



**Bundesinstitut für Berufsbildung (BIBB)**

**Ordinance on vocational education and training in  
Technical product designer and Technical system planner <sup>1)</sup>**

**promulgated on 21 June 2011**

**Skeleton Curricula for the training occupation  
in  
Technical product designer and Technical system planner**

(Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of 25 March 2004)

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<sup>1</sup>The present Statutory Ordinance constitutes training regulations within the meaning of § 4 of the Vocational Training Act. The training regulations and the coordinated skeleton curriculum for the vocational school adopted by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder of the Federal Republic of Germany will shortly be published as an Annex to the Federal Gazette.



**Ordinance on vocational education and training in the occupations of technical product designer and technical system planner**

**of 21 June 2011**

On the basis of § 4 Paragraph 1 of the Vocational Training Act of 23 March 2005 in conjunction with Paragraph 5 of said Act (Federal Law Gazette I p. 931), Paragraph 1 having been amended by Article 232, Section 1 Clause a) of the Ordinance dated 31 October 2006 (Federal Law Gazette I p. 2407), the Federal Ministry of Economics and Technology issues the following Ordinance in agreement with the Federal Ministry of Education and Research.

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## **Part 2**

### **Provisions for the training occupation of plant mechanic**

#### § 7

#### **Training profile**

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

1. Vocational education and training, 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. Differentiate, allocate and handle materials and auxiliary materials
8. Produce components and sub-assemblies
9. Maintain operating equipment
10. Control systems
11. Fix, secure and transport
12. Customer orientation
13. Process orders
14. Produce and assemble components and sub-assemblies
15. Maintenance; identify, localise and remedy errors and malfunctions
16. Check components and equipment
17. Business processes and quality management within the area of deployment

(2) Skills pursuant to Paragraph 1 above should be applied and deepened in at least one of the following areas of deployment.

1. Plant construction
2. Apparatus and container construction
3. Servicing
4. Pipe system technology
5. Welding technology

The area of deployment is stipulated by the company providing training. Other areas of deployment are permissible if the skills pursuant to Paragraph 1 above can be imparted.

#### § 8

#### **General training plan**

The skills stated in § 7 Paragraph 1 above should be imparted in accordance with the instructions regarding the content and time structure of vocational education and training (general training plan) contained in Annex 1 and Annex 2. 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.

#### § 9

#### **Part 1 of the final examination**

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

(2) Part 1 of the final examination encompasses such skills for the first three half years of training as are listed in Annex 2 and extends to include teaching material to be imparted at vocational school insofar as such teaching material is integral to the vocational education and training.

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

1. evaluate technical documentation, determine technical parameters, plan and agree work processes, plan material and tool requirements;
2. select production procedures, manufacture components using manual and machine production processes, apply prevention measures and accord due consideration to environmental protection regulations;
3. evaluate the safety of operating equipment;
4. select and apply testing procedures and equipment, check the deployability of test equipment, document and evaluate results;
5. document and explain the execution of orders, prepare technical documentation including test protocols.

These requirements should be demonstrated via the production of pipelines, plant or container components using sheet metals, profiles and semi-finished products. Tacking and welding works should be carried out. Candidates make a selection from several procedures on offer.

(4) The examination consists of the execution of a complex work-related task, which comprises situational oral examination phases and written examination assignments. The maximum examination time is 8 hours, whereby the situational oral examination phases should be of a total maximum duration of 10 minutes. The duration of the written assignments should not exceed 90 minutes.

#### § 10

#### **Part 2 of the final examination**

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

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

1. A work order
2. Order and functional analysis
3. Production engineering
4. Business and social studies

Due consideration should be accorded to vocational education and training, 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 work results, quality management and the safety of plants and operating equipment.

(3) In the examination area work order, candidates should demonstrate that they are able to:

1. clarify the nature and scope of orders, identify specific services, agree particular characteristics and deadlines with customers, procure information for the processing of the order;

2. evaluate and use information for the processing of the order, take technical developments into account, comply with stipulations relevant to safety, accord due consideration to business management and ecological points of view in planning the processing of orders, reach agreement with upstream and downstream divisions, prepare planning documents;
3. execute orders whilst in particular taking account of health and safety at work, environmental protection and deadlines, apply company quality assurance systems in their own work area, systematically seek out, remedy and document the causes of quality defects, arrange for partial orders;
4. select and apply testing procedures and equipment, identify the deployability of test equipment, apply test plans and company test regulations, check and document results, document order processes, services and consumption, handover technical systems or products to customers and explain such systems and products, prepare acceptance protocols;
5. execute three welding engineering test pieces with two different materials and two welding procedures in the field of welding technology or apply joining procedures in the other areas of deployment.

Manufacture, altering or servicing of plants or plant components are particularly considered as evidence of satisfactory performance.

(4) In order to demonstrate fulfilment of requirements in the examination area work order candidates should:

1. execute a company order within 18 hours including provision of practical documentation and to take part in a specialist oral examination of no more than 30 minutes' duration; the specialist oral examination should be conducted on the basis of the practically related documentation of the company order processed; the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the order under due consideration of the practically related documentation; prior to the execution of the company order the assignment including planned processing time should be presented to the Examination Board for approval; or
2. prepare, execute and follow-up a practical work task in 14 hours, including documentation via task specific records, and to conduct a supplementary specialist oral examination of no more than 20 minutes' duration; the execution of the work task lasts six hours; observations of the way in which the task is executed, the task specific documentation and the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the work task.

(5) The company providing training should select the examination option in accordance with Paragraph 4 above and should notify the candidate and the competent body of the selection at the same time as registration for the examination takes place.

(6) In the examination area order and functional analysis, candidates should analyse an order within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to accord due consideration to technical rules and guidelines in checking and supplementing technical documentation to ensure completeness and correctness, select test equipment and procedures, apply test

plans and company test regulations, document results and contribute to the optimisation of stipulations and work processes.

(7) In the examination area production engineering, candidate should plan the process of manufacture or alteration of plant components within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to analyse technical problems, develop solution concepts whilst according due consideration to production procedures, material properties, regulations, technical rules, guidelines, cost-effectiveness and company processes, stipulate system specifications to suit applications, determine costs, prepare technical documents, accord due consideration to health and safety at work and health protection and select welding or other joining procedures in an order-related manner.

(8) In the examination area business and social studies, candidates should process practically related employment-oriented tasks within the maximum examination time of 60 minutes and demonstrate that they are able to present and evaluate general business and societal correlations within the world of employment and work.

### **Part 3 Provisions for the training occupation of industrial mechanic**

#### § 1 1

#### **Training profile**

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

1. Vocational education and training, 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. Differentiate, allocate and handle materials and auxiliary materials
  8. Produce components and sub-assemblies
  9. Maintain operating equipment
  10. Control systems
  11. Fix, secure and transport
  11. Customer orientation
  12. Produce, assemble and dismantle components, sub-assemblies and systems
  13. Ensure the functionality of technical systems
  14. Maintain technical systems
  15. Build, expand and check electrical control engineering components
  16. Business processes and quality management within the area of deployment

(2) Skills pursuant to Paragraph 1 above should be applied and deepened in at least one of the following areas of deployment.

1. Construction of precision devices
2. Servicing
3. Machine and plant construction
4. Production engineering

The area of deployment is stipulated by the company providing training. Other areas of deployment are permissible if the skills pursuant to Paragraph 1 above can be imparted.

## § 12

### General training plan

The skills stated in § 11 Paragraph 1 above should be imparted in accordance with the instructions regarding the content and time structure of vocational education and training (general training plan) contained in Annex 1 and Annex 3. 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 should take place before the end of the second year of training.

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

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

1. evaluate technical documentation, determine technical parameters, plan and agree work processes, plan material and tool requirements;
2. select production procedures, manufacture components using manual and machine production processes, apply prevention measures and accord due consideration to environmental protection regulations;
3. evaluate the safety of operating equipment;
4. select and apply testing procedures and equipment, check the deployability of test equipment, document and evaluate results;
5. document and explain the execution of orders, prepare technical documentation including test protocols.

These requirements should be demonstrated via the production of a sub-assembly with a control engineering function.

(4) The examination consists of the execution of a complex work-related task, which comprises situational oral examination phases and written examination assignments. The maximum examination time is 8 hours, whereby the situational oral examination phases should be of a total maximum duration of 10 minutes. The duration of the written assignments should not exceed 90 minutes.

## § 14

### Part 2 of the final examination

(1) Part 2 of the final examination encompasses such skills as are listed in Annex 1 and Annex 3 and extends to include teaching material to be imparted at vocational school insofar as

such teaching material is integral to the vocational education and training.

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

1. A work order
2. Order and functional analysis
3. Production engineering
4. Business and social studies

Due consideration should be accorded to vocational education and training, 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 work results, quality assurance systems and the safety of plants and operating equipment.

(3) In the examination area work order, candidates should demonstrate that they are able to:

1. clarify the nature and scope of orders, identify specific services, agree particular characteristics and deadlines with customers, procure information for the processing of the order;
2. evaluate and use information for the processing of the order, take technical developments into account, comply with stipulations relevant to safety, accord due consideration to business management and ecological points of view in planning the processing of orders, reach agreement with upstream and downstream divisions, prepare planning documents;
3. execute orders whilst in particular taking account of health and safety at work, environmental protection and deadlines, apply company quality assurance systems in their own work area, systematically seek out, remedy and document the causes of quality defects, arrange for partial orders;
4. select and apply testing procedures and equipment, identify the deployability of test equipment, apply test plans and company test regulations, check and document results, document order processes, services and consumption, handover technical systems or products to customers and explain such systems and products, prepare acceptance protocols.

Manufacture, set up, altering, retrofitting or servicing of plants or plant components are particularly considered as evidence of satisfactory performance.

(4) In order to demonstrate fulfilment of requirements in the examination area work order candidates should:

1. execute a company order within 18 hours including provision of practical documentation and to take part in a specialist oral examination of no more than 30 minutes' duration; the specialist oral examination should be conducted on the basis of the practically related documentation of the company order processed; the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the order under due consideration of the practically related documentation; prior to the execution of the company order the assignment including planned processing time should be presented to the Examination Board for approval; or
2. prepare, execute and follow-up a practical work task in 14 hours, including documentation via task specific records, and

to conduct a supplementary specialist oral examination of no more than 20 minutes' duration; the execution of the work task lasts six hours; observations of the way in which the task is executed, the task specific documentation and the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the work task.

(5) The company providing training should select the examination option in accordance with Paragraph 4 above and should notify the candidate and the competent body of the selection at the same time as registration for the examination takes place.

(6) In the examination area order and functional analysis, candidates should analyse technical systems within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to recognise problems arising from the areas of production, assembly, commissioning and maintenance, accord due consideration to technical rules in selecting the necessary components, tools and auxiliary materials, adapt assembly plans and circuit diagrams and plan the required work stages.

(7) In the examination area production engineering, candidates should plan the production of technical systems within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to evaluate manufacturing procedures for the production of components and sub-assemblies and select such procedures whilst taking account of technical, business and economic points of view, calculate technological data, plan the mechanisation of technical systems, the use of materials and auxiliary materials and the necessary work stages and allocate tools and machines.

(8) In the examination area business and social studies, candidates should process practically related employment-oriented tasks within the maximum examination time of 60 minutes and demonstrate that they are able to present and evaluate general business and societal correlations within the world of employment and work.

## **Part 4**

### **Provisions for the training occupation of construction mechanic**

#### § 15

#### **Training profile**

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

1. Vocational education and training, 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. Differentiate, allocate and handle materials and auxiliary materials
8. Produce components and sub-assemblies
9. Maintain operating equipment
10. Control systems

11. Fix, secure and transport
12. Customer orientation
13. Use technical documentation
14. Separate and reform
15. Use production machines
16. Join components
17. Use mechanisms and auxiliary structures
18. Assemble and dismantle metal constructions
19. Test components and sub-assemblies
20. Business processes and quality management within the area of deployment

(2) Skills pursuant to Paragraph 1 above should be applied and deepened in at least one of the following areas of deployment.

1. Equipment technology
2. Precision sheet metal working
3. Shipbuilding
4. Welding technology
5. Steel and metal engineering technology

The area of deployment is stipulated by the company providing training. Other areas of deployment are permissible if the skills pursuant to Paragraph 1 above can be imparted.

#### § 16

### **General training plan**

The skills stated in § 15 Paragraph 1 above should be imparted in accordance with the instructions regarding the content and time structure of vocational education and training (general training plan) contained in Annex 1 and Annex 4. 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.

#### § 17

### **Part 1 of the final examination**

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

(2) Part 1 of the final examination encompasses such skills for the first three half years of training as are listed in Annex 4 and extends to include teaching material to be imparted at vocational school insofar as such teaching material is integral to the vocational education and training.

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

1. evaluate technical documentation, determine technical parameters, plan and agree work processes, plan material and tool requirements;
2. select production procedures, manufacture components using manual and machine production processes, apply prevention measures and accord due consideration to environmental protection regulations;
3. evaluate the safety of operating equipment;
4. select and apply testing procedures and equipment, check the deployability of test equipment, document and evaluate results;

5. document and explain the execution of orders, prepare technical documentation including test protocols.

These requirements should be demonstrated via the production of components and sub-assemblies using manual and machine manufacturing and reforming processes and soluble and non-soluble joining techniques.

(4) The examination consists of the execution of a complex work-related task, which comprises situational oral examination phases and written examination assignments.

The maximum examination time is 8 hours, whereby the situational oral examination phases should be of a total maximum duration of 10 minutes. The duration of the written assignments should not exceed 90 minutes.

## § 18

### Part 2 of the final examination

(1) Part 2 of the final examination encompasses such skills as are listed in Annex 1 and Annex 4 and extends to include teaching material to be imparted at vocational school insofar as such teaching material is integral to the vocational education and training.

(2) The final examination comprises the following examination areas.

1. A work order
2. Order and functional analysis
3. Production engineering
4. Business and social studies

Due consideration should be accorded to vocational education and training, 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 work results, quality assurance systems and the safety of plants and operating equipment.

(3) In the examination area work order, candidates should demonstrate that they are able to:

1. clarify the nature and scope of orders, identify specific services, agree particular characteristics and deadlines with customers, procure information for the processing of the order;
2. evaluate and use information for the processing of the order, take technical developments into account, comply with stipulations relevant to safety, accord due consideration to business management and ecological points of view in planning the processing of orders, reach agreement with upstream and downstream divisions, prepare planning documents;
3. execute orders whilst in particular taking account of health and safety at work, environmental protection and deadlines, apply company quality assurance systems in their own work area, systematically seek out, remedy and document the causes of quality defects, arrange for partial orders;
4. select and apply testing procedures and equipment, identify the deployability of test equipment, apply test plans and company test regulations, check and document results, document order processes, services and consumption, handover technical systems or products to customers and explain such systems and products, prepare acceptance protocols;

5. execute three welding engineering test pieces with two different materials and two welding procedures in the field of welding technology or apply joining procedures in the other areas of deployment.

Production, assembly and dismantling of metal constructions are particularly considered as evidence of satisfactory performance.

(4) In order to demonstrate fulfilment of requirements in the examination area work order candidates should:

1. execute a company order within 18 hours including provision of practical documentation and to take part in a specialist oral examination of no more than 30 minutes' duration; the specialist oral examination should be conducted on the basis of the practically related documentation of the company order processed; the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the order under due consideration of the practically related documentation; prior to the execution of the company order the assignment including planned processing time should be presented to the Examination Board for approval; or

prepare, execute and follow-up a practical work task in 14 hours, including documentation via task specific records, and to conduct a supplementary specialist oral examination of no more than 20 minutes' duration; the execution of the work task lasts six hours; observations of the way in which the task is executed, the task specific documentation and the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the work task.

(5) The company providing training should select the examination option in accordance with Paragraph 4 above and should notify the candidate and the competent body of the selection at the same time as registration for the examination takes place.

(6) In the examination area order and functional analysis, candidates should work out a sequence of work stages within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to accord due consideration to work organisation, safety regulations, environmental provisions and cost-effectiveness in setting up their workplace, evaluate documents, carry out calculations, explain complex correlations of metal constructions, select materials and auxiliary materials and align tools and machines to the respective production procedures.

(7) In the examination area production engineering, candidate should plan the production, assembly and dismantling of metal constructions within the maximum examination time of 120 minutes whilst according due consideration to quality assurance systems. Candidates should demonstrate that they are able to take account of material properties in differentiating production procedures, in particular the separation and reforming of sheet metals, pipes or profiles, stipulate mechanisms and auxiliary structures, accord due consideration to health and safety at work and health protection and select welding procedures or other joining techniques in a way that is related to the order.

(8) In the examination area business and social studies, candidates should process practically related employment-oriented tasks within the maximum examination time of 60 minutes and demonstrate that they are able to present and



evaluate general business and societal correlations within the world of employment and work.

**Part 5**  
**Provisions for the training**  
**occupation of tools mechanic**

§ 19

**Training profile**

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

1. Vocational education and training, 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. Differentiate, allocate and handle materials and auxiliary materials
8. Produce components and sub-assemblies
9. Maintain operating equipment
10. Control systems
11. Fix, secure and transport
12. Customer orientation
13. Use different manufacturing procedures to produce components
14. Assembly and dismantling
15. Trialing and handover
16. Maintenance of components and sub-assemblies
17. Programme machines and systems
18. Testing
19. Business processes and quality management within the area of deployment

(2) Skills pursuant to Paragraph 1 above should be applied and deepened in at least one of the following areas of deployment.

1. Moulding technology
2. Instrument technology
3. Pressing technology
4. Jig and fixture technology

The area of deployment is stipulated by the company providing training. Other areas of deployment are permissible if the skills pursuant to Paragraph 1 above can be imparted.

§ 20

**General training plan**

The skills stated in § 19 Paragraph 1 above should be imparted in accordance with the instructions regarding the content and time structure of vocational education and training (general training plan) contained in Annex 1 and Annex 5. 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.

§ 21

**Part 1 of the final examination**

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

(2) Part 1 of the final examination encompasses such skills for the first three half years of training as are listed in Annex 5 and extends to include teaching material to be imparted at vocational school insofar as such teaching material is integral to the vocational education and training.

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

1. evaluate technical documentation, determine technical parameters, plan and agree work processes, plan material and tool requirements;
2. select production procedures, manufacture components using manual and machine production processes, apply prevention measures and accord due consideration to environmental protection regulations;
3. evaluate the safety of operating equipment;
4. select and apply testing procedures and equipment, check the deployability of test equipment, document and evaluate results;
5. document and explain the execution of orders, prepare technical documentation including test protocols.

These requirements should be demonstrated via the production of components, the joining of components to form sub-assemblies, the securing of functions and the assembly of a drive element.

(4) The examination consists of the execution of a complex work-related task, which comprises situational oral examination phases and written examination assignments. The maximum examination time is 8 hours, whereby the situational oral examination phases should be of a total maximum duration of 10 minutes. The duration of the written assignments should not exceed 90 minutes.

§ 22

**Part 2 of the final examination**

(1) Part 2 of the final examination encompasses such skills as are listed in Annex 1 and Annex 5 and extends to include teaching material to be imparted at vocational school insofar as such teaching material is integral to the vocational education and training.

(2) The final examination comprises the following examination areas.

1. A work order
2. Order and functional analysis
3. Production engineering
4. Business and social studies

Due consideration should be accorded to vocational education and training, 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 work results, quality assurance systems and the safety of plants and operating equipment.

(3) In the examination area work order, candidates should demonstrate that they are able to:

1. clarify the nature and scope of orders, identify specific services, agree particular characteristics and deadlines with customers, procure information for the processing of the order;
2. evaluate and use information for the processing of the order, take technical developments into account, comply with stipulations relevant to safety, accord due consideration to business management and ecological points of view in planning the processing of orders, reach agreement with upstream and downstream divisions, prepare planning documents;
3. execute orders whilst in particular taking account of health and safety at work, environmental protection and deadlines, apply company quality assurance systems in their own work area, systematically seek out, remedy and document the causes of quality defects, arrange for partial orders;
4. select and apply testing procedures and equipment, identify the deployability of test equipment, apply test plans and company test regulations, check and document results, document order processes, services and consumption, handover technical systems or products to customers and explain such systems and products, prepare acceptance protocols.

Manufacture, altering or servicing of plants, mechanisms or instruments are particularly considered as evidence of satisfactory performance.

(4) In order to demonstrate fulfilment of requirements in the examination area work order candidates should:

1. execute a company order within 18 hours including provision of practical documentation and to take part in a specialist oral examination of no more than 30 minutes' duration; the specialist oral examination should be conducted on the basis of the practically related documentation of the company order processed; the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the order under due consideration of the practically related documentation; prior to the execution of the company order the assignment including planned processing time should be presented to the Examination Board for approval; or
2. prepare, execute and follow-up a practical work task in 14 hours, including documentation via task specific records, and to conduct a supplementary specialist oral examination of no more than 20 minutes' duration; the execution of the work task lasts six hours; observations of the way in which the task is executed, the task specific documentation and the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the work task.

(5) The company providing training should select the examination option in accordance with Paragraph 4 above and should notify the candidate and the competent body of the selection at the same time as registration for the examination takes place.

(6) In the examination area order and functional analysis, candidates should describe the function of a technical system within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to recognise possibilities and approaches for the systematic identification of errors and the combined effect of technical components, carry

out dismantling, assembly, commissioning and repairs in accordance with stipulated requirements, highlight maintenance procedures and present the cost-effectiveness of such procedures.

(7) In the examination area production engineering, candidates should select production procedures for the manufacture of components and sub-assemblies, give reasons for their selection and present quality assurance measures within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to plan the use of materials and auxiliary materials, select the necessary tools and technological data for this purpose, comply with technical rules and standards, present methods for the assembly of the finished components, select the necessary tools and equipment and accord due consideration to health and safety at work and environmental protection regulations.

In the examination area business and social studies, candidates should process practically related employment-oriented tasks within the maximum examination time of 60 minutes and demonstrate that they are able to present and evaluate general business and societal correlations within the world of employment and work.

## **Part 6**

### **Provisions for the training occupation of milling machine operator**

§ 23

#### **Training profile**

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

1. Vocational education and training, 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. Differentiate, allocate and handle materials and auxiliary materials
8. Produce components and sub-assemblies
9. Maintain operating equipment
10. Control systems
11. Fix, secure and transport
12. Customer orientation
13. Plan the production process
14. Programme numerically controlled machine tools or production systems
15. Set up machine tools or production systems
16. Produce workpieces
17. Monitor and optimise production processes
18. Business processes and quality management within the area of deployment

(2) Skills pursuant to Paragraph 1 above should be applied and deepened in at least one of the following areas of deployment.

1. Automatic lathe systems
2. Engine lathe systems
3. Milling machine systems
4. Grinding machine systems

The area of deployment is stipulated by the company providing training. Other areas of deployment are permissible if the skills pursuant to Paragraph 1 above can be imparted.

## § 24

### General training plan

The skills stated in § 23 Paragraph 1 above should be imparted in accordance with the instructions regarding the content and time structure of vocational education and training (general training plan) contained in Annex 1 and Annex 6. 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.

## § 25

### Part 1 of the final examination

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

(2) Part 1 of the final examination encompasses such skills for the first three half years of training as are listed in Annex 6 and extends to include teaching material to be imparted at vocational school insofar as such teaching material is integral to the vocational education and training.

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

1. evaluate technical documentation, determine technical parameters, plan and agree work processes, plan material and tool requirements;
2. select production procedures, manufacture components using manual and machine production processes, apply prevention measures and accord due consideration to environmental protection regulations;
3. evaluate the safety of operating equipment;
4. select and apply testing procedures and equipment, check the deployability of test equipment, document and evaluate results;
5. document and explain the execution of orders, prepare technical documentation including test protocols.

These requirements should be demonstrated via the processing of a combined production order from the area of lathe turning and milling, lathe turning and grinding or milling and grinding technology.

(4) The examination consists of the execution of a complex work-related task, which comprises situational oral examination phases and written examination assignments. The maximum examination time is 8 hours, whereby the situational oral examination phases should be of a total maximum duration of 10 minutes. The duration of the written assignments should not exceed 90 minutes.

## § 26

### Part 2 of the final examination

(1) Part 2 of the final examination encompasses such skills as are listed in Annex 1 and Annex 6 and extends to include teaching material to be imparted at vocational school insofar as such teaching material is integral to the vocational education and training.

(2) The final examination comprises the following examination areas.

1. A work order
2. Order and functional analysis
3. Production engineering
4. Business and social studies

Due consideration should be accorded to vocational education and training, 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 work results, quality assurance systems and the safety of plants and operating equipment.

(3) In the examination area work order, candidates should demonstrate that they are able to:

1. clarify the nature and scope of orders, identify specific services, agree particular characteristics and deadlines with customers, procure information for the processing of the order;
2. evaluate and use information for the processing of the order, take technical developments into account, comply with stipulations relevant to safety, accord due consideration to business management and ecological points of view in planning the processing of orders, reach agreement with upstream and downstream divisions, prepare planning documents;
3. execute orders whilst in particular taking account of health and safety at work, environmental protection and deadlines, apply company quality assurance systems in their own work area, systematically seek out, remedy and document the causes of quality defects, arrange for partial orders;
4. select and apply testing procedures and equipment, identify the deployability of test equipment, apply test plans and company test regulations, check and document results, document order processes, services and consumption, handover technical systems or products to customers and explain such systems and products, prepare acceptance protocols.

The execution and monitoring of manufacturing processes on machine tools or production systems are particularly considered as evidence of satisfactory performance.

(4) In order to demonstrate fulfilment of requirements in the examination area work order candidates should:

1. execute a company order within 15 hours including provision of practical documentation and to take part in a specialist oral examination of no more than 30 minutes' duration; the specialist oral examination should be conducted on the basis of the practically related documentation of the company order processed; the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the order under due consideration of the

practically related documentation; prior to the execution of the company order the assignment including planned processing time should be presented to the Examination Board for approval; or

2. prepare, execute and follow-up a practical work task in 14 hours, including documentation via task specific records, and to conduct a supplementary specialist oral examination of no more than 20 minutes' duration; the execution of the work task lasts six hours; observations of the way in which the task is executed, the task specific documentation and the specialist oral examination should act as a vehicle for evaluating relevant process skills with regard to the execution of the work task.

(5) The company providing training should select the examination option in accordance with Paragraph 4 above and should notify the candidate and the competent body of the selection at the same time as registration for the examination takes place.

(6) In the examination area order and functional analysis, candidates should analyse an order within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to check and supplement technical documentation to ensure completeness and correctness, stipulate production strategies, accord due consideration to health and safety at work and environmental protection in planning the set-up of their workplace and apply technical rules, guidelines and test regulations.

(7) In the examination area production engineering, candidates should plan the execution of a production order within the maximum examination time of 120 minutes. Candidates should demonstrate that they are able to process an order, align and programme machine tools and production systems and accord due consideration to the maintenance of such tools and systems, stipulate production procedures, production parameters, test methods and test equipment and document quality and work results.

(8) In the examination area business and social studies, candidates should process practically related employment-oriented tasks within the maximum examination time of 60 minutes and demonstrate that they are able to present and evaluate general business and societal correlations within the world of employment and work.

## **Part 7**

### **Joint pass regulations, transitional and final provisions**

## **§ 27**

### **Pass regulation**

(1) The pass regulations listed in the paragraphs below each apply to the training occupations stated in the present Ordinance.

(2) In determining the overall result, a weighting of 40 percent shall be accorded to Part 1 of the final examination and a weighting of 60 percent to Part 2 of the examination.

(3) In determining the result of Part 2 of the final examination, a weighting of 50 percent shall be accorded to the examination area work order, a weighting of 20 percent shall be accorded to each of the examination areas order and functional analysis and production engineering and a weighting of 10 percent shall be accorded to the examination area business and social studies.

(4) The final examination is deemed to have been passed if a mark of at least "pass" is achieved:

1. for the overall result pursuant to Paragraph 2 above;
2. in the examination area work order and
3. for the overall result in the examination areas order and functional analysis, production engineering and business and social studies.

A mark of at least "pass" must be achieved in two of the examination areas pursuant to 3 above. In the third area pursuant to 3 above, no mark of "fail" must be awarded.

(5) Upon application by the candidate or at the discretion of the Examination Board, the examination areas order and functional analysis, production engineering and business and social studies may be supplemented by an oral examination if this may be decisive for the passing of the examination. In calculating the result for the examination areas tested orally, the previous result and the result of the supplementary oral examination should be accorded weighting in the ratio of 2:1.

## **§ 28**

### **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.

## **§ 29**

### **Entry into force, ceasing to be in force**

The present Ordinance enters into force on 1 August 2007. The Ordinance of 9 July 2004 (Federal Law Gazette I p. 1502) in respect of vocational education and training in the industrial metal occupations ceases to be in force at this time.

**Annex 1**

(to § 14 Paragraph 1 Clause 1)

General training plan  
for vocational education and training in the occupation of technical system planer  
– Content structure –

**Section A: Joint skills, knowledge and competences making up the occupational profile**

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
1	Draw up and apply technical documents (§ 14 Paragraph 2 Section A No. 1)	<ul style="list-style-type: none"> <li>a) Take standard specifications into account in creating technical drawings</li> <li>b) Differentiate geometric relations</li> <li>c) Present individual components and sub-assemblies in conformity with standards in views and sections</li> <li>d) Apply measurement entry rules</li> <li>e) Present workpieces spatially</li> <li>f) Prepare and dimension freehand sketches</li> <li>g) Prepare and manage technical support documentation, in particular lists of parts</li> <li>h) Prepare technical and presentation documentation</li> <li>i) Use lists of parts, tables, diagrams, manuals and operating instructions</li> </ul>
2	Carry out computer-aided construction (§ 14 Paragraph 2 Section A No. 2)	<ul style="list-style-type: none"> <li>a) Prepare datasets for individual components and sub-assemblies in accordance with technical stipulations and own draft designs</li> <li>b) Apply structuring methods</li> <li>c) Derive or prepare drawings</li> <li>d) Select and use symbols</li> <li>e) Select and use purchased and standard parts from libraries and catalogues</li> </ul>
3	Differentiate materials (§ 14 Paragraph 2 Section A No. 3)	<ul style="list-style-type: none"> <li>f) Obtain information on materials with regard to their properties and possible processing and uses</li> <li>g) Differentiate materials and semi-finished parts with regard to availability, cost-effectiveness and environmental sustainability</li> <li>h) Take materials standardisation into account</li> </ul>
4	Differentiate production procedures and assembly techniques (§ 14 Paragraph 2 Section A No. 4)	<ul style="list-style-type: none"> <li>i) Differentiate production and joining procedures typical to the branch</li> <li>j) Differentiate assembly techniques</li> </ul>
5	Carry out calculations (§ 14 Paragraph 2 Section A No. 5)	<ul style="list-style-type: none"> <li>k) Calculate lengths, angles, areas, volumes and masses</li> <li>l) Calculate expansion of lengths and volumes</li> </ul>

**Section B: Further skills, knowledge and competences making up the occupational profile**

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
1	Evaluate materials and corrosion protection procedures (§ 14 Paragraph 2 Section B No. 1)	m) Evaluate material properties in an applications-related manner n) Select materials according to intended purpose o) Differentiate and evaluate corrosion protection procedures
2	Evaluate assembly and joining procedures (§ 14 Paragraph 2 Section B No. 2)	p) Evaluate and select connection technology for soluble and non-soluble connections q) Take local circumstances into account for individual assembly and assembly of sub-assemblies
3	Draw up technical documents (§ 14 Paragraph 2 Section B No. 3)	r) Use technical standards and regulations to create partial, group, overall and production drawings s) Read technical documents from adjacent areas, identify interfaces and present adjacent areas t) Dimension components and sub-assemblies in a manner appropriate to production, assembly and functionality u) Select semi-finished products, standard parts, components and sub-assemblies in accordance with stipulations, technical documents and performance data v) Draw up measurements w) Handle and prepare technical documents, in particular tables x) Comply with technical safety provisions, in particular with regard to fire protection
4	Prepare sketches (§ 14 Paragraph 2 Section B No. 4)	y) Prepare partial and detailed sketches in accordance with local circumstances and stipulations z) Sketch components and sub-assemblies with regard to their spatial alignment with each other

**Section C: Skills, knowledge and competences making up the occupational profile in the specialism of supply and equipment technology**

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
1	Draw up technical documents for supply and equipment technology (§ 14 Paragraph 2 Section C No. 1)	aa) Prepare function and measurement sketches bb) Comply with technical environmental stipulations in the preparation of technical documents cc) Prepare components and sub-assemblies for plants together with the respective installation parts dd) Stipulate and derive views and sections of components and sub-assemblies ee) Prepare developed views of components ff) Select and enter descriptions for material, corrosion protection and additional stipulations gg) Coordinate technical documents of plants and check for collisions, correct collisions by agreement hh) Prepare and collate technical documents to be passed on to external trades
2	Carry out detailed constructions (§ 14 Paragraph 2 Section C No. 2)	ii) Construct detailed points jj) Read technical documents from adjacent areas, design interfaces to adjacent components including those of other trades kk) Carry out constructive alterations in accordance with technical stipulations ll) Take constructive account of the properties of corrosion protection procedures

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
3	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section C No. 3)	mm) Use relevant standards and symbols to prepare schematic representations nn) Present and document functional processes of supply and equipment technology oo) Prepare schematic representations of specialist pneumatic, hydraulic and electrical control engineering systems pp) Prepare and derive spatial representations of components and plants
4	Prepare technical documentation for supply and equipment technology (§ 14 Paragraph 2 Section C No. 4)	qq) Draw up tables and diagrams for supply and equipment technology rr) Prepare and check measurements, protocols and lists of parts and describe technical facts and circumstances ss) Collate order-related data in a systematic and customer-oriented manner
5	Carry out technical calculations (§ 14 Paragraph 2 Section C No. 5)	tt) Apply basic laws of mechanics relating to liquids and gases uu) Calculate and determine parts and components of technical building equipment plants with the help of standards, guidelines, technical documents, design software, manuals and catalogues vv) Calculate or determine work, performance and degrees of effectiveness of the parts and components of technical building equipment plants with the help of calculation programmes, design guides and technical documents ww) Undertake the dimensioning of cables and components on the basis of drawings and previous calculations xx) Prepare requirements calculations within the scope of technical building equipment process sequences in accordance with project-related stipulations
6	Evaluate system components (§ 14 Paragraph 2 Section C No. 6)	yy) Evaluate production procedures for plant components, evaluate and select duct parts zz) Evaluate and select assembly and fixing systems and wall outlets in particular whilst also taking fire protection into account aaa) Connect elements of control engineering to circuits

**Section D: Skills, knowledge and competences making up the occupational profile in the specialism of steel and metal engineering technology**

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
1	Prepare technical documentation relating to steel and metal engineering technology (§ 14 Paragraph 2 Section D No. 1)	bbb) Use symbols and technical standards and regulations for workshops and construction sites to create partial, group, overall and summary drawings ccc) Select and enter additional information ddd) Take account of tolerances of own and adjacent components eee) Prepare drawings for offers fff) Prepare plans using relevant standards and guidelines in accordance with stipulations, drafts and instructions, in particular fixing plans, welding sequence plans, interlocking plans, assembly sequence plans, shipping plans and installation plans for components ggg) Stipulate, transfer and accord consideration to construction site measurement points, grids, coordinates and spot elevations hhh) Represent construction components and nodal points perspectively

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
2	Design and construct (§ 14 Paragraph 2 Section D No. 2)	iii) Undertake constructive changes in accordance with instructions jjj) Construct detailed points, in particular in full-scale sizes kkk) Stipulate and select connections to adjacent construction components in a constructive manner III) Take constructive account of the properties of corrosion protection procedures mmm) Comply with building regulations nnn) Comply with buildings inspection licences ooo) Comply with hiring regulations for construction services ppp) Apply the laws of mechanics
3	Take account of construction physics requirements (§ 14 Paragraph 2 Section D No. 3)	qqj) Take constructive account of thermal and noise insulation requirements rrr) Take constructive account of fire protection requirements sss) Take constructive account of weather and environmental influences ttt) Take account of relevant standards and regulations
4	Carry out calculations (§ 14 Paragraph 2 Section D No. 4)	uuu) Apply the laws of mechanics, in particular regarding speed, forces and resolution of forces, torque and friction vvv) Apply the laws of stability calculation, in particular regarding contact pressure, tensile load, pressure load and shear load www) Select connection elements and connections xxx) Calculate main periods of use yyy) Conduct length and surface calculations, in particular determine construction component measurements and system measurements zzz) Conduct static calculations, in particular determine the centre of gravity of lines and areas, bending moments and surface torques
5	Select production, assembly and joining procedures (§ 14 Paragraph 2 Section D No. 5)	aaaa) Evaluate and select separation procedures according due consideration to material, geometric circumstances and surface characteristic bbbb) Evaluate and select reforming procedures according due consideration to material, geometric circumstances, surface characteristic and auxiliary material cccc) Evaluate and select screw and welded connection dddd) Comply with the rules of composite construction



**Section E: Skills, knowledge and competences making up the occupational profile in the specialism of electro technical systems**

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
1	Prepare technical documents for electro technical systems (§ 14 Paragraph 2 Section E No. 1)	<p>eeee) Prepare functional circuit plans and diagrams</p> <p>ffff) Calculate and dimension system components and cables for energy and information technology plants according to stipulations</p> <p>gggg) Select, connect and represent construction components of energy and information technology plants on the basis of catalogues and data sheets</p> <p>hhhh) Design control circuits and control programmes and represent data transmission circuits</p> <p>iiii) Design and create alignment and wiring plans and tables for energy and information technology plants according to pre-stipulated circuit diagrams and sketches</p> <p>jjjj) Design and create installation plans for buildings installations involving energy and information technology equipment in accordance with stipulation and taking account of the relevant regulations</p> <p>kkkk) Evaluate and represent the functions of system components and their wiring connections</p>
2	Carry out calculations (§ 14 Paragraph 2 Section E No. 2)	<p>llll) Apply the basic laws of electro technology</p> <p>mmmm) Calculate work, performance and degree of effectiveness</p> <p>nnnn) Calculate lighting levels</p> <p>oooo) Use diagrams, tables and data sheets from manuals and catalogues</p> <p>pppp) Determine construction components on the basis of specific parameters</p> <p>qqqq) Calculate electrical values in direct, alternating and rotary current circuits</p> <p>rrrr) Apply basic laws of mechanics to the fixing of electro technical components</p>
3	Evaluate and use system components (§ 14 Paragraph 2 Section E No. 3)	<p>ssss) Evaluate and select fixing systems and wall outlets whilst also taking fire protection into account</p> <p>tttt) Explain electro technology components and connect to form circuits</p> <p>uuuu) Explain elements of open and closed loop control and drive technology and connect to form circuits</p> <p>vvvv) Identify risks, apply protective measures</p>
4	Execute detailed plans (§ 14 Paragraph 2 Section E No. 4)	<p>wwww) Create projection plans</p> <p>xxxx) Plan installations room</p> <p>yyyy) Create ductwork plans and wall views</p>
5	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section E No. 5)	<p>zzzz) Create summary circuit diagrams from floor plans</p> <p>aaaaa) Create schematic representations including perspective representations using relevant standards and symbols in accordance with technical documents</p> <p>bbbbb) Present and document specialist functional processes in accordance with technical documents</p>

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
6	Prepare technical documentation (§ 14 Paragraph 2 Section E No. 6)	<p>cccc) Select and create documentation for energy and information technology plants</p> <p>dddd) Create specialist tables and diagrams</p> <p>eeee) Evaluate technical facts and circumstances and prepare and check measurements, protocols and lists of parts</p> <p>ffff) Collate order-related data in a systematic and customer-oriented manner</p>

#### Section F: Joint integrative skills, knowledge and competences

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
1	VET, employment and collective wage agreement law (§ 14 Paragraph 2 Section F No. 1)	<p>a) Explain the significance of the training contract, in particular conclusion, duration and termination</p> <p>b) State mutual rights and responsibilities arising from the training contract</p> <p>c) State opportunities for advanced vocational training</p> <p>d) State essential parts of the training contract</p> <p>e) State essential provisions contained within the collective wage agreements applying to the company providing training</p>
2	Structure and organisation of the company providing training (§ 14 Paragraph 2 Section F No. 2)	<p>a) Explain structure and tasks of the company providing training</p> <p>b) Explain the basic functions of the company providing training, such as procurement, production, sales and administration</p> <p>c) State the relationships of the company providing training and its staff to organisations of trade and industry, professional bodies and trade unions</p> <p>d) Describe the basic principles, tasks and way of working of labour-management relations or staff representative organs within the company providing training</p>
3	Health and safety at work (§ 14 Paragraph 2 Section F No. 3)	<p>a) Ascertain health and safety risk in the workplace and adopt measures for the avoidance of this</p> <p>b) Deploy occupationally related health and safety and accident prevention measures</p> <p>c) Describe behaviours when accidents occur and institute initial measures</p> <p>d) Deploy regulations for preventative fire protection; describe behaviours in the event of fire and initiate fire fighting measures</p>
4	Environmental protection (§ 14 Paragraph 2 Section F 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> <p>ggggg) Explain possible instances of environmental pollution caused by the company providing training and its contribution to environmental protection using examples</p> <p>hhhhh) Deploy environmental protection regulations as these apply to the company providing training</p> <p>iiii) Take opportunities to use energy and materials in an environmentally friendly manner</p> <p>jjjj) Avoid waste; make substances and materials available for environmentally friendly disposal</p>
5	Use information and communication technology systems	<p>a) Use company communication and information systems for the transmission of data, images and language</p> <p>b) Use standard software, in particular spreadsheets, text</p>

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted
1	2	3
	(§ 14 Paragraph 2 Section F No. 5)	processing and presentation c) Procure, evaluate and use information, also including English language information in particular d) Manage and secure data e) Comply with regulations regarding data security
6	Work planning and organisation (§ 14 Paragraph 2 Section F No. 6)	a) Check work orders and stipulations in terms of feasibility b) Procure, evaluate and use order-related information and data c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria d) Accord due consideration to legal, operational and technical regulations e) Plan work order and coordinate this with upstream and downstream areas f) Check and present possible solutions and compare their cost-effectiveness g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations h) Plan and process tasks within a team; agree, evaluate and present team results
7	Carry out quality assurance measures (§ 14 Paragraph 2 Section F No. 7)	a) Take the objectives and tasks of quality assurance measures into account b) Apply quality assurance measures in own work area, in particular check and evaluate interim and final results c) Recognise errors and quality defects and their causes and initiate and document measures for rectification d) Contribute to the continuous improvement of work processes
8	Customer orientation (§ 14 Paragraph 2 Section F No. 8)	a) Receive customer-specific requirements and information, pass on such requirements and information within the company and take these requirements and this information into account b) Comply with company communication rules in informing and advising customers and take customer requirements into account c) Communicate with customers in English d) Take cultural identities into account

**Annex 2**  
(to § 4 Paragraph 1 Clause 2)

**General training plan**  
for vocational education and training in the occupation of technical system planer

**Section 1**

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted	Time framework in months
1	2	3	4
1	VET, employment and collective wage agreement law (§ 14 Paragraph 2 Section F No. 1)	<ul style="list-style-type: none"> <li>a) Explain the significance of the training contract, in particular conclusion, duration and termination</li> <li>b) State mutual rights and responsibilities arising from the training contract</li> <li>c) State opportunities for advanced vocational training</li> <li>d) State essential parts of the training contract</li> <li>e) State essential provisions contained within the collective wage agreements applying to the company providing training</li> </ul>	to be imparted over the whole course of the training period
2	Structure and organisation of the company providing training (§ 14 Paragraph 2 Section F No. 2)	<ul style="list-style-type: none"> <li>a) Explain structure and tasks of the company providing training</li> <li>b) Explain the basic functions of the company providing training, such as procurement, production, sales and administration</li> <li>c) State the relationships of the company providing training and its staff to organisations of trade and industry, professional bodies and trade unions</li> <li>d) Describe the basic principles, tasks and way of working of labour-management relations or staff representative organs within the company providing training</li> </ul>	
3	Health and safety at work (§ 14 Paragraph 2 Section F No. 3)	<ul style="list-style-type: none"> <li>a) Ascertain health and safety risk in the workplace and adopt measures for the avoidance of this</li> <li>b) Deploy occupationally related health and safety and accident prevention measures</li> <li>c) Describe behaviours when accidents occur and institute initial measures</li> <li>d) Deploy regulations for preventative fire protection; describe behaviours in the event of fire and initiate fire fighting measures</li> </ul>	
4	Environmental protection (§ 14 Paragraph 2 Section F 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"> <li>a) Explain possible instances of environmental pollution caused by the company providing training and its contribution to environmental protection using examples</li> <li>b) Deploy environmental protection regulations as these apply to the company providing training</li> <li>c) Take opportunities to use energy and materials in an environmentally friendly manner</li> <li>d) Avoid waste; make substances and materials available for environmentally friendly disposal</li> </ul>	

## Section 2

### 1. Up until 3<sup>rd</sup> training semester

Time framework 1: Present components and sub-assemblies

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Draw up and apply technical documents (§ 14 Paragraph 2 Section A No. 1)	<ul style="list-style-type: none"> <li>a) Take standard specifications into account in creating technical drawings</li> <li>b) Differentiate geometric relations</li> <li>c) Present individual components and sub-assemblies in conformity with standards in views and sections</li> <li>d) Apply measurement entry rules</li> <li>e) Present workpieces spatially</li> <li>f) Prepare and dimension freehand sketches</li> </ul>	3 to 5
2	Carry out computer-aided construction (§ 14 Paragraph 2 Section A No. 2)	<ul style="list-style-type: none"> <li>a) Prepare datasets for individual components and sub-assemblies in accordance with technical stipulations and own draft designs</li> <li>b) Apply structuring methods</li> <li>c) Derive or prepare drawings</li> <li>d) Select and use symbols</li> </ul>	
3	Carry out calculations (§ 14 Paragraph 2 Section A No. 5)	<ul style="list-style-type: none"> <li>a) Calculate lengths, angles, areas, volumes and masses</li> </ul>	
4	Draw up technical documents (§ 14 Paragraph 2 Section B No. 3)	<ul style="list-style-type: none"> <li>a) Use technical standards and regulations to create partial, group, overall and production drawings</li> <li>c) Dimension components and sub-assemblies in a manner appropriate to production, assembly and functionality</li> </ul>	
5	Use information and communication technology systems (§ 14 Paragraph 2 Section F No. 5)	<ul style="list-style-type: none"> <li>a) Use company communication and information systems for the transmission of data, images and language</li> <li>d) Manage and secure data</li> <li>e) Comply with regulations regarding data security</li> </ul>	
6	Work planning and organisation (§ 14 Paragraph 2 Section F No. 6)	<ul style="list-style-type: none"> <li>b) Procure, evaluate and use order-related information and data</li> </ul>	

### Time framework 2: Production and assembly engineering

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Draw up and apply technical documents (§ 14 Paragraph 2 Section A No. 1)	i) Use lists of parts, tables, diagrams, manuals and operating instructions	6 to 8
2	Differentiate materials (§ 14 Paragraph 2 Section A No. 3)	a) Obtain information on materials with regard to their properties and possible processing and uses b) Differentiate materials and semi-finished parts with regard to availability, cost-effectiveness and environmental sustainability c) Take materials standardisation into account	
3	Differentiate production procedures and assembly techniques (§ 14 Paragraph 2 Section A No. 4)	a) Differentiate production and joining procedures typical to the branch b) Differentiate assembly techniques	
4	Evaluate materials and corrosion protection procedures (§ 14 Paragraph 2 Section B No. 1)	a) Evaluate material properties in an applications-related manner	
5	Draw up technical documents (§ 14 Paragraph 2 Section B No. 3)	d) Select semi-finished products, standard parts, components and sub-assemblies in accordance with stipulations, technical documents and performance data e) Draw up measurements	
6	Arbeitsplanung und -organisation (§ 14 Absatz 2 Abschnitt F Nummer 6)	d) rechtliche, betriebliche und technische Vorschriften beachten	
7	Carry out quality assurance measures (§ 14 Paragraph 2 Section F No. 7)	a) Take the objectives and tasks of quality assurance measures into account	

### Time framework 3: Prepare technical documents

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Draw up and apply technical documents (§ 14 Paragraph 2 Section A No. 1)	g) Prepare and manage technical support documentation, in particular lists of parts h) Prepare technical and presentation documentation i) Use lists of parts, tables, diagrams, manuals and operating instructions	6 to 8
2	Carry out computer-aided construction (§ 14 Paragraph 2 Section A No. 2)	c) Derive or prepare drawings d) Select and use symbols e) Select and use purchased and standard parts from libraries and catalogues	
3	Differentiate materials (§ 14 Paragraph 2 Section A No. 3)	b) Differentiate materials and semi-finished parts with regard to availability, cost-effectiveness and environmental sustainability c) Take materials standardisation into account	
4	Carry out calculations (§ 14 Paragraph 2 Section A No. 3)	b) Calculate expansion of lengths and volumes	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
5	Evaluate materials and corrosion protection procedures (§ 14 Paragraph 2 Section B No. 1)	b) Select materials according to intended purpose c) Differentiate and evaluate corrosion protection procedures	
6	Evaluate assembly and joining procedures (§ 14 Paragraph 2 Section B No. 2)	a) Evaluate and select connection technology for soluble and non-soluble connections b) Take local circumstances into account for individual assembly and assembly of sub-assemblies	
7	Draw up technical documents (§ 14 Paragraph 2 Section B No. 3)	a) Use technical standards and regulations to create partial, group, overall and production drawings b) Read technical documents from adjacent areas, identify interfaces and present adjacent areas f) Handle and prepare technical documents, in particular tables	
8	Prepare sketches (§ 14 Paragraph 2 Section B No. 4)	a) Prepare partial and detailed sketches in accordance with local circumstances and stipulations b) Sketch components and sub-assemblies with regard to their spatial alignment with each other	
9	Use information and communication technology systems (§ 14 Paragraph 2 Section F No. 5)	b) Use standard software, in particular spreadsheets, text processing and presentation	
10	Carry out quality assurance measures (§ 14 Paragraph 2 Section F No. 7)	d) Contribute to the continuous improvement of work processes	

**4. 4<sup>th</sup> to 7<sup>th</sup> training semester:**

**Specialism of supply and equipment technology**

**Time framework 4: Specialist construction**

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Draw up technical documents for supply and equipment technology (§ 14 Paragraph 2 Section C No. 1)	<ul style="list-style-type: none"> <li>a) Prepare function and measurement sketches</li> <li>c) Prepare components and sub-assemblies for plants together with the respective installation parts</li> <li>d) Stipulate and derive views and sections of components and sub-assemblies</li> <li>e) Prepare developed views of components</li> <li>g) Coordinate technical documents of plants and check for collisions, correct collisions by agreement</li> <li>h) Prepare and collate technical documents to be passed on to external trades</li> </ul>	5 to 9
2	Carry out detailed constructions (§ 14 Paragraph 2 Section C No. 2)	<ul style="list-style-type: none"> <li>a) Construct detailed points</li> <li>b) Read technical documents from adjacent areas, design interfaces to adjacent components including those of other trades</li> </ul>	
3	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section C No. 3)	<ul style="list-style-type: none"> <li>d) Prepare and derive spatial representations of components and plants</li> </ul>	
4	Prepare technical documentation (§ 14 Paragraph 2 Section C No. 4)	<ul style="list-style-type: none"> <li>b) Prepare and check measurements, protocols and lists of parts and describe technical facts and circumstances</li> <li>c) Collate order-related data in a systematic and customer-oriented manner</li> </ul>	
5	Evaluate system components (§ 14 Paragraph 2 Section C No. 6)	<ul style="list-style-type: none"> <li>b) Evaluate and select assembly and fixing systems and wall outlets whilst also taking fire protection into account</li> </ul>	
6	Use information and communication technology systems (§ 14 Paragraph 2 Section F No. 5)	<ul style="list-style-type: none"> <li>c) Procure, evaluate and use information, also including English language information in particular</li> </ul>	
7	Work planning and organisation (§ 14 Paragraph 2 Section F No. 6)	<ul style="list-style-type: none"> <li>a) Check work orders and stipulations in terms of feasibility</li> <li>c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria</li> <li>e) Plan work order and coordinate this with upstream and downstream areas</li> <li>f) Check and present possible solutions and compare their cost-effectiveness</li> <li>g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations</li> <li>h) Plan and process tasks within a team; agree, evaluate and present team results</li> </ul>	
8	Carry out quality assurance measures (§ 14 Paragraph 2 Section F No. 7)	<ul style="list-style-type: none"> <li>b) Apply quality assurance measures in own work area, in particular check and evaluate interim and final results</li> <li>c) Recognise errors and quality defects and their causes and initiate and document measures for rectification</li> </ul>	
	Customer orientation (§ 14 Paragraph 2 Section F No. 8)	<ul style="list-style-type: none"> <li>d) Take cultural identities into account</li> </ul>	



Time framework 5: Project-related construction

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Draw up technical documents for supply and equipment technology (§ 14 Paragraph 2 Section C No. 1)	<ul style="list-style-type: none"> <li>b) Comply with technical environmental stipulations in the preparation of technical documents</li> <li>f) Select and enter descriptions for material, corrosion protection and additional stipulations</li> </ul>	11 to 15
2	Carry out detailed constructions (§ 14 Paragraph 2 Section C No. 2)	<ul style="list-style-type: none"> <li>c) Carry out constructive alterations in accordance with technical stipulations</li> <li>d) Take constructive account of the properties of corrosion protection procedures</li> </ul>	
3	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section C No. 3)	<ul style="list-style-type: none"> <li>a) Use relevant standards and symbols to prepare schematic representations</li> <li>b) Present and document functional processes of supply and equipment technology</li> <li>c) Prepare schematic representations of specialist pneumatic, hydraulic and electrical control engineering systems</li> </ul>	
4	Evaluate system components (§ 14 Paragraph 2 Section C No. 6)	<ul style="list-style-type: none"> <li>a) Evaluate production procedures for plant components, evaluate and select duct parts</li> <li>c) Connect elements of control engineering to circuits</li> </ul>	
5	Customer orientation (§ 14 Paragraph 2 Section F No. 8)	<ul style="list-style-type: none"> <li>e) Receive customer-specific requirements and information, pass on such requirements and information within the company and take these requirements and this information into account</li> <li>f) Comply with company communication rules in informing and advising customers and take customer requirements into account</li> <li>g) Communicate with customers in English</li> </ul>	

### Time framework 6: Specialist calculations

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Prepare technical documentation for supply and equipment technology (§ 14 Paragraph 2 Section C No. 4)	a) Draw up tables and diagrams for supply and equipment technology	3 to 5
2	Carry out technical calculations (§ 14 Paragraph 2 Section C No. 5)	a) Apply basic laws of mechanics relating to liquids and gases b) Calculate and determine parts and components of technical building equipment plants with the help of standards, guidelines, technical documents, design software, manuals and catalogues c) Calculate or determine work, performance and degrees of effectiveness of the parts and components of technical building equipment plants with the help of calculation programmes, design guides and technical documents d) Undertake the dimensioning of cables and components on the basis of drawings and previous calculations e) Prepare requirements calculations within the scope of technical building equipment process sequences in accordance with project-related stipulations	

### Specialism of steel and metal engineering technology

#### Time framework 7: Specialist construction

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Evaluate materials and corrosion protection procedures (§ 14 Paragraph 2 Section B No. 1)	b) Select materials according to intended purpose	12 to 16
2	Evaluate assembly and joining procedures (§ 14 Paragraph 2 Section B No. 2)	a) Evaluate and select connection technology for soluble and non-soluble connections	
3	Draw up technical documents (§ 14 Paragraph 2 Section B No. 3)	g) Comply with technical safety provisions, in particular with regard to fire protection	
4	Prepare technical documentation relating to steel and metal engineering technology (§ 14 Paragraph 2 Section D No. 1)	a) Use symbols and technical standards and regulations for workshops and construction sites to create partial, group, overall and summary drawings b) Select and enter additional information c) Take account of tolerances of own and adjacent components e) Prepare plans using relevant standards and guidelines in accordance with stipulations, drafts and instructions, in particular fixing plans, welding sequence plans, interlocking plans, assembly sequence plans, shipping plans and installation plans for components f) Stipulate, transfer and accord consideration to construction site measurement points, grids, coordinates and spot elevations g) Represent construction components and nodal points perspectively	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
5	Design and construct (§ 14 Paragraph 2 Section D No. 2)	a) Undertake constructive changes in accordance with instructions b) Construct detailed points, in particular in full-scale sizes Take constructive account of the properties of corrosion protection procedures kkkkk) Apply the laws of mechanics	4
6	Take account of construction physics requirements (§ 14 Paragraph 2 Section D No. 3)	c) Take constructive account of weather and environmental influences	
7	Carry out calculations (§ 14 Paragraph 2 Section D No. 4)	a) Apply the laws of mechanics, in particular regarding speed, forces and resolution of forces, torque and friction b) Apply the laws of stability calculation, in particular regarding contact pressure, tensile load, pressure load and shear load c) Select connection elements and connections e) Conduct length and surface calculations, in particular determine construction component measurements and system measurements	

#### Time framework 8: Project-related construction

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Prepare technical documentation relating to steel and metal engineering technology (§ 14 Paragraph 2 Section D No. 1)	d) Prepare drawings for offers	8 to 12
2	Design and construct (§ 14 Paragraph 2 Section D No. 2)	c) Stipulate and select connections to adjacent construction components in a constructive manner e) Comply with building regulations f) Comply with buildings inspection licences g) Comply with hiring regulations for construction services	
3	Take account of construction physics requirements (§ 14 Paragraph 2 Section D No. 3)	a) Take constructive account of thermal and noise insulation requirements b) Take constructive account of fire protection requirements d) Take account of relevant standards and regulations	
4	Carry out calculations (§ 14 Paragraph 2 Section D No. 4)	d) Calculate main periods of use f) Conduct static calculations, in particular determine the centre of gravity of lines and areas, bending moments and surface torques	
5	Select production, assembly and joining procedures (§ 14 Paragraph 2 Section D No. 5)	a) Evaluate and select separation procedures according due consideration to material, geometric circumstances and surface characteristic b) Evaluate and select reforming procedures according due consideration to material, geometric circumstances, surface characteristic and auxiliary material c) Evaluate and select screw and welded connection d) Comply with the rules of composite construction	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
6	Use information and communication technology systems (§ 14 Paragraph 2 Section F No. 5)	c) Procure, evaluate and use information, also including English language information in particular	
7	Work planning and organisation (§ 14 Paragraph 2 Section F No. 6)	a) Check work orders and stipulations in terms of feasibility c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria e) Plan work order and coordinate this with upstream and downstream areas f) Check and present possible solutions and compare their cost-effectiveness g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations h) Plan and process tasks within a team; agree, evaluate and present team results	
8	Carry out quality assurance measures (§ 14 Paragraph 2 Section F No. 7)	b) Apply quality assurance measures in own work area, in particular check and evaluate interim and final results c) Recognise errors and quality defects and their causes and initiate and document measures for rectification d) Contribute to the continuous improvement of work processes	
9	Customer orientation (§ 14 Paragraph 2 Section F No. 8)	a) Receive customer-specific requirements and information, pass on such requirements and information within the company and take these requirements and this information into account b) Comply with company communication rules in informing and advising customers and take customer requirements into account c) Communicate with customers in English d) Take cultural identities into account	

### Specialism of electro technical systems

#### Time framework 9: Plan electro technical systems

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Prepare technical documents for electro technical systems (§ 14 Paragraph 2 Section E No. 1)	a) Prepare functional circuit plans and diagrams b) Calculate and dimension system components and cables for energy and information technology plants according to stipulations e) Design and create alignment and wiring plans and tables for energy and information technology plants according to pre-stipulated circuit diagrams and sketches f) Design and create installation plans for buildings installations involving energy and information technology equipment in accordance with stipulation and taking account of the relevant regulations	
2	Carry out calculations (§ 14 Paragraph 2 Section E No. 2)	a) Apply the basic laws of electro technology b) Calculate work, performance and degree of effectiveness c) Calculate lighting levels d) Use diagrams, tables and data sheets from manuals and catalogues e) Determine construction components on the basis of specific parameters f) Calculate electrical values in direct, alternating and rotary current circuits	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
3	Evaluate and use system components (§ 14 Paragraph 2 Section E No. 3)	a) Evaluate and select fixing systems and wall outlets whilst also taking fire protection into account	12 to 16
4	Execute detailed plans (§ 14 Paragraph 2 Section E No. 4)	a) Create projection plans b) Plan installations room c) Create ductwork plans and wall views	
5	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section E No. 5)	a) Create summary circuit diagrams from floor plans b) Create schematic representations including perspective representations using relevant standards and symbols in accordance with technical documents	
6	Prepare technical documentation (§ 14 Paragraph 2 Section E No. 6)	a) Select and create documentation for energy and information technology plants b) Create specialist tables and diagrams	
7	Use information and communication technology systems (§ 14 Paragraph 2 Section F No. 5)	b) Use standard software, in particular spreadsheets, text processing and presentation c) Procure, evaluate and use information, also including English language information in particular	
8	Work planning and organisation (§ 14 Paragraph 2 Section F No. 6)	a) Check work orders and stipulations in terms of feasibility c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria e) Plan work order and coordinate this with upstream and downstream areas f) Check and present possible solutions and compare their cost-effectiveness	
9	Customer orientation (§ 14 Paragraph 2 Section F No. 8)	a) Receive customer-specific requirements and information, pass on such requirements and information within the company and take these requirements and this information into account	

#### Time framework 10: Project-related realisation

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Prepare technical documents for electro technical systems (§ 14 Paragraph 2 Section E No. 1)	c) Select, connect and represent construction components of energy and information technology plants on the basis of catalogues and data sheets d) Design control circuits and control programmes and represent data transmission circuits g) Evaluate and represent the functions of system components and their wiring connections	4 to 8
2	Evaluate and use system components (§ 14 Paragraph 2 Section E No. 3)	b) Explain electro technology components and connect to form circuits c) Explain elements of open and closed loop control and drive technology and connect to form circuits d) Identify risks, apply protective measures	
3	Prepare technical documentation (§ 14 Paragraph 2 Section E No. 6)	c) Evaluate technical facts and circumstances and prepare and check measurements, protocols and lists of parts	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
4	Work planning and organisation (§ 14 Paragraph 2 Section F No. 6)	h) Plan and process tasks within a team; agree, evaluate and present team results	
5	Carry out quality assurance measures (§ 14 Paragraph 2 Section F No. 7)	b) Apply quality assurance measures in own work area, in particular check and evaluate interim and final results c) Recognise errors and quality defects and their causes and initiate and document measures for rectification d) Contribute to the continuous improvement of work processes	
6	Customer orientation (§ 14 Paragraph 2 Section F No. 8)	b) Comply with company communication rules in informing and advising customers and take customer requirements into account c) Communicate with customers in English d) Take cultural identities into account	

Time framework 11: Document electro technical systems

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 3)	Time framework in months
1	2	3	4
1	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section E No. 5)	c) Present and document specialist functional processes in accordance with technical documents	3 to 5
2	Prepare technical documentation (§ 14 Paragraph 2 Section E No. 6)	d) Collate order-related data in a systematic and customer-oriented manner	
3	Work planning and organisation (§ 14 Paragraph 2 Section F No. 6)	g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations	



## Section 2

### 1. Up until 3<sup>rd</sup> training semester

Time framework 1: Present simple components and sub-assemblies

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Draw up and apply technical documents (§ 4 Paragraph 2 Section A No. 1)	<ul style="list-style-type: none"> <li>a) Take standard specifications into account in creating technical drawings</li> <li>b) Differentiate between geometric relations</li> <li>c) Present individual components and sub-assemblies in conformity with standards in views and sections</li> <li>d) Apply measurement entry rules</li> <li>e) Present workpieces spatially</li> <li>f) Prepare and dimension freehand sketches</li> </ul>	4 to 6
2	Carry out computer-aided construction (§ 4 Paragraph 2 Section A No. 2)	<ul style="list-style-type: none"> <li>a) Prepare datasets for individual components and sub-assemblies in accordance with technical stipulations and own draft designs</li> <li>b) Apply structuring methods</li> <li>e) Select and use purchased and standard parts from libraries and catalogues</li> </ul>	
3	Differentiate materials (§ 4 Paragraph 2 Section A No. 3)	<ul style="list-style-type: none"> <li>a) Obtain information on materials with regard to their properties and possible processing and uses</li> </ul>	
4	Carry out calculations (§ 4 Paragraph 2 Section A No. 5)	<ul style="list-style-type: none"> <li>a) Calculate lengths, angles, areas, volumes and masses</li> </ul>	
5	Use information and communication technology systems (§ 4 Paragraph 2 Section E No. 5)	<ul style="list-style-type: none"> <li>a) Use company communication and information systems for the transmission of data, images and language</li> <li>b) Use standard software, in particular spreadsheets, text processing and presentation</li> <li>c) Procure, evaluate and use information, also including English language information in particular</li> <li>d) Manage and secure data</li> <li>e) Comply with regulations regarding data security</li> </ul>	
6	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	<ul style="list-style-type: none"> <li>a) Check work orders and stipulations in terms of feasibility</li> <li>b) Procure, evaluate and use order-related information and data</li> </ul>	
7	Customer orientation (§ 4 Paragraph 2 Section E No. 8)	<ul style="list-style-type: none"> <li>c) Communicate with customers in English</li> <li>d) Take cultural identities into account</li> </ul>	



Time framework 2: Prepare technical documents

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Draw up and apply technical documents (§ 4 Paragraph 2 Section A No. 1)	g) Prepare and manage technical support documentation, in particular lists of parts h) Prepare technical and presentation documentation i) Use lists of parts, tables, diagrams, manuals and operating instructions	4 to 6
2	Carry out computer-aided construction (§ 4 Paragraph 2 Section A No. 2)	c) Derive or prepare drawings d) Select and use symbols	
3	Differentiate materials (§ 4 Paragraph 2 Section A No. 3)	b) Differentiate materials and semi-finished parts with regard to availability, cost-effectiveness and environmental sustainability c) Take materials standardisation into account	
4	Assess materials and auxiliary materials (§ 4 Paragraph 2 Section B No. 1)	d) Use materials standardisation e) Describe materials properties in technical documents	
5	Design, draw up and calculate components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.3)	c) Select components and semi-finished products in accordance with stipulations and technical documents d) Take account of the use of standardised and purchased parts f) Stipulate tolerances, matching and surfaces i) Take account of joining and connection technologies m) Prepare datasets and secure data quality within the process	
6	Use information and communication technology systems (§ 4 Paragraph 2 Section E No. 5)	b) Use standard software, in particular spreadsheets, text processing and presentation c) Procure, evaluate and use information, also including English language information in particular d) Manage and secure data e) Comply with regulations regarding data security	
7	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria d) Accord due consideration to legal, operational and technical regulations g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations	

Time framework 3: Design and prepare components in line with materials, production and assembly requirements

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Differentiate production procedures and assembly techniques (§ 4 Paragraph 2 Section A No. 4)	a) Differentiate production and joining procedures typical to the branch b) Differentiate assembly techniques	3 to 5
2	Carry out calculations (§ 4 Paragraph 2 Section A No. 5)	b) Calculate expansion of lengths and volumes	
3	Assess materials and auxiliary materials (§ 4 Paragraph 2 Section B No. 1)	a) Evaluate materials with regard to their properties and possible processing and uses b) Differentiate auxiliary materials and assign in accordance with use c) Evaluate materials and auxiliary materials with regard to availability, cost-effectiveness and environmental sustainability	
4	Product development process (§ 4 Paragraph 2 Section B No. 2.1)	a) Accord due consideration to the company product development process b) Align contents and tasks from within own field of work to the product development process f) Communicate with upstream and downstream areas, identify interfaces and effect coordination g) Comply with legal stipulations within the phases of the product life cycle, in particular development and construction, production and assembly, commissioning, maintenance and routine repair, service, disassembly and disposal	
5	Plan and design components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.2)	b) Define product requirements, differentiate user and functional specifications and requirements lists and take account of quality requirements c) Apply creative techniques to find solutions	
6	Design, draw up and calculate components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.3)	a) Take account of functional, conditions of use, production, assembly and monitoring requirements with regard to constructions e) Take account of materials requirements and properties	
7	Select production and joining procedures and assembly techniques (§ 4 Paragraph 2 Section B No. 3)	a) Select production procedures within the construction process b) Select assembly technique and joining procedures within the construction process	
8	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	e) Plan work order and coordinate this with upstream and downstream areas	
9	Carry out quality assurance measures (§ 4 Paragraph 2 Section E No. 7)	b) Apply quality assurance measures in own work area, in particular check and evaluate interim and final results c) Recognise errors and quality defects and their causes and initiate and document measures for rectification	

Time framework 4: Implement construction process

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Product development processes (§ 4 Paragraph 2 Section B No. 2.1)	<ul style="list-style-type: none"> <li>b) Align contents and tasks from within own field of work to the product development process</li> <li>c) Apply project and process management methods</li> <li>d) Differentiate stages of methodological construction</li> <li>e) Interpret and apply analytical and statistical tools for quality assurance</li> <li>f) Communicate with upstream and downstream areas, identify interfaces and effect coordination</li> <li>g) Comply with legal stipulations within the phases of the product life cycle, in particular development and construction, production and assembly, commissioning, maintenance and routine repair, service, disassembly and disposal</li> </ul>	3 to 5
2	Plan and design components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.2)	<ul style="list-style-type: none"> <li>b) Define product requirements, differentiate user and functional specifications and requirements lists and take account of quality requirements</li> <li>e) Visualise and present solutions</li> </ul>	
3	Design, draw up and calculate components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.3)	<ul style="list-style-type: none"> <li>n) Exchange and apply various data formats</li> </ul>	
4	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	<ul style="list-style-type: none"> <li>e) Plan work order and coordinate this with upstream and downstream areas</li> <li>f) Check and present possible solutions and compare their cost-effectiveness</li> <li>h) Plan and process tasks within a team; agree, evaluate and present team results</li> </ul>	
5	Carry out quality assurance measures (§ 4 Paragraph 2 Section E No. 7)	<ul style="list-style-type: none"> <li>d) Contribute to the continuous improvement of work processes</li> </ul>	
6	Customer orientation (§ 4 Paragraph 2 Section E No. 8)	<ul style="list-style-type: none"> <li>a) Receive customer-specific requirements and information, pass on such requirements and information within the company and take these requirements and this information into account</li> </ul>	

### Section 3

#### 4. Up until 7<sup>th</sup> training semester: Specialism of product design and construction

Time framework 5: Construct complex components and sub-assemblies

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Plan and design components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.2)	<ul style="list-style-type: none"> <li>a) Differentiate types of construction</li> <li>b) Define product requirements, differentiate user and functional specifications and requirements lists and take account of quality requirements</li> <li>c) Apply creative techniques to find solutions</li> <li>d) Develop, evaluate and select solutions according due consideration to technical, business and ecological criteria</li> <li>e) Visualise and present solutions</li> </ul>	11 to 13
2	Design, draw up and calculate components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.3)	<ul style="list-style-type: none"> <li>a) Take account of functional, conditions of use, production, assembly and monitoring requirements with regard to constructions</li> <li>b) Take design stipulations into account from technical and functional perspectives</li> <li>g) Prepare detailed constructions</li> <li>h) Undertake constructive changes</li> <li>j) Conduct mechanical calculations, in particular regarding speed, forces and resolution of forces, torque and friction</li> <li>k) Conduct stability calculations, in particular regarding contact pressure, tensile load, pressure load and shear load</li> <li>l) Calculate work, performance and degree of effectiveness</li> </ul>	
3	Select production and joining procedures and assembly technique (§ 4 Paragraph 2 Section B No. 3)	<ul style="list-style-type: none"> <li>a) Select production procedures within the construction process</li> <li>b) Select assembly technique and joining procedures within the construction process</li> </ul>	
4	Conduct simulations (§ 4 Paragraph 2 Section B No. 4)	<ul style="list-style-type: none"> <li>a) Develop virtual assemblies and check for collision</li> <li>b) Apply branch and company-specific simulation procedures</li> </ul>	
5	Design and develop objects (§ 4 Paragraph 2 Section C No. 1)	<ul style="list-style-type: none"> <li>c) Apply basic principles of design</li> <li>d) Prepare draft sketches</li> </ul>	
6	Construct freeform surfaces (§ 4 Paragraph 2 Section C No. 2)	<ul style="list-style-type: none"> <li>a) Differentiate types of curve</li> <li>b) Produce spatial curves</li> <li>c) Smooth curves</li> <li>d) Produce and evaluate curve transitions</li> <li>e) Produce and evaluate freeform surfaces</li> </ul>	
7	Construct objects (§ 4 Paragraph 2 Section C No. 3)	<ul style="list-style-type: none"> <li>d) Construct objects taking production techniques into account, in particular deep drawing, injection moulding and bending</li> <li>e) Construct objects taking joining procedures and assembly techniques into account into account, in particular gluing, welding and clip and snap connections</li> <li>g) Construct objects taking materials into account, in particular sheet metals, plastic, wood, composite materials, glass, paper and cardboard</li> </ul>	
8	Use information and communication technology systems (§ 4 Paragraph 2 Section E No. 5)	<ul style="list-style-type: none"> <li>c) Procure, evaluate and use information, also including English language information in particular</li> <li>d) Manage and secure data</li> </ul>	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
9	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria e) Plan work order and coordinate this with upstream and downstream areas f) Check and present possible solutions and compare their cost-effectiveness g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations	
10	Carry out quality assurance measures (§ 4 Paragraph 2 Section E No. 7)	a) Take the objectives and tasks of quality assurance measures into account c) Recognise errors and quality defects and their causes and initiate and document measures for rectification	
11	Customer orientation (§ 4 Paragraph 2 Section E No. 8)	a) Receive customer-specific requirements and information, pass on such requirements and information within the company and take these requirements and this information into account	

#### Time framework 6: Develop, design and construct products

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Design and develop objects (§ 4 Paragraph 2 Section C No. 1)	a) Carry out product, competition and patent research b) Differentiate stages of the design process, in particular sketches, CAD models and physical models e) Design objects in a functional manner f) Design objects in accordance with ergonomic guidelines and legal stipulations g) Take material properties into account when designing objects	11 to 13
2	Construct freeform surfaces (§ 4 Paragraph 2 Section C No. 2)	f) Produce and evaluate surface transitions g) Produce and evaluate polysurfaces h) Create and evaluate objects with freeform surfaces	
3	Construct objects (§ 4 Paragraph 2 Section C No. 3)	a) Implement design stipulations in accordance with technical, functional and aesthetic perspectives b) Construct objects as surface, volume and hybrid models c) Construct objects in accordance with functionality and requirements f) Construct objects ergonomically h) Optimise objects, in particular taking calculation and test results into account	
4	Simulation and presentation (§ 4 Paragraph 2 Section C No. 4)	a) Create, use and evaluate simulations b) Check behaviour of components and sub-assemblies via virtual movement simulations c) Present and animate objects in a photorealistic manner d) Apply visualisation techniques	
5	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	h) Plan and process tasks within a team; agree, evaluate and present team results	
6	Carry out quality assurance measures (§ 4 Paragraph 2 Section E No. 7)	c) Recognise errors and quality defects and their causes and initiate and document measures for rectification of causes d) Contribute to the continuous improvement of work processes	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
7	Customer orientation (§ 4 Paragraph 2 Section E No. 8)	<ul style="list-style-type: none"> <li>b) Comply with company communication rules in informing and advising customers and take customer requirements into account</li> <li>c) Communicate with customers in English</li> <li>d) Take cultural identities into account</li> </ul>	

## Section 4

### 4. 4<sup>th</sup> to 7<sup>th</sup> training semester: Specialism of in machinery and plant construction

Time framework 7: Construct complex components and sub-assemblies

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Assess materials and auxiliary materials (§ 4 Paragraph 2 Section B No. 1)	<ul style="list-style-type: none"> <li>a) Evaluate materials with regard to their properties and possible processing and uses</li> <li>b) Differentiate auxiliary materials and assign in accordance with use</li> </ul>	11 to 13
2	Plan and design components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.2)	<ul style="list-style-type: none"> <li>a) Differentiate types of construction</li> <li>b) Define product requirements, differentiate user and functional specifications and requirements lists and take account of quality requirements</li> <li>c) Apply creative techniques to find solutions</li> <li>d) Develop, evaluate and select solutions according due consideration to technical, business and ecological criteria</li> <li>e) Visualise and present solutions</li> </ul>	
3	Design, draw up and calculate components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.3)	<ul style="list-style-type: none"> <li>a) Take account of functional, conditions of use, production, assembly and monitoring requirements with regard to constructions</li> <li>b) Take design stipulations into account from technical and functional perspectives</li> <li>g) Prepare detailed constructions</li> <li>h) Undertake constructive changes</li> <li>j) Conduct mechanical calculations, in particular regarding speed, forces and resolution of forces, torque and friction</li> <li>k) Conduct stability calculations, in particular regarding contact pressure, tensile load, pressure load and shear load</li> <li>l) Calculate work, performance and degree of effectiveness</li> </ul>	
4	Select production and joining procedures and assembly techniques (§ 4 Paragraph 2 Section B No. 3)	<ul style="list-style-type: none"> <li>a) Select production procedures within the construction process</li> <li>b) Select assembly technique and joining procedures within the construction process</li> </ul>	
5	Conduct simulations (§ 4 Paragraph 2 Section B No. 4)	<ul style="list-style-type: none"> <li>a) Develop virtual assemblies and check for collision</li> <li>b) Apply branch and company-specific simulation procedures</li> </ul>	
6	Alter and check material properties (§ 4 Paragraph 2 Section D No. 1)	<ul style="list-style-type: none"> <li>a) Select procedures for the alteration of material properties</li> <li>b) Select test procedures for the identification of material properties</li> </ul>	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
7	Control and electrical engineering (§ 4 Paragraph 2 Section D No. 5)	<ul style="list-style-type: none"> <li>a) Differentiate elements of control engineering</li> <li>b) Evaluate circuits with hydraulic and electro pneumatic elements</li> <li>c) Take account of the fundamental laws of electrical engineering and calculate basic values</li> <li>d) Calculate control engineering values, in particular pressures and forces</li> <li>e) Take account of risks in control and electrical engineering and comply with the requirements of relevant protective measures</li> <li>f) Integrate control and electrical engineering circuit diagrams into CAD datasets</li> </ul>	
8	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	<ul style="list-style-type: none"> <li>e) Plan work order and coordinate this with upstream and downstream areas</li> <li>f) Check and present possible solutions and compare their cost-effectiveness</li> <li>g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations</li> <li>h) Plan and process tasks within a team; agree, evaluate and present team results</li> </ul>	
9	Carry out quality assurance measures (§ 4 Paragraph 2 Section E No. 7)	<ul style="list-style-type: none"> <li>b) Apply quality assurance measures in own work area, in particular check and evaluate interim and final results</li> <li>c) Recognise errors and quality defects and their causes and initiate and document measures for rectification</li> <li>d) Contribute to the continuous improvement of work processes</li> </ul>	
10	Customer orientation (§ 4 Paragraph 2 Section E No. 8)	<ul style="list-style-type: none"> <li>c) Communicate with customers in English</li> </ul>	

Time framework 8: Conceptualise, design and develop technical products

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
1	Design, draw up and calculate components and sub-assemblies (§ 4 Paragraph 2 Section B No. 2.3)	<ul style="list-style-type: none"> <li>c) Select components and semi-finished products in accordance with stipulations and technical documents</li> <li>d) Take account of the use of standardised and purchased parts</li> <li>i) Take account of joining and connection technologies</li> <li>j) Conduct mechanical calculations, in particular regarding speed, forces and resolution of forces, torque and friction</li> <li>k) Conduct stability calculations, in particular regarding contact pressure, tensile load, pressure load and shear load</li> <li>l) Calculate work, performance and degree of effectiveness</li> </ul>	11 to 13
2	Conduct simulations (§ 4 Paragraph 2 Section B No. 4)	<ul style="list-style-type: none"> <li>a) Develop virtual assemblies and check for collision</li> <li>b) Apply branch and company-specific simulation procedures</li> </ul>	
3	Create constructions (§ 4 Paragraph 2 Section D No. 2)	<ul style="list-style-type: none"> <li>a) Select the structure, function and functionality of machine elements, in particular gears, couplings and mechanisms</li> <li>b) Develop constructions with function units, standard parts and connection elements</li> <li>c) Create injection constructions</li> <li>d) Create welded constructions</li> </ul>	

No.	Part of the training occupation profile	Skills, knowledge and competences to be imparted (according to learning objectives of Annex 1)	Time framework in months
1	2	3	4
4	Production engineering (§ 4 Paragraph 2 Section D No. 3)	<ul style="list-style-type: none"> <li>a) Implement the effects of prototype forming on the dimensioning, design, surface characteristics and measurability of components in the construction</li> <li>b) Implement the effects of metal forming on the dimensioning, design, surface characteristics and measurability of components in the construction</li> <li>c) Implement the effects of milling machining on the dimensioning, design, surface characteristics and measurability of components in the construction</li> <li>d) Carry out technical production calculations</li> </ul>	
5	Joining and assembly engineering (§ 4 Paragraph 2 Section D No. 4)	<ul style="list-style-type: none"> <li>a) Implement the effects of joining and assembly engineering on the dimensioning, design, surface characteristics and measurability of components in the construction</li> <li>b) Calculate tolerances and matching</li> <li>c) Use machine or connecting elements in constructions in a manner which meets load and functionality requirements</li> </ul>	
6	Work planning and organisation (§ 4 Paragraph 2 Section E No. 6)	<ul style="list-style-type: none"> <li>c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria</li> <li>d) Accord due consideration to legal, operational and technical regulations</li> </ul>	
8	Carry out quality assurance measures (§ 4 Paragraph 2 Section E No. 7)	<ul style="list-style-type: none"> <li>a) Take the objectives and tasks of quality assurance measures into account</li> </ul>	
9	Customer orientation (§ 4 Paragraph 2 Section E No. 8)	<ul style="list-style-type: none"> <li>b) Comply with company communication rules in informing and advising customers and take customer requirements into account</li> <li>c) Communicate with customers in English</li> </ul>	



## **SKELETON CURRICULUM**

for the training occupation of

### **Technical system planner**

(Resolution of the Standing Conference of the  
Ministers of Education and Cultural Affairs of 27  
May 2011)

## **Part I Preliminary remarks**

This 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.

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 Economics and Technology or by the otherwise responsible ministry in agreement with the Federal Ministry for Education and Research).

The present skeleton curriculum takes the lower secondary school leaving certificate as its basis and describes minimum requirements.

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 creation of the essential prerequisites for qualified employment and entry into school based and advanced vocational and continuing training courses.

The skeleton curriculum does not contain any methodological stipulations in respect of teaching. In the organisation of teaching, however, particular consideration should be accorded to teaching methods which directly foster employability skills. Autonomous and responsible thoughts and actions constitute the overarching objective of training and must form part of the overall didactic and methodological concept.

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 achieved 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.

In 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 the vocational school. Vocationally related teaching is also guided by the nationally standardised 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);
- the Ordinance on Vocational Education and Training (training regulations) promulgated by the Federal Government in respect of company-based 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 and mobility 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 task 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;
- afford insights into different forms of employment, including entrepreneurial self-employment, so as to support autonomous career and life planning;
- 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.

The aims listed are aligned towards 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 occupational, social and private situations. Employability skills are developed within the dimensions of professional competence, human competence and social competence.

**Professional 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.

**Human 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. It 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 competence, communicative competence and learning competence are all components of professional competence, human competence and social competence.

**Methodological competence** describes the readiness and ability to adopt a target-oriented, planned approach to the processing of tasks and problems (e.g. when planning stages of work).

**Communicative competence** refers to the readiness and ability to understand and shape communicative situations. It includes the perception, understanding and representation of pupils' own intentions and requirements as well as those of partners.

**Learning competence** is the readiness and ability to understand and evaluate information on facts and circumstances and on correlations and to align thinking into conceptual structures acting both autonomously and in conjunction with others. Learning competence also particularly includes the readiness and ability to develop learning techniques and learning strategies both within and beyond a field of occupation and to use such techniques and strategies for lifelong learning.

### **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 fundamentally 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 take 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 and various perspectives of career and life planning.

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.

#### **Teil IV Occupationally related preliminary remarks**

The present skeleton curriculum for vocational education and training in the occupation of technical system planner is coordinated with the Ordinance on vocational education and training in the occupation of technical product designer and technical system planner of 21 June 2011 (Federal Law Gazette I p. 1215).

The skeleton curriculum for the training occupation of engineering draughtsman/engineering draughtswoman (Resolution of the KMK of 15 February 1994) 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 7 May 2008).

With regard to the first four learning fields, the skeleton curriculum corresponds to the skeleton curriculum for the training occupation of technical product designer. For this reason, joint schooling together with the training occupation of technical product designer is possible in the first year of training.

From the second year of training, training in the occupation of technical system planner is divided into the following specialisms.

- Supply and equipment technology
- Steel and metal engineering technology
- Electro technical systems

Technical system planners specialising in supply and equipment technology work for companies involved with heating, ventilation, air conditioning and sanitary technology. They

- comply with their particular responsibility to secure basic human existence in their social and professional actions;
- are mindful to use of energy and resources in a way which that is oriented towards sustainability and develop planning and advisory competence in this regard;
- consider technical supply plants as an overall energy system and take cross-trade correlations into account in design and planning;
- design supply technology plants, dimension components and plan the assembly of such components to form a complete plant in structures; prepare the necessary technical documents for the planning, construction and proper operation of the plants using specific CAD systems;
- take account of modern energy concepts;
- apply technical regulations and stipulations, data sheets and descriptions, operating instructions and other information typical to the occupation;
- use current information and communication systems to procure information, process orders (planning documents) and document and present results;
- also carry out computer-aided technical calculations for the design of supply technology systems, plants, equipment and components;
- view themselves as a service provider to the customer and align their actions and approach to customers' expectations and wishes.

Technical system planners specialising in steel and metal engineering technology work in the fields of steel manufacturing, metal engineering, container construction and precision sheet metal working. They

- prepare drawings that show penetrations and developed views of sheet metal components;
- prepare and alter production drawing for steel constructions;
- prepare and alter order-related production drawings of staircases and fall arresters;
- take account of the respective state building regulations in executing a construction project;
- take account of modern energy concepts;
- plan level and spatial timber-framed structures and their structural shell;
- prepare and alter design drawings for objects consisting of profiles and glass;
- calculate static and mechanic systems and carry out verification procedures;
- draw up lists of parts, calculate total mass on the basis of the overall drawing including with the assistance of libraries, catalogues and reference works;
- plan detailed drawings whilst according due consideration to heat insulation, damp proofing, sound insulation, fire protection, protection against corrosion, health and safety at work and economic and ecological aspects;
- complete and alter overall and detailed drawings and supporting documentation on the basis of measurements using specific CAD systems;

Technical system planners specialising in electro technology

- prepare documentation for the manufacture, installation and operation of technical building and plant systems and electrical installations;
- take account of modern energy concepts;
- prepare electro technical documentation with the help of specific CAD programmes whilst complying with standards, regulations and safety provisions;
- coordinate planning processes taking account of commercial and quality assurance aspects;
- use modern communication methods and application programmes for documentation and presentation whilst taking data security into account;
- deploy specific CAD systems in a project-oriented way to draw up plans;
- identify and calculate electrical values;
- carry out technical calculations, including software-aided calculations, for the design of electrical systems and plants and cost calculations;
- use technical regulations and stipulations, data sheets and descriptions and other information typical to the occupation.

40 hours of teaching are integrated into the learning fields for the imparting of foreign language skills in accordance with the training regulations for the purpose of the development of relevant communication skills. In addition, 80 hours of occupationally specific foreign language teaching can be provided as a voluntary supplement by the federal states.

The specialist contents of the individual learning fields are only stated in general terms and are not listed in differentiated form. Insofar as they are able, schools act in cooperation with the companies providing training to decide autonomously on the content organisation of the learning fields. There is close content correlation between the skeleton curriculum and the general training plan for company-based training. The recommendation is that the organisation of generic learning situations in the individual learning fields should be based on both plans.

Learning fields 1 to 6 correspond to the respective training occupation profile positions for the first 18 months of the general training plan for company-based training and thus form the basis for part 1 of the final examination.

In learning fields 12 and 13 (specialism of steel and metal engineering technology), 13 (specialism of electro technical systems) and 14 (specialism of supply and equipment technology), pupils should apply the competences acquired during training to process in full a customer order typical to the occupation. Particular consideration may be accorded in this respect to the areas of deployment that form the main focus of the company providing training.



**Part V Learning fields**

<b>Summary of the learning fields for the training occupation of technical system planner</b>					
<b>Learning fields</b>		<b>Suggested time allocations in teaching hours</b>			
No.		1st year	2nd year	3rd year	4th year
1	Analyse and record technical systems	60			
2	Create components and subassemblies in a computer-aided way in accordance with stipulations	80			
3	Take account of effects of selected production procedures and materials on component construction	80			
4	Execute orders in a customer-oriented manner	60			
<b>Specialism of supply and equipment technology (SET)</b>					
5	Plan and design heat distribution plants and thermal consumers		80		
6	Plan drinking water supply plants and water disposal plants		60		
7	Plan sanitary facilities and supply of hot water to such facilities		60		
8	Plan plants for fuel storage and provision		40		
9	Record and analyse supply and equipment technology processes		40		
10	Plan air distribution plants			100	
11	Plan power plants			100	
12	Plan air treatment in centralised and decentralised ambient air systems			80	
13	Plan resource-efficient plants				80
14	Process customer supply and equipment technology orders				60
<b>Specialism of steel and metal engineering technology (SMT)</b>					
	Plan and construct sheet metal components		80		
	Plan and construct objects from standardised semi-finished parts		100		
	Plan and construct steel staircases and fall arresters		60		
	Plan the execution of a construction project		40		
	Prepare technical working documents for steel constructions			100	
	Plan and build lightweight constructions			80	
	Plan and build metal constructions			100	
	Plan and build construction projects typical to the occupation				80
	Process customer orders in accordance with modern building management				60
<b>Specialism of electro technical systems (ETS)</b>					
	Analyse electro technical systems		80		
	Plan electrical installations		80		
	Analyse and adjust control systems		60		
	Plan and represent energy plants		60		
	Plan technical building systems			100	
	Select drive systems and take such systems into account in the planning process			80	
	Plan control systems for technical buildings services and automation technology			100	
	Plan communication systems for residential and functional buildings				80
	Process customer orders for technical buildings services systems				60
<b>Totals: overall time 980 hours</b>		<b>280</b>	<b>280</b>	<b>280</b>	<b>140</b>

<b>Learning field 1: Analyse and record technical systems</b>	<b>1<sup>st</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils record and analyse technical systems. They evaluate technical documentation, including documentation in English, and use specialist terms to describe functional correlations of technical systems. For this purpose, they carry out application-related calculations, complete freehand technical sketches and draw up necessary technical documents. They apply the possibilities provided by technical documentation, in particular presentation in accordance with standards.	
<b>Contents</b>  Spatial representation, representation in views Procurement of information: book of tables, catalogues, Internet lists of parts, standardised parts Dimensioning, tolerances Basic electro technology terms Calculations: length, surface area, volume, angle, masse, density	

<b>Learning field 2: Create components and subassemblies in a computer-aided way in accordance with stipulations</b>	<b>1<sup>st</sup> year of training</b> <b>Suggested time allocation: 80 hours</b>
<b>Aim</b>  Pupils prepare datasets for components in accordance with hand drawn sketches and drawings. They generate and alter components in a computer-aided manner for this purpose. They particularly recognise geometric correlations and take these into account. They create simple subassemblies according due consideration to soluble connections and reflect upon their ease of assembly. They check their work results, carry out changes to the components and generate the necessary technical documents. Pupils manage and secure data in suitable structures whilst complying with data protection provisions. They address the risks of misuse of data and reflect upon the legal and economic consequences of this.	
<b>Contents</b>  Views, sections, details Tolerance information Dataset structuring Purchased parts and standardised parts from libraries Lists of parts Computer-aided calculations: areas, volumes, masses, centres of gravitation Data formats	

<b>Learning field 3: Take account of effects of selected production procedures and materials on component construction</b>	<b>1<sup>st</sup> year of training</b> <b>Suggested time allocation: 80 hours</b>
<b>Aim</b>  Pupils construct components and obtain information on production procedures in an order-related way. They take the structure, properties and possible uses of materials into consideration. They evaluate and structure information on production procedures and materials typical to the branch, carry out necessary calculations and recognise the influence on component construction. Pupils document and present their work and use standard software in its development. They reflect upon and evaluate their presentations including from design points of view.	
<b>Contents</b>  Mechanical and physical materials properties Materials standardisation Surface characteristics, surface designation Expansion of lengths and volume Main groups of production procedures Copyright law Referencing sources	

<b>Learning field 4: Execute orders in a customer-oriented manner</b>	<b>1<sup>st</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils process a customer order. For this purpose, they record and analyse fundamental operational sequences and processes, reflect upon their own experiences and take these into account in the execution of the order. They procure project-related information, including in English. In executing the order, pupils work in a team and apply suitable work strategies. They present, compare and evaluate their possible solutions. Following the completion of the customer order, pupils reflect upon the processes and procedures.	
<b>Contents</b>  Product development process User and functional specifications Creative techniques Quality assurance measures Time planning Cost management	

**Specialism of supply and equipment technology (SET)**

<p><b>Learning field 15 (SET): Plan and design heat distribution plants and thermal consumers</b></p>	<p><b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 80 hours</b></p>
<p><b>Aim</b></p> <p>Pupils plan the installation of thermal consumers and of the necessary distribution plants. They analyse construction drawings and construction descriptions for this purpose and derive sketches and detail drawings.</p> <p>They determine the heat transfer coefficient and evaluate the results of insulation measures on the basis of heat transfer diagrams taking economic and ecological points of view into account.</p> <p>Pupils calculate the standard heating load in accordance with stipulations. Pupils plan the pipe layout for the connection of the thermal consumer whilst according due consideration to the distribution systems. They select a suitable material for the pipes, the relevant level of insulation and the corresponding connection technologies. They stipulate connections in accordance with construction circumstances, dimension the pipes and prepare sketches and diagrams. They take account of the basic laws of physics, chemistry and mathematics.</p> <p>Pupils draw up and explain lists of materials and parts, pipe network plans and working drawings with the assistance of catalogues and libraries. They use specialist English language terms for components and materials.</p>	
<p><b>Contents</b></p> <p>Heat quantity, thermal output, heat transfer, U-values</p> <p>Marches of temperature in components</p> <p>Heating surface design in accordance with standard</p> <p>Energy Saving Ordinance</p> <p>Radiant heating systems</p> <p>Branch-specific computer software</p> <p>Hydraulic matching</p> <p>Pump design</p> <p>Isometrics</p>	

<b>Learning field 6 (SET): Plan drinking water supply plants and water disposal plants</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils plan and dimension drinking water and sewage plants and for this purpose take local circumstances into account in determining the design data for drinking water, waste water and rain water. They stipulate cabling, which they dimension in accordance with stipulations, design types of pipe and pipe materials and select fittings whilst ensuring retention of water quality. They consider alternative options for the reduction of consumption of drinking water. Pupils comply with relevant technical rules in planning the sewage plant. They select protective measures to guard against backwater and hazardous materials depending on local circumstances. In connecting systems to the buildings they take protection against corrosion into account and comply with regulations for noise insulation and fire protection. Pupils document their planning in schematic drawings which contain all necessary fittings. They use specialist English language terms for components and materials.	
<b>Contents</b>  Drinking water treatment Circulation pipes Grey water use Rainwater use	

<b>Learning field 7 (SET): Plan sanitary facilities and supply of hot water to such facilities</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b> <p>Pupils take customer wishes into account in planning the installation of sanitary facilities. They draw up planning documentation, including in 3D, and prepare drawings for purposes of presentation.</p> <p>Pupils select hot water supply systems and the technical safety equipment for such systems in accordance with stipulations and give reasons for their choice. They plan the integration of water heating on the basis of resource-efficient forms of energy.</p> <p>Pupils take rules and regulations into account in implementing their planning proposals. They evaluate fittings and apparatus in accordance with function, functionality, possible areas of use and opportunities to save drinking water and use energy efficiently.</p> <p>They compare and evaluate the various equipment options, give reasons for their decisions and present the results in a customer-appropriate form.</p>	
<b>Contents</b> <p>Clearances</p> <p>Design, aesthetics, ergonomics</p> <p>Accessibility</p> <p>Adequate spaces</p> <p>Electrical regulations</p> <p>Connection and installation measurements, installation in accordance with tiling</p> <p>Noise protection measures</p> <p>Wall-mounted installation</p> <p>Connection pressure</p>	



<b>Learning field 8 (SET): Plan plants for fuel storage and provision</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 40 hours</b>
<b>Aim</b>  Pupils take local circumstances and regional regulations into account in planning plants for the storage and provision of fuels. They select incineration plants in accordance with customer requirements and local circumstances. They plan distribution networks for various fuels and design pipeline systems in accordance with the intended purpose. They select pipe materials, connection technologies, fixtures and fittings in accordance with standards and regulations and take account of the safety and fire protection of the plants. They prepare working drawings and schematic diagrams.	
<b>Contents</b>	

<b>Learning field 9 (SET): Plan sanitary facilities and supply of hot water to such facilities</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 40 hours</b>
<b>Aim</b>  Pupils record processes in supply and equipment technology and represent these processes schematically. For this purpose, they investigate and differentiate basic open and closed loop control engineering processes including in the form of simulation. They read functional plans and analyse electrical, electrical-pneumatic and hydraulic subassemblies. They represent the functional processes of supply and equipment technology for a simple technical system, compare their results and develop alternatives.	
<b>Contents</b>	

<b>Learning field 10 (SET): Plan air distribution plants</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 100 hours</b>
<b>Aim</b>  Pupils plan air distribution plants for the air conditioning of rooms. They determine external air rates and load, calculate necessary air mass and volume flows and design suitable air inlets and outlets whilst taking comfort criteria and customer wishes into account. They prepare drawings, including derivations from 3D representations, for the integration of the inlets and outlets into the building structure in accordance with stipulations. Pupils compare air distribution in the room depending on air inlet systems and take noise development into account. They dimension ducts and installations in accordance with stipulations and compare various options with regard to technical feasibility and economic realisation. They select systems, components and aggregates. They stipulate size and alignment and justify and document their decisions. They prepare schematic drawings and diagrams. Pupils draw up specifications and lists of parts and carry out duct surface calculations for the purpose of billing.	
<b>Contents</b>  Air exchange Thermal and sound stipulations Pressure losses Noise insulation Noise protection Fire protection Developed views	

<b>Learning field 11 (SET): Plan power plants</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation: 100 hours</b>
<b>Aim</b> <p>Pupils plan the construction of a power plant. They read construction drawings for this purpose, from which they derive calculations and designs for supply units.</p> <p>Pupils determine the building's heating load in accordance with stipulations including by using calculation software and select heat generators and accumulators. They dimension and select relevant components on the basis of catalogues, manuals and company-specific documentation.</p> <p>They prepare partial and detailed sketches for plant installation in the power plant and evaluate the spatial alignment of the components and subassemblies whilst taking fire protection regulations into account.</p> <p>Pupils draw up an overall plan for the plant on the basis of previous designs and also accord due consideration to various forms of heat recovery and regenerative forms of energy.</p> <p>They select and represent systems and components for connection of the heat generator to the exhaust plant in accordance with manufacturer information.</p> <p>Pupils prepare detail, group, overall and production drawings for the power plant and draw up the relevant lists of parts. They understand English product descriptions and use the specialist English language terms which arise.</p>	
<b>Contents</b>  Hydraulic matching Pipe network calculation Isometrics	

<b>Learning field 12 (SET): Plan air treatment in centralised and decentralised ambient air systems</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation: 80 hours</b>
<b>Aim</b> <p>Pupils plan air treatment in centralised and decentralised ambient air systems. For this purpose, they describe the state variables of the air and the change to such variables and represent the process in diagrams.</p> <p>They select air treatment plant concepts and subassemblies for ventilation and air conditioning systems in accordance with technical requirements and customer wishes and present these concepts and subassemblies. Pupils plan connection to heating and cooling systems and select the aggregates necessary for air transport in accordance with stipulations and taking environmental conditions into account. They determine the size of the equipment and position within the building structure. They produce connections to the air distribution system and prepare sketches and drawings of this. Pupils plan the deployment of various heat recovery procedures, select components and subassemblies for this purpose and represent these in schematic drawings and views together with all connections.</p> <p>They draw plant diagrams, floor plans with pipe layouts and subassemblies. They comply with safety regulations and provisions for pipe work. Pupils determine electrical connections for the plants and identify performance and dimension of the electrical installations. They select and represent the necessary components for open and closed loop control systems and monitoring.</p>	
<b>Contents</b>	

<b>Learning field 13 (SET): Plan resource-efficient plants</b>	<b>4<sup>nd</sup> year of training</b> <b>Suggested time allocation: 80 hours</b>
<b>Aim</b>  Pupils plan the installation of resource-efficient plants. For this purpose, they analyse local and construction circumstances and compare the various possibilities of conventional and alternative energy generation. They take particular account of new technical developments in supply and equipment technology. Pupils take technical rules and stipulations and manufacturer-specific documentation into account in drawing up a comparative economic and ecological analysis. They analyse the benefits and drawbacks of the various systems and explain possibilities and limitations to customers in terms of the respective deployment. Pupils prepare the planning of a resource-efficient plant following placement of order. They prepare sketches, working drawings and plant diagrams for this purpose.	
<b>Contents</b>	

<b>Learning field 14 (SET): Process customer supply and equipment technology orders</b>	<b>4<sup>nd</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils plan the construction of a sanitary, heating or air conditioning supply plant in accordance with the customer order. They prepare heating, air conditioning, water supply or water disposal proposals on the basis of construction data and customer stipulations. The pupils draw up the documentation necessary for planning and execution and present their concepts in customer meetings. Alterations are taken into account in working calculations and correct working drawings. They select all necessary components, draw up specifications and present the final results. They summarise their work results in concluding documentation. Pupils take account of corrections on the basis of specific customer wishes when coordinating works in meetings with installers.	
<b>Contents</b>  Presentation techniques Meetings Quality assurance measures	

**Specialism of steel and metal engineering technology (SMT)**

<b>Learning field 5 (SMT): Plan and construct sheet metal components</b>	<b>2<sup>nd</sup> year of training Suggested time allocation: 80 hours</b>
<p><b>Aim</b></p> <p>Pupils prepare order-related production drawings as penetrations and developed views of sheet metal components with the aid of suitable construction procedures. They select materials on the basis of the conditions of use of the components. They determine the cutting length for bent components whilst taking account of joining procedures and material thicknesses. In planning the cutting length, they take account of thermal and mechanical separation and reforming procedures including on CNC-controlled machines. Pupils use computer programmes for simulation, calculation and documentation. They take account of active and passive corrosion protection and of the necessary bracing of sheet metal when designing the sheet metal components. Pupils consider cost-effectiveness and company conditions in comparing and testing work results and document results.</p>	
<p><b>Contents</b></p> <p>Developed sheet metal views: prisms, pyramids, cylinders, cones, transitional structures, penetrations, sheet metal templates Surface lines, triangular and spheroid procedures Materials and sheet metal standardisation</p>	



<b>Learning field 6 (SMT): Plan and construct objects from standardised semi-finished parts</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 100 hours</b>
<b>Aim</b>  Pupils analyse, alter and prepare order-related production drawings of steel constructions. They take account of the functionality of braces, frames and clamps, dimension bearers and supports and carry out necessary verification procedures on the components. Pupils select materials and take account of the requirements of the procedures with regard to the alteration of material properties. They select suitable welding procedures and screw connections for constructions and conduct verification of stability testing arithmetically or with the aid of tables. They select appropriate non-destructive or destructive test procedures to check welding seams. Pupils document their results in detail, group and overall drawings for the order documentation and use standard symbols and images for welded and screw connections. Pupils draw up welding sequence plans for welded constructions. They determine cut lengths and masses for the lists of parts. They use specialist English language terms for components and materials.	
<b>Contents</b>  Semi-finished parts from profiles Reaction forces of statically determined systems Internal distribution of longitudinal force, shearing force and moment Determination of centre of gravity, section modulus, bending stress, deflection Thermal separation and alignment of steel profiles	

<b>Learning field 7 (SMT): Plan and construct steel staircases and fall arresters</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils prepare and alter order-related production drawings of staircases and fall arresters. They obtain information on national and federal state building regulations and procure information from technical documents or local facts and circumstances to calculate production measurement and connection details. They compare forms of staircase and take account of footstep noise in selecting suitable covering materials. They discuss solutions from cost, material-specific and aesthetic points of view. Pupils calculate and dimension the suitable fall arrester for the staircase selected. They plan the fixing of the construction in relation to requirements and to the structure. They use specialist English language terms for components, materials and fixings.	
<b>Contents</b>  Mathematical and graphical drawings of steps Banisters for public and industrial buildings Dowelling technology	

<b>Learning field 8 (SMT): Plan the execution of a construction project</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 40 hours</b>
<b>Aim</b>  Pupils take account of the respective state building regulations in executing a construction project; For this purpose, they obtain information on building law regulations, on characteristics specific to the property in question, on environmental law regulations and on hiring regulations for construction services. They draw up planning documentation on the basis of planning permission, plan the set up of the construction site and the building schedule. They take tolerances of their own and adjacent components into account in drawing up detailed plans with the assistance of dimensions which they have prepared themselves or which have been stipulated. Pupils select lifting equipment and fittings and accord due consideration to safety regulations in planning the deployment of such equipment and fittings.	
<b>Contents</b>  Accident prevention regulations Critical path analysis Test equipment for the calibration of structures Mathematical and graphical determination of forces	

<b>Learning field 9 (SMT): Prepare technical working documents for steel constructions</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation: 100 hours</b>
<b>Aim</b>  Pupils select supporting frameworks for construction and carry out calculations that take account of main and moving loads. They prepare sequence systems for skeleton structures. They take account of load absorption and load dissipation in selecting suitable stabilising elements at risk points of the supporting framework, prepare working drawings and detailed plans and carry out necessary calculations. In their detailed planning of steel skeleton structures, pupils take account of fire protection measures, protection against corrosion and energy aspects.	
<b>Contents</b>  Supports using binders, hinged frames, types of roof binder Stanchion splices, girder joints, girder and stanchion connections, foundation connections Framework construction System triangles, alteration of length via load and temperature Screw and welded connections that are resistant to bending	

<b>Learning field 10 (SMT): Plan and build lightweight constructions</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation: 80 hours</b>
<b>Aim</b>  Pupils plan level and spatial timber-framed structures and their structural shell. They take account of buildings physics, energy and cost aspects and accord due consideration to roof pitch and roof construction in designing the roof structure, the structure of the walls and claddings used for the walls. They select suitable construction materials for this purpose. Pupils prepare working plans regarding connection details for solid and prefabricated ceilings. They calculate the bar tensions for an ideal timber-framed structure mathematically and graphically. They take energy regulations into account in stipulating a suitable structure for the construction shell and decide upon joining procedures whilst according due consideration to fire protection. They document the arrangement of components in geometric, assembly and installation plans.	
<b>Contents</b>  Heat insulation and composite heat insulation systems Energy Saving Ordinance Heat insulation, damp proofing, noise insulation and fire protection in steel construction Graphical determination of forces, e.g. Cremona plan Plug and clamp connections	

<b>Learning field 11 (SMT): Plan and build metal constructions</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation: 100 hours</b>
<b>Aim</b> <p>Pupils take account of static, constructive and buildings physics requirements in preparing and altering working drawings for objects consisting of profiles and glass for building use and cladding. They use the libraries and catalogues of the profile manufacturers in preparing their CAD drawings and take account of the installation of windows and doors with regard to use of the building and load.</p> <p>They conduct energy verification of the metal components and draw detailed plans for construction work connections in different materials. They select fixings for this purpose.</p> <p>Pupils draw up circuit diagrams for the control of shading and locking systems of properties.</p> <p>They document the arrangement of facade elements in geometric, assembly and installation plans and prepare detailed drawings of facade sections. They use specialist English language terms for components, materials and fixings.</p>	
<b>Contents</b> <p>Types of glass, properties and use</p> <p>Building connection in accordance with RAL Quality Guidelines</p> <p>Insulation and sealing materials</p> <p>Damp proofing, sound insulation, heat insulation, fire protection</p>	

<b>Learning field 12 (SMT): Plan and build construction projects typical to the occupation</b>	<b>4<sup>th</sup> year of training Suggested time allocation: 80 hours</b>
<b>Aim</b>  Pupils alter and prepare planning and working documentation of steel or metal construction projects. They analyse the stipulations of the order and address local circumstances and customer wishes. They take account of constructive, static, buildings physics and legal requirements in preparing adapted solutions and proposals. They structure the order and organise the process. They recognise errors, describe causes of errors, draw up alternative proposals and show possibilities for the rectification of errors. They prepare calculations in accordance with the constructive, static, buildings physics and economic requirements.	
<b>Contents</b>  Customer meetings Advice Presentation techniques	

<b>Learning field 13 (SMT): Process customer orders in accordance with modern building management</b>	<b>4<sup>th</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils analyse an order in a customer-oriented way and check stipulations for feasibility. They take modern project management and preventative quality assurance methods into account in planning the processing of the order and discuss their results within the team. Pupils take account of modern energy saving concepts and accord due consideration to the use of regenerative energies. They draw up working technical documents on the basis of customer wishes in the field of modern building management. They take account of energy and ecological aspects and of innovative materials and auxiliary materials in preparing working plans for building services technology. On conclusion of the planning process, pupils draw up the necessary technical documents for routine repair and maintenance services. Pupils document and present their work results in a suitable form.	
<b>Contents</b>  FMEA Creative methods, ideas management	



**Specialism of electro technical systems (ETS)**

<b>Learning field 5 (ETS): Analyse electric technical systems</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 80 hours</b>
<b>Aim</b>  Pupils analyse electro technical systems of components and subassemblies and the correlative effects of such systems. 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. Pupils obtain information and use and evaluate technical documentation for this purpose, including in English. For the purposes of analysing 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. Pupils test the function of electrical circuits and equipment and take account of the risks that may occur for humans and the technology via the deployment of electrical energy. They analyse and correct errors.	
<b>Contents</b>  Calculate electrical values in direct, alternating and rotary current circuits Electro technology components Simple electronics components, the transistor as a switch Basic circuits Electrical measurement procedures Handling of tables and formulae Safety rules Circuit symbols, circuit diagrams,	

<b>Learning field 6 (ETS): Plan electrical installations</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 80 hours</b>
<b>Aim</b>  The pupils plan installations according due attention to typical network systems and the required protective measures. They assess components and select these in accordance with functional, economic and ecological aspects. They draw up circuit and installation plans, mostly using computer-aided means. They recognise possible risks posed by electrical current and act in accordance with safety provisions and protective measures. Pupils use specialist terminology from the field of electrical installation technology. They evaluate technical data sheets, including in English. They calculate the costs arising for the setting up of the plants and prepare offers. The pupils evaluate their work results for the purposes of improving work processes.	
<b>Contents</b>  Installation circuits Latching relay circuits Staircase circuits Installation values for residential properties Call systems and alarms Cable dimensioning Network systems Circuit diagrams, lists of parts	

<b>Learning field 7 (ETS): Analyse and adjust control systems</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils analyse connection-programmed and digital control systems and adapt these to the stipulation. They investigate the structural set-up and the functional correlations of the control systems for this purpose. They analyse logical links in block diagrams and construct simple control systems. Pupils change connection-programmed control systems into digital control systems, select subassemblies and their components in accordance with requirements and prepare documentation in a computer-aided way.	
<b>Contents</b>  Relay and protective circuits Connection designations, contact surface Wiring plans, connection plans Logical links and their uses Rules of circuit algebra Assembled logic components Circuit diagrams	

<b>Learning field 8 (ETS): Plan and represent energy plants</b>	<b>2<sup>nd</sup> year of training</b> <b>Suggested time allocation: 60 hours</b>
<b>Aim</b>  Pupils plan energy plants and represent such plants graphically. They analyse and classify electrical energy supply possibilities in accordance with functional, economic and ecological aspects and take regenerative forms of energy into account. For this purpose, they select and assess components for the plants and draw up circuit diagrams using branch-specific CAD software, specialist literature, data sheets and descriptions of equipment, including in English. They accord due consideration to network systems and protective measures. In the planning process, pupils check compliance with standards, regulations and rules.	
<b>Contents</b>  Switch gears Watt meter Electric circuit distributor Connections and cables Ampacity and circuit protection Photovoltaics Summary circuit diagrams, distribution plans	

<b>Learning field 9 (ETS): Plan technical building systems</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation 100 hours</b>
<b>Aim</b>  Pupils take technical stipulations into account in planning electrical systems and equipment for technical buildings services and analyse and expand existing systems in accordance with the order whilst according due consideration to energy saving measures. They dimension lighting equipment and plan internal and external protection against lightning in line with the protection requirements of the building. They take relevant standards and regulations into account. The pupils process and draw up the necessary service documentation for the operation of plants and present the results. They use branch-specific CAD software, symbol libraries, specialist literature and equipment and plant descriptions for this purpose, including in English. The pupils check their decisions to ensure that they are feasible, economical and environmentally sustainable.	
<b>Contents</b>  Technical buildings services Bus cabling used in technical buildings services Electrical building appliances Back-up electricity supplies Surge protection Installation plans, distribution plans, circuit diagrams	

<b>Learning field 10 (ETS): Select drive systems and take such systems into account in the planning</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation 80 hours</b>
<b>Aim</b>  Pupils analyse orders for drive systems and plan the technical realisation of such orders. Pupils select and dimension the required equipment, sub-assemblies and protective systems according due consideration to functional, economic and ecological aspects. 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 document compliance with these.	
<b>Contents</b>  Alternating and rotary current motors Ratings of motors Protection of motors Compensation Start-up of motors Rotational speed control Circuit layouts, circuit diagrams	

<b>Learning field 11 (ETS): Plan control systems for technical buildings services and automation technology</b>	<b>3<sup>rd</sup> year of training</b> <b>Suggested time allocation 100 hours</b>
<b>Aim</b> <p>Pupils plan control systems for technical buildings services and automation technology equipment. They analyse control systems of technical plants in order to adapt such systems. They record, analyse and represent control processes. During this process, they select forms of presentation in compliance with standards and regulations.</p> <p>Pupils investigate basic control technology circuits, including in a computer-aided manner, and differentiate between open and closed loop processes. They read circuit diagrams and take account of the symbols used for electrical and pneumatic subassemblies in making amendments.</p> <p>Pupils prepare or supplement documentation for technical plants in a computer-aided manner and using component libraries. They understand English product descriptions and use the specialist English language terms which arise.</p>	
<b>Contents</b> <p>Basic principles of memory-programmable control systems Use of compact control systems Wire breakage safety, EMERGENCY STOP equipment Process control systems with step sequence Selection of actuators and sensors Functional plans, contact plans</p>	

<b>Learning field 12 (ETS): Plan communication systems for residential and functional buildings</b>	<b>4<sup>th</sup> year of training</b> <b>Suggested time allocation 80 hours</b>
<b>Aim</b> <p>Pupils analyse the requirements of communication systems in accordance with customer stipulations and plan the realisation of such systems in residential and functional buildings. They take operational, economic and legal possibilities into account. Pupils accord due consideration to aspects of performance, comfort, future orientation and design in selecting components of current communication systems. They take account of safety and fire protection technology. Pupils plan an energy management system for functional buildings and evaluate interfaces of networks. They use current media, including English language media, to obtain information.</p> <p>Pupils plan and parameterise the communication systems. They draw up documentation on the basis of measurement protocols and technical checks and present the results. They use branch-specific CAD software in this process.</p>	
<b>Contents</b> <p>Building communication Telecommunications and data networks Antenna systems Alarm and surveillance systems Layout plans, connection plans, installation plans</p>	



<b>Learning field 13 (ETS): Process customer orders for technical buildings services systems</b>	<b>4<sup>th</sup> year of training</b> <b>Suggested time allocation 60 hours</b>
<b>Aim</b>  Pupils take account of modern energy concepts and accord due consideration to the use of regenerative energies in preparing and planning an overall or partial concept for the installation or modernisation of the electrical systems of a building in accordance with customer requirements. They select system components in accordance with functional, economic and ecological aspects and apply standards, regulations and rules for the set-up and operation of electrical plants. Pupils determine the necessary components with the aid of data sheets, manuals, catalogues and descriptions of equipment and plants, including in English. They carry out, document and evaluate the required calculations. Pupils calculate the costs arising and prepare offers. They draw up the technical documentation in a computer-aided way in the form of diagrams, tables and circuit plans. They use branch-specific CAD software and symbol libraries in this process and use these tools in a project-oriented manner. Pupils document and present their work results in the usual company form.	
<b>Contents</b>  Project work Presentation technique Cost Calculation Meetings Quality assurance measures	

**List of correlations**  
**between**  
**the skeleton curriculum for the vocational school and**  
**the general training plan for the company**  
**in the training occupation of technical system planner**

The list of correlations documents the coordination of learning contents between the learning venues of the vocational school and the company providing training.

The characteristic feature of dual vocational education and training is that trainees acquire their competences at the two learning venues of the vocational school and the company providing training. Different legal provisions exist for this purpose.

- The vocational school curriculum is based on the skeleton curriculum of the Conference of the Ministers of Education and Cultural Affairs (KMK).
- Company-based teaching takes place on the basis of the general training plan, which forms part of the training regulations.

Both plans have been drawn up by expert teachers and trainers working in constant conjunction with one another within the scope of a procedure jointly developed by the Federal Government and the Conference of the Ministers of Education and Cultural Affairs to coordinate training regulations and skeleton curricula within the field of vocational education and training (“Joint Results Protocol”).

In the following list of correlations, the learning fields of the skeleton curriculum are aligned to the positions of the general training plan in such a way so as to make the time and content coordination clear. This means that the list of correlations can serve as a tool to improve and intensify cooperation between the learning venues at a local level.

List of correlations between the general training plan and skeleton  
curriculum

**for vocational education and training in the occupation of  
technical system planner**

**Draft: Last updated  
13 May 2011**

**Revised: 24 May**

**2011**

**Section A: Joint skills, knowledge and competences making up the occupational profile**

Draft general training plan Last updated: 24 January 2011				Draft skeleton curriculum Last updated: 13 May 2011				
Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
1	Draw up and apply technical documents  (§ 14 Paragraph 2 Section A No. 1)	a) Take standard specifications into account in creating technical drawings	X		X			1 – 3
		b) Differentiate geometric relations	X		X			1 – 3
		c) Present individual components and sub-assemblies in conformity with standards in views and sections	X		X			1 – 3
		d) Apply measurement entry rules	X		X			1 - 3
		e) Present workpieces spatially	X		X			1
		f) Prepare and dimension freehand sketches	X		X			1
		g) Prepare and manage technical support documentation, in particular lists of parts	X		X	X		1, 6(E), 6(S), 5,6(V)
		h) Prepare technical and presentation documentation	X		X	X(S)		4 5(S), 6(S)
		i) Use lists of parts, tables, diagrams, manuals and operating instructions	X		X	X		1 – 6(E) 6(S), 5(V)

2	Carry out computer-aided construction  (§ 14 Paragraph 2 Section A No. 2)	a) Prepare datasets for individual components and sub-assemblies in accordance with technical stipulations and own draft designs	X		X			1, 2,4
		b) Apply structuring methods	X		X			2
		c) Derive or prepare drawings	X		X			1 – 4
		d) Select and use symbols	X		X	X		1 – 4,6(S), 6(V)
		e) Select and use purchased and standard parts from libraries and catalogues	X		X	X		1 – 6(E), 5(S), 6(S), 5(V)

Draft general training plan Last updated: 24 January 2011					Draft skeleton curriculum Last updated: 13 May 2011			
Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
3	Differentiate materials (§ 14 Paragraph 2 Section A No. 3)	a) Obtain information on materials with regard to their properties and possible processing and uses	X		X	X		2, 3 5(S),6(S), 5(V)
		b) Differentiate materials and semi-finished parts with regard to availability, cost-effectiveness and environmental sustainability	X		X	X		1 -3 5(S),6(S), 5(V)
		c) Take materials standardisation into account	X		X	X		1 – 3 5(S),6(S)
4	Differentiate production procedures and assembly techniques (§ 14 Paragraph 2 Section A No. 4)	a) Differentiate production and joining procedures typical to the branch	X		X			2, 3, 5(V), 6(V)
		b) Differentiate assembly techniques	X		X	X		2, 3 5(S),6(S), 5(V)
5	Carry out calculations (§ 14 Paragraph 2 Section A No. 5)	a) Calculate lengths, angles, areas, volumes and masses	X		X			1
		b) Calculate expansion of lengths and volumes	X		X			3

(In Sections A and B, the learning fields from No. 5 onwards are already aligned to the respective specialisms of supply and equipment technology (V), steel and metal engineering technology (S) and electro technical systems (E)).

**Section B: Further skills, knowledge and competences making up the occupational profile**

Draft general training plan Last updated: 24 January 2011					Draft skeleton curriculum Last updated: 13 May 2011			
Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
1	Evaluate materials and corrosion protection procedures (§ 14 Paragraph 2 Section B No. 1)	a) Evaluate material properties in an applications-related manner	X		X	X		1 – 3 5(S),6(S)
		b) Select materials according to intended purpose	X		X	X		1 – 3 5(S),6(S)
		c) Differentiate and evaluate corrosion protection procedures Use materials standardisation	X		X	X		1 – 3 5(S)

2	Evaluate assembly and joining procedures  (§ 14 Paragraph 2 Section B No. 2)	a) Evaluate and select connection technology for soluble and non-soluble connections	X		X	X		2 5(S),6(S), 5(V)
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Draft general training plan Last updated: 24 January 2011					Draft skeleton curriculum Last updated: 13 May 2011			
Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
		b) Take local circumstances into account for individual assembly and assembly of sub-assemblies	X		X			2, 4
3	Create technical documents  (§ 14 Paragraph 2 Section B No. 3)	a) Use technical standards and regulations to create partial, group, overall and production drawings	X		X	X		1 – 4 5(S)
		b) Read technical documents from adjacent areas, identify interfaces and present adjacent areas	X		X			1 – 4
		c) Dimension components and sub-assemblies in a manner appropriate to production, assembly and functionality	X		X			1, 2
		d) Select semi-finished products, standard parts, components and sub-assemblies in accordance with stipulations, technical documents and performance data	X		X	X		1, 2 5(S),6(S), 5(V)
		e) Draw up measurements	<del>X</del>	<del>?</del>	X	X		8(S), 8(E)
		f) Handle and prepare technical documents, in particular tables	X		X	X		1 – 4, 6(E)
		g) Comply with technical safety provisions, in particular with regard to fire protection		X			X	X
4	Prepare sketches (§ 14 Paragraph 2 Section B No. 4)	b) Prepare partial and detailed sketches in accordance with local circumstances and stipulations	X		X			1
		b) Sketch components and sub-assemblies with regard to their spatial alignment with each other	X		X			1

**Section C: Skills, knowledge and competences making up the occupational profile in the specialism of supply and equipment technology**

Draft general training plan Last updated: 24 January 2011					Draft skeleton curriculum Last updated: 13 May 2011			
Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
1	Draw up technical documents for supply and equipment technology (§ 14 Paragraph 2 Section C No.	a) Prepare function and measurement sketches		X		X	X	7, 8, 9, 10, 11, 14

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Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
		b) Comply with technical environmental stipulations in the preparation of technical documents		X		X	X	7-14
		c) Prepare components and sub-assemblies for plants together with the respective installation parts		X		X	X	5, 7, 9, 11, 12
		d) Stipulate and derive views and sections of components and sub-assemblies		X			X	11,12
		e) Prepare developed views of components		X		X		10
		f) Select and enter descriptions for material, corrosion protection and additional stipulations		X				6
		g) Coordinate technical documents of plants and check for collisions, correct collisions by agreement		X			X	13, 14
		h) Prepare and collate technical documents to be passed on to external trades		X			X	12, 14
2	Carry out detailed constructions (§ 14 Paragraph 2 Section C No. 2)	a) Construct detailed points		X			X	11,12
		b) Read technical documents from adjacent areas, design interfaces to adjacent components including those of other trades		X		X		6,7
		c) Carry out constructive alterations in accordance with technical stipulations		X			X	9, 14
		d) Take constructive account of the properties of corrosion protection procedures		X		X		6,7

3	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section C No. 3)	a) Use relevant standards and symbols to prepare schematic representations		X		X	X	7-14
		b) Present and document functional processes of supply and equipment technology		X			X	9, 12, 14
		c) Prepare schematic representations of specialist pneumatic, hydraulic and electrical control engineering systems		X			X	9, 12, 14
		d) Prepare and derive spatial representations of components and plants		X		X		5, 7

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Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
4	Prepare technical documentation for supply and equipment technology (§ 14 Paragraph 2 Section C No. 4)	a) Draw up tables and diagrams for supply and equipment technology		X		X	X	7-14
		b) Prepare and check measurements, protocols and lists of parts and describe technical facts and circumstances		X		X	X	6,7, 11, 12, 14
		c) Collate order-related data in a systematic and customer-oriented manner		X		X	X	7, 13, 14
5	Carry out technical calculations (§ 14 Paragraph 2 Section C No. 5)	a) Apply basic laws of mechanics relating to liquids and gases		X			X	10, 11,12
		b) Calculate and determine parts and components of technical building equipment plants with the help of standards, guidelines, technical documents, design software, manuals and catalogues		X		X	X	7-14
		c) Calculate or determine work, performance and degrees of effectiveness of the parts and components of technical building equipment plants with the help of calculation programmes, design guides and technical documents		X			X	9, 11,12
		d) Undertake the dimensioning of cables and components on the basis of drawings and previous calculations		X		X		6,7
		e) Prepare requirements calculations within the scope of technical building equipment process sequences in accordance with project-related stipulations		X			X	13,14



6	Evaluate system components (§ 14 Paragraph 2 Section C No. 6)	a) Evaluate production procedures for plant components, evaluate and select duct parts		X			X	11, 12, 14
		b) Evaluate and select assembly and fixing systems and wall outlets whilst also taking fire protection into account		X		X	X	5, 6, 7, 11, 14
		c) Connect elements of control engineering to circuits		X			X	9, 11,12, 14

**Section D: Skills, knowledge and competences making up the occupational profile in the specialism of steel and metal engineering technology**

Draft general training plan Last updated: 24 January 2011				Draft skeleton curriculum Last updated: 13 May 2011				
Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
1	Prepare technical documentation relating to steel and metal engineering technology (§ 14 Paragraph 2 Section D No. 1)	a) Use symbols and technical standards and regulations for workshops and construction sites to create partial, group, overall and summary drawings		X		X	X	6,7,9,10,11,12,13
		b) Select and enter additional information		X		X	X	6,9,10,12,13
		c) Take account of tolerances of own and adjacent components		X		X	X	7,9,12,
		d) Prepare drawings for offers		X			X	10,11,12,
		e) Prepare plans using relevant standards and guidelines in accordance with stipulations, drafts and instructions, in particular fixing plans, welding sequence plans, interlocking plans, assembly sequence plans, shipping plans and installation plans for components		X			X	10
		f) Stipulate, transfer and accord consideration to construction site measurement points, grids, coordinates and spot elevations		X		X		8
		g) Represent construction components and nodal points perspectively		X			X	9,10,12

2	Design and construct (§ 14 Paragraph 2 Section D No. 2)	a) Undertake constructive changes in accordance with instructions		X		X	X	5-13
		b) Construct detailed points, in particular in full-scale sizes		X		X	X	5-13
		c) Stipulate and select connections to adjacent construction components in a constructive manner		X		X	X	7,9,10,11,12
		d) Take constructive account of the properties of corrosion protection procedures		X		X	X	9,10,11,12
		e) Comply with building regulations		X		X	X	7,8,13
		f) f) Comply with buildings inspection licences		X		X		8
		g) Comply with hiring regulations for construction services		X		X	X	6,8,9 -13
		h) Apply the laws of mechanics						

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Training occupation profile position			Phase of training in months		School year			Learning field(s)	
			1 – 18	19 – 42	1	2	3/4		
3	Take account of construction physics requirements (§ 14 Paragraph 2 Section D No. 3)	a) Take constructive account of thermal and noise insulation requirements		X			X	10,11,12,13	
		b) Take constructive account of fire protection requirements		X			X	10,11,12,13	
		c) Take constructive account of weather and environmental influences		X				X	10,11,12,13
		d) Take account of relevant standards and regulations		X				X	10,11,12,13
4	Carry out calculations (§ 14 Paragraph 2 Section D No. 4)	a) Apply the laws of mechanics, in particular regarding speed, forces and resolution of forces, torque and friction		X		X	X	6,7,9,10	
		b) Apply the laws of stability calculation, in particular regarding contact pressure, tensile load, pressure load and shear load		X		X	X	6,9,10	
		c) Select connection elements and connections		X		X	X	6,9,10	
		d) Calculate main periods of use		X		X	X	6,9,10	
		e) Conduct length and surface calculations, in particular determine construction component measurements and system measurements		X		X			5
		f) Conduct static calculations, in particular determine the centre of gravity of lines and areas, bending moments and surface torques		X		X	X		5-12
				X		X		5-12	

5	Select production, assembly and joining procedures (§ 14 Paragraph 2 Section D No. 5)	a) Evaluate and select separation procedures according due consideration to material, geometric circumstances and surface characteristic		X		X		5,6
		b) Evaluate and select reforming procedures according due consideration to material, geometric circumstances, surface characteristic and auxiliary material		X		X		5,6
		c) Evaluate and select screw and welded connection		X		X	X	6 - 12

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Training occupation profile position		Phase of training in months		School year			Learning field(s)	
		1 – 18	19 – 42	1	2	3/4		
		d) Comply with the rules of composite construction		X			X	9 -12

**Section E: Skills, knowledge and competences making up the occupational profile in the specialism of electro technical systems**

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Training occupation profile position		Phase of training in months		School year			Learning field(s)
		1 – 18	19 – 42	1	2	3/4	

1	Prepare technical documents for electro technical systems (§ 14 Paragraph 2 Section E No. 1)	a) Prepare functional circuit plans and diagrams		X		X	X	7,11
		b) Calculate and dimension system components and cables for energy and information technology plants according to stipulations		X		X	X	8, 9, 12, 13
		c) Select, connect and represent construction components of energy and information technology plants on the basis of catalogues and data sheets		X		X	X	8, 9, 12, 13
		d) Design control circuits and control programmes and represent data transmission circuits		X		X	X	7, 11, 12
		e) Design and create alignment and wiring plans and tables for energy and information technology plants according to pre-stipulated circuit diagrams and sketches		X		X	X	7, 12
		f) Design and create installation plans for buildings installations involving energy and information technology equipment in accordance with stipulation and taking account of the relevant regulations		X		X	X	9, 12
		g) Evaluate and represent the functions of system components and their wiring connections		X		X	X	9, 11
2	Carry out calculations  (§ 14 Paragraph 2 Section E No. 2)	a) Apply the basic laws of electro technology		X		X		5
		b) Calculate work, performance and degree of effect		X		X		5
		c) Calculate lighting levels						

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Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
		d) Use diagrams, tables and data sheets from manuals and catalogues		X			X	9
		e) Determine construction components on the basis of specific parameters		X		X	X	7 – 13
		f) Calculate electrical values in direct, alternating and rotary current circuits		X		X	X	5, 9
		g) Apply basic laws of mechanics to the fixing of electro technical components		X		X	X	5 1

3	Evaluate and use system components (§ 14 Paragraph 2 Section E No. 3)	a) Evaluate and select fixing systems and wall outlets whilst also taking fire protection into account		X			X	12
		b) Explain electro technology components and connect to form circuits		X		X		5
		c) Connect elements of control engineering and drive technology to circuits		X		X	X	7, 10, 11
		d) Identify risks, apply protective measures		X		X	X	6 – 13
4	Execute detailed plans (§ 14 Paragraph 2 Section E No. 4)	a) Create projection plans		X			X	9, 12
		b) Plan installations rooms		X			X	9, 12
		c) Create ductwork plans and wall views		X			X	9, 12
5	Prepare schematic and perspective representations (§ 14 Paragraph 2 Section E No. 5)	a) Create summary circuit diagrams from floor plans		X		X	X	8, 9
		b) Create schematic representations including perspective representations using relevant standards and symbols in accordance with technical documents		X			X	9
		c) Present and document specialist functional processes in accordance with technical documents		X			X	11
6	Prepare technical documentation (§ 14 Paragraph 2 Section E No. 6)	a) Select and create documentation for energy and information technology plants		X		X	X	8, 9, 12, 13
		b) Create specialist tables and diagrams		X		X	X	7 – 13
		c) Evaluate technical facts and circumstances and prepare and check measurements, protocols and lists of parts						

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Training occupation profile position		Phase of training in months		School year			Learning field(s)
		1 – 18	19 – 42	1	2	3/4	
			X		X	X	9, 11
			X		X	X	7 – 13

**Section F: Joint skills, knowledge and competences making up the occupational profile**

Draft general training plan Last updated: 24 January 2011					Draft skeleton curriculum Last updated: 13 May 2011			
Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
1	Vocational education and training, employment and collective wage agreement law (§ 14 Paragraph 2 Section F No. 1)	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	X	X	X	X	X	WISO
2	Structure and organisation of the company providing training (§ 14 Paragraph 2 Section F No. 2)	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	X	X	X	X	X	WISO

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Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
3	Health and safety at work (§ 14 Paragraph 2 Section F No. 3)	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) Deploy regulations for preventative fire protection; describe behaviours in the event of fire and initiate fire fighting measures	X	X	X	X	X	WISO

4	Environmental protection (§ 14 Paragraph 2 Section F No. 4)	Contribute to the avoidance of instances of environmental pollution caused by the company within the occupational sphere of influence, in particular  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	X	X	X	X	X	WISO
5	Use information and communication technology systems (§ 14 Paragraph 2 Section F No. 5)	a) Use company communication and information systems for the transmission of data, images and language  b) Use standard software, in particular spreadsheets, text processing and presentation  c) Procure, evaluate and use information, also including English language information in particular  d) Manage and secure data  e) Comply with regulations regarding data security	X		X			1
			X	X	X	X		3,4
			X	X	X	X		1 – 13 14(V)
			X		X			1 – 4
			X		X			2

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Training occupation profile position	Phase of training in months	School year			Learning field(s)
	1 – 18   19 – 42	1	2	3/4	

6	Work planning and organisation  (§ 14 Paragraph 2 Section F No. 6)	a) Check work orders and stipulations in terms of feasibility		X		X	X	6, 8 – 13, 14 (V)
		b) Procure, evaluate and use order-related information and data	X		X	X	1 – 6	
		c) Stipulate and secure work stages and processes in accordance with functional, organisational, production and business criteria		X		X	6 – 13 14 (V)	
		d) Accord due consideration to legal, operational and technical regulations	X		X		1-4 8 – 13 14 (V)	
		e) Plan work order and coordinate this with upstream and downstream areas		X		X	14 (V)	
		f) Check and present possible solutions and compare their cost-effectiveness		X		X	5 – 13 14 (V)	
		g) Collate work results, monitor work performed and evaluate and document work on the basis of stipulations		X		X	5 – 13 14 (V)	
		h) Plan and process tasks within a team; agree, evaluate and present team results		X		X	5-13 14 (V)	
7	Carry out quality assurance measures  (§ 14 Paragraph 2 Section F No. 7)	a) Take the objectives and tasks of quality assurance measures into account	X		X	X	1 – 4, 13(S),	
		b) Apply quality assurance measures in own work area, in particular check and evaluate interim and final results		X		X	5 – 13 14 (V)	
		c) Recognise errors and quality defects and their causes and initiate and document measures for rectification		X		X	5 – 13 14 (V)	
		d) Contribute to the continuous improvement of work processes	X	X		X	1 – 13 14 (V)	
8	Customer orientation  (§ 14 Paragraph 2 Section F No. 8)	a) Receive customer-specific requirements and information, pass on such requirements and information within the company and take these requirements and this information into account		X		X	6 – 13,14 (V)	
		b) Comply with company communication rules in informing and advising customers and take customer requirements into account		X		X	6 – 13, 14 (V)	



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Training occupation profile position			Phase of training in months		School year			Learning field(s)
			1 – 18	19 – 42	1	2	3/4	
		c) Communicate with customers in English d) Take cultural identities into account						
				X		X	X	5 – 13, 14 (V)
				X		X	X	5 – 13,14 (V)