

# “Electrical, Electronic and Control Engineering” – New Mandatory Standards of Competence for Engineer Officers, Regarding Provisions of the Manila Amendments to the STCW Code

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**ABSTRACT:** The paper presents the new requirements for the certification of watchkeeping engineers, chief engineer officers and second engineer officers, in the part related to the function “Electrical, electronic and control engineering”, provided in the Manila amendments to the part A of the STCW Code and the consequences for maritime education and training resulting from them.

## 1 INTRODUCTION

These new requirements for engineers were proposed by Japan, and comparing them to the former text of the STCW’95 Code, now are much more higher.

The reason why Japan decided to do it was presented in its document STW 40/7/54: *“Japan believes that the proposed personnel like an electric officer and an electro-technical officer are not necessary, as long as the existing requirements and qualifications are appropriately maintained. Japan considers that there is a background for the proposals that the requirements in tables A-III/1 and A-III/2 lack detail or specifics and do not seem to reflect the contemporary technologies. Accordingly, Japan proposes amendments to tables A-III/1 and A-III/2, describing the requirements in more concrete ways and adding requirements in K.U.P. (Knowledge, Understanding and Proficiency) re-*

*garding high voltage installations that are considered as not a new technology, but a new category (STW 40/7/18)”*.

This approach is rather controversial and many opposite opinions were presented and discussed [1], [2]. The IMO STW forum decided to reject Japanese point of view as a general concept, but accepted a development of new “Electrical, electronic and control engineering” standards for engineer officers.

A short comparison of requirements and related standards for electro-technical and engineer officers leads to conclusion, that it would be very difficult or even almost impossible to achieve these new standards for marine engineers.

The authors are of the opinion that above mentioned amendments have a great impact on and must significantly change the model courses for marine engineers.

## 2 THE FUNCTION “ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING” IN THE PART A OF THE STCW CODE

### 2.1 STCW’95 Code

Table A-III/1. Specification of minimum standard of competence for officers in charge of an engineering watch in a manned engine-room or designated duty engineers in a periodically unmanned engine-room [3]

Function: electrical, electronic and control engineering at the operational level			
Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Operate alternators, generators and control systems	<p><i>Generating plant</i> Appropriate basic electrical knowledge and skills Preparing, starting, coupling and changing over alternators or generators Location of common faults and action to prevent damage</p> <p><i>Control systems</i> Location of common faults and action to prevent damage</p>	<p>Examination and assessment of evidence obtained from one or more of the following: approved in-service experience approved training ship experience approved simulator training, where appropriate approved laboratory equipment training</p>	<p>Operations are planned and carried out in accordance with established rules and procedures to ensure safety of operations</p>

Table A-III/2. Specification of minimum standard of competence for chief engineer officers and second engineer officers on ships powered by main propulsion machinery of 3,000 kW propulsion power or more [3]

Function: electrical, electronic and control engineering at the management level			
Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Operate electrical, electronic and control systems	<p><i>Theoretical knowledge</i> Marine electrotechnology, electronics and electrical equipment Fundamentals of automation, instrumentation and control systems</p> <p><i>Practical knowledge</i> Operation, testing and maintenance of electrical and electronic control equipment, including fault diagnostics</p>	<p>Examination and assessment of evidence obtained from one or more of the following: approved in-service experience approved training ship experience approved simulator training, where appropriate approved laboratory equipment training</p>	<p>Operation of equipment and system is in accordance with operating manuals</p> <p>Performance levels are in accordance with technical specifications</p>
Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition		<p>Examination and assessment of evidence obtained from one or more of the following: approved in-service experience approved training ship experience approved simulator training, where appropriate approved laboratory equipment training</p>	<p>Maintenance activities are correctly planned in accordance with technical, legislative, safety and procedural specifications</p> <p>The effect of malfunctions on associated plant and systems is accurately identified, ship’s technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and action taken are justified</p>

## 2.2 STCW'2010 Code

Table A-III/1. Specification of minimum standard of competence for officers in charge of an engineering watch in a manned engine-room or designated duty engineers in a periodically unmanned engine-room [4]

Function: electrical, electronic and control engineering at operational level			
Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Operate electrical, electronic and control systems	<p>Basic configuration and operation principles of the following electrical, electronic and control equipment:</p> <p>.1 electrical equipment: generator and distribution systems preparing, starting, paralleling and changing over generators electrical motors including starting methodologies high-voltage installations sequential control circuits and associated system devices</p> <p>.2 electronic equipment: characteristics of basic electronic circuit elements flowchart for automatic and control systems functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls</p> <p>.3 control systems: various automatic control methodologies and characteristics Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <p>approved in-service experience approved training ship experience approved simulator training, where appropriate approved laboratory equipment training</p>	<p>Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations</p> <p>Electrical, electronic and control systems can be understood and explained with drawings/instructions</p>
Maintenance and repair of electrical and electronic equipment	<p>Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment</p> <p>Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <p>approved workshop skills training approved practical experience and tests approved in-service experience approved training ship experience</p>	<p>Safety measures for working are appropriate</p> <p>Selection and use of hand tools, measuring instruments, and testing equipment are appropriate and interpretation of results is accurate</p> <p>Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good</p>

Detection of electric malfunction, location of faults and measures to prevent damage

practice

Reassembling and performance testing is in accordance with manuals and good practice

Construction and operation of electrical testing and measuring equipment

Function and performance tests of the following equipment and their configuration:  
 .1 monitoring systems  
 .2 automatic control devices  
 .3 protective devices  
 The interpretation of electrical and simple electronic diagrams

Table A-III/2. Specification of minimum standard of competence for chief engineer officers and second engineer officers on ships powered by main propulsion machinery of 3,000 kW propulsion power or more [4]

Function: electrical, electronic and control engineering at management level			
Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Manage operation of electrical and electronic control equipment	<p><i>Theoretical knowledge</i>                      Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices</p> <p>Design features and system configurations of automatic control equipment and safety devices for the following:                      main engine generator and distribution system steam boiler</p> <p>Design features and system configurations of operational control equipment for electrical motors</p> <p>Design features of high-voltage installations                      Features of hydraulic and pneumatic control equipment</p>	<p>Examination and assessment of evidence obtained from one or more of the following:                      approved in-service experience                      approved training ship experience                      approved simulator training, where appropriate                      approved laboratory equipment training</p>	<p>Operation of equipment and system is in accordance with operating manuals</p> <p>Performance levels are in accordance with technical specifications</p>
Manage troubleshooting restoration of electrical and electronic control equipment to operating condition	<p><i>Practical knowledge</i>                      Troubleshooting of electrical and electronic control equipment</p> <p>Function test of electrical, electronic control equipment and safety devices</p> <p>Troubleshooting of monitoring systems                      Software version control</p>	<p>Examination and assessment of evidence obtained from one or more of the following:                      approved in-service experience                      approved training ship experience                      approved simulator training, where appropriate                      approved laboratory equipment training</p>	<p>Maintenance activities are correctly planned in accordance with technical, legislative, safety and procedural specifications</p> <p>Inspection, testing and troubleshooting of equipment are appropriate</p>

### 2.3 Analysis of the text of the STCW'95 and STCW'2010 Code

Comparing specification of minimum standard of competence for officers in charge of an engineering watch listed in Table A-III/1, it is possible to find in the STCW'95 Code only one standard: "Operate alternators, generators and control systems", in the STCW'2010 Code there are two:

"Operate electrical, electronic and control systems" and "Maintenance and repair of electrical and electronic equipment".

In the STCW'95 Code these two standards of competence belonged to chief engineer officers and second engineer officers. It means that in the STCW'2010 Code the requirements for watchkeeping engineers are much higher than before. The contents of the second column (K.U.P.) of the table A-III/1 in the STCW'95 and STCW'2010 Code shows how big is the difference.

The chief engineer officers and second engineer officers in the STCW'2010 Code have two standards of competence:

"Manage operation of electrical and electronic control equipment" and "Manage troubleshooting, restoration of electrical and electronic control equipment to operating condition". It means that now they are not obliged to operate or maintain and repair of electrical, electronic and control equipment, as it was before, now it is a job of watchkeeping engineers.

It is interesting to compare the competences and K.U.P.s of engineer officers and electro-technical officers in the wake of the Manila amendments to the STCW Code [4].

A short comparison of competencies leads to conclusion, that engineer officers are obliged to know how to operate, maintain and repair all electrical, electronic and control systems onboard the ship.

The electro-technical officers should know how to monitor, maintain and repair the systems men-

tioned above and to operate only generators and distribution systems below and in excess of 1000 V.

With regard to overview of K.U.P.s of both kinds of officers under consideration results that for competence "Operate electrical, electronic and control systems" the requirements listed in K.U.P. column of Table A-III/1 for engineer officers are more detailed than for electro-technical officers.

Concluding, engineer officers competencies and K.U.P.s are comparable and sometimes more exactly described in detailed aspects than appropriate requirements for electro-technical officers.

That's why the validation of existing model training courses:

- 7.02 Chief and 2nd Engineer Officer,
- 7.04 Officer in Charge of an Engineering Watch is very important and should take into account all these new requirements provided in the STCW'2010 Code.

The authors are of the opinion, that it would be very difficult to meet these requirements without significant increase in the duration of the model courses, especially of the last one.

### REFERENCES

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- [3] STCW Convention. Final Act of the 1995 Conference of Parties to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978.
- [4] STCW CONF.2-DC-2 - Adoption of the final act and any instruments, resolutions and recommendations resulting from the work of the conference. Draft resolution 2. Adoption of amendment to the seafarers' training, certification and watchkeeping (STCW) Code, 2010.