

MANUFACTURING AND ENGINEERING TECHNOLOGY

# Water Technology



## WorldSkills Occupational Standards

# 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](http://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 (%)
<b>1 Work organization and management</b>	<b>10</b>

The individual needs to know and understand:

- principles and applications of safe working in general and for water and wastewater treatment and operation in the networks and in solid waste management
- the purposes, uses, care, calibration and maintenance of all equipment and materials, together with their safety implications
- environmental and safety principles and their application to good housekeeping in the work environment
- principles and methods for work organization, control, and management
- principles of team working and their applications
- the personal skills, strengths and needs that relate to the roles, responsibilities, and duties of others, individually and collectively
- the parameters within which activities need to be scheduled

The individual shall be able to:

- prepare and maintain safe, tidy, and efficient work areas
- manage and dispose of the refuse produced in the work area
- prepare for the tasks in hand, with full regard to health and safety
- schedule work to maximize efficiency and minimize disruption
- select and use all equipment and materials safely and in compliance with manufacturers' instructions
- apply or exceed health and safety standards applying to the environment, equipment, and materials
- restore work areas to an appropriate state and condition
- contribute to team performance broadly and specifically
- give and take feedback and support

<b>2 Communication and interpersonal skills</b>	<b>10</b>
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The individual needs to know and understand:

- the range and purposes of documentation in both paper and electronic form
- the technical language associated with the occupation and the industry
- the standards required for routine and exception reporting in oral, written, and electronic form (e.g. values, figures, units, minimal information, recommendations)
- the required standards for communication with clients, team members and others
- the purposes and techniques for generating, maintaining, and presenting records

Section	Relative importance (%)
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The individual shall be able to:

- read, interpret, and extract technical data and instructions from documentation in any available format
- communicate by oral, written, and electronic means to ensure clarity, effectiveness, and efficiency
- use a standard range of communication technologies
- discuss complex technical principles and applications with others
- complete reports and respond to issues and questions arising
- respond to clients' needs face-to-face and indirectly
- gather information and prepare documentation targeted to and as required by the client or client group

<b>3</b>	<b>Electrical</b>	<b>10</b>
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The individual needs to know and understand:

- The basic principles of electricity
- The basic principles of electrical systems
- The basics of electrical control of machines and actuators
- Circuit- and P&I-diagrams as well as operating manuals and/or instruction manuals
- The protection methods of electrical systems
- The dangers/hazards of electrical systems
- Analytical techniques for fault finding
- Strategies for problem solving
- Methods and procedures for identifying high energy consumers
- Strategies for energy efficiency

The individual shall be able to:

- Disengage electrical equipment commonly used in water and wastewater treatment plants
- Identify and resolve areas of uncertainty within the briefs or specifications
- Identify the different components within control cabinets and their functionality
- Exchange defective components within control cabinets
- Take electrical measurements and interpret/verify the results
- Connect wires/cables according to industrial standards
- Install, set up and adjust/calibrate electrical and sensor systems as required
- Ensure connection of all wiring according to circuit diagrams
- Ensure the functionality of electrical systems (i.e. rotation direction)

Section	Relative importance (%)
<b>4 Mechanical</b>	<b>10</b>

The individual needs to know and understand:

- The basics of materials (metals, composites, plastics, etc.)
- The basics in processing methods of different materials
- The basics of connection technology
- The basics of mechanical engineering (mechanics, sealing methods, gear technology, etc.)
- The basics of fluids
- Criteria and methods for testing equipment and systems
- Analytical techniques for fault finding
- Techniques and options for making mechanical repairs
- Strategies for problem solving
- Principles and techniques for generating creative and innovative solutions
- What water loss and leakage is, its potential causes and potential solutions for prevention

The individual shall be able to:

- Repair components (up to systems) efficiently
- Monitor and control process relevant equipment
- Adjust and/or calibrate systems where necessary, according to instruction manuals
- Use accessories efficiently
- Ensure the correct function of systems
- Adjust process relevant parameters
- Identify cost drivers and define methods for their minimization
- Work in a professional manner
- Identify equipment that requires preventive maintenance and develop/take appropriate measures
- Create quick and reliable makeshift solutions as an interim in emergencies.

<b>5 Environment Protection</b>	<b>10</b>
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The individual needs to know and understand:

- The logical sequence of network flow and purification steps
- The hazardous aspects/points for the environment (danger/risk analysis)
- Different mitigation methods
- The basic calculations required within water and wastewater network and treatment processes
- New trends in environmental processes and protection
- Dangers of relevant hazardous substances used on the networks and plants
- The different potential hazardous sources in the vicinity, their potential contents, and their possible effects
- Contingency plans

Section	Relative importance (%)
<p>The individual shall be able to:</p> <ul style="list-style-type: none"> <li>• Operate all steps within a water or wastewater network and treatment plants</li> <li>• Execute proper preventive or correction actions in order to maintain efficiency within all treatment steps</li> <li>• Perform calculations based on given facts</li> <li>• Identify potential problem zones and devise remedies accordingly</li> <li>• Communicate with defined target groups, in order to give the correct information about the types of refuse that can be disposed of in wastewater collection systems</li> <li>• Communicate with the defined target groups, in order to give the correct information about water distribution systems, its possible flaws, water quality and shortage periods</li> <li>• Take measurements and carry out analyses for process and quality control</li> <li>• Monitor and document information and data in compliance with legal requirements</li> <li>• Work in a cost, environmental and hygiene-conscious manner</li> <li>• Use different energy forms (electricity, oil, gas, air, water, and steam)</li> <li>• Review the possibilities of economical energy use (i.e.: mitigation of leakage or usage of heat)</li> <li>• Avoid the use of hazardous substances and make proposals for their replacement</li> <li>• Create and evaluate contingency plans</li> </ul>	
<b>6 Chemical/Biological – Quality Assurance</b>	<b>25</b>

The individual needs to know and understand:

- The basics and principles of solvents and solution preparation, mixing and dilution, including basics calculation
- The proper use of each specific glassware, analytical equipment, or instrument
- How to read and execute standard analytical assay protocols
- The basics and principles of sample pre-treatment, storage, sample preserving and sample taking
- The basics and principles of measuring samples using different techniques (classical and instrumental analysis)
- Basic principles of chemical analysis for quality assurance
- Basic principles of biological analysis for quality assurance
- The basics and principles of statistical analyses that concern specific samples (e.g. standard calibration curves, quantification limit, standard deviation)
- Basic operation/function of laboratory equipment

Section	Relative importance (%)
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The individual shall be able to:

- Prepare any kind of chemical reactants or solutions
- Execute analytical measurement using the proper glassware, equipment, and instrument, according to specific assay protocols
- Clean and calibrate equipment and instruments before starting an assay protocol
- Take samples, including their preservation and pre-treatment
- Select and use laboratory equipment according to their function
- Follow chemical and biological analysis protocols and quality
- Clean and store the equipment and instruments used
- Estimate the concentration of unknown samples, using proper analytical methods, protocols, and statistical analysis
- Document results/findings
- Provide information about water or wastewater quality, in order to identify any kind of problem within the water or wastewater treatment steps
- Acquire information about water or wastewater quality, in order to identify and execute preventative or corrective actions along the treatment steps
- Provide information about water or wastewater quality in order to fulfil laws and regulations, aiming to keep the population safe and healthy

<b>7</b>	<b>Automation and documentation</b>	<b>15</b>
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The individual needs to know and understand:

- The basic principles of sensor technology
- The basic principles and functionality of closed loop technology
- The basic principles of actuators
- The basic principles of control technology
- Analytical techniques for fault finding and solving

The individual shall be able to:

- Identify cost drivers and define methods for its minimization
- Interpret and differentiate circuit diagrams
- Regulate and adjust components for efficient use
- Identify different automation components within systems and make qualified adjustments
- Identify elements within process control, together with their functionality
- Monitor, control and regulate systems manually and by using control and communication systems
- Document all data in electronic and/or paper form

Section	Relative importance (%)
<b>8 Application of health and safety measures</b>	<b>10</b>
<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> <li>• Basics principles and practices of hygiene</li> <li>• Risk assessment for (biological, chemical, electrical, thermal and mechanical-operations)</li> <li>• Health and work-related regulations</li> <li>• The meaning of relevant danger and safety symbols/signage</li> <li>• Health maintaining regulations, personal protection equipment (PPE)</li> </ul> <hr/> <p>The individual shall be able to:</p> <ul style="list-style-type: none"> <li>• Recognize risks</li> <li>• Create/develop safety instructions</li> <li>• Apply and adhere to work related safety and accident mitigation regulations</li> <li>• Identify health and safety hazards as well as dangerous situations in the workspace environment and generate actions/steps towards their mitigation.</li> </ul>	
<b>Total</b>	<b>100</b>



## 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 3132
- ESCO: (<https://ec.europa.eu/esco/portal/home>)
- O\*NET Online ([www.onetonline.org/](http://www.onetonline.org/))

This WSOS appears to be a more senior version of *Water and Wastewater Treatment Plant and System Operators*:

<https://www.onetonline.org/link/summary/51-8031.00>

It appears to be a better fit with *Water Plant Technician*:

<http://data.europa.eu/esco/occupation/7f800e7d-9d86-406a-9116-b5eca7526869>

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
ADIRO Automatisierungstechnik GmbH (Germany)	Klaus Kronberger, Founder and CEO
Festo Didactic SE (Global)	Nader Imani, Executive Vice President
Novexx Pte Ltd (China, South East Asia)	Lee Tze Kang, Executive Director
WEF - Water Environment Association (North America)	Steve Harrison, Senior Manager, Operator Programs