CONSTRUCTION AND BUILDING TECHNOLOGY

Plumbing and Heating



WorldSkills Occupational Standards

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WorldSkills Occupational Standards (WSOS)

General notes on the WSOS

The WSOS specifies the knowledge, understanding, and specific skills that underpin international best practice in technical and vocational performance. It 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, and to the extent that it is able to. 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 that are set out in the Standards Specification. 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, provided that this does not distort the weightings assigned by the Standards.

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
- 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

Section		Relative importance (%)
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 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
- 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

Section		Relative importance (%)
4	**Installation of pipe work, fixtures, and appliances**	**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) 0
        - 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
    - Hot water installations
    - Cold Water Installations
    - Hybrid Heating systems
    - Rainwater harvesting or grey water system Installation of the piping system above ground level
    - Underfloor heating
    - Solar thermal heating
    - Heat pump systems (Not Refrigeration Type)
    - Wastewater systems
    - Gas installation systems

Section		Relative importance (%)
	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 the given materials to complete the assembly in a sustainable manner • Create freehand sketches for the purposes of pipe bending and assembly • Limit the generation of scrap and waste • 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 • 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	

Section		Relative importance (%)
	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 • 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	

Section	Relative importance (%)
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**

References for industry consultation

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/) ILO 7126
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.onetonline.org/)

This WSOS appears most closely to relate to *Plumber*:
https://www.onetonline.org/link/summary/47-2152.02

http://data.europa.eu/esco/occupation/ed3cf43d-c2c1-4c46-82fc-1375e27e0290

Adjacent occupations can also be explored through these links.

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 Shanghai 2021.

Organization	Contact name
Geberit Vertiebs AG (Global)	Walter Braendle, Head of Technical
R. Nussbaum AG (Switzerland)	Daniel Schneider, Head Product Manager
Schweizerisch- Liechtensteinischer Gebäudetechnikverband – Suissetec - (Switzerland)	Markus Niederer, Department Manager Plumbing at the National Vocational Education and Training Centre (Suissetec), Trainer for Swiss Certificate Masters and Chiefs in Plumbing