

## OPTIONAL SOFTWARE PACKAGES

**CYLINDER CARE PRO™**

For all our solutions we offer optional software algorithms improving efficiency of the cylinder lubrication systems. The software ensures that you get the value from your Hans Jensen solution and provides additional lubrication flexibility in challenging operational scenarios with slow steaming, green fuels and dual-fuel engines.

## Algorithms

Application	Automatic Cleaning Sequence	Multi-timing	Delta-timing	Sulphur regulation
HJ Smartlube 4.0	Yes	Yes		Yes
HJ Lubtronic 2.0	Yes		Yes	Yes
HJ Lubtronic	Yes		Yes	Yes
HJ X-Tronic	Yes			Yes
HJ Mechtronic	Yes			Yes

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## Automatic Cleaning Sequence

The ACS periodically increases the cylinder oil feed rate to facilitate better cleaning of the cylinder, behind the piston rings. This is especially relevant using low BN lube oil where detergency is less than using high BN.

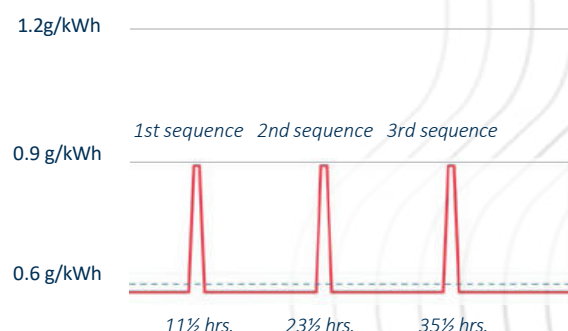
The algorithm injects an extra amount of oil into the piston rings at regular intervals to react with and flush out deposited particles.

Example: 2 times a day, each sequence by 50% lasting 30 mins. Increasing feed rate from 0.6 to 0.9 g/kWh (average feed rate 0.61 g/kWh during 48 hrs.)

Features:

- Control the amount of extra oil injected into the ring pack
- Control frequency within a 24 hrs. cycle (typical twice a day)
- Frequency, timing and amount is customizable by engine crew

## Feed rate example:



## Multi-Timing Injection Algorithm

The algorithm provides multiple cylinder oil injections in a single piston stroke. The timing combines:

Example: 1 x injection into the scavenging air swirl above the piston covering the upper liner surface to protect the combustion area.

With 1 x injection into the ring pack (compression stroke) for enhanced cleaning and 1 x injection into the ring pack (combustion stroke) for enhanced cleaning (optional).

... all in the same piston stroke!

Feed rate (g/kWh)	Quantity (%)	Injection Method
0.55	60	SIP injection
	30	Ring pack compression stroke
	10	Ring pack combustion stroke

## Delta-Timing Algorithm

On each engine revolution, the Delta-Timing algorithm can change the crankshaft angle at which cylinder oil is injected.

This can be customized to your needs. For example, if the algorithm is set to inject 40% in the ring pack and 60% according to SIP timing, the algorithm will inject 2 full injections into the ring pack and 3 full injections according to SIP timing over a total of 5 revolutions, as  $2/5 = 40\%$  and  $3/5 = 60\%$ .

Feed rate (g/kWh)	Quantity (%)	Injection Method
0.55	60	SIP injection
	40	Ring pack compression stroke

## Sulphur Regulation algorithm

The feed rate is automatically adjusted according to the sulphur level of the fuel oil. This prevents corrosion and build-up of deposits leading to long term damage of liner and rings.