

# "Stay Connected" through the Corona Virus with our customers



**Best Practices Maintenance OSBMA** 



### Maintenance holds the key to engine operation:

Maintenance is done as a preventive measure to help assure proper operating conditions exist.

- The operating manuals are based upon Truck duty cycles of average speed, and relatively low idle time. As we know, school buses are not trucks.
- Maintenance is a 3-legged stool and can be thought of as:
  - Equal Parts
    - Oil Drain
    - Aftertreatment
    - Daily Checks



#### **Issues to Consider:**

Role of Oil

- Lubricate the engine
- Cool the engine
- Suspend combustion byproducts

The DPF is a Filter, it must be maintained.

A leak left untended can damage key components and the engine itself.



## **Standard Intervals are Truck Intervals:**

#### V8 Oil Drain

EPA 07: 10,000 mi./350 hrs. 1,000 gal./6 mos.

EPA 10: 10,000 mi./500 hrs. 6 mos.

#### DPF

200,000 mi./6,000 hrs. 30 mos. EPA 07 & 10

### DT 466 <u>Oil Drain</u>

EPA 07 & 10 15,000 mi./550 hrs. 2,100 gal./6 mos.

### ISB6.7 & B6.7

#### Oil Drain

ISB & B6.7 15,000 mi./500 hrs./6 mos.

**DPF** 200,000 mi./6,000 hrs. 30 mos. EPA 07 & 10 **DPF** 200,000 mi./6,500 hrs.

Next, we'll look at these intervals in comparison to a school bus.



## What's wrong?

Nothing, if you have a truck.

#### <u>Oil:</u>

V8-07 10,000 mi./350 hrs. = 28.6 mph V8-10 15,000 mi./500 hrs. = 30.0 mph DT all 15,000 mi./550 hrs. = 27.3 mph B6.7 15,000 mi./500 hrs. = 30.0 mph School Buses average from a low of 12 mph, to a high of 24.

And have Idle Times that can range from 15% to as high as 70% with the bulk falling 25% to 50%

#### DPF

Int'l. 200,000 mi/6,000 hrs. = 33.3 mph CMI 200,000 mi./6,500 hrs. = 30.8 mph

Service operation interval - which ever comes first: miles/kilometers, months, years, hours, or liters/gallons of fuel

## **Interval - analysis**

77434249

75155126

7/24/2012

7/24/2012

71,225 13,680

71,762 17,108

4,208

5,180

216

1,884

DBxxxxx

DBxxxxx

DT 260/660

DT 260/660

101,557

83,122

3.1

3.1

												Recom	<u>mended</u>				
City of xx	k, Analysis											Time Ba	sed (30 m	os.)			
																How Many	How
										Maximum		How m	any DPF	How Man	y Oil	Oil Drains	Many Oil
			Total	Fuel	Total	Idle	Avg.	Avg.		Oil Drain in	DPF	Cleanin	gs should	Drains ba	sed	Miles/Time	Drains @
VIN	Eng.	In Svc. Date	Miles	Used	<u>Hours</u>	<u>Hours</u>	MPG	MPH	Idle %	Miles	Cleaning	have o	ccurred	on Time 6	Mos.	<u>Model</u>	<u>5000 mi.</u>
DBxxxxx	Mx7 220/560	9/19/2012	77,425	14,124	5,817	2,743	5.48	3 13.31	47.2%	6,655	79,861		3	15		11.6	15.5
DBxxxxx	Mx7 220/560	9/19/2012	82,359	14,280	6,325	3,096	5.77	/ 13.02	48.9%	6,511	78,127		3	15		12.7	16.5
DBxxxxx	Mx7 220/560	9/19/2012	91,942	14,632	5,415	2,054	6.28	16.98	37.9%	8,490	101,875		3	15		10.8	18.4
DBxxxxx	Mx7 220/560	9/19/2012	88,157	15,125	5,619	2,476	5.83	15.69	44.1%	7,845	94,135		3	15		11.2	17.6
DBxxxxx	Mx7 220/560	9/19/2012	81,614	13,200	5,432	2,427	6.18	3 15.02	44.7%	7,512	90,148		3	15		10.9	16.3
DBxxxxxx	Mx7 220/560	9/19/2012	71,820	12,762	5,132	2,311	5.63	13.99	45.0%	6,997	83,967		3	15		10.3	14.4
								'									
Eastern S	eaboard Cont	<u>ractor</u>															
													How m	any DPF	<u>How</u>	Many_	
			<u>Total</u>	Fuel	<u>Total</u>	<u>Idle</u>	Avg.			Maximun	n Oil	DPF	<u>Cleanin</u>	gs should	<u>Oil Ch</u>	nanges_	
VIN	Eng.	In Svc. Date	Miles	Used	<b>Hours</b>	<b>Hours</b>	MPG	Avg. MPH	<u>Idle %</u>	Drain in N	<u>liles</u> <u>C</u>	leaning	have o	ccurred	@6	Mos.	
CBxxxxx	DT 215/56	0 7/27/2011	193,199	23,800	7,969	2,132	8.12	24.24	26.8%	13,334	1	45,463	Э	8.5	17	7.4	
Ebxxxxx	DT 230/66	0 7/3/2013	180,887	22,642	6,821	2,024	7.99	26.52	29.7%	14,586	1	59,115	3	8.5	13	3.3	
Ebxxxxx	DT 230/66	0 8/20/2013	158,515	19,211	5,992	1,024	8.25	26.45	17.1%	14,550	1	58,727	2	2.7	13	3.3	
FBxxxxx	DT 215/56	0 8/21/2014	136,400	15,712	5,296	1,079	8.68	25.76	20.4%	14,165	1	54,532	2	2.3	1:	1.3	
FBxxxxx	DT 215/56	0 8/21/2014	128,348	15,500	5,335	1,311	8.28	24.06	24.6%	13,232	1	44,346	2	2.3	1:	1.3	
														Reco	mmenc	ded	
A City in	<u>TX</u>										<u>Recomr</u>	nended		Time Ba	sed (30	) mos.)	
														How	many D	OPF_	
				Total	Fue	<u>Total</u>	Idle	Avg.			Maxim	um Oil	DPF	Clean	ings sho	ould_	
VIN	Eng.	HR	In Svc. Dat	e <u>Miles</u>	Use	d <u>Hours</u>	Hours	MPG	Avg. MPH	l Idle %	<u>Drain i</u>	<u>n Miles</u>	<u>Cleanin</u>	g <u>have</u>	occurr	ed	
CBxxxxx	C DT 260/66	0 77576531	4/25/2011	72,01	.0 14,02	21 4,18	5 1,690	5.14	17.2	1 40.4%	9,4	64	103,240		3.6		
CBxxxxx	C DT 260/66	0 80946528	4/25/2011	72,70	6 17,9	63 5,70	5 2,390	4.05	12.74	4 41.9%	7,0	08	76,452		3.6		
CBxxxxx	C DT 260/66	0 70025563	4/25/2011	82,87	<b>'9 14,1</b>	10 4,73	5 1,515	5.87	17.5	0 32.0%	9,6	25	104,999		3.6		

5.21

4.19

16.93

13.85

5.1%

36.4%

9,309

7,620





	<u>Avg. Speed</u>	<u>Idle %</u>	
<ul> <li>Study 1</li> </ul>	14.7 mph	44.6%	Use Math:
<ul> <li>Study 2</li> </ul>	25.4 mph	23.7%	Avg. MPH * hours
• Study 3	15.6 mph	37.6%	Ex. 14.7 mph * 500 = 7350 miles

Speeds are less than ½ of a truck

Use Time:

- Oil: Every 6 months 2x per year
- As such maintenance intervals must be adjusted to accommodate this reality
- DPF Every 30 months

#### **Maintenance Best Practices**

## **DPF Cleaning:**

- DPF Maintenance a DPF is a filter, as a filter it has limits, it must be baked and maintained.
   SFX is the approved cleaning machine. Excess idle will impact the life of the filter. Limit idle time. The industry has said this for a long time, at this point in technology, there is no upside to excess idle.
  - Idle Shutdown
    - Saves Fuel
    - Could be mandated
    - Remember diesel "slobber"
  - We can be baking DPFs now

DIESEL EMISSIONS SYSTEM CLEANING AND MAINTENANCE Run clean. Run efficiently. Save money.



For all-makes trucks and heavy equipment at

[Dealership Logo]

Deelership Name

at a lower cost!

helps keep your trucks and

cleanly and efficiently-all

heavy equipment running

with one of our service

professionais today!

schedule e DPF cleaning

Proper Diesel Particulate Filter (DPF) cleaning at the recommended manufacturer intervals — and when indicated — will help your trucks run clean, run efficiently and save you money.

KNOW THE FACTS ABOUT DPF CLEANING!

- Fact: The Diesel Particulate Filter (DPF) on all 2007 and later engines must be cleaned at proper intervals of 250,000° miles (400,000 km or 6,000 hours) or less depending on duty cycle and manufacturers' recommendations.
- Fact: Many 2007 and later engines also have an Aftertreatment Fuel Injector (AFI), or doser, that is part of the exhaust system. Manufacturers recommend cleaning this component at approximately 100,000 miles (161,000 km or 3,000 hours) to prevent premature ash build-up in the DPF (see page 2).
- Fact: Left unchecked, soot and ash collected in a DPF can damage or destroy a filter — resulting in a DPF replacement cost of \$3,000 or more and unwanted, unscheduled downtime.
- Fact: Our specialized equipment can thoroughly clean a DPF, restoring the engine to full power and efficiency.
- Fact: DPF cleaning services are available for all-makes trucks and heavy equipment at (dealership name, location) and can be provided conveniently while your vehicle is in for service.

"Based on engine model/trake and operating conditione

# **Industry Information Support - DPF**

- At 30 mos. In service, these units should have been done multiple times
- 34.9% Idle Time is excessive



#### Idle Time:

One of the key operational activies that should be minimized when possible is Idle Time. When bus system or student comfort is critical, continue to idle as needed, however when possible, limit the idle time as the engine is operating at low engine speeds, low engine loads, and providing low heat and air flow to the Diesel Particulate Filter (DPF). A "good" idle time as a percent of operation is less than 20%.

Emergency DPF R&R is an expensive and sub-optimal solution causing excess unit downtime and higher costs. It may also have been preventable.

#### CCJ Innovators: Penske takes DPF cleaning inhouse, saving 'millions of dollars'

Jason Cannon | Y@By\_Jason\_Cannon / June 1, 2020

Shortly after the turn of the new millennium, maintenance technicians were staring down a new challenge: an exhaust aftertreatment system that only after a few years would be a ubiquitous piece of equipment.

"The DPF is simply a filter," Hasinec said. "Sometimes in 🛶 this industry we overcomplicate things and overthink them, but at the end of the day, that's all that DPF does is collect something just like an oil filter or a fuel filter, and it needs to be cleaned periodically or changed."

- 3 Step Analysis of DPF:
- Pneumatic, if <85% efficient</li>
   Then
- Aqueous Solution and Bake

## **Coolant Recovery Tool:**

- The EGR Cooler is directly in the intake air stream for combustion. An internal leak therefore allows coolant to the cylinders, affecting combustion, and potentially carrying coolant through the engine into the DPF affecting its performance.
- Hot pockets of super-heated air can prematurely damage an EGR Cooler when coolant level is low. Evac and Fill
  machines and procedures help to prevent low coolant. Daily checks look to report low coolant.
- Uses Shop air to create regulated pressure and a powerful vacuum.
  - The regulated pressure forces the coolant out of the entire system quickly into the 20 gal. tank.
    - No spills
    - No contamination of coolant
- Improves safety, efficiency, and quality
- No moving coolant around
- Diagnose the integrity of the System
  - Approx. 30 min. time savings
- Fill draws the coolant up into the entire system
- Safe, easy refill, eliminates warm-up/top-off
  - Approx. 30 min. time savings
- Eliminates/reduces air pockets forming in the EGR Cooler and a premature failure.
  - EGR Coolers are over \$1,000

# Cummins **B6.7** & L9 PM Schedule

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- Critical action

Kilometers x 1	000	6	11	22	45	112	146
Miles x 100	0	3.5	7	14	28	70	91
Hours		250	500 🔨	1000	2000	5000	6500
Procedure	Step						
Air Cleaner Restriction	Check	X					
Charge Air System	Check	X					
Fuel Filter	Change		Х	7,	000 miles/500	) hrs. = 14 mp	h
Batteries*	Check		X			•	
Lube Oil and Oil Filter	Change		Х				
Battery Cables*	Check		X				
Coolant Filter	Change		X				
Coolant Concentration	Check		X				
Radiator Pressure Cap	Check		X				
Lelles Theorem			·	Х			
iale lime:				x			
One of the key on	orational a	ctivics that should I	20	v v			

One of the key operational activies that should be minimized when possible is Idle Time. When bus system or student comfort is critical, continue to idle as needed, however when possible, limit the idle time as the engine is operating at low engine speeds, low engine loads, and providing low heat and air flow to the Diesel Particulate Filter (DPF). A "good" idle time as a percent of operation is less than 20%.

Х			
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		X	
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			X

# Cummins Recognition of Interval Management Common Strategy Strateg

\*See eq Recom

#### Fleet Maintenance Guidelines:

- Service Intervals should be based on HOURS
- Mileage based intervals assume a 30 mph average vehicle speed which is **NOT THE** CASE FOR MOST BUSES
- **Calculating Maintenance Mileage Intervals:** 
  - Determine fleet average speed via **INSITE/Other**
  - Multiply fleet average speed by maintenance hours to recalibrate mileage maintenance table

#### **EXAMPLE**:

- Fleet avg. speed = **11 mph** ٠
- DPF filter clean recommendation = 6500 hours
  - Original recommended mileage = 200.000 miles
- Adjusted mileage = (11 mph x 6500 h) = 71,500٠ miles

	TM	Kilometers	12,000	24,000	24,000	48,000	96,000	120,000	242,000	322,000		(Ex ave	: 11 n rage`	nph )		
	<b>D.</b> /	Miles	7500	15,000	15,000	30,000	60,000	75,000	150,000	200,000		are	, ago	/		
		Hours	250	500	500	1000	2000	2500	5000	6500						
	a a linta muala	Months	3	6	12											
aintenar	ice intervals	Years				1			4							
Pro	ocedure	Step														
	AIT Cleaner Restriction	Check	X													
	Charge Air Cooler	Check	x													
	Lubricating Oil and Filters	Change			Refer to P	rocedure	359-003 i	n Section 3	<u>.</u>							
	Engine Coolant Antifreeze	Check		X												
	Batteries	Check		X												
Ba	Sattery Cables and Connections Check X															
			Kilometers Miles Hours Months		4	4,500 9	9,000	9,000	18,000	35,500	44,000	89,000	115,00			
,					2	2,750		5,500	11,000	22,000	27,500 2500	55,000 5000	71,500 6500			
						250		500		2000						
	<b> -</b> .					3	6	12								
	Maintenar	5 📕	Years			-			1			Δ				
	Dr		6	ton					-							
Aftertre		riction	Ch	lep lock		v										
Anternet			aner Nesu hargo Air I	Dining			_	×							<u> </u>	
atment Diesel			harge All I	Coolor		ieck		<u>×</u>							<u> </u>	
equipment mar		U	narge Air (	Cooler	Cr	еск	_	X								
		Lubricatin	ig Oli and i	Filters	Chi	ange				Refer to H	rocedure	359-0031	n Section 3	<u>.</u>		
		freeze	Ch	neck			X									
		tteries	Ch	neck			X									
	Ba	ctions	Ch	neck			X									
		re Cap	Ch	neck			Х									
		Type)	Ch	ange				Х								
		ng Fan	Ch	neck					х							
		sioner	Ch	neck					x							
	A	: Lines	Ch	neck					х							
		ystem	Ch	neck						х						
		iscous	Ch	neck						х						
		aning	C	ean						x						
		Hoses	 Ch	neck						x						
		Filter	Ch	ange						~	x					
		ad Set	<u>کار</u>	linet	_						~	x	<u> </u>			
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## **Maintenance Policy Recommendations**

- First evaluate current practices
- Develop new norms
  - Oil
  - DPF
  - Daily Inspection Response

EGR Coolers and Aftertreatment are the new normal. If the DPF is damaged in any way, it will compensate which could create additional problems and progressive damage.





# Questions

# **Additional Information**

#### **Aftertreatment Resource Center**

- After Treatment Website Links:
- http://www.fsxinc.com/site1/Products/products.html

https://www.chevronlubricants.com/en\_us/home/learning/about-our-brands/delo/emissions-controlcenter.html?utm\_source=bing&utm\_medium=cpc&utm\_campaign=CHT-GEN-011%20DELO%20BMM\_Nonbrand%20-%20Delo%20600%20ADF%20Content&utm\_term=+dpf%20+filter&utm\_content=NikVEi8p\_pcrid\_770346536743 44\_pkw\_+dpf%20+filter\_pmt\_bb\_pdv\_c\_slid\_pgrid\_1232552735169239\_ptaid\_kwd-77034704436239:loc-190&mkwid=NikVEi8p\_77034653674344\_%2Bdpf%20%2Bfilter\_bb\_c&mtid=744icg56377&slid=&product\_id= https://www.schoolbusfleet.com/article/727873/franklin-tackles-critical-transportation-issues https://www.schoolbusfleet.com/news/731626/dpf-maintenance-for-your-school-bus https://www.ccjdigital.com/ccj-innovators-penske-in-house-dpfcleaning/?utm\_source=newsletter&utm\_medium=email&utm\_content=06-01-2020&utm\_campaign=Commercial%20Carrier%20Journal&ust\_id=7ca9b5b9d6ce907e7663e006bf17a7ab6852f6

f3&utm term=newsletter-2--position-top-story&oly enc id=4236l8878812B2l

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