MODUL 3

KRAFTFAHRZEUG-TECHNIK

MODULE 3

AUTOMOTIVE TECHNOLOGY

Bildung und Kultur

Leonardo da Vinci

This project was sponsored within the budget from the Leonardo-da-Vinci-Project of the European Union.

European Union module 3: Automotive technology

§ 1 Duration

The duration of the module is 120 instruction units.

§ 2 Target group

The module is addressed at participants who are almost ready to be accepted for a post as enterprise manager or workshop manager. The participants should, at a minimum, have successfully graduated from vocational or professional training, as well as having initial professional experience. These participants are qualified technicians aged between 20 and 45 years. From their training they already have a basic economic and technical understanding, which they were able to develop in connection with their work activity.

§ 3 Goal / intention

The goal of the course modules is to give the prospective operating/workshop manager or master craftsperson, the confidence that he is in a position to take up the challenge of business independence/autonomy by acquiring appropriate skills. It concerns having an intuition for feasibility. Here those participants who are still uncertain of their own independence are addressed in the first instance. The potential independent craftsperson is to gain the confidence that he has acquired the skills to tackle the tasks of an entrepreneur. This does not mean that all autonomous approaches to solving prblems are explored during training, but rather that the candidate is to acquire a broad overview of the daily life of an entrepreneur. In addition to technical expertise, this crucially also involves business management expertise. The potential entrepreneur must become more familiar with the management. He must have control over the economic aspects just as much as over the technical ones. Only then does he develop the necessary self-assurance. The issue concerns the development of vocational skills. Here, methods are to be selected which contribute to developing confidence in the candidate about his ability to resolve problems whose details are not known at present by his own endeavours or with appropriate consulting assistance.

After completing the module, the participant:

- shall have an understanding of the daily challenges which meet an entrepreneur in an automotive enterprise, both on a technical and on an economic level.
- shall understand the relevance of the relationship with the customer and of direct customer contact.

Emphasis: Technology

In the Automotive technology module, the focus is on innovative business fields in the industry.

§ 4 Contents

The contents of the course is divided into five fields:

1. **Legal regulations**
2. **Implementing the EDP enterprise organisation**
3. **Implementing EDP technology**
4. **Automotive system engineering**
5. **Industrial safety and environmental protection**

1. Legal regulations	**10 h**
Contents	**Skills**
• Information regarding country-specific automotive legislation (Example: Germany Road Traffic Regulations and Road Traffic Licensing Regulations)	Carry out the measures necessary to ensure that the vehicle is repaired in accordance with the legal stipulations.

2. Implementing the EDP enterprise organisation	**20 h**
Contents	**Skills**
• Workshop organisation software • Workshop planning • Merchandise management system • Order and invoice preparation • Reminders • Marketing measures	Gather the vehicle data and differentiate between varying cases of damage Ask the customer for background information regarding vehicle damage Set up orders and delegate work. Explain the Automotive Repair conditions to the customer Observe legal advice law Explain confirmation of repair costs assumption Allocate any external service Explain product liability to the customer, and differentiate here between guarantee, ex-gratia payment and warranty

3. Implementing EDP technology	**30 h**
Contents	**Skills**
• Country-specific workshop software (Diagnostic software) • Vehicle and repair data • Maintenance schedules • Service references • Damage calculation	Carry out independently an error search using diagnostic software Reading from circuit diagrams as well as evaluating measuring and inspection procedure System diagnosis

4. Automotive system engineering	50 h
Contents	**Skills**
• Design and function of power transmission: Engine, transmission, differential and drive shafts • Basis chassis technology: Wheels, suspension, steering element, axles and axle geometry • Engine technology: principles of petrol and diesel engines (mechanics) • Engine technology: Air/fuel mixture systems petrol and diesel engines • Design and function of the brake: Legal regulations, hydraulic system, compression, braking power aid, wheel brakes and ABS systems, • Automotive electrics and electronics • Chemical materials and materials technology • Determine the diagnostic methods for individual systems • Body and varnish technology	Use measuring and testing appliances Specify restoration and repair methods Diagnose vehicle systems Restore the road safety of vehicles Evaluate damage to body and paintwork Prepare accident damages for expert report Readout of error memory Locate defect components with the help of appropriate software programs Diagnosing and imlplementing pyrotechnic vehicle systems (expert proof)

5. Industrial safety and environmental protection	10 h
Contents	**Skills**
• Organisation of workshop • Fuels • Waste water • Disposal	Discuss risks in the enterprise, and describe the consequences of unrecognised risks Usage of regulations of the industrial safety law (rules for the prevention of accidents, workplace regulations) Usage of safety data sheets. In addition explain the meaning and application examples of personal protection equipment Recognise dangers of electrical current and describe sources of danger Meaning of the CE mark and the machine guideline in the automotive enterprise Explain environmental protection legislation (D: BimSchG), as well as the identification of wastes and recycling management legislation Explain the connection between industrial safety and environmental protection

§ 5 Methodology

Extensive teaching and learning methodologies, so-called “complex training/learning arrangements”, take centre stage. This would include, for example, case studies, investigations or role-games.

In the production of the case studies, please consider the points presented in the checklist below.

Steps of a case study development:

1. The basis of the task is an important and complex problematic situation such as might occur in practice, which is also in the content of the curriculum.
2. A first draft should contain a requirement catalogue with the relevant topics.
3. The tasks connected with the individual topics are now listed.
4. Is any (additional) information required, for resolution and/or treatment of the problem section?
5. How much total working time should be available for the case-based tasks?
6. Provide a rough solution or answer plan, which the examinee is to cover in principle in answering the questions.
7. Formulate tasks with a medium degree of difficulty, which reflects the vocational skills of a trades/crafts enterprise.
8. Specify, if necessary, which aids the class participants may use during processing the task.
9. Let a colleague countercheck the entire case.

§ 6 Examples of methods

Constant further training in the automotive sector is a MUST!

Lately in the Schulze automotive enterprise, repetition repairs are increasingly accumulating, which on the one hand leads to discontent on the part of the customers and on the other hand drives up the internal costs. Therefore the topic “repetition repairs” was put on the agenda for the next personnel meeting.

The following case points out the shortcomings at the Schulze company:

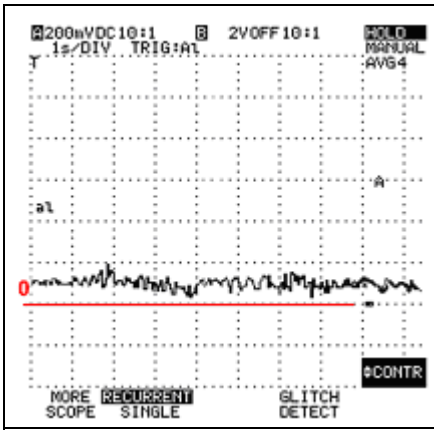
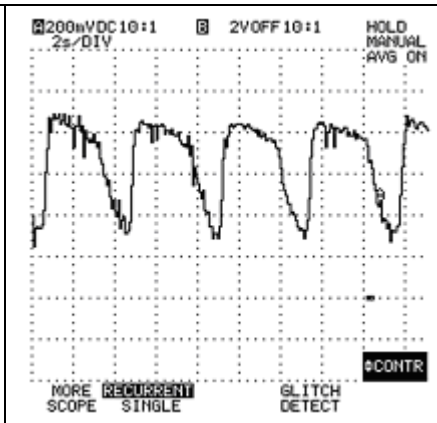
Mrs. Schmitz brings her vehicle, a Ford Escort 1.6 l, to the Schulze company with the complaint that the engine lamp lights up continuously. Thereupon, mechanic Klaus gets the order to take care of this matter. Since the Schulze company only recently invested in a universal appliance for the reading out of EOBD error codes, the equipment was attached straight away to the diagnostics plug. The readout of the error codes showed error codes P0131 - Lambda sensor circuit too low voltage (bank 1 Sensor1) and P0171 - mixture too lean (bank 1).

For mechanic Klaus the case was clear, it had to be the Lambda sensor. After he had replaced the sensor and deleted the error codes, the error lamp remained off. Even following a short test run the engine light remained off, thereby confirming his supposition.

One week later however came Mrs. Schmitz again to the company Schulze with the same complaint. Mrs. Schmitz also reported that the vehicle now had a verified higher fuel consumption. What had happened?

A renewed readout of the error codes indicated the same error codes again. Since one now knew that it could not possibly be the Lambda sensor, consideration was given as to what could possibly have caused this error.

The apprentice Peter made the suggestion of examining the voltage of the Lambda sensor with the oscilloscope; only the previous week he was shown this at school. The oscilloscope indicated a constantly low voltage of 0.1 V. After deleting the error codes, it was noticed that the no-load operation after the start ran a longer time with increased number of revolutions, and only when the engine speed dropped back down to about 800 rpm, did the Lambda sensor show a normal signal in the oscilloscope, and oscillated nicely between 0,1 and 0.8 V.

	
The Lambda probe indicates continuously low voltage and thus a lean mixture. However, this does not necessarily mean that the sensor is defective.	The Lambda probe oscillates between 0,1 and 0.8 V and thereby indicates a closed control loop.

Mechanic Klaus now made a more thorough visual check in the engine compartment and examined all plug and tube connectors. He noticed a porous negative pressure tube, through which the engine could suck in leaked air.

At the personnel meeting it came to the evaluation that there was a lack of knowledge concerning the EOBD regulation and use of the oscilloscope. Mr. Schulze realized that constant further training of his employees is indispensable and one can lower the number of repetition repairs only in this manner.

Question 1:
What could have been done better on the occasion of Mrs. Schmitz's first visit, in order to avoid the repetition repair?

Answer 1:

- Ask for more exact information from customer
- A better visual check
- First delete error codes and subsequently examine the voltage signal of the Lambda sensor
- Take the fuel tables into consideration

Question 2:
How can it be explained that the engine lamp did not light up after the short test run and no error codes were produced?

Answer 2:

- The engine regulation tries to balance leak air by adjustment of the amount of fuel. This explains the increased fuel consumption. A check of the fuel tables with the universal test equipment would have shown up this adjustment.
- Only with higher engine speeds could the automatic control loop no longer balance the sucked-in leak air.
- The MIL lamp can light up only when the inspection monitor of the Lambda probe is active. (Monitors are reset with the deletion of the error codes.)
- The MIL lamp is activated only when the error arises on the second operating cycle under same vehicle conditions.

Question 3:
What consequences does the wrong diagnosis have for the customer relationship? What can still be done to prevent the customer from changing his service provider?

Answer 2:

- The customer must feel that one takes his problem seriously and does everything to find the problem.
- Likewise the customer must be convinced that the error was finally found as a result of competence in this specific matter.
- In any case the old Lambda sensor must be inserted again!

§ 7 Examination/certificate

The candidate works on a case study in which at least three of the five topic fields are to be covered. The working time is 180 minutes. Besides this, the vocational skills of the candidate are examined by means of a verbal examination lasting 30 minutes.