TECHNICAL DESCRIPTION

Polymechanics/Automation

TD01 v3.0 – WSC2011

WorldSkills International, by a resolution of the Technical Committee and in accordance with the Constitution, the Standing Orders and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

Effective 31.03.10

Liam Corcoran
Technical Committee Chair

1. INTRODUCTION

1.1 Name and description of skill

1.1.1 The name of the skill is Polymechanics/Automation.

1.1.2 Description of skill
Polymechanics technicians carry out technical work in production plants. Professionals such as Mechanical and Maintenance Fitters may be included in the Polymechanics category. Using machining tools, people skilled in polymechanics can produce and install parts for production machinery and equipment. The profession requires skills in logic and automation control and the related basic electrical and circuitry work. Since automation often involves hydraulic and pneumatic components a basic understanding of these technologies is also required.

1.2 Scope of application

1.2.1 Every Expert and Competitor must know this Technical Description.

1.2.2 In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

1.3.1 As this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI - Competition Rules
- WSI - Competition Manual
- WSI - Online resources as indicated in this document
- Host Country - Health and Safety regulations

2. COMPETENCY AND SCOPE OF WORK

The Competition is a demonstration and assessment of the competencies associated with this skill. The Test Project consists of practical work only.

2.1 Competency specification

- Shall demonstrate work procedure and planning
  - be able to plan and produce the selected Test Project
- Shall understand and interpret engineering drawings
  - to extract information assemble and manufacture
- Demonstrate the use of a wide range of engineering materials
  - use a range of different materials to manufacture parts
- Shall be able manufacture parts on a range of general engineering machine tools
  - use the machine tools supplied to manufacture the given parts
- Shall be able to work to a high degree of accuracy using measuring tools
  - to manufacture parts to the specified drawing tolerances
- Demonstrate the use of automation and control systems
  - an understanding of operation of the assembly

- The use of PLC programming using Semen's LOGO 12 inputs / 8 outputs
  - to produce a programme which will control the selected Test Project

- Shall be able to integrate both mechanical and pneumatic/ hydraulic technical automation features
  - to assemble both the manufactured and supplied components

- Demonstrate assembly of manufacture parts

- Shall be able to commission mechanical engineering automation and control systems
  - The selected Test Project becomes operational

- It is recommended that past projects are reviewed as a guide

2.1.1 Theoretical knowledge is required but not tested explicitly.
The theoretical knowledge is limited to that necessary to carry out the practical work.

- Interpretation and practical use of detail and assembly drawings in accordance with ISO A or ISO E standards, depending on the usage in the Competitor's own country.
- A broad general knowledge of mechanical engineering automation and control engineering.
- Application of creativity and innovation in connection with mechanical and technical products or parts of these.
- Knowledge of materials used and of their correct use.

2.1.2 Knowledge of rules and regulations is not examined.

2.2 Practical work

The Competition work consists of practical work, which is based on project, and process orientated thinking and action within the areas of manufacture, assembly, maintenance and control engineering.

The Competitor has to perform the following work independently:

- An installation or part of an installation is constructed, installed and commissioned using manual skills and by working on machines.

All parts must be used by the Competitor in accordance with the working instructions (e.g. drawings in accordance with ISO A or ISO E or, where possible, in an application of the Competitor's own creativity and ability to innovate):

- For the construction of a functional unit, and
- For optimisation through the addition of parts
- The resulting function may be: an operational, mechanical, control engineering, pneumatic, or
- electro mechanical operation.

Possible working methods:

- General manual mechanical work
- Work with conventional, machine tools with digital incremental systems such as turning,
- milling and, drilling
- Surface finish measuring machines
- Operation of a technical measuring system
- Production of new parts to replace "defective components" or making of parts for upgrading the installation
- Assembly and commissioning of the "mechanical and pneumatic/ hydraulic technical automation" features
- Installation and commissioning of the PLC control system and commissioning of the entire production system with debugging own project of the PLC control system. PLC- LOGO 12 inputs / 8 outputs (the PLC that is may change it will depend on the project that has been accepted.
- Pneumatics, hydraulics. PLC control system, PC techniques and Software

- Technical measurement procedures
- Work preparation and planning of the working procedures
- Commissioning, proof of performance and preparation of a log.

3. THE TEST PROJECT

3.1 Format / structure of the Test Project

Test project assessed in stages of both individual and assembled with final commissioning.

Production and assembly	16.0 hours
Pneumatics and Electrical/Programming installation	3.5 hours
Initiation and commissioning	2.5 hours
	Total 22 hours

This is to be a made up of the following assessment criteria

A: Overall function of the installation including technical automation	= 10 marks
B: Primary dimensions / dimensional tolerances	= 40 marks
C: Secondary dimensions	= 12 marks
D: Surface finish Ra	= 05 marks
E: Supplementary material	= 03 marks
F: PLC Programming / Write and function	= 30 marks

3.2 Test Project design requirements

Test Project design requirements are as stated in paragraph 3.1

Materials to be included in the design are as follows:

- All work must be done using the materials and the infrastructure in normal use in the Host Country. An exception is those parts which the project designer has brought with him or which are provided.
- Competitors must be able to work with the materials specified below and must be able to comply with environmental requirements.
- General-purpose carbon steel and structural steel with circular section, and flats NF – metal alloys, circular section, and flats
  - Plastics
  - Adhesives
  - Lubricants and cutting oils
  - Water-miscible coolants
  - Auxiliary Materials

Tolerance range specification

Any tolerance used on the drawing must be ISO format or be supplied.
Suggested range for tolerance grades used in section B and C.

Section	No off	IT Grade
B Primary	6 to 8	IT6 – IT7
	6 to 8	IT8
C Secondary	10	IT9

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 an independent person/s or External Enterprise and must be quality assured by an Expert selected by vote at the previous Competition.

3.3.2 How and where is the Test Project / modules developed
The Test Project / modules are developed by independent person/s within the industry to comply with the Technical Description competencies and marking scheme. This independent person may be located in any part of the world.

3.3.3 When is the Test Project developed
The Test Project is developed and tested no later than 6 months before the Competition.

This is to be presented to a selected Expert for quality assurance for size and practical competence. This process should be completed no later than 6 months before the Competition.

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 validation will occur when it is presented to the Expert group attending the Competition. The presentation is to include a practical demonstration of the completed Test Project's function.

There is to be a majority agreement (minimum = 50% +1) from Experts on the accepted Test Project.

3.6 Test Project selection
The Test Project is selected by the External Enterprise in consultation with the selected quality assurance Expert.

3.7 Test Project circulation
The Test Project is not circulated.

The Test Project is submitted to Secretariat after quality assurance has taken place no later than 6 months before the Competition.

3.8 Test Project coordination (preparation for Competition)
Coordination of the Test Project will be undertaken by:
The Chief Expert and/or Deputy Chief Expert consult with the External Enterprise or independent person. Once the Test Project design is complete the selected quality assurance Expert communicates with the Host Member Workshop Supervisor.

3.9 Test Project change at the Competition
Any changes made to the Test Project will be made by the attending Experts in the preparation days prior to the Competition. These changes are to be by a majority agreement (minimum = 50% +1) of Experts attending the Competition.

3.10 Material or manufacturer specifications

Material specification taken from the Test Project drawings to be supplied by the Host Member.

If specific material or manufacturer specifications are required to allow the Competitor to complete the Test Project and if these can not be supplied by the Host Member then it will be asked of the independent designer to supply and/or source these special items.

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
- Infrastructure Lists
- Other Competition-related information

4.3 Test Projects

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

5. ASSESSMENT

This section describes how the Experts will assess the Test Project / modules. It also specifies the assessment specifications and procedures and requirements for marking.

5.1 Assessment criteria

This section defines the assessment criteria and the number of marks (objective) awarded. The total number of marks for all assessment criteria must be 100.

Section	Criterion	Marks		
		Subjective (if applicable)	Objective	Total
A	Overall function of the installation incl. technical automation		10	10
B	Primary dimensions/Dimensional tolerances		40	40
C	Secondary dimensions		12	12
D	Surface Finish Ra		5	5
E	Supplementary material		3	3
F	PLC Program /Write and function		30	30
	Total =		**100**	**100**

5.2 Subjective marking

Not applicable

5.3 Skill assessment specification

The assessment of Section A is to be objective.

- Marks will be awarded for the correct installation of parts as per drawings Layout
- Marks will be awarded for the neatness and accuracy of the layout of both the Pneumatic piping and Electrical wiring
- Marks will be awarded to the correct assemble of the production assembly

The assessment of Section B and C is to be objective – measured by CMM machine

- The assessment of both the Primary and Secondary manufactured components must conform to International Standards of engineering Fits and Limits and Tolerances of manufactured as in BS XXXX AS 1654 or the comparable International Standards
- Fits and limits / tolerances used in drawing must be in ISO format or copy supplied
- The tolerances used must be of a suitable working tolerance
- Marks will be given only if the tolerance has been achieved
- Section B will have tighter tolerances
- Section C will be based on more general tolerances

The assessment of Section D is to be objective – measured by Surface Finish machine

- The assessment of surface finish must also compile to the International Standards as above.

The assessment of Section E is to be objective

- Marks will be deducted from the total for each of extra material supplied
- 1 mark for the first, 2 for the second and 3 for the third or more parts

The assessment of Section F is to be objective

- Marks will be awarded for the conformity of the PLC
- For the correct functioning of the written and simulated PLC program
- The commissioning function must b as the operational programming as requested in the scheduling operation of the overall Test Project requirements.

5.4 Skill assessment procedures

- The Experts will split into working groups and signed parts of the project to mark, these groups will mark all of the allocated parts for the whole of the competitors
- A timetable will be prepared by the Experts as to when parts must be handed in for marking
- These parts will be marked as and when they are presented completed by the competitor
- An Expert must not mark his competitors components
- Parts must be handed in for marked before assemble
- These teams will be selected by the CE and the DCE
- A mix of experience will be required in the team make up

- The measuring tools which are use will be the same ones that are use to set competitors standards

The marking of the Test Project will take place as follows:

The assessment of section A is to be objective
- This section will be carried out by the Experts against the Objective Marking Form

The assessment of section B and C is to be objective
- The Experts will collectively decide on which parts will be measured by the CMM measuring machine section B (because of the high tolerances involved time permitting)
- This Assessment where possible will be carried out by machine CMM measuring by a specialist operator and recorded on to the Objective Marking Form by the Experts
- Parts form section C may be measured by the CMM and recorded on to the Objective Marking Form by the Experts

The assessment of section D is to be objective
- This will be carried out with the use of a surface measuring machine and measuring by a specialist operator and recorded on to the Objective Marking Form by the Experts

The assessment of section E is to be objective
- This will be carried out by the Experts

6. SKILL-SPECIFIC SAFETY REQUIREMENTS

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

There are no skill-specific safety requirements.

7. MATERIALS & EQUIPMENT

7.1 Infrastructure List

The Infrastructure List lists all equipment, materials and facilities provided by the Host Country.

The Infrastructure List is online (http://www.worldskills.org/infrastructure/).

The Infrastructure List specifies the items & quantities requested by the Experts for the next Competition. The Host Country will progressively update the Infrastructure List specifying the actual quantity, type, brand/model of the items. Host Country supplied items are shown in a separate column.

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

- Additional cutting tools and their bits with him as required.
- Own measuring and testing equipment as required.

7.3 Materials, equipment and tools supplied by Experts

Not applicable.

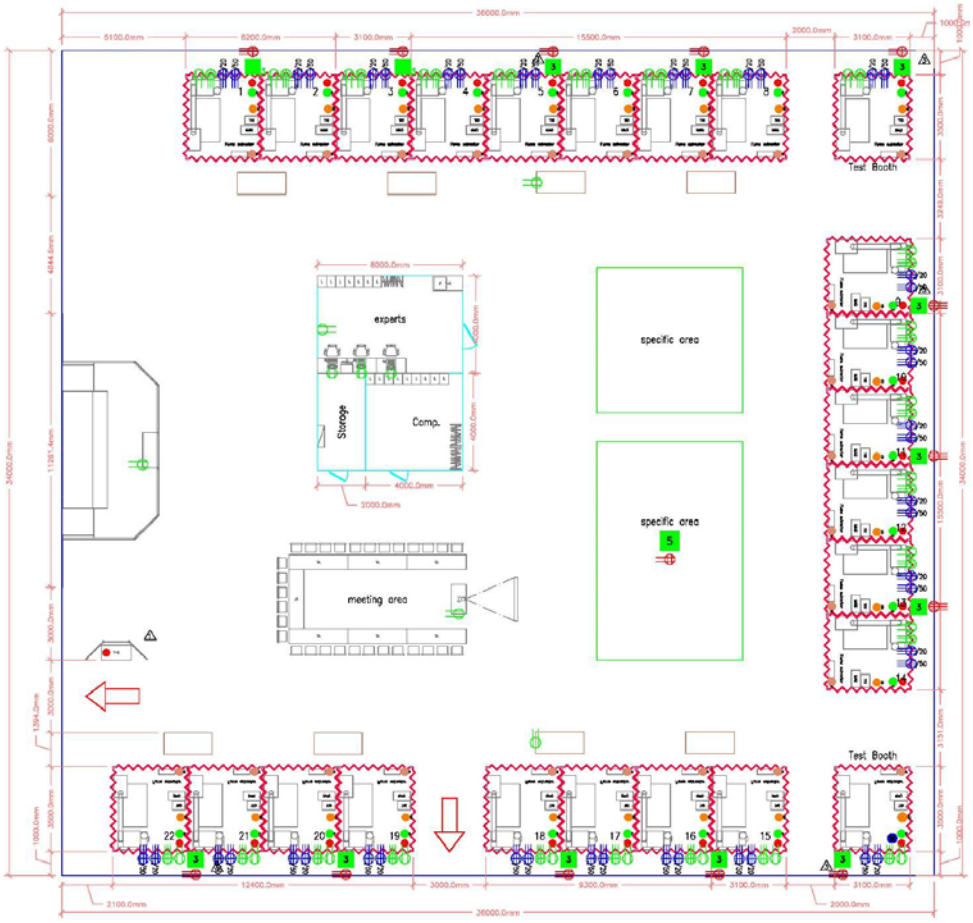
7.4 Materials & equipment prohibited in the skill area

- Materials and Equipment that is preserved to give an unfair advantage to a Competitor
- This will be a controlled toolbox check with all Experts deciding together that the toolbox meets the materials and equipment requirements.

7.5 Sample workshop layouts

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

Workshop layout from previous Competition:



8. MARKETING THE SKILL TO VISITORS AND MEDIA

8.1 Maximising visitor and media engagement

The following list is an example of ways in which visitor and media engagement can be achieved in Polymechanics. These will be considered for the Competition.

- Try a trade
- Display screens
- Test Project descriptions
- Enhanced understanding of Competitor activity by Experts talking with visitors
- Competitor profiles
- Career opportunities – DVDs from different countries showing continuously
- Daily reporting of competition status

8.2 Sustainability

- Recycling
- Use of ‘green’ materials
- Use of completed Test Projects after Competition