MANUFACTURING AND ENGINEERING TECHNOLOGY

Industrial Mechanics

Technical Description

 TD01 v8.0 WSC2021

worldskills

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:

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1 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

Industrial Mechanics

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

Industrial mechanics design and plan, install and commission, maintain, repair, and decommission, industrial plant. They work in a large range of industrial settings and production plants and may either have specialist knowledge about one particular industry or work across several. They may be employed within a large single plant, installing and maintaining production equipment, or work for subcontractors across a number of industrial settings. They normally work both indoors and outdoors, on small and large projects.

Industrial mechanics may manufacture parts and equipment, improve, modify, maintain, troubleshoot, and repair industrial machinery, mechanical equipment, and, increasingly, automated and robotics systems. They work in teams, or alone, according to each project and circumstance. They are likely to have ongoing contact with other trades, professions, and stakeholders such as customers and employers. The working environment may well be hazardous; therefore, industrial mechanics need proactively to promote best practice, with rigorous adherence to health and safety legislation, as a minimum.

Industrial mechanics must take on a high level of personal responsibility and autonomy. The role is wide-ranging, and every step is important. They must design, plan and provide a safe mechanical installation and maintenance service, in accordance with relevant standards; diagnose and correct malfunctions; and commission stand-alone industrial mechanical and automated systems. Concentration, precision, accuracy, and attention to detail are all essential because mistakes are largely irreversible, costly and potentially life threatening.

Industrial mechanics must recognize the implications, both financially and for businesses' reputations, of delays in production as a result of reliability issues on production lines. They therefore need to work logically and flexibly to find solutions that meet time constraints. They also need to provide Expert technical advice and guidance, and provide innovative and cost-effective solutions to production issues. Therefore, in addition to their specialist and technical expertise, the industrial mechanic must have strong work organization, communication and interpersonal skills, and be self-managing. Given the pace of industrial change, and growing environmental concerns, they must also maintain high levels of awareness and openness to their own professional development.

1.1.3 Number of Competitors per team

Industrial Mechanics 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.

2 The WorldSkills Occupational Standards (WSOS)

2.1 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.

2.2 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
- Principles of risk management
- Principles of energy isolation and the need for verification
- Principles for safe working with all forms of industrial equipment and settings
- Hazardous area work permit regulations
- The situations when personal protective equipment must or should be used
- The purposes, uses, care, maintenance, and storage of all tools and equipment together with their safety implications
- The importance of keeping a tidy and organized work area
- Sustainability measures applying to the use of "green" materials and recycling
- The ways in which working practices can minimize waste and help to manage costs whilst maintaining quality
- Principles of workflow and measurement
- The significance of planning, quality, accuracy, checking, and attention to detail in all working practices
- The impacts of new technology
- The financial and business implications of faulty engineering equipment or plant

The individual shall be able to:

- Follow health and safety standards, rules, and regulations
- Apply Risk Management techniques
- Apply and verify (test for "zero") energy isolation
- Diligently follow industrial safety procedures
- Apply Hazardous Work Area requirements
- Identify and use the appropriate personal protective equipment 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 industrial equipment
- Plan the work area to maximize efficiency and maintain the discipline of regular tidying
- Prioritize work and manage time effectively
- Work efficiently and check progress and outcomes regularly
- Establish and consistently maintain high quality standards and working processes
- Proactively engage in continuous professional development to keep abreast of new technologies, working practices, and environmental concerns.

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

The individual needs to know and understand:

- The importance of maintaining and keeping one's knowledge, understanding and skills up-to-date
- The significance of establishing and maintaining the confidence and trust of customers, employers, and stakeholders
- Customers' business environment and needs
- 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 importance of accurate and concise reporting.

The individual shall be able to:

- Research the nature of each assignment and customer, and prepare accordingly
- Represent the employer or contractor and one's personal authority within each assignment
- Clarify customers' and employers' wishes, preferences, and limitations
- Provide advice and guidance on products, options and/or solutions, while explaining the cost-benefits of each
- Visualize and translate customer/employer wishes into recommendations which meet and/or optimize their design and budgetary requirements
- Produce cost and time estimates for customers and employers or contractors, and adapt as required
- Provide clear instructions and guidance within the given reporting and support structures
- Introduce related trades to support customer/employer requirements
- Keep supervisors, peers and subordinates informed as required, by various methods
- Provide oral and detailed written reports for work completed
- Recognize and adapt to the changing needs of related trades
- Work effectively individually and as a member of teams
- Use oral communication to avoid misunderstandings
- Control personal conflicts in the workplace

Section		Relative importance (%)
3	**Planning and design**	**10**

The individual needs to know and understand:

- Principles, techniques, procedures and equipment for the design and production of goods and services
- Principles for work organization, planning and prioritization
- Raw materials, production processes, quality control, costs and other considerations for efficient manufacturing and distribution of goods
- Standards, blueprints, and schematics
- Procedures and technical manuals
- The management of equipment and materials, depending on their nature and environment
- Installation techniques and practices for different environments and purposes
- Principles and techniques for setting and incorporating goals
- Evaluation principles and techniques for determining compliance with standards and goals
- Relevant equipment, policies, procedures, and strategies for the protection of people, data, property, and installations
- Principles, requirements, and best practice for selecting, using, maintaining, disposing, and recycling of materials.

The individual shall be able to:

- Apply best practice principles, techniques, and procedures to production design
- Read, interpret, and revise drawings/blueprints and documentation including layout and schematic drawings
- Plan work using blueprints, schematics, and technical documentation
- Plan work for optimal efficiency and economy of installation and production
- Plan work to optimize safety and security, and create least environmental damage
- Design and incorporate milestones, checks and assessment points to ensure compliance with plan or better
- Prepare documentation, including written instructions and work procedures, and briefings
- identify and source equipment, tools and materials, and store appropriately prior to and during use.

Section		Relative importance (%)
4	**Installation**	**40**

The individual needs to know and understand:

- Units of measurement, and the skilled use of measuring devices
- Machining operations of milling machines and centre lathes to produce component parts to prescribed tolerances and standards
- The applications and correct use of fasteners
- Different types of lubricants: their properties, applications, and effects
- Rigging and hoisting procedures, and SWL calculations for the removal and installation of mechanical industrial equipment
- How to set-up and operate Oxy Fuel, SMAW, MIG, and TIG welding equipment
- How to fabricate components together to specification, and weld
- The principles of foundation preparation and installation of machine bases or sole plates
- Basic Electrical and electronic theory and principles
- Basic Electric and electronic terminology, schematics, applications, associated tools, installation, wiring and troubleshooting techniques
- Electrical and programable logic controller (PLC) or VFD systems and their use in automation and the manufacturing process
- Simple functional Programming of PLCs or VFDs
- Engineering drawings/blueprints, schematics, and manufacturers' manuals
- How to select, remove, install, and maintain plain and anti-friction bearings and interpret ISO charts and bearing catalogues
- How to identify, remove, select, and install appropriate power transmission systems and/or components for specific applications
- The use of precision measuring equipment relative to part sizes, machine installation, set-up, alignment, and preventative maintenance
- Types and principles of operation of various material handling systems
- The principles and applications of hydraulics/pneumatics and safety as they relate to fluid power systems.

The individual shall be able to:

- Select and install equipment from blueprints, plans and documentation
- Apply all machinery and equipment isolation (lock-out) and de-energizing procedures (mechanical and fluid power) before commencing any work procedures
- Select and use hand cutting tools for shaping components to specifications
- Use and interpret readings from a range of devices
- Set up and safely operate the required machine tools to produce components to given units of tolerance
- Identify and select the correct fasteners for specific applications
- Comply with all safety rules, proper usage protocols' and environmental legislation when handling and storing lubricants

Section		Relative importance (%)
	• Select, inspect, and use the correct hoisting and rigging equipment and SWL calculations for specific lifting applications • Use Oxy Fuel, SMAW, MIG, or TIG welding equipment and fabrication techniques, including layout and joint preparation to join various metal types • Install machine foundations, machine bases or sole plates using standard industry techniques • Apply correct lockout and tag-out and use multi-meters to ensure electrical components are not "live" or "zero energy" state • Troubleshoot, remove, and reset electrical and electronic overload devices, safely using electrical testing instruments • Read and interpret 1st and 3rd orthographic projections, and interpret assembly and detail drawings of machines • Install and maintain plain and anti-friction bearings, using standard industry practices • Remove, inspect, repair, or replace and install, components on power transmission systems and pumps • Remove and install devices on material handling systems • Use the appropriate measuring/alignment devices to align equipment and take appropriate readings/measurements • Service or replace as required the correct fluid power (pneumatic/hydraulic) devices / pieces of equipment • Create and initialize simple functional PLC or VFD programs for control and motion	
5	**Problem solving, innovation, and creativity**	**10**

	The individual needs to know and understand:
	• Principles and techniques for
	  • critical thinking
	  • judgement and decision-making
	  • troubleshooting
	  • monitoring and assessment
	  • quality control analysis
	  • complex problem-solving
	• The common types of problem that can occur within work processes
	• New expectations and standards, including environmental considerations, that impact on decision making, efficiency, and quality
	• New technologies affecting equipment, tools, methods, monitoring and assessment.	

Section		Relative importance (%)
	The individual shall be able to: • Use logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, and approaches to problems • Observe, receive, and otherwise obtain information from all relevant sources • Consider the relative costs and benefits of potential actions to choose the most suitable one • Check work regularly to minimize problems at a later stage in the process • Monitor and review information from materials, events, or the environment, to detect or assess problems • Identify problems originating from the work of related trades • Challenge incorrect technical information to forestall problems • Recognize and troubleshoot problems swiftly by following a self-managed logical process • Respond to opportunities to contribute ideas to improve solutions and overall level of customer/employer satisfaction • Demonstrate a willingness to try new methods and embrace change	
6	**Testing, reporting, and commissioning**	**15**
	The individual needs to know and understand: • The essential features of quality assurance • Industrial regulations and standards applicable to different types of machinery • Installation standards • Verification standards, methods, and reports for verification results • Types of measuring instruments such as Micrometres and Vernier Callipers • Laser alignment/measuring tools/vibration analysis/thermography • Tools and software used for programming and commissioning • The correct operation of the machine installations in accordance with planned specifications and customer/employer requirements • Test equipment and safe work instructions • Principles and applications for optimizing production processes	

Section		Relative importance (%)
	The individual shall be able to: • Cordon off work areas in order to conduct tests safely • Test installations and complete visual inspections before energizing to ensure personal, electrical, and mechanical safety • Test installations when energized by checking complete function on all equipment installed to ensure correct operation of new/repaired or refurbished installations as per instructions • Set installations to fully functioning and ensure operators can safely, effectively, and efficiently perform required functions to meet customer/employer satisfaction • Adjust equipment and machinery to ensure optimal performance • Brief and advise operators to maintain optimal usage • Complete detailed commissioning reports, including recommendations on optimization.	
7	**Maintenance, fault finding, repair, and decommissioning**	**15**

	The individual needs to know and understand:
	• Different types of installations and equipment for specific environments
	• Different generations of installations and equipment
	• The purpose of specific installations and equipment
	• Customers'/employers' needs for various functions of installations and equipment
	• Diagnostic approaches to problem solving (Failure Modes and Root Causes analogies)
	• Principles and methods for estimating the costs of restoration
	• Legislation and best practice for
	  • Sustainability
	  • Waste disposal and recycling	

Section	Relative importance (%)
The individual shall be able to: • Adapt to changing circumstances in "real time" • Disassemble equipment for maintenance and/or repair • Troubleshoot basic electrical faults, mechanical, power transmission and fluid power installations / systems • Use, test, and calibrate measuring and diagnostic equipment to find and locate faults during regular maintenance and troubleshooting actions • Repair or replace worn, damaged, or defective parts • Enter simple codes and/or instructions to re-program computer-controlled machinery • Set up and oversee test runs to ensure the adequacy of repairs and replacements • Verify that existing installations and equipment still meet current standards • Identify and advise on improvements to efficiency and sustainable practice • Arrange for the safe disposal of hazardous and other waste products, and recycling where possible.	
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, in order 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 people 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 Rules for further details.

Experts and Independent Assessors 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
		A	B	C	D	E	F	G	H			
STANDARDS SPECIFICATION SECTION	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)
- 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

WorldSkills is committed to continuous improvement. This particularly applies to assessment. The SMT is expected to learn from past and alternative practice and build on the validity and quality of assessment and marking. This section may provide specific and relevant information on this competition's assessment strategy. As required, it may cover:

- measures to use Experts' time efficiently and economically while generating a valid and clear result
- measures to ensure that high performance is fully rewarded, while recognizing the attainment of each Competitor
- changes and developments to take account of past competition performance.

The Test Project and Marking Scheme will reflect the WorldSkills Occupational Standards. The judgement and measurement forms are formalized by the Independent Test Project Designer in consultation with the Skill Competition Manager and Skill Advisor to make sure the Marking Scheme accurately reflects the WSOS.

4.10 Skill assessment procedures

Assessment and marking are an intense process that depends upon skilful leadership, management, and scrutiny.

- The Experts will split into working groups and assigned projects of work to mark. These groups will mark the same criteria for all Competitors;
- A timetable to be prepared by the Experts as to when the projects must be handed in for marking;
- These projects are marked in process and when they are completed and presented by the Competitor;
- An Expert must not mark their compatriot Competitor's work;
- Parts must be handed in for marking before final assembly of a project as per instructions;
- Expert teams to be selected by the CE and the DCE;
- A mix of experience is required in each Expert team;
- The manual measuring tools which are used are the same ones that are used to set the Competitors manual measuring tools
- Competitors' standards;
- If a Competitor is issued with additional material/equipment it is agreed that a penalty is incurred in the marking scale. This needs to be confirmed on the drawing to ensure consistency for Competitors and Experts. Maximum penalty of two marks for each additional piece of material or equipment
- Any additional material given to a Competitor must be signed off by two Experts (not compatriot Expert) to ensure consistency;
- Any details to be manufactured by the Competitor must be manufactured as per the supplied drawing with the specified process/equipment supplied and to industry standard with the correct usage of equipment at all times during the process;
- If equipment is used inappropriately/unsafely there is a penalty of 0.5 marks per infringement due to the unsafe/incorrect use of equipment, this is to be signed off by two Experts (not compatriot Expert) to ensure consistency

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 Developer, 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 de

5.2 Format/structure of the Test Project

The Test Project is a series of four (4) standalone modules.

5.3 Test Project design requirements

Test Project design requirements are as stated. All work must be done using the materials and the infrastructure in normal use in the Host Country/Region. An exception is those parts which the Independent Test Project Designer has brought or which are provided;

- Tolerance range specification;
- Any tolerance used on the drawing must be ISO format or be supplied;
- Mechanical - all items produced by the Competitor are utilized;
- The tolerances must be able to be inspected with the measuring tools that are listed on the IL;
- The choice of surface finish must reflect the desired results keeping in mind the material type;
- The Test Project will include four (4) separate modules involving multiple tasks, to be assessed according to the WSOS applicable to each task;
- Competitors must be able to work with the materials specified and must be able to comply with environmental requirements;
- The total working time for all four modules is 20 hours.

The following is the guideline for the number of work in hours:

- Module 1 = 4 hr
- Module 2 = 4 hr
- Module 3 = 6 hr
- Module 4 = 6 hr

5.4 Test Project 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 Who develops the Test Project or modules

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

5.4.2 When is the Test Project developed

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

Time	Activity
Prior to the Competition	The Test Project/modules are developed.
Seven (7) months prior to the Competition	Test Project skill areas, skills sets, and parameters are posted on the WorldSkills Discussion Forum.
Three (3) months prior to the Competition	The Test Projects/modules are finalized and sent to the WorldSkills International Skills Competitions Administration Manager.
At the Competition on C-3	The Test Project/modules are presented to Experts.
At the Competition at the beginning of each module	The Test Project/modules are presented to 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 is expected to identify one or more independent, expert, and trusted individuals initially to review the 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 and will ensure that the Test Project/modules can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project selection

The Test Project/modules are selected by the Independent Test Project Designer in collaboration with the Skill Competition Manager.

5.8 Test Project circulation

If applicable, the Test Project is circulated via the website as follows:

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Experts on C-3 and to Competitors every morning after Compatriot Communication.

Test Project skill areas, skills sets, and parameters are posted for the Experts on the WorldSkills Discussion Forum seven (7) months prior to the Competition to allow for proper preparation by their Competitors'.

5.9 Test Project coordination (preparation for Competition)

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

5.10 Test Project change

There is no 30% 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 to infrastructure limitations.

5.11 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 such items may include those for fault finding modules or modules not circulated.

The Competition Organizer provides information on the following equipment on the Infrastructure List.

- Machine tools and accessories;
- Welding equipment and tools;
- Fabrication equipment and tools;
- Required hand, power, precision measurement, and preventative maintenance tools.

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 skill specific Discussion Forum (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be the moderator for this Forum. Refer to 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 during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Skill Competition Manager. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalized at the Competition by agreement of the Experts. 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
Release of Test Project modules	• Test Project module documentation is released to the Competitors at the beginning of each competition day.
Translation work	• Translation work by Experts and Interpreters will begin on C-4 as per SMP.
Tools an Interpreter may use	• Interpreters may use a trade specific technology dictionary and a translation device.
Who can attend to a Competitor and when	• Competitors will advise the appropriate marking team Expert they require assistance. Where an Interpreter is required ONLY the Interpreter is summoned to answer any questions arising. If the compatriot Expert is part of the marking team they must step aside and observe only, interaction with their Competitor is not allowed.
Recording sign-off points	• If required designated Experts will record the Competitors work at each sign off point using a device allocated to them by the Skill Competition Manager
Marking information provided to Competitors	• At each workstation the Competitor will receive from the Expert/Industry Marking Team brief but clear descriptions/direction of the range of skills, equipment, and tolerances required to compete the given project/module.

7 Skill-specific safety requirements

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

Task	Safety glasses with side protection	Welding mask	dust mask	welding gloves	cut protection gloves	safety shoes with protective cap	sturdy shoes with closed toe and heel	tight fitting work clothes (long trousers	Fire resistant protective clothes	hairnet/hat	hearing protection
General PPE for safe areas							√	√			
Welding and Fabrication	√	√	√	√	√ (When not welding)	√		√	√	√	√
Machining (Lathe/Vertical Milling M/C)	√					√		√		√	√
Rigging/Lifting of equipment	√				√	√		√		√	√
Hand tools/hand drills/hole saws etc.	√		√			√		√		√	√

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 such 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.

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 the Industrial Mechanics skill competition 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.

8.4 Materials, equipment, and tools supplied by Experts

Experts are not required to bring materials, equipment, or tools. All requirements are supplied by the Competition Organizer.

Experts are required to supply their own Personal Protective Equipment (PPE) as specified in section 7 skill-specific safety requirements. Experts are responsible that Interpreters bring their PPE.

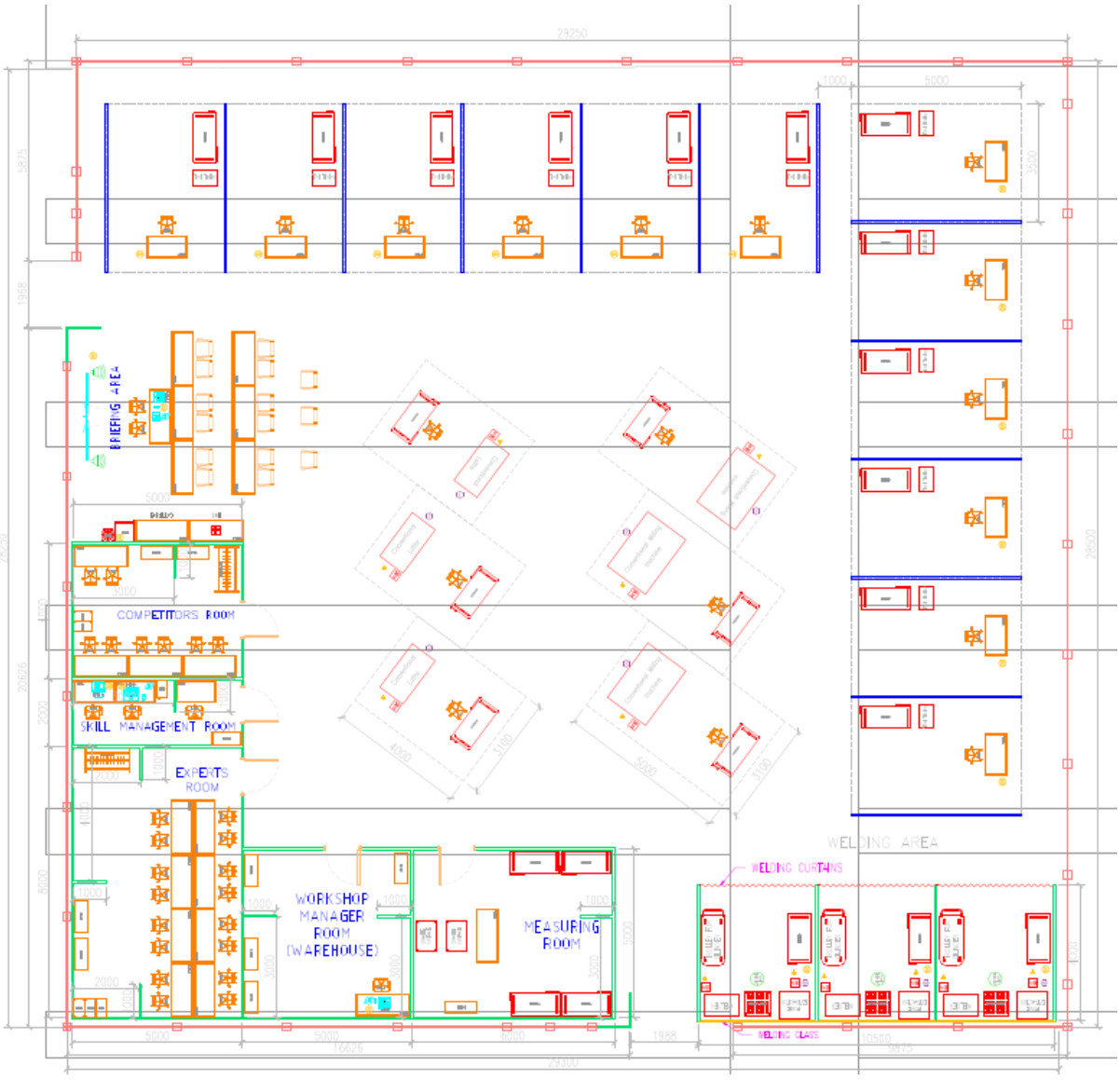
8.5 Materials and equipment prohibited in the skill area

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

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.

Topic/task	Skill-specific rule
Use of technology – USB, memory sticks	• Competitors, Chief Expert, Deputy Chief Expert, Experts, and Interpreters are not allowed to bring memory sticks into the workshop. The Skill Competition Manager is exempt from this rule. From C-6 to C+1.
Use of technology – personal laptops, tablets and mobile phones	• Competitors are not allowed to bring personal laptops, tablets, or mobile phones into the workshop. • Chief Expert, Deputy Chief Expert, Experts, and Interpreters are allowed to bring laptops or tablets for translation work only, the devices MUST be kept in the locker for the duration of the competition C-6 to C+1. The Skill Competition Manager is exempt from this rule. From C-6 to C+1.
Use of technology – personal photo and video taking devices	• Competitors, Chief Expert, Deputy Chief Expert, Experts, and Interpreters are not allowed to use personal photo and video taking devices in the workshop from C-6 until C+1. The Skill Competition Manager is exempt from this rule. • Competitors are not allowed to take photographs as they progress through their project work.
Drawings, recording information	• Competitors, Chief Expert, Deputy Chief Expert, Experts, and Interpreters are not permitted to bring drawings or prepared information into the workshop. The Skill Competition Manager is exempt from this rule.
Templates, aids, etc.	• Competitors are not permitted to bring or use templates/patterns and prepared parts. Expert marking teams will be given the required templates or patterns by the Skill Competition Manager only.

10 Visitor and media engagement

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

- Try-a-Skill;
- Display screens;
- Test Project descriptions;
- Enhanced understanding of Competitor activity;
- Competitor profiles;
- Career opportunities;
- Daily reporting of competition status.

11 Sustainability

This skill competition will focus on the sustainable practices below:

- Recycling – all waste generated by the Competitors in the workshop to be recycled;
- Use of "green" materials – where possible the use of "green" materials is maximized;
- Use of completed Test Projects after Competition – some of the completed Test Projects are donated to local technical institutions, colleges, universities, and high schools. Sponsor supplied tools, accessories, and equipment is returned at the completion of the competition.

12 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/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.onetonline.org/)

This WSOS (Section 2) appears most closely to relate to *Industrial Machinery Mechanics:* https://www.onetonline.org/link/summary/49-9041.00

and *Industrial Machinery Mechanic:* http://data.europa.eu/esco/occupation/269c47e7-9017-4aa6-bce8-49e89a696a64

These links also allow adjacent occupations to be explored.

There were no responses to the requests for feedback this cycle.