

MANUFACTURING AND ENGINEERING TECHNOLOGY

Industrial Mechanics



WorldSkills Occupational Standards

WorldSkills Occupational Standards (WSOS)

Occupation description and WSOS

The name of the occupation is

Industrial Mechanics

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.

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
- 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

Section	Relative importance (%)
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- 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.

2	Communication and interpersonal skills	5
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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

Section	Relative importance (%)
<ul style="list-style-type: none"> • 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 	
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.

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 programme 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
- 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
- Trouble shoot, 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
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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.

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
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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

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/repared 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
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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

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 codes and 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
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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 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.