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NEWBUILDINGS  
SPECIAL EQUIPMENT AND SYSTEMS – ADDITIONAL CLASS

# Systems and Arrangement for Meeting Regulations in Emission Control Areas (**ECA**)

JANUARY 2010

*This chapter has been amended since the main revision (January 2010), 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 Board approved this new chapter in December 2009.

The rules come into force on 1 January 2010.

This chapter is valid until superseded by a revised chapter.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.

### Amendments January 2011

- **Sec.2 Systems and Arrangements**

- In sub-section B, a reference has been corrected to Pt.4 Ch.1 Sec.2.

### 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. Application

#### A 100 Application

**101** The requirements in this chapter apply to vessels that are arranged to enable vessels machinery components (main propulsion plant, power generation plant and steam/thermal oil plant, inert gas plant and incinerator etc.) to change between residual oil and marine distillate fuel and operate for longer periods on marine distillate fuels with very low viscosity and very low sulphur content.

**102** The Rules are also applicable to vessels that will continuously operate on marine distillate fuels and vessels provided with approved abatement technology capable of cleaning emissions to a marine distillate fuel equivalent standard.

**103** The requirements in this chapter are supplementary to those given for the main class, unless otherwise specified.

#### A 200 Definitions

**201** Marine distillate fuel shall be taken to mean a fuel oil with a sulphur level not exceeding 0.10% and with a viscosity not less than 2 cSt at 40°C.

**Guidance note:**

Marine distillate fuel is considered equivalent to marine gas oil grade DMA as given in ISO8217 (latest revision), except for the sulphur and viscosity limits as stated in 201.

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**202** Residual oil shall be taken to mean Heavy Fuel Oil (ISO8217- marine residual fuels).

#### A 300 Classification

**301** Vessels arranged and equipped as required in these rules may be given the class notation **ECA(SOx)** appended by one of the mandatory qualifiers A or P where:

- ECA - denotes that the vessel is adapted to operate within Emission Control Areas.
- SOx - denotes that the vessel is adapted to comply with SOx regulations within Emission Control Areas as per Annex VI of MARPOL 73/78 and can operate specific machinery components on marine distillate fuels with very low viscosity and sulphur content for a minimum of 4 operating days reflecting the consumption specified in Sec.2 A101.
- A - denotes that the vessel is designed to operate all machinery components on marine distillate fuel.
- P - denotes that the vessel is designed to only operate machinery components used in port on marine distillate fuel.

**Guidance note:**

A vessel designed to operate all machinery components e.g. main propulsion plant, power generation plant, steam/thermal oil plant, incinerator etc. on marine distillate fuel may be given class notation: **ECA(SOx-A)**. This class notation is relevant for vessels operating e.g. within an ECA as of 1 July 2015 as per Annex VI of MARPOL 73/78.

A vessel designed to operate machinery components used in port e.g. power generation plant, steam/thermal oil plant, incinerator etc. on marine distillate fuel may be given class notation: **ECA(SOx-P)**. This class notation is relevant e.g. for vessels calling EU ports and thus required to comply with the EU low sulphur directive 2005/33/EC.

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#### A 400 Documentation

**401** The documentation required for main class shall include details confirming compliance with the requirements of this chapter. Additionally, the documentation required by Table A1 shall be submitted for approval.

<b>Table A1 Documentation requirements</b>			
<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>For approval (AP) or For information (FI)</i>
Fuel tanks	S030 – Capacity analysis		AP
Fuel oil system	Z300 – Declarations	Declarations from manufacturers of machinery components ability to use marine distillate fuels e.g. engines, boilers and any fuel oil pump. Declarations shall include relevant pages from the operations and maintenance manuals.	AP
	Z240 – Calculation report	Calculations confirming the viscosity of the marine distillate fuel at the inlet of machinery components (including fuel pumps). Calculations shall indicate viscosity as well as temperature.	AP
	Z160– Operation manual	Fuel oil change-over.	AP
	Z243 - Assessment report	Hazard identification study.	FI
Chiller system for fuel cooling	S010 – Piping diagram (PD)		AP

**402** If abatement technology is used to ensure compliance, the documentation requirements are subject to special consideration.

**403** For general requirements to documentation, see Pt.0 Ch.3 Sec.1.

**404** For a full definition of the documentation types, see Pt.0 Ch.3 Sec.2.

## SECTION 2 SYSTEMS AND ARRANGEMENTS

### A. Fuel Oil Tank Arrangements

#### A 100 Arrangement of fuel oil storage tanks

**101** The vessel shall be arranged with minimum one dedicated storage tank for each (e.g. low and/or high sulphur) marine distillate fuel grade carried.

The total storage tank capacity for marine distillate fuel shall be sufficient for:

- For vessels with qualifier A as given in Sec.1 A301, operating the vessel on a minimum of 4 days at 75% MCR of the main engine and for auxiliary engines, normal seagoing load as specified in Pt.4 Ch.8 Sec.2 B101 but also including load due to operation of thrusters not forming part of the main propulsion or steering, mooring, cargo handling gear and refrigerators for air conditioning. For tankers, the fuel oil capacity shall also be sufficient for the carriage of heated cargoes (if applicable) as well as minimum one cargo discharge operation (fully laden vessel).
- For vessels with qualifier P as given in Sec.1 A301, operating the Auxiliary engines for a minimum of 4 days on normal seagoing load as specified in Pt.4 Ch.8 Sec.2 B101 but including load due to operation of mooring, cargo handling gear and refrigerators for air conditioning. For tankers, the fuel oil capacity shall also be sufficient for the consumption needed to maintain the temperature of heated cargoes (if applicable) as well as minimum one cargo discharge operation (fully laden vessel).

**Guidance note:**

The fuel oil capacity for one cargo discharge operation shall include boiler consumption for steam turbine driven cargo pumps, additional consumption due to increased power demand during cargo discharging operations (e.g. ballast pump operation, hydraulic power packs etc.), as well as additional consumption due to inerting of cargo tanks.

Any marine distillate fuel settling tank capacity may be included in the total storage tank capacity.

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**102** Tanks for storage of marine distillate fuel shall not be located adjacent to heated tanks unless the calculations required in B101 confirm that viscosity in way of machinery components (including fuel oil pumps) is not below that specified in Sec.1 A201.

#### A 200 Arrangement of Fuel oil settling and service tanks

**201** Dedicated service and settling tanks shall be arranged for marine distillate fuels. Each service tank must have a capacity for at least 8 hours operation. Provided that the marine distillate fuel from storage tanks are arranged for separation prior to transfer to service tanks, settling tanks for marine distillate fuels are not required.

**202** Service and settling tanks for marine distillate fuel shall not be located adjacent to heated tanks.

### B. Fuel Oil System Arrangements

#### B 100 General

**101** Calculations shall be performed to confirm that the viscosity of the marine distillate fuel in way of machinery components (including fuel pumps for marine distillate fuel) is not lower than that specified in Sec.1 A201. The calculations shall indicate viscosity as well as temperature. Calculations shall be carried out for the operational loads given in A101 as well as during change-over from residual oil to marine distillate fuel and vice-versa. The calculations shall take into account the environmental conditions in Pt.4 Ch.1.

#### B 200 Fuel oil service piping systems

**201** Auxiliary engines for electric generators shall for each consumer have separate fuel oil service system piping (including required pumps, filters etc.) from service tanks for residual oils and marine distillate fuel.

**202** Boiler fuel service system piping (including required pumps, filters etc.) from service tanks for residual oils and marine distillate fuel to boilers may be accepted as common provided it can be documented that the change-over time from residual oil to marine distillate fuel is less than 4 hours (taking into account minimum viscosity and maximum sulphur levels for marine distillate fuel).

**203** For vessels with qualifier A as given in Sec.1 A301, main engine fuel service system piping (including required pumps, filters etc.) from service tanks for residual oils and marine distillate fuel to main engines may

be accepted as common provided it can be documented that the change-over time from residual oil to marine distillate fuel is less than 4 hours (taking into account minimum viscosity and maximum sulphur levels for marine distillate fuel).

**204** Separate supply pumps for marine distillate fuel shall be arranged with redundancy. If residual oil pumps are declared suitable for pumping marine distillate fuels at required pressure and capacity, then separate marine distillate pumps are not required.

**205** All fuel oil heaters shall be provided with by-pass arrangements. Heat tracing arrangements shall be provided with means for shut-off when operating common systems with marine distillate fuel.

**206** Fuel oil return system shall be arranged so that it is possible to return fuel from any machinery components to both marine distillate and residual oil tanks.

**207** The installation of seawater or freshwater coolers or chiller systems in the fuel oil service systems are normally required in order to maintain the marine distillate fuel viscosity above the minimum level as specified in Sec.1 A201. Cooling systems shall comply with the requirements of Pt.4 Ch.6, including redundancy requirements. Where the fuel system pressure exceeds the cooling system pressure, means for detection of leakage shall be provided e.g. high level alarms in expansion tanks.

**208** Arrangements shall be provided to prevent excessive heating of marine distillate fuel when a machinery component is in e.g. stand-by mode.

**209** Pump relief valves shall not discharge to the suction side of pumps.

### **B 300 Fuel oil treatment piping systems**

**301** Fuel oil treatment system piping (including pumps, separators etc.) from settling to service tanks for residual oils and marine distillate fuel oils shall be separated. Separate separator supply pumps for marine distillate fuel shall be arranged with redundancy. If residual oil separator pumps are declared suitable for pumping marine distillate fuels at required pressure and capacity, then separate marine distillate pumps are not required.

**302** Fuel oil heaters shall be provided with by-pass arrangement.

### **B 400 Fuel oil transfer piping systems**

**401** Fuel oil transfer system piping (including pumps etc.) from storage tanks to settling tanks for residual oils and marine distillate fuel oils shall be separated. If residual oil pumps are declared suitable for pumping marine distillate, then separate marine distillate pumps are not required.

### **B 500 Fuel oil tanks air and overflow systems**

**501** Each air and overflow pipe from residual oil tanks and marine distillate fuel tanks are self-draining and be arranged with loops of sufficient height or equivalent arrangement, to prevent cross contamination during overflow.

## **C. Lubrication Oil System Arrangements**

### **C 100 Lubrication oil**

**101** Vessels with cylinder lubricated engines shall be provided with two cylinder oil storage tanks. Further, for engines with a cylinder oil service tank arrangement, two cylinder oil service tanks shall be provided for each cylinder lubricated engine. The two service tanks shall be joined before the engine flange via a change-over valve.

**102** If the equipment manufacturer specifies that system lubrication oils need to be changed when using marine distillate fuel, then the vessel shall be equipped with storage capacity for two types of system lubrication oil.

## **D. Instrumentation**

### **D 100 General**

**101** The fuel oil piping systems and machinery components shall be provided with arrangements for monitoring the critical parameters in connection with change-over and operation on residual oils and marine distillate fuel. Alarms, indications and automatic controls as required for main class, as well as class notation **E0** (as applicable), shall be provided. In addition the monitoring functions in Table A1 are required. Systems for automatic change-over between fuel oils are not required, but are subject to approval if provided. Such automatic control systems need also to be arranged with means for manual operation.

**102** Alarms that are only relevant when operating on marine distillate fuel shall be inhibited when operating on residual oil and vice-versa.

<b>Table A1 Monitoring functions</b>	
Parameter	Alarm
Temperature or viscosity at machinery component inlet	High (temperature) or Low (viscosity)
Level in expansion tanks in marine distillate fuel cooling systems	High/Low
Temperature in marine distillate fuel service tanks (only when marine distillate cooling is not provided).	High
Pressure differential fuel filters	High
Level in fuel de-gassing/mixing tanks	High/Low

**103** Fuel coolers shall have automatic temperature control. Means for manual operation shall be provided.

**104** Oil fired boiler / thermal oil heater instrumentation and control systems shall comply with the requirements of Pt.4 Ch.7 Sec.7. It shall be ensured that they can safely be run on marine distillate fuel without impairing the required boiler steam/thermal oil capacity. Operation on the different fuels shall not require manual override of or switching off the automatic control.

**105** Oil fired burners shall be provided with a flame monitoring system that is capable of detecting the operation of any burner when operating on both residual oil and marine distillate fuel.

## SECTION 3 MACHINERY COMPONENTS

### A. General

#### A 100 Machinery components

**101** The manufacturer of machinery components shall declare that the machinery component (main engine(s), auxiliary engines, boiler(s) and any fuel oil pump) is capable of continuous operation on marine distillate fuel for the minimum number of operating days. Such declarations shall include details on the required modifications including details on additional equipment & arrangements, control or safety systems, as well as any possible conditions/limitations. Conditions or limitations that impair the efficiency of the change-over or impair the operation of the machinery components are not acceptable. The manufacturers' declarations and required detailed information is subject to approval.

**Guidance note:**

- Conditions/limitations related to e.g. maximum temperature increase/decrease of fuel (°C/min) to protect fuel equipment from thermal shock (expansion problems) are considered acceptable
- Conditions/limitations related to e.g. viscosity which are in conflict with Sec.1 A201 are not acceptable
- Conditions/limitations requiring continuously reduced power, machinery component load or pressure or flow when operating on marine distillate fuel are not acceptable
- Conditions/limitations requiring substantial and time-consuming modifications to machinery components & equipment e.g. replacement of gaskets, pumps, nozzles etc. during fuel switching are not acceptable
- Conditions/limitations requiring changing between residual oil and marine distillate fuel burner lances are normally considered acceptable.

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**102** The capability of operating on marine distillate fuel with the minimum viscosity specified in Sec.1 A201 and associated conditions or limitations are also to be reflected in the machinery component's operations and maintenance manuals.

## SECTION 4 OPERATIONAL REQUIREMENTS

### A. General

#### A 100 Hazard identification

**101** For new designs or solutions, a hazard identification study may be required carried out with representatives from equipment manufacturers. The analysis shall cover all machinery components and the entire fuel system and shall include control systems. A report from the hazard identification shall be submitted to DNV.

#### A 200 Fuel oil change-over manual

**201** An approved fuel oil change-over manual shall be available onboard and shall consist of three parts as specified below:

**202** Part I shall cover procedures for safe and efficient change-over from marine distillate to residual oil and vice versa for all relevant machinery components and associated piping systems. It shall include the machinery component manufacturers' instructions and declarations as well as calculations documenting the minimum obtainable viscosity/maximum obtainable temperature of marine distillate fuel in the fuel oil systems. The procedures shall include schematic fuel oil piping diagrams and specific pipelines, valves, fuel oil equipment and machinery components. Part I is also to include procedures for safe testing of the vessels capability to operate on marine distillate fuel and in particular starting and low load operation. For the propulsion plant testing should also include manoeuvring on marine distillate fuel.

*The following shall be included in a summary:*

- change-over time as a function of machinery components load, and temperature differences between residual oil and marine distillate fuel during change-over
- minimum allowable viscosity of marine distillates and associated maximum allowable temperatures of marine distillate fuel in way of machinery component inlets
- maximum machinery component load at change-over from residual oil to marine distillate fuel, including duration of any load reduction
- other approved conditions/limitations given in manufacturers' declarations
- procedures related to selection of lubrication oil based on sulphur level of fuel oil used. For cylinder lubricated engines procedures shall include e.g. feed rate reductions or change between cylinder lube oils with different Total Base numbers.

**203** Part II shall cover calculations of change-over time to ensure that the fuel oil being consumed by machinery components has a sulphur content not exceeding 0.10%. This part is only relevant for vessels where the piping system for residual oil and marine distillate fuel are common.

*The following parameters shall be taken into account:*

- volume of piping systems (including fuel de-gassing/mixing tank) where mixing of marine distillate fuel and residual oil will occur
- residual oil sulphur content (variable)
- marine distillate fuel sulphur content (variable but not above 0.10% sulphur)
- machinery component fuel consumption during change-over
- return oil flow to fuel de-gassing /mixing tank if relevant (increasing dilution time when changing from residual oil to marine distillate fuel)
- change-over time is defined as the time from start of change-over, until the sulphur level in the fuel oil entering into machinery components is below 0.10%. If the change-over time is shorter than that presented in Part I, the change-over times in Part I shall still apply.

**204** Part III shall include the following:

- contingency procedures in case of poor marine distillate fuel quality, or incompatibility between marine distillate fuel and residual oil
- contingency procedures are also to be developed for failures due to vapour lock (gasification) in the event of improper change-over sequence to distillate fuel oil
- procedures for maintaining machinery readiness for emergency departures with marine distillate fuel
- methods for monitoring cylinder condition and injection pump internal leakage after switching from residual oil to marine distillate fuel
- procedures for onboard testing of compatibility between residual oil and marine distillate fuel.

**Guidance note:**

It is recommended that vessels subscribe to a fuel oil testing programme with an accredited fuel testing laboratory for the purpose of verifying critical fuel oil quality parameters for marine distillate fuel and residual oils as per ISO8217 latest edition.

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**205** Vessels fitted with an automatic control system for change-over between fuel oils shall include a technical specification of the system in the fuel oil change-over procedures.

**206** For ships fitted with abatement technology the scope of the procedures will be specially considered.

## SECTION 5 SURVEYS AND TESTING

### A. General

#### A 100 Surveys and testing

**101** The systems and arrangements are subject to survey and function testing after installation onboard.

**102** A functional test shall be carried out in the presence of a DNV Surveyor to confirm safe and efficient change-over from residual oil to marine distillate fuel and continuous operation of machinery components on marine distillate fuel. The test shall confirm that the marine distillate fuel viscosities are in accordance with the calculations required in Sec.2 B101, i.e. does not exceed the min. viscosity as specified by the machinery component manufacturers. This can either be verified through viscosity measurements onboard or by verifying that the temperature before machinery components does not exceed 40°C.

The test shall as far as practicable cover all machinery components at different loads and using a marine distillate with viscosity in accordance with Sec.1 A201. For all machinery components the test shall include a minimum of 4 starts as well as continuous operation on marine distillate fuels, including low load operation at 25% MCR. The duration of the test shall be sufficient to achieve steady state conditions for all operational parameters but not less than 1 hour. For reversible propulsion engines the starting test shall include manoeuvring (2 starts ahead and 2 starts astern).

**Guidance note:**

If marine distillate fuel with viscosity as per Sec.1 A201 is not available, it may be accepted that the temperature of the marine distillate available is increased in the system to give a viscosity as per Sec.1 A201 at the machinery component inlet.

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**103** Where it is impracticable to test all machinery components on low viscosity fuel as specified in A102, it may be acceptable that such functional testing is carried out by the crew and the result reported to DNV. The report shall include:

- specification of marine distillate fuel used
- machinery components tested
- scope of testing (ref. A102)
- machinery component loads (ref. A102)
- marine distillate fuel viscosities and temperatures at machinery component inlet
- confirmation of satisfactory result of testing.

**104** It is required that a marine distillate fuel bunker sample is taken, tested with an accredited fuel testing laboratory and the results submitted to DNV. The fuel test shall cover the quality parameters specified in ISO8217 latest edition.

**105** For vessels where marine distillate fuel and residual oil systems are common, a functional test shall be carried out by the crew to confirm that the sulphur level before machinery components does not exceed the sulphur level of the marine distillate fuel as bunkered. The test shall be carried out after completion of change-over, ref. Sec.4 A203. It is required that fuel samples are taken immediately before machinery components upon completion of change-over. The samples shall be tested with an accredited fuel testing laboratory. The fuel tests shall cover the quality parameters specified in ISO8217 latest edition. Test results shall be submitted to DNV for verification.