

# 14

## SHEET METAL WORK

V2.1 - May 08, 2004

# technical description



## **INTRODUCTION**

WorldSkills, 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:

- Section 1 – Technical/Competition Description (TD)
- Section 2 – Project Design Criteria (PD)
- Section 3 – Skill Management Procedures (SM)
- Section 4 – Workshop Setup (WS)
- Section 5 – Infrastructure List (IL)
- Section 6 – Appendices

Effective 08.05.04



Liam Corcoran (LC)  
Chairman, Technical Committee

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## 1. SECTION 1 - TECHNICAL/COMPETITION DESCRIPTION (TD)

### 1.1 Name and description of skill

- 1.1.1 The name of the skill is Sheet Metal Work
- 1.1.2 Sheet metal work covers the fabrication of objects in thin metals (0.6 – 3.0mm) and structural section, such as rolled hollow section, angle, and pipe, for a variety of industrial and custom situations.
- 1.1.3 Every expert and competitor must know this Technical Description.
- 1.1.4 In the event of any conflict within the Technical Descriptions, the English version will take precedence.
- 1.1.5 Words implying male gender shall automatically imply female gender also.

### 1.2 Scope of work at WorldSkills Competitions

- 1.2.1 The Test Project consists only of practical work.
- 1.2.2 The theoretical knowledge is limited to that necessary to carry out the practical work.
- Interpretation and execution of drawings, a good knowledge of the intersection and development of surfaces, ISO welding symbols.
  - Arithmetic operations, and trigonometric calculations.
  - Knowledge of materials, planning, cutting, forming and assembly.

### 1.3 Practical work

- 1.3.1 The competitor has to carry out, independently, the following tasks:
- Studying the developed views of the required round and formed parts (simple geometrical bodies and transition areas)
  - Manufacturing parts based on the plans provided and patterns developed
  - Assembling the parts according to drawings.
- 1.3.2 Forms and shapes may include, but are not limited to:
- Frames, doors, and hinges
  - Bends, fans and augers
  - Ducts: round, square, rectangular, and elliptical
  - Transitions: round, square, rectangular, and elliptical
  - Offsets, trousers, breeches, and hoppers
  - Stiffeners
  - Self secured joints
  - Objects fabricated from rolled hollow section, angle, and pipe
- 1.3.3 Assembly of parts may include but are not limited to:
- Fastenings
  - Welding processes: GTAW, GMAW, OAW, brazing, resistance

- 1.3.4 The appropriate technical skills are as listed in paragraphs 1.3.5 – 1.3.11:
- 1.3.5 Systems for transferring the developed forms from drawings onto sheet metal
- Application of time-saving systems (e.g. plastic film) for transferring shapes traced onto sheet metal for the parts
  - Use of templates, drafting curves and compass
  - Measuring devices
- 1.3.6 Cutting out processes
- Cutting out with hand shears or bench knife
  - Cutting out with hand guided shearing machines
  - Cutting by nibbling
  - Plasma cutting (including aids)
  - Hand or mechanical sawing machines
- 1.3.7 Forming processes
- Folding
  - Rolling
  - Swaging (beading)
  - Cold forming or rolled sections (with the corresponding machines and fixtures)
  - Wired edge by hand or machine
  - Flanging by hand or machine
  - Smoothing
  - Straightening
  - Shrinking / stretching
  - Scoring of bends with a chisel or sharp object is not permitted
- 1.3.8 Metal cutting processes
- Filing
  - Sawing
  - Drilling
  - Countersinking
- 1.3.9 Finishing processes
- Welds: wire brush only unless grinding is instructed
  - Section materials: wire brush, rotary wire brush
  - Stainless steel welds left as welded, back purging where instructed
- 1.3.10 Assembling processes
- Gas welding
  - Brazing
  - GTAW / TIG / WIG
  - GMAW / MIG / MAG
  - Resistance / spot welding
  - Self secured joints
  - Riveting-bolting
  - Jointing with hinges (manufactured or supplied)
  - Adhesives

1.3.11 Measurement and inspection

- Measuring range (overall measurements) up to 1000 mm by 1000 mm by 1000 mm (calipers, gauge, vernier height gauge)
- Angle measuring with a protractor
- Checking with flat square and try-square (legs up to 1000 mm long)
- Inspecting with templates
- Use of calipers

1.3.12 The complete project must be contained within 1000 x 1000 x 1000 mm when fully assembled.

#### 1.4 Theoretical knowledge

1.4.1 Interpretation and execution of drawings. Good knowledge of intersection and development of surfaces. Welding symbols must be ISO symbols. Details to be indicated in the information to competitors, drawing joint details to be numbered accordingly.

1.4.2 Arithmetic operations, and trigonometric calculations (use of a scientific calculator is permitted).

1.4.3 Knowledge of materials, planning, cutting, forming and assembly.

#### 1.5 Materials

1.5.1 Refer Section 4.

#### 1.6 Workshop installations

1.6.1 Refer Section 4 and Section 5.

#### 1.7 Test Project marking

1.7.1 All documentation used must be available in digital form.

1.7.2 There is to be a majority agreement (minimum = 50 % + 1) from experts on the accepted Competition marking scale.

1.7.3 Selection of appropriate project/s is based on paragraph 1.7.2. The expert team may make modifications to the proposed project.

1.7.4 The experts will decide together on the test project, the marking criteria and the dimensional tolerances on Forms 5, 5A and 6 and they will prepare the material list.

1.7.5 Points awarded

- Perfect = 10 points
- Very good = 9 points
- Good = 8 points
- Fairly good = 7 points
- Sufficient = 6 points

- Average = 5 points
- Poor = 4 points
- Unsatisfactory = 3 points
- Very bad = 2 points
- Nothing = 1 point

1.7.6 Rating

Section/ Item/ Maximum Points

A/ Fundamental Dimensions/ 20 points

B/ Secondary Dimensions/ 10 points

C/ Square and Paralle/ 10 points

D/ Material Used/ 10 points

E/ Pattern Development/ 10 points

F/ Forming & Finish/ 20 points

G/ Fit up of Parts/ 10 points

H/ Welding/ 10 points

- 1.7.7 Conversion from the 0 – 100 scale to the 400 - 600 scale will be performed by the WorldSkills Competition Information System (CIS).

## **2. SECTION 2 - PROJECT DESIGN CRITERIA (PD)**

### **2.1 General requirements**

2.1.1 Overall, the Test Project must:

- Be modular
- Be in accordance with the current Technical Description
- Comply with WorldSkills requirements and numbering standard
- Be accompanied by a marking scale that will be finalised at the competition in accordance with Subsection 1.7.
- 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 a project done according to the Test Project within material, equipment, knowledge and time constraints.

### **2.2 Design requirements**

2.2.1 The competitor must independently carry out the activities required to complete the project.

2.2.2 Help may be given to the competitor if parts of the project require lifting or holding in place whilst securing.

2.2.3 Project elements must be possible to construct using the supplied tools and equipment.

2.2.4 The competitor will be required to perform a range of tasks both psychomotor and cognitive to produce completed components that are manufactured within the sheet metal working industries of all countries.

### **2.3 Project development and implementation procedure**

2.3.1 Experts, Technical Delegates, Jury Presidents, Shopmasters and other associated or invited people will use the WorldSkills Discussion Forums to communicate, collaborate and co-ordinate the development of the Test Project and the overall development of this skill category for the WorldSkills Competition. The address for the forum for this skill category is [http://www.worldskills.org/members/forums/forum\\_14/index.php](http://www.worldskills.org/members/forums/forum_14/index.php). The Chief Expert (or an expert nominated by the Chief Expert) will be moderator for this forum.

2.3.2 Countries will be grouped into design teams and develop projects to be offered for selection at the time of the event.

2.3.3 Teams are:

- A - Sweden / Canada / Netherlands
- B - Taiwan / New Zealand / Finland
- C - France / Korea / Switzerland
- D - Ireland / Japan / New Zealand

2.3.4 Any instructions to candidates should be provided in the format as per the Instruction Sheet (refer Appendices).

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### **3. SECTION 3 - SKILL MANAGEMENT PROCEDURES (SM)**

#### **3.1 Documents required**

- 3.1.1 The documents required are:
- Technical Description – Skill 14 Sheet Metal Work
  - (WorldSkills) Competition Rules
  - Health and Safety documents
  - QAMS – all documents
  - Any other documents referred to in the documents listed above.
- 3.1.2 While it is understood that the Chief Expert will have a copy of these documents in his/her own language, there shall also be a complete set in the language identified as that taking precedence.
- 3.1.3 The Chief Expert is expected to have a sound knowledge of the requirements and procedures specified in the documentation.
- 3.1.4 The Jury President is expected to have a thorough knowledge and understanding of the requirements and procedures specified in the documentation.

#### **3.2 Pre-Competition responsibilities**

- 3.2.1 In the period between one Worldskills Competition and the next, the elected Chief Expert is responsible to ensure that the requirements of Section 2 – Project Design Criteria are complied with.

#### **3.3 Skill Management procedures for the Chief Experts prior to and during the Competition**

- 3.3.1 The procedures specified below must be adhered to.
- 3.3.2 On arrival at the Competition site for the first time, the Chief Expert must:
- Welcome the experts and ensure introductions are made
  - Inform them of their duties and responsibilities in terms of the Competition Rules and Standing Orders
  - Ensure that the project is endorsed by all the experts and that a copy is signed by all the experts
- 3.3.3 The Chief Expert will then divide the experts into teams for the following activities:
- Verify that the material on site is appropriate and sufficient
  - Verify again that the quantities of material as specified on the material list is accurate
  - Develop a program for the competitors to complete the modules
  - Develop timetables for activities
  - Set up equipment
  - Confirm that the layout, work areas and equipment are in accordance with the workshop setup requirements
  - Confirm that all machinery/equipment is in a safe working order

- Confirm that all workstations/machinery/equipment are in accordance with the plan, and that they are numbered
  - Confirm that there is sufficient illumination
  - Confirm that there is sufficient space for the competitors to work efficiently
  - Confirm that the barriers are far enough removed from the competitors to ensure that there will be no interference, and if they are not, set up a roster among the experts to police the area during the Competition
  - If necessary, set up duty rosters for activities during the Competition – e.g. keeping watch during lunch, preventing access of unauthorised persons, etc
- 3.3.4 The Chief Expert will then divide the experts into teams for purpose of marking and setting up marking schedules in accordance with the requirements of Subsection 1.7.
- 3.3.5 Suggestions and comments for the revision and improvement of the Technical Description are to be provided to the Deputy Chief Expert in writing. The Deputy Chief Expert will reduce the information to a single typed document ready for discussion by all experts. Prior to leaving the Competition site, the Chief Expert, the Deputy Chief Expert and the Jury President will facilitate the discussion and revision of the Technical Description. Also refer paragraph 3.3.12.
- 3.3.6 At any time that a unanimous decision is not achieved within a reasonable time, the Chief Expert will put the matter under discussion to the vote. A majority will be 50% of the experts present plus one. This decision will be final. In the event that an expert is absent at the time that the vote takes place, he/she has the right to be informed of the decision but the matter will not be raised again or voted upon again. The exception to this majority rule will be in the case of approval of the changes to the Technical Description, where the majority of 80% is required.
- 3.3.7 In the event that an extension of time is requested for the Competition to exceed 22 hours, the matter must be discussed with the Jury President. All possible alternative solutions must be investigated before approval of an extension of time is requested, or will be approved.
- 3.3.8 Prior to the end of the Competition, the Jury President will facilitate the selection of the Chief Expert and Deputy Chief Expert for the next WorldSkills Competition.
- 3.3.9 Experts are eligible for selection as a Chief Expert if they:
- Can speak English
  - Have attended the WorldSkills Competition at least twice before (if less than 4 experts have been to the WorldSkills Competition before, this criteria may be relaxed at the discretion of the Jury President)
  - Demonstrate a high degree of expertise in the skill
  - Demonstrate leadership qualities.
  - Are competent using a computer and the Internet – specifically to facilitate the Discussion Forum for their skill category.
- 3.3.10 The process by which selection will take place is by secret ballot and is as follows:
- Each expert present will list their choice of three experts in order of preference
  - The Jury President will allocate a score of three (3) points to each experts first preference, two (2) points to the second preference and one (1) point to the third preference
  - The Jury President will then calculate total scores and announce the three highest scoring experts
  - The expert with the highest score will be appointed Chief Expert for the next WorldSkills Competition
  - If the first choice cannot attend, then the second choice will be Chief Expert

- If the first and second choice cannot attend, then the third choice will attend
- If none of the choices can attend, then the jury president will appoint, or facilitate the appointment of a Chief Expert
- The names of the selected experts will be entered into the provided documentation and signed by the Jury President and returned to the WorldSkills Secretariat.

- 3.3.11 Changes to the method of Competition design or suggestions offered for the next Competition design process or tasks must be written down and signed by 80% of the experts and included in Subsection 2.3.
- 3.3.12 The Deputy Chief Expert's primary role is to ensure that the Technical Description is updated to reflect the technological advances of the skill category and include overall improvements for the preparation and running of the Competition. He/she will ensure that all changes to the Technical Description are entered, that all experts sign it, and that it is delivered to the WorldSkills Secretariat as a hard copy and digitally.
- 3.3.13 The Deputy Chief Expert also assists in the distribution and collection of the QAMS Audit Questionnaires and assists the Chief Expert where necessary.

### **3.4 Competition procedures**

- 3.4.1 The project will be worked on over all four days of the Competition (project organised by tasks, sections or modules).
- 3.4.2 Each module/task/section will be completed on the assigned day so that progressive marking can take place. Progressive results are to be available each day via a PowerPoint presentation or similar.
- 3.4.3 Prior to the start of the Competition, each competitor will receive a detailed timetable reflecting the timing for completion of the project tasks, sections or modules.
- 3.4.4 Competitors will have 2 half days to become familiar with material, equipment and processes. Where processes are particularly difficult, a subject matter expert will be available to demonstrate the process and the competitors will be given the opportunity to practice.
- 3.4.5 The competitors will be given all Competition documents including the marking criteria 1 hour prior to the commencement of the Competition so that they may study the requirements.
- 3.4.6 At no time during the Competition may the expert from the same country of origin as the competitor be involved in any discussion without another expert present or without permission from the Chief Expert.
- 3.4.7 Prior to the start of the competition, each toolbox is to be checked by the experts for any specialist tools that might favour the competitor in question. These tools may be put in the centre area for common use.
- 3.4.8 Experts and competitors who continually fail to abide by the Technical Description and Competition Rules may be temporarily or permanently removed from the Competition.

### **3.5 Competition safety requirements**

- 3.5.1 Policies and procedures specified within the following documentation will be adhered to or followed at all times.
- Health and Safety Policy – General Requirements
  - Health and Safety Policy – Skill Specific
  - Procedure for Safety Training
  - Safety Training Development Flowchart
  - Host Country Health and Safety Requirements
  - Medical Assistance Request Procedure
  - Accident Report Form
- 3.5.2 After having received training and briefing, the Chief Expert will provide the experts, competitors and personnel for whom he has responsibility with the information and training required to ensure a safe Competition in accordance with the requirements of the documentation specified in paragraph 3.5.1 above, and taking into account any of the specified requirements identified in Subsection 3.6 below.
- 3.5.3 The Chief Expert will ensure that all experts, competitors and personnel for whom he has responsibility complete and sign the Confirmation of Receipt of Training Form (refer Appendices) on completion of the training session.
- 3.5.4 The Chief Expert will countersign these forms, and keep them secure until the end of the Competition at which time they will be returned to the Quality Auditor for the Competition.
- 3.5.5 The Chief Expert will additionally task the experts with the responsibility of ensuring that all experts, competitors, and other personnel comply with the safety requirements for the skill category and Competition site.
- 3.5.6 The Chief Expert will receive nominations and appoint a safety officer whose responsibility will be to carry out the tasks specified in the Safety Checklist (refer Appendices).
- 3.5.7 Work clothes must comply with relevant codes. If the host country has any specific codes that are to be in place during the Competition, then these must be made known to the competitors at least 6 months prior.
- 3.5.8 All machinery and/or equipment must comply with the safety requirements of the host country.
- 3.5.9 Competitors must keep their work area clear of obstacles and their floor area clean of any material, equipment or items likely to cause someone to trip, slip or fall.
- 3.5.10 Failure by the competitor to comply with safety directions or instructions may incur loss of marks for safety. Continuous unsafe practice may result in competitors being temporarily or permanently removed from the Competition.

### **3.6 Skill specific safety requirements**

- 3.6.1 All competitors must use safety glasses when using any hand, power or machine tools or equipment likely to cause or create chips or fragments that may injure the eyes.
- 3.6.2 A first-aid kit must be available throughout the Competition.

- 3.6.3 Experts will use the appropriate personal safety equipment when inspecting, checking or working with a competitor's project.

### **3.7 Judging procedural requirements**

- 3.7.1 The experts that attend the Competition will be divided into marking groups.
- 3.7.2 Every completed module/task/section will be marked on the same day in which it was completed.
- 3.7.3 To ensure transparency, each competitor is provided the same evaluation sheet as used by the experts.
- 3.7.4 The experts agree that a majority vote is needed to:
- Change scoring system (within limits specified in the Technical Description)
  - Change Competition sequence or content
  - Agree on a solution for disputes concerning points awarded etc.

### **3.8 Honesty, fairness and transparency**

- 3.8.1 The competitors that attend the WorldSkills Competition have the right to expect fair and honest treatment during the Competition in terms of the following:
- Instructions that are clear and unambiguous
  - Marking schedules that provide no advantage to an opposing competitor
  - All necessary equipment and material specified within the skill documentation that are required to complete the Competition
  - The assistance necessary from judges and officials to ensure that he is able to complete the project. (The assistance deemed necessary will be provided equally and at the same time to all competitors present)
  - No undue interference by officials or spectators that may hinder them in the completion of their project
- 3.8.2 Every competitor has the right to expect and demand that no opposing competitors will receive undue or unfair assistance or intervention that may provide that opposing competitor with an unfair advantage.
- 3.8.3 All officials and judges present on the Competition site are expected to ensure that paragraphs 3.8.1 and 3.8.2 above are complied with and maintained.
- 3.8.4 It is the responsibility of the Chief Expert or his Deputy to ensure that all competitors, interpreters, officials and judges comply with and maintain the integrity of the Competition, and additionally ensure that all necessary steps are taken to ensure that:
- Translations and any interpretation to a particular competitor does not advantage that competitor
  - Outside influences do not unduly improve or decrease competitors' abilities to provide a worthy performance.
- 3.8.5 A briefing will be provided to all experts and competitors on the requirements for integrity during the Competition.

- 3.8.6 Additionally, the Chief Expert is expected to identify these and any other factors that may exist on the Competition site that may result in the contravention of paragraphs 3.8.1 and 3.8.2 above, and reduce them to a checklist for continuous reference.
- 3.8.7 In the event that any competitor, judge, official, observer or competitor compatriot is found to be attempting to gain or provide assistance in any form that may result in an unfair advantage, the Chief Expert is to immediately refer the matter to the Jury President.
- 3.8.8 The Chief Expert will receive nominations and appoint a Security Officer whose responsibility it will be to ensure that these requirements are carried out.
- 3.8.9 It will be explained to all experts and competitors that nothing is to come in or out of the site unless specified by the Chief Expert as being allowed after being briefed on this topic.
- 3.8.10 Security checks will be carried out each day on experts and competitors (by experts and competitors) upon entry and exit to the site.

### **3.9 Information policy**

- 3.9.1 TBC

## **4. SECTION 4 - WORKSHOP SETUP (WS)**

### **4.1 Materials**

- 4.1.1 Sheet metal 1mm with matte paint finish or zinc coating for developments and layout marking.
- 4.1.2 Sheet metal for parts can range from 0.6 to 3 mm:
- Mild steel sheet 1203, CRCA thickness 0.6 to 3 mm
  - Stainless steel 304 2B finish thickness 1.0 to 2 mm
  - Aluminium sheet thickness 2.0 to 3 mm
  - Plain galvanized iron 0.6 to 1 mm
- 4.1.3 Plexi glass 200 x 200 x 2 mm
- 4.1.4 Rolled hollow sections in mild steel:
- Flat bar, 20x3 / 25x3 / 32x4 / 40x5
  - Angle iron 25x25x3 / 25x25x4 / 30x30x4 / 35x35x4 / 40x40x5
  - Channel 35x10 / 40x10 / 50x12
  - Round steel wire 4 and 5 mm diameter
- 4.1.5 Fastenings:
- Solid / Pop rivets
  - Nut inserts M6
  - Screws M4 up to M10 x 20 mm long
  - Nuts M4 to M10
  - Adhesives
- 4.1.6 Welding consumables:
- MIG/MAG wire 0.6 to 0.9 mm
  - OAW welding wire 1.0 to 2 mm
  - OAW brazing wire 1.6 mm
  - GTAW aluminium welding wire 1.2 to 2.4 mm
  - GTAW stainless steel welding wire 1.2 to 1.6 mm

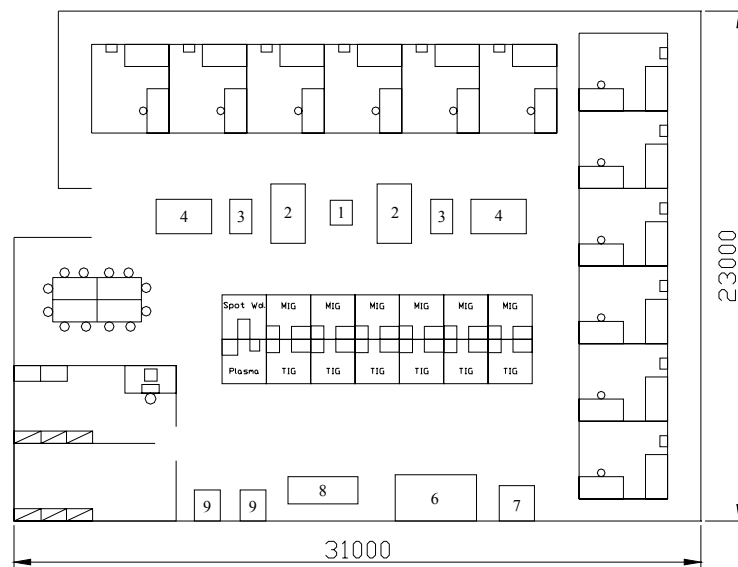
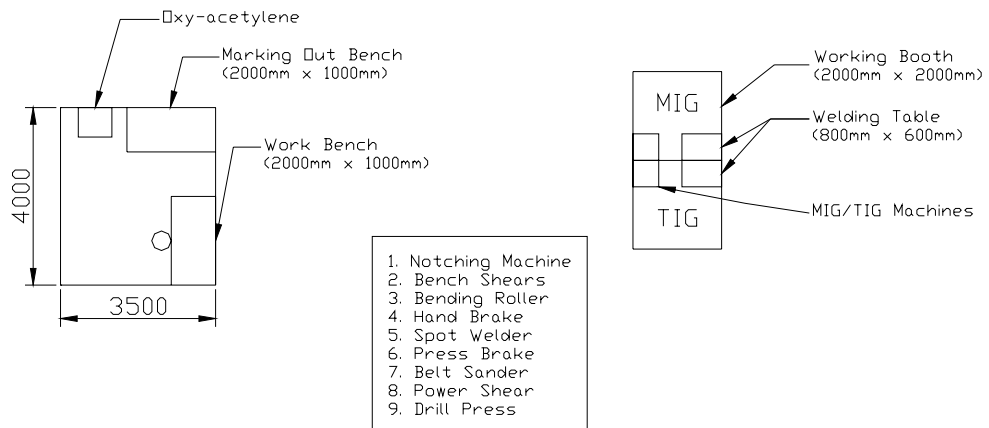
### **4.2 Workshop installations**

- 4.2.1 Each competitor will have a work area that should provide enough space to work in (nominally 3.5 m x 4 m).
- 4.2.2 The general layout of the workshop venue will be as in the diagram in Subsection 4.3, 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.
- 4.2.3 The layout should be designed for public access and maintain equal exposure of visitors to each competitor.
- 4.2.4 The following machines will be made available for all competitors:
- |  |                     |
|--|---------------------|
| 1. Surface plate bench 1000 x 1000 x 20 mm | 1 for 2 competitors |
|--|---------------------|

- |     |  |                        |
|-----|--|------------------------|
| 2.  | GTAW / WIG / TIG welding machine                               | 1 for 2 competitors    |
| 3.  | GMAW / MIG-MAG welding machine                                 | 1 for 2 competitors    |
| 4.  | Power guillotine shears  | 1 for all competitors  |
| 5.  | Folding machine (box and pan brake, 2mm capacity)              | 1 for 4 competitors    |
| 6.  | 60mm rolls with grooves (2 mm capacity)                        | 1 for 4 competitors    |
| 7.  | Spot welding machine   | 2 for all competitors  |
| 8.  | Drilling machine (drill press)                                 | 1 for 5 competitors    |
| 9.  | Level shears (bench knife, bench shears)                       | 1 for 4 competitors    |
| 10. | Floor pedestal grinder   | 1 for all competitors  |
| 11. | Belt sander (linisher)   | 1 for all competitors  |
| 12. | Machine vice   | 1 per Drilling Machine |
| 13. | Forming bar 80 - 100 mm curvature (rail)                       | 1 per 3 competitors    |
| 14. | Plasma cutter 4 mm cap, radius bars, dragtips                  | 1 for all competitors  |
| 15. | Universal swaging (turning) machine – manual                   | 1 for all competitors  |
| 16. | Stakes (must be in good condition, free from nicks and smooth) |                        |
|     | • Funnel   | 2 for all competitors  |
|     | • Knife  | 2 for all competitors  |
|     | • Round  | 2 for all competitors  |
|     | • Beak iron  | 2 for all competitors  |
|     | • Anvil  | 1 for 3-4 competitors  |
| 17. | Press brake - 2000 mm plus tooling 25 tonne minimum            | 1 for all competitors  |
| 18. | Notching machine, angle variable, 100 x 100 mm, 90°            | 2 for all competitors  |
| 19. | Angular cut-off saw  | 1 for all competitors  |
- 4.2.5 The following equipment will be made available to each competitor:
- |    |  |                  |
|----|--|------------------|
| 1. | Marking-out bench 2000 x 1000 x 800 mm | 1 per competitor |
| 2. | Workbench 2000 x 900 x 800 mm          | 1 per competitor |
| 3. | Gas welding installation               | 1 per competitor |
| 4. | Straightening plate 600 x 800 x 10mm   | 1 per competitor |
| 5. | Vice                                   | 1 per competitor |
| 6. | Stool                                  | 1 per competitor |
| 7. | Electrical connection                  | 1 per competitor |
- 4.2.6 Equipment supplied for marking:
- |    |                            |           |
|----|----------------------------|-----------|
| 1. | Surfaced inspection table  | 1 only    |
| 2. | Set of 3mm number punches  | 1 only    |
| 3. | Height gauge 1000 mm       | 1 only    |
| 4. | Vernier caliper 1000 mm    | 1 only    |
| 5. | Straight edges 150/1000 mm | 1 of each |
| 6. | Rule 1000mm                | 1 only    |
- 4.2.7 The competitor must bring the remaining tools in a toolbox: (recommended list)
- 1 aluminium hammer
  - 1 pair of gas welding goggles
  - 1 hammer 300 g
  - 1 hammer 500 g
  - 1 wooden hammer
  - 1 stretching hammer
  - 1 hollowing hammer

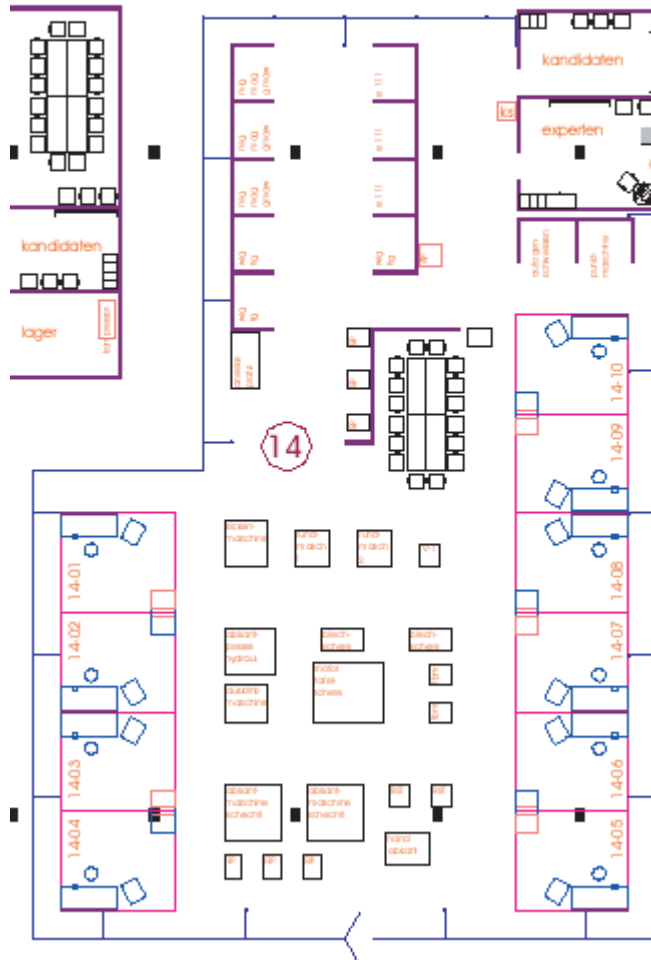
- 1 planishing hammer
- 1 rubber or plastic soft hammer
- 1 flat file
- 1 half-round file
- 1 round file
- 1 wire cutter
- 4 hand vices (vice grips)
- 4 C clamp vice grips
- 4 flat jaw vice grips
- 2 hand grooving tools (8 and 12 mm)
- 1-3 sheet metal dollies
- 1 aviation snips right
- 1 aviation snips left
- 1 gilbows right
- 1 gilbows left
- 1 pop riveter
- 1 electric hand shears
- 1 electric drill
- 1 electric disk sander (cup brush)
- 1 jigsaw c/w stainless and aluminium blades
- 1 hacksaw
- 1 wire brush
- 1 screwdriver
- 1 hand brush
- 1 large vernier calipers 250/500 mm
- 1 try-square 700 mm
- 1 plate square
- 1 dividers 500 mm
- 1 scriber 3 rulers 300 / 600 / 1000 mm
- 1 trammel 600 mm minimum
- 1 outside callipers
- 1 inside callipers
- 1 protractor
- 1 flat chisel
- 1 centre punch
- 1 flexible pad grinder
- 1 pair safety gloves
- 1 pair leather gloves
- 1 pair safety shoes
- Plastic film

### 4.3 Sample layout



Please note that this is an example of the layout, and is not definitive.

14 feinblechbau  
sheet metal work  
chaudronnerie



Layout in St Gallen 2003.

Please note: The Infrastructure List provided in this Technical Description is from St Gallen. The Infrastructure List for Helsinki 2005 is available from the WorldSkills website (Document ILXX\_38FI\_OC\_vX.pdf where XX = skill number and vX is version number).

The column 'OC CH Qty' = Organising Committee Switzerland Qty i.e. what was supplied in St Gallen (CH) – the St Gallen Infrastructure List  
 The column 'Tech Desc FI Qty' = Technical Description Finland Qty i.e. what is specified for Helsinki (FI) – not used at the moment/to be completed in Helsinki for Japan Competition  
 The column 'OC FI Qty' = Organising Committee Finland Qty i.e. what is being supplied in Helsinki (FI) – this is available in ILXX\_38FI\_OC\_vX.pdf

## 5. INFRASTRUCTURE LIST

14

Sheet Metal Work

Chaudronnerie

Feinblechbau

Description (EN)	Description (FR)	Beschrieb (DE)	OC CH Qty	Tech Desc FI Qty	OC FI Qty	Type Type	Measures mm Masse mm	Partner	Comments
<b>General installations</b>									
<b>Installations générales</b>									
<b>Allgemeine Einrichtung</b>									
Tables	Tische	Tische	6						
Chairs	Sièges	Stühle	13			grün			
Set office material	Jeu matériel de l'office	Büromaterial-Set	1						
Phone	Telephone	Telefon	0						
Computer	Ordinateur	Computer	1						
Printer b / w	Imprimante b / n	Drucker s/w	1						
Working table	bureau	Schreibtisch	1				1600 x 800		
Chair	Siège	Stuhl	1			grün			
Photocopier	Photocopieuse	Fotokopierer							
File shredder		Fotokopierer Halle 9.1.2							
		Aktenvernichter Halle 9.1.2							
Flipchart / Writer	Flipchart / Stylo-feutre	Flipchart / Schreiber	1						
First Aid Kit	Caisse de premier secours	Erste Hilfe Koffer	1						
Fire extinguisher	Extincteur	Feuerlöscher	1						
Box Competitors	Caisse pour candidats	Garderoben Kandidaten	1x12			11.929	300 x 500 x 380		
Box Experts	Caisse pour experts	Garderoben Experts	1x12			11.929	300 x 500 x 380		
Cloakroom	Vestiaire	Garderobe	1						
Cupboard lockable	Armoire fermer à clé	Schrank abschliessbar	1			C 12			
Clock	Pendule	Wanduhr	1						
Refrigerator	Réfrigérateur	Kühlschrank	1				150 l		
Coffee machine	Cafetière électrique	Kaffeemaschine	1						



per 6 competitors on workbench	par 6 participants sur établi	1 pro 6 Teilin. auf Werkbank	2	88.297	1500 x 800
Table drilling machine	perceuse à colonne	Tischbohrmaschine	2		10
per 6 competitors	par 6 participants	1 pro 6 Teilin.	2		
Twist drill set with machine vice	jeu de forets hélicoïdaux avec étau de machine	Spiralbohrer-Satz mit Maschinenschraubstock	2		1-10
		Anschluss:	2		230 V, 1 kW-Motor
Beading and flanging machine with pairs of rolls	Machine à moulurer et à border avec paires de molettes	Sickenmaschine mit Paar Walzen	1	Prinzing SM 50	
Pair flanging rolls	paire de molettes à border	PaarBördelrolle	9		
Pair closing rolls	paire de molettes à fermer	PaarZulegerolle	1		1-2
Trail roll, size 8	jeu de 8 inserts de moulurage	8er Schweifrolle	1		manuel
		Anschluss:			
Marking and scribing block	poste de traçage, traceur de hauteur	Anreissplatz, Höhenreisser	1		1200 X 800
<b>Welding station</b>	<b>Poste de travail, soudage</b>	<b>Arbeitsplatz Schweißen</b>			
Spot welding machine	Equipement de soudage par points	Punktmaschine	1	OERLIKON DPM 20	400 V, 50 Hz 20 kVA, 60 A träge
		Anschluss:			
Gas welding station	Poste de soudage oxyacétylénique	Autogenschweisplatz	1		
Tongs, welding and cutting equipment, leight, welding wires,	avec pince, équipement de soudage / de coupage	Zange, Schweiß- / Schneidegarnitur,			
	allume-gaz, baguettes de soudure	Anzünder, Schweißdrähte			
welding rods of unalloyed steel,	électrodes, acier non allié	Schweisstäbe aus unlegiertem Stahl		AWS: A5.2 R 60, DIN G II	
Wire, rod length	fil électrode, longueur électrode	Draht, Stablänge			1000, Ø 1,6
Electrodes	Electrodes	Elektroden			

rutile-coated rod electrodes	électrodes à enrobage rutile	rutil umhüllte Stabelektroden			AWS:A5.1 E6013, DIN: E5131 RR6 ISO: E51 5B 120 24 K	
length	longueur	Länge			350, Ø 2,5	
welding station, per 3 competitors	Équipement de soudage par 3 participants	Schweißmaschine 1 pro 3 Teilnehmer	3		GMAW /MIG /MAG ESABMig C280	
Wire	fil électrode	Draht			0.8	
		Anschluss:			230 V , max. abgesichert	
<b>Manual arc welding</b> per 3 competitors	<b>Soudage manuel à l'arc</b> par 3 participants	<b>Lichtbogenhandschweissen</b> 1 pro 3 Teilnehmer	3		E 111 Magic Wave 1700 (MW1700)	
Welding cable with grips	câble de soudage avec pince	Schweißkabel mit Zange				
Earth/current cables	câble de masse / câble électrique	Massekabel/Stromkabel				
		Anschluss:			230 V , max. abgesichert	
welding station per 3 competitors	Équipement de soudage par 3 participants	Schweißmaschine 1 pro 3 Teilnehmer	3		WIG/TIG Magic Wave 1700 (MW1700)	
		Anschluss:			230 V , max. abgesichert	
welding helmets	casque de soudeur	Schweisshelm	8			
Folding machine	Presse plieuse	Abkantmaschine			Schechtl KSV 200	
sheet-metal thickness per 6 competitors	épaisseur de tôle par 6 participants	Blechklicke 1 pro 6 Teilnehmer	2		2	
		Anschluss:			manuel	
hand folding machine with rapid-action clamping system and end piece.	presse plieuse manuelle avec système de serrage rapide et queue arrière	Handabkantmaschine mit Schnellspannsystem und Endstück	1		Schechtl VK 100S	1.5 x 1000
Rounding machine per 12 competitors	cintruse par 12 participants	Rundmaschine pro 12 Teilnehmer	1		Prinzing RM52/103	

Metal-sheet thickness	épaisseur de tôle	Blechkdicke Anschluss:			2, Ø 52 manuel
Rounding machine per 12 competitors	Cintreuse pour 12 participants	Rundmaschine pro 12 Teilnehmer Anschluss:	1	Hylus ROL	Ø 33 manuel
Powered sheet-metal shears	Cisaille guillotine à moteur,	Motor-Tateischere Anschluss:	1	Schechtl SMT 200	2000 x 2.5 400 V, 3 kW-Motor
belt grinding / grinding machine	meuleuse à bande abrasive	Band-/Schleifmaschine Anschluss:	1	VITAX V-1 bsh	400 V, 0.55 kW-Motor
Tube rod with stand	Barre tubulaire à montants	Rohrstange mit Ständer	2		2000
Workshop block, cast iron	Bloc de fonte	Werkstattklotz Gusseisen	1		
Notching machine with adjustable angles	Machine à gruger, angle réglable	Ausklümmmaschine winkelverstellbar	1		220-380V 50 Hz 3 Pasen / 3 kW
Hydraulic folding press incl. Tools	Presse plieuse hydraulique avec outillage	Hydraulische Abkantpresse inkl. Werkzeug Anschluss:	1	V 85	2000, 85 t 400 V, 14 kVA, 3 x 50 A
Surface plate	6 x plaque de dressage	Richtplatte	6		600 x 600 x 20
Plasma arc cutter, cap	équipement de coupage plasma, d'action, pointe	Plasmaschneider Radiusstangen, Spitze Anschluss: Druckluft	1	ESAB CaddyCut ESAB Zirkelreinheit	4 230 V, 16 A 6 bar mit Druckreduzierventil
Nibbler	Grignoteuse	Nibbler	1	200	
Sheet-metal thickness	épaisseur de tôle	Blechkdicke Anschluss:			2 230 V
<b>Pour les experts</b>			<b>Für Experten</b>		



Perspex	Plexiglas	Plexiglas	200 x 200 x 2
Hollow-rolled profiles of construction steel	Profils de laminage en acier de construction	Hohl-Walzprofile aus Baustahl	
Flat material	produits plats	Flachmaterial	20x3, 25x3, 32x4, 40x5
Angular steel	cornières	Winkelisen	25x25x3, 25x25x4, 30x30x4, 35x35x4, 40x40x5, 35x10, 40x10, 50x12
U-profiles	profilés en U	U-Profile	
Steel wire, circular section	Fil d'acier, section circulaire	Stahldraht, Kreisquerschnitt	Ø 5
Rivets	Rivets	Nieten	
Round-head rivets	Rivets à tête ronde	Halbrundkopf-Nieten	3x8 / 4x10
Weld nuts	Ecrus à souder	Schweissmuttern	M4 bis M10
Bolts, long	Vis, longueur	Schrauben, lang	M4 bis M10 20
Nuts	Ecrus	Muttern	M4 bis M10

