

Action code: WHEN CONVENIENT

Fuel tank cleaning

Supplement to SL2019-670

SL2019-674/JAP

July 2019

Concerns

Owners and operators of MAN B&W two-stroke marine diesel engines.

Type: All MAN B&W engines.

Summary

Cleaning of fuel tanks by using cleaning agents to dissolve sediments may increase the cat fines content of the fuel oil supplied to the engine. The cat fines content must be lowered to the guiding values (SL2017-638/DOJA) to ensure safe operation of the engine.

Other relevant Service Letters:

SL2019-670/DOJA

SL2017-638/DOJA

SL2019-671/JAP

Dear Sir or Madam

The forthcoming switch to 0.50% S very-low-sulphur fuel oil (VLSFO) will be a challenging task for owners and operators securing that the fuel bunker tanks are sufficiently cleaned before filling in 0.50% S VLSFO.

It has come to our attention that vendors are promoting the use of cleaning agents, that when mixed into the fuel tanks dissolve the sediment in the bottom of the tanks. It makes it possible to clean the tanks in service and remove the tank sediment with the fuel system separators.

It is of the utmost importance to secure that the sediment containing large amounts of settled catalytic fines (cat fines) from previously bunkered fuel is sufficiently removed from the fuel before it enters the main engine.

The current maximum allowed content of cat fines (Al+Si) in the fuel before the engine is 15 mg/kg for short periods.

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

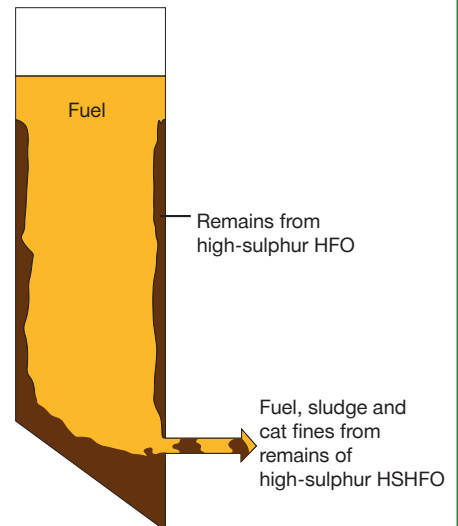
Yours faithfully



Mikael C Jensen
Vice President
Engineering



Stig B Jakobsen
Senior Manager
Operation



Introduction

Future limitations lower the limit of the fuel oil sulphur content to 0.50% sulphur, and it is expected that this results in the need for cleaning existing bunker tanks to remove the sediment containing sulphur and settled cat fines from the bottom of the tanks.

If operators choose to dissolve the sediment and dilute it with the bunkered fuel (see Figure 1), great care should be taken to secure that cat fines or other particles from the sediment are not supplied to the engine, which will cause heavy wear and potentially liner scuffing.

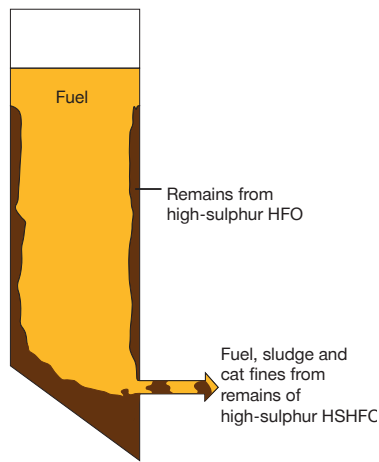


Figure 1: Dissolved sediment from HSFO may contain a large amount of cat fines.

Fuel tank cleaning

Cleaning the fuel tanks can be done by emptying the tanks (stripping) and manually cleaning the tanks to secure that the sediment is removed and thus not endangering the operation of the fuel consumers as well as the equipment in the fuel system, i.e. pump valves and separators.

However, choosing to dissolve the sediment and dilute it with fuel to be consumed can potentially increase the risk of supplying particles from the sediment (cat fines) to the engines. If the sediment is dissolved, we advise the operators to secure sufficient cleaning of the fuel to meet the guiding values put forward in SL2017-638/DOJA.

Fuel tank sediment

Investigation of sediment from tanks has shown that the content of cat fines may be as high as 19,000 mg/kg in adverse situations. Values in the range of 4,000 to 19,000 mg/kg can be expected. If the sediment is dissolved we recommend to take samples of the sediment before applying the dissolving agents.

The expected level of cat fines in the fuel tank, once the sediment is dissolved, should be calculated (Appendix A).

Proper action should be taken to secure sufficient cleaning to lower the cat fines content to meet the guiding values. Please note that the calculations cannot take into account that the dissolved sediments are mixed unhomogenously in the fuel tank. The sediment concentration most likely increases in the bottom of the tank (see Figure 2), which leads to a higher concentration of cat fines in the fuel pumped to the settling tank when using the fuel.

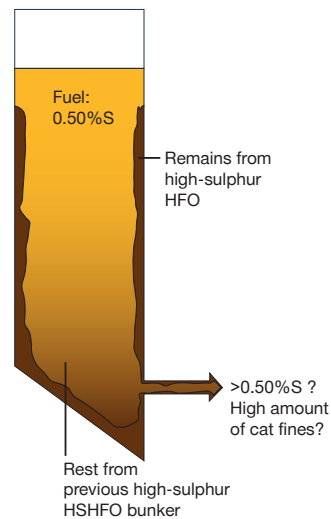


Figure 2: Once the sediment is dissolved the concentration in the tank may vary and cause an uneven flow of cat fines in the fuel.

The procedure for using fuel containing dissolved sediment

We recommend to take fuel samples frequently to be able to document that the fuel has been sufficiently cleaned. We also recommend to take fuel samples before the fuel separator, after the separator and at the main engine inlet.

Engine wear

If the cat fines content in the fuel is not lowered sufficiently, there is a risk that the engine will suffer from abrasive wear. This will typically show as piston ring wear, cylinder liner wear and piston crown ring groove wear and it can occur very quickly, and in some cases it may evolve to liner scuffing.

Keeping track of engine wear when using the fuel can be done by checking the iron (Fe) content of the drain oil. In this case, using an onboard test kit which measures the magnetic Fe content should be sufficient to monitor day-to-day variations in engine wear. It is recommended to keep such daily recordings when using the diluted or treated fuel (Appendix B).

Appendix A

Example of fuel cat fines concentration, if the fuel tank sediment with a high concentration of cat fines is dissolved in the fuel.

Table 1 shows the cat fines concentrations of the fuel, depending on the filling level of the fuel tank and the amount of dissolved sediment. If a fuel tank contains 20 mm of sediment with 19,000 mg/kg cat fines and this is completely dissolved in a full tank filled with a fuel containing 25 mg/kg cat fines at a tank height of 1.7 m, the fuel later pumped to the settling tank will contain 248 mg/kg of cat fines. This amount needs to be lowered to below 15 mg/kg before the engine inlet.

Tank height [m]		1.7	Sediment thickness [m]		0.02	Cat fines content in sediment [mg/kg]		19,000			
New fuel cat fines [mg/kg]		Tank filling level [%]									
25		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Dissolved sediment [%]	10%	246	135	99	80	69	62	57	53	50	47
	20%	469	247	173	136	114	99	88	81	74	69
	30%	693	359	248	192	159	136	120	108	99	92
	40%	916	471	322	248	203	174	152	136	124	114
	50%	1,140	582	397	304	248	211	184	164	149	136
	60%	1,363	694	471	360	293	248	216	192	174	159
	70%	1,587	806	546	415	337	285	248	220	199	181
	80%	1,810	918	620	471	382	323	280	248	223	204
	90%	2,034	1,029	695	527	427	360	312	276	248	226
100%	2,257	1,141	769	583	471	397	344	304	273	248	

Table 1: Examples of cat fines concentrations in the final fuel, depending on how much new fuel is bunkered in the tank and how much sediment is dissolved in the final fuel.

Appendix B

The guiding levels for Fe content in the drain oil can be seen in Table 2. The stated numbers are the total Fe content, as described in SL2019-671. The limits can also be used as guidance for on-board testing of magnetic iron.

Guiding drain oil levels

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

Table 2: Guiding values for Fe content in the drain oil. Refer to SL2019-671.