



In July 2016 the independent laboratory Intertek analysed the effects of the XBEE Enzyme Fuel Technology in ChangeXL diesel fuel and gasoline.

The tests showed that ChangeXL completely complies with the EN590 and EN228 fuel specifications. The tests also showed the XBEE enzyme technology increased the cetane number of the fuel, decreased water content, partially broke down the biocomponent and increased the lubricity of the fuel.

### About Intertek

Intertek is one of the largest suppliers of test, inspection and certification services with more than 43,000 employees in 1,000 locations in over 100 countries.

Intertek delivers assurance, testing, inspection and certification services to refiners, producers, blenders, distributors, consumers and research institutes across the world.

Intertek is a global leader in testing and inspection of fuels, chemicals and biofuels.

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### Fuel specifications

Intertek analysed whether diesel fuel EN590 and gasoline EN228 still complied to the specification after being treated with the XBEE Enzyme Fuel Technology. The analysis show that the XBEE enzyme technology entirely respects the EN590 and EN228 fuel specifications and in fact even has a positive effect on several parameters.

#### Water in diesel fuel EN590

The first analysis of the standard EN590 fuel sample showed a water content of 80 mg/kg (ppm) in the fuel. After treatment of the diesel fuel sample with XBEE the second analysis showed the water content had been reduced by 12,5% to 70mg/kg (ppm).

#### Cetane number diesel fuel EN590

The first diesel fuel analysis also showed the EN590 sample to have a cetane number of 51.0. The second analysis showed the treatment with XBEE increased the cetane number by over 7% to 54.6.

A higher cetane number contributes to an easier and more efficient burn of the fuel.

#### FAME content in diesel fuel EN590

From the first analysis of the EN590 diesel fuel sample a FAME content was measured of 7.0 volume percent. FAME (Fatty Acid

Methyl Ester) is a biofuel component, obligated to be blended in the fuel in many countries. After addition of the XBEE enzyme technology the second analysis showed the FAME content in the diesel fuel sample decreased to 6.1 volume percent, a nearly 13% reduction.

FAME consists of esterified fatty acids from for instance palm or soy oil but in most cases from used cooking oils (UCO). Unfortunately the atomization of the biofuel component in the engine is often not optimal. Furthermore FAME is (besides water) an important nutrition for micro organism that can cause serious fuel issues.

The partial degradation of the FAME by XBEE improves engine performance and helps to prevent fuel quality issues from occurring.

#### Lubricity of diesel fuel EN590

The analysis also showed the lubricity of the fuel had been improved significantly after the treatment with XBEE enzymes. HFRR tests showed a decrease of almost 39% in wear.



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# REPORT OF ANALYSIS N° 244382

**OPERATION :**

Your ref : Diesel before additivation

Sampling Date : 01/07/2016 10:53

Lab Number : 070116-000335

Nature :

Order Number : Bon pour accord

Test	Test Method	Result	Unit	Spec
Appearance	VISUEL	Clair & Limpide		
Colour	VISUEL	jaune		
Density at 15°C	NF EN ISO 12185	834.9	kg/m <sup>3</sup>	820.0 - 845.0
<i>Distillation</i>	NF EN ISO 3405			
initial boiling point		164.4	°C	
temperature at 5% evaporated		183.2	°C	
temperature at 10% evaporated		194.2	°C	
temperature at 20% evaporated		213.2	°C	
temperature at 30% evaporated		232.3	°C	
temperature at 40% evaporated		250.8	°C	
temperature at 50% evaporated		267.8	°C	
temperature at 60% evaporated		284.6	°C	
temperature at 70% evaporated		301.1	°C	
temperature at 80% evaporated		317.9	°C	
temperature at 90% evaporated		334.6	°C	
95% V/V condensated point		349.9	°C	360 max
finall boiling point		358.5	°C	
residue		0.6	% vol	
loss		0.9	% vol	
Condensated at 250°C		38.7	% vol	65 max
Condensated at 350°C		95.0	% vol	85 min
kinematic Viscosity at 40°C	NF EN ISO 3104	2.625	mm <sup>2</sup> /s	2.000 - 4.500
Sulfur content	FUV EN ISO 20846	9.2	mg/kg	10.0 max
Mn content	PR NF EN 16576	<0.5	mg/l	2.0 max
<b>Water content</b>	NF EN ISO 12937	<b>80</b>	<b>mg/kg</b>	200 max
Total contamination	NF EN 12662	<12.0	mg/kg	24 max
ash	NF EN ISO 6245	<0.001	% m	0.010 max
<b>mesurated cetane number</b>	NF EN ISO 5165	<b>51.0</b>	<b>Cotation</b>	51.0 min
	NF EN ISO 4264	51.8	Cotation	46.0 min
CCR	NF EN ISO 10370	<0.10	% m	0.30 max
	NF EN ISO 2160	1a	Cotation	classe 1
Potential sediments	NF EN ISO 12205	2	g/m <sup>3</sup>	25 max
Rancimat Oxydation	NF EN 15751	20.0	h	

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Lab Number : 070116-000335

Nature :

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Test	Test Method	Result	Unit	Spec
Flash point Pensky-Martens Flash point	NF EN ISO 2719	61.5	°C	55 min
		A		
HFRR at 60°C HFRR at 60°C	NF EN ISO 12156-1	330	µm	460 max
		330	µm	
		335	µm	
		311	µm	
		323	µm	
		24.4	°C	
		47.6	%	
		24.2	°C	
		36.3	%	
		1.275	kPa	
		~		
cloud point	NF EN 23015	-6	°C	-5 max
CFPP	NF EN 116	-19	°C	-15 max
Aromatic content (HPLC)	NF EN 12916	19.9	% m	
		2.3	% m	
		0.2	% m	
		22.4	% m	
Aromatic content (HPLC)		2.5	% m	8.0 max
Fame Content	NF EN 14078	7.0	% vol	7.0 max

**Comment : Diesel sample within specifications according to EN 590(2014)**

The results are valid only for the sample under test. Full or partial reproduction of this report is prohibited without authorization of the laboratory.

Date of Issue : 03/09/2016

 Julien HERNANDEZ  
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**Electronic report**

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# REPORT OF ANALYSIS N° 244383

**OPERATION :**

Your ref : Diesel after additivation (1:4000)

Sampling Date : 01/07/2016 10:53

Lab Number : 070116-000336

Nature :

Order Number : Bon pour accord

Test	Test Method	Result	Unit	Spec
Appearance	VISUEL	Clair & Limpide		
Colour	VISUEL	jaune		
Density at 15°C	NF EN ISO 12185	834.9	kg/m <sup>3</sup>	820.0 - 845.0
<i>Distillation</i>	NF EN ISO 3405			
initial boiling point		169.6	°C	
temperature at 5% evaporated		184.4	°C	
temperature at 10% evaporated		197.3	°C	
temperature at 20% evaporated		217.9	°C	
temperature at 30% evaporated		236.0	°C	
temperature at 40% evaporated		253.5	°C	
temperature at 50% evaporated		270.5	°C	
temperature at 60% evaporated		287.3	°C	
temperature at 70% evaporated		303.8	°C	
temperature at 80% evaporated		320.1	°C	
temperature at 90% evaporated		337.3	°C	
95% V/V condensated point		355.5	°C	360 max
finall boiling point		360.6	°C	
residue		1.4	% vol	
loss		1.1	% vol	
Condensated at 250°C		37.0	% vol	65 max
Condensated at 350°C		93.8	% vol	85 min
kinematic Viscosity at 40°C	NF EN ISO 3104	2.635	mm <sup>2</sup> /s	2.000 - 4.500
Sulfur content	FUV EN ISO 20846	9.0	mg/kg	10.0 max
Mn content	PR NF EN 16576	<0.5	mg/l	2.0 max
<b>Water content</b>	NF EN ISO 12937	<b>70</b>	<b>mg/kg</b>	200 max
Total contamination	NF EN 12662	<12.0	mg/kg	24 max
ash	NF EN ISO 6245	<0.001	% m	0.010 max
<b>mesurated cetane number</b>	NF EN ISO 5165	<b>54.6</b>	<b>Cotation</b>	51.0 min
	NF EN ISO 4264	52.6	Cotation	46.0 min
CCR	NF EN ISO 10370	<0.10	% m	0.30 max
	NF EN ISO 2160	1a	Cotation	classe 1
Potential sediments	NF EN ISO 12205	1	g/m <sup>3</sup>	25 max
Rancimat Oxydation	NF EN 15751	20.0	h	

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Lab Number : 070116-000336

Nature :

Order Number : Bon pour accord

Test	Test Method	Result	Unit	Spec
Flash point Pensky-Martens Flash point	NF EN ISO 2719	61.0	°C	55 min
		A		
HFRR at 60°C HFRR at 60°C	NF EN ISO 12156-1	202	µm	460 max
		202	µm	
		197	µm	
		174	µm	
		186	µm	
		25.1	°C	
		33.3	%	
		25.1	°C	
		37.5	%	
		1.128	kPa	
		~		
cloud point	NF EN 23015	-5	°C	-5 max
CFPP	NF EN 116	-18	°C	-15 max
Aromatic content (HPLC)	NF EN 12916	19.8	% m	
		2.5	% m	
		0.2	% m	
		22.5	% m	
Aromatic content (HPLC)		2.7	% m	8.0 max
Fame Content	NF EN 14078	6.1	% vol	7.0 max

**Comment : Diesel sample within specifications according to EN 590(2014)**

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Date of Issue : 03/09/2016

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# REPORT OF ANALYSIS N° 244385

**OPERATION :**

Your ref : Gasoline before additivation

Sampling Date : 01/07/2016 10:58

Lab Number : 070116-000337

Nature :

Order Number : Bon pour accord

Test	Test Method	Result	Unit	Spec
Density at 15°C	NF EN ISO 12185	750.2	kg/m <sup>3</sup>	720.0 - 775.0
Vapor pressure	NF EN 13016-1	57.2	Kpa	45.0 - 60.0
<i>Distillation</i>	NF EN ISO 3405			
		30.4	°C	
		49.5	°C	
		56.2	°C	
		65.9	°C	
		74.9	°C	
		83.9	°C	
		93.4	°C	
		103.6	°C	
		115.4	°C	
		128.3	°C	
		145.4	°C	
		157.3	°C	
final point		182.7	°C	210 max
residue		1.0	%vol	2 max
		0.6	% vol	
distillated volume at 70°C		24.6	%vol	22.0 -50.0
distillated volume at 100°C		56.6	%vol	46.0 - 72.0
distillated volume at 150°C		92.2	%vol	75.0 min
VLI		744		
Sulfur content	FUV EN ISO 20846	6.8	mg/kg	10.0 max
	NF EN ISO 2160	1a	Cotation	classe 1
<i>Gums content</i>	NF EN ISO 6246			
Gums content		<1	mg/100mL	5 max
		13	mg/100mL	
		<1	mg/100mL	
Research octane number (RON)	NF EN ISO 5164	98.5	cotation	95.0 min
lead content (AA)	NF EN 237	<2.5	mg/L	5.0 max
Oxidation stability	NF EN ISO 7536	>360	min	360 min
<i>Benzene content</i>	NF EN ISO 22854			
Benzene content		0.60	% vol	1.00 max
		0.71	% m	3.0 max

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Sampling Date : 01/07/2016 10:58

Lab Number : 070116-000337

Nature :

Order Number : Bon pour accord

Test	Test Method	Result	Unit	Spec
<i>Oxygenate compounds</i>	NF EN ISO 22854			
methanol content		< 0.01	% vol	3.0 max
ethanol content		0.36	% vol	5.0 max
popanol content		< 0.01	% vol	
butanol content		< 0.01	% vol	
MTBE content		0.25	% vol	
ETBE content		15.75	% vol	
DIPE content		0.06	% vol	
TAME content		< 0.01	% vol	
oxygenate compounds total		16.55	% vol	
oxygen content		2.68	% m	2.7 max
isopropylic alcohol		0.13	% vol	
isobutylic alcohol		< 0.01	% vol	
tertbutylic alcohol		< 0.01	% vol	
ether >= 5C		16.06	% vol	
other oxygenated compounds		< 0.01	% vol	
Motor octane number (MON)	NF EN ISO 5163	87.5	cotation	85.0 min
<i>Reformulyzer</i>	NF EN ISO 22854			
aromatics content		31.4	% vol	35.0 max
olefins content		10.8	% vol	18.0 max
saturated content		41.4	% vol	
Manganese content	PR NF EN 16136	<2.00	mg/L	2.0 max

**Comment : Gasoline sample within specifications according to EN228 - classe A (2013)**

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# REPORT OF ANALYSIS N° 244386

**OPERATION :**

Your ref : Gasoline after additivation (1:4000)

Sampling Date : 01/07/2016 11:04

Lab Number : 070116-000338

Nature :

Order Number : Bon pour accord

Test	Test Method	Result	Unit	Spec
Density at 15°C	NF EN ISO 12185	750.7	kg/m <sup>3</sup>	720.0 - 775.0
Vapor pressure	NF EN 13016-1	57.3	Kpa	45.0 - 60.0
<i>Distillation</i>	NF EN ISO 3405			
		32.4	°C	
		48.1	°C	
		55.0	°C	
		64.3	°C	
		73.0	°C	
		81.7	°C	
		90.1	°C	
		100.4	°C	
		113.0	°C	
		127.0	°C	
		143.4	°C	
		154.1	°C	
final point		181.9	°C	210 max
residue		0.6	%vol	2 max
		1.5	% vol	
distillated volume at 70°C		26.3	%vol	22.0 - 50.0
distillated volume at 100°C		59.5	%vol	46.0 - 72.0
distillated volume at 150°C		94.1	%vol	75.0 min
VLI		757		
Sulfur content	FUV EN ISO 20846	6.9	mg/kg	10.0 max
	NF EN ISO 2160	1a	Cotation	classe 1
<i>Gums content</i>	NF EN ISO 6246			
Gums content		<1	mg/100mL	5 max
		12	mg/100mL	
		<1	mg/100mL	
Research octane number (RON)	NF EN ISO 5164	98.9	cotation	95.0 min
lead content (AA)	NF EN 237	<2.5	mg/L	5 max
Oxidation stability	NF EN ISO 7536	>360	min	
<i>Benzene content</i>	NF EN ISO 22854			
Benzene content		0.60	% vol	1.00 max
		0.71	% m	



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**OPERATION :**

Your ref : Gasoline after additivation (1:4000)

Sampling Date : 01/07/2016 11:04

Lab Number : 070116-000338

Nature :

Order Number : Bon pour accord

Test	Test Method	Result	Unit	Spec
<i>Oxygenate compounds</i>	NF EN ISO 22854			
methanol content		< 0.01	% vol	3.0 max
ethanol content		0.38	% vol	5.0 max
popanol content		< 0.01	% vol	
butanol content		< 0.01	% vol	
MTBE content		0.26	% vol	
ETBE content		15.98	% vol	
DIPE content		0.06	% vol	
TAME content		< 0.01	% vol	
oxygenate compounds total		16.81	% vol	
oxygen content		2.70	% m	2.7 max
isopropylic alcohol		0.13	% vol	
isobutylic alcohol		< 0.01	% vol	
tertbutylic alcohol		< 0.01	% vol	
ether >= 5C		16.30	% vol	
other oxygenated compounds		< 0.01	% vol	
Motor octane number (MON)	NF EN ISO 5163	87.3	cotation	85.0 min
<i>Reformulyzer</i>	NF EN ISO 22854			
aromatics content		31.8	% vol	35.0 max
olefins content		10.4	% vol	18.0 max
saturated content		41.1	% vol	
Manganese content	PR NF EN 16136	<2.00	mg/L	2 max

**Comment : Gasoline sample within specifications according to EN228 - classe A (2013)**

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