

Introducing Delo[®] 600 ADF!



Industry Specialist

Matt Mazanek

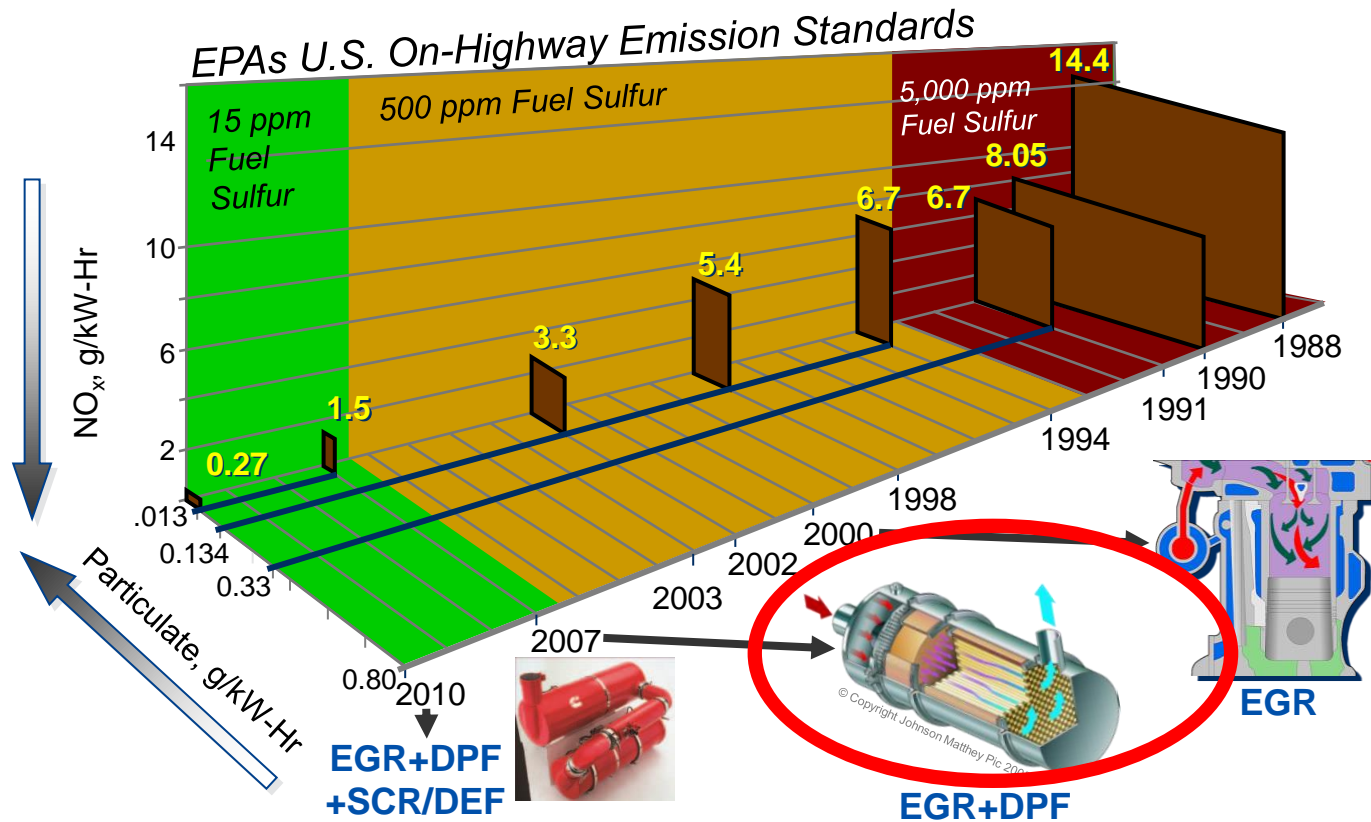
STLE – CLS, OMA-1

- Title: Industry Specialist
- Team: SouthCentral Business Area (SCBA)
- Service Date: April 15, 2013
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- Phone: 281-380-5976
- Office: The Woodlands, TX
- Background:
 - B.S. Chemical Engineering- West Virginia University
 - 38 Years Experience in Lubricants Industry
 - 15 years with ExxonMobil and 13 years Chevron Lubricants Marketers
- Primary Responsibilities:
 - Technical Support and Business Growth With Our SCBA Marketer Customers- TX, OK, NM, CO, KS, MO, AR and LA



2007 On-Highway

2014 Off-Highway



EMISSIONS TECHNOLOGY WORKS



1988
470 Pounds of P.M. in
120,000 Miles



2011
8 Pounds of P.M.
in 120,000 Miles



WHAT IS A DPF? (DIESEL PARTICULATE FILTER)



A filter in the diesel exhaust system



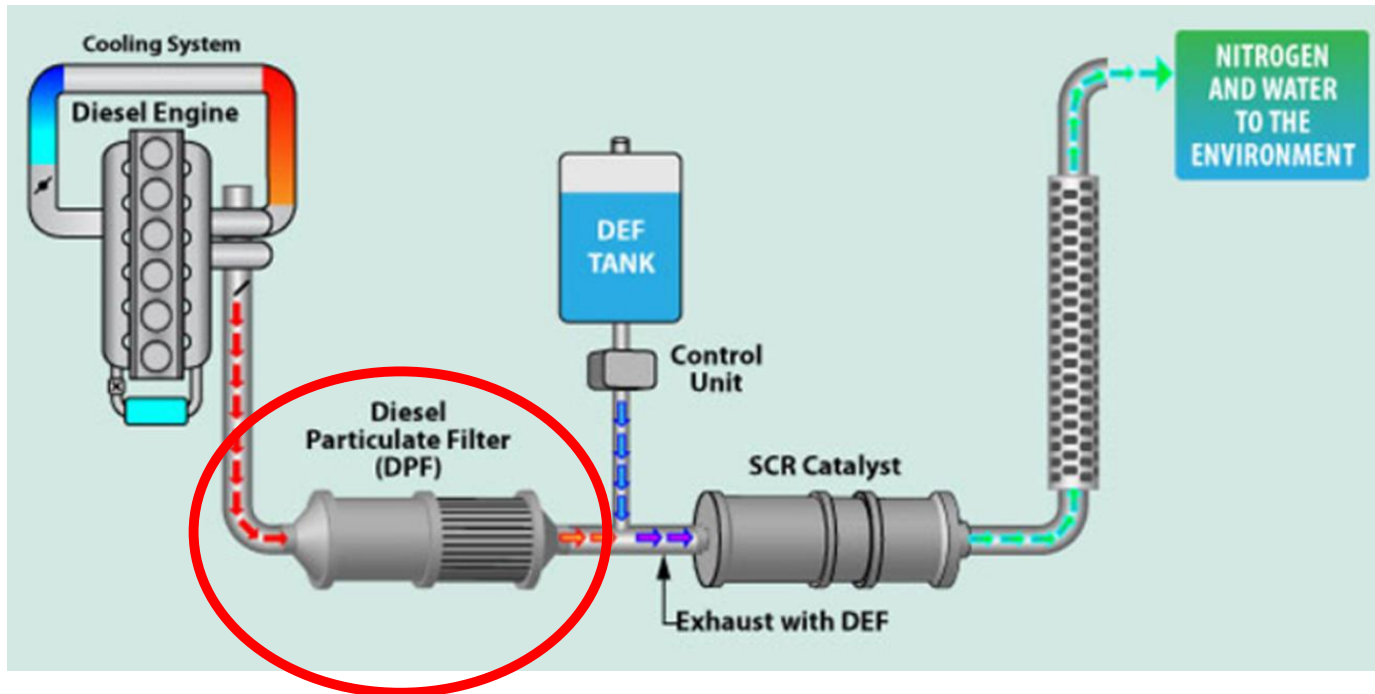
WHAT DOES A DPF DO? (DIESEL PARTICULATE FILTER)



Filters out particles from the
exhaust like ...

Soot and Ash

SHOW ME A DPF IN A SYSTEM? (DIESEL PARTICULATE FILTER)



WHAT ABOUT SOOT?



- Soot is **unburned fuel** ... every diesel engine starts making soot as soon as it is started
- **Excessive Soot** is mostly caused by idling and bad injectors
- Engine Oil should **control Soot** by **dispersing** it ... not allowing Soot to form deposits or aggregate in the engine
- Engine Oils generally **are not the cause of Soot**
- Soot **does** add to the particulates that **plug DPFs**



CAN THE DPF BURN OFF THE SOOT?

Yes ... mostly ...

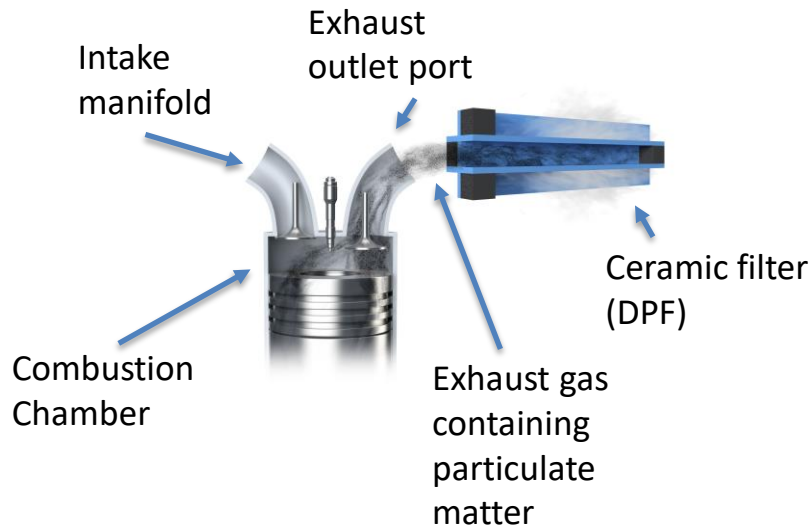
The DPF burns off the Soot via "Regeneration" ...

Often called "Regen"...

Like a "self-cleaning oven"



DPF Function & Regeneration



- **DPF Regeneration** removes soot but does not remove ash.
- **Passive Regeneration:** Once the DPF gets to a sufficiently high operating temperature it will combust soot particles.

DPF Function & Regeneration

- **Active Regeneration:** If the duty cycle does not produce high enough exhaust temperatures, fuel is injected to achieve regeneration temperatures in the DPF while the equipment continues to operate.
- **Manual (Forced) Regeneration:** Check engine light illuminates and the operator must park equipment and manually initiate a regeneration process. The process takes between 30-45 minutes.

DPF Clogging – Maintenance and Failures

- In some instances, the engine will go into derate until **Manual Regeneration** is completed.
- If too much soot & ash builds up, the large amount of heat upon regeneration can result in filter damage.
- DPFs eventually needing cleaning or replacement forcing equipment out of service to restore the DPF functionality - **COSTLY MAINTENANCE & DOWNTIME**



WHERE DOES THE ASH COME FROM?

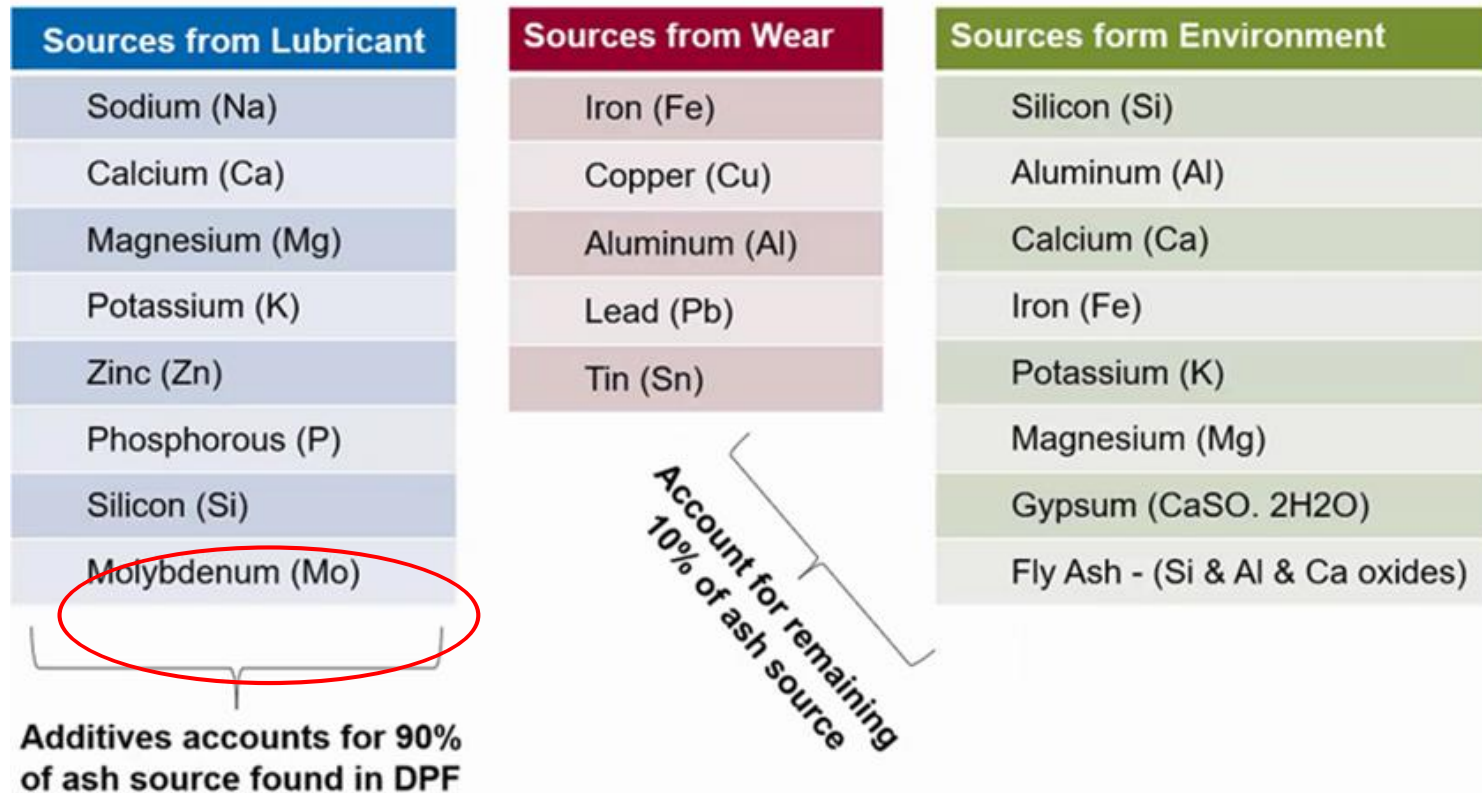


Most of the **Ash** comes from the motor oil additive package ... **Sulfated Ash**

Ash is added to Engine Oil for:

- Antiwear
- Detergency
- etc.

Sources of Ash in the DPF



WHAT DOES ASH DO THAT IS BAD?



HD Diesel Engines **consume +/- 10% of the Engine Oil** sump capacity during a typical oil drain interval ... (we often see more than 10%)

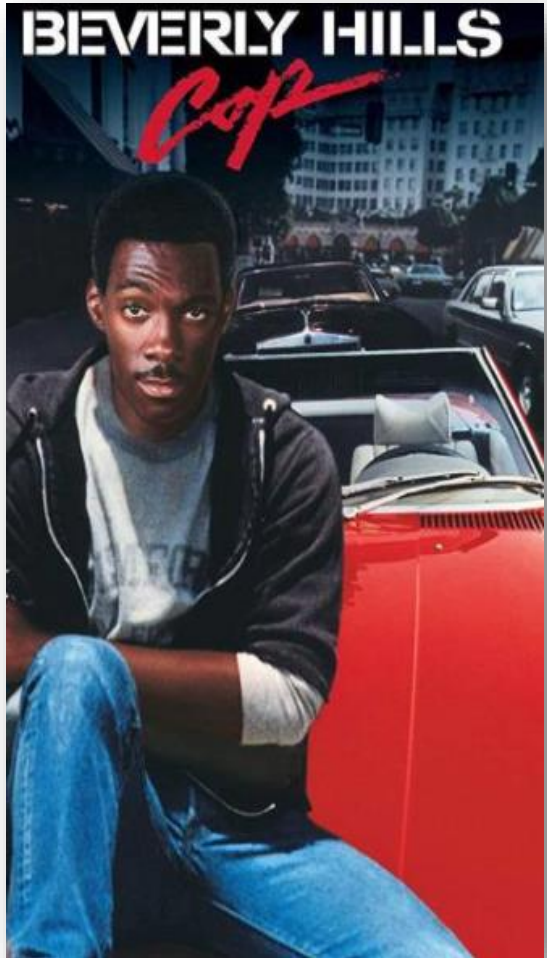
This Engine Oil that gets by the rings **burns off ... mostly ...**

... all except for the associated **Ash** (Solid Metallic Particles) in the Engine Oil which **does not burn off**

That **Ash** (Solid Metallic Particles) builds and builds and then eventually plugs up the exhaust system

Specifically plugging the **DPF** (Diesel Particulate Filter)

Kind of like ...



Banana(s) in the Tailpipe



WHICH DOES NOT ALLOW THE ENGINE TO ...



Breathe

Backpressure prevents engine from mixing air properly



CAN THE DPF BURN OFF THE ASH?

No ...

The DPF burns off the Soot ... but the Ash remains because it won't burn

The Ash then builds and builds until it plugs things up

HOW MUCH ASH IS ALLOWED BY API?



Starting with CJ-4 in 2007 ...

... and continuing with CK-4
and FA-4 in 2016 ...

... the maximum allowable limit
of ASH is ...





Chevron Delo[®] 600 ADF

WITH **OMNIMAX**, A CHEVRON PATENTED TECHNOLOGY

SYNTHETIC TECHNOLOGY



CHEVRON IS THE ONLY ONE ...



OMNIMAX™: A Chevron Patented 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.

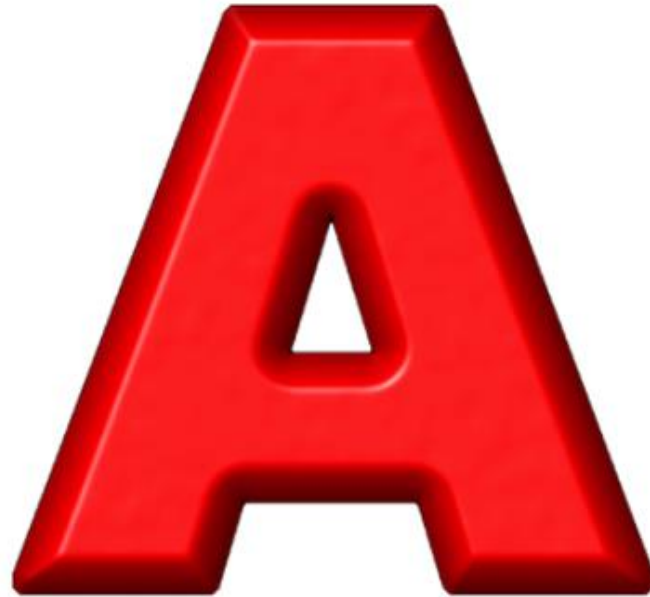
The Road to Complete System Protection



API CK-4/FA-4

Delo[®] 600 ADF
0.4%

Sulfated ash



After Treatment Protection

AFTERTREATMENT SERVICE INTERVALS



A

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"

CK-4 1% Ash Engine Oil

Delo 600 ADF
Equivalent loading duration

OFF-HIGHWAY OEM RECOMMENDATIONS

A

OEM	DPF Cleaning Intervals - Hours
Caterpillar*	5,000
Komatsu	4,500
Volvo Construction	4,500
John Deere	OBD Indicator
Case/New Holland	4,500

For Off-Highway, in real world:

–Significant variance in DPF service intervals due to ‘engine bench qualification’ vs. real world operations experienced by customers

–Engine Load Factor – Low, Moderate or Severe – can significantly impact DPF time to cleaning

*Caterpillar DPFs are relatively bigger than competitors for similar class engines

Source: Caterpillar Performance Handbook #48

ON-HIGHWAY OEM RECOMMENDATIONS



Operation Parameters	Fuel Burn Rate	Detroit Diesel DD15	Volvo* D11 / D13 or D16	PACCARR MX13	Cummins X15
Severe Duty	Less than 5.0 mpg Greater than 50L per 100km	500,000 to 550,000 Note: Fuel limit for Line-Haul is typically reached at 300-400,000	250,000	150,000	
Short Haul or Heavy Duty*	Between 5.1 to 5.9 mpg Between 39L to 49L per 100km		400,000	300,000	250 – 400,000
Long Haul or Normal Duty*	Between 6.0 to 6.9 mpg Between 39L to 34L per 100km				400 – 600,000
Efficient Long Haul	Greater than 7.0 mpg Less than 34L per 100km				600 – 800,000

A DPF that needs to be cleaned of ash is not a warrantable failure.

OEMS also state something to the effect: **‘A check engine light will illuminate when ash removal is required’**, so cleaning may need to occur before the target mileage.

How to treat vocational Trucks?
Hours or mileage?





Drain Interval Extension

OIL DRAIN CUSTOMER TRENDS (HOURS)



D

- Standard Drain Norms of 250-300 Hours
- Extended Drains with API CJ-4 Oils Near 500 Hours*
- Current Extended Norm for API CK-4 Oils Toward 1,000 Hours+*

***Note: Customer Adopted Extended Drains Always Supported
By Use of an Effective Used Oil Analysis Program**



OIL DRAIN TRENDS (MILES)

	API CJ-4	API CK-4
Volvo	45,000	55,000
Cummins	40,000	50,000 80,000 with Oil Analysis
PACCAR	60,000	75,000
Detroit Diesel	50,000	55,000- 75,000
Navistar	40,000	40,000

**Normal caveats apply, refer to OEM recommendations:
Less than 20% idle and 6.5 mpg or better**

DRAIN INTERVAL

D



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





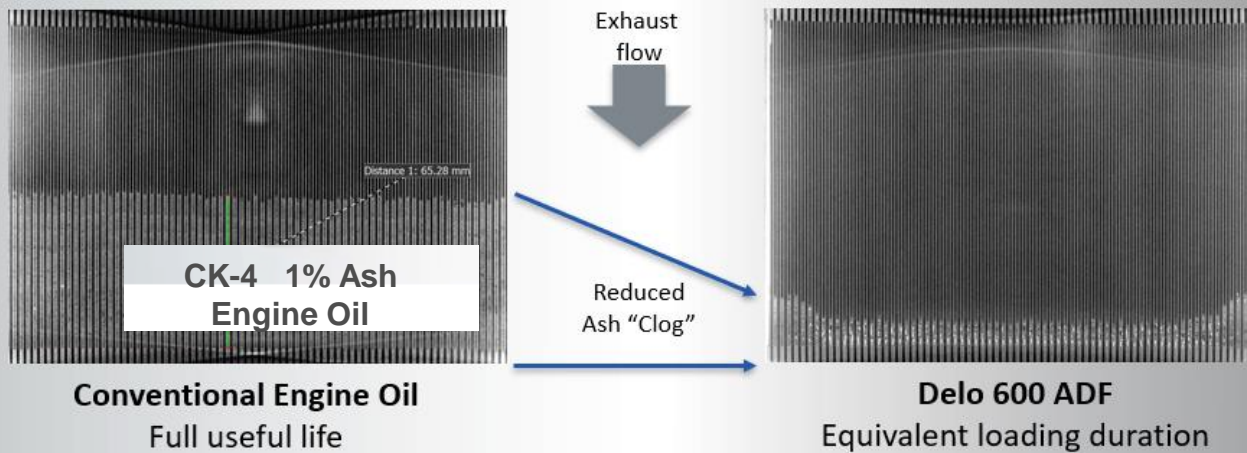
Fuel Economy Retention

F



Delo
Let's go further

Delo 600 ADF – a New Dimension in Fuel Efficiency



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

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FUEL ECONOMY RETENTION



F

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

2. 3% over the life of the DPF

- Won't see 3% initially
- Will see 3% ... as an average ... over the life of the DPF



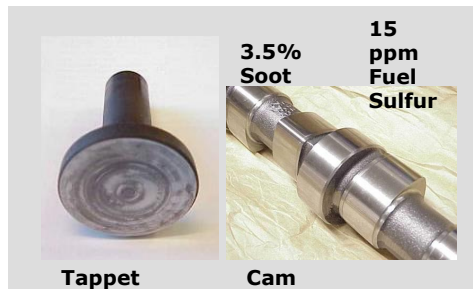
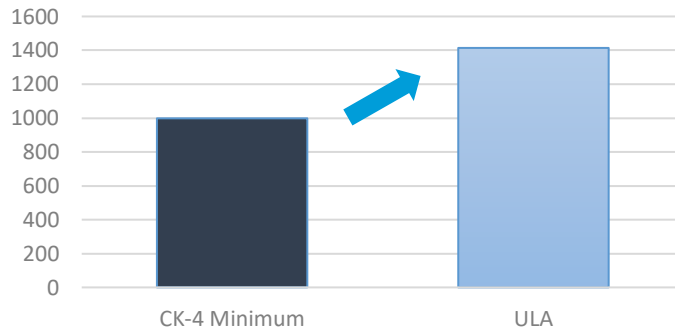
Cummins ISB and ISM Diesel Engine Test

- Core Engine Test for Qualifying API CK-4/FA-4 Approved Oils
- Objective Evaluates Engine Oils' Ability to Reduce Valve Train Wear Under Conditions to Accelerate Soot Loading
- Test Duration Is 350 Hours and Utilizing 15 ppm ULSD
 - Initial 100 hours at steady-state 1,600 rpm allowing for accumulation of 3.25% soot loading
 - Remaining 250 hours on a multi-step 28 second cycle
- Evaluated parts include camshaft, mushroom-style slider tappets and crosshead
- Outstanding Cam Wear Results With “0” ppm Cam Wear and Test Limit 55 ppm!
- Multiple On-Hwy and Off-Hwy OEMs Testing Delo 600 ADF to Validate Wear Results



Robust Sooted Wear Control with ZERO P! Cummins ISM and ISB Tests; “0” Cam Wear!

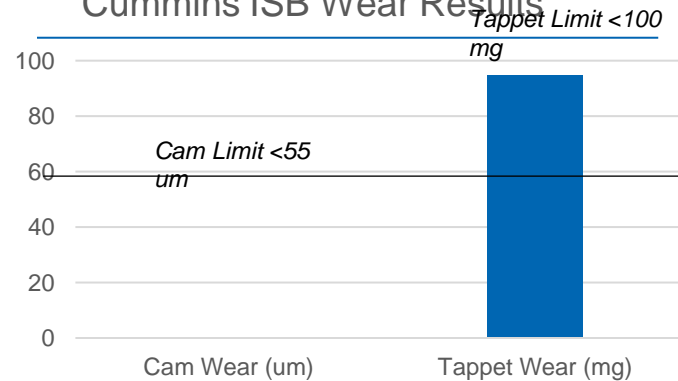
Cummins ISM Merits



0 μ m cam wear!



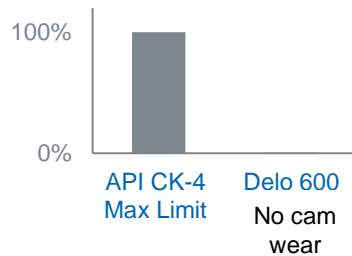
Cummins ISB Wear Results



Delo 600[®] ADF Engine Performance OEM Testing

Excellent wear, deposit & oxidation performance

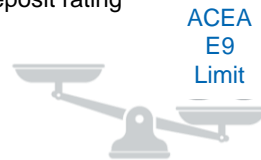
Cummins ISB



Evaluates an engine oil's ability to reduce camshaft lobe and sliding cam follower wear.

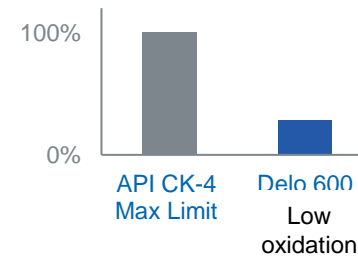
Daimler OM501LA

Delo 600 ADF
94% better
deposit rating



Evaluates the ability of an engine oil to protect against piston wear, piston cleanliness and bore polishing.

Volvo T-13



Evaluates the ability of an engine oil to minimize piston ring wear, cylinder liner wear, lead corrosion, oil consumption, oxidation and nitration.

DELO 600 ADF 5 YEAR BENEFIT



\$170,587

Delo 600 ADF Extended DPF Service Interval:
Total Downtime Savings \$60,000
DPF Service Cost Savings \$6,000

Delo 600 ADF Extended Oil Service Life:
Lube & Filter Costs Savings \$2,164
Uptime Benefit \$48,000
Labor Savings \$8,000



Example

Delo 600 ADF Fuel Economy Savings:
Fuel Economy Retention \$27,678
Viscosity Fuel Savings \$18,745



BOTTOM LINE



ADF

- DPF life up to 2.5x longer
- Extended Drain Intervals
- 3% Fuel Economy Retention

CHEVRON TESTIMONIALS



- Kokosing Construction- Off-Road- 2,200 Pieces of Equipment
- Talon Logistics- On-Road- 180 Tractor Fleet
- Cox Construction- Mixed Fleet- 75 Off-Road, 70 On-Road
- Western Transport- On-Road, Long Haul- 65 Tractor Fleet



Appendix





Save on Performance Monitoring of Delo® 600 ADF Diesel Engine Oils with LubeWatch®

LubeWatch® Oil Analysis Program

Delo 600 ADF diesel engine oil customers will be provided LubeWatch oil analysis testing and Lubrication Performance Reviews at no charge until December 31, 2022.

This initial promotional offering is an additional value beyond the numerous reliability performance and business benefits gained from the use of the new Delo 600 ADF diesel engine oil. Proper monitoring of in-service lubricants are a requirement for ensuring proper lubrication and achieving optimal equipment performance. The LubeWatch Lubrication Performance Reviews delivered by a Chevron Lubrication expert are a critical component for management of equipment and operational performance.



PROMOTION DETAILS

- Applies to lab testing fees for Delo 600 ADF SAE 10W-30 and SAE 15W-40 products using the Delo 600 Test Package through the LubeWatch Oil Analysis Program. The initial promotional offering does not cover testing fees on other products or test packages.
- If a Delo 600 ADF product is submitted for testing via a prepaid LubeWatch package, there will not be a reimbursement provided for the testing fees. This offer is exclusive to the LubeWatch Delo 600 Test Package only.
- The cost of sample bottles and shipping to a Chevron LubeWatch laboratory is not included nor reimbursable.
- Promotional offering is only available to operations in the U.S. and Canada.

Please consult with your Chevron Lubricants Representative for further information and assistance in getting started today.

The Delo 600 Test Package Includes the Following:

Test Description	Test Method
Elemental Metals by ICP	mod. ASTM D5185
Water by Crackle, confirm by Karl Fischer (0.5% reporting limit)	Crackle Test / mod. ASTM D6304C
Viscosity @ 100'C	mod. ASTM D445
Viscosity Index Calculation	ASTM 2270
% Fuel Dilution	ASTM D7593
% Fuel Soot	ASTM E2412
Oxidation C2AN	ASTM E2412 (Standard)
Nitration	ASTM E2412 (Standard)
Acid Number (TAN)	ASTM D664



Delo[®] 400 -vs- Delo[®] 600

	Delo 400 LE SAE 15W-40	Delo 400 XLE SAE 10W-30	Delo 600 ADF 15W-40 & 10W-30
Calcium (ppm)	1560	1340	430
Magnesium	390	720	100
Zinc	1290	820	0
Phosphorus	1170	760	0
Boron	540	100	750
Molybdenum	90	0	1160
Potassium	0	0	460
Sulfur (%)	0.3%	0.3%	0.2%
Sulfated Ash (%)	1%	1%	0.4%

