



Result 3.3

Curricula, teaching materials and examination regulations for specific dual vocational training

Part B

Curricula for dual vocational training in five professions



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Content

Project Summary and Introduction

Electronics technician for industrial engineering

Vehicle mechatronics engineer

Plumber

Sewage engineering technician

Environmental Technology

Language

English

German



Project Summary and Introduction

About the 3LOE project

Around 99% of all EU businesses are SMEs, creating up to 70% of all jobs. In general, SMEs have good growth prospects for the future and are particularly well equipped to solve environmental problems and to enhance the green economy. However, in most of the project countries, SMEs are confronted with a shortage of skilled workers and young entrepreneurs. This shortage of skilled workers is even more alarming taking into account that due to aging of current entrepreneurs, a large and growing number of companies will have to be handed over to the next generation. Furthermore, young specialists and entrepreneurs often lack the qualifications and skills needed in order to respond to contemporary developments in the fields of energy, climate and environmental protection. The following problems have been identified in SMEs working in the fields of green economy, energy and environmental protection:

- Blatant and growing shortage of skilled workers.
- Large qualification deficits, especially in the Green Economy.
- Loss of attractiveness and low qualification of school-based VET.
- Low rates of further training and insufficient orientation of offers to SME needs.
- Ageing of entrepreneurs and increasing shortage of young people (demographic change).
- Failure of business transfers and low rates of business start-ups.
- Low innovation rates and insufficient productivity.
- Not enough cooperation between universities and SMEs and a lack of teaching geared to SME needs.
- Comparably low internationalization of SMEs and vocational training providers.
- Lack of national level support for SMEs”.

To meet these challenges, work-based learning and new paths in vocational training must be provided through cooperation between educational institutions, economic chambers and SMEs. University graduates are often well-qualified in theory, but lack practical knowledge, skills and abilities that are crucial for SMEs. For this reason, VET reforms must also involve higher education, and should implement dual bachelor's degree programs that combine a bachelor's degree with vocational training and on-sight work in companies.

In the 3LOE project, an innovative and complex project structure with 22 project partners from 7 countries as well as 60 associated partners from 13 countries was designed. In each country, centers of vocational excellence (COVEs) in Green Economy will be established, managed and their permanent continuation ensured. A transnational cooperation of the centers will be developed, extended to 60 education stakeholders from 13 countries and operated permanently in an institutionalized form. The centers will offer a wide range of dual education measures in vocational training, further education and higher education, that are being developed, tested and evaluated in the project. These educational measures on EQF levels 3-7 focus on Green Economy, Digitalization and Entrepreneurship. Furthermore, vocational and educational consulting and innovation support for SMEs will be developed and implemented. In total,



seven Train-the-Trainer programs will be developed and implemented permanently by the project partners. All results will be transferred to the 60 associated partners together with implementation advice.

The objectives and aimed outcomes of the 3LOE project can be summarized as following:

1. Foundation of a three-level Center in each project country

1.1 Building the "Green Economy" skills alliance for qualifications in SMEs with educational and economic actors from the 7 project countries; development of information and cooperation tools.

1.2 Expansion of the skills alliance to the 60 associated partners from 13 countries, comprising chambers of commerce, SME associations, as well as universities of applied sciences/colleges.

1.3 Development, testing and evaluation of a curriculum and teaching materials for Train the Trainer courses for personnel and center management (vocational school-teachers, trainers in SMEs and lecturers in further and higher education institutions).

1.4 Evaluation of the construction and operation of the seven centers of Excellence and of the transnational cooperation.

1.5 Development of business and financing plans and ensuring the long-term continuation of the seven centres and transnational cooperation.

1.6 Development, consulting and introduction of political strategy program.

2. Implementation and realization vocational training

2.1 Development and implementation of a tool for vocational and qualification counselling as well as a training for consultants and teachers to use the tool.

2.2 Implementation of the dual system, so that work-based learning is put into practice in the project countries.

Preparation and transfer of curricula and examination regulations for dual vocational training for different professions and implementations in Poland, Lithuania, Latvia and Spain.

Development, test and implementation Trainings for teachers to conduct dual vocational training as well as Training of trainers in SMEs.

2.3 Development political concept for the training and integration of young people with learning difficulties for young people with learning difficulties (EQF level 3).

Development, test and implementation of a dual vocational training "Specialist for Building Insulation".

2.4 Development, testing and evaluation of education programme, teaching materials and examination regulations for the provision of sector-specific qualifications already during the initial vocational training for stronger learners. Implementation in the dual system, so that work-based learning is put into practice in the project countries.

2.5 Development and implementation five-year technician training „Ecologic Solutions in Logistics”.

3. Implementation and realization of further vocational training

3.1 Development and implementation of concepts and instruments for the management of continuing vocational training.

3.2 Development, test and implementation of a Train-the-Trainer program for teachers to conduct further training.

3.3 Development and implementation of a concept "SME-fair digitalization" as well as development, test and implementation of two train the trainer programs "Basic and advanced digital skills".

3.4 Transfer and implementation of four further trainings Energy Saving and Renewable Energies.

3.5 Preparation, transfer and implementation of six further trainings in the Green Economy.

3.6 Development, testing and evaluation of different training programs and teaching material for owners, managers and qualified workers of SMEs (EQF level 5 and 6). The trainings are specifically tailored to SME needs and different qualification levels and combine the transfer of technical, professional and management know-how.

- Training Enterprise and Entrepreneurship in Green Economy
- Training Energy Service Manager
- Trainings vocational Master Carpenter and Electric
- Training Construction Technician
- Training Service Technician
- Training Sustainability in foodservice industry

3.7 Development of regulations for new continuing education occupational profiles with a focus on the green economy.

3.8 Development of an integration programme for the unemployed (EQF level 4) in order to be able to place the unemployed in permanent jobs through further training seminars and a further training qualification.

4. Implementation and realization of higher education

4.1 Preparation and transfer of curricula, evaluation and examination regulations for two existing dual Bachelor degree programmes "Management of Renewable Building Energy Technology" and "Business Administration for SMEs".

4.2 Development and beginning of implementation of new dual Bachelor degree programs

- Business Administration & Sustainable Management of SMEs
- Entrepreneurship and Innovation in Green Economy
- Logistics - Green Supply Chains
- Service technician
- Tutorial "Sustainable management Climate neutrality for companies"

4.3 Development, test and implementation of four study modules (EQF level 6) on SME management in the Green Economy sector, which will be carried out in the dual study system and integrated into existing Bachelor degree programmes.



4.4 Development and implementation of concept for innovation promotion Solutions for manageable R&D tasks of SMEs and conducting manageable R&D projects for SMEs-

4.5 Development, testing and implementation of Training program for university lecturers and SME advisors.

5. Dissemination, transfer and use of the project results

5.1 Development of a concept and summary evaluation of the dissemination results of all partners

5.2 Transfer of all educational measures to 60 educational institutions in 13 countries and needs-oriented implementation consultations as well as realization of a bundle of measures for further dissemination of the project results.

5.3 Further dissemination activities such as presentations online, at third-party events, press releases and conferences.

5.4 Book with all results of the project and distribution via book trade.

For each of the three levels of educational measures there will be:

- Target-group-specific educational programs.
- Curricula, teaching materials, etc. developed in a leading role by the educational institutions of the respective level, whereby the educational institutions of the other levels (in particular universities) participate in an advisory and supportive manner.
- Representatives of the participant target groups involved in the development work.

All educational measures will be tested with the respective target groups under different national conditions in the countries, evaluated and completed on the basis of the evaluation results with application notes.

About the transfer of the German dual vocational training systems

As part of the 3LoE project, dual vocational training was to be implemented in all seven partner countries. The basis for this was the German dual system, which was adapted to the respective national conditions and implemented.

The German dual system was analyzed and described in detail. Strategies were developed for the organization of vocational education and training in the federal states as well as recommendations for transfer and implementation in countries where school-based vocational education and training has been predominant to date. Comprehensive presentations were also developed to enable the partners to independently present, communicate and explain the dual system in their countries. The results of this work are summarized as Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training, Part A Preparation and transfer of the German dual vocational training systems.



A train-the-trainer seminar for management and teaching staff at vocational schools was developed, trialed, evaluated and implemented to ensure that qualified staff are available in the implementing countries.¹

In accordance with the focus of the 3LoE project in the Green Economy and the needs of the project partners, framework curricula for the school part and training regulations for the company part of vocational training as well as examination regulations for the following professions were prepared and transferred:

- Electronics technician for industrial engineering
- Vehicle mechatronics engineer
- Plumber
- Sewage engineering technician
- Environmental technology

These documents are presented as Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training, Part B Curricula for dual vocational training in five professions.

The Polish partner Izba Rzemieslnicza Malej i Sredniej Przedsiębiorczosci wanted to realize a dual vocational training program "Fitter of fixtures and fittings in building industry" in accordance with national conditions and regional needs. As such a profession does not exist in Germany, the German vocational training programs "painter and varnisher" and "tiler and panel layer" were transferred. On this basis, the Polish partner developed and implemented a dual vocational training program "Fitter of fixtures and fittings in building industry" with comprehensive advice from Partner 1 Hanse-Parlament².

The Lithuanian partner Verslo ir svetingumo profesinės karjeros centras wanted to realize a two-year dual vocational training program "Cook" in accordance with national conditions and regional needs. As there is no such training program in Germany, the German vocational training programs "Cook" and "Ordinance in the hospitality services industry" were transferred. On this basis, the Lithuanian partner has developed and implemented a two-year dual vocational training program "Cook" with comprehensive advice from Partner 1 Hanse-Parlament³.

As part of the further project implementation, dual vocational training programs were implemented and evaluated for the following professions in the following countries:

- Poland: Electrician
- Poland: Fitter of fixtures and fittings in building industry
- Lithuania: Cook
- Latvia: Motor vehicle mechanic/Car mechanic
- Spain: Electromecanico

¹ See Result 3.2 Training programs for teachers to conduct dual vocational training

² See Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training, Part C Implementation and Evaluation

³ See Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training, Part C Implementation and Evaluation



The implementation reports as well as an evaluation concept and evaluation reports are summarized as Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training, Part C Implementation and Evaluation.

The entire Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training consists of three parts:

- Part A Preparation and transfer of the German dual vocational training systems
- Part B Curricula for dual vocational training in five professions
- Part C Implementation and Evaluation

Part B is reproduced below.

Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training

Part B

Curricula for dual vocational training in five professions

- Electronics technician for industrial engineering
- Vehicle mechatronics engineer
- Plumber
- Sewage engineering technician
- Environmental Technology

Languages

English

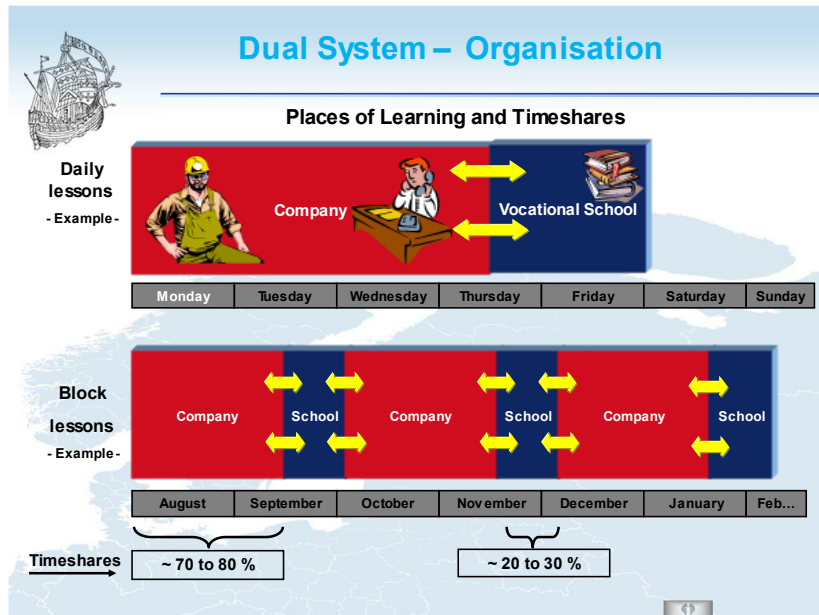


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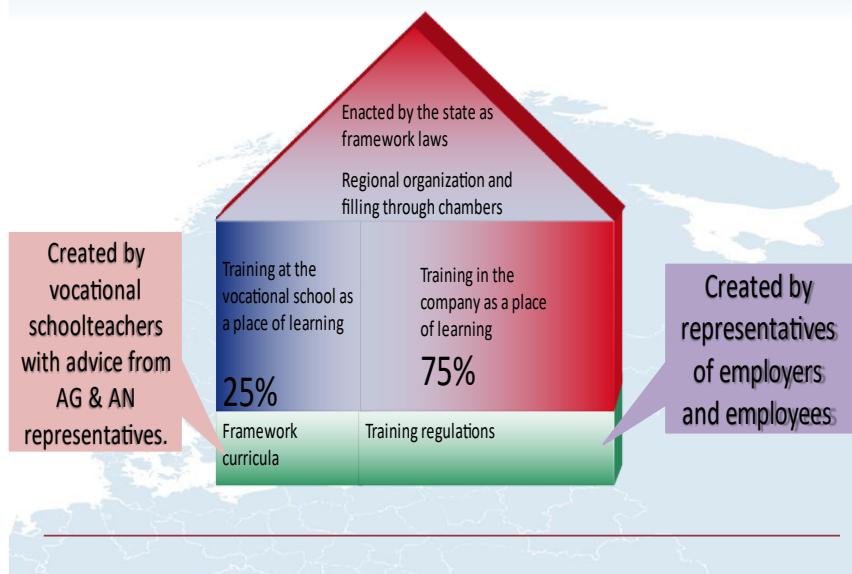
Introduction

Vocational training takes place in Germany under the dual system. About 70 - 75 % of the training takes place in a company and about 25 - 30 % in a state vocational school. The contents of the training in the company are regulated in a training regulation and the theory lessons in the vocational school in a framework curriculum. Both curricula, which are coordinated in terms of content and timing, are state framework regulations. In addition, depending on regional requirements, the chambers can define inter-company instruction courses that are mandatory for the regional area of the respective chamber. In these instruction courses, which are part of the training in the companies, the trainees receive training in new technologies in inter-company training workshops in addition to the in-company training. These inter-company training workshops are run by the chambers or by guilds and associations.



HANSE-PARLAMENT Dual system: overview- organizational forms

Network for Small and Medium Enterprises

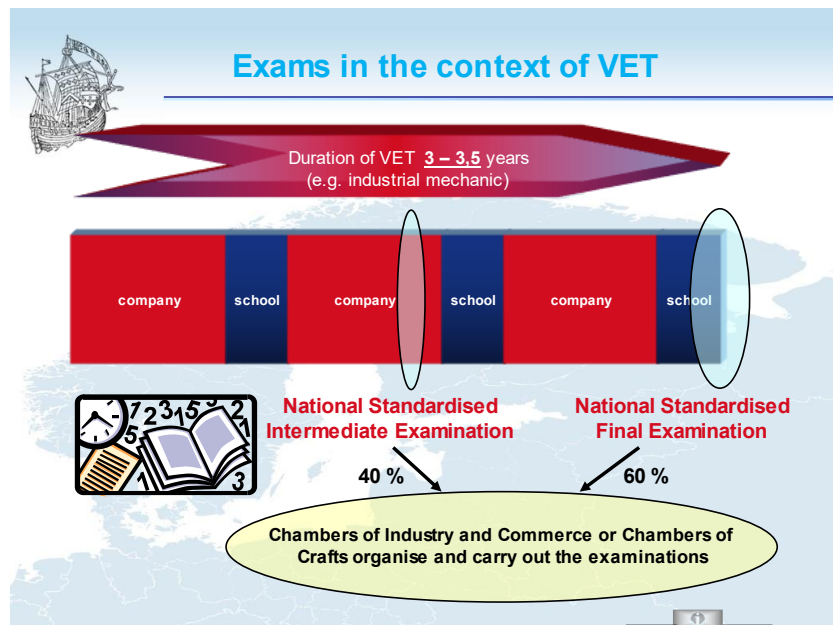


The training regulations that govern in-company training are developed by representatives of employers and employees together with experts and formally adopted as ordinances by two responsible federal ministries. The framework curricula for vocational school instruction are developed by vocational schoolteachers and formally adopted as binding regulations by the Confer-

ence of Ministry of Education. The inter-company instruction courses are developed by a vocational training committee of the respective chamber, one-third of which is made up of representatives of employers, one-third of which is made up of representatives of employees, and one-third of which is made up of representatives of vocational

schoolteachers. However, the vocational schoolteachers have an advisory function and no voting rights. The inter-company training courses are given legal validity by a resolution of the general assembly of the respective chamber and after legal examination by the respective Ministry of Education.

A state intermediate examination is held halfway through the training period and a state final examination is held at the end, based on state examination regulations. The state examination regulations are intended as a framework on the basis of which the individual chambers develop and adopt specific implementing regulations with legal force. The chambers conduct the examinations on behalf of the state. For this purpose, the chambers appoint examination boards, each of which consists of one-third representatives of employers and of employees and one-third representatives of vocational schoolteachers. The examination boards are autonomous; the chambers exercise legal supervision. After passing the final examination, graduates receive a state certificate from the chamber as skilled workers in the respective occupation and an examination certificate.



After passing the final examination, graduates receive a state certificate from the chamber as skilled workers in the respective occupation and an examination certificate.

A very important goal of the 3LOE project is to implement a dual vocational training system in partner countries with previously school-based education. For this purpose, a profession that is very important to the COVEs of the respective country will first be implemented in the individual countries during the project period. For this purpose, training regulations for the company-based part of the training, framework curricula for the school-based part of the training and examination regulations will be transferred from Germany for the professions concerned, adapted to the respective national conditions and implemented. The respective curriculum etc. will be transferred to all other COVEs, so that in the further process dual vocational training for further professions can be realized in the individual countries.

In addition, the 3LOE project develops, tests and evaluates curricula for new vocational training courses, finalizes them on the basis of the evaluation results and transfers them to all seven COVEs. For this development work, parts of curricula of existing professions from Germany and Austria form a basis.

The selection of the professions is done according to the respective national needs and the work and interest priorities of the project partners. In the 3LOE project, the following dual professions are to be transferred or newly developed and implemented during the project period.

- Poland: Electrical technician

- Poland: Fitter of fixtures and fittings in building industry
- Poland: Technician training "Ecologic Solutions in Logistics
- Lithuania: Cook
- Lithuania Sustainable restaurant worker
- Latvia: Motor vehicle mechanic
- Latvia: Specialist for Building Insulation
- Spain: Electrical technician

For the realization of this work, curricula, examination regulations etc. for dual vocational training were prepared, translated and transferred. These documents are listed according to the focus of the 3LOE project in the Green Economy and the interests of the project partners for the following five professions:

- Electronics technician for industrial engineering
- Vehicle mechatronics engineer
- Plumber
- Sewage engineering technician
- Environmental Technology

Work Package 3 First center level "Vocational training"

Activity A4.2 Preparation and transfer of curricula and examination regulations for dual vocational training

Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training

Curricula and examination regulations for dual vocational training as electronics technician for industrial engineering

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Work Package 3, Activity A4.2

Dual Vocational Training

“Electrician - Electronics technician for industrial engineering”

CURRICULUM FROM GERMANY

Content

1. Ordinance on vocational education and training in the industrial electrical occupations
2. General training plan for vocational education and training in the industrial electrical occupations

Prepared by:

Bundesinstitut für Berufsbildung (BIBB)
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übersetzt im Auftrag des BIBB durch Global Sprachteam Berlin

Stand I/2009

**Extract from the Ordinance
on vocational education and training in the industrial electrical occupations^{*)}**

From 24 July 2007, in respect of training for the occupation of

Electronics technician for industrial engineering

Whereas by reason of § 25 para. 1 of the Vocational Training Act of 14 August 1969 (Federal Law Gazette, BGBl., I p. 1112) in conjunction with para. 2 clause 1 ibid (as amended by Article 212 No. 2 of the Ordinance dated 29 October 2001 (BGBl. I p. 2785), in conjunction with § 1 of the German Jurisdictional Harmonisation Act of 16 August 2002 (BGBl. I p. 3165) and in conjunction with the Organisational Ordinance of 22 October 2002 (BGBl. I p. 4206) and in agreement with the Federal Ministry of Education and Research, the Federal Ministry of Economics and Labour does decree:

Part 1

Joint stipulations § 1 State recognition of the training occupations

The training occupations

1. Electronics technician for building and infrastructure systems,
2. Electronics technician for industrial engineering,
3. Electronics technician for automation,
4. Electronics technician for devices and systems,
5. Systems informatics technician,
6. Electronics technician for aerospace systems are accorded state recognition pursuant to § 4 para. 1 of the Vocational Training Act.

§ 2

Duration of training

Training is of three and a half years' duration.

§ 3 Structure and objective of the vocational education and training

(1) The competences, knowledge and skills stated in the present Ordinance (occupational employability) are to be imparted in a process related manner. These qualifications are to be imparted in such a way so as to enable trainees to exercise a qualified occupational activity within the meaning of § 1 para. 3 of the Vocational Training Act, this particularly to encompass autonomous planning, execution and checking as well as activities within the overall business context. Evidence of the competence described in Clause 2 is also to be provided in the examinations

:)

* The present statutory Ordinance constitutes a training regulation within the meaning of § 4 of the Vocational Training Act. The training regulation has been published in the Federal Gazette. The training regulation is supplemented by the skeleton curriculum for theoretical vocational training, whereby the latter is not included in this transcription.

pursuant to §§ 9 and 10, 13 and 14, 17 and 18, 21 and 22, 25 and 26 and 29 and 30.

(2) The imparting of the joint basic skills pursuant to § 7 para. 1 clauses 1 to 11, § 11 para. 1 clauses 1 to 11, § 15 para. 1 clauses 1 to 11, § 19 para. 1 clauses 1 to 11, § 23 para. 1 clauses 1 to 11 and § 27 para. 1 clauses 1 to 11 and the occupationally specific skills pursuant to § 7 para. 1 clauses 12 to 17, § 11 para. 1 clauses 12 to 17, § 15 para. 1 clauses 12 to 17, § 19 para. 1 clauses 12 to 17, § 23 para. 1 clauses 12 to 17 and § 27 para. 1 clauses 12 to 17 each extends over a period of 21 months and takes place in an integrated fashion distributed across the entire duration of training and according due consideration to the aspects of sustainability.

(4) Within the scope of the occupationally specific specialist skills, occupational competence is to be extended and deepened within a field of deployment via the imparting of skills which enabled holistic execution of complex tasks within the respective business process.

§ 4 Training plan

The general training plan is to constitute the basis by which those providing training are to draw up a training plan for trainees.

§ 5 Written record of training

Trainees are to keep a written record of training. They are to be afforded the opportunity of maintaining their report book during training time. Trainees are to review the report book on a regular basis.

§ 6 Final examination

The final examination comprises Parts 1 and 2, which take place in a staggered fashion at different times. The function of the final examination is to ascertain whether the candidate has acquired occupational competence. In the final examination, candidates are to demonstrate that they have obtained the necessary skills for this purpose, are in possession of the required vocational knowledge and abilities and are familiar with the teaching material to be imparted during teaching at the vocational school. During the examination process, skills which have already formed an object of Part 1 of the final examination are only to be included in Part 2 of the final examination to the extent that such inclusion is necessary for the determination of employability pursuant to § 38 of the Vocational Training Act.

Part 3

**Stipulations for the training occupation of
Electronics technician for industrial engineering**

§ 11

Training profile

(1) The following skills shall constitute the minimum object of the vocational education and training:

- 1 VET, employment and collective wage agreement law,
- 2 Structure and organisation of the company providing training,
- 3 Health and safety at work,
- 4 Environmental protection,
- 5 Company and technical communication,
- 6 Planning and organisation of work, evaluation of work results,
- 7 Assembly and connection of operating equipment,
- 8 Measuring and analysis of electrical functions and systems,
- 9 Assessing the safety of electrical plants and equipment,
- 10 Installing and configuring IT systems,
- 11 Advising and assisting customers, provision of services,
- 12 Technical analysis of orders, developing solutions,
- 13 Installing and putting electrical plants into service,
- 14 Configuring and programming controls,
- 15 Maintenance of plants and systems,
- 16 Technical service & operation,
17. Business processes and quality management within the field of deployment.

(2) The skills pursuant to para. 1 are to be applied and deepened in one of the following areas of deployment:

1. Power distribution facilities/networks
2. Installations and networks in buildings
3. Factory facilities, factory equipment
4. Production and process engineering facilities
5. Switch and control gear
6. Electro technical equipment

The area of deployment is to be stipulated by the company providing training. Other areas of deployment are permissible, providing it is possible to impart the skills pursuant to para. 1.

§ 12 General training plan

The skills stated in § 10 para. 1 (training profile) are to be imparted in accordance with the instructions contained within Annex 1 and Annex 3 in respect of the content and time structure of the vocational education and training (general training plan). Content and time structure of training content which deviates from that contained within the general training plan is permitted in particular to the extent to which specific company practices necessitate such a deviation.

§ 13 Part 1 of the final examination

(1) Part 1 of the final examination is to take place before the end of the second year of training.

(2) Part 1 of the final examination encompasses such skills as are listed for the first year of training in Annex 3 and also includes teaching material to be imparted at vocational school in accordance with the skeleton curriculum insofar as such material is integral to the vocational education and training.

(3) Candidates are to demonstrate that they are able to

1. evaluate technical documentation, determine technical parameters, plan and coordinate work processes, obtain materials and tools;
2. assemble, disassemble, wire, connect and configure pieces of equipment according due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
3. Assess the safety of electrical plants and operating equipment, check electrical safety measures;
4. analyse electrical systems and check functions, identify and eliminate errors, set and measure operating values;
5. put products into service, hand over and explain products, document the processing of the order, draw up technical documentation, including test protocols.

Candidates should use a functioning piece of electronic equipment to demonstrate these requirements.

(4) The examination comprises the execution of a complex work related task, the situational oral examination elements and written assignment of tasks. The examination is of a maximum duration of eight hours, whereby the situational oral examination elements are to take up a total of no more than ten minutes. The written assignment of tasks are to extend over a maximum period of 90 minutes.

§ 14 Final examination

(1) Part 2 of the final examination encompasses such skills as are listed for the first year of training in Annex 1 and Annex 3 and also includes teaching material to be imparted at vocational school insofar as such material is integral to the vocational education and training.

(2) Part 2 of the final examination comprises the examination areas of

1. a company order,
2. system design,
3. function and system analysis and
4. business and social studies.

Attention is also to be accorded to VET, employment and collective wage agreement law, structure and organisation of the company providing training, health and safety at

work, environmental protection, company and technical communication, planning and organisation of work, evaluation of results, quality management and assessing the safety of electrical plants and equipment.

(3) In the examination area of the company order, candidates are to demonstrate that they are able to

1. analyse company orders, obtain information, clarify technical and organisational interfaces, evaluate and select possible solutions according due attention to business administration and ecological aspects,
2. plan and agree order processes, stipulate partial tasks, draw up planning documentation, accord due attention to work processes and areas of responsibility in the area of deployment,
3. execute orders, check and document functionality and safety, comply with standards and specifications relating to the quality and safety of plants, and systematically troubleshoot and solve causes of errors and defects,
4. authorise and transfer products, provide specialist information, prepare acceptance protocols, document work results and services, charge for services and document plant data and paperwork.

In terms of certification of the above, particular regard will be accorded to the setting up, modification or maintenance of electrical plants or the production of electrical pieces of equipment.

(4) For the purposes of certification of the requirements in the examination area of the company order, candidates are to

1. execute a company order within 18 hours, documenting this in the form of practice related documentation, and conduct a specialist oral examination of a maximum of 30 minutes' duration in respect of the order. The specialist oral examination will take place on the basis of the practically related documentation for the order executed. The specialist oral examination is to act as a vehicle for the evaluation of skills relevant to the process in respect of the execution of the order and the practically related documentation is to be accorded consideration. Before execution of the order, the task assignment including the planned processing time is to be submitted to the examination board for approval or
2. in not more than 14 hours prepare, execute, and follow up a work related task, documenting this with task specific paperwork and conducting an attendant specialist oral examination of not more than 20 minutes. The duration of the execution of the work related task is to be seven hours. Evaluation of skills relevant to the process in respect of the execution of the work related task is to take place via observations of the execution of the work related task and via the task specific documentation and the specialist oral examination.

(5) The company providing training is to select the examination mode in accordance with paragraph 4 and inform candidates and the competent body when registration for the examination is made.

(6) In the examination area of the system design, candidates are to draw up modifications to be made to a piece of technical equipment in accordance with requirements stipulated. During this process, candidates are to demonstrate that they are able to conduct technical problem analyses, develop concepts for solutions according due attention to regulations, technical rules, guidelines, economic profitability and company processes, stipulate plant specifications in a way appropriate to use, select electrical components, adapt circuit documentation and use standard software.

(7) In the function and system analysis examination area, candidates are to analyse an electrical plant in a maximum of 120 minutes. During this process, candidates are to demonstrate that they are able to evaluate circuit and plant documentation, analyse functional correlations in electrical plants, interpret and modify control programmes, select measurement and inspection procedures, allocate signals functionally to interfaces, determine the causes of errors and evaluate electrical protection measures.

(8) In the examination area of business and social studies, candidates are to process practically related and employment oriented tasks in a maximum of 60 minutes, demonstrating that they are able to present and judge general business and social contexts with the world of occupations and work.

1. The specialist oral examination is to act as a vehicle for the evaluation of skills relevant to the process in respect of the execution of the order and the practically related documentation is to be accorded consideration. Before execution of the order, the task assignment including the planned processing time is to be submitted to the examination board for approval or
2. in not more than 14 hours prepare, execute, and follow up a work related task, documenting this with task specific paperwork and conducting an attendant specialist oral examination of not more than 20 minutes. The duration of the execution of the work related task is to be seven hours. Evaluation of skills relevant to the process in respect of the execution of the work related task is to take place via observations of the execution of the work related task and via the task specific documentation and the specialist oral examination.

(5) The company providing training is to select the examination mode in accordance with paragraph 4 and inform candidates and the competent body when registration for the examination is made.

(6) In the examination area of system design, candidates are to design appliances and circuits for the testing of technical aeronautical systems in accordance with requirements stipulated and in a maximum of 120 minutes. During this process, candidates are to demonstrate that they are able to conduct a technical problem analysis and select and deploy testing procedures and diagnostic systems whilst according due attention to regulations, technical rules, economic profitability and company processes, stipulate tests and inspection processes according due consideration to specifications and system stipulations, stipulate test processes in compliance with guidelines relating to quality and process assurance, evaluate circuit documentation and use standard software.

(7) In the examination area of function and system analysis, candidates are to analyse a technical aeronautical subsystem or system in a maximum of 120 minutes. During this process, candidates are to demonstrate that they are able to evaluate technical documentation, including English language documentation, analyse functional correlations in technical aviation systems, allocate signals functionally to interfaces, determine the causes of errors, evaluate electromagnetic compatibility and evaluate electrical protection measures.

(8) In the examination area of business and social studies, candidates are to process practically related and employment oriented tasks in a maximum of 60 minutes, demonstrating that they are able to present and judge general business and social contexts with the world of occupations and work.

Part 8

Joint pass regulations, transitional and final provisions

§ 31 Pass regulation

(1) The pass regulations stated in the subsequent paragraphs apply in respect of the training occupations listed in the present regulation.

(2) For the purposes of determining the overall result, weighting of 40 percent is applied to Part 1 of the final examination and weighting of 60 percent is applied to Part 2 of the final examination.

(3) For the purposes of determining the result of Part 2, weighting of 50 percent will be applied to the examination area of the company order, 20 percent each to the examination areas of system design and function and system analysis and 10 percent to the area of business and social studies.

(4) The examination shall be deemed to have been passed if at least sufficient fulfilment of requirements has been achieved

1. in the overall result pursuant to para. 2 and
2. in the examination area of the company order and
3. for the overall result achieved in the examination areas of system design, function and system analysis and business and social studies.

At least sufficient fulfilment of requirements must be achieved in two of the examination areas in point 3. Fulfilment of requirements must not have been unsatisfactory in the third examination area under point 3n.

(5) On application of the candidate or by the judgement of the examination board within individual examination areas, the examination areas of system design, function and system analysis and business and social studies may be replaced by an oral examination if this can prove decisive for the passing of the examination. In calculating the result for this examination area, the previous result and the result of the supplementary oral examination shall be accorded weighting in the ratio of 2:1.

§ 32 Transitional regulation

Existing regulations shall continue to apply to vocational education and training contractual arrangements already in place at the time the present Ordinance comes into effect, insofar as the contractual parties do not agree that the provisions of the present Ordinance should apply.

§ 33 Entry into force, ceasing to be in force

The present Ordinance enters into force on 1 August 2007. The Ordinance of 3 July 2003 (BGBl. I p. 1144) in respect of vocational education and training in the industrial electrical occupations ceases to be in force at this time.

Berlin, 24 July 2007

The Federal Minister of Economics and Technology

per procuratorem

Wuermeling

General training plan for vocational education and training in the industrial electrical occupations

Joint basic skills

No.	Part of the training occupation profile	Basic skills to be imparted, incorporating autonomous planning, execution and checking and integrated with occupationally specific specialist skills
1	2	3
1	VET, employment and collective wage agreement law (§ 7 para. 1 No. 1, § 11 para. 1 No. 1, § 15 para. 1 No. 1, § 19 para. 1 No. 1, § 23 para. 1 No. 1, § 27 para. 1 No. 1)	<ul style="list-style-type: none"> a) Explain the significance of the training contract, in particular conclusion, duration and termination b) State mutual rights and responsibilities arising from the training contract c) State opportunities for advanced vocational training d) State essential parts of the training contract e) State essential provisions contained within the collective wage agreements applying to the company providing training
2	Structure and organisation of the company providing training (§ 7 para. 1 No. 2, § 11 para. 1 No. 2, § 15 para. 1 No. 2, § 19 para. 1 No. 2, § 23 para. 1 No. 2, § 27 para. 1 No. 2)	<ul style="list-style-type: none"> a) Explain structure and tasks of the company providing training b) Explain the basic functions of the company providing training, such as procurement, production, sales and administration c) State the relationships of the company providing training and its staff to organisations of trade and industry, professional bodies and trade unions d) Describe the basic principles, tasks and way of working of labour-management relations or staff representative organs within the company providing training
3	Health and safety at work (§ 7 para. 1 No. 3, § 11 para. 1 No. 3, § 15 para. 1 No. 3, § 19 para. 1 No. 3, § 23 para. 1 No. 3, § 27 para. 1 No. 3)	<ul style="list-style-type: none"> a) Ascertain health and safety risk in the workplace and adopt measures for the avoidance of this b) Deploy occupationally related health and safety and accident prevention measures c) Describe behaviours when accidents occur and institute initial measures d) Comply with provisions and safety regulations when working on electrical plants, appliances and equipment e) Deploy regulations for preventative fire protection; describe behaviours in the event of fire and initiate fire fighting measures
4	Environmental protection (§ 7 para. 1 No. 4, § 11 para. 1 No. 4, § 15 para. 1 No. 4, § 19 para. 1 No. 4, § 23 para. 1 No. 4, § 27 para. 1 No. 4)	<p>Contribute to the avoidance of instances of environmental pollution caused by the company within the occupational sphere of influence, in particular</p> <ul style="list-style-type: none"> a) Explain possible instances of environmental pollution caused by the company providing training and its contribution to environmental protection using examples b) Deploy environmental protection regulations as these apply to the company providing training c) Take opportunities to use energy and materials in an environmentally friendly manner d) Avoid waste; make substances and materials available for environmentally friendly disposal
5	Company and technical communication (§ 7 para. 1 No. 5, § 11 para. 1 No. 5, § 15 para. 1 No. 5, § 19 para. 1 No. 5, § 23 para. 1 No. 5, § 27 para. 1 No. 5)	<ul style="list-style-type: none"> a) Research and obtain sources of information and information, conduct database enquiries, evaluate information b) Evaluate, use and draw up technical drawings and circuit documentation, prepare sketches c) Evaluate and use documents and technical regulations and occupationally related provisions, including in English d) Manage, protect, secure and archive data and documents e) Conduct appropriate and target oriented discussions with line managers, employees and within the team f) Present facts and circumstances, prepare protocols, use German and English specialist terminology g) Compile and supplement documentation in German and English, use standard software h) Organise and chair meetings, prepare decisions within the team, minute results of discussions i) Present data, facts and circumstances and possible solutions k) Resolve disputes within the team l) Conduct written communication in German and English

No.	Part of the training occupation profile	Basic skills to be imparted, incorporating autonomous planning, execution and checking and integrated with occupationally specific specialist skills
1	2	3
6	Planning and organisation of work, evaluation of work results (§ 7 para. 1 No. 6, § 11 para. 1 No. 6, § 15 para. 1 No. 6, § 19 para. 1 No. 6, § 23 para. 1 No. 6, § 27 para. 1 No. 6)	a) Set up workplace or assembly location according due consideration to operational stipulations b) Ascertain and select tools and materials for the work process, request, test, transport, store and make these available for use in a timely manner c) Plan work processes and partial tasks in compliance with statutory, economic and schedule stipulations, set priorities in the event of deviations from planning d) Plan and agree tasks within the team, accord consideration to cultural identities e) Conduct calculations in accordance with company stipulations f) Demonstrate possible solutions, compare costs g) Deploy IT systems to plan and execute orders and track schedules h) Set up computer workplace in accordance with ergonomic aspects, set up graphical user interfaces i) Check order documentation and technical feasibility of the order and coordinate with company capacities k) Record and evaluate data relevant to business administration l) Recognise and deploy influences with the work situation, the working environment and working behaviours within the team which lead to an increase in quality in work results m) Compare internal and external provision of services n) Ascertain skills gaps, use training opportunities and various learning techniques
7	Assembly and connection of electrical operating equipment (§ 7 para. 1 No. 7, § 11 para. 1 No. 7, § 15 para. 1 No. 7, § 19 para. 1 No. 7, § 23 para. 1 No. 7, § 27 para. 1 No. 7)	a) Assembly and disassembly of sub-assemblies and modification of parts using mechanical processing b) Select and prepare cables and connect sub-assemblies and equipment with different connection technologies c) Stipulate cabling routes and locations for the assembly of equipment according due consideration to electromagnetic compatibility d) Select and assemble operating equipment and cabling routing systems e) Install cabling f) Produce electrical equipment or set up electrical plants, put equipment or plants into operation g) Comply with electro technical rules when setting up, modifying, maintaining and operating electrical plants and operating equipment h) Avoid waste, evaluate waste materials, unused operating materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal
8	Measurement and analysis of electrical functions and systems (§ 7 para. 1 No. 8, § 11 para. 1 No. 8, § 15 para. 1 No. 8, § 19 para. 1 No. 8, § 23 para. 1 No. 8, § 27 para. 1 No. 8)	a) Select measuring procedures and measuring equipment b) Measure, evaluate and calculate electrical values c) Check ratings and function of sub-assemblies d) Analyse control circuits e) Track signals and check these at interfaces f) Conduct systematic trouble shooting g) Check and set sensors and actuators h) Check and evaluate open and closed loop controls in respect of function i) Check functionality of systems and components, interpret data protocols
9	Assessment of the safety of electrical plants and operating equipment (§ 7 para. 1 No. 9, § 11 para. 1 No. 9, § 15 para. 1 No. 9, § 19 para. 1 No. 9, § 23 para. 1 No. 9, § 27 para. 1 No. 9)	a) Check and assess the function of protection and potential equalisers b) Measure and assess insulating resistances c) Assess basic protection measures against electrical shock d) Assess cables and other operating equipment and the protective measures applied to these, in particular in respect of ampacity e) Assess the types of protection applied to electrical devices or plants in respect of environmental conditions and additional stipulations for special types of premises f) Assess risks arising from the operation of electrical devices, operating equipment and plants and ensure safe use via instigation of protective measures g) Assess the effectiveness of measures to counter electrical shock when errors arise, in particular occasioned by the switching off of over current protection devices and residual current protection devices h) Assess the electrical safety of portable operating equipment i) Assess fire protection regulations when setting up and operating electrical equipment and plants

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No.	Part of the training occupation profile	Basic skills to be imparted, incorporating autonomous planning, execution and checking and integrated with occupationally specific specialist skills
1	2	3

10	Installation and configuration of IT systems (§ 7 para. 1 No. 10, § 11 para. 1 No. 10, § 15 para. 1 No. 10, § 19 para. 1 No. 10, § 23 para. 1 No. 10, § 27 para. 1 No. 10)	<ul style="list-style-type: none"> a) Select hardware and software components b) Install and configure operating systems and applications c) Integrate IT systems into networks d) Deploy tools and test programmes
11	Customer advice and care, provision of services (§ 7 para. 1 No. 11, § 11 para. 1 No. 11, § 15 para. 1 No. 11, § 19 para. 1 No. 11, § 23 para. 1 No. 11, § 27 para. 1 No. 11)	<ul style="list-style-type: none"> a) Determine wishes and requirements of customers, develop possible solutions and alternative forms of implementation b) Indicate maintenance works and intervals c) Record fault reports d) Agree details of the processing of the order, in the event of faults in processing of the order indicate alternative solutions e) Explain performance characteristics, provide instruction in operation, indicate risks, safety rules and regulations f) Provide technical support g) Organise exchange of information with the customers

Annex 3
(to § 11)

General training plan for vocational education and training in the occupation of Electronics technician for industrial engineering

Part A: Content structure for the occupationally specific specialist skills

No.	Part of the training occupation profile	Specialist skills to be imparted, incorporating autonomous planning, execution and checking and integrated with basic skills
1	2	3
12	Technical analysis of orders, developing solutions (§ 11 para. 1 No. 12)	<ul style="list-style-type: none"> a) Analyse customer requirements b) Assess existing plants included in operating equipment c) Design modifications and extensions to plants, stipulate electrical circuits and protective measures, select components and cables d) Check order documentation and compare with local conditions, stipulate delineation of on-site services e) Select measuring, open and closed loop control systems, sensors, actuators, software and other components f) Plan modifications to plants according due consideration to company processes of the customer g) Document services to be provided, modify circuit documentation
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	<ul style="list-style-type: none"> a) Select, assemble and disassemble ladders, scaffolding and installation platforms b) Select and deploy lifting equipment, fittings and transport, secure loading and execute transport c) Check suitability of the subsurface for mounting, prepare anchoring and load bearing constructions and fix consoles d) Adjust, fix and connect machines, equipment, drive systems and other operating equipment e) Assemble and erect plug-in modules, housings and control unit combinations f) Install, wire up and label control units g) Install, wire up and label operating equipment for open and closed loop control, measuring and checking h) Mount protective systems, cladding and insulation i) Assemble data links k) Adjust and connect energy technology links and cables l) Process communication technology cables using various connecting technologies m) Connect components using pipe and hose links n) Create earthing and potential equaliser, measure and assess earthing and loop impedance o) Put main and auxiliary current circuits into operation p) Install, check and put into operation signal and data transmission systems q) Parameterise and put drive systems into operation, adjust ratings r) Check non-electrical components of plants, in particular pneumatic sub-assemblies s) Mount and assemble lighting systems t) Adjust protective systems and check the effectiveness of these, ensure the effectiveness of safety measures u) Check emergency shut down and alarm systems and mechanical safety systems v) Check compliance with measures relating to electromagnetic compatibility w) Draw up test protocols, draw up and adapt documentation, hand over plants or system
14	Configuration and programming of controls (§ 11 para. 1 No. 14)	<ul style="list-style-type: none"> a) Adjust, modify and put into operation the hardware and software used for measurement and control technology sub-assemblies b) Install and configure applications software c) Analyse, adjust and modify control programmes d) Check functional processes and modify programme processes e) Adjust architectures, protocols and interfaces of automation devices to networks and bus systems f) Install storage media and programmes to secure data

No.	Part of the training occupation profile	Specialist skills to be imparted, incorporating autonomous planning, execution and checking and integrated with basic skills
1	2	3
15	Maintenance of plants and systems (§ 11 para. 1 No. 15)	<ul style="list-style-type: none"> a) Plan maintenance and inspection measures b) Inspect systems, check function of plants and safety systems and protocol checks c) Maintain systems in accordance with maintenance and repair plans, replace wearing parts as part of preventative maintenance d) Compare systems parameters with stipulated values and adjust e) Use diagnostic systems, check function of sub-assemblies, replace defective subassemblies f) Maintain and repair decentralised energy supply systems g) Assess, maintain and repair energy distribution systems h) Maintain and repair processing machines i) Maintain and repair communication plants k) When putting back into operation equipment or parts of plants which have been the object of maintenance, adjust protective measures and safety systems and check the effectiveness of these l) Document maintenance measures
16	Technical service and operation (§ 11 para. 1 No. 16)	<ul style="list-style-type: none"> a) Provide and execute service b) Comply with company stipulations when drawing up offers and estimates c) Make customers aware of guarantee claims and provide advice on technical and economic feasibility d) Hand over plants, provide customers with initial instructions on how to operate technical systems e) Document services provided f) Monitor technical plants g) Conduct remote diagnosis and maintenance h) Evaluate plant and diagnostic data and use this for purposes of optimisation i) Operate and adjust visualisation applications of technical plants k) Record consumption data of energy and operating equipment, establish reasons for deviations from reference value, optimise consumption
17	Business processes and quality management within the area of deployment (§ 11 para. 1 No. 17)	<ul style="list-style-type: none"> a) Make customers aware of and provide advice on specific offers, accept orders b) Obtain and evaluate information, use and process documentation, ascertain technological developments, accord due consideration to documentation relating to safety c) Analyse starting position, clarify technical and organisational interfaces, document interfaces, stipulate order objectives, define subtasks, draw up technical documentation and take part in cost planning d) Obtain, check and evaluate offers and estimates according due consideration to company stipulations e) Plan order processing and coordinate this with upstream and downstream areas, draw up planning documentation f) Arrange for, monitor and check services from third parties g) Process orders, in particular according consideration to health and safety and environmental protection, monitor observance of schedules h) Select checking methods and test equipment, ascertain utilisability of test equipment, use inspection plans and company testing procedures i) Comply with standards and specifications in respect of quality and safety of the products and safety of the order processing, use quality assurance systems, search for, resolve and document causes of errors and quality defects in a systematic manner k) Document the order process, charge for services, draw up charge data, conduct subsequent calculations l) Authorise technical systems for use, hand technical systems over, prepare acceptance protocols, explain products and services m) Conduct target-performance comparison with planning data, evaluate work results and implementation of work n) Make a contribution to continuous improvement of work processes both within company operations and within own work area

Part B: Time structure

Occupational profile item	Part of the training occupation profile	Basic and specialist skills to be imparted in an integrated manner, incorporating autonomous planning, execution and checking	Time framework in months
1	2	3	4

Section 1:

1	VET, employment and collective wage agreement law (§ 11 para. 1 No. 1)	<ul style="list-style-type: none"> a) Explain the significance of the training contract, in particular conclusion, duration and termination b) State mutual rights and responsibilities arising from the training contract c) State opportunities for advanced vocational training d) State essential parts of the training contract e) State essential provisions contained within the collective wage agreements applying to the company providing training 	to be imparted over the whole course of the training period
2	Structure and organisation of the company providing training (§ 11 para. 1 No. 2)	<ul style="list-style-type: none"> a) Explain structure and tasks of the company providing training b) Explain the basic functions of the company providing training, such as procurement, production, sales and administration c) State the relationships of the company providing training and its staff to organisations of trade and industry, professional bodies and trade unions d) Describe the basic principles, tasks and way of working of labourmanagement relations or staff representative organs within the company providing training 	
3	Health and safety at work (§ 11 para. 1 No. 3)	<ul style="list-style-type: none"> a) Ascertain health and safety risk in the workplace and adopt measures for the avoidance of this b) Deploy occupationally related health and safety and accident prevention measures c) Describe behaviours when accidents occur and institute initial measures d) Comply with provisions and safety regulations when working on electrical plants, appliances and equipment e) Deploy regulations for preventative fire protection; describe behaviours in the event of fire and initiate fire fighting measures 	
4	Environmental protection (§ 11 para. 1 No. 4)	<p>Contribute to the avoidance of instances of environmental pollution caused by the company within the occupational sphere of influence, in particular</p> <ul style="list-style-type: none"> a) Explain possible instances of environmental pollution caused by the company providing training and its contribution to environmental protection using examples b) Deploy environmental protection regulations as these apply to the company providing training c) Take opportunities to use energy and materials in an environmentally friendly manner d) Avoid waste; make substances and materials available for environmentally friendly disposal 	

Section 2:**1st year of training (Time**

framework 1)

5	Company and technical communication (§ 11 para. 1 No. 5)	<ul style="list-style-type: none"> a) Research and procure sources of information and information, conduct database enquiries, evaluate information b) Evaluate, use and draw up technical drawings and circuit documentation, prepare sketches 	2 to 4
6	Planning and organisation of work, evaluation of work results (§ 11 para. 1 No. 5)	<ul style="list-style-type: none"> a) Set up workplace or assembly location according due consideration to operational stipulations b) Ascertain and select tools and materials for the work process, request, test, transport, store and make these available for use in a timely manner 	
7	Assembly and connection of electrical operating equipment (§ 11 para. 1 No. 7)	<ul style="list-style-type: none"> a) Assembly and disassembly of sub-assemblies and modification of parts using mechanical processing 	

Occupational profile item	Part of the training occupation profile	Basic and specialist skills to be imparted in an integrated manner, incorporating autonomous planning, execution and checking	Time framework in months
1	2	3	4
8	Measurement and analysis of electrical functions and systems (§ 11 para. 1 No. 8)	a) Select measuring procedures and measuring equipment b) Measure, evaluate and calculate electrical values	

(Time framework 2)

5	Company and technical communication (§ 11 para. 1 No. 5)	b) Evaluate, use and draw up technical drawings and circuit documentation, prepare sketches c) Evaluate and use documents and technical regulations and occupationally related provisions, including in English	3 to 5
6	Planning and organisation of work, evaluation of work results (§ 11 para. 1 No. 6)	a) Set up workplace or assembly location according due consideration to operational stipulations c) Plan work processes and partial tasks in compliance with statutory, economic and schedule stipulations, set priorities in the event of deviations from planning	
7	Assembly and connection of electrical operating equipment (§ 11 para. 1 No. 7)	b) Select and prepare cables and connect sub-assemblies and devices with different connection technologies c) Stipulate cabling routes and locations for the assembly of equipment according due consideration to environmental conditions d) Select and assemble company equipment and cabling routing systems e) Install cabling	
9	Assessment of the safety of electrical plants and operating equipment (§ 11 para. 1 No. 9)	c) Assess basic protection measures against electrical shock d) Assess cables and other company equipment and the protective measures applied to these, in particular in respect of ampacity	
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	a) Select, assemble and disassemble ladders, scaffolding and installation platforms c) Check suitability of the subsurface for mounting, prepare anchoring and load bearing constructions and fix consoles f) Install, wire up and label control units	

(Time framework 3)

5	Company and technical communication (§ 11 para. 1 No. 5)	b) Evaluate, use and draw up technical drawings and circuit documentation, prepare sketches	2 to 4
7	Assembly and connection of electrical operating equipment (§ 11 para. 1 No. 7)	b) Select and prepare cables and connect sub-assemblies and devices with different connection technologies f) Produce electrical equipment or set up electrical plants, put equipment or plants into operation	
8	Measurement and analysis of electrical functions and systems (§ 11 para. 1 No. 8)	c) Check ratings and function of sub-assemblies d) Analyse control circuits e) Track signals and check these at interfaces f) Conduct systematic trouble shooting	
12	Technical analysis of orders, developing solutions (§ 11 para. 1 No. 12)	e) Select measuring, open and closed loop control systems, sensors, actuators, software and other components	
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	g) Install, wire up and label operating equipment for open and closed loop control, measuring and checking	

(Time framework 4)

5	Company and technical communication (§ 11 para. 1 No. 5)	d) Manage, protect, secure and archive data and documents	1 to 3
6	Planning and organisation of work, evaluation of work results (§ 11 para. 1 No. 6)	h) Set up computer workplace in accordance with ergonomic aspects, set up graphical user interfaces	

Occupational profile item	Part of the training occupation profile	Basic and specialist skills to be imparted in an integrated manner, incorporating autonomous planning, execution and checking	Time framework in months
1	2	3	4
10	Installation and configuration of IT systems (§ 11 para. 1 No. 10)	a) Select hardware and software components, install and configure these b) Install and configure operating systems and applications c) Integrate IT systems into networks d) Deploy tools and test programmes	

2nd year of training, 1st half year

(Time framework 5)

7	Assembly and connection of electrical operating equipment (§ 11 para. 1 No. 7)	g) Comply with electro technical rules when setting up, modifying, maintaining and operating electrical plants and company equipment	3 to 5
9	Assessment of the safety of electrical plants and operating equipment (§ 11 para. 1 No. 9)	a) Check and assess the function of protection and potential equalisers b) Measure and assess insulating resistances e) Assess the types of protection applied to electrical devices or plants in respect of environmental conditions and additional stipulations for special types of premises f) Assess risks arising from the operation of electrical devices, company equipment and plants and ensure safe use via instigation of protective measures g) Assess the effectiveness of measures to counter electrical shock when errors arise, in particular occasioned by the switching off of over current protection devices and residual current protection devices h) Assess the electrical safety of portable company equipment i) Assess fire protection regulations when setting up and operating electrical equipment and plants	
12	Technical analysis of orders, developing solutions (§ 11 para. 1 No. 12)	c) Stipulate modifications and extensions to plants, electrical circuits and protective measures, select components and cables d) Check order documentation and compare with local conditions, stipulate delineation of on-site services	
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	e) Assemble and erect plug-in modules, housings and control unit combinations h) Mount protective systems, cladding and insulation k) Adjust and connect energy technology links and cables n) Create earthing and potential equaliser, measure and assess earthing and loop impedance o) Put main and auxiliary current circuits into operation	

(Time framework 6)

5	Company and technical communication (§ 11 para. 1 No. 5)	f) Present facts and circumstances, prepare reports, use German and English specialist terminology g) Compile and supplement documentation in German and English, use standard software	1 to 3
8	Measurement and analysis of electrical functions and systems (§ 11 para. 1 No. 8)	g) Check and set sensors and actuators h) Check and evaluate open and closed loop controls in respect of function	
11	Customer advice and care, provision of services (§ 11 para. 1 No. 11)	c) Record fault reports	
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	t) Adjust protective systems and check the effectiveness of these, ensure the effectiveness of safety measures u) Check emergency shut down and alarm systems and mechanical safety systems	
15	Maintenance of plants and systems (§ 11 para. 1 No. 15)	a) Plan maintenance and inspection measures b) Inspect systems, check function of plants and safety systems and protocol checks c) Maintain systems in accordance with maintenance and repair plans, exchange wearing parts as part of preventative maintenance	

Occupational profile item	Part of the training occupation profile	Basic and specialist skills to be imparted in an integrated manner, incorporating autonomous planning, execution and checking	Time framework in months
1	2	3	4

2nd year of training, 2nd half year

(Time framework 7)

5	Company and technical communication (§ 11 para. 1 No. 5)	i) Present data, facts and circumstances and possible solutions	2 to 4
6	Planning and organisation of work, evaluation of work results (§ 11 para. 1 No. 6)	i) Check order documentation and technical feasibility of the order and coordinate with company capacities	
7	Assembly and connection of electrical operating equipment (§ 11 para. 1 No. 7)	h) Avoid waste, evaluate waste materials, unused operating materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal	
11	Customer advice and care, provision of services (§ 11 para. 1 No. 11)	a) Determine wishes and requirements of internal or external customers, develop possible solutions and alternative forms of implementation	
12	Technical analysis of orders, developing solutions (§ 11 para. 1 No. 12)	e) Select measuring, open and closed loop control systems, sensors, actuators, software and other components	
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	g) Install, wire up and label operating equipment for open and closed loop control, measuring and checking n) Put main and auxiliary current circuits into operation	
14	Configuration and programming of controls (§ 11 para. 1 No. 14)	a) Adjust, modify and put into operation the hardware and software used for measurement and control technology sub-assemblies b) Install and configure applications software c) Analyse, adjust and modify control programmes d) Check functional processes and modify programme processes f) Install storage media and programmes to secure data	
15	Maintenance of plants and systems (§ 11 para. 1 No. 15)	d) Compare systems parameters with stipulated values and adjust	
16	Technical service and operation (§ 11 para. 1 No. 16)	i) Operate and adjust visualisation applications of technical plants	

(Time framework 8)

6	Planning and organisation of work, evaluation of work results (§ 11 para. 1 No. 6)	e) Conduct calculations in accordance with company stipulations f) Demonstrate possible solutions, compare costs k) Record and evaluate data relevant to business administration	2 to 4
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	d) Adjust, fix and connect machines, equipment, drive systems and other operating equipment m) Connect components using pipe and hose links q) Parameterise and put drive systems into operation, adjust ratings r) Check non-electrical components of plants, in particular pneumatic sub-assemblies	
15	Maintenance of plants and systems (§ 11 para. 1 No. 15)	h) Maintain and repair processing machines k) When putting back into operation equipment or parts of plants which have been the object of maintenance, adjust protective measures and safety systems and check the effectiveness of these	
Occupational profile item	Part of the training occupation profile	Basic and specialist skills to be imparted in an integrated manner, incorporating autonomous planning, execution and checking	
1	2	3	4

3rd and 4th year of training (Time

framework 9)

5	Company and technical communication (§ 11 para. 1 No. 5)	c) Evaluate and use documents and technical regulations and occupationally related provisions, including in English e) Conduct appropriate and target oriented discussions with line managers, employees and within the team h) Organise and chair meetings, prepare decisions within the team, minute results of discussions k) Resolve disputes within the team	3 to 5	
6	Planning and organisation of work, evaluation of work results (§ 11 para. 1 No. 6)	d) Plan and agree tasks within the team, accord consideration to cultural identities g) Deploy IT systems to plan and execute orders and track schedules l) Recognise and deploy influences with the work situation, the working environment and working behaviours within the team which lead to an increase in quality in work results m) Compare internal and external provision of services		
8	Measurement and analysis of electrical functions and systems (§ 11 para. 1 No. 8)	i) Check functionality of systems and components, interpret data protocols		
11	Customer advice and care, provision of services (§ 11 para. 1 No. 11)	d) Agree details of the processing of the order, in the event of faults in processing of the order indicate alternative solutions		
12	Technical analysis of orders, developing solutions (§ 11 para. 1 No. 12)	a) Analyse customer requirements b) Assess existing plants included in company equipment f) Plan modifications to plants according due consideration to company processes of the customer g) Document services to be provided, modify circuit documentation		
13	Installing and putting electrical plants into operation (§ 11 para. 1 No. 13)	b) Select and deploy lifting equipment, fittings and transport, secure and execute transport i) Assemble data links l) Process communication technology cables using various connecting technologies p) Install, check and put into operation signal and data transmission systems s) Mount and assemble lighting systems v) Check compliance with measures relating to electromagnetic compatibility w) Draw up test protocols, draw up and adapt documentation, hand over plants or system		
14	Configuration and programming of controls (§ 11 para. 1 No. 14)	e) Adjust architectures, protocols and interfaces of automation devices to networks and bus systems		
15	Maintenance of plants and systems (§ 11 para. 1 No. 15)	g) Assess, maintain and repair energy distribution systems i) Maintain and repair communication plants		
16	Technical service and operation (§ 11 para. 1 No. 16)	d) Hand over plants, provide customers with initial instructions on how to operate technical systems		
Occupational profile item	Part of the training occupation profile	Basic and specialist skills to be imparted in an integrated manner, incorporating autonomous planning, execution and checking		Time framework in months
1	2	3		4

(Time framework 10)

5	Company and technical communication (§ 11 para. 1 No. 5)	l) Conduct written communication in German and English	2 to 4
6	Planning and organisation of work, evaluation of work results (§ 11 para. 1 No. 6)	n) Ascertain skills gaps, use training opportunities and various learning techniques	

11	Customer advice and care, provision of services (§ 11 para. 1 No. 11)	<ul style="list-style-type: none"> b) Indicate maintenance works and intervals e) Explain performance characteristics, provide instruction in operation, indicate risks, safety rules and regulations f) Provide technical support g) Organise exchange of information with the customers
15	Maintenance of plants and systems (§ 11 para. 1 No. 15)	<ul style="list-style-type: none"> e) Use diagnostic systems, check function of sub-assemblies, replace defective sub-assemblies f) Maintain and repair decentralised energy supply systems l) Document maintenance measures
16	Technical service and operation (§ 11 para. 1 No. 16)	<ul style="list-style-type: none"> a) Provide and execute service b) Comply with company stipulations when drawing up offers and estimates c) Make customers aware of guarantee claims and provide advice on technical and economic feasibility e) Document services provided f) Monitor technical plants g) Conduct remote diagnosis and maintenance h) Evaluate plant, diagnostic and process data and use this for purposes of optimisation k) Record consumption data of energy and operating equipment, establish reasons for deviations from reference value, optimise consumption

(Time framework 11)

17	Business processes and quality management within the area of deployment (§ 11 para. 1 No. 17)	<ul style="list-style-type: none"> a) Make customers aware of and provide advice on specific offers, accept orders b) Obtain and evaluate information, use and process documentation, ascertain technological developments, accord due consideration to documentation relating to safety c) Analyse starting position, clarify technical and organisational interfaces, document interfaces, stipulate order objectives, define subtasks, draw up technical documentation and take part in cost planning d) Obtain, check and evaluate offers and estimates according due consideration to company stipulations e) Plan order processing and coordinate this with upstream and downstream areas, draw up planning documentation f) Arrange for, monitor and check services from third parties g) Process orders, in particular according consideration to health and safety and environmental protection, monitor observance of schedules h) Select checking methods and test equipment, ascertain utilisability of test equipment, use inspection plans and company testing procedures i) Comply with standards and specifications in respect of quality and safety of the products and safety of the order processing, use quality assurance systems, search for, resolve and document causes of errors and quality defects in a systematic manner k) Document the project process, charge for services, draw up charge data, conduct subsequent calculations l) Authorise technical systems for use, hand technical systems over, prepare acceptance protocols, explain products and services m) Conduct target-performance comparison with planning data, evaluate work results and implementation of work n) Make a contribution to continuous improvement of work processes both within company operations and within own work area 	10 to 12
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SKELETON CURRICULUM

for the training occupation of

Electronics technician for industrial engineering

(Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of 16 May 2003)

Part I: Preliminary remarks

The present skeleton curriculum for occupationally related teaching at a vocational school has been passed by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK).

The present skeleton curriculum has been agreed in conjunction with the corresponding training regulations promulgated by the Federal Government (issued by the Federal Ministry of Labour and Economics or by the otherwise responsible ministry in agreement with the Federal Ministry for Education and Research). The process for such agreement is regulated via the "Joint Results Protocol of 30 May 1972". The present skeleton curriculum takes the lower secondary school leaving certificate as its basis and describes minimum requirements.

In the case of allocated occupations, the present skeleton curriculum is structured to include basic training extending across all occupational fields and specialist training for which such basic training forms the foundation.

The training regulations and the skeleton curriculum stipulating the objectives and content of vocational education and training form the basis for the imparting of final qualifications in a recognised training occupation and of the qualification issued by the vocational school in conjunction with teaching in further subjects. This enables the essential prerequisites for qualified employment and entry into school based and vocational advanced and continuing training courses to be put into place.

The skeleton curriculum does not contain any methodological stipulations in respect of teaching. Autonomous and responsible thoughts and actions constitute the overarching objective of training, and the preferred course of action is for delivery of these aims to take place via such forms of teaching in which they represent part of the overall methodological concept. In principle, any methodological approach adopted may contribute to the achievement of this objective. Methods which directly foster occupational competence are particularly suited to purpose and appropriate consideration should be accorded to these within the structuring of the teaching.

The federal states either adopt the skeleton curriculum directly or else implement it via their own curricula. In the latter case, the federal states ensure that coordination of the result stipulated in the skeleton curriculum in terms of structure of specialist content and time remains intact.

Part II: Educational remit of the vocational school

Within the dual system of vocational education and training, the vocational school and the company providing training fulfil a joint educational remit.

Within this process, the vocational school constitutes an independent learning venue. The vocational school cooperates with other VET participants as an equal partner. The task of the vocational school is to impart vocational and general educational content to pupils according particular consideration to VET requirements.

The aim of the vocational school is to provide basic and specialist vocational training and to extend general education previously acquired. Within this process, the vocational school pursues the objective of enabling pupils to carry out occupational tasks and be involved in shaping the world of work and of society whilst fulfilling their social and ecological responsibility. It is guided by the regulations contained within the educational laws of the federal states as these apply to such schools. Vocationally related teaching is also guided by the national vocational regulatory instruments in respect of each individual recognised training occupation:

- the skeleton curriculum issued by the Standing Conference of the Ministers of Education and Cultural Affairs (KMK);
- training regulations promulgated by the Federal Government in respect of in-company training;
- Pursuant to the Framework Agreement on Vocational Schools (Resolution of the KMK of 15 March 1991), the aims of vocational schools are:
 - "to impart employability encompassing a combination of specialist competence and general skills of a human and social nature;
 - to develop occupational flexibility enabling the changing requirements within the world of work including in respect of the convergence of Europe to be met;
 - to stimulate readiness to engage in advanced and continuing vocational training;
 - to foster the ability and readiness to act in a responsible manner in the way in which pupils organise their own lives and act within public life."

In order to achieve these aims, a vocational school must:

- structure teaching in such a way so that it is aligned to the specific educational purpose of the tasks it pursues and emphasises an employment oriented approach;
- impart vocational skills and skills which extend across occupational fields whilst according due consideration to necessary vocational specialisation;
- guarantee differentiated and flexible educational provision in order to accord full consideration to varying degrees of ability and talent whilst also fulfilling the needs of the world of work and of society;

- provide extensive support for and promotion of opportunities for the disabled and the disadvantaged insofar as possible;
- indicate environmental threats and accident risks in conjunction with the exercise of an occupation and in connection with pupils' private lives and highlight means by which such threats and risks may be avoided or reduced.

In addition to this, the vocational school should, within the general teaching it conducts and to the greatest possible extent within occupationally related teaching, address core contemporary problems such as:

- work and unemployment,
- the peaceful coexistence of people, peoples and cultures in the world whilst maintaining a sense of cultural identity,
- the preservation of the natural basis of life and - The guarantee of human rights. eingehen.

The aims listed address the development of **employability skills**. Employability skills within this context are defined as the readiness and ability of an individual person to conduct himself or herself in an appropriate, considered and individually and socially responsible manner in social, occupational and private situations.

Employability skills are contained within the dimensions of specialist competence, personal competence and social competence.

Specialist competence describes the readiness and ability to use specialist knowledge and ability as a basis to solve tasks and problems in a target oriented, appropriate, methodologically suitable and autonomous manner and to assess results.

Personal competence describes the readiness and ability to act as an individual personality in clarifying, considering and assessing development opportunities, requirements and restrictions within the family, within an occupation and within public life, to evolve individual talents and to make and further develop life plans. Personal competence encompasses such personal qualities as autonomy, critical ability, confidence, reliability and a sense of responsibility and duty. It also particularly includes the development of considered values and self-determined loyalty to values.

Social competence describes the readiness and ability to develop and live out social relationships, to detect and understand areas of affinity and conflict and to deal with and reach understanding with others in a rational and responsible manner. It also particularly includes the development of social responsibility and solidarity.

Methodological and learning competence arise from a balanced development of these three dimensions.

Competence describes successful learning in respect of the individual learner and the equipping of him or her with the ability to act autonomously in private, occupational and social situations. In contrast to this, **qualification** is defined as successful learning in respect of usefulness of competences within the

context of the demand for such competences in private, occupational and social situations (cf. German Education Council, recommendations of the Educational Commission for the Reorganisation of Upper Secondary Education).

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Part III: Didactic principles

The objectives of vocational education and training require teaching to be conducted in accordance with educational methods aligned to the tasks of the vocational school and to enable young people to plan, execute and evaluate work related tasks within the scope of their occupational activity.

Learning at vocational school essentially takes place with reference to specific occupational actions, a variety of mental operations and theoretical understanding of the actions of others. This learning is primarily linked to reflecting on the execution of actions (action plan, process, results). The fact that occupational work is pervaded by this thought process creates the preconditions for learning at and from work. As far as the skeleton curriculum is concerned, this means that the description of aims and the choice of content takes place in an occupationally related way.

Learning theory and didactic cognitions form the basis for the adoption of a pragmatic approach towards the structuring of employment oriented teaching in which the following points of reference apply.

- Situations which are usual for the execution of the occupation form the didactic points of reference (learning in order to be able to act).
- Actions which trainees can perform themselves wherever possible or understand in theory constitute the starting point for learning (learning via acting).
- Wherever possible, actions need to be autonomously planned, executed, checked, corrected where necessary and finally evaluated in writing by the learners themselves.
- Actions should foster a holistic understanding of occupational reality, incorporating technical, safety, economic, legal, ecological and social aspects amongst others.
- Actions need to be integrated into the experiences of the learners and be reflected upon with reference to their societal implications.
- Actions should also include social processes such as declaration of interest or conflict resolution.

Employment oriented teaching is a didactic concept bundling together specialist and action system structures and may be realised via a range of teaching methods.

Teaching provision at vocational schools is directed towards young people and adults who have different prior learning, cultural backgrounds and experiences gained from companies providing training. Vocational schools are only able to fulfil their educational remit if they accord due consideration to these differences and encourage pupils, including disadvantaged and particularly talented pupils, to develop in line with their individual potential.

Part IV Occupationally related preliminary remarks

The present skeleton curriculum for vocational education and training in the occupation of Electronics technician for industrial engineering has been harmonised with the Ordinance on Vocational Education and Training in the Industrial Electrical Occupations of 3 July 2003 (Federal Law Gazette, BGBl. I p. 1144).

The training occupation has been aligned to the occupational field of electro technology pursuant to the Basic Vocational Training Year Accreditation Directive issued by the Federal Ministry for Economics and Labour.

In respect of the first year of training, the skeleton curriculum corresponds to the vocationally related specialist theory area of the skeleton curriculum for the school based basic vocational training year. Insofar as the first year of training takes place within a school based basic vocational training year, the skeleton curriculum applies to the vocationally related learning area within such a basic vocational training year.

The skeleton curriculum for the training occupation of Energy electronics engineer (resolution of the KMK of 7 January 1987) is replaced by the present skeleton curriculum.

The principle vocational school curriculum content in the examination area of business and social studies is imparted on the basis of "Elements for teaching at vocational schools in the area of business and social studies for technical training occupations" (resolution of the KMK of 18 May 1984).

The aims and content of the skeleton curriculum relate to the vocational qualifications and the training occupation profile for the occupation of Electronics technician for industrial engineering.

Electronics technicians for industrial engineering assemble systems and plants for power supply, measurement and control, communications technology, signalling technology, drive technology and lighting. They put these systems and plants into operation, maintain and operate them.

The skeleton curriculum takes the following objectives as its starting point.

Pupils

- work predominantly in a team and within the scope of their occupational activity communicate with others inside and outside the company, including with persons from other cultural circles.
- advise customers and provide customer service, analyse customer requirements in respect of the design of electrical systems and plants.
- accord due consideration to standards and regulations, use technical regulations and stipulations, technical bulletins and descriptions, operating instructions and other information typical to the occupation, including English language information.
- use current information and communication systems to procure information, process orders and projects and document and present results.
- design modifications and extensions to electrical systems and plants, including computer aided design.

- also conduct software aided technical calculations for the design of electrical systems and plants and cost calculations.
- plan and steer work processes when setting up and decommissioning workplaces/construction sites; organise and monitor the work of other trades and service providers, document and evaluate work results.
- accord due consideration to ergonomic, economic, ecological and societal aspects when planning and executing work. minimise the negative impact of the work process on the environment by using appropriate materials, acting in a responsible manner and according due consideration to environmental regulations.
- programme and configure systems, check functionality and safety systems.
- install/assemble wiring systems, information and energy cables including general supply lines.
- install automation systems, machines and drive systems and set these up.
- use standards, regulations and rules relating to securing product quality, ensure the smooth operation of plants and systems and Make a contribution to continuous improvement of work processes.
- develop approaches to be adopted for the putting into operation of electrical systems and plants.
- check safety measures.
- take over and hand over plants, instruct users in their operation and provide services.
- monitor and maintain plants, conduct regular checks, analyse malfunctions, instigate immediate measures and repair plants.

The learning fields contained within the present skeleton curriculum are aligned to work and company operational processes. For this reason, customer oriented occupational actions and order processing are accorded particular significance and need to be given special consideration when implementing the learning fields within learning situations.

The imparting of competences and skills should take place using assignment of tasks typical to the occupation and should also be conducted in an order and project oriented manner involving cooperation with other learning venues.

Mathematical and scientific content, technical safety information and economic, business administration and ecological aspects should be imparted in an integrative manner within the learning fields.

Appropriate aims and content comprising 40 teaching hours have been integrated into the learning fields for the imparting of English language elements below the communication level.

The main focus in the learning fields for the first year of training is on the acquisition of basic knowledge across the occupational field within the context of typical, cross-vocational occupational action processes. Consideration should be accorded to occupationally specific aspects via the selection of appropriate examples and tasks.

The objects of the interim examination or of Part 1 of the final examination have been accorded consideration in the aims and content of learning fields 1 to 6.

The new form of final examination also requires vocational schools to adopt a new concept for integrative preparation for the examination situation. The holistic and integrative approach of the final examination is particularly reflected in the expansions of competence in the seventh half year of training. The complex assignment of projects tasks in the learning fields of the seventh half year of training accord particular attention to occupational areas of deployment. These complex task assignments enable competences and skills which have already been imparted to be used and extended in a recapitulatory and project related manner as well as allowing

additional aims and content specific to the area of deployment to be developed with the agreement of and in conjunction with the companies providing training.

The objective of all learning fields is the development of employability skills. In order to emphasise selected facts and circumstances relating to personal and social competence and methodological, learning and communication competence, such competences are expressly included as an integral part of some learning fields. In all other learning fields, these competences should be addressed situationally and individually according particular consideration to the typical main characteristics of the occupation and should be consolidated and extended.

Part V Learning fields

Summary of the learning fields for the training occupation of Electronics technician for industrial engineering					
Learning fields		Suggested time allocation in hours			
		1st year	2nd year	3rd year	4th year
1	Analyse electrical systems and check functions	80			
2	Plan and execute electrical installations	80			
3	Analyse and adjust control systems	80			
4	Make information technology systems available for use	80			
5	Ensure electrical energy supply and the safety of operating equipment		80		
6	Analyse and check equipment and sub-assemblies in plants		60		
7	Programme and realise control systems for plants		80		
8	Select and integrate drive systems		60		
9	Execute technical building services plants and put these into operation			80	
10	Set up and maintain energy plants			100	
11	Put into operation and maintain automated plants			100	
12	Plan and realise electrical plants				80
13	Maintain and adjust electrical plants				60
	Total	320	280	280	140

Learning field 1	Analyse electrical systems and check functions
1st year of training	Suggested time allocation: 80 hours
Formulation of objectives:	
Pupils find out about the tasks, work requirements, activities and sample work processes within their occupation. Pupils analyse electrical systems at the plant, device, sub-assembly and component level and the correlative effects between the individual levels. During this process, they read and draw up technical documentation. They determine the functions and operational characteristics of selected components and sub-assemblies and their tasks within electrical systems. For these purposes, the pupils obtain information independently which they then evaluate. They evaluate English language technical documentation with the assistance of tools.	
For the purposes of analysing and checking basic circuits and recognising the general laws of electro technology, the pupils determine electrical values by measurement technology and calculation and document and evaluate these.	
The pupils check the function of electrical connections and operating equipment. They analyse and correct errors.	
The pupils realise tasks within a team and communicate using correct specialist language. They deploy work, time and learning planning methods. They act in a responsible manner according due consideration to technical safety aspects.	

Contents: Company structures, work organisation, company communication Products, services Circuit diagrams, circuit symbols Electrical operating equipment, basic circuits, basic electrical values Performance and ratings of sample components and functional units Risks posed by electrical current, safety rules, health and safety at work Measurement procedures, functional checks, trouble shooting Team work	
Methods of obtaining and processing information	
Learning field 2 1st year of training	Plan and execute electrical installations Suggested time allocation: 80 hours
Formulation of objectives: The pupils analyse orders for the installation of energy supply to plants and equipment. The pupils plan installations according due attention to typical network systems and the required protective measures. They draw up circuit and installation plans, including using computer aided means. They assess components and select these in accordance with functional, economic and ecological aspects. Pupils use specialist terminology from the field of electrical installation technology. They also evaluate English language information. Pupils plan the typical processes for the setting up of plants. They determine the approach to be adopted in respect of fulfilment of order, materials requirements and coordination with other parties involved, select equipment and coordinate the work process. They calculate the costs involved in setting up the plant, draw up offers and explain these to customers. The pupils set up plants according due consideration to safety rules and accident prevention stipulations relating to work in and on electrical plants. They recognise possible risks posed by electrical current and act in accordance with the relevant safety provisions and protective measures. The pupils put plants into operation, record ratings and draw up documentation. They check the functionality of plants, find and eliminate errors. They hand over plants to customers, demonstrate the functions of the plants and provide introductory guidance on use. The pupils evaluate their work results for the purposes of improving work organisation. They issue an invoice for the orders which have been processed.	
Contents: Order planning, execution of order Energy requirements of a plant or piece of equipment Safety regulations Installation technology Ratings of operational equipment Types of circuit diagram Dimensioning of cables Work organisation Calculation of costs, drawing up offers	

Learning field 3 1st year of training	Analyse and adjust control systems Suggested time allocation: 80 hours
Formulation of objectives: The pupils plan modifications and adjustments to control systems in accordance with stipulations. The pupils analyse plants and equipment and visualise structural composition and functional correlations. They determine control systems and differentiate between open and closed loop control systems. The pupils differentiate techniques for the realisation of control systems and evaluate the benefits and drawbacks of these in accordance with economic and technical safety aspects. The pupils alter control systems, selecting sub-assemblies and constituent components in accordance with requirements. The put systems to which control systems have been applied into operation, check functionality, record ratings using measurement technology and carry out necessary adjustments. They document technical changes using standard and bespoke software. The pupils organise their learning and work tasks autonomously and within the team. They analyse, reflect upon and evaluate the findings they have obtained within this process. They evaluate English language documentation with the assistance of tools and also use specialist English terminology for the written representation of facts and circumstances related to control technology.	

Contents:

Block diagram, IPO model, sensors, actuators, interfaces
 Chain of effects, functional descriptions
 Connective and stored programme signal processing
 Logical basic interconnections, storage functions
 Standards, regulations and rules
 Technical documentation

Learning field 4 Make information technology systems available for use

1st year of training

Suggested time allocation: 80 hours

Formulation of objectives:

The pupils plan the provision and expansion of information technology systems in accordance with functional specifications. They analyse systems, check the technical and economic feasibility of orders and offer solutions. They research German and English language media by using networks.

The pupils select hardware and software components according due consideration to function, performance, area of deployment, compatibility, economic efficiency and environmental sustainability and procure these components. The pupils install and configure information technology systems and task related standard and bespoke software and use these. They integrate information technology systems into existing networks and carry out the necessary configurations for this purpose. The pupils accord due attention to statutory regulations in respect of data protection, copyright law and media law. They deploy selected data back-up and data protection measures.

The pupils document and present the work processes and results relating to the provision of information technology systems. For this purpose, they use word processing, spreadsheet, graphical representation and presentation software.

Contents:

Function and structure of functional specifications
 Hardware, operating systems, standard and bespoke software
 Procurement process
 Installation and configuration processes for hardware and software components Ergonomic workplace design
 Tools and methods for diagnostics and trouble shooting
 Local and global networks, data transmission protocols
 Data back-up and data protection, copyright and media law
 Presentation technologies and methods

Learning field 5 Ensure electrical energy supply and the safety of operating equipment

2nd year of training

Suggested time allocation: 80 hours

Formulation of objectives:

The pupils plan electrical energy supply for operating equipment and plants. They analyse and classify electrical energy supply possibilities in accordance with functional, economic and ecological aspects.

The pupils dimension plants according due consideration to network systems and protective measures. For this purpose, they select and assess components from the plants and draw up circuit diagrams using specialist literature, technical bulletins and descriptions of equipment, including in English.

The pupils check compliance with standards, regulations and rules relating to protection against electric shock, health and safety at work and prevention of accidents when setting up, putting into operation and maintaining electrical energy supply plants and when using operating equipment.

The pupils check permanently sited and portable electric operating equipment and put such equipment into service. They record ratings and test results and classify these in document form.

The pupils instruct users in how to operate the plants.

Contents:

Circuit and distribution systems
 Environmental sustainability
 Voltage levels
 Alternating and rotary current systems
 Network systems
 Protective systems
 Measurement and test equipment
 Test protocols
 Classes of protection, classes of insulation
 Types of protection User instructions

Learning field 6 Analyse and check equipment and sub-assemblies in plants

2nd year of training

Suggested time allocation: 60 hours

Formulation of objectives:

The pupils plan and organise modification and repair orders to equipment and sub-assemblies in line with customer requirements and stipulate the stages for the execution of orders.

The pupils analyse equipment, sub-assemblies and the correlative effects between the components constituting the plant. For this purpose, they use specialist literature and equipment descriptions, including in English. They determine the function and operational characteristics of sub-assemblies constituting the plant.

The pupils record measurement values and signal processes and evaluate these in the light of secure operational functioning of the equipment and sub-assemblies.

The pupils systematically isolate errors and eliminate malfunctions within the components constituting the plant. They carry out modifications and repair work to equipment and sub-assemblies and monitor and check these.

The pupils use standards, regulations and rules applying to the modification and repair of equipment and sub-assemblies and comply with regulations in respect of health and safety at work and environmental protection.

The pupils use computer aided methods to draw up technical paperwork to document the modification or repair work. They substantiate, present and evaluate the work results.

Contents:

Operating instructions and instructions for use
 Connection analysis methods
 Analogue and digital sub-assemblies
 Standard connection solutions
 Error isolation methods
 Simulation software
 Measurement and test procedures
 Test regulations, test protocols
 Technical connection documentation
 Health and safety at work, health protection
 Electromagnetic compatibility
 Conducting discussions, taking minutes

Learning field 7 Programme and realise control systems for plants

2nd year of training

Suggested time allocation: 80 hours

Formulation of objectives:

The pupils plan control systems for plants. They analyse control systems in existing plants in order to adapt these to modified customer requirements.

The pupils record and analyse control processes. They use programme development tools and configure and parameterise the necessary hardware and software components. During this process, they select forms of presentation in compliance with standards and regulations.

The pupils put control systems into operation according due consideration to the functions of the plant. They undertake autonomous checks of the function of control systems, also including aspects relevant to safety, and use appropriate test and measurement procedures for the purposes of identifying errors. They eliminate errors in the control programmes they have developed.

The pupils supplement or draw up technical documentation for control systems and present the results of their work.

During the work process, the pupils use specialist language and terminology, including in English.

The pupils work independently and assume responsibility within the team. They evaluate the experiences and findings they have obtained.

Contents:

Catalogue of requirements
 Computer aided procurement of information Sensors, actuators
 Functional groups within a control system
 Programme documentation
 Functions, function modules
 Storage, time and counting functions
 Sequences
 Programme test, error search
 Test protocols, technical documentation and programme archiving
 Standards, regulations and rules
 Presentation techniques using standard software
 Lead presentation techniques

Learning field 8**Select and integrate drive systems**

2nd year of training

Suggested time allocation: 60 hours

Formulation of objectives:

The pupils plan the order processing of technical drive tasks in accordance with customer requirements. They analyse orders for drive systems and plan the technical realisation of the drive system.

The pupils coordinate the procurement of order related information within the team, including English language information. For this purpose, they conduct specialist discussions and evaluate their findings.

The pupils select the required equipment, sub-assemblies and protective systems according due consideration to functional, economic and ecological aspects and dimension these.

The pupils set up electrical and pneumatic drive systems, check and put these into operation having parameterised the components. They measure and document ratings, draw up technical documentation and connection documentation using computer aided means, present these to users and instruct users.

The pupils use standards, regulations and rules applying to the setting up and operation of electrical drive systems and comply with regulations in respect of health and safety at work and environmental protection. They check compliance with and document the above in a professional manner.

The pupils conduct a holistic analysis of work results.

Contents:

Structure of drive systems
 Actuators
 Direct and alternating current machines
 Protective systems
 Construction forms, types of operation, types of protection and cooling of machines
 Equipment and sub-assemblies for switching and steering drive systems
 Starting and braking processes
 Revolution speed control
 Test procedures
 Specialist discussions
 Technical documentation

Learning field 9Execute technical building services plants and put these into operation

3rd year of training

Suggested time allocation: 80 hours

<p>Formulation of objectives:</p> <p>The pupils plan order processing for electrical building services plants in accordance with technical and time stipulations. They coordinate their time and work planning within the team and in agreement with other trades. The pupils check their decisions to ensure that they are feasible, economical and environmentally sustainable.</p> <p>The pupils analyse, expand, set up and configure technical building services systems including communication systems and integrate visualisation into the project planning process.</p> <p>The pupils check the technical building services plants when these have been completed, put them into operation and instruct users.</p> <p>The pupils monitor technical building services systems, systematically isolate error in the event of malfunctions and initiate measures to eliminate such errors. During this process, they deploy diagnostic systems and interpret function and error protocols. They use complaints to improve plants and services.</p> <p>The pupils comply with safety and fire prevention regulations and stipulate measures to ensure compliance with these.</p> <p>The pupils process and draw up the necessary service documentation for the operation of plants. They use software which is usually deployed within the branch for this purpose.</p> <p>The pupils use specialist literature, product databases and equipment and plant descriptions, including in English.</p>		
<p>Contents:</p> <ul style="list-style-type: none"> Customer advice Materials management and calculation Light and lighting technology Risks and fire alarm systems Communication systems Protection against lightning Building services systems technology and its constituent components Load management Visualisation software Standards, regulations and rules 		
Learning field 10	Set up and maintain energy plants	
3rd year of training		Suggested time allocation: 100 hours
<p>Formulation of objectives:</p> <p>The pupils analyse customer orders relating to the setting up of energy plants and plan the processing of orders in agreement with all of those involved in the process.</p> <p>The pupils obtain order related information on the structure and operational characteristics of low voltage switch gears and evaluate the combined effects of the components. They plan stages of the work and make decisions on work organisation in order to execute assembly and installation in a target oriented and time efficient manner. During this process, they accord particular consideration to compliance with safety rules, accident prevention regulations and environmental protection provisions.</p> <p>The pupils check and evaluate stages and results of work in accordance with economic, ecological and technical safety aspects.</p> <p>When setting up plants, they deploy measurement and test procedures and initiate the necessary adjustments and modifications.</p> <p>The pupils conduct regularly scheduled testing in a timely manner and localise and evaluate operational malfunctions. They discuss possible solutions for elimination of errors with involved parties and repair malfunctions in a targeted way.</p> <p>The pupils document all work processes and modifications made to the plants.</p>		
<p>Contents:</p> <ul style="list-style-type: none"> Cables and cable networks Switch gears Protective systems for electrical networks Types of network Decentralised energy supply systems Energy plants in buildings, in special premises and outside Compensation Recording, processing and evaluating metered values Types of error and methods of trouble shooting Recycling and disposal 		
Learning field 11	Put into operation and maintain automated plants	
3rd year of training		Suggested time allocation: 100 hours

Formulation of objectives:

The pupils plan control systems for complex automated plants. They analyse the control systems within existing plants and install automated plants. They use industrial communication systems to integrate components into superordinate automated systems.

The pupils organise and optimise their work processes based on a system of division of labour. They use predictive analysis to prevent possible sources of error in the planning of plants. They record the effects of sources of error on the plants and services and initiate preventative measures.

The pupils configure and parameterise automated plants and the drive systems integrated into these. During this process, they accord due consideration to the topology and structures of automated systems. They record and analyse the data exchange between these systems and deploy programme development and programme visualisation instruments.

The pupils use standards, regulations and rules applying to the setting up and operation of automated plants, communication electric drive systems and health and safety at work regulations. They document compliance with these in a professional manner.

The pupils conduct independent checks on the functionality and safety of automated plants and put these into operation.

The pupils carry out maintenance and diagnostic works on automated plants and drive systems, including remote diagnoses. For these purposes, they deploy strategies for systematic identification and elimination of errors.

The pupils draw up and modify documentation, also use English language documentation and present their results. They use standard and bespoke software for these purposes.

Contents:

Levels of automation technology

Ratings and norms of bus systems

Configuration of networks and bus systems

Digital software control systems

Types of operation of automated plants

Value processing, analogue value processing

Open and closed loop control systems for communication drive systems Inverter fed drive systems

Network perturbation and electromagnetic compatibility measures

Potential error and error influence analysis

Continuous improvement process

Conflict resolution strategies

Learning field 12**Plan and realise electrical plants**

4th year of training

Suggested time allocation: 80 hours

Formulation of objectives:

The pupils plan control systems for electrical plants. They define targets, analyse and structure tasks in respect of their feasibility and accord due consideration to areas of deployment in the project selection process.

The pupils plan, develop and realise practice oriented solutions. During this process, they assume responsibility for project organisation and coordination of the learning and work processes. The pupils document project progress and analyse and evaluate the process. They comply with basic quality management standards and processes thus securing the quality of products and processes.

The pupils set up the electrical plants or plant components, put these into operation and test partial and overall functions. They demonstrate the structure and function of the plants or plant components.

During the project realisation process, the pupils accord due consideration to recycling opportunities and environmental compatibility issues.

They draw up and modify documentation, also use English language documentation and present their results. They use current information and communication media in order to do this.

The pupils evaluate project results in accordance with learning organisation, work organisation, technical and economic aspects.

Contents:

Project description

Time and work planning

Economic efficiency

Plant and product design

Standards, regulations and rules

Quality assurance

Project evaluation

Learning field 13 4th year of training	Maintain and adjust electrical plants Suggested time allocation: 60 hours
Formulation of objectives: The pupils plan maintenance and adjustment measures in electrical plants. The pupils analyse malfunctions and deploy strategies for systematic identification and elimination of errors in electrical plants or plant components. They adjust electrical plants or plant components in accordance with customer wishes and document this in a professional manner. The pupils instruct customers in the operation of the adjusted plants, provide information about statutory stipulations applying in respect of maintenance and explain the revised maintenance conditions. The pupils also use English language documentation for project documentation and present their results. The pupils reflect upon their vocational learning and work processes. They use appropriate training opportunities and a variety of learning techniques and learning media to develop their competences and skills further.	
Contents: Time and work planning Maintenance concepts Standards, regulations and rules Customer advice and instruction Process documentation Knowledge management	

Work Package 3 First center level "Vocational training"

Activity A4.2 Preparation and transfer of curricula and examination regulations for dual vocational training

Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training

Curricula and examination regulations for dual vocational training as vehicle mechatronics engineer

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Assignment of dual training as a vehicle mechatronics engineer - specialisation in passenger cars

Teaching assignment

The vocational school and the training companies fulfil a joint educational role in dual vocational training. The vocational school is an independent place of learning. As an equal partner, it works together with all other parties involved in vocational training and has the task of conveying vocational and cross-vocational competence to students. This enables the students to fulfil the job-specific tasks relating to their profession and to help shape the world of work and society in a socially, economically and ecologically responsible manner, in particular, against a backdrop of ever-changing requirements. This includes the promotion of young people's competences

- for personal and structural reflection,
- for lifelong learning,
- for professional and individual flexibility / mobility with a view to European integration.

In order to fulfil its educational mandate, the vocational school must provide a differentiated educational offer, which:

- ✓ develops action-oriented learning arrangements in didactic planning for the school year that are coordinated with in-company training,
- ✓ allows inclusive lessons providing the corresponding level of individual support against the background of the students' different experiences, abilities and talents,
- ✓ sensitises students to health maintenance and specific accident risks at work, in private life and in society,
- ✓ demonstrates perspectives of different forms of employment, including entrepreneurial independence, in order to support self-reliant career and life planning,
- ✓ is geared to the relevant scientific findings and results with regard to competence development and skill assessment.

The central goal of vocational schools is to promote the development of comprehensive professional competences. Professional competence is understood as the willingness and ability of an individual to act appropriately in professional, social and private situations, in a well-thought-out manner, taking individual and social responsibility into account.

Professional competence is further developed in the areas of professional expertise, self-competence and social competence.

Professional expertise

The willingness and ability to solve tasks and problems on the basis of technical knowledge and skills in a goal-oriented, appropriate, methodical and independent manner and the ability to appropriately evaluate results.

Self-competence

The willingness and ability as an individual, to evaluate, think through and assess the development opportunities, requirements and restrictions present in family, work and public life, to develop one's own talents and to define and further develop life plans. It includes characteristics such as independence, the ability to handle feedback, self-confidence, reliability, responsibility and sense of duty. In particular, it includes an individual's development of well thought-out values as well as their independent commitment to them.

Social competence

The willingness and ability to live and shape social relationships, to grasp and understand gratuities and tensions as well as the ability to deal with, communicate or confront others rationally and responsibly. This includes, in particular, the development of social responsibility and solidarity. Methodological competence, communicative competence and learning competence are an integral part of professional competence, self-competence and social competence.

Methodological competence

The willingness and ability to work on tasks and problems in a goal-oriented, structured manner (e.g. when planning work steps)

Communicative competence

The willingness and ability to understand and shape communicative situations. This includes perceiving, understanding and presenting one's own intentions and needs as well as those of any partners.

Learning competence

The willingness and ability to understand, evaluate and classify information on facts and interrelationships independently and jointly with others in a conceptual manner. Learning competence includes, in particular, the ability and willingness to develop learning techniques and learning strategies both professionally and beyond the professional sphere and to use them for lifelong learning.

In order to fulfil the vocational school's educational mandate, young people are enabled to plan, carry out and assess work tasks independently within the scope of their professional activities. Studying at vocational school aims to develop comprehensive professional competences. With the didactically based practical implementation (or at least intellectual integration) of all phases of a vocational action taking place in learning situations, learning takes place both at and from work.

Activity-oriented teaching within the framework of the modular learning concept shown below is primarily oriented towards activity-oriented structures and represents a changed perspective compared to primarily subject-oriented teaching. According to learning theory and didactic findings, the following points of reference must be considered when planning and implementing activity-oriented lessons in learning situations:

- ✓ Didactic points of reference are situations that are important for the practice of the profession.
- ✓ Learning is accomplished via complete activities which are, if possible, performed independently or at least conceptually understood.
- ✓ Activities and actions promote a holistic understanding of professional reality, for example with regard to technical, safety, economic, legal, ecological and social aspects.
- ✓ Activities address learners' experiences and reflect them with regard to their social effects.
- ✓ Activities also consider social processes, for example the declaration of interests or conflict resolution, as well as different perspectives with regard to career and life planning.

1. The structure of vocational theoretical training

The vocational theoretical training as a vehicle mechatronics engineer should be structured according to the following focal points, which extend over the 3-year training period:

Service

This subject includes all modules which focus on service, maintenance and inspection activities, which may arise either as a result of manufacturer specifications or customer requirements. These concepts are derived from the typical industry understanding of such activities. When carrying out care, maintenance, inspection and additional work, the focus lies on maintaining the function and value of vehicles as well as complying with the relevant operational and work process-oriented workflows. The work process-oriented assignment of the corresponding modules follows the approach of a progressive curriculum over the course of the training years. With an increased training duration, the complexity, requirements and scope of the service work in the respective modules also increases, resulting in a higher level of competence. If the focus at the beginning of the training at the lowest level is on maintenance and standard service, the requirements increase with the duration of training, for example, at the highest level, the performance of inspections and inspections including additional work all the way up to inspections featuring special tests and approvals is included. As the duration of training increases, the higher-level modules also take an increased degree of independence in the work process into account. Descriptions of the core competences in the respective modules: The students acquire the competence to carry out maintenance and service work to maintain the function and value of vehicles and industry-specific systems according to manufacturer-related standards and customer requirements and to apply standardised instructions and simple rules according to specifications (LF 1). They carry out inspection work on vehicles and industry-specific systems independently, identifying any additional work steps required and integrating them into the work process in coordination with the regular inspection work (LF 5). The students plan service processes and carry out standardised service tasks on comfort and safety systems independently (LF 9). The students plan and carry out service tasks to prepare vehicles for safety tests and approvals within the framework of statutory regulations (LF 12).

Repair

The subject includes all modules that focus on the repair of components, modules, assemblies and (sub)systems to maintain vehicle system functions or the operational condition of the vehicle. The work process-oriented assignment of the corresponding modules follows the approach of a progressive curriculum over the course of the training years. With an increased training duration, the complexity, requirements and scope of the repair work in the respective modules also increases, resulting in a higher level of competence. These increases are directly evident from the increasing complexity of the following activities; starting with an exchange repair according to standardised procedures and the assessment of wear status including determination of the repair effort involved, followed by complex damage analysis, repair and calculations, right up to the repair of complex vehicle systems based on comprehensive system knowledge. Descriptions of the core competences in the respective modules: Students acquire the competence to replace and repair components, modules and systems according to standardised instructions in order to maintain vehicle system functions (LF 2). They assess the condition of vehicle wear parts, replace components, modules and systems and determine the repair effort required (LF7). The students carry out damage analyses to determine the repair costs for chassis systems, determine repair costs, use repair methods and estimate the time and costs involved. The damage correction aims, in particular, to avoid consequential damages and the recurrence of damage (LF 10). The students repair drive components and use detailed specialist knowledge for system- and vehicle-related repair processes (LF 13).

Diagnostics

The subject includes all modules which focus on the application of diagnostic strategies and the evaluation and repair of modules and systems resulting from their use. Diagnostics takes a closer look at the functional relationship between components and subsystems including their interrelationships in the system, particularly with regard to hybrid systems. In addition, the interdependencies in networked systems must also be considered from a safety-related standpoint. The work process-oriented assignment of the corresponding modules follows the approach of a progressive curriculum over the course of the training years. With an increased training duration, the complexity, requirements and scope of the diagnostic work in the respective modules also increases, resulting in a higher level of competence. These increases are directly evident from the increasing complexity of the activities; starting with simple diagnostic work using routine diagnostics to identify, locate and eliminate faults in electrical, electronic, hydraulic and pneumatic systems to ensure the functionality of the overall system. This is later followed by the diagnosis and analysis of malfunctions in complex electronic and mechatronic systems using independent and guided troubleshooting with the aid of diagnostic devices before cross-system, complex diagnoses in networked systems and the observation of data communication between ECUs with the help of expert systems is implemented. Descriptions of the core competences in the respective modules:

The students acquire the competence to identify faults in electrical, electronic, hydraulic and pneumatic systems, to systematically eliminate faults and to ensure the functionality of the overall system (LF 3). The students diagnose and repair malfunctions in power supply, storage and starting systems with the aid of manufacturer documentation and diagnostic devices (LF 6). The students identify malfunctions in complex drive technology control and regulation systems and eliminate them (LF 8). The students acquire the competence to carry out cross-system, complex diagnoses on networked drive, comfort and driver assistance systems, to analyse data communication between ECUs and to use expert systems for troubleshooting (LF 11).

Conversion and retrofitting

The subject includes all modules which focus on the functional expansion of the vehicle or a subsystem as well as the provision of any supplementary equipment. These activities can result from manufacturer specifications as well as customer requirements. The work process-oriented assignment of the corresponding modules follows the approach of a progressive curriculum over the course of the training years. With an increased training duration, the complexity, requirements and scope of the conversion and retrofitting work in the respective modules also increases, resulting in a higher level of competence. At the beginning of the training, the main focus is on the implementation of customer requirements in the area of simple equipping and retrofitting work including subsequent preparation of the vehicle handover, whereby primarily simple activities are carried out, above all, in compliance with technical conditions and legal regulations. An increased complexity level is a direct outcome of the subsequent requirements for equipping and converting complex and networked systems as well as the necessary

systemic and technical adaptation work including final preparation of a subsequent customer briefing. Descriptions of the core competences in the respective modules:

The students convert and retrofit vehicle components and prepare the vehicle for handover to the customer, considering customer requirements, economic efficiency and legal regulations (LF 4). The students acquire the competence to identify customer-specific requests, to plan and implement conversion, extension and modification work on the basis of these whilst complying with manufacturer specifications and regulatory standards.

This leads to a module presentation within the field of the 4 main focus areas

1. Teaching year	2. Teaching year	3. Teaching year	
LF 1	LF 5	LF 9, LF 12	Service
LF 2	LF 7	LF 10, LF 13	Repair
LF 3	LF 6, LF 8	LF 11	Diagnosis
LF 4		LF 14	Conversion and retrofitting

Learning modules include the following contents which are taught in vocational theory lessons:

	Timing — Learning situations	Content
<p>Module 1</p> <p>Service and inspect vehicles and systems according to specifications</p> <p>80 hours</p>	<p>Description of the distinction between systems, subsystems, functional units and their interrelationships</p> <p>Operating and auxiliary materials</p> <p>Identification of modules and components which present special hazards</p> <p>Information acquisition, documentation, evaluation of error memories, maintenance data, technical documents and service instructions</p> <p>Knowledge about operational processes; a substantiated selection of tools for service work</p>	<ul style="list-style-type: none"> • Block diagrams • Flow diagrams • Maintenance instructions • Sourcing • Standards, rules, regulations • Brake fluid • Disposal, recycling • High voltage systems • Pyrotechnic systems • Hazardous/explosive/high pressure fluids (e.g. coolants) Use of selected data processing devices <ul style="list-style-type: none"> • Diagnosis • Test devices • Internet • Standard tool set • Special tools

	Timing - Learning situations	Content
<p>Module 2</p> <p>Test, dismantle, exchange and assemble simple modules and systems</p> <p>100 hours</p>	<p>Information retrieval with the help of technical documents</p> <p>Type and scope of necessary replacement repairs</p> <p>Creation of work plans; selection of tools and operating materials; analysis of spare parts for suitability</p> <p>Analysis of screw connections and other force-fit, form-fit and material-locking connections</p> <p>Determination of appropriate reuse, modification or replacement</p> <p>Analysis of the consequences for the environment in case of improper use</p>	<ul style="list-style-type: none"> • Installation instructions • Repair instructions • Replacement part catalogues • Online information systems • Vocational regulations • Brake mechanism • Exhaust system • Wheels and tyres • Manufacturer keys • Coding of replacement parts • Mechanics • Model types • Usage and assembly • Screw locks • Standards • Key parameters • Corrosion protection • Clamp connections • Rivet connections • Welded connections • Solder connections • Disposal • Recycling • Exchange parts • Quality specifications • Wages and costs of spare parts

		<ul style="list-style-type: none"> • UVV (Accident prevention regulations) • Health hazards • Ecological consequences
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	Timing - Learning situations	Content
<p>Module 3</p> <p>Identifying and eliminating functional problems</p> <p>100 hours</p>	<p>Diagnosis of faults in electrical, electronic, hydraulic and pneumatic systems</p> <p>Determination of the function and mode of operation of vehicle-specific control and regulation systems</p> <p>Use of manufacturer documents</p> <p>Circuit analysis of vehicle subsystems</p> <p>Work with / on high voltage components</p> <p>Determination of physical sizes and use of suitable testing and measuring devices</p>	<ul style="list-style-type: none"> • Reading of vehicle control unit error memories • Performance of visual inspections • Use of workshop information systems • Online information systems <ul style="list-style-type: none"> • Vehicle electrical systems • Lighting systems <ul style="list-style-type: none"> • Circuit diagrams / switching symbols • Connection and terminal designation • Troubleshooting guidelines <ul style="list-style-type: none"> • Safety • Line technology • Electrical and electronic basic circuits • Hydraulic and pneumatic switches <ul style="list-style-type: none"> • Activation, securing to prevent against being switched on again, ensuring that no voltage is present whilst observing the manufacturer's instructions. <ul style="list-style-type: none"> • Use of multimeters, current meters, pressure gauges, flow meters

	Timing - Learning situations	Content
<p>Module 4</p> <p>Implementation of retrofitting work according to customer requirements</p> <p>40 hours</p>	<p>Determination of technical specifications and installation regulations for conversions and retrofits and for the installation of accessories</p> <p>Planning for the implementation of the order and the creation of work contracts</p> <p>Vehicle transfer to the customers</p>	<p>Consideration of</p> <ul style="list-style-type: none"> • Technical possibilities (additional features, functional integration) • Appropriate economic efficiency and legal obligations (registration certificate, road traffic licensing regulations) • Determination of technical requirements for assembly (mechanical, electrical) • Application of industry and standard software <ul style="list-style-type: none"> • Compilation of all necessary documents and components (instructions for use, general operating permit, entries, replaced components, invoice)

	Timing - Learning situations	Content
<p>Module 5</p> <p>Implementation of inspections and additional work</p> <p>60 hours</p>	<p>Providing an overview of the operating principles and functional relationships of the individual subsystems</p> <p>Identification of necessary inspection and maintenance work</p>	<ul style="list-style-type: none"> • Engine mechanics • Engine control • Cooling and lubricating systems <p>With assistance</p> <ul style="list-style-type: none"> • Vehicle data and documents • Diagnostic devices • Integrated vehicle diagnostic systems

	Planning of inspection and maintenance work	<ul style="list-style-type: none"> • Workshop information • Web portals • Determination of the work sequence • Substantiated selection of tools, devices, testing and measuring devices • Causes of wear on vehicle systems and components (scientific principles)
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	Timing - Learning situations	Content
<p>Module 6</p> <p>Diagnosis and rectification of malfunctions in on-board power systems, charging current systems and starting systems</p> <p>80 hours</p>	<p>Comprehension of customer complaints and creation of error hypotheses based on subsystem error memory entries</p> <p>Use of manufacturer-specific security and testing routines</p> <p>Analysis of the function and interaction of components and modules, considering the information exchange of the control devices involved</p> <p>Evaluation of signal images</p> <p>Selection of replacement parts</p>	<ul style="list-style-type: none"> • Installation instructions • Repair instructions • Replacement part catalogues • Online information systems • Vocational regulations • Activation of high-voltage vehicles • Further development of own test routines • Application of circuit diagrams and function charts • Impact of possible errors on the overall system (battery management, start-stop system, pyrotechnic safety switches) • Operational planning of suitable measuring devices (multimeters, diagnostic tests) • Laws of voltage generation (induction) • Rectification (one-way, multi-way rectification) • Electric motor principles • Electrical energy storage • Starter, battery and generator parameters
	Timing - Learning situations	Content

<p>Module 7</p> <p>Reparation of modules and systems exposed to wear and tear</p> <p>60 hours</p>	<p>Information retrieval with the help of technical documents 8 hours</p> <p>Type and scope of necessary replacement repairs 18 hours</p> <p>Creating work plans; selection of tools and operating materials; analysis of spare parts for suitability 16 hours</p> <p>Analysis of screw connections and other force-fit, form-fit and material-locking connections 6 hours</p> <p>Choosing between appropriate reuse, modification or replacement 10 hours</p> <p>Analysis of the consequences for the environment in case of improper use</p>	<ul style="list-style-type: none"> • Installation instructions • Repair instructions • Replacement part catalogues • Online information systems • Vocational regulations • Brake mechanism • Exhaust system • Wheels and tyres • Manufacturer keys • Replacement part coding • Mechanics • Model types • Usage and assembly • Screw locks • Standards • Key parameters • Corrosion protection • Clamp connections • Rivet joints • Welded connections • Solder connections • Disposal • Recycling • Exchange parts • Quality specifications
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		<ul style="list-style-type: none"> • Wages and spare parts costs • UVV (Accident prevention regulations) • Health hazards • Ecological consequences
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	Timing - Learning situations	Content
Module 8 Diagnosis of mechatronic drive management systems 80 hours	<p>Malfunctions based on error descriptions, by evaluating the vehicle's own diagnosis 16 hours</p> <p>Functions and functional relationships of individual drive subsystems 14 hours</p> <p>Selection of suitable measuring and testing methods 10 hours</p> <p>Recognition of correlations and dependencies of relevant control and regulation systems 14 hours</p> <p>Determination of the status of the systems to be tested using diagnostic systems 15 hours</p>	<ul style="list-style-type: none"> • Actuator analysis • Repair instructions • Error diagnosis • Online information systems • Repair possibilities <ul style="list-style-type: none"> • Torque controlled engine management systems for gasoline and diesel engines • Hybrid systems • Electric drive units • Transmission clutches <ul style="list-style-type: none"> • Computer-integrated sensors and actuators (analog, digital) <ul style="list-style-type: none"> • Ignition • Carburetion • Supercharging • Exhaust system • Exhaust purification system • Control of drive subsystems and electric machines <ul style="list-style-type: none"> • Error memory entries and environmental conditions, • Actual values of actuators and sensors,

	Comparison with database systems and evaluation of results 11 hours	<ul style="list-style-type: none"> • Signal characteristics and characteristic values in ECUs, exhaust gas values, • System reactions • Determination and documentation of • a systematic procedure and sequence of test steps, checking of sensors and actuators of the drive and motor management according to • manufacturer specifications, evaluation of signal images from
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	Timing - Learning situations	Content
<p>Module 9</p> <p>Completion of service tasks on comfort and safety systems</p> <p>80 hours</p>	<p>Identification of necessary inspection and maintenance work on comfort and safety systems via focused dialogue with customers and the use of workshop information / diagnostic systems. 8 hours</p> <p>Analysis of the vehicle condition to determine the necessity of any additional work 6 hours</p> <p>Distinguish between measuring and testing methods on hydraulic, pneumatic and pyrotechnic systems and determine the relevant safety regulations 14 hours</p>	<ul style="list-style-type: none"> • air conditioning, • comfort systems, active and passive safety systems, • Lubricant systems • Leak testing and detection for filters and seals • Coolants • Pressures, • Pyrotechnics, • Explosives law, • Regulations, • Disposal and recycling

	<p>Planning of inspection, maintenance and conversion work with the aim of preserving the functionality, safety and value of the vehicle 20 hours</p> <p>Systematise the exchange of wear parts and liquids with an emphasis on an economical and customer-friendly approach 7 hours</p> <p>Manufacturer-specific operation and target-oriented use of integral vehicle diagnostic systems 5 hours</p> <p>Testing of hydraulic, pneumatic, electrical and data networked lines, connections and mechanical connections 20 hours</p>	<ul style="list-style-type: none"> • A substantiated selection of tools, devices and measuring devices for service works, • Description of their use • Compliance with safety regulations when handling hazardous materials. • Determination of the material requirements for operating materials, auxiliary materials and spare parts • Planning of testing and adjustment work using manufacturer documents and data sheets • Parts exchange • Parts repair, • System replacement • A/C service units • Error memory • Documentation of work processes and measurement results • Completion of customer and vehicle-specific service documents • Evaluation of works with regard to the • Improvement of operational and customer-oriented procedures • Recognition of conflicting goals between technical requirements, normative specifications and customer requirements • Systematise the work routines for handling the diagnostic systems and devices with an emphasis on efficient and safe use as well as compliance with safety regulations
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	Timing - Learning situations	Content
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<p>Module 10</p> <p>Reparation of damages to chassis and braking systems</p> <p>80 hours</p>	<p>Analysis of existing chassis and braking systems and their interaction with other vehicle components 20 hours</p> <p>Evaluation of damage analysis results from the self-diagnosis of electronic chassis and brake energy regulation systems 24 hours</p> <p>Determination of repair requirements with the aid of repair instructions, inspection and maintenance instructions 15 hours</p> <p>Determination and measurement of physical driving parameters, setting of required values 20 hours</p>	<ul style="list-style-type: none"> • Steering • Mountings • Suspension • Damping <ul style="list-style-type: none"> • Anti-lock braking system, • Traction control system, • Electronic stability program, • Brake assistant <ul style="list-style-type: none"> • Team communication with regard to repair methods in accordance with legal requirements • Determination of measures to avoid consequential damages • Reaching of decisions on reuse in line with current value based on manufacturer specifications and customer requirements <ul style="list-style-type: none"> • Brake test stand • Wheel alignment work station • manufacturer specifications, evaluation of signal images from the use of tables and formulas • Review of the repair process with regard to quality and cost-effectiveness and the formulation of possible strategies for its improvement
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	Timing - Learning situations	Content

<p>Module 11</p> <p>Diagnose and repair networked drive, comfort and safety systems</p> <p>80 hours</p>	<p>Identification of vehicle equipment with the aid of electronic information systems 12 hours</p> <p>Interpretation of the results of the self-diagnosis and familiarise themselves with the operating principles of networked vehicle systems with the aid of technical information systems 8 hours</p> <p>Analysis of data exchange and system interfaces as well as their associated mutual dependencies and functions 24 hours</p> <p>Selection of system-related testing devices and the limitation of errors with the aid of integral vehicle diagnostics 12 hours</p> <p>Checking of sensors and actuators that are part of the network 24 hours</p>	<ul style="list-style-type: none"> • Comfort systems, • Safety and driver assistance systems, • Drive train <ul style="list-style-type: none"> • Manufacturer-specific network instructions and topology-guided and user-based diagnostics <ul style="list-style-type: none"> • BUS systems, • Voltage levels, • Clocking, • Line technology <ul style="list-style-type: none"> • Measured value blocks, • Actuator diagnosis, • Adaptation values <ul style="list-style-type: none"> • Students evaluate, and document measured values and signals as well as ECU parameters and generate error logs. • They can control the functions of the repaired systems and consider the work that has been carried out from a work economic point of view.
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	Timing - Learning situations	Content

<p>Module 12</p> <p>Preparation of vehicles for safety tests and approvals 40</p>	<p>Analysis of the legal requirements and application of the rules, norms and regulations to perform these services.</p> <p>Identification of vehicles with manufacturer-specific information systems and detection of system data with diagnostic devices 10 hours</p> <p>Preparation of prescribed test and inspection conditions for the tests and approvals, Review of the functionality of vehicle subsystems, Logging of testing and assessment procedures 15 hours</p> <p>Planning of necessary repair and modification work and the determination of expected costs. Informing the customer about the condition of the vehicle, service intervals, any defects and the subsequent necessary repairs 15 hours</p>	<ul style="list-style-type: none"> • Investigation of vehicle relevant conditions • Preparation and documentation of checklists • Implementation of target value comparisons • Main inspection, • Exhaust inspection, • Additional inspections, • Approvals, • Authorisation • Type, • Scope, • Costs
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	Timing - Learning situations	Content
<p>Module 13</p> <p>Reparation of drive components</p>	<p>Identification of workshop information systems and</p>	<ul style="list-style-type: none"> • Engine mechanics, • Coupling, • Manual, torque converter and distribution gearboxes,

80 hours	<p>determination of drive components in need of repair 25 hours</p> <p>Evaluation of customer complaints in order to limit the causes of errors 15 hours</p> <p>Analysis of the functions and interactions of modules and the assessment of the influence of possible errors on the functionality of the entire system 16 hours</p> <p>Interpretation of electronically controlled system self-diagnosis results and planning of the repair with the aid of digital information technology. In order to better understand the subsystems, students perform technical calculations via.. 12 hours</p> <p>..the selection of suitable special tools and machines and application of occupational safety and environmental protection regulations. 12 hours</p>	<ul style="list-style-type: none"> • Axle drives • Oil loss, • Power deficiency, • Gear changes • Sounds • Movement changes, • Power and torque transmission, • Gear transmission ratios, • Changing of the rotational direction, • Rotation and torque compensation • Thermal expansion, • Force diagrams, • Torque curves, • Transmission ratios, • Clutch slippage • Comparison of repair costs • Evaluation of replacement costs • Informing the customer of the advantages and disadvantages of various repair solutions • Consultation with regard to the repairs to be carried out • Implementation of test routines before vehicle handover
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	Timing — Modules	Content
Module 14		<ul style="list-style-type: none"> • Lighting systems,

<p>Equipping, modification and retrofitting of systems and components 60 hours</p>	<p>Equipping, modification and retrofitting in accordance with technical requirements and possibilities 14 hours</p> <p>Observance of legal regulations and economic aspects; determination of the respective technical requirements for the conversion and installation of any additional equipment 8 hours</p> <p>Checking of the availability of the required parts and the comparison of alternative offers with regard to qualitative and quantitative aspects 8 hours</p> <p>Implementation of the planned assembly and connection work and incorporation of systems into the vehicle assembly 12 hours</p> <p>Preparation of the documentation for the replacement parts necessary for the work carried out as part of the vehicle handover and verification of completeness 18 hours</p>	<ul style="list-style-type: none"> • Gas powered systems, • Wireless signal transmission, • Antenna systems, • Entertainment electronics), • mechanical, electrical features • Compliance with technical documents and industry-standard information systems • Observance of safety regulations (technical, traffic-related and operating safety guidelines as well as ergonomic requirements) • Labour costs, • Parts costs • Integration, familiarisation, activation, coding • Selection of suitable tools, devices and measuring devices for the conversion and retrofitting work • Observance of the relevant specifications, rules and regulations (technical, traffic and safety standards for the protection of persons) • Documentation of work procedures and completion of vehicle-specific documents (general operating permit, approvals, entries) • Implementation of the handover, briefing and familiarisation of the customer with the handling • Development of customer-oriented consultancy forms • Evaluation of student's work with regard to the improvement of operational and customer-oriented approaches and communication • Identification of conflicting interests between technical requirements, normative specifications and customer wishes and contribute to their solution during
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2. the development of the practical vocational training structure.

The theoretical content of the lessons is supported by practical content. Practical training courses should take place according to progress made with the theoretical content.

		Teaching year 1		Teaching year 2		Teaching year 3		Total teaching units
		1	2	3	4	5	6	
Vocational theoretical classes								
1	Service and inspect vehicles and systems according to specifications	40	40					80
2	Test, dismantle, exchange and assemble simple modules and systems	50	50					100
3	Identifying and eliminating functional problems	50	50					100
4	Implementation of retrofitting work according to customer requirements	20	20					40
5	Implementation of inspections and additional work			30	30			60
6	Diagnosis and rectification of malfunctions in on-board power systems, charging current systems and starting systems			40	40			80
7	Repairing modules and systems exposed to wear and tear			30	30			60
8	Diagnosis of mechatronic drive management systems			40	40			80
9	Completion of service tasks on comfort and safety					40	40	80
10	Reparation of damages to chassis and braking systems					40	40	80
Specialisation								

11	Diagnosis and repair of networked drive, comfort and safety systems					40	40	80
12	Preparation of vehicles for safety tests and approvals					20	20	40
13	Reparation of drive components					40	40	80
14	Equipping, modification and retrofitting of systems and components					30	30	60
Vocational practical classes — Basic level								
G-K1/15	Repair technology 1 - Vehicle electrical systems	40						40
G-K2/15	Repair technology 2 - Vehicle mechatronics	40						40
G-K3/15	Repair technology 3 - Service and maintenance of vehicles		40					40
G-K4/15	Repair technology 4 - Vehicle repair and maintenance		40					40
Vocational practical classes — Specialist level								
K1/15	Diagnostic technology 1 - Electrical vehicle systems			40				40
K2/15	Diagnostic technology 2 - Motor management			40				40
K3/15	Diagnostic technology 3 - Chassis/brakes				40			40
K4/15	Diagnostic technology 4 - High voltage technology				40			40
K5/15	Diagnostic technology 5 - Vehicle data transmission					40		40
K6/15	Diagnostic technology 6 - Linked vehicle systems						40	40

Total-teaching units of theoretical and practical vocational training classes

1420

The contents of the practical training classes are presented below. Here the basic level courses Repair technology 1 – 4 are carried out according to the student's learning progress with the theoretical contents of the vocational training. After the transition to the 2nd training year, the specialist level courses Diagnostic Technology 1 to 6 shall follow.

1.

Training topic Repair technology 1 — Vehicle electrical systems

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Section	Contents	Time allocation
1.1 Commissioning and decommissioning vehicle technical systems	Application of manufacturer-specific specifications, safety regulations and protective measures, in particular, standards and regulations for electrical works on motor vehicles and high-voltage vehicles, as well as compliance with accident prevention regulations and technical rules	10 %
1.2 Measurement and testing of systems	Obtaining target data, selection of suitable measuring methods and instruments Recording and evaluating measured values with target data, in particular measuring, testing and evaluating electrical quantities and signals on components, modules and systems. Visual inspection of electrical connections, lines and line connections for mechanical damage. Checking functionality of electronic components, cables and fuses Documentation of test results	40 %
1.3. Implementation of service and maintenance work	Circuit diagrams and function charts and inspection of electrical lines, connections and mechanical connections in vehicles Documentation of work steps as well as test and measurement results	10 %
1.4 Diagnosis of faults and errors in vehicles and systems	Understanding customer complaints Identification of damage and malfunctions to electrical	15 %

	<p>and electronic systems of vehicles and their components</p> <p>Determination of errors and their causes with the aid of circuit diagrams and function charts</p> <p>Creation of test protocols and documentation of results</p>	
3.5 Disassembly, repair and assembly of components, modules and systems	<p>Dismantling and disassembly of components</p> <p>Assembly of components and functionality testing</p> <p>Inspection, repair and documentation of electrical connections and terminals</p>	25%

Integral parts

Additional knowledge and skills to be imparted within the context of the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication
 - Presentation of facts
- Planning and controlling of work processes, monitoring and assessment of work results
 - Planning and determination of work steps and procedures
 - Preparation of the work place taking the assigned work into account
 - Monitoring, evaluation and documentation of work results using target/actual value comparisons
 - Compliance with the manufacturer's safety instructions
- Quality management
 - Application of testing methods and testing equipment according to requirements
- Maintenance and servicing of operating materials
 - Cleaning and maintenance of operating resources

Training topic

Repair technology 2 — Vehicle mechatronics

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Operation of vehicles and systems	<p>Observation and implementation of safety and operations regulations and guidelines</p> <p>Application and explanation of operating instructions</p> <p>Handling of vehicle and system controls</p>	5 %
1.2 Decommissioning and commissioning of vehicle technical systems	<p>Implementation of manufacturer-specific specifications, accident prevention regulations and technical rules</p> <p>Verification of functionality and documentation of results</p>	5 %
1.3 Measurement and testing of systems	<p>Identification of target data, selection of measuring methods and instruments</p> <p>Recording and evaluation of measured values with target data</p> <p>Measurement and testing of physical parameters, particularly pressures and temperatures</p> <p>Documentation of test results</p>	35 %
1.4 Implementation of service and maintenance work	<p>Implementation of work and safety rules</p> <p>Inspection of mechanical modules and systems for wear, damage, impermeability, positional deviations and functionality</p> <p>Implementation of circuit diagrams and function charts Inspection of hydraulic, pneumatic and electrical lines, connections and mechanical connections</p> <p>Performance of functionality checks and documentation of work steps as well as testing and measurement results</p>	15 %

1.5 Diagnosis of errors and faults in vehicles and systems	<p>Understanding customer complaints, performance of functionality checks</p> <p>Identification of damage and malfunctions to mechanical, mechatronic and pneumatic systems of vehicles and their components</p> <p>Identification of errors and their causes with the aid of functional plans</p> <p>Creation of test protocols and documentation of results</p>	15 %
1.6 Disassembly, repair and assembly of components, modules and systems	<p>Decommissioning, disassembly, recyclability, labelling and systematic storage of components, modules and systems</p> <p>Assembly of components, modules and systems, commissioning and inspection of functionality and dimensional accuracy</p>	25%

Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication
 - Presentation of facts
 - Identification of vehicles, systems, components and modules
 - The reading and use of drawings / diagrams
- Planning and controlling of work processes, monitoring and assessment of work results
 - Planning and determination of work steps and procedures
 - Preparation of the work place taking the assigned work into account
 - Monitor evaluate and document work results using target/actual value comparisons
 - Compliance with the manufacturer's safety instructions
- Quality management
 - Implementation of testing equipment according to requirements
- Maintenance and servicing of operating materials
 - Cleaning and maintenance of operating resources

Training topic

Repair technology 3 - Service and maintenance of vehicles

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Operation of vehicles and systems	Menu navigation and use of information, communications, comfort and safety systems	5 %
1.2 Decommissioning and commissioning of vehicle technical systems	Application of manufacturer-specific guidelines Verification of functionality and documentation of results	5 %
1.3 Measurement and testing of systems	Electrical connections, Inspection of lines and line connections for mechanical damage Documentation of test results	20 %
1.4 Implementation of service and maintenance work	Application of work and safety rules and regulations as well as manufacturer guidelines during transport and lifting Moving, parking, lifting, supporting and securing vehicles, modules and systems The performance of maintenance work according to specifications, in particular, the monitoring of operating fluids, as well as their refilling and replacement including their proper disposal Inspection of mechanical modules and systems for wear, damage, impermeability, positional deviations and functionality Use of maintenance and testing instructions and the performance of maintenance work Implementation of functionality checks and the reading of error memories	

	The documentation of work steps as well as testing and measurement results	
1.5 Diagnosis of errors and faults in vehicles and systems	<p>Understanding customer complaints, implementation of functionality checks</p> <p>Creation of test protocols and documentation of results</p> <p>Identification of data communication between ECUs</p>	15 %
1.6 Disassembly, repair and assembly of components, modules and systems	Inspection of electrical connections and terminals	15 %

Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication
 - Presentation of facts
 - Communication with customers and safeguarding of previous and subsequent functional areas
 - Reading and implementation of repair, assembly, commissioning and operating instructions, catalogues, tables and diagrams
- Planning and controlling of work processes, monitoring and assessment of work results
 - Planning and determination of work steps and procedures
 - Preparation of the work place taking the assigned work into account
 - Monitoring, evaluation and documentation of work results using target/actual value comparisons
 - Observation of manufacturer safety instructions, particularly for vehicles with alternative drive systems
- Quality management
 - The systematic identification of errors and quality deficiencies, their elimination and the documentation of the work involved
- Maintenance and servicing of operating materials
 - Cleaning and maintenance of operating resources

Training topic

Repair technology 4 - Vehicle repair and maintenance

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Decommissioning and commissioning of vehicle technical systems	<p>Implementation of manufacturer-specific guidelines and accident prevention regulations</p> <p>Verification of functionality and documentation of results</p>	5 %
1.2 Measurement and testing of systems	<p>Obtaining target data, selection of suitable measuring methods</p> <p>Suitable selection of measuring tools for measuring and checking lengths, angles and surfaces</p> <p>Measurement of lengths, in particular with callipers, gauges and dial gauges, verification of compliance with tolerances and fits</p> <p>Verification of work pieces with angles, limit gauges and thread gauges</p> <p>Documentation of test results</p>	25%
1.3 Implementation of service and maintenance work	<p>Inspection of mechanical modules and systems for wear, Inspection for damages, leak tightness, positional variations and functionality</p>	5 %
1.4 Diagnosis of faults and errors in vehicles and systems	<p>Understanding customer complaints, implementation of functionality checks and definition of diagnostic paths</p> <p>Determination of damage and malfunctions to mechanical components</p> <p>Creation of test protocols and documentation of results</p>	20 %
1.5 Disassembly, repair and assembly of components, modules and systems	<p>Decommissioning of components, modules and systems, dismantling, disassembly and identification of substances hazardous to safety and health, determination of reusability, labelling and systematic storage.</p>	45 %

	<p>Allocation of disassembled components and modules systems and verification of completeness Cleaning, sanitisation, preservation and storage of components and modules</p> <p>Assembly of components, modules and systems, especially screw connections whilst considering the parts sequence and the torque</p> <p>Assembly of components, modules and systems, commissioning and inspection of functionality and dimensional accuracy</p> <p>Marking and centering of reference lines, hole centres and outlines considering the material properties, drilling and installation of work pieces, producing and repairing internal and external threads</p> <p>Reparation of components and systems subject to wear, in particular, brakes</p>	
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Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication
 - Use of the operational information system to process work orders and to obtain technical documents and information.
 - Presentation of facts
 - Communication with customers and safeguarding of previous and subsequent functional areas
 - Reading and implementation of repair, assembly, commissioning and operating instructions, catalogues, tables and diagrams
 - Interpretation of technical information
- Planning and controlling of work processes, monitoring and assessment of work results
 - Planning and determination of work steps and procedures
 - Identification of working materials, operating materials and auxiliary materials
 - Requesting, providing and documenting parts requirements, materials, tools and aids for specific orders
 - Determination of time requirements
 - Preparation of the work place taking the assigned work into account
 - Monitoring, evaluation and documentation of work results using target/actual value comparisons and the proposal of measures to improve work results

- Observation of manufacturer safety instructions, particularly for vehicles with alternative drive systems
- Quality management
 - Application of testing methods and testing equipment according to requirements
- Maintenance and servicing of operating materials
 - Cleaning and maintenance of operating resources

Training topic

Diagnostic technology 1 — Electrical vehicle systems

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Operation of vehicles and systems	Observation and implementation of instructions on safety and operation	5 %
1.2 Decommissioning and commissioning of vehicle technical systems	<p>Implementation of manufacturer-specific specifications, safety and protective measures, in particular, standards and regulations for electrical works on motor vehicles and high-voltage vehicles, as well as compliance with accident prevention regulations and technical rules</p> <p>Identification of increased hazard potential in vehicles</p> <p>Observation of safety specifications for high-voltage systems and securing of the work area</p> <p>Disconnection of systems from the power supply in accordance with work instructions, securing systems to prevent re-activation, ensuring that no voltage is present</p> <p>Verification of functionality and documentation of results</p> <p>Assessment and analysis of electrotechnical hazards</p>	10 %
1.3 Measurement and testing of systems	<p>Obtaining target data, selection of suitable measuring methods</p> <p>Implementation of protective measures against electrical current and electric arcs</p> <p>Acquisition of measured values and comparison with target data, particularly with regard to the measurement, testing and evaluation of electrical and electronic quantities and signals on components, modules and systems</p>	35 %

	<p>Electrical connections, lines and line connections for mechanical damage.</p> <p>Inspection of functionality of electrical components, lines and fuses</p> <p>Documentation of test results</p>	
1.4 Diagnosis of faults and errors in vehicles and systems	<p>Understanding customer complaints, implementation of functionality checks and definition of diagnostic paths</p> <p>Determination of errors and their causes with the aid of circuit diagrams and function charts</p> <p>Creation of test protocols and documentation of results</p> <p>Inspection, evaluation of on-board, charging, starting and lighting systems and parameterisation according to customer requirements, documentation of results</p> <p>Implementation of measures to avoid hazards due to insulation faults</p>	40 %
1.5 Disassembly, repair and assembly of components, modules and systems	<p>Establishment, inspection, maintenance and documentation of electrical connections and terminals</p> <p>Assembly and connection of electrical systems, inspection of functionality and provision of safety guarantees</p> <p>Observation of electrotechnical safety rules when working</p>	10%

Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication
 - Use of the operational information system to process work orders and to obtain technical documents and information.
 - Conducting conversations according to the situation, presentation of facts and use of English technical terms
 - Communication with customers and safeguarding of previous and subsequent functional areas

- Reading and application of circuit diagrams, connection diagrams, wiring diagrams, layout diagrams and function charts
- Planning and controlling of work processes, monitoring and assessment of work results
 - Monitoring, evaluation and documentation of work results using target/actual value comparisons and the proposal of measures to improve work results
 - Observation of manufacturer safety instructions, particularly for vehicles with alternative drive systems
- Quality management
 - Application of testing methods and testing equipment according to requirements
- Maintenance and servicing of operating materials
 - Cleaning and maintenance of operating resources

Training topic

Diagnostic technology 2 — Motor management

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Implementation of service and maintenance work	<p>Performance of adjustment work on vehicles and systems</p> <p>Creation and interpretation of test and measurement protocols</p>	10 %
1.2 Diagnosis of faults and errors in vehicles and systems	<p>Identification of system conditions using diagnostic systems, comparison with information in databases and evaluation of results</p> <p>Determination and updating of control software, implementation of reset and basic settings on vehicle systems and adjustment of learning values</p> <p>Performance of adjustment work on vehicles and systems</p> <p>Determination of diagnostic and repair possibilities</p> <p>Determination of causes of malfunctions with the aid of diagnostic systems</p> <p>Inspection and diagnosis of drive units including engine management systems, exhaust systems and ancillary units</p>	65 %
1.3 Disassembly, repair and assembly of components, modules and systems	<p>Identification of repair measures following diagnostics, Implementation of repair methods</p>	15 %
1.4 Implementation of vehicle inspections in accordance with legal requirements	<p>Preparation of vehicles for statutory tests</p> <p>Determination of target and actual values using diagnostic systems recording of settings values, implementation of settings and documentation of results</p>	10 %

Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication
 - Implementation of fault and damage analysis by means of a limited customer survey
 - Planning and controlling of work processes, monitoring and assessment of work results
 - Identification of correct testing equipment and determination of its use
 - Identification and logging of damage to adjacent components and modules and implementation of measures to remedy them
- Quality management
 - Review, evaluation and logging of one's own work results as well as those of others

Training topic

Diagnostic technology 3 — Chassis/brakes

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Implementation of service and maintenance work	Implementation of adjustment work on vehicles and systems Creation and interpretation of test and measurement protocols	10 %
1.2 Diagnosis of faults and errors in vehicles and systems	Determination of diagnostic and repair possibilities Determination of the causes of malfunctions in drive, chassis, comfort and safety systems with the aid of diagnostic systems Performance of chassis measurement and the creation of measurement protocols Testing and assessment of brake, chassis, spring, damping and level control systems	55 %
1.3 Disassembly, repair and assembly of components, modules and systems	Reparation of chassis, suspension, damping and level control systems	25%
1.4 Implementation of vehicle inspections in accordance with legal requirements	Preparation of vehicles for statutory tests Determination of the road worthiness and operational safety condition of motor vehicles, documentation of defects and the implementation of measures to eliminate them Determination of target and actual values using diagnostic systems recording of settings values, implementation of settings and documentation of results	10 %

Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication

- Reading and application of circuit diagrams, wiring diagrams, layout diagrams, function charts as well as reading and observation of function charts for pneumatic and hydraulic vehicle controls and power transmissions
- Quality management
 - Review, evaluation and logging of one's own work results as well as those of others

Training topic

Diagnostic technology 4 — High voltage technology

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Operation of vehicles and systems	Observation and implementation of instructions on safety and operation	5 %
1.2 Decommissioning and commissioning of vehicle technical systems	<p>Manufacturer-specific specifications, safety and protective measures, in particular, standards and regulations for electrical works on motor vehicles and high-voltage vehicles, as well as compliance with accident prevention regulations and technical rules</p> <p>Identification of increased hazard potential in vehicles</p> <p>Observation of safety specifications for high-voltage systems and securing of the work area</p> <p>Disconnection of systems from the power supply in accordance with work instructions, securing systems to prevent re-activation, ensuring that no voltage is present Verification of functionality and documentation of results</p> <p>Assessment and analysis of electrotechnical hazards</p> <p>Ensuring vehicle systems are in a safe maintenance and repair condition, in particular, under observation of any potentially explosive substances, fuels, gases, liquids and electrical voltages.</p> <p>Commissioning and decommissioning of vehicle technical and electrical systems</p>	40 %
1.3 Measurement and testing of systems	<p>Observation of protective measures to prevent electric shocks and electrical arcs</p> <p>Visual inspection of electrical connections, power lines and</p>	30 %

	<p>line connections for mechanical damage</p> <p>Inspection of functionality of electrical components, lines and fuses</p> <p>Testing and evaluation of earthing and equipotential bonding conductors</p> <p>Measurement and evaluation of insulation resistances</p>	
1.4 Diagnosis of faults and errors in vehicles and systems	<p>Implementation of measures to combat hazards due to insulation faults</p> <p>Use of expert systems in particular, with regard to guided troubleshooting, database and telephone diagnosis, hotline use</p>	10 %
1.5 Disassembly, repair and assembly of components, modules and systems	<p>Establishment, inspection, maintenance and documentation of electrical connections and terminals</p> <p>Assembly and connection of electrical systems, inspection of functionality and provision of safety guarantees</p> <p>Observation of electrical safety rules when working on electrical systems, in particular, on high voltage systems and fuel cells</p> <p>Replacement of high voltage components</p>	15 %

Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Planning and preparation of work processes as well as monitoring and evaluation of work results
 - Identification of correct testing equipment and determination of its use
 - Identification and logging of damage to adjacent components and modules and implementation of measures to remedy them
- Operational, technical and customer-oriented communication
 - Reading and application of circuit diagrams, connection diagrams, wiring diagrams, layout diagrams and function charts
 - Implementation, application and use of service information including from English language documents

- Quality management
 - Review, evaluation and logging of one's own work results as well as those of others

Training topic

Diagnostic technology 5 — Vehicle data transmission

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Implementation of service and maintenance work	Creation and interpretation of test and measurement protocols	10 %
1.2 Diagnosis of faults and errors in vehicles and systems	<p>Identification of data communication between ECUs</p> <p>Determination of system states with the help of diagnostic systems, comparison with information in databases and evaluation of results</p> <p>Use of trouble shooting programs, manufacturer information and databases as well as hotlines and tele diagnostics</p> <p>Determination and updating of control software, implementation of reset and basic settings on vehicle systems and adjustment of learning values</p> <p>Recording and evaluation of data communication between ECUs</p> <p>Identification and localisation of errors in wireless signal transmission systems</p>	65 %
1.3 Disassembly, repair and assembly of components, modules and systems	Reparation of electrical and optoelectronic data communication cables	15 %
1.4 Equipping, modification and retrofitting of vehicles	<p>Integration of components and systems into the vehicle network</p> <p>Coding and configuration of ECUs, updating software versions, documentation of changes</p> <p>Upgrading of signal processing systems, components and circuits for optical transmission systems</p> <p>Equipping of motor vehicles with wireless signal</p>	10 %

	transmission systems, antenna systems and entertainment electronics	
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Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Quality management
 - Review, evaluation and logging of one's own work results as well as those of others

Training topic

Diagnostic technology 6 — Linked vehicle systems

The following qualifications should be taught in an action-oriented and interlinked manner on the basis of tasks that relate to customer orders.

Differentiation	Contents	Time allocation
1.1 Implementation of service and maintenance work	Creation and interpretation of test and measurement protocols	10 %
1.2 Diagnosis of faults and errors in vehicles and systems	<p>Identification of data communication between ECUs</p> <p>Determination of system states with the help of diagnostic systems, comparison with information in databases and evaluation of results</p> <p>Use of trouble shooting programs, manufacturer information and databases as well as hotlines and tele diagnostics</p> <p>Determination and updating of control software, implementation of reset and basic settings on vehicle systems and adjustment of learning values</p> <p>Determination of diagnostic and repair options based on the customer's order</p> <p>Testing, evaluation and configuration of comfort, safety and driver assistance systems according to customer requirements, Documentation of results</p> <p>Determination of the causes of malfunctions to the drive, chassis, comfort and safety systems with the aid of diagnostic systems</p> <p>Testing and evaluation of body systems, in particular, locking systems, convertible roof systems and sliding roofs</p> <p>Recording and evaluation of data communication between ECUs</p>	65 %

	<p>Localisation of errors in wireless signal transmission systems</p> <p>Use of expert systems in particular, with regard to guided troubleshooting, database and telephone diagnosis, hotline use</p>	
1.3 Disassembly, repair and assembly of components, modules and systems	Reparation of electrical and optoelectronic data communications lines	15 %
1.4 Equipping, modification and retrofitting of vehicles	<p>Integration of components and systems into the vehicle network</p> <p>Coding and configuration of ECUs, updating software versions, documentation of changes</p> <p>Upgrading of signal processing systems, components and circuits for optical transmission systems</p> <p>Equipping of motor vehicles with wireless signal transmission systems, antenna systems and entertainment electronics</p>	10 %

Integral parts

Additional knowledge and skills to be imparted in connection with the course:

- Observation and application of work safety, environmental protection and rational energy-use measures. Observation of occupational safety and accident prevention regulations.
- Operational, technical and customer-oriented communication
 - Reading and application of circuit diagrams, connection diagrams, wiring diagrams, layout diagrams and function charts
 - Application and use of knowledge databases
- Quality management
 - Review, evaluation and logging of one's own work results as well as those of others

3. General acquisition of competences

3.1 Foreign language communication

Foreign language content should complement the theoretical learning modules in accordance with the profession's industry requirements. In order to take into account the automotive industry in particular, it is advisable to teach student's English as a lot of information and technical terms used by manufacturers are in English. The following approaches can be integrated into the modules or taught as an independent subject:

- a. Summary of essential statements from foreign language texts (listening and reading)
 - Understanding and evaluation of regulations, rules and technical documents
 - Understanding and evaluation of manufacturer documents (plans, drawings)
 - Understanding and evaluation of information with regard to on-board electronics
 - Understanding and evaluation of regulations on occupational safety and environmental protection
 - Understanding and evaluation of customer complaints
- b. Preparation of oral and written messages of all kinds in the foreign language
 - Description of typical tasks that are part of the vocational training
 - Presentation of results in a team
 - Creation of manuals and instructions for use for the customer
 - Creation of work plans, documentation of work steps
 - Notification of the customer with regard to the condition of the vehicle and any defects or repairs
 - Documentation of customer complaints
- c. Translation of texts, facts and problems from one language to the other
 - Translation of operating and instruction manuals
 - Translation of measurement catalogues
- d. Leading of conversations and the exchange of written messages in the foreign language
 - Communication of shared experiences at the workplace and on the basis of work assignments
 - Exchanging of information with customers about the feasibility of the order and the explanation of any necessary additional work
 - Provision of consultation with customers

3.2 Acquisition of competence in economics and business administration

Apprentices who have completed their vocational training should be able to demonstrate that they understand, present and also assess general economic and social contexts in the world of work and professional employment. Therefore, a vocational education not only prepares students for a specific subject, but also for life. For this reason, the subject of economics and business administration should impart knowledge according to the following approaches:

- a. Securing one's professional existence
 - Development of professional identity, development of professional prospects, also taking family planning into account
 - The seizing of opportunities to secure one's existence
 - Balancing of entrepreneurial opportunities and risks
- b. Assessment of costs
 - Planning of cost processes, analysis of personnel costs
 - Identification of costs and calculation of prices

- Preparation of investment decisions and the assessment of the economic viability of other companies
- c. Communication with customers and suppliers
 - Conclusion of contracts and the handling of contractual obligations
 - Identification of compensation claims
 - Instruction of customers in the use of products and services
 - Presentation of a company and promotion of its identity
 - Evaluation of competitive situations and the determination of a resulting course of action from them
- d. Organisation of production processes / services (see also p. 23)
 - Planning and controlling of work processes
 - Conservation of resources
 - Development of work steps in humane manner
 - Ensuring quality standards
 - Organisation of material procurement and storage
 - Assessment of incentives resulting from remuneration systems
- e. Best serving the interests of the company
 - Reflection of the individual roles in the company
 - Observation of legal, collective bargaining and operational framework conditions
 - Contributing to a positive working atmosphere
 - Seizing of co-determination opportunities
 - Representation of both individual and common rights

3.3 Acquisition of competence in the field of IT and Data processing

With regard to IT and data processing, trainees should be familiarised with current Microsoft Office applications and be able to operate them confidently.

3.4 Acquisition of competence in Politics and Social Studies

As part of the vocational training this acquisition of competence prepares students for the independent development of political judgement and the competence to act. This independent subject should be taught to the trainees according to the following approaches

- a. Securing and developing democracy
 - Determination of the risks and the securing of fundamental and human rights, for example, demonstration of the value of due diligence at work and the formation of the student's own values from this
 - The influence of politics on the world around us
- b. The opportunities and risks of internationalisation and globalisation
 - Identification of the consequences of the process of Europeanisation on politics, society and the economy
- c. The safeguarding of peace and conflict resolution procedures

As a result of the integration of general competence acquisition, the school curriculum now totals 2132 teaching hours. Furthermore, the content learned as part of the course should be practised and consolidated in the training organisation / company providing the internship.

		Teaching year 1		Teaching year 2		Teaching year 3		
		1	2	3	4	5	6	
Vocational theoretical classes								Total
1	Service and inspect vehicles and systems according to specifications	40	40					80
2	Test, dismantle, exchange and assemble simple modules and systems	50	50					100
3	Identifying and eliminating functional problems	50	50					100
4	Implementation of retrofitting work according to customer requirements	20	20					40
5	Implementation of inspections and additional work			30	30			60
6	Diagnosis and rectification of malfunctions in on-board power systems, charging current systems and starting systems			40	40			80
7	Reparation of modules and systems exposed to wear and tear			30	30			60
8	Diagnosis of mechatronic drive management systems			40	40			80
9	Completion of service tasks on comfort and safety					40	40	80
10	Reparation of damages to chassis and braking systems					40	40	80
Specialisation								
11	Diagnosis and repair of networked drive, comfort and safety systems					40	40	80
12	Preparation of vehicles for safety tests and approvals					20	20	40
13	Reparation of drive components					40	40	80

14	Equipping, modification and retrofitting of systems and components						30	30	60
Vocational practical classes - Basic level									
G-K1/15	Repair technology — Vehicle electrical systems	40							40
G-K2/15	Repair technology — Vehicle mechatronics	40							40
G-K3/15	Repair technology - Service and maintenance of vehicles		40						40
G-K4/15	Repair technology - Vehicle repair and maintenance		40						40
Vocational practical classes - Specialist level									
K1/15	Diagnostic technology 1 - Electrical vehicle systems			40					40
K2/15	Diagnostic technology 2 - Motor management			40					40
K3/15	Diagnostic technology 3 - Chassis/brakes				40				40
K4/15	Diagnostic technology 4 - High voltage technology					40			40
K5/15	Diagnostic technology 5 - Vehicle data transmission					40			40
K6/15	Diagnostic technology 6 - Linked vehicle systems						40		
Multi-vocational training									
1	Native language and communication	30	30	20	20	20	20	20	140
2	Religious education	10	10	10	10				40
3	IT and data processing	16	16	16	16	16	16		96
4	Politics and Social Studies	30	30	20	20	16	16		132
5	Foreign language communication	20	20	20	20	20	20		120
6	Economics and Business Management	24	24	24	24	24	24		144
7	Consideration of scientific laws	40	20	20					80
Total hours per half year		410	390	350	290	386	346		2132

Weeks per half year	12	11	10	8	11	10	59
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General training plan
for vocational education and training
in the occupation of motor vehicle mechatronics technician

Ausbildungsrahmenplan
für die Berufsausbildung zum/zur
Kraftfahrzeugmechatroniker/-in

Section I: Basic vocational education and training

Abschnitt I: Berufliche Grundbildung

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
1	Vocational education and training, employment and collective bargaining law (§ 4 No. 1) Berufsbildung, Arbeits- und Tarifrecht	a) Explain significance of the training contract, especially in respect of qualification, duration of training and termination b) State mutual rights and responsibilities contained within the training contract c) State opportunities for further vocational education and training d) State essential elements of the contract of employment e) State essential stipulations in respect of collective wage agreements applying to the company providing training	a) Bedeutung des Ausbildungsvertrages, insbesondere Abschluss, Dauer und Beendigung erklären b) Gegenseitige Rechte und Pflichten aus dem Ausbildungsvertrag nennen c) Möglichkeiten der beruflichen Fortbildung nennen d) Wesentliche Teile des Arbeitsvertrages nennen e) Wesentliche Bestimmungen der für den ausbildenden Betrieb geltenden Tarifverträge nennen
2	Structure and organisation of the company providing training (§ 4 No. 2)	a) Explain structure and tasks of the company providing training b) Explain basic functions of the company providing training such as procurement, production, sales and administration	a) Aufbau und Aufgaben des ausbildenden Betriebes erläutern b) Grundfunktionen des ausbildenden Betriebes wie Beschaffung, Fertigung, Absatz und Verwaltung erklären

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
	<p>Aufbau und Organisation des Ausbildungsbetriebes</p>	<p>c) State relationships of the company providing training and its employees to organisations within trade and industry, vocational representative bodies and trade unions</p> <p>d) Describe basic functions, tasks and way of working of organs relating to works constitution and employee representation legislation in respect of the company providing training</p>	<p>c) Beziehungen des ausbildenden Betriebes und seiner Beschäftigten zu Wirtschaftsorganisationen, Berufsvertretungen und Gewerkschaften nennen</p> <p>d) Grundlagen, Aufgaben und Arbeitsweise der betriebsverfassungs- oder personalvertretungsrechtlichen Organe des ausbildenden Betriebes beschreiben</p>
3	<p>Health and safety at work (§ 4 No. 3)</p> <p>Sicherheit und Gesundheitschutz bei der Arbeit</p>	<p>a) Ascertain risks to health and safety in the workplace and take measures for avoidance of same</p> <p>b) Apply occupation related health and safety standards and accident prevention regulations</p> <p>c) Describe procedures to be adopted in the event of accidents and take initial measures</p> <p>d) Apply regulations for prevention of fire; describe procedures to be adopted in the event of fire and take measures to tackle fires</p>	<p>a) Gefährdung von Sicherheit und Gesundheit am Arbeitsplatz feststellen und Maßnahmen zu ihrer Vermeidung ergreifen</p> <p>b) Berufsbezogene Arbeitsschutz- und Unfallverhütungsvorschriften anwenden</p> <p>c) Verhaltensweisen bei Unfällen beschreiben sowie erste Maßnahmen einleiten</p> <p>d) Vorschriften des vorbeugenden Brandschutzes anwenden; Verhaltensweisen bei Bränden beschreiben und Maßnahmen der Brandbekämpfung ergreifen</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
4	Environmental protection (§ 4 No. 4) Umweltschutz	Contribute to the avoidance of environmental pollution caused by the company within individual area of activity, in particular relating to a) Using examples to explain potential environmental pollution caused by the company providing training and the contribution the company makes to environmental protection b) Applying existing company regulations relating to environmental protection c) Taking advantage of opportunities to use economically and environmentally friendly sources of energy and materials d) Avoiding waste; arranging for environmentally friendly disposal of substances and materials	Zur Vermeidung betriebsbedingter Umweltbelastungen im beruflichen Einwirkungsbereich beitragen, insbesondere a) mögliche Umweltbelastungen durch den Ausbildungsbetrieb und seinen Beitrag zum Umweltschutz an Beispielen erklären b) für den Ausbildungsbetrieb geltende Regelungen des Umweltschutzes anwenden c) Möglichkeiten der wirtschaftlichen und umweltschonenden Energie- und Materialverwendung nutzen d) Abfälle vermeiden; Stoffe und Materialien einer umweltschonenden Entsorgung zuführen
5	Planning and preparation of work processes and the monitoring and evaluation of work results (§ 4 No. 5)	a) Plan and establish stages of work and work processes in accordance with functional, organisational, technical and economic criteria and in accordance with manufacturers' instructions b) Determine working materials, company resources and auxiliary materials c) Requisition, prepare and document required parts, material, tools and auxiliary materials in an order related way	a) Arbeitsschritte und -abläufe nach funktionalen, organisatorischen, technischen und wirtschaftlichen Kriterien sowie nach Herstellervorgaben planen und festlegen b) Werkstoffe, Betriebsmittel und Hilfsstoffe ermitteln c) Teilebedarf, Material, Werkzeuge und Hilfsmittel auftragsbezogen anfordern, bereitstellen und dokumentieren

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
	Planen und Vorbereiten von Arbeitsabläufen sowie Kontrollieren und Bewerten der Arbeitsergebnisse	<ul style="list-style-type: none"> d) Determine time requirement e) Prepare workplace with due consideration to job in hand f) Check, evaluate and document work results by deploying actual versus estimate comparisons and propose measures for the improvement of work results 	<ul style="list-style-type: none"> d) Zeitbedarf ermitteln e) Arbeitsplatz unter Berücksichtigung des Arbeitsauftrages vorbereiten f) Arbeitsergebnisse durch Soll-Ist-Wertvergleiche kontrollieren, bewerten, dokumentieren und Maßnahmen vorschlagen
6	Quality management (§ 4 No. 6) Qualitätsmanagement	<ul style="list-style-type: none"> a) Deploy testing procedures and materials as required b) Investigate causes of errors and quality deficiencies in a systematic way, make a contribution to overcoming same document work c) Use the company's quality management system 	<ul style="list-style-type: none"> a) Prüfverfahren und Prüfmittel anforderungsbezogen anwenden b) Ursachen von Fehlern und Qualitätsmängeln systematisch suchen, zur Beseitigung beitragen und dokumentieren c) Qualitätsmanagementsystem des Betriebes anwenden
7	Measuring and testing systems (§ 4 No. 7) Messen und Prüfen an Systemen	<ul style="list-style-type: none"> a) Select procedures and measuring equipment, estimate errors of measurement b) Measure, test and evaluate electric and electronic values and signals in subassemblies and systems, document test results c) Make visual inspection of electrical connections, wires and wire connections for mechanical damage d) Test the function of electrical components, wires and fuses 	<ul style="list-style-type: none"> a) Verfahren und Messgeräte auswählen, Messfehler abschätzen b) Elektrische, elektronische Größen und Signale an Baugruppen und Systemen messen, prüfen und beurteilen, Prüfergebnisse dokumentieren c) Elektrische Verbindungen, Leitungen und Leitungsanschlüsse auf mechanische Schäden sichtbar prüfen d) Funktion elektrischer Bauteile, Leitungen und Sicherungen prüfen

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<ul style="list-style-type: none"> e) Select and use measuring tools to measure and check lengths, angles and areas f) Measure lengths, in particular by using calliper gauges, micrometers and metering clockwork, test compliance with tolerances and fits g) Test work pieces with set squares, limit gauges and thread gauges h) Measure, test and document test results of physical values, especially in relation to pressures and temperatures 	<ul style="list-style-type: none"> a) Messzeuge zum Messen und Prüfen von Längen, Winkeln und Flächen auswählen und anwenden b) Längen, insbesondere mit Messschiebern, Messschrauben und Messuhren messen, Einhaltung von Toleranzen und Passungen prüfen c) Werkstücke mit Winkeln, Grenzlehren und Gewindelehren prüfen d) Physikalische Größen, insbesondere Drücke und Temperaturen messen, prüfen und Prüfergebnisse dokumentieren
8	<p>Company and technical communication (§ 4 No. 8)</p> <p>Betriebliche und technische Kommunikation</p>	<ul style="list-style-type: none"> a) Evaluate significance of information, communication and documentation for economic operational procedures and make a contribution to the avoidance of malfunctions b) Deploy company information system to process jobs and use same to obtain technical documentation and information c) Conduct appropriate discussions with line managers, employees and in group situations, present facts and use specialist terminology in German and English d) Secure communication with upstream and downstream functional areas 	<ul style="list-style-type: none"> a) Bedeutung der Information, Kommunikation und Dokumentation für den wirtschaftlichen Betriebsablauf beurteilen und zur Vermeidung von Störungen beitragen b) Betriebliches Informationssystem zum Bearbeiten von Arbeitsaufträgen anwenden und zur Beschaffung von technischen Unterlagen und Informationen nutzen c) Gespräche mit Vorgesetzten, Mitarbeitern und in der Gruppe situationsgerecht führen, Sachverhalte darstellen sowie deutsche und englische Fachausdrücke anwenden d) Kommunikation mit vorausgehenden und nachfolgenden Funktionsbereichen sicherstellen

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<ul style="list-style-type: none"> e) Handle data storage media and comply with data protection; read analogue and digital measuring and test data f) Identify vehicles, systems, components and sub-assemblies g) Read and use drawings, prepare sketches h) Read and use instruction manuals and instructions relating to repair, assembly and putting into service; read and use catalogues, tables and diagrams i) Read and use circuit diagrams, flow diagrams, connection plans, layouts and functional plans k) Read and take account of functional plans relating to vehicle pneumatics and hydraulics control systems and power transmission l) Use regulations and guidelines relating to road traffic safety and road traffic behaviour 	<ul style="list-style-type: none"> e) Datenträger handhaben und Datenschutz beachten; digitale und analoge Mess- und Prüfdaten lesen f) Fahrzeuge, Systeme, Bauteile und Baugruppen identifizieren g) Zeichnungen lesen und anwenden, Skizzen anfertigen h) Instandsetzungs-, Montage-, Inbetriebnahme- und Betriebsanleitungen, Kataloge, Tabellen, Diagramme lesen und anwenden i) Schaltpläne, Stromlaufpläne, Anschlusspläne, Anordnungspläne und Funktionspläne lesen und anwenden k) Funktionspläne fahrzeugpneumatischer und hydraulischer Steuerungen und Kraftübertragungen lesen und beachten l) Vorschriften und Richtlinien für die Verkehrssicherheit sowie für das Verhalten im Straßenverkehr anwenden
9	Communication with internal and external customers (§ 4 No. 9)	<ul style="list-style-type: none"> a) Receive requests and information from customers, pass on same within the company and take due account of regulations relating to same b) Comply with regulations in respect of providing information about maintenance work 	<ul style="list-style-type: none"> a) Kundenwünsche und Informationen nach Anleitung entgegennehmen, im Betrieb weiterleiten und berücksichtigen b) unter Anleitung auf Instandhaltungsarbeiten hinweisen

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
	Kommunikation mit internen und externen Kunden	<ul style="list-style-type: none"> c) Comply with regulations in respect of operating accessories and extra features, indicate safety rules and regulations d) indicate safety rules and regulations 	<ul style="list-style-type: none"> c) hinsichtlich der Bedienung des Zubehörs und der Zusatzeinrichtungen nach Anleitung informieren d) auf Sicherheitsregeln und Vorschriften hinweisen
10	<p>Operating vehicles and systems (§ 4 No. 10)</p> <p>Bedienen von Fahrzeugen und Systemen</p>	<ul style="list-style-type: none"> a) Comply with and use regulations and information relating to safety and operation b) Read, use and explain operating instructions c) Use operational controls of vehicles d) Use operational controls of systems, in particular with relation to plants, machines or devices 	<ul style="list-style-type: none"> a) Vorschriften und Hinweise zur Sicherheit und zur Bedienung beachten und anwenden b) Bedienungsanleitungen lesen, anwenden und erklären c) Bedienelemente von Fahrzeugen anwenden d) Bedienelemente von Systemen, insbesondere Anlagen, Maschinen oder Geräten anwenden
11	<p>Maintaining, testing and adjusting vehicles, systems and operational equipment (§ 4 No. 11)</p> <p>Warten, Prüfen u. Einstellen von Fahrzeugen und Systemen sowie von Betriebseinrichtungen</p>	<ul style="list-style-type: none"> a) Use health and safety rules and manufacturers' guidelines when transporting materials or lifting same by hand b) Move, deposit, lift, support and secure vehicles, subassemblies and systems c) Carry out maintenance work in line with standards, in particular test, fill, change and contribute to the disposal of operational liquids, document stages of work d) Test mechanical and electrical components, subassemblies and systems for wear and tear, damage, leaks, deviation of position and functionality, document stages of work 	<ul style="list-style-type: none"> a) Arbeits- und Sicherheitsregeln, sowie Herstellerrichtlinien beim Transport und Heben von Hand anwenden b) Fahrzeuge, Baugruppen und Systeme bewegen, abstellen, anheben, abstützen und sichern c) Wartungsarbeiten nach Vorgabe durchführen, insbesondere Betriebsflüssigkeiten kontrollieren, nachfüllen, wechseln und zur Entsorgung beitragen, Arbeitsschritte dokumentieren d) Mechanische und elektrische Bauteile, Baugruppen und Systeme auf Verschleiß, Beschädigungen, Dichtheit, Lageabweichungen und Funktionsfähigkeit prüfen und dokumentieren

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<ul style="list-style-type: none"> e) Test hydraulic, pneumatic and electrical wires, line terminations and electrical connections and document test results f) Test and adjust pressures within pneumatic and hydraulic systems g) Give due consideration to maintenance when dealing with vehicles and operating equipment 	<ul style="list-style-type: none"> e) hydraulische, pneumatische und elektrische Leitungen, Anschlüsse und mechanische Verbindungen prüfen und Prüfergebnisse dokumentieren f) Drücke an pneumatischen und hydraulischen Systemen messen und einstellen g) Beim Umgang mit Fahrzeugen und Betriebseinrichtungen die Werterhaltung berücksichtigen
12	<p>Assembling, disassembling and repairing components, subassemblies and systems (§ 4 No. 12)</p> <p>Montieren, Demontieren und Instandsetzen von Bauteilen, Baugruppen und Systemen</p>	<ul style="list-style-type: none"> a) Take components, subassemblies and systems out of service, disassemble, dismantle same, check for recycling potential of same, classify and systematically store same b) Collate disassembled components, subassemblies and systems and check for completeness c) Clean, purify, preserve and store components and subassemblies d) Join components, subassemblies and systems together, in particular using threaded joint fittings paying due regard to order of components and torque. e) Assemble components, subassemblies and systems, put same into operational use and test same for functionality and precision. f) Prepare surfaces for protection against corrosion, reapply and replace protection against corrosion 	<ul style="list-style-type: none"> a) Bauteile, Baugruppen und Systeme außer Betrieb nehmen, demontieren, zerlegen, auf Wiederverwertbarkeit prüfen, kennzeichnen und systematisch ablegen b) Demontierte Bauteile und Baugruppen Systemen zuordnen und auf Vollständigkeit prüfen c) Bauteile und Baugruppen säubern, reinigen, konservieren und lagern d) Fügen, insbesondere Schraubverbindungen unter Beachtung der Teilefolge und des Drehmomentes herstellen e) Bauteile, -gruppen und Systeme montieren, in Betrieb nehmen sowie auf Funktion und Formgenauigkeit prüfen f) Oberflächen für den Korrosionsschutz vorbereiten, Korrosionsschutz ergänzen und erneuern

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<ul style="list-style-type: none"> g) Test position of components and subassemblies, measure deviations of position h) Mark and punch reference lines, drill holes and outlines paying due regard to the nature of the working material, separate and reshape components and semi-finished components i) Determine and adjust settings for hand-held and fixed machines, drill and countersink work pieces and components k) Produce and repair internal and external screw threads l) Produce, monitor, repair and document electrical connections and terminations 	<ul style="list-style-type: none"> g) Lage von Bauteilen und Baugruppen prüfen, Lageabweichungen messen h) Unter Berücksichtigung der Werkstoffeigenschaften Bezugslinien, Bohrungsmitten und Umrisse anreißen und körnen, Bauteile und Halbzeuge trennen und umformen i) Maschinenwerte von handgeführten und ortsfesten Maschinen bestimmen und einstellen; Werkstücke und Bauteile bohren und senken j) Innen- und Außengewinde herstellen und instandsetzen k) Elektrische Verbindungen und Anschlüsse herstellen, überprüfen, instandsetzen und dokumentieren

Section II: Specialist vocational education and training

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
13	<p>Planning and preparation of work processes and the monitoring and evaluation of work results (§ 4 No. 5)</p> <p>Planen und Vorbereiten des Arbeitsablaufes sowie Kontrollieren und Bewerten der Arbeitsergebnisse</p>	<p>a) Plan, check and evaluate work processes, paying due regard to the job at hand, maintenance regulations, installation instructions and the prevailing staff and technical conditions</p> <p>b) Stipulate requirements for the job at hand in respect of time, components, materials, operational materials and auxiliary materials</p> <p>c) Stipulate requirements in respect of workplace, tools, testing tools and deployment of same</p> <p>d) Recognise and log damage to contiguous components and subassemblies and take measures to eliminate same</p> <p>e) Check and document road traffic and operational safety</p> <p>f) Comply with safety information issued by manufacturers, in particular regarding vehicles with alternative drive systems</p> <p>g) Plan team work, divide up tasks and evaluate results of cooperation</p> <p>h) Prepare vehicles for delivery to customers</p>	<p>a) Arbeitsabläufe unter Berücksichtigung des Arbeitsauftrages, der Instandhaltungsvorgaben, Einbauanleitungen, der personellen und technischen Gegebenheiten planen, kontrollieren und bewerten</p> <p>b) Zeit-, Teile- und Materialbedarf sowie Betriebs- und Hilfsstoffe für den Arbeitsauftrag festlegen</p> <p>c) Arbeitsplatzbedarf festlegen, Werkzeuge und Prüfmittel ermitteln sowie deren Einsatz abstimmen</p> <p>d) Schäden an angrenzenden Bauteilen und Baugruppen erkennen, protokollieren und Maßnahmen zu ihrer Beseitigung einleiten</p> <p>e) Kontrollieren und Dokumentieren der Verkehrs- und Betriebssicherheit</p> <p>f) Sicherheitshinweise der Hersteller, insbesondere bei Kraftfahrzeugen mit alternativen Antrieben beachten</p> <p>g) Arbeit im Team planen, Aufgaben aufteilen und Ergebnisse der Zusammenarbeit auswerten</p> <p>h) Kraftfahrzeuge zur Kundenübergabe vorbereiten</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
14	<p>Quality management (§ 4 No. 6)</p> <p>Qualitätsmanagement</p>	<p>a) Comply with guidelines to assure quality of products and work</p> <p>b) Comply with test and maintenance intervals of operational and testing tools and take appropriate action</p> <p>c) Comply with and use procedures for product recalls or improvements</p> <p>d) Make a contribution to continuous improvement process regarding work processes in own area of work</p> <p>e) Seek, evaluate, eliminate and document causes of errors or defects within the work process in a systematic way, assess consequences of errors and defects</p> <p>f) Monitor, evaluate and log own work results and work results of others</p> <p>g) fehlt auch im Original</p>	<p>a) Richtlinien zur Sicherung der Produkt- und Arbeitsqualität beachten</p> <p>b) Prüf- und Wartungsfristen von Betriebs- und Prüfmitteln beachten und Maßnahmen einleiten</p> <p>c) Verfahrensabläufe für Rückrufmaßnahmen oder Nachbesserungen beachten und anwenden</p> <p>d) Zur kontinuierlichen Verbesserung von Arbeitsvorgängen im eigenen Arbeitsbereich beitragen</p> <p>e) Ursachen von Fehlern und Mängeln im Arbeitsprozess systematisch suchen, bewerten, beseitigen und dokumentieren, Folgewirkungen von Fehlern und Mängeln abschätzen</p> <p>f) Eigene und von anderen erbrachte Arbeitsergebnisse überprüfen, bewerten und protokollieren</p> <p>g) Qualitätsmanagementsystem des Betriebes anwenden</p>
15	<p>Company and technical communication (§ 4 No. 8)</p> <p>Betriebliche und technische Kommunikation</p>	<p>a) Use communication and information systems</p> <p>b) Interpret, prepare, impart, present and document technical information</p> <p>c) Comply with laws and regulations, in particular regarding vehicle registration</p> <p>d) Use electrical, electronic, electro pneumatic and electro hydraulic circuit diagrams and functional plans of vehicles</p>	<p>a) Kommunikations- und Informationssysteme nutzen</p> <p>b) Technische Informationen interpretieren, aufbereiten, vermitteln, präsentieren und dokumentieren</p> <p>c) Gesetze und Vorschriften, insbesondere über die Zulassung im Straßenverkehr beachten</p> <p>d) Elektrische, elektronische, elektropneumatische und elektrohydraulische Schalt- und Funktionspläne von Kraftfahrzeugen anwenden</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<ul style="list-style-type: none"> e) Comply with guidelines in respect of guarantees, gestures of goodwill and liability for material defects f) Identify and use network plans g) Update electronic information systems and technical devices h) Access and use service information from English language documentation and databases 	<ul style="list-style-type: none"> e) Richtlinien für Garantie, Kulanz und Sachmängelhaftung beachten f) Vernetzungspläne identifizieren und anwenden g) Elektronische Informationssysteme und technische Geräte aktualisieren h) Service-Informationen englischsprachigen Unterlagen und Datenbanken entnehmen und anwenden
16	<p>Communication with internal and external customers (§ 4 No. 9)</p> <p>Kommunikation mit internen und externen Kunden</p>	<ul style="list-style-type: none"> a) Deal with customers in a manner appropriate to the situation b) Conduct analysis of malfunctions and damage by means of specific questioning of customers c) Instruct customers in the operation of vehicles and systems d) Indicate to customers necessary repair and maintenance work and make same aware of further services provided by the manufacturer and the company e) Advise customers in respect of technical and economic feasibility of repair works, comply with vehicle registration regulations f) Identify, evaluate and action customer and supplier wishes 	<ul style="list-style-type: none"> a) Mit Kunden situationsgerecht umgehen b) Störungs- und Schadensanalyse durch eingrenzende Kundenbefragung durchführen c) Kunden in die Bedienung von Kraftfahrzeugen und Systemen einweisen d) Kunden auf erforderliche Instandsetzungs- und Wartungsarbeiten sowie weitere Serviceleistungen der Hersteller und des Betriebes hinweisen e) Kunden hinsichtlich technischer und wirtschaftlicher Durchführbarkeit von Instandsetzungen beraten, Zulassungsrechtliche Vorschriften beachten f) Kunden- und Lieferantenwünsche ermitteln, bewerten und Maßnahmen zur Erfüllung einleiten

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		g) Use communication rules as the basis of efficient team work	g) Kommunikationsregeln als Basis effizienter Teamarbeit anwenden
17	<p>Operating and putting into service of motor vehicles and motor vehicle systems (§ 4 No. 13)</p> <p>Bedienen und Inbetriebnehmen von Kraftfahrzeugen und deren Systemen</p>	<p>a) Recognise and use menu functions and operate information, communication, comfort and safety systems</p> <p>b) Code accessories, extra features and special features and put same into service</p> <p>c) Use mechanical emergency functions</p> <p>d) Recognise heightened risk in respect of vehicles, apply safety regulations</p>	<p>a) Menüfunktionen erkennen, anwenden und Informations-, Kommunikations-, Komfort- und Sicherheitssysteme bedienen</p> <p>b) Zubehör, Zusatzeinrichtungen und Sonderausstattungen codieren und in Betrieb nehmen</p> <p>c) Mechanische Notfunktionen anwenden</p> <p>d) Erhöhtes Gefährdungspotential an Kraftfahrzeugen erkennen, Sicherheitsvorschriften anwenden</p>
18	<p>Maintaining, testing and adjusting motor vehicles and systems (§ 4 No. 14)</p> <p>Warten, Prüfen und Einstellen von Kraftfahrzeugen und Systemen</p>	<p>a) Apply maintenance and testing procedures in accordance with manufacturers' stipulations</p> <p>b) Conduct functional checks and take reading of error log</p> <p>c) Carry out maintenance work in accordance with maintenance schedules</p> <p>d) Carry out adjustments to vehicles and systems</p> <p>e) Interpret and document results and take action to carry out repairs</p>	<p>a) Wartungs- und Prüfvorschriften nach Herstellerangaben anwenden</p> <p>b) Funktionskontrollen durchführen und Fehlerspeicher auslesen</p> <p>c) Wartungsarbeiten nach Wartungsplänen durchführen</p> <p>d) Einstellarbeiten an Kraftfahrzeugen und Systemen vornehmen</p> <p>e) Ergebnisse interpretieren, dokumentieren und Maßnahmen zur Instandsetzung einleiten</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
19	<p>Diagnosing errors, malfunctions and their causes and evaluating the results (§ 4 No. 15)</p> <p>Diagnostizieren von Fehlern, Störungen und deren Ursachen sowie Beurteilen der Ergebnisse</p>	<p>a) Identify damage and malfunctions in mechanical, electrical, electronic, mechatronic, pneumatic and hydraulic systems of vehicles and subassemblies of same</p> <p>b) Narrow down and determine errors and malfunctions and causes of same using circuit diagrams, connection plans and functional plans</p> <p>c) Use standardised diagnostic routines; narrow down and determine errors and malfunctions, in particular by use of functional checks, sensory perception, taking readings of error logs and measuring and testing electrical, electronic, hydraulic, mechanical and pneumatic values; interpret composition of exhaust gases</p> <p>d) Draw up test reports, evaluate and document results</p> <p>e) Take due account of flow of information between data transmission systems, use network plans and troubleshooting programmes</p> <p>f) Narrow down and determine errors and malfunctions in networked systems</p>	<p>a) Schäden und Funktionsstörungen an mechanischen, elektrischen, elektronischen, mechatronischen, pneumatischen und hydraulischen Systemen von Kraftfahrzeugen und deren Baugruppen feststellen</p> <p>b) Fehler und Störungen und deren Ursachen mit Hilfe von Schalt-, Anschluss- und Funktionsplänen eingrenzen und bestimmen</p> <p>c) Standarddiagnoseroutinen anwenden; Fehler und Störungen eingrenzen und bestimmen, insbesondere durch Funktionskontrolle, Sinneswahrnehmungen, Auslesen von Fehlerspeichern sowie Messen und Prüfen elektrischer, elektronischer, hydraulischer, mechanischer, pneumatischer Größen; Zusammensetzung der Abgase interpretieren</p> <p>d) Prüfprotokolle erstellen, Ergebnisse beurteilen und dokumentieren</p> <p>e) Informationsfluss zwischen den Datenübertragungssystemen berücksichtigen, Vernetzungspläne und Fehlersuchprogramme anwenden</p> <p>f) Fehler und Störungen in vernetzten Systemen eingrenzen und bestimmen</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
20	<p>Assembling, disassembling, and repairing motor vehicles, their systems, subassemblies and components (§ 4 No. 16)</p> <p>Montieren, Demontieren und Instandsetzen von Kraftfahrzeugen deren Systemen, Baugruppen und Bauteilen</p>	<p>a) Test systems and subassemblies for functionality and damage</p> <p>b) Disassemble and assemble systems, subassemblies and components with due regard to assembly instructions</p> <p>c) Test and measure function of sensors and actuators, in particular signals</p> <p>d) Document work and stages of work</p> <p>e) Repair electrical, electronic, mechatronic, pneumatic and hydraulic systems, subassemblies and components</p>	<p>a) Systeme und Baugruppen auf Funktion und Schäden prüfen</p> <p>b) Systeme, Baugruppen und Bauteile unter Berücksichtigung von Montageanleitungen demontieren und montieren</p> <p>c) Funktion von Sensoren und Aktoren prüfen, insbesondere Signale, messen</p> <p>d) Arbeiten und Arbeitsschritte dokumentieren</p> <p>e) Elektrische, elektronische, mechanische, mechatronische, pneumatische und hydraulische Systeme, Baugruppen und Bauteile instandsetzen</p>
21	<p>Fitting, re-fitting and retro-fitting (§ 4 No. 17)</p> <p>Aus-, Um- und Nachrüsten</p>	<p>a) Allocate accessories, extra features and special features to the type of vehicle in accordance with statutory regulations and technical documentation</p> <p>b) Prepare accessories, extra features and special features for installation or modification, install or modify and connect same, test functionality, integrate into existing systems, document modifications</p> <p>c) Instruct customers operationally and indicate reliable regulations</p>	<p>a) Zubehör, Zusatzeinrichtungen und Sonderausstattung nach gesetzlichen Vorschriften und technischen Unterlagen dem Fahrzeugtyp zuordnen</p> <p>b) Zubehör, Zusatzeinrichtungen und Sonderausstattung für den Ein- oder Umbau vorbereiten, ein- oder umbauen, anschließen, Funktion prüfen, die Integration in die vorhandenen Systeme vornehmen; Änderungen dokumentieren</p> <p>c) Kunden in die Bedienung einweisen und auf zulassungsrechtliche Vorschriften hinweisen</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
22	<p>Examining vehicles in accordance with road traffic regulations (§ 4 No. 18)</p> <p>Untersuchen von Kraftfahrzeugen nach straßenverkehrsrechtlichen Vorschriften</p>	<p>a) Prepare vehicles for statutory inspections, monitor implementation of same</p> <p>b) Monitor road traffic and operational safety of vehicles, document defects and take appropriate action to eliminate same</p> <p>c) Record actual and estimated values using diagnostic systems, record adjustment values, carry out adjustments and document results</p>	<p>a) Kraftfahrzeuge für gesetzlich vorgeschriebene Prüfungen vorbereiten, Durchführung begleiten</p> <p>b) Verkehrs- und Betriebssicherheit des Kraftfahrzeuges überprüfen, Mängel dokumentieren und erforderliche Maßnahmen zu ihrer Beseitigung einleiten</p> <p>c) Unter Anwendung der Diagnosesysteme Soll- und Istwerte ermitteln, Einstellwerte erfassen Einstellungen durchführen und Ergebnisse dokumentieren</p>

Section III: Specialist vocational education and training according to specialist area

SPECIALIST AREA A: Private motor vehicle technology - Personenkraftwagentchnik

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
1	<p>Diagnosing, maintaining, fitting, re-fitting and retro-fitting (§ 4 No. 19)</p> <p>Diagnostizieren, Instandhalten, Aus-, Um- und Nachrüsten</p>	<p>a) Use diagnostic systems for drive, chassis, comfort and safety systems, take readings of and interpret data</p> <p>b) Use expert systems, in particular guided troubleshooting, databases and tele-diagnosis. Use hotline.</p> <p>c) Identify and update software in control devices, carry out re-settings and basic settings in vehicle systems, adjust learning values, document changes</p> <p>d) Test, diagnose and adjust brake, chassis, suspension damping and levelling systems, test control system and steering</p> <p>e) Test, diagnose and repair drive assemblies using engine management system and auxiliary units</p> <p>f) Test, diagnose, repair and adjust automated gear boxes and automatic gear boxes</p>	<p>a) Diagnosesysteme für Antriebs-, Fahrwerks-, Komfort- und Sicherheitssysteme anwenden, Daten auslesen und interpretieren</p> <p>b) Expertensysteme, insbesondere geführte Fehlersuche, Datenbank, Telediagnose und Hotline, anwenden</p> <p>c) Software von Steuergeräten ermitteln und aktualisieren, Rückstellungen und Grundeinstellungen an Fahrzeugsystemen durchführen, Lernwerte anpassen, Änderungen dokumentieren</p> <p>d) Brems-, Fahrwerks-, Federungs-, Dämpfungs- und Niveauregelungssysteme prüfen, diagnostizieren und einstellen, Regelung und Steuerung prüfen</p> <p>e) Antriebsaggregate mit Motormanagementsystem und Nebenaggregate prüfen, diagnostizieren und instandsetzen</p> <p>f) Automatisierte Schaltgetriebe und Automatikgetriebe prüfen, diagnostizieren, instandsetzen und einstellen</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<ul style="list-style-type: none"> g) Test, diagnose, repair, adjust and parameterise comfort and safety systems in accordance with customer wishes, document results h) Repair data communication wires, in particular electrical and opto-electrical wires i) Test, diagnose, repair and adjust body work systems, in particular door closers, canopy top systems and sun roofs, use mechanical emergency functions k) Test and repair steering systems l) Test, repair and adjust 4-wheel drive systems, conduct survey of chassis 	<ul style="list-style-type: none"> g) Komfort- und Sicherheitssysteme prüfen, diagnostizieren, instandsetzen, einstellen und nach Kundenwünschen parametrieren, Ergebnisse dokumentieren h) Datenkommunikationsleitungen, insbesondere elektrische und optoelektronische Leitungen, instandsetzen i) Karoseriesysteme, insbesondere Türschließanlagen, Verdeckanlagen und Schiebedächer prüfen, diagnostizieren, instandsetzen und einstellen; mechanische Notfunktionen anwenden k) Lenksysteme prüfen und instandsetzen l) Allradantriebssysteme prüfen, instandsetzen und einstellen, Fahrwerksvermessung durchführen

SPECIALIST AREA B: Commercial motor vehicle technology - Nutzfahrzeugtechnik

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	
1	<p>Diagnosing, maintaining, fitting, re-fitting and retro-fitting (§ 4 No. 19)</p> <p>Diagnostizieren, Instandhalten, Aus-, Um- und Nachrüsten</p>	<p>a) Set up and retool special metal working machines, machine down components</p> <p>b) Attach and join components and profiles in various welded positions using a variety of welding processes and thermally separating components and profiles</p> <p>c) Use diagnostic systems for drive, brake, chassis, comfort and safety systems and extra features, take readings of and interpret data</p> <p>d) Use expert systems, in particular guided troubleshooting, databases and tele-diagnosis, use hotline, Observe vehicle specific emergency call systems</p> <p>e) Update and parameterise update control devices, carry out re-settings and basic settings in vehicle systems, adjust learning values, document changes. Repair data communication lines</p> <p>f) Use telematic services</p>	<p>a) Spezialmaschinen für die spanende Bearbeitung einrichten und umrüsten, Bauteile spanend bearbeiten</p> <p>b) Bauteile und Profile in verschiedenen Schweißpositionen durch unterschiedliche Schweißverfahren heften und fügen, sowie Bauteile und Profile thermisch trennen</p> <p>c) Diagnosesysteme für Antriebs-, Brems-, Fahrwerks-, Komfort- und Sicherheitssysteme und Zusatzeinrichtungen anwenden, Daten auslesen und interpretieren</p> <p>d) Expertensysteme, insbesondere geführte Fehlersuche, Datenbank, Telediagnose und Hotline anwenden; fahrzeugspezifische Notrufsysteme beachten</p> <p>e) Steuergeräte aktualisieren und parametrieren Rückstellungen und Grundeinstellungen an Fahrzeugsystemen durchführen, Lernwerte anpassen, Änderungen dokumentieren, Datenkommunikationsleitungen instandsetzen</p> <p>f) Internetbasierte Telematikdienste zur Diagnose, Instandhaltung, Steuerung und Optimierung des technischen und dispositiven Flottenmanagements nutzen</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	
		<ul style="list-style-type: none"> g) Test, diagnose and repair drive assemblies using engine management system and auxiliary units h) Test and repair gear systems, in particular those with hydraulic, pneumatic and electro pneumatic gear shifting, automatic gearboxes with integrated retarder, clutch systems, systems to increase torque when starting and power dividers i) Test, diagnose and parameterise electro pneumatic systems, in particular brake systems, suspensions, door operations and supplies of compressed air, using safety and drying systems, document results k) Test and repair 4-wheel drive systems l) Test and repair auxiliary drives, in particular hydraulic drives, parameterise auxiliary drives m) Measure, test, repair adjust and calibrate mechanical and hydraulic steering systems of vehicles with more than two axles, in particular double circuit steering systems and steering systems for forward travel axles and trailing axles n) Repair special features of commercial vehicles, in particular lifting and loading equipment 	<ul style="list-style-type: none"> g) Antriebsaggregate mit Motormanagementsystem und Nebenaggregaten prüfen, diagnostizieren und instandsetzen h) Getriebesysteme, insbesondere mit hydraulischen, pneumatischen und elektro-pneumatischen Schaltungen, Automatikgetriebe mit integriertem Retarder, Kupplungssysteme, Systeme zur Drehmomentanhebung beim Anfahrvorgang und Verteilergetriebe prüfen und instandsetzen i) Elektropneumatische Systeme, insbesondere Bremsanlagen, Federungen und Türbetätigungen, Druckluftversorgung mit Sicherheits- und Trocknungssystemen prüfen, diagnostizieren sowie parametrieren, Ergebnisse dokumentieren k) Allradantriebssysteme prüfen und instandsetzen l) Nebenantriebe, insbesondere hydraulische Antriebe, prüfen und instandsetzen, Nebenantriebe parametrieren m) Mechanische und elektro-hydraulische Lenksysteme von Fahrzeugen mit mehr als zwei Achsen, insbesondere Zweikreislenksysteme sowie Lenksysteme für Vor- und Nachlaufachsen vermessen, prüfen, instandsetzen, einstellen und kalibrieren n) Zusatzeinrichtungen an Nutzkraftwagen, insbesondere Hub- und Ladeeinrichtungen, instandsetzen

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	
		<ul style="list-style-type: none"> <li>o) Test and repair hydraulic and electromagnetic auxiliary brake systems and engine brake systems <li>p) Use mechanical emergency functions, reset emergency functions, test system 	<ul style="list-style-type: none"> <li>o) Hydraulische und elektromagnetische Zusatzbremsanlagen sowie Motorbremsanlagen prüfen und instandsetzen <li>p) Mechanische Notfunktionen anwenden, Notfunktionen zurückstellen, System prüfen

SPECIALIST AREA C: Motor cycle technology - Motorradtechnik

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
1	<p>Diagnosing, maintaining, fitting, re-fitting and retro-fitting (§ 4 No. 19)</p> <p>Diagnostizieren, Instandhalten, Aus-, Um- und Nachrüsten</p>	<p>a) Use diagnostic systems for drive and chassis systems, take readings of and interpret data</p> <p>b) Narrow down, determine and ascertain the cause of errors and malfunctions in electrical and electronic systems by testing and measuring and paying due regard to customer information</p> <p>c) Narrow down, determine and ascertain the cause of errors and malfunctions in motor cycle combustion engines by testing and measuring, paying due regard to the mixture preparation and exhaust system and customer information, document results</p> <p>d) Narrow down, determine and ascertain the cause of errors and malfunctions in components, subassemblies and systems relating to power transmission of motor cycles</p> <p>e) Disassemble, test, measure, repair, adjust, assemble and test for functionality components and subassemblies of drive systems which are installed or not installed</p>	<p>a) Diagnosesysteme für Antriebs- und Fahrwerksysteme anwenden, Daten auslesen und interpretieren</p> <p>b) Fehler und Störungen an elektrischen und elektronischen Systemen unter Berücksichtigung von Kundenangaben durch Prüfen und Messen eingrenzen, bestimmen und deren Ursache feststellen</p> <p>c) Fehler und Störungen an Verbrennungsmotoren von Motorrädern unter Beachtung der Gemisch-aufbereitungs- und Abgasanlage auf Basis von Kundenangaben durch Prüfen und Messen eingrenzen, bestimmen und deren Ursachen feststellen, Ergebnisse dokumentieren</p> <p>d) Fehler und Störungen an Bauteilen, Baugruppen und Systemen der Kraftübertragungen von Motorrädern durch Prüfen und Messen eingrenzen und bestimmen und deren Ursachen feststellen</p> <p>e) Bauteile und Baugruppen an ein- und ausgebauten Antriebssystemen demontieren, demontieren, prüfen, vermessen, instand setzen, einstellen, montieren sowie auf Funktion prüfen</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<ul style="list-style-type: none"> f) Test, disassemble, assemble, adjust frame, wheel suspension systems and chassis in respect of wear and tear and damage, particularly relating to accident damage, document results g) Test chassis alignment, carry out chassis alignment and document results h) Check and repair wheels and their components, in particular in respect of centring and balancing, pay due regard to vehicle registration regulations i) Maintain brake systems, repair and test for functionality k) Retro-fit extra equipment, in particular trim and lining and carriers l) Plan and carry out performance enhancing measures paying due regard to vehicle registration regulations and manufacturers' information m) Prepare motor cycles for statutory inspections in respect of noise and exhaust gas emission n) Inform and advise customers as to feasibility of alterations paying particular regard to technical rules, manufacturers' stipulations, norms and laws o) Prepare and carry out procurement of parts in accordance with customer order 	<ul style="list-style-type: none"> f) Rahmen, Radaufhängungssysteme und Fahrwerke auf Verschleiß und Schäden, insbesondere auf Unfallschäden, prüfen, demontieren, montieren und einstellen, Ergebnisse dokumentieren g) Fahrwerksgeometrie prüfen, Fahrwerke abstimmen und Ergebnisse dokumentieren h) Räder und ihre Bauteile prüfen und instandsetzen, insbesondere zentrieren und auswuchten, zulassungsrechtliche Bedingungen beachten i) Bremssysteme warten, instand setzen und auf Funktionsfähigkeit prüfen k) Zusatzausrüstungen, insbesondere Verkleidungen und Trägersysteme, nachrüsten l) Leistungsverändernde Maßnahmen unter Berücksichtigung zulassungsrechtlicher und Herstellervorschriften planen und durchführen m) Motorräder für gesetzlich vorgeschriebene Geräusch- und Abgasuntersuchungen vorbereiten n) Kunden bezüglich der technischen Machbarkeit von Veränderungen unter besonderer Berücksichtigung von technischen Regeln, Herstellervorschriften, Normen und Gesetzen informieren und beraten o) Teilebeschaffungen nach Kundenauftrag vorbereiten und durchführen

SPECIALIST AREA D: Vehicle communication technology - Fahrzeugkommunikationstechnik

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
1	<p>Diagnosing, maintaining, fitting, re-fitting and retrofitting (§ 4 No. 19)</p> <p>Diagnostizieren, Instandhalten, Aus-, Um- und Nachrüsten</p>	<p>a) Use diagnostic systems for drive, brake, chassis, comfort, safety, energy management and communication systems, take readings of and interpret data</p> <p>b) Use expert systems, in particular guided troubleshooting, databases and tele-diagnosis. Use hotline</p> <p>c) Update and adjust control devices, install and adjust software systems, carry out re-settings and basic settings in vehicle systems, adjust learning values, document changes</p> <p>d) Carry out diagnoses in networked systems on the basis of results obtained from standard diagnostic routines, in particular analyse and interpret messages in data bus systems and recognise malfunctions caused by electromagnetic incompatibility</p> <p>e) Use telematic services, test and repair vehicle specific emergency call systems , retro-fit telematic systems</p>	<p>a) Diagnosesysteme für Antriebs-, Brems, Fahrwerks-, Komfort- und Sicherheits- und Energiemanagementsysteme sowie insbesondere Kommunikationssysteme, anwenden, Daten auslesen und interpretieren</p> <p>b) Expertensysteme, insbesondere geführte Fehlersuche, Telediagnose, Datenbank und Hotline anwenden</p> <p>c) Steuergeräte aktualisieren und anpassen, Softwaresysteme installieren und einrichten, Rückstellungen und Grundeinstellungen an Fahrzeugsystemen durchführen, Lernwerte anpassen, Änderungen dokumentieren</p> <p>d) Diagnosen in vernetzten Systemen auf Basis der Ergebnisse von Standarddiagnoseroutinen vornehmen, insbesondere Botschaften in Daten-BUS-Systemen analysieren und interpretieren, Störungen aufgrund elektromagnetischer Unverträglichkeit erkennen</p> <p>e) Telematikdienste nutzen, fahrzeugspezifische Notrufsysteme prüfen und instand setzen, Telematiksysteme nachrüsten</p>

No.	Element of the regulated occupation profile	Skills and knowledge to be imparted making reference to independent planning, execution and monitoring	Fertigkeiten und Kenntnisse, die unter Einbeziehung selbständigen Planens, Durchführens und Kontrollierens zu vermitteln sind
1	2	3	3
		<p>f) Diagnose, repair, adjust, parameterise in accordance with customer wishes and retro-fit comfort systems, vehicle information and vehicle operation systems, in particular memory and speech systems</p> <p>g) Diagnose, repair and retro-fit signal processing systems, components and circuits for optical transmission systems</p> <p>h) Diagnose and repair errors and malfunctions in wireless signal transmission systems, aerial systems and entertainment electronics, retrofit vehicles with wireless signal transmission systems, aerial systems and entertainment electronics.</p>	<p>f) Komfortsysteme, Fahrzeuginformations- und -bediensysteme, insbesondere Memory- und Sprachsysteme diagnostizieren, instand setzen, einstellen, nach Kundenwünschen parametrieren und nachrüsten</p> <p>g) Systeme, Komponenten und Schaltkreise der Signalverarbeitung für optische Übertragungssysteme diagnostizieren, instandsetzen und nachrüsten</p> <p>h) Fehler und Störungen an drahtlosen Signalübertragungssystemen, Antennenanlagen und an der Unterhaltungselektronik diagnostizieren und instand setzen, Kraftfahrzeuge mit drahtlosen Signalübertragungssystemen, Antennenanlagen und Unterhaltungselektronik nachrüsten</p>

*) To be imparted in conjunction with other training content listed in the general training plan

Examination regulations for the training occupation of automotive mechatronics engineer/automotive mechatronics technician¹

from 04th June 2013

§ 1 Duration of vocational training

Training for the automotive mechatronics engineer and the automotive mechatronics technician lasts three and a half years.

§ 2 Training framework plan, vocational training profile

(1) The subject of vocational training shall be at least the skills, knowledge, and abilities (professional capacity) listed in the training framework (Annex). An organization of vocational training deviating from the training curriculum is particularly permissible insofar as practical operational peculiarities require the deviation.

(2) Vocational training as an automotive mechatronics engineer and automotive mechatronics technician is divided into

1. Profiling skills, knowledge, and abilities,
2. Integrative skills, knowledge, and abilities.

(3) Occupational profiling skills, knowledge, and abilities:

1. operating vehicles and systems,
2. decommissioning and commissioning of technical vehicle systems,
3. measuring and testing on systems,
4. carrying out service and maintenance work,
5. diagnosing faults and malfunctions in vehicles and systems,
6. disassembly, repair, and assembly of components, assemblies, and systems,
7. conducting investigations on vehicles in accordance with legal requirements,
8. removal, conversion and retrofitting of vehicles.

(4) Integrative skills, knowledge, and abilities are:

1. Vocational training, labor, and collective bargaining law,
2. Structure and organization of the training company,
3. Health and safety at work,
4. Environmental protection,
5. Planning and preparing work processes as well as checking and evaluating work results,
6. Operational and technical communication,
7. Implementation of quality assurance measures.

§ 3 Implementation of vocational training

(1) The skills, knowledge, and abilities specified in this Ordinance shall be arranged so that the trainees are enabled to pursue a qualified professional activity within the meaning of § 1 paragraph 3 of the Vocational Training Act, which in particular includes independent planning, implementation, and control. This qualification must also be demonstrated in tests in accordance with §§ 6 to 8.

(2) The trainers shall draw up a training plan on the basis of the training curriculum for the trainees.

(3) Trainees shall hold written evidence of formal qualifications. They must be given the opportunity to obtain written evidence of formal qualifications during the training period. Trainees shall regularly review the written evidence of formal qualifications.

¹ Bundesgesetzblatt Jahrgang 2013 Teil I Nr. 29, ausgegeben zu Bonn am 20. Juni 2013

§ 4 Final examinations or journeyman's examination

The final examination or journeyman's exam consists of the two temporally separated parts 1 and 2. The final examination or journeyman's examination must determine whether the candidate has acquired the professional capacity to act. In the final examination or journeyman's examination, the candidate must prove that he/she has the necessary professional skills, possesses the necessary professional knowledge and abilities and is familiar with the teaching material essential for vocational training. Skills, knowledge, and abilities which were already the subject of Part 1 of the final examination or journeyman's examination should only be included in Part 2 of the final examination or journeyman's examination to the extent necessary to determine the professional qualification.

§ 5 Part 1 of the final or journeyman's examination

- (1) Part 1 of the final or journeyman's examination shall take place before the end of the second year of training.
- (2) Part 1 of the final exam or journeyman's examination covers the skills, knowledge, and abilities listed in the annex for the first three semesters of training as well as the material to be taught in vocational education and training, insofar as it is essential for vocational training.
- (3) Part 1 of the final or journeyman's examination consists of the examination area service order.
- (4) The following requirements exist for the examination area:
 1. The candidate should demonstrate that he/she can,
 - a. plan the work steps, to research data, to analyze circuit diagrams and functions,
 - b. to select work equipment and measuring devices, to carry out measurements, to document results,
 - c. maintenance requirements, in particular, the connection between technology, work organization, environmental protection as well as safety and health protection,
 - d. to present subject-related problems and their solutions, to identify the relevant technical backgrounds and to be able to justify the procedure for their implementation;
 2. The test object should be connected to at least one of the following systems
 - a. Electrical system,
 - b. Lighting System,
 - c. Charging current system,
 - d. Starting system or
 - e. Brake mechanismPerforming measurements and tests, determining faults, malfunctions and their causes, preparing measurement or test reports, as well as dismantling, maintaining, assembling and drawing up documentation for a technical vehicle assembly;
 3. by way of derogation from point 2, other activities may be used if they permit the verification referred to in point 1 to the same width and depth;
 4. the candidate should perform a work task, which can consist of several subtasks and corresponds to customer orders, conduct a situational technical discussion, which can consist of several discussion phases, and process tasks that relate to the work task in writing;
 5. the examination time for the work task and the situational technical discussion is three hours; within this time, the situational technical discussion should last a maximum of ten minutes; the examination time for the written assignments is 120 minutes.

§ 6 Part 2 of the final or journeyman's examination

(1) Part 2 of the final examination or journeyman's examination covers the skills, knowledge, and abilities listed in the Annex as well as the teaching material to be taught in vocational education and training, insofar as it is essential for vocational training.

(2) Part 2 of the final examination or journeyman's examination consists of the examination areas:

1. Customer order,
2. Motor vehicle and maintenance technology,
3. Diagnostics technology,
4. Economics and Social Studies

(3) The following requirements apply to the customer order check area:

1. The candidate should prove that he is capable
 - a. to independently plan and implement work processes and to document the results,
 - b. use information systems to communicate with customers,
 - c. to operate and explain vehicles and systems,
 - d. disable and commission technical vehicle systems,
 - e. check system functions, use diagnostic systems, diagnose errors and malfunctions,
 - f. to repair or retrofit vehicles and their systems,
 - g. to document results, to prepare and analyze measurement and test protocols,
 - h. to present problems and their solutions and to point out technical backgrounds as well as to justify the procedure for the execution of the customer order;
2. the following activities shall be taken as a basis for the verification referred to in point 1:
 - a. Inspection of vehicles or vehicle systems according to manufacturer's specifications or road traffic regulations;
 - b. Diagnosing errors, malfunctions and their causes on at least one of the following systems:
 - i. Braking system,
 - ii. Chassis system,
 - iii. Power transmission system,
 - iv. Drive system,
 - v. Comfort system,
 - vi. Security system,
 - vii. High voltage system or
 - viii. networked systems;
 - c. Repair of vehicles or vehicle systems;
3. other activities may be used if they permit the verification referred to in point 1 to the same width and depth;
4. the candidate should work on three equivalent work tasks, which can consist of several subtasks and correspond to customer orders, as well as conduct a situational technical discussion, which can consist of several discussion phases;
5. the examination time is five hours; within this time, the situational technical discussion should be conducted within a maximum of 20 minutes.

(4) The following requirements exist for the motor vehicle and maintenance technology testing area:

1. The candidate should demonstrate that he/she is able to,
 - a. describe motor vehicle systems and their functions,
 - b. Perform problem analysis, to analyze and evaluate technological and mathematical facts, present procedure and solutions,

- c. Apply safety, health and environmental protection regulations, licensing regulations and maintenance methods taking into account quality management and the principles of customer orientation and evaluate results,
 - d. select spare parts, tools, measuring and testing equipment as well as workshop equipment and aids required for maintenance in compliance with technical rules and manufacturer specifications,
 - e. to plan measures taking into account operational processes,
 - f. to use industry-specific software and evaluate data as well as
 - g. present electrotechnical work on high-voltage components in accordance with safety regulations;
2. the candidate is to work on tasks relating to customer orders in writing;
 3. the examination time is 120 minutes.

(5) The following requirements apply to the diagnostic technology test area:

1. The candidate should demonstrate that he/she can,
 - a. Perform problem analysis, to analyze and evaluate technological and mathematical facts, present procedure and solutions,
 - b. Evaluate information from functional, circuit and networking plans, industry-specific software and manufacturer's instructions,
 - c. systematically isolate errors, malfunctions, and their causes,
 - d. use, evaluate and evaluate the results of the measuring, testing and diagnostic devices used as well as customer information,
 - e. to describe and analyze the interconnection of systems of the motor vehicle;
2. the candidate is to work on tasks relating to customer orders in writing;
3. the examination time is 120 minutes.

(6) The following requirements apply to the area of economic and social studies:

1. The candidate should demonstrate that he/she can represent and judge the general economic and social contexts of the professional and working world;
2. the candidate should work on practice-related tasks;
3. the examination time is 60 minutes.

§ 7 Weighting and existence regulations

1. The examination areas are to be weighted as follows:
 - a. Service order with 35 percent,
 - b. Customer order with 35 percent,
 - c. Motor vehicle and maintenance technology with 10 percent,
 - d. Diagnostics technology with 10 percent,
 - e. Economic and social studies with 10 percent.
2. The final examination or the journeyman's examination is passed if the performance has been assessed as follows:
 - a. in the overall result of Part 1 and Part 2 of the final examination with at least "sufficient,"
 - b. in the inspection area customer order with at least "sufficient,"
 - c. in the result of Part 2 of the final examination with at least "sufficient,"
 - d. in at least two of the remaining examination areas of Part 2 of the final examination with at least "sufficient" and
 - e. in none of the examination areas of Part 2 of the final examination as "unsatisfactory."
3. At the request of the candidate, the examination in one of the examination areas automation and maintenance engineering, diagnostic technology or economic and social studies shall be supplemented by an oral examination of about 15 minutes, if
 - a. if the examination area has been rated as "insufficient" and
 - b. the oral supplementary examination for the passing of the final exam can make the difference.

In the determination of the result for this examination area, the previous result and the result of the oral supplementary examination in a ratio of 2: 1 should be weighted.

No.	Skills, knowledge, and ability	to be taught as part of the apprenticeship profile	Timed guideline values in weeks	
			1st to 18th Month	19th to 36th month
1	2	3	4	
1	Operation of vehicles and systems (§2 para. 3 No. 1)	a) Observe and apply regulations and instructions for safety and operation b) Use and explain operating instructions c) Handle controls of vehicles, equipment, and systems as well as their protective devices d) Use menu functions and operate information, communication, comfort, and safety systems	5	
2	Decommissioning the machine and put into operation from vehicle technical systems (§ 2, paragraph 3, point 2)	a) manufacturer-specific instructions, Safety regulations and protective measures, in particular standards and regulations for electrotechnical work on high-voltage vehicles as well as accident prevention regulations and rules of technology (b) increased risk potential for vehicle detection c) Observe safety regulations for high-voltage systems and secure the working area d) Disconnect the systems from the power supply in accordance with the operating instructions and secure them against being switched on again, and determine that they are free from voltage e) Check functions and document results f) assess and analyse electrical hazards	3	
		g) put vehicle-technical systems in a work-safe maintenance and repair condition, especially their explosive substances, Note fuels, gases, liquids and electrical		2

		voltages		
		Vehicle technical systems, especially air conditioning systems, electrical systems, compressed air systems, hydraulic systems and pyrotechnic systems, according to manufacturer's instructions except and put into operation, check functions and document results		4
3	measurement and testing systems (§ 2, paragraph 3, point 3)	<p>a) Determine target data, select measuring methods, and instruments</p> <p>(b) Apply protective measures against electric flow through the body and arcing faults</p> <p>c) Acquire measured values and compare them with target data, in particular, electrical and electronic quantities and signals on components, assemblies, and Measure, testing and assess systems</p> <p>d) visually check electrical connections, lines and line connections for mechanical damage</p> <p>e) Check function of electrical components, lines, and fuses</p> <p>f) Select and use measuring equipment for measuring and checking lengths, angles, and surfaces</p> <p>g) Measure lengths, especially with calipers, micrometers and dial indicators, Check compliance with tolerances and fits</p> <p>h) Check workpieces with angles, limit gauges, and thread gauges</p> <p>i) measure and test physical quantities, in particular pressures and temperatures</p> <p>j) Document test results</p>	5	
		k) Check and evaluate the function of protective and equipotential bonding conductors l) Measure and evaluate insulation resistance		2
4	Execution of service and maintenance	a) Apply work and safety regulations as well as manufacturer	14	

	<p>(§ 2, paragraph 3, point 4)</p>	<p>guidelines during transport and lifting</p> <p>b) Moving, parking, lifting, supporting and securing vehicles, assemblies, and systems</p> <p>c) Perform maintenance work according to specifications, in particular check operating fluids, refill, change and contribute to disposal</p> <p>d) Check mechanical and electrical components, assemblies and systems for wear, damage, leaks, positional deviations and functionality</p> <p>e) Use circuit diagrams and function diagrams, check hydraulic, pneumatic and electrical lines, connections and mechanical connections</p> <p>f) Measure and adjust pressures on pneumatic and hydraulic systems</p> <p>g) Apply maintenance and testing instructions and carry out maintenance work</p> <p>h) Carry out function checks and read out fault memory</p> <p>i) Document work steps as well as test and measurement results</p>		
		<p>j) Make adjustments to vehicles and systems</p> <p>k) Create and interpret test and measurement protocols</p>		4
5	<p>Diagnosing of errors and malfunctions in vehicles and systems (§ 2, paragraph 3, point 5)</p>	<p>a) Recognize customer complaints, carry out a functional check and define diagnostic methods</p> <p>b) Damage and malfunctions to mechanical, electrical, electronic components, mechatronic, pneumatic, hydraulic and networked vehicle systems and their components</p> <p>c) Determine errors and their causes with the help of circuit diagrams and function diagrams</p> <p>d) Create test reports and document results</p> <p>e) Check, evaluate and parameterize onboard electrical system, charging current, start and lighting systems and document</p>	8	

		<p>results according to customer requirements</p> <p>f) Take measures to avoid hazards due to insulation faults</p> <p>g) Detect data communication between control units</p>		
		<p>h) Determine system states with the help of diagnostic systems, compare with information in databases and evaluate the result</p> <p>i) Use troubleshooting programs, manufacturer information as well as databases and use the hotline and telediagnosics</p> <p>j) Detect and update ECU software, make provisions and adjustments to vehicle systems and adjust learning values</p> <p>k) Determine diagnosis and repair options depending on the customer order</p> <p>l) Check, assess and parameterize comfort, safety and driver assistance systems according to customer requirements, documenting results</p>		6
		<p>a) Determine diagnosis and repair options</p> <p>b) Determine causes of malfunctions in drive, chassis, comfort and safety systems with the aid of diagnostic systems</p> <p>c) Carry out wheel alignment and generate a measurement report</p> <p>d) Check and evaluate brake, chassis, suspension, damping and level control systems</p> <p>e) Check and diagnose drive units including engine management system, exhaust system, and ancillaries</p> <p>f) Check and evaluate body systems, in particular, locking systems, convertible top systems and transmissions</p> <p>g) perform a functional analysis of air conditioning systems and networked vehicle components, in particular driver assistance systems and active safety systems</p>		30

		<p>h) Record and evaluate data communication between control units</p> <p>i) Locate faults on wireless signal transmission systems</p> <p>j) Test and evaluate power transmission systems, in particular, manual transmissions and automatic transmissions</p> <p>k) Check and diagnose steering systems</p> <p>l) use expert systems, in particular, guided troubleshooting, database and telediagnosis, using the hotline</p>		
6	<p>Dismantling, repairing and assembling components, Assemblies and systems (§ 2, paragraph 3, point 6)</p>	<p>a) Decommission, dismantle, disassemble components, assemblies, and systems, identify substances that are hazardous to safety and health, check for reusability, label and systematically store them</p> <p>b) Assign dismantled components and assemblies to systems and check them for completeness</p> <p>c) Cleaning, preserving and storing components and assemblies</p> <p>d) add components, assemblies, and systems, in particular, produce screw under consideration of the partial sequence and the torque</p> <p>e) Assemble components, assemblies, and systems, commission them and check their function and form accuracy</p> <p>f) Prepare surfaces for corrosion protection, add corrosion protection and renew</p> <p>g) Check the position of components and assemblies, measure positional deviations</p> <p>h) Mark and circle reference lines, bore centers and outlines, taking into account the material properties, and separating and forming components and semi-finished products</p>	18	

		<p>i) Determine and set machine values of hand-held and stationary machines; drill and lower workpieces and components</p> <p>j) Make internal and external threads and repair</p> <p>k) Establish, check, repair and document electrical connections and connections</p> <p>l) repair wear-prone assemblies and systems, especially brakes</p> <p>m) Fit tires and balance wheels</p>		
		<p>n) Derive repair measures after diagnosis, Implement repair procedures</p> <p>o) Install and connect electrical systems, check their operation and ensure safety</p> <p>p) repair electronic, mechatronic, pneumatic and hydraulic systems, assemblies and components</p> <p>q) observe electro-technical safety rules when working on electrical systems, in particular on high-voltage systems and fuel cells</p>		6
		<p>a) Replace high-voltage components</p> <p>b) repair electrical and optoelectronic data communication cables</p> <p>c) Repair drive units including engine management system, exhaust system, and ancillaries</p> <p>d) Repair power transmission systems, in particular, manual transmissions, automatic transmissions and four-wheel drive systems</p> <p>e) Repair bodywork systems, especially locking systems, roof systems and sunroofs</p> <p>(f) repairing chassis, suspension, damping and level control systems</p>		14
7	<p>Performing Investigations on vehicles according to legal requirements (§ 2, paragraph 3, point 7)</p>	<p>(a) Prepare vehicles for statutory tests</p> <p>b) Check traffic and operational safety of motor vehicles, document deficiencies and initiate measures for their elimination</p> <p>c) Determine target and actual values using the diagnostic</p>		6

		systems, record-setting values, make adjustments and document results		
8	Removal, conversion and retrofitting of vehicles (§ 2, paragraph 3, point 8)	a) Determine wheels, chassis and body components vehicle-related	2	
		b) Assign, remodel and convert accessories, additional equipment, and special equipment according to legal regulations and technical documentation to the vehicle type, check function as well as document changes c) Integrate components and systems into the vehicle network d) Coding and parameterizing control units, updating software versions, documenting changes e) instruct customers in operation and draw attention to licensing regulations		4
		a) Retrofit systems, components, and circuits of signal processing for optical transmission systems b) Retrofit motor vehicles with wireless signal transmission systems, antenna systems, and entertainment electronics		4

No.	Skills, knowledge, and ability	to be conveyed in the vocational training model	Time values in weeks	
			1st to 18th Month	19th to 36th Month
1	2	3	4	
1	Vocational training, labor and collective bargaining (Article 2, paragraph 4, point 1)	a) The significance of the training contract, in particular, completion, duration, and termination, explaining (b) specify mutual rights and obligations under the training contract c) Name opportunities for vocational training d) Name significant parts of the employment contract (e) Identify key provisions of collective agreements applicable to the training enterprise	to be arranged throughout the training	

2	Construction and organization of the training company (Article 2, paragraph 4, point 2)	<ul style="list-style-type: none"> a) Explain the structure and tasks of the training company b) Basic functions of the training company such as procurement, manufacturing, sales, and administration c) Name the relationships of the training company and its employees with business organizations, professional bodies and trade union d) Describe the fundamentals, tasks and working methods of the company constitution or personnel representation organs of the training company 		
3	Safety and health at work (Article 2, paragraph 4, point 3)	<ul style="list-style-type: none"> a) Identify occupational health and safety and take precautions to prevent it (b) apply occupational health and safety and accident prevention regulations c) Describe accident behavior and initiate initial action d) apply preventive fire protection regulations; Describe fire behaviors and take fire-fighting measures 		
4	Environmental protection (§ 2, paragraph 4, point 4)	<p>Contribute to avoiding operational environmental pollution in the occupational sphere of influence, in particular</p> <ul style="list-style-type: none"> a) Explain possible environmental impacts of the training company and its contribution to environmental protection using examples b) apply environmental protection regulations applicable to the training company c) use opportunities for economical and environmentally friendly use of energy and materials d) Avoid waste; dispose of substances and materials in an environmentally friendly manner 	to be arranged throughout the training	
5	Plan and prepare work processes as well as the control and	<ul style="list-style-type: none"> a) Planning and defining work steps and processes b) Determine materials, equipment, and auxiliary materials 	6	

	evaluation of work results (§ 2, paragraph 4, point 5)	<ul style="list-style-type: none"> c) Request, provide and document parts, material, d) Determine time requirements e) Prepare the workplace taking the work order into account f) Checking, evaluating, documenting and proposing measures to improve the results of work by means of target/actual value comparisons g) Observe the safety instructions of the manufacturers, especially for motor vehicles with alternative drives 		
		<ul style="list-style-type: none"> h) Prepare vehicle transfer i) Plan, control and evaluate work processes, taking into account the work order, the maintenance specifications, the installation instructions, the personnel and technical conditions j) Determining test equipment and coordinate its use k) detect, record and initiate measures for their disposal on adjacent components and assemblies l) Plan work in a team, divide tasks and evaluate results of cooperation 		8
6	Operational and technical communication (§ 2, paragraph 4, point 6)	<ul style="list-style-type: none"> a) apply a business information system to process work orders and use it to procure technical documentation and information b) conduct discussions in accordance with the situation, present facts and apply English diagrams c) ensure communication with customers as well as with preceding and following functional areas d) handle data carriers and observe data protection; read digital and analog measurement and test data e) identify vehicles, systems, components, and assemblies f) Read and apply drawings, make sketches g) Read and apply repair, installation, commissioning and 	11	

		operating instructions, catalogs, tables and diagrams h) interpret, process, convey and present technical information		
		i) read and apply wiring diagrams, circuit diagrams, wiring diagrams, layout diagrams and function diagrams j) Read and observe the function diagrams of vehicle-pneumatic and hydraulic controls and power transmissions k) apply road safety and traffic regulations and guidelines l) Accept customer requests and information, forward it during operation and consider it according to specifications m) Observe specifications for informing about maintenance work n) Observe the instructions for informing about the operation of the accessories and ancillary equipment, and refer to safety rules and regulations o) Use, deploy and apply knowledge databases p) Take service information also from English-language documents and apply q) Observe guidelines for warranty, goodwill, and material defect liability (r) update operational information systems and technical equipment s) Carry out fault and damage analysis using a restrictive customer survey t) customers for repair and maintenance work as well as other services u) Determine and evaluate customer and supplier requirements and initiate measures for fulfillment		8

7	<p>Performing quality assurance measures (§ 2, paragraph 4, point 7)</p>	<p>a) Apply test methods and test equipment according to requirements b) Systematically search for causes of defects and quality defects, contribute to elimination, document work c) Apply the company's quality management system d) Observe inspection and maintenance periods for operating and testing equipment and initiate measures e) Observe and apply procedures for recall actions or rework</p>	6	
		<p>f) contribute to the continuous improvement of work processes in one's work area g) systematically seek, assess, eliminate and document the causes of errors and deficiencies in the work process as well as estimate the consequential effects of errors and deficiencies h) review, evaluate and record own and other work results</p>		6

Work Package 3 First center level "Vocational training"

Activity A4.2 Preparation and transfer of curricula and examination regulations for dual vocational training

Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training

Curricula and examination regulations for dual vocational training as plumber

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Ordinance on professional training for plumbers (Plumbers' Training Ordinance)

Plumbers' Training Ordinance (*Klempner-Ausbildungsverordnung – KlempnerAusbV*)

Date of issue: June 21, 2013

Full text:

"Plumbers' Training Ordinance of June 21, 2013 (Federal Law Gazette vol. I, p. 1614)"

* This ordinance is a training regulation within the meaning of § 25 of the Crafts Code. The training regulations and the coordinated framework curriculum for the vocational school adopted by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany are enclosed as an appendix and published in the Federal Gazette.

Footnote

(+++ Text version of August 1, 2013 +++)

Preamble

On the basis of § 25 Paragraph 1 Clause 1 of the Crafts Code, as amended by Article 146 of the Ordinance of October 31, 2006 (Federal Law Gazette, I p. 2407), the Federal Ministry of Economics and Technology, in agreement with the Federal Ministry of Education and Research hereby declares:

§ 1 State recognition of the vocational training

The vocational training as a plumber is recognized by the state to be in accordance with § 25 of the Crafts Code for training for trade 23 "plumber" in Appendix A of the Crafts Code.

§ 2 Duration of the vocational training

The training lasts three and a half years.

§ 3 Framework training plan, vocational training program

(1) The basic goal of the vocational training is to teach skills, knowledge and abilities (professional competence) listed in the training framework plan (Appendix). Deviations from the training framework plan are permitted as long as they are motivated by practical reasons.

(2) The vocational training comprises:

1. skills, knowledge and abilities that determine the professional profile,
2. integrated skills, knowledge and abilities.

(3) Skills, knowledge and abilities that define the professional profile are:

1. manual and machine processing,
2. joining of workpieces and components,
3. handling and maintenance of tools, devices and machines,
4. installation of electrical components,
5. designing and manufacturing templates and blanks,
6. checking, treating and protecting surfaces,
7. fastening components and modules in brickwork, concrete and wood,

8. covering and maintaining roof and wall surfaces on buildings,
9. manufacturing and installing systems for the drainage of rainwater,
10. manufacturing and installing ventilation systems,
11. transporting components and modules,
12. manufacturing joint seals and implementing thermal insulation and sealing measures,
13. installing energy collectors, energy converters and sustainable energy use systems,
14. installing air termination systems and down conductors for external lightning protection,
15. setting up work scaffolding and protective systems.

(4) Integrated skills, knowledge and abilities include:

1. vocational training, labor and collective bargaining law, profession-specific legal principles,
2. structure and organization of the training company,
3. safety and health protection at work,
4. environmental protection,
5. operational and technical communication,
6. customer-oriented communication,
7. planning and preparation of work processes,
8. implementation of quality assurance measures.

§ 4 Implementation of the vocational training

(1) The skills, knowledge and abilities mentioned in this ordinance should be taught in such a way that the trainees are prepared to perform a qualified professional activity as defined in § 1, Paragraph 3 of the Vocational Training Act, which includes, in particular, independent planning, execution and inspection of work. This skills and knowledge must also be demonstrated in the examinations according to § 6 and § 7.

(2) The teachers must draw up a training plan for the trainees based on the training framework plan.

(3) The trainees must keep a written record of their training and must be given the opportunity to do so during the training period. The teachers shall review the written training record on a regular basis.

§ 5 Journeyman Examination

The journeyman examination consists of two parts, each taken at a different time. In this context, the qualifications that were already the subject of Part 1 of the examination are to be included in Part 2 only to the extent that is necessary to assess professional qualifications.

§ 6 Part 1 of the journeyman examination

(1) Part 1 of the journeyman examination should take place before the end of the second year of the training.

(2) Part 1 of the journeyman examination covers the skills, knowledge and abilities listed in the appendix for the first three semesters of the training as well as the subjects taught in vocational school classes that are essential for the vocational training.

(3) Part 1 of the journeyman examination consists of a work order assignment. The following requirements apply to it:

The trainees should demonstrate that they are able to:

- a) use technical documents, plan work steps, carry out and perform measurements, plan material and tools usage,

- c) implement measures for work organization, occupational safety and health environmental protection and quality assurance,
 - d) show the technical background relevant to the examination task and justify the procedure.
2. The scope of the examination shall be based on the manufacturing of a component or part.
 3. The trainee should complete a task that is typical of the profession, perform a related technical discussion and complete tasks in writing that relate to the subject of the task.
 4. The examination time is
 - a) 7 hours for the work assignment; during this time, a related technical discussion should take place, lasting a maximum of 15 minutes,
 - b) 60 minutes for the written tasks.

§ 7 Part 2 of the journeyman examination

(1) Part 2 of the journeyman examination covers the skills and knowledge listed in the Appendix as well as the subjects to be taught in the vocational school that are essential for the vocational training.

(2) Part 2 of the journeyman examination comprises the following areas:

- Customer's order
- Manufacturing, installation and maintenance technologies
- Economics and social studies

(3) The following requirements apply to the customer order area:

The trainees should demonstrate that they are able to:

- a) independently plan work processes and subtasks, taking into account economic, technical, organizational and time requirements,
 - b) manufacture, assemble and install components or modules, and check their functionality,
 - c) check work results for accuracy of fit, secure attachment and visual quality, as well as implement corrections,
 - d) hand over components or modules to the customer, provide technical information, instruct customers and prepare acceptance reports.
 - e) demonstrate the technical background relevant to the customer's order as well as justify the choice of procedures,
2. For the verification of point 1, choose from the following areas:
 - a) roof cladding,
 - b) facade cladding,
 - c) rainwater drainage systems,
 - d) fittings of ventilation systems.
 3. The trainee should produce the object of the examination and record the production process with documents that are customary to the field, as well as conduct an order-related technical discussion.
 4. The examination time is 16 hours, including the task-related technical discussion lasting a maximum of 20 minutes.

(4) The following requirements apply to the production, installation and maintenance

- a) prepare work plans for customer orders,
 - b) describe the procedure for the production of plumbing components or modules,
 - c) identify errors, describe their causes, assess the consequences and take measures to eliminate them,
 - d) work on technical problems using the relevant information technology and mathematical concepts,
 - e) describe measures for preventive maintenance,
 - f) take into account safety, economic efficiency and environmental protection.
2. The trainee should complete the practice-related tasks in writing.
 3. The examination time is 240 minutes.
- (5) The following requirements apply to the examination on economics and social studies:
1. The trainee should demonstrate an understanding of general, economic and social contexts of the profession.
 2. The trainee should complete the tasks related to the profession in writing.
 3. Examination time is 60 minutes.

§ 8 Weighting and passing regulations

(1) The individual examination areas are to be weighted as follows:

- | | |
|---|-------|
| 1. work assignment | – 30% |
| 2. customer's order | – 40% |
| 3. manufacturing, installation and maintenance technologies | – 20% |
| 4. economics and social studies | – 10% |

(2) The journeyman examination is passed when the performance has been assessed as follows:

1. the overall result of Part 1 and Part 2 is at least "sufficient" (*ausreichend*),
2. the result of the customer's order part is at least "sufficient" (*ausreichend*),
3. the result of Part 2 of the journeyman examination is at least "sufficient" (*ausreichend*),
4. the result of at least one of further examination areas of Part 2 is at least "sufficient" (*ausreichend*),
5. the result of any examination area of Part 2 is not "not sufficient" (*ungenügend*).

(3) If the trainee receives the "not sufficient" (*ungenügend*) result (or worse) in either the manufacturing, assembly and maintenance technologies examination area or the business and social studies area in Part 2 of the journeyman examination, they can request the examination to be supplemented with an oral task of around 15 minutes, if the result

This Regulation shall enter into force on August 1, 2013. At the same time, the plumbers' training ordinance from March 10, 1989 (Federal Law Gazette vol. I, p. 420) shall cease to be in force.

Appendix (to § 3, Paragraphs 3 and 4) Framework training plan for vocational training as a plumber

(Reference: Federal Law Gazette vol. I 2013, pp. 1617 - 1622)

Skills, knowledge and abilities that define the professional profile

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
1	Manual and machine processing (§ 3, Paragraph 3, Number 1)	a) Differentiating between and selecting materials and semi-finished products according to the intended application. b) Manufacturing parts from different materials, especially metal, wood and plastic. c) Processing parts manually as well as with hand-operated and stationary machines, in particular by cutting, edging, bending and rounding.	12	
2	Joining workpieces and components (§ 3, Paragraph 3, Number 2)	a) Specifying joining tools and processes. b) Checking components for surfaces and joining quality as well as for shape tolerance, and fastening them in the correct position for installation. c) Connecting components with different fastening materials and securing elements, observing the sequence and material properties, securing connections. d) Making plug-in connections, in particular of pipes and fittings. e) Joining components by cold riveting. f) Selecting and using soldering tools, brazing alloys and fluxes. g) Joining workpieces and components made of different materials while applying the relevant processing guidelines, in particular by soldering, welding and flanging. h) Joining non-ferrous metals, especially heavy plates that are at least 3 mm thick and supporting structures, using inert gas welding. i) Joining metal sheets manually and automatically by folding.	16	

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
		<p>j) Joining non-ferrous metals, especially sheets that are up to 3 mm thick, using inert gas welding.</p> <p>k) Selecting adhesives according to material properties and processing guidelines, in particular the manufacturer's specifications, and joining components taking into account the involved loads.</p> <p>l) Joining PVC-containing and PVC-free roofing membranes, in particular by hot gas welding and solvent welding.</p>		14
3	Handling and maintaining tools, devices and machines (§ 3, Paragraph, 3 Number 3)	<p>a) Maintaining, cleaning, taking care of equipment and protecting it from corrosion.</p> <p>b) Changing and filling up operating fluids.</p> <p>c) Removing and installing components and modules with and without tools.</p>		
		<p>d) Labeling dismantled components, disposing and storing in a systematic manner.</p> <p>e) Visually inspecting electrical connections, especially at connections, for mechanical damage.</p> <p>f) Applying safety measures for electrical machines and devices, applying measures to eliminate faults.</p>	6	
4	Installation of electrical components. (§ 3, Paragraph, 3 Number 4)	<p>a) Applying safety rules for work on electrical systems, following accident prevention regulations.</p> <p>b) Making electrical connections using plug-in connections.</p> <p>c) Visually inspecting electrical connections for mechanical damage.</p> <p>d) Identifying deficiencies, initiating corrective action.</p>	4	
		<p>e) Installing and starting up electrical equipment and devices.</p> <p>f) Performing mechanical function tests.</p>		4
5	Designing and manufacturing templates and blanks (§ 3, Paragraph 3, Number 5)	<p>a) Manufacturing templates from metallic and non-metallic materials.</p> <p>b) Marking and labeling materials and semi-finished products with the aid of templates and gauges and with the use of auxiliary equipment,</p>	6	

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
		taking into account material properties, manufacturer's guidelines and processing practices.		
		c) Designing templates, especially of objects and penetrations, using the surface line method.		4
6	Inspecting, treating and protecting surfaces (§ 3, Paragraph 3, Number 6)	<p>a) Visually inspecting workpieces and semi-finished products for material defects, surface protection and surface quality.</p> <p>b) Preparing surfaces for the application of conservation and anti-corrosion agents.</p> <p>c) Tinning surfaces.</p> <p>d) Applying conservation and anti-corrosion agents in compliance with the relevant processing guidelines.</p> <p>e) Removing corrosion-promoting residues and impurities, especially solder and flux residues.</p>		6
7	Fastening of components and modules in brickwork, concrete and wood (§ 3, Paragraph 3, Number 7)	a) Creating wall slots, ceiling and wall openings.	4	
		<p>b) Checking the suitability of the subsurface for fastening.</p> <p>c) Processing mortar mixtures.</p> <p>d) Making support and fastening structures.</p> <p>e) Mounting wall brackets.</p> <p>f) Installing components in brickwork and concrete, especially with mortar mixtures, and closing openings and gaps.</p> <p>g) Fastening workpieces using dowels, screws and nails, taking into account the linear expansion.</p>		6
8	Covering and maintaining roof and wall surfaces on buildings (§ 3, Paragraph 3, Number 8)	<p>a) Manufacturing roofing and facade cladding from metal sheets, strips and profiles, taking into account static and physical specifications, in particular the wind load.</p> <p>b) Manufacturing roofing with plastic sheets.</p>		14

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
		<p>c) Differentiating between and applying various installation techniques for layered structures in green roofs.</p> <p>d) Covering roofs with molded parts made of plastic, making connections and finishes on building structures as well as covering walls and cornices.</p> <p>e) Framing penetrations on roofs, especially for chimneys, exit windows and skylights, as well as on walls and facades.</p> <p>f) Carrying out maintenance work as well as repair work, in particular replacing damaged parts.</p> <p>g) Dismantling roof coverings and facade cladding, particularly in compliance with health and environmental protection regulations.</p> <p>h) Covering, manufacturing and repairing parts of roof and wall surfaces with other covering materials.</p> <p>i) Producing elastic maintenance joints.</p>		
9	Manufacturing and assembling systems for the drainage of rainwater (§ 3, Paragraph 3, Number 9)	<p>a) Preparing systems for the drainage of rainwater, taking into account the amount of precipitation to be expected.</p> <p>b) Manufacturing molded parts for gutters, especially expansion compensators, gutter boxes and gutter angles</p> <p>c) Making gutters and downpipes.</p> <p>d) Attaching and fastening gutters, gutter supports and downpipes.</p>	8	
		<p>e) Manufacturing sheet metal valleys, eaves and verges and attaching them, taking into account expansion.</p> <p>f) Installing and connecting roof outlets.</p> <p>g) Creating external drainage.</p> <p>h) Connecting internal drainage.</p>		10
10	Manufacturing and assembling ventilation systems (§ 3, Paragraph 3, Number 10)	<p>a) Manufacturing and installing fittings, especially bends and branches.</p> <p>b) Manufacturing and installing cladding for ducts, pipes and tanks.</p>		8

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
		<p>c) Manufacturing and installing exhaust pipes, taking into account the relevant regulations and rules.</p> <p>d) Installing pipes and ducts made of metallic and non-metallic materials and connecting them tightly.</p> <p>e) Manufacturing and installing brackets and fixings.</p>		
11	Transporting components and modules (§ 3, Paragraph 3, Number 11)	<p>a) Attaching and securing loads for transport.</p> <p>b) Handling hoists, in particular cables and winches.</p> <p>c) Setting up and securing transport routes.</p>	4	
		<p>d) Securing and carrying out transports.</p> <p>e) Unloading and securing the transported goods.</p>		2
12	Manufacturing joint closures and implementing thermal insulation and sealing measures (Section 3 (3) number 12)	<p>a) Applying noise insulation measures on pipe and unit fastenings.</p> <p>b) Carrying out thermal insulation and cold protection measures, taking into account the structural and physical conditions, for ventilated and non-ventilated sloping roof structures as well as for external wall cladding.</p> <p>c) Applying structural measures for fire protection.</p> <p>d) Applying subsequent insulation and sealing measures, especially on sub-roofs, undercoverings and under-tensioning.</p> <p>e) Creating connections and terminations.</p>		8
13	Installing energy collectors, energy converters and sustainable energy use systems (§ 3, Paragraph 3, Number 13)	<p>a) Installing energy collectors and energy converters, in particular solar collectors and photovoltaic elements, in roof and wall surfaces.</p> <p>b) Creating connections, in particular on roof coverings, roof seals and exterior wall cladding.</p> <p>c) Installing rainwater harvesting systems.</p>		4
14	Installing interception devices and down conductors for external lightning protection (§ 3, Paragraph 3, Number 14)	<p>a) Mounting roof accessories, in particular snow guard systems, bird and insect repellent systems and safety devices.</p>		4

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
		installing, mechanically checking, monitoring and repairing interception systems and lightning arresters.		
15	Setting up work scaffolding and protective systems (§ 3, Paragraph 3, Number 15)	<p>a) Applying regulations on work scaffolding and protective systems.</p> <p>b) Securing construction sites and installation sites.</p> <p>c) Setting up, securing and dismantling auxiliary structures, working and protective scaffolding.</p> <p>d) Installing and maintaining safety and fall protection systems on roofs and facades.</p>		6

Integrated skills, knowledge and abilities

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
1	Vocational training, labor and collective bargaining law, profession-specific legal principles (§ 3, Paragraph 4, Number 1)	<p>a) Explaining the significance of the apprenticeship contract, in particular its conclusion, duration and termination.</p> <p>b) Listing mutual rights and obligations arising from the training contract.</p> <p>c) Pointing out opportunities for professional development.</p> <p>d) Listing essential parts of an employment contract.</p> <p>e) Listing essential provisions of the collective agreements applicable to the training company.</p>		
2	Structure and organization of the training company (§ 3, Paragraph 4, Number 2)	<p>a) Understanding of the structure and tasks of the company providing the training.</p> <p>b) Understanding of the basic operations of the training company such as procurement, production, sales and administration.</p> <p>c) Understanding of the relationship of the company providing the training and its employees with business organizations, professional associations and trade unions.</p> <p>d) Describing the basic principles, tasks and working methods of the organs of the training company under the works constitution or staff representation law.</p>		Skills and knowledge to be taught during the entire training period.

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
3	Work health and safety. (§ 3, Paragraph 4, Number 3)	<p>a) Identifying health and safety hazards in the workplace and taking measures to avoid them.</p> <p>b) Applying occupational health and safety and accident prevention regulations.</p> <p>c) Describing actions in the event of an accident and taking initial counter-measures.</p> <p>d) Applying regulations of preventive fire protection; Describing the actions in the event of fire and taking fire-fighting measures.</p>		
4	Environmental protection. (§ 3, Paragraph 4, Number 4)	<p>Contributing to the prevention of operational environmental pollution in the area exposed to the impact of the work, in particular:</p> <p>a) Explaining possible environmental pollution caused by the training company and its contribution to environmental protection using examples.</p> <p>b) Following environmental protection regulations applicable to the training company.</p> <p>c) Taking advantage of the opportunities for economical and environmentally friendly use of energy and materials.</p> <p>d) Avoiding waste and disposing of substances and materials in an environmentally friendly manner.</p>		
5	Operational and technical communication (§ 3, Paragraph 4, Number 5)	<p>a) Reading, creating and using technical documents, especially sketches and drawings.</p> <p>b) Making measurements.</p> <p>c) Applying installation plans.</p> <p>d) Using customary software as well as company-specific communication and information systems.</p> <p>e) Applying data protection and data security rules.</p> <p>f) Planning work in a team, applying communication rules and problem-solving methods.</p>	6	
		<p>g) Carrying out work in a team.</p> <p>h) Recording technical information, in particular in the form of logs and reports.</p>		2
6	Customer oriented communication (§ 3, Paragraph 4, Number 6)	a) Contributing to customer satisfaction and operational success through own actions.	4	

Ref. no.	Part of the training program	Skills, knowledge and skills to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
		<p>b) Determining customer's requirements, checking for feasibility, comparing with the company's range of services, estimating costs.</p> <p>c) Handing over the system, creating acceptance reports.</p> <p>d) Informing customers about maintenance periods, possibilities of energy-saving measures as well as necessary maintenance measures, offering services.</p> <p>e) Receiving and assessing customer complaints and taking action to deal with them.</p>		4
7	Planning and preparing workflows (§ 3, Paragraph 4, Number 7)	<p>a) Planning tasks in a team in a customer-oriented manner, taking into account the effective use of tools and materials.</p> <p>b) Estimating the time and human resources required to carry out work assignments.</p> <p>c) Considering economical and environmentally friendly use of work equipment.</p> <p>d) Checking the consistency of planning and construction site situation with regard to the work to be carried out.</p> <p>e) Including the work of other trades in the planning and taking into account preliminary work, particularly with regard to the location and the size of recesses.</p> <p>f) Planning effectively and adjusting if needed.</p>	4	4
8	Implementing quality assurance measures (§ 3, Paragraph 4, Number 8)	<p>a) Following the relevant standards and guidelines to ensure quality.</p> <p>b) Selecting test equipment, checking and manufacturing its usability, applying company test regulations.</p> <p>c) Checking components for dimensional accuracy, tightness and securing connections.</p> <p>d) Identifying errors and malfunctions, determining causes.</p> <p>e) Taking measures to eliminate errors and faults.</p> <p>f) Contributing to the continuous improvement of work processes in the work area.</p>	4	

Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Duration in weeks (approx.)	
			Months 1 to 18	Months 19 to 42
1	2	3	4	
		<p>g) Controlling, assessing and documenting one's own and other's services.</p> <p>h) Documenting the processing of customer's order, performed quality controls and technical tests.</p> <p>i) Informing superiors, colleagues and customers about disruptions in the planned order process and suggesting solutions.</p> <p>j) Understanding the relationship between quality, customer's satisfaction and operational success.</p>		4

FRAMEWORK PLAN

of the training as a

plumber

(Resolution of the Conference of Ministers of Education and
Cultural Affairs of April 25, 2013)

Part I Introductory remarks

This framework curriculum for profession-oriented teaching at the vocational school has been approved by the Standing Conference of the Education Ministers of the Länder and is in line with the relevant federal regulations (issued by the Federal Ministry of Economics and Technology or other competent ministry in agreement with the Federal Ministry of Education and Research).

The framework curriculum is generally based on the level of the lower secondary school leaving certificate or comparable qualifications. It does not contain any methodological guidelines. The framework curriculum describes the minimum profession-oriented requirements to acquire the qualifications.

The federal training regulations and the framework curriculum of the Standing Conference as well as the curricula of the Länder for the interdisciplinary learning area regulate the goals and contents of the vocational training. On this basis, the trainees acquire the qualification in a recognized training profession as well as the qualification from the vocational school.

The Länder adopt the framework curriculum directly or implement it in their own curricula. In the latter case, they must ensure that the specifications of the framework curriculum concerning the schedule and subjects for the respective training regulations are retained.

Part II Educational mission of the vocational school

The vocational school and the training companies fulfill a common educational mandate in the dual vocational training.

The vocational school is an independent place of learning that operates on the basis of the framework agreement on the vocational school (Resolution of the Conference of Ministers of Education and Cultural Affairs of March 15, 1991, as amended). It works as an equal partner with the other parties involved in the vocational training and has the task of teaching the trainees profession-oriented and interdisciplinary skills. This enables the trainees to fulfill specific tasks in their job as well as to help shape the workplace and society in terms of social, economic and ecological responsibility, especially against the backdrop of evolving standards. That includes promoting young people's competences

- for personal and organizational reflection,
- for lifelong learning,
- for professional and personal flexibility and mobility in view of the increasingly unified Europe.

The teaching of the vocational school is based on the nationally issued regulations for every state-recognized apprenticeship occupation. In addition, the regulations and school laws of the federal states issued for vocational schools apply.

In order to fulfill its educational mission, the vocational school must provide a differentiated educational offer that

- includes action-oriented learning instructions in didactic planning for the school year, that are coordinated with the in-company training,
- enables inclusive lessons with appropriate individual support that takes into consideration different experiences, abilities and talents of all trainees,
- raises awareness of health and specific accident risks at work on an individual and social level,
- shows perspectives of different forms of employment, including entrepreneurial independence, in order to support independent career and life planning,
- is based on the relevant scientific knowledge and results with regard to competence development and assessment.

The main goal of vocational schools is to promote the development of comprehensive action-oriented competence. Action-oriented competence is understood as the willingness and ability of the individual to act appropriately and in an individually and socially responsible manner in professional, social and private environments.

Action-oriented competence is developed in the areas of professional competence, personal competence and social competence.

Professional competence

Willingness and ability to solve tasks and problems in an appropriate, goal-oriented, method-based and independent manner and to assess the result on the basis of technical knowledge and skills.

Self-competence¹

Willingness and ability to clarify, think through and assess the development opportunities, requirements and restrictions in the family, work and public life, aimed at developing one's own talents and formulating life plans. It includes qualities such as independence, critical thinking, self-confidence, reliability, and a sense of responsibility and duty. This includes, in particular the development of carefully thought-out values and a self-sustained commitment to those values.

Social skills

Willingness and ability to shape and live in social relationships, to understand their benefits and tensions as well as to deal with others in a rational and responsible manner and to be able to communicate effectively. This includes in particular the development of social responsibility and solidarity.

Methodological, communicative and learning competences as well as social skills are integral components of professional and personal competence.

Methodological competence

Willingness and ability to take a goal-oriented, planned approach when processing tasks and problems (e.g. when planning career steps).

Communicative competence

Willingness and ability to understand and shape communicative situations. This includes expressing, understanding and considering your own intentions and needs as well as those of your partners.

Learning competence

Willingness and ability to understand and evaluate information and its context independently and together with others, and to classify it in thought patterns. Learning competence also includes, in particular, the ability and willingness to develop learning techniques and strategies in the workplace and beyond and to use them for lifelong learning.

¹ The term "personal competence" replaces the previously used term "human competence". It puts bigger emphasis on the specific educational mission of the vocational school and takes up the systematization of the German Qualifications Framework.

Part III Didactic principles

In order to fulfil the educational mission of the vocational school, young people are enabled to independently plan, carry out and assess work tasks in the context of their professional activity.

Learning in the vocational school aims to develop comprehensive action-oriented skills. Learning at and from work is carried out with the didactically justified practical implementation - or at least intellectual analysis - of all phases of a professional activity in learning situations.

Action-oriented teaching within the framework of the learning area aims primarily to develop systematic structures and represents a different perspective compared to mostly subject-oriented teaching. According to learning theory and didactic knowledge, the following guidelines must be taken into account when planning and implementing action-oriented teaching in learning situations:

- Didactic reference points are situations that are important for the professional practice.
- Learning takes place through participation in tasks, preferably carried out by oneself or at least reproduced mentally.
- Action-oriented tasks promote a holistic grasp of the profession's nature, including technical, safety-related, economic, legal, ecological and social aspects.
- Learners obtain experience this way and reflect on it in terms of its social implications.
- The tasks also take into account social processes, for example expressing social interests or resolving conflicts, as well as different perspectives on career and life planning.

Part IV Profession-oriented preliminary remarks

The present framework curriculum for professional training as a plumber is in accordance with the ordinance on professional training as a plumber of June 21, 2013 (Federal Law Gazette vol. I, p. 1614).

The framework curriculum for the plumber training (Resolution of the Conference of Ministers of Education and Cultural Affairs of June 5, 1989) is superseded by the present framework curriculum.

The skills required to take the examination on economics and social studies are developed on the basis of the "Program for teaching the fields of economics and social studies at the vocational school for commercial-technical professions" (Resolution of the Conference of Ministers of Education of May 7, 2008).

In addition to the job description (Federal Institute for Vocational Education and Training at <http://www.bibb.de>), the following aspects are important in the context of vocational school teaching:

Trainees should

- take into account the special responsibility of plumbers for securing and maintaining buildings' structure with a sustainable use of energy and resources. They should consider the building's envelope as part of a complex energetic system and take into account interdependencies between its various aspects.
- consider themselves to be a service provider and target their actions and approach at the expectations of the customers.

The implementation of this curriculum aims to develop the following qualifications and skills in the trainees:

- Independent execution of the usual plumbing work on a building's envelope.
- Creation of more complex building's envelopes according to specifications.

Relevant standards and legal provisions are to be used as a basis when specifications are not explicitly mentioned.

The necessary technical calculations and drawings are taught as part of the educational program.

Foreign language teaching is integrated into the learning areas in the amount of 40 hours.

Learning areas 1 to 4 of the framework curriculum correspond to learning areas 1 to 4 of the framework curriculum for the metal industry professions. Joint schooling is therefore possible in the first year of the training.

Due to the relevance of Part 1 of the final exam, learning areas 1 to 6 of the framework curriculum must be taught in the first three semesters of the training.

Learning areas 9 and 10 build on learning areas 7 and 8. These learning areas should therefore be trained one after the other, whereas learning areas 7 and 8 could be swapped.

Part V Learning areas

Overview of the learning areas for the plumber's training					
Learning areas		Recommended teaching time (in teaching hours)			
No.		Year 1	Year 2	Year 3	Year 4
1	Manufacturing components with hand-held tools	80			
2	Manufacturing components with machines	80			
3	Manufacturing and assembling components	80			
4	Maintaining technical systems	80			
5	Creating templates and blanks		60		
6	Manufacturing and installing systems for the drainage of rainwater		80		
7	Covering roofs with metallic materials		100		
8	Covering roofs with non-metallic materials		40		
9	Installing system roofs			40	
10	Manufacturing and installing flashings, roof penetrations and joint closures			80	
11	Manufacturing and installing wall coverings			80	
12	Carrying out maintenance on roofs and walls			80	
13	Manufacturing and installing components for ventilation systems and exhaust systems				60
14	Installing energy collectors, lightning protection systems and roof accessories				80
Total: 1020 hours		320	280	280	140

Learning area 1: Manufacturing components with hand-held tools

Year 1. Recommended teaching time: 80 hours

Trainees acquire the competence to create components according to engineering, technological and qualitative specifications using hand-held tools.

Trainees **plan** the production of typical construction components using hand-held tools. Trainees analyze *part, component and overall* drawings in order to obtain the necessary data (*dimensions, tolerances, material specifications and semi-finished products*). Trainees create, modify and supplement technical documents (*drawings, components lists and work plans*) with the help of application programs.

Trainees plan the work steps on the basis of the theoretical principles of the manufacturing processes to be used. Trainees prepare the use of tools by comparing the material properties for various material groups (*ferrous, non-ferrous and plastic materials*) and by selecting the appropriate *tools*. Trainees calculate the *mass of the components*.

Trainees decode material names and information for semi-finished products, such as *sheet metal and profiles*. Trainees explain the wedge effect when removing chips, determine the suitable tools and the material-specific tool geometry (*clearance, wedge and rake angle*). Trainees apply standards and determine the manufacturing parameters.

Trainees establish the connection between the material properties and the deformation behavior of the material during bending. Trainees establish the technological data (*stretched length, springback, bending angle and bending radius*).

Trainees select suitable *tooling and workpiece clamping devices* and auxiliary materials, prepare the manufacture of the components and **carry out** the processing in compliance with the provisions on occupational safety. Trainees roughly determine the *material, labor and tool costs*.

Trainees differentiate between various test methods (*measuring and gauging*), select suitable test equipment, apply it, create corresponding test reports and **evaluate** test results.

Trainees document and explain the performance of the assignment, evaluate, present and **reflect** on the work results. Trainees optimize their own learning and work processes.

Learning area 2: Manufacturing components with machines
Year 1. Recommended teaching time: 80 hours

Trainees acquire the competence to manufacture components with machines according to structural, technological and qualitative specifications.

Trainees **analyze** *part, component and overall drawings and work plans* with the aim of obtaining and evaluating production-related data (*tolerances, fits, surface information, semi-finished products and material specifications*).

Trainees **plan** the production process. They create and supplement individual part drawings and work plans with the aid of application programs.

They compare the selected manufacturing processes and determine the required manufacturing parameters, taking into account *functional and quality specifications*, as well as technological (*manufacturing processes*) and economic (*manufacturing time and cost*) aspects.

Trainees carry out the relevant calculations. To do this, they use technical documents such as *books of tables and manufacturer's documents*, also in a foreign language. Trainees plan the use of tools by determining the specific material properties, taking into account the properties of the cutting material. Trainees determine the appropriate tools and tool geometries. Trainees select material-specific and cutting material-specific *coolants and lubricants*.

Trainees analyze and describe the tool movements, the structure and the mode of operation of machine tools and their mechanical components. Trainees determine the required machine data, evaluate it and present the results in a clear manner.

Trainees prepare the tools and machines for the components manufacturing process. They assess the safety of equipment, set up the machines and **carry out** the processing in compliance with the regulations on occupational health and safety.

Trainees analyze the impact of the manufacturing process on dimensional and surface quality and **evaluate** the product quality.

Trainees select the test equipment according to the qualitative requirements and create test plans and test reports. They determine the usability of the test equipment, check the components, document and evaluate the test results (*including test and production-related errors*).

Trainees document and explain the performance of the assignment, evaluate, present and **reflect** on the work results (*presentation techniques*) and optimize their own learning and work processes.

Learning area 3: Manufacturing and assembling components
Year 1. Recommended teaching time: 80 hours

Trainees acquire the competence to assemble components into modules, taking into account the functional and qualitative requirements.

Trainees analyze technical documents such as *part, component and overall drawings, parts lists and technical schematics* with the aim of obtaining information and describing the functional relationships. On this basis, they **analyze** the flow of forces in the module.

Trainees **plan** the assembly of modules by getting an overview of the proper *assembly sequence*. They create an *installation plan* and use various structuring and visualization variants (*structure tree, table, flowchart, exploded view*).

They compare the structuring and visualization variants with regard to their informative value and planning effectiveness. Trainees differentiate between the operating principles (*force fit, form fit, material fit*) and select suitable *joining techniques*. They determine the tools, aids and devices required for a proper assembly and justify their choices.

Trainees select the necessary standard parts and components with the help of technical documents (*books of tables, standard sheets, catalogues, electronic media, manufacturer's documents*). In order to understand the structural design and to avoid installation errors, trainees carry out the necessary calculations (*force, torque, surface pressure, friction, strength of screws, material parameters*). They determine the parameters, recognize and evaluate the physical relationships and **carry out** the assembly.

Trainees take responsibility for their own and others' safety in the workplace by understanding the consequences of not following the *occupational health and safety regulations*.

Trainees test the functions of the assembled module, taking into account job-specific requirements. Trainees develop *test criteria*, create *test plans*, apply *test equipment* and document the results in *test reports*.

For high quality, trainees assess functional and qualitative features of components and modules and **evaluate** test reports. They derive measures for *quality improvement* and *quality assurance*. They reflect on the assembly process and the procedures used. Possible errors are systematically examined for their causes using quality management tools (*cause-effect diagram*).

Trainees develop and present the results as a team. They **reflect** on their way of working, optimize work strategies and their own learning techniques.

Learning area 4: Maintaining technical systems
Year 1. Recommended teaching time: 80 hours

Trainees acquire the competence to maintain, inspect and repair machines and technical systems within the scope of maintenance and to ensure their operational readiness, while observing the safety regulations for electrical equipment.

Trainees prepare the maintenance of machines and technical systems, in particular of the operating equipment. To do this, they **plan** the necessary steps, taking into account security, availability and economic efficiency.

They read *operating instructions* as well as *maintenance plans* for machines and technical systems, also in a foreign language. Trainees determine the impact on the operational readiness of machines and technical systems and describe the steps for starting them up. They differentiate between various maintenance measures (*maintenance, inspection, repair, improvement*).

Trainees analyze the names and labeling of *lubricants, coolants, hydraulic fluids* and *anti-corrosion agents*. They describe their mode of action and areas of application. They analyze *signs of wear and tear* and determine its *causes*. Trainees prepare maintenance, inspection and repair work on machines and technical systems and **carry it out** in compliance with the regulations on environmental protection (*disposal regulations*) and on the handling of hazardous substances.

Trainees describe the relationship between maintenance measures, product quality and machine availability in the context of quality assurance. Through visual inspection and in compliance with the safety regulations for electrical equipment, they detect possible faults on machines and technical systems, check the functions of safety devices and assess their operational safety.

With the help of basic electrical engineering and control technology, trainees explain simple circuit diagrams. They measure, calculate and compare electrical and physical parameters. Trainees **assess** protective measures and types of protection for electrical equipment.

They document the maintenance measures carried out and prepare a *fault analysis*. They describe possible causes of faults and develop measures to avoid and correct them.

Learning area 5: Creating templates and blanks

Year 2. Recommended teaching time: 60 hours

Trainees acquire the competence to design templates for the production of components related to the plumbing technology according to specifications and to produce blanks from them.

They **analyze** the task using conventional and electronic information sources. Trainees record the details of the task through photos, sketches, technical drawings and using existing workpieces.

They **find out** about the local and structural conditions (*building location, application site, preservation of historical buildings*). In doing so, they take into account the legal framework, the technical rules and the safety regulations.

Trainees **plan** the production of templates and blanks by creating technical drawings and describing the process with conventional and electronic aids. They select a suitable manufacturing process, plan the tooling and material requirements and carry out the necessary calculations. They take dimensions and shapes from existing parts and transfer them, making adjustments and corrections if necessary.

They **create** templates and use them to manufacture components. They transfer the results of their work to the semi-finished products, taking into account the additions.

After completing the templates and blanks, trainees **check** the parts for accuracy of *size and fit*, as well as for other previously defined quality criteria.

They **reflect** on the production of the templates and blanks and the time spent. To improve the fit and dimensional accuracy, trainees discuss and document opportunities for improvement of the process and procedures. They make necessary modifications to the templates and blanks.

Learning area 6: Manufacturing and installing systems for the drainage of rainwater.

Year 2. Recommended teaching time: 80 hours

Trainees acquire the competence to plan, manufacture and install systems for the drainage of rainwater according to a customer's order.

Trainees **analyze** a customer order, get an overview of the structural and local conditions and use this as a basis for further procedures.

They **find out** about the necessity of roof drainage and the relationship between watercourse, roof pitch and roof covering. They analyze the roof with its functions, its complete geometry and roofing types. They explore the importance of the slope for a safe drainage of rainwater and differentiate between external and internal drainage. In doing so, they follow the statutory provisions, current developments in technology and technical regulations. Taking this knowledge into account, they advise the customer on the feasibility of the order.

Trainees **develop** drainage concepts and measure the necessary channel cross-sections and downpipes in accordance with standards. They select suitable metals and plastics, taking into account thermal expansion, corrosion protection measures, applied joining techniques as well as economic and ecological aspects.

Trainees **create** the roof drainage with the help of detailed drawings, templates and selected working and connection techniques. They apply appropriate installation techniques and create roof drainage systems, taking into account given requirements, in particular *slope, gutter connections, downpipe outlets, gutter bracket spacing, bracket fastenings, expansion options, gutter heating*. They use suitable and approved fasteners and apply occupational safety and health protection measures (*fall protection, ladders, scaffolding, fire protection*).

After completing the installation, trainees **check** the system for *function, tightness, dimensional and fitting accuracy and tension*, as well as check fastenings, connections and surface quality. They document the test results and hand over the system to the customer.

They **analyze** the production and installation process and suggest areas for improvement.

Learning area 7: Covering roofs with metallic materials

Year 2. Recommended teaching time: 100 hours

Trainees acquire the competence to cover various roof shapes with metallic materials according to a given specification.

They **analyze** the task with regard to the roof shape, the materials to be used, the type of cover and the structural design. With the help of work plans, trainees record the details of the task.

They **find out** about the structural conditions (*building location, condition, historical buildings preservation*). In doing so, they follow the legal framework, the technical regulations and current developments in plumbing technology.

They **plan** the covering of the roof by creating installation plans and work flow plans. To do this, they make detailed sketches and designs, create tool and material lists and carry out the necessary calculations (*material requirements and length changes*). They plan the transport and storage of materials, tools and machines as well as the construction site equipment, taking into account the legal framework (*road traffic regulations, accident prevention regulations*).

They **manufacture** individual parts of the roof using plumbing techniques. To do this, they set up the machines, taking the operational process into account. They carry out the transport to the construction site and ensure that the materials are properly stored.

Trainees **carry out** the covering of the roof. Before starting work, they check the preliminary work of the other trades and take the necessary measures in the event of deviations. They use selected working techniques, tools and machines to install the roof parts. During the work, trainees always follow the accident prevention regulations and ensure that waste products are disposed of in an environmentally friendly manner. Trainees document the work progress during the installation.

After completing the covering surfaces, trainees **check** the installed parts for dimensional and fitting accuracy as well as for freedom from tension. Trainees ensure the quality of the work by checking the *surfaces, folding quality and fastenings*. As part of quality assurance, they document the results of all testing work.

They **reflect** on the manufacturing and installation process, the procedures used and the time spent. To improve the processes and results, they discuss and document optimization options.

Learning area 8: Covering roofs with non-metallic materials.

Year 2. Recommended teaching time: 40 hours

Trainees acquire the competence to cover different roof shapes with non-metallic materials according to a given specification.

Trainees **analyze** construction drawings and sectional drawings (*full, half and partial sections*) from the relevant technical documents.

Trainees determine the material properties of non-metallic cover materials. They **find out** about the specific types of use, types of fastening, installation techniques, fasteners, connection and termination types.

Trainees **plan** the installation of non-metallic cover materials (*foils, high-polymer bitumen, liquid plastics*). They follow the manufacturer's specifications and flat roof guidelines. Depending on the material, type of installation and structural conditions, they select appropriate fastening options and joining methods.

Trainees prepare and set up appropriate tools and machines. They **carry out** the installation using various joining methods and processes (*form-fit, force-fit and material fit*). They install finished parts and semi-finished products using technical documentation.

They **check** the roof for leaks and surface quality, taking into account the requirements of the job. They develop test criteria and create test plans. Errors are systematically examined for their causes. They record their results, **evaluate** them and take measures to avoid quality defects.

They **reflect** on the installation process, particularly the joining processes used. They present their results and discuss optimization possibilities with regard to economic efficiency, environmental protection, occupational safety and ergonomics.

Learning area 9: Installing system roofs
Year 2. Recommended teaching time: 40 hours

Trainees acquire the competence to cover roofs with different systems made of metallic materials according to a given specification.

They **analyze** the job with regard to the *roof shape, roof slope, roofing systems, materials to be used, type and structural design of the roofing, including its substructure*. They differentiate between self-supporting and non-self-supporting metal coverings. With the help of work plans, trainees record the details of the task.

They **find out** about the structural conditions (*building location, historical building preservation requirements and building condition*). To do so, they follow the manufacturer's specifications, legal framework, technical regulations and current developments in the plumbing technology.

They **plan** the covering of the roof by creating installation plans and workflow plans. They work according to the measures for absorbing *wind and snow loads*, make detailed sketches of solutions, create tools and material lists and carry out the necessary calculations (*material requirements and thermal expansion*) using software. Depending on the selected cover system, material and blanks, they decide on longitudinal and cross connections. They **plan** the transportation and storage of materials, tools and machines as well as the construction site equipment, taking into account the legal framework (*road traffic regulations, accident prevention regulations*).

They **organize** the transportation of the covering materials, tools, machines and auxiliary materials to the construction site. In addition to a timely transfer of the cover materials for the roofing and their appropriate storage, they ensure safety against possible slipping and other dangers in various weather conditions, such as *storm, rain or snow*.

Trainees **carry out** the covering of the roof. Before starting work, they check the preliminary work of other trades and take the necessary measures in the event of deviations. They use selected working techniques, tools and machines to install the roof parts. They measure the system parts with suitable a measuring technology. During the work, trainees always follow the accident prevention regulations and ensure that waste products are disposed of in an environmentally friendly manner. Trainees document the work progress during the installation.

After completing the cover surfaces, trainees **check** the installed parts for *dimensional and fitting accuracy* as well as for *freedom from tension*. They ensure the quality of the work by checking the *surfaces, types of connections and fastenings*. They document the results of all check-up work.

Trainees **present** the planning and installation steps to the customer using a continuous documentation process.

**Learning area 10: Manufacturing and installing flashings, roof penetrations and joint closures
Year 3. Recommended teaching time: 80 hours**

Trainees acquire the competence to prepare and install flashings, connections, roof penetrations, joint closures according to a customer's order and technical specifications.

Trainees get an overview of the specific requirements of a customer's order and technical specification.

They **analyze** the order with regard to the *roof and wall types, the location, the type of cover and the structural design*. While doing so, they particularly take into account the material transitions, the suitability of the substrate and connections as well as the specified heat insulation, cold protection and noise protection measures. With the help of detailed drawings, trainees **find out** about the structural conditions and the preparatory work to be carried out by other trades.

Trainees **plan** the production and installation of flashings, connections and terminations, roof penetrations and joint closures by creating workflow plans and implementation drawings using manufacturer's documents, also in a foreign language and in line with technical regulations. They determine the dimensions and material requirements and present them graphically and mathematically. They plan the choice of materials according to the type of construction and take into account *thermal expansion, wind loads, the requirements of corrosion protection and the building's physics*. They check the consistency of planning and construction site circumstances with the work to be carried out. They also check the use of system components.

As far as possible, they **pre-manufacture** storage facilities, connections and closures and roof penetrations and select manufacturing processes that are suitable for the material and are economically viable. They perform the work paying attention to detail.

They **create and pre-install** storages, connections, closures and roof penetrations. They make joint seals. In doing so, they take into account different requirements of handcrafted components and system components and implement various fastening options, as needed. Before starting work, they check the preliminary work of other trades and take the necessary measures in the event of deviations from the planned specification. They pay particular attention to material transitions, taking into account the properties of metallic and non-metallic materials. They advise the customer on maintenance.

They **check** the installed storage facilities, connections and closures, roof penetrations and joint closures for *functional and dimensional accuracy* using inspection plans that they create with the help of the relevant regulations. Trainees evaluate the effectiveness of the measures taken to ensure rainproofing and waterproofing, *to absorb thermal expansion, to protect against corrosion and to ensure visual quality*.

They **reflect** on the nature and need for collaboration with other trades and evaluate opportunities for improvement.

Learning area 11: Manufacturing and installing wall coverings

Year 3. Recommended teaching time: 80 hours

Trainees acquire the competence to manufacture and install wall coverings using system technology from industrially or manually manufactured systems according to a customer's order.

They **analyze** the customer order with regard to the *building's shape, facade design, cladding systems, materials to be used, cladding type, structure of the facade cladding, including the substructure.*

Trainees **find out** the details of the task aimed at facade cladding in the building's envelope, taking into account *technological, physical, economic, ecological, and architectural aspects.* They record the details of the order with the help of work plans. They find out about the structural conditions (*building's location, historical building protection and legal requirements, as well as and building's state*). To do so, they follow the manufacturer's specifications, legal framework, technical regulations and current developments in the plumbing technology.

They **plan** the cladding of the facade and select suitable measuring and working techniques, taking into account the *design elements, installation methods and choice of materials.* They create *installation plans, parts lists and workflow plans.* They follow measures for absorbing loads (*wind and special loads*), they prepare detailed sketches of solutions, create tools and material lists and carry out the necessary calculations (*heat protection, moisture protection, material requirements and thermal expansion*) using software. Depending on the cladding system selected, the type of installation, the material and the selected blanks, they decide on the longitudinal and cross joints, connections and terminations and the design of transitions.

They **manufacture** the individual parts of the facade cladding. To do this, they set up the tools and machines and ensure that they are used appropriately. They also take operational processes into account and prepare storage that is appropriate for the material. They **plan** the transport and storage of materials, tools and machines as well as the construction site equipment, taking into account the legal framework (*road traffic regulations, accident prevention regulations*). They **organize** the transport of the materials, tools, machines and auxiliary materials to the construction site. In addition to a scheduled transportation of the cladding materials to the installation locations and their appropriate storage, they ensure safety measures against mechanical damage and adverse weather effects (*storm, rain*).

Trainees **perform** cladding of the facade. Before starting work, they check the preliminary work of other trades and take the necessary measures in the event of deviations. They document the work progress during the installation process.

After the completion of the facade surfaces, including the substructure, they **check** the installed parts for *dimensional and fitting accuracy, freedom from tension, and for architectural requirements.* By checking the *surfaces, the types of connections and the fastenings,* they ensure the quality of the work. They document the results of all check-up work.

Trainees **present** the planning and installation steps to the client with the help of a continuous documentation process.

Learning area 12: Carrying out maintenance on roofs and walls

Year 3. Recommended teaching time: 80 hours

Trainees acquire the competence to carry out maintenance measures on roofs and walls according to a customer's order.

Trainees get an overview of the condition of the property and **analyze** the customer's order with regard to the maintenance work to be carried out on various areas of the roof and walls. Using visual inspection and other check-up procedures, trainees record and document the current state of the roof and walls. Trainees take the necessary maintenance measures, comparing them with the existing inventory and maintenance plans.

They **find out** the details of the structural condition (*historical buildings protection requirements, property's state and traffic situation*). They follow the relevant regulations and current developments in plumbing technology.

Together with the customer they agree on the scope of the maintenance work to be carried out.

They **plan** the maintenance work to be carried out for the *drainage systems, roof coverings, wall cladding, flashings, connections and terminations, roof penetrations and joint seals* by creating disassembly and installation plans. Trainees take particular note of the *type of cover and method of application*. They examine possible accesses to the elements to be maintained, determine their availability and select the access options, taking into account accident prevention regulations.

Trainees **carry out** the necessary maintenance work on drainage systems, roof coverings, wall cladding, storage, connections and terminations, roof penetrations and joint seals. While doing so, they follow health protection regulations and dispose of the waste in an environmentally friendly manner.

Trainees **check** connection types and connections for quality of work. As part of preventive maintenance, they advise the customer about the necessary regular maintenance measures.

Trainees **document** the results of the customer service, together evaluate the efficiency of the proposed measures and explain the decisions they have made in a presentation.

**Learning area 13: Manufacturing and installing components for ventilation and exhaust systems
Year 4. Recommended teaching time: 60 hours**

Trainees acquire the competence to manufacture and install components for ventilation and exhaust systems according to design and technological specifications.

They **analyze** technical documents, records and get an overview of the different requirements and characteristics of ventilation systems and exhaust systems.

They **find out** details about the job and its importance, including the thermal processes and hygienic basics of air and its state changes (*heating, cooling, humidification, drying, mixing and purifying*). They get an overview of the properties and composition of *solid, liquid and gaseous fuels* as well as complete combustion, taking into account economic and ecological conditions (*Federal Immission Control Ordinance*).

Trainees determine the dimensions needed to manufacture the components for ventilation systems and exhaust systems and select suitable materials. They **select** the manufacturing and joining techniques, taking into account the relevant thermal expansion and corrosion protection measures.

Trainees **manufacture** components for ventilation systems and exhaust systems with the help of detailed drawings and templates.

After the completion of the components, trainees **check** them for *dimensional and fitting accuracy and tightness*. They use appropriate installation techniques as well as suitable and approved equipment, and they take protection measures against *corrosion, noise and fire*.

After the completion of the installation, trainees **check** if the components have been installed in accordance with their function, carry out the necessary corrective measures in the event of deviations and hand over the systems for acceptance.

Learning area 14: Installing energy collectors, lightning protection systems and roof accessories
Year 4. Recommended teaching time: 80 hours

Trainees acquire the competence to install energy collectors, lightning protection systems and roof accessories according to customer's requirements and legal regulations.

They **recognize** the importance of the use of renewable energies, the need for suitable lightning protection measures and the necessary protective and safety devices (*snow guards, fall protection, facilities for ladders, steps and hooks*).

Trainees **analyze** the customer's order with regard to the structural conditions, the roof shape, the type of cover and the structural design (*availability of the structural analysis certificate*). With the help of implementation plans and manufacturer's specification, trainees record the details of the order and compare them with the customer's specification and the work of other trades involved.

Depending on the existing roof system, they **plan** the installation and storage of energy collectors (*photovoltaic, solar thermal collectors*) by creating installation plans and work plans. They take into account measures to absorb *wind and snow loads*. Trainees plan the installation of external lightning protection. While doing so, they use the manufacturer's documents and follow the legal framework, the technical regulations and the accident prevention regulations (*in particular against electrical current and fire*). They determine the required installation parameters for the protection and safety devices. Trainees make detailed sketches of solutions, create tools and material lists and carry out the necessary calculations (*material requirements and thermal expansion*) using software.

They **plan** the transport and storage of materials, tools and machines as well as the construction site equipment, taking into account the legal framework (*road traffic regulations, accident prevention regulations*).

They **carry out** the installation of energy collectors and external lightning protection systems as well as the protection and safety devices. Before starting work, they check the work of other trades (*substructures and cover quality*) and take appropriate measures in the event of deviations. They use the selected work techniques, tools and machines for the installation. Trainees use the joining methods required for a proper installation.

After the installation is completed, trainees **check** the *dimensional and fitting accuracy*. By checking the *surfaces and fastenings*, they ensure the quality of the performed work. They create an acceptance report and discuss it with the customer when the system is handed over. If any complaints are received, they are assessed and, if necessary, eliminated through appropriate measures.

Part VI Reader's Notes

Consecutive learning area number.

Core competence of the primary professional activity described in a concise manner; learning area name.

Year of training and number of teaching hours during the training period.

Learning area 10. Manufacturing and installing flashings, roof penetrations and joint closures.

Year 3. Recommended teaching time: 80 hours

The first paragraph contains a generalized description of the core competence (see description of the learning area) acquired at the end of the training period.

Trainees acquire the competence to manufacture and install flashings, connections, roof penetrations and joint closures according to a customer's order and technical specifications.

Expanded text containing a detailed description of the stages of the task.

Trainees gain an overview of the specific requirements of the customer's order and the structural aspects.

They **analyze** the order with regard to the *roof and wall types, the location, the type of cover and the structural design*. While doing so, they take into account particularly the material transitions, suitability of the substrate and connections as well as specified heat insulation, cold and noise protection measures. With the help of detailed drawings, trainees **find out** details of the structural condition and the preparatory work carried out by other trades.

Foreign language is adequately considered.

They **plan** manufacturing and installation of flashings, connections and terminations, roof penetrations and joint closures by creating workflow diagrams and working drawings using manufacturer's documents, also in a foreign language and in line with technical regulations. While doing so, they present graphically and mathematically the dimensions and material requirements. They plan the selection of materials in accordance with the type of construction, taking into account *thermal expansion, wind loads, requirements of corrosion protection and the building's physics*. They check the consistency of planning and construction site situation with regard to the work to be carried out. They also check the use of system components.

Mandatory minimum content is marked in italics.

If possible, they **pre-manufacture** materials and select a manufacturing process that is economical and appropriate for the used materials. They perform work paying attention to detail. They **create** storages, connections and closures, roof penetrations and install them. They make joint seals. While doing so, they take into account various requirements of handcrafted components and system components and carry out installation as required in the given circumstances. Before starting work, trainees check the preliminary work of other trades and, in the event of deviations from the planned implementation, take appropriate measures. They pay particular attention to the material transitions, taking into account metallic and non-metallic material properties. They advise the customer on maintenance with regard to the special features of flexible joints.

Open formulations enable different methodological approaches, taking into account the school's equipment.

The complexity and relations of actions are taken into account.

They **check** the installed storage facilities, connections and terminations, roof penetrations and joints for *function and dimensional accuracy* based on test plans, which they create with the help of the relevant regulations. Trainees evaluate the effectiveness of the measures taken for *rain safety, water-tightness, thermal expansion and corrosion*, as well as ensure visual quality.

Full text provides guidelines on creating holistic learning situations across the action phases - complete scope.

They **reflect** on the nature and need for collaboration with other trades and present opportunities for improvement.

Professional, personal and social skills, as well as methodological learning and communicative competence are taken into account.

Enabling the inclusion of organizational and technological changes through open formulations.

**List of correspondences
between
the framework curriculum for the
vocational school and the company
training framework in the plumbing
training.**

The list of correspondences is meant to document the coordination of the learning content between the vocational school and the training at a company.

It is characteristic of dual vocational training in which the trainees acquire their skills at two learning locations: the vocational school and the training company. Different legal regulations apply:

- The curriculum in the vocational school is based on the framework curriculum of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany.
- Training in the company takes place on the basis of the training framework plan, which is part of the training regulations.

Both plans were drawn up in a procedure jointly developed between the Federal Government and the Standing Conference for the coordination of training regulations and framework curricula in the field of vocational training ("Joint results protocol") by competent teachers and trainers in constant coordination with one another.

In the following list of correspondences, the learning areas of the framework curriculum are assigned to the positions in the training framework so as to clearly present the time and factual coordination between them. It can therefore be a tool to improve and strengthen the cooperation between the learning locations on site.

List of correspondences
between the training framework plan and the framework curriculum
 of the vocational training for a
plumber

Draft version of February 5, 2013

Section A: Skills, knowledge and abilities that define the professional profile

Draft training framework plan		Draft framework curriculum								
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area	
			1 - 18	19 - 42	1.	2.	3.	4.		
1	2	3	4		5				6	
SECTION A Skills, knowledge and abilities that define the professional profile										
1	Manual and automatic processing.	a) Differentiating and selecting materials and semi-finished products according to their intended use.	12		x				Learning area 1, 2	
		b) Manufacturing parts from different materials, in particular metal, wood and plastic.			x	x			Learning area 1, 2, 6 (also learning area 10, 13)	
		c) Processing parts manually as well as with hand-operated and stationary machines, in particular by cutting, edging, bending and rounding.			x				Learning area 1, 2 (also learning area 10, 13)	
2	Joining workpieces and components.	a) Specifying joining tools and processes.	16		x				Learning area 3	
		b) Checking components with regard to surface condition, shape changes tolerance, joining quality, and fastening them in a position suitable for installation.			x	x			Learning area 3, 6	
		c) Connecting components with different fastening materials, securing elements and connections, taking into account the sequence of individual tasks and material properties.			x	x			Learning area 3, 6	
		d) Making plug-in connections, in particular of pipes and fittings.			x	x			Learning area 3, 6	
		e) Joining components by cold riveting.								Learning area 5
		f) Selecting and using soldering tools, brazing alloys and fluxes.			x	x				Learning area 3, 6
								x		

Draft training framework plan				Draft framework curriculum					
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area
			1 - 18	19 - 42	1.	2.	3.	4.	
1	2	3	4		5				6
		g) Joining workpieces and components made of different materials in compliance with the relevant processing guidelines, in particular by soldering, welding and flanging.				x			Learning area 6 (also further learning areas)
		h) Joining non-ferrous metals, especially heavy plates that are 3 mm thick or thicker, and supporting structures using inert gas welding.				x			Learning area 3
		i) Joining sheets manually and mechanically by folding.					x		Learning area 6 (also further learning areas)
		j) Joining non-ferrous metals, especially sheets that are up to 3 mm thick, using inert gas welding.					x		Learning area 6 (also further learning areas)
		k) Selecting adhesives according to material properties and processing guidelines, in particular manufacturer's specifications, and joining components, taking tensions into account.		14		x			Learning area 3
		l) Joining PVC-containing and PVC-free roofing membranes, in particular by hot gas welding and solvent welding.						x	Learning area 8
3	Handling and maintenance of tools, devices and machines.	a) Maintaining, cleaning, taking care of equipment and protecting it from corrosion.				x			Learning area 4
		b) Changing and filling up operating liquids.				x			Learning area 4
		c) Removing and installing components and modules with and without tools.				x			Learning area 4
		d) Labeling, recording and storing dismantled components in a systematic manner.				x			Learning area 4
		e) Visually inspecting electrical connections for mechanical damage, in particular at connection points.		6		x			Learning area 4
		f) Following safety measures for electrical machines and devices.				x			Learning area 4
		g) Taking measures to eliminate faults.				x			Learning area 4

4	Installation of electrical components.	a) Applying safety rules for work on electrical systems, following accident prevention regulations.	4		x				Learning area 4				
		b) Making electrical connections using plug-in connections.							Learning area 4				
		c) Visually inspecting electrical connections for mechanical damage.							Learning area 4				
		d) Identifying deficiencies, initiating corrective actions.							Learning area 4				
		e) Installing and operating electrical equipment and devices.							4			x	Learning area 14
		f) Performing mechanical function tests.										x	Learning area 14
5	Designing and manufacturing templates and blanks to size.	a) Making templates from metallic and non-metallic materials.	6			x			Learning area 5 (also further learning areas - on a recurring basis)				
		b) Marking and gauging materials and semi-finished products with the help of templates and gauges using auxiliary aids, taking into account material properties, manufacturer's guidelines and processing practices.							Learning area 5 (also further learning areas - on a recurring basis)				
		c) Designing templates, especially of objects and penetrations, using the surface line method.							4			x	Learning area 10
6	Checking, treating and protecting surfaces.	a) Visually inspecting workpieces and semi-finished products for material defects, and ensuring surface protection and surface quality.	6			x	x		Learning area 7, 8, 9, 11				
		b) Preparing surfaces for the application of conservation and anti-corrosion agents.							Learning area 7, 8, 9, 11				
		c) Tinning surfaces.							Learning area 7, 10				
		d) Applying conservation and anti-corrosion agents, taking into account the processing guidelines.							Learning area 12				
		e) Removing corrosion-promoting residues and impurities, especially solder and flux residues.							Learning area 10, 12				

		Draft training framework plan				Draft framework curriculum				
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area	
			1 - 18	19 - 42	1.	2.	3.	4.		
1	2	3	4		5				6	
7	Fastening components and modules to brickwork, concrete and wood.	a) Creating wall slots, ceiling and wall openings.	4	6			x	x	Learning area 10, 11, 13	
		b) Checking the suitability of the subsurface for fastening.					x	x		Learning area 10, 11, 13
		c) Processing mortar mixtures.					x	x		
		d) Making supporting and fastening constructions.					x	x		Learning area 10, 11, 13
		e) Mounting wall brackets.					x	x		
		f) Using components in brick and concrete structures, in particular with mortar mixtures; closing openings and gaps.					x	x		Learning area 10, 11, 13
		a) Fastening workpieces with dowels, screws and nails, taking linear expansion into account.								
8	Covering and maintenance of roof and wall surfaces.	a) Manufacturing roof coverings and facade cladding from sheet metal panels, strips and profiles, taking into account structural and physical specifications, in particular wind load.	14			x	x	Learning area 7, 8, 9		
		b) Creating roofing with plastic sheets.				x	x		Learning area 7, 8, 9	
		c) Differentiating between and applying various installation techniques for layered structures in green roofs.				x	x			
		d) Covering roofs with molded plastic parts, making connections and terminations on building's structures, as well as covering walls and cornices.				x	x		Learning area 7, 8, 9	
		e) Framing penetrations on roofs, especially for chimneys, exit windows and skylight domes, as well as on walls and facades.				x	x			
		f) Performing maintenance and servicing, in particular replacing defective parts.				x	x		Learning area 7, 8, 9	

Draft training framework plan		Draft framework curriculum							
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area
			1 - 18	19 - 42	1.	2.	3.	4.	
1	2		4		5				6
		g) Dismantling roof coverings and facade cladding in compliance with health and environmental protection regulations.				x	x		Learning area 7, 8, 9
		h) Manufacturing, covering and repairing sections of roof and wall surfaces with other covering materials.				x	x		Learning area 7, 8, 9
		i) Making flexible maintenance joints.				x	x		Learning area 7, 8, 9, 10
9	Manufacturing and installing systems for the drainage of rainwater.	a) Preparing systems for the drainage of rainwater, taking into account the amount of precipitation to be expected.	8			x			Learning area 6
		b) Manufacturing molded parts for gutters, especially expansion compensators, gutter boxes and gutter angles.							Learning area 6
		c) Making gutters and downpipes.							Learning area 6
		d) Attaching and securing gutters, gutter support and downpipes.							Learning area 6
	e) Making sheet metal valleys, eaves and verges and fastening them, taking into account possible expansion.	10							Learning area 10
	f) Installing and connecting roof outlets.								Learning area 10
	g) Creating external drainage.								Learning area 10
	h) Connecting internal drainage.								Learning area 10
10	Manufacturing and installing ventilation systems.	a) Manufacturing and installing fittings, especially bends and branches.	8						Learning area 13
		b) Manufacturing and installing cladding for ducts, pipes and tanks.							Learning area 13
		c) Manufacturing and installing exhaust pipes in accordance with the relevant regulations and practices.							Learning area 13
		d) Installing and connecting pipes and ducts made of metallic and non-metallic materials.							Learning area 13

Draft training framework plan				Draft framework curriculum					
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks).		School year				Learning area
			1 - 18	19 - 42	1.	2.	Year 3.	4.	
1	2	3	4		5				6
		e) Manufacturing and installing brackets and fixings.						x	Learning area 13
11	Transporting components and modules.	a) Attaching and securing loads for transport.				x	x	x	Integrated in learning areas 7-14, specified explicitly in learning area 7, 9, 11, 14
		b) Handling of lifting equipment, in particular wire rope hoists and winches.				x	x	x	Integrated in learning areas 7-14, specified explicitly in learning area 7, 9, 11, 14
		c) Establishing and securing transport routes.				x	x	x	Integrated in learning areas 7-14, specified explicitly in learning area 7, 9, 11, 14
		d) Securing and carrying out transportation.		2		x	x	x	Integrated in learning area 7, 9, 11, 14
		e) Dropping off and securing the transported load.					x	x	x
12	Manufacturing joint closures	a) Applying measures for sound insulation on pipes						x	Learning area 13
		b) and unit fastenings						x	Learning area 13
	and implementation of thermal insulation and sealing measures.	c) Applying thermal insulation and cold protection measures, taking into account building's structural and physical conditions for ventilated and non-ventilated sloping roof structures as well as for exterior wall cladding.		8			x	x	Learning area 7, 8, 9
		d) Applying constructional measures for fire protection.						x	Learning area 13
		e) Applying subsequent insulation and sealing measures, in particular on subroofs, undercoverings and subspannings.						x	Learning area 12
		f) Making connections and terminations.						x	Learning area 10
13	Installation of energy collectors and converters and sustainable energy use systems.	a) Installing energy collectors and energy converters, in particular solar collectors and photovoltaic elements in roof and wall surfaces.		4				x	Learning area 14
		b) Making connections, in particular on roof coverings, roof seals and exterior wall cladding.				x		x	Learning area 6, 14

Draft training framework plan					Draft framework curriculum				
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area
			1 - 18	19 - 42	1.	2.	3.	4.	
1	2		4		5				6
		c) Installing rainwater collection systems.				x		x	Learning area 6, 14
14	Installation of collecting devices and down conductors for external lightning protection.	a) Installing roof accessories, in particular snow guard systems, bird and insect repellent systems and safety devices.		4				x	Learning area 14
		b) Installing, mechanically checking, monitoring and repairing air termination systems and lightning protection conductors.						x	Learning area 14
15	Setting up work scaffolding and safety systems.	a) Applying regulations on work scaffolding and safety systems.		6		x	x	x	Integrated in learning areas 7 to 14, specified explicitly in learning area 6, 7, 9, 11, 12
		b) Securing construction sites and installation sites.				x	x	x	Integrated in learning areas 7 to 14, specified explicitly in learning area 6, 7, 9, 11, 12
		c) Setting up, securing and dismantling auxiliary structures, as well as working and protective scaffolding.				x	x	x	Integrated in learning areas 7 to 14, specified explicitly in learning area 6, 7, 9, 11, 12
		d) Installing and maintaining safety and fall protection systems on roofs and facades.				x	x	x	Integrated in learning areas 7 to 14, specified explicitly in learning area 6, 7, 9, 11, 12

Draft training framework plan				Draft framework curriculum	
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)	School year	Learning area
			1 - 18. 19. - 42.	1. 2. 3. 4.	
1	2		4	5	6
SECTION B Integrated skills, knowledge and abilities					
1	Vocational training, labor and collective bargaining law, job-specific legal principles.	a) Explaining the significance of the apprenticeship contract, in particular its conclusion, duration and termination. b) Listing mutual rights and obligations arising from the training contract. c) Pointing to opportunities for professional development. Naming essential parts of an employment contract. e) Listing essential provisions of the collective agreements applicable to the training company.	Skills and knowledge to be taught during the entire training period.	Economics and social studies	
2	Understanding of the structure and organization of the training company.	a) Understanding of the structure and tasks of the company providing the training. b) Understanding of the basic operations of the training company such as procurement, production, sales and administration. c) Understanding of the relationships between the company providing the training and its employees with business organizations, professional associations and trade unions. d) Understanding of the basic tasks and working methods of the works constitution or employee representation bodies of the training company.	Skills and knowledge to be taught during the entire training period.	Economics and social studies	
3	Work health and safety.	a) Identifying health and safety hazards in the workplace and taking measures to avoid them. b) Applying occupational health, safety and accident prevention regulations. c) Describing the actions to be taken in the event of accidents and taking initial counter-measures. d) Applying regulations of fire prevention; describing the actions to be taken in the event of fire and taking fire-fighting measures.	Skills and knowledge to be taught during the entire training period.		Integrated in all learning areas. Specified explicitly in learning area 1, 2, 3, 4, 6, 7, 9, 11, 14

Draft training framework plan		Draft framework curriculum								
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area	
			1 - 18	19 - 42	1.	2.	3.	4.		
1	2	3	4		5				6	
4	Environmental protection.	Contributing to the prevention of operational environmental pollution in the area exposed to the impact of the work, in particular: a) Explaining possible environmental pollution caused by the training company and its contribution to environmental protection using examples. b) Following environmental protection regulations applicable to the training company. c) Taking advantage of the opportunities for economical and environmentally friendly use of energy and materials d) Limiting waste and disposing of substances and materials in an environmentally friendly manner.	Skills and knowledge to be taught during the entire training period.						Integrated in all learning areas - see the preliminary remarks of the vocational training program. Specified explicitly in learning area 4, 6, 9, 10, 13	
5	Operational and technical communication.	a) Reading, creating and using technical documents, especially sketches and drawings.	6		x	x			Learning area 1, 2, 3, 4, 5, 6	
		b) Making measurements.			x	x			Learning area 1, 2, 5, 6	
		c) Creating installation plans.				x			Learning area 5, 6	
		d) Using standard industry software as well as company-specific communication and information systems.			x				Learning area 2, 4	
		e) Applying data protection and data security rules.			x				Integrated in all learning areas with the use of EDP	
		f) Planning work in a team, applying communication rules and problem-solving methods.			x	x	x		Learning area 3, 6, 12	
		g) Working in a team.					x	x	x	Learning area 3, 6
		h) Recording technical issues, particularly in the form of protocols and reports.			2	xx				Specified explicitly in learning area 1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 14
6	Customer-oriented communication.	a) Contributing to customer satisfaction and business success through own actions.	4			x			Learning area 5, 6	
		b) Determining customer requirements, checking for feasibility, comparing with the company's range of services, estimating costs.				x				
		c) Handing over the system and creating acceptance reports.			4		x	x	x	Learning area 6, 9, 10, 11

Draft training framework plan		Draft framework curriculum								
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area	
			1 - 18	19 - 42	1.	2.	3.	4.		
1	2	3	4		5				6	
		d) Informing customers about maintenance periods, possible energy-saving measures as well as necessary maintenance measures and offering services.					x		Learning area 12	
		e) Receiving, evaluating and taking action to process customer complaints.				x	x	x	Integrated in all learning areas, specified explicitly in learning area 6, 7, 8, 9, 13	
7	Planning and preparation of work processes.	a) Planning tasks in a team in a customer-oriented manner, ensuring the effective use of tools and materials.	4		x	x	x	x	All learning areas 1 - 14	
		b) Estimating the time and staff support required to carry out work assignments.				x	x		Can only be taught in the company, basic information included in learning area 7, 8, 9, 10, 11, 12	
		c) Ensuring economical and environmentally friendly use of work equipment.	4		x	x	x	x	Integrated in all learning areas, specified explicitly in learning area 4, 6, 7, 8, 9, 12, 14	
		d) Checking the consistency of planning and construction site situation with regard to the work to be carried out.				x	x	x	Learning area 5, 6, 7, 9, 10, 11, 12, 13, 14	
		e) Including work of other trades in the planning and taking into account preliminary work, particularly with regard to the location and size of recesses.				x	x	x	Learning area 7, 9, 10, 11, 13, 14	
		f) Planning effectively and adjusting if needed.				x	x	x	Learning area 5, 6, 7, 8, 10, 11, 12, 13, 14	
8	Implementation of quality assurance measures.	a) Following standards and guidelines for quality assurance.	4		x	x	x	x	Integrated in all learning areas, specified explicitly in learning area 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14	
		b) Selecting testing equipment, determining its usability, applying company check-up regulations.				x	x	x	x	Learning area 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14
		c) Checking components for dimensional accuracy, tightness and reliability of connections.							x	Learning area 13, 14,
		d) Identifying errors and malfunctions and determining their causes.				x		x		Learning area 4, 12

		Draft training framework plan				Draft framework curriculum			
Ref. no.	Part of the training program	Skills, knowledge and abilities to be taught	Time guidelines for the training (year/weeks)		School year				Learning area
			1 - 18	19 - 42	1.	2.	3.	4.	
1	2	3	4		5				6
		e) Taking measures to eliminate faults.			x		x	x	Learning area 4, 12, 13, 14
		f) Contributing to the continuous improvement of work processes in one's own work area.			x	x	x		Integrated in all learning areas, see also 8a
		g) Controlling, assessing and documenting services provided by oneself and others.		4	x	x	x	x	Trainee's performance integrated in all learning areas 1 - 14, Services provided by third parties, see also 7e
		h) Documenting the processing of customer orders, performed quality controls and technical check-ups.			x	x	x	x	Processing customer orders: Learning area 6, 7, 8, 9, 10, 11, 12, 14; Carrying out quality control. See: 8a
		i) Informing supervisors and customers about disruptions in the planned order processing and suggesting solutions.				x	x	x	Integrated in learning area 6, 7, 8, 9, 10, 11, 12, 14
		j) Understanding the relations between quality, customer satisfaction and operational success.			x	x	x	x	See: 8a

Work Package 3 First center level "Vocational training"

Activity A4.2 Preparation and transfer of curricula and examination regulations for dual vocational training

Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training

Curricula and examination regulations for dual vocational training as sewage engineering technician

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FRAMEWORK CURRICULUM

for the training occupation

Sewage engineering technician

(resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK) of 14 May 2002)

Part I: Preliminary remarks

This framework curriculum for occupationally oriented instruction in vocational schools has been approved by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK).

It has been coordinated with the relevant training regulations of the Federation (issued by the Federal Ministry of Economics and Technology or such other ministry as may be competent, and acting in agreement with the Federal Ministry of Education and Research). The relevant consultation procedure is defined by the "Joint Memorandum of 30 May 1972" ("Gemeinsames Ergebnisprotokoll vom 30.05.1972"). In general, the framework curriculum is based on the lower secondary school leaving certificate, and it describes minimum requirements.

For the occupations allocated to it, the framework curriculum is divided into a) basic vocational training of relevance for the entire occupational area involved and b) specialised training that builds on the basic training.

On the basis of the training regulations and the framework curriculum, which define the aims and content of vocational training, training is provided that leads to a formal qualification in a recognized training occupation and – in conjunction with instruction in additional subjects – a leaving certificate from the vocational school. Such training thus provides the key basis for high-quality employment and for entry into continuing vocational education and training, including school-based training.

The framework curriculum does not mandate any methods for instruction. Skill in thinking and acting independently and responsibly, as an overarching training aim, is best achieved by instructional forms that make it part of an overall methodological concept. In general, any methodological approach can contribute to the achievement of that aim. Methods that directly promote individual competence are especially useful and thus should be suitably considered in designing and structuring instruction.

The Länder either adopt the framework curriculum directly or implement it within their own curricula. In the second case, they take care to ensure that the manner in which the curriculum has been coordinated with the relevant training regulations, in terms of subjects and scheduling, remains intact.

Part II: The educational mission of part-time vocational schools

In the dual system of vocational training, part-time vocational schools and training companies fulfil a joint educational mission.

The part-time vocational school is a full-fledged learning venue in its own right. It cooperates, as an equal partner, with the other entities that participate in providing vocational training. Its task is to offer pupils general and occupationally oriented learning content, while giving special consideration to requirements pertaining to vocational training.

Education at part-time vocational schools, which builds on pupils' previously acquired general education, consists of basic and specialised vocational training. Its mission is thus to equip pupils to carry out their occupational tasks and to help shape the workplace and society from a perspective of social and ecological responsibility. In fulfilling this mission, it conforms to the Länder laws pertaining to the school category to which it belongs. In particular, occupationally focused instruction is also oriented to the nationally consistent occupation regulations that have been issued, at the national level, for each state-recognized training occupation:

- the framework curriculum of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK)
- the Federation's training regulations for in-company training.

Pursuant to the framework agreement on part-time vocational schools (resolution of the KMK of 15 March 1991), the part-time vocational school has the aims

- "of imparting occupational capabilities that combine specialised competence with general human and social skills;
- of developing flexibility for the management of the changing requirements in the workplace and society, and also with regard to the European integration and fusion;
- of encouraging participation in continuing vocational education and training;
- of promoting the capabilities and willingness that people need in order to act responsibly, both in their individual life choices and in the public sphere."

To be able to achieve these aims, the part-time vocational school

- has to base its instruction on pedagogy that is tailored to its tasks and that emphasizes an orientation to action;
- has to provide overarching qualifications that transcend individual occupations and occupational fields, while still imparting the necessary occupational specialisation;
- has to provide a flexible, suitably differentiated range of education and training that can meet the needs of different people, with their different skills and talents, along with the requirements of the workplace and the needs of society;

- needs to comprehensively support and promote persons with disabilities and disadvantaged persons, within the context of its possibilities and resources;

- needs to call attention to the environmental threats and accident risks associated with the practice of an occupation, and with private life choices, and offer options for preventing and reducing such threats and risks.

Furthermore, in its general instruction, and in its vocationally oriented instruction – to the extent possible – the part-time vocational school needs to call attention to key problems of our time, such as

- the availability of work, and unemployment,
- the challenge of enabling people, peoples and cultures to co-exist peacefully in one world, while preserving their cultural identity,
- the need to protect vital natural resources, and
- the need to safeguard human rights.

The above aims are tied to the development of action competence. In the present context, such competence is understood as the willingness and ability of individuals to act fairly, rationally and responsibly in societal, occupational and private life situations.

Action competence develops within the dimensions of professional competence, personal competence and social competence.

Professional competence refers to the willingness and ability to solve tasks and problems independently, efficiently, objectively and with suitable methods, and on a basis of technical, specialised knowledge and skills.

Personal competence refers to a person's willingness and ability, as an individual personality, to identify, consider and assess development opportunities, requirements and constraints – in family life, the workplace and the public sphere – to develop one's own talents and to make and develop life plans. It comprises personal characteristics such as independence and self-reliance, critical faculties, self-confidence, reliability, responsibility and a sense of duty. It also especially includes the ability to develop well-considered values and to be true, via one's own initiative, to one's values.

Social competence refers to a person's willingness and ability to cultivate and develop social ties, to recognize and understand trust and devotion and tensions and to be able to deal and communicate with others rationally and from a sense of responsibility. It thus especially includes the development of social responsibility and solidarity.

Methodological competence and learning competence grow via balanced development of these three dimensions.

Competence refers to learning success, with regard to the learner's own situation and his or her ability to act independently and responsibly in private, occupational and societal situations. By contrast, "qualification" refers to learning success with respect to usefulness and applicability, i.e. with respect to the relevant demand encountered in private, occupational and societal situations (cf. the German Educational Council (Deutscher Bildungsrat), recommendations of the education commission on the reorganisation of the secondary level II (Empfehlungen der Bildungskommission zur Neuordnung der Sekundarstufe II)).

Part III: Didactic principles

In light of its aims, vocational training instruction has to be oriented to a pedagogy tailored to the tasks of the part-time vocational school, a pedagogy that emphasises action and equips young people for independent, self-reliant planning, execution and assessment of work tasks within the framework of their occupations.

In general, learning in a part-time vocational school is focused on specific occupational actions and on a broad variety of thought processes, including processes for understanding the actions of others. Such learning is tied especially to reflection on the results of actions (execution of action plans, execution of defined procedures, achievement of results). This reflective focus on occupational work provides the basis for learning on and from the job. This implies that a framework curriculum must apply an occupational orientation in describing relevant aims, and in selecting relevant content.

Via a pragmatic approach, and on the basis of findings from learning and didactic theory, it specifies the following orientational principles for the design of action-oriented instruction:

- The didactic references consist of situations of significance to the performance of the relevant occupation (learning for action).
- Actions are the starting point for the learning process – either (ideally) actions that the learner carries out himself or herself or that he or she reflects on (learning via action).
- Relevant actions need to be planned, carried out, reviewed, corrected (if necessary) and, finally evaluated – by the learners themselves.
- Actions should promote a holistic perception and understanding of the occupational reality involved; for example, they should take account of its technical, safety-relevant, economic, legal, ecological and social aspects.
- Actions need to be integrated within learners' own experience, and learners need to consider them in terms of their social impacts.
- Actions should also include social processes – such as processes for clarifying interests or managing conflicts.

Action-oriented instruction is a didactic concept that dovetails technical and action-related system structures. It can be implemented via various different instruction methods.

The educational services of part-time vocational schools are aimed at a diverse range of young people and adults, i.e. at people who differ in terms of their previous education, cultural background and experience gained in training companies. The part-time vocational school can fulfil its educational mission only if it takes account of such differences and promotes and supports pupils – including disadvantaged and especially gifted pupils – in keeping with their specific individual potential.

Part IV: Occupationally oriented preliminary remarks

The framework curriculum for vocational training for the occupation of sewage engineering technician has been coordinated with the Ordinance on Vocational Training in Environmental Technology Occupations (Verordnung über die Berufsausbildung in den umwelttechnischen Berufen) of 17 June 2002 (Federal Law Gazette I, p. 2335).

The part-time vocational school's main course content in the examination subject economics and social sciences is presented on the basis of the "Elements for part-time vocational school instruction, in the area of economics and social sciences, for industrial and technical training occupations" ("Elemente für den Unterricht der Berufsschule im Bereich Wirtschafts- und Sozialkunde gewerblich-technischer Ausbildungsberufe") (resolution of the KMK of 18 May 1984).

The framework curriculum for the training occupation of supplier and disposer (Ver- und Entsorger/Ver- und Entsorgerin) (resolution of the KMK of 20 August 1984) is hereby rescinded.

The framework curriculum for the training occupation of sewage engineering technician has been developed together with the framework curricula for the training occupations of a) water supply engineering technician, b) recycling and waste management technician and c) pipe, sewer and industrial service technician. In keeping with the scope of the common core qualifications that are required for the performance of these occupations, the learning fields 1 through 6 (1st and 2nd year of training) of these four framework curricula are identical and should be taught jointly.

The learning fields 7 through 14 have been designed specifically for the occupation of sewage engineering technician.

The necessary mathematical skills are taught via an integrative approach, in the relevant learning fields.

Part V: Learning fields

Overview of the learning fields for the training occupation of sewage engineering technician				
Learning fields		Suggested time allocation in hours		
		No.	1st year	2nd year
1	Planning of an environmental concept	80		
2	Handling of microorganisms	40		
3	Use of environmental chemicals	80		
4	Operation of pipeline systems	80		
5	Testing of substances in water and waste		60	
6	Operation and maintenance of machines and equipment		80	
7	Operation and maintenance of electrical facilities		40	
8	Operation of drain systems		60	
9	Mechanical cleansing of wastewater		40	
10	Testing of wastewater and sludges			60
11	Biological and chemical treatment of wastewater and sludges			80
12	Connection of electrical equipment			40
13	Maintenance of drain systems, and monitoring of indirect dischargers			60
14	Control and regulation of wastewater treatment facilities			40
	Total (total of 840 hours)	280	280	280

Learning field 1: Planning of an environmental concept

**1st year of training
Suggested time allocation: 80 hours**

Statement of objectives:

The pupils develop a concept for the operation of an environmental technology facility. To this end, they collect information about the material flows in environmental technology facilities, and they learn about the functioning of supply and disposal facilities and of relevant pipeline, sewage and industrial services. In their planning, they take account of the causes and consequences of the air, water and soil pollution originating in the facility, and they identify pertinent interactions with living organisms. They take account of possibilities for preventing and minimising environmental pollution and stresses. In their concept development, which they carry out via work-sharing, they learn to plan and execute tasks in teams and to consult with each other as necessary. They use information and communications systems efficiently, and they document and evaluate results.

Content:

Ecosystems
Water cycles and water quality
Water pollution: eutrophication, contamination, acidification
Air pollution, soil pollution, biotope destruction
Waste prevention
The structure and functioning of wastewater treatment facilities
The structure and functioning of water supply facilities
The structure and functioning of recycling and waste-management operations
The structure and functioning of facilities for pipeline, sewage and industrial services
Legal provisions, technical regulations and guidelines
Organisation of work
Workplace design
Use of information systems
Data protection provisions
Procurement of work equipment and materials
Accident prevention, occupational safety

Learning field 2: Handling of microorganisms

**1st year of training
Suggested time allocation: 40 hours**

Statement of objectives:

The pupils create suitable living conditions for microorganisms, and they know how to use microorganisms to carry out substance conversions in facilities. They are aware of the risks that microorganisms can present for their own personal health, and for the health of the general public. They are able to take hygienic measures within the facility and to combat pathogenic microorganisms.

Content:

Microorganisms: structures, types and properties
The hardiness of microorganisms, and the living conditions they require
The importance of microorganisms for environmental technology occupations
Microorganisms as the most important group of destruent
Substance cycles
Hazards presented by microorganisms: viruses, bacteria, fungi, animal parasites
Hygienic measures
Vaccinations
Identification of microorganisms
Accident prevention and industrial safety
Occupational safety

Learning field 3: Use of environmental chemicals

**1st year of training
Suggested time allocation: 80 hours**

Statement of objectives:

The pupils plan the use of environmental chemicals for water processing, industrial cleansing and waste/wastewater management. They are familiar with the nature and properties of these substances, and they can assess the hazardousness of their reactive behaviour. The pupils assign chemical agents and hazardous substances to hazard classes and dispose of them responsibly. They store and package hazardous materials and substances properly, and they are familiar with the legal provisions pertaining to transports of hazardous materials and substances. They recognize the health impacts of hazardous materials and substances, and they take suitable protective measures. The pupils help to prepare operational instructions for handling of hazardous substances, and they can respond appropriately to hazardous situations within the facility.

Content:

Mixtures of substances
Nature and properties of substances
Precipitation, acid-base and redox reactions
Substance classes
Stoichiometric calculations
Temperature, conductivity, pH, oxygen level
Mass, volume, density
Classification of hazardous substances
Production/emergence of hazardous substances
Handling of hazardous substances
How hazardous substances can disrupt operational procedures
Dangerous chemical reactions
Proper disposal of hazardous substances
Storage and packaging of hazardous substances
Transports of hazardous materials
Operational instructions
Accident prevention, occupational safety

Learning field 4: Operation of pipeline systems

**1st year of training
Suggested time allocation: 80 hours**

Statement of objectives:

The pupils read pipework plans and prepare pertinent sketches. They are able to imagine in detail how pipeline sections have been laid or need to be laid. The pupils plan the installation of fittings and pumping equipment, and they select required materials, including sealing material, in light of the media that are to be transported. They carry out calculations relative to the pipeline system involved, and they prepare relevant lists of materials. In the production of pipeline systems, they use various procedures for installing and joining pipeline components, taking account of the characteristics of the different work and process materials involved and of the circumstances and conditions affecting the procedures. The pupils measure relevant sizes and quantities, and they explain relevant methods for converting, transmitting and processing measured values. They evaluate determined values and, in cases of disruptions, initiate measures for the elimination of the disruptions. The pupils make decisions relative to the use of control and regulating systems.

Content:

Pipelines, fittings, seals
Pipe and hose connections
Pipework plans, basic sketches, flow diagrams and piping and instrumentation diagrams
Labelling of pipes and fittings
Linear expansion, mass-flow and volume-flow calculations
Pressure losses in pipelines
Material properties
Work and process materials
Corrosion and corrosion protection
Procedures for measuring temperature, pressure, fill level, volume, flow rate
Measuring transducers
Standard signals
Relay logic and programmable logic control
Continuous and discontinuous controllers, control loops
Relevant legal provisions and technical regulations
Accident prevention, occupational safety

Learning field 5: Testing of substances in water and waste

**1st year of training
Suggested time allocation: 60 hours**

Statement of objectives:

The pupils take, prepare, preserve and transport samples, for selected purposes, and in keeping with applicable legal provisions. They qualitatively verify the presence of key substances in water and waste. They carry out simple quantitative measurements, check the results for plausibility and interpret and record the results. They are aware of how analytical results affect process sequences, and they are able to initiate measures for process optimisation.

Content:

Sampling

Sensory analysis and pertinent quantities

Physical parameters

Single, group and sum parameters

Laboratory equipment

Qualitative determination of relevant cations and anions

Quantitative measurements – titrimetric, gravimetric, instrumental

Operational logs, performance levels

Accident prevention and industrial safety

Occupational safety

Precision

Accident prevention, occupational safety

Learning field 6: Operation and maintenance of machines and equipment

**2nd year of training
Suggested time allocation: 80 hours**

Statement of objectives:

The pupils operate different types of machines, and they make decisions on use of such equipment in keeping with the relevant situation, as well as on an understanding of the machines' working principles. With the help of instruction manuals, they can carry out inspection and maintenance of machines typically used in their occupational area. They use relevant modern resources to keep records of such inspection and maintenance work. In cases of operational disruptions, they determine the underlying causes, with the help of technical drawings and instruction manuals. In all such activities, they apply up-to-date knowledge of technically based environmental protection. They plan the environmentally compatible storage and disposal of the operating materials the machines require, and they take an active role in making decisions regarding allocations of consumables. The pupils are familiar with methods for combining and separating materials, and they can describe and differentiate such methods in terms of their working principles. They are able to use solid, liquid and gaseous fuels, and electrical energy, properly and efficiently, in keeping with operational circumstances. The pupils select electrical equipment by applying an understanding of basic electrical quantities. In the process, they remain attentive to potential electrical hazards, and they take the necessary protective measures.

Content:

Electric motors and combustion engines
Pumps, blowers and compressors
Selection, use and applications of equipment
Assembly and disassembly of operational equipment and facilities
Maintenance of operational equipment and facilities, card files, logs
Lifting devices and transport equipment
Material storage and planning
Avoidance and minimisation of the environmental pollution and stresses caused by work equipment
Technical documents
Combination and separation of materials
Fuels
Equipment for heating and cooling
Basic electrical quantities
Voltage generators, transformers and motors
Protective measures, proper behaviour in connection with accidents involving electricity
Accepting responsibility
Accident prevention and industrial safety
Occupational safety

Learning field 7: Operation and maintenance of electrical facilities

**2nd year of training
Suggested time allocation: 40 hours**

Statement of objectives:

The pupils operate electrical equipment and systems. To that end, they read circuit diagrams, prepare relevant freehand sketches, measure electrical quantities and assess the pertinent measurements. They check safety equipment and, in cases of disruptions or other problems, initiate steps to restore proper operation and condition. They are familiar with the effects of electricity, and they are aware of the potential hazards presented by electrical systems and equipment. They inform themselves regarding applicable VDE regulations (VDE = Association for Electrical, Electronic & Information Technologies), and they take the necessary measures to protect persons and equipment.

Content:

Effects and dangers of electricity
Safety rules and regulations
Relevant symbols
Circuit diagrams
Direct current, alternating current, three-phase alternating current
Capacitance, inductance
Protective measures with and without protective conductors
Types of networks
Measurement of voltage and current
Legal provisions, technical regulations – such as VDE 0100
Accident prevention, occupational safety

Learning field 8: Operation of drain systems

**2nd year of training
Suggested time allocation: 60 hours**

Statement of objectives:

The pupils help prepare a concept for drainage of wastewater from a drainage area. They select a drain system in keeping with the applicable legal regulations and the local circumstances. They select pipelines, equipment and structures in keeping with the wastewater characteristics, wastewater quantities involved, the local geography and the operational requirements. The pupils plan the monitoring, control and maintenance of drain systems, pumping stations and rainwater overflow facilities. They detect disruptions and take measures to eliminate them. They are aware that the operation, inspection and maintenance of stormwater management facilities are of great significance with regard to protection of water bodies. In planning and execution of their work, the pupils take account of all potential hazards, in order to protect themselves and the other members of their working group.

Content:

Technical communications
Water cycles, water-body protection
Types, quantities and composition of wastewater
Systems for mixing, separation and seepage of rainwater
Gravity sewers, pressure drainage systems, vacuum sewer systems
Building and property drainage
Reading of site maps, construction drawings and piping and instrumentation diagrams
Shafts, intake structures, connecting structures, drop-level structures, junctions
Rainwater overflows
Rainwater management and treatment facilities
Clearing and spraying systems
Measurement of precipitation, water level, flow rate
Management of sewer networks
Requirements pertaining to sewer networks
Corrosion
Gradients
Wastewater conduits, materials, cross-sections, connectors, fittings
Control valves, isolation valves, safety fittings
Relevant legal provisions and technical regulations
Accident prevention, occupational safety

Learning field 9: Mechanical cleansing of wastewater

**2nd year of training
Suggested time allocation: 40 hours**

Statement of objectives:

Working on the basis of the physical composition of wastewater, the pupils plan the removal of suspended substances in wastewater using mechanical separation processes. They evaluate alternative approaches, and derive from such evaluation measures for cost-effective, operationally reliable wastewater treatment. The pupils are able to operate and maintain facilities for mechanical wastewater treatment. They are able to recover residues (for use), or dispose of them (as necessary), in an environmentally compatible manner. They record operational data and work results, visualise them with software commonly used in the industry and interpret the results.

Content:

Physical processes
Lifting systems
Raking and sieving systems
Sand traps
Light-material separators
Treatment and disposal of residues
Settling basins
Flotation basins
Combined facilities
Assessment principles, specific types of calculations for the area involved
Monitoring of operations, records of operations
Relevant legal provisions and technical regulations
Accident prevention, occupational safety

Learning field 10: Testing of wastewater and sludges

**3rd year of training
Suggested time allocation: 60 hours**

Statement of objectives:

The pupils take wastewater and sludge samples, prepare them suitably and prepare sampling logs. They test samples taken from indirect dischargers, or from components within the facility, for the parameters specified in applicable legal provisions. From the results of such testing, they draw conclusions for process control and regarding the quality of the wastewater and sludges tested.

Content:

Sampling
Microscopic images
Dry matter content, dry residue, loss on ignition, residue on ignition
Sludge volume, sludge volume index
Proof of aerobic sludge stabilisation – for example, TTC test, breathing activity
Lime reserve, acid capacity, organic acids
Gas measurements, gas yield
Determination of physical parameters such as conductivity, turbidity, pH, coloration, oxygen
Filtratable substances, settleable solids
Individual parameters, such as phosphorous, nitrogen
Nitrogen balance: Total N, nitrate N, nitrite N, ammonium N
Sum parameters, such as COD, BOD₅, TOC, methylene blue test
Luminescent bacteria test
Precipitation and flocculation tests
Neutralisation tests
Monitoring of indirect dischargers
Recording of weather data
Water-quality determination
Analytical quality assurance
Accident prevention, occupational safety

Learning field 11: Biological and chemical treatment of wastewater and sludges

**3rd year of training
Suggested time allocation: 80 hours**

Statement of objectives:

The pupils carry out biological and chemical procedures for treatment of wastewater. On the basis of the key data and the flow chart for the wastewater-treatment facility, they learn about wastewater-treatment and sludge-treatment processes and about gas recovery and use. From these insights, they derive measures for operation and maintenance of the facility. The pupils optimise operational procedures with the help of process-control systems, with a view to ensuring compliance with the required outflow quality values and to preventing unnecessary operational costs. They carry out maintenance work in keeping with operational instructions, manufacturers' data and the relevant maintenance and inspection files. They document all work results, monitor the work of outside companies and coordinate work procedures. In team meetings, they analyse the various work procedures and define future approaches.

Content:

Biological and chemical processes
C, N and P compounds as nutrients
Carbon elimination
Nitrogen elimination
Phosphorous elimination
Wastewater treatment processes modelled after natural processes
Small wastewater-treatment plants
Trickling-filter and rotating-biological-contactor processes
Activation processes
Special process types, such as SBR processes
Industrial wastewater treatment
Anaerobic wastewater treatment
Relevant machines and equipment
Relevant quantities for assessment, application-specific calculations
Types of sludge, sludge production, sludge quality
Sludge treatment processes
Sludge dewatering
Sludge use and disposal
Gas treatment and use, explosion prevention
Strategies for problem-solving
Monitoring of operations, records of operations
Quality-assurance measures
Legal provisions, technical regulations
Accident prevention, occupational safety

Learning field 12: Connection of electrical equipment

**3rd year of training
Suggested time allocation: 40 hours**

Statement of objectives:

The pupils read circuit diagrams, isolate electrical systems from the network, carry out maintenance work and reconnect equipment, taking account of all safety regulations. In cases of disruptions of electrical systems and equipment, they carry out measurements in keeping with VDO guidelines, assess the measurements, detect operational disruptions and initiate necessary repairs. They can replace defective parts of equipment, using properly selected materials. The pupils understand the responsibility that they assume by working on electrical equipment and facilities. They apply regulations for prevention of electrically triggered explosions.

Content:

Connection and disconnection of electric motors and pumps

Types of connection

Torque behaviour

Rating plate

Motor soft starters

Clamping board

Types of motors, and their behaviour:

such as shunt motors, series motors, AC universal motors,
rotary current induction motors

Replacement of electrical components

such as fluorescent lamps, cables, switches, fuses, contactors,
emergency generators

Measurements, measurement results, operational disruptions

Test reports

Legal provisions, technical regulations – such as VDE 0100

Accident prevention, occupational safety

Learning field 13: Maintenance of drain systems, and monitoring of indirect dischargers

**3rd year of training
Suggested time allocation: 60 hours**

Statement of objectives:

The pupils organise the cleaning, repair, inspection and maintenance of conduits, shafts and special structures. They familiarise themselves with the relevant potential hazards, and they take notice of such hazards in the preparation and execution of their work. In keeping with the pertinent situation, they select personal safety equipment, rescue equipment and measurement and warning equipment, and use such equipment responsibly. They help plan and monitor repair and modernisation measures, and they take account of such measures' impacts on sewage operation. The pupils help to prepare an indirect-discharger cadastre, and they are able to use it locate illegal wastewater discharges. In cooperation with staff of commercial and industrial companies, they review possibilities for cooperation, reach suitable agreements and monitor compliance with such agreements.

Content:

Technical communications
Securing of work areas within the public traffic infrastructure
Climbing into shafts
Working in enclosed spaces
Hygiene and health protection
Measurement and warning equipment
Protective, safety and rescue equipment
Accident-prevention regulations, safety regulations, pertinent instruction sheets
Physical, biological and biochemical processes taking place in sewers
Sewer cleaning – procedures, equipment
Inspection and maintenance of sewers, shafts and special structures
Keeping of records, and archiving and processing of data
Leakage testing
Damages, causes of damage, consequences of damage
Documentation, condition classification and condition assessment
Repair procedures
Pre-treatment facilities
Light-material separators
Small wastewater-treatment plants
Wastewater registry, indirect-discharger cadastre
Requirements pertaining to wastewater discharges
Sampling equipment
Relevant legal provisions and technical regulations

Learning field 14: Control and regulation of wastewater treatment facilities

**3rd year of training
Suggested time allocation: 40 hours**

Statement of objectives:

The pupils simulate the control of a drainage network and of equipment for wastewater and sludge treatment. To that end, they analyse the pertinent control and regulation systems, and the impacts of system changes on operations. They detect disruptions that occur during process control, and they eliminate the causes of such disruptions. The pupils discuss their work results, and they record them in an experience report.

Content:

Simulation models
Regulation principles
Measurement, control and regulation systems
Process-control systems
Documentation

Work Package 3 First center level "Vocational training"

Activity A4.2 Preparation and transfer of curricula and examination regulations for dual vocational training

Result 3.3 Curricula, teaching materials and examination regulations for specific dual vocational training

Curricula and examination regulations for dual vocational training as Environment technician

"The European Commission support for the production of this publication does not constitute endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein"

Ordinance on Vocational Training in Environmental Technology Occupations^{*}
of 17 June 2002

On the basis of Section 25 (1) in conjunction with Section 2 first sentence of the Vocational Training Act of 14 August 1969 (Federal Law Gazette I p. 1112), last amended by Article 212 no. 2 of the Ordinance of 29 October 2001 (Federal Law Gazette I p. 2785), the Federal Ministry of Economics and Technology and the Federal Ministry for the Environment, Nature Conservation and Reactor Safety (BMU), in agreement with the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of the Interior (BMI), decree:

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* This ordinance is a set of training regulations within the meaning of Section 25 of the Vocational Training Act. The training regulations, along with the pertinent framework curriculum for part-time vocational schools that has been approved by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany, and coordinated with those regulations, will soon be published as a supplement to the Federal Gazette.

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Part 1
Common provisions

Section 1

State recognition of training occupations

The training occupations

1. water supply engineering technician,
2. sewage engineering technician,
3. recycling and waste management technician,
4. pipe, sewer and industrial service technician

are recognized by the state. Where relevant training takes place in the public service, the training occupation shall be a training occupation in the public service. Where relevant training takes place in the industry and trade sector, the training occupation shall be a training occupation in the industry and trade sector.

Section 2

Duration of training

The training shall have a duration of three years.

Section 3

Structure and aims of initial vocational training

(1) The training is divided into the following categories:

1. core qualifications that are common to all training occupations, and that are to be taught in an integrative manner, pursuant to Section 4 Nos. 1 through 12, Section 10 Nos. 1 through 12, Section 16 Nos. 1 through 12 and Section 22 Nos. 1 through 12;
2. specific professional qualifications for each training occupation:
 - a) for the occupation of water supply engineering technician, pursuant to Section 4 Nos. 13 through 24,
 - b) for the occupation of sewage engineering technician, pursuant to Section 10 Nos. 13 through 22,
 - c) for the occupation of recycling and waste management technician, pursuant to Section 16 Nos. 13 through 22,
 - d) for the occupation of pipe, sewer and industrial service technician, pursuant to Section 22 Nos. 13 through 18,

(2) The skills and knowledge referred to in this Ordinance shall be imparted in such a manner that, in each case, the trainee is enabled to carry out a recognized training occupation within the meaning of Section 1 (2) of the Vocational Training Act – in particular, an occupation that calls for independent planning and execution of tasks, and for monitoring of their proper completion. The vocational competence described in sentence 1 shall be demonstrated in the examinations pursuant to Sections 8, 9, 14, 15, 20, 21, 26 and 27.

Part 2
Provisions applying to the
training occupation of
water supply engineering technician

Section 4

Training occupation profile

The vocational training shall cover at least the following skills and knowledge:

1. vocational training, labour law and collective bargaining law,
2. the structure and organisation of a training company,
3. safety and health protection in the workplace,
4. environmental protection,
5. business processes, organisation of work,
6. information and documentation, quality assurance measures,
7. environmental protection technology, ecological cycles and hygiene,
8. fundamentals of machinery and process engineering, and of measurement, control and regulation technology,
9. management of electrical hazards,
10. application of scientific principles,
11. relevant materials, including production and process materials, hazardous substances, materials processing,
12. relevant storage, implements and facilities,
13. safety of persons and protection of facilities,
14. water resources management,
15. water extraction,
16. water quality, water processing,
17. water transport, storage and distribution,
18. water analysis,
19. measurement, control and regulation,
20. electrical systems and equipment used in water supply,
21. documentation,
22. protection of drinking-water supplies, and customer systems,
23. orientation to customers,
24. relevant legal provisions and technical regulations.

Section 5

Overall training plan

The skills and knowledge pursuant to Section 4 shall be imparted in keeping with the guideline, contained in Annex 1, for the syllabus and timetable for the vocational training (overall training plan). The syllabus and timetable for the training content may depart from the overall training plan if special practical operational circumstances so require.

Section 6

Training plan

The training employer shall prepare a training plan for the trainee, on the basis of the overall training plan.

Section 7

Report book

The trainee shall keep a report book, a written record of his initial training. The trainee must be given the opportunity to keep such a report book during the period of initial training. The training employer shall review the report book regularly.

Section 8

Interim examination

(1) An interim examination shall be administered in order to determine the level of competence the trainee has attained. It shall take place prior to the end of the second year of training.

(2) The interim examination shall cover the skills and knowledge listed, in Section 1 of Annex 1, for the first 15 months, as well as the subjects to be covered in instruction in part-time vocational school, pursuant to the framework curriculum, to the extent such subjects are of central importance for the relevant initial vocational training.

(3) In the practical section of the examination, the examinee shall be required to complete a practical task, which may consist of several parts, within a total of no more than seven hours. In the process, the examinee shall demonstrate that he or she can cost-effectively plan relevant work processes, choose suitable work tools, equipment, resources etc., keep proper records of his or her work results and take proper measures for safety and health protection in his or her work, for environmental protection and for quality assurance. The following types of practical tasks are especially suitable for this purpose:

processing of materials; assembly, disassembly and maintenance of components or tools and implements; taking of samples; measuring of physical quantities; execution of tests; and use of communications equipment.

(4) In the written section of the examination, the examinee shall solve problems of practical relevance, in a maximum of 180 minutes. Such problems shall involve descriptions of proper measures for safety and health protection in the workplace, for environmental protection and for quality assurance. The examination problems involved may cover especially the following areas, including relevant scientific relationships and occupationally relevant calculations:

1. environmental protection technology, ecological cycles and hygiene,
2. plant engineering and machine technology,
3. measurement and analytical technology,
4. relevant materials, production and process materials and hazardous substances.

Section 9

Final examination

(1) The final examination shall cover the skills and knowledge listed in Annex 1, as well as the subjects covered in instruction in part-time vocational school, to the extent such subjects are of central importance for the relevant vocational training.

(2) In the practical section of the examination, the examinee shall be required to complete a practical task, which may consist of several parts, within a total of no more than ten hours. The following types of practical tasks are especially suitable for this purpose:

operation, monitoring and maintenance of water supply facilities, including testing of quality parameters and execution of electro-technical tasks involving use of measurement, control and regulation technology.

In carrying out the practical task, the examinee shall demonstrate that he or she can cost-effectively plan relevant work processes, recognize relationships of relevance to the work, check his or her work results and keep proper records of such results and take proper measures for safety and health protection in the workplace, for environmental protection and for quality assurance. In addition, the examinee shall demonstrate that he or she can recognize potential electrical hazards, can assess electrical work and carry out such work in accordance with applicable safety criteria.

(3) In the written section of the examination, the examinee shall be tested in the examination areas water supply, electrical installation work and economics and social sciences. In the examination areas water supply and electrical installation work, the examinee shall demonstrate that he or she can solve practically oriented problems involving aspects of organisation of work, and technological, mathematical and scientific aspects, while observing relevant technical regulations and legal foundations. Such problems shall involve descriptions of proper measures for safety and health protection in the workplace and for quality assurance. Problems in the following areas are especially suitable for this purpose:

1. in the examination area water supply:

- a) operation, monitoring and maintenance of facilities,
- b) control of water-treatment processes,
- c) sampling; measurement, recording and analysis of quality parameters,
- d) pipeline networks and pipelines;

2. in the examination area electrical installation work:

- a) foundations of electrical engineering:
- b) electrical systems and components,
- c) electrical measuring instruments and safety equipment;

3. in the examination area economics and social sciences:

general economic and societal interrelationships of relevance in careers and in the workplace.

(4) The written section of the examination shall have the following maximum durations:

1. in the examination area

water supply 180 minutes,

2. in the examination area

electrical installation work 60 minutes,

3. in the examination area

economics and social sciences 60 minutes.

(5) At the request of the examinee, or by decision of the examination committee, the written section of the examination shall be complemented, in various individual areas, by an oral examination if such an examination can be a deciding factor in the examinee's ability to pass the examination. In the determination of the results for the orally tested examination areas, the results prior to such oral testing and the results of the complementary oral examination shall be weighted as a ratio of 2 :1.

(6) Within the written section of the examination, the examination areas shall be weighted as follows:

1. the examination area
water supply 60 percent,
2. the examination area
electrical installation work 20 percent,
3. the examination area
economics and social sciences 20 percent.

(7) The examination shall have been passed if at least satisfactory answers/solutions have been provided in both the practical and the written sections of the examination. As part of this criterion, at least satisfactory answers/solutions must be provided within the examination area electrical installation work, within the practical section of the examination, and within the examination area water supply within the written section of the examination.

Part 3

Provisions applying to the training occupation of sewage engineering technician

Section 10

Training occupation profile

The vocational training shall cover at least the following skills and knowledge:

1. vocational training, labour law and collective bargaining law,
2. the structure and organisation of a training company,
3. safety and health protection in the workplace,
4. environmental protection,
5. business processes, organisation of work,
6. information and documentation, quality assurance measures,
7. environmental protection technology, ecological cycles and hygiene,
8. fundamentals of machinery and process engineering, and of measurement, control and regulation technology,
9. management of electrical hazards,
10. application of scientific principles,
11. relevant materials, production and process materials, hazardous substances, materials processing,
12. relevant storage, implements and facilities,
13. security regulations and operational instructions,
14. operation and maintenance of drain systems,
15. monitoring of indirect dischargers,

16. operation and maintenance of wastewater treatment facilities,
17. treatment of sewage sludge, and recycling of waste from wastewater systems,
18. sampling and analysis of wastewater and sludge,
19. record-keeping, quality management and environmental management,
20. electrical systems used in wastewater facilities,
21. relevant legal provisions and technical regulations.
22. in-depth phase: operation of sewer systems or of wastewater-treatment facilities.

Section 11

Overall training plan

The skills and knowledge pursuant to Section 10 shall be imparted in keeping with the guideline, contained in Annex 2, for the syllabus and timetable for the vocational training (overall training plan). The syllabus and timetable for the training content may depart from the overall training plan if special practical operational circumstances so require.

Section 12

Training plan

The training employer shall prepare a training plan for the trainee, on the basis of the overall training plan.

Section 13

Report book

The trainee shall keep a report book, a written record of his initial training. The trainee must be given the opportunity to keep such a report book during the period of initial training. The training employer shall review the report book regularly.

Section 14

Interim examination

(1) An interim examination shall be administered in order to determine the level of competence the trainee has attained. It shall take place prior to the end of the second year of training.

(2) The interim examination shall cover the skills and knowledge listed, in Section 1 of Annex 2, for the first 15 months, as well as the subjects to be covered in vocational-school instruction, pursuant to the framework curriculum, to the extent such subjects are of central importance for the relevant vocational training.

(3) In the practical section of the examination, the examinee shall be required to complete a practical task, which may consist of several parts, within a total of no more than seven hours. In the process, the examinee shall demonstrate that he or she can cost-effectively plan relevant work processes, choose suitable work tools, equipment, resources etc., keep proper records of his or her work results and take proper measures for safety and health protection in his or her work, for environmental protection and for quality assurance. The following types of practical tasks are especially suitable for this purpose:

processing of materials; assembly, disassembly and maintenance of components or tools and implements; taking of samples; measuring of physical quantities; execution of tests; and use of communications equipment.

(4) In the written section of the examination, the examinee shall solve practically oriented problems in a maximum of 180 minutes. Such problems shall involve descriptions of proper measures for safety and health protection in work, for environmental protection and for quality

2. in the examination area

electrical installation work 60 minutes,

3. in the examination area

economics and social sciences 60 minutes.

(5) At the request of the examinee, or by decision of the examination committee, the written section of the examination shall be complemented, in various individual areas, by an oral examination if such an examination can be a deciding factor in the examinee's ability to pass the examination. In the determination of the results for the orally tested examination areas, the results prior to such oral testing and the results of the complementary oral examination shall be weighted as a ratio of 2 :1.

(6) Within the written section of the examination, the examination areas shall be weighted as follows:

1. the examination area

wastewater technology 60 percent,

2. the examination area

electrical installation work 20 percent,

3. the examination area

economics and social sciences 20 percent.

(7) The examination shall have been passed if at least satisfactory answers/solutions have been provided in both the practical and the written sections of the examination. As part of this criterion, at least satisfactory answers/solutions must be provided within the examination area electrical installation work, within the practical section of the examination, and within the examination area wastewater technology within the written section of the examination.

Part 4

Provisions applying to the training occupation of recycling and waste management technician

Section 16

Training occupation profile

The vocational training shall cover at least the following skills and knowledge:

1. vocational training, labour law and collective bargaining law,
2. the structure and organisation of a training company,
3. safety and health protection in the workplace,
4. environmental protection,
5. business processes, organisation of work,
6. information and documentation, quality assurance measures,
7. environmental protection technology, ecological cycles and hygiene,
8. fundamentals of machinery and process engineering, and of measurement, control and regulation technology,
9. management of electrical hazards,
10. application of scientific principles,
11. relevant materials, production and process materials, hazardous substances, materials processing,

12. relevant storage, implements and facilities,
13. safety regulations and operational instructions,
14. customer-oriented actions,
15. proper business dealings,
16. waste and waste acceptance,
17. waste-management procedures,
18. operation and maintenance,
19. material and substance flows, logistics and scheduling,
20. quality assurance measures,
21. information technology,
22. relevant legal provisions and technical regulations.

Section 17

Overall training plan

The skills and knowledge pursuant to Section 16 shall be imparted in keeping with the guideline, contained in Annex 3, for the syllabus and timetable for the vocational training (overall training plan), and with inclusion of focuses on "logistics, collection and distribution", "waste recovery and treatment" and "waste disposal and treatment". The syllabus and timetable for the training content may depart from the overall training plan if special practical operational circumstances so require.

Section 18

Training plan

The training employer shall prepare a training plan for the trainee, on the basis of the overall training plan.

Section 19

Report book

The trainee shall keep a report book, a written record of his initial training. The trainee must be given the opportunity to keep such a report book during the period of initial training. The training employer shall review the report book regularly.

Section 20

Interim examination

(1) An interim examination shall be administered in order to determine the level of competence the trainee has attained. It shall take place prior to the end of the second year of training.

(2) The interim examination shall cover the skills and knowledge listed, in Section 1 of Annex 3, for the first 15 months, as well as the subjects to be covered in vocational-school instruction, pursuant to the framework curriculum, to the extent such subjects are of central importance for the relevant vocational training.

(3) In the practical section of the examination, the examinee shall be required to complete a practical task, which may consist of several parts, within a total of no more than seven hours. In the process, the examinee shall demonstrate that he or she can cost-effectively plan relevant work processes, choose suitable work tools, equipment, resources etc., keep proper

records of his or her work results and take proper measures for safety and health protection in his or her work, for environmental protection and for quality assurance. The following types of practical tasks are especially suitable for this purpose:

processing of materials; assembly, disassembly and maintenance of components or tools and implements; taking of samples; measuring of physical quantities; execution of tests; and use of communications equipment.

(4) In the written section of the examination, the examinee shall solve practically oriented problems in a maximum of 180 minutes. Such problems shall involve descriptions of proper measures for safety and health protection in work, for environmental protection and for quality assurance. Examination problems in the following areas, including relevant scientific relationships and occupationally relevant calculations, are especially suitable for this purpose:

1. environmental protection technology, ecological cycles and hygiene,
2. plant engineering and machine technology,
3. measurement and analytical technology,
4. relevant materials, production and process materials and hazardous substances.

Section 21

Final examination

(1) The final examination shall cover the skills and knowledge listed in Annex 3, as well as the subjects covered in the vocational-school instruction, to the extent such subjects are of central importance for the relevant vocational training.

(2) In the practical section of the examination, the examinee shall be required to complete three practical tasks, including two joint tasks and one focus task, within a total of no more than ten hours. The following types of tasks are especially suitable as joint tasks:

identification, declaration and analysis of waste; assignment of waste to the proper waste-management pathways; and operation and maintenance of waste-treatment facilities.

The following types of tasks are especially suitable as focus tasks:

1. in the focus area logistics, collection and distribution: execution of a logistical task;
2. in the focus area waste recovery and treatment: execution of a task in the area of waste recovery and treatment;
3. in the focus area waste disposal and treatment: execution of a waste disposal and treatment task.

In carrying out such tasks, the examinee shall demonstrate that he or she can cost-effectively plan relevant work processes, recognize relationships of relevance to the work, check his or her work results and keep proper records of such results and take proper measures for safety and health protection in his or her work, for environmental protection and for quality assurance. The two joint practical tasks shall be given a total weighting of 70 percent, while the focus task shall be given a weighting of 30 percent.

(3) In the written section of the examination, the examinee shall be tested in the examination areas waste-management processes, sound business dealings and business law and economics and social sciences. In the examination areas waste-management processes, sound business dealings and business law, the examinee shall demonstrate that he or she can solve practically oriented problems involving aspects of organisation of work, and technological, mathematical and scientific aspects. Such problems shall involve descriptions of proper measures for safety and health protection in work and for quality assurance. Problems in the following areas are especially suitable for this purpose:

1. in the examination area waste-management processes:
 - a) hygiene,
 - b) waste composition,

- c) waste collection and transport,
 - d) recycling, disposal,
 - e) relevant scientific processes,
 - f) operation and maintenance,
2. in the examination area sound business dealings and business law:
- a) information technology,
 - b) customer-oriented actions,
 - c) relevant legal provisions and technical regulations,
 - d) waste-relevant planning;
3. in the examination area economics and social sciences:
 general economic and societal interrelationships of relevance in careers and in the workplace.
- (4) The written section of the examination shall have the following maximum durations:
- 1. in the examination area

waste-management processes	180 minutes,
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 - 2. in the examination area

sound business dealings and business law	60 minutes,
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 - 3. in the examination area

economics and social sciences	60 minutes.
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- (5) At the request of the examinee, or by decision of the examination committee, the written section of the examination shall be complemented, in various individual areas, by an oral examination if such an examination can be a deciding factor in the examinee's ability to pass the examination. In the determination of the results for the orally tested examination areas, the results prior to such oral testing and the results of the complementary oral examination shall be weighted as a ratio of 2 :1.
- (6) Within the written section of the examination, the examination areas shall be weighted as follows:
- 1. the examination area

waste-management processes	60 percent,
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 - 2. the examination area

sound business dealings and business law	20 percent,
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 - 3. the examination area

economics and social sciences	20 percent.
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- (7) The examination shall have been passed if at least satisfactory answers/solutions have been provided in both the practical and the written sections of the examination and, within the written section of the examination, in the examination area waste-management processes.

Part 5

Provisions applying to the training occupation of pipe, sewer and industrial service technician

Section 22

Training occupation profile

The vocational training shall cover at least the following skills and knowledge:

1. vocational training, labour law and collective bargaining law,
2. the structure and organisation of a training company,
3. safety and health protection in the workplace,
4. environmental protection,
5. business processes, organisation of work,
6. information and documentation, quality assurance measures,
7. environmental protection technology, ecological cycles and hygiene,
8. fundamentals of machinery and process engineering, and of measurement, control and regulation technology,
9. management of electrical hazards,
10. application of scientific principles,
11. relevant materials, production and process materials, hazardous substances, materials processing,
12. relevant storage, implements and facilities,
13. work preparations, securing and clearing of the work area,
14. respiratory protection, fire prevention and explosion prevention,
15. quality assurance measures, safety technology and environmental protection,
16. waste management,
17. cleaning machines and equipment,
18. relevant legal provisions and technical regulations.
19. cleaning,
20. maintenance and servicing.

Section 23

Overall training plan

The skills and knowledge pursuant to Section 22 shall be imparted in keeping with the guideline, contained in Annex 4, for the syllabus and timetable for the vocational training (overall training plan), and with inclusion of focuses on "pipe and sewer services" and "industrial services". The syllabus and timetable for the training content may depart from the overall training plan if special practical operational circumstances so require.

Section 24

Training plan

The training employer shall prepare a training plan for the trainee, on the basis of the overall training plan.

Section 25

Report book

The trainee shall keep a report book, a written record of his initial training. The trainee must be given the opportunity to keep such a report book during the period of initial training. The training employer shall review the report book regularly.

Section 26

Interim examination

(1) An interim examination shall be administered in order to determine the level of competence the trainee has attained. It shall take place prior to the end of the second year of training.

(2) The interim examination shall cover the skills and knowledge listed, in Section 1 of Annex 4, for the first 15 months, as well as the subjects to be covered in vocational-school instruction, pursuant to the framework curriculum, to the extent such subjects are of central importance for the relevant vocational training.

(3) In the practical section of the examination, the examinee shall be required to complete a practical task, which may consist of several parts, within a total of no more than seven hours. In the process, the examinee shall demonstrate that he or she can cost-effectively plan relevant work processes, choose suitable work tools, equipment, resources etc., keep proper records of his or her work results and take proper measures for safety and health protection in his or her work, for environmental protection and for quality assurance. The following types of practical tasks are especially suitable for this purpose:

processing of materials; assembly, disassembly and maintenance of components or tools and implements; taking of samples; measuring of physical quantities; execution of tests; and use of communications equipment.

(4) In the written section of the examination, the examinee shall solve practically oriented problems in a maximum of 180 minutes. Such problems shall involve descriptions of proper measures for safety and health protection in work, for environmental protection and for quality assurance. Examination problems in the following areas, including relevant scientific relationships and occupationally relevant calculations, are especially suitable for this purpose:

1. environmental protection technology, ecological cycles and hygiene,
2. plant engineering and machine technology,
3. measurement and analytical technology,
4. relevant materials, production and process materials and hazardous substances.

Section 27

Final examination

(1) The final examination shall cover the skills and knowledge listed in Annex 4, as well as the subjects covered in the vocational-school instruction, to the extent such subjects are of central importance for the relevant vocational training.

(2) In the practical section of the examination, the examinee shall be required to complete two practical tasks, including one joint task and one task in his or her relevant focus, within a total of no more than ten hours. The joint task may consist especially of the following types of tasks:

cleaning of a wastewater facility, including proper measures for work preparation and work safety.

The following types of tasks are especially suitable as focus tasks:

1. in the focus area pipe and sewer services:
 - execution of a maintenance and service task;
2. in the focus area industrial services:

selection and checking of implements, and execution of an industrial service task.

In carrying out such tasks, the examinee shall demonstrate that he or she can cost-effectively plan relevant work processes, recognize relationships of relevance to the work, check his or her work results and keep proper records of such results and take proper measures for safety and health protection in his or her work, for environmental protection and for quality assurance. The two practical tasks shall each receive a weighting of 50 percent.

(3) In the written section of the examination, the examinee shall be tested in the examination areas work safety, health protection, relevant legal aspects, process engineering and economics and social sciences. In the examination areas work safety, health protection, relevant legal aspects and process engineering, the examinee shall demonstrate that he or she can solve practically oriented problems involving aspects of organisation of work, and technological, mathematical and scientific aspects. Such problems shall involve descriptions of proper measures for safety and health protection in work and for quality assurance. Problems in the following areas are especially suitable for this purpose:

1. in the examination area work safety, health protection and legal aspects:

- a) handling of hazardous substances; hygiene,
- b) technical and personal work-safety equipment,
- c) relevant legal provisions and technical regulations relative to the occupation.

2. in the examination area process engineering:

- a) cleaning processes,
- b) maintenance and service procedures,
- c) machines and equipment;

3. in the examination area economics and social sciences:

general economic and societal interrelationships of relevance in careers and in the workplace.

(4) The written section of the examination shall have the following maximum durations:

1. in the examination area work safety,

health protection and legal aspects 120 minutes,

2. in the examination area

process engineering 120 minutes,

3. in the examination area

economics and social sciences 60 minutes.

(5) At the request of the examinee, or by decision of the examination committee, the written section of the examination shall be complemented, in various individual areas, by an oral examination if such an examination can be a deciding factor in the examinee's ability to pass the examination. In the determination of the results for the orally tested examination areas, the results prior to such oral testing and the results of the complementary oral examination shall be weighted as a ratio of 2 :1.

(6) Within the written section of the examination, the examination areas shall be weighted as follows:

1. the examination area work safety,

health protection and legal aspects 40 percent,

2. the examination area

process engineering 40 percent,

3. the examination area

economics and social sciences 20 percent.

(7) The examination shall have been passed if at least satisfactory answers/solutions have been provided in both the practical and the written sections of the examination. The examination shall not have been passed if unsatisfactory answers/solutions have been provided in one of the examination areas.

Part 6

Transitional and final provisions

Section 28

Transitional provision

Apprenticeships in force upon the entry into force of this ordinance shall continue to be subject to existing provisions, unless the contracting parties agree that the provisions of this ordinance shall be applied.

Section 29

Entry into force, expiry

This ordinance shall enter into force on 1 August 2002. At the same time, the Ordinance on training of suppliers and disposers (Ver- und Entsorger-Ausbildungsverordnung) of 30 May 1984 (Federal Law Gazette I p. 731) shall cease to be effective.

Berlin, 17 June 2002

For the Federal Minister of Economics and Technology

Tacke

For the Federal Minister for the Environment, Nature Conservation and Nuclear Safety

Rainer Baake

Annex 1

(to Section 5)

Overall training plan
for vocational training for water supply engineering technicians

Section 1: Common core qualifications pursuant to Section 3 (1) No. 1

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Vocational training, labour law and collective bargaining law (Section 4 No. 1)	<ul style="list-style-type: none"> a) Explain the meaning of the training contract, including especially how it is concluded, its duration and its termination b) Name the reciprocal rights and obligations under the training contract c) Name possibilities for obtaining further vocational training d) Name the main parts of the employment contract e) Name key provisions of the collective agreements applying to the training company 	To be imparted throughout the entire training period	
2	Structure and organisation of the training company (Section 4 No. 2)	<ul style="list-style-type: none"> a) Describe the structure and tasks of the training company b) Describe the basic functions of the training company, such as the nature of its operations, its production, its sales and its administration c) Name applicable relationships between a) the training company and its workforce and b) industry/economic organisations, professional and trade associations and unions d) Describe the basic aspects, tasks and functioning of the training company's bodies under the Works Constitution Act and workers' representations under the Works Constitution Act 		
3	Safety and health protection in the workplace (Section 4 No. 3)	<ul style="list-style-type: none"> a) Be able to identify safety and health hazards in the workplace, and take measures to prevent such hazards b) Apply occupationally relevant work-safety and accident-prevention provisions c) Describe proper procedures to follow in case of accidents, and be able to initiate suitable initial measures d) Be able to apply rules and regulations for preventive fire protection; describe the proper actions to take in case of fire, and be able to take initial fire-fighting measures 		

4	Environmental protection (Section 4 No. 4)	Help prevent operationally related environmental pollution and stresses within one's sphere of influence in the workplace; in particular, a) Using examples, describe the environmental pollution and stresses that the training company could cause, and illustrate the company's environmental protection contributions b) Apply the environmental protection provisions applying to the training company c) Be able to use energy and materials in cost-effective, environmentally compatible ways d) Avoid waste; ensure that substances and materials are disposed of in environmentally compatible ways	
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Seq . no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
5	Business processes, organisation of work (Section 4 No. 5)	<ul style="list-style-type: none"> a) Ensure that company services are provided cost-effectively b) Be able to differentiate cost types and cost centres c) Carry out one's own work in a customer-oriented manner d) Use work implements and resources, organisational resources and work methods properly e) Work constructively in a team in planning, executing and coordinating tasks; evaluate, check and describe relevant results f) Contribute to measures to improve the manner in which work is organised and work areas are set up 	4	
6	Information and documentation, quality assurance measures (Section 4 No. 6)	<ul style="list-style-type: none"> a) Obtain, process and assess information; use information and communications systems b) Read technical documents and plans; make sketches c) Apply organisational instructions d) Produce work records and reports e) Conform with data privacy provisions f) Carry out, record and check quality assurance measures 	4	
7	Environmental protection technology, ecological cycles and hygiene (Section 4 No. 7)	<ul style="list-style-type: none"> a) Describe relevant ecological cycles b) Become familiar with, and describe, the causes and interactions of environmental pollution and stresses in the air, water, soil and surroundings c) Observe principles and applicable provisions relative to hygiene in operation of networks, systems and facilities d) Describe the risks presented by pathogens in raw water, wastewater, sludges and waste e) Describe relevant networks and facilities f) Describe the possibilities for preventing and minimising the environmental pollution and stresses caused by facilities and technical systems g) Be able to apply relevant legal provisions and technical regulations 	8	
8	Fundamentals of machinery and process engineering, and of measurement, control and regulation technology (Section 4 No. 8)	<ul style="list-style-type: none"> a) Apply proper methods for combining substances and for separating substances in mixtures b) Apply proper methods for transporting solids, liquids and gases c) Assemble and disassemble fittings d) Use and operate powered units, especially pumps, blowers, compressors, electric motors, combustion engines and devices for heating, cooling and thermoregulation e) Explain the differences between different methods for measurement, control and regulation, and explain the structure and function of operationally relevant equipment f) Carry out measurement, control and regulation processes in accordance with specifications g) Select and use different fuels and energy forms, taking 	19	

		account of cost-effectiveness, efficiency aspects and any potential hazards h) Describe methods for energy transformation		
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Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
9	Management of electrical hazards (Section 4 No. 9)	<ul style="list-style-type: none"> a) Describe basic values and their interrelationships b) Be able to identify electrical hazards at both permanent and changing work sites c) Carry out and initiate protective measures to prevent and guard against electrical hazards d) Describe the proper procedures for responding to accidents involving electricity, and be able to initiate initial measures 	4	
10	Application of scientific principles (Section 4 No. 10)	<ul style="list-style-type: none"> a) Measure and analyse physical quantities; determine the properties of substances b) Collect, prepare, label, preserve and store samples, using various suitable procedures c) Explain the interrelationships between the structures and compositions of substances and their characteristic properties d) Prepare mixtures of substances, after making the necessary calculations, and separate substances in mixtures; check pertinent results e) Describe the reactive behaviour of substances, especially their precipitation reactions, acid-base reactions and redox reactions f) Carry out qualitative and quantitative determinations, and assess the pertinent results g) Discuss the relevant types of microorganisms, and explain how they are structured and the conditions under which they live; also explain the significance of such microorganisms for operations within the company h) Describe relevant substance cycles and methods of microbiological analysis 	10	
11	Relevant materials, production and process materials, hazardous substances, materials processing (Section 4 No. 11)	<ul style="list-style-type: none"> a) Select and use production and process materials, taking account of their properties and suitabilities b) Identify and recognize hazardous substances, including hazardous chemical agents, and use them in conformance with applicable safety regulations, taking all necessary precautions c) Use tools, machines and equipment for materials processing d) Make metal and plastic workpieces e) Describe relevant joining and bonding techniques f) Shape, join and separate metals and plastics, using both cutting and non-cutting processes 	12	

12	Relevant storage, implements and facilities (Section 4 No. 12)	a) Store and transport materials and goods in ways that are suitable in light of their condition and characteristics b) Carry out inventories, and initiate necessary corrections c) Operate lifting devices and transport equipment d) Use, inspect, service and clean implements and facilities e) Detect malfunctions of implements and facilities, and take measures to eliminate them	4	
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Section 2: Specific professional qualifications pursuant to Section 3 (1) No. 2 letter a

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
13	Safety of persons and protection of facilities (Section 4 No. 13)	<ul style="list-style-type: none"> a) Comply with occupationally specific regulations relative to work safety and health protection b) Take measures to protect facilities and equipment from external influences 		2
14	Water resources management (Section 4 No. 14)	<ul style="list-style-type: none"> a) Describe key overall interrelationships in the water resources sector b) Describe and differentiate the different types of water resources there are c) Describe the different ways to use water resources d) Determine and justify water requirements 		2
15	Water extraction (Section 4 No. 15)	<ul style="list-style-type: none"> a) Describe processes for water extraction b) Describe and be able to apply measures to protect water resources c) Be able to operate and maintain facilities for water extraction 		4
16	Water quality, water processing (Section 4 No. 16)	<ul style="list-style-type: none"> a) Describe the properties of water and the substances found in it b) Observe water-quality requirements c) Apply principles of proper hygiene in operation of water-supply facilities d) Describe processes for water processing and treatment e) Operate and maintain facilities for water processing and treatment 		12

17	Water transport, storage and distribution (Section 4 No. 17)	<ul style="list-style-type: none"> a) Operate and maintain facilities for water transport b) Describe the different types of water-storage facilities c) Operate and maintain water-storage facilities d) Know the differences between the different components and systems found in pipeline networks e) Select and use tools and materials needed for the construction and operation of pipelines f) Secure construction sites on public roads g) Supervise civil engineering works, lay pipelines h) Operate and maintain pipeline networks i) Describe the available possibilities for refurbishing pipeline networks 		24
18	Water analysis (Section 4 No. 18)	<ul style="list-style-type: none"> a) Explain the need for water analysis b) Operate and maintain sampling equipment c) Collect water samples, and carry out on-site analysis d) Carry out, evaluate and keep proper records of physical and chemical analyses 		9

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
19	Measurement, control and regulation (Section 4 No. 19)	<ul style="list-style-type: none"> a) Describe procedures for measuring water levels, water quantities, water flow and water-quality parameters b) Determine and adjust technical parameters and processes c) Explain relevant remote control methods d) Use, check and maintain measurement, control and regulation equipment and systems e) Detect process disruptions, and take proper measures to eliminate them 		8
20	Electrical systems and equipment used in water supply (Section 4 No. 20)	<ul style="list-style-type: none"> a) Select and use measuring instruments and tools b) Read operationally relevant circuit diagrams c) Check and replace fuses, sensors, measuring equipment, lighting and signal lamps d) Assess operational disruptions, and replace and restart relevant parts of facilities – especially pumps and motors e) Replace directly activatable electrical components outside of switch cabinets f) Use and operate emergency generators g) Install, check and service battery systems 		16
21	Documentation (Section 4 No. 21)	<ul style="list-style-type: none"> a) Prepare installation plans for pipelines b) Determine and request required materials c) Keep and evaluate operational records, prepare reports 		4
22	Protection of drinking-water supplies, and customer systems (Section 4 No. 22)	<ul style="list-style-type: none"> a) Detect water-quality hazards posed by customer systems, and initiate relevant measures b) Describe and assess components, devices and materials in building installations 		4
23	Orientation to customers (Section 4 No. 23)	<ul style="list-style-type: none"> a) Understand and observe the legal aspects of relationships between companies and customers b) Conduct discussions and negotiations with customers in a customer-oriented manner, and make use of possibilities for fostering customer loyalty 		4

24	Relevant legal provisions and technical regulations (Section 4 No. 24)	Apply relevant legal provisions and technical regulations.		2)
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Annex 2
(to Section 11)

Overall training plan for vocational training for specialists for wastewater technology

Section 1: Common core qualifications pursuant to Section 3 (1) No. 1

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Vocational training, labour law and collective bargaining law (Section 10 No. 1)	<ul style="list-style-type: none"> a) Explain the meaning of the training contract, including especially how it is concluded, its duration and its termination b) Name the reciprocal rights and obligations under the training contract c) Name possibilities for obtaining further vocational training d) Name the main parts of the employment contract e) Name key provisions of the collective agreements applying to the training company 	To be imparted throughout the entire	
2	Structure and organisation of the training company (Section 10 No. 2)	<ul style="list-style-type: none"> a) Describe the structure and tasks of the training company b) Describe the basic functions of the training company, such as the nature of its operations, its production, its sales and its administration c) Name applicable relationships between a) the training company and its workforce and b) industry/economic organisations, professional and trade associations and unions d) Describe the basic aspects, tasks and functioning of the training company's bodies under the Works Constitution Act and workers' representations under the Works Constitution Act 		

* To be taught in connection with other training content.

3	Safety and health protection in the workplace (Section 10 No. 3)	<ul style="list-style-type: none"> a) Be able to identify safety and health hazards in the workplace, and take measures to prevent such hazards b) Apply occupationally relevant work-safety and accident-prevention provisions c) Describe proper procedures to follow in case of accidents, and be able to initiate suitable initial measures d) Apply rules and regulations for preventive fire protection; describe the proper actions to take in case of fire, and take initial fire-fighting measures 	training period
4	Environmental protection (Section 10 No. 4)	<p>Help prevent operationally related environmental pollution and stresses within one's sphere of influence in the workplace; in particular,</p> <ul style="list-style-type: none"> a) Using examples, describe the environmental pollution and stresses that the training company could cause, and illustrate the company's environmental protection contributions b) Apply the environmental protection provisions applying to the training company c) Use energy and materials in cost-effective, environmentally compatible ways d) Avoid waste; ensure that substances and materials are disposed of in environmentally compatible ways 	

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
5	Business processes, organisation of work (Section 10 No. 5)	<ul style="list-style-type: none"> a) Ensure that company services are provided cost-effectively b) Differentiate cost types and cost centres c) Carry out one's own work in a customer-oriented manner d) Use work implements and resources, organisational resources and work methods properly e) Work constructively in a team in planning, executing and coordinating tasks; evaluate, check and describe relevant results f) Contribute to measures to improve the manner in which work is organised and work areas are set up 	4	
6	Information and documentation, quality assurance measures (Section 10 No. 6)	<ul style="list-style-type: none"> a) Obtain, process and assess information; use information and communications systems b) Read technical documents and plans; make sketches c) Apply organisational instructions d) Produce work records and reports e) Conform with data privacy provisions f) Carry out, record and check quality assurance measures 	4	
7	Environmental protection technology, ecological cycles and hygiene (Section 10 No. 7)	<ul style="list-style-type: none"> a) Describe relevant ecological cycles b) Become familiar with, and describe, the causes and interactions of environmental pollution and stresses in the air, water, soil and surroundings c) Observe principles and applicable provisions relative to hygiene in operation of networks, systems and facilities d) Describe the risks presented by pathogens in raw water, wastewater, sludges and waste e) Describe relevant networks and facilities f) Describe the possibilities for preventing and minimising the environmental pollution and stresses caused by facilities and technical systems g) Be able to apply relevant legal provisions and technical regulations 	8	

8	Fundamentals of machinery and process engineering, and of measurement, control and regulation technology (Section 10 No. 8)	<ul style="list-style-type: none"> a) Apply proper methods for combining substances and for separating substances in mixtures b) Apply proper methods for transporting solids, liquids and gases c) Assemble and disassemble fittings d) Use and operate powered units, especially pumps, blowers, compressors, electric motors, combustion engines and devices for heating, cooling and thermoregulation e) Explain the differences between different methods for measurement, control and regulation, and explain the structure and function of operationally relevant equipment f) Carry out measurement, control and regulation processes under supervision g) Select and use different fuels and energy forms, taking account of cost-effectiveness, efficiency aspects and any potential hazards h) Describe methods for energy transformation 	19	
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Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
9	Management of electrical hazards (Section 10 No. 9)	<ul style="list-style-type: none"> a) Describe basic values and their interrelationships b) Be able to identify electrical hazards at both permanent and changing work sites c) Carry out and initiate protective measures to prevent and guard against electrical hazards d) Describe the proper procedures for responding to accidents involving electricity, and be able to initiate initial measures 	4	
10	Application of scientific principles (Section 10 No. 10)	<ul style="list-style-type: none"> a) Measure and analyse physical quantities; determine the properties of substances b) Collect, prepare, label, preserve and store samples, using various suitable procedures c) Explain the interrelationships between the structures and compositions of substances and their characteristic properties d) Prepare mixtures of substances, after making the necessary calculations, and separate substances in mixtures; check pertinent results e) Describe the reactive behaviour of substances, especially their precipitation reactions, acid-base reactions and redox reactions f) Carry out qualitative and quantitative determinations, and assess the pertinent results g) Discuss the relevant types of microorganisms, and explain how they are structured and the conditions under which they live; also explain the significance of such microorganisms for operations within the company h) Describe relevant substance cycles and methods of microbiological analysis 	10	
11	Relevant materials, production and process materials, hazardous substances, materials processing (Section 10 No. 11)	<ul style="list-style-type: none"> a) Select and use production and process materials, taking account of their properties and suitabilities b) Identify and recognize hazardous substances, including hazardous chemical agents, and use them in conformance with applicable safety regulations, taking all necessary precautions c) Use tools, machines and equipment for materials processing d) Make metal and plastic workpieces e) Describe relevant joining and bonding techniques f) Shape, join and separate metals and plastics, using both cutting and non-cutting processes 	12	

12	Relevant storage, implements and facilities (Section 10 No. 12)	a) Store and transport materials and goods in ways that are suitable in light of their condition and characteristics b) Check inventory levels, and initiate necessary corrections c) Operate lifting devices and transport equipment d) Use, inspect, service and clean implements and facilities e) Detect malfunctions of implements and facilities, and take measures to eliminate them	4	
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Section 2: Specific professional qualifications pursuant to Section 3 (1) No. 2 letter b

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
13	Safety regulations and operational instructions (Section 10 No. 13)	<ul style="list-style-type: none"> a) Select and use personal safety equipment b) Use safety equipment in the workplace, and maintain its proper function c) Describe relevant explosion hazards, and take explosion-prevention measures d) Take account of risks presented by pathogens in wastewater and sludges, and observe rules for proper occupational hygiene e) Observe rules for proper behaviour during work in enclosed spaces 		2
14	Operation and maintenance of drain systems (Section 10 No. 14)	<ul style="list-style-type: none"> a) Describe relevant drain systems b) Operate and maintain relevant facilities, especially special structures and pumping stations c) Using control systems, monitor, control and regulate operational procedures d) Plan, execute and check measures for cleaning, inspection and leakage testing, taking account of the characteristics of relevant materials and of any required remedial measures e) Detect disruptions and malfunctions, and take proper measures to eliminate them f) Use network information systems g) Secure work areas in and along roads 		18
15	Monitoring of indirect dischargers (Section 10 No. 15)	<ul style="list-style-type: none"> a) Carry out site inspections b) Monitor indirect-discharge sites; carry out mobile sampling and on-site measurements c) Use the indirect-discharger cadastre 		3

16	Operation and maintenance of wastewater treatment facilities (Section 10 No. 16)	<ul style="list-style-type: none"> a) Describe procedures for mechanical wastewater treatment, and use and maintain relevant facilities b) Describe procedures for chemical-biological wastewater treatment, and use and maintain relevant facilities c) Observe relevant relationships between different stages of wastewater treatment d) Describe special procedures for wastewater treatment e) Detect disruptions and malfunctions, and take proper measures to eliminate them f) Using control systems, monitor, control and regulate operational procedures 		20
17	Treatment of sewage sludge, and recycling of waste from wastewater systems (Section 10 No. 17)	<ul style="list-style-type: none"> a) Operate and maintain facilities for sludge treatment b) Operate and maintain facilities for gas treatment, recovery and utilisation c) Monitor, control and regulate operational procedures d) Properly allocate waste for recycling and disposal e) Detect disruptions and malfunctions, and take proper measures to eliminate them 		6

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
18	Sampling and analysis of wastewater and sludge (Section 10 No. 18)	<ul style="list-style-type: none"> a) Carry out sensory evaluation of various types of wastewater and sludge b) In wastewater collection and treatment, carry out and evaluate the standard physical tests, including the relevant sampling, and, in particular, determine such aspects as settleable solids, dry matter in sludge, loss on ignition, sludge volume index, depth of visibility and turbidity c) Measure relevant quantities, fill levels, flows and concentrations d) Carry out wastewater and sludge analyses for purposes of operational and quality control; determine relevant individual and sum parameters, especially phosphorous, nitrogen, carbon dioxide, methane, TOC, BOD₅, COD and acid capacity e) Carry out microbiological tests f) Know the differences, in terms of their functions and applications, between the different types of laboratory devices needed for analysis of wastewater and sludge, and select and use such equipment g) Use and maintain online measuring instruments 		14
19	Record-keeping, quality management and environmental management (Section 10 No. 19)	<ul style="list-style-type: none"> a) Apply the legal and operationally relevant provisions given by the areas of quality and environmental management b) Check, record and assess work procedures and work results c) Record results, especially by adding them to operational logs and databases, and make necessary backups 		2*)
20	Electrical systems used in wastewater facilities (Section 10 No. 20)	<ul style="list-style-type: none"> a) Select and use measuring instruments and tools b) Read operationally relevant circuit diagrams c) Check and replace fuses, sensors, measuring equipment, lighting and signal lamps d) Assess operational disruptions, and replace and restart relevant parts of facilities – especially pumps and motors e) Replace directly activatable electrical components outside of switch cabinets f) Use and operate emergency generators g) Install, check and service battery systems 		16

21	Relevant legal provisions and technical regulations (Section 10 No. 21)	Apply relevant legal provisions and technical regulations.		2 [*])
22	In-depth phase: operation of sewer systems or of wastewater-treatment facilities (Section 10 No. 22)	The vocational training should be continued, taking account of operationally relevant emphases, by refining/deepening skills and knowledge pursuant to sequential numbers 14 and 15, for operation of sewer systems, or pursuant to 16 and 17, for operation of wastewater-treatment facilities.		8

* To be taught in connection with other training content.

Overall training plan for vocational training for recycling and waste management technicians

Section 1: Common core qualifications pursuant to Section 3 (1) No. 1

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Vocational training, labour law and collective bargaining law (Section 16 No. 1)	<ul style="list-style-type: none"> a) Explain the meaning of the training contract, including especially how it is concluded, its duration and its termination b) Name the reciprocal rights and obligations under the training contract c) Name possibilities for obtaining further vocational training d) Name the main parts of the employment contract e) Name key provisions of the collective agreements applying to the training company 	To be imparted throughout the entire training period	
2	Structure and organisation of the training company (Section 16 No. 2)	<ul style="list-style-type: none"> a) Describe the structure and tasks of the training company b) Describe the basic functions of the training company, such as the nature of its operations, its production, its sales and its administration c) Name applicable relationships between a) the training company and its workforce and b) industry/economic organisations, professional and trade associations and unions d) Describe the basic aspects, tasks and functioning of the training company's bodies under the Works Constitution Act and workers' representations under the Works Constitution Act 		
3	Safety and health protection in the workplace (Section 16 No. 3)	<ul style="list-style-type: none"> a) Identify safety and health hazards in the workplace, and take measures to prevent such hazards b) Apply occupationally relevant work-safety and accident-prevention provisions c) Describe proper procedures to follow in case of accidents, and be able to initiate suitable initial measures d) Apply rules and regulations for preventive fire protection; describe the proper actions to take in case of fire, and take initial fire-fighting measures 		

4	Environmental protection (Section 16 No. 4)	Help prevent operationally related environmental pollution and stresses within one's sphere of influence in the workplace; in particular, <ul style="list-style-type: none">a) using examples, describe the environmental pollution and stresses that the training company could cause, and illustrate the company's environmental protection contributionsb) apply the environmental protection provisions applying to the training companyc) use energy and materials in cost-effective, environmentally compatible waysd) avoid waste; ensure that substances and materials are disposed of in environmentally compatible ways	
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Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
5	Business processes, organisation of work (Section 16 No. 5)	<ul style="list-style-type: none"> a) Ensure that company services are provided cost-effectively b) Differentiate cost types and cost centres c) Carry out one's own work in a customer-oriented manner d) Use work implements and resources, organisational resources and work methods properly e) Work constructively in a team in planning, executing and coordinating tasks; evaluate, check and describe relevant results f) Contribute to measures to improve the manner in which work is organised and work areas are set up 	4	
6	Information and documentation, quality assurance measures (Section 16 No. 6)	<ul style="list-style-type: none"> a) Obtain, process and assess information; use information and communications systems b) Read technical documents and plans; make sketches c) Apply organisational instructions d) Produce work records and reports e) Conform with data privacy provisions f) Carry out, record and check quality assurance measures 	4	
7	Environmental protection technology, ecological cycles and hygiene (Section 16 No. 7)	<ul style="list-style-type: none"> a) Describe relevant ecological cycles b) Become familiar with, and describe, the causes and interactions of environmental pollution and stresses in the air, water, soil and surroundings c) Observe principles and applicable provisions relative to hygiene in operation of networks, systems and facilities d) Describe the risks presented by pathogens in raw water, wastewater, sludges and waste e) Describe relevant networks and facilities f) Describe the possibilities for preventing and minimising the environmental pollution and stresses caused by facilities and technical systems g) Apply relevant legal provisions and technical regulations 	8	

8	Fundamentals of machinery and process engineering, and of measurement, control and regulation technology (Section 16 No. 8)	<ul style="list-style-type: none"> a) Apply proper methods for combining substances and for separating substances in mixtures b) Apply proper methods for transporting solids, liquids and gases c) Assemble and disassemble fittings d) Use and operate powered units, especially pumps, blowers, compressors, electric motors, combustion engines and devices for heating, cooling and thermoregulation e) Explain the differences between different methods for measurement, control and regulation, and explain the structure and function of operationally relevant equipment f) Carry out measurement, control and regulation processes under supervision g) Select and use different fuels and energy forms, taking account of cost-effectiveness, efficiency aspects and any potential hazards h) Describe methods for energy transformation 	19	
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Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
9	Management of electrical hazards (Section 16 No. 9)	<ul style="list-style-type: none"> a) Describe basic quantities and their interrelationships b) Be able to identify electrical hazards at both permanent and changing work sites c) Carry out and initiate protective measures to prevent and guard against electrical hazards d) Describe the proper procedures for responding to accidents involving electricity, and be able to initiate initial measures 	4	
10	Application of scientific principles (Section 16 No. 10)	<ul style="list-style-type: none"> a) Measure and analyse physical quantities; determine the properties of substances b) Collect, prepare, label, preserve and store samples, using various suitable procedures c) Explain the interrelationships between the structures and compositions of substances and their characteristic properties d) Prepare mixtures of substances, after making the necessary calculations, and separate substances in mixtures; check pertinent results e) Describe the reactive behaviour of substances, especially their precipitation reactions, acid-base reactions and redox reactions f) Carry out qualitative and quantitative determinations, and assess the pertinent results g) Discuss the relevant types of microorganisms, and explain how they are structured and the conditions under which they live; also explain the significance of such microorganisms for operations within the company h) Describe relevant substance cycles and methods of microbiological analysis 	10	
11	Relevant materials, production and process materials, hazardous substances, materials processing (Section 16 No. 11)	<ul style="list-style-type: none"> a) Select and use production and process materials, taking account of their properties and suitabilities b) Identify and recognize hazardous substances, including hazardous chemical agents, and use them in conformance with applicable safety regulations, taking all necessary precautions c) Use tools, machines and equipment for materials processing d) Make metal and plastic workpieces e) Describe relevant joining and bonding techniques f) Shape, join and separate metals and plastics, using both cutting and non-cutting processes 	12	

12	Relevant storage, implements and facilities (Section 16 No. 12)	a) Store and transport materials and goods in ways that are suitable in light of their condition and characteristics b) Check inventory levels, and initiate necessary corrections c) Operate lifting devices and transport equipment d) Use, inspect, service and clean implements and facilities e) Detect malfunctions of implements and facilities, and take measures to eliminate them	4	
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Section 2: Specific professional qualifications pursuant to Section 3 (1) No. 2 letter c

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
13	Safety regulations and operational instructions (Section 16 No. 13)	Take proper occupational safety measures in collection, transport and treatment of waste, hazardous substances and special waste		4
14	Customer-oriented actions (Section 16 No. 14)	<ul style="list-style-type: none"> a) Describe the tasks to be carried out in field service and office work, and describe the importance of the two work categories b) Conduct discussions and negotiations with customers in a customer-oriented manner, and make use of possibilities for fostering customer loyalty c) Understand and observe the legal aspects of relationships between companies and customers d) Take customer-satisfaction analyses and supplier assessments into account 		4
15	Sound business dealings (Section 16 No. 15)	<ul style="list-style-type: none"> a) Describe the applicable principles in the waste-management sector, the competition situation prevailing in the section and the bases for structuring prices in the sector b) Explain the concept of supply and demand 		4
16	Waste and waste acceptance (Section 16 No. 16)	<ul style="list-style-type: none"> a) Know the differences between products, waste for recovery and waste for disposal b) Provide relevant information about waste origins, waste-production sites, quantities of produced waste and types of waste c) Monitor and keep records of waste quantities d) Differentiate and allocate waste in terms of relevant characteristics, especially in terms of hazardousness (i.e. monitoring requirements) e) Identify and declare waste, and categorize waste in accordance with the European Waste Catalogue f) Accept and collect waste at facilities and premises of waste producers, separate the waste properly and prepare it for the relevant material flows and their further processing g) Name materials and products that can be recovered and recycled, and name materials and products that have to be disposed of; describe the relevant materials' and products' characteristics and applicable quality requirements h) Describe the processing criteria for various types of 		9

		waste, along with the potential reactions the waste can undergo		
17	Waste-management procedures (Section 16 No. 17)	<ul style="list-style-type: none"> a) Describe relevant physical, chemical and biological processes b) Describe the different types of equipment used in relevant facilities, and describe relevant combinations of facility components c) Describe the requirements pertaining to relevant processes and facility equipment d) Detect environmental pollution and stresses, describe possibilities for preventing such pollution and stresses and initiate countermeasures as necessary 		11

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
18	Operation and maintenance (Section 16 No. 18)	<ul style="list-style-type: none"> a) Commission and decommission parts of facilities, and keep relevant records b) Keep records of normal operation of facilities c) Operate, monitor and maintain relevant equipment, devices and facilities d) Detect and keep records of operational disruptions, and initiate countermeasures as necessary 		8
19	Material and substance flows, logistics and scheduling (Section 16 No. 19)	<ul style="list-style-type: none"> a) Describe relevant types of vehicles, containers and collection systems, and combine such equipment in keeping with customer requirements and operation areas b) Use tools and resources for managing assignments c) Plan assignments of vehicles, personnel and containers d) Describe available options for carrying out waste-management-capacity provision, waste transport, waste storage and interim waste storage 		7
20	Quality assurance measures (Section 16 No. 20)	<ul style="list-style-type: none"> a) Explain the basic principles of quality management and environmental management, and explain how specialised waste-management companies are important b) Apply procedural and work instructions for systems, and make records of relevant changes c) Describe the requirements pertaining to recyclable, recoverable and disposable waste and materials, and carry out relevant quality inspections d) Carry out sampling, and prepare samples, for purposes of analysis e) Apply measurement and analytical procedures to incoming and outgoing materials f) Assess analytical results in light of acceptance criteria g) Observe requirements pertaining to labelling of waste and products 		6
21	Information technology (Section 16 No. 21)	<ul style="list-style-type: none"> a) Use operationally specific programmes for closed-cycle economies and waste management b) Prepare bar and circle diagrams, hydrographs, summation curves and tables relative to waste-management issues and documentation c) Use the relevant company's forms 		4

22	Relevant legal provisions and technical regulations (Section 16 No. 22)	<ul style="list-style-type: none"> a) Apply relevant legal provisions and technical regulations b) Carry out proper record-keeping relative to waste recovery and disposal c) Discuss relevant waste-management concepts and records, and prepare data for such concepts and records 		4*)
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* To be taught in connection with other training content.

Focus area of logistics, collection and distribution

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Sound business dealings (Section 16 No. 15)	<ul style="list-style-type: none"> a) Analyse and compile customer requirements; accept and carry out customer orders b) Order waste and assign it to suitable recovery and disposal pathways c) Prepare accompanying documents and invoices d) Record expenses incurred in providing services, determine relevant costs and calculate the resulting prices of services e) Take part in preparing specifications and bids f) Process complaints g) Keep records of processes and operations in accordance with applicable legal and operational requirements 		9
2	Material and substance flows, logistics and scheduling (Section 16 No. 19)	<ul style="list-style-type: none"> a) Accept waste at interim storage sites and transfer stations b) Compile records of storage inputs and outputs, taking account of applicable quality and quantity specifications c) Operate stationary and mobile collection sites, and provide hazardous-waste-collection services d) Describe "bring-it-yourself" systems and collection systems e) Describe the different types of containers used for collecting different types of waste, including swap-body, discharge-system and other waste-collection containers, and describe the applications for which each type is used f) Use transport systems for pasty, liquid and other waste g) Describe various types of relevant vehicle equipment, including collection, filling, identification and weighing systems, and describe the various possible uses for such equipment h) Schedule deployments of personnel, vehicles and containers i) Plan assignments and help optimise routing j) Determine the expenses related to the various relevant systems, and determine actual costs and monitor performance 		19

3	Safety regulations and operational instructions (Section 16 No. 13)	<ul style="list-style-type: none">a) Apply safety regulations in connection with hazardous substances, hazardous waste and biological agentsb) Apply occupational safety guidelines relative to storage, collection and transportc) Apply relevant provisions of laws pertaining to hazardous materialsd) Apply relevant provisions of traffic laws, including laws pertaining to goods transports, in waste collection and transporte) Apply operational instructions oriented to specific tasks		2
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Focus area of waste recovery and treatment:

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Waste-management procedures (Section 16 No. 17)	<ul style="list-style-type: none"> a) Accept, treat and provide waste b) Put waste and products into interim storage and longer-term storage c) Describe the basic operations involved in processing, recovering and treating waste d) Describe the process steps involved in making products from waste e) Carry out processes for cleaning secondary raw materials f) Use combinations of procedures for processing and recovery g) Eliminate contaminants and foreign matter in processing and recovery h) Identify pollutants, be familiar with their potential hazards and assign them to the proper disposal pathways 		17
2	Operation and maintenance (Section 16 No. 18)	<ul style="list-style-type: none"> a) Control, regulate and monitor processing and recovery procedures b) Operate measurement, control and regulation equipment c) Operate, monitor and maintain facilities and their components d) Detect malfunctions of units, machines and equipment, and relevant operational disruptions, and initiate measures to eliminate such malfunctions and disruptions e) Detect shortcomings in process equipment, and initiate improvements f) Plan and initiate inspections, and help carry out relevant modifications and conversions g) Keep records of ongoing operations and of maintenance and servicing work 		6
3	Material and substance flows, logistics and scheduling (Section 16 No. 19)	<ul style="list-style-type: none"> a) Track and keep records of material and substance flows in facilities b) Carry out sampling and sample preparation, keep records of sampling and monitor relevant quality levels and values c) Check recovery (recycled) products in terms of quality, and keep pertinent records, and initiate any required quality-improvement measures d) Make recovery (recycled) products and secondary raw materials available for sale, and distribute such products and materials e) Allocate residual waste to proper disposal pathways f) Plan and keep records of personnel, vehicle and equipment assignments 		5

4	Safety regulations and operational instructions (Section 16 No. 13)	a) Describe the hazards presented by biological substances and hazardous substances b) Apply safety regulations pertaining to facilities and processes c) Describe and operate fire-prevention and fire-safety equipment d) Take proper measures to prevent explosions e) Apply operational instructions oriented to specific tasks		2
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Focus area of waste disposal and treatment

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Waste-management procedures (Section 16 No. 17)	<ul style="list-style-type: none"> a) Accept, process, pre-treat and provide waste b) Describe methods for treating and disposing of waste, including the pertinent process steps c) Carry out two of the five waste-treatment processes listed below <ul style="list-style-type: none"> aa) waste storage bb) thermal treatment of waste cc) composting of waste dd) mechanical-biological waste treatment ee) treatment of special waste 		17
2	Operation and maintenance (Section 16 No. 18)	<ul style="list-style-type: none"> a) Control, regulate and monitor treatment and disposal procedures b) Operate measurement, control and regulation equipment c) Operate, monitor and maintain facilities and their components d) Detect malfunctions of units, machines and equipment, and relevant operational disruptions, and initiate measures to eliminate such malfunctions and disruptions e) Plan and initiate inspections, and help carry out relevant modifications and conversions f) Keep records of ongoing operations and of maintenance and servicing work 		6
3	Material and substance flows, logistics and scheduling (Section 16 No. 19)	<ul style="list-style-type: none"> a) Describe operational procedures for waste treatment and waste disposal b) Carry out sampling and sample preparation, keep records of sampling and carry out relevant testing c) Track material flows within facility systems, and keep pertinent records, within regard to quantities, quality and relevant characteristics d) Carry out measurements relative to control of facilities and to immissions analysis e) Keep records of outputs of materials, substances and energy f) Collect waste for disposal in properly separated form, place it in temporary storage and prepare it for disposal g) Plan and keep records of personnel, vehicle and equipment assignments 		5

4	Safety regulations and operational instructions (Section 16 No. 13)	a) Describe the hazards presented by biological substances and hazardous substances b) Apply safety regulations pertaining to facilities and processes c) Describe and operate fire-prevention and fire-safety equipment d) Take proper measures to prevent explosions e) Apply operational instructions oriented to specific tasks		2
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Overall training plan for vocational training for pipe, sewer and industrial service technicians

Section 1: Common core qualifications pursuant to Section 3 (1) No. 1

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Vocational training, labour law and collective bargaining law (Section 22 No. 1)	<ul style="list-style-type: none"> a) Explain the meaning of the training contract, including especially how it is concluded, its duration and its termination b) Name the reciprocal rights and obligations under the training contract c) Name possibilities for obtaining further vocational training d) Name the main parts of the employment contract e) Name key provisions of the collective agreements applying to the training company 	To be imparted throughout the entire training period	
2	Structure and organisation of the training company (Section 22 No. 2)	<ul style="list-style-type: none"> a) Describe the structure and tasks of the training company b) Describe the basic functions of the training company, such as the nature of its operations, its production, its sales and its administration c) Name applicable relationships between a) the training company and its workforce and b) industry/economic organisations, professional and trade associations and unions d) Describe the basic aspects, tasks and functioning of the training company's bodies under the Works Constitution Act and workers' representations under the Works Constitution Act 		
3	Safety and health protection in the workplace (Section 22 No. 3)	<ul style="list-style-type: none"> a) Be able to identify safety and health hazards in the workplace, and take measures to prevent such hazards b) Apply occupationally relevant work-safety and accident-prevention provisions c) Describe proper procedures to follow in case of accidents, and be able to initiate suitable initial measures d) Apply rules and regulations for preventive fire protection; describe the proper actions to take in case of fire, and take initial fire-fighting measures 		

4	Environmental protection (Section 22 No. 4)	Help prevent operationally related environmental pollution and stresses within one's sphere of influence in the workplace; in particular, a) Using examples, describe the environmental pollution and stresses that the training company could cause, and illustrate the company's environmental protection contributions b) Apply the environmental protection provisions applying to the training company c) Use energy and materials in cost-effective, environmentally compatible ways d) Avoid waste; ensure that substances and materials are disposed of in environmentally compatible ways	
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Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
5	Business processes, organisation of work (Section 22 No. 5)	<ul style="list-style-type: none"> a) Ensure that company services are provided cost-effectively b) Differentiate cost types and cost centres c) Carry out one's own work in a customer-oriented manner d) Use work implements and resources, organisational resources and work methods properly e) Work constructively in a team in planning, executing and coordinating tasks; evaluate, check and describe relevant results f) Contribute to measures to improve the manner in which work is organised and work areas are set up 	4	
6	Information and documentation, quality assurance measures (Section 22 No. 6)	<ul style="list-style-type: none"> a) Obtain, process and assess information; use information and communications systems b) Read technical documents and plans; make sketches c) Apply organisational instructions d) Produce work records and reports e) Conform with data privacy provisions f) Carry out, record and check quality assurance measures 	4	
7	Environmental protection technology, ecological cycles and hygiene (Section 22 No. 7)	<ul style="list-style-type: none"> a) Describe relevant ecological cycles b) Become familiar with, and describe, the causes and interactions of environmental pollution and stresses in the air, water, soil and surroundings c) Observe principles and applicable provisions relative to hygiene in operation of networks, systems and facilities d) Describe the risks presented by pathogens in raw water, wastewater, sludges and waste e) Describe relevant networks and facilities f) Describe the possibilities for preventing and minimising the environmental pollution and stresses caused by facilities and technical systems g) Apply relevant legal provisions and technical regulations 	8	

8	<p>Fundamentals of machinery and process engineering, and of measurement, control and regulation technology (Section 22 No. 8)</p>	<ul style="list-style-type: none"> a) Apply proper methods for combining substances and for separating substances in mixtures b) Apply proper methods for transporting solids, liquids and gases c) Assemble and disassemble fittings d) Use and operate powered units, especially pumps, blowers, compressors, electric motors, combustion engines and devices for heating, cooling and thermoregulation e) Explain the differences between different methods for measurement, control and regulation, and explain the structure and function of operationally relevant equipment f) Carry out measurement, control and regulation processes under supervision g) Select and use different fuels and energy forms, taking account of cost-effectiveness, efficiency aspects and any potential hazards h) Describe methods for energy transformation 	19	
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Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
9	Management of electrical hazards (Section 22 No. 9)	<ul style="list-style-type: none"> a) Describe basic quantities and their interrelationships b) Be able to identify electrical hazards at both permanent and changing work sites c) Carry out and initiate protective measures to prevent and guard against electrical hazards d) Describe the proper procedures for responding to accidents involving electricity, and be able to initiate initial measures 	4	
10	Application of scientific principles (Section 22 No. 10)	<ul style="list-style-type: none"> a) Measure and analyse physical quantities; determine the properties of substances b) Collect, prepare, label, preserve and store samples, using various suitable procedures c) Explain the interrelationships between the structures and compositions of substances and their characteristic properties d) Prepare mixtures of substances, after making the necessary calculations, and separate substances in mixtures; check pertinent results e) Describe the reactive behaviour of substances, especially their precipitation reactions, acid-base reactions and redox reactions f) Carry out qualitative and quantitative determinations, and assess the pertinent results g) Discuss the relevant types of microorganisms, and explain how they are structured and the conditions under which they live; also explain the significance of such microorganisms for operations within the company h) Describe relevant substance cycles and methods of microbiological analysis 	10	
11	Relevant materials, production and process materials, hazardous substances, materials processing (Section 22 No. 11)	<ul style="list-style-type: none"> a) Select and use production and process materials, taking account of their properties and suitabilities b) Identify and recognize hazardous substances, including hazardous chemical agents, and use them in conformance with applicable safety regulations, taking all necessary precautions c) Use tools, machines and equipment for materials processing d) Make metal and plastic workpieces e) Describe relevant joining and bonding techniques f) Shape, join and separate metals and plastics, using both cutting and non-cutting processes 	12	

12	Relevant storage, implements and facilities (Section 22 No. 12)	a) Store and transport materials and goods in ways that are suitable in light of their condition and characteristics b) Check inventory levels, and initiate necessary corrections c) Operate lifting devices and transport equipment d) Use, inspect, service and clean implements and facilities e) Detect malfunctions of implements and facilities, and take measures to eliminate them	4	
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Section 2: Specific professional qualifications pursuant to Section 3 (1) No. 2 letter d

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
13	Work preparations, securing and clearing of the work area (Section 22 No. 13)	<ul style="list-style-type: none"> a) Assess the work area, and detect any hazards emanating from it b) Take proper account of the structures and function of industrial facilities and drain systems c) Know the differences between the different types of control components d) Read inventory plans and flow diagrams for processes, and apply pertinent information in selection of work methods and procedures e) Select and define work methods and procedures in light of environmental protection criteria f) Obtain and use workslips and permits g) Check proper activation of facility equipment h) Carry out safety measures in connection with service and maintenance work i) Hand over a cleared work area 		16
14	Respiratory protection, fire prevention and explosion prevention (Section 22 No. 14)	<ul style="list-style-type: none"> a) Select, use and maintain work-safety equipment, including equipment for personal safety, and especially including breathing apparatus b) Use ventilation systems c) Explain occupationally relevant principles applying to fire safety and explosion prevention d) Pinpoint and identify fire and explosion hazards e) Use devices for measuring gas levels and potential explosion hazards f) Select and use equipment for areas with explosion hazards 		12
15	Quality assurance measures, safety technology and environmental protection (Section 22 No. 15)	<ul style="list-style-type: none"> a) Apply relevant elements of operational safety, quality-assurance and environmental protection systems b) Systematically search for, and record, the causes of errors and defects, and help eliminate them c) Contribute to the ongoing improvement of work procedures within one's own work area d) Implement customer-specific specifications relative to safety, quality and environmental protection e) Conduct discussions and negotiations with customers in a customer-oriented manner, and make use of possibilities for fostering customer loyalty 		4

16	Waste management (Section 22 No. 16)	a) In cleaning and maintenance, properly identify residues and impurities from one's own work and initiate proper measures b) Properly package, collect and transport residues, mixtures and pure substances c) Clean transport units, packaging and equipment		4
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Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
17	Cleaning machines and equipment (Section 22 No. 17)	<ul style="list-style-type: none"> a) Explain the structure, function and working principles of relevant machines and tools b) Carry out maintenance and care for equipment c) Ready equipment for use, and carry out functional tests prior to working with equipment d) Detect any malfunctions of equipment, and initiate measures to limit damage and eliminate the problems e) Carry out hydrodynamic, mechanical and electro-mechanical procedures for cleaning equipment and facilities used in the wastewater sector 		19
18	Relevant legal provisions and technical regulations (Section 22 No. 18)	Apply relevant legal provisions and technical regulations.		4 [*]

Focus area pipe and sewer services:

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Cleaning (Section 22 No. 19)	<ul style="list-style-type: none"> a) Clean pipelines, wastewater structures, sewage lines and conduits, and separators, using various procedures b) Inspect pipelines, wastewater structures, sewage lines and conduits, and separators, using various procedures – especially camera-aided inspections, on-site inspections and endoscopy c) Check pipelines, wastewater structures, sewage lines and conduits, connections, supports, and separators for proper function and leak-tightness d) Detect any defects and connection errors e) Determine the position of wastewater lines and conduits 		16

* To be taught in connection with other training content.

2	Maintenance and servicing (Section 22 No. 20)	<ul style="list-style-type: none">a) Service pipelines, wastewater structures, and sewage lines and conduits, taking account of the materials involved and of measures needed to ensure trouble-free operationb) Detect foreign objects and obstructions in pipelines, wastewater structures, and sewage lines and conduits, and separators, and initiate measures to remove and eliminate themc) Explain the differences between different types of relevant measuring systemsd) Carry out repairs of locally confined damages, and explain the differences between additional types of repair/refurbishment procedures		16
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Focus area of industrial services

Seq. no.	Training occupation profile: sections to be covered	Skills and knowledge that are to be imparted, in a framework that supports the trainee's own independent planning, execution and checking	Durational guidelines, in weeks within the relevant training month	
			1st – 15th month	16th – 36th month
1	2	3	4	
1	Cleaning (Section 22 No. 19)	<ul style="list-style-type: none"> a) Use machines and systems for removal of residual quantities, especially vacuuming equipment, air-mover equipment, screening equipment and filling equipment b) Remove production rejects from systems and system components, using high-pressure-water-jet equipment, vacuuming equipment, air-mover equipment, screening equipment and filling equipment c) Clean the interiors of systems and system components, using high-pressure-water-jet equipment, vacuuming equipment, air-mover equipment, screening equipment and filling equipment d) Remove surface impurities, using abrasive, vacuuming and chemical processes, in systems and system components e) Treat surfaces using physical procedures, especially procedures involving high-pressure water jets and abrasive processes f) Remove system components for cleaning purposes, and reinstall them, in keeping with specifications and instructions 		16
2	Maintenance and servicing (Section 22 No. 20)	<ul style="list-style-type: none"> a) Detect any divergences from planned processes b) Replace solid and liquid processing aids in systems c) Remove system components for exchange of processing aids, and reinstall them, in keeping with specifications and instructions 		16