SGS - CAN/CGSB-3.517

Diesel – April 21, 2023

In March 2023, the independent and accredited laboratory SGS received a sample of diesel oil supplied by the fuel supplier SG Énergie, established in Quebec City, Canada. The laboratory analyzed the regular fuel, then treated a sample with **XBEE Enzyme Fuel Technology** at the advised ratio of 4,000:1. This additized sample was stored for a few weeks in order to simulate storage, and was finally analyzed according to the Canadian standard CAN/ CGSB-3.51-2020.

According to the assistant to the head of the Laboratory Alexandra Cosquer :
"*The analyzed characteristics comply with the specifications.*"

Analyses	Methods	Without XBEE	With XBEE	Units	Limits
Flash point	ASTM D 93	42.0	43.0	°C	40 min
Kinematic viscosity at 40°C	ASTM D 445	1.740	1.736	mm²/s	1.70 – 4.10
Distillation at 90%	ASTM D 86	297.3	297.8	°C	360 max
Water and sediment	ASTM D 2709	<0.01	<0.01	Vol %	0.02 max
Acid number	ASTM D 664A	<0.1	<0.1	mgKOH/g	0.10 max
Total sulphur	ASTM D 5453	6.9	6.6	mg/kg	15 max
Copper corrosion (3h at 50°C)	ASTM D 130	1a	1a		n°1
Carbon residue Conradson	ASTM D 4530	<0.10	<0.10	mass %	0.20 max
Ash from petroleum products · Ash content · Mass of the sample taken	ASTM D 482	<0,01 100.76	<0,01 79.81	mass % g	0.010 max
Measured cetane number · Cetane number · CRS reference	ASTM D 613	43.2 T32/U32	43.1 T32/U32		40 min
Electrical conductivity at 20°C	ASTM D 2624	> 2 000	> 2 000	pS/m	25 min
... next page					

Analysis of Canadian diesel by SGS

Analyses	Methods	Without XBEE	With XBEE	Units	Limits
Upper pour point	ASTM D 97	-45	-45	°C	
Cloud point	ASTM D 2500	-31	-32	°C	
Cold filter plugging point	ASTM D 6371	-45	-47	°C	
Lubricity by HFRR · Minor axis · Major axis · Wear scar diameter · Fuel temperature	ASTM D 6079	 500 400 450 25	 440 360 400 25	 µm µm µm C°	

Among the most notable elements, we can notice that the lubricity is improved, going from 450 to 400 µm of wear, i.e. a 12.5% improvement.

Annexes

Original reports

(The modifications and additions made are identified in ***blue, bold and italic*** characters)

CERTIFICATE OF ANALYSIS

Client	**XBEE SA**	**Operation**	**XBEE 02/23**
File Nr	**H2300145LV**	**Product**	**GO**
Order	**PO#XBGOCA**	**SGS OGC Nr**	**LV2303308a**
Sample Ref	**10208/10209**		
Receipt on	**2023-03-09**		

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
Flashpoint P-M Closed (meth A)	**ASTM D 93**	°C	**42.0**	**40**		
Kinematic Viscosity at 40°C	**ASTM D 445**	mm2/s	**1.740**	**1.70**		**4.10**
Distillation at 101.3 kPa, auto	**ASTM D 86**					
Initial Boiling Point		°C	**146.9**			
5 % recovered at		°C	**164.8**			
10 % recovered at		°C	**171.8**			
20 % recovered at		°C	**185.7**			
30 % recovered at		°C	**199.2**			
40 % recovered at		°C	**214.2**			
50 % recovered at		°C	**228.6**			
60 % recovered at		°C	**243.4**			
70 % recovered at		°C	**258.5**			
80 % recovered at		°C	**275.0**			
90 % recovered at		°C	**297.3**			360
95 % recovered at		°C	**315.6**			
Final Boiling Point		°C	**325.6**			
Recovered at 250°C		Vol Pct	**64.4**			
Total condensed		Vol Pct	**98.2**			
Residue		Vol Pct	**1.3**			
Loss		Vol Pct	**0.5**			
Water and Sediment	**ASTM D 2709**	Vol Pct	**< 0.01**			**0.02**
Acid Number (method A)	**ASTM D 664A**					
Acid Number (Met A)		mgKOH/g	**< 0.1**			0.10
Total sulfur	**ASTM D 5453**	mg/kg	**6.9**			**15**

In specification parameters.

Compliance established excluding results uncertainty.

PORT DE BOUC on, 2023-04-21
Alexandra Cosquer
Deputy Laboratory ManagerChemist

(The modifications and additions made are identified in ***blue, bold and italic*** characters)

CERTIFICATE OF ANALYSIS

Client	**XBEE SA**	**Operation**	**XBEE 02/23**
File Nr	**H2300145LV**	**Product**	**GO**
Order	**PO#XBGOCA**	**SGS OGC Nr**	**LV2303308a**
Sample Ref	**10208/10209**		
Receipt on	**2023-03-09**		

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
Copper Corrosion, 3h at 50°C	**ASTM D 130**		**1a**			**1**
Lubricity by HFRR	**ASTM D 6079**					
Minor Axis		µm	***500***			
Major Axis		µm	***400***			
Wear Scar Diameter		µm	***450***			
Fuel Temperature		°C	**25**			
Carbon residue (micro method) 10% bottoms used	**ASTM D 4530**	Mass Pct	**< 0.10**			**0.2**
Ash from petroleum products	**ASTM D 482**					
Ash content		Mass Pct	**< 0.010**			0.010
Mass of the sample taken		g	**100.76**			
Measured cetane number	**ASTM D 613**					
(s) Cetane Number			**43.2**	40		
(s) Batch of SRF			**T32/U32**			
Electrical conductivity at 20°C	**ASTM D 2624**	pS/m	**> 2000**	**25**		
Upper Pour Point	**ASTM D 97**	°C	**-45**			
Cloud Point	**ASTM D 2500**	°C	**-31**			
Cold Filter Plugging Point	**ASTM D 6371**	°C	**-45**			

(s) Test performed by other laboratory.

In specification parameters.

Compliance established excluding results uncertainty.

PORT DE BOUC on, 2023-04-21
Alexandra Cosquer
Deputy Laboratory ManagerChemist

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CERTIFICATE OF ANALYSIS

Client	**XBEE SA**	**Operation**	**XBEE 02/23**
File Nr	**H2300145LV**	**Product**	**GO**
Order	**PO#XBGOCA**	**SGS OGC Nr**	**LV2303309b**
Sample Ref	***D+15: diesel with additive at 4,000:1***		
Receipt on	**2023-03-09**		

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
Flashpoint P-M Closed (meth A)	**ASTM D 93**	°C	**43.0**	**40**		
Kinematic Viscosity at 40°C	**ASTM D 445**	mm2/s	**1.736**	**1.70**		**4.10**
Distillation at 101.3 kPa, auto	**ASTM D 86**					
Initial Boiling Point		°C	**143.9**			
5 % recovered at		°C	**163.6**			
10 % recovered at		°C	**171.5**			
20 % recovered at		°C	**183.9**			
30 % recovered at		°C	**197.6**			
40 % recovered at		°C	**212.6**			
50 % recovered at		°C	**228.0**			
60 % recovered at		°C	**242.1**			
70 % recovered at		°C	**257.3**			
80 % recovered at		°C	**274.4**			
90 % recovered at		°C	**297.8**			360
95 % recovered at		°C	**314.9**			
Final Boiling Point		°C	**325.2**			
Recovered at 250°C		Vol Pct	**65.1**			
Total condensed		Vol Pct	**98.0**			
Residue		Vol Pct	**1.0**			
Loss		Vol Pct	**1.0**			
Water and Sediment	**ASTM D 2709**	Vol Pct	**< 0.01**			**0.02**
Acid Number (method A)	**ASTM D 664A**					
Acid Number (Met A)		mgKOH/g	**< 0.1**			0.10
Total sulfur	**ASTM D 5453**	mg/kg	**6.6**			**15**

In specification parameters.

Compliance established excluding results uncertainty.

PORT DE BOUC on, 2023-04-21
Alexandra Cosquer
Deputy Laboratory ManagerChemist

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CERTIFICATE OF ANALYSIS

Client	**XBEE SA**	**Operation**	**XBEE 02/23**
File Nr	**H2300145LV**	**Product**	**GO**
Order	**PO#XBGOCA**	**SGS OGC Nr**	**LV2303309b**
Sample Ref	***D+15: diesel with additive at 4,000:1***		
Receipt on	**2023-03-09**		

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
Copper Corrosion, 3h at 50°C	**ASTM D 130**		**1a**			**1**
Lubricity by HFRR	**ASTM D 6079**					
Minor Axis		µm	**440**			
Major Axis		µm	**360**			
Wear Scar Diameter		µm	**400**			
Fuel Temperature		°C	**25**			
Carbon residue (micro method) 10% bottoms used	**ASTM D 4530**	Mass Pct	**< 0.10**			**0.2**
Ash from petroleum products	**ASTM D 482**					
Ash content		Mass Pct	**< 0.010**			0.010
Mass of the sample taken		g	**79.8149**			
Measured cetane number	**ASTM D 613**					
Cetane Number			**43.1**	40		
Electrical conductivity at 19.8°C	**ASTM D 2624**	pS/m	**> 2000**	**25**		
Valeur réelle mesurée hors domaine d application de la norme ASTM D 2624 : 2001 pS/m						
Upper Pour Point	**ASTM D 97**	°C	**-45**			
Cloud Point	**ASTM D 2500**	°C	**-32**			
Cold Filter Plugging Point	**ASTM D 6371**	°C	**-47**			

In specification parameters.

Compliance established excluding results uncertainty.

PORT DE BOUC on, 2023-04-21
Alexandra Cosquer
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