

Table 2

Competency matrix for car service and repair (car mechatronics)

Core Work Processes	Fields of competency Steps of competency development			
<p>1. Standard service</p>	<p>He/she receives the vehicle from the customer and prepares the service tasks. The customer order is more precisely defined and includes the identification of the vehicle. Customer advisory service must be carried out.</p>	<p>He/she carries out all tasks relevant for service and ensures that the car remains functional with regard to traffic, operation and technical functions. The service adheres to service plans and customer requirements.</p>	<p>He/she carries out service tasks and hands the fully functional car over to the customer. He/she explains the performed service tasks. All of the manufacturers' provisions for service have to be adhered to.</p>	
<p>2. Repair of parts subject to wear</p>	<p>He/she exchanges parts subject to wear. The functions of the car systems are safeguarded. A new set of parts subject to wear are installed (brakes, V-belts, wheels, tires, clutches, lighting system, shock absorbers, water pump ..).</p>	<p>He/she adheres to stipulations with regard to safety and health during repair. Qualitatively premium but at the same time favorably priced parts are carefully selected. Recycling processes for used parts are initiated and disposal stipulations are adhered to.</p>	<p>He/she talks with customers in order to determine service and repair tasks beyond the standard service followed by a very detailed coordination with the customer and a documentation of the interlocution to be used as an order.</p>	<p>He/she manages the service and repair concept determined by the manufacturer. Existing technical information systems are applied. Technically relevant specifications as well as safety regulations and other stipulations for the safety of human beings and vehicle safety are adhered to.</p>

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3. Standard diagnosis , diagnostic processes, fault repair and smaller repairs	During talks with the customer, he/she identifies malfunctions and faults, e.g. in the fuel system, injection, motor management, aggregates and defines the order.	He/she carries out a standard diagnosis and checks the identified error indication. The required diagnosis routines are observed. Required minor repairs for the elimination of faults are carried out.	With the help of a standard diagnosis and conversations with the customer, he/she identifies faults and malfunctions which hamper the functionality of the vehicle. Minor problems are analyzed and repaired immediately.	He/she deals with more complex malfunctions in aggregates such as fuel-mixture generation, motor management, comfort and safety electronics, communication electronics and carries out standard repairs in order to reinstate the functionality. Devices for diagnosis and measurement are applied if necessary.
4. Inspection	According to the inspection categories he/she determines the scope of the service tasks dependent on the service plans and customer requirements. The inspection process is prepared. The damage is pinpointed.	He/she carries out a first diagnosis in order to determine the precise scope of service and inspection with regard to technical issues. Workshop related service documents, checklists, diagnostic devices and customer information are used for this task.	He/she takes special care of the safeguarding of functionality with regard to traffic, operational and functional safety. This is done by an exchange of parts and preventive service and includes a careful check of all safety-relevant parts and their environment.	He/she carries out all necessary inspection tasks on the engine, motor management, chassis, power train, electronic system. The adequate tools are applied. During the exchange of parts, he/she adheres to technical standards and ensures that no harm is done to people.

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	Steps of competency development				
5. Repair of the power train and the suspension	He/she prepares repair based on a fault diagnosis and in agreement with the customer. The malfunctions are accurately identified in order to facilitate a target-oriented repair. The damage is pinpointed.	He/she precisely analyzes the functionality, the effectiveness of aggregates and their malfunctions. Based on the results, he/she determines which of the parts are damaged, to be repaired or to be exchanged in order to restore their functionality.	He/she determines the extent of repair of the aggregates in question by judging the malfunctions and faults. The necessary repair measures are derived from these findings. A precise damage calculation is carried out.	He/she identifies the most effective fault repair and selects the respective tools. Parts/aggregates are repaired according to manufacturers' stipulations and by applying adequate tools and processes. It is important to safeguard high precision and quality.	He/she documents the performed repair and maintenance tasks for invoicing, safeguards the disposal or reuse of used parts and concludes the order. He/she carefully explains the damage situation to the customer.
6. Electrical and electronic repairs	With the aid of a fault diagnosis, he/she identifies defects and coordinates the scope of repair with the customer. Workshop resources are planned accordingly. Depending on the case of damage, the task is assigned to a certain team or a certain mechanic who then performs the repairs and selects the adequate tools.	He/she determines the aggregates to be exchanged or to be repaired by focusing on the restoration of the normal condition. This includes troubleshooting, fault repair and partial modernization. A precise judgment and advisory tasks are crucial for the determination of faults.	He/she narrows down the possible faults and looks for solutions for fault repair. Faults are repaired in malfunctioning systems and/or in faulty components. The indications of the diagnostic device are carried out. If this does not help to attain the target, checks and measuring is performed in order to narrow down faults.	He/she identifies the fault in the electronic system, reads the circuit diagram and pinpoints faults in the respective current paths. Indications of the diagnostic device and the use of measurement devices are applied for the identification of faults and their repair. With the aid of circuit diagrams, the location of faults is pinpointed and repaired.	

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7. Extended diagnosis and repair of aggregates, components and elements	He/she carries out an expert diagnosis for especially difficult cases. This means that non-redundant, non-documented and cursory faults and malfunctions in automotive systems will be looked for with the aid of a diagnosis. In a further step causes for the malfunctions are narrowed down and the scope of repair is estimated.	He/she checks the individual faults and malfunctions and their impact on the operation of the vehicle. The different interrelations, phenomena and processes with regard to the vehicle network are checked and conclusions are drawn for trouble repair. An important issue is the identification of concrete components as a source of trouble. There will be telecommunication with the manufacturer.	He/she checks different kinds of faults with the help of diagnosis and test devices (e.g. status images, sound charts, burn-off diagrams) and the respective specialist systematic and experience-guided explanations. By determination of the interrelationship of the components, possible defects can be precisely located. Documentations on similar faults, circuit diagrams and hotline support will be used for quicker troubleshooting.	He/she narrows down the faults by experimenting in order to determine the exact cause for the malfunction. Focus is on the analysis of the symptoms by making use of different methods. The methods concentrate mainly on individualized troubleshooting with measuring and diagnostic devices. As soon as the fault is located, it is repaired by adhering to technical standards and safety regulations.	He/she documents the fault and the fault repair. The manufacturer will be informed via the existing communication paths and suggestions for the improvement of the diagnostic interface will be submitted.

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8. Repair and servicing of aggregates such as engine, gearbox (automatic and mechanic)	He/she talks with customers in order to identify the claimed damage in aggregates. Based on this conversation and a preliminary check as well as after a precise diagnosis, a repair order will be issued. The repair order characterizes the damage. An exact definition of the damage will be given in a next step.	He/she deals with the customer's complaint and the results of the first diagnosis and defines the exact damage. Based on this, he/she determines which tasks have to be tackled – e.g. repair, general overhaul, exchange etc. In order to facilitate the decision, components must be closely checked (palpating, listening, visual inspection). Parts have to be ordered if required. The customer has to be informed prior to making the final decision on fault repair.	After clarification of all details, he/she establishes a more intensive communication between customer and workshop in order to make a decision on an effective repair resulting in customer satisfaction. This involves the discussion on different options and costs with the customer. The repair is carried out after this decision.	After the decision on the kind of repair, he/she carries out the repair tasks by making use of adequate tools and by adhering to the legal stipulations. The repair process has to be optimally organized. The optimal functionality and operability of the aggregates must be safe-guarded. During repair it is important to concentrate on adhering to all quality and safety standards and to repair the faults with highest precision.

Core Work Processes	Fields of competency			
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9. Extension of standards and installation of accessories	He/she notes the customer's wishes, advises the customers, defines an order in cooperation with the customer, adjusts the order accordingly and works out an offer. It is to be checked whether changes on the vehicle have an impact on the operating permit or whether traffic regulations are in jeopardy. Orders that do not comply with legal stipulations must be rejected.	He/she deals with the issue of an optimal technical performance of retrofitting and adheres to all legal stipulations and standards set by the manufacturer. Contradictions between customers' interests, ecologically adequate operation of the vehicle and traffic and operational safety must be clarified. It is necessary to clarify these issues with the customers very carefully.	He/she carries out special extension measures and ensures that they serve a cause. The impact on vehicle systems and properties of the entire vehicle has to be checked. Prior to the service tasks the required parts must be procured. An order planning must be established. It has to be ensured, that the installations do not interfere with the vehicle's functionality and safety.	He/she ensures that the retrofitting is carried out professionally and that all connections are installed fully functionally. A check against the legal stipulations must be made. Fine tuning for a better driving function and performance must be carried out with adequate tools. All technical, traffic related and other safety standards for the protection of persons must be adhered to.
10. Personnel development	These core competencies are not shown in detail here. They count among the leadership competences necessary for positions above the level of a car mechatronic.			
11. Accounting/Offers/Clearance				
12. Entrepreneurial competence				