VALIDATION DU PROCESS

DE REGENERATION

DES HUILES OIL PLUS

RAPPORT D'ESSAIS

1

CHOIX DU LABORATOIRE

SGS est le leader mondial de l'inspection, de la vérification, de l'analyse et de la certification.

SGS est reconnu comme la référence mondiale en termes de qualité et d'intégrité. Ils emploient plus de 80.000 collaborateurs et exploitent un réseau de plus de 1 650 bureaux et laboratoires à travers le monde.

Leurs services s'organisent en quatre catégories :

- Inspection
- Analyse
- Certification
- Vérification

SGS Vernolab, leader français en analyse d'huiles, membre du Groupe SGS, a su conquérir la planète avec son savoir-faire unique. Depuis son laboratoire historique de Verneuil-sur-Avre (27) en France, SGS Vernolab déploie sa technologie et son innovation aux quatre coins du globe. En 10 ans : 32 laboratoires, 3 900 clients, 643 000 équipements contrôlés… et chaque jour plus de 4 000 échantillons analysés. Une activité de niche à haute valeur ajoutée qui s'impose sur tous les secteurs utilisant des lubrifiants : l'aéronautique, l'automobile, la marine, les travaux publics, les compagnies pétrolières, l'énergie (nucléaire, éolienne) et les transports. Retour sur les raisons d'un succès « à la française »…

À l'origine, le laboratoire de Verneuil-sur-Avre était la propriété de Shell. Vendu en 1999 à PCAS il est ensuite racheté par le Groupe SGS, en février 2004. SGS Vernolab compte alors 2 laboratoires : un en France et un 2ème en Angleterre. 10 ans plus tard, on en dénombre 32, répartis sur les 5 continents !

Aujourd'hui, les implantations et commandes fleurissent et leur chiffre d'affaires ne cesse de croître, et leur savoir-faire est indispensable à tous les acteurs utilisant des moteurs ou mécanismes nécessitant un lubrifiant (huile ou graisse), soit quasiment toutes les industries !
En 2014 SGS Vernolab s'est lancé d'ailleurs sur 3 nouveaux marchés : l'Algérie, la Corée du Sud et la Russie .

C'est donc tout naturellement que Be Energy a fait appel à ce leader mondial du contrôle et des analyses de lubrifiants pour valider son procédé de régénération OIL PLUS.

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Siret 799 666 367 00013 – SARL au capital de 3 000, 00 € - N° TVA Intra com FR60799 666 367

MODE OPERATOIRE

Be Energy a choisi la transparence totale et a mis en place un appareil de régénération d'huile de type OR2 directement dans le laboratoire SGS Vernolab.

Ainsi les prélèvements avant et après régénération pour analyses comparatives ont été faits par le technicien de SGS Vernolab.

Mise en place du régénérateur OR2 dans le laboratoire SGS Vernolab.

Toutes les opérations de régénération des huiles se sont déroulées sur place et en direct sous le contrôle du responsable technique du laboratoire.

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PRELEVEMENTS ET ECHANTILLONNAGES

Les échantillonnages et les analyses ont concerné les différentes huiles suivantes :

Type d'huile	Engin	Modèle utilisé	Photo	Application
Huile Moteur diesel	**CITROEN C4 diesel 140.000km**	**Régénérateur OR 2**		Huile moteur Huile hydrauliques Parc engins chantier Flotte poids lourds Petits prestataire
Huile Hydraulique	**Pelle mécanique MECALAC**			
Huile Moteur Diesel CAMION	**RENAULT TRUCK**			

Chaque huile a été échantillonnée avant et après régénération.

L'échantillonnage a été fait par le technicien spécialiste de SGS Vernolab selon les procédures en vigueur dans les standards internationaux.

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PROGRAMME ANALYTIQUE

Les programmes analytiques choisis sont les plus complets conformément aux standards internationaux en vigueur :

Huiles moteur :

Séquence Analytique	Moteur
Viscosité à 100°C (ASTM D 7279)	✪
Point d'éclair (go/no go) (ASTM D 3828)	✪
Teneur en eau (Crackle + Aquatest)	✪
Spectrométrie (ASTM D 5185)	✪
Teneur en suies (Interne - Tache)	✪
Oxydation/nitration/sulfation (Interne (FTIR))	✪
Dilution gazole estimée (Interne) (**)	✪
TBN (ASTM D 2896 Mod)	✪

Huiles hydrauliques :

Séquence Analytique	Hydraulique Spécifique
Référence	BR3
Teneur en eau Karl-Fischer (ASTM D6304 Mod)	✪
Viscosité à 40°C (ASTM D 7279)	✪
TAN (ASTM D 664 Mod)	✪
Spectrométrie (ASTM D 5185)	✪
Gravimétrie à 0.8 µm (NF E 48-652)	✪
Aspect / Couleur (ASTM D 1500)	✪

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RESULTATS DES ANALYSES

Les fiches complètes des résultats d'analyses sont présentées dans les pages ci après.

Le tableau ci après résume les résultats obtenus :

Type d'huile	Engin	AVANT REGENERATION		APRES REGENERATION	
		Statut	Commentaires	Statut	Commentaires
Huile Moteur diesel	CITROEN C4 diesel 140.000km		Engine oil before regeneration. Some tests cannot be performed because of the high presence of water in the oil. The other results are satisfactory in spite of slightly high silicon content (no obvious effect on wear). NOTE: sampling before and after regeneration and all the tests were performed in our laboratory in Verneuil sur avre under the control of the technician whose name appears on this report		Engine oil after "OIL Plus" regeneration. The water has been removed (the allowable amount is 0,20 % for engine oil). The tests indicated as impossible due to abnormale presence of water are now possible and carried out. In spite of slightly high silicon content (no obvious effect on wear), the results are satisfactory and do not show any problem. NOTE: sampling before and after regeneration and all the tests were performed in our laboratory in Verneuil sur avre under the control of the technician whose name appears on this report.
Huile Hydraulique	Pelle mécanique MECALAC		Hydraulic oil before regeneration. Some tests cannot be performed because of the high presence of water. The measured characteristics of the fluid are satisfactory. Wear levels are normal. The particle count cannot be carried out due to water and visible particles in the sample. NOTE: sampling before and after regeneration and all the tests were performed in our laboratory in Verneuil sur avre under the control of the technician whose name appears on this report.		After Oil Plus regeneration. The analysis results show satisfactory contamination and wear levels. The particle count results are satisfactory. The measured characteristics of the fluid are satisfactory.
Huile Moteur Diesel CAMION	RENAULT TRUCK		Engine oil before "OIL Plus" regeneration. Contamination and wear levels are satisfactory. The water and soot content are acceptable. The oil is slightly deteriorated as indicated by the oxydation products (the TBN value is a little low, oxidation and sulfation values are rather high).		Engine oil after "OIL Plus" regeneration. Contamination and wear levels remain satisfactory. The regeneration has improved several results. The water and soot content have been reduced a little (the allowable amount of water is 0,20 % for engine oil). The tests show improvement in the oil condition probably by removing oxidation products (see TBN increase, oxidation, nitration and sulfation decrease).

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SGS VERNOLAB - DIAGNOSTICS
MORE THAN OIL ANALYSIS

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Online results

http://vernolab-tech.fr.sgs.com/
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SAMPLE 06140855

Sampling date:	08/04/2015	*Equipment (km/h):*	0
Analysis date:	08/04/2015	*Lubricant (km/h):*	0
Diagnosis date:	13/04/2015	*Top-up (l):*	0
Lubricant in use:	SAE 5W30	*Test suite:*	ESNT+ONS

EQUIPMENT 00744276/AMO2

Equipment description: CITROEN C4 DIESEL 140 000 K AVANT REGENERATION
Component description: Moteur Diesel
Fleet no / Ref.: .
Ref ID:

DIAGNOSIS

Reference : Engine oil before regeneration. Some tests cannot be performed because of the high presence of water in the oil. The other results are satisfactory in spite of slightly high silicon content (no obvious effect on wear). NOTE: sampling before and after regeneration and all the tests were performed in our laboratory in Verneuil sur avre under the control of the technien whose name appears on this report.

TESTS	RESULTS
Viscosity 100°C ASTM D7279	
Viscosity 100°C mm2/s	IMP
Water content	
Water content %	1.2
Flash point 180°C ASTM D3828	
Flash point °C	IMP
Dilution Gasoil Estimée	
Dilution Gasoil Estimée %	IMP
Chromatography	
Contamination index %	1.5
MD	95
DP	6
TBN ASTM D2896	
TBN mgKOH/g	4.1
Spectrometrie ASTM D5185	
P %	0.07
Zn %	0.09
Ca %	0.17
Ba %	0
Mg ppm	8
Al ppm	20
Fe ppm	114
Cr ppm	4
Mo ppm	176
Cu ppm	12
Pb ppm	0
Sn ppm	1
Si ppm	32
Na ppm	2
B ppm	24
V ppm	0
S %	0.27
Ni ppm	1
Ag ppm	0
Ti ppm	0
K ppm	9

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SAMPLE			06140855
Sampling date:	08/04/2015	*Equipment (km/h):*	0
Analysis date:	08/04/2015	*Lubricant (km/h):*	0
Diagnosis date:	13/04/2015	*Top-up (l):*	0
Lubricant in use:	SAE 5W30	*Test suite:*	ESNT+ONS

TESTS	RESULTS
Tungstene ppm	2
FTIR ASTM D2412	
Oxidation A/cm	14.4
Nitration A/cm	18.2
Sulfation A/cm	2.2

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SAMPLE 06140856

Sampling date:	08/04/2015	*Equipment (km/h):*	0
Analysis date:	08/04/2015	*Lubricant (km/h):*	0
Diagnosis date:	14/04/2015	*Top-up (l):*	0
Lubricant in use:	SAE 5W30	*Test suite:*	ESNT+ONS

EQUIPMENT 00744276/AMO2

Equipment description: CITROEN C4 DIESEL 140 000 KM APRES REGENERATION
Component description: Moteur Diesel
Fleet no / Ref.: .
Ref ID:

DIAGNOSIS

Reference : Engine oil after "OIL Plus" regeneration. The water has been removed (the allowable amount is 0,20 % for engine oil). The tests indicated as impossible due to abnormale presence of water are now possible and carried out. In spite of slightly high silicon content (no obvious effect on wear), the results are satisfactory and do not show any problem. NOTE: sampling before and after regeneration and all the tests were performed in our laboratory in Vernouil sur avre under the control of the technien whose name appears on this report.

TESTS	RESULTS
Viscosity 100°C ASTM D7279	
Viscosity 100°C mm2/s	10.5
Water content	
Water content %	0.08
Flash point 180°C ASTM D3828	
Flash point °C	>180
Dilution Gasoil Estimée	
Dilution Gasoil Estimée %	3.2
Chromatography	
Contamination index %	1.5
MD	97
DP	4
TBN ASTM D2896	
TBN mgKOH/g	4.2
Spectrometrie ASTM D5185	
P %	0.06
Zn %	0.08
Ca %	0.17
Ba %	0
Mg ppm	7
Al ppm	19
Fe ppm	113
Cr ppm	4
Mo ppm	173
Cu ppm	12
Pb ppm	0
Sn ppm	0
Si ppm	32
Na ppm	3
B ppm	21
V ppm	0
S %	0.25
Ni ppm	1
Ag ppm	0
Ti ppm	0
K ppm	9

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SAMPLE			06140856
Sampling date:	08/04/2015	*Equipment (km/h):*	0
Analysis date:	08/04/2015	*Lubricant (km/h):*	0
Diagnosis date:	14/04/2015	*Top-up (l):*	0
Lubricant in use:		*Test suite:*	
	SAE 5W30		ESNT+ONS

TESTS	RESULTS
Tungstene ppm	2
FTIR ASTM D2412	
Oxidation A/cm	14.1
Nitration A/cm	18.5
Sulfation A/cm	1.9

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SAMPLE			06140851
Sampling date:	08/04/2015	*Equipment (km/h):*	0
Analysis date:	08/04/2015	*Lubricant (km/h):*	7000
Diagnosis date:	13/04/2015	*Top-up (l):*	0
Lubricant in use:	ISO 46	*Test suite:*	BR3E+ISAE

EQUIPMENT	00744276/BHY
Equipment description:	MECALAC PELLE MECANIQUE AVANT REGENERATION
Component description:	Hydraulique
Fleet no / Ref.:	.
Ref ID:	

DIAGNOSIS

Reference : hydraulic oil before regeneration. Some tests cannot be performed because of the high presence of water. The measured characteristics of the fluid are satisfactory. Wear levels are normal. The particle count cannot be carried out due to water and visible particles in the sample. NOTE: sampling before and after regeneration and all the tests were performed in our laboratory in Verneuil sur avre under the control of the technien whose name appears on this report.

TESTS	RESULTS
Viscosity 40°C ASTM D7279	
Viscosity 40°C mm2/s	46.6
Water Karl Fisher ASTM D 6304	
Water content ppm	4144
Colour aspect	
Appearance	IMP
Colour	IMP
TAN ASTM D664	
TAN mgKOH/g	0.39
Filtration 0.8µ	
Sample preparation ml	50
Filtration 0.8µ mg/l	26
Spectrometry ASTM D5185	
P ppm	268
Zn ppm	283
Ca ppm	42
Ba ppm	0
Mg ppm	9
Al ppm	0
Fe ppm	0
Cr ppm	0
Mo ppm	0
Cu ppm	0
Pb ppm	0
Sn ppm	0
Si ppm	0
Na ppm	0
B ppm	0
V ppm	0
S ppm	10409
Ni ppm	0
Ag ppm	0
Ti ppm	0
K ppm	0
Particle count (ISO/SAE)	
SAE AS4059 > 4µm(c)	IMP

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SAMPLE			06140851
Sampling date:	08/04/2015	*Equipment (km/h):*	0
Analysis date:	08/04/2015	*Lubricant (km/h):*	7000
Diagnosis date:	13/04/2015	*Top-up (l):*	0
Lubricant in use:	ISO 46	*Test suite:*	BR3E+ISAE

TESTS	RESULTS
SAE AS4059 >6µm(c)	IMP
SAE AS4059 >14µm(c)	IMP
SAE AS4059 >21µm(c)	IMP
SAE AS4059 >38µm (c)	IMP
SAE AS4059 >70µm(c)	IMP
SAE AS4059	IMP
Particle Count ISO4406	IMP

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SAMPLE			6140853
Sampling date:	05/05/2015	*Equipment (km/h):*	0
Analysis date:	05/05/2015	*Lubricant (km/h):*	1
Diagnosis date:	07/05/2015	*Top-up (l):*	0
Lubricant in use:	ISO 46	*Test suite:*	BR3E+ISAE

EQUIPMENT	00744276/BHY
Equipment description:	MECALAC PELLE MECANIQUE APRES REGENERATION
Component description:	Hydraulique
Fleet no / Ref.:	-
Ref ID:	

DIAGNOSIS

Reference : after Oil Plus regeneration. The analysis results show satisfactory contamination and wear levels. The particle count results are satisfactory. The measured characteristics of the fluid are satisfactory.

TESTS	RESULTS
Viscosity 40°C ASTM D7279	
Viscosity 40°C mm2/s	47.5
Water Karl Fisher ASTM D 6304	
Water content ppm	140
Colour aspect	
Appearance	Clear
Colour	0.5
TAN ASTM D664	
TAN mgKOH/g	0.35
Filtration 0.8µ	
Sample preparation ml	50
Filtration 0.8µ mg/l	2
Spectrometry ASTM D5185	
P ppm	289
Zn ppm	302
Ca ppm	57
Ba ppm	0
Mg ppm	4
Al ppm	0
Fe ppm	0
Cr ppm	0
Mo ppm	0
Cu ppm	0
Pb ppm	0
Sn ppm	0
Si ppm	0
Na ppm	0
B ppm	0
V ppm	0
S ppm	13264
Ni ppm	0
Ag ppm	0
Ti ppm	0
K ppm	0
Particle count (ISO/SAE)	
SAE AS4059 > 4µm(c)	7

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SAMPLE			6140853
Sampling date:	05/05/2015	*Equipment (km/h):*	0
Analysis date:	05/05/2015	*Lubricant (km/h):*	1
Diagnosis date:	07/05/2015	*Top-up (l):*	0
Lubricant in use:	ISO 46	*Test suite:*	BR3E+ISAE

TESTS	RESULTS
SAE AS4059 >6µm(c)	7
SAE AS4059 >14µm(c)	5
SAE AS4059 >21µm(c)	6
SAE AS4059 >38µm (c)	7
SAE AS4059 >70µm(c)	8
SAE AS4059	8
Particle Count ISO4406	17/15/11

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SAMPLE 06780911

Sampling date:	02/07/2015	*Equipment (km/h):*	238280
Analysis date:	13/07/2015	*Lubricant (km/h):*	40000
Diagnosis date:	17/07/2015	*Top-up (l):*	0
Lubricant in use:	TOTAL SAE 15W30	*Test suite:*	ESNT+ONS

EQUIPMENT 00744276/AMO2

Equipment description:	RENAULT TRUCK
Component description:	Moteur Diesel
Fleet no / Ref.:	.
Ref ID:	

DIAGNOSIS

Reference : Engine oil before "OIL Plus" regeneration. Contamination and wear levels are satisfactory. The water and soot content are acceptable. The oil is slightly deteriorated as indicated by the oxydation products (the TBN value is a little low, oxidation and sulfation values are rather high).

TESTS	RESULTS
Viscosity 100°C ASTM D7279	
Viscosity 100°C mm2/s	10.3
Water content	
Water content %	0.12
Flash point 180°C ASTM D3828	
Flash point °C	>180
Dilution Gasoil Estimée	
Dilution Gasoil Estimée %	3.3
Chromatography	
Contamination index %	0.5
MD	100
DP	0
TBN ASTM D2896	
TBN mgKOH/g	6.2
Spectrometrie ASTM D5185	
P %	0.10
Zn %	0.13
Ca %	0.23
Ba %	0.00
Mg ppm	210
Al ppm	7
Fe ppm	18
Cr ppm	0
Mo ppm	0
Cu ppm	3
Pb ppm	4
Sn ppm	2
Si ppm	10
Na ppm	3
B ppm	1
V ppm	0
S %	1.15
Ni ppm	1
Ag ppm	0
Ti ppm	0
K ppm	3

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SAMPLE			06780911
Sampling date:	02/07/2015	*Equipment (km/h):*	238280
Analysis date:	13/07/2015	*Lubricant (km/h):*	40000
Diagnosis date:	17/07/2015	*Top-up (l):*	0
Lubricant in use:	TOTAL SAE 15W30	*Test suite:*	ESNT+ONS

TESTS	RESULTS
Tungstene ppm	0
FTIR ASTM D2412	
Oxidation A/cm	21.0
Nitration A/cm	12.5
Sulfation A/cm	26.7

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Online results
http://vernolab-tech.fr.sgs.com/
Internet login: VER84020

SAMPLE 06780912

Sampling date:	02/07/2015	*Equipment (km/h):*	238280
Analysis date:	13/07/2015	*Lubricant (km/h):*	40000
Diagnosis date:	17/07/2015	*Top-up (l):*	0
Lubricant in use:	TOTAL SAE 15W30	*Test suite:*	ESNT+ONS

EQUIPMENT 00744276/AMO2

Equipment description: RENAULT TRUCK
Component description: Moteur Diesel
Fleet no / Ref.: -
Ref ID:

DIAGNOSIS

Reference : Engine oil after "OIL Plus" regeneration. Contamination and wear levels remain satisfactory. The regeneration has improved several results. The water and soot content have been reduced a little (the allowable amount of water is 0,20 % for engine oil). The tests show improvement in the oil condition probably by removing oxydation products (see TBN increase, oxidation, nitration and sulfation decrease).

TESTS	RESULTS
Viscosity 100°C ASTM D7279	
Viscosity 100°C mm2/s	10.9
Water content	
Water content %	0.08
Flash point 180°C ASTM D3828	
Flash point °C	>180
Dilution Gasoil Estimée	
Dilution Gasoil Estimée %	3.0
Chromatography	
Contamination index %	0.3
MD	99
DP	0
TBN ASTM D2896	
TBN mgKOH/g	8.3
Spectrometrie ASTM D5185	
P %	0.12
Zn %	0.14
Ca %	0.24
Ba %	0.00
Mg ppm	221
Al ppm	4
Fe ppm	10
Cr ppm	0
Mo ppm	0
Cu ppm	2
Pb ppm	2
Sn ppm	1
Si ppm	9
Na ppm	3
B ppm	1
V ppm	0
S %	1.33
Ni ppm	0
Ag ppm	0
Ti ppm	0
K ppm	2

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SAMPLE			06780912
Sampling date:	02/07/2015	*Equipment (km/h):*	238280
Analysis date:	13/07/2015	*Lubricant (km/h):*	40000
Diagnosis date:	17/07/2015	*Top-up (l):*	0
Lubricant in use:	TOTAL SAE 15W30	*Test suite:*	ESNT+ONS

TESTS	RESULTS
Tungstene ppm	0
FTIR ASTM D2412	
Oxidation A/cm	15.6
Nitration A/cm	9.1
Sulfation A/cm	20.8

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