



Main Engines - Twin Caterpillar 3512A 1150HP

Engine Oil Reports: Starboard Main Engine

Oil Samples - New Oil	New Oil		WearCheck	WearCheck	WearCheck	WearCheck	Metro Tech
	400LE	15W40	Date: 4-12-2016	Date: 5-10-2016	Date: 6-7-2016	Date: 7-31-2016	Date 8-25-2016
	Chevron Delo		32 Hrs. on Oil	388.5 Hrs. on Oil	804 Hrs. on Oil	1433 Hrs. on Oil	1,886 Hrs on Oil
	Chev Delo 400		Chev Delo 400	Chev Delo 400	Chev Delo 400	Chev Delo 400	Chev Delo 400
Metals: (D5185) mg / kg ppm			w 10% BL- DET	w 10% BL- DET	w 10% BL- DET	w 10% BL- DET	w 10% BL- DET
Tin	0		0	0.1	0	0.1	0
Lead	0.1		0.1	0	0.7	0.5	2
Copper	0.3		0.6	0.6	1	2.7	19
Aluminum	2		2.1	2.4	2.5	2.1	2
Silicon	7		5.4	2.7	4.3	10	5
Iron	2		2.6	3	7.3	2.6	25
Chromium	0		0	0	0.2	0	0.3
Silver	0		n/a	n/a	n/a	n/a	0
Zinc	1178		897	905	1017	933	1150
Magnesium	356		304	305	366	304	332
Nickel	0		0.1	0.1	0.3	0.1	0
Barium	0		0	0	0	0	0
Sodium	1		1.2	1.5	1.5	1.2	2
Calcium	1428		1499	1466	1686	1592	1650
Vanadium	0		n/a	n/a	n/a	n/a	0
Phosphorus	1001		824	822	908	905	950
Molybdenum	82		68	69	78	72	81
Boron	512		380	370	388	376	356
Manganese	0		n/a	n/a	n/a	n/a	0

Physical Properties:

Viscosity (D445) @ 40C							
Viscosity (D445) @ 100C	15.69		14.2	14.4	14.3	13.61	13.73
Water	0		0	0	0	0	0
Solids	0		0	0	0	0	0
Glycol							
Fuel Dilution			2	2	2	2	

Other Properties:

Acid # (D664)							
Base # (D2896) Titration	8.66		7.86	5.87	8.73	5.89	3.87
Oxidation	0						11.86
Nitro Compounds							
Particle Count (ISO 4406)							

Notes:

- 1 Please notice that with the addition of the BestLine Diesel Engine Treatment that that Zinc and Phosphorous components that make up the ZDDP anti wear package never depleted confirming that the oxidation reaction required to case the reaction to activate the ZDDP never occurred rendering the ZDDP inert with no negative impact on emission control systems.
- 2 Please notice that the Base number showed a fairly consistent downward movement over the 1886 hours on run time on this oil other than the anomaly for possible added oil at the 805 hour mark. The base number fell just below 50% of the original BN until the end of the oil change interval, at which time an oil change was recommended. \*\* None of the wear metals has approached an ab-normal reading. Oxidation is still quite low.
- 3 In the prior year of operation, over the same time frame there were four (4) complete oil changes. With the addition of the BestLine Diesel Engine Treatment, this year we had one oil change over the same operating time frame.



Main Engines - Twin Caterpillar 3512A 1150HP

Engine Oil Reports: Port Main Engine

Oil Samples - New Oil	New Oil		WearCheck	WearCheck	WearCheck	WearCheck	Metro Tech
	400LE	15W40	Date: 4-12-2016	Date: 5-10-2016	Date: 6-7-2016	Date: 7-31-2016	Date 8-25-2016
	Chevron Delo		32 Hrs. on Oil	394.6 Hrs. on Oil	810 Hrs. on Oil	1426 Hrs. on Oil	1,886 Hrs on Oil
Metals: (D5185) mg / kg ppm	Chevron Delo		Chev Delo 400	Chev Delo 400	Chev Delo 400	Chev Delo 400	Chev Delo 400
	400LE	15W40	w 10% BL- DET	w 10% BL- DET	w 10% BL- DET	w 10% BL- DET	w 10% BL- DET
Tin	0		0	0.2	0	0	1
Lead	0.1		0	0	0	0	1
Copper	0.3		0.6	0.9	1.2	7.1	15
Aluminum	2		1.9	2.4	2.4	2.1	2
Silicon	7		4.5	2.5	4.8	3.1	4
Iron	2		1.6	2.1	7	16	23
Chromium	0		0	0	0.2	0	0.3
Silver	0		n/a	n/a	n/a	n/a	0
Zinc	1178		950	883	1005	994	1150
Magnesium	356		347	297	370	329	335
Nickel	0		0.2	0.1	0.3	0.1	0
Barium	0		0	0	0	0	0
Sodium	1		1.4	1	1.3	4.3	2
Calcium	1428		1591	1444	1684	1534	1650
Vanadium	0		n/a	n/a	n/a	n/a	0
Phosphorus	1001		819	818	938	786	950
Molybdenum	82		70	67	79	76	81
Boron	512		410	388	416	358	393
Manganese	0		n/a	n/a	n/a	n/a	0

**Physical Properties:**

Viscosity (D445) @ 40C							
Viscosity (D445) @ 100C	15.69		14.4	14	14.1	14	13.34
Water	0		0	0	0	0	0
Solids	0		0	0	0	0	0
Glycol							
Fuel Dilution			2	2	2	2	

**Other Properties:**

Acid # (D664)							
Base # (D2896) Titration	8.66		7.97	10.87	7.57	5.56	4.34
Oxidation	0						10.04
Nitro Compounds							
Particle Count (ISO 4406)							

**Notes:**

- 1 Please notice that with the addition of the BestLine Diesel Engine Treatment that that Zinc and Phosphorous components that make up the ZDDP anti wear package never depleted confirming that the oxidation reaction required to case the reaction to activate the ZDDP never occurred rendering the ZDDP inert with no negative impact on emission control systems.
- 2 Please notice that the Base number showed a fairly consistent downward movement over the 1886 hours on run time on this oil other than the anomaly for possible added oil at the 805 hour mark. The base number never fell below 50% of the original BN until the end of the oil change interval, at which time an oil change was recommended. \*\* None of the wear metals has approached an ab-normal reading. Oxidation is still quite low.
- 3 In the prior year of operation, over the same time frame there were four (4) complete oil changes. With the addition of the BestLine Diesel Engine Treatment, this year we had one oil change over the same operating time frame.



## MetroTech Systems Lab Reports

Oil Samples - New Oil	Lab#: WI6090 <b>Chevron Delo 400LE 15W40</b>	Lab#: WI6091 <b>Chevron Delo 400LE 15W40 With 10% DET</b>	Lab#: WI6093 <b>BestLine Full Synthetic 15W40 - Blended with DET</b>
<b>Metals:</b> (D5185) Milligrams per Kilogram ppm			
Tin	0	0	0
Lead	0.1	0	0
Copper	0.4	0.2	0.1
Aluminum	1	2	1
Silicon	16	15	16
Iron	2	2	2
Chromium	0	0	0
Silver	0	0	0
Zinc	1213	1046	953
Magnesium	382	349	29
Nickel	0	0	0
Barium	0	0	0
Sodium	1	4	5
Calcium	1418	1792	2361
Vanadium	0	0	0
Phosphorus	1019	883	788
Molybdenum	80	68	0
Boron	496	426	48
Manganese	0	0	0

**Physical Properties:**

Viscosity (D445) @ 40C			
Viscosity (D445) @ 100C	16.19	12.98	12.54
Water	0	0	0
Solids	0	0	0
Glycol			
Fuel Dilution			

**Other Properties:**

Acid # (D664)			
Base # (D2896) Titration	9.28	9.66	9.72
Oxidation			
Nitro Compounds			
Particle Count (ISO 4406)			



# BestLine Diesel Engine Treatment Economic Model

Un Cruise S/S Legacy Main Engine Analysis

Product: BestLine Diesel Engine Treatment

		Summer 2015		Summer 2016	
		Port Yes Yes	Strbd Yes Yes	Port Yes Yes	Strbd Yes Yes
Engine Make & Model	Twin Caterpillar 3512A 1150 Hp				
Oil Type	Chevron Delo 400 LE 15W40				
Crankcase Capacity	150 Gallons per Engine	150	150	150	150
<b>Operating Hours per Oil Change Interval</b>	<b>Indicated by 2015 / 2016 Oil Samp.</b>	<b>500</b>	<b>500</b>	<b>1886</b>	<b>1886</b>
Total Operating April through Sept		1991	1991	1940	1940
# of Oil Changes -Summer Operations		4	4	1	1
Cost per Gallon of Oil:		\$ 17.10	\$ 17.10	\$ 17.10	\$ 17.10
Total Cost of Oil Change per Engine		\$ 2,565.00	\$ 2,565.00	\$ 2,565.00	\$ 2,565.00
Total Cost for Oil per Operating Season		\$ 10,260.00	\$ 10,260.00	\$ 2,565.00	\$ 2,565.00
Total for Both Engines				\$ 20,520.00	\$ 5,130.00
BestLine Diesel Eng. Treatment / 2016					
10% Solution by Volume Recommended	15 Gallons per Engine Note: Plus 1 gallon Spare			15	15
Cost Per Gallon of BestLine DET				\$ 115.00	\$ 115.00
# of BestLine Oil Treatments -Summer Operations				1	1
Cost to Utilize BestLine DET				\$ 1,725.00	\$ 1,725.00
Total Cost for BestLine per Operating Season					\$ 3,450.00
Total Cost for Oil Changes for Summer Seasons:				\$ 20,520.00	\$ 8,580.00

**Net Savings On Oil Changes with BestLine Diesel Engine Treatment:**

**\$ 11,940.00**



# BestLine Diesel Engine Treatment Economic Model

Un Cruise S/S Legacy Main Engine Analysis

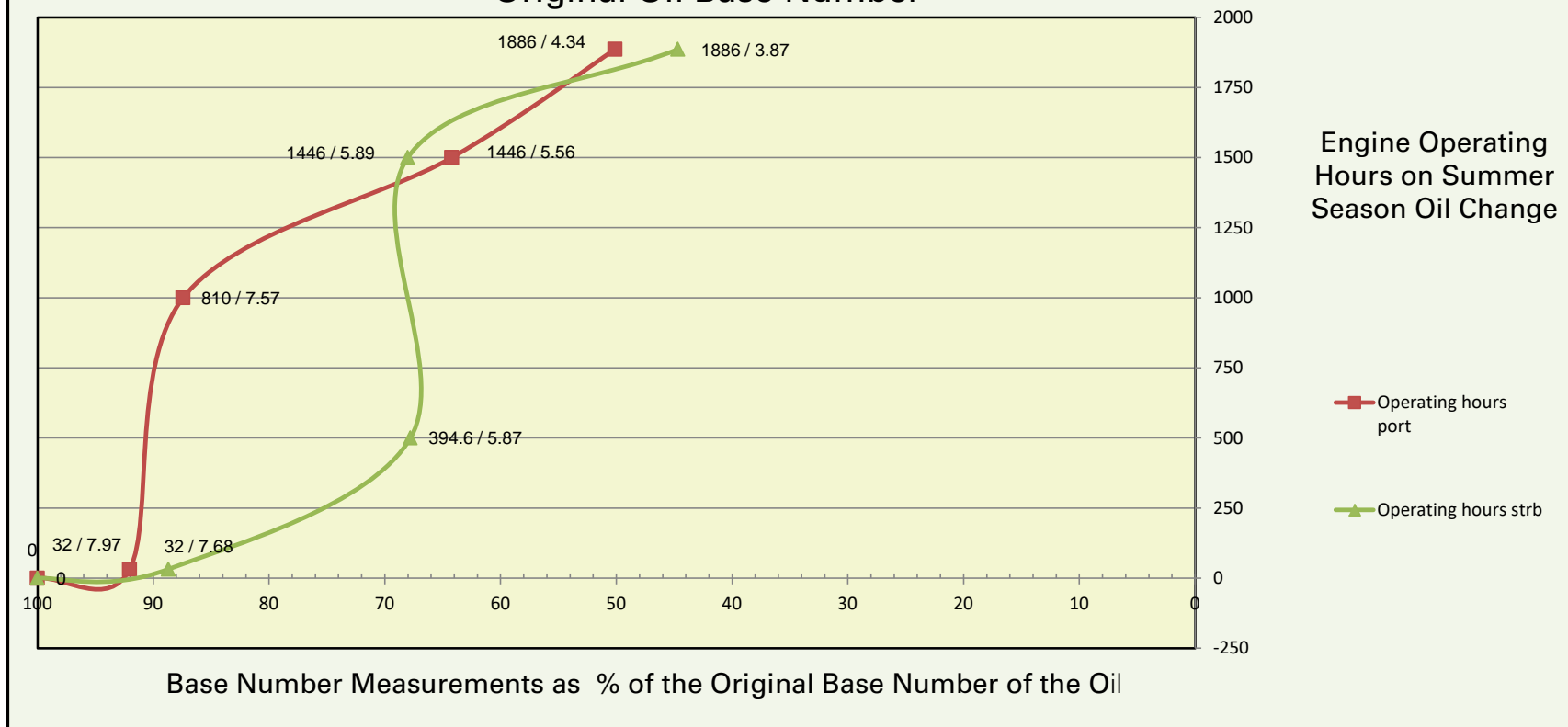
Product: BestLine Diesel Engine Treatment

		2015 Full Year Run Time		2017 Full Year Run Time		
		Port Yes	Strbd Yes	Port Yes	Strbd Yes	
Engine Make & Model	Twin Caterpillar 3512A 1150 Hp	Yes	Yes	Twin Caterpillar 3512A 1150 Hp	Yes	Yes
Oil Type	Chevron Delo 400 LE 15W40	Yes	Yes	Chevron Delo 400 LE 15W40	Yes	Yes
Crankcase Capacity	150 Gallons per Engine	150	150	150 Gallons per Engine	150	150
Operating Hours per Oil Change Interval	Indicated by 2015 / 2016 Oil Samp.	500	500	Indicated by 2015 / 2016 Oil Samp.	3500	3500
Total Operating April through Sept	Estimated 3500 Hours	3500	3500	Estimated 3500 Hours	3500	3500
# of Oil Changes -Summer Operations		7	7		1	1
Cost per Gallon of Oil:		\$ 17.10	\$ 17.10		\$ 22.66	\$ 22.66
Total Cost of Oil Change per Engine		\$ 2,565.00	\$ 2,565.00		\$ 3,399.00	\$ 3,399.00
Total Cost for Oil per Operating Season		\$ 17,955.00	\$ 17,955.00		\$ 3,399.00	\$ 3,399.00
Total for Oil Cost for Both Engines					\$ 35,910.00	\$ 6,798.00
BestLine Diesel Eng. Treatment / 2016		N/A	N/A	** BestLine Full Synthetic Oil includes BestLine DET		
10% Solution by Volume Recommended	15 Gallons per Engine Note: Plus 1 gallon Spare					
Cost Per Gallon of BestLine DET		N/A	N/A	Adding Glacier ACS6000 Centrifuges on each engine	\$ 8,500.00	\$ 8,500.00
# of BestLine Oil Treatments -Summer Operations				Total cost for Centrifuge Equipment		\$ 17,000.00
Cost to Utilize BestLine DET		N/A	N/A			
Total Cost for BestLine per Operating Season		N/A	N/A			
<b>Total Annual Cost for Oil Changes</b>					<b>\$ 35,910.00</b>	<b>\$ 23,798.00</b>
<b>Net Savings On Oil Changes with BestLine Diesel Engine Treatment in First Year:</b>						<b>\$ 12,112.00</b>
<b>Net Savings On Oil Changes with BestLine Diesel Engine Treatment in Second Year:</b>						<b>\$ 29,112.00</b>

Note: Saving increase since expense for ACS6000 Centrifuges has already taken place. Estimated Service life is 12-15 Years



## Engine Operating Hours to 50% Depletion of Original Oil Base Number



### Data Set

Base # Port	Base # Strb	% of initial base	Sampling Hours - Port Engine	Sampling Hours - Strb. Engine
8.66	8.66	100.00	0	0
7.97	7.68	92.03	32	32
	5.87	67.78		394.6
7.57		87.41	810	
5.56		64.20	1446	
	5.89	68.01		1446
4.34		50.12	1886	
	3.87	44.69		1886

### Notes:

1. The oil shown here is a Chevron Delo 400 LE 15W40 with a 10% solution of Bestline Diesel Eng. Treatment
2. The oil change was done April 4th 2016 and the BestLine was added and sampled on April 12th 2016
3. The last oil sample was done Aug 25th 2016 with 1886 hours on the the oil.
4. The TBN number had reach 50% of the original base number value and an oil change was recommended.
5. In 2015 there were 4 complete oil changes during the same summer operating season
6. We recognize that some data points are missing however the general trend is well indicated
7. The data points on the chart show the # of hours at the time of the sample, and the second # is the base number of the oil as indicated by the oil analysis lab.