

TECHNICAL DESCRIPTION

SHEET METAL TECHNOLOGY



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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

[Sheet Metal Technology](#)

1.1.2 Description of skill

[Sheet Metal Technology](#) covers manual and CAD pattern development, fabrication, machine operation, welding and component assembly from various sheet and hollow sections, ranging in thickness from 0.6 to 3mm with a variety of metals, covering the marine, aviation, food equipment, ventilation, transport, architectural and street furniture industries.

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**

[Pattern development](#)

Competitors shall have the following knowledge and understanding:

- 1st or 3rd angle projection drawings (1st angle projection is optional at the Competition)
- Pattern development by manual and CAD 2D methods in triangulation, radial and parallel line
- Cutting, rolling, folding, forming, assembly, mechanical fastening and welding methods
- Arithmetic and trigonometric calculations (use of scientific calculator is permitted)
- Folding allowances to be given to the Competitors on familiarisation day in accordance with folding equipment supplied

Competitors shall be able to:

- Interpret drawings in first or third angle projection
- Layout and develop patterns for parts manually
- Develop parts utilising appropriate CAD programmes (English version)
- Verify programmes and/or transfer to Sheet Metal

Pattern cut out

Competitors shall be able to:

- Select appropriate manual cutting techniques
- Utilise CNC profiling equipment
- Finish edges to standard

Forming

Competitors shall be able to:

- Perform the shaping of the parts to their 2/3D geometry's
- Utilise appropriate CNC/Manual rolling, folding, bending, shaping equipment
- Construct and produce designed jigs and fixtures
- Check using gauges, vernier callipers, rules, squares.

Assemblies

Competitors shall be able to:

- Construct assemblies using appropriate techniques
- Prepare jigs and fixtures
- Interpret assembly drawings
- Determine and plan assembly methods

Welding/Joining

Competitors shall be able to:

- Determine correct welding/joining methods
- Interpret correctly drawings
- Produce appropriate joints as defined in drawings
- Implement appropriate safety measures

Finishing

Competitors shall be able to:

- Determine correct finishes
- Prepare components for finishing
- Utilise appropriate finishing techniques
- Implement appropriate safety techniques

2.2 Theoretical knowledge

2.2.1 Theoretical knowledge is required but not tested explicitly.

2.2.2 Knowledge of rules and regulations is not examined.

2.3 Practical work

The Competitor is required to carry out, independently, the following tasks:

- AutoCAD 2D development to a .dxf format (version will be supplied before the Competition) and/or manual pattern development
- Fabrication of a modular project(s) to a tolerance
- Machine operation
- Welding
- Component assembly from supplied items
- Grinding and polishing of given materials (finish will not change in 30% changes)

Forms and shapes may include but are not limited to:

- Frames, doors and hinges
- Benches, cupboards and furniture
- Duct: round, square, rectangular, offsets and transitions, cladding and lagging.
- Marine, transport, architectural and street furniture products

Assembly processes of parts may include but are not limited to:

- GTAW (TIG Welding)
- GMAW (MIG Welding)
- Mechanical fasteners and hinges
- Adhesives

Cutting processes

- CNC Profiling cutting machine (machine setup and operation not required)
Laser/Plasma/Waterjet/Punching
- Cutting out with hand snips, nibbling, shearing, drilling or grinding equipment
- Guillotine and notching machines
- Hand or mechanical sawing machines

Forming processes

- Primary folding, rolling, forming, flanging operations to be achieved utilising supplied machines (correction of forming may utilise forming stakes)
- In all forming processes all setup and template (jig) materials will be supplied (can be cut out on profiling machine)

Finishing processes

- All materials are to be left as supplied finish unless instructed
- Stainless steel polishing where instructed (finish will not change in 30% changes)
- Stainless steel welds finished as instructed (including purge welding)
- Hot and cold rolled section material: wire brush or rotary wire brush only

3. THE TEST PROJECT

3.1 Format / structure of the Test Project

The Test Project is modular

3.2 Test Project design requirements

Test Projects proposals must include the following requirements.

- Modular design
- Be in accordance with the current Technical Description
- Comply with WorldSkills International requirements and numbering standard
- Be accompanied by a marking scale that will be finalised at the Competition in accordance with paragraphs 5.1 and 5.3.
- Be accompanied by proof of function/proof of construction/ completion in the set time etc – as appropriate to this skill category. For example, a photograph of the completed project according to the Test Project instructions and within material, equipment, knowledge and time constraints
- All project modules must be contained within 1000 x 1000 x 1800mm high.
- Project elements must be possible to construct using the supplied tools and equipment.

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.

3.3.1 Who develops the Test Project / modules

The Test Project / modules are developed by:

Experts independently and/or Expert groupings, taking account of geographical areas and Competition experience.

Experts/groups design Test Project proposals and post them on the Discussion Forum for consideration for the following Competition.

3.3.2 How and where is the Test Project / modules developed

The Test Project/modules are developed independently by Experts and/or Expert groups.

The Discussion Forum is to be used on a regular basis for discussion, collaboration and communication.

3.3.3 When is the Test Project developed

The Test Project is developed according to the following timeline:

Time	Activity
At the previous Competition	Experts bring proposed Test Projects. The Test Project is selected from the proposals by vote of Experts.
Immediately after the previous Competition	The selected Test Project is circulated on the WSI website.
At the Competition	30% change is made to the Test Project

Experts bring an outline of a proposed Test Project to the current Competition for the following Competition. This will allow materials for the following Competition to be decided on a more economical basis and be reflected in the updated Technical Description.

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

Test Project proposals must be accompanied by proof of function/proof of construction/completion in the set time etc – as appropriate to this skill category. This will be demonstrated by including a photograph with the proposal.

3.6 Test Project selection

The Test Project is selected as follows:

By vote of Experts at the previous Competition and if required additional information will be available on the Discussion Forum 9 months before the current Competition.

3.7 Test Project circulation

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

Immediately after the previous Competition.

3.8 Test Project coordination (preparation for Competition)

Coordination of the Test Project will be undertaken by:

Chief Expert and Deputy Chief Expert

3.9 Test Project change at the Competition

Proposals for the minimum of 30% change to the Test Project are brought to the Competition by Experts. The Experts consider the proposals and vote which one will be used. The minimum 30% change should have regard to the Infrastructure List as provided by Host Member and the materials specified in original proposal.

3.10 Material or manufacturer specifications

Specific material for use in project should be outlined at the Test Project development stage before Expert voting. Material and equipment specifications and Material Safety Data Sheets are to be supplied by the Workshop Supervisor prior to the Competition on the Discussion Forum.

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	Pattern development		20	20
B	Dimensions, square and parallel		40	40
C	Forming and welding		25	25
D	Assembly and finish, material use and safety		15	15
	Total =		100	100

5.2 Subjective marking

Not applicable

5.3 Skill assessment specification

A - Pattern development

- Pattern template
- Radius – measured on major parts with a tolerance for measurements

B – Dimensions

- Measurements taken in specified places to be indicated
- Diameter
- Width
- Height
- Square
- Stability
- Flatness

C – Forming and welding

- Free of broken backs
- Free of manual deformations
- Fit of joints
- Size of MIG welding
- Size of TIG welding
- Free of arc strikes and weld spatter

D – Assembly and finish, material use and safety

- Overall completion
- Safety in the workshop
- General safe working
- Use of materials – quantity
- Regular finishing

5.4 Skill assessment procedures

The Experts who attend the Competition will be divided into marking groups based on industry experience, Competition experience, specific competencies and geographical spread.

Completed modules will be marked on the same day in which they were completed where possible.

Measurement and inspection

- Measuring range (overall measurements) up to 1000 mm by 1000 mm by 1800mm (Calipers, vernier height gauge and rulers)
- Angle measuring with a protractor (manual or digital)
- Checking for flatness, square and level
- Inspection of patterns by templates.

6. **SKILL-SPECIFIC SAFETY REQUIREMENTS**

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

The following skill-specific safety requirements must be adhered to:

- Safety gloves (leather welding & kevlar glazer gloves for all forming)
- Safety shoes (leather and steel cap)
- Safety eye protection (glasses, goggles and shields)
- Must wear flame retardant long sleeve shirts and long pants/boiler suits

7. **MATERIALS & EQUIPMENT**

7.1 Infrastructure List

The Infrastructure List details all equipment, materials and facilities provided by the Competition Organiser.

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. Items supplied by the Competition Organiser are shown in a separate column.

At each Competition, the Experts must review and update the Infrastructure List in preparation for the next Competition. Experts must advise the Technical Director of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

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

The following is a recommended list of tools the Competitor should bring to the Competition.

- Toolbox excluding packing to be no bigger than 1 cubic metre total, 1 or 2 boxes unpacked (10% over is acceptable over that will not be able to use in competition)
- Welding helmet
- Assortment of sheet metal hammers
- Assortment of nylon or wooden hammers
- Assortment of files
- Assortment of hand snips
- Assortment of locking pliers (vice and c grips)
- Assortment of sheet metal dollies
- Assortment of chisels and dressing punches
- Pop rivet pliers
- Wire brush and or rotary wire brush
- Set of screwdrivers
- Set of drills up to 13mm
- Hand brush (clean up)
- Inside and outside callipers
- Protractor (manual or digital)
- Electric hand shears or nibblers
- Electric drill
- Electric sander and or angle grinder (100 or 125mm dia. and all discs required)
- Electric polisher
- Polishing buffs, mops, scotch wheels etc (polishing stainless steel to a required finish on project. Finish will not change in 30% changes)
- Plastic Film (for protective film and or for transferring patterns)

7.3 Materials, equipment and tools supplied by Experts

No equipment to be supplied by Experts.

7.4 Materials & equipment prohibited in the skill area

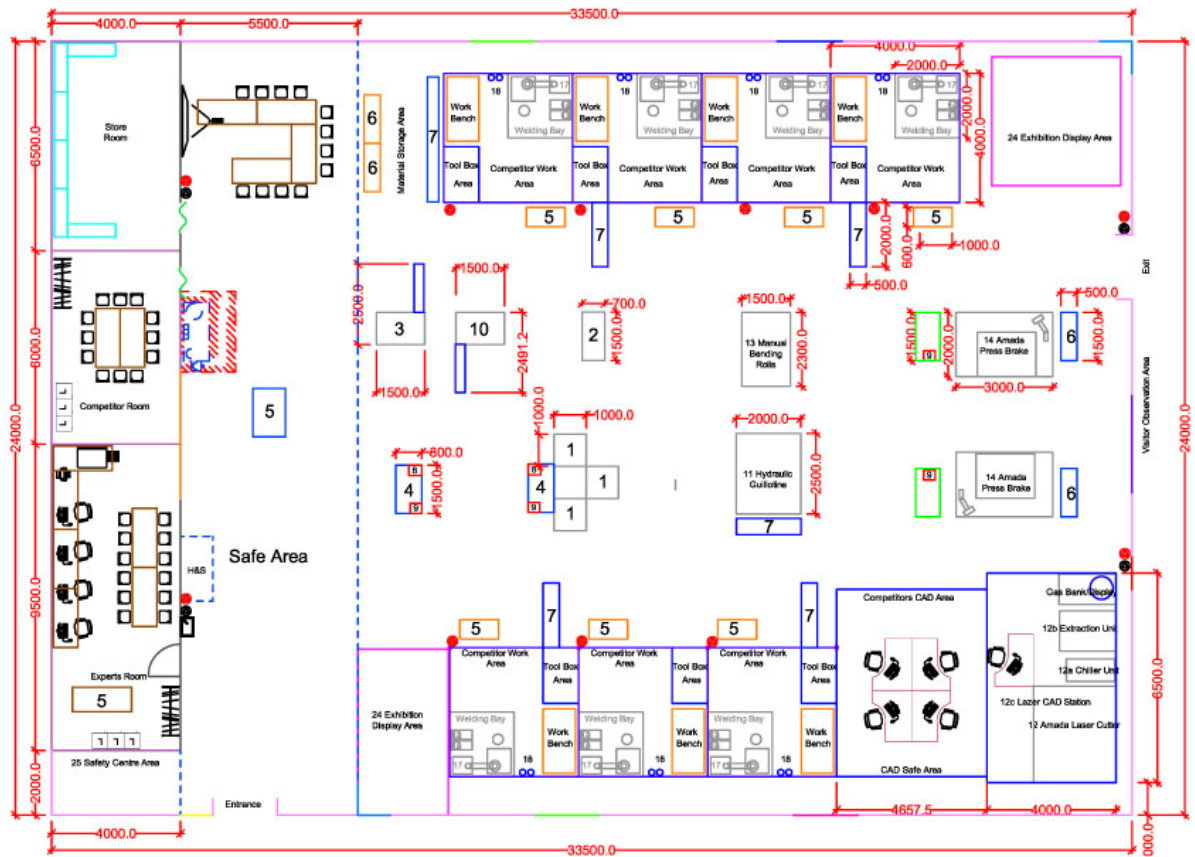
- Any material that may be used to assemble a project or part of a project is not allowed to be brought to the Competition.
- No additional consumables or practice materials are allowed to be brought to the Competition.
- The only items allowed are listed in paragraph 7.2.

7.5 Proposed workshop and workstation layouts

An example of the general layout of the workshop is as per the following diagram with sufficient space for the Competitors working area and with the usual facilities for Experts, material and tool storage. The layout of the workshop in the diagram is only a guide, but the size of the Competitor's work areas and other installations must be the specified size and if not as specified, of a suitable size to fit the number of Competitors/Experts.

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

Workshop layout:



8. MARKETING THE SKILL TO VISITORS AND MEDIA

8.1 Maximising visitor and media engagement

The following ideas may be considered to maximise visitor and media engagement:

- Test Project descriptions
- Enhanced understanding of Competitor activity by meeting with Competitors during their downtime.
- Competitor profiles
- Career opportunities
- Daily reporting of competition status
- Display of Host Member projects

8.2 Sustainability

- Recycling
- Use of 'green' materials
- Use of completed Test Projects after Competition