

Competence area	Steps of competence development			
<p>1</p> <p>Maintaining Providing "preventive maintenance" and assuring the reliability of mechatronic systems</p>	<p>He/She can perform the basic scheduled maintenance on mechatronic machines and systems and adhere to the equipment maintenance plans. He/she can complete relevant maintenance records accurately and pass them on to the appropriate person. He/she can dispose of waste materials in accordance with safe working practices and approved procedures.</p>	<p>He/She can master the maintenance procedures for mechatronic systems such as the use of service documents and maintenance plans.</p>	<p>He/She can use preventive maintenance to assure the trouble-free operation of mechatronic systems.</p>	<p>He/She can develop the necessary procedures for maintenance of mechatronic devices and systems, and can schedule the maintenance and quality-assurance procedures.</p>
<p>2</p> <p>Installing and dismantling mechatronic systems and facilities</p>	<p>He/She can use written instructions to install and dismantle individual components (sensors, actuators, drives, motors, transport systems, bus systems, racks) that form a functional group of mechatronic systems. He/she can assist in the completion of installation documentation and is able to dispose of waste items in a safe and environmentally acceptable manner.</p>	<p>He/She can master the installation and dismantling of mechatronic systems that use several technologies (mechanics, hydraulics, pneumatics, electrical-mechanics, electronics, optics, optoelectronics), set up the connexion technology, and check the efficiency of the overall system.</p>	<p>He/She can provide independent mechatronic solutions for the construction of production lines, assure their overall ability to function, and, in addition, can use both existing and modified standard components.</p>	
<p>3</p> <p>Installing and adjusting mecha- tronic compo- nents in systems and production lines</p>	<p>He/She is able to install and adjust standardized mechatronic components, e.g. individual electro-pneumatic valves, sensor and actuator units. He/she can work safely at all times complying with health and safety regulations and can deal promptly and effectively with problems within one's control and report those that cannot be solved.</p>	<p>He/She can install and adjust components of mechatronic subsystems (e.g., linear drives, measuring systems, transport systems).</p>	<p>He/She can install and adjust complex mechatronic facilities that include diverse technologies and instrumentation and control (I&C) equipment, adjust the associated parameters, test the facilities overall functions, and assure their reliability</p>	

<p>4 Designing, adapting, and building mechatronic systems and facilities on the basis of client needs and site plans</p>	<p>He/She can use machine tools controlled either manually or via computer-program to fabricate (according to production designs and customer requirements) the individual components for mechatronic systems. He/she can provide simple designs and descriptions of mechatronic subsystems and can use basic CAD applications. He/she can deal promptly and effectively with problems within one's control and report those that cannot be solved.</p>	<p>He/She can build simple mechatronic subsystems by using engineering drawing and can install the devices according to specific production needs. He/She can act on extensive knowledge of standards and regulations (e.g. on surface treatments) and is able to use CAD's more advanced functions (e.g. interference check).</p>	<p>He/She can build mechatronic systems by using both original construction techniques and previously designed parts. He/She fully understands CAD functions and can document system developments (parts lists, descriptions of function, operating instructions).</p>	<p>He/She can design and build autonomous mechatronic subsystems and, with suitable measuring and testing facilities, can assess the necessary production accuracy. He/She can document the results with quality-control systems.</p>	<p>He/She can make independent adaptations to the various devices (including selection of drives, sensors, PLC) and can use CNC programs for building the system. He/She can, through a digital mock up, assemble and simulate the functioning system and use computer-aided computations (e.g. FEM). He/She can perform cost-benefit analyses (e.g. as a basis for deciding whether components should be bought or individually constructed.)</p>	<p>He/She can independently develop complex mechatronic systems taking into account ecological and sustainable development considerations. He/she can calculate the economic usefulness of the system. He/She can optimise CNC programs for the manufacturing of complex mechatronic devices and systems and monitor the automated quantity of an open loop control system.</p>
<p>5 Putting mechatronic systems into operation and providing clients with technical and</p>	<p>He/She can, according to specifications and blueprints, put mechatronic devices into operation and provide support to the client in the hand-over phase. He/she is able to ensure health and safety and other parameters are achieved, be able to deal with eventualities and</p>	<p>He/She, after considering the enterprise's needs and basic conditions, can put the mechatronic systems into operation, create the necessary</p>	<p>He/She, after considering all basic conditions, can master the start-up of interconnected mechatronic systems and machines, and can provide the necessary documentation including a manual.</p>			

economic support	to handle the equipment to the relevant user.	documentation.			
6 Monitoring and /or supervising and evaluating both the process sequences of mechatronic systems and facilities and the operational sequence (including quality assurance)	He/She can monitor and /or supervise process sequences according to specifications as well as implement any requested quality-control measures. He/she can work safely at all times complying with health and safety regulations and can deal promptly and effectively with problems within one's control.	He/She can independently supervise the process sequences, evaluate the results, operate an accompanying statistic process control (SPC) for the quality control plan, and prepare simple work schedules, including production schedule and time management.	He/She can operate and supervise mechatronic facilities, choose testing and monitoring plans, set up the accompanying SPC, seek the optimal results of the production line according to material-flow, and provide work schedules including standard production times.	He/She can master the monitoring of complex mechatronic systems using virtual instruments and PPS systems as well as open loop control for the optimisation of machinery arrangement, material flow analysis, and scheduling.	He/She can optimise the process cycles of mechatronic production lines, provide instructions on modifying the PPS systems (e.g. adjustment to SAP systems) and introduce quality systems for continuous improvement processes (CIP/KVP).
7 Installing, configuring, programming and testing hardware and software components for control and regulation of mechatronic systems and facilities	He/She is able to install and configure programs for hardware and software components as well as set up simple programmable logic control programs (PLC).	He/She can master the selection of basic hardware and software for mechatronic systems (sensors, actuators, interfaces, communication procedures) and can provide and test simple programmable logic control programs (PLC) according to production process requirements.		He/She can integrate and configure program-, control-, and regulation-mechanisms in mechatronic systems, program simple devices (in co-operation with developers), and simulate the program sequence before start-up.	He/She can develop, test, and configure hardware and software solutions for networked mechatronic systems; and can monitor system conditions with suitable measuring and visualisation tools.

<p>8</p> <p>Providing "curative maintenance": diagnosing and repairing malfunctions with mechatronic systems and facilities, advising clients on avoiding malfunctions, and modifying and expanding mechatronic systems</p>	<p>He/She can diagnose and/or repair errors and malfunctions on the simple components and devices in the mechatronic systems. He/She can use the necessary checking, measuring, and diagnostic tools. He/she can work safely at all times complying with health and safety regulations.</p>	<p>He/She can independently correct problems in mechatronic production equipment with the help of (computer-aided) diagnostic systems and the use of expert systems, databases, and error documentations.</p>	<p>He/She can diagnose and repair errors and disturbances in complex mechatronic equipment, estimate the time needed for reparations and is able to advise clients on how to avoid sources of malfunctions through changes or upgrades in the equipment and system.</p>	<p>He/She can develop, through analyses of malfunctions in the mechatronic equipment, a monitoring and diagnostic system and can calculate "impact on business"</p>
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Table: Modified VQTS Competence Matrix "Mechatronics"