



Action code: **WHEN CONVENIENT**

Hard-Coated Piston Rings for Operation on Ultra-Low Sulphur Fuel

Including gas and liquefied gas

SL2016-633/JAP
November 2016

Concerns

Owners and operators of MAN B&W two-stroke marine diesel engines. Type: MC/MC-C, ME/ME-C and ME-B

Summary

New cermet hard-coated piston rings for continued operation on ultra-low sulphur fuel including gas and liquefied gas.

Reference is made to: SL12-562/JAP, SL2014-593/DOJA and SL2016-611/JAP.

Dear Sirs

Since 1 January 2015, the specified fuel sulphur limit in SECAs (sulphur emission controlled areas) has been 0.1% sulphur or lower. The owners of engines operated on ultra-low sulphur fuel (ULSF) (0.1% sulphur or lower) face certain challenges with scuffing between the cylinder liner and piston rings.

Operation on gas or liquefied gas containing no sulphur gives challenges similar to those faced when operating on ULSF in a SECA. Prolonged operation on ULSF may lead to bore polished liner surfaces and increases the risk of liner surface smearing with a subsequent risk of liner scuffing as the consequence.

To increase the margin against damage to the piston rings and cylinder liners, which will lead to overhaul of the engine on short notice, we have introduced a piston ring configuration that incorporates cermet hard-coating on the running side of all the piston rings.

Cermet hard-coating on the piston ring running surface increases the reliability of the main engine. In many cases, the cermet-coated rings continue to perform after an episode with seizures, provided the seizures are stopped. This ensures that the engine can continue in normal operation until the next planned overhaul.

Additionally, special attention should be paid to ensure a proper running-in of new rings in liners suffering from polishing. Wave-cut grinding or honing may be needed in such cases.

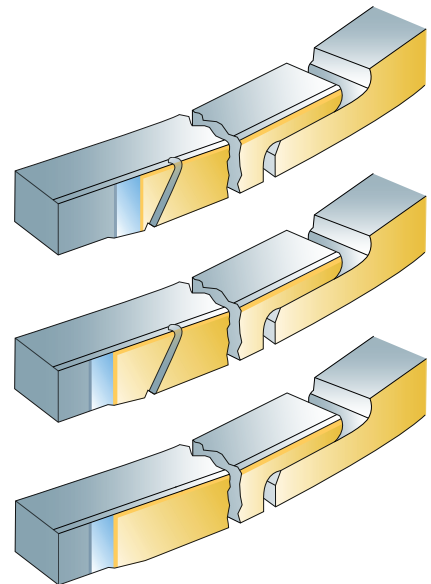
Yours faithfully


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Operation on ULSF increases the risk of bore polishing of the liner surface and may lead to smearing of the liner.

Under normal conditions, when operating on fuel containing sulphur, the sulphuric acid formed during the combustion process will ensure a controlled amount of corrosion. This corrosion causes the liner surface to sustain adequate level of wear that ensures a high number of open graphite lamellas in the cast iron matrix.

When operating on ULSF the level of corrosion is very low and the liner wear is negligible in most cases. Over time, this will lead to polishing and, possibly, smearing of the surface. When the liner surface is smeared, the open graphite lamellas are closed making it difficult to keep a proper oil film.

When the oil film is compromised, the cast iron piston rings, which are in contact with the cast iron liner, may generate high friction and seizures that will not recover (liner scuffing). During scuffing, the surface of the liner is hardened and will need machining to recover before new rings can be run in.

Cermet is a composite, part-ceramic, part-metal material. It combines the best properties of a ceramic, i.e. high temperature-resistance and hardness, with those of a metal, for example the ability to undergo plastic deformation.

When applying cermet hard-coating to the piston ring running side, see Figs. 1 and 2, an incident with contact between piston rings and liner surface will not lead to irrecoverable seizures. The cermet rings will generate high friction and heat, but the risk of seizures is reduced. Furthermore, the cermet will recover after the incident, provided the situation is timely discovered and action is taken to ensure that it stops (increased lubrication and reduced load). However, the liner will need machining at the next overhaul to ensure proper running-in of the new rings.

Please note that for 50 bore engines and smaller, the cermet CPR top rings will be of the CPR-CL not the CPR-POP type. For more information on the CPR-POP type please see SL12-562/JAP.

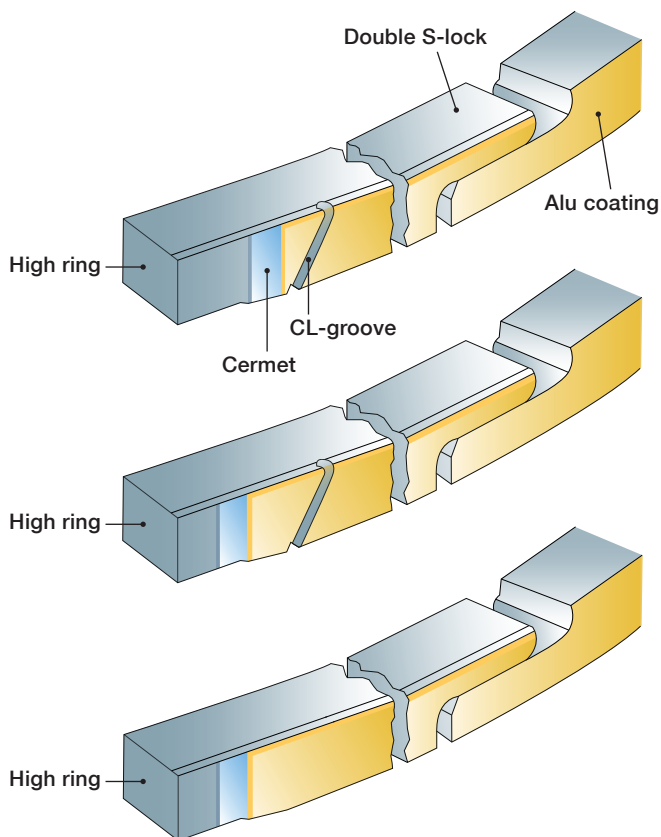


Fig. 1: The CPR ring pack containing 3 high rings with cermet-coating on all rings for 70 bore and above (SL2016-611/JAP).

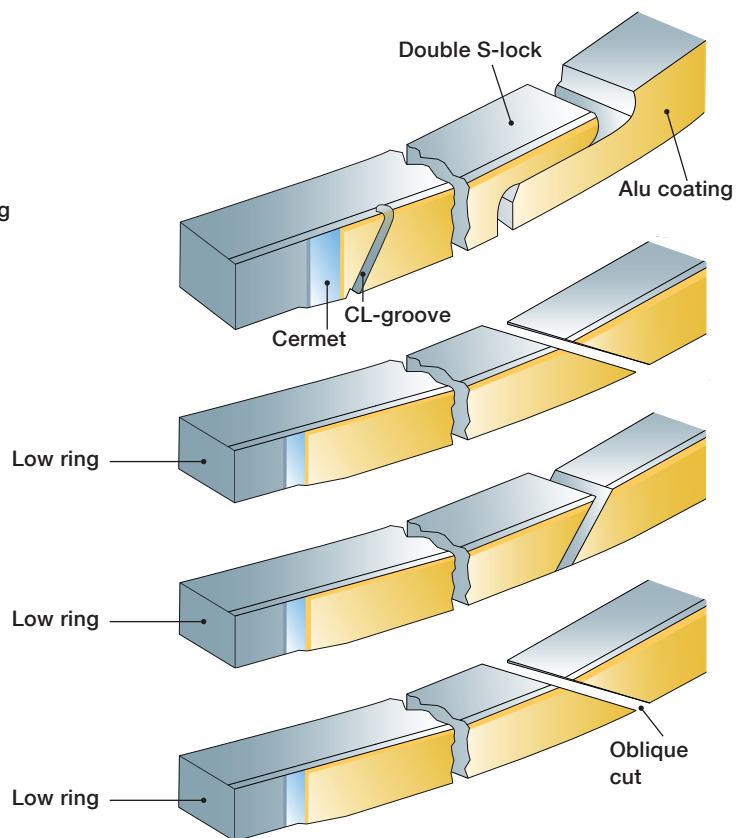


Fig. 2: The CPR ring pack containing 1 high ring and 3 low rings with cermet-coating on all rings.

NEW ENGINES with continued service in a SECA or running on gas/liquefied gas

New engines still retain the original wave-cut machining marks on the liner surface. The wave-cut retains oil and provides a reliable operation of the engine on ULSF. The liner wear on clean ULSF is very low, but the wave-cut marks will maintain safe operation for a long time. However, if the wave-cut marks are worn away the liner surface may become polished.

At the first scheduled overhaul, it is recommended to install cermet-coated rings to raise the safety margin against liner seizures.

Machining of the liner surface may be needed to open up the surface and facilitate easy running-in of the new piston rings. If the wave-cut surface has been worn away, it can be re-freshened by wave-cut grinding, see Fig. 3.

OLD ENGINES with continued service in SECA or running on gas/liquefied gas

Older engines, which have been operating on HFO, have normally lost the wave-cut marks in the top of the liner. In addition, prolonged operation in SECA before 1 January 2015 on 1% sulphur may also have led to some degree of polishing, depending on feed rate and type of cylinder lube oil.

We recommend installing cermet-coated piston rings at the first opportunity and to wave-cut grind the liners to re-freshen the liner surface.

Vessels trading in and out of SECA or gas/liquefied gas engines using HFO containing sulphur for pilot fuel

Vessels trading predominantly outside SECAs, and thus burning HFO containing sulphur, do not face a great risk of suffering polishing of the liner surface, if our guidelines for lubrication are followed.

However, it is very important to keep a correct level of lubrication and not to overdose, both when operating on high-sulphur fuels as well as on ULSF. Lubrication according to the adaptive cylinder-oil control (ACC) factor (feed rate factor) is recommended. Otherwise, polishing and smearing of the liner surface may occur and, thereby, increase the risk for seizures.

Conditioning the liner surface

When overhauling after prolonged operation on ULSF, the liner surface may not be in an adequate condition to facilitate the running-in of new piston rings as is the case when operating on high-sulphur fuels. It may therefore be necessary to wave-cut grind the liner surface if the machining marks have been worn away. This is done to ensure that the liner surface

is able to facilitate running-in of the new rings.

Honing is an alternative to wave-cut grinding. We recommend that qualified workshops are used if honing is chosen, and that honing with diamond stones is followed by honing with grinding stones. According to instructions from the honing machine maker, at least 0.1 to 0.2 mm to the diameter should be removed to ensure that the damaged surface is removed. In case of liner scuffing, at least 0.5 to 1 mm (to the diameter) should be removed to condition the liner. The finished surface roughness after honing must not exceed Ra 1.6.

Choice of cylinder oil and piston cleaning (PC) ring

The deposits that build up on the piston crown have a big influence on liner polishing and smearing. Most engines built after year 2000 have PC rings installed in the top of the liner to scrape away excessive deposits which build up on the piston crown top-land. PC rings are recommended for engines operating in a SECA and can be retrofitted on most older engines.

It is also important to choose the right cylinder oil. Operating for longer periods on high-BN and low-sulphur fuel, or with a high feed rate, may lead to a build-up of deposits and/or liner polishing. We recommend using a low-BN cylinder oil when operating on ULSF, see the current guideline on lubrication and SL2014-593.



Fig. 3: *Cylinder with wave-cut pattern*

Group recess system (GRS) - alternative liner machining

As an addition to wave-cut grinding, a special kind of machining can be applied where pockets are ground into the surface to secure retention of oil even if the wave cut is worn away. The machining provides a pattern with pockets that are deeper than those obtained from wave cut grinding and, therefore, will last even if there is wear on the liner surface, see Fig. 4.

This type of machining may be a benefit for engines operating in and out of SECAs as well as for engines operated on ULS hybrid fuels. These may contain cat fines and, therefore, be the source of wear that will remove the wave-cut pattern.

Currently, this machining can only be applied as a retrofit to existing liners, and it cannot be ordered for new liners unless they are brought for machining before delivery to the vessel.

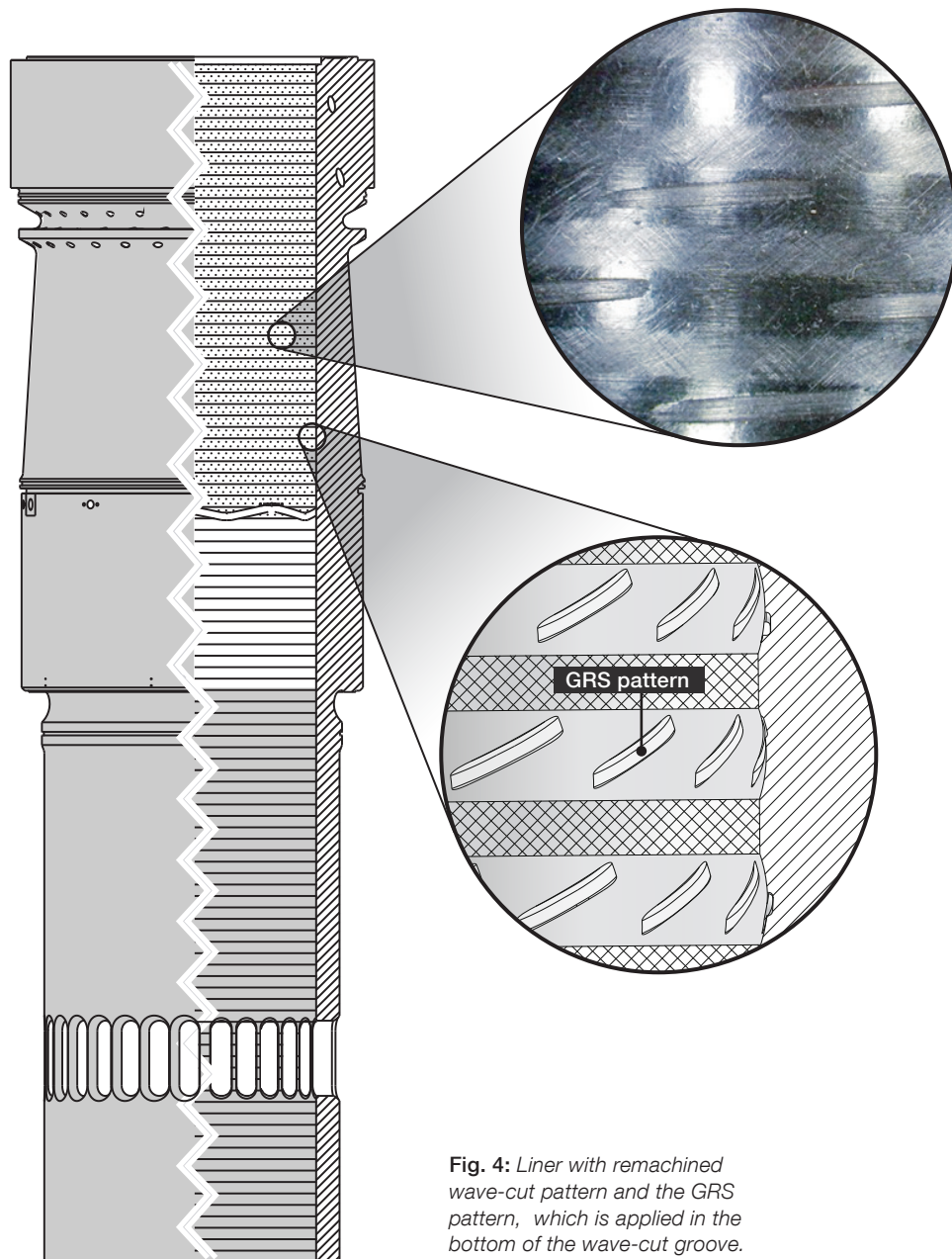
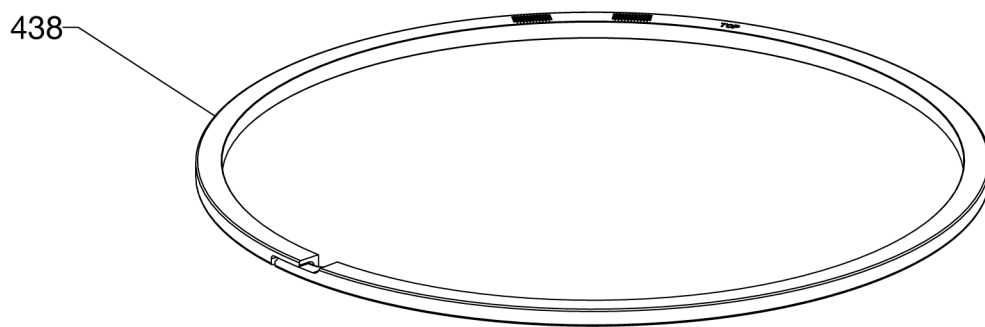
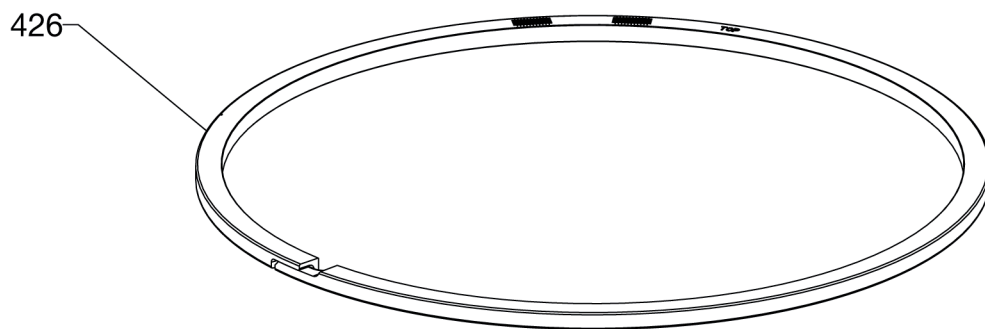
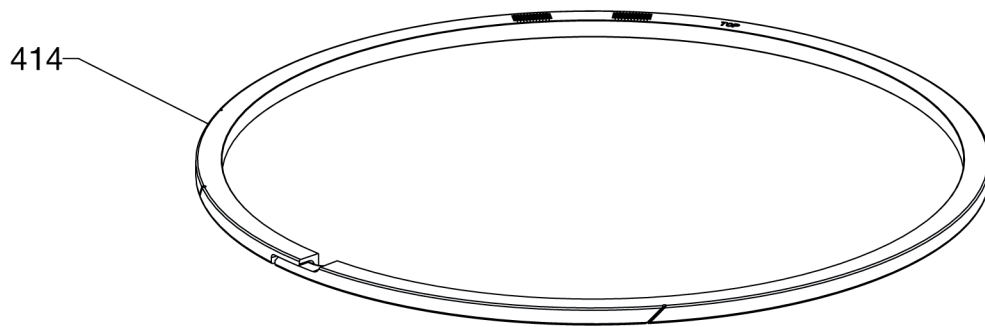


Fig. 4: Liner with remachined wave-cut pattern and the GRS pattern, which is applied in the bottom of the wave-cut groove.

Operation on Ultra Low Sulphur Fuel

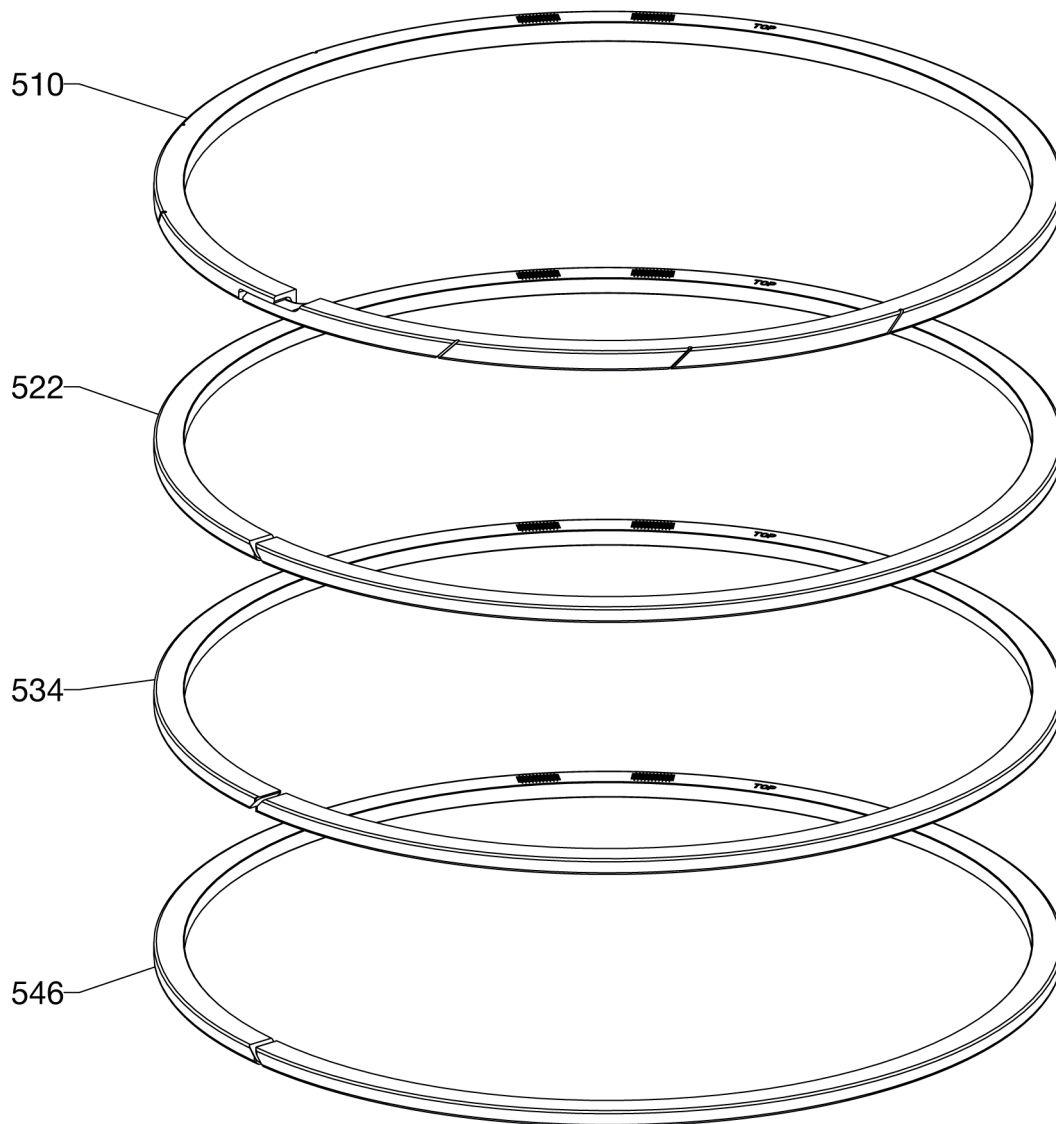


Item No.	Qty	Item Designation
414	-	Piston ring, cermet type ¹⁾
426	-	Piston ring, cermet type ¹⁾
438	-	Piston ring, cermet type ¹⁾

Note:

¹⁾ When ordering, please state IMO no., engine type and height of each ring.

Operation on Ultra Low Sulphur Fuel



Item No.	Qty	Item Designation
510	-	Piston ring, cermet type ¹⁾
522	-	Piston ring, cermet type ¹⁾
534	-	Piston ring, cermet type ¹⁾
546	-	Piston ring, cermet type ¹⁾

Note:

¹⁾ When ordering, please state IMO no., engine type and height of each ring.