Canadian Diesel Analysis by SGS

SGS – CAN/CGSB-3.517 – Diesel – April 21, 2023

ANALYSIS BACKGROUND

In March 2023, the independent, accredited laboratory SGS received a sample of diesel fuel supplied by the fuel distributor SG Énergie, based in Quebec City, Canada. The laboratory analysed the regular fuel, then treated a sample with **XBEE Enzyme Fuel Technology** at a dosage of 1:4,000.

This treated sample was stored for a few weeks to simulate a storage period, and was then analysed according to the Canadian standard CAN/CGSB-3.517-2020. According to the assistant head of the laboratory, Alexandra Cosquer:

"The analysed characteristics comply with the specifications."

TEST SUMMARY

Laboratory	SGS
Fuel	Regular diesel fuel
Supplier	SG Énergie, QC, Canada
Treatment	XBEE
Dosage	1:4,000
Standard	CAN/CGSB-3.517-2020
Report date	21 April 2023

ANALYSIS RESULTS

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**	mg KOH/g	0.10 max
Total sulphur	ASTM D 5453	6.9	**6.6**	mg/kg	15 max
Copper strip corrosion (3 h at 50 °C)	ASTM D 130	1a	**1a**		No. 1
Conradson carbon residue	ASTM D 4530	< 0.10	**< 0.10**	% mass	0.20 max
Ash · Ash content · Test portion	ASTM D 482	 < 0.01 100.76	 **< 0.01** **79.81**	 % mass g	0.010 max
Measured cetane number · Cetane number · CRS references	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
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 (HFRR) · Minor axis · Major axis · Wear scar diameter · Temperature	ASTM D 6079	 500 400 450 25	 **440** **360** **400** **25**	 µm µm µm °C	

CONCLUSION

All analysed characteristics, with and without XBEE, comply with the specifications of the CAN/CGSB-3.517 standard.

Among the notable results, the **lubricity is improved**, with wear decreasing from 450 to 400 µm, i.e. approximately 11% less wear.

APPENDICES

Original SGS reports follow on the next page. Further documentation and analyses are available on request.

More information
XBEE Group
customerservice@xbee.com

(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.

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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)

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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.

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

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(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**	**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**

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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**			

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