Adult Education Program

TRUCK MECHATRONICS SPECIALIST AND HEAVY VEHICLES

May, 2025

The regional training program - Adult Education Program for Specialist in Mechatronics for Trucks and Heavy Vehicles was developed within the project *Navigating the Road Ahead:* Creating Shared Values in the Trucking Industry in the Western Balkans, which is implemented within the RECONOMY program, managed by Helvetas in partnership with the Swedish International Development Agency. The development of the regional training program – Adult Education Program was coordinated by the Education Reform Initiative of South Eastern Europe - *ERI SEE Secretariat*. The regional program was developed and validated by experts in vocational education, qualifications, and experts from the business sector from Albania, Bosnia and Herzegovina, Montenegro, Kosovo*[1], North Macedonia, and Serbia in May 2025.

[1] This designation is without prejudice to positions on status and is in line with UNCSCR 1244 and the ICJ Opinion on the Kosovo* declaration of independence.

I GENERAL INFORMATION ABOUT THE SPECIAL ADULT EDUCATION PROGRAM

1	Name of the adult education program	Specialist in truck and heavy vehicle mechatronics
2	Sector	Mechanical engineering
3	Related occupational standards	Specialist in truck and heavy vehicle mechatronics
4	Qualification level according to the National Qualifications Framework, i.e. according to the European Qualifications Framework (EQF - European Qualifications Framework)	Regional qualification - Level 5 EQF
5	Number of credits	Loans are determined based on the rules provided by the regulations of the respective economies.
6	Total number of study hours (theory, practice and exercises)	750 (theory: 224 hours, practice: 450 hours, exercises: 76 hours)
7	Criteria for enrolling participants in the program	The minimum requirements for admission are defined by the prescribed legislation of each economy. Previous qualification in the relevant sector at level 3 or 4 (in accordance with EQF) and work experience in the relevant sector, in accordance with the regulations of the respective economies.
8	Type of public document acquired by the participant	Upon successful completion of the training within the "Truck and Heavy Vehicle Mechatronics Specialist" program, the participant acquires: • Certificate of the acquired qualification, if all modules provided in the program have been completed, and/or • Certificate of completed module/modules, if the participant participated and successfully completed only individual modules from the program. These documents serve as proof of acquired knowledge, skills and competencies in accordance with the content of the modular program. The form, status and value of the public document issued by the training institution (provider) are determined in accordance with the legal regulations of each economy, i.e. in accordance with their national system for qualifications and recognition of training for adults.

II DESCRIPTION, PROGRAM AIM, MODULES, MODULAR UNITS, LEARNING OUTCOMES, PROGRAM RESOURCES

1	**Program description**	This program is intended for the training of adults who want to acquire or improve their competence in the field of mechatronics for trucks and heavy vehicles. The program is organized by modules and enables the systematic mastering of knowledge and skills through flexible and practically oriented teaching. The training is adapted to adult participants, with a flexible schedule: it can be realized with a normal intensity of 3-4 days a week or through intensive block classes, depending on the needs of the participants and the context. The program lasts 6 months, i.e. 25 weeks, with a total of 750 teaching hours. The training structure includes 30% theory, 60% practical work and 10% projects, exercises, tests and self-assessment. Teaching combines various methods: practical demonstration, laboratory and workshop work, work on real vehicles, simulations, failure analysis, project tasks, as well as diagnostics using software. The program consists of seven thematic modules: Planning and organization of work; Engines and mechanical systems; Pneumatic and hydraulic systems; Electrical and electronic systems; Comfort and safety systems; Communication and entrepreneurship; and Safety and Environment. Green and digital skills are built into each module where appropriate – such as: efficient use of energy and resources, environmental impact analysis, waste management, use of diagnostic devices and software, digital documentation and communication. Green skills are included through the topics of reducing harmful emissions, safe handling of materials, sustainable use of energy, as well as ecological management of vehicle systems. Digital skills are integrated through the use of electronic diagnostic devices, digital platforms for documentation, simulation tools and online channels for communication and organization of work. The training enables the development of technical and general skills required for modern and efficient employment in service centers, logistics and transport companies, as well as for self-employment. Completion of the program enables participants to apply acquired knowledge immediately in the workplace, with a strong emphasis on safety, sustainability, technological readiness and professional responsibility.
2	**Maximum number of participants per group**	For adult participants, especially when the training is technical and practical, the maximum number of participants in the group is up to 12 participants, for the realization of practical lessons, enabling work in smaller groups of 4 to 6 participants significantly increases the quality of the teaching process through a more individual approach, more effective monitoring of progress and greater engagement of each participant. In practical classes, the number of participants must be limited in accordance with: • the number of available tools and devices (e.g. multimeters, diagnostic tools), • workstations and vehicles, • capacity of the workshop (safe area per participant). Each participant should have clear access to equipment, work space and protective equipment for individual or team work.

3.	**Program objectives**	• Acquisition of advanced technical knowledge and practical skills for servicing, diagnostics and repair of mechanical, electrical and electronic systems, hydraulic and pneumatic systems in trucks and heavy vehicles. • Developing the ability to plan, organize and control work activities and resources, while applying safety and environmental standards. • Application of digital tools, diagnostic software and e-documentation in the process of diagnosis, intervention and reporting. • Developing green skills through energy efficiency, waste management and sustainable vehicle servicing. • Preparation for independent work, including the basics of communication with clients, creating a business plan and running your own service.

4.	***Program schedule***			
No.	Modules	Number of lessons - theoretical teaching	Number of lessons - practical teaching	Number of exercise hours
1	Planning and organization of work	18	36	6
2	Engines and mechanical systems	45	90	15
3	Pneumatic and hydraulic systems	40	81	14
4	Electrical and electronic systems	45	90	15
5	Comfort and safety systems	40	81	14
6	Communication and entrepreneurship	18	36	6
7	Safety and environment	18	36	6
Total hours		224	450[2]	76[3]
Total (theory, practice and exercises)		750[4]		

[2]Practical teaching is a form of education that takes place through the performance of real work activities, with the aim of acquiring practical skills, knowledge and habits for independent performance of work in the profession.

[3]Exercises are structured activities that are performed with the aim of applying and deepening theoretical knowledge through solving specific tasks, analyses, measurements or simulations in controlled conditions.

[4]The specified number of hours is planned for this regional training program and will be adapted at the national level in accordance with the applicable regulations.

5. Learning plan (Modules / Modular units / Learning outcomes / Evaluation criteria)

Module 1: Planning and organization of work

Theoretical classes	**18**
Practical classes	**36**
Exercise classes	**6**

Modular unit	Learning outcomes	Evaluation criteria
1. Analysis of the work order and documentation	• Analyzes work order and identifies tasks and priorities	▫ Interprets key work order information and provides guidance ▫ Identifies the individual tasks specified in the order and links them to the corresponding execution steps ▫ - Determines priorities in the execution of tasks based on their urgency, sequence and availability of resources
	• Uses relevant information from technical and technological documentation, manuals, checklists and instructions	▫ Extracts accurate data from technical drawings, schematics and manuals required to perform the work task ▫ Distinguishes relevant from irrelevant information and applies only appropriate data ▫ Uses checklists and instructions during the preparation and implementation of the task according to the set standards
	• Recognizes client requirements and incorporates them into task planning	▫ Describes the client's requirements verbally or in writing ▫ It connects the client's requirements with concrete technical activities in the realization of the task ▫ It includes the client's priorities and expectations when defining the phases and time frame of the work
2. Initial assessment and planning of work phases	• Performs visual and acoustic control of trucks and heavy vehicles	▫ Identifies visible physical damage, leaks or irregularities during a visual inspection of the vehicle ▫ It recognizes unusual sounds when starting or operating the engine and other systems, and records them as potential malfunctions

		▫ Record findings from visual and acoustic inspection in appropriate format (checklist, notes, report) for further diagnosis or intervention
	• Performs initial diagnosis based on symptoms and available documentation	▫ Analyzes reported symptoms and compares them with data from technical documentation
		▫ It formulates a possible cause of the failure based on the symptoms and a logical assessment of the system's operation
		▫ Suggests next steps for confirmed diagnosis or intervention based on initial findings
	• It plans the flow of work activities by stages, in accordance with the requirements of the task and the available resources	▫ Creates a logical sequence of activities by stages, in accordance with the technical documentation and work order
		▫ Adjusts work phases according to resource availability (people, equipment, materials)
		▫ Determines the time frame for each phase of the activity, taking into account the efficiency and sequence of execution
3. Organization of resources and workplace	• Organizes the workplace in accordance with safety and technical standards	▫ Arranges tools, equipment and materials to enable safe and efficient work
		▫ Implements the prescribed measures of personal and collective protection when organizing the workplace
		▫ Identifies potential risks and eliminates them in accordance with safety standards
	• Identifies and prepares the necessary tools, equipment, measuring devices, machines and cranes	▫ Determines the tools, devices and machines needed to perform a specific work task based on technical documentation
		▫ Checks the technical correctness and functionality of tools, equipment and measuring devices before use
		▫ Prepares tools and equipment in a safe and organized manner for their efficient use during work
	• Plans and coordinates the engagement of human resources, materials and spare parts	▫ Evaluates the required human resources in relation to the complexity and scope of the task
		▫ Prepares a plan for timely provision of appropriate materials and spare parts based on technical documentation

			▫ Assigns tasks to associates according to their expertise and resource availability
4.	**Control, efficiency and sustainability of the work process**	• Coordinates the flow of work activities with a high degree of independence	▫ It assesses whether the activities are carried out according to the planned sequence, time schedule and quality standards ▫ Observes deviations and independently undertakes appropriate corrective measures ▫ Provides clear instructions and support to other team members, ensuring coordinated task execution
		• Completes and files work documentation during and after operations	▫ Enters relevant data into work lists, checklists and records according to prescribed forms ▫ Maintains accurate and precise documentation on the course and results of activities ▫ Archives and stores documentation in accordance with internal procedures and legal regulations
		• Organizes the process in accordance with the principles of energy efficiency, sustainability and internal procedures	▫ It chooses work methods and resources that contribute to the reduction of energy and material consumption ▫ Identifies and implements measures to reduce waste and properly manage material remains ▫ Conducts activities in accordance with internal procedures, taking into account environmental protection and rational use of resources

Module 2: Engines and mechanical systems	Theoretical classes	45
	Practical classes	90
	Exercise classes	15

Modular unit	Learning outcomes	Evaluation criteria
1. Engine types and power transmission	• Explains the operation of internal combustion engines (diesel, gasoline) in trucks and heavy vehicles	▫ It explains the principle of operation of a diesel engine, including the processes of compression and explosion ▫ Describes the basic components of a gasoline engine and their function, such as the ignition system, fuel supply system, and carburetor/injectors ▫ It explains the differences and similarities between diesel and petrol engines in terms of efficiency, emissions and fuel consumption
	• It explains the principle of operation of hybrid and electric motors	▫ It explains the basic principle of operation of an electric motor, including the use of electricity to propel a vehicle ▫ Describes the operation of a hybrid propulsion system, including a combination of an internal combustion engine and an electric motor ▫ Distinguishes electric and hybrid engine components (batteries, electric motors, controllers) and explains their function
	• Identifies and explains the principle of operation of the power transmission system (transmission, transmission distributor, reducer, differential, drive shaft, transmission shaft, half-shaft)	▫ Identifies the type of gearbox (mechanical, automatic, semi-automatic) and explains the principle of operation ▫ It explains the principle of operation of the transmission distributor and its role in power transmission ▫ It explains the working principle of the differential and its role in torque distribution ▫ Describes how power is transmitted from the transmission to the wheels via the transmission shafts, drive shafts, drive shafts and identifies possible points of failure
2. Engine and transmission		▫ Identifies the exact location and type of fluids (engine oil, coolant, transmission fluid) and filters (engine, air, fuel) according to technical documentation

	system maintenance	• Checks and replaces fluids and filters in the engine and transmission	▫ Performs the procedure for checking and changing the engine oil and filter safely and correctly using the appropriate tools ▫ Implements appropriate measures for collection, storage and disposal of old fluids and filters in accordance with environmental regulations
		• Implements preventive maintenance procedures according to the manufacturer's plan	▫ Describes preventive maintenance procedures as specified in the manufacturer's technical documentation ▫ Performs preventive inspections and replacement of components according to specified intervals and manufacturer's specifications ▫ Documents and reports on the status of performed preventive inspections and maintenance according to manufacturer monitoring requirements
		• Uses appropriate tools and equipment to clean and service mechanical components	▫ Selects and uses appropriate tools and means for cleaning mechanical components according to their type and condition ▫ Applies proper cleaning and servicing techniques as outlined in operating instructions and safety procedures ▫ Uses specialized tools and service tools, ensuring workplace safety and optimal results
3.	**Diagnostics and repair of motor systems**	• Diagnose defects using diagnostic devices and software	▫ Selects appropriate diagnostic devices and software based on defect type and vehicle characteristics ▫ Connects the diagnostic device to the vehicle and interprets the results obtained from the diagnostic program ▫ Uses diagnostic software to detect defects, perform necessary tests and suggest solutions to eliminate defects
		• Repairs or replaces parts of ignition, cooling, fuel, lubrication, distribution and exhaust gas recirculation (EGR) systems	▫ Identifies and analyzes defects in components from the ignition, cooling, fuel, lubrication and distribution systems according to the technical documentation and the EGR system according to the technical documentation ▫ Replaces or repairs damaged parts, using appropriate tools and repair methods, in accordance with safety standards

		▫ Tests and checks the function of rebuilt components, ensuring that the ignition, cooling, fuel, lubrication, distribution and EGR valve systems are working properly
	• Selection of spare parts and components according to technical documentation and manufacturer's instructions	▫ Analyzes technical specifications and manufacturer's instructions to select appropriate spare parts and components for a specific system ▫ Selects spare parts, taking into account technical requirements and compatibility with existing vehicle components ▫ Checks the availability and quality of spare parts and components, ensuring that they meet all standards and requirements of the manufacturer
4. Testing and final control of the engine	• Tests engine after repair using performance measurement equipment	▫ Installs and connects appropriate devices and equipment to measure engine performance, in accordance with instructions and safety procedures ▫ Performs engine testing after repair, collecting performance data such as speed, temperature and fuel consumption ▫ Analyzes test results and compares them to technical specifications to confirm engine correctness and functionality
	• Performs exhaust gas control and acoustic check after repair	▫ Performs exhaust gas control using appropriate measuring devices, according to standards for environmental parameters and safety ▫ Performs a sound check of the engine, identifying malfunctions or non-compliance with the manufacturer's specifications ▫ Analyzes the results of exhaust gas controls and acoustic checks and compares them with technical and environmental standards, confirming the correctness and safety of repairs
	• Documents test results and compares them to manufacturer standards	▫ Documents test results using appropriate forms and records, in accordance with documentation standards ▫ Compares test results to technical specifications and manufacturer standards to evaluate repair success ▫ Recognizes and documents all discovered non-conformities with standards, proposing necessary corrections or additional tests

Module 3: Pneumatic and hydraulic systems	Theoretical classes	40
	Practical classes	81
	Exercise classes	14

Modular unit	Learning outcomes	Evaluation criteria
1. Basics and principle of operation of pneumatic and hydraulic systems	• It explains the principle of operation of hydraulic and pneumatic systems in trucks and heavy vehicles	▫ It describes the basic principle of force transmission through liquid (for hydraulics) and compressed air (for pneumatics) ▫ Differentiate between closed and open hydraulic systems and explain their purpose ▫ Explains how to create and maintain pressure in a pneumatic system using professional terminology
	• Identifies the main components: pump, cylinder, compressor, valves, reservoirs, filters	▫ Recognizes and correctly names major components in pneumatic and hydraulic systems using technical posters or schematics ▫ Explains the function of each of the identified components (eg "a pump creates flow in a hydraulic system") ▫ Classifies components according to system type: hydraulic or pneumatic
	• Explains how the air brake and hydraulic lift/lower system work	▫ Describes the process of activating and deactivating air brakes with correct terminology (pressure, air, valve, brake mechanism) ▫ Describes the hydraulic lift/lower cycle in order: actuation, flow, pressure, piston movement ▫ Explains the role of safety features in both systems (eg "safety valve", "relief valve")
	• Compares hydraulic and pneumatic systems according to purpose and operating parameters.	▫ Lists application examples for each system (eg "pneumatic brakes - hydraulic jack") ▫ Compares the working environment and the type of transfer medium (air/oil) and explains the differences ▫ Compares operating pressures and system sensitivities based on real-world examples (eg "pneumatics: ~8 bar, hydraulics: 150-300 bar")

2. Preventive system maintenance	• Creates a plan for regular inspection and maintenance of pneumatic and hydraulic systems	▫ Performs regular maintenance activities (fluid level check, filter condition, leak check, functional testing) ▫ It determines the time dynamics (weekly, monthly, every 500 hours of work...) for each activity in the plan ▫ It relates maintenance activities to the type of system (pneumatic / hydraulic) and the components used
	• Identifies signs of wear, leaks and fluid contamination	▫ Lists typical visual and functional wear indicators (worn piston, damaged hose, fluid discoloration) ▫ Distinguishes leakage (external) from internal damage (eg loss of pressure) ▫ Uses appropriate terminology to describe the state of contamination (presence of metal particles, turbidity, water in liquid)
	• Performs filter and fluid replacement according to the preventive maintenance plan and completes the checklist of performed checks	▫ Describes the steps to safely and correctly change filters and fluids without leaking or polluting the environment ▫ Use the correct type of filter and fluid in accordance with the technical documentation or manufacturer's instructions ▫ Accurately and neatly fills out the checklist with date, performed activities and signature, without missing items
3. Diagnostics and failure analysis	• Diagnoses faults with visual, audible and instrumental checks	▫ Describes observed problems using at least two of the three methods (visual, audible, instrumental) ▫ Locates a fault in the system (e.g. a leaking joint, damaged piston, unusual valve noise) ▫ Applies instruments (eg pressure gauge, tester) to confirm suspected malfunction
	• Use technical documentation to compare operating parameters with standard values	▫ Finds the relevant part of the technical documentation for a specific system or component ▫ Reads and interprets standard parameters (pressure, flow, temperature) ▫ compares actual and standard values and correctly concludes whether there is a deviation

	• Uses manometer, vacuum gauge and digital devices to measure pressure and flow and analyze causes of failure in pneumatic or hydraulic system	▫ Selects the appropriate measuring tool (manometer, vacuum gauge, digital sensor) in accordance with the type of system and parameter ▫ Measure values and document the results (with accuracy in the appropriate unit of measurement) ▫ Analyzes the obtained results and logically connects them with possible causes of failure (eg pressure drop due to leakage or blockage)
4. System intervention and testing	• Demonstrates proper tool handling when disassembling, replacing or adjusting components (valves, hoses, pistons)	▫ Uses appropriate tools and protective equipment during disassembly/replacement without damaging components or the environment ▫ It describes the sequence of the procedure in accordance with the technical instructions ▫ Adjusts components (eg tightening, alignment) according to functional requirements
	• Performs reassembly according to technical instructions and performs a test after the intervention to determine correctness	▫ Performs reassembly following the phases and torque from the technical documentation ▫ Perform a functional test (visual / instrumental) immediately after the intervention ▫ Confirms the correctness of the component/system by checking the pressure, flow or signal (according to norms)
	• Documents test results and compares them with manufacturer parameters	▫ Completes a checklist or test report with all relevant values (with correct units of measurement) ▫ It lists deviations if they exist compared to the manufacturer's technical data ▫ Formulates a logical conclusion about the correctness or need for a new intervention based on the comparison

Module 4: Electrical and electronic systems	Theoretical classes	45
	Practical classes	90
	Exercise classes	15

Modular unit	Learning outcomes	Evaluation criteria
1. Electrical measurements and basics of electronic components	• It measures voltage, current and resistance with a multimeter and current clamps	▫ Selects the appropriate mode (voltage, current, resistance) and correctly adjusts the multimeter before measuring ▫ Connects instruments correctly according to the type of measurement and follows safety procedures ▫ Reads and records measured values with the appropriate measurement unit
	• Distinguishes and explains the functions of electrical components (resistor, sensor, relay)	▫ Identifies components visually or with diagrams (resistor, sensor, relays) and names them correctly ▫ Explains the basic function of each component with a concrete example (eg "temperature sensor") ▫ Establishes a logical connection between a component's function and its role in the vehicle's electrical system
	• Compares measured values with technical documentation for diagnosis	▫ It uses technical parameters from the documentation for a specific system or component ▫ compares real and normal values and recognizes possible deviations ▫ It formulates a logical conclusion (if there is a fault and where), based on the comparison
2. Diagnostics of electronic systems with diagnostic devices	• Reads and analyzes errors in the control unit using a diagnostic device	▫ It connects the diagnostic device to the vehicle and initiates the reading of errors ▫ Accurately reads and records DTCs ▫ Interprets the meaning of the error and suggests further steps (reset, check, replace) ▫ Use a tool to monitor parameters in real time (live data)

	• It checks the operation of sensors and actuators in real time	▫ Identifies whether parameters of selected sensors or actuators are within expected limits ▫ Associates deviations with a possible malfunction (e.g. unstable signal = possible bad contact)
	• Monitors the communication network (CAN, LIN) and locates interruptions or signal losses	▫ Uses a suitable tool (eg oscilloscope, OBD (On-Board Diagnostics) scanner with CAN function) to determine the presence of communication between modules ▫ Identifies the location of an interrupted or weakened communication based on a map or network diagram ▫ Explains the cause of signal loss or defect (eg physical break, module failure)
3. Electrical interventions and functional check	• Repairs or replaces starting, power and injection system components	▫ Removes defective components using appropriate tools ▫ Installs new components without physical damage and in correct order ▫ Observes safety measures while working with electrical and fuel systems
	• Tests functionality after intervention	▫ Connects diagnostic or measuring devices and performs component checks ▫ Compares the obtained values with the standards from the documentation ▫ It confirms the correctness of the system with no errors present after the intervention
	• Performs calibration and parameter setting	▫ Access parameters via diagnostic tool (eg pressure, injection time) ▫ Adjusts values according to manufacturer's specifications ▫ Confirms calibration success via tool report or hands-on test
4. Operation and safety of electric and hybrid vehicles	• Deactivates the high voltage system before intervention	▫ It carries out the procedure for safe disconnection of the high-voltage system (HV lockout/tagout). ▫ Checks if the system is de-energized before starting operation ▫ Use personal protective equipment (insulating gloves, safety glasses) ▫ Safely removes HV components following technical instructions

• Performs replacement of HV battery, converter and electric motor components	▫ Installs a new component and connects it according to the wiring diagram. ▫ Checks the correctness and stability of the system after the intervention
• Upgrades or recalibrates software in ECUs and control modules	▫ Connects the diagnostic device to the appropriate interface ▫ Initiates the upgrade or calibration process according to the manufacturer's instructions and monitors success ▫ Validates module functionality through a test or report

Module 5: Comfort and safety systems	Theoretical classes	40
	Practical classes	81
	Exercise classes	14

Modular unit	Learning outcomes	Evaluation criteria
1. Basics and principle of operation of comfort and safety systems	• It explains the types, functions and principle of operation of comfort systems (heating, ventilation, air conditioning, electric windows, multimedia...)	▫ Names and classifies comfort systems according to their function ▫ It explains how the HVAC system (heating/ventilation/air conditioning) works, using the correct terminology ▫ - Gives examples of how a multimedia or electrical system affects driver/passenger comfort
	• Identifies active and passive safety systems and explains their role in the vehicle (ABS, ESP, ADAS, eCall, airbags, etc.)	▫ Distinguishes between active and passive security systems with a precise definition ▫ Explains how the ABS or ESP system works in a specific situation (e.g. during sudden braking) ▫ Describes the function of ADAS or eCall systems and their benefit in preventing accidents
	• Recognizes integrated controls and sensors in the system network	▫ Lists sensors or control devices used in comfort or safety systems ▫ Identifies their connection via a communication network (CAN, LIN, FlexRay) ▫ It explains how a signal from a sensor is transmitted and used in another system over an electronic network
2. Diagnosis and measurement of comfort and safety system parameters	• Uses diagnostic equipment to read errors in control units (Body ECU, Gateway, ADAS modules)	▫ Selects the appropriate diagnostic tool and correctly connects it to the vehicle ▫ Reads and interprets error codes from various control units ▫ Documents received codes and suggests corrective measures based on diagnostic report
	• It measures voltage, resistance and current in parts of the	▫ Use a multimeter and clamp meter with appropriate measuring ranges ▫ He enters the measured values into a control sheet or table

	system (sensors, actuators, contacts, electric motors).	▫ Follows safety procedures when measuring electrical quantities
	• Analyzes and compares parameters with technical documentation and localizes faults	▫ Compares measured parameters with reference values from technical documentation ▫ Recognizes deviations that indicate possible malfunctions ▫ It identifies the exact component or part of the system that is causing the malfunction
3. Interventions on comfort systems	• Performs disassembly/assembly, installation and repair of systems for heating, air conditioning, power windows, lighting, seat adjustment	▫ Performs disassembly and assembly according to technical instructions using appropriate tools ▫ Connects electrical connections and system components without damage
	• Performs disassembly, assembly, inspection, installation and adjustment (calibration) of lighting and safety systems (daytime running lights, position lights, fog lights, brake lights, direction indicators...). on the vehicle in accordance with technical regulations and manufacturer's instructions.	▫ Identifies the type and components of the light-safety system on the vehicle. ▫ Safely dismantles the damaged system component. ▫ Installs new or repaired component according to instructions. ▫ Performs basic calibration and adjustment (eg reflector angle or light sensor).
	• Adjusts or adjusts parameters through the interface of multimedia and control units	▫ Accesses the software interface using the appropriate diagnostic tool ▫ Enter or adjust parameters (eg volume, time, language, sensor settings) ▫ Saves changes and checks functionality after customization
		▫ Use the diagnostic tool to activate functions and read parameters ▫ It confirms through a test that the systems function in accordance with the standards

		• Performs functional testing after the intervention with the help of diagnostic equipment	▫ Creates and maintains a test report or documents it in a worksheet
4.	**Interventions on active and passive safety systems**	• Performs installation, repair and calibration of ABS, ESP, driving assistance systems (ADAS), cameras, radars, sensors	▫ Connects sensors and electronic devices according to the connection scheme ▫ Performs a functional check after installation with the diagnostic tool ▫ Performs system calibration (ABS, ESP, ADAS) and documents success
		• Disassembles, checks and reinstalls airbags, seat belts and anti-rollover systems	▫ Applies safety protocols when disassembling airbags and safety devices ▫ Visually and instrumentally checks the condition of components before reassembly ▫ Reassembles devices and confirms their correctness with a diagnostic test
		• Upgrades and calibrates electronic devices after intervention (ECU, ADAS module, eCall)	▫ Selects the appropriate upgrade software and connects the device to the interface ▫ Successfully performs upgrade or calibration according to technical instructions ▫ Confirms system functionality and records changes after intervention

Module 6: Communication and Entrepreneurship	Theoretical classes	18
	Practical classes	36
	Exercise classes	6

Modular unit	Learning outcomes	Evaluation criteria
1. Communication with clients, team and use of technical documentation	• It explains the importance of professional communication in contact with clients, colleagues and superiors	▫ It states the basic principles of professional communication ▫ Gives examples of appropriate communication with different types of interlocutors. ▫ Explains the impact of behavior and body language in the work environment.
	• Uses clear and effective communication when presenting problems and solutions related to comfort and safety systems in vehicles	▫ Describes the problem in the vehicle using appropriate technical terminology ▫ It suggests a solution and explains the steps taken to fix the problem ▫ Uses a logical and structured way of expression in written or oral presentation
	• Appropriately communicates diagnostic and repair findings to clients and management, verbally or in writing	▫ Produces a clear report containing diagnosis, intervention and result ▫ Presents information in an understandable way to people without technical knowledge (clients) ▫ Uses professional and precise vocabulary in communication with management
2. Basics of entrepreneurship and independent work	• It explains basic terms related to self-employment, micro businesses and technical service workshops	▫ Defines basic terms related to self-employment and micro businesses (eg self-employment, small business, startups) ▫ It explains the role of technical service workshops in the context of the automotive industry ▫ It presents examples of micro business types and their application in daily work with mechanical and electronic systems
	• Describes administrative procedures for opening a service/workshop and	▫ It outlines the step-by-step procedure for opening a service or workshop, including legal and financial aspects ▫ Completes basic technical documentation (receipt forms, invoices, technical reports)

	maintains basic technical and financial documentation (offers, receipts, invoices)	▫ Identifies and explains the importance of proper management of financial documentation (payment orders, offers) in the daily operation of the service
	• Creates a simple business plan for offering services related to installation, diagnostics or calibration of active or passive security systems	▫ Draws up a basic business plan that describes the services (installation, diagnostics or calibration) to be offered ▫ Develops a plan for marketing and promoting services, including target groups and competitive advantages ▫ Presents a business plan with an estimate of costs and expected earnings from services, with attention to the necessary resources and equipment

Module 7: Safety and environmental protection	Theoretical classes	18
	Practical classes	36
	Exercise classes	6

Modular unit	Learning outcomes	Evaluation criteria
1. Occupational health and safety	• Uses personal protective equipment (helmet, goggles, gloves, footwear...) in accordance with regulations and the nature of tasks (assembly, electrical engineering, work at height)	▫ Selects appropriate personal protective equipment depending on the nature of the task ▫ Checks the correctness of protective equipment before starting work ▫ It explains the importance of each type of equipment and identifies the risks of its inappropriate use
	• Recognizes and identifies risks associated with the work environment and processes (electric shock, slipping, exposure to heat, toxic fumes...)	▫ Identifies potential safety risks and consequences ▫ Recognizes specific hazards by systems (electrical, mechanical) and processes (diagnosis, repair) ▫ It explains how to avoid or reduce risks in the work environment through appropriate protection, workplace organization and the use of safety measures
	• Implements safety measures and reacts in case of injury or emergency (PPE devices, evacuation, first aid)	▫ Conducts evacuation and uses PP devices in case of fire ▫ Applies basic first aid techniques (wound compression, stabilization of injured persons) in case of injury ▫ Documents incidents and informs authorities
	• Follows instructions and manuals for safe use of tools, machines and diagnostic equipment	▫ Applies instructions for safe work before starting the activity ▫ Identifies and reports damaged or malfunctioning tools and machinery that may pose a risk
	• Follows instructions for safe handling of vehicles when	▫ Describes the process of safely lifting and securing a vehicle ▫ Implements safety measures when working under the vehicle (use of cranes, hoists or fuses)

		lifting, fixing and working under the chassis	▫ Identifies risks during interventions under the vehicle and applies appropriate safety measures to protect against possible injuries
2.	**Environmental protection and waste management**	• Applies environmental standards and national regulations when working with trucks and heavy vehicles (emissions control, fluids, filters)	▫ It applies emission control methods in accordance with regulations ▫ Works with liquids (fuels, oils, antifreeze) in accordance with regulations for safe storage and handling, avoiding environmental contamination ▫ Installs or replaces filters in accordance with environmental standards and monitors their proper function to minimize negative environmental impacts
		• Performs selection and management of different types of waste: electronic, liquid, metal, plastic, composite	▫ Properly selects different types of waste (electronic, metal, plastic) and places them in the designated containers for recycling or disposal ▫ Applies methods for safe handling and storage of waste liquids and chemicals, according to environmental regulations ▫ It explains the importance of proper waste management and recycling, in order to reduce the negative impact on the environment
		• It explains the importance of "green skills" and their role in sustainable vehicle servicing	▫ Explains what "green skills" are and how they affect sustainability in vehicle servicing, using examples from everyday practice ▫ Identifies examples of sustainable work (efficient tools, less waste) ▫ Applies green skills in real work environments, such as minimizing resource consumption and using environmentally efficient methods
		• Chooses and uses materials and methods with less impact on the environment (environmental means, recycled parts)	▫ Selects and uses environmentally friendly means for cleaning and maintaining vehicles, reducing the impact of toxic chemicals and harmful fumes ▫ It uses recycled parts or materials when servicing the vehicle, reducing the consumption of new resources ▫ It explains how the choice of environmentally friendly materials and methods affects the reduction of negative effects on the environment and the increase of process efficiency

• Implements procedures for safekeeping, storage and transportation of hazardous technological waste in accordance with technical and environmental instructions	▫ Applies accurate procedures for storage and handling of hazardous technological waste (temporary landfill, protection against contamination) in accordance with environmental standards ▫ Transports hazardous waste in accordance with regulations, ensuring safety and minimizing risks to the environment and health ▫ Identifies and implements safety measures for the management of waste materials that may cause damage to the ecosystem and documents processes in accordance with regulations

6.	Forms of implementation of the teaching and learning process						
Form of implementation	**Module 1**	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**	**Module 7**
Classroom/office teaching	✓	✓	✓	✓	✓	✓	✓
Practical classes	✓	✓	✓	✓	✓	✓	✓
Blended learning	✓	✓	✓	✓	✓	✓	✓
E-learning		✓			✓	✓	✓
Distance learning							
7.	**Teaching and learning methods**						
Method	**Module 1**	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**	**Module 7**
Lecture	✓	✓	✓	✓	✓	✓	✓
Group discussions	✓	✓	✓	✓	✓	✓	✓
Observation	✓	✓	✓	✓	✓	✓	✓
Research/Discovery	✓	✓	✓	✓	✓	✓	✓
Learning through simulations	✓	✓	✓	✓	✓	✓	✓
Problem-based learning	✓	✓	✓	✓	✓	✓	✓
Practical teaching in the classroom	✓	✓	✓	✓	✓	✓	✓
On-the-job training	✓	✓	✓	✓	✓	✓	✓
Individual lessons	✓	✓	✓	✓	✓	✓	✓
Self-directed learning	✓	✓	✓	✓	✓	✓	✓
Visits/Study trips		✓	✓	✓	✓		
Other (please specify):							

8.	**Resources / equipment for teaching and learning**	For the successful implementation of the modular program, adequate infrastructure and equipment are necessary, which will provide high-quality theoretical and practical training. The training combines face-to-face teaching, demonstrations, exercises, laboratory work, diagnostics and work on real vehicles, so the resources should cover all aspects of the teaching process. Modernly equipped classrooms with computers, internet, projectors and blackboards are needed, as well as access to technical and technological documentation in printed and/or digital form. Practical work requires well-equipped workshops and simulation rooms, as well as appropriate teaching aids. ▫ Work planning and organization: work orders, plans, checklists, digital tools. ▫ Engines and mechanical systems: engine units, hand and specialized tools, fluids, filters, spare parts, test stands. ▫ Pneumatic and hydraulic systems: trainers, pressure gauges, vacuum gauges, flow sensors, valves, hoses, tanks. ▫ Electrical and electronic systems: multimeters, current clamps, oscilloscopes, ECU units, sensors, actuators, cables, OBD/CAN diagnostic equipment. ▫ Comfort and safety systems: HVAC systems, electric windows, multimedia, sensors and radars for ADAS, ABS/ESP modules, airbags, seat belts. ▫ Communication and entrepreneurship: templates of business plans, offers, invoices, simulations of client situations. ▫ Safety and environment: personal protective equipment, first aid, fire fighting equipment, instruction boards, waste selection systems. In all modules, the use of digital resources (diagnostic software, video instructions) and ecological tools (recycled parts, ecologically clean means) is preferred, in order to develop digital and green skills
9.	**Teaching staff**	For the "Truck and Heavy Vehicle Mechatronics Specialist" program, teaching staff should have appropriate qualifications in several technical areas, as the program is interdisciplinary and includes mechanics, electrical engineering, electronics, hydraulics, pneumatics and information technology. Required teaching staff for this program: **Graduated engineers or professors:** Mechanical engineering Electrical engineering (electronics and automation) Mechatronics **Master instructors or professional associates with work experience in:**

		maintenance and servicing of trucks and heavy machinery diagnostics and repairs of electronic systems in vehicles working with diagnostic tools and software **Professional teachers with pedagogical and didactic training for practical teaching in real conditions.**
10.	**Place of implementation**	**Theoretical teaching**: is conducted in classrooms equipped with basic teaching aids: blackboards, projectors, computers with Internet access and access to digital and technical documentation. The premises should provide suitable conditions for working with adult participants: adapted working hours, opportunities for interaction, discussion, presentations and individual research. Theoretical teaching includes explaining concepts, procedures, standards, reading diagrams, understanding instructions and processing information related to technical and technological aspects of work.
		Exercises:they are performed in technical laboratories, specialized classrooms or workshops where didactic models, measuring instruments, diagnostic equipment and simulators are used. The exercises represent a bridge between theory and practice and are intended to deepen knowledge, develop manual precision, measure parameters and perform technical calculations. Practice rooms should enable the performance of tasks in a controlled environment, with mentoring support.
		Practical classes: is carried out in a real or simulated work environment - in cooperation with a company, service center or school workshop. The space should be technically equipped with the necessary equipment for diagnostics, disassembly, repair, calibration and testing of components and systems of heavy vehicles. Special attention is paid to safety and environmental standards, as well as the application of digital tools in work. Workshops and service areas should enable direct contact with vehicles, tools, software and systems, through which participants develop real, applicable skills. Practical work takes place under the supervision of a teacher or professional mentor, according to predetermined tasks, plans and checklists.
		Combined approach: The program applies a combined learning approach, which allows part of the teaching - especially practical - to be carried out on site in a partner company or service, while theoretical and part of practical teaching are carried out in an educational institution or training center. This approach enables high flexibility, adaptation of teaching to real working conditions and direct learning through work (Work-Based Learning - WBL). The combined approach is particularly important for adult education, because it motivates participants, shortens the time of transition to employment and enables learning through solving real tasks and problems in an authentic environment.
11.	**Assessment methods and instruments**	Assessment in this program for adults is based on the principles of transparency, objectivity, practicality and orientation towards learning outcomes. Each module includes different forms of assessment that allow assessment

	(written assignments, projects, practical works, presentations, exam questions, performances, work portfolios, learning by doing, final exam, etc.)	of theoretical knowledge, practical skills, communication skills and understanding of the principles of sustainability and safety at work. One of the main methods is practical performance, where the participant demonstrates the ability to perform certain tasks, diagnose or repair systems on trucks and heavy vehicles. This method is most often used in modules that contain technical and manual work, such as: Engines and Mechanical Systems, Pneumatic and Hydraulic Systems, Electrical and Electronic Systems and Comfort and Safety Systems. For these activities, assessment instruments are observation with a checklist, a practical task or a technical demonstration. Written assignments and tests are used to check theoretical knowledge, understanding of technical terms, procedures, standard values and regulations. They are most often applied in the modules Planning and Organization, Safety and Environment and Communication and Entrepreneurship. These tests can be short tests, multiple choice questions, explanations of concepts or filling in technical diagrams. Work-based learning, in a real or simulated work environment, also has added value, where it follows how the participant applies the acquired knowledge and skills in concrete work situations. This method enables continuous evaluation of work process, independence, safety and quality of performed tasks. Small projects are also used during the training, such as: creating a service plan, gap analysis, business plan or technical presentation. Project tasks are evaluated according to established criteria, which enables the development of independent thinking, planning, teamwork and problem solving. A portfolio of works is another important tool. Each participant keeps a document with notes, completed practical tasks, reports, performance images and personal reflections. The portfolio is used for self-monitoring of progress and as proof of acquired skills. The Communication and Entrepreneurship module uses presentations and oral presentations, through which participants learn how to clearly explain technical solutions, communicate with clients and argue their proposals. In addition, case studies are also applied, especially when analyzing security or environmental problems, where participants solve a concrete practical situation. At the end of the training, a final exam is organized, which combines a written part, a practical task and a presentation of the performed intervention. In this way, a complete picture of the readiness of the participants for the actual application of the acquired knowledge is obtained. These methods enable the diversity, inclusiveness and practical orientation of the assessment process, adapted to the real working conditions and needs of the adult participants.
12.	**Key competencies**	▫ **Communication in mother tongue**: is able to share and interpret concepts, thoughts, feelings, facts and attitudes in oral and written form, as well as to achieve linguistic interaction with candidates and colleagues in an appropriate and creative way in different social and cultural contexts. He is able to use

		different types of texts related to the field of automotive technology and to formulate and express his own oral and written arguments in a persuasive way, adapted to the context. ▫ **Communication in a foreign language**: when there is a need to use a foreign language in a specific social and cultural context related to work, is able to understand, express and interpret concepts, thoughts, feelings, facts and attitudes, both orally and in writing. He is able to use a foreign language in order to monitor progress in the profession and to improve his own knowledge and skills in the field of automotive technology. ▫ **Mathematical competences and basic competences in the field of science and technology**: applies numerical thinking and knowledge in explaining and solving various tasks in daily work with equipment and administration. Uses technical-technological tools and data to perform tasks. Collects data needed for independent advancement in the field of mechanical engineering. ▫ **Digital competences**: uses basic information technology to properly use diagnostic devices and work equipment. Searches, collects and processes digital information and uses it in a critical and systematic way. Uses tools to prepare, present and understand complex information in the performance of mechatronics activities. ▫ **Learning how to learn**: is able to access, acquire, process and adopt new knowledge and skills for personal development, as well as to apply them for the advancement of the profession. He is able to manage his own studies, career and work routines. He is persistent in independent learning, but also in learning in cooperation with colleagues in the field of automotive engineering. ▫ **Social and civic competences**: in the everyday environment manifests personal, interpersonal and intercultural competences for constructive communication with people of different profiles, shows tolerance, expresses and understands different opinions and builds trust. ▫ **Initiative and entrepreneurial skills**: shows the initiative to implement important ideas and their realization in order to improve conditions. He is able to recognize opportunities and initiate improvements in different situations. Contributes to the development of a culture that supports initiative and innovation and recognizes the diverse skills of everyone within the service. ▫ **Cultural awareness and expression**: recognizes and appreciates the creative expression of ideas, experiences and emotions and connects them to personal development. Aligns his creative and expressive views with the thinking of other team members, their families and colleagues, and expresses them in a way that contributes to the common well-being**.**
13.	**Passability of the program within the**	After completing the qualification, the student has the following options: **Employment:**

	framework of education	▫ Completion of this qualification enables the individual/candidate to join the labor market and be employed in various private/public entities dealing with the maintenance, repair and technical control of trucks and heavy transport vehicles, in the field of spare parts trade and vehicle sales. ▫ Also, the individual/candidate can be self-employed within his own business in the field of services for trucks, heavy machinery and other means of transport. **Enrollment in another educational program from a related sector and at the same level:** ▫ When enrolling in another educational program, the professional modules that are part of this qualification are taken into account. ▫ Vertical passability: ▫ Level 5 – there is no direct vertical mobility to higher levels of education. ▫ Horizontal passability: ▫ When enrolling in another educational program, the achieved learning outcome units that are part of the curriculum are taken into accountplan and program for the qualification Specialist for mechatronics on trucks and heavy vehicles