



Practical Skills For Marine Engineers Training Course

<p>Responsible Authority</p> <p>The Director, Marine Personnel Standards and Pilotage, is responsible for this document, including any change, correction, or update.</p>	<p>Approval</p> <hr/> <p>Director, Marine Personnel Standards and Pilotage Marine Safety</p> <p>Date signed: November 2003</p>
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Scope and Application

1.1 Purpose

- (1) To identify to ship owners, ship operators, masters, officers and crew members, the requirement to successfully complete an approved course in “Practical Skills for Marine Engineers” as a part of the mandatory training, before being examined for an officer in charge of an engineering watch certificate of competency.
- (2) To provide information to institutions and marine schools outlining the requirements of the course, before Marine Safety can grant approval.

1.2 Scope

- (1) Compliance with the mandatory requirements as detailed in Chapter III of the Seafarers’ Training, Certification and Watchkeeping (STCW) Code A of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995, to which Canada is a party. Effectively this requirement applies to applicants for 4th Class, 3rd Class and 2nd Class certificates of competency as a marine engineer as applicable.
- (2) Compliance with section 34 of the July 1997, *Marine Certification Regulations*, modified in April 2002.

1.3 Effective date

- (1) This document enters into force on January 1, 2004.

1.4 Authority

- (1) Section 34 of the *Marine Certification Regulations*, SOR/97-391 and SOR/2002-150 made pursuant to the *Canada Shipping Act (R.S.C. 1985, c.s-9)* as amended.

General

2.1 Background

- (1) Canada being party to the International Convention on the Standards of Training, Certification and Watchkeeping for Seafarers (STCW) 1978, as amended in 1995, must implement all applicable provisions of the convention, including Code A.
- (2) Regulation III/1 (2.3) and section A III /1 (1) of STCW 95 outline the requirements for training relevant to the duties of an officer in charge of an engineering watch.
- (3) While the *Marine Certification Regulations*, section 34(2)(b), (SOR/97-391) has mandated this requirement since 1997, an equivalent clause of the regulations was used to allow candidates outside of the approved cadet programs to qualify for the 4th Class Engineering examination. This interpretation falls contrary to the STCW-95 convention and thus cannot be sustained. Therefore, after the effective date of this TP, all candidates for their first engineering certificate, will have to present evidence of passing an approved “Practical Skills for Marine Engineers Course” before being allowed to sit for examination.

Requirements

3.1 Watchkeeping certificates

- (1) After the effective date, all candidates for their first engineering certificate will be required to show a certificate of successful completion of an approved course in “Practical Skills for Marine Engineers”.
- (2) The first engineering certificate generally refers to the 4th Class Engineer Motor Ship or 4th Class Engineer Steam Ship. However, candidates who proceed directly to the 3rd or 2nd Class certificate will also be required to successfully complete an approved “Practical Skills For Marine Engineers Course”.

3.2 Approved marine engineering cadet training programs

- (1) Graduates from Marine Safety approved, engineering cadet training programs are not affected by this requirement since this training is already included in their program.

Course Approval Conditions

4.1 General

- (1) Access to course location and suitable accommodations,
- (2) Suitable teaching environment and facilities,
- (3) Compliance with the course content as presented in this document,
- (4) Transport Canada approved instructional staff,
- (5) Policy on course attendance,
- (6) Quality control system.

4.2 Number of trainees in courses

- (1) The student/instructor or supervisor ratio is not to exceed 12 for all practical work.
- (2) The number of trainees must not exceed 24 for lectures and audiovisual instruction under the supervision of an approved instructor.

4.3 Course duration

- (1) A minimum of 390 hours of classroom and workshop time.

4.4 Mature student status

- (1) Institutions are to make provisions within the course structure, to allow mature students (holders of existing qualifications) to be exempted from sections of the course that, by virtue of their qualifications, make portions of the training redundant. Examples being, that a qualified welder should not have to complete the welding section of the course, nor should a qualified machinist be required to complete the basic machining section of the course.

4.5 Instructor qualifications

- (1) The main instructor or programme co-ordinator must have either 1st or 2nd Class Marine Engineering Certificate.
- (2) If portions of the course are under the supervision of more than one instructor, the assistant or alternate instructors shall hold qualifications related to the marine industry, or have related skills, and shall be approved by Transport Canada.

Course Goals and Outline

5.1 Course goals

- (1) The goal of the Course is to equip marine engineers with the skills required to:
 - (a) Use appropriate tools for fabrication and repair operations typically performed on ships,
 - (b) Use hand tools and measuring equipment for dismantling, maintenance, repair and re-assembly of shipboard plant and equipment,
 - (c) Use hand tools, electrical and electronic measuring and test equipment for fault finding, maintenance and repair operations,
 - (d) Monitor compliance with legislative requirements,
 - (e) Maintain seaworthiness of the ship.
- (2) After completing this course, graduates will be able to carry out engineering maintenance and watchkeeping duties that are integral to the duties of an officer in charge of an engineering watch.

5.2 Course outline

Marine Engineer Program – Instructional Hours

<u>Subject</u>	<u>Hours</u>
Marine Engineering Basic Skills	90
Basic Machining and minor Overhauls	120
Shipboard related maintenance	120
Legislative Requirements	20
Seaworthiness	40
Total number of hours	390

- (1) The course outline has been taken from the Marine Engineer Cadet Training Programme (TP 8911E) and from the STCW Code Table A-III/1.
- (2) In sections 6, 7 and 8, the following must be considered as an integral part of the skills acquired:
 - (a) Safe and efficient use of equipment,
 - (b) Safe Working Practices,
 - (c) Inspection and care of equipment,
 - (d) Selection of equipment.

- (3) The fundamentals of work planning, preparation of work area, spare part considerations, testing and commissioning, the clean up of work area and record keeping are to be stressed throughout the course.

Marine Engineering Basic Skills

6.1 Work Shop

- (1) Safety
- (a) Accident prevention and shop safety
 - (b) Hazards
 - (c) Protective clothing
 - (d) Shielding
- (2) Hand Tools
- (a) Files
 - (b) Pliers
 - (c) Screwdrivers
 - (d) Hacksaws
 - (e) Chisels
 - (f) Sharpening
 - (g) Punches
 - (h) Drill bits, sharpening angles
 - (i) Cutting tools
 - (j) Hammers
 - (k) Calipers
 - (l) Wrenches
 - (m) Reamers
 - (n) Taps and dies
 - (o) Countersinks
- (3) Layout tools
- (a) Surface plate
 - (b) Scriber
 - (c) Dividers
 - (d) Square and combination set

- (e) Parallels
- (4) Power tools, fixed
 - (a) Drill press
 - (b) Grinder
- (5) Power tools, portable
 - (a) Grinder
 - (b) Chipper
 - (c) Impact wrench
 - (d) Drills
- (6) Fasteners
 - (a) U-clamp
 - (b) J-bolt
 - (c) Turnbuckle
 - (d) Sheet metal screw
 - (e) Self tapping screw
 - (f) Taper pin
 - (g) Cotter pin
 - (h) Carriage bolt
 - (i) Studs
 - (j) Nuts

6.2 Shipboard tools

- (1) Torque wrench
- (2) Grease gun and fittings
 - (a) Types of grease
 - (b) Fittings
- (3) Tube Fittings
 - (a) Compression
 - (b) Flared
 - (i) Copper
 - (ii) Steel
- (4) Hydraulic hoses and fittings

- (a) Types of hoses and their application
- (b) Fittings
- (5) Valve repairs and gaskets
 - (a) Seats
 - (b) Discs
 - (c) Spindles
 - (d) Packing
 - (e) Flange faces
 - (f) Gaskets
 - (g) Testing

6.3 Welding

- (1) Gas welding
 - (a) Principles
 - (i) Fundamentals
 - (ii) Equipment
 - (iii) Techniques
 - (iv) Faults
 - (v) Inspection
 - (b) Exercises
 - (i) Welding
 - (ii) Cutting
 - (iii) Brazing
 - (iv) Soldering
 - (v) Normalizing
- (2) Arc (electrical) welding
 - (a) Shielded metal electrodes
 - (b) Electrode selection
 - (c) Exercises
 - (i) Pre-heating and post-heating
 - (ii) Ferrous metals
 - (iii) Pipes

Note: Emphasis to be placed on shipboard welding safety practices, such as grounding, heat transfer, ventilation, gas freeing and knowledge of the pertinent regulations.

Basic Machining and Minor Overhauls

7.1 Basic Machining

(1) Machine shop practices

- (a)** Principles of machining
- (b)** Layout work and shop safety
- (c)** Set-up tools and measurement
- (d)** Machine maintenance

(2) Lathe operations

- (a)** Safety
- (b)** Tool bit grinding
- (c)** Facing
- (d)** Short turning
- (e)** Long turning
- (f)** Turning between centres
- (g)** Taper turning
- (h)** Drilling
- (i)** Boring
- (j)** Parting
- (k)** Tapering
- (l)** Reaming
- (m)** External threading
- (n)** Internal threading

(3) Machine shop project

This portion will be completed with the student manufacturing a practical project incorporating diversified lathe operations.

7.2 Minor overhauls

- (1) Bearings**
 - (a) Removal**
 - (i)** Shaft fitted taper roller bearing
 - (ii)** Shaft fitted ball bearing
 - (iii)** Housing fitted ball bearing
 - (iv)** Journal bearing
 - (b) Fit**
 - (i)** Tapered roller bearing
 - (ii)** Ball bearing
 - (iii)** Journal bearing
- (2) Pumps**
 - (a)** Identification
 - (b) Strip and overhaul**
 - (i)** Bearing clearances and tolerances
 - (ii)** Wear rings
 - (iii)** Impellers
 - (iv)** Pistons and rings
 - (v)** Shaft wear
 - (vi)** Alignment and balance
 - (vii)** Mechanical seals
 - (c)** Assemble and test
- (3) Heat exchangers**
 - (a)** Types (shell and tube / plate type)
 - (b)** Strip and inspect
 - (c)** Test for leaks
 - (d)** Plugging and end tube sealing
 - (e)** Assemble and test
- (4) Gauges**
 - (a)** Calibration of gauges

- (b) Gauge glasses
 - (i) Removal
 - (ii) Fitting
 - (iii) Testing
- (5) Internal combustion engine
 - (a) Strip a small internal combustion engine for practical exposure to all engine components:
 - (i) Injectors
 - (ii) Pumps
 - (iii) Cylinder heads
 - (iv) Pistons and rings
 - (v) Crankshaft
 - (vi) Bearings and seals
 - (b) Assemble small internal combustion engine noting:
 - (i) Clearances
 - (ii) Tolerances
 - (iii) Assembly procedures
- (6) Repair project
 - (a) Remove 4 broken studs from a metal block using:
 - (i) Drilling
 - (ii) Ez-out
 - (iii) Chisel

7.3 Electrical systems

- (1) Cable and wiring
 - (a) Removing and replacing shipboard electrical wiring
 - (b) Bulkhead penetration and waterproofing
 - (c) Test, repair and replacement of florescent and incandescent lighting
- (2) Test equipment
 - (a) Voltmeter (digital)
 - (b) Multimeter
 - (c) Tong tester

- (d) Megger
- (3) Minor overhaul and repair of electrical contacts, switches and circuit breakers.

Shipboard related maintenance

8.1 Shipboard machinery maintenance

- (1) Maintenance procedures and practices stressing dismantling, examination, repair, tolerances, fits, clearances, reassembly and testing of shipboard equipment and systems including:
 - (a) Reciprocating machines
 - (b) Centrifugal machines
 - (c) Gear pumps
 - (d) Turbines
 - (e) Gearing
 - (f) Purifiers
 - (g) Telemotor systems
 - (h) Alternators/generators
 - (i) Refrigeration Systems
 - (j) Evaporators
- (2) Boiler maintenance
 - (a) Internal and external cleaning
 - (b) Mountings
 - (c) Soot blowers
 - (d) Gauges and monitoring devices
 - (e) Brickwork / refractory
 - (f) Boiler openings (handholes etc...)
- (3) Electrical Shipboard maintenance skills
 - (a) Electrical fault identification
 - (b) Electrical connection and disconnection of motors
 - (c) Check security and condition of grounding straps
 - (d) Change and bed in brushes
 - (e) Inspect and clean commutators

Legislative requirements

9.1 International Conventions

- (1) Basic working knowledge of the relevant IMO Conventions concerning safety of life at sea and protection of the marine environment

9.2 Canadian Laws and Regulations

- (1) Basic working knowledge of the Canada Shipping Act and Regulations

Seaworthiness

10.1 Ship stability

- (1) Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment
- (2) Understanding of the fundamentals of watertight integrity
- (3) Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy

10.2 Ship construction

- (1) General knowledge of the principal structural members of a ship and the proper names for the various parts.