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INTRODUCTION

The aim of the research was to identify how the employers see the skills and knowledge of mechanical engineering technicians now and in the future. This research has been built upon responses given by the employers in Slovenia and Croatia during the semi-structured interviews conducted between June and November 2019. The report has followed the methodology defined in the Guidelines for the Research of Employers and Market Needs (see more in deliverable 3.1). Report includes an adapted occupational standard for mechanical engineering technician, which list competences identified by the employers. The research projects that future jobs are likely to have higher cognitive and interactive components, this being a probable consequence of global, skill-based technological change.

The purpose of this document is to provide project partners with an overview of educational needs identified in the labour market. This document lists skills and knowledge identified by employers in both countries i.e. Croatia and Slovenia. There were no major differences detected among both countries. This report will be used as a base for drafting qualification profile which will identify learning units and learning outcomes that are common in both countries.

EXECUTIVE SUMMARY

There are wide employment opportunities for mechanical engineering technicians. In their work, they are usually involved in production planning and control, estimating, quality management, process and system optimization. Type of work and level of expertise depend on size of the company and type of business activity. They may work as CNC programmers or operators, planners, project managers, quality assurance co-ordinators or as workers in maintenance. The answers provided by employers were widely dependent on the type of organisation/company and line of production. As the results are much more dependent on type of organization, (robotics, sector, SME, specialised producer, etc...) than the country of origin, we will provide results in this report upon task type.

Mechanical engineering technicians work in offices or manufacturing and processing plants, usually in closed or open spaces. They usually work in shifts and may work overtime to meet project deadlines. The jobs for mechanical engineering technicians require them to work in teams or individually. The minimum requirement is a high school diploma in mechanical engineering, EQF level 4. Mechanical engineering technicians have many opportunities to continue their education at higher level. The changes in skill requirements throughout their careers is not mayor. A lot of employers also expressed that they are keen to pay for further education and prefer that they enrol student from the lower level of education (3-year education) and then enable them further education, because they all agree that practical knowledge is important even for the person who has PhD in mechanical engineering.

METHODOLOGY

Preparation for the survey started with the desk research. In the second step, consortium reviewed statistical data on the occupation gathered by the project partners in scope of WP3 on the position of mechanical engineering technicians at the labour market in Slovenia and Croatia. Several data sources were used to collect description of the occupation such as websites of VET schools with programme for engineering technician, national employment centre, ESCO classification of occupation and skills/competences and job posting sites.

In the final step of preparation, consortium independently in Slovenia and Croatia had several internal meetings to discuss the instructions which would be given to interviewees and to agree on companies to be contacted that would most likely have employed engineering technicians. Companies were chosen randomly and contacted directly, via e-mail or by phone. There were no difficulties in organizing meeting and all companies' representatives were forthcoming.

Consortium team conducted semi-structured interviews conversationally with one or more respondents that lasted from 1 to 2 hours. In the beginning, in we introduced the project and aims of the survey, the structure and the content of the survey template and explained the methodology. Answers to open-ended questions were accompanied by follow-up questions to specify tasks and particular skills and knowledge. Consortium team mostly spoke with head of production or other department such as quality etc. We weren't able to interview worker in the occupation as it was inconvenient for the companies.

In interview, we asked employers representative to describe work-specific or technical skills and or transferable skills or soft skills like the communication and teamwork skills. For each category, we asked them to list all the tasks a worker has to perform on the job and break down each task into the skills and knowledge. Some skills and knowledge mentioned by the interviewees were relevant for different key tasks across the different task types. When analysing the data, researchers tried to avoid the repetitions of skills and knowledge and connect the skill with one specific task type.

Profile of Participants

In this section, we will provide a brief overview of the interviewing participants, including a short summary of the company and size of the company. Target group in our research has been composed by:

- 10 companies from engineering sector Slovenia
- 10 companies from engineering sector Croatia

	Name of Company and Participant	Company Description and Size
1.	Alas-info d.o.o. Donji Vukojevac 83/D 44272 Lekenik	The company manufactures special tools for machines used by manufacturing companies and the automotive industry and is engaged in smaller serial jobs. Other areas of activity are the design of complex devices, the

	company director and deputy director	construction of special tools and gadgets, the adoption and development of new products. Size: 31 employed
2.	Dok-ing d.o.o. Kanalski put 1, HR-10000, Zagreb, Croatia Head of Production Department	DOK-ING is a company registered for the production of robotized and special purposes systems and equipment. Company manufactures machines for unmaned landmine clearance and other multi-purpose vehicles and electric vehicles. Size: 92 employed
3.	Knauf Insulation D.O.O. Varaždinska Ul. 140, 42220, Novi Marof Head of Engineering, Maintenance and Investment	Knauf Insulation d.o.o. has developed into a group of companies that have become the European market leader in gypsum-based building materials, delivering products and services worldwide in the following fields: dry wall construction, gypsum plasters, thermal and sound insulation materials and injection moulding / moulded parts. Size: 92 employed
4.	Kostwein proizvodnja strojeva d.o.o. Ul. Mihovila Pavleka Miškine 65, 42000, Varaždin Leader of Logistics Department	Mechanical production, Welding, Assembly, Switch Cabinet Construction Size: 417 employed
5.	Oprema d.d. Gospodarska ulica 5, 42230 Ludbreg Technology Manger, Head of Production and Technology Department	The company Oprema d.d. is a manufacturer of cooling units with primarily production of refrigeration for cooling and dispensing beer, and also devices for cooling and dispensing soft drinks, wine, water, soda water, with modern organization Size: 217 employed
6.	General Electric Hrvatska d.o.o. Mala Švarča 197, 47000, Karlovac Head of Facility Management, Director of Human Resources Management	General Electric Hrvatska d.o.o. is a company, providing construction and upgrade services to power plants. The company is a part of the USA-based General Electric Group. GE Hrvatska is a Center of Excellence (CoE) for service turbine production and structural parts reconditioning. Size: 550 employed
7.	Tvornica turbina d.o.o. Ul. Stanka Vraza 53, 47000, Karlovac Head of Production, Senior Technologist	TTK d.o.o. is a 100% privately owned company established in 1991 through organizational changes of former "Jugoturbina". Main areas of activities are design and manufacture of new marine and industrial equipment, manufacture of spare parts for marine and industrial pumps and turbines, refurbishment of marine and industrial power equipment, etc. Size: 160 employed
8.	ALATI STUHNE d.o.o. Valentinovo 8/2, 49218, Pregrada	ALATI STUHNE is a family owned mould manufacturer that designs, develops and manufactures moulds and finish equipment for glass factories around the world.

	Head of Production	With over 30 years' experience in the production of moulds and finish equipment, the company is an expert in the production of mould for glass industry. Size: 215 employed
9.	EKO Međimurje d.d. Ul. Braće Radić 37, 40000, Čakovec Head of Technology and Quality Assurance	Eko Medjimurje d.d. is a Croatian brick and machine components manufacturer. Main activities are manufacturing of machine parts for construction machinery (cabins, fuel and oil tanks, chassis, staircases...), food industry plants (baking ovens and other equipment for baking industry, meat industry, dairy industry etc.), boilers for heating, recycling plant parts and other metal structures. Size: 450 employed
10.	Novi Feromont d.o.o. Kolodvorska BB. 40320 Donji Kraljevec Head of Quality Assurance	Novi Feromont manufactures metal structures in two specialized programs: production of transformer enclosures and production of enclosures for high-voltage switches and measuring devices (power equipment). Size: 318 employed
11.	AMTEC.PRO d.o.o. ; Gabrsko 12, 1420 Trbovlje, CEO	The company has been established in 2003 and their basic area of activity is the production of carrier tapes, machines for automation of production and embedded electronic control units. Size: 10 to 19 employed
12.	Gorenje gospodinjski aparati, d.o.o. , Partizanska cesta 12, 3320 Velenje; Direktor-Skupno vzdrževanje	The Gorenje Group is one of the leading European manufacturers of home products with a 68-year tradition. They have two global brands (Gorenje and Asko premium brand) and six local brands. Their technologically is sophisticated, innovative, energy-efficient. They are present in 90 countries around the world. Size: over 1000 employed
13.	EMO-Orodjarna d.o.o. , Bežigrajska 10, 3000 Celje, tehnični direktor	EMO programme is divided into: transfer tools for transforming sheet metal, progressive tools for transforming sheet metal and individual tools for transforming sheet metal. Size:200 to 249 employed
14.	LTH Castings d.o.o. , Vincarje 2, Vincarje, 4220 Škofja Loka, Tehnolog izdelave orodij	LTH Castings is a specialist for complex, high-quality high-pressure die-cast aluminium components and systems. They are supplier of both high-tech and less complex parts manufactured by a network that is spread across Central and South Europe (Slovenia, Croatia and Macedonia). Size: over 1000 employed

15.	<p>LITOSTROJ POWER d.o.o., Litostrojska cesta 50, Ljubljana, 1000 Ljubljana,</p> <p>Pomočnik direktorja proizvodnje</p>	<p>Litostroj Power Group, as part of the hydro focused investment group Energo-Pro, offers integrated solutions for hydroelectric power generation equipment. They offer projects on a water-to-wire basis, ranging from project design, planning, execution and commissioning to after-sales services. Water-to-wire solutions are delivered and treated as equipment packages covering Hydro mechanical equipment, Turbine, Generator, EBoP equipment and Automation. Packages that are not in the production range of Litostroj Power are implemented together with proven, experienced and reliable partners. For each individual customer they deliver tailored solutions that are optimized by price and quality.</p> <p>Size: 250 to 499 employed</p>
16.	<p>UNIOR d.d., Kovaška cesta 10, Zreče, 3214 Zreče</p> <p>Vodja Šolske delavnice</p>	<p>Unior joint-stock company is one of the largest and, in terms of export, the most important Slovenian companies. As part of its four programmes: Forgings, Hand tools, Special Machines, and Tourism, they pursue the following goals: high quality; high level of utilisation of capabilities; increasing productivity; and optimum profitability. The company operates in accordance with a certified system of quality of international standards ISO 9001, ISO 14001, ISO 14001, IAFT 16949 and VDA 6.4. Their products are mainly intended for the automotive industry, where their main buyers are the most recognisable producers of private cars and cargo vehicles.</p> <p>Size: over 1000 employed</p>
17.	<p>GKN Driveline Slovenija, d.o.o., Rudniška cesta 20, Zreče, 3214 Zreče,</p> <p>tehnolog</p>	<p>GKN Automotive's roots in the automotive industry go back to the 1930s when GKN first started to produce military vehicles, including Spitfires and tanks used in the D-Day landings. GKN Automotive has pioneered the development and industrialization of electric axle drives for use in plug-in hybrid and pure electric vehicles. It has also driven the introduction of all-wheel drive systems with disconnect and torque vectoring functions that deliver significant improvements in the vehicle's emissions and dynamic response.</p> <p>Size: 250 to 499 employed</p>
18.	<p>HTZ Velenje, I.P., d.o.o., Partizanska cesta 78, Velenje, 3320 Velenje,</p> <p>delovodja</p>	<p>HTZ is the biggest sheltered workshop in Slovenia, and with some more than 800 employees, also the biggest subsidiary company in the group of Velenje Coal Mine. They are distinguished for wide specialist knowledge in a field of maintenance and service of different, especially mining devices, where also designing, execution, installation, and automation can be provided.</p> <p>Size: 500 to 999 employed</p>

19.	<p>MAHLE Electric Drives Slovenija d.o.o., Polje 15, Šempeter pri Gorici, 5290 Šempeter pri Gorici,</p> <p>vodja OPE</p>	<p>MAHLE is a leading international development partner and supplier to the automotive industry as well as a pioneer and technology driver for the mobility of the future. Based on a broad systems competence consisting of Engine Systems and Components, Filtration, and Thermal Management, the group's product portfolio addresses all the crucial issues relating to the powertrain and air conditioning technology.</p> <p>Size: over 1000 employed</p>
20.	<p>S.A.J., d.o.o., Kraigherjeva ulica 60, Slovenska Bistrica, 2310 Slovenska Bistrica,</p> <p>CEO</p>	<p>Mechanical treatment of metals. SAJ is involved in the troling of vibration drums, where the final stage of processing takes place, which means removing needles from pre-treatment (gritting), preparation for polishing workpieces to high gloss. Ceramic or plastic material is used as the main medium, and various liquids are used as an additive, which accelerate the process of degreasing, cleaning and preserving the workpiece shine. Blasted all types of surfaces. Sandblasting is done with different media (corundum, silica sand, stainless steel balls ...).</p> <p>Size: 5 to 9 employed</p>

SUMMARY OF COMMENTS AND FINDINGS

Mechanical engineering technicians are typically involved in operating on a CNC machine or classic processing machines, programming CNC machines, quality control of production and products, design of technological processes and realization of technological operations, technological preparation and development of structural components, measuring, maintenance, technological preparation and procurement of materials, project managing etc. They prepare specifications for mechanical components, equipment and systems, develop new programmes, conduct quality control analysis, participate in procurement of materials, prepare layouts for new machines and develop products and services together with customers. We asked the interviewees to estimate the need for the mention task type in the future. All responses have been marked as they will be needed in the next 3 years too.

Task type: Analysis, planning and organization of work

REQUIRED KNOWLEDGE AND SKILLS

- To successfully manage the lines, one has to organise own task.
- Problem analysing this knowledge is required when performing machine maintenance to identify the causes of the malfunction.
- Planning, only basic knowledge is required, plans are prepared by another department.
- Existing situation has to be analysed.
- Knowledge of processing technology (individual / mass production).
- Getting to know the machine.

- Planning work by stages / Work planning / Document planning.
- Leadership provides work plan.
- Must be able to read plans.
- Knowledge of software systems (MRP, BPCS, ...).
- Know the methods for analysing and solving problems.
- Consistent analytical work.
- Have leadership skills and self-organization skills.
- Familiarity with process and management.
- Preparing for the production process, reading the documentation.
- Knows how to organize and divide work while taking control of individual parts.
- He is able to plan or be flexible when switching from one operation to another.
- Receiving, reviewing and analysing technical documentation.
- Be able to read technical documentation.
- Understand technical designs.
- Knowledge of technical drawing.
- Knowledge of mechanical elements.
- Identify errors in drawings.
- Knowledge of manufacturing technologies and processes.
- Knowledge of the functionality of the needed tools.
- Knowledge of mechanical properties of materials.
- Knowledge of working in ERP / enterprise resource planning system.
- Knowledge of programming basics.
- Elaborate material specifications - analysis of parameters of technological process.
- Knowledge of standard material consumption and heat treatment.
- Selection of tools, materials, positions for machine operation according to the given requirements.
- Knowledge of mechanical elements.
- Knowledge of machine positions and different types of machines.
- Plan for the preparation and use of resources for operation - the necessary tools and devices in accordance with the documentation.
- Schedule production process according to the given requirements.

Task type: Preparation of own work or work post

REQUIRED KNOWLEDGE AND SKILLS

- Getting to know the machine and tools.
- Knowledge of processing technology (individual / mass production).
- Has to take care of the operational workplace.
- Communicating problems to superiors.
- Choice of Supporting Documentation (Work Order, Tool Sheet, Operation Sheet)

- Preparation of the cutting tool according to the Tool Sheet (calibration of the cutting tool, loading of the cutting tool, take into account the length of cutting of the cutting tool, visual defect of the worn cutting tool, replacement of worn cutting tools, correction input - label printing or transmission via RS232 connection).
- Data entry at the end of the operation (work order completion - digital entry).
- Project management.
- Make decisions, take initiative.
- Creativity at work.
- Responding quickly to changes.
- Prioritize own work.
- Inspection of the machine before starting work.
- Make decisions, take initiative.
- Knows how to properly prepare a job by adhering to lean manufacturing techniques.
- Preparation of appropriate consumable tools for machine operation.
- Preparation of the appropriate clamping element.
- Familiarity with work tools, equipment and machinery and technology of work.
- Graphic inspection of the program on the machine and machine commissioning.
- Checking all machine functions - perform preventative maintenance procedures - inspect tool quality and take action in the event of damage.
- Inspects work and safety equipment.
- Checking the accuracy of the machine - control and diagnose faults.
- Knowledge of instructions for work equipment and safety devices - must know what a CE mark is standing for.
- Determine the condition of pneumatic and hydraulic power, control, regulation and executive elements and systems.
- Knowledge of LOTO locking and marking systems.

Task type: Operational work

Management and / or programming of CNC machines

REQUIRED KNOWLEDGE AND SKILLS

- Fundamentals of programming, CNC machine management requires programming skills, logical lines management is required.
- Knowing the operation of pneumatic elements.
- Knowledge of the operation of hydraulic elements.
- Basic knowledge of mechanical engineering, required to change the settings of individual machine parts or lines.
- CNC is based on computer programming.
- Designing in 3D.
- Scanning.
- Assembling small units into an integrated common model.
- Compatibility with clients' requirements.

- Simple programming on the machine.
- 3D programming on a computer with option to transfer program to the tools.
- Repair certain models directly on the tool itself.
- Cutting the whole program into parts for local repair.
- An integrated aspect of programming.
- Almost all programming skills are necessary to do the job independently.
- CPV (implementation of self-maintenance of the machine according to the requirements of the lubrication scheme, the requirements of the preventive maintenance plan and the requirements of the self-maintenance list).
- Clamping / extending the workpiece, selecting zero points, selecting the appropriate program.
- Monitoring of the entire machining cycle (sustainability of the cutting tool, monitoring of machining anomalies (vibrations, sound)).
- Simultaneous programming / operation of multiple machines (1 to 3 machines).
- Clean the inside and outside of the machine / appliance at the end of work.
- Reading technological documentation (workshop drawings, control documents ...).
- Known metrology.
- Ability to correct minor errors (mechatronics).
- Knowledge of CNC programs: inductive measurement, hard milling,...
- It prepares programs, documentation, programming...
- Knowledge of system operation and programming.
- Designing simpler processing programs for numerically controlled machines.
- Designing more complex processing programs for numerically controlled machine tools.
- Develop a program to create positions (programmable firmware).
- Knowledge of the function and layout of standard machine elements.
- Knowledge of postprocessor for CNC machines.
- Knowledge of machine operation - Knowledge of G code.
- Knowledge of computer aided manufacturing (CAM) software.
- Knowledge of the principles of operation of the basic equipment group - basics of operation of turbines, internal combustion engines, operation of pumps.
- Assembling and removing tools from machine to machine and handing over to the next operation.
- Loading and starting programs.
- Inserting and modifying material on the machine.

Controlling automated / robotized production lines and / or correcting minor errors REQUIRED KNOWLEDGE AND SKILLS

- Set-up the machine parameters.
- Controlling the output of the process.
- Re-establish process after minor errors.
- Daily inspection and machine maintenance.
- Knowledge of the operation of the pneumatic elements.
- Knowledge of the operation of hydraulic elements.

- Basic knowledge of mechanical engineering, required to change the settings of individual machine parts or lines.
- Lots of practical knowledge of how the elements are composed, how they are disassembled ...
- Preparation of the program.
- Parameter setting.
- Experimental determination of laser quenching.
- Electrics / Mechatronics.
- Measurement of specific tasks for optimal robotization (coordination of 350 robots).
- Manual programming of VW robots.
- Robot imaging and positioning (manual) recording or transferring data from a real environment to a program.
- Clamp unification (defining starting point 0) should all have the same starting point so that no subsequent centring is necessary to prevent errors.
- Process inventory (all for optimal production organization) - full automation.
- Correction of the wear of the cutting tool (either manually or automatically via a sensor / laser).
- Knowledge of TPM basics - device maintenance.
- Knowledge of CNC programming languages - Error correction.
- Programming for corrections of the programs.
- He knows the good functioning of the machine and increases its productivity in terms of automation.
- Monitoring the sequence of operations and machine performance indicators - graphical representation.
- Testing programs through simulation.
- Control the dimensional and functional accuracy of manufactured parts and assemblies in accordance with the technical documentation.
- Take corrective action - eliminate minor failures - address measurement flaws and inaccuracies.
- Product testing / verification - control of manufactured pieces and correction of non-conforming goods.
- Knowledge and application of different measurement methods.
- Final visual control.
- Monitoring machine engine load.

Optimization of energy systems by including renewable energy sources

REQUIRED KNOWLEDGE AND SKILLS

- This post requires energy knowledge: fluid knowledge, knowledge of fluid, gas and solid material behaviour.
- Knowledge of energy, heating, stoves, gas boilers, burners.
- Pressure vessels, necessary inspections on pressure vessels and equipment.
- It is not the job of the machine technician as such but of the management.
- He takes care of his work unit like e.g. machine replacement.
- Procurement of a new tool that keeps energy consumption down.
- Not so relevant / bidding / more in the domain of leadership.

- Directed investment in the acquisition of newer CNC machine tools, which are currently on the market already offering energy recovery systems and so-called renewable energy solutions with accumulation directly into the electricity grid.
- Knowledge of STD ISO 50001 energy management system.
- Introducing new technologies.
- Adherence to electricity saving and renewable energy guidelines.
- Making useful suggestions.

Digitization of production

REQUIRED KNOWLEDGE AND SKILLS

- Only basic knowledge and an overview of what currently exists, in the workplace is not much needed.
- 3D design.
- Hard calculations.
- Software solutions.
- All tools are measured on optical measuring machines with which they are transferred to machines - elimination of errors.
- The whole process goes towards eliminating errors.
- Human factor elimination by directly transferring functions to a computer.
- Direct correction of cutting tool and transfer to the machine tool.
- Digitization for the field of work orders, evaluation of processing parameters within the reporting of all work operations of the technological process, 3D scanning of worn contours and comparison of these with the so-called normative 3D model.
- Knowledge of MFGPro, CAPTOR programs.
- Calculations of the KPI of the company.
- Basics of standardization.
- Knowledge of digitalisation systems.
- Making helpful suggestions.
- Self-introduction of digitization into the production system.

Task type: Commercial business

REQUIRED KNOWLEDGE AND SKILLS

- Basic knowledge only (general overview).
- Reporting (tool states, PPT, comments).
- Bid preparation (in a limited sense) for non-complex products.
- It prepares bids.
- Supply (10000) of suppliers.
- Annual rebates.
- Technology + Economics.
- Be able to overestimate the technical advantage of the product (price / technology ratio).

- Constant monitoring of normative machining times and wear of the cutting tool (direct evaluation of machining costs through the register of technological operations - basis of calculations).
- Computer literacy.
- Foreign language skills (ANG, NEM).
- Preparation of bases, estimates calculations.
- Product Cost Calculation.
- Knowledge for making product calculations in technological sense.
- Preparation of product and service offerings.
- Evaluate operating costs - Make a calculation of the product price and an estimate of production time.
- Receiving an order.
- Production of basic commercial documents (inquiry, offer, order).
- Know how to stack and pack materials and goods.
- Develop specifications / prepare information on required materials, tools, equipment and supplies.
- Know the procurement rules.
- Contact suppliers and receive offers.
- Evaluate operating costs - Make a product price calculation for easier purchases.
- Develop specifications / prepare information on required materials, tools, equipment and supplies.
- Know the procurement rules.
- Contact suppliers and receive offers.

Task type: Administration

REQUIRED KNOWLEDGE AND SKILLS

- Work orders fill.
- Machine check lists.
- Technical documentation revisions.
- Maintenance procedure forms fill.
- Quality control reports.
- Basic knowledge to fill in the required forms (basic literacy).
- Reporting (tool states, PPT, comments).
- Project management (time plans).
- Technology process reports / analyses.
- Write a work order.
- Entering data into production order (manually or via e-format).
- Data entry and analysis.
- Preparation of reports.
- Computer literacy.
- Preparation of daily reports / Reporting.
- Knowledge of the system of work in production.

- Skilful completion of forms accompanying production.
- Archiving technical and technological documentation of created programs.
- Digitize technical and technological documentation into a business information system.
- Preparation of work assignment reports.
- Using computers and other office equipment.

Task type: Leadership/management

REQUIRED KNOWLEDGE AND SKILLS

- Small project management.
- Knowing the tools of lean manufacturing.
- Taking decisions.
- Communications.
- Organization of production processes.
- Organization, communication and transmission of information.
- Organizes, manage repairs.
- Knowledge of the basics of leadership.
- A team man.
- Mentoring new employees and students in the training.
- Coordinate work and lead teams within production.
- Leading external experts.

Task type: Supervision of work

REQUIRED KNOWLEDGE AND SKILLS

- Production coordinator / group up to 30 people.
- Monitoring / reporting / communication.
- Self-control.
- Consultation with a constructor.
- Continuous inspection of quality works (according to the prescribed operations from the technological process).
- Data entry and analysis (SPC, Cm, Znc).
- CNC programming.
- Mechanical adjustment of machines.
- Supervision of elements in interphases.
- Knows and checks if work is done according to the order.
- Supervision of production.
- Take action to solve production problems.

Task type: Quality assurance

REQUIRED KNOWLEDGE AND SKILLS

- Continuous improvement, detection of the non-conforming products & processes, sampling...
- Basic knowledge (general insight), what is quality, how are measurements made, how is error calculated, filling in forms...
- Testing of producing accuracy.
- Basic measurement methods.
- Methods for measuring hardness.
- Self-control + measurement calculation.
- In processing (requests / X-ray) scanning.
- It is not that pronounced.
- Self-control of a minimum of two basic depth measures at the completion of the processing operation of an individual work order (entry of results into a work order by technological process).
- Knowledge of STD: IATF 16949, ISO 14001, ISO 50001.
- PST problem solving (complaints, downtime).
- Computer literacy.
- Foreign language.
- Production process risk analysis for quality assurance, FMEA analysis.
- Rational use of materials, tools, time.
- Participates in the development of proposals for improving the production process.
- Knowledge of control stages in the production process.
- Application of standards and norms - knows the standards and methods of quality control of materials and products.
- Assess risk.
- Define in each production step risk, quality analysis, testing and control activities.
- Knows the types and methods of record keeping for quality assurance - when examining materials.

Task type: Maintenance**REQUIRED KNOWLEDGE AND SKILLS**

- Scheduled basic maintenance procedures where special skills are not needed.
- Knowledge of machine elements, joining of materials (welding, riveting, screwing...).
- Knowing the operation of pneumatic elements.
- Knowledge of the operation of hydraulic elements.
- A lot of practical knowledge (hand skills), how the elements are composed, how they are dismantled...
- Computer Maintenance.
- Physical maintenance of machinery.
- Provides internal / external services (guides + electricity).
- Keeping service records (records).
- The maintainer is also the team leader.

- Knowledge of processing tools.
- Maintenance, assembly, planning and assembly activities.
- CPV (TPM - Total Productive Maintenance).
- Method of lean organization 5S / 6S.
- PLC Programming.
- Regulation and control of hydraulic and pneumatic systems.
- Mechanical repair of machinery - basics of mechanical engineering.
- Inspection of machines.
- Troubleshooting.
- Check the suitability of machines and appliances.
- Knows customer requirements for product quality.
- Knows the role, function and arrangement of standard machine elements.
- Know how to detect a malfunction.
- Assembly and disassembly of the machine.
- Knowledge of automatic regulation - PLC problem controlling.
- Knowledge of the mechanics and basics of sensors.
- Choosing the right replacement parts.
- Replacing parts.

Task type: Communication

REQUIRED KNOWLEDGE AND SKILLS

- Communication with co-workers / team focusing on work interactions, quality assurance, improvements, problem solving...
- General knowledge and communication skills.
- Very important knowledge of foreign languages.
- Knowledge of processing and technology ability to communicate it.
- Relationships with superiors and clients.
- Communication to suppliers / subscribers.
- Foreign language skills (German / English).
- Teamwork (collaboration to implement a specific project).
- Communication between team and management for problem solving.
- Communication with the company's dislocated units.
- The following personal skills (analytics, clarity, cooperativeness, eloquence) are welcome for communication skills.
- Conflict resolution.
- Public appearance.
- Lead teams and workshops.
- The basics of etiquette.
- Communicating and handing over instructions.
- Communicates with partners, compulsory foreign language skills.
- Good communication between employees.

- Knowledge of individual approach.
- Knowledge of foreign languages.
- Internal communication, coordination activities and the transfer of information about the work process, the status of tools and equipment.
- Training and development - knowledge transfer.
- Knowledge of professional / technical terminology.
- Business communication skills - external communication with suppliers or customer representatives.
- Teamwork skills.

Task type: Health and environment protection

REQUIRED KNOWLEDGE AND SKILLS

- Health & work safety, environment protection minimum at the level prescribed by the law, organization procedures and quality management systems implemented in organization.
- Basic knowledge of environmental protection (waste separation, environmental impact of derivatives and lubricants...).
- Basic skills in firefighting, first aid ...
- Basic skills in workplace safety.
- Knowledge of ISO standards.
- Regular health check-ups.
- Use of protective equipment.
- Knowledge of all regulations.
- Protective equipment.
- High level of knowledge of litigation / lawsuit / high requirements.
- Use of prescribed personal protective equipment so-called OVO.
- Waste separation and environmental care according to ISO 14001.
- Hazardous waste management according to ISO 14001 standard and DNQ / PNQ / OP internal regulations.
- Compliance with safe work rules (strict observance of safety instructions) under OHSAS.
- Understand the ISO 14001 standard.
- STD ISO 50001.
- Appropriate competence.
- Use of protective equipment.
- Identifying dangerous events.
- They should know everything about the use of protective equipment and devices.
- Knowledge of fire safety and company safety documents.
- Risk assessment.
- Knowledge of proper separation of waste, materials, paper and plastic.
- Apply safety regulations and measures, use of appropriate equipment.
- Apply regulations on fire protection.
- Apply regulations on environmental protection.

- Basic knowledge of first aid.

Newly emerging key tasks (Innovation: new products, systematic improvement, organization, digitization)

REQUIRED KNOWLEDGE AND SKILLS

- Activities under different quality system management standards.
- Knowledge of materials - knowledge of the structure of different materials.
- Materials analysis.
- Molecular composition of materials.
- Chemical structure of materials.
- Identifying parts.
- Use of measuring tools.
- Knowledge of protocols.
- Technological / assembly technologist.
- Benefits of digital service solutions: the purpose of the digitalisation system is to provide faster access to the database for all users, as well as for other authorized persons, that is, servicers of devices and machines. quick access to on-line data enables quick application solutions and access to the database at the level of production planning, machine servicing, preventive interventions, etc.... example: portal "My DMG MORI" offers free access to the digital service portal. Werkbliq and Netservice, however, provide additional tools for optimizing the entire service process. The continuous maintenance and repair platform, platform for continuous maintenance and repair are in use.
- Digitization and automation of all storage processes.
- Automation - robotization of repetitive work.
- The gradual transition to the so-called e-education / training (digitization of on-the-job training / training with a view to continuous development of human resources in the areas of expertise, health and safety at work or in all fields of environmental protection).
- Import paper documents into computer form.
- COBOT programming.
- Automatic measuring devices - automatic SPC.
- Knowledge of the system of techniques and techniques of lean manufacturing.
- Team competencies, communication skills, role model for employees.
- Knowledge of measurement methods, tools and devices.
- Knowledge of measuring instruments and measurement technology.
- Calibration of measuring instruments before use.
- Use measuring devices.
- Perform stress tests on models.
- Testing, measurement of material tolerance.
- Skills in using 3d measuring devices.

In the future, new technology enables the reduction of certain activities, primarily administration and control, and requires more programming. The introduction of new technology does not change the type of technological knowledge and cognitive / perceptual skills.

A few interviewees highlighted the importance of knowledge and skills in robotics, pneumatics and hydraulics will possibly be important in the future, as well as skills related to computer technology development and software integration, e.g. augmented reality.

In terms of organization philosophy, several employers mentioned the importance of implementing approaches to management such as Lean production, 5S tools, Kaizen (continuous improvement, every worker makes suggestions for improvement), SMED, VSM, which are now widespread and workers need to understand them.

Developments in robotics require new skills but employers think this requires a higher education level than the one for engineering technician.

OTHER

Almost all interviewees said they prefer to hire employees with mechanical knowledge and skills but they are willing to train the employees to do the technical tasks the work requires, usually due to the lack of available workforce with required qualification in mechanical engineering sector. The necessary training time can last anywhere from 3 months to a year for a person with no previous experience or with previous experience on the job.

There are no certification requirements. There are few exceptions for engineering technicians who work in quality assurance, who are required to pass through different levels of certification for measuring the quality of materials (NDT control).

RECOMMENDATIONS

Some recommendations from the employers regarding skills/knowledge mentioned often:

- Basic knowledge that an engineering technician must have will always be knowledge of mechanical elements, characteristics of materials and tools and technical drawing. Also, the practical application of engineering technology principles and procedures to the design and production of various products and services.
- Importance of reading technical drawings. Employers mentioned that students lack skills in technical drawing. Also they mentioned that MET need to possess the ability to see objects in 3 dimensions by looking at drawings

- Optimizing workflows by implementing systems as Lean production, 5S tools, Kaizen, SMED, VSM. Implementation of these models is widespread and employers mentioned that this is something students could get familiar with during their education.
- Familiarity with working in ERP (Enterprise resource planning), as most companies implement some form of document management system which is used in all work activities. Employers thought that students should be familiar with this way of work.
- Important soft skills are the ability to solve problems and the ability to work as part of a team. Also, because of the international nature of the business and standards, technicians should have good knowledge of the technical terminology in English language.
- Relevant general high school subjects are native and foreign language, mathematics, physics and chemistry.

CONCLUSION

Consortium interviewed companies from different industries that differ in sizes, organizational structure and management. The jobs for mechanical engineering technicians that were described are varied. Even though there were some differences in the scope and level of skills from company to company, employers agreed there are basic mechanical engineering skills and knowledge every mechanical engineering technician should have. Employers agreed that new technology does not change the knowledge and skills needed to perform key tasks. Basic knowledge of tools, technologies and materials can be applied to new technologies. Employers agree there will be no significant changes in the workplace that would deem a certain skill unnecessary in the next three years. On the other hand, they think new skills that would be required for the handling of the new technology, are easily acquired by well-educated technicians.

Employers welcomed the survey and the project aims to develop new or updated educational programme for mechanical engineering technicians. They agreed that students that come to work in their companies sometimes lack basic engineering skills such as technical drawing. They also highlighted the importance of practical training during the student's education, as the specificities of a production organization cannot be taught in schools. Employers are interested in ensuring a quality workforce. That's why they individually invest in the development of the workforce by organizing internal training both in introduction stage to the workplace and after, enabling them to develop their skills for the future technologies and innovations. This is an area they would welcome state support.

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