worldskills

Technical Description

Plumbing and Heating

WorldSkills International, by a resolution of the Competitions 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 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

Plumbing and Heating

1.1.2 Description of the associated work role(s) or occupation(s)

A plumbing and heating technician works on commercial, residential, agricultural, and industrial projects. There is a direct relationship between the nature and quality of the product required and the payment made by the customer. Therefore, the practitioner has a continuing responsibility to work professionally in order to meet the requirements of the customer and thus maintain and grow the business. Plumbing and heating is closely associated with other parts of the construction industry, and with the many products that support it, normally for commercial purposes.

The plumbing and heating technician works internally and externally, including the homes of customers and on small and major projects. He or she will plan and design, select and install, commission, de-commissioning, test, report, maintain, fault find, and repair systems to a high standard. Work organization and self-management, communication and interpersonal skills, problem solving, flexibility, and a deep body of knowledge are the universal attributes of the outstanding practitioner.

Whether the plumbing and heating technician is working alone or in a team, the individual takes on a high level of personal responsibility and autonomy. From working to provide a safe and reliable plumbing and heating service, in accordance with relevant standards, through to diagnosing malfunctions, and commissioning plumbing and heating systems and components, precision, accuracy and attention to detail every step in the process matters and mistakes are largely irreversible, costly, and potentially life threatening.

Automation, digitalisation and, especially, climate change are impacting on the plumbing and heating technician's role. Prefabrication, with embedded services, enable rapid construction, while not necessarily enabling efficient maintenance and repair. The response to pressures on users to preserve water and monitor its use is increasingly assisted by automation. Plumbers are at the heart of measures to reduce energy costs both in economic use of materials that use natural resources in manufacture and in the supply of water, its heating, cooling, and disposal, wherever there is supply to and use by customers.

With the international mobility of people, the plumbing and heating technician face rapidly expanding opportunities and challenges. For the talented practitioner there are many commercial and international opportunities; however, they carry with them the need to understand and work with diverse needs, cultures, and trends. The diversity of skills associated with plumbing and heating is therefore likely to expand.

1.1.3 Number of Competitors per team

Plumbing and Heating is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 22 years in the year of the Competition.

1.2 The relevance and significance of this document

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods, and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

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

1.3 Associated documents

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

- WSI – Code of Ethics and Conduct
- WSI – Competition Rules
- WSI – WorldSkills Occupational Standards framework
- WSI – WorldSkills Assessment Strategy
- WSI online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations
- WorldSkills Standards and Assessment Guide (skill-specific)

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

The WSOS specifies the knowledge, understanding, skills, and capabilities that underpin international best practice in technical and vocational performance. These are both specific to an occupational role and also transversal. Together they should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, to the extent that it can. The Standard is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the “weighting”. The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills and capabilities that are set out in the WorldSkills Occupational Standards. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, if this does not distort the weightings assigned by the Standards.

2.2 WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	**10**
	The individual needs to know and understand: • The purposes, uses, maintenance, and care of all equipment, together with their safety implications • The purposes, uses, care, and potential risks associated with materials and chemicals • The purposes and uses of manufacturers’ specifications and drawings • How to search for specific and non-specific information, specifications, and guidance to complete a task • The time available and associated with each activity • The parameters within which activities need to be scheduled • The health and safety standards applying at any one time	

Section		Relative importance (%)
	• The use of new technologies such as digitised electronic equipment and lasers as a work aid, where readily available and straightforward to use • Principles and their application to good housekeeping in the work environment	
	The individual shall be able to: • Prepare and maintain a safe, tidy, and efficient work area • Prepare and if need remedy the surfaces to which systems and appliances will be installed • Select and use appropriate personal protective equipment when necessary • Select and use appropriate hand tools to complete tasks safely • Follow specific precautions when manual handling, long and/or heavy items • Follow specific precautions when working with electrically powered hand tools • Follow specific precautions when soldering • Use digital and/or laser technology for installation/assessment • Schedule work to maximize efficiency and minimize disruption • Plan, prepare and complete each task within the available time • Restore the work area to an appropriate condition • Prepare reports based on the type of work completed	
2	**Communication and interpersonal skills**	**10**
	The individual needs to know and understand: • The range and purposes of documentation, including text, graphical, paper based and electronic • Drawing notation and the symbols for pipe work, fittings, and appliances • The technical language associated with the skill • The standards required for routine and exceptional reporting in oral, handwritten, and/or electronic form • The nature of the reports provided by measuring equipment, together with their interpretation • The required standards for customer service and care • The changing nature of customers' needs and wants in the face of environmental pressures	
	The individual shall be able to: • Read, interpret, and extract technical data and instructions from manuals and other documentation • Communicate in the workshop by oral, written, and electronic means using standard formats with clarity, effectiveness, and efficiency • Use a standard range of communications technology • Respond to customers' needs face to face and indirectly	

Section		Relative importance (%)
	• Estimate and advise customers on the cost benefit initially and over time of the available choices of equipment and systems • Explain the functionality and operation of appliances and/or installations	
3	**Design and adapt installation systems**	**15**
	The individual needs to know and understand: • The required information regarding the design of the installation • Symbols and abbreviations used in specifications and drawings • Drawing aspects (e.g. plan, elevations, isometric, and schematic) • The uses and limitations of the generally available drawing tools	
	The individual shall be able to: • Design installation systems within given parameters • Produce simple freehand sketches including isometric to support given architect drawings to aid the installation process, using standard symbols and abbreviations • Estimate the requirement for equipment and materials • Select the equipment and materials according to given criteria • Where required, recommend alternatives, and either order the equipment and materials or amend the design of the system	
4	**Install pipe work, fixtures, and appliances: traditional and new**	**40**
	The individual needs to know and understand: • The uses and limitations of the specified bending and jointing methods, materials, and fittings in order to complete a leak-free installation • The range and characteristics of bending/jointing methods, materials, and fittings • Properties of the piping material available: for example: ◦ Copper ◦ Black mild steel and Galvanised mild steel “GMS” (no heat bending or welding) ◦ Press fit: stainless steel, copper, or galvanized steel ◦ Cast iron ◦ Polymer pipe ◦ Plastic (single or multi-layered) • The handling, cutting, bending, jointing, and forming sub-assemblies • The safe operation of the cutting, bending, threading, soldering, and testing equipment provided, according to manufacturer guidelines • The applications appropriate to: ◦ Pre-wall installation systems ◦ Surface wall installation	

Section		Relative importance (%)
	◦ Hot water installations ◦ Cold Water Installations ◦ Heating installations ◦ Underfloor heating ◦ Gas installation systems ◦ Wastewater systems • Systems and installation requirements to contribute to United Nations Sustainable Development Goals ◦ Goal 6 - Ensure access to water and sanitation for all ◦ Rainwater harvesting or grey water system Installation of the piping system above ground level Installation of appliances systems that reduce water consumption and provide access to safe water, sanitation and hygiene • ◦ Goal 7 - Ensure access to affordable, reliable, sustainable and modern energy and Goal 13 - Take urgent action to combat climate change and its impacts ◦ Heat pump systems, Ground Source and Air Source (Not Refrigeration Type) ◦ Hybrid Heating systems for conversion of older systems ◦ Solar thermal hot water systems	
	The individual shall be able to: • Read and interpret drawing for a range of systems and appliances • Interpret drawings to facilitate pipe-work fabrication and the installation of appliances • Modify the area and surfaces, as required, to permit fixing and assembly • take and transfer measurements and angles from given drawings to surfaces and piping materials • Select suitable fixing methods for the available surfaces, appliances, and environment • Fix an appropriate number and diameter of pipe brackets/clips in the correct or specified configuration • Determine the optimal way to use given materials to complete assembly and installation of systems in a sustainable manner • Install systems to ensure they provide access to safe water, sanitation and hygiene standards • Create freehand sketches for the purposes of pipe bending and assembly • Limit the generation of waste through uneconomic use of materials to aid sustainability of natural resources • Determine and use the correct positions for cutting the piping material • Measure, set out, and mark the materials and pipework • Determine the correct positions for bending the piping material • Select an appropriate and safe method for handling, cutting, installing, and jointing the piping material	

Section		Relative importance (%)
	• Utilize the chosen method to bend the piping material safely • Utilize the chosen jointing method to form the pipe-work sub-assemblies • Install the pipework utilizing the previously fitted brackets/clips • Install sanitary fixtures • Install appliances • Connect the pipework to the appliances/utilities • Install gas, water, heating, and effluent pipe work	
5	**Connect, test, and commission assemblies and appliances**	**15**
	The individual needs to know and understand: • The procedures, equipment, and tools for applying soundness tests to systems • The methods of establishing adequate supply from the utilities • The actions to take where pre-commissioning checks or tests reveal system or component defects • How to complete commissioning documentation • The sources of information on the performance of systems or components • The procedures for ensuring the component performance against the design specification • The sequences for commissioning systems or components • The actions to take when components are being commissioned and do not meet design requirements • System handover procedures and demonstrating the operation of systems and components to end users	
	The individual shall be able to: • Perform all pre-commissioning/commissioning tasks • Connect test equipment to the pipework • Test the plumbing and heating components (pressure test and/or other tests) to ensure conformity to specification • Flush and drain the installations • Fill pipework and appliances and assess the flow rate/pressures to domestic sanitary appliances • Hand over installations to customers, including documentation • Provide customers with all appropriate user information and answer questions	
6	**Generate and apply solutions for maintenance, repair, and replacement**	**10**
	The individual needs to know and understand: • Features of excellent customer service • The techniques for identifying customers' problems	

Section		Relative importance (%)
	• The information that should be available on the routine and non-routine service and maintenance requirements of systems and components • The methods of protecting customers' property in the area where the work is carried out • The maintenance procedures necessary to ensure compliance with industry requirements for routine and non-routine maintenance activities • How to complete records and reports of the maintenance of systems and components • The action to take when a system or component does not work to full performance specification • The measures to ensure that systems do not present a safety hazard to potential users, or the workforce, when carrying out rectification procedures • How to isolate unsafe systems and components • The main features of each possible option, including risk factors • The selection and use of different methods for exploring problems, including dividing it into sub-problems, and analysing its features • System handover procedures and demonstrations of the operation of systems and components to end users	
	The individual shall be able to: • Prepare the work area, safeguarding surrounding areas • Diagnose the quality or deficiencies of appliances, components, and systems • Identify the relative advantages or possibilities of maintenance, repair, or replacement • Identify the method of maintaining, repairing, or replacing the appliances or systems • Acquire components or replacements as determined • Isolate and drain the plumbing and heating components • Maintain, repair, or replace appliances or systems, as advisable and agreed • Open isolating valves, recharge with water and check for leaks • Re-commission systems • Check for correct functioning (flow and pressure) • Restore areas to their former condition • Hand over installations to customers • Provide customers with all appropriate user information and answer questions	
	Total	**100**

3 The Assessment Strategy and Specification

3.1 General guidance

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: Measurement and Judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, to demonstrate their quality and conformity with the Standards.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

4 The Marking Scheme

4.1 General guidance

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more Independent Test Project Designer(s) with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance. Please see the Competition Rules for further details.

Experts and Independent Test Project Designers are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition. Skill Advisors actively facilitate this process.

4.2 Assessment Criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). **The Assessment Criteria, the allocation of marks, and the assessment methods, should not be set out within this Technical Description. This is because the Criteria, allocation of marks, and assessment**

methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published.

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

4.3 Sub Criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by Measurement or Judgement, or both Measurement and Judgement.

Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

4.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by Measurement or by Judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

		CRITERIA								TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE
STANDARDS SPECIFICATION SECTION		A	B	C	D	E	F	G	H			
	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		9.50	10.00	0.50
	3								11.00	11.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS		5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by Judgement, Measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

4.6 Assessment and marking using Judgement

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, Judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts, or separate guidance notes). This is documented in the Standards and Assessment Guide.
- the 0-3 scale to indicate:
  - 0: performance below industry standard
  - 1: performance meets industry standard
  - 2: performance meets and, in specific respects, exceeds industry standard
  - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

4.7 Assessment and marking using Measurement

Normally three Experts will be used to assess each Aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

4.8 The use of Measurement and Judgement

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

4.9 Skill assessment strategy and procedures

WorldSkills is committed to continuous improvement including reviewing past limitations and building on good practice. The following skill assessment strategy and procedures for this skill competition take this into account and explain how the marking process will be managed.

The submitted Marking Scheme to the CIS will reflect the assessment strategy in the Standards and Assessment guide all Experts will be briefed on the marking criteria, during Mandatory Assessment Training (MAT).

Competitors are given all the necessary material prior to the commencement of each Module. It is the responsibility of the Competitor with the compatriot Expert to check the material supplied against the Module material list, which will have been previously checked and signed by the Workshop Manager and Workshop Manager Assistant and/or the compatriot Expert.

Criteria for measurement marking

The criteria for the assessment of measurement marking can be found in the “Task Description” document and the Appendix (13.1) document for the "Assessment Document - Skill 15 Plumbing and Heating".

Pressure test

- Directly after each successful pressure test, the two Experts who witnessed it must prove its validity by ensuring that the entire pipe-work installation was actually under test;
- Competitors may pressure test their own work, as many times as they consider necessary, within the competition time;
- When the Competitor reaches the stage in a Module when the two Experts are requested to witness the pressure test, this test is considered the last and final test for this Module and this result is the one recorded for assessment. The Competitor will not be permitted under any circumstances to carry out further leak detection/repair work or request another pressure test for this Module;
- The entire witnessed pressure test must be completed within the competition time allocated to the Module for the result to be included in the Competitor's assessment total;
- Hot water, cold water, gas and heating pipes are air tested to 200KPa (two bar) for two (2) minutes;
- The duration of the pressure test is two (2) minutes and as such the Competitor must have his pressure test verified by the two (2) Experts assigned at least two (2) minutes before time limit.
- The pressure test will ONLY be done if the complete Module is done within time limit and according the Module drawing;
- The pressure gauge used for pressure testing gas, water, and heating pipes to have a full-scale deflection of 2 bar;
- The testing of sanitation pipework may be done if the project and material from Competition Organizer makes this a possibility;
- A log sheet must be installed at each workstation, in order to record the Competitors' pressure test results, safety warnings, extra material, and the material list check.

Procedure:

- If the project is modular, this is to be assessed in the evening or following morning of the day in which it was carried out; live tasks are assessed at time of activity;
- If the project is a short project on a shift system and not modular this is assessed on the completion of the Module;
- The Experts are divided into teams of minimum of four (3+1) by the Chief Expert, as outlined in the Skill Management Plan, to carry out the assessment each evening;
- The Chief Expert will ensure (within reason) that an equal number of assessment criteria and marks are allocated to each Expert marking group;
- Measuring instruments to be available for all assessment teams e.g. rules, protractors, levels, etc. required for the assessment of the modules are provided by the Competition Organizer in the Competitor toolbox and the Competitors instruments must be used by the Experts for this task. If templates are required, these are to be prepared by an Expert nominated by the Chief Expert and checked by all of the Experts prior to their use;
- All pressure tests must be witnessed and signed off by two Experts and the result entered on the Competitor's log sheet. This duty is rotated daily among the Experts, by the Chief Expert, as outlined in the Skill Management Plan;
- Minimum of two Experts are assigned daily to check that all Health, Safety, and Environment regulations are observed by the Competitors. A record of each Competitor's safety warnings are entered on his/her log sheet. This duty is rotated among the Experts on a daily basis, by the Chief Expert, as outlined in the Skill Management Plan;
- Verification of each Competitors material check list and the recording, on the log sheet, of any extra material requested by a Competitor are carried out by two (2) Experts, who are assigned to this task on a daily basis. This duty is rotated among the Experts on a daily basis, by the Chief Expert, as outlined in the Skill Management Plan.

5 The Test Project

5.1 General notes

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS.

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Standards will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Standards or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work. The Test Project will not assess knowledge of WorldSkills rules and regulations.

Most Test Projects and Marking Schemes are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Designer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

Please refer to the current version of the Competition Rules for further details.

5.2 Format/structure of the Test Project

The Test Project is a series of standalone modules.

The project is in modular format, the minimum number of Modules being one (1), the maximum number being six (6) installed over an 18 to 22-hour period. Each Module must be completed in the prescribed order and pressure tested within the time allocated for that particular module.

Each pressure test must be validated as set out in section 4.9.

The Test Project may contain the following Modules:

1. Installation of plumbing systems into/on a pre-wall structure
2. Design an installation;
3. Sanitation pipe installation;
4. Gas pipe installation;
5. Heating installation
6. Cold water installation;
7. Hot water installation
8. Heat Pump/Solar installation;
9. Fault-finding (Hot and Cold water and Sanitation).

5.3 Test Project design requirements

Test Projects should reflect the purposes, structures, processes, and outcomes of the occupational role they are based on. They should aim to be a small-scale version of that role. Before focusing on practicalities, SMTs should show how the Test Project design will provide full, balanced, and authentic opportunities for assessment and marking across the Standards, as set out in Section 5.1.

- The Test Project shall reflect current commercial, domestic plumbing and heating standards and practices as detailed in the WSOS;
- The project should be as small as practical and materials available in the Host Country for sustainability;
- Where possible the Competition Organizer and the Skill Management Team should partner with local sponsors willing to organize a “Help Project” within the Host Country to support sustainability of materials after the competition. The final Test Project must be designed as much as possible to support this Help Project;
- All pipes supplied by the Competition Organizer, for which bending is intended, must be of a grade that permits bending by hand operated machines;
- All piping materials supplied by the Competition Organizer must be of uniform wall thickness throughout;
- The use of solvent weld adhesives on PVC pipe-work and components; could be considered in countries/region where this type of jointing system is predominantly used, providing that vapours, if present are not hazardous to humans when used as prescribed by the manufacturer;
- The bronze welding/hard soldering (Copper Phosphorus) of copper pipe and copper fittings is not permitted;
- The work may involve the use of the following materials:
  - Galvanized, Black Mild Steel, Press fit Stainless Steel;
  - Copper pipes (half hard temper bender quality in straight lengths);
  - Plastic pipes (PE, PEX, PB, HDPE, PP, PP-R, PVC, composite pipe) for water supply, heating, and effluent services;
  - Commercially available fittings to suit all piping materials as required without any adaptation;
  - Jointing and sealing materials;
  - Pipe brackets and fixing materials;
  - Leak detection fluid or spray;
- Project to be designed should be in accordance with the available tools described in the Infrastructure List (IL);
- The Test Project must:
  - Be a Computer Assisted Drawing (CAD) available in hard copy;
  - Contain a detailed material list. Note: the materials must be available in the Host Country or region;
  - Be self-explanatory requiring a minimum of translation.

5.4 Test Project coordination and development

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Test Project coordination (preparation for Competition)

Coordination of the Test Project/modules will be undertaken by the Skill Competition Manager.

5.4.2 Who develops the Test Project/modules

The Test Project/modules are developed by an Independent Test Project Designer (ITPD) in collaboration with the Skill Competition Manager.

5.4.3 When is the Test Project developed

The Test Project/modules are developed according to the following timeline:

Time	Action
Ten (10) months prior to the Competition	The ITPD is identified and a Confidentiality Agreement between WSI and the ITPD is organized.
No later than one (1) month prior to the Competition	The Test Project documents are sent to the WorldSkills International Skills Competitions Administration Manager.
At the Competition on C-2	The Test Project/modules are presented to Experts and Competitors.

5.5 Test Project initial review and verification

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations.

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer (ITPD) is expected to identify one or more independent expert(s), and trusted individuals initially to review the Independent Test Project Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

5.6 Test Project validation

The Skill Competition Manager coordinates the validation of the Test Project/modules and will ensure that it can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project circulation

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Experts and Competitors on C-2.

5.8 Test Project change

Due to the Test Project being developed by an Independent Test Project Designer (ITPD), there is no change required to be made to the Test Project/modules at the Competition. Exceptions are

amendments to technical errors in the Test Project documents and according to infrastructure limitations.

5.9 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

The Competition Organizer must make available the following information about the pipes and sanitary appliances and fixtures to be used for the competition:

- Technical data sheets;
- Jointing methodology;
- Tools and equipment related to the installation;
- Properties of the pipes;
- Installation brochures of sanitary appliances/fixtures.

Copper, carbon steel, and PEX pipes supplied by the Competition Organizer must be of a grade that permits bending by hand operated machines. A data sheet for such pipes from the Competition Organizer and details of the supplier or merchant must be made available to all participating Members via the Infrastructure List.

6 Skill management and communication

6.1 Discussion Forum

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

6.2 Competitor information

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

This information includes:

- Competition Rules
- Technical Descriptions
- Mark Summary Form (where applicable)
- Test Projects (where applicable)
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 Test Projects and Marking Schemes

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 Day-to-day management

The day-to-day management of the skill competition during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and the Expert Leads. The Skill Management Plan is progressively developed in the six (6) months prior to the Competition and finalized at the Competition. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

6.5 General best practice procedures

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

Topic/task	Best practice procedure
The process of and timing of the release of modules of an uncirculated Test Project	• The written Test Project brief is issued as detailed in the Skill Management Plan and Competitors are briefed on this document on Familiarization Day C-2. • The drawings for each module that require a technical drawing are issued at the start of each module and 15 minutes allowed for Competitors to ask questions as per Competition Rules.
Translation/ Interpreter	• Interpreters are to stay in the Expert room unless called for assistance of a Competitor and at break times for refreshments. • No Expert should expect a fellow Expert to translate English on their behalf for both the Competitor and themself. • If an Interpreter is required, it is the responsibility of the Member concerned to provide an Interpreter thereby not relying on fellow Experts to perform that task for another Member. • An Interpreter can use a dictionary for the translation process. • A three-line spaced project brief is provided to those Members that need to carry out translation for their Competitor/Expert. Competitors/Experts that speak English will receive a single line spaced project brief.
Who can attend to a Competitor and when?	• When a Competitor requests support or has a question during competition time on C1-C4 the Expert who makes contact in the first instance must not be the compatriot Expert. Two independent Experts must be the only Experts within the workstation to attend to the Competitor inquiry. The compatriot Expert must remain outside the workstation unless required to interpret. Where there is an Interpreter, they shall be allowed into the workstation while the compatriot Expert remains outside.
Pressure testing	• Only the assessment team assigned the task of assessing a pressure test are allowed in the workstation and where possible only two should enter to perform the test and the remainder of the assessment team stay outside the workstation. All other Experts are to continue with their normal duties and not place undue pressure on a Competitor who is still working at this time.
Fault-finding/ Independent Assessment	• The fault-finding module will require a pro forma document to be completed by the Competitor in their own language or English to determine their findings in relation to the task. This form will need to be translated by a person with no knowledge of the skill to ensure a straight translation. • The fault-finding module is assessed by independent industry representatives selected from each continent, where possible, to ensure fair independent assessment. The module where equipment is available will also be recorded on CCTV for assessment purposes and security of the secure area. • The fault-finding area is not to be entered by Chief Expert, Experts, or Interpreters. It can only be accessed by Competitors when authorized and the assessment team/Skill Competition Manager.

7 Skill-specific safety requirements

7.1 Personal Protective Equipment

Refer to WorldSkills Health, Safety, and Environment Policy and Regulations for Host country or region regulations.

Task	Safety glasses clear glasses	Heat resistant Gloves (min 250^{O} C)	Gloves that prevent cutting of hands (No broken threads should be exposed)	Safety shoes with protective cap
General PPE for safe areas (All)				
Competitors work area (Except for SCM, C, E after the Competitor competition work time has ended or is paused, and is low risk)	√		√	√
Soft soldering or hot work	√	√		√
Battery Powered Reciprocating saw/Cutting activities	√		√	√

Task	Tight fitting work clothes (long trousers)	Work clothes with Long sleeves or wearable protective sleeves for arm protection	Sturdy shoes with closed toe and heel	Dust mask (certified FFP3 minimum)
Competitors work area (Except for SCM, C, E after the competitor competion work time has ended or is paused, and is low risk)	√			
Soft soldering or hot work	√	√		√
Battery Powered Reciprocating saw/ Cutting activities	√			
Drilling activities or cutting activities (wood) or cleaning activities (sweeping up) that creates dust particles that could cause respiratory issues				√

Task	Safety glasses clear glasses	Heat resistant Gloves (min 250^{O} C)	Gloves that prevent cutting of hands (No broken threads should be exposed)	Safety shoes with protective cap
Drilling activities or cutting activities (wood) or cleaning activities (sweeping up) that creates dust particles that could cause respiratory issues	√		√	

General PPE for safe areas (All)	√		√	
	√			

Task	Tight fitting work clothes (long trousers)	Work clothes with Long sleeves or wearable protective sleeves for arm protection	Sturdy shoes with closed toe and heel	Dust mask (certified FFP3 minimum)
Competitors work area (Except for SCM, C, E after the competitor competion work time has ended or is paused, and is low risk)				
Soft soldering or hot work	√	√		√
Battery Powered Reciprocating saw/ Cutting activities	√			
Drilling activities or cutting activities (wood) or cleaning activities (sweeping up) that creates dust particles that could cause respiratory issues				√

8 Materials and equipment

8.1 Infrastructure List

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

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions 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 for the upcoming WorldSkills 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.

8.2 Competitors toolbox

Competitors are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

8.3 Materials, equipment, and tools supplied by Competitors

It is not applicable for Competitors to bring materials, equipment, and tools to the Competition.

However, Competitors are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

Furthermore, Competitors need to bring their own personal pens, pencils, marker pens, compass, scientific calculator and a 300 mm ruler.

8.4 Materials, equipment, and tools supplied by Experts

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

Experts are responsible that Interpreters bring their PPE.

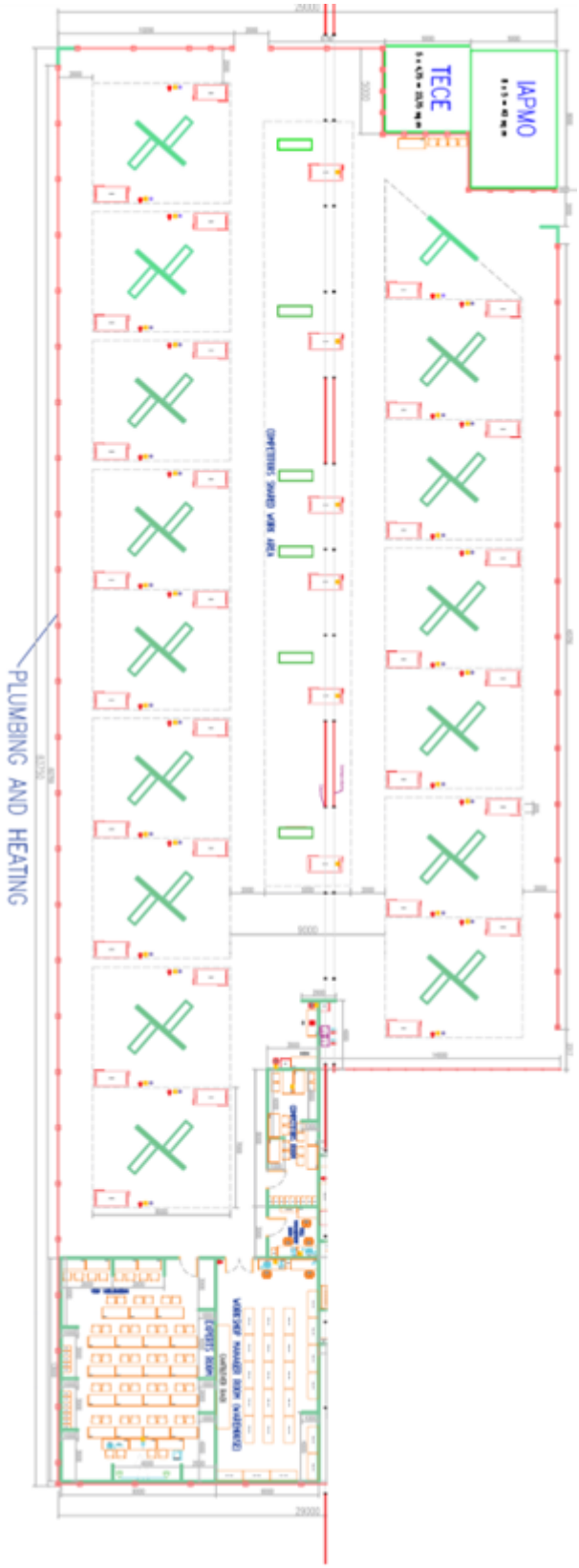
8.5 Materials and equipment prohibited in the skill area

Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4.

8.6 Proposed workshop and workstation layouts

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout



9 Skill-specific rules

9.1 General notes

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

9.2 Skill-specific rules

Topic/task	Skill-specific rules
Use of technology – USB, memory sticks	• Competitors are not allowed to bring memory sticks into the workshop. • Skill Competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring memory sticks into the workshop.
Use of technology – personal laptops, tablets, and mobile phones	• Competitors are not allowed to bring personal laptops, tablets, or mobile phones into the workstation. If Competitors do bring these items into the workshop, they must place them in their locker. They can use them at break times and take them at the end of each day. • Skill Competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring personal laptops, tablets, or mobile phones into the workshop.
Use of technology – personal photo and video taking devices	• Chief Expert and Experts are allowed to use personal photo and video taking devices during the competition of their compatriot Competitor only. This can only be done in such a way that it is not within the workstation, or obstructing the workflow of the competition proceedings. • Competitors and Interpreters are not allowed to use personal photo and video taking devices within the workshop. • The Skill Competition Manager may use these devices in such a way that it is not within the workstation, or obstructing the workflow of the competition proceedings. • At the end of competition on C4 photos and videos can be taken freely.
Templates, aids, etc.	• Competitors are not allowed to use pre-made templates or jigs however these can be fabricated during competition time from the materials provided.
Other: Waste Materials	• Competitors must place all waste pipe (off cuts) must be placed in the container provided at the end of each time session. If the off cuts are too long, they must be placed close to the container.

10 Visitor and media engagement

10.1 Engagement methods

Following is a list of possible ways to maximize visitor and media engagement:

- A full colour copy of the project drawing (without dimensions) should be prepared for displaying to the public, for information, at the skill area;
- A live timed water test may be carried out by Competitors, possibly three at a time with an explanation via loud speaker to visitors and media to maximize engagement;
- Sustainability project could be explained to visitors through Global Partners;
- A model of a similar plumbing project (not the actual Test Project) could be prepared by the Competition Organizer and put on display to attract public interest and publicity.

Other ways to maximize engagement may include:

- Try-a-Skill – for example the bending of copper pipe;
- Display screens;
- Enhanced understanding of Competitor activity;
- Competitor profiles;
- Career opportunities;
- Daily reporting of competition status.

11 Sustainability

11.1 Sustainable practices

This skill competition will focus on the sustainable practices below:

- Recycling of materials and water where used;
- Use of “green” materials where possible;
- Use of completed Test Projects or components of the Test Projects after the Competition in an external sustainable project.

12 References for industry consultation

12.1 General notes

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.onetonline.org/)

12.2 References

This WSOS appears most closely to relate to *Plumber*:
https://www.onetonline.org/link/summary/47-2152.02
and
http://data.europa.eu/esco/occupation/ed3cf43d-c2c1-4c46-82fc-1375e27e0290

Adjacent occupations can also be explored through these links.

ILO 7126.

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Lyon 2024.

Organization	Contact name, position
BPEC	Neil Collishaw, CEO
Geberit Vertriebs AG	Walter Brändle, Technical Sales Manager
Reece Pty Ltd	John Doig, Plumbing Business Development Manager
IAPMO	Grant Stewart, Programme Director

13 Appendix

13.1 Appendix information

Not applicable.