

# Technical Briefing

## MCLS for ECA Operation

Feb 15 Update

### Two Stroke Engine Cylinder Oil Requirements



**Map of Emission Control Areas (ECAs)**

Due to changes in the sulphur content of fuels that will be required to be used to meet future emissions requirements ship-owners must consider the implications of these changes on two stroke cylinder oil requirements. The current cylinder oil ranges in Base Number from 55 to 100 with 70BN and 100BN being the most common grades able to handle fuel sulphur ranging from 1.0%S to 4.5%S (noting that the use of fuel with sulphur content above 3.5%S is illegal unless an alternative means of emissions compliance is in use).

To reduce emission from ships in many cases much lower sulphur fuels will be used in some regions. Operating for long periods (typically in excess of 24 hours) on these very low sulphur fuels with standard BN cylinder oils will almost certainly result in adverse cylinder liner & piston conditions.

The purpose of this briefing note is to advise Gulf Oil Marine customers of the details of impending regulatory requirements, the options they have and what actions they should take to ensure optimum cylinder lubrication.

### ECA Compliance Regulations

The International Maritime Organization has adopted regulations that have designated certain sea areas as Emission Control Areas. In these sea areas ships have to comply with limits to emissions from diesel engines of sulphur oxide (SOx) and nitrogen oxides (NOx).

Currently there are two sea areas that are designated as ECAs. Along the western, eastern and southern seaboard of North America the coastlines of Canada and the USA include a sea area extending 200 nautical mile offshore which is designated a SOx & NOx ECA (note that the NOx ECA does not come into effect until 2016 and only applies to ships with keels laid from the 1st January 2016). The sea area to the east of the entrance to the English Channel in the south and coordinates between Scotland and Norway in the north which includes the North Sea and Baltic Sea is designated a SOx ECA.

From the 1st January 2015 ships entering an ECA must reduce the emissions of sulphur oxides to a concentration that is no more than the emissions when consuming a fuel with a sulphur content of no more than 0.1%S.

In 5 years' time it will be a requirement that all ships entering EU member state waters will be required to operate a 0.5%S fuel global cap. At present IMO MARPOL Annex VI sets a global cap of 0.5%S from 1st January 2020. The implementation date is subject to a review clause which could postpone implementation until 2025. The current view of the International Chamber of Shipping is that the implementation is unlikely to be postponed.

## Current Compliance Options

In regulation 14.4 of MARPOL Annex VI it is stipulated that "While ships are operating within an emission control area, the sulphur content of the fuel oil used on board ship shall not exceed the following limits". The limit prescribed for after the 1st January 2015 is 0.10%S.

Most ship-owners will comply with the ECA requirements by switching to 0.1%S Gas Oil (ISO 8217 Fuel Grade DMA with 0.1%S max specified). However there are a number of other options that may be adopted to reduce fuel costs. The currently known options are;

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1. Fitting and operating an exhaust gas cleaning system (a wet or dry scrubber)
2. Converting engines to use LNG, LPG or Methanol
3. Procuring one of the new range of low sulphur fuels that have recently appeared on the market.

## Cylinder Oil Requirements for 0.1%S Fuel Operation

The majority of Gulf Oil Marine customers will be switching fuels prior to arrival in an ECA and recording the changeover in the ship's log for Post State Control inspection.

Gulf Oil Marine's offer a 0.1%S cylinder oil **GulfSea Cylcare ECA50** has been formulated to enable a simple switch over from the customer's standard GulfSea Cylcare cylinder oil without the need to make any adjustments to the cylinder oil feed rate.

**GulfSea Cylcare ECA50** is fully compatible with other GulfSea Cylcare cylinder oils. When changing to a 0.1%S fuel (entering an ECA) the cylinder oil should be switched at the next daily top-up of the cylinder oil day tank. When changing back to high sulphur fuel oil (leaving an ECA) the cylinder oil should be switched on the day prior during the daily top-up of the cylinder oil day tank. By adopting this procedure the cylinder liners will always be provided with sufficient BN reserve to neutralize any acidic conditions.

It is recommended that for those engines where higher cylinder oil feed rates are being used due to cold corrosion problems that the cylinder oil feed rate is reduced to the recommended average feed rate in accordance with the OEMs feed rate chart when operating on **GulfSea Cylcare ECA50**.

## Cylinder Oil Requirements for Scrubber Operation

Vessels fitted with exhaust gas cleaning systems will not under normal circumstances be required to change fuel oil in use. Likewise the cylinder oil will not require to be switched.

## Cylinder Oil Requirements for Gas & Methanol Operation

Vessels operating on natural gas, (Methane) Ethane and Methanol should use **GulfSea Cylcare ECA50**. This cylinder oil is suitable for pilot injection using Gas Oil or HFO.

When a natural gas fuelled engine switches to using 100% HFO for periods of longer than 12 hours the cylinder must be switched to **GulfSea Cylcare DCA5070H** or **GulfSea Cylcare 50100** dependent upon the recommendation in the vessel's lubrication chart.

## OEM Guidelines – MAN, Wärtsilä and Mitsubishi

MAN have for some years recommended the installation of two cylinder oil daily tanks; designated high BN and low BN cylinder oils respectively. In ships with two daily tanks fitted, the switch from high BN to low BN and vice versa should be performed at the same time as fuel switching.

In general the most common combination of cylinder oils used by most customers will be **GulfSea Cylcare ECA50** and **GulfSea Cylcare 50100**. In situations where the ship is likely to use consistently low sulphur fuels such as commonly delivered in South America then there will then be a requirement to use **GulfSea Cylcare DCA 5040H**.

MAN strongly recommends the use of specially formulated cylinder oil for ECA operations. It is therefore recommended that customers deplete their stocks of **GulfSea Cylcare DCA 5040H** and then switch to **GulfSea Cylcare ECA50**. Wärtsilä is more relaxed about the continued use of 40BN cylinder oil but also specify a switch to a specially formulated cylinder oil for ECA operation. Mitsubishi do not require a special formulation cylinder for ECA operation. However Gulf Oil Marine strongly recommends a switch to **GulfSea Cylcare ECA50** when stocks of 40BN are depleted.

## Scrape Down Analysis

It is becoming increasingly important to utilize SDA as a supplement to the monthly scavenges port visual assessment of cylinder liner, piston and ring pack condition. Gulf Oil Marine provides an SDA service including reporting against allowable iron content limits.

When using **GulfSea Cylcare ECA50** the SDA iron limits are reduced. The limits recommended by MAN and Wärtsilä are shown in the table below.

	MAN	MAN	Wärtsilä	Wärtsilä
<b>GulfSea Cylcare ECA50</b>	Residual BN Limit 5 -10	Iron Content 50 - 100	Residual BN Limit 5-10	Iron Content No limit stated

It should be noted that SDA analysis provides several assessments;

- Fuel contained in the scrape down oil which may be an indication of poor combustion and/or faulty injection as well as a correction for residual BN
- System oil contained in the scrape down oil which indicates the quantity of system oil leakage and enables a correction for residual BN
- Water content of the scrape down oil may provide indication of the operation of the intercooler water separators and dew point conditions in the cylinder liner
- Indications of low BN reserve normally require an increase in the specific feed rate of cylinder oil

It is generally not recommended to undertake a SDA sampling during ECA operations. However if the vessel is to operate for several weeks or nearly permanently in an ECA then SDA sampling can be done.

## Cold Corrosion Conditions – Implications on Liner Wear Rates

Corrosion is an essential element of satisfactory liner lubrication and liner wear. When operating with very low sulphur content fuels it is essential that there is sufficient residual alkalinity to neutralize acid formation but not too high to cause piston crown land deposits. The latter will in the presence of low corrosion create liner polish and loss of cylinder oil retention.

Although both MAN and Wärtsilä have previously approved SAE 40 grade cylinder oils, their position today is for the use of SAE 50 grade with a minimum viscosity of 18.5cSt @ 100°C. The use of blend on board is likely to produce cylinder oil that is not in compliance with current minimum viscosity requirements.

Both MAN and Wärtsilä recommend cylinder oil feed rate in the range of 0.6g/kWhr to 1.0g/kWhr. The use of a periodic SWEEP test is a useful indicator of the engine corrosivity. The test consists of adjusting the cylinder oil feed-rate every 24 hours starting

with a cylinder oil feed-rate of 1.4g/kWhr and reducing it in 0.2g/kWhr steps to 0.6g/khr. SDA sampling is done after each 24 hour period and prior to reducing the cylinder oil feed-rate.

Cold corrosion is believed to occur where the liner and combustion chamber conditions are such that the gas temperatures fall below the dew point and acids form on the liner walls. Most corrosion normally occurs at the top of the liner hence the essential need to ensure BN reserve in the SDA. In the past liner lifetime was defined by a maximum allowable liner diameter. This rule of thumb no longer applies due to bowl effects and liner ovality. It is quite common for corrosive wear to occur on only part of the liner circumference due to combustion patterns and intensity of flame path. As the wear and ovality progress liner life will be limited by piston ring performance and eventual ring blowby and ring failure.