



worldskills

04

MECHATRONICS

V1.0 - 10 May 2006

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 10.05.06



Liam Corcoran (LC)
Chairman, Technical Committee
10.05.06

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

1.1 Name and description of skill

- 1.1.1 The name of the skill is Mechatronics
- 1.1.2 The theoretical and practical training of the Mechatronics technician is concerned with the mechanical, hydraulic, pneumatic and electronic equipment in a manufacturing or assembly plant.
- 1.1.3 The Mechatronics technician works mainly in a manufacturing or assembly plant in the design, installation, commissioning and maintenance of software-driven, electronically controlled equipment.
- 1.1.4 Every expert and competitor must know this Technical Description.
- 1.1.5 In the event of any conflict within the Technical Descriptions, the English version will take precedence.
- 1.1.6 Words implying male gender shall automatically imply female gender also.

1.2 Scope of work at WorldSkills Competitions

- 1.2.1 The competitor must be able to:
- Solve logic problems
 - Carry out system design
 - Assemble a machine according to documentation
 - Design a program
 - Connect a machine to its control system
 - Commission the machine to carry out its correct function to solve a series of practical operational problems as set by the experts
 - Document procedures carried out
 - Interpret hardcopy and/or electronic forms of technical documents (e.g. Circuits, displacement-step diagram, sequence instructions etc)
 - Design electrical and pneumatic circuits by hand or by using commercially available software.
- 1.2.2 There will be two competitors per team. The competition may include team and individual events.
- 1.2.3 Expert recommendations for the WorldSkills Competition in Japan 2007: The experts maintain their recommendation to keep teams of two (2) competitors. The recommended age for competitors will remain at 25 in the year of competition to suit the varying vocational training circumstances of all countries involved so as not to exclude a country due to their vocational training setup (this vote was unanimous in favour for both the age limit to remain at 25 and to keep the teams of 2). It was also voted to continue to display at least the top 10 competitors' standing on a daily basis.
- 1.2.4 The total working time for the project will be between 18 and 22 hours.

1.3 Practical work

- 1.3.1 Design - The project will be designed using the industrial components in accordance with specifications. Optimisation may be included in the project.
- 1.3.2 Assembly and Connection - The project is to be assembled using the industrial components in accordance with the instructions and documentation, or own design as per instructions provided at the competition.
- The speed of assembly of known stations will not be a criterion. The assessment of the quality of assembly must reflect industrial standards and professional practice (refer to Professional Practice Agreement as suggested in Appendices – this document is a ‘live’ document and suggestions will be made over the discussion forum leading up to Japan and the final version will be made available to competitors at the competition).
 - If a robotic station is to be introduced to the competition, the robot model/type will be announced as soon as known prior to the competition.
 - Connections are to be made according to instructions and documentation to ensure correct function of the machine. Any circuit diagrams necessary for successful completion of the project are to be included.
- 1.3.3 Commissioning - The machine must be made to function in accordance with the instructions, documentation and professional practices. No deliberate faults are to be introduced.
- Any robot station used for the competition must be adequately guarded to ensure safe operation without limiting the functionality of the robot in any way.
- 1.3.4 Troubleshooting - There may be a series of multiple problem troubleshooting sections, which will draw on a prepared set of faults, preferably with computer-generated random selection immediately prior to their use or a selected group of experts at the competition. These sections may also include the introduction of the principles of Total Productive Maintenance (commonly referred to as TPM or the equivalent) to ensure the machine operation is capable of self-monitoring etc. It may also consist of repairing or replacing faulty components.
- 1.3.5 Information Technology - Tasks must be included to test the competitor's ability to carry out system programming. Documentation produced by competitors and communication may also be included.
- 1.3.6 Optimisation – refers to improving processes to increase the efficiency of the operation of a system.

1.4 Theoretical knowledge

- 1.4.1 Mechanical design - Competitors must be able to understand and design mechanical systems. This must include knowledge of pneumatic and/or hydraulic systems, their standards and their documentation.
- 1.4.2 Circuit design - Competitors must be able to understand and design electrical circuits in machine/controller systems.
- 1.4.3 Industrial controllers - Competitors must have an understanding of the configuration of the industrial controller and how a software program relates to a machine action. They must be able to configure all aspects of their PLC as required and the associated control circuitry for correct operation.

- 1.4.4 Software programming - Competitors must be able to write programs to control a machine, and visualize the process and operation using software.
- 1.4.5 Analytical techniques - Competitors must be able to demonstrate mastery of problem-solving techniques to ensure correct and safe machine operation.

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 All results may be displayed in the competition area as per previous competitions. This will be of the progressive marking for all sections of the competition and will display the current total aggregate result per country/team.
- 1.7.5 All marking will be objective in accordance with the marking scale.
 - Form 5 will be used for the submission of all objective task marks and Form 6 will be required for the submission of final marks.
 - Marking is to be entered after each section has been completed, and a program has been developed for computer calculation after time and task data has been entered.
 - A sample marking scale spreadsheet will be provided digitally to the World Skills secretariat as an example of how time marks are calculated with the technical description.
 - The spreadsheet used for the competition is to be developed by the Project Design team and issued at least 2 months prior to the competition on the Discussion forum for feedback.
 - We will continue to use a percentage of total marks to come up with the mark for Form 5.
- 1.7.6 Experts are to complete a score sheet for each section completed, for each team and will be required to sign this as verification of their assessment (a minimum of 3 experts).
- 1.7.7 Marks will vary according to the Marking Scale as defined for the competition, but will align to the following ranges within the skill groups as defined in paragraph 1.7.8 below.

- 1.7.8 Assessment criteria
Section/ Item/ Maximum Points
A/ Design/ 5 – 15 points
B/ Assembly/ 10 – 15 points
C/ Programming/ 30 – 40 points
D/ Commissioning/ 15 – 20 points
E/ Troubleshooting/ 15 – 25 points
F/ Optimising & reliability/ 5 – 15 points
- 1.7.9 Conversion from the 0 – 100 scale to the 400 - 600 scale will be performed by the WorldSkills Competition Information System (CIS).
- 1.7.10 In the event of any discrepancies over the marking scale, the English language version will always take precedence.

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.
- Be supplied to the competition site for expert teams to develop the project with fully functional equipment. This is to allow the experts to form a consistent evaluation of the tasks with the working models.
- Be supplied with documentation clarifying the operation of special or new equipment for the experts to finalise project design.
- Be supplied with a library of photos or drawings to clarify specific requirements of the tasks.

2.2 **Design requirements**

2.2.1 Refer Subsection 2.3.

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_04/index.php. The Chief Expert (or an expert nominated by the Chief Expert) will be moderator for this forum.

2.3.2 All experts are encouraged to provide suggestions to the Chief Expert or the Festo MPS Product Manager for sections of the competition to be designed in liaison with Festo.

- Elected Chief Expert - 1. Benoit Maisonneuve CA, 2. Andy Heath AU, 3. Nils Karlsson SE

2.3.3 Information policy – refer to Subsection 3.9.

2.3.4 The Chief Expert will be responsible to ensure that:

- The circuit designs are accurate and complete
- There are no installation requirements that cannot be completed
- The tasks can be completed in the prescribed time
- Proper function is achievable
- The material/equipment list is accurate
- Competitor instructions are kept to a minimum of text
- The project is complete in all aspects. This part of the preparation must be completed six (6) months prior to the WorldSkills competition

- 2.3.5 All equipment provided for the competition is to be fully tested for reliability and functionality to ensure that the equipment does not create any additional problems at the competition, such as unreliability, incorrect/inconsistent function or confusion for the competitors in its operation. If equipment is considered to be untested sufficiently prior to the competition it is up to the Chief Expert or person designated by the Chief Expert to remove it or propose an alternative.
- 2.3.6 The Chief Expert will ensure that all required communication occurs between all experts and participating countries. An FAQ (Frequently Asked Questions) document/email will be developed in the months leading up to the Competition to ensure that the same answers are provided to everyone. This is to ensure that no country has an unfair advantage. All experts are also to sign a Declaration of Confidentiality document (refer Appendices) before being provided with any details of the competition.

3. SECTION 3 - SKILL MANAGEMENT PROCEDURES (SM)

3.1 Documents required

- 3.1.1 The Chief Expert will have available a current copy of all documents associated with this skill for the Competition.
- 3.1.2 The documents required are:
- Technical Description – Skill 04 Mechatronics
 - (WorldSkills) Competition Rules
 - Health and Safety documents
 - QAMS – all documents
 - Any other documents referred to in the documents listed above.
- 3.1.3 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.
- 3.1.4 The Chief Expert is expected to have a sound knowledge of the requirements and procedures specified in the documentation.
- 3.1.5 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 an agenda 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, French or German
 - 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
 - The Deputy Chief Expert will be selected using the same voting process and is only required to have attended 1 International competition.
- 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 standings 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 a maximum of 8 hours 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 the Competition documents for each task (including the marking criteria) prior to the commencement of that task. They can read the instructions and marking criteria prior to competition time. Afterwards the expert may spend an allotted time to clarify the task to their team. The expert in charge of that day will provide clarification to the competitors if required.
- 3.4.6 At no time (except as specified in 3.4.5) during the Competition may the expert from the same country of origin as the competitor be involved in any discussion without another expert present (who understands the language – only if available) or without permission from the Chief Expert.
- 3.4.7 Experts and competitors who continually fail to abide by the Technical Description and Competition Rules may be temporarily or permanently removed from the Competition.

- 3.4.8 If a task is not completed during competition time, if practical, time may be built into the schedule to allow for each team to commence the next task at a fair and equal position.
- The maximum time allowed to do this shall be decided upon by the expert team and assistance may be provided to achieve this by experts or the Shopmaster, not the expert of the team(s) involved.
 - If some additional time for the team(s) has been allowed and they are still not to the same point, then the competition must be allowed to continue and the team(s) will then need to fulfil the requirements of the previous task in the next one.
- 3.4.9 Experts will be required to complete a feedback form prior to leaving the competition site. This is to enable future improvement to the competition.

3.5 Competition safety requirements

- 3.5.1 Policies and procedures specified within the following documentation will be adhered to 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 Professional Practice. 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 and 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 in accordance to Expert Grouping (refer Appendices).
- 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 Competitors participating in 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 they are 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

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- 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 an 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 no data storage device is to come out of the site unless specified by the Chief Expert as being allowed after being briefed on this topic. A possible exclusion could be a camera that is placed directly into a locker.
- 3.8.10 Security checks will be carried out each day on both experts and competitors upon entry and exit to the site.

3.9 Information policy

- 3.9.1 Information on the competition contents is distributed based on the following two principles:
- “Need to know” – Information is given only to those that need it to perform a task.
 - “Just in time” – Information is given to those that need it just before they need it to perform a task.
- 3.9.2 This information covers everything to do with types of stations, components, assemblies and other equipment and on the tasks to be completed during the competition.
- 3.9.3 Any persons involved in the development of the tasks, testing and shipping of the hardware (as few as possible) are required to sign a Declaration of Confidentiality (refer Appendices) before being entrusted with information concerning the competition.

4. WS – WORKSHOP SETUP

4.1 Materials

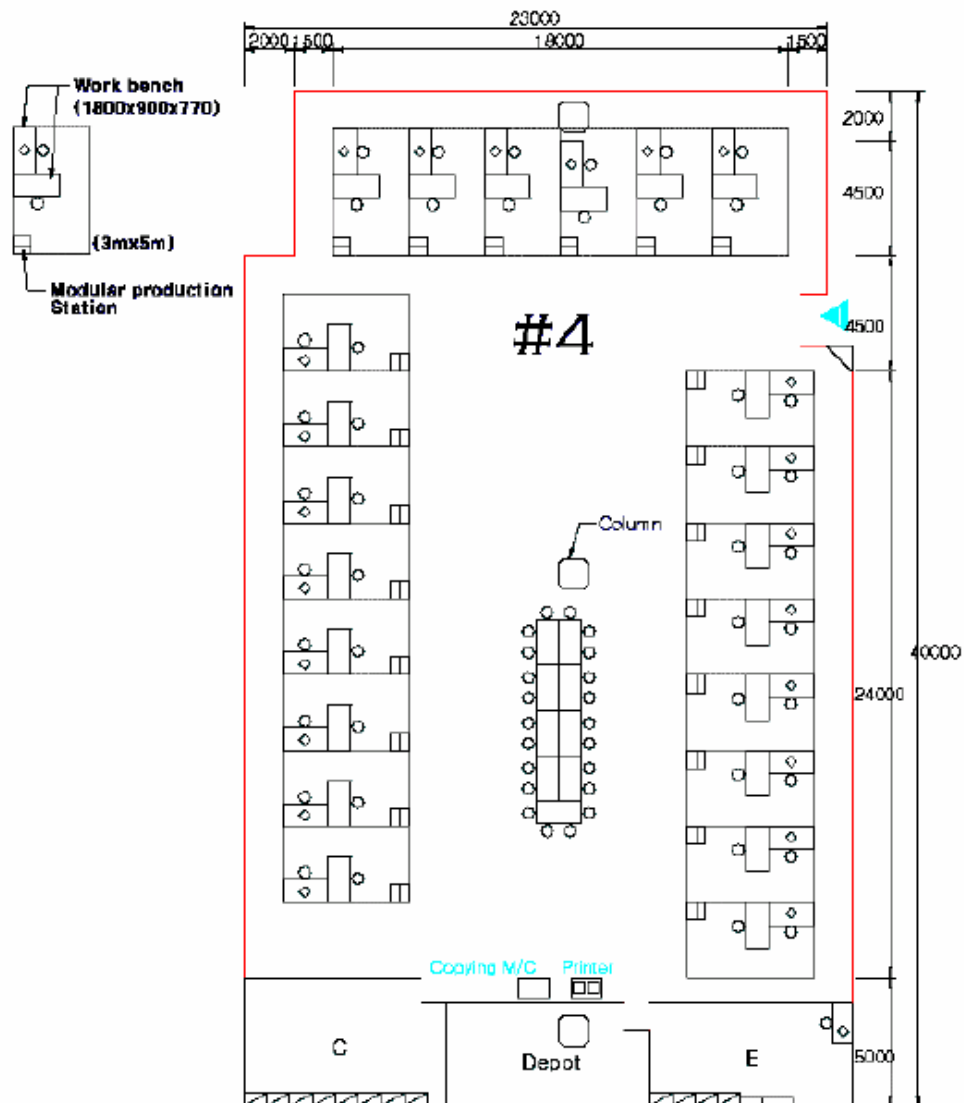
- 4.1.1 A general description of the previous test work, including a sample of the competition schedule and last project is to be made available on the Mechatronics website if available or from the official WorldSkills website for the next competition. All participating teams are to be advised of their location by the Chief Expert.
- 4.1.2 PLC specifications and quantity are to be posted on the Discussion Forum at least 6 months before the competition by the Chief Expert.
- Pre-competition on-site training will be provided and shall be a maximum of 8 hours.
 - Software for the PLC must be provided by the competitor team.
 - PLC spare parts must be provided by the competitor team
- 4.1.3 All work is to be carried out using working materials that are to be provided to the competitors.
- 4.1.4 All wiring terminations and cable ties will be provided by the sponsor.
- 4.1.5 Only equipment provided by the sponsor can be mounted on the top of the work stations.
- 4.1.6 All other consumable equipment required for the competition such as spare components etc is to be provided by the sponsor.

4.2 Workshop installations

- 4.2.1 Each team of competitors will have a work area that should provide enough space to work in teams of two (nominally 5m x 3m).
- 4.2.2 The general layout of the workshop venue will be as in the diagram in Section 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 teams 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 competitor's work area dimension is to be a minimum of 5 x 3 metres (see layout). In addition to the competitor's work areas and administration section, an equipment store needs to be centrally located (3m x 3m) for each team. An area for storage of competitor's toolboxes must also be provided (3m x 3m) to ensure they are not left in visible sight to spectators and take away from the professional look of the stand.
- 4.2.4 The layout should be designed for public access and maintain equal exposure of visitors to each competing team.
- 4.2.5 The competitor's area must be at least 0.5 metres from the visitor barrier.
- 4.2.6 A soundproof conference room for experts must be provided for up to 30 people and must have telephone and Internet facilities.
- 4.2.7 Two computers with standard English Windows operating system with "QWERTY" keyboard and printing facilities (colour & B/W) must be provided for experts .

- 4.2.8 The following equipment will be made available to each team of competitors at each workstation:
- Tables for equipment plus working surface
 - A computer with standard English Windows operating system with “QWERTY” keyboard.
- 4.2.9 Tools for competitors
- Any commercially available tools may be used. This is subject to approval by the Safety Officer, but must not take away from commonly used "tools of the trade" as used by the competitors in their every day job.
 - Competitors must supply their own tools.
 - Competitors must bring all software required to program their PLC.
 - It is the responsibility of the team's expert to check software compatibility with the PC's to be supplied by the host country.
 - The team is responsible for the provision of connectors, adaptors, plugs, and interfaces suitable for the host country and for the PLC to any station.
- 4.2.10 Refer to Section 5 for the Infrastructure List.

4.3 Sample layout



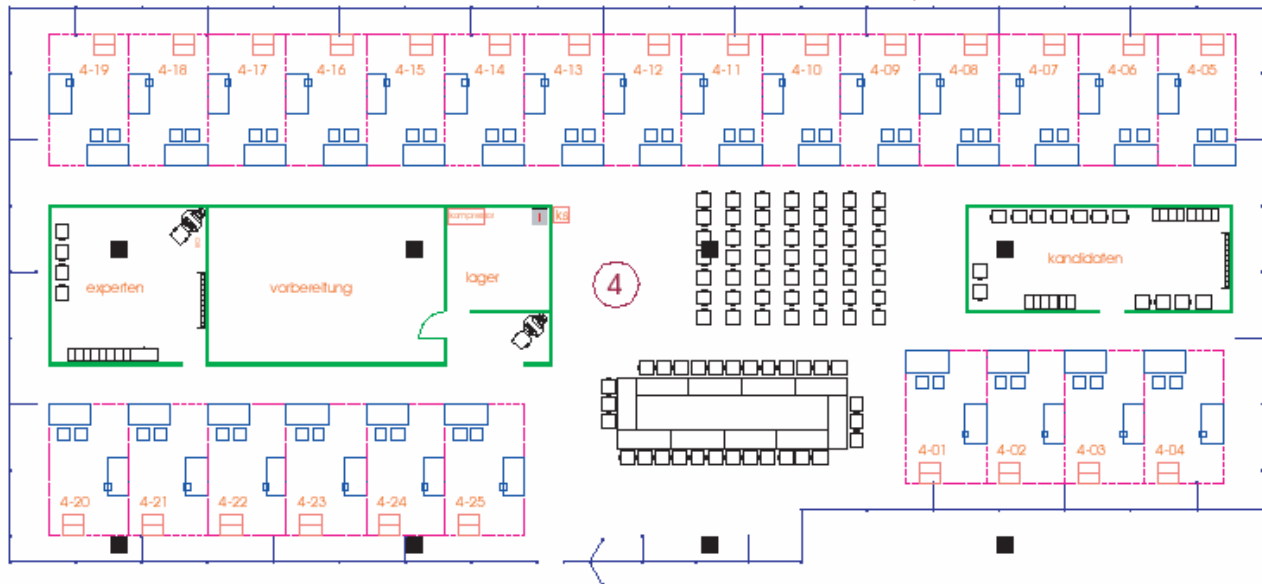
Please note that this is an example of the layout, and is not definitive.

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mechatroniker 4



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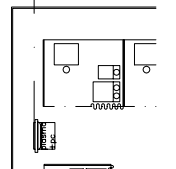
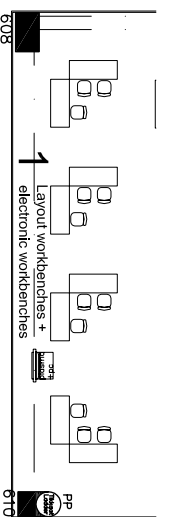
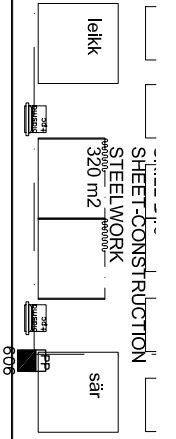
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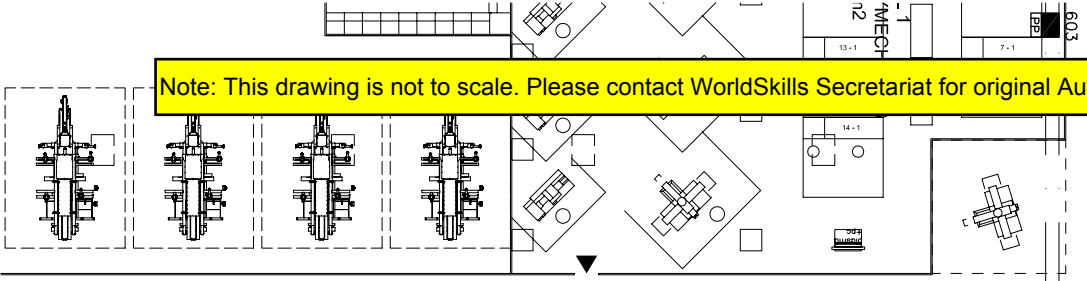
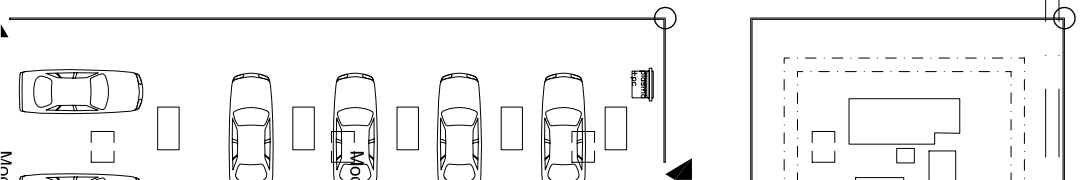
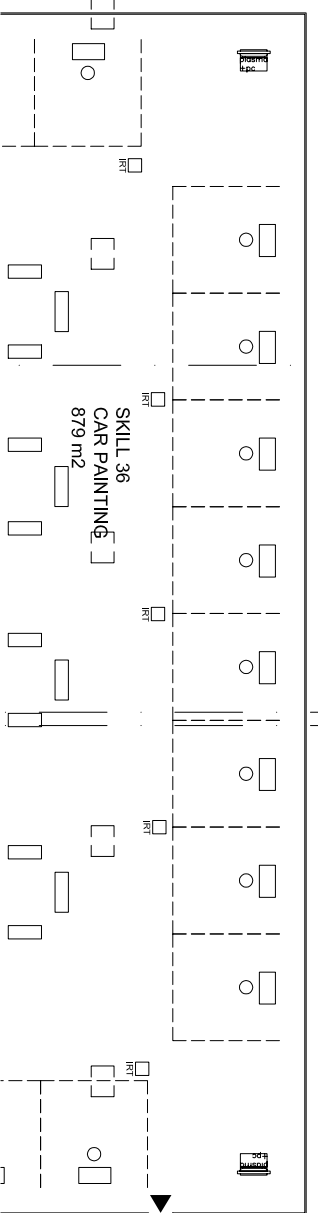
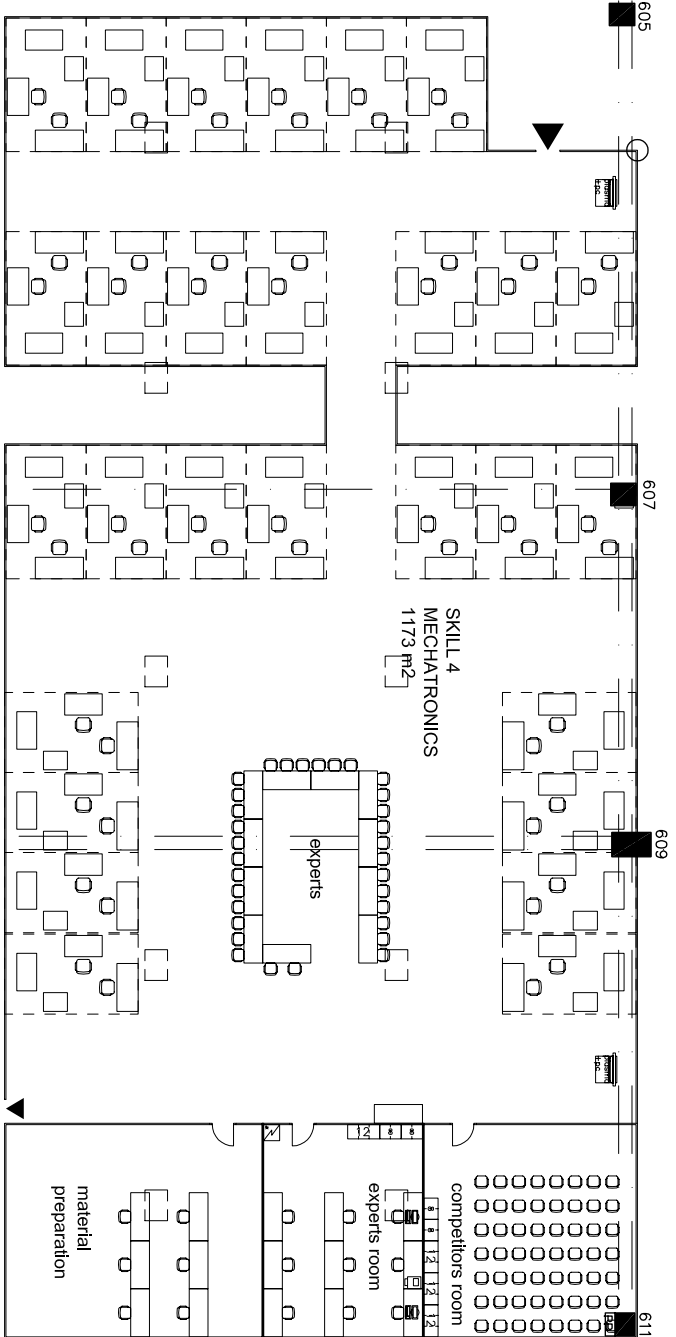
Layout in St Gallen 2003.



SKILLS 2005

Skill 4
1:200
2.5.2005



Note: This drawing is not to scale. Please contact WorldSkills Secretariat for original AutoCAD file.



	WorldSkills Competition	Berufsweltmeisterschaft	Concours Mondial des Métiers	
	Shizuoka, Japan			
	14 – 21 November, 2007			

5. INFRASTRUCTURE LIST

04 Mechatronics

Mécatronique



Mechatronik

Description (EN)	Description (FR)	Beschrieb (DE)	TD Qty	OC Qty	JP Type Type	Measures mm Mesures mm Masse mm	Partner	Comments
General installations	Installations générales	Allgemeine Einrichtung					Partner	
Tables	Tables	Tische	10		B	2000 x 700		
Chairs	Sièges	Stühle	30		grün			
Set office material	Jeu matériel de l'office	Büromaterial-Set	1					
Phone	Telephone	Telefon	1					
Computer	Ordinateur	Computer	2					
Printer b / w	Imprimante b / n	Drucker s/w	1					
Working table	bureau	Schreibtisch	2		DL 22.052	1600 x 800		
Chair	Siège	Stuhl	4		grün			
Colour Printer			1					
Digital camera								
Flipchart / Writer	Flipchart / Stylo-feutre	Flipchart / Schreiber	2					
First Aid Kit	Caisse de premier secours	Erste Hilfe Koffer	1					
Fire extinguisher	Extincteur	Feuerlöscher	2					
Box Competitors	Caisse pour candidats	Garderoben Kandidaten	1			300 x 500 x 380		Lockers
Box Experts	Caisse pour experts	Garderoben Experten	1			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					



Cleaning Set	Set de ménage	Reinigungsmaterial-Set	-			
Washroom	Lavabos	Waschgelegenheit	-			
Floor carpeted	Plancher du béton	Bodenbelag Beton	-			
Rubbish bins			10			
Hand broom and shovel			5			
Technical descriptions	Descriptions techniques	Technische Beschriebe				Partner
Each team has to bring the following PLC boards ready assembled.	Chaque équipe doit apporter les cartes SPC ci-après, entièrement montées.	Jedes Team muss folgende SPS Boards fertig montiert mitbringen.				
PLC boards with:	cartes SPC avec :	SPS Boards mit:	2			
digital inputs:	entrées numériques	digitale Eingänge:	16		24 VDC	
digital outputs:	sorties numériques	digitale Ausgänge:	16		24 VDC, 400 mA	
Connections: cable (digital)	raccordement : câble (numér.)	Anschluss: Kabel (digital)	2	SysLink		
1 PLC board with:	1 carte SPC avec :	SPS Board mit:	1			
digital inputs:	entrées numériques	digitale Eingänge:	16		24 VDC	
digital outputs:	sorties numériques	digitale Ausgänge:	16		24 VDC, 400 mA	
analogue input:	entrée analogique :	analog Eingang:	1		0...10V	
1 analogue output: 0-10V,	sortie analogique :	analog Ausgang:	1		0...10V	
Connections: cable (digital)	raccordement : câble (numérique)	Anschluss: Kabel (digital)	2	SysLink		
	raccordement : 15 points					
Connections 15 pol. (analogue)	(analogique)	Anschluss: 15 polig (analog)	1	Sub-D		
Contact:	Contact :	Kontakt:				Festo Didactic AG, D-73770 Denkendorf, Tel. +49 711 34 67 1346 /Fax +49 711 347 54 1346, e-mail tzi@festo.com
Installation of workstations	Installation des postes de travail	Einrichtung Arbeitsplätze				Partner
Workstation for each team	Plage utile par équipe	Arbeitsbereich / Team			5000 x 3000	

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Connections:	Raccordements :	Anschlüsse:			
Electricity	électrique	Elektrizität			230 V
7 sockets - separately protected	7 prises par poste - protégés individuellement par fusibles	7er-Steckerleiste - einzeln abgesichert	1		
Compressed air	pneumatique	Druckluft			6 bar
Compressed air supply with - Thread - Manifold - filtered, oil-free, min. for each 8 competitors for all workstations	Raccord pneumatique, filetage - Pouce - distributeur pneumatique - air déshuilé, filtré à min. pour 8 participants pour tous les postes de travail	Druckluftanschluss mit Gewinde - Druckluftverteiler - ölfrei gefiltert min. Anschlüsse pro Team	1	FR-8-1/8	1/8" 1m3/min
Workbench	Etabli à revêtement bois massif	Werkbank mit Multiplex-Abdeckung	1	88.297	1500 x 800 40
		Werkbank-Schraubstock mit gehauenen Backen Backenbreite		AXM.160.000.04	100
Desk	Bureau	Schreibtisch	1	DL 22.052	1600 x 800
swivel chairs	siège de bureau, pivotant	Bürostuhl	2		
Computer	Ordinateur	Computer	1	Pentium 4	
RAM	RAM	RAM			256 MB
hard disk	disque dur	Festplatte			30 GB
network card	carte réseau	Netzwerkkarte			10/100 MB
CD-ROM drive	lecteur CD-ROM	CD-ROM Laufwerk			
Floppy drive	lecteur de disquette	Floppylaufwerk			1.44 MB
Wheel mouse	souris à molette	Wheel-Maus			
Mouse pad	tapis de souris	Mausmatte			
Keyboard, English	Clavier anglais	Tastatur englisch			
Colour screen	Moniteur couleur	Farbmonitor			17"
Windows English	Windows anglais	Windows englisch			

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MPS stations fully equipped	postes MPS complet, avec accessoires	MPS-Stationen komplett mit Zubehör	4		700 x 350 x 900
Rack with storage tray Shelves	Classeur rayons	Boy B 316 mit Ablagen	1 1	14.467	572 x 733 x 760
Stopwatch with lap times	Chronomètre tachymétrique	Stoppuhr mit Rundenzeitmess.	1		
Workshop installations	Equipement d'atelier	Werkstatteinrichtung			Partner
Loudspeaker system with microphone, amplifier and boxes	Installation de haut-parleur avec microphone, amplificateur et enceintes	Lautsprecheranlage kompl. Mit Mikrofon, Verstärker und Boxen	1		
Beamer 3000 Ansl	Beamer 3000 Ansl	Beamer 3000 Ansl	3		
Silver screen	écran de projection	Leinwand	3		
computer for the judges	ordinateur pour experts	Computer für Experten	2		
RAM	RAM	RAM			256 MB
hard disk	disque dur	Festplatte			30 GB
Network card	carte réseau	Netzwerkkarte			10/100 MB
CD-ROM drive	lecteur CD-ROM	CD-ROM Laufwerk			
Floppy drive	lecteur de disquette	Floppylaufwerk			1.44 MB
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Windows English	Windows anglais	Windows englisch			
Storeroom central	Magasin central	Ausrüstlager zentral	1		3000 x 3000
Lighting: FL lamp tables	éclairage à tube fluorescent table	Beleuchtung FL-Leuchte Tische		B	
chairs	siège	Stuhl			
Storeroom, lockable for work preparation	Magasin, fermant à clé, pour travaux de préparation	Lagerraum, abschließbar für Vorbereitungsarbeiten	1		6000 x 8000

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Compressed air	Compresseur	Kompressor	1		
Materials	Consommables	Verbrauchsmaterialien			Partner
Writing material	Fouritures de bureau	Schreibmaterial			
Pencils, eraser, ruler and paper	Crayons, gomme, règle et papier	Bleistifte, Radiergummi, Lineal und Papier			