Supraregional SYLLABUS

of the coast-Länder
Lower Saxony, Mecklenburg-Western Pomerania and Schleswig-Holstein

for the training occupation
Ship's mechanic

(Publication of the Conference of the Ministers for Cultural Affairs on 20.06.2013)

This Syllabus has been translated from German. As a result, the German version is the legally binding version.

Part I Preliminary Remarks

This supraregional syllabus of the coast-Länder Lower Saxony, Mecklenburg-Western Pomerania, and Schleswig-Holstein for the vocational lessons of the vocational school has been coordinated with the respective federal Training Ordinance (issued by the Federal Ministry for Traffic, Construction, and Urban Development in agreement with the Federal Ministry for Education and Research).

The supraregional syllabus basically builds on the level of the German Certificate of Secondary Education (Hauptschulabschluss) or comparable graduations. It does not contain any methodological specifications for the lessons. The supraregional syllabus describes occupationally-specific minimum requirements with respect to the graduations to be achieved.

The Federal Maritime Vocational Training Ordinance and the supraregional syllabus of the coastal-Länder Lower Saxony, Mecklenburg-Western Pomerania and Schleswig-Holstein as well as the syllabuses of the Länder for interprofessional learning regulate the goals and contents of the vocational training. On these foundations the students acquire the graduation in a recognised training occupation and the graduation of the vocational school.

Part II Educational mandate of the vocational school

The vocational school and the training facilities fulfil a joint educational mandate in the dual vocational training.

Hereby the vocational school is an independent place of learning which acts on the basis of the Framework Agreement on the Vocational School (Resolution of the Conference of Ministers of Cultural Affairs on 15.03.1991 as amended). It cooperates as an equal partner with the other parties involved in the vocational training and has the task to impart to the students vocational and transdisciplinary competences to act. This enables the students to fulfil the specific tasks in their profession and to be involved in the shaping of their working environment and the society, taking over social, economic, and ecological responsibility, in particular against the background of changing requirements. This includes the promotion of the competences of the young people

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

The lessons of the vocational school are based on the organising instruments issued consistently in all of Germany for each officially recognized training occupation. In addition, the regulations and school laws of the Länder apply.

In order to fulfil their educational mandate, the vocational school has to guarantee differentiated training offerings which

- develop action-oriented learning arrangements coordinated with the company training in didactic planning for the school year,
- enable inclusive lessons with a corresponding individual support in the light of different experiences, skills, and talents of all students,
- increase the awareness for maintaining one's health and for specific accident hazards at the workplace, for private life and society,
- demonstrate perspectives of different forms of occupation, including entrepreneurial independence, in order to support an autonomous career and life planning,
- is oriented at the relevant scientific knowledge and results with respect to the development and the determination of competences.

It is the central goal of a vocational school to promote the development of a comprehensive competence to act. Competence to act is understood as the readiness and competence of the individual to act in professional, social, and private situations in an appropriately reasoned and individually and socially responsible manner.

The competence to act unfolds in the dimensions of professional competence, self competence, and social competence.

Professional competence
Readiness and ability to solve tasks and problems on the basis of professional knowledge and skills in a goal-orientated, appropriate, method-led, and independent manner, and to assess the result.

Self competence[1]
Readiness and ability, as an individual personality, to determine, think through, and assess the development opportunities, requirements, and limitations in family, profession, and public life, to develop own talents, and to make life-plans and to develop them further. It includes characteristics such as independence, critical faculty, self-confidence, reliability, a sense of responsibility and duty. It includes in particular also the development of thought out concepts of values and the self-determined commitment to values.

Social competence
Readiness and ability to live and shape social relationships, to recognize and understand devotion and tensions, and to argue and agree with others rationally and responsibly. This includes in particular also the development of social responsibility and solidarity.

Methodological competence, communicative competence, and learning competence are an integral part of the professional competence, self competence, and social competence.

Methodological competence
Readiness and ability to proceed target-orientated and systematically when working on tasks and problems (e.g. when planning the individual work steps).

Communicative competence
Readiness and ability to understand and shape communicative situations. This includes recognizing, understanding, and presenting own intentions and needs as well as those of the partners.

Learning competence
Readiness and ability to understand and analyse information on facts and contexts, independently and together with others, and to integrate it into systematic thinking. Learning competence in particular includes the ability and readiness to develop learning techniques and learning strategies in the professional sphere and beyond and to use them for lifelong learning.

[1] The term „self competence“ replaces the term „human competence“ used until now. It takes greater account of the specific educational mandate of the vocational school and takes on the DQR's systematic approach.

Part III Didactical principles

In order to comply with the educational mandate of the vocational school, the young people are enabled to independently plan, carry out, and asses the tasks they face in the context of their professional activity.

Learning at the vocational school aims at the development of a comprehensive competence to act. By means of the didactically based practical implementation – but at least by the thinking through – of all phases of a professional activity in learning situations learning during and resulting from work is carried out.

Action-orientated lessons within the context of the learn area ("Lernfeld") concept is primarily orientated at structures that are the systematic basis for actions and represent a changed perspective compared to lessons that are primarily orientated at structures that are the systematic basis for a specific subject. According to learning-theoretical and didactical findings, the following points of orientation have to be considered in learning situations when planning and implementing the action-oriented lessons:

- Didactical reference points are situations which are of importance for the professional practice.
- Learning happens in complete actions which are carried out – or at least thought through – independently.
- Actions improve the holistic comprehension of the professional reality, e.g. technical, safety-related, economical, legal, ecological, social aspects.
- Actions take on the experiences of the learner and reflect them with respect to their social effects
- Actions also consider social processes, e.g. the declaration of interests or the resolution of conflicts as well as different perspectives of the career and life planning.

Part IV Preliminary remarks concerning the occupation

This supraregional syllabus for the vocational training of ship's mechanics has been aligned with the Maritime Vocational Training Ordinance (See-BAV) of September 10th 2013 (Fed. Law Gazette I p. 3665) and the International Convention of Standards of Training, Certification and Watchkeeping (STCW Convention) as amended.

Due to the nature of the training institutions (ships) and the minimum requirements of the international regulations the schooling of the ship's mechanics apprentices poses particular challenges to the design of the vocational school's lessons. Therefore it was necessary to align the standard durations concerning the number of hours with the specific needs of this kind of vocational training, observing the decisions of the Conference of the Minsters for Cultural Affairs for the vocational training.

The framework syllabus for the vocational occupation ship's mechanic (Decision of the Conference of the Minsters for Cultural Affairs on 28.12.1993) is cancelled by this supraregional syllabus.

The competences required for the exam subject economics and social studies are imparted on the basis of the “Elements for the teachings at the vocational school in the subject of economics and social studies of industrial/technical vocational training" (Decision of the Conference of the Ministers for Cultural Affairs on 07.05.2008).

In addition to the job description the following aspects are important within the framework of the vocational training:

- Relevant norms and legal provisions as well as work safety regulations have to be applied also where they are not explicitly mentioned.
- During the training as a ship's mechanic a specific focus is placed on the safety of the ship, work safety, health protection, and first-aid measures.
- Environmental protection and the efficient use of energy and materials as well as the communication during the ship's operation and nautical terminology in German and in English is to be imparted as part of the learn areas in an integral manner.
- To acquire inter-cultural competence the foreign language goals and contents are included into the learn areas with 40 hours.

The learn areas are coordinated as to their content in the following way:

The learn areas 2, 6, and 11 build on one another, as do the learn areas 4, 9, and 15. The learn area 7 is the basis for the learn area 13.

Part V Learn areas

Overview over the learn areas for the training occupation ship mechanic				
Learn areas		**Standard duration in number of hours**		
No.		1st year	2nd year	3rd year
1	Manufacture components for machines, tools, and facilities of the ship's operation by means of hand-operated tools	120		
2	Start up, monitor, and shut down power machines	60		
3	Carry out watch duty tasks within the context of the nautical operation of the ship	36		
4	Carry out simple measures of ship safety and security and industrial safety and health protection as well as first-aid measures	108		
5	Manufacture components for machines, tools, and facilities of the ship's operation by means of machines		120	
6	Start-up, monitor, and shut down ship systems		84	
7	Maintain subsystems of the ship		36	
8	Calculate technical data for the nautical operation of the ship		24	
9	Handling fire-fighting and rescue equipment of the ship's operation		36	
10	Handling and securing cargoes and stores		24	
11	Operate the ship's systems economically, efficiently, and environmentally friendly			84
12	Monitor automated systems of the ship			60
13	Check and maintain complex ship systems			72
14	Carry out works in the context of ship manoeuvres			36
15	Carry out complex fire-fighting, rescue, and security measures in the ship's operation			24
16	Carry out cargo care			48
Total: 972		**324**	**324**	**324**

Learn area 1:	Manufacture components for machines, tools, and facilities of the ship's operation by means of hand-operated tools	1st year of training Standard duration: 120 hours

The students have the competence to manufacture components that are typical of their profession by means of hand-operated tools.

The students prepare the manufacture of components that are typical of their profession by means of hand-operated tools. To do this, they analyse general arrangement drawings and simple technical drawings *(Assembly drawings, functional descriptions, and production plans)*. They have knowledge of the respective norms.

They prepare, among other things, partial drawings and sketches for components of functional units and simple assemblies. They develop and amend lists of components and work plans, also with the help of application programmes.

On the basis of the theoretical principles *(Tolerances, general tolerances)* of the technologies to be applied they plan the work steps with the necessary tools, materials *(characteristics of metallic materials, ferrous metals)*, semi-finished products, and aids. They determine the technical data and carry out the necessary calculations.

They carry out calculations of the number and mass of goods and select standard parts.

The students select suitable test mediums, operate them, and prepare the respective test certificates. They try out selected work steps *(separate, reshape, calibrate, measure, and test)* and present their work results.

Learn area 2:	**Start up, monitor, and shut down power machines**	**1st year of training** **Standard duration: 60 hours**

The students have the competence to start up, monitor, and shut down power machines.

The students prepare power machines for operation, carry out the start-up and the monitoring of the operation and then stop the power machines again. Hereby they apply the underlying general and occupationally specific rules, norms, and regulations.

They develop the assembly *(terminology, components)* and the function *(working method, controls, and controls diagram)* of power machines considering occupationally specific aspects. For the system and function analysis they obtain manufacturer-specific information in German and English. They use conventional and electronic media for the acquisition of information.

They visualize functional connections and active principles of systems and subsystems *(cooling, lubrication, fuel, and starting systems)* by means of sketches, technical drawings, functional diagrams, diagrams, and calculations. They document their work results and assess them by comparisons with the calculated values and manufacturer requirements.

In the context of the preparations for operation, the monitoring of the operation, and the shut-down they develop an awareness for safety and quality and apply the regulations concerning safety at work and environmental protection.

Learn area 3:	**Carry out watch duty tasks within the context of the nautical operation of the ship**	**1st year of training Standard duration: 36 hours**

The students have the competence to carry out watch duty tasks within the context of the nautical operation.

They know the sea and harbour watch systems. They assume tasks as lookout by recognizing and assessing objects, indicated in degrees and angular mils, considering the rules of way for vessels according to the *Conventions on the International Regulations for Preventing Collisions at Sea (exhibiting lights, daytime signals)* and the buoyage and navigation lights pursuant to IALA (International Association of Lighthouse Authorities).

They assign the acoustic signals to the respective vessels and interpret specific manoeuvring signals. They assign the flags to their respective meanings.

As helmsmen they apply helm commands in German and English, considering the standard IMO phrases. Hereby they apply the knowledge over the respective nautical instruments, such as the rudder angle indicator and the compass rose.

They master the handling of winches and ropes used in the mooring and unmooring in a harbour, in the warping and anchoring of ships. Hereby they use the communication rules, including the hand signs, and the measures for the safety at work.
They deploy a pilot ladder for the change of pilot with respect to their own safety and the safety of the pilot.

They apply the necessary rigging works *(knots and splicing)* safely in the context of seamanship.

Learn area 4:	**Carry out simple measures of ship safety and ship security and industrial safety and health protection as well as first-aid measures.**	**1st year of training Standard duration: 108 hours**

The students have the competence to live and move safely on board. Hereby they consider the principles of ship safety *(fire-fighting and life saving) and security* prevention, and occupational health and safety.

They inform themselves about the muster list and the fire-fighting and safety plan, they recognize the standard on-board alarms and react accordingly in cases of emergency as required by the muster list. They are aware of the dangers of infectious diseases in tropical regions and apply the respective preventive measures.

They familiarize themselves with the means and tools of rescue *(lifeboats, life rafts, and launching appliances)*, considering the manufacturer's instructions. With all procedures they comply with the national and international regulations (SOLAS: Safety of Life at Sea) on self-rescue and third-party-rescue. They know the signal devices and nautical distress signals.

On the basis of the legal provisions they apply efficiently the measurements for personal safety and the personal protection equipment *(breathing apparatus and cabin escape sets)* and the defence tactics for the respective fire classes as well as the fire-fighting tools. They carry out first-aid measures.

They are aware of the dangers of terrorist attacks and the threats by international piracy and use the recognized defence measures.

The students present their work results.

Learn area 5:	**Manufacture components for machines, tools, and facilities of the ship's operation by means of machines**	**2nd year of training Standard duration: 120 hours**

The students have the competence to manufacture components that are typical of the occupation.

The students prepare the manufacture of elements typical of the occupation *(functional descriptions)* by means of machines. For this purpose they analyse assembly drawings, general arrangement drawings, and parts lists. They prepare and change partial drawings and the respective work plans. They inform themselves about the assembly and mode of action of the machines. They have knowledge of the relevant norms and fits systems.

They plan the production sequences, determine the technological data, and carry out the necessary calculations.

They select the machines and tools according to the task and considering functional and technological criteria *(functional units of machines and their mode of action)* and prepare the machine for operation.

They select materials *(ferrous metals, non-ferrous metals, and plastics)* and auxiliary materials considering their specific characteristics and assign them to the respective components.

The students develop assessment criteria *(measurement errors)*, select test mediums and apply them, and interpret test certificates.

They try out work steps *(cutting and joining)* and alternative possibilities and assess the work results. Hereby they consider the influences of the production process on the dimensions and the surface quality.

They present their work results, optimise workflows, and develop alternatives.

Learn area 6:	**Start-up, monitor, and shut down ship systems**	**2nd year of training Standard duration: 84 hours**

The students have the competence to prepare ship systems for operation, to carry out the start-up and the monitoring of the operation, and to shut down the ship systems again. Hereby they apply the underlying general and occupationally specific rules, norms, and regulations.

For the system and function analysis of the power machines *(combustion, fuel injection and carburetion, charging and reversing)* they obtain the manufacturer-specific information in German and English. They use conventional and electronic media for the acquisition of information.

They develop the function of ship systems (*motors, fittings, pipe systems, pumps, compressors, separators, filters, centrifuges, de-oiling equipment, and de-emulsifiers*) by analysing and visualizing functional connections and active principles by means of sketches, technical drawings, functional diagrams, diagrams, and calculations. They document their work results and assess them by comparisons with the calculated values and manufacturer requirements.

They develop awareness for safety and quality and apply the regulations concerning safety at work and environment protection.

They document their work results and assess them by comparing them with the calculated values and manufacturer requirements.

In the context of the preparations for operation, the operation, the monitoring of the operation, and the shut-down they have knowledge of the working materials and auxiliary materials used.

Learn area 7: Maintain subsystems of the ship	**2nd year of training** **Standard duration:** **36 hours**

The students have the competence to plan and carry out maintenance works on sub-systems of the ship to maintain the function and the value.

Considering the assembly instructions and standard on-board aids they develop assembly and test plans for the disassembly and testing of the ship's subsystems which they disassemble in assembly groups and assembly elements. For this purpose they select the necessary tools, test equipment, and auxiliary materials and apply the provisions concerning work safety.

They develop strategies for troubleshooting, recognize wear patterns and causes of failures as well as damages *(wear and tear, overload)* on the ship's subsystems.

The plan the proper disposal of defective parts and used-up auxiliary materials, considering the regulations concerning environment protection *(recycling).*

The students present the work results.

Learn area 8:	**Calculate technical data for the nautical operation of the ship**	**2nd year of training Standard duration: 24 hours**

The students have the competence to operate different nautical instruments within the context of the bridge and watch duty.

They recognize the purposes of the individual instruments on the bridge *(GPS and radar)* and are able to interpret the values displayed and to integrate them in the tasks of their watch duty.

They read course, depth, and speed data from the nautical instruments *(gyro and magnetic compass, sonar, and logs)* and assess them.

They read the indications and signs of the nautical charts *(paper chart and ECDIS)* and assess their meaning for the safety of the ship.

They determine the time with respect to the time units used on board and convert local time in the respective time zones.

The students determine and assess the results.

Learn area 9:	**Handling fire-fighting and rescue equipment of the ship's operation**	**2nd year of training Standard duration: 36 hours**

The students have the competence to operate the fire-fighting and rescue equipment of the ship's operation.

The students master the operational tactics of the fire-fighting and rescue. They take over responsibility for the proper use of the necessary equipment and installations on board *(life-boats and recue equipment, fire alarm and large fire extinguishing systems)*. Hereby they apply the underlying general, occupationally specific, and also international requirements.

They observe the given procedures and take their fixed positions within their groups.

They behave safe during emergency situations *(emergency at sea)* and communicate safely in German and English during the rescue measures *(IMO standard phrases)*.

The students present their work results.

Learn area 10:	**Handling and securing cargoes and stores**	**2nd year of training** **Standard duration:** **24 hours**

The students have the competence to handle and secure cargoes and stores.

The students assign the different cargo types, considering their characteristics, treatment, and hazardousness (IMDG code) to the respective ship types. They assign the cargo to the different transhipment procedures and equipment.

They select the necessary means for slinging and securing the cargo, considering the indicated symbols for the treatment of the cargo. They select adequate lashing materials *(lashing systems)* to secure the cargo and determine the number of necessary securing systems.

They consider the personal occupational safety measures and avoid dangerous situations during loading and unloading and during sea transport.

The students present their work results.

Learn area 11:	**Operate the ship's systems economically, efficiently, and environmentally friendly**	**3rd year of training** **Standard duration: 84 hours**

The students have the competence to operate the ship's systems economically, efficiently, and environmentally friendly. Hereby they apply the underlying general and occupationally specific rules, norms, and regulations.

For the system and function analysis they obtain the manufacturer-specific information in German and English. They use conventional and electronic media for the acquisition of information.

They expand their knowledge over the assembly and function of ship systems *(gas turbine, engines, ship propulsion, steam, cooling, fresh water production, hydrophore, wastewater treatment, and waste incineration systems)* by visualizing the functional connections and active principles by means of sketches, technical drawings, functional diagrams, diagrams, and calculations.

They analyse disruptions, check components and subsystems in a target-oriented manner, and work out proposals for solutions to achieve an economical, efficient, and environmentally friendly operation, considering the occupationally specific framework conditions.

They document their work results and assess them by comparing them with the calculated values and the manufacturer's requirements.

In the context of the operation and the search for and analysis of the disruption they develop awareness for safety and quality and apply the regulations concerning work safety and environmental protection.

Learn area 12: Monitor automated systems of the ship	**3rd year of training** **Standard duration:** **60 hours**

The students have the competence to monitor automated systems of the ship.

They determine from circuit diagrams and other documentation the control system components to be used as well as the sequence of operation for the controls in different tool technologies *(electrical engineering, hydraulics, pneumatics*). Hereby they use the manufacturer's documentation, in German and English.

The students apply the principles of electrical engineering, electrical machine building, and control technology and explain simple circuit diagrams *(basic circuits)* within the various tool technologies. Hereby they consider the safety regulations for electrical equipment. They measure and calculate electrical and physical values.

The have knowledge of the types of error and of protective measures in the electrical circuit.

They plan and realize the set up of the controls and start-up the controls system, considering work safety.

They monitor the operation of accumulators and carry out maintenance work.

The students present their work results. They develop troubleshooting strategies and strategies to optimize controls systems and apply them.

Learn area 13:	**Check and maintain complex ship systems**	**3rd year of training** **Standard duration:** **72 hours**

The students have the competence to check and maintain complex ship systems.

They use manufacturer-specific information *(ship technology documentation)* for error search and troubleshooting. They read general arrangement drawings *(extended tasks on spatial understanding)*, maintenance regulations, and instructions in German and English. They name important components of the ship and recognize their meaning.

They prepare partial and total drawings as well as parts lists of standard on-board systems. They plan and carry out diagnosis and maintenance works. For this purpose they apply extended knowledge of materials technology *(heat treatment, carbide metals, sinter and compound materials)*.

They guarantee the function of bearings and couplings.

They comply with the regulations concerning work safety and environmental protection and provide seaworthiness and operational safety.

The students present their work results.

Learn area 14:	**Carry out works in the context of ship manoeuvres**	**3rd year of training** **Standard duration:** **36 hours**

The students have the competence to carry out works in the context of ship manoeuvres.

They recognize the influences of the rudder system *(rudder effect and types of rudders)*, the drive unit, the loading condition, and the hydro-meteorological conditions on the steering characteristics of the ship.

They watch and determine the weather situation and tides prevailing at the station (ship).

They carry out the necessary activities for the preparation and carrying out of a pilot change, during berth and unberthing, and for the preparation of an anchoring manoeuvre, considering the international requirements. They combine the details from compass, landmarks, navigational marks, and the instructions from the nautical officer on duty or the pilot concerning the steering of the ship.

Learn area 15:	Carry out complex fire-fighting, rescue, and security measures in the ship's operation	3rd year of training Standard duration: 24 hours

The students have the competence to carry out complex fire-fighting, rescue, and security prevention measures.

The students expand the operational tactics for fire-fighting, rescue, and security prevention and operate the on-board equipment and installations necessary for this independently and considering the underlying regulations.

They take over responsibility for the success of the task force in an emergency situation, keeping an eye on their own safety as well as the safety of the members of their group. Doing this, they communicate the circumstances and the major steps of their actions. They carry out measures for the care of injured and freezing persons in emergencies.

They apply the necessary occupational safety equipment and measures to protect themselves and third parties, they recognize any hazard by using the measurement results of test mediums *(gas detectors)* and take the appropriate actions.

The students apply problem solving strategies.

Learn area 16: Carry out cargo care **3rd year of training**
Standard duration:
48 hours

The students have the competence to carry out measures of cargo care.

They describe the work with derricks, cranes, and pumps during cargo handling, considering the forces occurring on the lifting equipment, cranes, and hoisting equipment.

The students cooperate in the treatment and care of the cargo.
They prepare cargo space, cargo tanks, and decks for the loading and unloading of common cargo, considering the individual characteristics of the cargo and the international regulations.

They assess the safety of the hoisting and lifting equipment according to the manufacturer's information and their own visual inspection. They assess the proper execution of the securing and lashing of the cargo, they control the volume and asses any damages to the cargo. They connect the necessity of these controls logically with the requirements of the sea freight business and the safety of the ship. They assign the freeboard and draught values to the loading condition of the ship.

They operate different hatch closing systems and observe the respective safety precautions and operating instructions of the manufacturer. They observe the international requirements concerning work safety and environmental protection.

The students present the work results.

Part VI Notes on reading