



NEWBUILDINGS
SPECIAL EQUIPMENT AND SYSTEMS – ADDITIONAL CLASS

Fuel Treatment and Conditioning Systems

JULY 2006

*This chapter has been amended since the main revision (July 2006), most recently in July 2011.
See "Changes" on page 3.*

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The Rules lay down technical and procedural requirements related to obtaining and retaining a Class Certificate. It is used as a contractual document and includes both requirements and acceptance criteria.

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CHANGES

General

The present edition of the rules includes additions and amendments approved by the Board as of June 2006 and supersedes the January 2003 edition of the same chapter.

The rule changes come into force as indicated below.

Text affected by the main rule changes is highlighted in red colour in the electronic pdf version. However, where the changes involve a whole chapter, section or sub-section, only the title may be in red colour.

This chapter is valid until superseded by a revised chapter.

Amendments July 2011

- **General**

- The restricted use legal clause found in Pt.1 Ch.1 Sec.5 has been added also on the front page. In addition, the layout has been changed to one column in order to improve electronic readability.

Main changes coming into force 1 July 2006

- **General**

Minor adjustments to the rule text have been done, modifying the text in accordance with new knowledge, and practical arrangements. The consequences of these rule changes for DNV customers are assumed small, yet it is intended that the modifications now proposed will make the rules more suitable - for both owners and building yards alike.

- **Sec.1 General Requirements**

- Item C101 has been amended with respect to plans and particulars that shall be submitted for approval.
- Item D201 has been amended with respect to requirements for the fuel operation manual.

- **Sec.2 System Arrangements and Components**

- Requirements for transfer lines with respect to means for draining/ sampling and venting have been deleted.
- In item C206 a guidance note has been added to clarify the interpretation of requirements to drainage from fuel oil service tanks.

- **Sec.3 Instrumentation and Automation**

- The sub-section on requirements for measuring equipment for testing of fuel properties has been deleted.

- **Sec.4 Testing and Survey**

- In item A102 a guidance note has been added to clarify the requirements for sea trials.

Corrections and Clarifications

In addition to the above stated rule requirements, a number of corrections and clarifications have been made in the existing rule text.

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SECTION 1 GENERAL REQUIREMENTS

A. Fuel Treatment System

A 100 Application

101 The rules in this chapter apply to systems and equipment for treatment of residual fuel for use in diesel engines.

A 200 Class notation

201 Vessels with fuel system and equipment complying with the relevant rules may be given the additional class notation **FUEL (- cSt, - kg/m³, -°C)** The numbers in brackets indicate the maximum viscosity in cSt at 50°C, the maximum density in kg/m³ at 15°C of the fuel oil and the minimum outside air temperature for which the installations are approved .

A 300 Environmental conditions

301 For determining heating capacity the following minimum temperatures apply:

- Sea: 0°C
- Outside air temperature: 0°C, if a lower temperature is not defined in the class notation.

B. Definitions

B 100 Terms

101 *Fuel* as used in this context is an organic liquid hydrocarbon oil derived from petroleum refining. This does not preclude the incorporation of small amounts of additives intended to improve some aspects of performance.

102 *Fuel quality* is determined with reference to values of parameters describing chemical and physical properties.

It is assumed that fuels containing contamination in excess of that specified in ISO 8217/latest version/ Grade RMH55 are not bunkered.

103 *Fuel storage system* incorporates tanks for fuel storage which are not intended to influence the cleaning process (settling and drainage of contaminants).

104 *Transfer system* incorporate the system of pipes, valves, filters and pumps intended for the transfer of fuel between storage tanks and from storage tanks to the treatment system

105 *Treatment system* incorporates the system of tanks, pipes, valves heaters, filters, pumps, separators and other permanently installed components intended for cleaning and conditioning of the fuel. It also comprises arrangements for chemical treatment of the fuel by the use of fuel additives.

106 *Booster system* is the pressurised system of pumps, heaters, valves, filters and other equipment permanently installed to provide the transfer of fuel from the day tank to the engine high pressure fuel pumps.

107 *Separator* is a permanently fitted centrifuge for fuel cleaning.

108 *Fuel additives* are chemical substances used to improve the fuel treatment efficiency and or fuel performance in diesel engines as well as minimising harmful effects.

C. Documentation

C 100 Plans and particulars

101 Additional to the documentation required by other relevant rules, the following plans and particulars shall be submitted for approval:

- drawing and specification of transfer pipes with heat tracing (including any low sulphur fuel change over system for SO_x Emission Control area -SECA)
- arrangement of heating coils in fuel tank
- arrangement of fuel pre-treatment monitoring and alarm system
- heat balance calculations comprising heated fuel tanks, fuel pre-heaters and heat losses, throughout the system

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- test programme for onboard trial, including log of temperatures, viscosity, alarms, etc.
 - fuel operation manual including bunkering procedures, including change over procedures and time needed for change over to low sulphur fuel oil before entering SO_x Emission Control areas
 - procedures for fuel oil samples handling and records in connection with MARPOL Annex VI.

D. General Requirements

D 100 System design principles

101 The fuel treatment plant shall be designed and installed in accordance with relevant parts of the rules unless otherwise stated in this chapter.

102 The fuel system shall ensure that:

- the content of undesired impurities is reduced to a level safe for diesel engine use.
- the fuel is delivered to the engine with the correct viscosity and pressure throughout the full operating range of engine power.
- the system provides redundancy as required in relevant rules.
- two different bunker batches may be stored and handled without need for mixing.

D 200 Fuel operation manual

201 A manual describing systems, equipment and guidance for bunkering, handling of fuel and operation of systems shall be provided.

The fuel operation manual shall emphasize measures and procedures in order to minimize the mixing of old and or new or incompatible fuel oils during bunkering and change over operations.

SECTION 2 SYSTEM ARRANGEMENTS AND COMPONENTS

A. System for Storage and Transfer of Fuel

A 100 Bunker manifolds

101 An adequate bunker manifold shall be provided on each side equipped with spill tray with a volume of at least 160 litre capacity to prevent oil pollution during bunkering operations.

102 An approved arrangement for sampling of fuel shall be provided at each of the bunker manifolds or in the fuel bunkering line.

A 200 Fuel storage tanks

201 At least two storage tanks shall be provided. If only two tanks are installed, the smallest tank shall not to be less than one third of the total tank capacity.

202 Arrangement enabling representative fuel sampling shall be provided.

203 All tanks shall be provided with sufficient heating capacity to keep the bulk temperature of the oil on at least 45°C.

204 Isolating valves for heating coils in each tank to be provided. Sampling cocks in condensate return lines to be provided.

205 The storage tanks shall be provided with monitoring equipment for temperature and level.

A 300 Fuel transfer system

301 The transfer pumps should be located as low as possible.

302 As far as practical, long suction lines shall be avoided.

303 Transfer lines shall be provided with heat tracing and insulation.

B. Fuel Oil Settling and Daily Service Tanks

B 100 Tank arrangement

101 At least two settling and two daily service tanks shall be provided.

102 Settling and daily service tanks shall not be located adjacent to the ship's side.

Guidance note:

Minimum distance between hull and tank bulkhead to be 760 mm for inspection access.

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B 200 Settling tanks

201 The usable capacity of each settling tank to be sufficient for 24 hours operation at maximum fuel consumption.

202 Heating capacity, sufficient to increase the temperature of the oil from 45°C to at least 70°C within 12 hours, shall be provided.

203 The tanks shall be provided with suitable openings for access and ventilation to allow effective tank cleaning.

204 The tank bottom to be so designed that precipitated material may be drained to the sludge tank by opening an easily accessible drain valve. Tank bottom to be sloped towards the drain outlet.

205 Suction outlets for separators shall be placed above bottom to avoid precipitated material to escape. Minimum distance from the bottom to the suction shall be 500 mm.

206 For sludge removal by use of separator, a bottom suction is required.

B 300 Daily service tanks

301 The usable capacity of each daily service tank to be sufficient for 12 hours operation at maximum fuel consumption.

302 Heating capacity, sufficient to increase the temperature of the oil from 70°C to at least 90°C within 6 hours, shall be provided.

303 The tanks shall be provided with suitable openings for access and ventilation to allow effective tank cleaning

304 The tank bottom to be constructed with smooth bottom and with slope towards the drain outlet.

305 The suction to the booster system shall be placed minimum 500 mm above bottom to avoid precipitated material to escape.

306 The arrangement of the tanks and interconnected piping has to be such that unintentional ingress of fuel from one tank to another is avoided.

307 Overflow pipe to run from the bottom of the service tank to the top of the settling tank (above the overflow discharge from the settling tank).

C. Fuel Treatment System

C 100 General

101 The fuel treatment system shall at least consist of:

- centrifugal separators
- fuel heaters
- automatic filters
- booster system including pressurised mixing tank
- automatic viscosity control equipment
- automatic temperature control.

C 200 Centrifugal separators

201 Separators shall be type approved according to the Type Approval Programme for Fuel Oil Separators ensuring sufficient cleaning.

202 The capacity of separators, their number and configuration shall be such that with any unit out of operation, the system shall maintain an adequate performance at the maximum fuel consumption.

Guidance note:

Capacity of separators will be considered equal to Certified Flow Rate (for the viscosity class in question) as determined by the Type Approval Programme for Fuel Oil Separators.

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203 Heaters, control systems, pumps and other auxiliary equipment for the cleaning process shall be so designed that the fuel is kept at the condition necessary for the separators to function as required.

204 Fuel feed rate to separators to be controlled by means of rpm (frequency) of feed pump. (Or other equal means to control flow rate approved by the Society in each case).

205 Fuel heaters for separators to have automatic temperature control. Controller to have proportional and integral function (PI-controller). Possibility for manual control to be arranged.

206 For steam heating arrangements condensate drain from heaters to be controlled by float operated drain traps (or other equal means approved by the Society in each case). Drain traps discharge shall be by gravity.

Guidance note:

If the pressure of the heating medium inside the heater is sufficient to displace the condensate to the condensate tank located at a higher level, this is considered equivalent to gravity drain.

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207 The discharge pipe to the sludge tank shall be made as short and vertical as possible. The pipe diameter shall not be less than the separator sludge outlet stud.

208 Centrifugal separators are preferably to be positioned on top of the sludge tank.

209 A fixed arrangement for sampling fuel before and after the separator(s) shall be provided.

C 300 Fuel heaters and viscosity control equipment

301 The system of fuel heaters shall be designed with built in redundancy.

302 With anyone heater out of service, the remaining heaters shall have the capacity of raising the fuel

temperature sufficiently to achieve a viscosity required for the correct injection of fuel into the diesel engine at a flow rate corresponding to 120% of the maximum fuel consumption.

303 Heaters to be designed with a maximum surface temperature of the heating elements of 170°C for steam and 200°C for thermal oil heating systems.

Guidance note:

170°C surface temperature normally corresponds to a heat load of 10 kW/m².

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304 Fuel heaters in the booster system shall be provided with control equipment maintaining the desired viscosity.

305 The viscosity controller shall have proportional and integral action (PI controller).

306 Means for manual temperature control of the heaters are required.

307 For steam heating arrangements condensate drains from heaters to be controlled by float operated drain traps (or other equal means approved by the Society in each case). Drain trap discharge shall be by gravity.

SECTION 3 INSTRUMENTATION AND AUTOMATION

A. General

A 100 Extent of instrumentation

101 Alarms, indications and automatic controls as required for the class notation **E0** (unattended machinery spaces), as far as applicable for the fuel system, shall be provided.

102 In addition to 101 the monitoring functions given in Table A1 are required.

Table A1 Monitoring functions	
<i>Parameter</i>	<i>Alarm</i>
Viscosity at engine inlet	High /Low
Temperature in settling and service tanks	High/Low
Pressure differential areas - fuel filters	High
Level in mixing tank	Low

SECTION 4 TESTING AND SURVEY

A. General

A 100 General

101 The complete installation is subject to testing in the presence of a surveyor.

102 When all work concerning adjustment and starting of various units of the plant has been completed, sea trials shall be carried out. The sea trials shall include at least 4 hours continuous operation in stabilised condition and on a fuel grade close to the grade for which the system is designed. For systems designed for IF 700, fuel with lesser viscosity may be accepted, but not less than IF 380.

Guidance note:

The 4 hours continuous operation may be carried out concurrently with the endurance test as required by Pt.4 Ch.3 Sec.1 I300.

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103 The builders shall prepare and submit for approval a detailed test programme. The test programme shall be kept onboard, all filled in and signed by the surveyor.

104 The instruction and routines prescribed for fuel oil treatment shall be surveyed.