Chevron

OMNIMAX™

Introducing Delo® 600 ADF

James Booth

Delo®
Let's go further®

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Content

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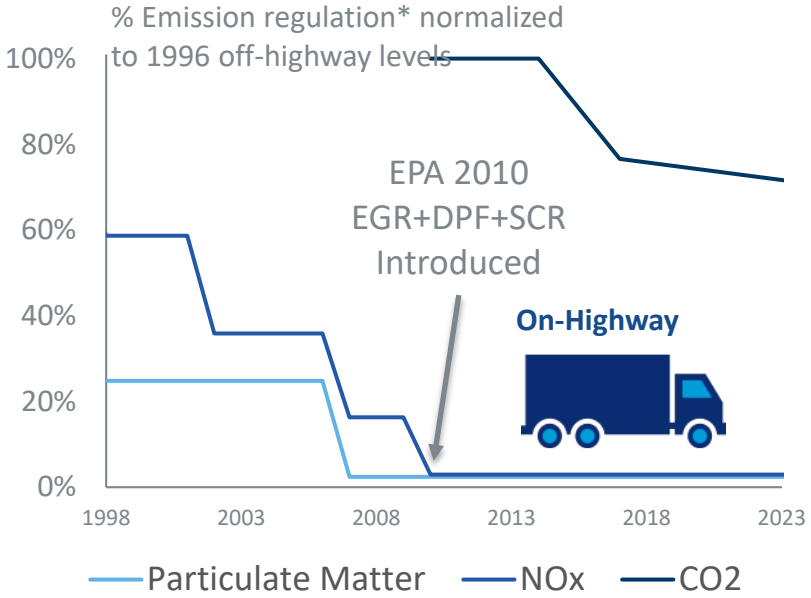
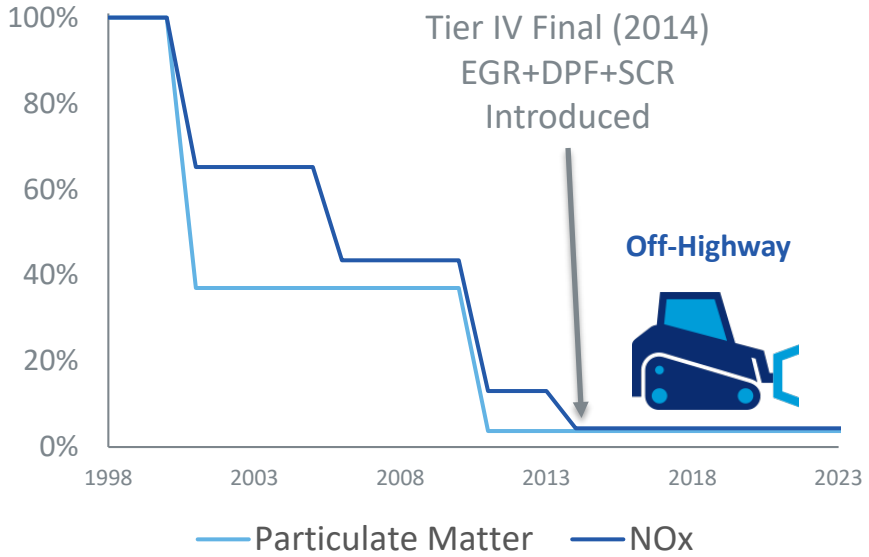
Tightening Emissions Regulations
Emergence of EGR+DPF+SCR





EGR: Exhaust Gas Recirculation
DPF: Diesel Particulate Filter
SCR: Selective Catalytic Reduction

*Source EPA

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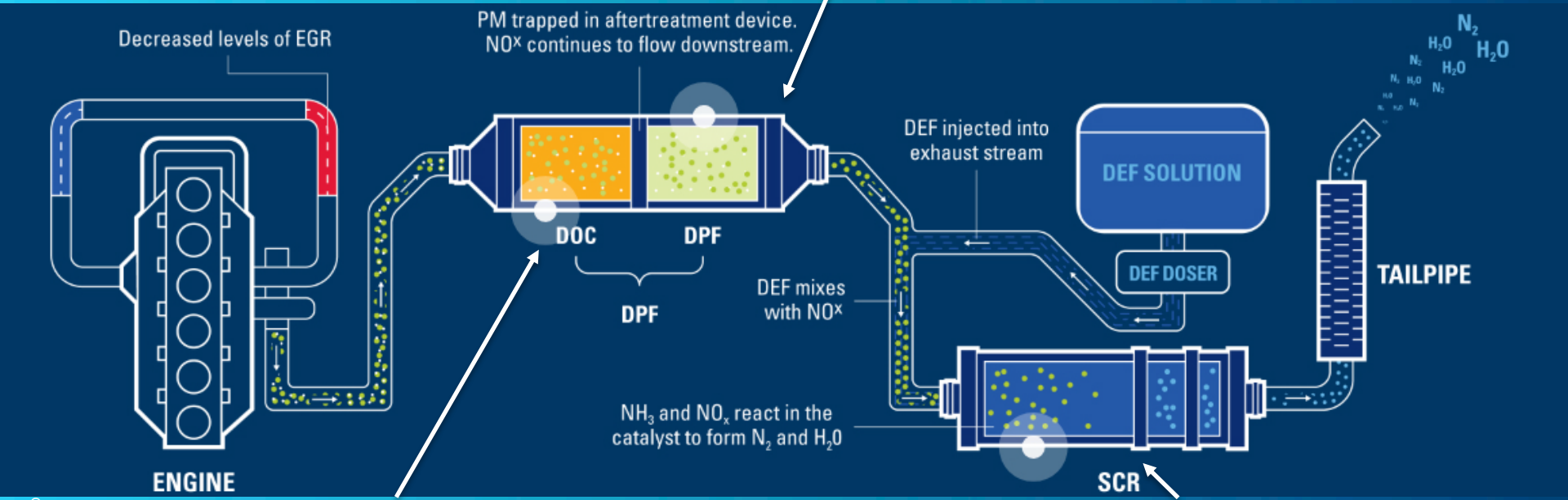
Engine After Treatment System (EATS)

The diesel particulate filter (DPF) collects up to 98% of particulate matter (PM) emissions in the form of ash & soot. Ash is incombustible material derived from metallic lubricant additives



Diesel oxidation catalyst (DOC) converts CO into CO2. Oxidizes unburnt hydrocarbon emission to increase the temperature of exhaust to help with DPF function.

In the selective catalytic reduction (SCR) unit, diesel exhaust fluid (DEF) in conjunction with the catalyst to converts NOx into N_2 & H_2O

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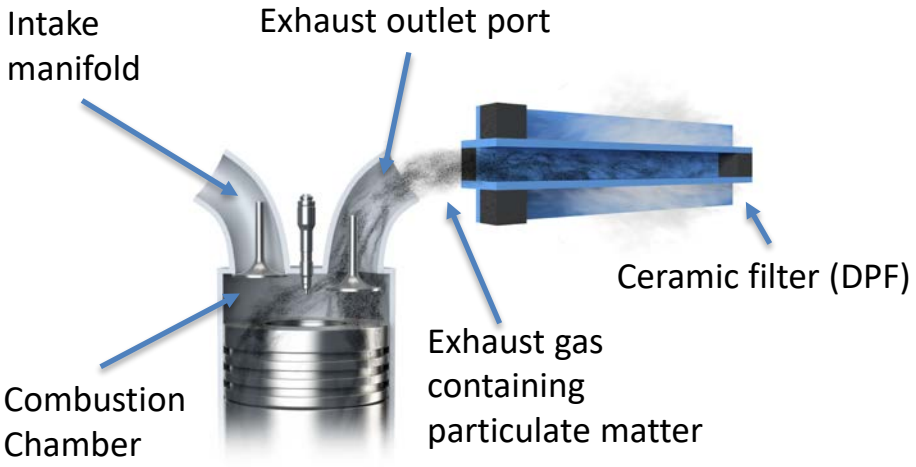
DPF Function & Regeneration



- DPF **Regeneration** removes soot, but <u>does not remove ash</u>

- **Passive Regeneration:** once the DPF gets to a sufficiently high operating temperature it will combust soot particles
- **Active Regeneration:** if the duty cycle does not produce high enough exhaust temperatures, raw fuel is injected to achieve regeneration temperatures in the DPF, while equipment continues to operate. Methods of injection include:
  - Via engine common rail injectors
  - Directly into DPF
- **Manual (Forced) Regeneration:** check engine light illuminates, operator must park equipment and manually initiate a regeneration process where raw fuel is injected into the exhaust gas, and engine rpm increased to generate the appropriate regeneration temperatures. The process takes between 30-45 min

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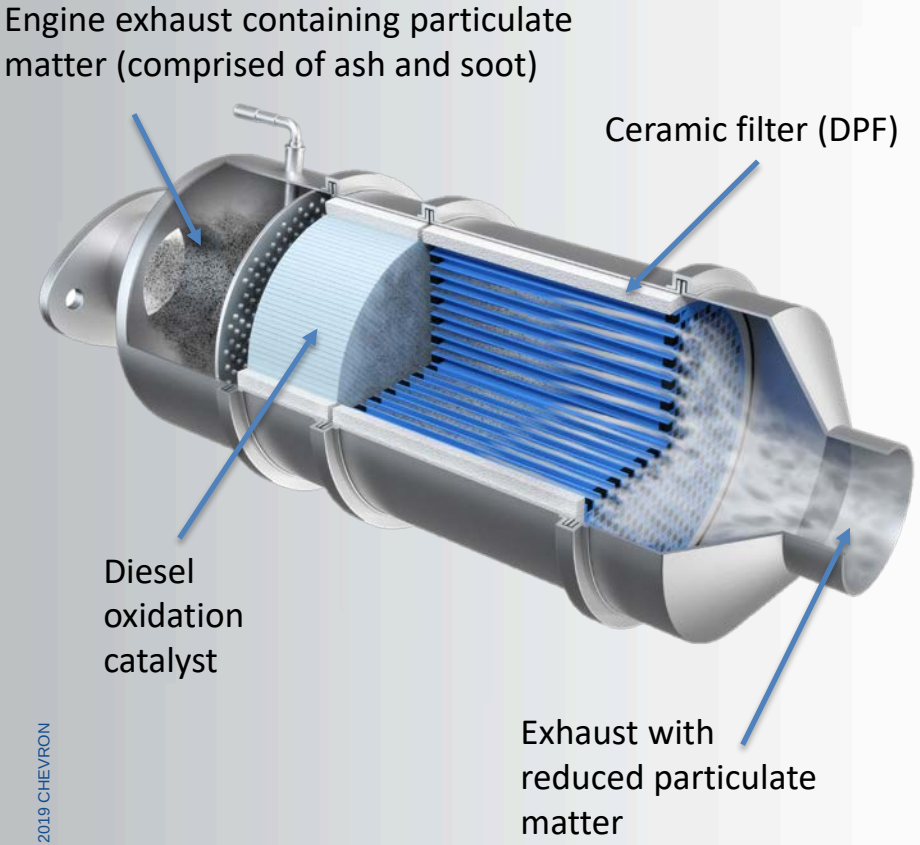
DPF Clogging – Fuel Economy Impact



- As ash & soot build up in the DPF, it increases engine back-pressure negatively impacting fuel economy

- **Active & Manual Regeneration** – elevating DPF temperature via additional fuel dosing – may be required to combust and relieve DPF clogging, negatively impacting fuel economy

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DPF Clogging – Maintenance and Failures

- In some instances the engine will go into derate until **Manual Regeneration** is completed – UNSCHEDULED DOWNTIME
- If too much soot & ash builds up, the large amount of heat upon regeneration can result in filter damage – COSTLY REPAIR
- Regeneration (all types) only removes the soot; ash is left behind, eventually clogging the filter
  - Equipment owners are forced to take units out of service to restore the DPF function - COSTLY MAINTENANCE & DOWNTIME

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The Road to Complete System Protection

- Oil specifications have changed over time to keep up with tightening emission regulations, but have not specifically sought improved EATS performance since 2006. The maximum sulfated ash content allowed in diesel engine lubricants has remained at 1% under the API CK-4 standard, introduced in late 2016.
- Not all CK-4 oils are formulated the same. Certain types or higher amounts of metallic additives will result in faster rates of DPF ash accumulation.
- Chevron has led the industry in research and development on low ash diesel engine oil technology for over a decade.

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OMNIMAX: A Chevron Patented Technology

Delo 600 ADF leverages significant corporate strategic research and intellectual property held by Chevron. It's formulated to provide protection to BOTH the engine and the emissions aftertreatment system to deliver:

MAXIMUM SYSTEM PROTECTION

This revolutionary technology sets us apart from the competition by offering an unmatched value proposition for customers with modern, low emissions engine technology.

The product name underscores all facets of the value proposition:

Aftertreatment Protection – Chevron's Ultra-low Ash additive technology uses 60% less metallic components that can build up in aftertreatment systems and require costly maintenance and equipment downtime.

Drain Interval Extension – Utilizes a potent antioxidant system that prevents breakdown at elevated operating temperatures which otherwise limits engine oil life.

Fuel Economy Retention – A new and proven performance dimension that enables equipment to retain its fuel economy performance, offering significant lifecycle cost savings.

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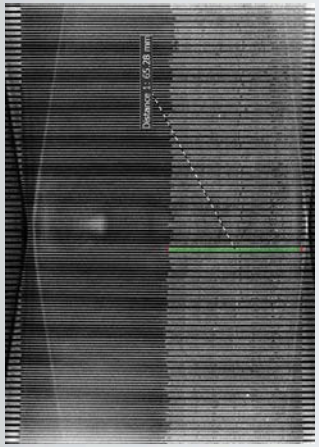
Delo 600 ADF – a New Dimension in DPF Service Intervals

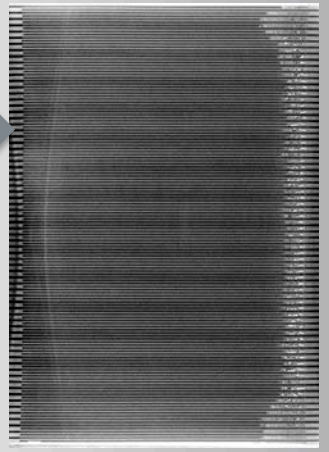
Delo 600 ADF increases DPF maintenance interval by up to 2.5* times

*relative to API CK-4 1% ash products



Exhaust flow

Reduced Ash "Clog"



Conventional Engine Oil
Full useful DPF life

Delo 600 ADF
Equivalent loading duration

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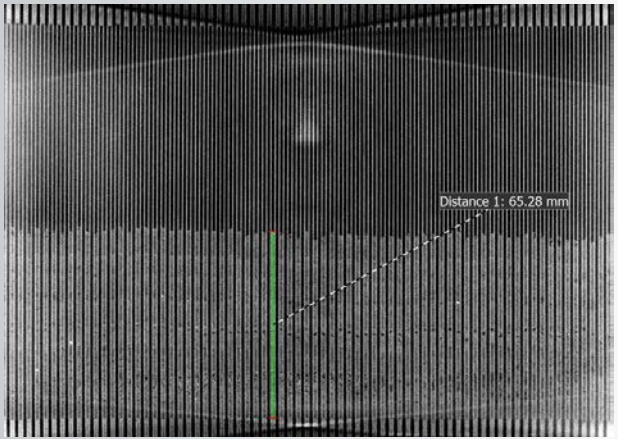
Delo 600 ADF – a New Dimension in Fuel Efficiency Improvement

Less Ash Accumulation → Lower Backpressure and Less Frequent Regeneration → Improved Fuel Economy



Exhaust flow

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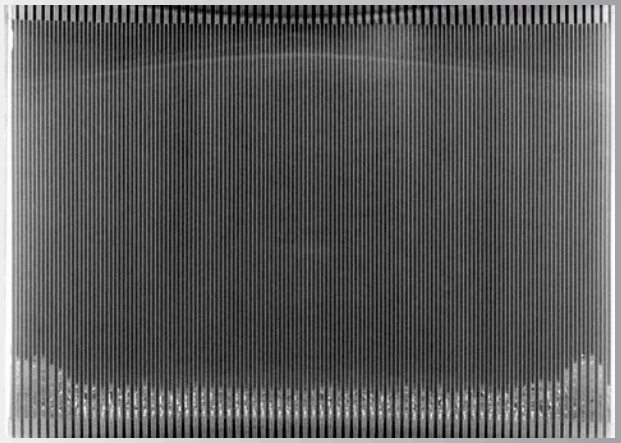

Conventional Engine Oil
Full useful DPF life

Delo 600 ADF
Equivalent loading duration

Delo 600 ADF reduces fuel consumption by up to 3%* over the life of the system

*compared to API CK-4 1% ash oil

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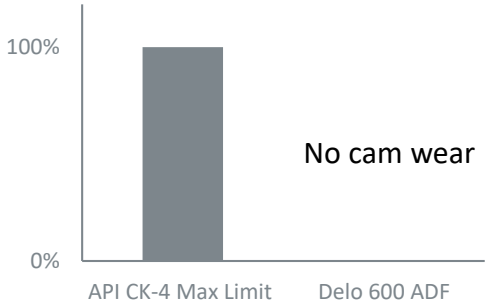
Delo 600 ADF Engine Performance

Excellent wear, deposit & oxidation performance

Cummins ISB Cam Wear



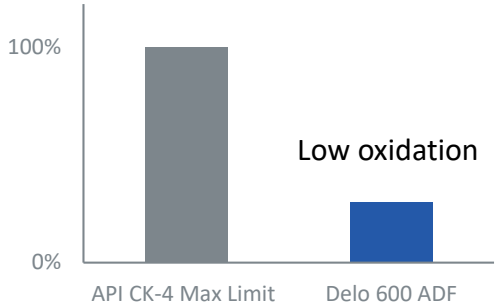
Daimler OM501LA Piston Deposit

Delo 600 ADF

94% better

deposit rating

Volvo T-13 Oxidation by IR



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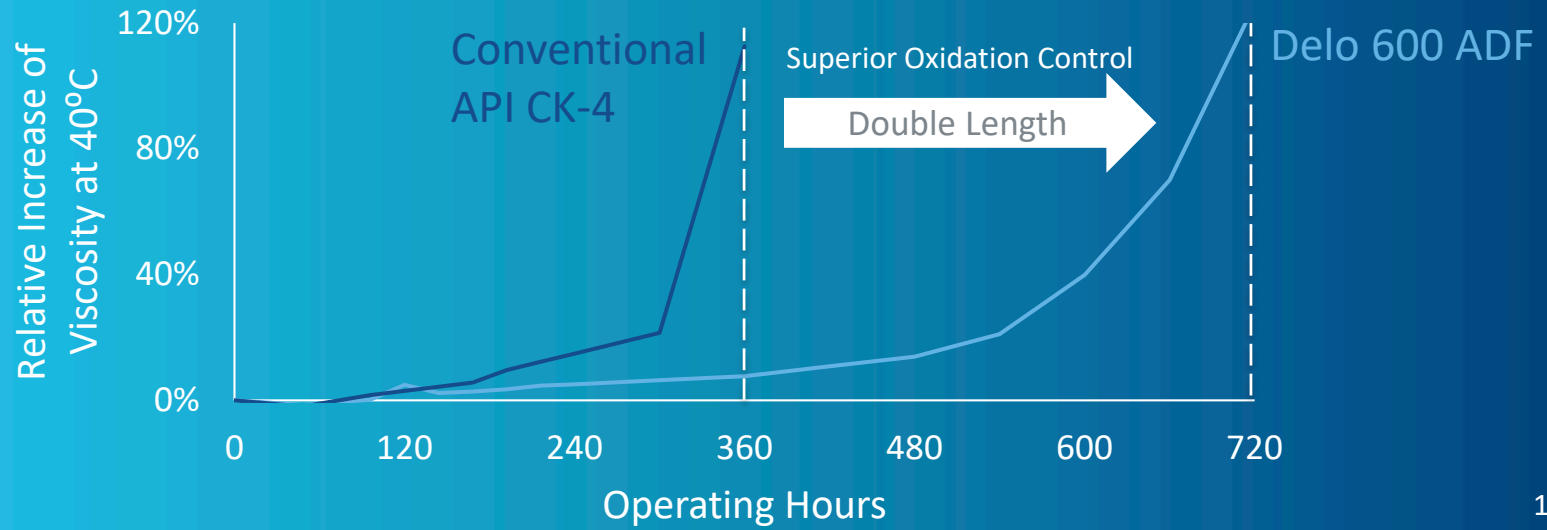
Drain Interval Extension

Delo 600 ADF stands up to the rigorous demands of the Volvo T-13 oxidation test at **2x the standard test length!**

The Volvo T-13 engine oxidation test is one of the industry's more severe measures of oxidation control, and was one of the tools OEMs used to establish increased oil drain intervals for API CK-4



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Construction & Mining

Tier IV Final Engines (25% of market)
Typical DPFs cleaning interval 4,000-5,000 h

Value Driver: Maintenance & Repair

Labor & Cleaning Cost: $1,700
New DPF: $3,000-18,000

Value Driver: Operating Cost

1 – 2 days of downtime for maintenance or replacement: $1,360 to $5,600
Or Renting equipment during downtime: $3,000
5 year 3% fuel efficiency savings on CAT C13: $2,400

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On Highway

EPA 2010 or newer engines (>50% of market)
Typical DPFs cleaning interval 250k-400k miles

Value Driver: Operating Cost

3% fuel efficiency saving over 5 years: $6,300

Value Driver: Maintenance & Repair

Labor & Cleaning Cost: ~$1,000
New DPF: $3,000-5,000k

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Delo 600 ADF Product Profile & Availability

- Positioned between Synblend & Synthetic Delo 400 products
- Carries Synthetic Technology label

	SAE 10W-30	SAE 15W-40
API Category	CK-4	CK-4
ACEA Category	E6	E6
OEM Approvals/Claims		
Deutz	DQC-IV-18 LA	DQC-III-18 LA
Volvo	VDS-4.5	VDS-4.5
MTU	Category 3.1	Category 3.1
Cummins	CES 20086	CES 20086
Caterpillar	ECF-3	ECF-3

- Drums available Dec 1st from Richmond
- Port Arthur and Charleston blending planned for 1Q2020. more details to follow.

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In Summary

Delo 600 ADF is

- **Valuable:** it reduces the rate of DPF clogging to deliver extended DPF service life & industry redefining fuel economy retention.
- **Unique:** no competitor has a product which can reduce DPF clogging to the extent Delo 600 is able to.
- **Proven:** by extensive engine lab and field testing. The formulation approach is patented, proving and protecting differentiation vs. the competition.

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