



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	mm ² /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 <ul style="list-style-type: none"> · 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

CERTIFICATE OF ANALYSIS

Client **XBEE SA**
 File Nr **H2300145LV**
 Order **PO#XBGOCA**
 Sample Ref **10208/10209**
 Receipt on **2023-03-09**

Operation **XBEE 02/23**
 Product **GO**
 SGS OGC Nr **LV2303308a**

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	mm ² /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.

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirement should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement within it specifying that the precision statements were determined using UOP Method 999.
*For dated references, only the edition referred to applies. For undated references the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The informations provided by the customer and on the report are not the responsibility of the company SGS France.

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

CERTIFICATE OF ANALYSIS

Client **XBEE SA**
 File Nr **H2300145LV**
 Order **PO#XBGoca**
 Sample Ref **10208/10209**
 Receipt on **2023-03-09**

Operation **XBEE 02/23**
 Product **GO**
 SGS OGC Nr **LV2303308a**

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.

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirement should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement within it specifying that the precision statements were determined using UOP Method 999.
 *For dated references, only the edition referred to applies. For undated references the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The informations provided by the customer and on the report are not the responsibility of the company SGS France.

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

CERTIFICATE OF ANALYSIS

Client **XBEE SA**
 File Nr **H2300145LV**
 Order **PO#XBGOCA**
 Sample Ref ***D+15: diesel with additive at 4,000:1***
 Receipt on **2023-03-09**

Operation **XBEE 02/23**
 Product **GO**
 SGS OGC Nr **LV2303309b**

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	mm ² /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.

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirement should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement within it specifying that the precision statements were determined using UOP Method 999. For dated references, only the edition referred to applies. For undated references the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The informations provided by the customer and on the report are not the responsibility of the company SGS France.

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

CERTIFICATE OF ANALYSIS

Client	XBEE SA	Operation	XBEE 02/23
File Nr	H2300145LV	Product	GO
Order	PO#XBGCOA	SGS OGC Nr	LV2303309b
Sample Ref	<i>D+15: diesel with additive at 4,000:1</i>		
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.

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirement should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement within it specifying that the precision statements were determined using UOP Method 999. For dated references, only the edition referred to applies. For undated references the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The informations provided by the customer and on the report are not the responsibility of the company SGS France.

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