

WorldSkills Standards Specification

Manufacturing Team Challenge

Manufacturing and Engineering Technology



THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)

GENERAL NOTES ON THE WSSS

The WSSS 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/WSSS).

The skill competition is intended to reflect international best practice as described by the WSSS, and to the extent that it is able to. The Standards Specification 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 Standards Specification 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 Specification. This is often referred to as the “weighting”. The sum of all the percentage marks is 100.

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

The Marking Scheme and Test Project will follow the allocation of marks within the Standards Specification to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Standards Specification.

WORLDSKILLS STANDARDS SPECIFICATION

SECTION		RELATIVE IMPORTANCE (%)
1	Work organization and management	5
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> Principles and applications of safe working generally and in relation to manufacturing The purposes, uses, care, 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 of team working and their applications Personal skills, strengths and needs relative the roles, responsibilities, and duties of others individually and collectively The parameters within which activities need to be scheduled 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> Prepare and maintain a safe, tidy, and efficient work area Prepare self for the tasks in hand, including 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 the health and safety standards applying to the environment, equipment, and materials Restore the work area to an appropriate state and condition Contribute to team performance both broadly and specifically Give and take feedback and support Manufacture components and assembly to meet cost constraints and record manufacturing costs and budgets Maximize material utilization in order to reduce waste 	
2	Communication and interpersonal skills	5
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> The range and purposes of documentation in both paper based and electronic forms The technical language associated with the skill and technology The standards required for routine and exception reporting in oral, written, and electronic form The required standards for communicating with clients, team members and others The purposes and techniques for maintaining and presenting records, including financial records 	

	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • 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 • Explain complex technical principles and applications to non-experts • Complete reports and respond to issues and questions arising • Respond to clients' needs face to face and indirectly • Arrange to gather information and prepare documentation as required by the client 	
3	Design and realization	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The principles and applications of project design • The nature and formats of project specifications • The bases on which the manufactured item will be appraised • Design parameters including: <ul style="list-style-type: none"> • Options appraisal • Selection of materials and work processes • Prototype development • Manufacture • Refinement • Commissioning • Principles and methods for work organization, control and management 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Read and interrogate briefs or specifications for manufactured items • Identify and resolve areas of uncertainty within the briefs or specifications • Generate designs for the manufacture of a functioning item within given timescales • Generate innovative solutions to design challenges • Prepare and implement documentation for work management and control • Complete the design stage within the required limits of cost and time • Use of engineering measurement tools including rules, verniers, micrometres and digital measuring tools 	
4	Drawing	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • How to interpret drawings that conform to ISO standards • How to create drawings that conform to ISO standards • The principles and uses of 2D and 3D modelling software • The principles and uses of CAM software 	

	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Create drawings to ISO standards • Create and modify 2D and 3D models • Create CNC programs using CAM packages and appropriate postprocessors • Interpret, construct, and modify engineering CAD drawings to work with 3D modelling and to convert both to CAM • Complete drawing activities within the planned timetable and to suit the project's overall requirements 	
5	Machining (conventional and CNC)	15
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The principles and applications of CNC machining • The routines of CNC machining • The use of general machining equipment used in activities such as central lathing and milling • The relationship between drawings and machining, including modifying the machining to meet specifications • The characteristics of metals and the potential impact on them of cutting tools and processes • The applications of machining to a range of metals and materials 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Machine components to drawings on conventional machine tools and from CAM generated tool paths • Safely operate conventional machine tools such as lathes, mills, and drill presses • Safely operate a CNC machine centre • CNC programming • Address the issues caused by temperature during machining, including the use of coolants • Complete machining within the planned timetable and to suit the project's overall requirements • Manufacture components to industry finishes and tolerances • Measure and adjust manufacturing process to meet specifications 	
6	Sheet metal working and welding	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The specific safety principles and practices to be used with sheet metal • The principles and applications of working with sheet metal • The processes required for bending and cutting sheet metal • Specific safety principles and applications for welding • The principles and applications of a range of welding types, including TIG (for steel and aluminium) and MAG (for steel). 	

	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Apply safe working practices for sheet metal working • Bend and cut sheet metal components in accordance with drawings • Fit sheet metal components to an assembly • Complete the sheet metal work within the planned timetable and to suit the project's overall requirements • Use safe welding holding and welding techniques • Weld a variety of materials • Use a range of welding types • Complete the welding activities within the planned timetable and to suit the project's overall requirements 	
7	Electronics	12
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The principles and applications for working with electronics and related equipment • The principles and uses of PCBs • The principles and applications of electronic programming software • The principles and applications of robotics and mechatronics 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Assemble and commission electronics from drawings • Design control circuits • Generate programs for automated sections of the manufacturing process, including those for CNC machining, robots, PCs, and PLCs • Complete the electronics activities within the planned timetable and to suit the project's overall requirements • Generate programmes for automated sections of the manufacturing process, including CNC machining, robots, PC, and PLCs 	
8	Fitting	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Principles and methods for manufacturing parts such as jigs, fixtures, adaptors and process attachments • Principles and methods for assembly and fastening of manufactured parts such as jigs, fixtures, adaptors, and process attachments 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Design a range of jigs, fixtures, and accessories • Manufacture jigs, fixtures, and accessories in accordance with drawings and specifications • Assemble and commission items in accordance with drawings and specifications • Assemble items using fasteners such as glues, screws, bolts, etc. • Complete the fitting activity within the planned timetable and to suit the project's overall requirements 	

9	Testing and commissioning	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The criteria and methods for operating test runs • The scope and limits of the technologies and methods employed • Strategies for thinking creatively and generating innovation • The possibilities and options for making incremental and/or radical changes 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Test run the assembled item • Review each part of the manufacturing and assembly process against established criteria, including quality, functionality, time, and cost • Modify, test, and appraise each part of the process, including: <ul style="list-style-type: none"> • Design • Tool paths • Assembly procedures • Jigs • Fixtures • Machining • Undertake a final test run to commission the item • Present the item to the client with explanations and responses to questions • Generate and present a portfolio including all essential documentation such as: <ul style="list-style-type: none"> • 2D mechanical drawings • Electronic solid models • Electrical drawings • Manufacturing plans • Design calculations • Manufacturing costs • Generate support documents such as: <ul style="list-style-type: none"> • the Operating Manual • the Maintenance Manual 	
10	Additive manufacturing	3
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Principles and methods to design parts; • Principles and methods to design parts in special software; • Principles and methods to make postprocessing for 3D printers (FDM, SLS, DLP and SLM); • Principles and methods to design parts considering variety of materials used; • Principles and methods to reduce production time keeping with quality in resistance and durability. 	

	The individual shall be able to: <ul style="list-style-type: none"> • Design parts in the special software; (www.autodesk.com/solutions/generative-design); • Calculate the variety of materials used; • Postprocess jobs of 3D printers; • Start and control the process; • Operate a 3D printer; • Adjust and set up parameters for 3D printing; interpret drawings. 	
	Total	100

REFERENCES FOR INDUSTRY CONSULTATION

WorldSkills is committed to ensuring that the WorldSkills Standards Specifications 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 Standards Specification 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/).

This WSSS (Section 2) appears to be a junior version of a *Mechanical Engineer*:
<https://www.onetonline.org/link/summary/17-2141.00>

and to relate to a *Mechanical Engineering Technician*:

<http://data.europa.eu/esco/occupation/b31e404e-9af6-457d-a58a-208f612eeba3>

Adjacent occupations can also be explored through these links.