

OIL ANALYSIS REPORT

Area Plymouth & Brockton 428 Component

Diesel Engine Elui

PETRO CANADA DURON SHP 15W40 (39 QTS)

DIAGNOSIS

Recommendation

Oil and filter change at the time of sampling has been noted. Resample at the next service interval to monitor.

Wear

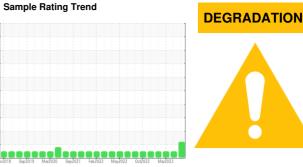
All component wear rates are normal.

Contamination

There is no indication of any contamination in the oil.

Fluid Condition

The BN level is low.



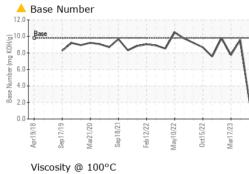
2020 Sep2021	Feb2022 May2022 Oct2022	Mw2023	
mit/base	current	history1	history2
	PCA0013378	PCA0083271	PCA0083355
	25 Aug 2023	05 May 2023	17 Mar 2023
	304973	291041	280078
	24000	12000	12000
	Changed	Not Changd	Not Changd
		NICONAAL	

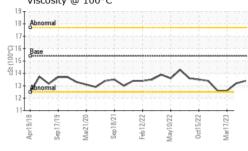
pr2018 Sep2019 Mar

SAMPLE INFORI	MATION	method	limit/base	current	history1	history2
Sample Number		Client Info		PCA0013378	PCA0083271	PCA0083355
Sample Date		Client Info		25 Aug 2023	05 May 2023	17 Mar 2023
Machine Age	mls	Client Info		304973	291041	280078
Oil Age	mls	Client Info		24000	12000	12000
Oil Changed		Client Info		Changed	Not Changd	Not Changd
Sample Status				ABNORMAL	NORMAL	NORMAL
CONTAMINAT	ION	method	limit/base	current	history1	history2
Fuel		WC Method	>3.0	<1.0	<1.0	<1.0
Glycol		WC Method		NEG	NEG	NEG
WEAR METAL	S	method	limit/base	current	history1	history2
Iron	ppm	ASTM D5185m	>165	51	18	31
Chromium	ppm	ASTM D5185m	>5	3	1	2
Nickel	ppm	ASTM D5185m	>4	0	<1	0
Titanium	ppm	ASTM D5185m		<1	<1	<1
Silver	ppm	ASTM D5185m	>2	0	0	0
Aluminum	ppm	ASTM D5185m		17	0	2
Lead	ppm	ASTM D5185m	>150	7	1	6
Copper	ppm	ASTM D5185m	>90	4	1	5
Tin	ppm	ASTM D5185m	>5	<1	<1	<1
Vanadium	ppm	ASTM D5185m		0	0	0
Cadmium	ppm	ASTM D5185m		0	0	0
ADDITIVES		method	limit/base	current	history1	history2
ADDITIVES Boron	ppm	method ASTM D5185m	limit/base		history1 8	history2 12
	ppm ppm	ASTM D5185m		6		12
Boron Barium	ppm		0		8	
Boron Barium Molybdenum	ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m	0	6 0	8 0	12 0
Boron Barium Molybdenum Manganese	ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60	6 0 63	8 0 64	12 0 66
Boron Barium Molybdenum Manganese Magnesium	ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 0	6 0 63 <1	8 0 64 <1	12 0 66 <1
Boron Barium Molybdenum Manganese Magnesium Calcium	ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 0 1010	6 0 63 <1 907	8 0 64 <1 952	12 0 66 <1 951
Boron Barium Molybdenum Manganese Magnesium	ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 0 1010 1070	6 0 63 <1 907 1105	8 0 64 <1 952 1115	12 0 66 <1 951 1196 1042
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus	ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 0 1010 1070 1150	6 0 63 <1 907 1105 1005	8 0 64 <1 952 1115 1044	12 0 66 <1 951 1196
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc	ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 0 1010 1070 1150 1270	6 0 63 <1 907 1105 1005 1201	8 0 64 <1 952 1115 1044 1280	12 0 66 <1 951 1196 1042 1291
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur	ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 1010 1070 1150 1270 2060	6 0 63 <1 907 1105 1005 1201 2638	8 0 64 <1 952 1115 1044 1280 3296	12 0 66 <1 951 1196 1042 1291 3548
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN	ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 1010 1070 1150 1270 2060	6 0 63 <1 907 1105 1005 1201 2638 current	8 0 64 <1 952 1115 1044 1280 3296 history1	12 0 66 <1 951 1196 1042 1291 3548 history2
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon	ppm ppm ppm ppm ppm ppm ppm ppm TS	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m method	0 0 60 1010 1070 1150 1270 2060	6 0 63 <1 907 1105 1005 1201 2638 current 8	8 0 64 <1 952 1115 1044 1280 3296 history1 5	12 0 66 <1 951 1196 1042 1291 3548 history2 6
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon Sodium	ppm ppm ppm ppm ppm ppm ppm ppm TS	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	0 0 60 1010 1070 1150 1270 2060 Iimit/base >35	6 0 63 <1 907 1105 1005 1201 2638 <u>current</u> 8 25	8 0 64 <1 952 1115 1044 1280 3296 history1 5 10	12 0 66 <1 951 1196 1042 1291 3548 history2 6 6
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon Sodium Potassium	ppm ppm ppm ppm ppm ppm ppm ppm TS	ASTM D5185m ASTM D5185m	0 0 60 0 1010 1070 1150 1270 2060 limit/base >35	6 0 63 <1 907 1105 1005 1201 2638 current 8 25 1 25 1	8 0 64 <1 952 1115 1044 1280 3296 history1 5 10 <1	12 0 66 <1 951 1196 1042 1291 3548 history2 6 6 6 6 0
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon Sodium Potassium INFRA-RED Soot %	ppm ppm ppm ppm ppm ppm ppm ppm TS ppm ppm	ASTM D5185m ASTM D5185m	0 0 0 1010 1070 1150 1270 2060 limit/base >35 >20 limit/base >7.5	6 0 63 <1 907 1105 1201 2638 current 8 25 1 2 5 1 current	8 0 64 <1 952 1115 1044 1280 3296 history1 5 10 <1 history1 0.4	12 0 66 <1 951 1196 1042 1291 3548 history2 6 6 6 6 0 0 history2 0.6
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon Sodium Potassium	ppm ppm ppm ppm ppm ppm ppm ppm TS ppm ppm	ASTM D5185m ASTM D5185m	0 0 0 1010 1070 1150 1270 2060 limit/base >35 >20 limit/base >7.5	6 0 63 <1 907 1105 1005 1201 2638 current 8 25 1 25 1	8 0 64 <1 952 1115 1044 1280 3296 history1 5 10 <1 history1	12 0 66 <1 951 1196 1042 1291 3548 history2 6 6 6 6 0 0
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon Sodium Potassium INFRA-RED Soot % Nitration	ppm ppm ppm ppm ppm ppm ppm ppm TS ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	0 0 0 1010 1070 1150 1270 2060 limit/base >35 >20 limit/base >7.5 >20	6 0 63 <1 907 1105 1201 2638 current 8 25 1 8 25 1 current 0.9 12.4	8 0 64 <1 952 1115 1044 1280 3296 history1 5 10 <1 5 10 <1 history1 0.4 9.0	12 0 66 <1 951 1196 1042 1291 3548 history2 6 6 6 6 0 v history2 0.6 10.8
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon Sodium Potassium INFRA-RED Soot % Nitration Sulfation	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D7844 *ASTM D7624	0 0 0 1010 1070 1150 2060 Imit/base >35 20 Imit/base >7.5 >20 >30 Imit/base	6 0 63 <1 907 1105 1005 1201 2638 current 8 25 1 current 0.9 12.4 24.8 current	8 0 64 <1 952 1115 1044 1280 3296 history1 5 10 <1 5 10 <1 0.4 9.0 20.5 history1	12 0 66 <1 951 1196 1042 1291 3548 history2 6 6 6 6 0 0 history2 0.6 10.8 22.8 history2
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINAN Silicon Sodium Potassium INFRA-RED Soot % Nitration Sulfation	ppm ppm ppm ppm ppm ppm ppm ppm TS ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	0 0 0 1010 1070 1150 1270 2060 Iimit/base >35 >20 Iimit/base >7.5 >20 >30	6 0 63 <1 907 1105 1201 2638 current 8 25 1 current 0.9 12.4 24.8	8 0 64 <1 952 1115 1044 1280 3296 history1 5 10 <1 5 10 <1 history1 0.4 9.0 20.5	12 0 66 <1 951 1196 1042 1291 3548 history2 6 6 6 6 0 history2 0.6 10.8 22.8



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White Metal Yellow Metal Precipitate Silt Debris Sand/Dirt Appearance Odor Emulsified Water Free Water FLUID PROPE Visc @ 100°C GRAPHS Iron (ppm)	scalar scalar scalar scalar scalar scalar scalar scalar scalar scalar scalar	*Visual *Visual *Visual *Visual *Visual *Visual *Visual *Visual *Visual Method ASTM D445	NONE NONE NONE NONE NORML NORML >0.2 limit/base 15.4	- Abnormal	NONE NONE NONE NONE NORML NORML NEG NEG history1 13.2	NONE NONE NONE NONE NORML NORML NEG NEG history2 12.6
Precipitate Silt Debris Sand/Dirt Appearance Odor Emulsified Water Free Water FLUID PROPEI Visc @ 100°C GRAPHS Iron (ppm)	scalar scalar scalar scalar scalar scalar scalar scalar scalar scalar	*Visual *Visual *Visual *Visual *Visual *Visual *Visual Method ASTM D445	NONE NONE NONE NORML >0.2 limit/base 15.4	NONE NONE NORML NORML NEG NEG Current 13.4	NONE NONE NONE NORML NORML NEG NEG history1	NONE NONE NONE NONE NORML NORML NEG NEG history2
Precipitate Silt Debris Sand/Dirt Appearance Odor Emulsified Water Free Water FLUID PROPEI Visc @ 100°C GRAPHS Iron (ppm)	scalar scalar scalar scalar scalar scalar scalar scalar scalar scalar	*Visual *Visual *Visual *Visual *Visual *Visual *Visual Method ASTM D445	NONE NONE NONE NORML >0.2 limit/base 15.4	NONE NONE NORML NORML NEG NEG Current 13.4	NONE NONE NONE NORML NORML NEG NEG history1	NONE NONE NONE NORML NORML NEG NEG history2
Silt Debris Sand/Dirt Appearance Odor Emulsified Water Free Water FLUID PROPE Visc @ 100°C GRAPHS Iron (ppm)	scalar scalar scalar scalar scalar scalar scalar RTIES cSt	*Visual *Visual *Visual *Visual *Visual *Visual Method ASTM D445	NONE NONE NORML NORML >0.2 limit/base 15.4	NONE NORE NORML NORML NEG NEG Current 13.4	NONE NONE NORML NORML NEG NEG history1	NONE NONE NORML NORML NEG NEG history2
Debris Sand/Dirt Appearance Odor Emulsified Water Free Water FLUID PROPE Visc @ 100°C GRAPHS Iron (ppm)	scalar scalar scalar scalar scalar scalar scalar scalar	*Visual *Visual *Visual *Visual *Visual Method ASTM D445	NONE NORML NORML >0.2 limit/base 15.4 300 250 200 50 50 00 00 00 00 00 00 00 00 00 00 0	NONE NORML NORML NEG NEG Current 13.4	NONE NORML NORML NEG NEG history1	NONE NORML NORML NEG NEG history2
Sand/Dirt Appearance Odor Emulsified Water Free Water FLUID PROPE Visc @ 100°C GRAPHS Iron (ppm) Severe Aluminum (ppm)	scalar scalar scalar scalar scalar scalar scalar scalar	*Visual *Visual *Visual *Visual Method ASTM D445	NONE NORML >0.2 limit/base 15.4 300 200 200 200 200 200 200 200 200 200	NONE NORML NEG NEG Current 13.4	NONE NORML NORML NEG NEG history1	NONE NORML NORML NEG NEG history2
Appearance Odor Emulsified Water Free Water FLUID PROPEI Visc @ 100°C GRAPHS Iron (ppm)	scalar scalar scalar scalar scalar CSt	*Visual *Visual *Visual Method ASTM D445	NORML NORML >0.2 limit/base 15.4 300 250 200 510 100 000 500 100 000 500 000 100 1	NORML NORML NEG NEG 13.4	NORML NORML NEG NEG history1	NORML NORML NEG NEG history2
Odor Emulsified Water Free Water FLUID PROPE Visc @ 100°C GRAPHS Iron (ppm)	scalar scalar scalar RTIES cSt	*Visual *Visual *Visual Method ASTM D445	NORML >0.2 limit/base 15.4 300 250 200 150 150 100 50	NORML NEG NEG 13.4 Lead (ppm)	NORML NEG NEG history1	NORML NEG NEG history2
Emulsified Water Free Water FLUID PROPE Visc @ 100°C GRAPHS Iron (ppm) Severe BULLIG B	scalar scalar RTIES cSt	*Visual *Visual Method ASTM D445	>0.2 limit/base 15.4 300 250 250 250 250 250 250 250 250 250 2	NEG NEG Current 13.4 Lead (ppm)	NEG NEG history1	NEG NEG history2
Free Water FLUID PROPEI Visc @ 100°C GRAPHS Iron (ppm) Severe Abnormal Abnormal Abnormal Auminum (ppm) Severe	scalar RTIES cSt	*Visual method ASTM D445	limit/base 15.4 300 250 200 5150 100 50	NEG current 13.4 Lead (ppm)	NEG history1	NEG history2
FLUID PROPE	CSt	method ASTM D445	15.4 300 250 200 5150 100 50	Current 13.4 Lead (ppm)	history1	history2
Visc @ 100°C GRAPHS Iron (ppm) Severe Abnormal Blue Blue Blue Blue Blue Blue Blue Blu	cSt	ASTM D445	15.4 300 250 200 5150 100 50	13.4 Lead (ppm)		
GRAPHS Iron (ppm) Severe Abnormal BU/SLIdes BU/SLIdes BU/SLIdes Aluminum (ppm)			300 250 200 6 150 100 200	Lead (ppm)	13.2	12.0
Iron (ppm) Severe Abnormal BU(51/104y Aluminum (ppm)	Feb12/22	May10/22		Abnormal		
Abnormal Abnormal 6U/L1 des Aluminum (ppm)	Feb12/22	May10/22		Abnormal		
Abnormal Blue Blue Blue Blue Blue Blue Blue Blue	Feb12/22	May10/22	200 <u>E</u> 150 100 50 0)- Abnormal)- -		
Aluminum (ppm)	Feb12/22	May 10/22		Abnormal		
April 9/18/21 April	Feb12/22	May10/22				
April 9/18/21	Feb12/22	May10/22	× 50)		
Aluminum (ppm)	Feb12/22	May10/22				
Aluminum (ppm)	Feb12/2	0ct15/2	2		2	3 5
Aluminum (ppm)	Fel	Mar		Apr19/18 - Sep17/19 - Mar21/20 -	Sep18/21 Feb12/22 May10/22	0ct15/22 Mar17/23
Severe			M			0c Ma
Severe			12	Chromium (pr	om)	
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			8			
Abnormal			und G	Abnormal		
			4			
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1/18 //19 //20	2/22	5/22)/18 //19	8/21 	6/22 -
Apr19/18 Sep17/19 Mar21/20 Sep18/21	Feb12/22	May10/22 0ct15/22	Mar1 //23	Apr19/18 - Sep17/19 - Mar21/20 -	Sep18/21 Feb12/22 May10/22	0ct15/22 Mar17/23
Copper (ppm)		~ .	_	Silicon (ppm)	~	_
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Severe			60	Severe		
			Ean			
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Apr19/18 Sep17/19 Mar21/20 Sep18/21	Feb 12/22	May10/22 0ct15/22	Mar1 //23	Apr19/18 - Sep17/19 - Mar21/20 -	Sep18/21 Feb12/22 May10/22	0ct15/22 Mar17/23
Apr Sep Mar Ser	Feb	May Oct	Mar	Apr Sep Mar	Ser Feb May	Mar
Viscosity @ 100°C				Base Number		
	111111		12.0 \$10.0			
			9 8 0			M
Base			E 6.0			
Abnormal		\sim	4.0			
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	22 -	22	• 0.0	19	/21+ 22 + 22 +	22 + 23 + 23 +
pr19/ ep17/ ep18/	eb 12/	ay10/ cct15/	arl //	pr19/ ep17/	ep18, eb12/	0ct15/22 Mar17/23
WearCheck USA - 5	01 Madia Received Diagnose	son Ave., Ca I : 31 / ed : 05 s	ny, NC 27513 Aug 2023 Sep 2023		PLYMOUTH & 8 INDUSTF PL	& BROCKTOI RIAL PARK RI YMOUTH, M/ US 0236
05939843 [10630455 [Diagnost					onald Pelpquii quin@P-B.con
05939843 E 10630455 E MOB 2	Ū		-		D	$1 \cup 0 \cap O \cup O \cap O$
,	Abnormal Base Base Building Buil	Abnormal Base Building Buildin	Abnormal Base CZ71 (2000) Base 0701 (2000) CZ71 (2000) Building 0701 (2000) CZ71 (2000) WearCheck USA - 501 Madison Ave., Ca PCA0013378 Received : 31 / 2000) 05939843 Diagnosed : 05 / 3000) Diagnosed : 05 / 3000) 10630455 Diagnostician : Dor : 05 / 3000) : 05 / 3000)	Abnormal 12.1 Base 6.1 Base 0.7 Base 0.7	Abnormal 	WearCheck USA - 501 Madison Ave., Cary, NC 27513 PCA0013378 PCA0013378 Diagnosed : 05 Sep 2023 Diagnostician : Don Baldridge MOB 2