Five (5) programmable ICs are provided by the Competition Organiser. Types of PIC software and ICs will be in the Infrastructure List.

The Infrastructure List should contain the following materials for the Surprise Project.

- 100 x 100 x 50mm aluminium – 2 per team (same material as CNC Milling)
- 150 x 100 x 50mm aluminium – 2 per team (same material as CNC Milling)
- 100 x 25mm aluminium flat – 300mm per team (leave as length)
- 100 x 10 aluminium flat – 250mm per team (leave as length)
- 50 dia aluminium round – 150mm per team (leave as length)
- 50 dia mild bright steel round – 150mm per team (leave as length)
- 25 dia mild bright steel round – 150mm per team (leave as length)
- 50 x 5 mild steel flat – 250mm per team (leave as length)
- 1.6mm thick flat MS sheet – 400 x 400mm per team (leave as sheet)

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

Teams have to submit a list of the parts that they bring to the Competition and present these parts for inspection to the Experts before the commencement of the Competition. The Expert will then determine what security arrangements will apply for these items.

- It is the responsibility of the team to supply all the tooling, components and raw materials to manufacture the Main Test Project including consumables (LEDs, resistors, circuit boards, sheet metal, screws, nuts, pipe flat bar, etc)
- All electric and electronic components
- Electric cables, connectors and couplings
- Jigs, fixtures, formers and clamping devices
- Machining centre consumable tooling required for manufacturing project components
- All hand tools, cutting tools and measuring equipment
- Other manufacturing equipment you require that is not listed in the MTC Infrastructure List
- Lathe and mill tools and hand tools for manufacturing the Main Test project

Standard tool items for the Surprise Test Project

Surprise Test Project design will be able to be manufactured with these tools plus items listed in MTC Infrastructure List

- Slot drill suggested sizes – 5mm, 6mm, 8mm, 10mm, 12mm, 16mm and 20mm
- 2mm dia ball nose slot drill
- End mill suggested sizes – 5mm, 6mm, 8mm, 10mm, 12mm, 16mm and 20mm
- Drills form 3mm to 12mm diameter in 0 increments
- 16mm dia drill
- 18mm dia drill
- 20mm dia drill
- Parallel strips
- Lathe tools to suit machining steel, including roughing, finishing and screw cutting
- Lathe tools to suit machining aluminium, including rough, finishing and screw cutting
- Boring bars – 12mm, 16mm and 20mm
- Hand taps and tap wrench to suit – M3, M4, M5, M6, M8, M10 and M12
- Drills – size to suit M3, M4, M5, M6, M8, M10 and M12
- Screwdriver set
- Spanner set

- Allen key set – metric
- Tin snips
- Hammer – engineers
- Centre punch
- Combination pliers
- Measuring tools – 0-25mm, 25-50mm, 50-75mm and 75-100mm outside micrometers
- Depth micrometer – 0-75mm
- 200mm vernier/digital callipers
- Telescopic gauges – 10mm to 75mm range
- Engineers square
- Dial indicator – lever type with magnetic base
- Edge finder for locating datum points on a work piece
- Soldering iron to suit electronics

Note:

- All software will be provided and installed by the Competition Organiser.
- Independent metrology will be provided for the dimensional measurement of components. Holders are to be provided by the Competition Organiser. Except measuring equipment.

7.3 Materials, equipment and tools supplied by Experts

Not applicable

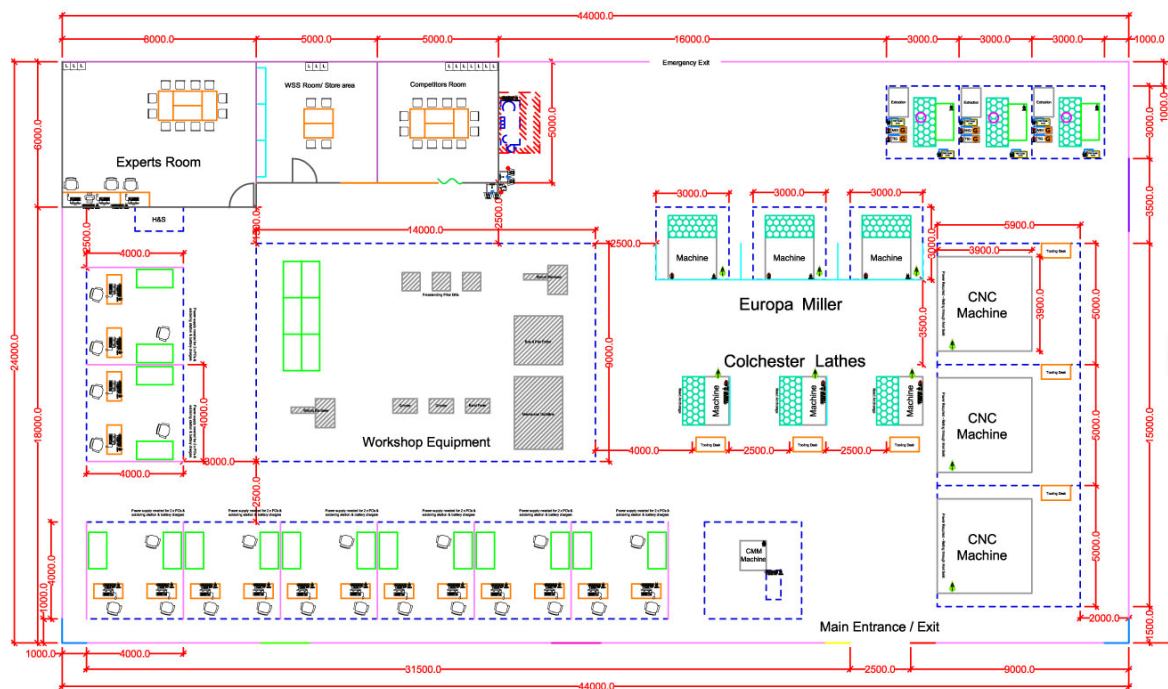
7.4 Materials & equipment prohibited in the skill area

- Digital storage devices including:
 - Laptop or portable computers
 - PDAs such as Palm, IPAQ etc
 - Mobile phones
 - Digital or film cameras
 - Memory sticks/MP3 players
 - Walkman radio/CD players
 - Electronic organisers/diaries
 - Wireless communication devices
 - Non-approved CDs or floppy discs – approval by Chief Expert or delegate
- Any additional software not supplied by organisers unless approved by majority of Experts
- Purchased items are not to be modified in any way prior to the Competition.
- Teams will be controlled for components of the unit that they are not allowed to bring into the Competition. In other words, bringing purchased and self-made items that have to be made at the Competition will be banned. A toolbox inspection will be conducted before the Competition and any suspect components will be quarantined and banned from use during the Competition.
- During the Competition, no tools, equipment, stationary, components, manuals, drawings or digital storage devices may be removed from the Competition venue, unless approved by Chief Expert.
- If suitable equipment is provided by the Host Country, Competitors are not permitted to use substitute equipment provided by them.

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

To maximise visitor and media engagement for MTC the following ideas will be considered:

- Utilise MTC Media Liaison Person (previous competitor is ideal) at Competition site to explain MTC concept and escort media on site.
- Display screens with head cam showing live images.
- Test Project descriptions.
- Enhanced understanding of Competitor activity.
- Site layout to enable public and media to get close to competitors – have access bays.
- Display screen with Competitor profiles.
- Daily reporting of competition status including marks, costs and times.
- Active assessment involving timed and active tasks – use announcer to inform public of what is happening.

8.2 Sustainability

- Selection of projects to be related to sustainability and energy conservation e.g. wind generator, solar powered water pump and inner city rechargeable electric vehicle
- Main project ideally be of benefit to developing countries.
- Use of 'green' materials.
- All swarf and scrap materials to be collected for recycling.
- Use of completed Test Projects after the Competition.