CONSTRUCTION AND BUILDING TECHNOLOGY

Electrical Installations

WorldSkills Occupational Standards

 WSC2021_WSOS18_Electrical_Installations

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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**	5

The individual needs to know and understand:

- Health and safety legislation, obligations, and documentation
- The principles of working safely with electricity
- The situations when personal protective equipment (PPE) must be used
- The purposes, uses, care, maintenance, and storage of all tools and equipment together with their safety implications
- The purposes, uses, care, and storage of materials
- The importance of keeping a tidy work area
- Sustainability measures applying to the use of 'green' materials and recycling
- The ways in which working practices can minimize wastage and help to manage costs whilst maintaining quality
- The principles of workflow and measurement
- The significance of planning, accuracy, checking, and attention to detail in all working practices
- Impact of new technology

The individual shall be able to:

- Develop and follow Health, Safety, and Environment standards, rules, and regulations
- Diligently follow electrical safety procedures
- Identify and use the appropriate personal protective equipment (PPE) including safety footwear, ear, and eye protection
- Select, use, clean, maintain, and store all tools and equipment safely
- Select, use, and store all materials safely
- Identify and take care of expensive fixtures/fittings
- Plan the work area to maximize efficiency and maintain the discipline of regular tidying
- Measure accurately
- Manage time effectively
- Work efficiently and check progress and outcomes regularly
- Establish and consistently maintain high quality standards and working processes

Section		Relative importance (%)
2	**Communication and interpersonal skills**	5

The individual needs to know and understand:

- The significance of establishing and maintaining customer confidence and trust
- The importance of maintaining and keeping knowledge base up-to-date
- The roles and requirements of related trades
- The value of building and maintaining productive working relationships
- Techniques of effective teamwork
- The importance of swiftly resolving misunderstandings and conflicting demands

The individual shall be able to:

- Interpret customer requirements and manage customer expectations positively
- Provide advice and guidance on products/solutions e.g. technological advancements
- Visualize and translate customer wishes making recommendations which meet/improve their design and budgetary requirements
- Question customers closely/deeply to fully understand requirements
- Provide clear instructions
- Introduce related trades to support customer requirements
- Produce written reports for customers and the organization
- Produce cost and time estimates for customers
- Recognize and adapt to the changing needs of related trades
- Work effectively as a member of a team

3	**Problem solving, innovation, and creativity**	5

The individual needs to know and understand:

- The common types of problem which can occur within the work process
- Diagnostic approaches to problem solving
- Trends and developments in the industry including new technology, standards, and working methods e.g. "smart house" and energy saving measures
- Potential problems with procurement and alternate solutions

Section		Relative importance (%)
	The individual shall be able to: • Check work regularly to minimize problems at a later stage • Identify problems originating from the work of a related trade e.g. heating pump, ventilation system, etc. • Challenge incorrect information to prevent problems • Recognize and understand problems swiftly and follow a self-managed process for resolving • Recognize opportunities to contribute ideas to improve solutions and overall levels of customer satisfaction • Demonstrate a willingness to try new methods and embrace change e.g. ready- made components • Recommend customers alternative solutions for better, smarter and more cost efficient and sustainable installations	
4	**Planning and design**	**10**
	The individual needs to know and understand: • Different types of standards, drawings, installation descriptions, and manuals • Range of materials and installation techniques to be used in different environments	
	The individual shall be able to: • Read, interpret, and revise drawings and documentation including layout and circuit drawings • Follow written instructions • Plan installation work using drawings and documentation provided	
5	**Installation**	**35**
	The individual needs to know and understand: • Ducting and wiring systems for commercial, domestic, residential agricultural, and industrial use and when and where to use a specific ducting and/or wiring system • The range of electrical switchboards used for commercial, domestic, residential, agricultural, and industrial uses and when and where to use a specific switchboard system • Types of electric lighting and heating systems for commercial, domestic residential, and industrial use • Control devices and socket outlets used for commercial, domestic, residential, agricultural, and industrial uses, including smart building technologies • Structured cabling systems including: computer network cabling, fire/burglar alarm (conventional and addressable), evacuation control (audio and optical), control and monitoring, access control ('stand-alone'	

Section	Relative importance (%)
and 'network supervised'), closed circuit television (cameras, lenses and attachment components), recorders and monitors • Energy production systems such as solar- and wind-power • Systems for charging of Electrical Vehicles	
The individual shall be able to: • Select and install equipment and wire ways as per drawings and documentation provided • Install ducting and cabling systems on different surfaces as per manufacturer's instructions and current industrial standards • Select and install single and double insulated cables inside ducts, conduits, and flexible conduits • Install and securely fix double insulated cables onto cable ladders, cable trays and different surfaces as per manufacturer's instructions and current industrial standards • Install metal and plastic ducting (trunking); accurately measure and cut ducts at specified lengths/angles; assemble without distortion to joints and to specified tolerances • Assemble different termination adaptors, including glands onto ducts and attach ducts, of different types, securely onto surfaces • Install metal and plastic conduits/flexible conduits and accessories and attach securely onto surfaces, maintaining even radius bends, without distortion to conduits if manually bent. • Correct termination adaptors used for entry of conduits into boxes, boards, and ducts • Install and securely attach different types of cable ladders and cable trays to surfaces • Install electrical switchboards onto surfaces in a secure way and assemble switchboard apparatus in switchboards as per layout drawings/instructions to include main switches, RCDs, MCBs, fuses, controlling equipment such as relays and timers and home and building automation devices • Terminate and install wiring inside switchboards according to circuit drawings • Connect equipment as per instructions provided to include structured cabling systems as per manufacturers' instructions and current industrial standards and regulations • Install systems such as electrical car chargers, solar panels, energy management systems and other related systems for a sustainable future	

Section		Relative importance (%)
6	**Testing, reporting, and commissioning**	**25**

The individual needs to know and understand:

- Industrial regulations and standards applicable to different types of installations
- Verification standards, methods, and reports to be used to record verification results
- Types of measuring instruments
- Tools and software used for parameterization, programming, and commissioning
- The correct operation of the electrical installation in accordance with the planned specification and customer requirements
- The importance of delivering correct and proper documentation "as built" after finalized installations for future reference and maintenance purposes

The individual shall be able to:

- Test installations before energizing to ensure personal and electrical safety to include insulation resistance and earth continuity tests, correct polarity, and complete visual inspections
- Test installations when energized by checking complete function on all equipment installed to ensure correct operation of new installations as per instructions, for example, correct voltage, phase rotation and correct functioning of protection devices
- Set-up equipment to include: selecting and using the appropriate software for programming programmable relays, bus-systems; creating necessary settings on devices such as timers and overload relays; programming programmable relays: downloading and importing applications required and programming bus-systems, for example KNX, DALI, Modbus, and IP or IT based systems
- Set installations to fully functioning and ensure customers can operate
- Provide data for updating drawings and other related documentation after finalized installation work

7	**Maintenance, fault finding, and repair**	**15**

The individual needs to know and understand:

- Different types of installations for specific environments
- Different generations of installations
- The purpose of a specific installation
- The customers' needs for various functions

Section	Relative importance (%)
The individual shall be able to: • Adapt to changing circumstances • Troubleshoot electrical installations and identify faults including short and open circuits, incorrect polarity, insulation resistance and earth continuity faults, incorrect settings on equipment, and incorrect program on programmable devices • Diagnose electrical installations and identify problems including bad connections, incorrect wiring, high loop impedance, and equipment failure • Verify that existing electrical installations still meet current standards • Use, test and calibrate measuring equipment including insulation resistance, continuity, and installation testers, multi, clamp and network cable testers • Repair and replace faulty components in electrical installations • Rewire and or repair faulty installations • Recycle replaced equipment in a correct and sustainable way	
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 7411
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.**onet**online.org/)

This WSOS appears most closely to relate to *Electrician*:
https://www.onetonline.org/link/summary/47-2111.00

or *Domestic Electrician*:
http://data.europa.eu/esco/occupation/5dbb9cf0-b226-402c-a295-2f42ef05ff8b

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
IEK Group (Northern Europe and Eurasia)	Peter Nekrasov, Head of Direction
EuropeOn (Europe)	Giorgia Concas
Elektroplan Buchs and Grossen AG (Germany, Switzerland)	Samuel Schenk, Project Leader
KNX Association (Belgium)	Christian Stahn, Marketing