Delo® 400 NG SAE 15W-40

CNG/LNG Heavy Duty Engine Oil

Product Launch Introduction

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Delo® 400 NG SAE 15W-40

Growth in Natural Gas for Vehicle Applications

Mobile natural gas continues to grow in popularity in over-the-road applications

- CNG and LNG Fuels have favorable low “carbon intensity” compared to diesel
- Centralized Vehicle/Fueling Applications
  - Increased usage in ports and airports to reduce Particulate Matter
  - Fleets such as UPS, AT&T, Waste Management, Republic Waste converting to CNG/LNG vehicles – savings plus green
- Over-the-Road
  - Pilot - Flying J Truck Stops installing facilities
  - Clean Energy Fuels developing a LNG “Corridor”
  - Installations increasing through Mansfield Oil on a regional basis
  - Growing public/private company fueling sites
- LNG preferred for long-haul applications – higher fuel energy density (1/600th volume relative to CNG)
- CNG/LNG trucks typically cost $40,000 to $80,000 more than conventional trucks, but quick ROI is achieved from reduced fuel cost

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Clean Energy Fuels / Pilot –Flying J Plan for "Natural Gas Highway"

Major highway segments include those linking Southern California and Las Vegas, the Texas Triangle of Houston, San Antonio and Dallas/Ft. Worth, Los Angeles to Dallas, Houston and Atlanta to Chicago and networks along major Midwest trucking corridors.

- Funding of $450 Million for infrastructure (T Boone Pickens on Board)
- Plan to open 150 stations - 70 stations in 33 states by end of 2012, and balance in 2013
- Many stations will be co-located with existing Pilot Flying J truck stops
- Focus is on LNG for long-haul applications

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CNG/LNG Vehicle Lubrication Background

- CNG/LNG fuel is continuing to grow in use and applications
  - Significantly lower cost than Diesel Fuel – US has large domestic supply
  - Truck Fleets are adopting where CNG filling stations are available
  - Investment incentives by federal government

- Chevron RPM GEO 15W-40 utilizes 10+ year technology
  - Expanded future use by on-road trucks – not only buses anymore
  - New OEM performance requirements needed by Truck Mfgs
  - Extended drain levels needed by truck fleets

- Introducing new Delo 400 NG - Premium CNG/LNG oil for expanding market
  - Promote with the Delo family of products
  - Low environmental impact product
  - Proof of performance / testimonial support focus

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Types of CNG / LNG Engines

- Spark Ignition (SI – Spark Plug):
  - Uses 100% natural gas and a spark plug for ignition
  - Spark plug fouling and combustion chamber/valve deposits are usually the problems
  - May also use catalysts to further reduce emissions
  - Engines like Cummins ISX 12G / Cummins ISL G (8.9L) and below
- Direct Ignition (DI, no spark plugs)
  - Also called “dual-fuel”, uses diesel fuel to induce compression ignition to burn natural gas (NG)
  - 30~40% more efficient and up to 25% less fuel consumption than SI
  - When biofuel is used in place of diesel, total carbon emissions can be reduced by up to 70% relative to conventional diesel engines
  - Normally LNG engines – typically larger in size and horsepower – examples would be Cummins ISX 15G / LNG Maxxforce 13
  - Direct Ignition is replacing Spark Ignition in heavy duty natural gas vehicle applications

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Announced Natural Gas Vehicle Models from Major OEMs

Truck	Engine	Application	Fuel	Ignition
Freightliner Md 112	Westport ISL-G (8.9L)*	MD Truck	CNG/LNG	Spark
Peterbilt 367	Westport ISX-G (12L)*	HD Freight/Vocational	CNG/LNG	Spark
Peterbilt 367	Westport ISX-G (15L)	HD Freight/Vocational	Dual	Direct
Kenworth T800	Westport ISX-G (12L)*	HD Freight/Vocational	CNG/LNG	Spark
Kenworth T800	Westport ISX-G (15L)	HD Freight/Vocational	Dual	Direct
Kenworth T440	Westport ISL-G (8.9L)*	MD Freight	CNG/LNG	Spark
Navistar ProStar	LNG Maxxforce 13	HD Truck	Dual	Direct
Navistar WorkStar 7300/7400	DT466#	MD Utility Truck	CNG/LNG	Spark
International Type C	Phoenix NG (7.6L) by ESI#	School Bus	CNG/LNG	Spark
Bluebird	Westport ISL-G (8.9L)*	School Bus	CNG/LNG	Spark
Thomas Built	Westport ISL-G (8.9L)*	School Bus	CNG/LNG	Spark
Mack TerraPro	Westport ISL-G (8.9L)*	Refuse Truck	CNG/LNG	Spark
Orion (Daimler)	Westport ISL-G (8.9L)*	Transit Bus	CNG/LNG	Spark
Volvo (Not in US yet)	D13D (UK) or Westport	HD Truck	Dual	Direct

*: this site references OEMs using Westport engines: http://www.westport.com/products/natural-gas-trucks
#: also offered as Phoenix 7.6L NG by Emission Solutions to other OEMs in refuse trucks and other applications

Makes, models, and engine types are subject to change at any time

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OEM Approvals

- Original Engine Manufacturers Approvals
  - Cummins CES 20074
  - Detroit Diesel 93K216

- Chevron Recommends use in:
  - Mercedes Benz CNG Engines
  - Volvo CNG Engines
  - Renault RGD Engines
  - Mack CNG Engines
  - Isuzu CNG Engines
  - Hino CNG Engines
  - Hyundai CNG Engines

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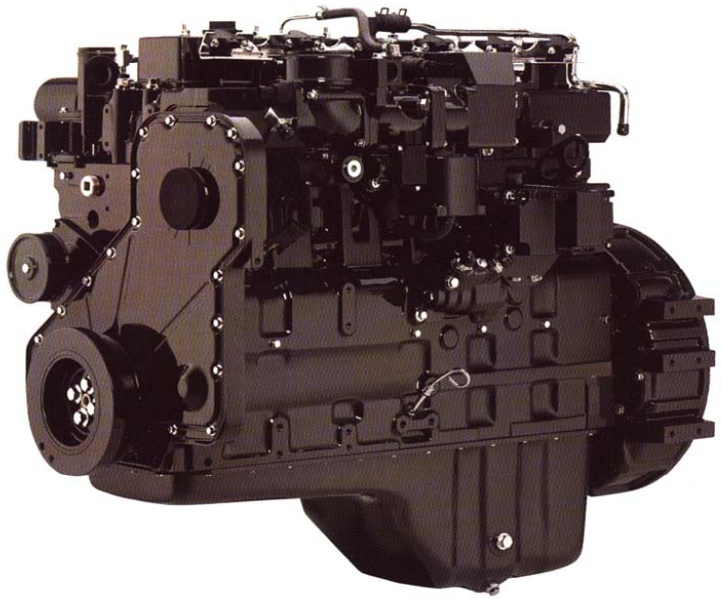
Cummins CES 20074 Approval Performance

Cummins 8.3 G engine test protocol for CES 20074 approval

Test Duration	200 h
Engine Speed	2400 RPM
Power Output	200 kW
Fuel Feed Rate	43 kg/h
Gallery Oil Temp	106 °C
Coolant Temp	90 °C
Intake Air Temp	46 °C
Fuel Temp	20 °C



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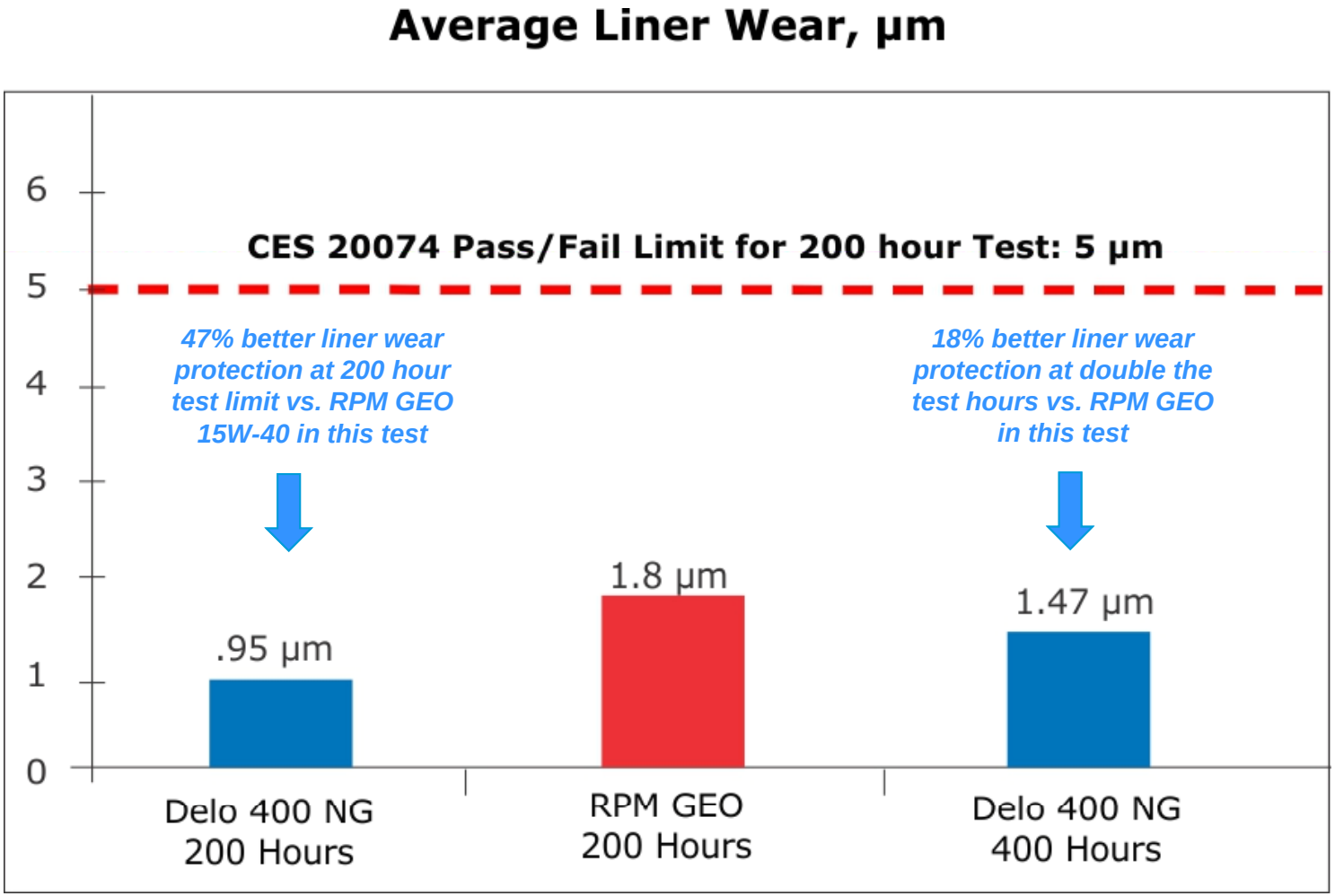
Cummins CES 20074 Approval Liner Wear Performance



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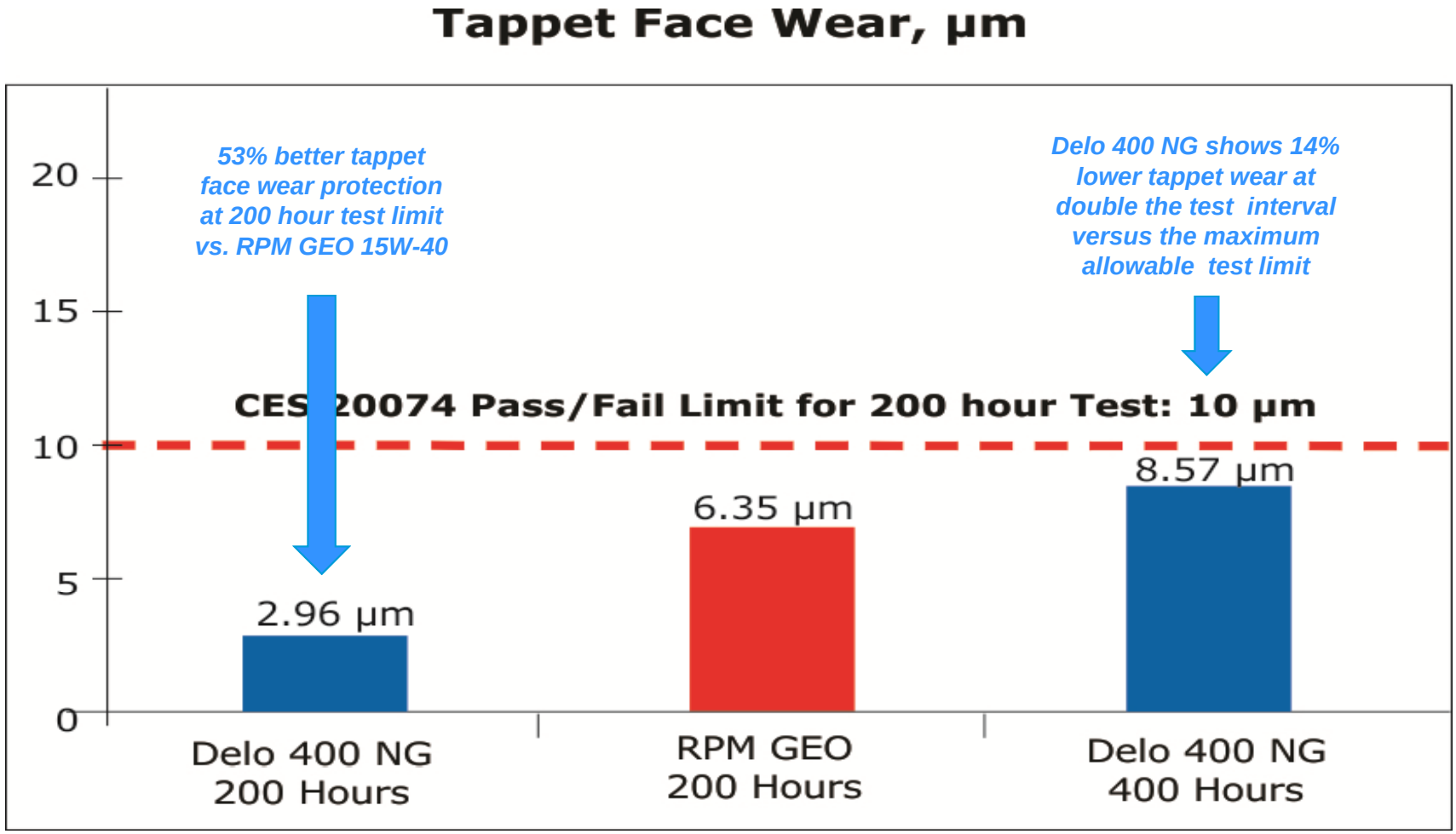
Cummins CES 20074 Approval Tappet Facet Wear Performance



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CNG/LNG Heavy Duty Engine Oil

Various Bus Performance Testing

- DDC Series 50 G Engines
- Volvo THG 103 Engines
- Mack CNG Engine
- MB OM 366LAG

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DDC Series 50G Bus Engine Field Testing

- **Delo 400 NG SAE 15W-40 field test in a city bus fleet**
  - Sonoma County Transit (SCT), Santa Rosa, Ca
  - Three Orion city bus coaches, rebuilt and upgraded
  - 275 hp, Detroit Diesel Series 50G

- **Field test protocol**
  - Test Duration 120,000 miles (Approximately 2 years)
  - Drain Interval 6,000 miles
  - Full analysis of drain oil samples

- **Final inspections involved**
  - Complete dismantling of all the engines
    - 4 Complete Engine Tear-Down Inspections done at DDC Dealership witnessed by (Andy Quiniones) DDC Field Representative
  - Rating of piston deposits, valve deposits, sludge, etc.
  - Visual inspection for VTW and bore polish

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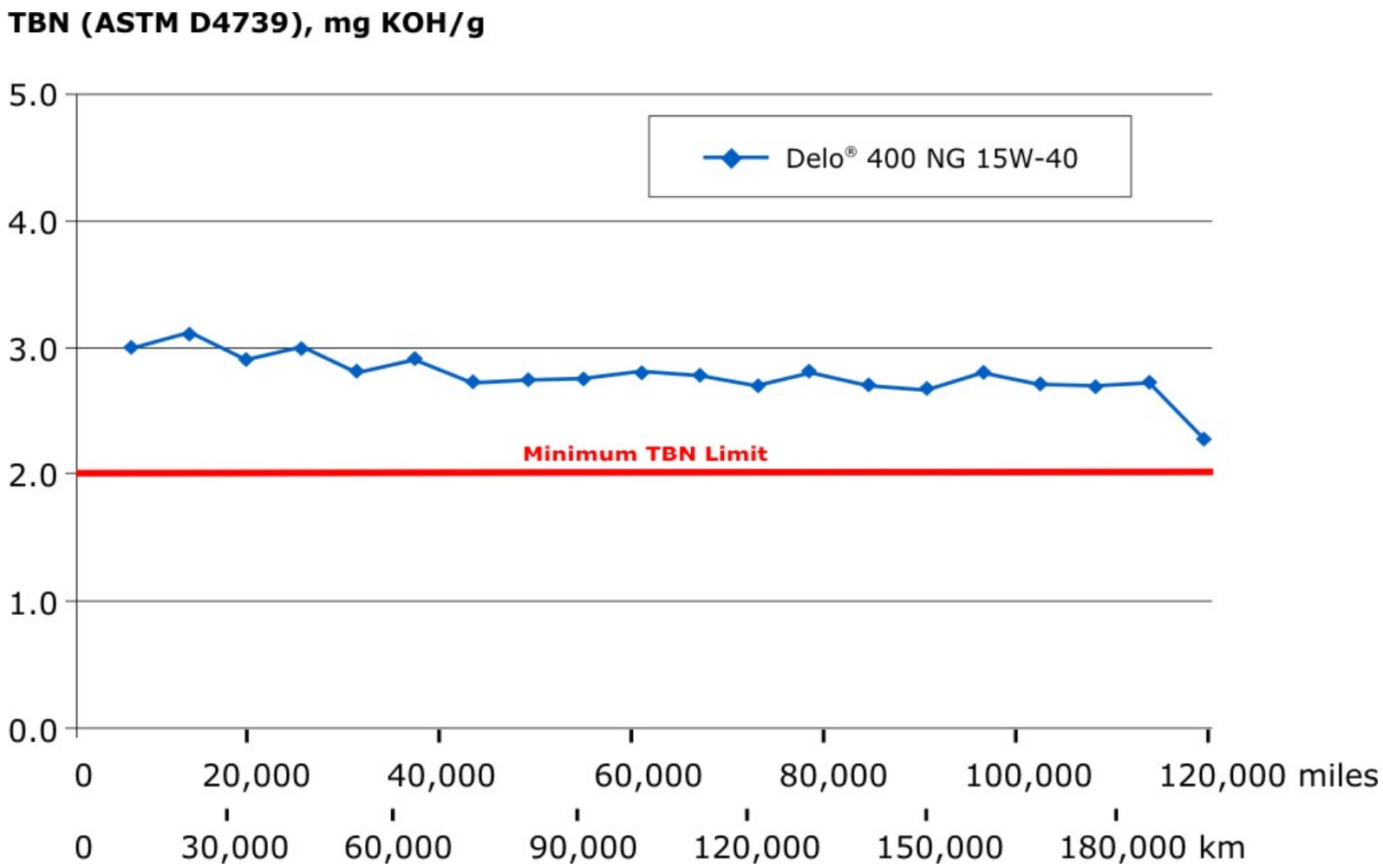
DDC Series 50G Bus Engine Field Testing – TBN Retention



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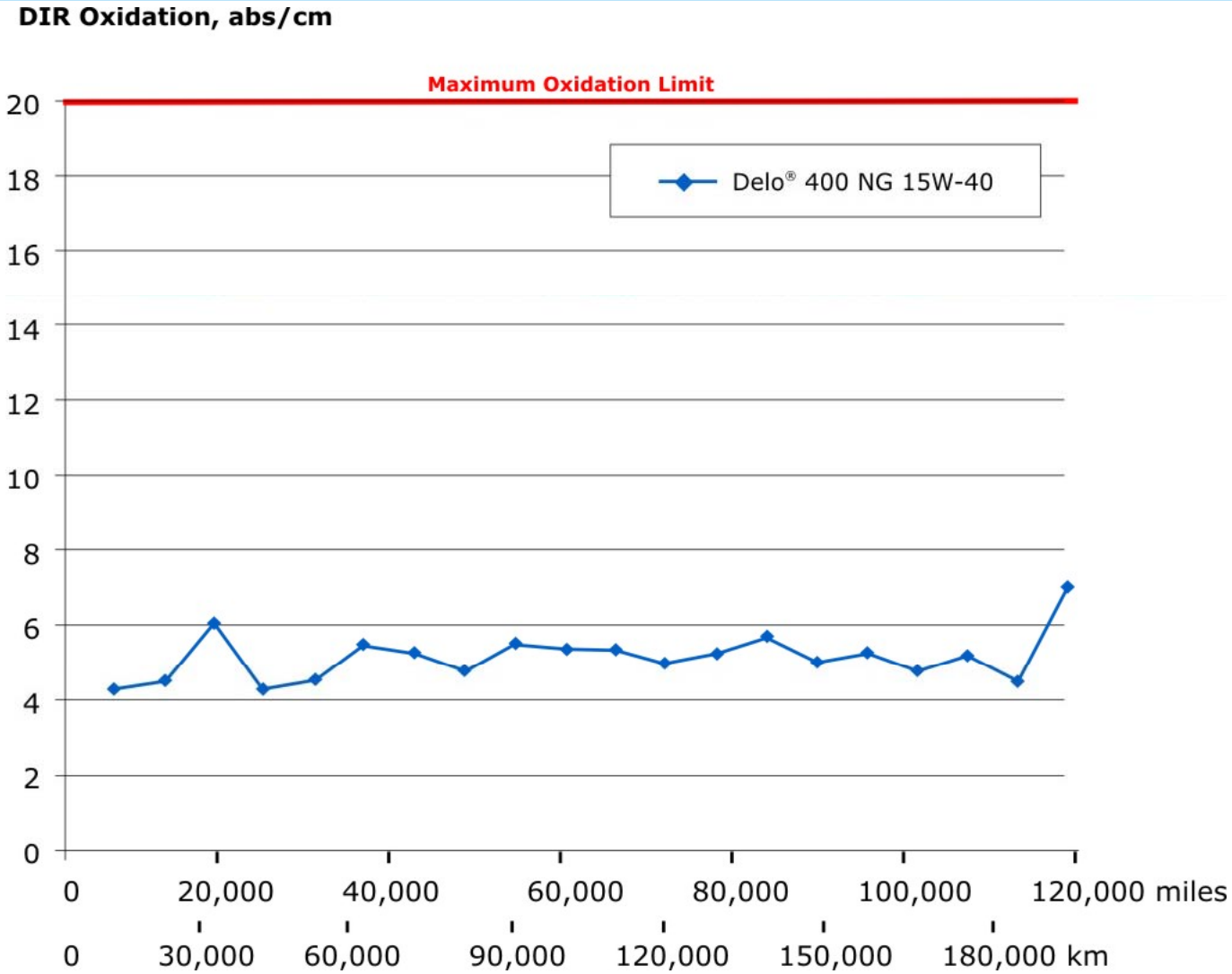
DDC Series 50G Bus Engine Field Testing – Oxidation Performance



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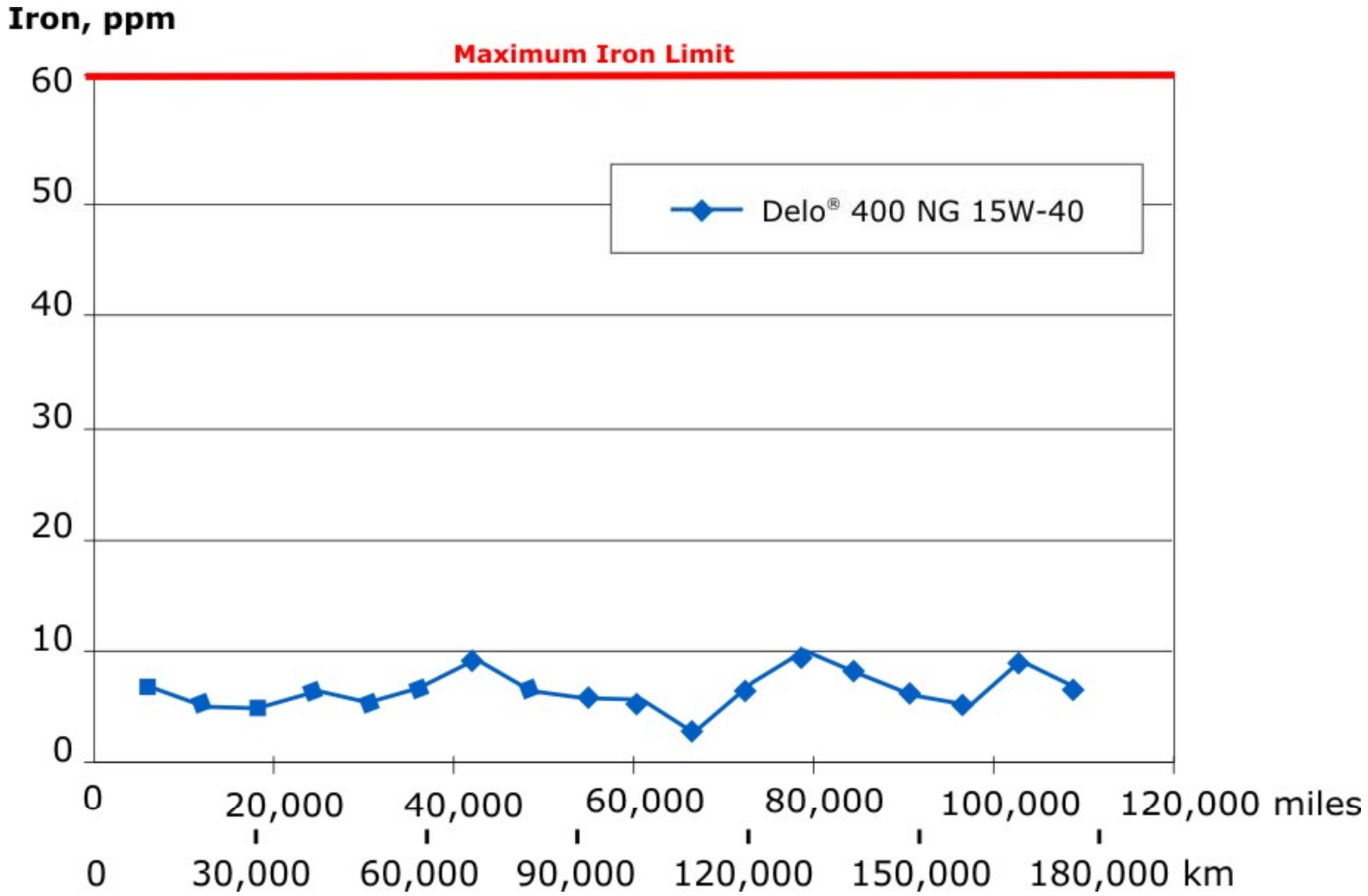
DDC Series 50G Bus Engine Field Testing – Wear Metals - Iron



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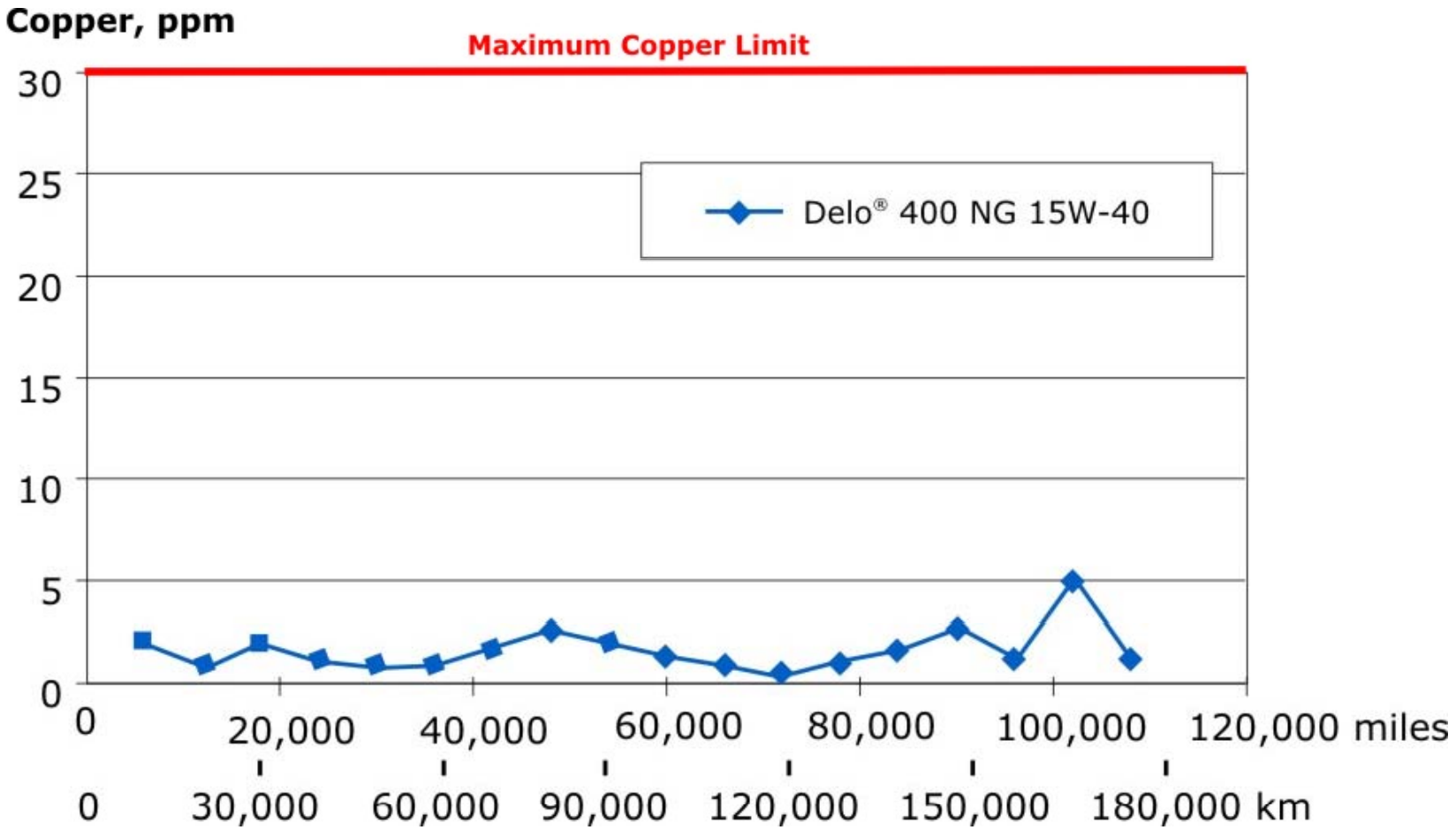
DDC Series 50G Bus Engine Field Testing – Wear Metals - Copper



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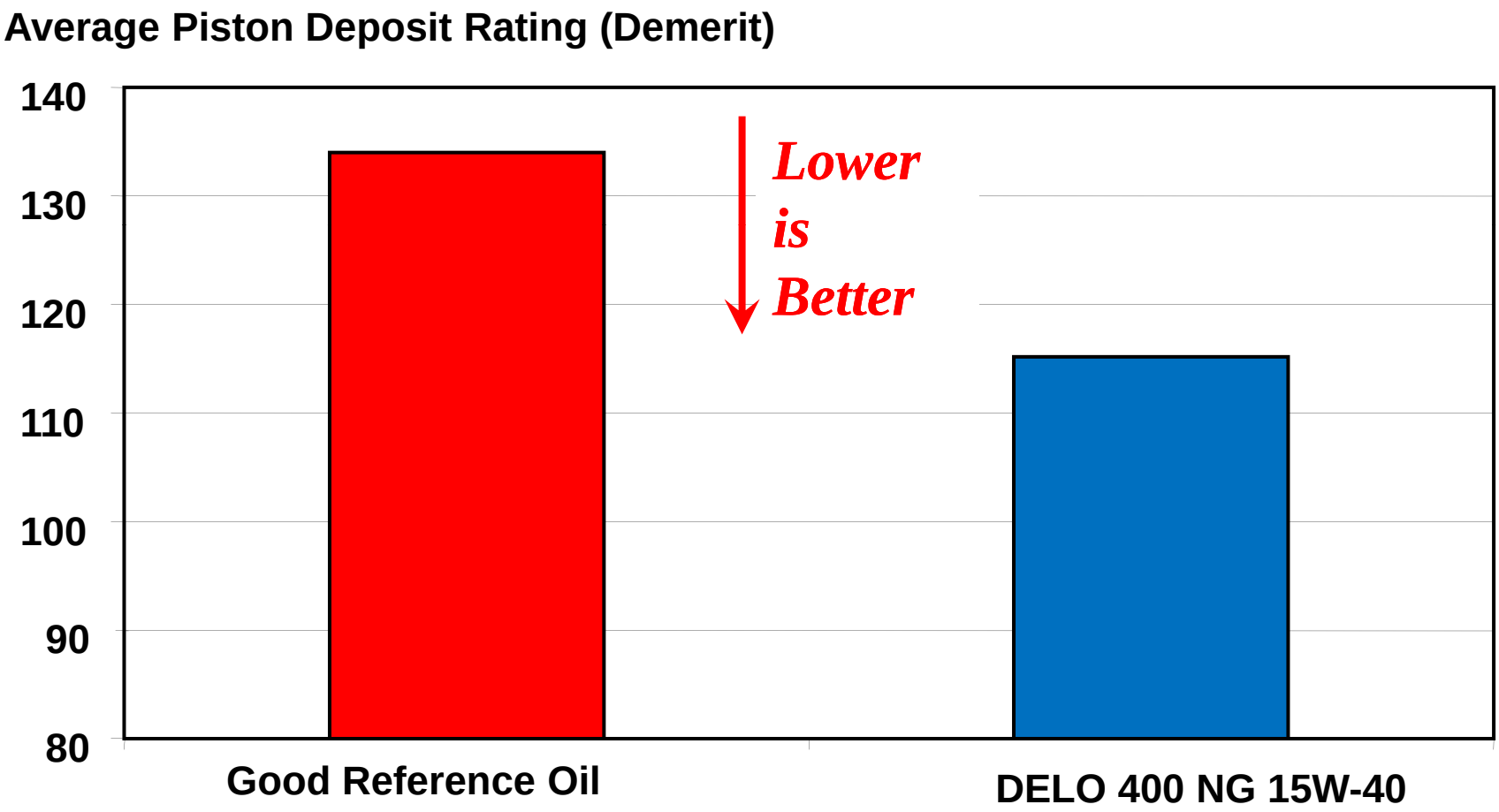
DDC Series 50G Bus Engine Field Testing – Piston Deposit Formation



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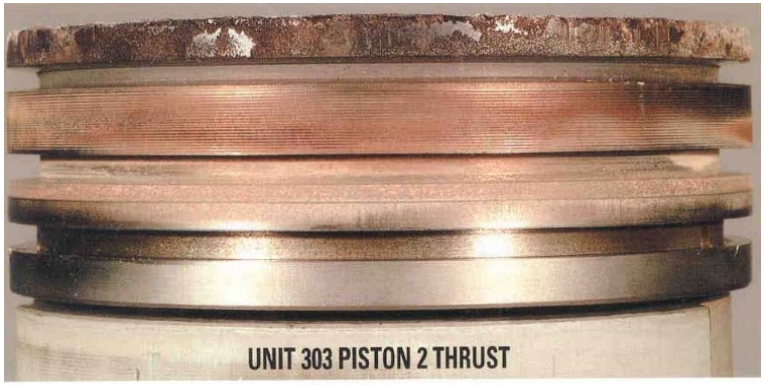
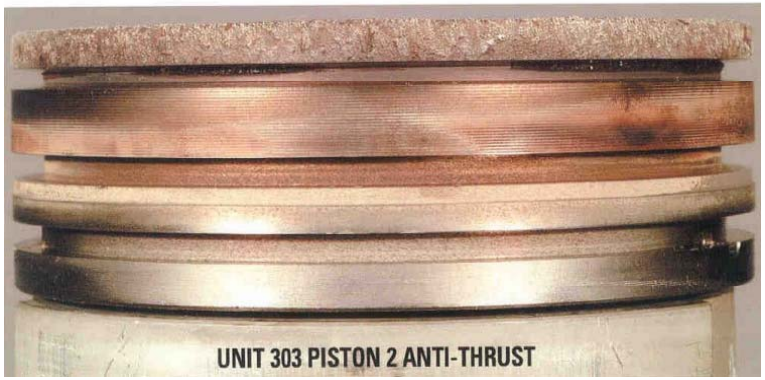
DDC Series 50G Bus Engine Field Testing – Teardown Pictures

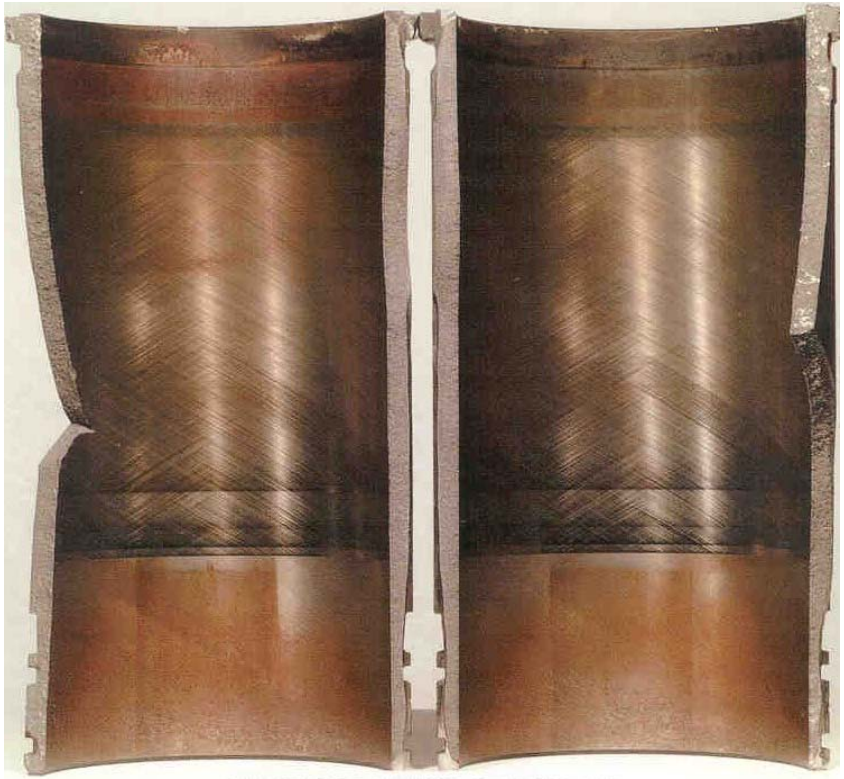
Bus Unit 303 Pistons & Liners in superb condition – virtually no wear and limited crown land deposits



UNIT 303 PISTON 2 THRUST



UNIT 303 PISTON 2 ANTI-THRUST



UNIT 303 LINER (TYPICAL)

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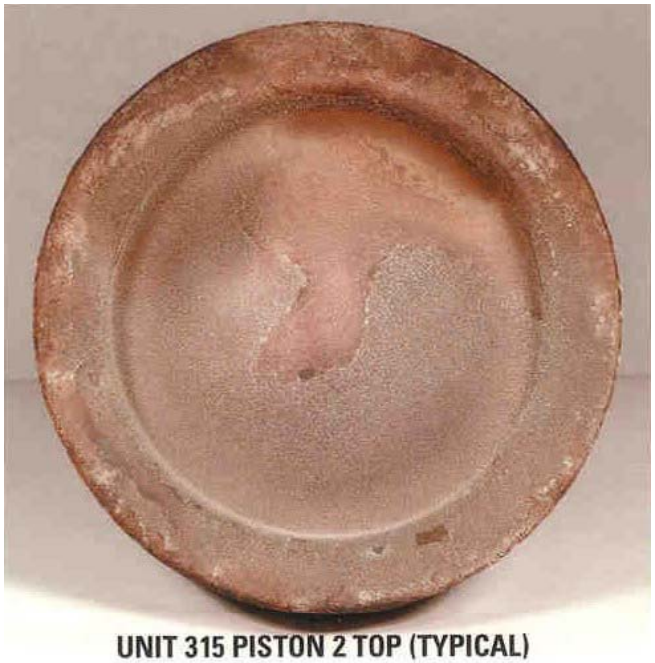
DDC Series 50G Bus Engine Field Testing – Teardown Pictures

- Bus Unit 315 Piston Undercrown is free of deposits
- Piston Crown shows low ash buildup using Delo 400 NG

UNIT 315 PISTON 2 UNDERCROWN (TYPICAL)



UNIT 315 PISTON 2 TOP (TYPICAL)

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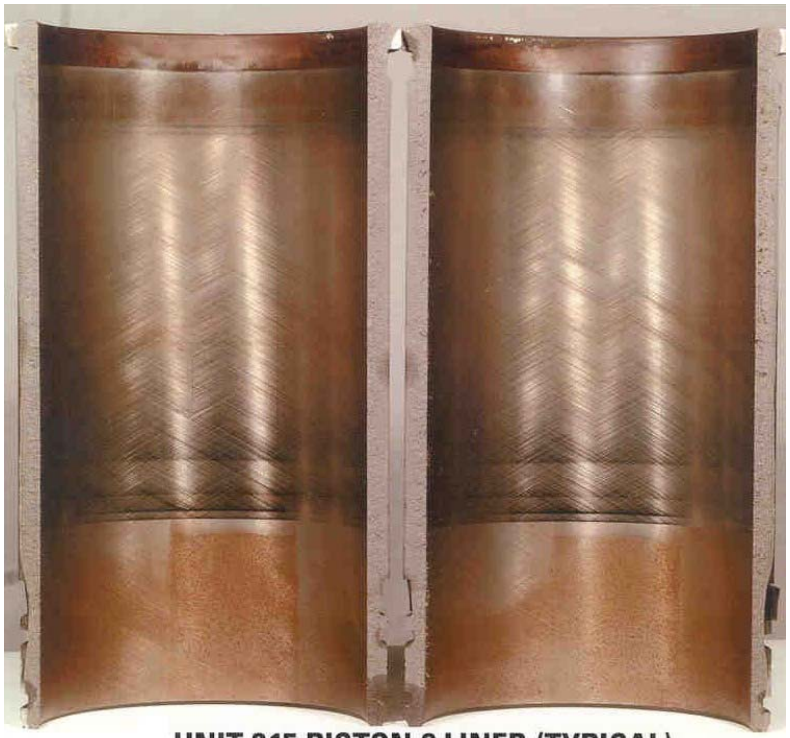
DDC Series 50G Bus Engine Field Testing – Teardown Pictures

- Bus Unit 315 shows virtually no liner wear
- Piston rings are free of carbon & ash deposits using Delo 400 NG



UNIT 315 PISTON 2 LINER (TYPICAL)

UNIT 315 PISTON 2 RINGS (TYPICAL)

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Volvo CNG Bus Engine Field Testing

BACKGROUND:

- City bus fleet located in Sweden
- At least 3 units must be included
- Engine type : VOLVO THG103
- Test Duration 150,000 km
- Drain Interval 50,000 km (~30,000 mile)
- Full engine inspection at end of test

RESULTS:

- Superb engine cleanliness and wear protection
- Long drain interval achieved with Delo 400 NG
- Volvo CNG field performance capability confirmed

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Mack CNG Test Program

- **Volvo-Mack used Delo 400 NG SAE 15W-40 in engine durability test**
  - Duration 800 hour
  - Cycle 30 sec idle / 30 sec rated speed full load
- **Used oil analysis looked very good**
  - Sufficient TBN retained, no TAN increase
  - Very low levels of the wear metals
- **Engine inspection**
  - Deposit levels on piston very low
  - No sludge formation
  - No visible wear on bearings, cylinders, and valve train
  - All parts looked like new

- **Mack endorsed Delo 400 NG SAE 15W-40 for Commercial CNG vehicle use**

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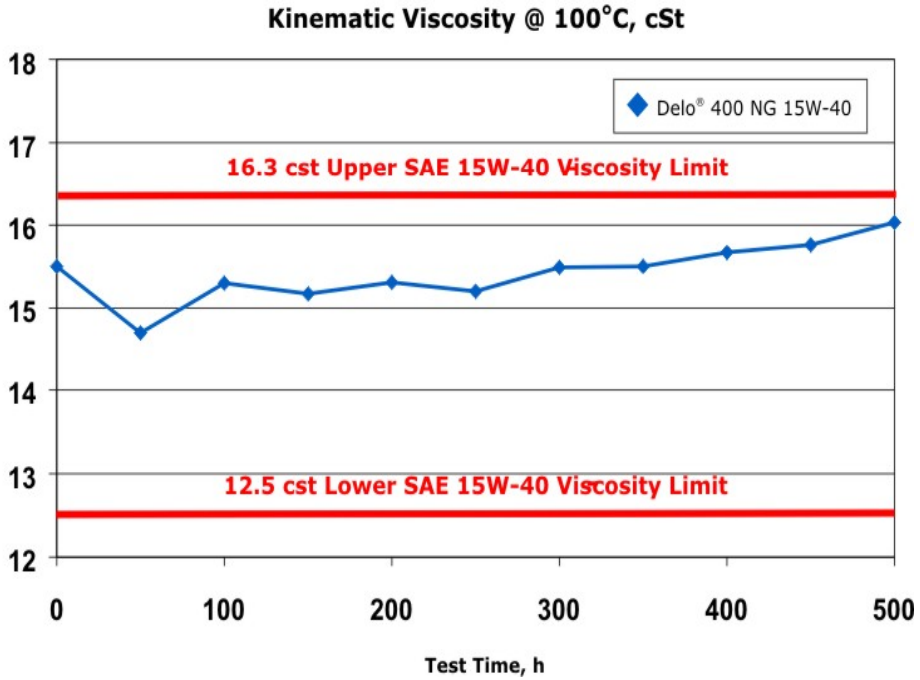
Mercedes-Benz Engine test – OM 366LAG

Mercedes-Benz Brazil in-house engine test

- Duration 500 h - Used oil analysis very good
  - Low used oil wear metals
  - Sufficient TBN left at the end of the test
  - Hardly any viscosity increase (see chart)
- Engine inspection
  - Engine showed low wear and good cleanliness
  - MB/DB confirmed MB 226.9 performance capability



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CNG/LNG Heavy Duty Engine Oil

Truck Field Test Performance

Talon Logistics

Cummins ISL-G (8.9L) Engines

OEM recommended 9000 mile oil drains

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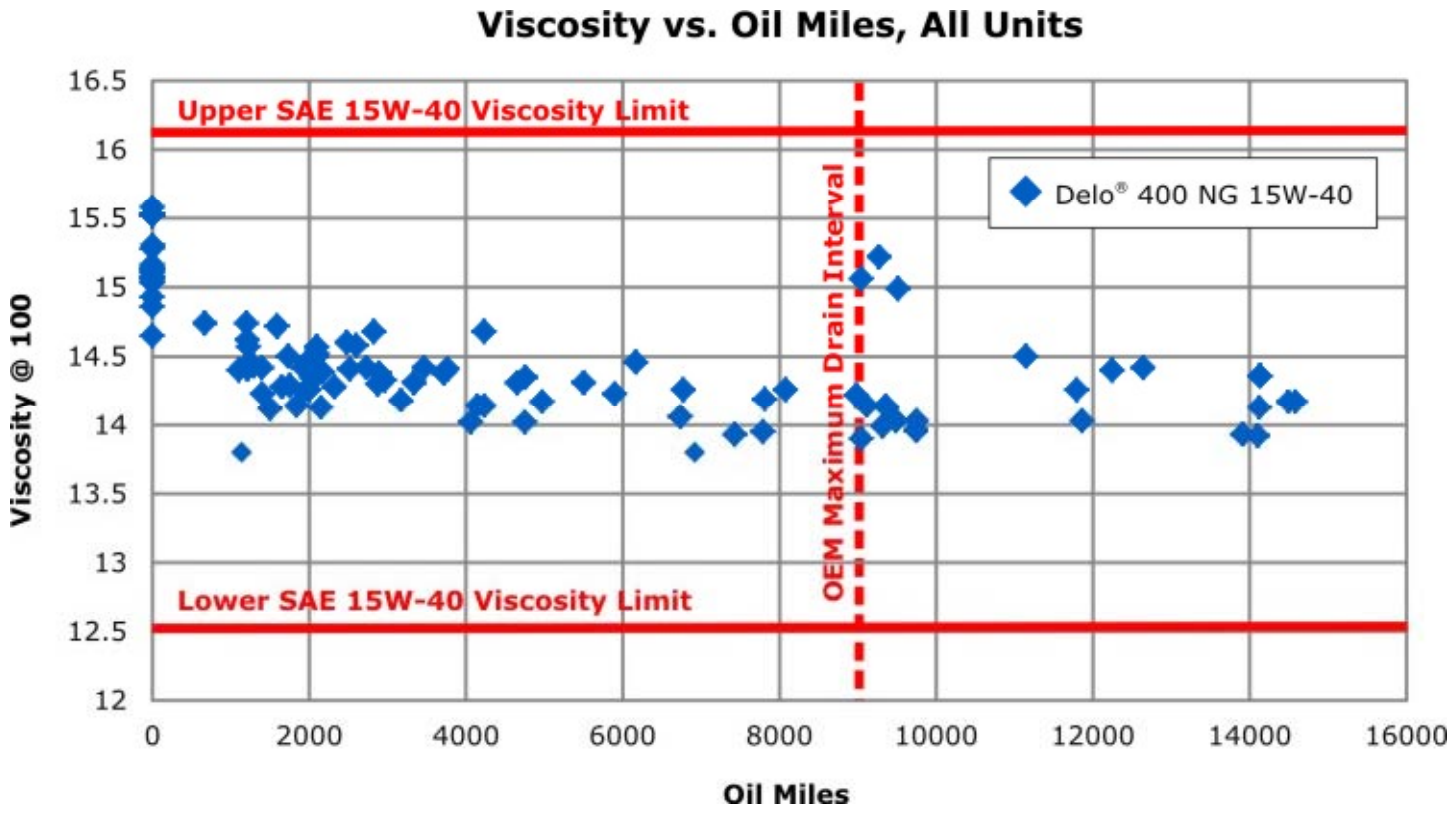
Talon Logistics – Cummins ISL-G Field Testing – Viscosity Control



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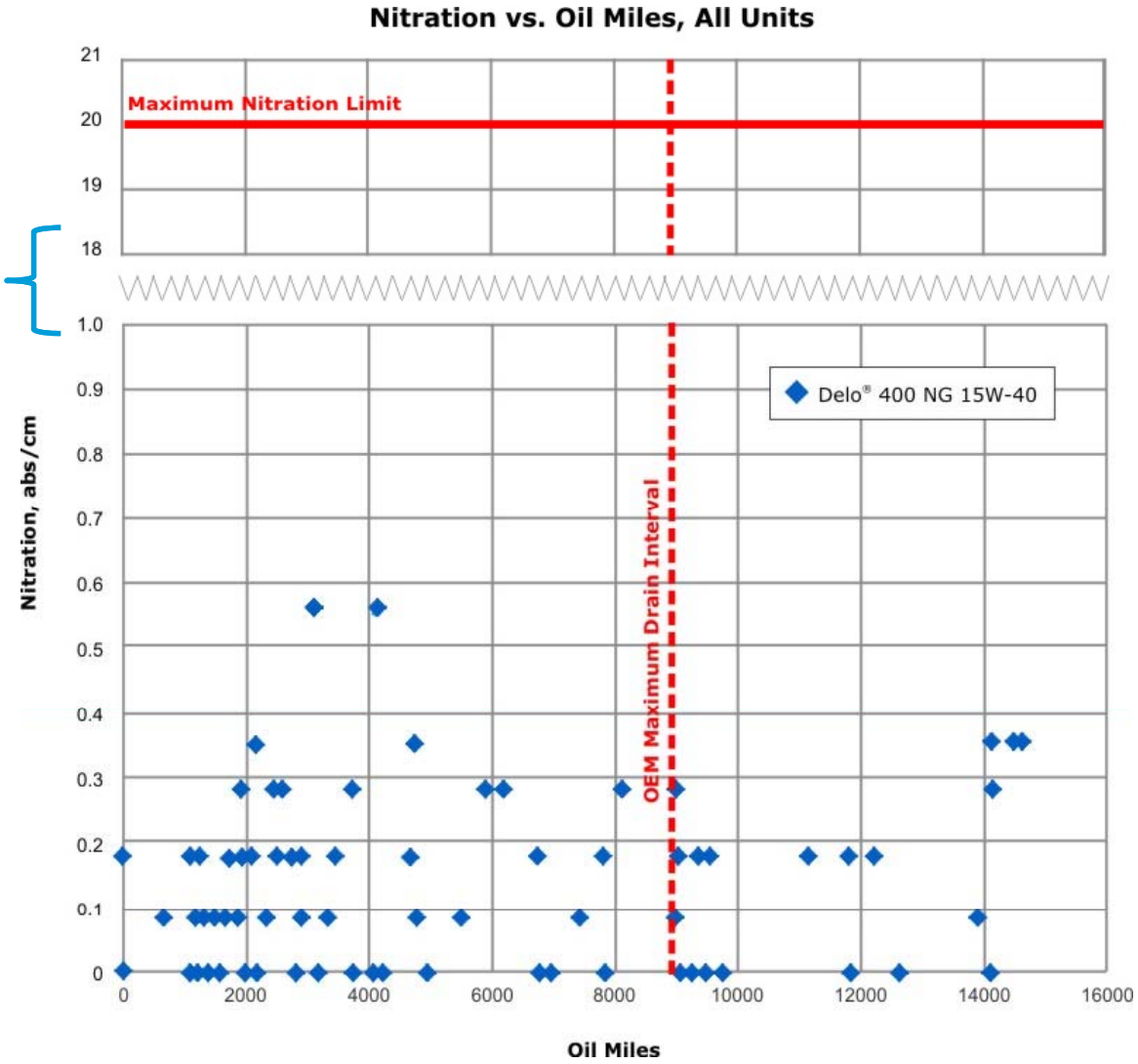
Talon Logistics – Cummins ISL-G Field Testing – Nitration Control

Scale break (Low Nitration level versus maximum limit)



Nitration performance is exceptional showing a level that is significantly under the maximum limit. This indicates excellent bearing corrosion protection with the Delo 400 NG formulation

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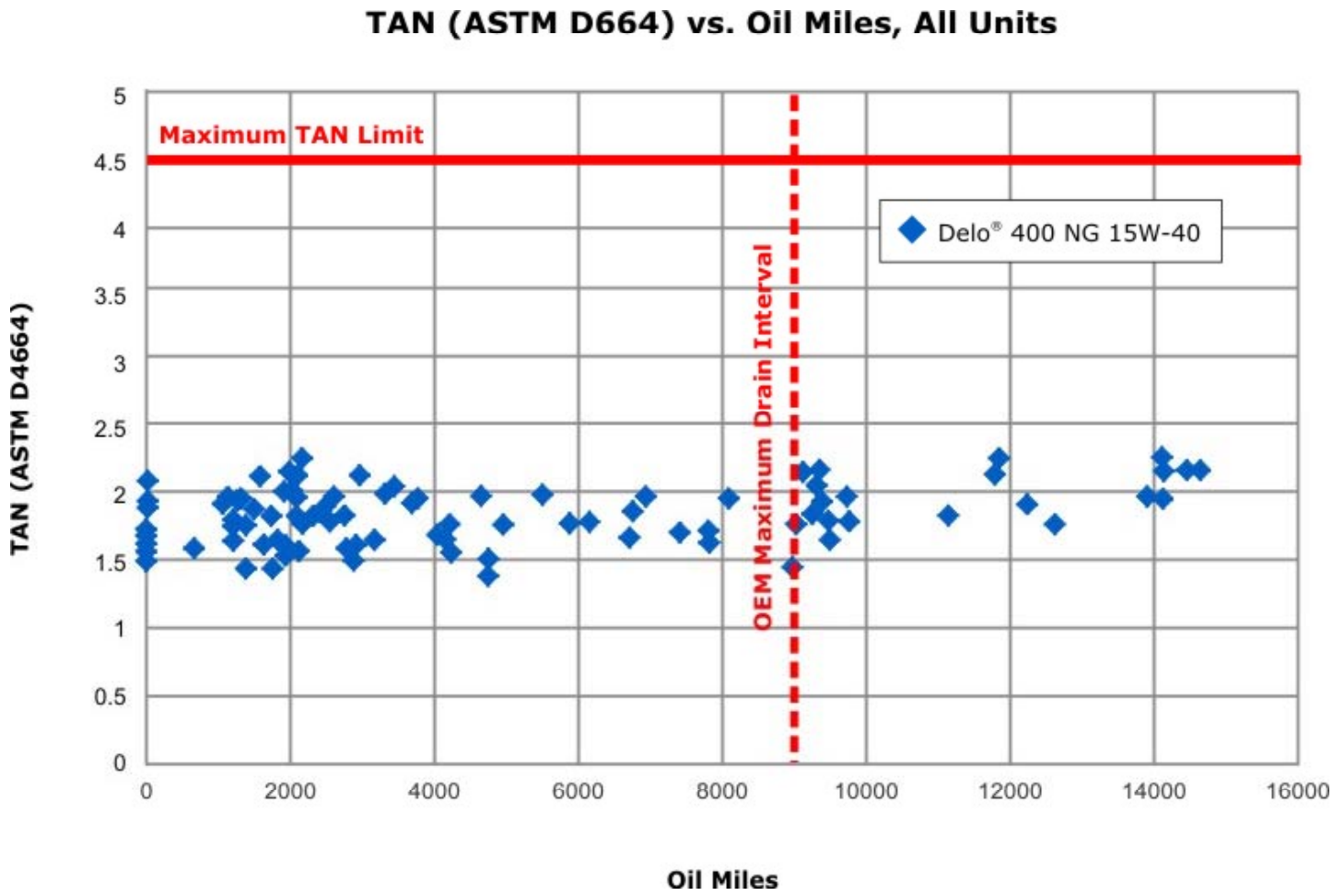
Talon Logistics – Cummins ISL-G Field Testing – TAN Resistance



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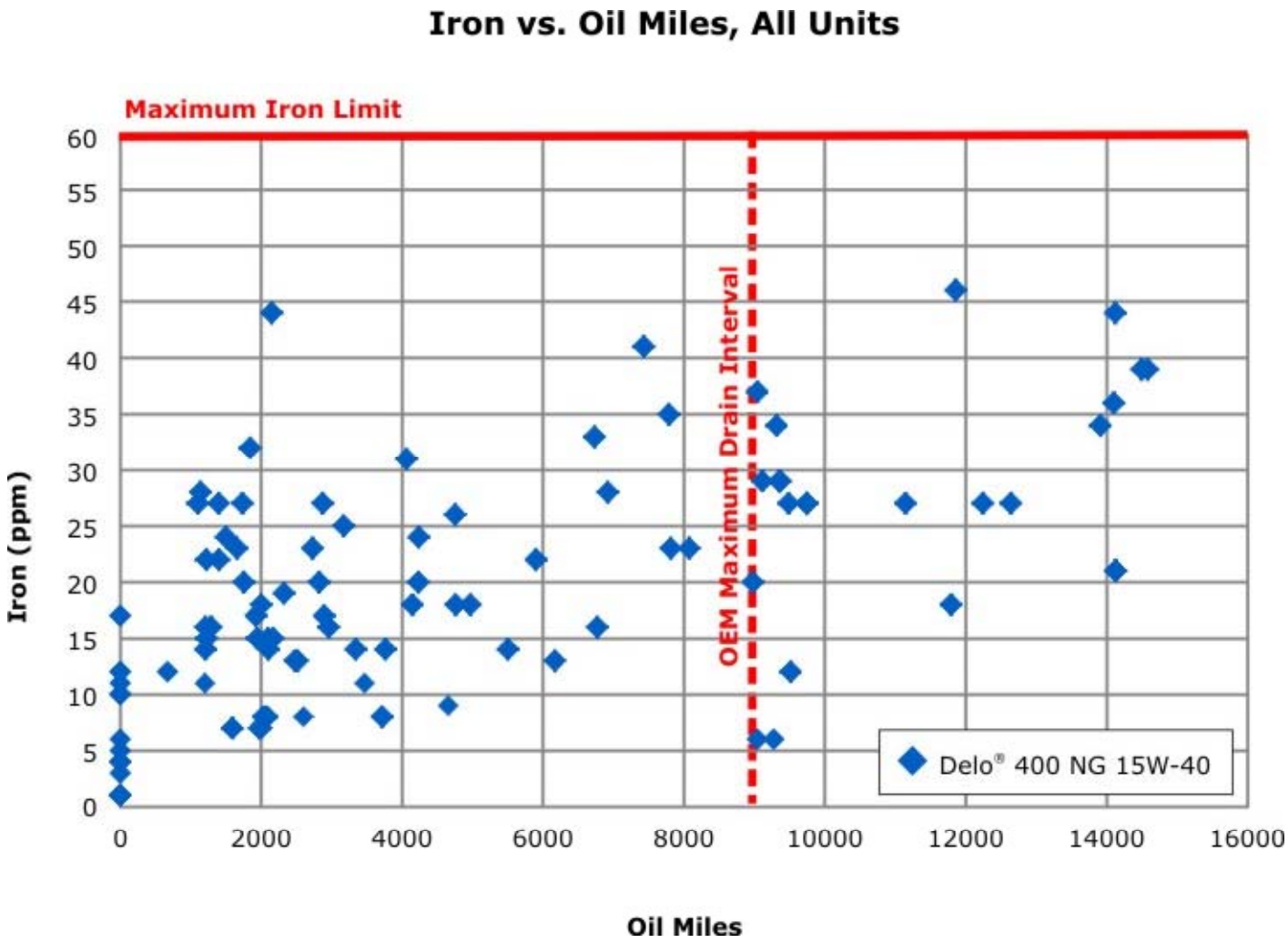
Talon Logistics – Cummins ISL-G Field Testing – Wear Control - Iron



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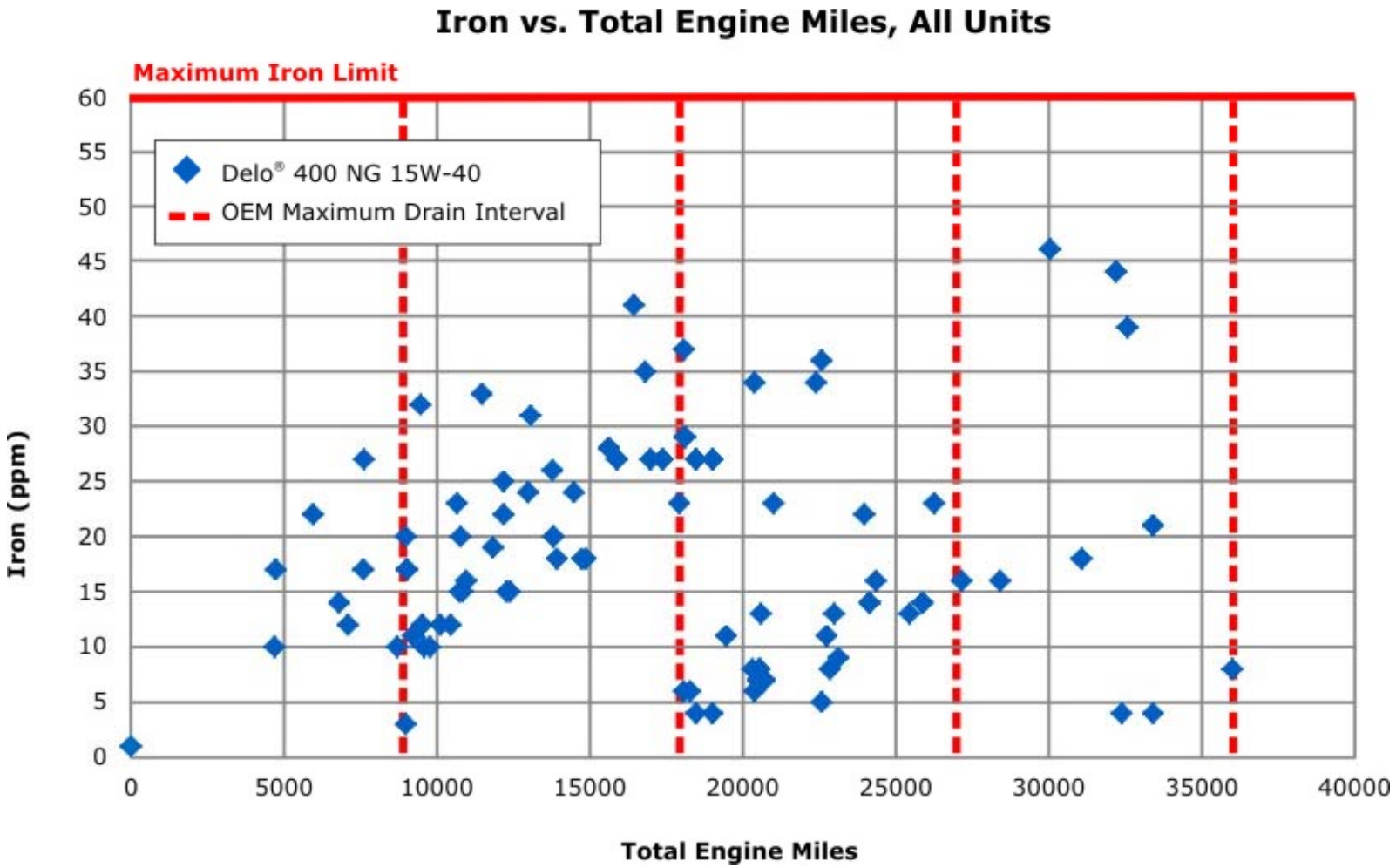
Talon Logistics – Cummins ISL-G Field Testing – Wear Control - Iron



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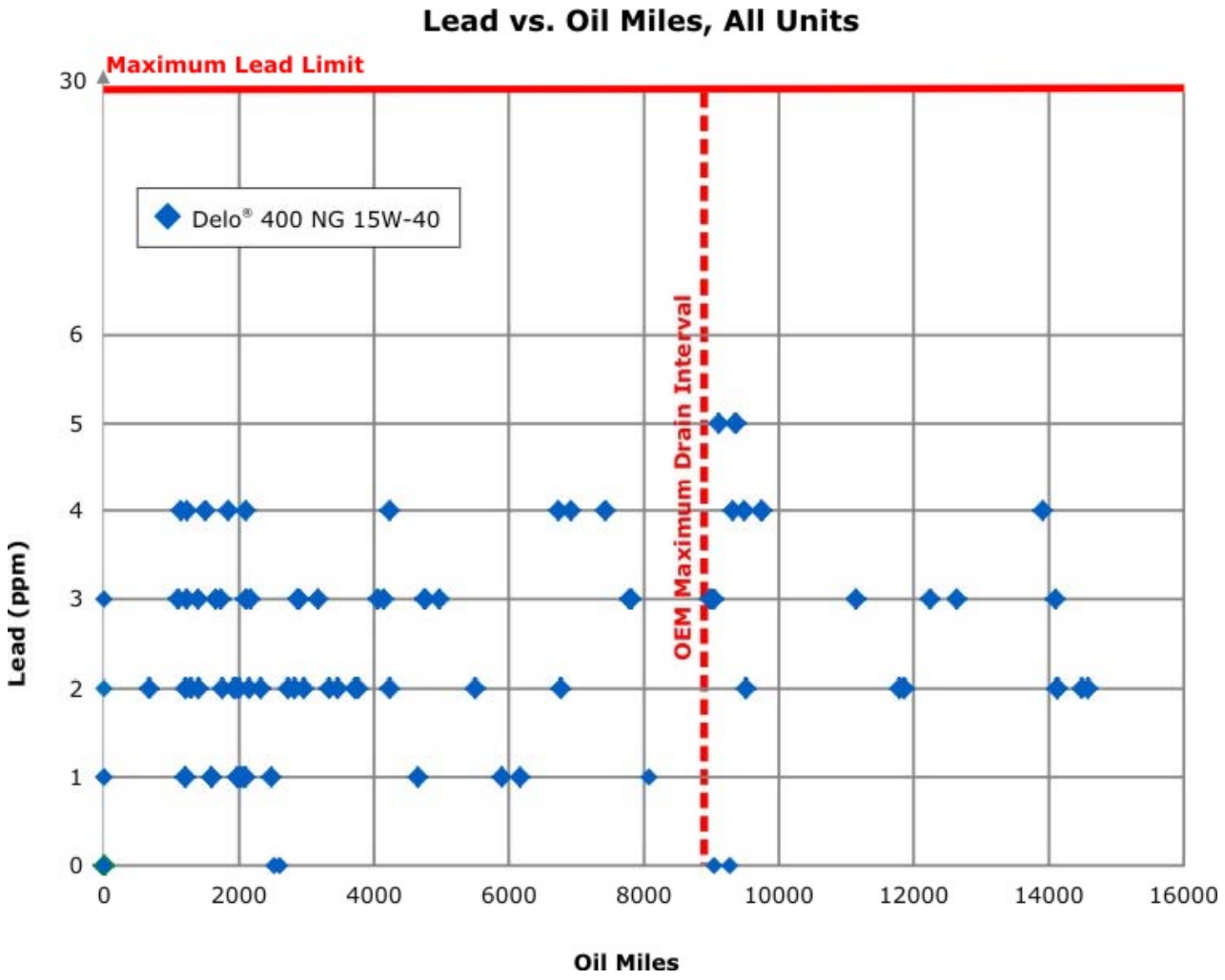
Talon Logistics – Cummins ISL-G Field Testing – Wear Control - Lead



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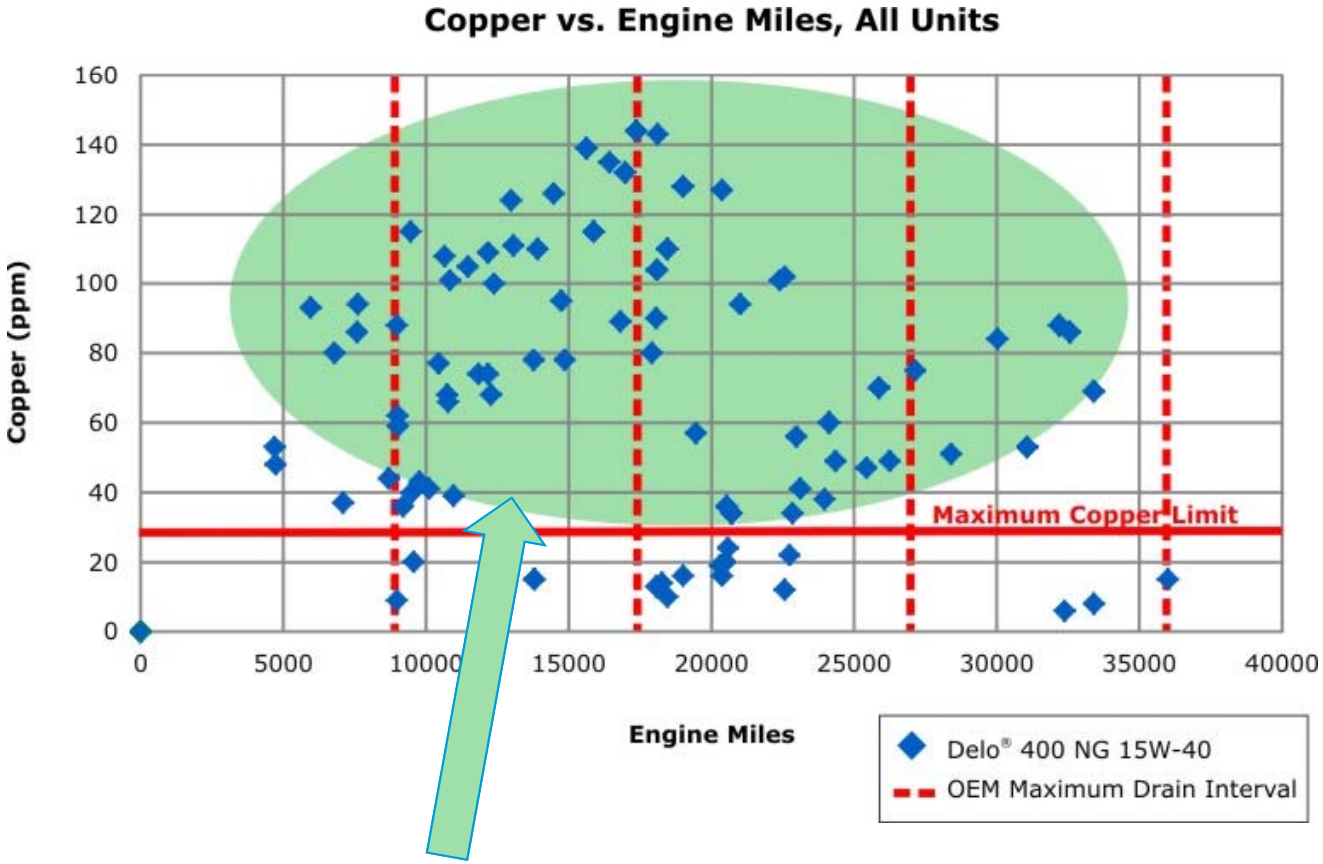
Talon Logistics – Cummins ISL-G Field Testing – Wear Control - Copper



High Copper level due to new engine break-in – copper oil cooler passivation process occurring. Once the oil cooler is passivated between 50,000 to 75,000 miles, we expect copper to fall under the maximum limit – indicating very good bearing corrosion protection.

Delo® 400 NG SAE 15W-40

Summary of Performance in Various Engine Types

- **Delo 400 NG offers excellent performance:**
  - Good oxidation/nitration control - no connecting rod or main bearing corrosion
  - Excellent Engine cleanliness – no sludge or valve deposits
  - Piston deposit control is better than diesel engine oils used in CNG engines
  - Piston top deposit level much lower than conventional diesel engine oils
  - UOA shows performance is excellent, despite higher stress of CNG combustion

- **Delo 400 NG Proof of Performance continuing field testing program:**
  - NA Bus Fleet Field testing performance - completed
  - Truck Field testing performance – in progress – teardown in 2013
  - Waste Truck Field testing beginning in May 2012
  - Bus Fleet testing in Thailand and Vietnam starting 2H12