

Excellium Pro Concentrate

TECHNICAL BOOKLET

TotalEnergies

Excellium Pro Concentrate

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Excellium Pro Concentrate

INTRODUCTION

TRUST A LEADER

The purpose of **Excellium Pro Concentrate** additive is to bring to professionals (B2B segment) the performances of Excellium® fuels in areas where the retail or general sale of this premium fuel technology is not available. **Excellium Pro Concentrate** is designed to protect and preserve large engines as highly valuable assets, with affordable cost.

TotalEnergies Additives & Fuels Solutions (AFS) is a major player in the design and the production of high performance fuel additives since 40 years. AFS has the double characteristic of being the only additive company **inside a major retail company** but also the only additive company with in-house special fuels design capability. Benefiting from world-class R&D centers and **understanding the reality and the needs of fuel use**, AFS designs optimized products and supplies major retailers and B2B customers around the world.

WHY Excellium Pro Concentrate?

As opposed to many diesel additives available on the market and because it is proposed by a major fuel retailer, **Excellium Pro Concentrate** provides all the laboratory and engine test documentation and performances expected from a premium diesel fuel additive:

- strong **engine cleanliness** and **injectors protection** (especially for common-rail technologies)
- deposits **clean-up** and **power recovery** effect
- **up to 3,3% fuel economy**
- engine **wear protection**
- **anticorrosion** protection
- diesel **filterability** improvement.

This combination of performances extends engine lifetime, provides valid fuel economy figures and contributes to a lower emissions pattern.

Excellium Pro Concentrate is compatible with all materials used in engines and after-treatment devices.

Excellium Pro Concentrate performs in all fuels, even with high amounts of bio or renewable products as it counterbalances and compensates their possible drawbacks (oxidation stability for FAME, lubricity for renewable diesel such HVO…).

Excellium Pro Concentrate is recorded on the American EPA® list of registered diesel fuel additives.

Excellium Pro Concentrate

TREAT RATE & PERFORMANCE

The treat rate of **Excellium Pro Concentrate** is set at 600ml/m3 (0,6L/1000L).

TYPICAL PERFORMANCE & TREAT RATE	
Additive	**Excellium Pro Concentrate**
Treat rate (ml/m3)	600
Technical features	
Fuel economy	Up to 3.3%
Engine cleanliness	
XUD9 injector flow loss	< 5%
DW10B power change	> -2%
Deutz HD torque change	Pass
Engine clean-up	55 to 98%
Deutz HD lacquering	Pass (incl. clean-up)
HFRR wear reduction	improves
Anticorrosion protection	100% (NACE 'A')
Water separation	≥ base fuel
Oxidation stability	+10h Rancimat boost

Excellium Pro Concentrate meets the engine performance level of the Worldwide Fuel Charter highest categories. It has been tested against all industry standard tests in independent laboratories for both engine keep-clean and clean-up abilities.

But more than this, **Excellium Pro Concentrate** confirms its performance and customer benefits by numerous vehicle tests (passenger car, heavy-duty truck, tractor) with a positive contribution on fuel economy and no-harm on emissions. All the results of these vehicle tests are described in the following pages.

Excellium Pro Concentrate

PRODUCT CHARACTERISTICS

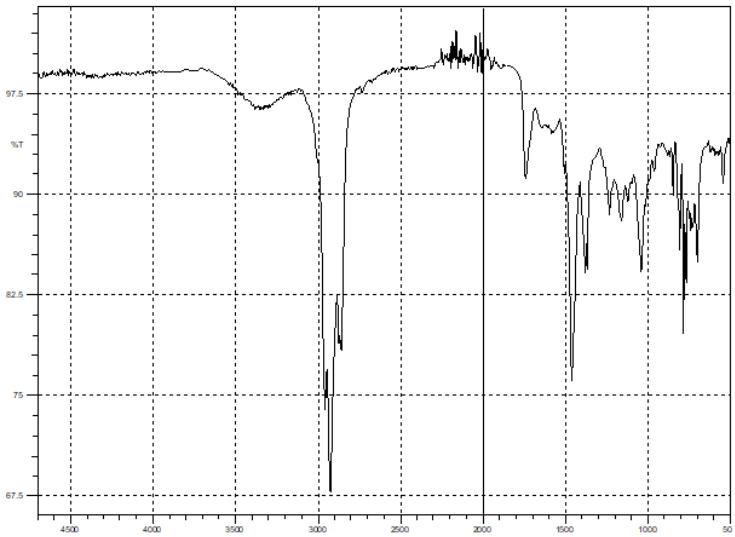
PROPERTIES

The physical-chemical properties of pure **Excellium Pro Concentrate** additive are detailed in the table below:

PHYSICAL-CHEMICAL CHARACTERISTICS		
Excellium Pro Concentrate		
Appearance	Visual	Orange liquid
Density @15°C	EN ISO 12185	906 kg/m3
Kinematic viscosity @40°C @20°C @-10°C	ASTM D 445	 7,3 mm²/s 13 mm²/s 45 mm²/s
Pour Point	ASTM D97	< -30 °C
Flash Point	ASTM D93	63 °C
TBN	ASTM D2896	14,2 mgKOH/g
Nitrogen content	ASTM D5291	1,3 %w

Excellium Pro Concentrate presents easy handling properties (adaptable on demand).

FTIR SPECTRUM



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ENGINE PERFORMANCE TESTS

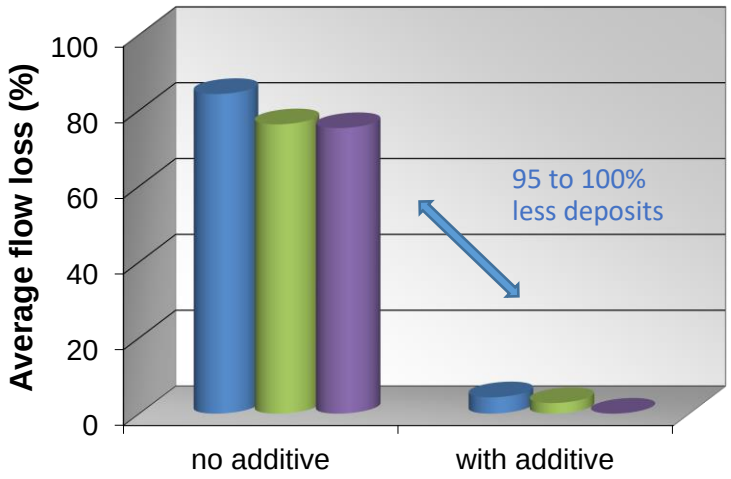
INJECTOR CLEANLINESS
XUD9 keep-clean

The PSA XUD9 engine (4 cylinders, indirect injection, 1.9L displacement) is used to evaluate the propensity of diesel fuel and diesel additives to prevent deposits formation in injector nozzles. The engine is operated at low speed/load for a period of 10 hours. XUD9 is a worldwide reference test for diesel fuel quality.

The propensity of the fuel to promote deposits formation in the nozzles is determined by measuring the injector nozzles air flow before and after the test (pneumatic measurement). The results are given in terms of airflow reduction (%).

INJECTOR FOULING TEST XUD9 (CEC F23-01)		
Laboratory	Intertek	
Base fuel	B0 Afr. / B0 high aromatics / CEC RF-79-07	
Additive	////	EPC* @600ml/m3
Airflow loss	84,3% / 76,3% / 75,3%	4,3% / 2,8% / 0%

**test run with R&D code E4G-086 (=EPC with antifoam agent)*



Excellium Pro Concentrate almost totally prevents injector deposits build-up with premium type of performance (<5% flow loss). The additive has been tested with various origins of regular diesel fuel.

Excellium Pro Concentrate

ENGINE PERFORMANCE TESTS

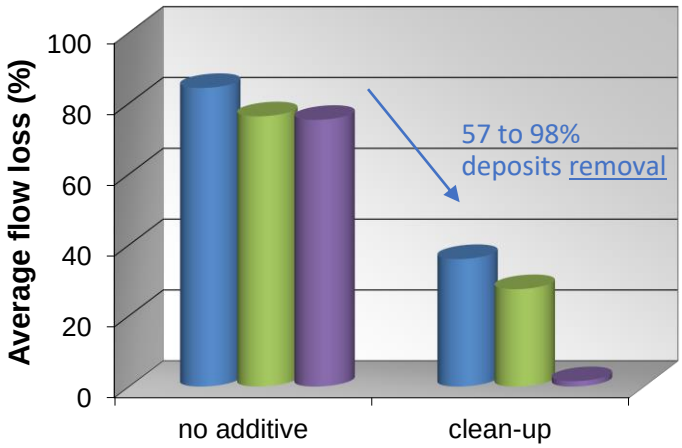
INJECTOR CLEANLINESS
XUD9 clean-up

The PSA XUD9 engine (4 cylinders, indirect injection, 1.9L displacement) is used to evaluate the propensity of diesel fuel and diesel additives to prevent deposits formation in injector nozzles. The engine is operated at low speed/load for a period of 10 hours. XUD9 is a worldwide reference test for diesel fuel quality.

The test is run in the clean-up mode meaning that it is first operated with blank fuel. Then injectors are then analyzed to calculate the airflow loss and they are mounted again, with their existing deposits, in the engine. The test is started again this time with the additized fuel. At the end of the procedure, it is possible to measure the ability of the additive to remove existing deposits.

INJECTOR FOULING TEST XUD9 (CEC F23-01)		
Laboratory	Intertek	
Base fuel	B0 Afr. / B0 high aromatics / CEC RF-79-07	
Additive	Dirty-up	Clean up with EPC* @600ml/m3
Airflow loss	84,3% / 76,3% / 75,3%	36% / 27,5% / 1,5%

**test run with R&D code E4G-086 (=EPC with antifoam agent)*



In-line with the previous keep-clean results, **Excellium Pro Concentrate** reduces existing injectors deposits. Depending on the base fuel type, this reduction ranges from half (minimum) to almost total reduction.

Excellium Pro Concentrate

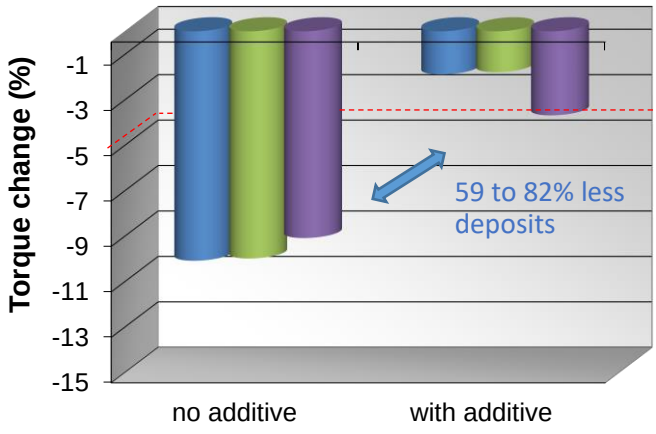
ENGINE PERFORMANCE TESTS

INJECTOR CLEANLINESS
DEUTZ coking keep-clean

The DEUTZ TCD engine (4 cylinders, heavy-duty common rail direct injection, 3.6L displacement) is used to evaluate the propensity of diesel fuel or diesel additives to prevent deposits formation in injector nozzles. The engine is operated for 35 hours with blank fuel plus a very small amount of lubricant (to further promote engine fouling). The propensity of the fuel to generate deposits in the nozzles is determined by measuring the torque change between start-of-test and end-of-test at iso-engine speed.

INJECTOR FOULING IN-HOUSE DEUTZ TEST		
Laboratory	TotalEnergies OneTech, France	
Base fuel	B0 Afr. / B0 high aromatics / CEC RF-79-07	
Additive	////	EPC* @600ml/m3
Torque change	-10,1% / -10% / -9.1%	-1,9% / -1,8% / -3,7%

**test run with R&D code E4G-086 (=EPC with antifoam agent)*



Excellium Pro Concentrate almost totally prevents injector deposits build-up with premium type of performance and in this manner protects the engine of torque losses (the test is considered as a clear pass when torque change is above -4,7%). It ensures stable engine power and long-term efficiency. The additive has been tested with various origins of regular diesel fuel.

Excellium Pro Concentrate

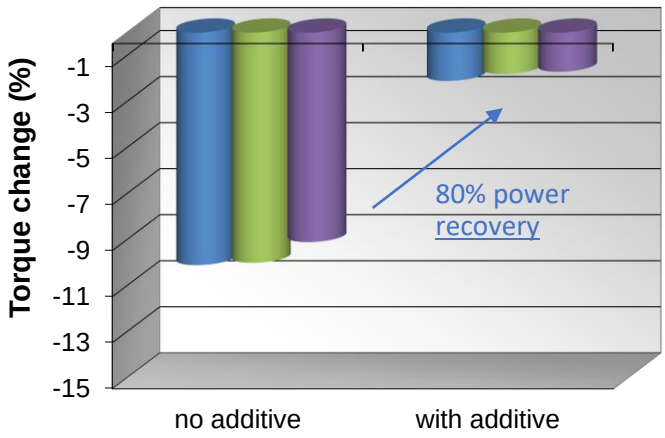
ENGINE PERFORMANCE TESTS

INJECTOR CLEANLINESS
DEUTZ coking clean-up

The DEUTZ TCD engine (4 cylinders, heavy-duty common rail direct injection, 3.6L displacement) is used to evaluate the propensity of diesel fuel or diesel additives to remove existing deposits in injector nozzles (clean-up mode). The engine is first operated for 35 hours with blank fuel plus a very small amount of lubricant (to further promote injector fouling). The test is then run again, keeping the engine parts as they were after the dirty-up process, this time with the additized fuel. At the end of the full procedure, it is possible to measure the ability of the additive to remove existing deposits by monitoring the torque recovery between the end of the dirty-up phase (with blank fuel) and the end of the clean-up phase (with the additive).

INJECTOR FOULING IN-HOUSE DEUTZ TEST		
Laboratory	TotalEnergies OneTech, France	
Base fuel	B0 Afr. / B0 high aromatics / CEC RF-79-07	
Additive	Dirty-up	Clean up with EPC* @600ml/m3
Airflow loss	-10,1% / -10% / -9.1%	-2.1% / -1.8% / -1.7%

**test run with R&D code E4G-086 (=EPC with antifoam agent)*

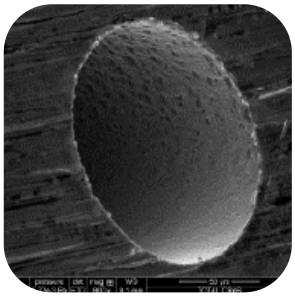


In-line with the previous keep-clean results, **Excellium Pro Concentrate** reduces significantly existing injectors deposits (this happens when torque loss after clean-up is better than after dirty-up by more than 2.5%) and allows to get back almost to the initial performance of the engine. The additive has been tested with various origins of regular diesel fuel.

Excellium Pro Concentrate

ENGINE PERFORMANCE TESTS

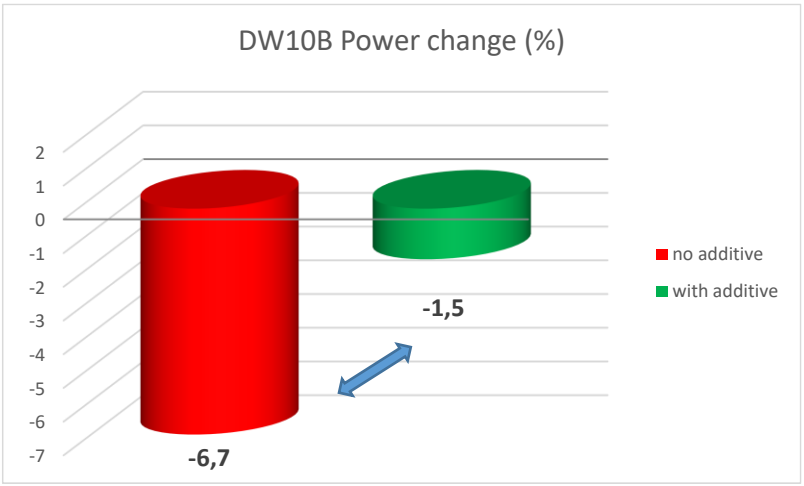
INJECTOR CLEANLINESS
DW10B keep-clean



The PSA DW10B engine (4 cylinders, common rail direct injection, 2.0L displacement) is used to evaluate the propensity of diesel fuel or diesel additives to prevent deposits formation in injector nozzles. The engine is operated for 16 hours with blank DF-79 fuel, then for 56 hours with the additive (including 3*8 hours of engine stop). The propensity of the fuel to promote deposits formation in the nozzles is determined by measuring the power change between start-of-test and end-of-test.

INJECTOR FOULING TEST DW10B (CEC F98-08)		
Laboratory	Drive Technology Center, Austria	
Base fuel	CEC RF79-07 + 1ppm Zn	
Additive	////	EPC* @250ml/m3
Power change	-6.7%	-1.5%

**test run with R&D code E4G-086 (=EPC with antifoam agent)*



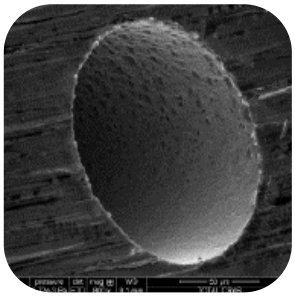
The results show that fuel treated with **Excellium Pro Concentrate** protects the engine regarding power loss (being superior to -2%, it is considered as a clear pass) as opposed to untreated fuel.

The result obtained with 250ppm only guarantees an at least or better performance in terms of power preservation with 600ppm of additive.

Excellium Pro Concentrate

ENGINE PERFORMANCE TESTS

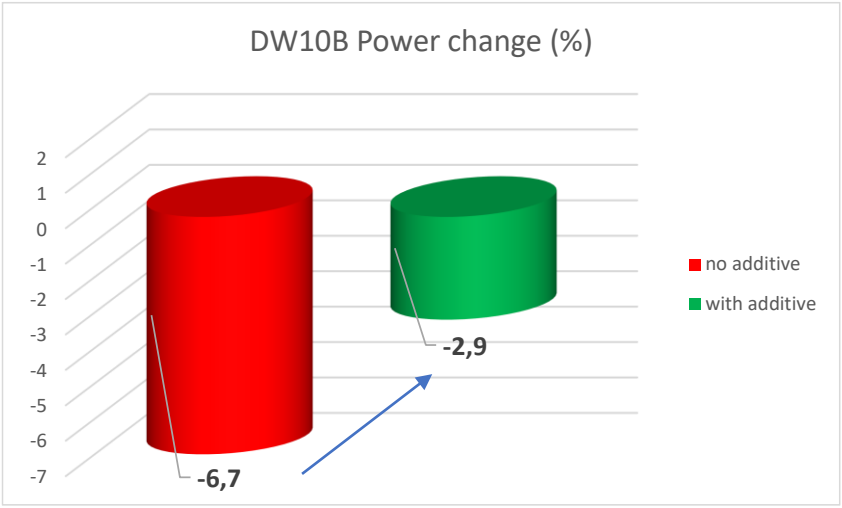
INJECTOR CLEANLINESS
DW10B clean-up



The PSA DW10B engine (4 cylinders, common rail direct injection, 2.0L displacement) is here run in the clean-up mode, meaning that the engine is first operated with the base fuel (without additive) and rated for engine power change (dirty-up phase). The same engine (without parts change, meaning with deposits inside the injectors from the dirty-up phase) is then operated with additized fuel and it is observed how much injector cleaning and power recovery is obtained.

INJECTOR FOULING TEST DW10B (CEC F98-08)		
Laboratory	Drive Technology Center, Austria	
Base fuel	CEC RF79-07 + 1ppm Zn	
Additive	//// (dirty-up)	Clean-up with EPC* @250ml/m3
Power change	-6.7%	-2.9%

**test run with R&D code E4G-086 (=EPC with antifoam agent)*



The results show that fuel treated with **Excellium Pro Concentrate** allows to recover almost 60% of power loss experienced during initial dirty-up in just one test. This is an indication of progressive removal of deposit build-up which has happened during the dirty-up phase.

The result obtained with 250ppm only guarantees an at least or better performance in terms of power restoration with 600ppm of additive.

Excellium Pro Concentrate

ENGINE NO-HARM TESTS

INJECTOR CLEANLINESS
DEUTZ IDID lacquering

Internal Diesel Injectors Deposits (IDID) are known to be a key concern with latest fuel injection equipments. IDID are generally accepted as a matter of complex interactions between the engine, the base fuel (incl. biodiesel and its specific additives), refining/process additives (corrosion inhibitors) and potentially performance additives. Those interactions might lead to two types of needle deposits: 'soap-type' deposits (usually associated with sodium) and 'lacquer-type'. IDID lead to fast and sensitive harm to the engine performances, typically significant power losses or impossibility to start at cold temperature.

TotalEnergies has been a leading company in understanding IDID and has developed various in-house procedure to control the phenomenon. The first effort has been detailed in SAE technical paper 2012-01-1687. In a second effort and while CEC was starting the development of DW10C procedure, another procedure has been developed also using DDSA and Na as contaminants in a DEUTZ heavy-duty engine.

The same DEUTZ TCD engine (4 cylinders, heavy-duty common rail direct injection, 3.6L displacement) as for coking protocol (see p. 8-9) is used to evaluate the propensity of IDID formation. The test cycle is adapted with a longer duration (100h), a different cycle (simulation plowing mode) and DDSA and Na as contaminants. The propensity of the fuel to promote IDID is determined by a visual rating of the different deposits and lacquers present on the needle surface.

DEUTZ IN-HOUSE INTERNAL DIESEL INJECTOR DEPOSITS		
Laboratory	TotalEnergies One Tech R&D, France	
Base fuel	B0 Afr.	
Additive	////	EPC @600ml/m3*
IDID merit (/10)		
- **keep-clean**	5,92 /10	7,84 /10
- **clean-up**	5,92/10 →	7,71 /10

**test run with R&D code E4G-086 (=EPC with antifoam agent)*

Excellium Pro Concentrate improves the merit rating compared to the base fuel (keep-clean) but also recovers the same merit level when tested from dirty-up injectors (clean-up). As such, **Excellium Pro Concentrate** ensures no-harm regarding IDID formation tendency.

Excellium Pro Concentrate

VEHICLE PERFORMANCE TESTS

FUEL ECONOMY

The purpose of any fuel additive (in addition to all the standard engine tests or laboratory performances) is ultimately to **improve vehicle operation** in terms of fuel efficiency and emissions control. **Excellium Pro Concentrate** has been tested in the most recent and stringent possible test conditions, using the latest WLTC chassis-dyno test cycle with Euro6b vehicles.

The tests have been conducted at APL, Germany, certified and independent laboratory. The Renault Scenic €5 vehicle has first been tested on the chassis-dyno with CEC RF79 base fuel without any performance additives. After 500km conditioning the vehicle has been tested on the harmonized WTLC test cycle which is the only one to be considered following the Dieselgate. Four consecutive measurements have been performed for statistical validity. The vehicle has then been switched to **Excellium Pro Concentrate** use. Here again, after 500km conditioning the fuel consumption has been measured 4 times according to the WLTC test cycle.

The test results are detailed in the table below:

WLTC CHASSIS-DYNO FUEL ECONOMY		
Laboratory	APL, Germany	
Vehicle	Renault Scenic €5 81kW	
Base fuel	CEC RF79-07	
Test cycle	500km + WTLC x4	500km + WLTC x4
Additive	////	EPC @600ml/m3*
Fuel consumption	4,824 L/100km	4,734 L/100km **(-1.9%)**

**test run with R&D code E4G-086 (=EPC with antifoam agent)*

Excellium Pro Concentrate exhibits an immediate and significant neat **fuel economy benefit of about 2%**. This performance is obtained by the combination of improved fuel spray, absolute engine cleanliness and engine parts friction reduction. The result has been obtained with 250ppm dosage only, ensuring possible higher results at full 600ppm dosage.

Excellium Pro Concentrate

VEHICLE PERFORMANCE TESTS

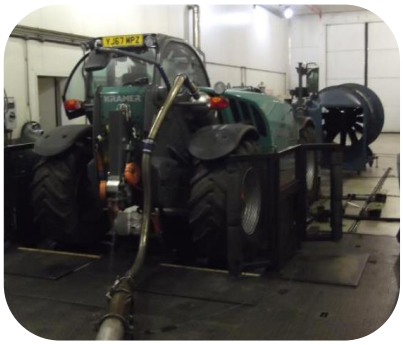
FUEL ECONOMY

Being mainly dedicated for professional users (B2B) **Excellium Pro Concentrate** has also been tested on heavier equipments such as an MAN 430 Tractor unit and Kramer-Deutz agri machine.

The tests have been conducted at MILLBROOK, UK, certified and independent laboratory. The vehicles have been evaluated on chassis-dyno first for their consumption and emissions performance with base fuel (without additive) according to a specific transient cycle for each. The vehicles have then been switched to the same fuel containing **Excellium Pro Concentrate** additive, operated for real service for some time (20.000km accumulation driving for MAN) and evaluated again on the chassis-dyno on the repeated transient cycle. The results below show the fuel comparison at the end of the full protocol compared to the initial consumption when the base fuel was first used.

CHASSIS-DYNO FUEL ECONOMY		
Laboratory	MILLBROOK, UK	
Vehicle	MAN TGA 26 430 XXL €3	
Base fuel	B0 EN590 winter	
Test cycle	FIGE transient before additive use x9	FIGE transient before additive use x6
Additive	////	EPC @600ml/m3*
Fuel consumption	24.06 L/100km	23.75 L/100km **(-1.3%)****

**test run with R&D code E4G-086 (=EPC with antifoam agent)*
*** JPS Fuel Consumption, overall result (all phases, hot cycle)*



Vehicle	**Kramer KT356 (Deutz TCD 3,6L)**	
Base fuel	B0 EN590 winter	
Test cycle	transient before additive use x4	transient before additive use x5
Additive	////	EPC @600ml/m3*
Fuel consumption Overall Low drive & Idle (ph1)	 84.5 L/100km 104.9 L/100km	 82.5 L/100km **(-2.4%)** 101.4 L/100km **(-3.3%)**

Excellium Pro Concentrate exhibits a significant neat **fuel economy benefit of around 2%** again and up to 3.3% in typical use conditions.

Excellium Pro Concentrate

VEHICLE PERFORMANCE TESTS

EMISSIONS CONTROL

As for fuel economy (previous pages), **Excellium Pro Concentrate** has been tested according to the same WLTC protocol for emissions control. Post-Dieselgate, it is absolutely necessary to check that the use of performance fuel additives do not harm the emissions performances of the vehicles.

WLTC CHASSIS-DYNO EMISSIONS		
Laboratory	APL, Germany	
Vehicle	Renault Scenic €5 81kW	
Base fuel	CEC RF79-07	
Test cycle	500km + WTLC x4	500km + WLTC x4
Additive	////	EPC @600ml/m3*
Emissions exhaust - CO - HC - NOx - PM - PN	[mg/km] 70,6 8,7 594,1 0,10 2,59E10 [/km]	[mg/km] 65,8 (-6.8%) 7,3 (-16%) 569,0 (-4%) 0,18 1,83E11 [/km]

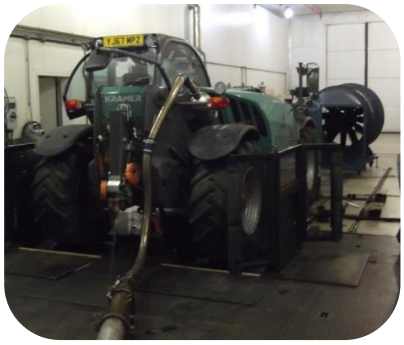
**test run with R&D code E4G-086 (=EPC with antifoam agent)*

Excellium Pro Concentrate exhibits the remarkable performance of improving all gaseous pollutant emissions. This is of particular importance regarding NOx (significant contributor to urban city pollution) and because most of after-treatment system development look after solid pollutants (particulate filters). PM and PN values are not statistically different and below the Euro 5-6 limits.

Excellium Pro Concentrate

VEHICLE PERFORMANCE TESTS

EMISSIONS CONTROL



The MAN and KRAMER vehicles have been evaluated for their emissions performances during the same fuel economy evaluation which has been previously described (previous pages).

The results below show the evolution of emissions exhaust between the end of the full protocol (actual driving with **EXCELLIUM PRO CONCENRATE**) compared to the initial consumption when the base fuel was first used.

CHASSIS-DYNO EMISSIONS		
Laboratory	MILLBROOK, UK	
Vehicle	MAN TGA 26 430 XXL €3	
Base fuel	B0 EN590 winter	
Test cycle	FIGE transient before additive use x9	FIGE transient before additive use x6
Additive	////	EPC @600ml/m3*
Emissions exhaust - CO - HC - NOx - PM	[g/km] 0.997 0.127 8.58 0.0547	[g/km] 0.933 (-6.4%) 0.1 (-21%) 8.41 (-2%) 0.0575 (+5%)

Vehicle	**Kramer KT356 (Deutz TCD 3,6L)**	
Base fuel	B0 EN590 winter	
Test cycle	transient before additive use x4	transient before additive use x4
Additive	////	EPC @600ml/m3*
Emissions exhaust - CO - HC - NOx - PM - PN	[g/km] 0.007 0.0095 9.4 0.117 1.34E11	[g/km] 0.0085 0.031 7.9 (-16%) 0.048 (-59%) 1.12E11 (-16%)

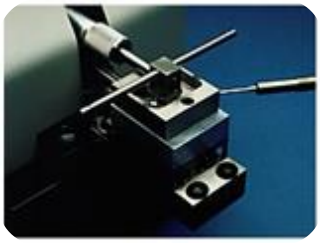
**test run with R&D code E4G-086 (=EPC with antifoam agent)*

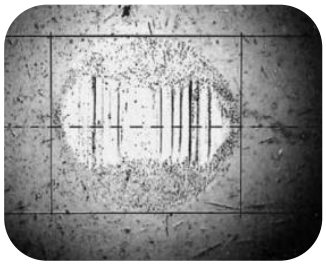
Excellium Pro Concentrate systematically reduces NOx and other pollutants when they reach an absolute level which has some significance (e.g. CO, HC for MAN – values are too low for any significance with Kramer – and PM for Kramer).

Excellium Pro Concentrate

LABORATORY PERFORMANCE TESTS

WEAR PROTECTION





Excellium Pro Concentrate is also formulated with a specific friction modifier not specifically for reducing HFRR lubricity of the fuel but because it has shown a specific contribution to maximum fuel economy performance. As an incidental consequence, it provides a supplementary protection regarding engine wear, even for diesel fuels already meeting the <460µm specification. It is additionally of interest in case the base fuel does not meet the specification or if FAME was not available in the fuel depot at the right time.

The HFRR test (High Frequency Reciprocating Rig) is designed to assess diesel fuel pump wear. It consists of evaluating diesel fuel lubricity between a plate and a small ball with a high frequency translation movement. At the end of the test, the Mean Wear Scar Diameter is measured on the ball.

HFRR FRICTION TEST (EN ISO 12156)		
Laboratory	TotalEnergies OneTech, France	
Base fuel	CEC RF79 / B0 high HAP	
Additive	////	EPC @600ml/m3
MWSD (µm)	250 / 450	220 / 390

Excellium Pro Concentrate reduces wear and friction for all fuel types, whether they are way below the 460µm limit or closer to this limit. As such, **Excellium Pro Concentrate** maintains full conformity of diesel fuels regarding HFRR specifications.

Excellium Pro Concentrate

LABORATORY PERFORMANCE TESTS

ANTI-CORROSION

ASTM D 665 test consists in visually assessing the corrosion (hence the efficiency of corrosion inhibitor) of newly polished steel test sample plunged into an agitated fuel/water blend. Method ASTM D665A is using distilled water, method B synthetic sea water (which is more severe). Rating is done at the end of the test with the NACE scale (from 'A' to 'E' depending on the % of surface of the probe which is corroded).

%	NACE rating
0	A
<0.1%	B++
0.1% - 5%	B+
5% - 25%	B
25% - 50%	C
50% - 75%	D
75% - 100%	E

ANTI-CORROSION TEST (ASTM D665)		
Laboratory	TotalEnergies OneTech, Solaize, France	
Base fuel	B0 Afr.	
Additive	////	EPC @600ml/m3
NACE rating (method A, distilled water)	B+	A
NACE rating (method B, sea water)	D	A

Base fuel	B0 High HAP	
Additive	////	EPC @600ml/m3
NACE rating (method A, distilled water)	B++	A
NACE rating (method B, sea water)	B+	A

Excellium Pro Concentrate provides the highest possible protection feature regarding rust corrosion, as expected from a premium diesel fuel. This contributes to engine, tank and fuel lines protection.

Excellium Pro Concentrate

LABORATORY PERFORMANCE TESTS

OXIDATION STABILITY INDUCTION PERIOD

The Rancimat EN 15751 oxidation test is run at 110°C and looks after acidity condensates. It is widely admitted that biodiesel containing fuels can suffer from lower oxidation stability depending on the FAME type and quality. It is dramatically important to protect all biodiesel regarding degradation because it is the root cause of many troubles: the fuel is more acidic, more sensitive to metal traces which catalyzes again the oxidation process and leads to higher deposits build-up in the injectors.

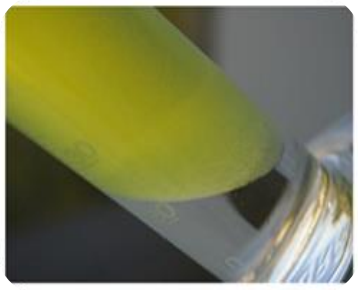
RANCIMAT EN 15751		
Laboratory	TotalEnergies AFS, France	
Base fuel	CEC RF79	
Additive	////	EPC @600ml/m3
Induction period (h)	38,6	>48h

Excellium Pro Concentrate largely improves the oxidation stability of all diesel fuels, avoiding diesel fuel ageing. **Excellium Pro Concentrate** is a 'safety-net' regarding fuel degradation.

Excellium Pro Concentrate

LABORATORY NO-HARM TESTS

WATER SEPARATION

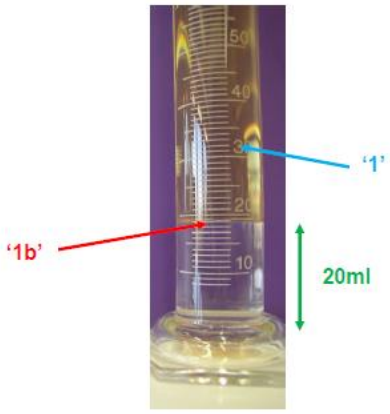


This test consists of agitating for 2 minutes a 80/20 mL blend of diesel fuel and water and observing both rapidity and quality of phase separations. The purpose of the test is to see if the additized diesel fuel can easily separate water, in case of any ingress during transportation and handling.

Water volume change and quality of the interface are then quoted after 5 minutes as required by ASTM procedure. Another popular rating is the necessary time to recover 15ml of clear water at the bottom of the probe.

WATER SEPARATION TEST (ASTM D1094)		
Laboratory	TotalEnergies OneTech, Solaize, France	
Base fuel	CEC RF79	
Additive	////	EPC @600ml/m3
ASTM rating after 5 min	20ml/2/2	20ml/2/2
Time for 15ml water (s)	40	176

Excellium Pro Concentrate presents 'no-harm' regarding separation ability of diesel fuel and separation speed (for 15ml of water, PASS when <300s). As such, **Excellium Pro Concentrate** properly handles eventual water ingress in the fuel system.



Excellium Pro Concentrate

LABORATORY NO-HARM TESTS

ELECTRICAL CONDUCTIVITY

For security reasons (electrostatic discharge during fuel transportation or transfer), specifications might be set on electrical conductivity of road fuels. ASTM D-2624 method allows to determine the conductivity of the liquid fuels by dipping the electrode in the sample of fuel.

ELECTRICAL CONDUCTIVITY TEST (ASTM D2624)		
Laboratory	TotalEnergies OneTech, Solaize, France	
Base fuel	CEC RF79	
Additive	////	EPC @600ml/m3
Conductivity (pS/m)	71	572

Excellium Pro Concentrate acts as a 'safety-net', adding more conductivity to the base fuel. Due to its technology the kick in anti-static ability is superior to usual gasoline additive technologies on the market, allowing to reach the 150 pS/m minimum value which is in place for EN 590 diesel fuels.

Excellium Pro Concentrate

ADDITIONAL INFORMATION

MATERIALS COMPATIBILITY

Once diluted into gasoline, **Excellium Pro Concentrate** is fully compatible with all materials encountered in a vehicle fuel system.

Recommended materials

TotalEnergies Additives & Fuels Solutions recommends the following materials for storage capacities to be in contact with pure **Excellium Pro Concentrate** additive:

- Stainless steel/aluminium (***NO INSIDE VARNISHING***)
- PTFE (Teflon ®) coated packaging
- Any other material fully compatible with C_9/C_{10} aromatic solvents like PET.

Forbidden materials

The following materials are to be avoided for contact with *pure* **Excellium Pro Concentrate**:

- PVC
- Polypropylene
- Rubber (synthetic or natural)
- Polystyrene

Excellium Pro Concentrate

ADDITIONAL INFORMATION

PRODUCT'S HANDLING & STORAGE

Excellium Pro Concentrate quality is not modified during storage up to 24 months if normal handling and storage procedures are applied.

Excellium Pro Concentrate drums may be stored and handled at temperatures between -25°C and 50°C.

The recommended blending methods are on-line injection into the fuel flow or injection into the recirculation lines of the storage tanks. For spot use, **Excellium Pro Concentrate** can be directly poured into the storage tank before filling with diesel.

SAFETY

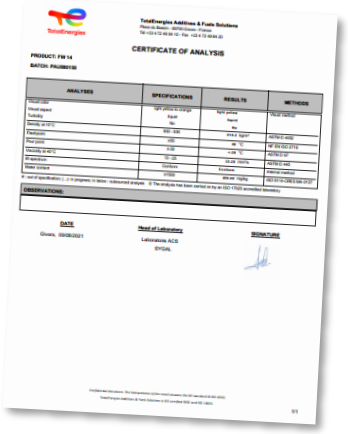
Excellium Pro Concentrate presents hazards usually associated to additives or petroleum products (risk-phrase H-304, H-315, H-317, H-319, H-336, H-351, H-411) and it is strongly recommended to avoid any contact with eyes and skin and not to inhale the vapours. Safety apparel (gloves, goggles) must be used when handling the product. For further details about handling conditions and the product's toxicology, please consult the relevant material safety data sheet (MSDS).

Components of this product have been registered according to REACH requirements (REACH Regulation EC 1907/2006).

Excellium Pro Concentrate

ADDITIONAL INFORMATION

QUALITY CONTROL



CERTIFICATE OF ANALYSIS

ANALYSES	SPECIFICATIONS	RESULTS	METHODS
Visual aspect			
Turbidity			
Density at 15°C			
Flashpoint			
Pour point			
Viscosity at 40°C			
Ash content			
Water content			

OBSERVATIONS

DATE

Head of Laboratory

SIGNATURE

At each step of the manufacturing process, analyses are performed in order to ensure the consistent quality of the active material. The quality of each batch of active materials is reviewed at the blending facility before blending can proceed.

During blending, the quality of each batch of **Excellium Pro Concentrate** is analyzed again by the blending facility laboratory to ensure consistent finished product quality. A Certificate of Analysis is issued to customer for each batch to guarantee **Excellium Pro Concentrate** quality.

TotalEnergies Additives & Fuels Solutions conforms to the following international standards:

- ISO 9001 V2008 quality standard
- ISO 14001 environment standard
- ISO 45001 safety standard (new)