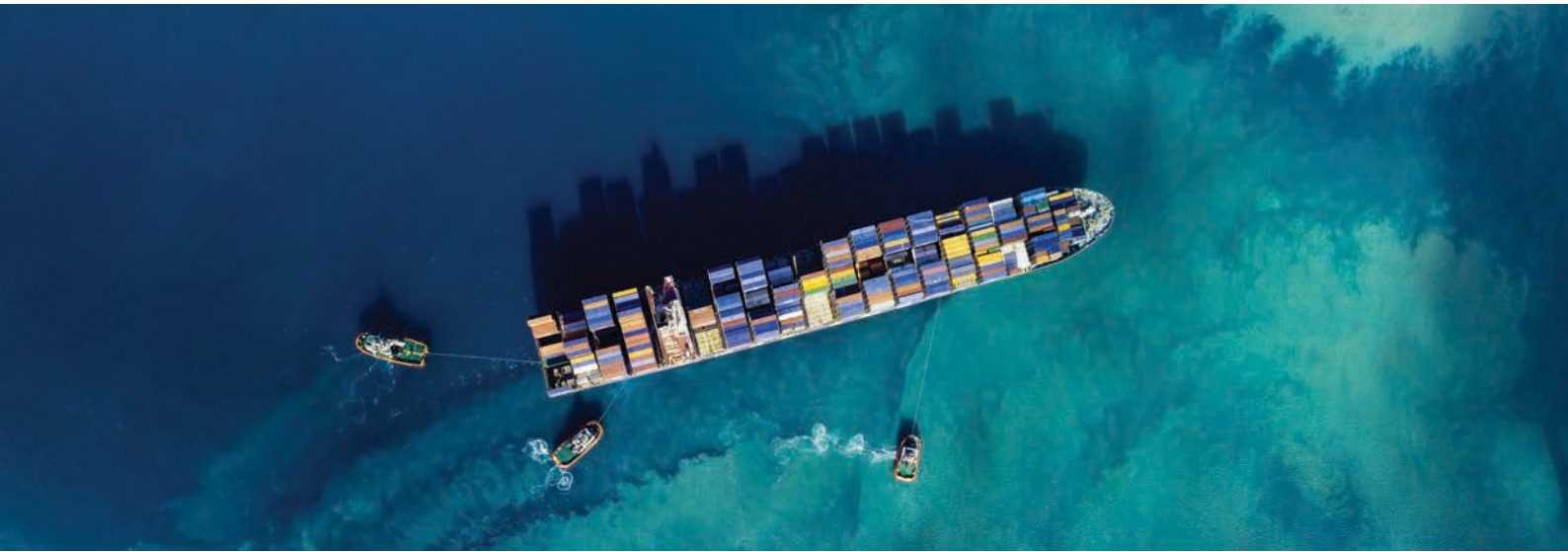




marine lubricants

the 2020 global sulphur cap and the role of cylinder oil lubricants



The impending onset of the Global Sulphur Cap 2020 is catalysing a monumental shift in the types of fuel being bunkered by the international shipping fleet away from predominantly heavy sulphur fuel oil (HSFO) to a wider variety of fuel options.

With an entry into force date of January 1, 2020, stricter fuel sulphur content restrictions imposed on the global fleet has put the industry on the verge of what will be the most significant period of change in the past decades. Under the new rules, ships must burn fuels with a sulphur content of no more than 0.50% m/m or a maximum equivalent emission output. This is a significant drop from the current limit of 3.50% which has been in effect since January 1, 2012.

Owners and operators must switch their vessels to use lower sulphur fuels or alternatives to meet the IMO legislation. Those wishing to continue to use HSFO must equip their vessels with emissions abatement technology that 'scrubs' the sulphur from exhaust gas to achieve an equivalent method of compliance to those burning a compliant low sulphur fuel. <0.5% low sulphur fuel oil (LSFO) is expected to be the predominant compliance option to meet IMO legislation requirements post-2020.

Regardless of the compliance route chosen, bunkering low sulphur fuel alternatives—versus installation of scrubbers on board—impacts cylinder oil lubricant use. The use of one type of fuel oil by the majority of the global fleet accompanied by one type of lubricant will soon become a thing of the past. In the post-2020 industry, the role of the cylinder oil lubricant will become ever more crucial in protecting the engine.

Ian Thurloway, Brand and Marketing Manager for Chevron Marine Lubricants, says: "We expect the implementation of IMO 2020 legislation to result in the use of a wider range of marine fuels, from distillates and low sulphur residual fuels, to new blends and other innovations appearing on the market. It's widely expected that well over 90% of vessels in the global fleet will switch to using compliant fuels, with the remaining percentage continuing to burn HSFO with scrubber technology installed on board."



New fuels, new challenges

HSFO has been the go-to fuel for ocean-going ships since the conversion of the fleet from coal to oil in the early 20th century. However, the entry into force of MARPOL Annex VI in 2005 marked the beginning of a sea-change in the traditional, HSFO-favoured fuel landscape, initially sparked by the enforcement of a global sulphur cap of 4.50% m/m, later lowered to 3.50% in 2012.

The establishment of Emission Control Areas (ECAs) pushed owners and operators sailing ships in these designated zones towards using fuels with a lower sulphur content due to the stricter limits on permissible sulphur content being enforced.

The first ECA was created in Europe in 2005, requiring all ships sailing in the Baltic Sea area and the North Sea area to use fuels with a maximum sulphur content of 1.50% m/m. In 2011, this cap on sulphur was further reduced to 1.00% m/m and in 2012 a new ECA in North America was established. Since 2015, ships sailing in ECAs have faced the strictest fuel sulphur contents cap of 0.10%.

China has governed its own equivalent of an ECA since April 2016 wherein ships berthing at a total of 11 regional ports must use fuel with a maximum sulphur content of 0.50%. Since July 1, 2015, Hong Kong has enforced a requirement for all vessels to switch to fuel not exceeding 0.50% sulphur content while at berth. The port of Sydney, Australia has also imposed a 0.10% fuel sulphur content limit for cruise ships berthing at the port since October 2015.

Therefore, a great number of vessels navigating within areas hosting existing sulphur content restrictions are well versed in the practice of switching from a high sulphur fuel oil to a low sulphur fuel oil or alternatives, and mastering the associated cylinder oil lubrication requirements.

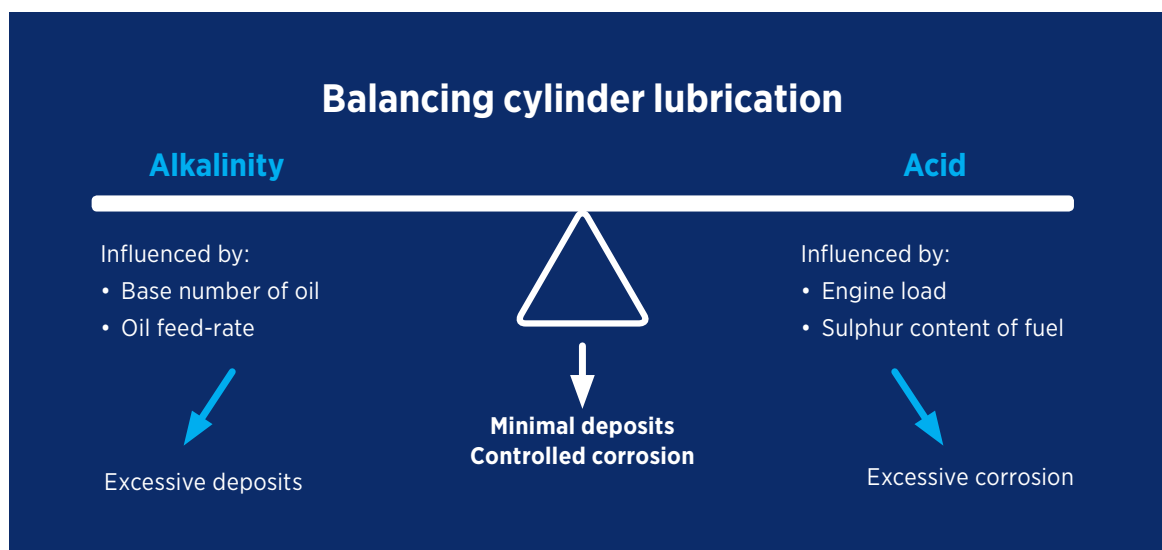
However, for the rest of the global fleet the arrival of the Global Sulphur Cap will still create seismic change, and the adoption of either compliance option will result in momentous changes being undertaken by the owner or operator.

Sulphur emissions and 2020 are only part of the story. The IMO is also looking at ways to further reduce ship emissions, including greenhouse gases (GHGs). New international regulations set by the IMO to reduce CO₂ emissions require a reduction in the total annual GHG emissions produced by shipping by at least 50% by 2050 compared to 2008, while, at the same time, pursuing efforts towards phasing them out entirely. This will promote the use of fuel alternatives to oil-based bunkers, and ultra-low sulphur and CO₂ emission fuel types such as methanol, liquefied natural gas (LNG), liquefied petroleum gas (LPG), and ethane will become increasingly attractive options for compliance.

The role of lubricants in a sulphur-constrained industry

Lubrication is the lifeblood of an engine, the dominant function of cylinder oil being to protect the engine from acidic corrosion. This is achieved by balancing the alkalinity of the cylinder oil, defined by its base number (BN) and its feed rate. Sulphur-containing fuel oils produce oxides of sulphur (SO_x) during combustion. In the presence of water, SO_x forms sulphuric acid which causes a corrosive environment in the engine. Therefore, the differing sulphur content in fuels is what governs the varying levels of acidity and risk of corrosion in the engine cylinder.

The role of a cylinder oil's BN is pivotal in controlling the acidic/alkalinity balance in the engine cylinder. Too little alkalinity can put an engine at risk from cold corrosion, whereas too much alkalinity can result in the formation of excessive abrasive deposits on the piston crown top lands, ultimately leading to increased liner wear and scuffing. It is crucial to maintain the correct sulphur/BN balance by using cylinder oil with an appropriate BN, by adjusting the cylinder oil feed rate, or a combination of the two (see illustration on page 3).



Using alternative fuel types to HSFO has a direct impact on engine lubrication and cylinder lubrication, as the BN of the lubricant must be matched to the sulphur content of the fuel and operating conditions within the engine.

“Under the rules of the Global Sulphur Cap, fuels with <0.50% sulphur content will drive demand towards lower BN cylinder oils, whereas use of HSFO with sulphur content potentially higher than 3.50%, coupled with the use of scrubber technology, will drive the demand for higher BN cylinder oils,” says Luc Verbeeke, Senior Engineer, Chevron Marine Lubricants.

2020: are you ready?

The post-2020 fuel landscape poses different challenges for cylinder oil lubricant use to those previously faced by equipment manufacturers (OEMs).

Previously the use of cylinder oils based on a 70BN chemistry have been favoured. However, changes in engine machinery, operational profiles and the types of fuel used have posed greater corrosive risk in the engine cylinders in the past decade.

The operational profiles of engines have changed over the past 10–15 years from vessels running at high speed, high load to running at low speed, low load. Feed rates have reduced, and lubrications system have become more efficient. This has created a significant impact on optimal cylinder oil use and in some cases with lower liner surface temperatures, allowing cold corrosion to form. More recently, 100–140 BN cylinder oils have been needed to protect newer engines against cold corrosion under part-load conditions for those burning higher sulphur fuels.

“The BN level of the lubricant must be matched, and the correct feed rate applied to meet the fuel sulphur level content. As a general rule, the lower the fuels sulphur content, the lower the BN level required.

“Moving away from the use of a 70 BN lubricant to other cylinder lubricant BN levels could be perceived as challenging, akin to making the change to using a different type of fuel. However, in reality, this isn’t the case when handled correctly,” says Luc Verbeeke.

When changing over to a different cylinder oil product, the existing cylinder oil lubricant stock on board should be reduced as much as possible, allowing the empty tank to be re-filled with the new cylinder oil product matched to the compliant fuel of choice. However, if this is not possible, you can blend down to next level of BN by combining the existing cylinder oil with a lower BN cylinder oil product. Mixing two-cylinder oil products together and conducting monitoring via used oil analysis will help ensure the BN level remains optimal.

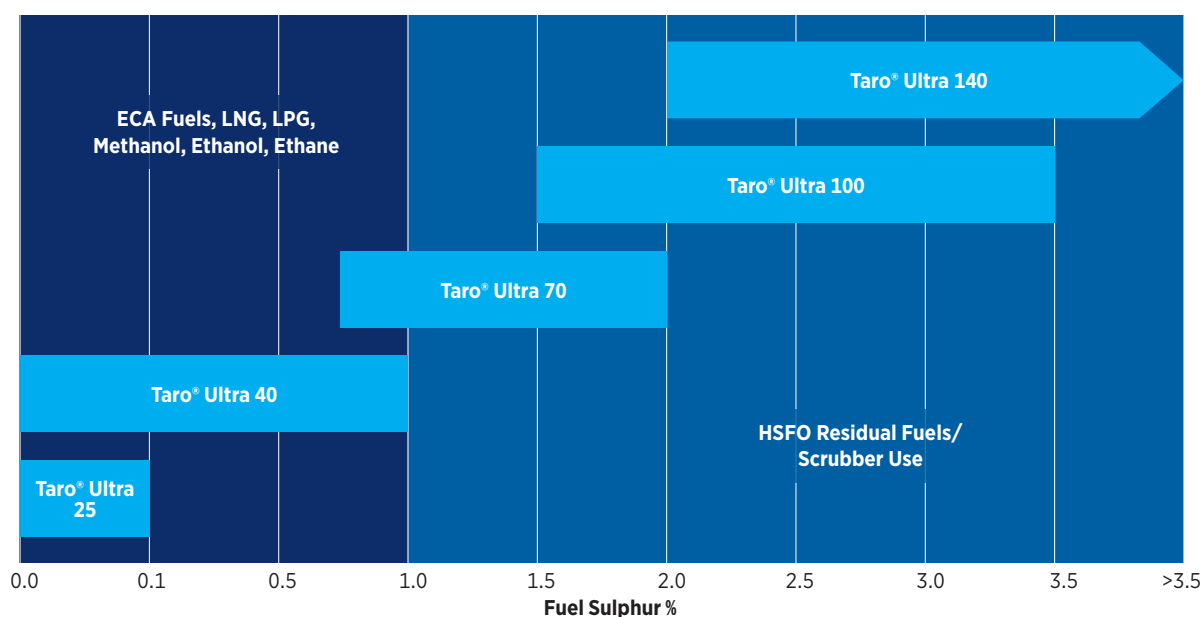


Once the Global Sulphur Cap regulations come into play, changes to the bunker supply chain will take effect. This will possibly result in HSFO blends bunkered for use by vessels equipped with scrubber technology potentially operating continuously on a higher sulphur content than 3.5 m/m and experiencing more severe corrosion issues.

Therefore, continued HSFO use does not necessarily mean continued use of current cylinder oil products without further consideration. If you use a HSFO with a higher sulphur content than that currently bunkered, you could risk an increased corrosive regime occurring in the engine unless you increase the cylinder oil BN or the feed rates. There is significant risk associated with using a too low BN cylinder oil with a high sulphur content fuel. If the BN level of the lubricant is too low and the feed rate is not optimised, then an engine will be experiencing severe corrosive wear. Optimising feed rate is essential for any ship changing fuels or cylinder oil lubricants. It is not always possible to operate an engine at or close to the OEM's minimum feed rate without entering a corrosive regime, although this may be overcome with a move to a higher BN cylinder lubricant providing additional neutralization and enabling the engine to operate on an optimized feed rate. This can often not only reduce engine wear, but also reduce the overall cost of operation.

Over-lubrication can also have a detrimental effect, impacting liner surface condition and reducing the oil film effectiveness. In ships continuing to burn HSFO or moving to a compliant fuel, used oil analysis should always be conducted to ascertain the optimal feed rate to minimise corrosive and abrasive wear. If corrosion does start to occur, then a switch to a higher BN or a feed rate adjustment may be required.

“For intermittent operations that vary between the use of LSFO, blends and distillates when voyaging between the open ocean and emission control areas, the use of a 40 BN single grade product is recommended by Chevron Marine Lubricants. This removes the use of multiple cylinder oils, reducing on-board complexity,” says Luc Verbeeke.



Fuel strategy	Optimum Lubricant
Up to 3.5%, or even higher HSFO with scrubber	100 – 140 BN
Distillates	25 BN
LNG	25 BN
Intermittent use of LSFO and distillates	40 BN
Ultra-low sulphur alternatives	25 BN
Methanol	40 BN



New challenges, new lubricants

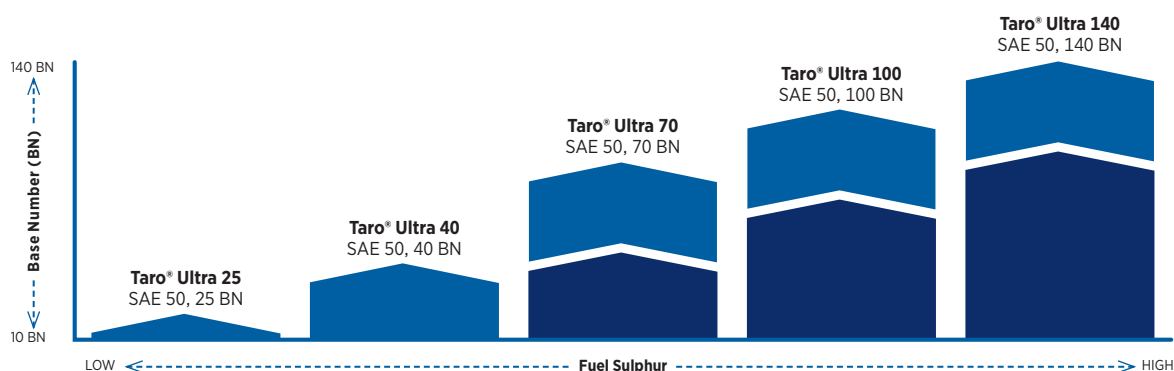
“The ‘one size fits all’ approach is not something we have ever adopted at Chevron, and going forward, our experience in this customised approach is even more imperative,” added Ian Thurloway.

Choosing the right cylinder oil with the correct BN and feed rate can be particularly challenging for ship owners navigating the shift to bunkering different types of fuel.

To support the operation of vessels in an emissions-constrained era now and in the future, Chevron Marine Lubricants developed the Taro® Ultra range of cylinder oil lubricants.

Taro® Ultra 25	Taro® Ultra 40	Taro® Ultra 70	Taro® Ultra 100	Taro® Ultra 140
High performance 25 BN SAE 50 cylinder oil for large cross-head diesel engines operating on fuels with <0.1% wt in sulphur content such as distillate, LNG, LPG, ethane or ethanol	High performance 40 BN SAE 50 cylinder oil for engines operating on LSFO, LNG, methanol & distillate fuel, including 0.5% wt fuel blends with sulphur content and intermittent ECA use providing all round lubricant flexibility and performance	High performance 70 BN SAE 50 cylinder oil for a wide range of fuels, or for vessels operating on 0.5% wt fuels with high levels of cold corrosion	High performance 100 BN SAE 50 cylinder oil, the optimal choice for many new built vessels and for vessels fitted with scrubber, operating on fuels with sulphur content above 1.5% wt	High performance 140 BN SAE 50 cylinder oil developed to help combat cold corrosion and allow for operation with high sulphur fuel and scrubber at lowest cylinder oil feed rate possible

The Taro Ultra range covers virtually all fuel options and combinations, comprising products from 25 BN to 140 BN. By applying years of experience gathered developing high performance lubricating oils, Chevron Marine Lubricants has created each Taro Ultra Cylinder oil product with a formulation that specifically supports an industry facing multi-fuel use post 2020.



“Chevron Marine Lubricants has further strengthened the supply chain capability for our cylinder oil lubricant products to help provide ultimate global availability and flexibility to cope with demand changes in 2020 in line with fuel availability,” says Ian Thurloway.

Development of the Taro Ultra range started in 2016 and the resulting cylinder oils have undergone extensive in field testing with OEMs, and in a wide range of engine types. This field testing amounts to over 65,000 hours of operational time, with all products in the Taro Ultra range tested with a multitude of fuel types and across all applications, including the most severe and demanding operations. Chevron Marine Lubricants has also tested Taro Ultra 40 BN product with 0.5% compliant LSFO fuel blends which are anticipated to be widely used in early 2020.

Enabling Chevron Marine Lubricant customers to make an easy transition between lubricant products prior to and post-2020, the Taro Ultra portfolio replaces the existing Taro Special HT range and is fully compatible and miscible with existing products. Therefore, if you have a Taro Special HT cylinder oil product remaining in your tank, adding a Taro Ultra product will be perfectly acceptable.



“DOT.FAST onboard analysis is a critical service that tells the user immediately whether to adjust the cylinder oil feed rate up or down accordingly. There is no need to wait for shore analysis, allowing prompt action,” says Ian Thurloway.

The onshore analysis component of the DOT.FAST service sees samples sent to Chevron’s laboratory fully analysed for base number, iron, and all other elements. The results are tabulated and reviewed by technical experts, and recommendations are reported back to the ship. Using onshore analysis ensures the testing of drip oil samples to the highest industry standards in a quality certified laboratory and provides comprehensive reporting with to-the-point commentary. Additional benefits include monitoring the effectiveness of onboard (heavy) fuel purification procedures through measurement of CAT Fines (Al+Si).

Future-proofed protection

Cylinder oil lubricants will play an increasingly important role as shipping navigates its way into a lower sulphur, lower emissions future. Failure to ensure that the correct cylinder lubricant is used can have a serious effect on your operation.

“As an industry leader with one of the best supply networks in the world and a full range of products to meet the diverse range of needs of both today and tomorrow, Chevron remains committed to providing reliable solutions for the marine fuels of the future. To meet the uncertain demands of 2020, Chevron’s global supply network has been further strengthened to provide a robust, flexible and agile model to ensure supply in a changing landscape. From ship visits, to FAST and DOT.FAST fluid analysis, Chevron’s world-class technical support team holds the expertise to help your 2020 transition. 2020 — we’ve got you covered,” concluded Ian Thurloway.



helping you navigate through IMO 2020