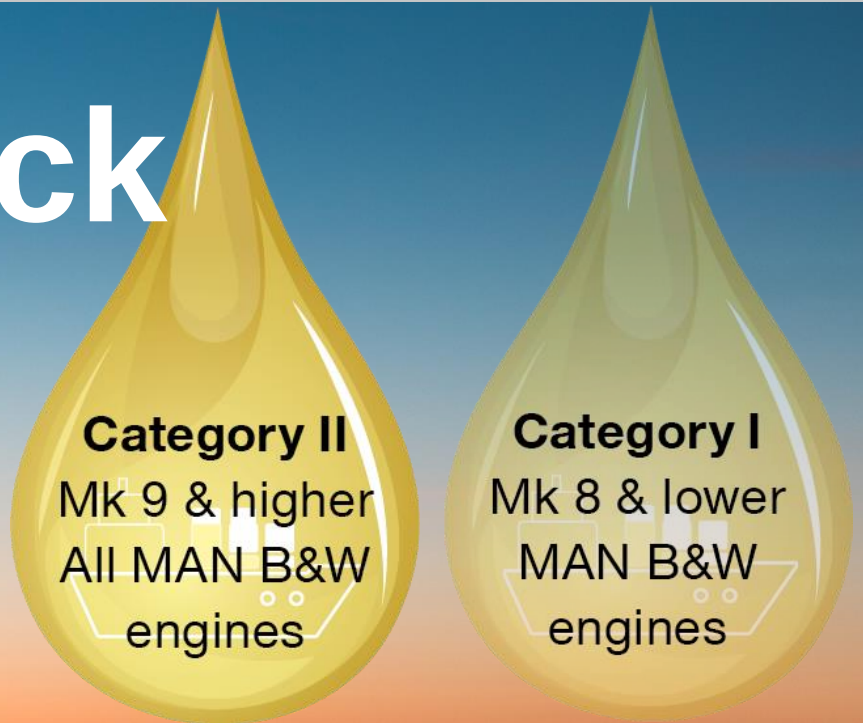
MAN Energy Solutions
Future in the making

Introducing a new cylinder oil strategy – SL2020-694

Fuels 2020 – Feed back

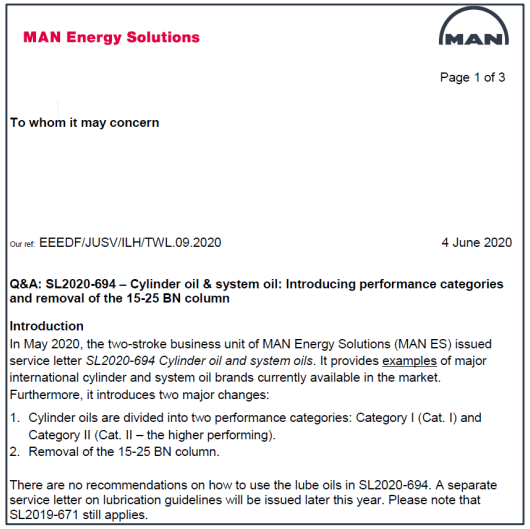


Mevlüt Civelek
MAN Energy Solutions - Marine two-stroke
5 December 2020

Agenda

1 Introducing a new cylinder oil strategy
2 Cylinder oil - Performance level: Category II
3 Cylinder oil - Performance level: Category I
4 Summary – cylinder oil
5 Fuels 2020 – feedback
6 Summary – Fuels 2020

1 Introducing a new cylinder oil strategy



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Page 1 of 3

To whom it may concern

Our ref. EEEDF/JUSV/ILH/TWL.09.2020 4 June 2020

Q&A: SL2020-694 – Cylinder oil & system oil: Introducing performance categories and removal of the 15-25 BN column

Introduction

In May 2020, the two-stroke business unit of MAN Energy Solutions (MAN ES) issued service letter *SL2020-694 Cylinder oil and system oils*. It provides examples of major international cylinder and system oil brands currently available in the market. Furthermore, it introduces two major changes:

1. Cylinder oils are divided into two performance categories: Category I (Cat. I) and Category II (Cat. II – the higher performing).
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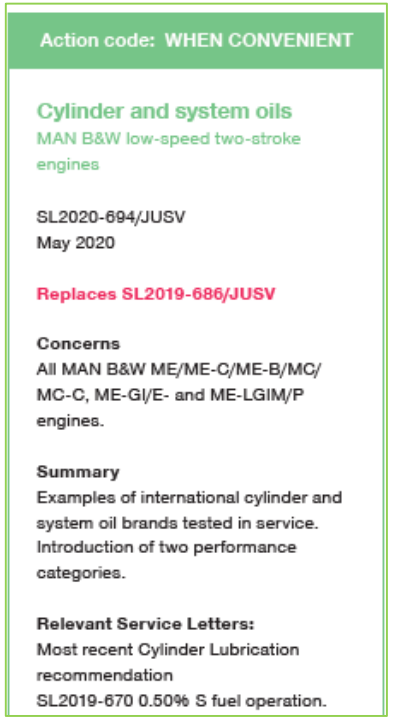


Action code: WHEN CONVENIENT

Cylinder and system oils

MAN B&W low-speed two-stroke engines

SL2020-694/JUSV
May 2020

Replaces SL2019-686/JUSV

Concerns
All MAN B&W ME/ME-C/ME-B/MC/MC-C, ME-GI/E- and ME-LGIM/P engines.

Summary
Examples of international cylinder and system oil brands tested in service. Introduction of two performance categories.

Relevant Service Letters:
Most recent Cylinder Lubrication recommendation
SL2019-670 0.50% S fuel operation.

Introduction

SL2019-671

Service letter SL2019-671/JAP

MAN Energy Solutions

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.

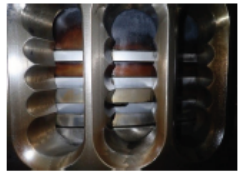
In case of deposit build-up, a cylinder oil with higher detergency properties should be considered. For some engines, a lower BN oil will be acceptable whereas others will need to change to a higher BN oil.

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

Yours faithfully

Mikael C. Jensen
Vice President
Engineering

Stig B. Jakobsen
Senior Manager
Operation



SL2020-694

Service Letter SL2020-694/JUSV

MAN Energy Solutions

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Dear Sir or Madam

This service letter introduces a new cylinder oil strategy where the aim is to raise the performance level of cylinder oils by dividing them into two performance categories. It also provides a general overview of the major international cylinder and system oil brands currently available in the market.

For specific lubrication guidelines, reference is made to the most recent lubrication guidelines available for your specific engine type, for example service letters and circular letters. Service letters are available at: https://marine.man-es.com/two-stroke/service-letters

For questions and inquiries regarding the content in this letter, contact our Operation department at: operation2s@man-es.com

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Q&A: SL2020-694

MAN Energy Solutions

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Q&A: SL2020-694 – Cylinder oil & system oil: Introducing performance categories and removal of the 15-25 BN column

Introduction
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There are no recommendations on how to use the lube oils in SL2020-694. A separate service letter on lubrication guidelines will be issued later this year. Please note that SL2019-671 still applies.

Cylinder oil

SL2020-694 Cylinder oil and system oils. Introduction of Cat. I and Cat. II

Purpose

Main Purposes of the cylinder oil are to:

- lubricate the piston and liner
- reduce the friction
- introduce wear protection
- minimise risk of seizures
- neutralise acids and oxidation products in accordance with the engine requirement
- and to keep the piston, piston rings, ringlands, and liner clean,
  - ➢ as it is important to ensure free movement of the rings by managing and preventing excessive deposit build-up.

Action code: WHEN CONVENIENT

Cylinder and system oils
MAN B&W low-speed two-stroke engines

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SL2020-694 Cylinder oil and system oils. Introduction of Cat. I and Cat. II

Highly fuel-efficient engines with higher pressures and higher temperatures require lubricants with matching performance.

Aim:

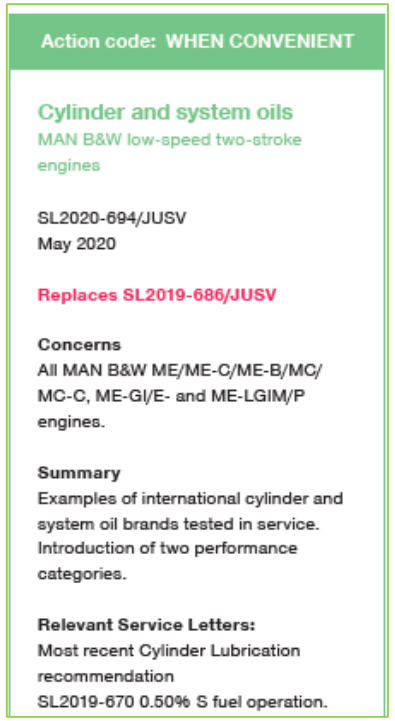
- ✓ Raise the performance level of cylinder oils.

What is new?

- ✓ The cylinder oils are divided into two categories (Cat. I and Cat. II),
  - ✓ Cat. II - overall higher performing
- ✓ Removal of the 15-25 BN column

Note!

- ✓ Important tables with lubricants.
  - ➢ Examples of CLO and SO brands.
- ✓ NO recommendations on how to use the lube oils in SL2020-694.
- ✓ **SL2019-671 is still valid.**
- ✓ Key messages:
  - ➢ Monitoring of cylinder condition and
  - ➢ take action if condition deteriorates.



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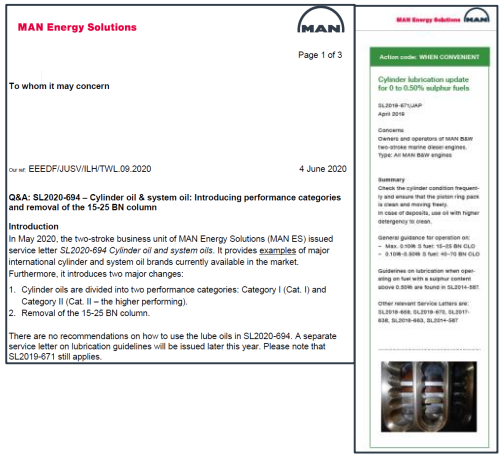
Motivation to the introduced changes

Bring attention to the development and usage of higher performing cylinder oils!

1. Operation on <0.50% S VLSFO will be the most predominant in the coming years.
2. Highly fuel-efficient engines with higher pressures and higher temperatures require lubricants with matching performance.
3. Cleanliness of the piston rings and crowns is important to secure an acceptable time between overhaul of the cylinder units.
4. Many low-BN cylinder oils (15-25 BN) were not giving the cleanliness required in the newest MAN B&W engines.
   a) MAN ES has withdrawn the No Objection Letters (NOL, approvals) from many of the 15-25 BN products.
   b) Some 15-25 BN cylinder oils have a valid NOL. Use SL2019-671. Contact lube oil supplier for NOL status.
   c) A number of lower-Mark engine types have experienced acceptable performance with 15-25 BN oils.



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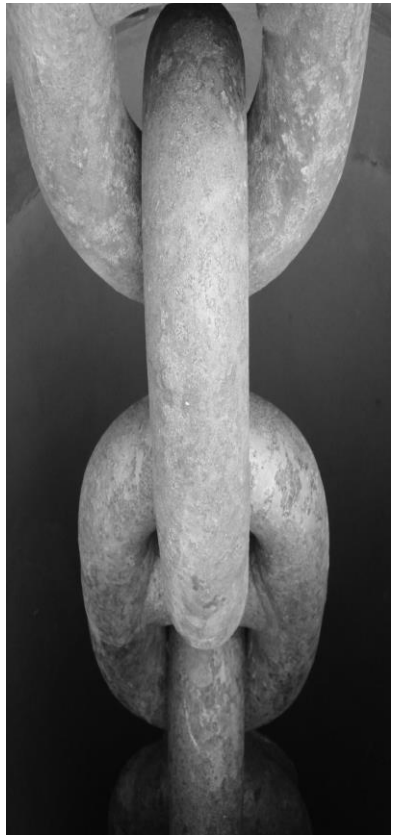
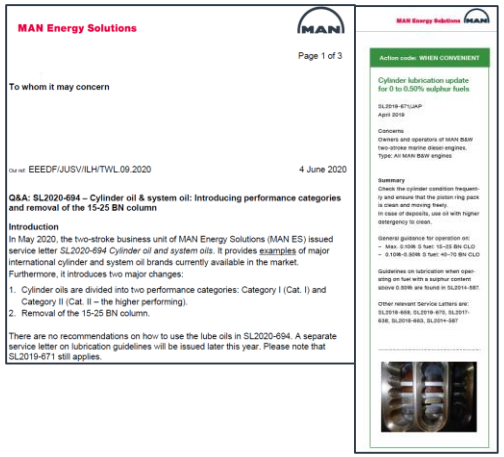


Which SL for cylinder lubrication guidelines should be used?

SL2019-671 Cylinder lubrication update for 0 to 0.50% sulphur fuels applies until a new SL is issued.



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1. SL2019-671 is very flexible.
   - The focus is on **monitoring** the cylinder condition
   - Ensure that the piston ring pack is clean and moving freely
   - In case of excessive deposit build-up, use oil with higher cleaning ability
2. The **alternation time** period between high- and low-BN cylinder oils can mean from a **couple of days to over 300 running hours**,
   - as long as the crew make scavenge port inspections, monitor the condition closely,
   - and take action if the condition deteriorates.
3. **As always, it is of great importance to monitor and act on the cylinder condition.**
   - ✓ Drain oil samples should be taken, analysed and evaluated.
   - ✓ Take action if the analysis shows deterioration by, for example, increasing iron content.

Deposit Control!

Monitor & Act!

Cylinder lubrication – SL2019-671

Low sulphur ≤ 0.50%

Guiding drain oil levels	
Engine bore size	**Max. Total-Fe (ppm)**
25-50	100
60-70	150
80-98	200
Cylinder oil BN levels in drain oil samples may vary depending on engine and oil type. *Generally the remaining BN should not be lower than 25% of original cylinder oil*	

Drain oil sample intervals:

- 14 days – 1 month
- More frequently if suspicion on issues.

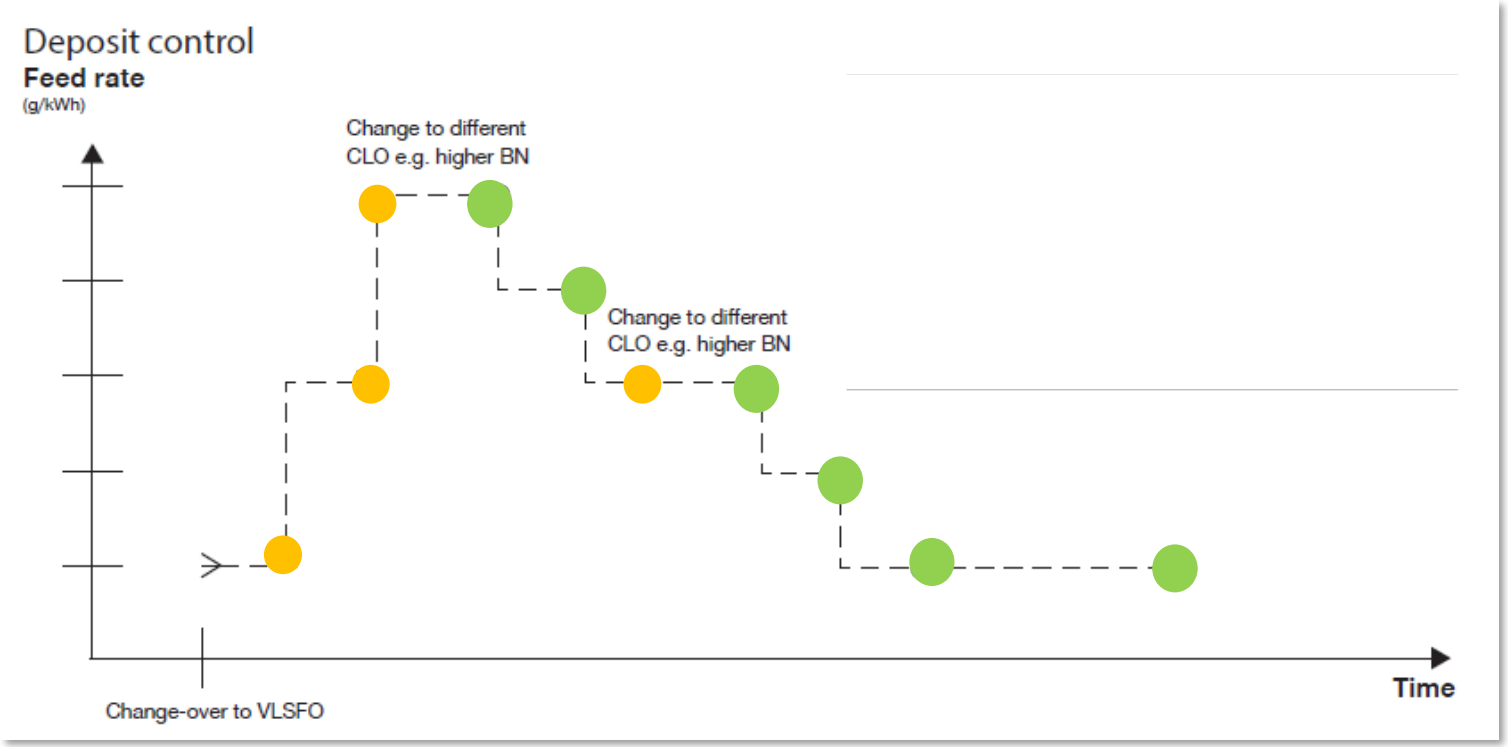
Monitoring:

- Scavenge port inspections:
  - **Deposits!**
- Measure wear:
  - Piston rings: Every port inspection
  - Liner: Once a year

SL2019-671 Lubrication guideline

Low sulphur ≤ 0.5%

- > 1.0 g/kWh or Normal minimum feed rate (minimum feed rate may be higher than 0.6 g/kWh on some vessels.)
- Inspection showing acceptable condition
- Inspection showing worse condition e.g. ring land land deposits

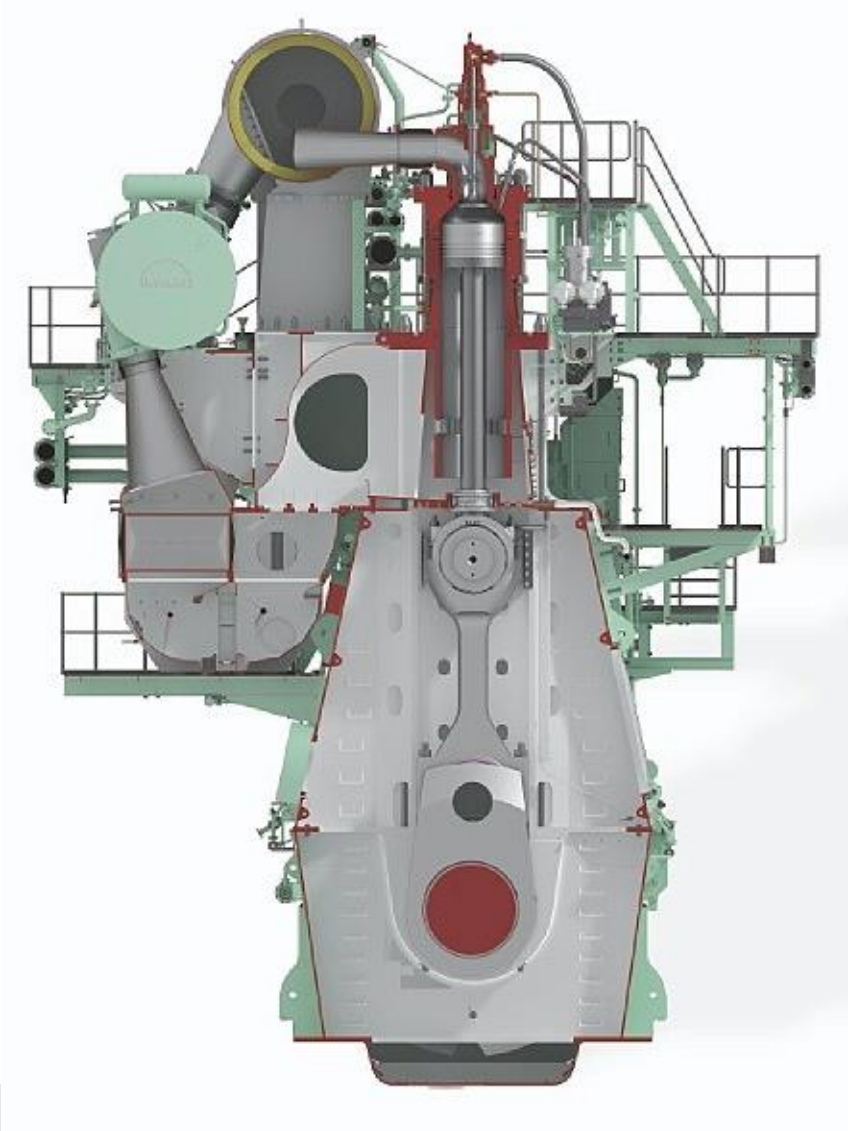


– Running-in: as SL2014-587

Topics

Drain oil sampling

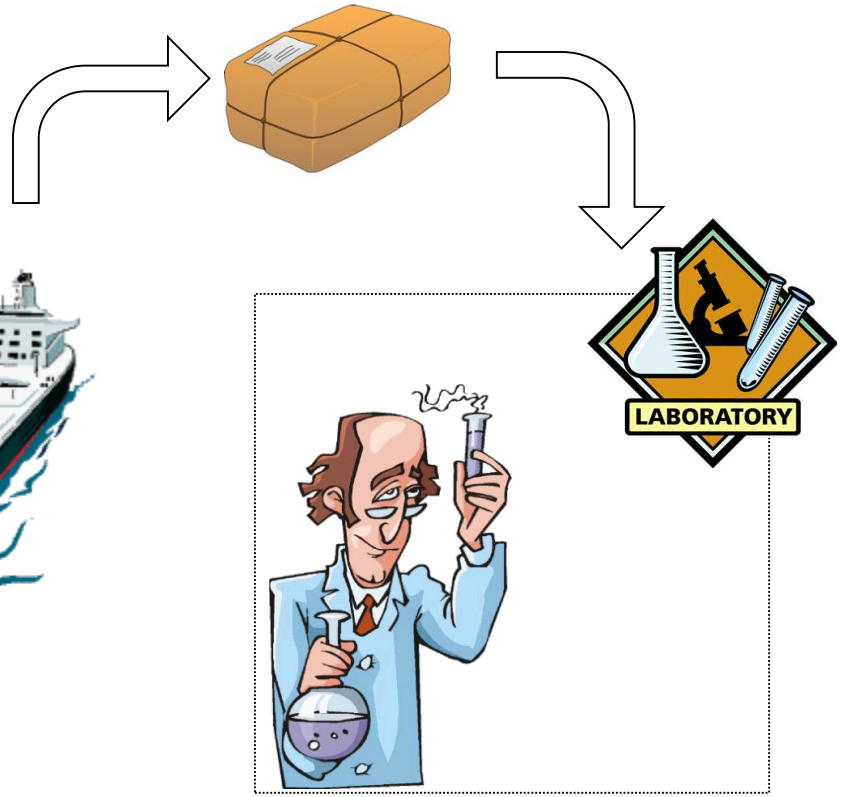
- Drain oil sampling
- Cylinder oil
- Evaluation



Drain Oil Evaluation

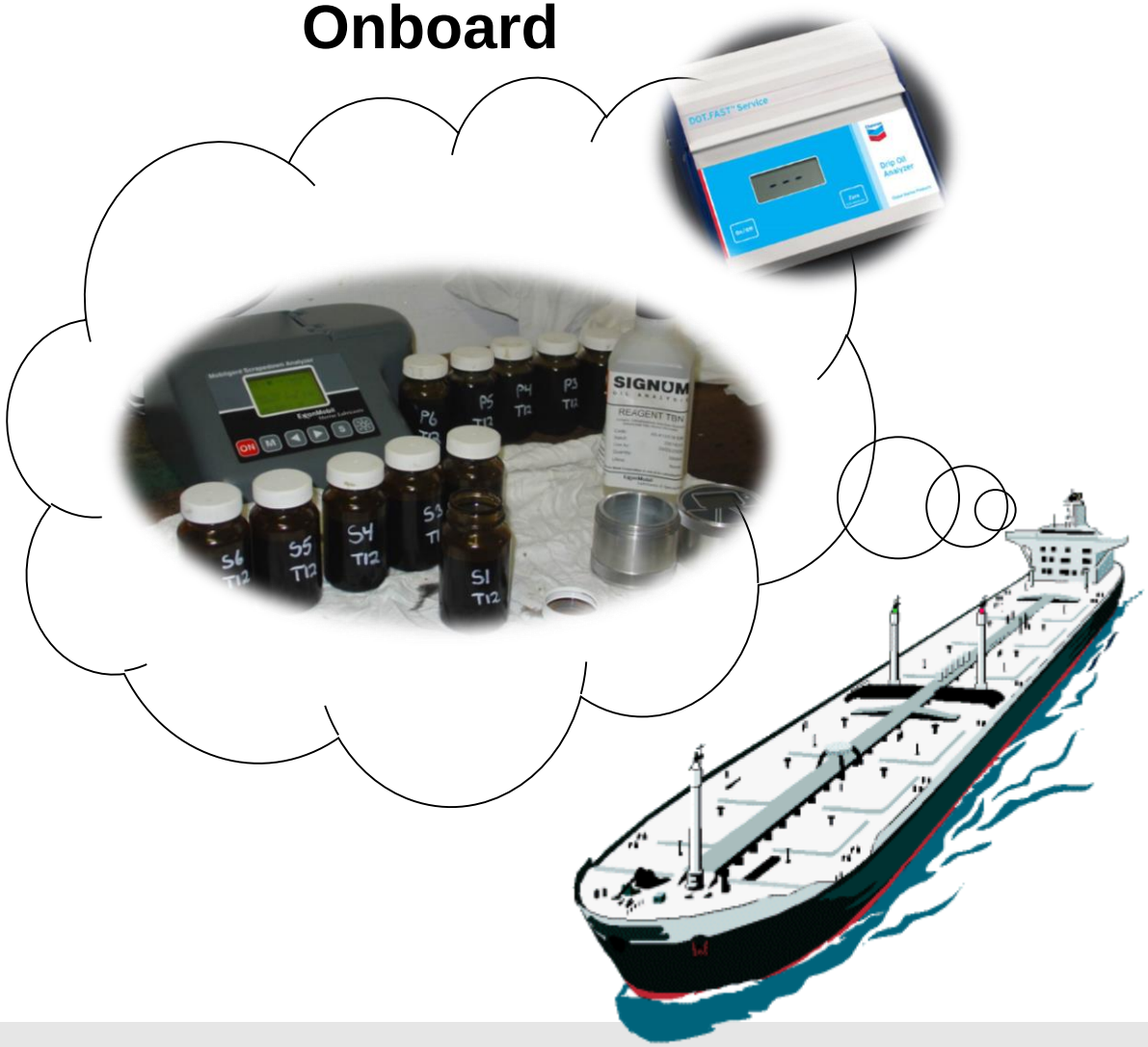
Onboard

Laboratory



Drain Oil Evaluation

Onboard



Pro:

- Quick response

Con:

- Lower Accuracy

  Only DotFast measure Total iron
- Crew dependent
- Less Data (only BN and Fe)

Drain Oil Evaluation

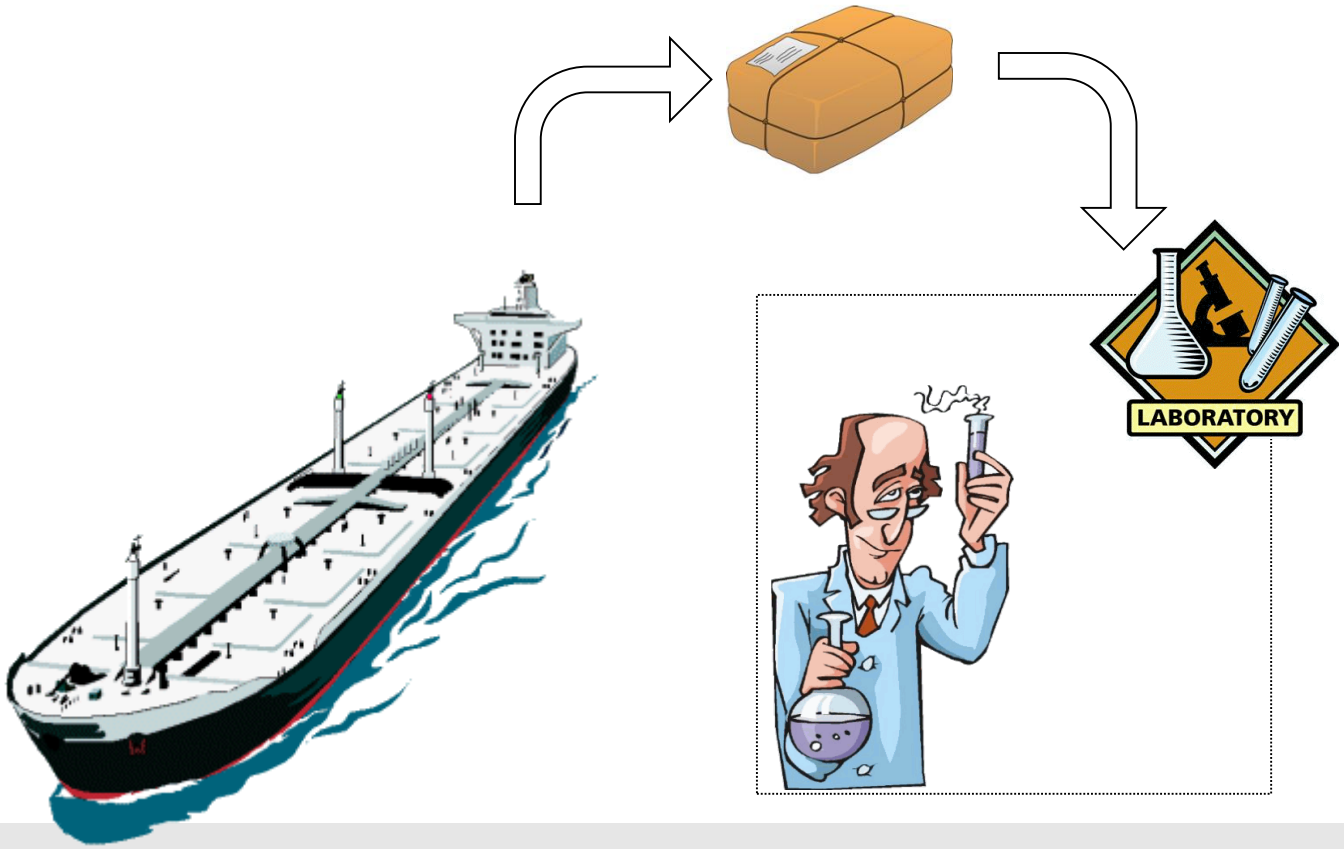
Pro:

- Higher Accuracy
- More data (metals and other elements such as P)

Con:

- Slower response

Laboratory



Drain Oil Evaluation

Example of a drain oil feed rate sweep result

QC-No.	Cyl.	Sampling point	BN (mg KOH/g)	BN Comp P%	Ca (%)	P (mg/kg)	Dilution P%	Ni (mg/kg)	Si (mg/kg)	Cu (mg/kg)	Mg (mg/kg)	Zn (mg/kg)	V (mg/kg)	Fe (mg/kg)	Fe Comp P%	Pb (mg/kg)	Ba (mg/kg)	Na (mg/kg)	Al (mg/kg)	Cr (mg/kg)	Sn (mg/kg)	B (mg/kg)	K (mg/kg)
136403	1	#3628	27.7	29.5	2.14	17	104	49	60	<5	64	140	110	96	99.48	<5	<5	40	8	6	<5	<5	<5
136409	1	#3634	23.8	24.7	1.96	15	102	41	54	<5	60	130	99	120	122.61	<5	<5	51	6	5	<5	5	8
136415	1	#3640	17.1	19.2	2.04	22	107	55	59	9	64	140	140	400	428.99	<5	<5	67	7	7	<5	<5	10
136421	1	#3646	14.6	15.6	1.99	18	104	64	70	36	61	130	180	1800	1878.26	<5	<5	76	8	26	<5	23	7
136427	1	#3652	7.7	8.6	1.99	25	109	100	97	86	63	140	270	3930	4300.22	<5	<5	110	12	49	<5	<5	8
136404	2	#3629	28.9	31.6	2.11	19	105	40	58	<5	61	140	91	54	56.74	<5	<5	38	7	<5	<5	7	<5
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136405	3	#3630	24.8	25.4	2.19	14	101	52	61	<5	65	140	120	69	70.00	<5	<5	45	8	5	<5	<5	<5
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136417	3	#3642	12.6	13.0	2.14	15	102	64	58	13	65	130	160	390	398.48	<5	<5	78	8	9	<5	<5	9
136423	3	#3648	7.2	7.8	1.99	22	107	77	67	35	60	140	200	1620	1737.39	<5	<5	81	9	16	<5	5	7
136429	3	#3654	3.6	3.6	1.96	31	114	110	97	110	60	140	280	4090	4653.12	7	<5	120	11	35	<5	<5	9
136406	4	#3631	25.8	26.5	2.40	14	101	55	67	<5	73	150	130	52	52.75	<5	<5	51	9	<5	<5	<5	7
136412	4	#3637	21.3	21.3	2.28	12	100	52	61	<5	69	140	120	53	53.00	<5	<5	64	7	<5	<5	<5	13
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136430	4	#3655	5.9	6.2	1.98	21	107	110	85	63	62	130	280	3040	3238.26	<5	<5	110	11	28	<5	<5	9
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136413	5	#3638	22.8	23.4	2.24	14	101	50	59	<5	68	140	120	71	72.03	<5	<5	59	8	<5	<5	<5	11
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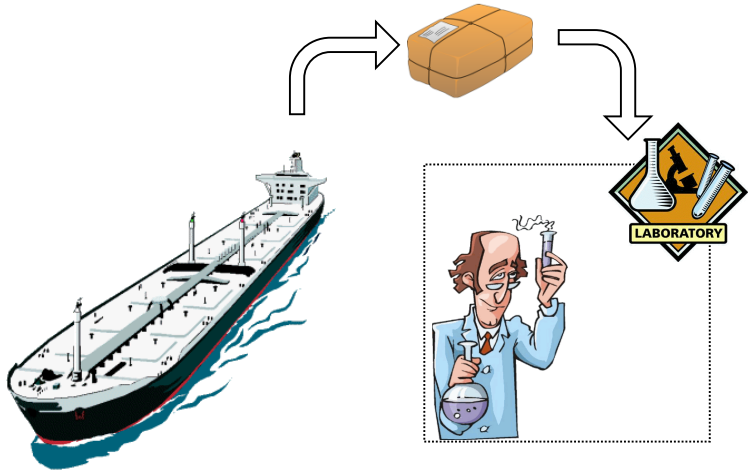
136420	6	#3645	17.3	17.7	2.02	14	101	54	56	6	62	130	130	310	314.49	<5	<5	61	7	9	<5	<5	7
136426	6	#3651	12.5	13.2	1.96	17	104	66	61	24	59	130	180	1190	1233.12	<5	<5	72	8	13	<5	<5	8
136432	6	#3657	7.9	9.4	2.04	32	114	100	91	81	58	140	260	3600	4121.74	<5	<5	95	12	40	<5	<5	<5
136433		#3658	27.2	27.9	2.16	14	101	44	60	<5	62	140	120	120	121.74	<5	<5	46	7	6	<5	<5	<5
136434		#3659	23.6	24.2	2.24	14	101	41	61	7	63	140	110	120	121.74	<5	<5	44	7	5	<5	7	<5
136435		#3660	20.9	21.2	2.23	13	101	49	61	5	62	140	130	120	120.87	<5	<5	54	7	5	<5	<5	<5
136436		#3661	24.5	24.8	2.24	13	101	48	60	<5	63	140	130	99	99.72	<5	<5	54	7	5	<5	<5	<5
136437		#3662	24.3	25.3	2.26	16	103	48	61	<5	62	140	130	120	123.48	<5	<5	52	8	5	<5	<5	<5
136438		#3663	22.7	27.7	2.01	28	112	42	53	<5	58	140	110	100	111.59	<5	<5	44	7	<5	<5	<5	<5
136401		#3664	70.1		2.28	12		<5	60	<5	62	140	<5	6		<5	<5	<5	5	<5	<5	5	<5
136402	System oil	#3665	7.2		3.10	150		<5	5	<5	11	200	6	12		<5	<5	<5	<5	<5	<5	<5	<5

Laboratory

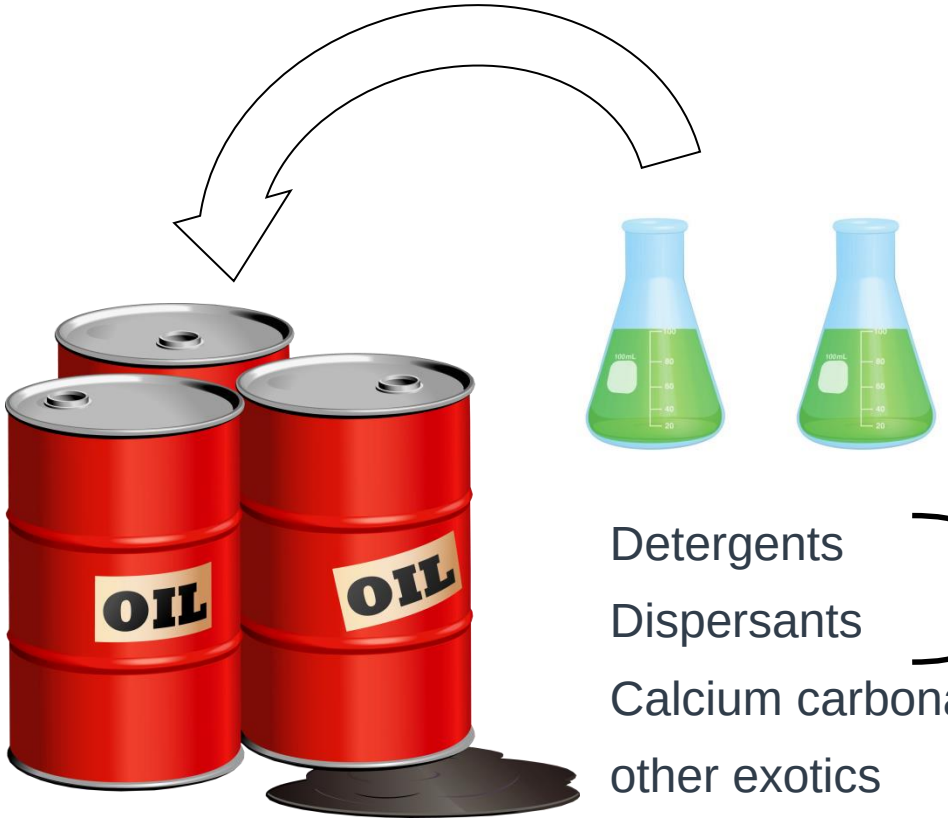


Key elements to look for are

- Fe (iron) (wear)
- BN (mg_{KOH}/g_{oil}) (indicates amount of acid neutralized and oil degradation)
- P (phosphorus) (indicates the level of system oil present)

Fuels influence at Cylinder Oil

What is cylinder oil?



Detergents
Dispersants

} Surface active compounds (surfactants)

Calcium carbonate ($CaCO_3$)

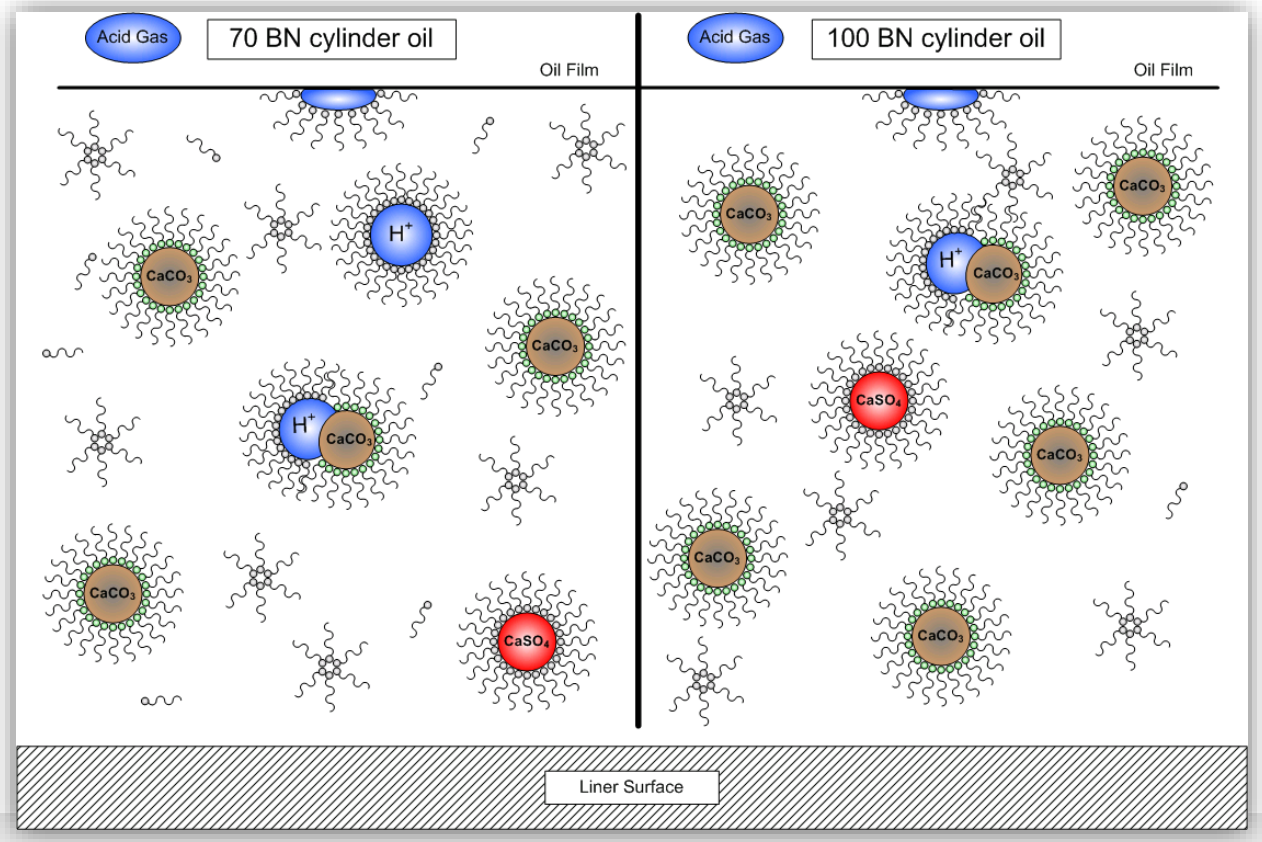
other exotics

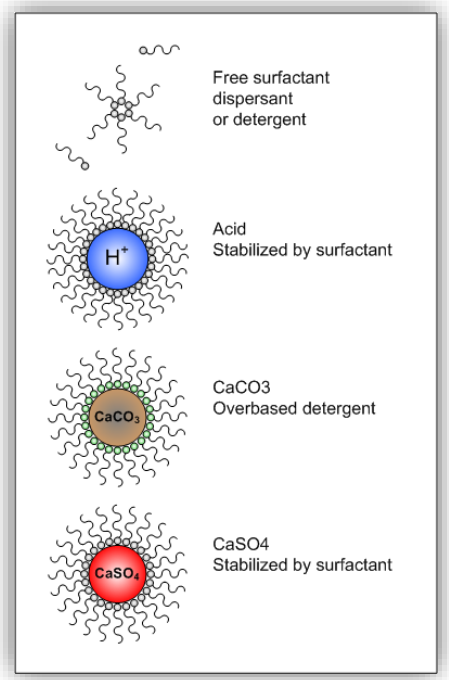
Base oil

Cylinder Oil

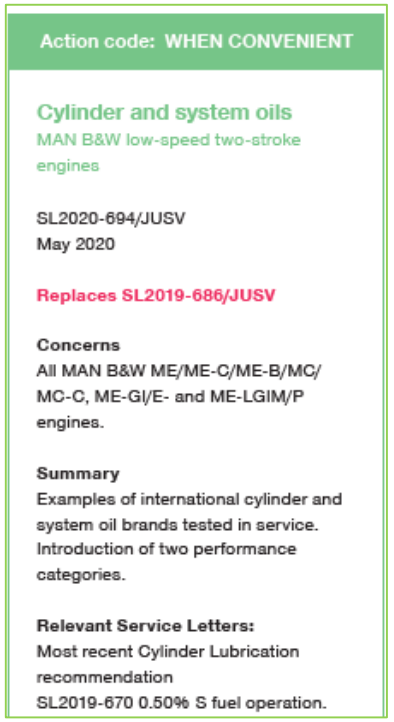
Chemistry and Formulation

BN 100 have 40% more BN,
containing more molecules in the oil film.





2 Cylinder oil - Performance level: Category II



Action code: WHEN CONVENIENT

Cylinder and system oils
MAN B&W low-speed two-stroke engines

SL2020-694/JUSV
May 2020

Replaces SL2019-686/JUSV

Concerns
All MAN B&W ME/ME-C/ME-B/MC/MC-C, ME-GI/E- and ME-LGIM/P engines.

Summary
Examples of international cylinder and system oil brands tested in service. Introduction of two performance categories.

Relevant Service Letters:
Most recent Cylinder Lubrication recommendation
SL2019-670 0.50% S fuel operation.

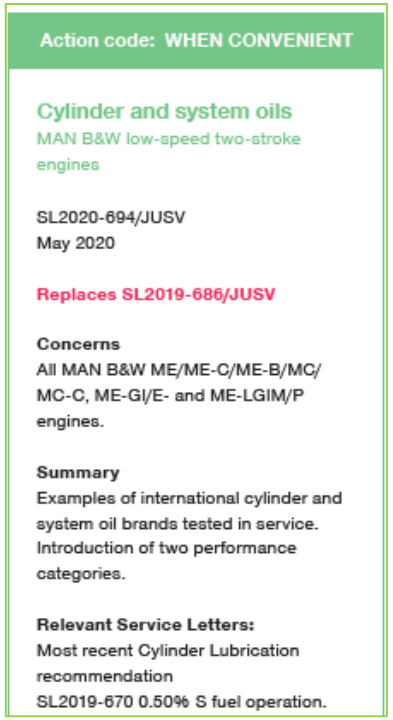
Category II – Cylinder oils for all MAN B&W engines

SL2020-694 Cylinder oil and system oils. Introduction of Cat. I and Cat. II

Category II

- Cat. II cylinder oils have excellent overall performance with a special focus on cleaning ability.
- In order to receive this status, the cylinder oil is tested thoroughly.
- The first cylinder oils to go through the Cat. II process were 100 and 140 BN oils
- The aim is that the other lubricant grades will follow, such as the 40 BN oil.

Cat. II cylinder oils are applicable for ALL engines and recommended for MAN B&W two-stroke engines **Mark 9** and higher.



Action code: WHEN CONVENIENT

Cylinder and system oils
MAN B&W low-speed two-stroke engines

SL2020-694/JUSV
May 2020

Replaces SL2019-686/JUSV

Concerns
All MAN B&W ME/ME-C/ME-B/MC/MC-C, ME-GI/E- and ME-LGIM/P engines.

Summary
Examples of international cylinder and system oil brands tested in service. Introduction of two performance categories.

Relevant Service Letters:
Most recent Cylinder Lubrication recommendation
SL2019-670 0.50% S fuel operation.

Category II – Cylinder oils for all MAN B&W engines

SL2020-694 Cylinder oil and system oils. Introduction of Cat. I and Cat. II

Cat. II cylinder oils are applicable for ALL engines and recommended for MAN B&W two-stroke engines **Mark 9** and higher.

Table 1: Category II cylinder oils*

Company	Category II cylinder oils		
	140 BN	100 BN	40 BN[1]
Castrol	Cyltech 140	Cyltech 100	
Chevron	Taro Ultra 140	Taro Ultra 100	
ExxonMobil	Mobilgard 5145	Mobilgard 5100	
Gulf Oil Marine		Gulfsea Cylcare 50100S	
JXTG Nippon Oil & Energy		Marine C1005	
Lukoil	Navigo 140 MCL	Navigo 100 MCL	
Shell	Shell Alexia 140	Shell Alexia 100	
Sinopec		Sinopec Marine Cylinder Oil 50100	
Total Lubmarine	Talusia HR 140	Talusia Universal 100	

[1] Ask your lube oil supplier whether there is a Cat. II 40 BN available.

* Category II cylinder oils applicable for all engines and recommended for MAN B&W two-stroke engines Mark 9 and higher. Examples of international cylinder oils for which an NOL has been granted Cat. II status by MAN Energy Solutions.

Action code: WHEN CONVENIENT

Cylinder and system oils
MAN B&W low-speed two-stroke engines

SL2020-694/JUSV
May 2020

Replaces SL2019-686/JUSV

Concerns
All MAN B&W ME/ME-C/ME-B/MC/MC-C, ME-GI/E- and ME-LGIM/P engines.

Summary
Examples of international cylinder and system oil brands tested in service. Introduction of two performance categories.

Relevant Service Letters:
Most recent Cylinder Lubrication recommendation
SL2019-670 0.50% S fuel operation.

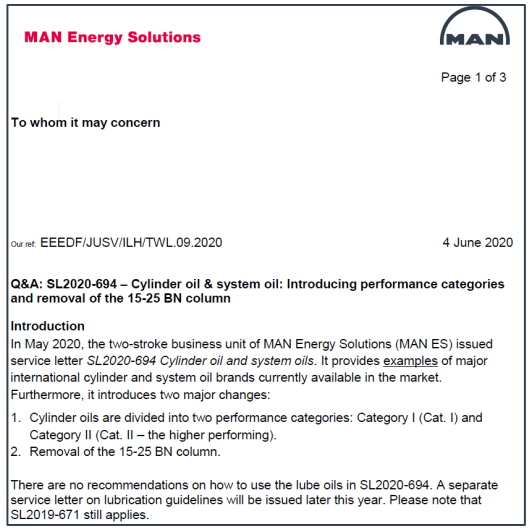
Mark 9, higher & new builds – what cylinder oil to use?

SL2020-694 and SL2019-671

There are no Cat. II 40 BN cylinder oils approved yet (December 2020).

Mark 9 engines and higher & newly built engines:

1. Use a Cat. I 40 BN cylinder oil and Cat. II 100 BN cylinder oil with alternation (if necessary) or
2. with the cylinder oil available as according to the recommendations in SL2019-671.
3. If the cylinder condition is acceptable when using Cat. I 40 BN cylinder oil, there is no need for alternation with category II, 100 BN cylinder oil.
   a) If the cleaning ability <u>is not enough</u> in the Cat. I 40 BN cylinder oil, a Cat. II 100 BN cylinder oil could facilitate the situation.



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Page 1 of 3

To whom it may concern

Our ref: EEEDF/JUSV/ILH/TWL.09.2020 4 June 2020

Q&A: SL2020-694 – Cylinder oil & system oil: Introducing performance categories and removal of the 15-25 BN column

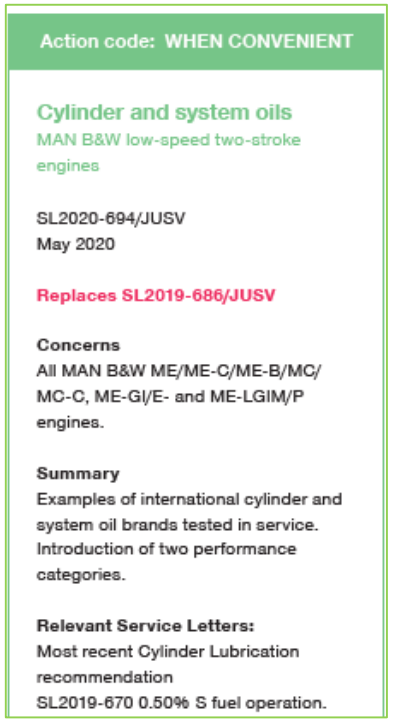
Introduction

In May 2020, the two-stroke business unit of MAN Energy Solutions (MAN ES) issued service letter *SL2020-694 Cylinder oil and system oils*. It provides examples of major international cylinder and system oil brands currently available in the market. Furthermore, it introduces two major changes:

1. Cylinder oils are divided into two performance categories: Category I (Cat. I) and Category II (Cat. II – the higher performing).
2. Removal of the 15-25 BN column.

There are no recommendations on how to use the lube oils in SL2020-694. A separate service letter on lubrication guidelines will be issued later this year. Please note that SL2019-671 still applies.

3 Cylinder oil - Performance level: Category I



Action code: WHEN CONVENIENT

Cylinder and system oils
MAN B&W low-speed two-stroke engines

SL2020-694/JUSV
May 2020

Replaces SL2019-686/JUSV

Concerns
All MAN B&W ME/ME-C/ME-B/MC/MC-C, ME-GI/E- and ME-LGIM/P engines.

Summary
Examples of international cylinder and system oil brands tested in service. Introduction of two performance categories.

Relevant Service Letters:
Most recent Cylinder Lubrication recommendation
SL2019-670 0.50% S fuel operation.

Category I – Cylinder oils for Mark 8 and lower

SL2020-694 Cylinder oil and system oils. Introduction of Cat. I and Cat. II

Category I cylinder oil are applicable for MAN B&W two-stroke engines Mark 8 and lower.

Table 2: Category I cylinder oils**

Company	Cylinder oils			
	140 BN	100 BN	70 BN	40 BN
Castrol	Cyltech 140 *	Cyltech 100 *	Cyltech 70	Cyltech 40SX Cyltech 40
Chevron	Taro Ultra 140 *	Taro Ultra 100 *	Taro Ultra 70	Taro Ultra 40
ExxonMobil	Mobilgard 5145 *	Mobilgard 5100 *	Mobilgard 570	Mobilgard 540
Gulf Oil Marine	Gulfsea cylcare 50140X1	Gulfsea Cylcare 50100S *	Gulfsea Cylcare DCA 5070S	Gulfsea Cylcare DCA 5040S
JXTG Nippon Oil & Energy		Marine C1005 *	Marine C705	Marine 405Z
Lukoil	Navigo 140 MCL *	Navigo 100 MCL *	Navigo 70 MCL AW	Navigo MCL Extra
Shell	Shell Alexia 140 *	Shell Alexia 100 *	Shell Alexia 70	Shell Alexia 40
Sinopec	Sinopec Marine Cylinder Oil 50140	Sinopec Marine Cylinder Oil 50100 *	Sinopec Marine Cylinder Oil 5070S	Sinopec Marine Cylinder Oil 5040
SK Lubricants	SK Supermar Cyl 140	SK Supermar Cyl 100	SK Supermar Cyl 70 Plus	SK Supermar Cyl 40
Total Lubmarine	Talusia HR 140 *	Talusia Universal 100 * Talusia Optima	Talusia HR 70	Talusia LS 40

* Cylinder oils marked with a * have Cat. II status. See Table 1, Category II cylinder oils

** Category I cylinder oils applicable for MAN B&W two-stroke engines Mark 8 and lower. Examples of international cylinder oils with an NOL from MAN Energy Solutions.

Action code: WHEN CONVENIENT

Cylinder and system oils
MAN B&W low-speed two-stroke engines

SL2020-694/JUSV
May 2020

Replaces SL2019-686/JUSV

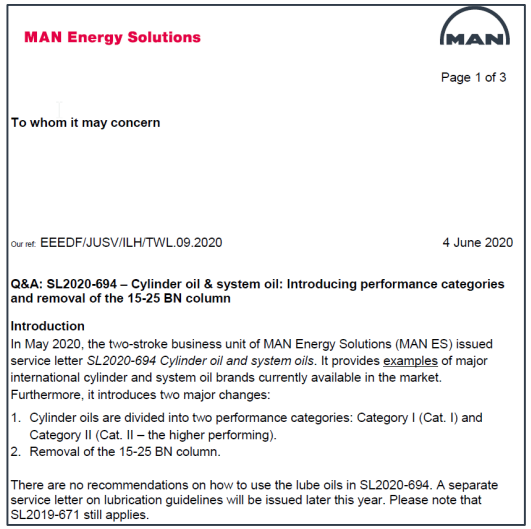
Concerns
All MAN B&W ME/ME-C/ME-B/MC/MC-C, ME-GI/E- and ME-LGIM/P engines.

Summary
Examples of international cylinder and system oil brands tested in service. Introduction of two performance categories.

Relevant Service Letters:
Most recent Cylinder Lubrication recommendation
SL2019-670 0.50% S fuel operation.

0.10% S fuel operation, which cylinder oil to use?

- There are low-BN cylinder oils (15-25 BN) that have a valid NOL.
- These can be used according to SL2019-671.
- Contact the lube oil supplier for NOL status.
- 40 BN cylinder oils are available and will often be used instead of 15-25 BN cylinder oils.
- Monitor the condition and use a cylinder oil with a higher cleaning ability in case of deposits.



MAN Energy Solutions

Page 1 of 3

To whom it may concern

Our ref: EEEDF/JUSV/ILH/TWL.09.2020 4 June 2020

Q&A: SL2020-694 – Cylinder oil & system oil: Introducing performance categories and removal of the 15-25 BN column

Introduction

In May 2020, the two-stroke business unit of MAN Energy Solutions (MAN ES) issued service letter *SL2020-694 Cylinder oil and system oils*. It provides examples of major international cylinder and system oil brands currently available in the market. Furthermore, it introduces two major changes:

1. Cylinder oils are divided into two performance categories: Category I (Cat. I) and Category II (Cat. II – the higher performing).
2. Removal of the 15-25 BN column.

There are no recommendations on how to use the lube oils in SL2020-694. A separate service letter on lubrication guidelines will be issued later this year. Please note that SL2019-671 still applies.

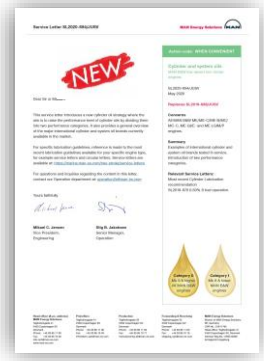
4 Summary – Cylinder oil

2020 Compliant Fuel

Lubrication Strategy

Guideline for SELECTION

SL2020-694/JUSV



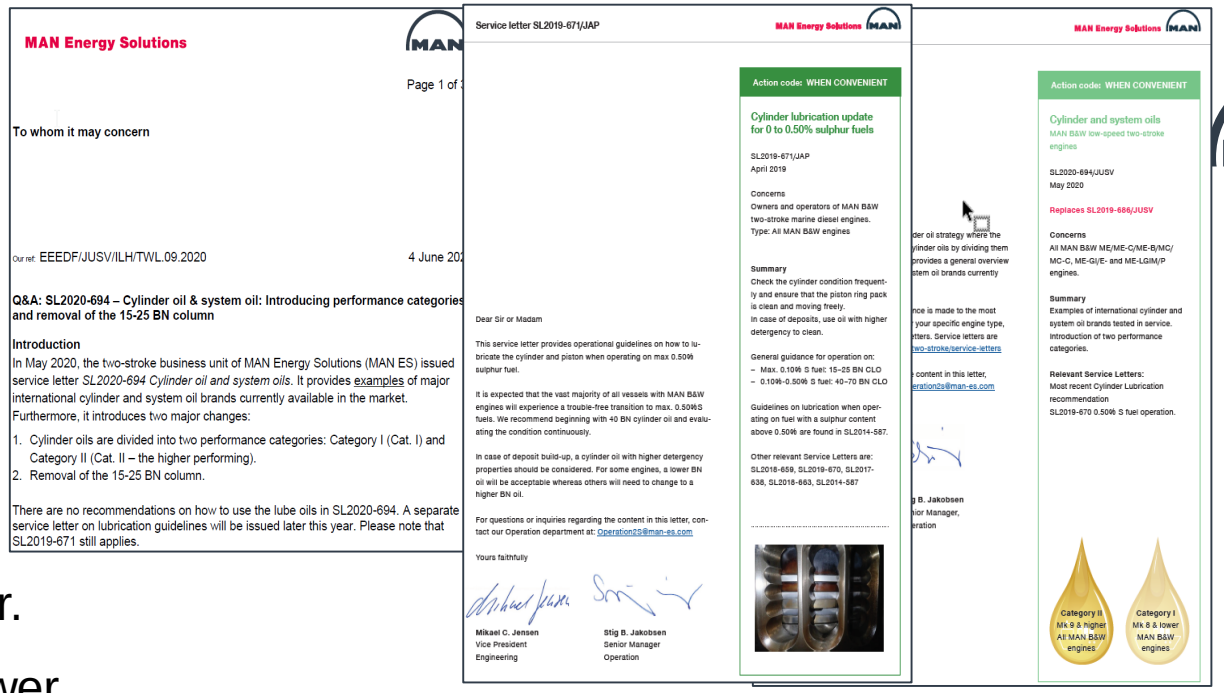
Mk.	VLSFO & ULSFO
Mk. 9 & above	1. BN40 Cat.2 2. BN40 Cat.1 and BN100Cat.2 (alternate IF NEEDED) (Alternation period between BN100Cat.2 and BN40Cat.1 must be evaluated for each engine, based upon inspection)
Mk. 8 & Below	1. BN40 Cat.1 If deposit: 2. as for Mk. 9 above

BN25 Remaining on-board can be used, in case of deposit, use BN100Cat.2 to alternate and keep the engine clean.

Mixing on-board BN25 with BN100Cat.2 is also an option, contact the oil supplier for details.

Summary

- ✓ **SL2020-694**
- ✓ Raise the performance level of cylinder oils.
- ✓ Cat. II - applicable for ALL engines and recommended for engines Mark 9 and higher.
- ✓ Cat. I - applicable for engines Mark 8 and lower.
- ✓ **SL2019-671 is still valid.**
- ✓ Deposit control
- ✓ Monitor cylinder condition
- ✓ Take action if condition deteriorates



MAN Energy Solutions

Page 1 of 2

To whom it may concern

Our ref. EEEDF/JUSV/ILH/TWL.09.2020 4 June 2020

Q&A: SL2020-694 – Cylinder oil & system oil: Introducing performance categories and removal of the 15-25 BN column

Introduction

In May 2020, the two-stroke business unit of MAN Energy Solutions (MAN ES) issued service letter *SL2020-694 Cylinder oil and system oils*. It provides examples of major international cylinder and system oil brands currently available in the market. Furthermore, it introduces two major changes:

1. Cylinder oils are divided into two performance categories: Category I (Cat. I) and Category II (Cat. II – the higher performing).
2. Removal of the 15-25 BN column.

There are no recommendations on how to use the lube oils in SL2020-694. A separate service letter on lubrication guidelines will be issued later this year. Please note that SL2019-671 still applies.

Service letter SL2019-671/JAP

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

Mikael C. Jensen, Vice President Engineering

Stig B. Jakobsen, Senior Manager Operation

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

Action code: WHEN CONVENIENT

Cylinder and system oils
MAN B&W low-speed two-stroke engines

SL2020-694/JUSV
May 2020

Replaces SL2019-686/JUSV

Concerns
All MAN B&W ME/ME-C/ME-B/MC/MC-C, ME-GI/E- and ME-LGIM/P engines.

Summary
Examples of international cylinder and system oil brands tested in service. Introduction of two performance categories.

Relevant Service Letters:
Most recent Cylinder Lubrication recommendation
SL2019-670 0.50% S fuel operation.

Category II
Mk 9 & higher
All MAN B&W engines

Category I
Mk 8 & lower
MAN B&W engines

Monitor & Act

5 Fuels 2020 – Feedback

0.50% S VLSFO – First feedback from the field

List of observations - PRELIMINARY

Generally, the service experience is good

Our recommendations can be found in: MUN2019-09-11 + SL2019-685 + etc…

Sporadic cases of scuffing and high wear

- **Cat fines** – from cleaning of the tanks
- **No cermet on the piston rings**
- **Lubrication feed rate too low**
- **High wear due to cold corrosion**

Fuel system

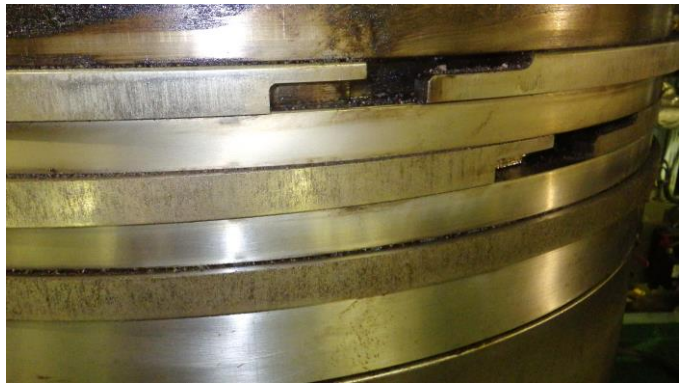
– Stuck high pressure fuel pumps

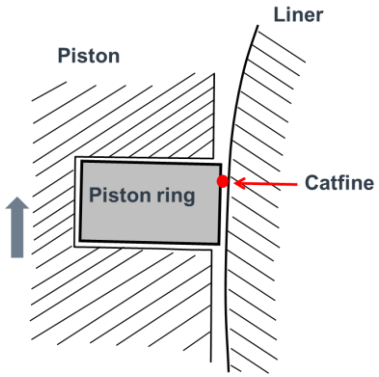
– Gasification of low viscosity fuel

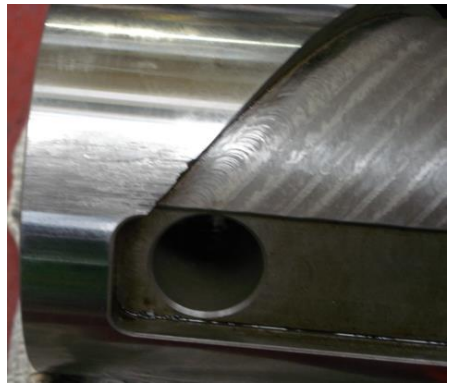
Cold flow properties of the fuel

– Temperature control

Incompatibility between fuels







Cleaning of fuel: Remove cat fines

SL2017-638

0.50% S VLSFO	Kin. Viscosity at 50°C, cSt
Fuel 1	45
Fuel 2	360
Fuel 3	7.4
Fuel 4	215
Fuel 5	60

Fuel type		Fuel temperature in the separator
Distillates		40-50°C
ULSFO	Viscosity @ 50 C	
	Up to 20 cSt	50°C
	20-40 cSt	60°C
	40-50 cSt	70°C
	50-80 cSt	80°C
	>80 cSt	98°C
HFO		98°C or higher

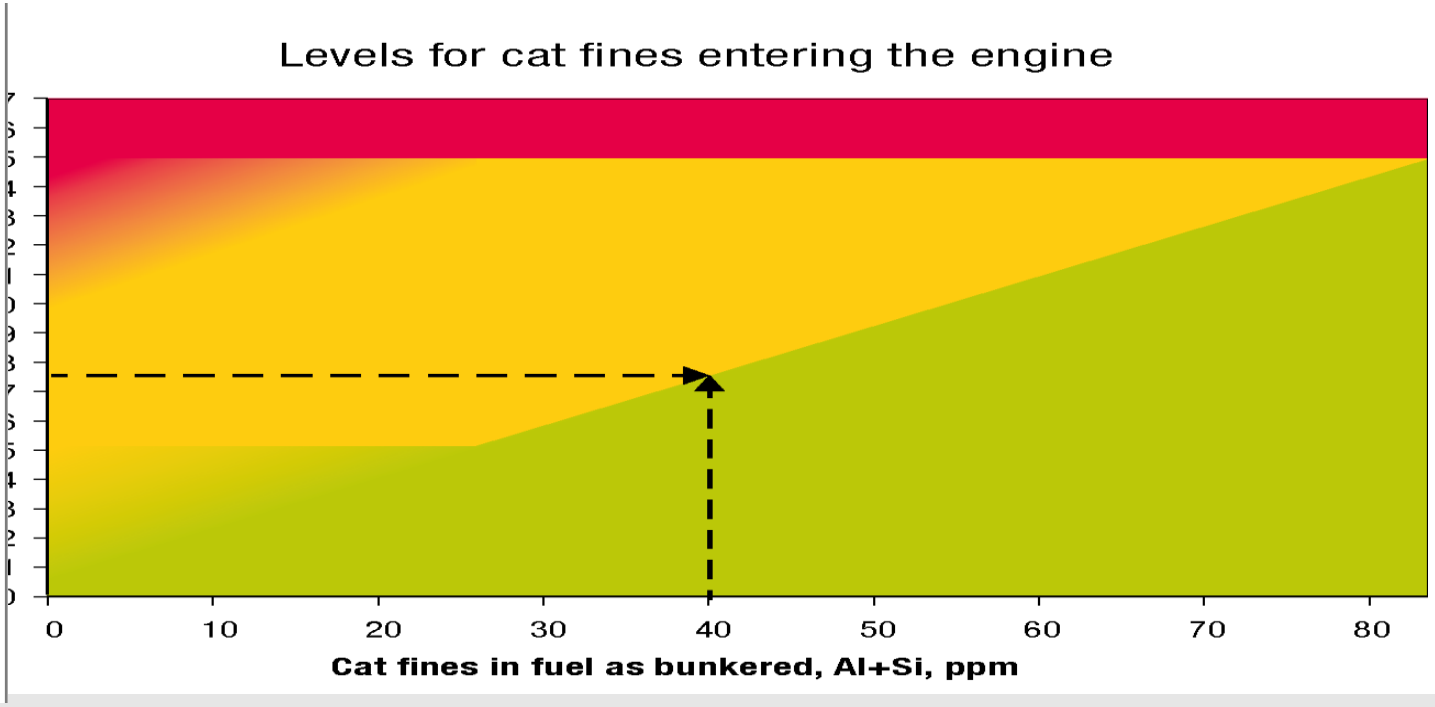
Table 5 Recommended fuel cleaning temperature in the separator. [7]

Maximum Limit for Cat Fines in the Fuel Entering the Engine

Cases have shown that even very small amounts of cat fines can be detrimental to the engine. So all measures must be taken to reduce the risk of introducing cat fines into the engine. Consequently, we specify keeping as low a cat fine level as possible before the engine inlet. A maximum level of 15 ppm is acceptable for a short period of time, but the normal level must be kept lower, see Fig. 3.

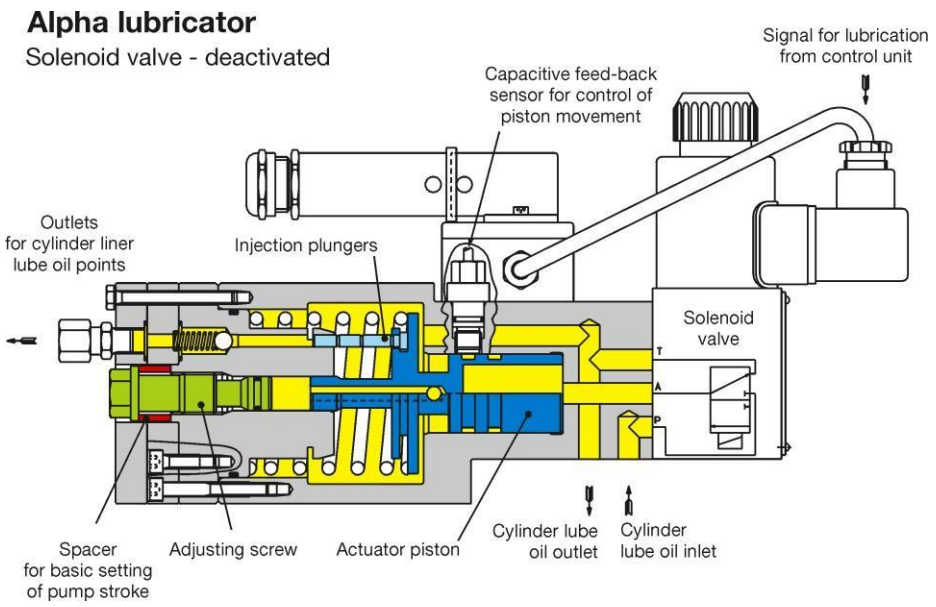
The Al and Si content should be measured according to ISO 8217: IP 501, IP 470 or ISO 10478.

Cat fines in the fuel as bunkered are specified with between 0-80 ppm Al + Si in ISO 8217-2005 and 0-60 ppm in newer versions of ISO 8217. Tests have shown that the lower the cat fines content, the lower the wear in the combustion chamber.



2020 Fuel switch

Lubricators, Underlubrication



Lubricator efficiency

New lubricators have a volumetric efficiency of between 90 to 100%

In the control system the efficiency is expected to be 97%, but as for all pumps wear may cause the efficiency to be reduced,

An actual reduction of volumetric efficiency from 97% to 80% means that the actual feed rate at a setting of 0.6 g/kWh in reality on is 0.49 g/kWh

Caustion must be taken that the lubricators are performing as expected

SL2019-681 *state that lubricators must be checked for every 32.000 RH (5 year renewal)*

And that liner Non Return valves must be checked for every 3000 RH

2020 Fuel switch

2020 Fuel switch

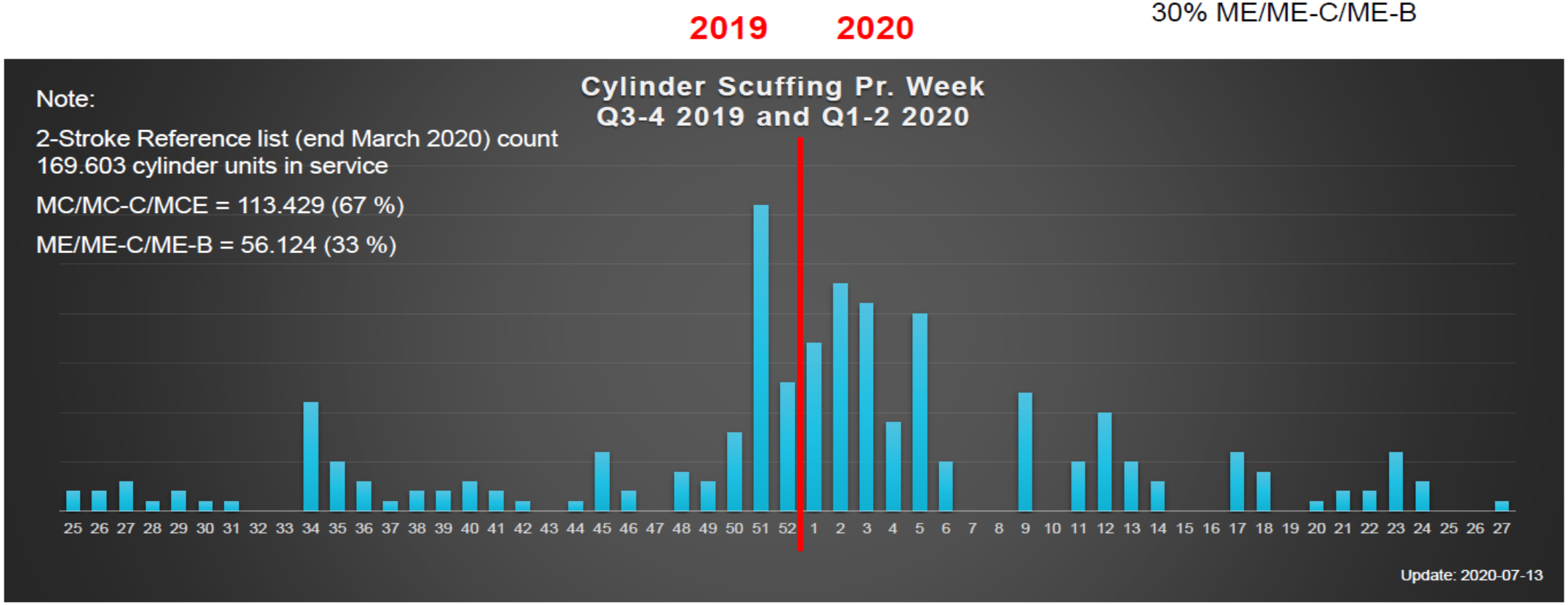
HFO to VLSFO

The cases we have seen are both ME/ME-C/ME-B and MC/MC-C

From what we can estimate it is

70% MC/MC-C and

30% ME/ME-C/ME-B



0.50% S VLSFO – Cat fines (Al+Si)

LR FOBAS data

Fuel data

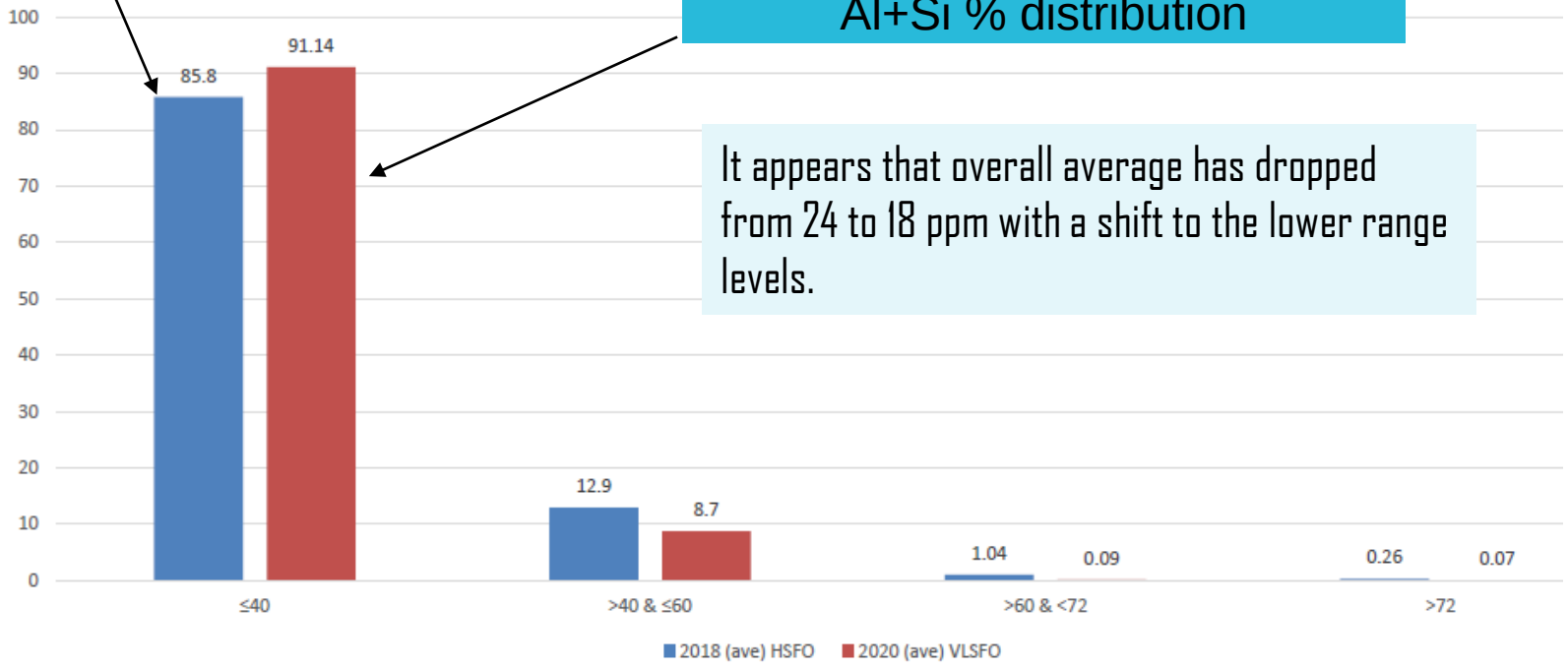
2018 (6 months average) –

High Sulphur HFO

Al+Si % distribution

2020 (6 months average) - VLSFO

Al+Si % distribution



It appears that overall average has dropped from 24 to 18 ppm with a shift to the lower range levels.

Fuel cleaning is still relevant!

Manage the settings on the separator to get optimum cleaning.

Service letters:

2019-674; 2017-638

Ref. Lloyd's Register FOBAS. VLSFO quality update. September 2020

0.50% S VLSFO – First feedback from the field

List of observations - PRELIMINARY

Sporadic cases of scuffing and high wear

No cermet on the piston rings. (Refer to SL2019-685)

- Cermet coating must be measured and the wear must be recorded.
- Once 100 µm is reached, the rings should be replaced.

Cermet-coating thickness action table

Above 100 µm	No action
100-50 µm	Plan the overhaul of the piston ring pack
50-20 µm	Overhaul at first opportunity

Service Letter SL2019-685/KAMO

MAN Energy Solutions

SL2019-685

Action code: WHEN CONVENIENT

Condition-based overhaul
Cermet-coated piston rings

SL2019-685/KAMO
November 2019

Concerns
Owners and operators of MAN B&W two-stroke marine diesel engines.
Type: All MAN B&W engines fitted with cermet-coated piston rings.

Summary
The overhaul criteria for cermet-coated piston rings are defined, and guidance on how to estimate the remaining lifetime of a cermet-coated piston ring is given based on the remaining coating thickness and wear rate.

Other relevant Service Letters are:
SL2018-659/JAP
SL2019-671/JAP
SL2019-681/SRJ

Dear Sir or Madam

This Service Letter defines the overhaul criteria for cermet-coated piston rings, and it provides guidance on how to estimate the remaining lifetime of a cermet-coated piston ring based on the remaining coating thickness.

Cermet-coated piston rings were introduced as a scuffing preventive countermeasure. The cermet-coated piston rings are now standard on most large-bore engines and are recommended for all engines operating on 0.5% S fuel or lower, as described in Service Letter SL2018-659/JAP.

The overhaul criteria in this Service Letter apply to all engines fitted with cermet-coated piston rings.

Yours faithfully

Mikael C Jensen
Vice President, Engineering

Stig B Jakobsen
Senior Manager, Operation

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Amtsgericht Augsburg

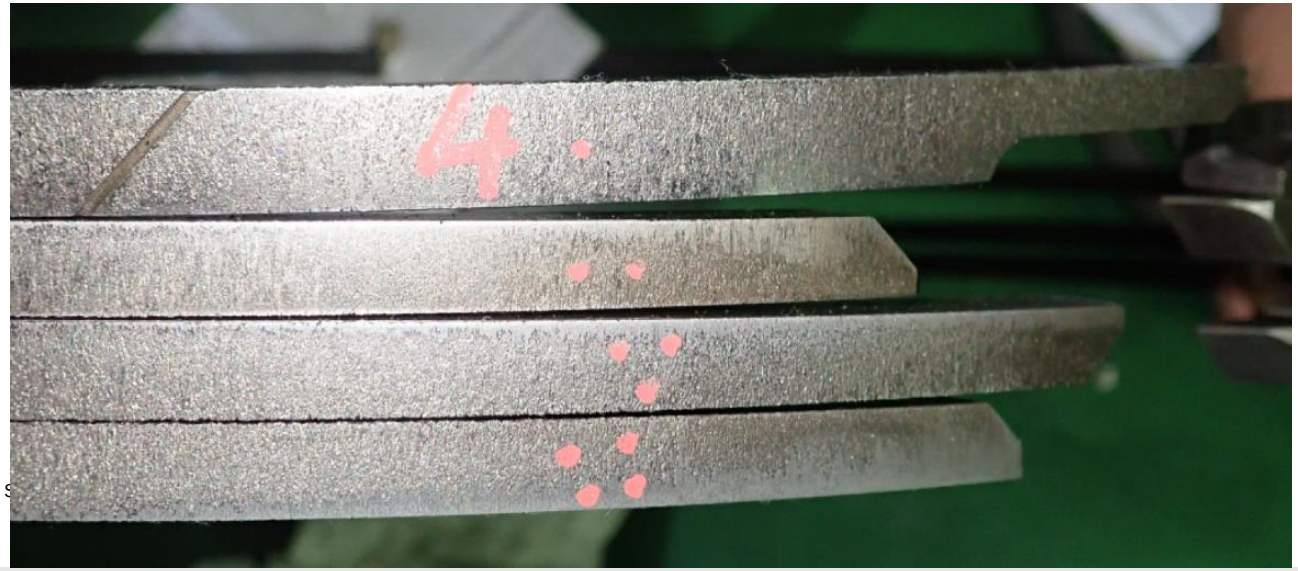
0.50% S VLSFO – First feedback from the field

List of observations - PRELIMINARY

Sporadic cases of scuffing and high wear

No cermet on the piston rings. (Refer to SL2019-685 and SL2018-659)

- Cermet coating is recommended on all piston rings for operation on low-S fuel.
- Contact between liner surface to cast iron piston ring is more sensitive to seizure and scuffing than liner to cermet.
- **New SL2020-698 CRP piston 3-ring pack!** Cermet coated rings available for retrofit on engines designed with one high, three low rings.

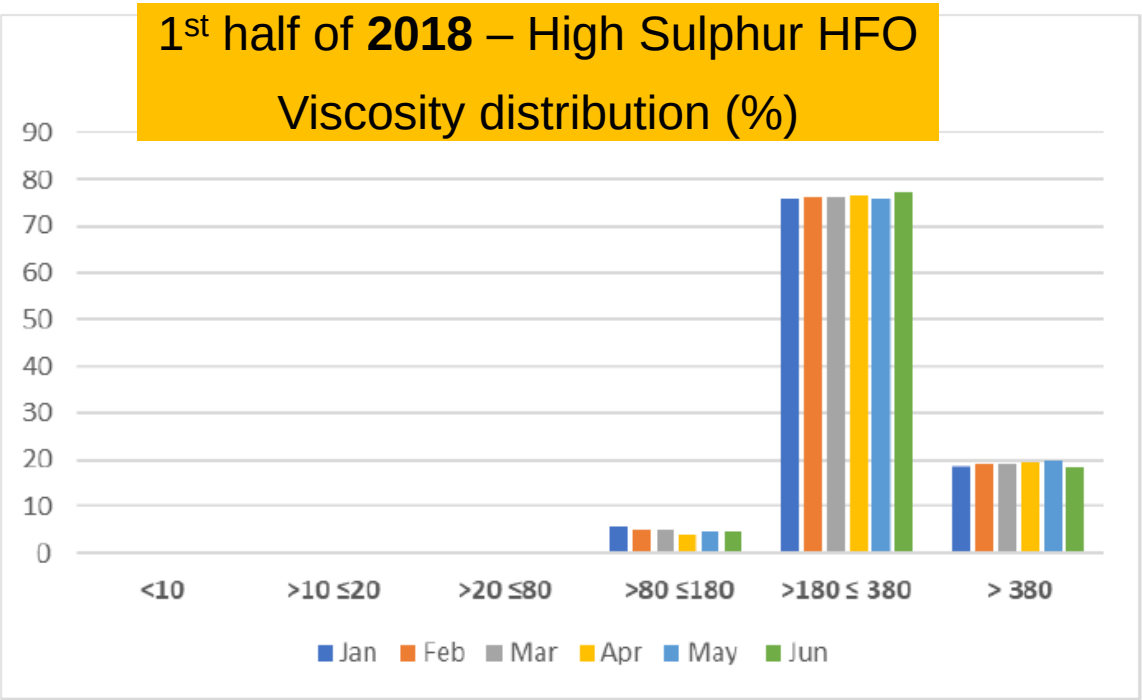


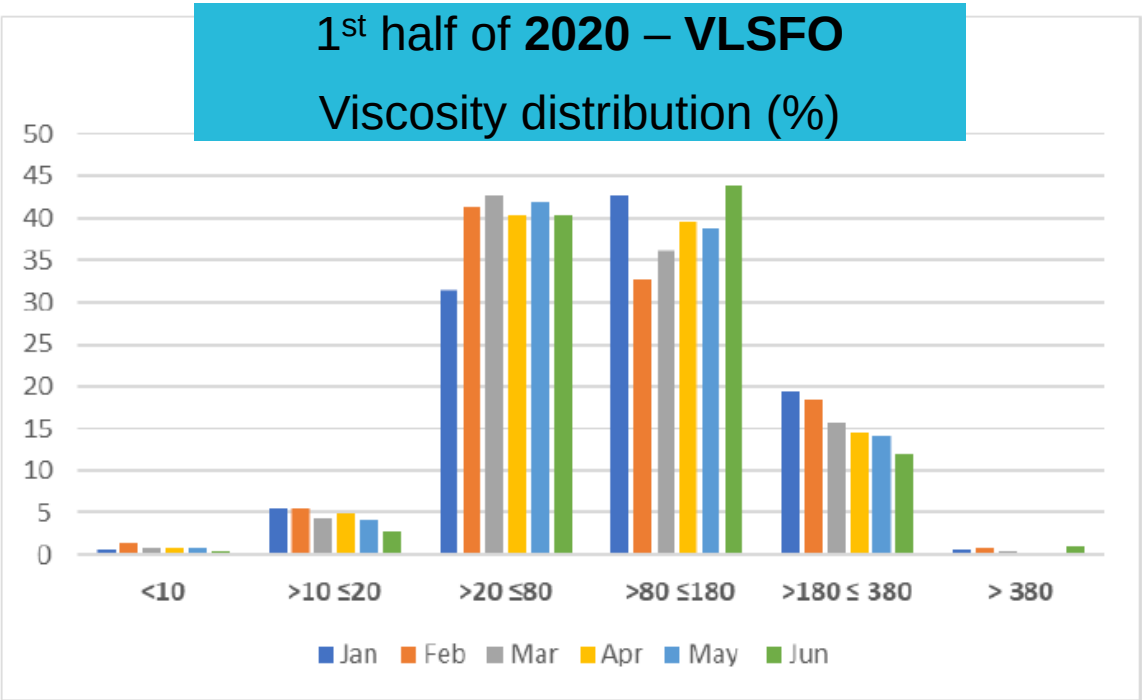
0.50% S VLSFO – Viscosity

LR FOBAS data

Fuel data

➢ The viscosity of the fuel is low.





VLSFO in 2020

- 75% of samples have a viscosity between 20-180 cSt at 50°C.
- **YES!** The Viscosity is lower than it was 2018.

Advise when placing an order

- Specify a minimum viscosity.
- Specify whether DM or RM is desired.

Ref. Lloyd's Register FOBAS. VLSFO quality update. September 2020

0.50% S VLSFO – First feedback from the fie

Compatibility and stability - **SLUDGE**

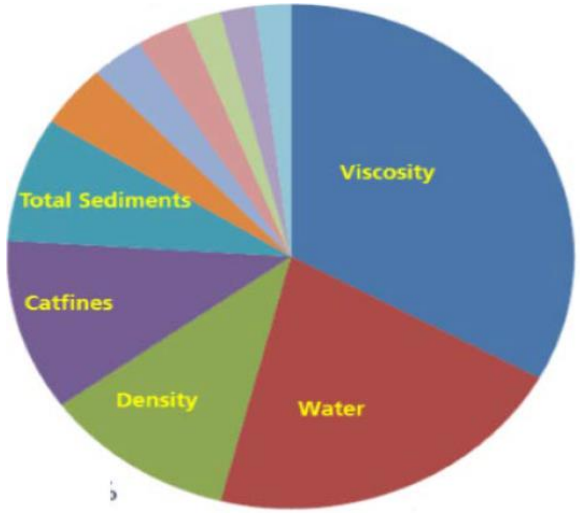
Data

List of observations - PRELIMINARY

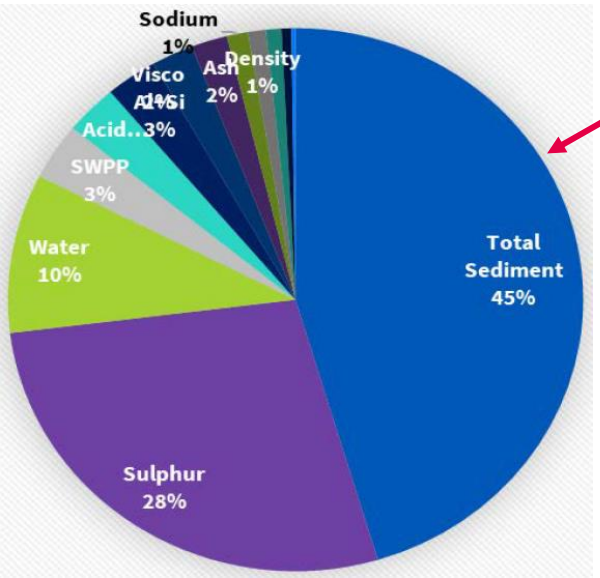
Stability and Compatibility issues

- Fuel sludging in storage and treatment main issues with VLSFO according to LR FOBAS.
- Data suggests a rise in higher TSP (tendency to deposit sludge) results in 2020 compared to 2018.
- Indicates that blenders have not yet fully mastered the art of stabilizing these more paraffinic fuels.

Pre-2020 RM fuels – Off-spec parameters



1st half of **2020** RM fuels – Off-spec parameters



Total Sediment Potential (TSP)

Ref. Lloyd's Register FOBAS. VLSFO quality update. September 2020

0.50% S VLSFO – First feedback from the field

List of observations - PRELIMINARY

➢ Compatibility and stability

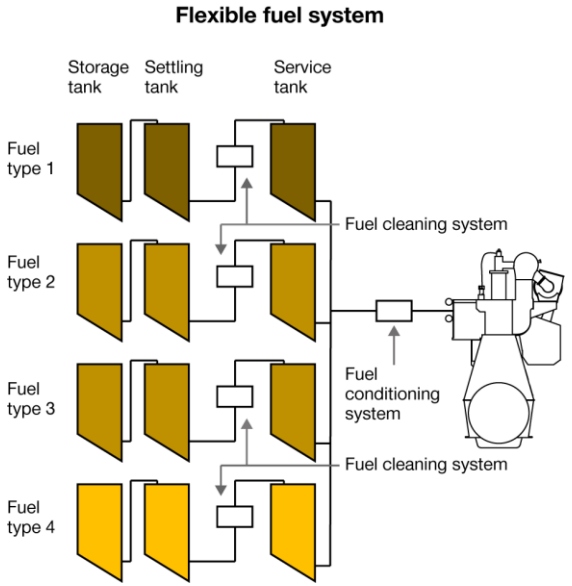
Stability and Compatibility issues

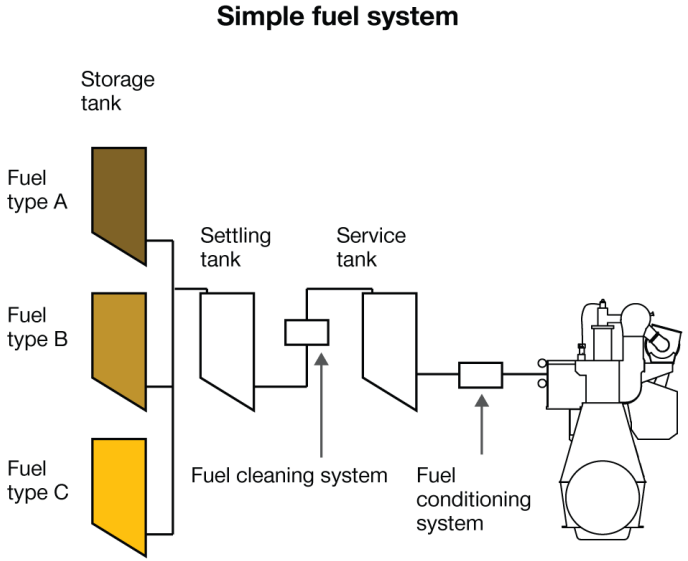
- Compatibility issues and instability have been reported.
- Generally, the situation has been under control.
- Different fuels – different tanks! Fuel management.
- Load it – use it!
- Fuel supplier should be informed if severe sluding occur.

Recommendations:
Refer to MUN2019-09-11 and Detailed paper.

16. Fuel stability and fuel incompatibility

17. Tank management





0.50% S VLSFO – First feedback from the field

What can be done to cope with the fuel variations (if any)?

- MAN B&W engines are reliable and robust.
- Well maintained engine, fuel pumps and fuel system
- Well established procedures
- Cermet coated piston rings (preferably)
- Healthy cylinder condition
  - Liners, piston, and rings in good condition
  - Lubrication
- **Use the auto-tuning features available** on the engine or
  - Available as Retrofit opportunity

MAN Energy Solutions expects that fuels having characteristics within the ISO 8217 standard are well-suited for MAN B&W two-stroke engines.

6 Summary – Fuels 2020

0.50% S VLSFO – First feedback from the field

Summary

Generally, the service experience is good

Sporadic cases of scuffing and high wear

- **Cat fines** – from cleaning of the tanks
- **No cermet on the piston rings**
- **Lubrication feed rate too low**
- **High wear due to cold corrosion**

Fuel system

– Stuck high pressure fuel pumps

– Gasification of low viscosity fuel

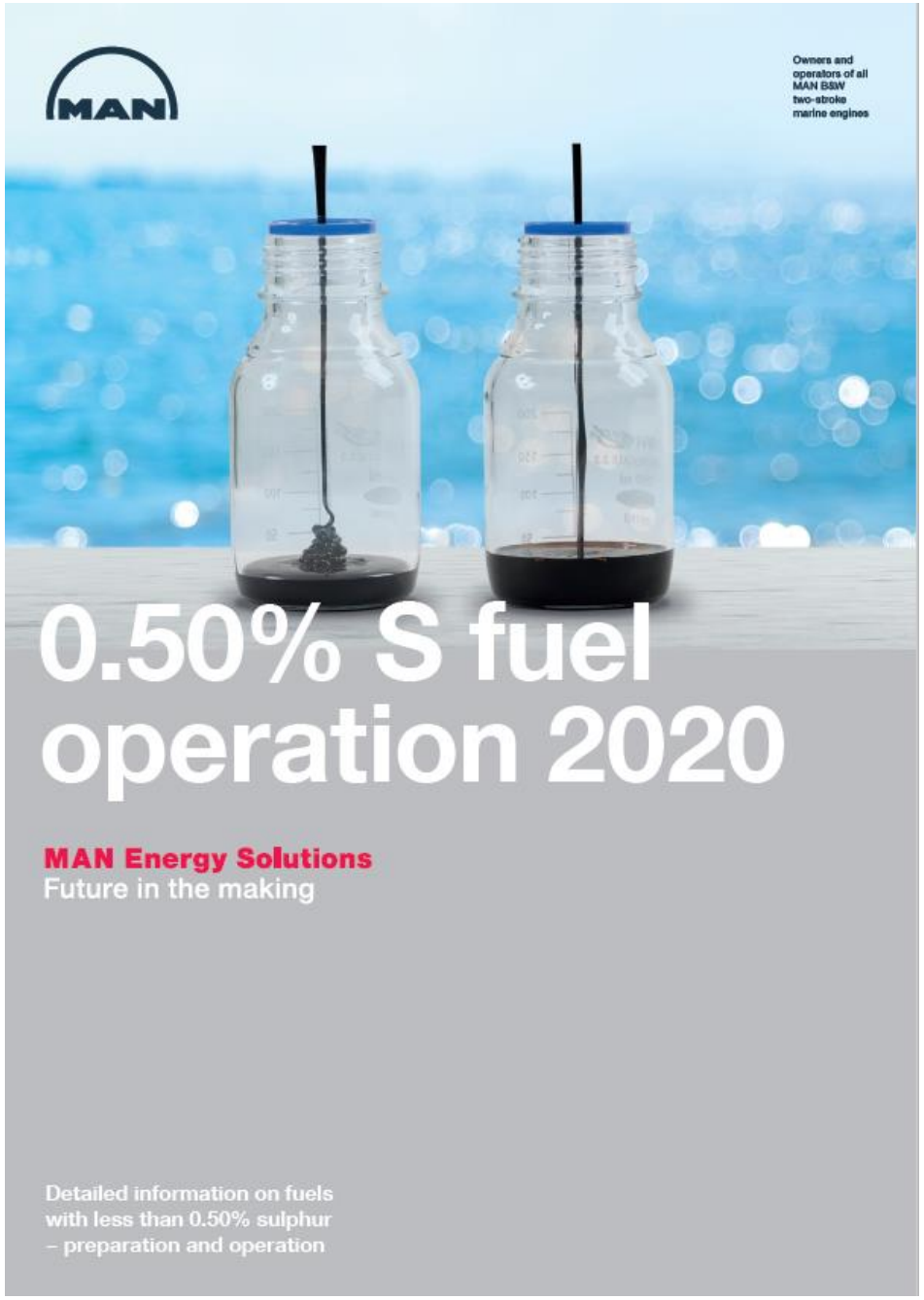
Cold flow properties of the fuel

– Temperature control

Incompatibility between fuels

Remember

- Know what is bunkered.
- Check the parameters of the fuel and act upon the results, e.g. fuel temperature adjustments, viscosity.
- Avoid mixing different fuel batches.
- Fuel cleaning – Remove cat fines.
- Cermet coated rings.
- **If scuffing –**
  - ✓ **Exchange the rings.**
  - ✓ **Exchange or machine the liner.**



Market Update Note

11 September 2019

0.50% S fuel operation 2020

Important service letters and papers on MAN B&W two-stroke engines

Do you have questions about 0.50% sulphur (S) operation? Or do you consider retrofitting a scrubber? MAN Energy Solutions has issued information and recommendations relevant to 0.50% S operation and how to prepare for IMO's global 0.50% sulphur limit. Click on the links below and check it out!

Main 2020-information on 0.50% S fuel operation
The service letter and paper listed below provide information and guidance on 0.50% S fuel operation and how to prepare for the change from operation on high-sulphur fuel to 0.50% S fuel. Attention is drawn to specific fuels properties that should be in focus and how 0.50% S fuels affect the equipment on board. Expectations for the new types of fuels are given, and information on fuel testing, biofuels, and fuels that are not fit for purpose is also included.

- SL2019-670 – Operation on fuels with max 0.50% S
- Paper: 0.50% S fuel operation 2020 – detailed information on fuels with less than 0.50% sulphur – preparation and operation

Cylinder lubrication
The cylinder lubrication recommendation has undergone extensive revision. The three most important factors are: 1. cleanliness in the piston ring pack; 2. feed rate and 3. close monitoring of the cylinder condition and appropriate action.

- SL2019-671 – Cylinder lubrication update for 0 to 0.50% sulphur fuels
- SL2014-587 – Cylinder lubrication update (for vessels with scrubbers and for running-in)

Piston rings
Cermet-coated rings are recommended for VLSFO operation. Cermet coating increases the margin against damage to rings and liners and increases the reliability of the main engine.

- SL2018-659 – Cermet coated piston rings for operation on low-sulphur fuels (0.50% S or lower)

Fuel cleaning
Fuel cleaning and removing cat fines (Al+Si) are and will still be very important.

- SL2019-674 – Fuel tank cleaning
- SL2017-638 – Cleaning of heavy fuel oil and maximum 0.10% S fuels – How to remove cat fines
- Paper: Cat fines – impact on engine wear and how to reduce wear

Scrubbers
MAN PrimeServ offers a SO_x scrubber retrofit package with recommendations on the turbocharger re-matching parts.

- SL2018-665 – SO_x scrubber retrofit on two-stroke engines in service

Link to Service Letters (SL):

- https://marine.man-es.com/two-stroke/service-letters

Link to Technical Papers:

- https://marine.man-es.com/two-stroke/technical-papers

Communication on 0.50% S fuels and related

Paper: 0.50% S fuel operation 2020. https://marine.man-es.com/two-stroke/technical-papers

Detailed information on preparation and operation on fuels with maximum 0.50% Sulphur

Service Letters: https://marine.man-es.com/two-stroke/service-letters

- **SL2020-698 – CPR piston ring pack – three ring configuration**
- **SL2020-694 – Cylinder oil and System oils. Introduction of Cat. I and Cat. II.**
- SL2020-692 - LDCL cooling system update
- SL2019-687 - Liner jacket cooling water system update
- **SL2019-685 – Condition-based overhaul. Cermet coated piston rings**
- SL2019-684 – Piston cleaning ring. Update of instruction for cleaning ring replacement. At First Opportunity!
- SL2019-674 - Fuel tank cleaning. Supplement to SL2019-670
- SL2019-671 - Cylinder lubrication update for 0 to 0.50% Sulphur fuels
- **SL2019-670 – Operation on fuels with max 0.50% S**
- SL2018-659 - Cermet coated piston rings for operation on low sulphur fuels (0.50% S or lower)
- SL2017-638 - Cleaning of Heavy Fuel Oil and Maximum 0.10% S Fuels - How to remove cat fines
- SL2014-587 - Cylinder Lubrication Update. For vessel with scrubbers. Always check for the newest!

MAN Energy Solutions Papers: https://marine.man-es.com/two-stroke/technical-papers

Cat fines. Impact on engine wear and how to reduce wear. https://marine.man-es.com/marketing-publications/catfines-paper

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MAN Energy Solutions
Future in the making

Thank you very much!

2020