

TRAINING AND EDUCATION PROGRAMME

FOR MARINE ENGINEER CANDIDATES

CRAFTSMAN TRAINING:

WORKSHOP TRAINING AND SEAGOING SERVICE

Version 1.0

Dated: 31st of January 2000

Background

This training and education programme for candidates with workshop training states the aims and the pedagogic framework for craftsman training in connection with marine engineer training and education.

Admission requirements

For admission to workshop training, the following schooling requirements have to be met:

- certificate for the advanced leaving examination of the Folkeskole (Danish primary school) in the subjects mathematics, physics/chemistry, Danish and English passed with the grade 6 or above, or higher education.
- For students who do not comply with the above-mentioned requirements, the college may – based on a concrete assessment of the maturity and schooling of the individual student - make it a condition that supplementary education is accomplished.

For admission to subsequent seagoing service or apprenticeship ashore, the requirements are:

- completed workshop training with satisfactory results.

Taxonomy

The taxonomy (classification of training objectives) in annex 1 has been applied for the description of purposes and objectives.

Aim

The student is to acquire the craftsmanship skills relevant for a marine engineer through vocational training and theoretical education, so that he will be capable of independently applying these skills in planning as well as execution of marine engineering, refrigeration and electro technical maintenance and repairs. These craftsman tasks are to be carried out in consideration of economy and existing environment- and safety regulations.

The candidate shall be able to evaluate the professional quality of executed work .

The candidate shall develop his understanding and familiarization with the crafts relevant to marine engineers.

After workshop college and subsequent seagoing service, the candidate shall

- be able to work manual machine tools and hand tools.
- be able to carry out thermal joining and cutting
- be able to carry out erection and dismantling of machines and components
- be able to carry out troubleshooting, corrections of errors, maintenance and repair of machines and plants

This purpose is considered on the basis of theoretic and craftsmanship training and education at the workshop college plus a subsequent seagoing service term/period of apprenticeship in an engineering and/or electro technical enterprise by means of

- basic craftsman training in manual chip removing and chip less finishing, drilling, grinding, mechanical joining, thermal joining, turning, milling, measuring techniques, wiring, diesel- and refrigeration assemblage.
- basic theoretic education in material theory, workshop technology, electro technical and engineering documentation, electric fitting, engine theory, refrigeration and hydraulics/pneumatics
- projects and project related training
- apprenticeship in an approved enterprise, where craftsman skills are trained and developed
- training is arranged and carried out in a manner, which creates the basis of an educational environment focusing on developing cooperation, flexibility and performance of tasks in a natural way and considering well-being and personal growth.

Schedule for craftsman training

Workshop college app. 1480 lessons (two semesters)

Apprenticeship 12 months

Apprenticeship

Practical service is carried out continuously or divided into terms within the fields of electro technology and/or engineering at sea or ashore. There may, however, be no more than 6 months in the field of electro technology.

Seagoing service requires use of a training record book “Uddannelsesbog til brug for Uddannelse af Dæks- og Maskinofficerer” worked out by the Danish Maritime Authority.

Apprenticeship is to be completed before the last 1 ½ years of marine engineer training.

Distribution of tasks regarding craftsman training

The workshop colleges are responsible for

- elaboration of syllabi based on the description of purpose and objectives from the training and education programmes worked out by the educational office, including laying down of examination requirements, craftsman drills and statement of teaching techniques and – means
- working out course of teaching plans
- ensuring that the training is approved by a quality control system
- conducting teaching and appurtenant evaluation in accordance with the syllabi
- guidance of the students on the actual course of training programmes, including apprenticeship options
- carrying out final evaluations of workshop training in accordance with the procedures/guidelines of the college
- procuring agreements of apprenticeship with approved enterprises and in cooperation with these and the students arrangement of apprentice training
- entering into a cooperation with the enterprise in connection with the carrying out of industrial/seagoing training
- working out final evaluation of the industrial/seagoing training in cooperation with the enterprise and in compliance with the procedures/guidelines of the college
- certification for completed training and education
- documentation for and fulfilment of admission requirements at enrolment
- registration of the achieved evaluation results for the individual student and verification of the training record book in connection with seagoing service

The educational office is responsible for

- working out and maintenance of training and education programmes, including training record book for seagoing service
- auditing the workshop college

The training enterprise is responsible for

- involving and guiding the student through relevant tasks in connection with manufacturing, repairs and maintenance
- being instrumental in the efficient and exemplary conduct of the apprenticeship

The student is responsible for

- being active in his own learning

Training and education subjects for workshops

The following subjects are included:

<u>Subject</u>	<u>Page</u>
Engineering documentation	5/17
Material theory	6/17
Workshop technology	7/17
Vice- and engineering work	8/17
Thermal joining and cutting	9/17
Occupational safety and fire-fighting	10/17
Maintenance	11/17
Wiring	12/17
Diesel engine theory and -assemblage	13/17
Refrigeration technology and –assemblage	14/17
Pneumatics and hydraulics	15/17
Projects	16/17

Evaluation

Internally conducted tests.



Description of subjects

Subject: Engineering documentation

Purpose

The student is to acquire the sufficient theoretical and practical skills to be capable of producing engineering documentation in the form of engineering drawings, craftsman instructions and other technical maintenance directions and regulations for use within his process technical training and region of operation.

Objectives

After having completed training and education, the student shall

1. be capable of applying relevant drawing rules and drawing directions (aim, tolerance, edges and surface condition etc.) with a view to production of suited engineering drawings and working directions,
2. be capable of producing suited documentation material, preferably by use of EDP based documentation programmes,
3. be able to apply and develop his knowledge of engineering documentation through the course of the learning process,
4. be able to apply engineering documentation for manufacture of engine components and constructions,
5. be able to apply engineering documentation for planning and implementation of maintenance and repair,
6. be able to apply engineering documentation as a tool at miscellaneous suggestions for improvements and alterations.

Subject: Material theory

Purpose

The student is to acquire the qualifications required to select suited materials in the shape of structural-, joining- and packing material for use in marine engineering maintenance and repairs.

Objectives

After completed training and education, the student shall

1. be able to understand the adequate use of structural materials in the shape of iron, steel, copper, aluminium and metals, including bearing metals, especially the limitations of these materials, so that demands for strength, initial stability, density and corrosion as well as suited working- and manufacturing methods are considered,
2. be able to understand appropriate use of joining materials and techniques in the shape of screwed and bolted joints, thermal joining and additives used for this purpose in welding, hard- and soft soldering, so that demands for strength, initial stability, density and corrosion as well as suited working- and manufacturing methods are considered,
3. be able to understand appropriate use of packing material in the shape of natural or synthetic products, so that demands for strength, initial stability, density and corrosion as well as suited working- and manufacturing methods are considered,
4. have practical knowledge of techniques for material testing, including tensile test, impact test and hardness test. Furthermore, practical knowledge of structural tension conditions plus the concepts of creep and fatigue and be capable of applying this knowledge, so that demands of strength, initial stability and other material properties as well as working- and manufacturing methods are considered,
5. have knowledge of techniques for alteration of material structure and/or material tension in the form of among other things heat treatment, coating and strain-hardening.

Subject: Workshop technology

Purpose

The student is to acquire the qualifications required to select suited and appropriate techniques and tools plus controlling equipment for marine engineering processes in manufacturing, maintenance, repair and assemblage.

Objectives

After having completed training and education, the student shall

1. have an understanding of the correct functions for hand tools and measuring equipment plus machine tools inclusive associated tools,
2. have an understanding of form- and positional tolerance plus be capable of selecting suited measuring techniques for control and manufacturing processes,
3. be able to chose correct application of occurring components in the shape of screws, bolts, disks, nuts, sprigs, split pins, locking rings, bearings, packing etc along with associated principles and techniques used for joining/separation and assemblage/dismounting of engine components, including understanding of safeguarding against unintentional loosening/slackening of the components,
4. be familiar with the equipment and techniques applied for density control and leakage search,
5. have an understanding of non-destructive techniques for crack search of engine components in the form of magnetic flux, penetrating liquid and ultra-sound,
6. have an understanding of techniques for demonstrating/assessing the condition of a bearing.

Subject: Vice- and engineering work

Purpose

The student is to acquire the practical skills in the use of hand tools, measuring equipment and miscellaneous machine tools belonging to this region of operation, so that he is able to apply relevant tools and equipment for work tasks comprising manufacturing, repairs, testing and maintenance of engine plants with associated systems and components together with other related constructions and technical installations.

Objectives

After completed training and education, the student shall

1. be able to utilize the hand tools, measuring equipment and machine tools in the shape of drills, screw-cutting machines, cold saws and/or cutting machines, milling machines and lathes normally present at a process technical maintenance- and repair workshop.
Furthermore, to be capable of demonstrating this in practical drills designed to develop the basic skills by practical execution of suited and approved marine engineering tasks of gradually increasing independency, difficulty and complexity,
2. be capable of carrying out ordinary user control and maintenance of tools and other equipment
3. be capable of applying current techniques for separation of complicated and problematic thread joints plus techniques for repairs of destroyed or damaged thread,
4. be capable of carrying out correct bolting together in compliance with torque demands and linear expansion demands
5. be capable of applying correct techniques when joining tolerance fit is employed, including among other things replacement of ball- and roller bearings together with packing and understanding regarding shrinking technique,
6. be capable of carrying out correct alignment of clutched machines.

Subject: Thermal joining and cutting

Purpose

The student is to acquire the theoretic and practical skills to be capable of utilizing welding equipment and suited welding technique as well as well as carrying out soldering tasks in the form of hard- and soft soldering. The student is to be able to select the suited and adequate soldering techniques in actual work situations.

Objectives

After having completed training and education, the student shall

1. be able to operate and maintain welding plants and -equipment and in this connection be able to organize a workplace for welding, cutting or soldering.
2. be able to perform occurring welding tasks by employment of MAG, TIG-, electrode- and gas welding for joining of iron/steel with low content of carbon as well as TIG welding of stainless steel,
3. have an understanding of welding techniques involving MIG welding
4. be capable of performing oxyacetylene cutting by employing oxygen and gas,
5. be capable of performing hard soldering in the form of silver solder by employment of gas burner,
6. be capable of performing soft soldering in the form of tin man's solder by employment of gas burner and/or soldering iron,
7. be capable of performing minor welding tasks by employment of TIG welding for joining of aluminium.

Subject: Occupational safety and fire fighting

Purpose

The student is to acquire theoretic and practical skills in the planning, establishing and sustaining of occupational safety aiming at eliminating risks as far as circumstances may permit by performance of craftsman tasks.

Objectives

After completed training and education, the student shall

1. understand the potential risks involved in the execution of craftsman work at a permanent as well as temporary workplace and be able to demonstrate, how these risks are eliminated or minimized,
2. be able to plan and establish occupational safety prior to starting a working task, so that risks of for instance electric chock, unintentional start and movement of machinery etc, fall and plunge, burns and scalding, poisoning or lack of oxygen, unintentional admission and/or accumulated energy in the form of electricity, air/gas, steam, liquid and radiation plus unintentional pollution are eliminated and in this connection to be capable of performing qualified working- and safety direction of involved personnel,
3. be capable of carrying out initial and current risk assessment in connection with the execution of a work task, so that potential elements of risk are met,
4. be conscious of potential risks and accordingly protection by application of equipment, substances and materials in an actual working process,
5. be capable of utilizing portable fire extinguishers.

Subject: Maintenance

Purpose

The student is to acquire sufficient theoretic knowledge of maintenance to be capable of employing and developing the obtained skills of craftsman training to carry out maintenance of process technical plants in consideration of operational economy as well as safety and environment.

Objectives

After completed training and education, the student shall

1. be familiar with the general principles of common maintenance policies,
2. be familiar with the advantages and disadvantages of different forms of maintenance,
3. be able to understand the application of maintenance policies and acknowledge the importance of observing the maintenance policies for the regions of operation and the fields of responsibility,
4. be capable of applying techniques aimed at optimal operation and life span for process technical plants in full consideration of environment and safety.

Subject: Wiring

Purpose

On the basis of electro technical documentation and under guidance, the student is to acquire sufficient theoretic and practical skills to perform limited wiring tasks, including selecting and applying suited electric materials, techniques and associated tools.

Objectives

After completed training and education, the student shall

1. be capable of utilizing relevant hand tools for wiring,
2. have an understanding of how to arrange a correct electric connection as well as be capable of understanding the principles for correct use of materials and components generally applied for this purpose,
3. be familiar with current standards and norms for electro technical documentation.

Subject: Diesel-engine theory and assemblage

Purpose

The students is to acquire elementary theoretic and practical skills in order for him to complete tasks of maintenance and repair of smaller diesel-engines on the basis of available documentation and under guidance.

Objectives

After completed training and education, the student shall

1. be able to account for the structure and mode of operation of the diesel-engine,
2. be capable of utilizing the necessary special tools and measurement equipment for the maintenance of diesel engines,
3. be capable of carrying out separation, control, repair and assemblage of the wear parts of diesel engines,
4. be capable of carrying out separation, control, repair, adjustment and assemblage of the fuel system,
5. be capable of carrying out separation, control, repair, adjustment and assemblage of the diesel engine's charging air, lubricants, cooling water systems and starting system.

Subject: Refrigeration and – assemblage

Purpose

The student is to acquire the elementary theoretic and practical skills concerning the structure and operation of smaller commercial refrigeration plants in order for him to complete tasks of assemblage and maintenance of these plants under guidance.

Objectives

After completed training and education, the student shall

1. be able to construct smaller commercial plants on the basis of documentation and professionally relevant assemblage techniques,
2. be capable of utilizing the necessary special tools and measuring equipment for refrigeration plants,
3. be capable of draining off and containing refrigerants and oils for recycling or destruction,
4. be capable of performing leakage test, discharging and filling up with the correct amount of refrigerant and oil.

Subject: Pneumatics and hydraulics

Purpose

The student is to acquire the sufficient elementary theoretic and practical skills concerning the structure and operation of pneumatic and hydraulic plants to be capable of carrying out assemblage and maintenance of these plants under guidance.

Objectives

After completed training and education, the student shall

1. be able to account for the structure and mode of operation for pneumatic plants, including compressors and air processing systems,
2. be capable of constructing simple pneumatic control systems on the basis of documentation and professionally relevant assemblage techniques,
3. be capable of constructing simple hydraulic plants on the basis of professionally relevant assemblage techniques,
4. be capable of utilizing the necessary special tools and measuring equipment for hydraulic plants,
5. be informed of purity requirements in connection with hydraulic and pneumatic plants,
6. be able to account for the structure and mode of operation for simple hydraulic plants,
7. be informed of safety requirements in connection with hydraulic and pneumatic plants.

Subject: Projects

Purpose

The student is to practise earlier learned craftsman skills and disciplines for a complex exercise in cooperation with other students.

Objectives

The project is carried out as teamwork, and the students are to elaborate projects with appurtenant working descriptions and workshop drawings under guidance.



ANNEX 1: TAXONOMY (classification of training objectives)

General

In the table below, the taxonomy primarily used for the following goal descriptions is stated. The following applies for this taxonomy:

- The individual steps of the classification explain the behaviour, which is to be demonstrated by a candidate for certification, who has completed training and education.
- The system consists of six classification steps (goal categories). Together they should cover all sorts of objectives within the field of knowledge and intellectual skills, irrespective of the nature and subjects of the training.
- The classification steps are arranged according to complexity. The knowledge objectives are the most simple and the assessment objectives the most complex. When the student for instance succeeds at the analysis level, he will be capable of succeeding at the levels of knowledge, understanding and applying within the same problem complexity or field.
- If the designation "familiar with" is applied, an actual learning is considered non-existing. Consequently, the material that has been worked through is not supposed to be rendered, and check of result is not carried out.

Classification of training objectives (taxonomy) in knowledge and intellectual skills

The steps of the classification are:	Examples of other suited behavioural terms:	In brief, the steps of classification may be described as follows:
<p>1. <u>Be familiar with:</u> Shall be capable of rendering conveyed information from memory</p>	Describe, explain, acquire, identify, mention, render, recognize	Familiarization is defined narrowly as approval or rendering of conveyed information
<p>2. <u>Have an understanding of:</u> Shall in his own words be capable of accounting for conveyed information and implementing it in a known situation according to instruction</p>	Explain, express, interpret, calculate, advance, demonstrate, explain in own words, give examples	Understanding includes, that a given information is interpreted, which presupposes a reorganization of given information
<p>3. <u>Be able to apply:</u> Shall in any normal situation to which conveyed information can be naturally referred to, be able to apply this without further instruction</p>	Apply, choose, solve, distinguish, test, use, carry out, classify, demonstrate, construct, meet with, arrange, utilize, exert, handle, work	Application implies the transfer of acquired skills to new situations or new problems, which correspond to already known types
<p>4. <u>Be able to analyse:</u> Shall be able to disintegrate information and account for the distinctive characteristics of the relationship between the different elements</p>	Compare, check, find, exempt, select, infer, analyse, point out, register	Analysis of information is the first step of more independently solving of entirely new and unknown problems
<p>5. <u>Be able to form synthesis:</u> Shall be able to compare information to previous experience and through this articulate his own view of the subject</p>	Suggest, produce, combine, conclude, organize, plan	Synthesis demands a forming of a new whole. The candidate must collocate their knowledge in a – to them – new way
<p>6. <u>Be able to assess:</u> Shall be able to make assessment of different views on the basis of combined knowledge, application, understanding, analysis and synthesis</p>	Determine, control, assess, consider, criticize, debate, evaluate	Assessment implies assessing based on criteria. It is not sufficient to bring forward a subjective estimation. Often an assessment will be characterized by individual opinions, but these will then have to be clearly expressed in the criteria laid down for the assessment

