



**TECHNICAL
DESCRIPTION**

MANUFACTURING TEAM CHALLENGE



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 THE SKILL COMPETITION

1.1.1 The name of the skill competition is

Manufacturing Team Challenge

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

The skill competition of Manufacturing Team Challenge is based on the design, manufacture assembly and testing of equipment by teams of complementary specialists. In either large or small manufacturing operations there is a strong demand for several specialists to come together to design, manufacture, assemble and test new or improved equipment either as a one-off item or as the prototype for mass production.

Technicians skilled in project management, computer-aided design, programming, machining, welding, electrical/electronics and fitting can combine to form efficient and effective teams covering design through to commissioning. While each specialism has value in its own right, each team member requires additional attributes. The capacity to work within and contribute to a team is vital, requiring both self-understanding and interpersonal skills. Team members also need the ability to think beyond their own specialisms and the boundaries of each skill, in order to make the most of the team's combined efforts.

This skill has exceptional value as an exemplar of modern manufacturing practices. Whatever the size or sector of the manufacturing organization, continuous improvement and innovation are key to its survival and prosperity. These features do not happen in isolation, but through the combined efforts of high level, insightful specialists. Where diverse manufacturing teams are most successful, this will also be due to the inclusion within the team of both broad and specific financial and organizational skills. These skills will strictly control time and cost while seeking at all times to go beyond the client's expectations for quality.

Whatever their specialism, members of successful manufacturing teams have the opportunity to generate the skills normally associated with accelerated promotion and management development. As the skills also associated with successful enterprise, they open up many positive career choices within the labour market and economy.

1.1.3 Number of Competitors per team

Manufacturing Team Challenge is a team skill with three Competitors per team.

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 – Competition Rules
- WSI – WorldSkills Standards Specification framework
- WSI – WorldSkills Assessment Strategy (when available)
- WSI – Online resources as indicated in this document
- Host Country – Health and Safety regulations



2 THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)

2.1 GENERAL NOTES ON THE WSSS

The WSSS specifies the knowledge, understanding and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSSS).

The skill competition is intended to reflect international best practice as described by the WSSS, and to the extent that it is able to. The Standards Specification 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 not be separate tests of knowledge and understanding.

The Standards Specification 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 Specification. The sum of all the percentage marks is 100.

The Marking Scheme and Test Project will assess only those skills that are set out in the Standards Specification. They will reflect the Standards Specification as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme and Test Project will follow the allocation of marks within the Standards Specification to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Standards Specification.

2.2 WORLDSKILLS STANDARDS SPECIFICATION

SECTION		RELATIVE IMPORTANCE (%)
1	Work organization and management	10
	The individual needs to know and understand: <ul style="list-style-type: none">• Principles and applications of safe working generally and in relation to manufacturing• The purposes, uses, care and maintenance of all equipment and materials, together with their safety implications• Environmental and safety principles and their application to good housekeeping in the work environment• Principles of team working and their applications• Personal skills, strengths and needs relative the roles, responsibilities and duties of others individually and collectively• The parameters within which activities need to be scheduled	



	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Prepare and maintain a safe, tidy and efficient work area • Prepare self for the tasks in hand, including full regard to health and safety • Schedule work to maximize efficiency and minimize disruption • Select and use all equipment and materials safely and in compliance with manufacturers' instructions • Apply or exceed the health and safety standards applying to the environment, equipment and materials • Restore the work area to an appropriate state and condition • Contribute to team performance both broadly and specifically • Give and take feedback and support • Manufacture components and assembly to meet cost constraints and record manufacturing costs and budgets • Maximize material utilization in order to reduce waste 	
2	Communication and interpersonal skills	5
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The range and purposes of documentation in both paper based and electronic forms • The technical language associated with the skill and technology • The standards required for routine and exception reporting in oral, written and electronic form • The required standards for communicating with clients, team members and others • The purposes and techniques for maintaining and presenting records, including financial records 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Read, interpret and extract technical data and instructions from documentation in any available format • Communicate by oral, written and electronic means to ensure clarity, effectiveness and efficiency • Use a standard range of communication technologies • Explain complex technical principles and applications to non-experts • Complete reports and respond to issues and questions arising • Respond to clients' needs face to face and indirectly • Arrange to gather information and prepare documentation as required by the client 	



3	Design and realization	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The principles and applications of project design • The nature and formats of project specifications • The bases on which the manufactured item will be appraised • Design parameters including: <ul style="list-style-type: none"> • Options appraisal • Selection of materials and work processes • Prototype development • Manufacture • Refinement • Commissioning • Principles and methods for work organization, control and management 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Read and interrogate briefs or specifications for manufactured items • Identify and resolve areas of uncertainty within the briefs or specifications • Generate designs for the manufacture of a functioning item within given timescales • Generate innovative solutions to design challenges • Prepare and implement documentation for work management and control • Complete the design stage within the required limits of cost and time • Use of engineering measurement tools including rules, verniers, micrometres and digital measuring tools 	
4	Drawing	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • How to interpret drawings that conform to ISO standards • How to create drawings that conform to ISO standards • The principles and uses of 2D and 3D modelling software • The principles and uses of CAM software 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Create drawings to ISO standards • Create and modify 2D and 3D models • Create CNC programs using CAM packages and appropriate postprocessors • Interpret, construct and modify engineering CAD drawings to work with 3D modelling and to convert both to CAM • Complete drawing activities within the planned timetable and to suit the project's overall requirements 	



5	Machining	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The principles and applications of CNC machining • The routines of CNC machining • The use of general machining equipment used in activities such as central lathing and milling • The relationship between drawings and machining, including modifying the machining to meet specifications • The characteristics of metals and the potential impact on them of cutting tools and processes • The applications of machining to a range of metals and materials 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Machine components to drawings on conventional machine tools and from CAM generated tool paths • Safely operate conventional machine tools such as lathes, mills and drill presses • Safely operate a CNC machine centre • CNC programming • Address the issues caused by temperature during machining, including the use of coolants • Complete machining within the planned timetable and to suit the project's overall requirements • Manufacture components to industry finishes and tolerances • Measure and adjust manufacturing process to meet specifications 	
6	Sheet Metal Working	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The specific safety principles and practices to be used with sheet metal • The principles and applications of working with sheet metal • The processes required for bending and cutting sheet metal 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Apply safe working practices for sheet metal working • Bend and cut sheet metal components in accordance with drawings • Fit sheet metal components to an assembly • Complete the sheet metal work within the planned timetable and to suit the project's overall requirements 	
7	Electronics	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The principles and applications for working with electronics and related equipment • The principles and uses of PCBs • The principles and applications of electronic programming software • The principles and applications of robotics and mechatronics 	



	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Assemble and commission electronics from drawings • Design control circuits • Generate programs for automated sections of the manufacturing process, including those for CNC machining, robots, PCs and PLCs • Complete the electronics activities within the planned timetable and to suit the project's overall requirements • Generate programmes for automated sections of the manufacturing process, including CNC machining, robots, PC and PLCs 	
8	Welding	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Specific safety principles and applications for welding • The principles and applications of a range of welding types, including TIG, MIG, OXY and Stick s 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Use safe welding holding and welding techniques • Weld a variety of materials • Use a range of welding types • Complete the welding activities within the planned timetable and to suit the project's overall requirements 	
9	Fitting	15
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Principles and methods for manufacturing parts such as jigs, fixtures, adaptors and process attachments • Principles and methods for assembly and fastening of manufactured parts such as jigs, fixtures, adaptors and process attachments 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Design a range of jigs, fixtures and accessories • Manufacture jigs, fixtures and accessories in accordance with drawings and specifications • Assemble and commission items in accordance with drawings and specifications • Assemble items using fasteners such as glues, screws, bolts etc. • Complete the fitting activity within the planned timetable and to suit the project's overall requirements 	
10	Testing and Commissioning	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The criteria and methods for operating test runs • The scope and limits of the technologies and methods employed • Strategies for thinking creatively and generating innovation • The possibilities and options for making incremental and/or radical changes 	



	<p>The individual shall be able to:</p> <ul style="list-style-type: none">• Test run the assembled item• Review each part of the manufacturing and assembly process against established criteria, including quality, functionality, time and cost• Modify, test and appraise each part of the process, including<ul style="list-style-type: none">• Design• Tool paths• Assembly procedures• Jigs• Fixtures• Machining• Undertake a final test run to commission the item• Present the item to the client with explanations and responses to questions• Generate and present a portfolio including all essential documentation such as<ul style="list-style-type: none">• 2D mechanical drawings• Electronic solid models• Electrical drawings• Manufacturing plans• Design calculations• Manufacturing costs• Project documents such as Maintenance Manual	
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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 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 judgment. These are referred to as **objective** and **subjective**, respectively. 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 Specification. The Test Project is the assessment vehicle for the skill competition, and also follows the Standards Specification. The CIS enables the timely and accurate recording of marks, and has expanding supportive capacity.

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

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



4 THE MARKING SCHEME

4.1 GENERAL GUIDANCE

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

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standards that represent the skill. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards Specification.

By reflecting the weightings in the Standards Specification, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill 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 Specification, if there is no practicable alternative.

The Marking Scheme and Test Project may be developed by one person, or several, or by all Experts. The detailed and final Marking Scheme and Test Project must be approved by the whole Expert Jury prior to submission for independent quality assurance. The exception to this process is for those skill competitions which use an external designer for the development of the Marking Scheme and Test Project.

In addition, Experts are encouraged to submit their Marking Schemes and Test Projects for comment and provisional approval well in advance of completion, in order to avoid disappointment or setbacks at a late stage. They are also advised to work with the CIS Team at this intermediate stage, in order to take full advantage of the possibilities of the CIS.

In all cases the complete and approved Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition using the CIS standard spreadsheet or other agreed methods.

4.2 ASSESSMENT CRITERIA

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

Assessment Criteria are created by the person(s) developing the Marking Scheme, who are free to define 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 Mark Summary Form generated by the CIS will comprise a list of the Assessment 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 of assessment 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) has a specified day on which it will be marked.

Each marking form (Sub Criterion) contains either objective or subjective Aspects to be marked. Some Sub Criteria have both objective and subjective aspects, in which case there is a marking form for each.

4.4 ASPECTS

Each Aspect defines, in detail, a single item to be assessed and marked together with the marks, or instructions for how the marks are to be awarded. Aspects are assessed either objectively or subjectively and appear on the appropriate marking form.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it and a reference to the section of the skill as set out in the Standards Specification.

The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the skill in the Standards Specification. 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)

CRITERIA										TOTAL MARKS PER SECTION
Standard Specification Sections										
	Total marks per criterion									

SAMPLE OF TABLE FROM CIS



4.5 SUBJECTIVE MARKING

Subjective marking uses the 10 point scale below. To apply the scale with rigour and consistency, subjective marking should be conducted using:

- benchmarks (criteria) to guide judgment against each Aspect
- the scale to indicate:
 - 0: non attempt;
 - 1-4: below industry standard;
 - 5-8: at or above industry standard;
 - 9-10: excellence.

4.6 OBJECTIVE MARKING

A minimum of three experts will be used to judge each aspect. Unless otherwise stated only the maximum mark or zero will be awarded. Where they are used, partial marks will be clearly defined within the Aspect.

4.7 THE USE OF OBJECTIVE AND SUBJECTIVE ASSESSMENT

The final deployment of objective or subjective assessment will be agreed when the Marking Scheme and Test Project are finalized. The table below is advisory only for the development of the Test Project and Marking Scheme.

SECTION	CRITERION	MARKS		
		Subjective	Objective	Total
A	Main project performance	0	55	55
B	Total manufacturing cost	0	10	10
C	Portfolio	0	5	5
D	Surprise Project	0	30	30
Total		0	100	100



4.8 COMPLETION OF 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 three 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 @ €30.00/person/hour;
- CNC machine @ €35.00/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).



4.9 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 three minute tolerances. Time sheets to be used during competition will be on the Discussion Forum three 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 four of Competition)
Main project cost	C4 (day four of Competition)
Portfolio - section A	C1 (day one of Competition)
Portfolio - section B	C4 (day four of Competition)
Surprise Project	C3 (day three of Competition)



Portfolio

Portfolio A is to be submitted in paper during familiarization 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 and should be referenced to materials, parts etc. (e.g. a number).

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 Familiarization 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 (cut down sheet material must be cut 50mm larger in two directions). 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.



5 THE TEST PROJECT

5.1 GENERAL NOTES

Sections three and four 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 skills in each section of the WSSS.

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

The Test Project will not cover areas outside the Standards Specification, or affect the balance of marks within the Standards Specification other than in the circumstances indicated by Section 2.

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.

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 Specification. Section 0 refers.

5.2 FORMAT/STRUCTURE OF THE TEST PROJECT

Main Test Project is 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 5.9 Test Project change at the Competition. The Surprise Project must relate to the main project and must demand work on all equipment listed on the Infrastructure List.

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.



5.3 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:

- 100x100x50mm aluminium – two per team;
- 150x100x50mm aluminium – two per team;
- 100x25mm aluminium flat – 300mm per team;
- 100x10 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;
- 50x5 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.

Optimization

Revise the manufacturing and assembly process to optimize 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.

5.4 TEST PROJECT DEVELOPMENT

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

5.4.1 Who develops the Test Project or modules

The Test Project/modules are developed independently by each Expert.



5.4.2 How and where is the Test Project or 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 5.6 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.

One 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 5.6 Test Project Selection.

After the previous Competition

- Three 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 months after the previous Competition the Marking Scheme is developed. The CE or nominated Expert/s facilitates this.
- Eight months after the previous Competition the complete assessment procedures including assessment check lists and testing equipment is developed.

Before the Competition

Twelve 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.

5.4.3 When is the Test Project developed

The Test Project is developed according to the following timeline:

TIME	ACTIVITY
Before the previous Competition	Test Project proposals are developed by the Experts
One (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
Three (3) months after the previous Competition	The complete specifications of the Test project are put on the Discussion Forum
Four (4) months after the previous Competition	The Marking Scheme is developed
Eight (8) months after the previous Competition	The assessment procedures including assessment check lists and testing equipment is developed
Twelve (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



5.5 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.

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

5.6 TEST PROJECT SELECTION

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 5.3 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.

5.7 TEST PROJECT CIRCULATION

The Test Project is circulated via the website as follows:

The Test Project is circulated via the website twelve months before the current Competition.

5.8 TEST PROJECT COORDINATION (PREPARATION FOR COMPETITION)

Coordination of the Test Project will be undertaken by Chief Expert.



5.9 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.

5.10 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.

All software including that required for CNC and Robotics must be available to each team at least 6six 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.



6 SKILL MANAGEMENT AND COMMUNICATION

6.1 DISCUSSION FORUM

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

6.2 COMPETITOR INFORMATION

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

This information includes:

- Competition Rules
- Technical Descriptions
- Marking Schemes
- Test Projects
- Infrastructure List
- Health and Safety documentation
- Other Competition-related information

6.3 TEST PROJECTS [AND MARKING SCHEMES]

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

6.4 DAY-TO-DAY MANAGEMENT

The day-to-day management of the skill during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the 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 finalized at the Competition by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).



7 SKILL-SPECIFIC SAFETY REQUIREMENTS

Refer to Host Country/Region Health and Safety documentation for Host Country/Region regulations.

Competitors must carefully familiarize 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. Familiarize 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.



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 Experts for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Items supplied by the Competition Organizer 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.

8.2 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. (Jigs should be clearly identified by a permanent mark. (E.g. paint, stamp, engrave etc.);
- 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 sips;
- Hammer – engineers;
- Centre punch;
- Combination pliers;
- Measuring tools – 0-25mm, 25-50mm, 50-75mm and 75-100mm outside micrometres;
- Depth micrometre – 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 Organizer.

Independent metrology will be provided for the dimensional measurement of components others are to be provided by the Competition Organizer. Except measuring equipment.

8.3 MATERIALS, EQUIPMENT AND TOOLS SUPPLIED BY EXPERTS

Not applicable.



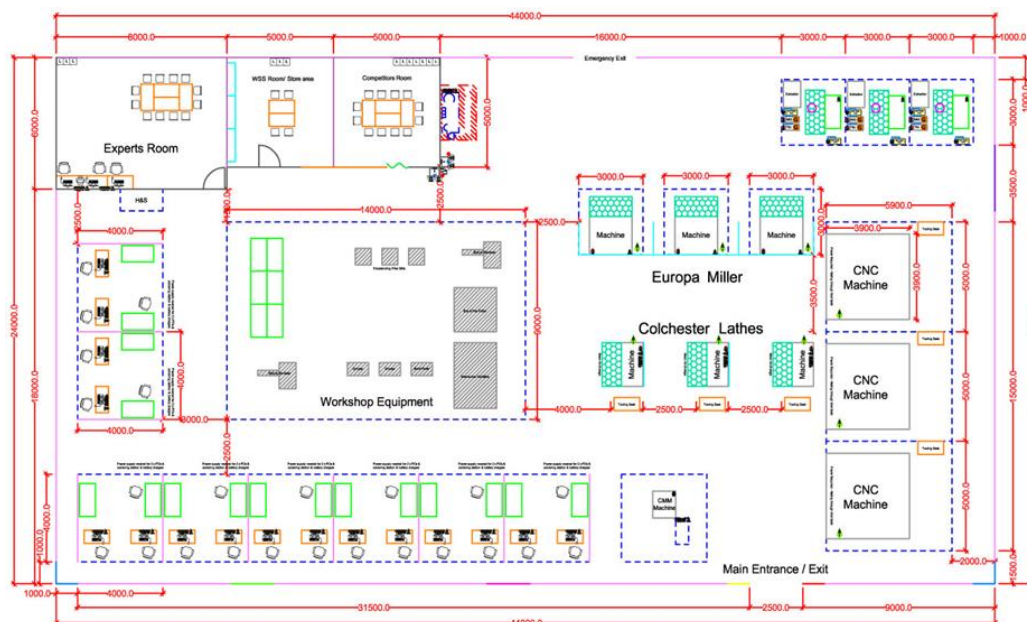
8.4 MATERIALS AND EQUIPMENT PROHIBITED IN THE SKILL AREA

- 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 organizers/diaries;
 - Wireless communication devices;
 - Non-approved CDs or floppy discs – approval by Chief Expert or delegate;
 - Any additional software not supplied by organizers 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.

8.5 PROPOSED WORKSHOP AND WORKSTATION LAYOUTS

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

Example workshop layout:





9 VISITOR AND MEDIA ENGAGEMENT

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

- Utilize 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.



10 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.