Action code: WHEN CONVENIENT

Cylinder lubrication update for 0 to 0.50% sulphur fuels

SL2019-671/JAP
April 2019

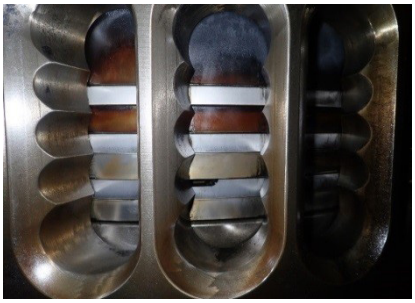
Concerns
Owners and operators of MAN B&W two-stroke marine diesel engines.
Type: All MAN B&W engines

Summary
Check the cylinder condition frequently and ensure that the piston ring pack is clean and moving freely.
In case of deposits, use oil with higher detergency to clean.

General guidance for operation on:
- Max. 0.10% S fuel: 15–25 BN CLO
- 0.10%-0.50% S fuel: 40–70 BN CLO

Guidelines on lubrication when operating on fuel with a sulphur content above 0.50% are found in SL2014-587.

Other relevant Service Letters are: SL2018-659, SL2019-670, SL2017-638, SL2018-663, SL2014-587



Dear Sir or Madam

This service letter provides operational guidelines on how to lubricate the cylinder and piston when operating on max 0.50% sulphur fuel.

It is expected that the vast majority of all vessels with MAN B&W engines will experience a trouble-free transition to max. 0.50%S fuels. We recommend beginning with 40 BN cylinder oil and evaluating the condition continuously.

In case of deposit build-up, a cylinder oil with higher detergency properties should be considered. For some engines, a lower BN oil will be acceptable whereas others will need to change to a higher BN oil.

For questions or inquiries regarding the content in this letter, contact our Operation department at: Operation2S@man-es.com

Yours faithfully

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Introduction

In preparation for the 0.50% S fuel era, it is necessary to update the lubrication guideline for MAN B&W engines. This guideline aims at facilitating lubrication of engines operating on 0.50% S very low sulphur fuel oils (VLSFO), and 0.10% S ultra-low sulphur fuel oils (ULSFO), which include both distillate (DM) and residual grades (RM) according to ISO 8217. Operation using low-flashpoint fuels such as liquefied natural gas (LNG), ethane, methanol and liquefied petroleum gas (LPG) is furthermore included in our recommendation for 0.10% S ULSFO operation. We recommend that engines operating on VLSFO or ULSFO are fitted with cermet coating on all piston rings as well as piston cleaning rings.

This guideline includes directions on what to pay attention to regarding the properties of lube oils and how the lube oils affect equipment on board. Expectations for the new types of fuels are also given. Notwithstanding the foregoing, it remains the responsibility of the owner/operator of an engine to ensure that suitable fuel and lube oil is conditioned and used in order to prevent damage to the engine and other equipment on board.

Cylinder oils

We recommend using cylinder oils which have obtained a No Objection Letter (NOL) from MAN Energy Solutions. Due to the reduced sulphur content in the fuel combined with the current range of cylinder oils on the market, we need to update our lubrication strategy recommendation. For low-sulphur fuels, keeping piston cleanliness is equally important as controlling corrosive wear today when operating on high-sulphur fuel. Cylinder oil performance and cleaning ability are key factors to maintain good cylinder condition (see Appendix I, D.1).

Monitoring the iron content from drain oil analyses is necessary to obtain good cylinder condition at the low-

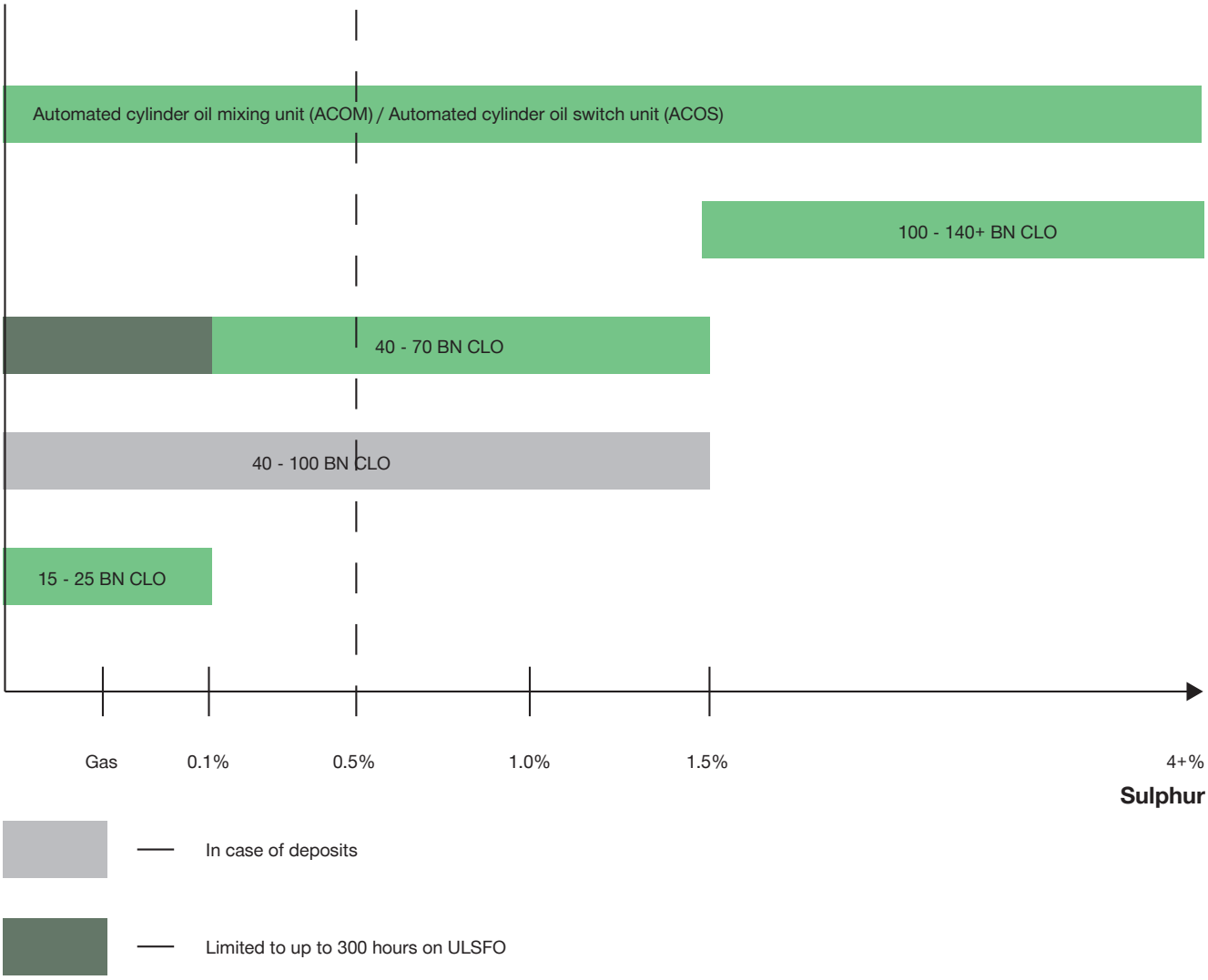


Fig. 1: Recommended BN levels for all MAN B&W engines
*Prolonged use may lead to deposit

est possible feed rate in the future fuel environment. In case higher BN cylinder oils are needed to keep the engine clean from deposits, attention must be paid to secure against cylinder liner bore polish. When using a high-BN cylinder oil, the risk of top land deposits increases. The deposits may polish on the cylinder liner surface and cause polished areas which can initiate a cylinder liner scuffing. A way to reduce the risk is to alternate between high- and low-BN cylinder oil using a high-BN oil for one week and a low-BN oil for the next week. The time for using high-BN should be adjusted to what is needed to keep the engine clean from deposits.

Cylinder oil for max 0.10% S ULSFO operation:
- 15-100 BN cylinder oil:
- Start by using a 15-25 BN cylinder oil
- Depending on condition, up to 100 BN cylinder oil can be used.

Cylinder oil for 0.10-0.50% S VLSFO operation:
- 40-100 BN cylinder oil:
- Start by using a 40 BN cylinder oil
- Depending on condition, up to 100 BN cylinder oil can be used.

Fig. 1 gives an overview of the recommended BN levels. This recommendation is valid for all engine types and mark numbers, and for all lubricator types.

As for the 0.10% S ULSFO, the 0.50% S VLSFOs will be a range of residual and distillate types. Cylinder oil suitable for 0.50% S VLSFO and 0.10% S ULSFO operation should be able to handle all distillate and residual types of fuels as well as fuels like LNG, ethane, methanol and LPG.

Cleanliness of engines operating on 0.50% S VLSFO and 0.10% S ULSFO

Just as some engines have higher corrosive levels than others, some engine types are more prone to deposit formation if the cylinder oil and feed rate used are not suitable. Operation pattern, ambient conditions and condition of the components can also make a significant difference.

We recommend checking the cylinder condition according to the instruction manual (monthly). However, during the transition period to VLSFO, scavenge port inspections may be required more frequently and when convenient. Feed rate reductions without a prior inspection showing good condition should be avoided.

Feed rate

The target is to minimise the cylinder oil feed rate yet maintaining acceptable cleanliness, acceptable wear and avoiding hard contact such as micro-seizures on the piston rings and cylinder liners.

Vessels in service, which have already optimised their feed rates to low sulphur levels and operation in ECAs, do not have to take further action with regards to feed rate optimisation when changing to VLSFO.

Upon changing to max 0.50% S fuel, the cylinder oil type should be reassessed according to this guideline. Feed rates can be kept unchanged unless issues with deposits and/or micro seizures are observed. If deposits are observed, follow the deposit control guideline illustrated in Fig. 2 and Table 2.

New ships entering service must follow the guidance given in SL2014-587 during initial running-in of the components. Deposit formation must be monitored when reaching 1.0 g/kWh and further feed rate reduction requires acceptable cylinder condition based on inspections.

Vessels in service, which have not yet optimised the feed rate for ULSFO or VLSFO operation, should start at the existing feed rate or 1.0 g/kWh and then reduce the feed rate based on inspections until the minimum feed rate is reached.

If signs of hard contact or micro-seizures on the rings, ring land deposits, or other abnormalities are observed before the minimum feed rate is reached, the feed rate has to be kept sufficiently high to avoid micro-seizures (see Appendix II, C3 and C4).

If the condition starts to deteriorate above the minimum feed rate (typically 0.6 g/kWh), we recommend changing the cylinder oil type and/or BN level to one with increased detergency properties.

Fuel oil cleaning

As the use of VLSFO is expected to generate little corrosion, any presence of high iron content in drain oil analyses may suggest contaminants such as cat fines (Al+Si) in the fuel and could point towards ineffective fuel cleaning systems. In such cases, it should be confirmed that the amount of Al+Si at engine inlet does not exceed our recommendations (SL2017-638). If cat fines have already entered the engine, proper operation of the fuel cleaning

equipment must be verified. Increasing the cylinder oil lubrication feed rate will not protect against cat fines.

Drain oil levels

Continuous evaluation of drain oil samples is recommended. The feed rate must be adjusted so that the total iron (Fe) content does not exceed the values stated in Table 1, Guiding drain oil levels, measured as average values over a period of 2-3 samples. Samples should be taken at regular intervals at between 14 days to monthly, and more frequently if wear issues are suspected.

MAN ES recommend that drain oil samples are sent to a laboratory for analysis. It is important to get a valid test result that shows the total content of iron (Fe). Laboratory testing according to ASTM D5185-09 is the only certain measuring method. The BN must be tested in accordance with ISO 3771:2011(E). On board analysis kits can be used to supplement the laboratory analysis, but feed rate adjustments should not be based on these analyses alone.

Maximum total Fe content must be adjusted to the individual engine based on actual wear measurements.

MAN ES recommend that cylinder liner wear measurements are obtained at least once a year, while piston ring related wear should be measured during every scavenge port inspection i.e. ring coating thickness and pressure relief grooves.

Guiding drain oil levels

Engine bore size	Max. Fe content (ppm)
26-50	100
60-70	150
80-98	200

NB: Cylinder oil BN levels in drain oil samples may vary depending on engine and oil type. For guidance, the BN in the drain oil should be kept above 25% of the original BN value.

Table 1: Guiding drain oil levels

BN level in the drain oil can be used as a guide to the depletion of cylinder oil. When operating on HFO in a corrosive environment, it is of great importance to keep the BN at an adequate level to secure against corrosion. However, when operating on VLSFO or ULSFO, the level of BN must also be assessed against the cylinder oil's ability to clean the engine. For guidance, the remaining BN should be around 25% of the original value, however, if deposits start to build up inside the engine, the BN level may need to be increased.

Operating in and out of 0.10% S ECAs

When operating on 0.10% S, it may be possible to use the same cylinder oil as for 0.50% S VLSFO operation. The time span for such operation is limited to 300 running hours (2 weeks) without inspections. The possibility to use the same cylinder oil for VLSFO and ULSFO

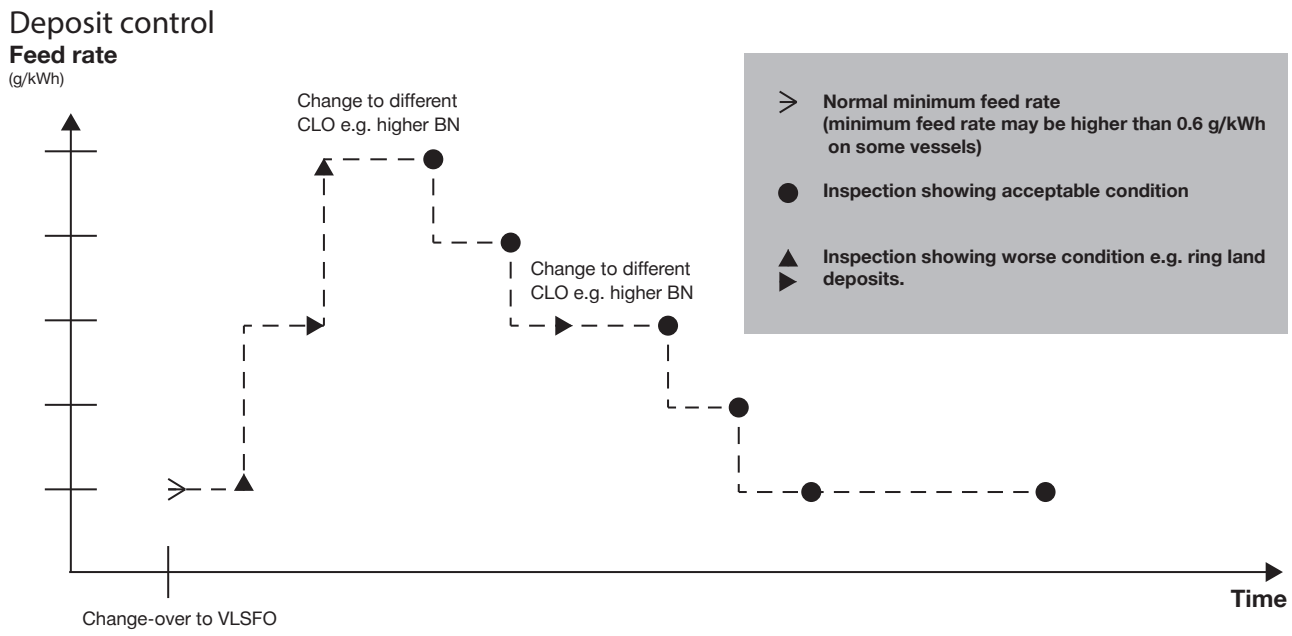


Fig. 2: Devised scenario for existing engines. New engines and renewed cylinder units will have a higher starting feed rate due to running-in (see Table 2 for detailed description)

should be based on experience from the actual engine. The condition of the engine is decided from scavenge port inspections before entering and after exiting the 0.10% S ECA, in the first couple of roundtrips.

Jacket cooling water temperature

The jacket cooling water outlet temperature can be reduced to 80°C as higher temperatures are considered irrelevant when operating on up to 0.50% S VLSFO. This recommendation is valid for all cylinder liner types. The cooling water set point must be aligned with other components in the cooling water system, such as the fresh water generator.

JBB (jacket basic bypass) and LDCL (load-dependent cylinder liner) cooling water systems

It is recommended closing down the LDCL system and de-activating any JBB system when using up to 0.50% S VLSFO. On newer engines, the control system (ECS) will close down the LDCL system automatically when low Sulphur content is keyed in on ECS-MOP. On older ECS versions, the LDCL system should be manually set to off.

Two cylinder oil tanks design

For all vessels and engine types, we recommend that two storage tanks for cylinder oil are used. This will provide greater flexibility if the need to change between two cylinder oil types arises.

Optimising the cylinder lubrication

1. If deposits have built up on ring lands using ULSFO and VLSFO fuel and low-BN oil:	
1A. Start by increasing the feed rate of the low-BN oil to up to 1.0 g/kWh.	
1B. The ACOM system can be used to mix high- and low-BN cylinder oil. Start by selecting 50 BN and change up or down in steps of 10 BN. Inspect again when convenient.	
If no or insignificant improvement is found with only increased feed rate applied:	– Change to cylinder oil with higher BN – Alternating the use of high-BN oil and low-BN oil is recommended as some engines can be more susceptible to scuffing incidents due to liner polish. Use the high-BN oil for one week and then the low-BN oil for one week. Switch back to the high-BN oil for one week and so forth. Depending on performance, the intervals can be adjusted to secure clean pistons, but avoid using high-BN oil for longer than necessary. Note: The ACOS system will ease this procedure as the switch between low-BN and high-BN oil can be done by pressing a button on the MOP of the engine control system.
If improvement is found with higher BN oil:	– Reduce the feed rate in steps of 0.1g/kWh. Every reduction must be based on visual inspection – Reduce the feed rate as close to min. feed rate as possible while maintaining an acceptable cylinder condition
If deterioration resumes after feed rate reduction:	– Change to cylinder oil with higher BN – Increase feed rate
If the engine suffers from heavy ring land deposits, a prolonged period using only high-BN oil (100 BN) has shown to be able to clean the engine. In such cases, we recommend carrying out scavenge port inspections every two weeks.	
2. If deposits have built up on top lands using VLSFO fuel:	
The cylinder oil BN may be too high. Decrease the feed rate or change to a lower BN oil.	
3. When a suitable oil and feed rate has been found, it can remain unchanged for operation in and out of SECAs	

Table 2: Optimising the cylinder lubrication

Appendix I

Deposit on ring lands

D.1

Clean condition

Description:

No deposits found on the ring land

Action:

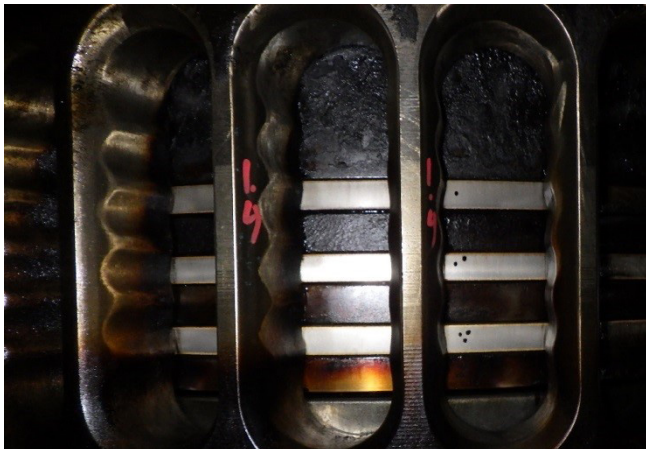
- No action is required

D.2

Medium amount of deposits on first ring land

Description:

Medium amount of deposits on first ring land



Action: Monitor the condition

- Increase the feed rate with 0.2 g/kWh
- If the feed rate (g/kWh) is 1.0 g/kWh or above, consider changing to a higher BN CLO

D.3

High amount of deposits on first ring land

Description:

High amount of deposits on first ring land, and medium amount of deposits on second ring land

Action: At first opportunity

- Increase feed rate by 0.2 g/kWh
- If the feed rate (g/kWh) is 1.0 g/kWh or above, consider changing to a higher BN CLO

Appendix II

Cermet condition overview

C.1

Cermet-coated piston ring, good condition

Description:

Cermet coated piston ring in good condition with a smooth running surface and rounded edges

Action: No action

No action is required

C.2

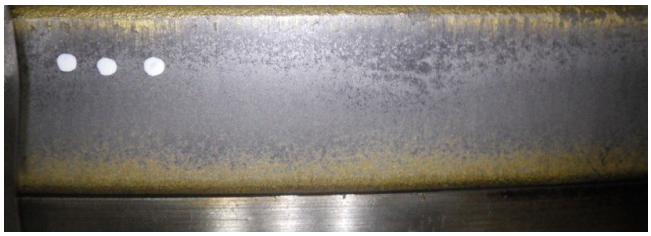
Alucoating and hard piston ring contact marks

Description:

Alu and cermet-coated piston ring with hard contact marks

Action: Monitor the condition

- Increase the feed rate to 1.2 g/kWh
- Monitor the condition
- Initiate stepwise feed rate reduction



C.3

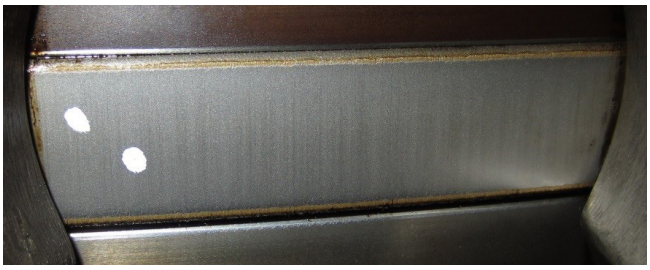
Hard piston ring contact marks

Description:

Cermet-coated piston ring with hard contact marks after the alucoating has been worn off

Action: Monitor the condition

- Increase the feed rate to 1.2g/kWh
- Monitor the condition
- Initiate stepwise feed rate reduction



C.4

Hard piston ring contact

Description:

Partly damaged piston ring after hard contact

Action: At first opportunity

- Increase the feed rate to 1.2 g/kWh
- Monitor the performance of the unit
- Consider ring renewal
- Check liner surface condition in case redressing / machining is needed.