

TECHNICAL DESCRIPTION  
**Industrial Control**  
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TD19 v3.1 – 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:

1.	<b>INTRODUCTION .....</b>	<b>2</b>
2.	<b>COMPETENCY AND SCOPE OF WORK .....</b>	<b>2</b>
3.	<b>THE TEST PROJECT .....</b>	<b>4</b>
4.	<b>SKILL MANAGEMENT AND COMMUNICATION.....</b>	<b>9</b>
5.	<b>ASSESSMENT .....</b>	<b>10</b>
6.	<b>SKILL-SPECIFIC SAFETY REQUIREMENTS .....</b>	<b>12</b>
7.	<b>MATERIALS &amp; EQUIPMENT .....</b>	<b>13</b>
8.	<b>MARKETING THE SKILL TO VISITORS AND MEDIA.....</b>	<b>15</b>

Effective 06.08.10



Liam Corcoran  
Technical Committee Chair

## **1. INTRODUCTION**

### **1.1 Name and description of skill**

1.1.1 The name of the skill is [Industrial Control](#).

1.1.2 Description of skill

[Industrial Control](#) covers elements from electrical installation and automation installation, although the requirements are now leaning more and more towards automation installation. The current mix of categories includes Electrical Installation and Mechatronics, a field covering automation installations for component manufacture.

The category requirements include the basics of electrical and automation installation including conduits, cables, devices, instruments, automated devices and control centre fittings quickly and safely, and implementation of the assemblies safely. Designing of circuits and parameters, and programmes and implementation of frequency transformers and programmable logic are common tasks for this skill. Troubleshooting for relay control and logic programmes is also a common practice.

### **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**

#### Health and safety

Competitor must know and understand:

- Competitor must know and understand the safety regulations of the Host Country and the WorldSkills Health and Safety minimum requirements.
- Test and Commissioning procedure
- Safe working methods in fault finding and when using measuring equipment
- What kind of the personal safety clothes and equipment must be used at different working phases and when using electrical tools

Competitors shall be able to:

- Work 100% safely during the competition.
- Use right Personal Safety Equipments
- Test and Commissioning in practice
- Fill the T&C documentation
- Safe working at Fault Finding
- Inform the Workshop Supervisor about the possible safety risks and broken materials or components which could cause the risk

#### Circuit design and/or modification

Competitor must know and understand:

- Symbols and components of the relay based circuit diagrams
- Basic principles and functions of the relay/contactor controlled circuits

Competitors shall be able to:

- Draw corrections / additions / plan on blanco or prefilled paper according the nonverbal function description and given amount of the different symbols.
- Logical thinking and systematic work flow

#### Making of the Automation Control Panel/Centre

Competitor must know and understand:

- Reading of the Layouts, Circuit Diagrams, terminal drawings, function descriptions
- Basic working methods for the sheet metal
- Use of the mechanical/electrical tools which are required to making holes

Competitors shall be able to:

- Install the ducts, terminals, correct components and wiring of the control panel according the drawings and tolerances
- Install the labels of the components and cables

#### Field Installations

Competitor must know and understand:

- Installation of the field components, boxes, instruments, motors, VSD's, wire ways, cables, wires,
- Technical drawings of the Project: Layout of the wall installation, layout of the control panel, circuit diagrams, flow charts,
- Principals and Functions of all components in the material list
- Working methods for different parts of Test Project

Competitors shall be able to:

- Measure the correct positions for the components to be installed
- Make component installations in right order
- Prepare and Install the wire-ways within tolerances
- Installation of the field components, boxes, instruments, motors, VSD's, wire ways, cables, wires
- Use safely electrical tools for fixing, sawing, drilling and bending

#### Programming of the Automation equipments of the project

Competitor must know and understand:

- Non-Verbal Function Descriptions (like in the Pre-Project)
- How to control motors, valves, and other objects listed in the material list with PLC and listed PLC-Instructions
- VSD-functions and possibilities
- HMI and PC-based HMI/Visualisation possibilities to create the possible HMI-functions listed in TD.
- Sequence-programming methods

Competitors shall be able to:

- Create PLC-program according the Non-verbal Function Description with allowed PLC-instructions
- Configure the HMI-screens according the non-verbal function description
- Configure the VSD as described in the function description
- Test the functions safely
- Show the functions to the evaluation groups

#### Fault finding

Competitor must know and understand:

- Safety risks and Instructions in fault finding
- Circuit Diagrams and nonverbal function Descriptions
- Principles of the Relay Control Fault Finding with multimeter
- Components and Symbols of the Relay based Circuit Diagrams
- Basic principles and functions of the common Industrial relay/contactors Control Circuits and Main Circuits
- Meaning of the Logical thinking

Competitors shall be able to:

- Analyse the right functions of the Fault Finding process/control cabinet
- Recognise the wrong functions
- Localise the right positions of the Faults to the drawings with multimeter

## **2.2 Theoretical knowledge**

2.2.1 Theoretical knowledge is required but not tested explicitly.

- Theoretical knowledge is limited to that necessary to carry out the practical work, the programming of electronic and electromechanical components, reading and interpretation of drawings, sketches or schematic diagrams.
- Knowledge of material and processes.

2.2.2 Knowledge of rules and regulations is not examined.

## **2.3 Practical work**

The Competitor must independently carry out the requirements for the modules described in subsection 3.2 Test Project design requirements using commercially available material and equipment, which must be installed and wired into an installation in accordance with the documentation provided.

Competitors must use the necessary and appropriate working techniques to complete the installation.

Any materials-related requirements or manufacturers specifications shall be provided to the Competitor at the same time as the Test Project.

## **3. THE TEST PROJECT**

### **3.1 Format / structure of the Test Project**

The main Test Project which includes the PLC programming component is designed and assessed in a modular format.

Circuit design and fault finding are standalone modules

The following table shows the duration and location of the modules.

Module	Name	Approx. hours	Place
A	Main project	16	Panel A and B
B	PLC programming	4	At workbench on computer
C	Circuit design and/or modification	1	Away from booth
D	Fault finding hardware	1	Away from booth
Total =		22	

Commissioning is embedded in the main Test Project.

### 3.2 Test Project design requirements

The Test Project must meet the following requirements:

- The Test Project must be modular
- Be in accordance with the current Technical Description.
- Be a Computer Assisted Drawing (CAD) to ISO-standards supplied in digital format (in AutoCAD .dwg format) and in hard copy
- Contain a standard legend
- Be self explanatory requiring a minimum of translation
- Include measurements for the installation of materials and equipment from the horizontal and vertical datum (or reference) lines
- Soft copies of text documents must be provided in Microsoft Word format.

With reference to the material specifications - see Sec. 4 below, the Test Project may include any of the following sub-modules. Any sub-module must be integrated into the overall function of the installation or module concerned.

- Installation of signal/control/power circuits (heat, motors etc. e.g. pumpstation, boiler control and similar industrial applications)
- Testing and commissioning of wiring and relay logic
- PLC, HMI, and VSD installation and I/O wiring
- PLC, HMI, VSD installation and I/O wiring
- Testing and commissioning of PLC, HMI and VSD programs

The appropriate technical skills are:

- Measuring and marking of installation materials and equipment
- Measuring and installing equipment and pipes
- Sawing, drilling, and de-burring
- Working with and assembling materials made from metal and plastic
- Wiring and connecting switches, control devices and consumer appliances

#### Module 'A' – Main Project

The main Test Project will consist of four (4) main elements:

1. The installation and wiring element (power and control), which includes:
  - The assembly of and construction of components commonly used in the industry
  - Installation of control panels and boxes
  - Installation of wiring systems
  - Installation of wiring and cabling
  - Terminations and connections
  
2. Testing and commissioning of wiring and relay logic in which the following tests are to be completed:

- Insulation resistance between phases, phases to neutral, phases to earth, and neutral to earth. The resistance must be equal or more than 1 MΩ when tested at 500V d.c. with an insulation resistance tester.
  - Earth continuity resistance – The maximum resistance between the main incoming earth and any point on the installation required to be earthed may not be more than 0.5 Ohm tested at 4.5V d.c. with a continuity tester.
  - Individual loads used for Test Projects shall not exceed 1 kW. The total load shall not exceed 2 kW.
  - Polarity of socket outlets when viewed from the front (looking at the pins) shall be:  
Single-phase – clockwise from the earth pin: (L1-N)  
Three-phase – clockwise from the earth pin: (L1-L2-L3-N)
  - Polarity of switches and circuit breakers
  - Voltage tests – correct voltages to be measured between conductors at any point in the circuits
  - Electrical safety
  - Correct wiring to specification
  - Commissioning  
Faults identified and corrected  
Live testing completed  
Function to specification
3. PLC installation and I/O wiring
- Mounting and wiring of the PLC
  - I/O wiring and termination
  - Segregation of power, analogue and digital inputs and outputs
4. Testing and commissioning of I/O wiring, PLC program, VSD setup and HMI configuration
- PLC communication to HMI, VSD and PC
  - I/O wiring in accordance with I/O addresses
  - Program testing and commissioning

In the event that standard colour codes for wiring cannot be made available by the Host Country, the Experts are to select other colours for use by the Competitors. Sufficient colours must be available as required by the Test Project.

An external electrical supply must be available for testing communication between the PC and PLC prior to commencement of the Competition and for programming during the Competition (if required).

### **Module 'B' – PLC Programming and HMI Configuration**

1. The PLC program must conform to IEC 1131.3 and be programmed using only the following instructions:
- Bit level instructions – NO, NC, Transitional, Coils, Jumps, Calls, Sets and Resets,
  - Math instruction – ADD, SUBTRACT, MULTIPLY, DIVIDE
  - Word level instruction – MOVE, COMPARE, BCD, AND, OR
  - Basic instruction – TIMERS, COUNTERS, REGISTERS
  - File control – The Competitor will decide on how they will write the program and which of the listed PLC instructions he will use.

No other programming methods are to be used.

- All programming and configuration must satisfy module B specification.
- The HMI is limited to display and pushbutton controls only.
- The VSD is limited to basic controls with digital and analogue signals.

### **Module 'C' – Circuit Design and/or Modification**

1. The Competitor is required to design/modify a relay logic, control and/or power circuit diagram using no more than the listed components (within this Technical Description) in accordance with a specification and/or the functional diagram.
2. The design will be marked on:
  - Functional requirements being met
  - Economy of design
  - Accurate use of symbols
  - Accuracy of design
  - Provision of a legend
  - 
  - 60% of marks for this section will be awarded for correct functioning.

### **Module 'D' – Relay Logic Fault Finding – in existing plant (or system)**

1. Relay logic fault finding on a given panel
  - The Competitor is required to find five introduced faults within a control and/or power circuit.
  - The Competitor is provided with the circuit diagram and may see an operational circuit before the faults are introduced.
  - Using a multimeter the Competitor shall test the panel and identify the faults on the form provided. The form may consist of the circuit diagram, or a function diagram, or a developed form.
  - The Competitor must identify the type of fault and fault location.
  - All faults must be identified on the document(s) provided.
  - A Competitor may return to an earlier fault within the one-hour period.
  - Fault documents completed by the Competitors should indicate: Competitor's name, country/region, and fault test panel number.
2. Design specification for relay logic fault finding
  - Three circuits are to be submitted from different countries to the Chief Expert, who will select one to be constructed by the Host Country for the fault finding test.
  - The Host Country will construct five identical test panels.
  - The type of faults will be selected by the Expert team selected for supervising and marking this module at the WorldSkills Competition 3 hours before the fault-finding module starts.
  - Faults must be introduced in the same order for all Competitors.
  - Only one fault is introduced for each test.
  - Marks are awarded for each fault identified.
  - Bonus marks may be awarded for finding individual faults within a given time.
  - Bonus marks may be awarded for finding all faults.
3. Circuit specifications  
The test circuit includes:
  - Timers
  - Switches or pushbuttons
  - Relays
  - Contactors with 2xNO and 2xNC auxiliary contacts
  - Simulated loads
4. Types of faults  
Faults should be selected from the following list:
  - Open circuit
  - Short circuit
  - Incorrect timer setting
  - Incorrect overload setting



- Only one fault is to be applied per test.

The Experts may allocate marks based on the time taken to find each or all faults by making marking points for finding a fault in less than a given time or times. (Accurate timekeeping is essential so a stop watch or similar must be provided for this purpose.)

### **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 the Chief Expert and three Experts selected by vote at the previous Competition, and must be validated as defined in 3.5.

#### **3.3.2 How and where is the Test Project / modules developed**

The Test Project / modules are developed jointly on the Discussion Forum.

#### **3.3.3 When is the Test Project developed**

The Test Project is developed by 6 months before the current Competition.

The main Test Project is distributed to all Competitors at least 3 months before the Competition. The main Test Project is subject to a 30% change at 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**

It must be demonstrated that the Test Project/modules can be completed within the material, equipment, knowledge and time constraints. This will be demonstrated by written confirmation by one or more Experts.

### **3.6 Test Project selection**

The Test Project is selected as follows:

The Chief Expert and the three selected Experts will develop a project in accordance with the current Technical Description for the next WorldSkills Competition. The selection of the Test Project content is solely made by these four Experts.

### **3.7 Test Project circulation**

The Test Project is circulated via WorldSkills International website 3 months before the current Competition.

### **3.8 Test Project coordination (preparation for Competition)**

Coordination of the Test Project will be undertaken by the Chief Expert with three selected Experts.

Three Experts will be selected by vote at the previous Competition to work with the elected Chief Expert to develop a Test Project in accordance with the current Technical Description for the next Competition.

The Chief Expert will be responsible for ensuring 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 of 22 hours.
- Proper function is achievable.
- The material list is accurate.
- Competitor instructions are kept to a minimum of text. Flow charts or functional diagrams may be used.
- The project is complete in all aspects.
- The Chief Expert will forward the completed Test Project to the WorldSkills Secretariat six (6) months before the current Competition so that material availability can be confirmed with the Host Member.
- The Chief Expert will ensure that all required communication occurs between all Experts and participating Members.

### **3.9 Test Project change at the Competition**

The 30% change will be selected and agreed by vote of all Experts prior to the commencement of the Competition. The changes will normally be of the software type.

The panel of Experts who developed the Test Project should also propose 30% changes. Part or all of the 30% change can also be proposed by any other Expert at the Competition. The changes must be agreed by majority vote of the Experts at the Competition.

### **3.10 Material or manufacturer specifications**

The Test Project should be constructed from commercially available materials. When materials in the Host Country are not readily available in other countries, then samples of these materials must be sent to each Competitor 6 months prior to the commencement of the Competition. The Workshop Supervisor will confirm if this is necessary.

## **4. SKILL MANAGEMENT AND COMMUNICATION**

### **4.1 Discussion Forum**

Prior to the Competition, all discussion, communication, collaboration and decision making regarding the skill must take place on the skill-specific Discussion Forum (<http://www.worldskills.org/forums>). All skill-related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be moderator for this forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

### **4.2 Competitor information**

All information for registered Competitors is available from the Competitor Centre (<http://www.worldskills.org/competitorcentre>).

This information includes:

- Competition Rules
- Technical Descriptions
- Test Projects
- Other Competition-related information

### **4.3 Test Projects**

Circulated Test Projects will be available from [worldskills.org](http://www.worldskills.org) (<http://www.worldskills.org/testprojects>) and the Competitor Centre (<http://www.worldskills.org/competitorcentre>).

#### 4.4 Day-to-day management

The day-to-day management is defined in the Skill Management Plan that is created by the Skill Management Team led by the Chief Expert. The Skill Management Team comprises the Jury President, Chief Expert and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalised at the Competition (agreed by Experts and submitted to the Chair/Vice Chair of the Technical Committee). The Chief Expert is to regularly share updates of the Skill Management Plan via the Forum.

## 5. ASSESSMENT

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

### 5.1 Assessment criteria

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

Section	Sub section	Criterion	Subcriterion	Marks		
				Subjective (if applicable)	Objective	Total
A		Circuit design and/or modification			10	10
	A1		Function			
	A2		Accurate using of symbols			
	A3		Provision of a Legend and marking			
	A4		Accurate using of symbols			
B		Fault finding – Hardware			10	10
	B1		Located faults			
C		Measurement			15	15
	C1		Measurements wall - tolerance: +/- 3mm >500mm +/- 1mm <500mm			
	C2		Measurements control box - tolerance: +/- 3mm >500mm +/- 1mm <500mm			
	C3		Waterlevel wall - between the marks			
	C4		Waterlevel control box - between the marks			

Section	Sub section	Criterion	Subcriterion	Marks		
				Subjective (if applicable)	Objective	Total
<b>D</b>		Installation wall and panel			30	30
	D1		Wall			
	D2		Control Box and panel			
<b>E</b>		Test, commissioning, and safety			5	5
	E1		Competitors make a written record			
	E2		If the plant is safety ? YES - Experts gives voltage			
	E3		Competitors must finish the record - supervision by the expert group (test & comm.)			
<b>F</b>		Hardware Function (Manual operation/wiring)			10	10
	F1		Switches and fuses			
	F2		Operator panel screen overview page			
	F3		Operator panel manual mode page			
	F4		Operating according diagram			
<b>G</b>		Software Function (Automatic operation)			20	20

Section	Sub section	Criterion	Subcriterion	Marks		
				Subjective (if applicable)	Objective	Total
	G1		Operator panel automatic mode page			
	G2		Operating according diagram			
<b>TOTAL</b>					100	100

## 5.2 Subjective marking

Not applicable

## 5.3 Skill assessment specification

The tolerances to be used for measurement criteria are as follows:

± 1 mm for any measurements between 0 and 500 mm

± 3 mm for any measurements over 500 mm

Evaluation of cables, conductors and terminations

- Cables should be correctly selected for the application.
- There shall be no damage to cables or conductors.
- Excessive conductor should not appear at terminations.
- Conductor insulation should not be damaged by the termination.

### Commissioning and marking

- The installation must be in compliance with safety standards, instructions and specification.
- The Competitor must complete a test certificate for the electrical installation.
- Cable ducts and covers must be securely fixed in place.
- All devices must be identified with labels.
- Competitors must provide a written record of all electrical tests including earth continuity, insulation resistance, voltage levels and phase rotation.
- The power wires to and out from the VSD and to any power supply must be not be connected when the Competitor is making the insulation test.

### For Module B

The Competitor is required to produce an I/O address list for the PLC used. The completed I/O list must be handed to the Chief Expert (or their nominee) prior to leaving the skill area on the day the PLC section is to be tested and marked.

## 5.4 Skill assessment procedures

The Expert groups will develop the appropriate marking schedules for the section of the marking criteria that they are responsible for. Each measurement of each section will be clear and unambiguous, with appropriate parameters or tolerances specified.

The prepared marking schedule must be checked and approved for use by the Experts, who must sign a set of the complete schedules before they are used.

Procedure for testing PLCs and programming software prior to being used

- Experts must be sure that PLCs are cleared prior to the Competition start and that the programming software is correctly installed.
- Experts must check that no PLCs program is copied on the Competitor's working PC .
- A seal must be put on the disk drive, and the memory slot of the PLC if it has one.

Section	Criterion	Test end of day	Min. number of test groups
A	Circuit design and/or modification	C1	1
B	Fault finding – Hardware	C2	1
C	Measurement	C2	2
D	Installation wall and panel	C3	3
E	Test, commissioning, and safety	C3 or C4	2
F	Hardware Function (Manual operation/wiring)	C4	1
G	Software Function (Automatic operation)	C4	1

## 6. **SKILL-SPECIFIC SAFETY REQUIREMENTS**

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

- Safety goggles must be worn when using power tools for drilling or cutting materials.
- Protective gloves must be worn when handling materials likely to cause injury.
- The workstation must be maintained in a safe and clean working condition.
- Electrical supply may only be connected to control panels with the permission of the Chief Expert or Deputy Chief Expert.

## 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

The following materials, equipment and tools are to be brought to the Competition by the Competitor.

All necessary hand-tools of the trade required to complete the project, including battery drills.

### Computer programs

Original operating system media and other program media. Program is to be installed with assistance of Host Country IT specialist.

### PLC, PLC programming software and communication cables

To suit (10 metres minimum length) – PLC and software to satisfy specification below.

The PLC must fit into a space 250 mm (high) x 400 mm (wide) x 200 mm (deep).

The PLC must have the following:

Sixteen (16) x 24 V DC. PNP inputs

Sixteen (16) x 24V DC. Relay outputs

Two (2) x 4mA to 20mA / 0 to 10 V analog input

Two (2) x 4mA to 20mA / 0 to 10 V analog output

One 'high speed' counting input

Microsoft Windows compatible programming software

Programming interface and cables (minimum length 10 metres)

The Competitor must confirm that his PLC will operate on the power supply available in the Host Country. Alternatively the Competitor must bring the appropriate power supply.

If the main Test Project includes a frequency controller and/or operator panel, each Competitor must bring their own.

### Variable Speed Drive (VSD)

- Variable Speed Drive with the following specification:
- 230/400V, single-/3-phase, =1kW (or voltage suitable to Host Country)
- 4mA – 20 mA/ 0 – 10V input
- Digital input for remote control
- Start/Stop
- Fwd/Rev
- Fixed speed 1 & 2
- 1 relay output

### HMI

HMI could be Operator panel or PC-Based HMI – program

Operator panel

HMI – PC-based software

The Competitor must bring their own HMI software and original software licence (if required).

The HMI is limited to basic graphics, text display, fill in effects and trends with mouse controls.

The Host Member will ensure that Competitor computers are installed and operating so that Competitors can be provided with the opportunity to install software and make sure that communication occurs prior to the start of the Competition.

## 7.3 Materials, equipment and tools supplied by Experts

Not applicable

## 7.4 Materials & equipment prohibited in the skill area

- Preformed templates
- Mobile phones
- Memory storage devices for PC or PLC programs.

## 7.5 Sample workshop layouts

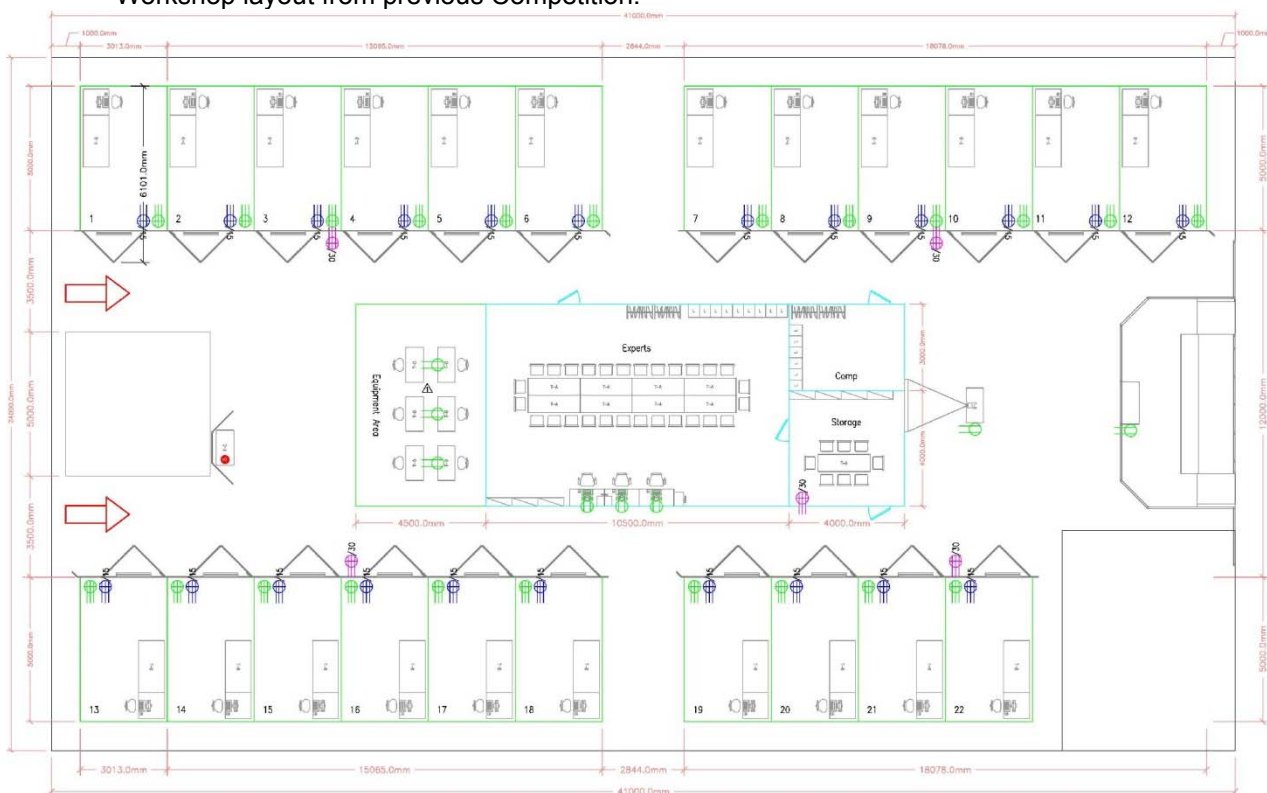
Workshop layouts from Calgary are available at:

[http://www.worldskills.org/index.php?option=com\\_halls&Itemid=540](http://www.worldskills.org/index.php?option=com_halls&Itemid=540)

Instructions for building the electric power supply for each Competitor will be attached to this document.

Basic rule is that workstation electric supplies will be provided for each Competitor with RCD's (leakage current switches)

Workshop layout from previous Competition:



## 8. MARKETING THE SKILL TO VISITORS AND MEDIA

### 8.1 Maximising visitor and media engagement

Following are examples of how this skill could maximise visitor and media engagement:

- The main Test Project will reflect an automated working plant
- Each Competitor will construct an active visualisation image of the automated plant which will be visible to visitors and media
- All Competitor profiles can be shown on a common screen for visitors and media

### 8.2 Sustainability

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