TECHNICAL DESCRIPTION
Joinery

world skills 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:

Effective 30.09.10

Liam Corcoran
Technical Committee Chair

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1. INTRODUCTION

1.1 Name and description of skill

1.1.1 The name of the skill is Joinery.

1.1.2 Description of skill
Joinery is the process of connecting or joining two or more pieces of wood together through the use of various forms of wood joints. In fine woodworking, common forms of joinery include dovetail joints, mortise-and-tenon joints biscuit joints, lap joints, spline joints, etc. Joiners construct doors, windows, stairs and other architectural objects. Joinery involves work both by hand and machine.

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 - Competition Manual
- 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

Drawing
Knowledge and understanding of drawing:

- Interpretation of drawings/setting-out according to ISO standards
- Understand the need for accurate drawing to produce accurate work

Competitors shall be able to:

- Draw a full size, 1:1, front elevation of a two dimensional project, for example a door or frame
- Draw lines that are straight, ‘crisp’, accurate, and meet cleanly at intersections.
- Draw lines of a consistent thickness and correct weight
- Draw all line types required: finish lines, hidden lines, break lines
- Draw joint details that are accurate and proportioned correctly. All hidden detail must be shown.
- Measurements - Ensure that all measurements are accurate to within 1mm
- Draw the horizontal and vertical sections if required of each component if required, ensuring accuracy to within 1mm.
- Produce a finished drawing/setting out that is clean and not marked with smudges from pencil lead or from the use of an eraser.

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Interior joints

- Knowledge and understanding of interior joints:
- Knowledge of materials and their processes of manufacture
- Application of safety regulations when running machines in the host country
- Demonstrate the need for close fitting joints to form good surface area for gluing

Competitors shall be able to:

- Produce accurately mortices by hand and using a variety of machines, for example hollow chisel morticer
- Produce mortices that are parallel and free from cutter or chisel marks
- Produce mortices and haunches to correct sizes within 1mm
- Produce tenons by hand and/or machine, for example traditional tenon saws, Japanese pull saws, bandsaw, powered hand router and mitre saw.
- Produce tenons that are parallel and free from undulations caused by saw or chisel.
- Produce well fitting mortice and tenon joints that fit together with a 'push fit'

Exterior joints

Knowledge and understanding of exterior joints:

- Knowledge of materials and their processes of manufacture
- Application of safety regulations when running machines in the host country
- Demonstrate the need for close fitting joints to form good surface area for gluing

Competitors shall be able to:

- Form joints that conform to the drawing
- Form joints that are complete
- Form joints that have a maximum gap of 0.15mm on the shoulders
- Form joints that have no filling or piecing in of gaps

Finish and appearance

Knowledge and understanding of finish and appearance:

- Understand that the visual appearance of a joinery project is what the client bases their appreciation on

Competitors shall be able to:

- Make a joinery project with twist within 1mm
- Make a joinery project square to within 1mm
- Make a joinery project with flush surfaces
- Make a joinery project with consistency of curved shapes
- Make a joinery project with perfect fit of panels
- Make a joinery project without chips or other defects

Conformity

Knowledge and understanding of conformity:

- Interpretation of drawings/setting-out according to ISO standards
- Understand that what a customer orders must be what a customer receives

Competitors will be able to:

- Ensure that the finished project is built exactly as the drawing
- Ensure that the finished project has no piecing in or repairs

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Measurements
Knowledge and understanding of measurements
- Interpretation of drawings/setting-out according to ISO standards
- Demonstrate that sizes are critical, an incorrect size will not fit the required location

Competitors shall be able to:
- Make a joinery project within 1mm of given sizes

Material
Knowledge and understanding of material:
- Knowledge of materials and their processes of manufacture
- Understand that mistakes are costly and the need to cut down on waste

Competitors shall be able to:
- Make a joinery project without mistake/s requiring replacement timber

2.2 Theoretical knowledge

2.2.1 Theoretical knowledge is required but not tested explicitly.
- Interpretation of drawings/setting-out according to ISO-standards, A and E.
- Knowledge of materials and their processes of manufacture.
- Application of safety regulations when running the machines in the Host Member country. The Competitors will abide by the safety procedures of the Host Member as determined prior to each Competition by the Chief Expert and Host Member.

2.2.2 Knowledge of rules and regulations is not examined.

2.3 Practical work
Only practical work is assessed in this Competition. However, Competitors will require a wide range of theoretical knowledge to adequately demonstrate their practical skills during the Competition. Joinery knowledge and skill, project planning, time allocation, the order of processes and safe work methods will all be factors during the Competition.

3. THE TEST PROJECT

3.1 Format / structure of the Test Project
The format of the Test Project is modular. It comprises 2 modules, each taking 2 days (11 hours) to complete.

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3.2 Test Project design requirements

3.2.1 The two modules that are developed will come from 2 different Joinery groups. For example, one of the modules (flat) will consist of a frame of some type (as per the Technical Description) and the other from another aspect (3 dimensional) of the Technical Description (stairs, panelling etc).

3.2.2 The flat module is to have a maximum size of 1 square metre OR 0.15 cubic metres. The 3D module may have a larger volume than the flat module.

3.2.3 In general, the modules must require the Competitor to display a range of hand and machine skills.

3.2.4 The Test Project must be designed to enable the least competent competitors to achieve some good results, whilst also allowing the most skilled competitors to demonstrate their ability without achieving 100%.

3.2.5 All projects proposals must be in 2 languages, one in the language of the designer's country and the other in English. For English speaking countries, the other language must be German or French.

3.2.6 If it is possible, each module is designed to have two separate assemblies that are not glued, for example, they could be pegged or doweled together. If there is only one module that is not demountable, competition time must be stopped to allow for gluing

3.2.7 There must be at least a minimum of 4 different types of joints used in a two day competition project. For example, open mortise and tenon, wedged mortise and tenon, double mortise and tenon, dovetail…etc. Dowels and biscuits may be used for no more than 10% of the joints in the project.

3.2.8 Suggested Design Guideline - 1 joint = about 1 hour work. At most 11 joints per module = 2 day project

3.2.9 Each Test Project is limited to three profile shapes. These profiles include Chamfers, rebates and grooves. For clarification, each project is limited to no more than three shapes in total. For example, if a project has two chamfers it may only have one other profile – a groove or a rebate.

3.2.10 All joints to be formed using any or all of the following: by hand, portable router, mitre saw, mortise machine, band saw. (Please note that tenoners have been removed from the infrastructure list.)

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.

Project proposals must be submitted in a computer assisted drawing format to ISO-standards.

All Test Project proposals submitted by members have to include the following details and **must** be accompanied by:

1. Front cover
2. Table of contents
3. Working instructions
4. Working drawings to scale full size (1:1)
5. Section details
6. Elevations showing project materials
7. Marking criteria for the Competitors showing divisions A-G and B-G for the 3D project. (There is no drawing required for the 3D project.)
8. Detailed marking criteria in CIS format
9. Elevations showing measurements for marking
10. Provide a photograph to show that the project has been made

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11. Exploded details of complex joints
12. Machine tooling requirements
13. Elevation showing joints for marking
14. Materials list for the Workshop Supervisor to prepare the materials

There can be no exceptions to this list of 14 points. Test Project proposals not meeting this criteria will not be considered.

3.3.1 Who develops the Test Project modules

The Test Project modules are developed by two independent groups of Experts.

The 2D module comprises a design that must be completed in 11 hours. Included in this 11 hours is drawing set-out that will take approximately 1 hour to complete. It is important to remember that when designing a flat project the Competitor will have approximately 10 hours to build the project after the drawing set-out is complete. The 3D module must be completed in 11 hours and has no requirement for a drawing.

3.3.2 How and where are the Test Project modules developed

The Test Project modules are developed independently within each of the two groups.

Each group must work independently of the other on the Discussion Forum in private/closed groups using the following criteria:

Development process

9 months prior to the Competition	▪ Experts are divided into 2 module development groups. ▪ The Chief Expert organises 2 closed forums, one for each group. ▪ Returning Experts will change groups after each competition. ▪ The Chief Expert will select which group (flat or 3D) a new Expert will be placed into. ▪ A time table with the exact deadline dates for Test Project development must be placed on the forum at this time.
7 months prior to the Competition	▪ Experts (divided into 2 different groups – 3D/Flat) submit their Test Project proposals to the WSI Technical Director – jane.stokie@worldskills.org ▪ The Technical Director will put the proposals on their respective closed forums. This will be carried out the same day it is received. ▪ Proposals must be in AutoCad. ▪ Each Expert submits only one Test Project proposal according to their designated module and their closed group on the forum. ▪ During the initial design phase, Experts may choose to initially submit their project proposals with only working drawings to scale 1:1. This is to give Experts an opportunity to give and receive positive construction feedback to aid in the design process. However, once initial feedback is received on an Expert's design, they must re-submit their project proposal as outlined in the Joinery Technical Description in order to be compliant and eligible for voting.

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Between 7 months and 4 months prior to the Competition	▪ Experts discuss the proposed modules and ensure they are compliant. ▪ Experts of the non-compliant proposed modules have the opportunity to make their proposed module compliant and re-submit it.
3 months prior to the Competition	▪ All eligible Experts vote for one 3D or one Flat project in their respective closed forums. ▪ The Technical Director posts the selected 3D and Flat Test Projects on the open forum for all Experts to view. ▪ The selected Test Project modules and material lists are given to the Workshop Supervisor.
Starts 3 months prior to the Competition	▪ The Experts in each closed group (3D and Flat) prepare a proposal for a 30% change. 30 % change proposals CANNOT change the material lists. At this time, the official CIS spreadsheet is prepared and translations are made into the three official languages. Once this is complete, translations may be prepared in each Competitor's chosen language.
At the Competition – First day of preparation	▪ A vote of all eligible Experts is conducted for the 30% change for both the 3D and flat project. ▪ Proposals for the 30% change are accepted in their entirety and will not be modified to include other proposal ideas. ▪ At this time the CIS is modified to account for the 30% change.

3.3.3 When is the Test Project developed
The Test Projects are developed before the Competition by each Expert and then posted to the relevant closed group in the Joinery Discussion Forum.

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 on the Discussion Forum.

3.4.2 Marking schemes are to be entered into the CIS prior to the Competition.

3.5 Test Project compliance
For a Test Project module to be compliant must meet the following requirements:
- It meets all the requirements listed in the Technical Description.
- Both the 3D and the Flat modules are able to be built in the 11 hour time requirement. Included in the 11 hours for the flat module is a drawing set-out that will take approximately 1 hour to complete.
- The Test Project modules must be built under the supervision of the designing Expert by a person of simular competence to that of a Competitor.

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3.6 Test Project selection

Only compliant modules are eligible for selection.

The Test Project is selected by a vote of eligible Experts in each closed group on the Discussion Forum 4 months prior to the Competition. The Technical Director will advise which Experts are eligible to vote.

The Technical Director monitors the vote by the eligible Experts and posts the selected modules in each of the flat and 3D modules on the open forum for all Experts to view.

3.7 Test Project circulation

The Test Project modules are circulated to all Experts on the Discussion Forum 3 months 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 who will lead each closed project selection group on the Joinery Discussion Forum.

3.9 Test Project change at the Competition

Three months before the Competition the Experts in each group (3D and Flat) prepare proposals for 30% change. Experts from the Flat closed forum work on a 30% proposal for the Flat module and Experts from the 3D closed forum work on a 30% proposal for the 3D module. Changes to proposals must work within the materials already identified on the Infrastructure List. At the Competition, a vote is made for the 30% change for both the 3D and flat modules.

Proposals for the 30% change are accepted in their entirety and will not be modified to include other proposal ideas.

3.10 Material or manufacturer specifications

Materials used for the project modules may be hardwood, manufactured panel products or combinations of these. Dressed material is to be supplied 0.5mm oversize, at a moisture content common to the Host Member country and considered of high quality by the Workshop Supervisor. Special consideration should be given to materials which exhibit a high degree of "green, enviro-friendly, eco-consciousness". Samples of materials should be forwarded to all Experts and Competitors 6 months prior to the competition.

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.

In the case of project selection in two closed groups on the Discussion Forum the Chief Expert and Deputy Chief Expert will moderate one group each. Neither the Chief Expert or the Deputy Chief Expert will have access to the other group.

4.2 Competitor information

Information for registered Competitors is available from the Competitor Centre (http://www.worldskills.org/competitorcentre).

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This information includes:
- Competition Rules
- Technical Descriptions
- Other Competition-related information

4.3 Test Projects
Test Projects modules will be available from worldskills.org (http://www.worldskills.org/testprojects) at the completion of the Competition for all Members to access.

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 (agreed by Experts and submitted to the Chair/Vice Chair of the Technical Committee). The Chief Expert is to regularly share updates of the Skill Management Plan via the Forum.

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				
		Flat module		3D module		Total
		Subjective	Objective	Subjective	Objective	
A	Drawing – setting out	3	2			5
B	Internal joints	10		10		20
C	External joints		12.5		12.5	25
D	Finish and appearance	7	3	7	3	20
E	Conformity		2.5		2.5	5
F	Measurement		7.5		12.5	20
G	Material		2.5		2.5	5
	Total =	**20**	**30**	**17**	**33**	**100**

5.2 Subjective marking
Scores are awarded on a scale of 1 to 10.

5.3 Skill assessment specification
Breakdown of marking criteria

A: Drawing / Setting out
This marking aspect checks the Competitor's ability to set out the project. A drawing / set-out is only required in the flat module and not in the 3D module. The marking criteria will include:
- Linework
- Joint details
- Measurements

Linework: Subjective Marking
Points to consider when marking (note; CAD drawing full size is available to have along side for clarity and reference) are as follows:

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- Lines are consistent
- Line types are present: object lines, hidden lines, break lines, etc.
- Lines have the correct line weights
- Neatness

Joint Details: Subjective Marking
Points to consider when marking are as follows:
- Joint geometry and proportions are shown accurately

Measurements: Objective Marking
Points to consider when marking are as follows:
- Measurements within 1mm 100%
- Measurements over 1mm and up to and including 2mm 50%
- Measurements over 2mm 0%

B: Interior Joints
This marking aspect checks the Competitor's ability to form accurately fitting joint surfaces by hand and machine as shown on the competition project drawing. Each joint is apportioned a mark according to its complexity.

All competitors must identify each piece of material submitted for marking with their bench number only. After marking, Experts will identify which internal joints have been marked with a stamp or coloured marker.

Points to consider when marking are as follows:
- Joints assemble so the internal surfaces of the joint are in close contact, but not so tight as to require excessive force to assemble them.
- Tenons are parallel
- Mortises are parallel
- Tenon shoulders are not undercut
- The internal joint geometry conforms with the drawing – including length of tenon and depth of mortise
- Surfaces have clean even sheared or cut grain without irregularities
- No silicone, wax or other foreign material is permitted in internal joints – just wood.

C: Exterior Joints: Objective Marking
This marking aspect checks the Competitor's ability to produce an assembled project with good strong joints and no gaps.

Points to consider when marking are as follows:
- Inspect for gaps on the external joint
- The joint is made according to the drawing
- The joint is complete

Tolerance	Points
Within 0.15mm	100%
Up to & including 0.3mm	50%
Over 0.3mm	0%

- Note:
- Any filling or piecing in gaps = 0%.
- Use of silicone, wax or other foreign material in internal joints = 0%

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D: Finish and Appearance
This marking aspect determines the Competitor's ability to produce a project with a good visual and architectural appearance. The marking criteria will include:

- Twist of component
- Surface finish of the component
- Edge finish of the component
- Squareness of the component
- Fit of any panels
- Alignment of components
- Others may be added or some of the above subtracted depending on the nature of the project.

Twist and squareness: Objective marking

Tolerance	Points
Within 1mm	100%
Up to an including 2mm	70%
Up to and including 3mm	40%
Over 3mm	0

Points to consider when marking are as follows:
- Consistency of curved shapes
- Fit of panel, that is: doesn't rattle or have gaps
- Flush surfaces, checked with straightedge
- Look for the following defects:
  - Over sanded edges
  - Cross sanding
  - Blemishes
  - Chips and other defects

E: Conformity
This marking aspect determines the Competitor's ability to build the project exactly as described in the drawing. Penalties can be as follows but the final list will be determined by the CE, DCE and the marking panel during the Competition.

Points to consider when marking are as follows:
- Missing panel
- Missing frame component
- Other non conformities e.g. a repair
- To a maximum loss of five points

F: Measurement
This aspect of the marking criteria determines the dimensional accuracy of the completed project, and will be marked as follows:

Primary dimensions
- Measurements within 1mm 100%
- Measurements up to and including 2mm 50%
- Measurements over 2mm 0%

Secondary dimensions
- Measurements within 1mm 100%
- Measurements over 1mm 0%

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G: Material
This aspect of marking allows for the penalising of points for the replacement of non usable components.

The penalties are as follows:
- Replacement of the first piece - 2 mark deduction
- Replacement of subsequent pieces - 1 mark deduction
- To a maximum loss of five points

5.4 Skill assessment procedures

- The Experts that attend the Competition will be divided into marking groups to assess each section of the marking criteria. When dividing the Experts, consideration will be given to the composition of the module development groups.
- The Chief and Deputy Chief Expert will train Experts on each area of the marking scheme so they know what to look for when assessing the Competitors' work.
- The Chief Expert will discuss how each section of the marking criteria will be assessed prior to adjudication to ensure conformity and consistency.
- All Experts must meet one of the following criteria:
  - A practicing wood trade worker
  - A practicing wood trade educator
  - Hold a wood trade qualification

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 create chips or fragments that may injure the eyes.
- A first-aid kit and eye wash station must be available throughout the Competition.
- Experts will use the appropriate personal safety equipment when inspecting, checking or working in the machinery work area and Competitors' work areas.
- All Competitors must use respiratory protection when using any hand or power equipment which creates dust.
- All machines will use the necessary safety guards, tooling, suction devices, auxiliary equipment and extraction system that meet the machine manufacturer's specifications.
- The Workshop Supervisor will be responsible for tooling and tooling changes on machinery. The Workshop Supervisor is not allowed to adjust any machinery for a Competitor but is required to provide supervision.
- The lighting level at bench height is to be a minimum of 500 lux.
- The competition site requires a smooth, flat and level floor. This floor must not have large cracks, gaps, irregularities or other tripping hazards.

7. MATERIALS & EQUIPMENT

7.1 Infrastructure List

The Infrastructure List lists 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 Host Country will progressively update the Infrastructure List specifying the actual quantity, type, brand/model of the items. Host Country supplied items are shown in a separate column.

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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 Workshop Supervisor will have at their disposal a professional/competent machinist to monitor the shapers during the Competition. This will be at a preferred coverage rate of one professional to two shapers and a maximum of one professional to three shapers. A student or apprentice is not suitable for this role.

All shapers will have manual hold down devices that apply pressure in two directions, down to the bed of the machine and horizontal to the shaper fence.

To reduce the cost of tooling, shaper heads (cutters) will be limited to the following profiles:
A – Chamfers at 45 degrees
B – Rebates
C – Grooves

A master rule is used to check all Competitors measuring devices against. If the Competitor's rule does not match, measurements will be made with the Competitor's measuring device during measurement evaluation on the competitor's competition project.

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

The Competitor may bring the following tools to the Competition. The list is a suggestion only and is not limited. However only 2 bench mounted static power tools are allowed.

- Set of drawing instruments
- Awls
- Planes
- Chisels
- Shaping tools
- Rebate plane
- Plough plane
- Gauges
- Squares
- Mallet
- Drill and bits
- Hammer
- Screwdrivers
- Hand tool sharpening equipment
- Electric powered routers, which may be bench mounted, with the necessary safety guards
- Portable compound mitre saw that may have sliding mechanism that is depth adjustable, having suitable rear guarding so as to protect other Competitors, the public and Experts from dust and flying materials
- The only stationary machines allowed in a Competitor's area are a bench mounted router and a drop saw on a stand (mitre saw). All other power tools must be hand-held.
- Hand-held routers
- Sander
- Trammel points
- Portable lamp
- Portable vice

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Note: The maximum open height of the toolbox MUST not exceed 1.5 m. No other object in the Competitor's area is to exceed 1.5m in height.

Upon arrival and unpacking of toolboxes, Competitors will show all tools and demonstrate all jigs and templates to the tool inspection team for validation prior to the commencement of the Competition.

7.3 Materials, equipment and tools supplied by Experts

Not applicable

7.4 Materials & equipment prohibited in the skill area

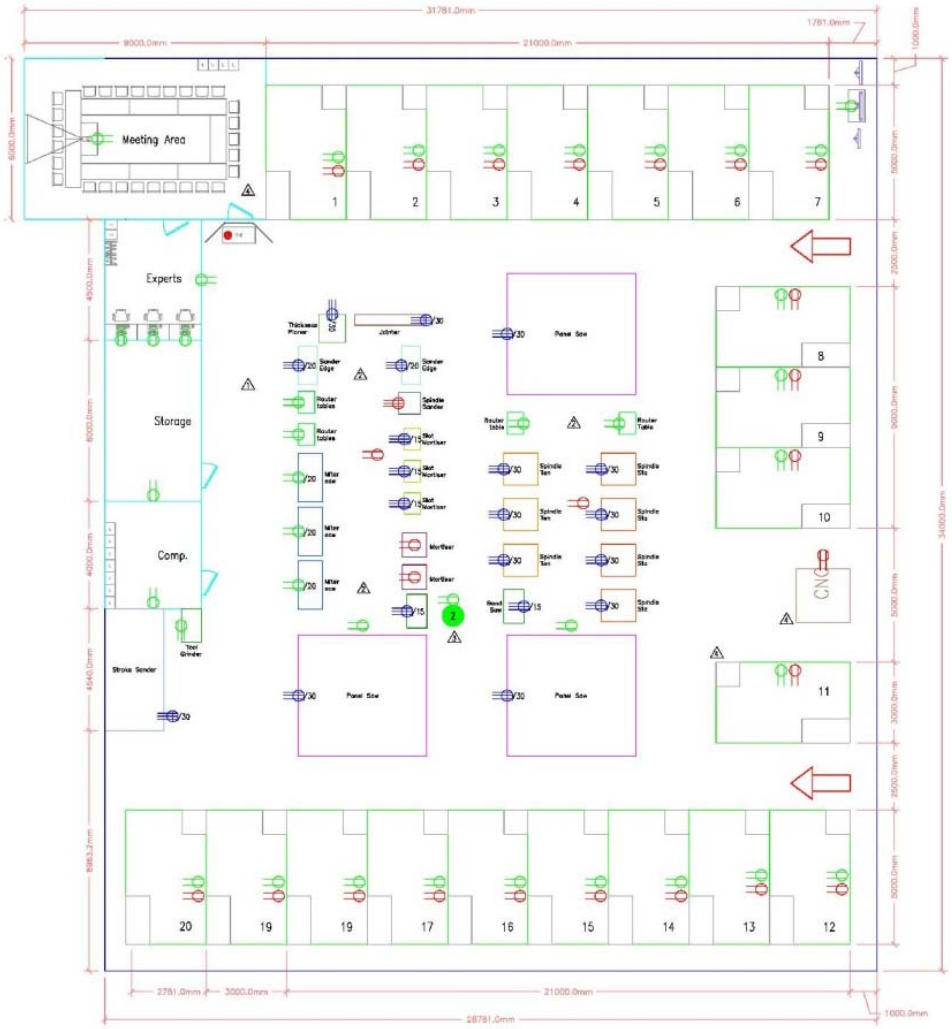
During the Competition, Competitors are prohibited from using mobile phones, cameras, personal music devices, radios and any other device deemed to be a distraction by the Chief Expert.

Competitors are not permitted jigs, fixtures or templates that are determined to be project specific.

7.5 Sample workshop layout

Workshop layouts from Calgary are available at:
http://www.worldskills.org/index.php?option=com_halls&Itemid=540

Workshop layout from previous Competition:



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8. MARKETING THE SKILL TO VISITORS AND MEDIA

8.1 Maximising visitor and media engagement

The Joinery competition area will maximise visitor and media engagement by including the following in their competition area:

- Try a trade – An area were spectators and media try joinery related skills
- Demonstration of a CNC router
- Display screens – A screen that shows visuals of joinery projects, communicates career opportunity and Competitor profiles.
- Test Project descriptions – A posting of the test project drawing that is in public view.
- Display of completed modules – Module 1 may be displayed at the completion of the assessment.

8.2 Sustainability

Sustainability will be demonstrated in the Joinery Competition area as follows:

- Recycling bins will be provided for paper, cans and bottles
- Use of recycled paper for printing of Competition documents
- Wood used in the Competition projects is harvested from sustainable sources.

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