Excellium Pro Concentrate WINTER

TECHNICAL BOOKLET

TotalEnergies

Excellium Pro Concentrate WINTER

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Excellium Pro Concentrate WINTER

INTRODUCTION

TRUST A LEADER

The purpose of **Excellium Pro Concentrate WINTER** 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 WINTER** 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 WINTER?

As opposed to many diesel additives available on the market and because it is proposed by a major fuel retailer, **Excellium Pro Concentrate WINTER** 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
- **combustion improvement** (cetane number increase)
- **up to 3.3% fuel economy**
- **easier start at low temperature** (lower fuel CFPP)
- engine **wear protection**
- **anticorrosion** protection and **antifoaming** effect
- 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 WINTER is compatible with all materials used in engines and after-treatment devices.

Excellium Pro Concentrate WINTER 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 WINTER

TREAT RATE & PERFORMANCE

The treat rate of **Excellium Pro Concentrate WINTER** is set at 1700 ml/m3 (1,7L/1000L diesel).

TYPICAL PERFORMANCE & TREAT RATE	
Additive	**Excellium Pro Concentrate WINTER**
Treat rate (ml/m3)	1700
Technical features	
Fuel economy	Up to 3,3%
XUD9 injector flow loss	< 5%
DW10B power change	0%
DEUTZ HD torque change	Pass (96% less deposits)
Engine clean-up	>=90%
DEUTZ HD lacquering	Pass
Cetane increase	+1 to +2pt
HFRR wear reduction	no change
Anticorrosion protection	100% (NACE 'A')
Water separation	≥ base fuel
Oxidation stability	+10h Rancimat boost
Antifoaming	<50ml/5s

Excellium Pro Concentrate WINTER meets the engine performance requirements 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 WINTER** 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 WINTER

PRODUCT CHARACTERISTICS

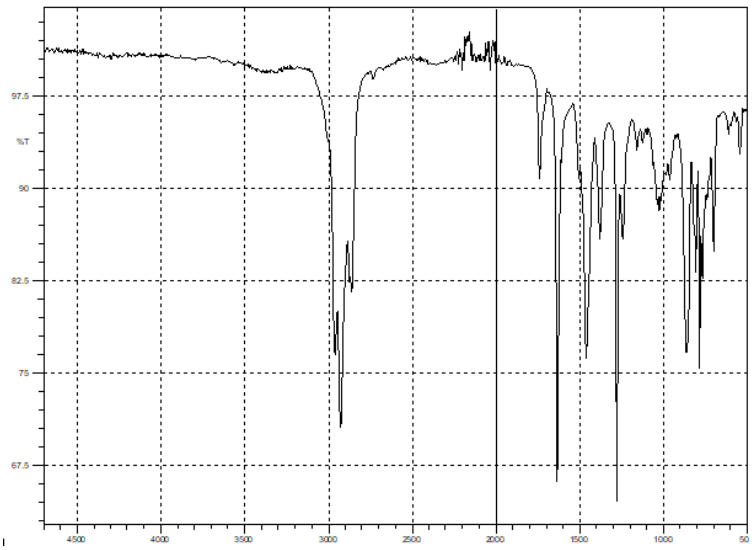
PROPERTIES

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

PHYSICAL-CHEMICAL CHARACTERISTICS		
Excellium Pro Concentrate WINTER		
Appearance	Visual	Orange liquid
Density @15°C	EN ISO 12185	909 kg/m3
Kinematic viscosity @40°C @20°C @-10°C	ASTM D 445	 4,8 mm²/s 7 mm²/s 22 mm²/s
Pour Point	ASTM D97	< -30 °C
Flash Point	ASTM D93	64 °C
Nitrogen content	ASTM D5291	1,6 %w

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

FTIR SPECTRUM



Excellium Pro Concentrate WINTER

ENGINE PERFORMANCE TESTS

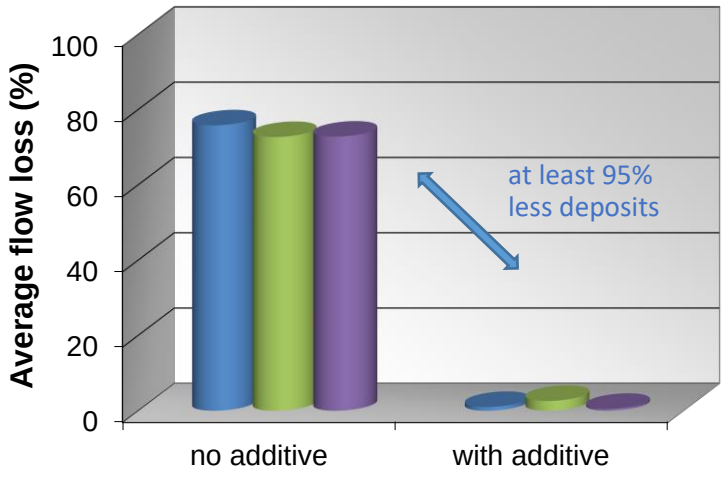
INJECTOR CLEANLINESS
XUD9 keep-clean

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	B7 EN590 / B10 EN16734 / CEC RF79-07	
Additive	////	EPC Winter @1700ml/m3*
Airflow loss	75,8% / 72,7% / 72,8%	1,0% / 2,6% / 0,5%

**test result of Excellium Pro Concentrate Plus (= Winter in terms of deposit control content)*



Excellium Pro Concentrate WINTER totally prevents injector deposits build-up (<3% flow loss compared to ~75% with unadditized diesel) for all possible fuel types, from biofree diesel up to B10 EN16734 fuels.

Excellium Pro Concentrate WINTER

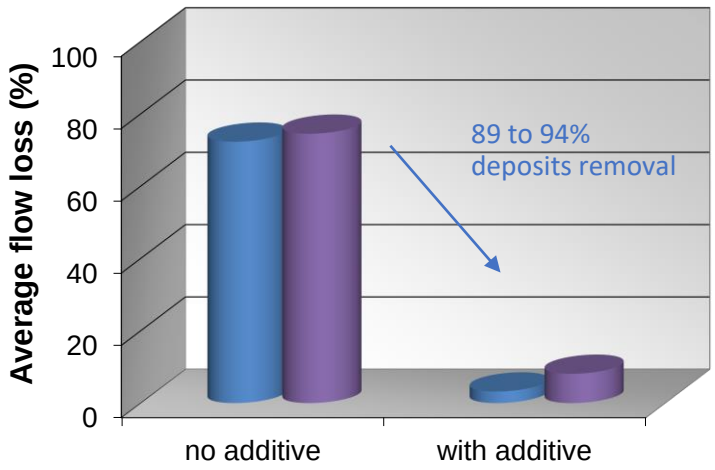
ENGINE PERFORMANCE TESTS

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	B7 EN590 #1 / #2	
Additive	Dirty-up	Clean up with EPC WINTER @1700ml/m3
Airflow loss	72,3% / 74,5%	3,2% / 8,1%



In-line with the previous keep-clean results, **Excellium Pro Concentrate WINTER** reduces existing injectors deposits down to almost total reduction in just 10 hours. The injectors are brought back to new for optimal operation, power and efficiency.

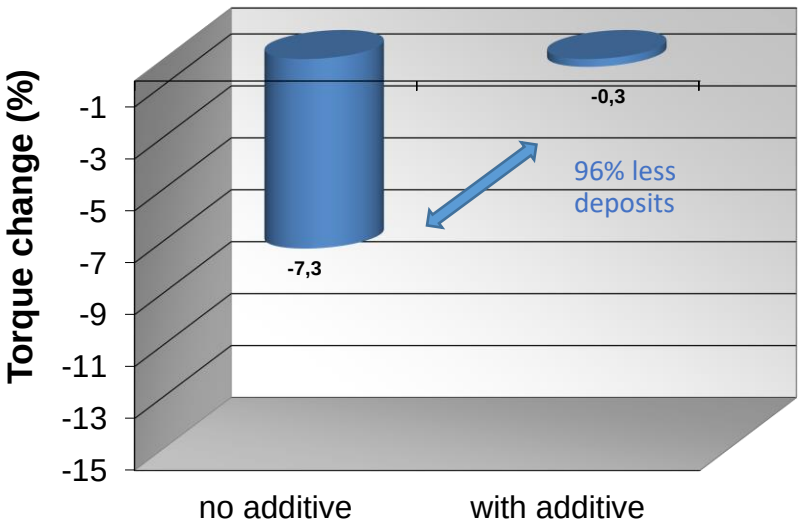
Excellium Pro Concentrate WINTER

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 promote deposits formation in the nozzles is determined by measuring the torque change between start-of-test and end-of-test as we are at iso-engine speed.

DEUTZ INJECTOR FOULING TEST (in-house)		
Laboratory	TotalEnergies OneTech, France	
Base fuel	B7 EN590 Winter	
Additive	////	EPC WINTER @1700ml/m3
Torque change	-7,3 %	-0,3%



Excellium Pro Concentrate WINTER 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.

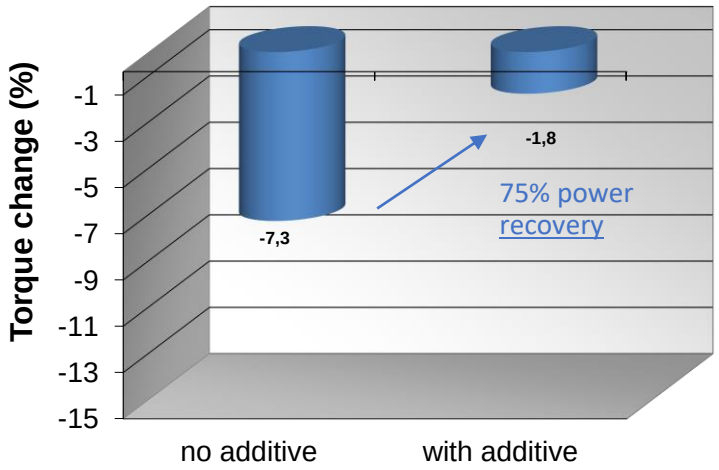
Excellium Pro Concentrate WINTER

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).

DEUTZ INJECTOR FOULING TEST (in-house)		
Laboratory	TotalEnergies OneTech, France	
Base fuel	B7 EN590 Winter	
Additive	Dirty-up	Clean up with EPC WINTER @1700ml/m3
Torque change	-7,3 %	-1.8% (+75%)

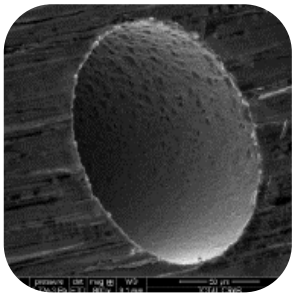


In-line with the previous keep-clean results, **Excellium Pro Concentrate WINTER** reduces significantly existing injectors deposits (this happens when torque loss after clean-up is better than after dirty-up by more than 2.5%) and allows to get back almost to the initial performance of the engine.

Excellium Pro Concentrate WINTER

ENGINE PERFORMANCE TESTS

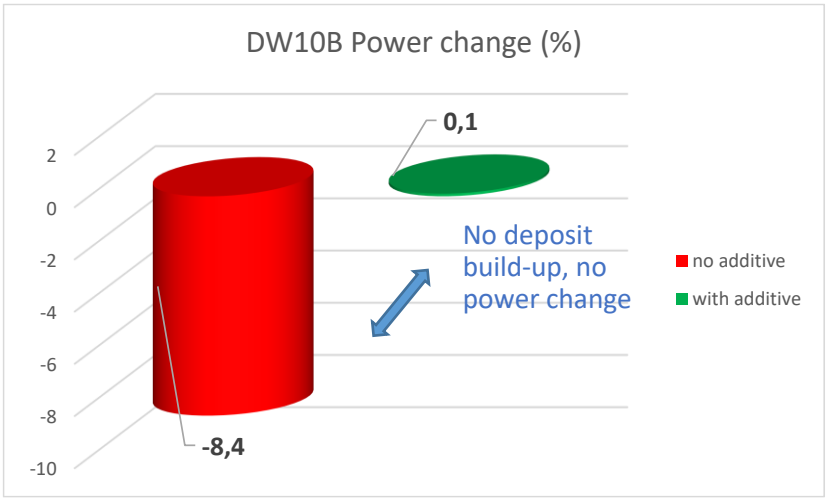
INJECTOR CLEANLINESS
DW10B keep-clean



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 Winter @1700ml/m3*
Power change	-8.4%	0.1%

**test result of Excellium Pro Concentrate Plus (= Winter in terms of deposit control content)*

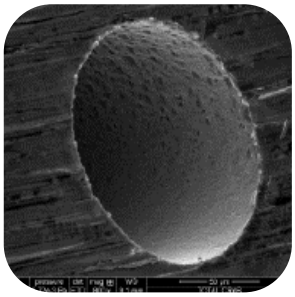


The results show that fuel treated with **Excellium Pro Concentrate WINTER** protects the engine regarding any power loss: the engine maintains its original power output performance.

Excellium Pro Concentrate WINTER

ENGINE PERFORMANCE TESTS

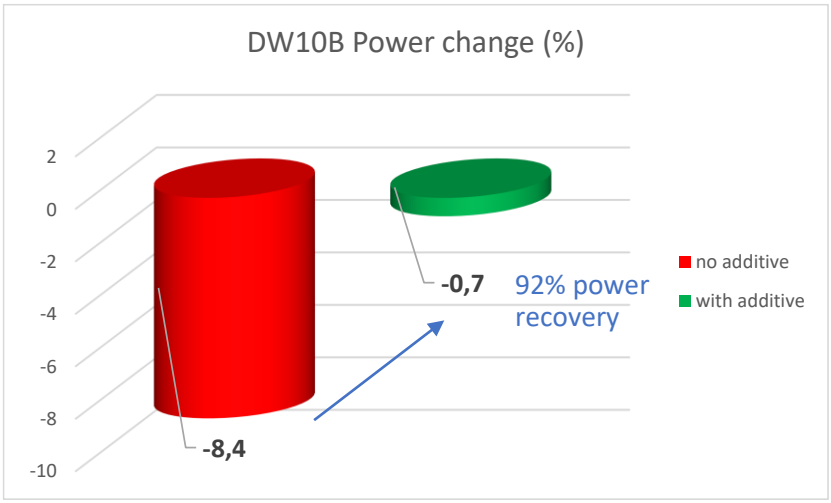
INJECTOR CLEANLINESS
DW10B clean-up



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	//// (dirty-up)	Clean-up with EPC Winter @1700ml/m3*
Power change	-8.4%	-0.7% (+92%)

**test result of Excellium Pro Concentrate Plus (= Winter in terms of deposit control content)*



The results show that fuel treated with **Excellium Pro Concentrate WINTER** completely restores engine power with 92% recovery. From more than 8% power loss, the final power is brought back to much less than 1% (being superior to -2%, it is considered that the engine delivers its original performance).

Excellium Pro Concentrate WINTER

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 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	B7 EN590 / B10 EN16734	
Additive	////	EPC Winter @1700ml/m3*
IDID merit (/10)		
- keep-clean	6.32 / 6.87	7.67 / 9.64
- clean-up	6.32 / 6.87 →	7.36 / 8.54

**test result of Excellium Pro Concentrate Plus (= Winter in terms of deposit control content)*

Excellium Pro Concentrate WINTER 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 WINTER** ensures no-harm regarding IDID formation tendency.

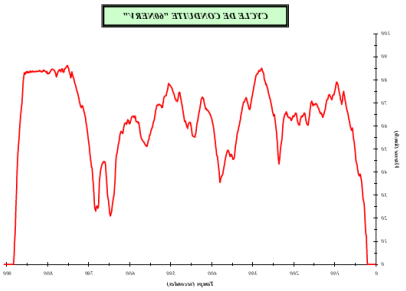
Excellium Pro Concentrate WINTER

VEHICLE PERFORMANCE TESTS

FUEL ECONOMY & EMISSIONS

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** technology has been tested in the most recent and stringent possible test conditions.

The tests have been conducted at Greenmot, France, under the supervision of UTAC-CERAM certified and independent laboratory. The Daimler Actros Euro5 truck (DPF+SCR) has been tested on the 60NERV HD test cycle on chassis-dyno equipment. In the first sequence, a serie of 10 repetitions of the test cycle has allowed to determine the average fuel consumption of unadditized fuel. The truck has then been driven in normal driving condition for 20.000km using **Excellium Pro Concentrate** technology. In a second phase, the truck has been evaluated again on the chassis-dyno with 10 repetitions of 60NERV test cycle to observe the evolution of the vehicle performances.



The test results are detailed in the table below :

60NERV CHASSIS-DYNO FUEL ECONOMY		
Laboratory	GreenMot (UTAC-CERAM), France	
Vehicle	Daimler Actros €5 330kW	
Base fuel	B7 EN590	
Test cycle	60NERV x10	20.000km + 60NERV x10
Additive	////	EPC Winter @1700ml/m3*
Fuel consumption	249.08g/kWh	240.99g/kWh **(-3.3%)**
Emissons		
- **CO2**	772.3g/kWh	747.1g/kWh **(-3.27%)**
- **CO**	0.572g/kWh	0.467g/kWh **(-18.5%)**
- **THC**	0.033g/kWh	0.021g/kWh **(-34.1%)**
- **NOx**	4.505g/kWh	5.172g/kWh (NSS)
- **PM**	0.133mg/m3/kWh	0.105mg/m3/kWh **(-21.2%)**

**test result of Excellium Pro Concentrate Plus (= Winter in terms of deposit control content)*

Excellium Pro Concentrate PLUS exhibits 3.3% improvement in specific fuel consumption (confirmed by CO2 measurements) as well as a significant reduction of CO, THC and particulate matter.

Excellium Pro Concentrate WINTER

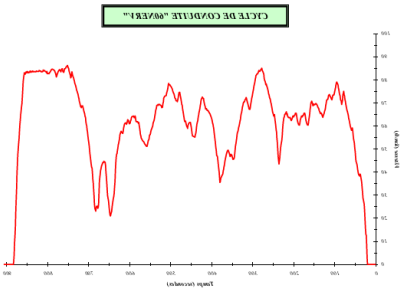
VEHICLE PERFORMANCE TESTS

FUEL ECONOMY & EMISSIONS

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 WINTER** has been tested in the most recent and stringent possible test conditions.

The tests have been conducted at Greenmot, France, under the supervision of UTAC-CERAM certified and independent laboratory. The Daimler Actros Euro5 truck (DPF+SCR) has been tested on the 60NERV HD test cycle on chassis-dyno equipment. In the first sequence, a serie of 10 repetitions of the test cycle has allowed to determine the average fuel consumption of unadditized fuel. The truck has then been driven in normal driving condition for 15.000km using **Excellium Pro Concentrate WINTER**. In a second phase, the truck has been evaluated again on the chassis-dyno with 10 repetitions of 60NERV test cycle to observe the evolution of the vehicle performances.

The test results are detailed in the table below:



60NERV CHASSIS-DYNO FUEL ECONOMY		
Laboratory	UTAC-CERAM, France	
Vehicle	Volvo FH500 €6b 368kW	
Base fuel	B7 EN590	
Test cycle	60NERV x10	20.000km + 60NERV x10
Additive	////	EPC Winter @1700ml/m3
Fuel consumption	219.2g/kWh	217.1g/kWh (-0.96%)
Emissions		
- **CO2**	695.4g/kWh	687.3g/kWh (-1.17%)
- **CO**	0.141g/kWh	0.132g/kWh **(-6.5%)**
- **THC**	0.009g/kWh	0.002g/kWh **(-79%)**
- **NOx**	0.568g/kWh	0.403g/kWh **(-29.1%)**
- **PN**	6.4E11/kWh	5.4E11/kWh (-15.2%)

The results confirms the improvement regarding all emissions while achieving a positive contribution to specific fuel consumption (confirmed by CO2 measurements).

Excellium Pro Concentrate WINTER

VEHICLE PERFORMANCE TESTS

COLD START

Excellium Pro Concentrate WINTER has been formulated to help operations in cold climate conditions. It allows to use the fuel at lower temperature than originally possible by delaying the wax / crystals appearance which otherwise leads to diesel solidification and impossibility to start.

The benefits of **Excellium Pro Concentrate WINTER** have been proven both in the laboratory (with CFFP test – Cold Flow Filter Plugging Point) and with vehicle chassis-dyno evaluation in climatic cell. For the latter, the temperature in the climatic cell is progressively reduced during 12h down to the test temperature and stabilized for 4h. An attempt of actual vehicle start and operability is then tested. The Operability Temperature corresponds to the last cell temperature were start and vehicle operation happened properly.

The test results are detailed in the table below:

CHASSIS-DYNO LOW TEMPERATURE OPERABILITY TEST		
Laboratory	EMC France, Emitech Groupe	
Vehicle	OPEL Insigna €5 160hp	
Base fuel	B7 EN590	
Additive	////	EPC Winter @1700ml/m3
Last Operability Temperature	-12°C	-13°C
CFPP	-16°C	-24°C

Base fuel	B10 EN16734	
Additive	////	EPC Winter @1700ml/m3
Last Operability Temperature	-15°C	-22°C
CFPP	-17°C	-22°C

Excellium Pro Concentrate WINTER exhibits a systematic ability to operate at lower temperature compared to unadditized diesel. The lower CFPP indicates a lower tendency to crystals formation and growth at low temperatures, leading to a confirmed ability to crank vehicle engine at lower outside temperature.

Excellium Pro Concentrate WINTER

LABORATORY PERFORMANCE TESTS

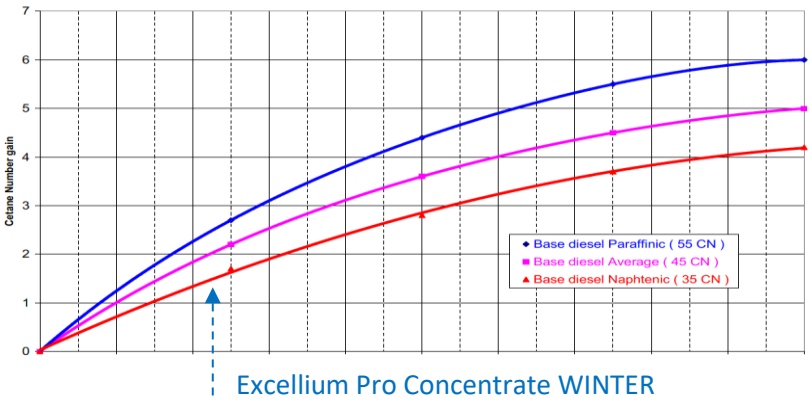
CETANE IMPROVER

CFR diesel engine

As a common characteristic of all premium diesel, **Excellium Pro Concentrate WINTER** has been formulated to increase the cetane level of diesel fuels with the objectives of optimizing fuel economy performance and reducing pollutant emissions.

The CFR engine is used to compare Cetane Number from blank fuel to different additized fuels, in order to evaluate the real cetane gain using the additive. In the ASTM D 613 test, the cetane number of a diesel fuel is determined by comparing its ignition delay characteristics in a standard CFR test engine with those for blends of reference fuels of known cetane number. The compression ratio is varied by adjusting a calibrated hand wheel to obtain the same ignition delay for the sample and for each of two bracketing reference fuels, permitting interpolation of cetane number in terms of the hand wheel readings.

The typical data here under of cetane improvement (depending on the original cetane number of the base fuel) position the cetane increase provided by **Excellium Pro Concentrate WINTER** at 1700ppm dosage:

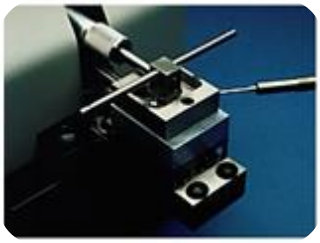


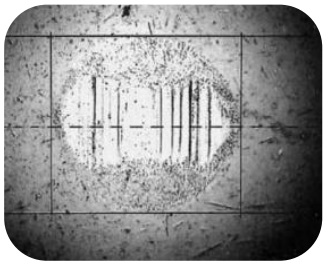
The typical improvement ranges from +1/+2pt depending on the original cetane value of the diesel fuel.

Excellium Pro Concentrate WINTER

LABORATORY PERFORMANCE TESTS

WEAR PROTECTION





Excellium Pro Concentrate WINTER 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	B7 EN590 winter #1 / #2	
Additive	////	EPC Winter @1700ml/m3
MWSD (µm)	200 / 164	210 / 155

Excellium Pro Concentrate WINTER reduces wear and friction for all fuel types. Naturally, fuels already meeting largely the 460µm limit cannot be further increased. In any case, **Excellium Pro Concentrate WINTER** exhibits a full no-harm regarding HFRR specification (even in presence of cetane improver) if not an improved behavior.

Excellium Pro Concentrate WINTER

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	B7 EN590 Winter #1 / #2	
Additive	////	EPC Winter @1700ml/m3
NACE rating (method A, distilled water)	A / B+	A / A
NACE rating (method B, sea water)	C / E	A / B++

Base fuel	B7 EN590 Summer	
Additive	////	EPC Winter @1700ml/m3
NACE rating (method A, distilled water)	B	A
NACE rating (method B, sea water)	E	A

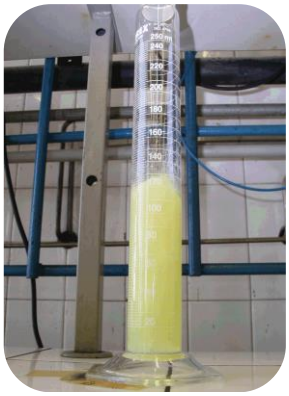
Excellium Pro Concentrate WINTER provides the highest possible protection feature regarding rust corrosion, as expected from a premium diesel fuel. This contributes to engine, tank and fuel lines protection.

Excellium Pro Concentrate WINTER

LABORATORY PERFORMANCE TESTS

FOAMING CONTROL

Excellium Pro Concentrate WINTER multifunctional additive contains an antifoam agent that prevents foam formation during tank filling. It prevents diesel overflow during the filling and it allows a faster and more complete tank fill. This first test consists in sudden release 100 ml of fuel trough atmospheric pressure and observing the volume of foam and then the rate of foam collapse. The purpose of the test is to simulate real tank filling.



ANTI-FOAMING TEST (NF M 07-075)		
Laboratory	TotalEnergies OneTech, Solaize, France	
Base fuel	B7 EN590 Winter #1 / #2	
Additive	////	EPC Winter @1700ml/m3
Foam volume (ml)	120 / 124	40 / 48
Defoaming time (s)	27 / 40	3 / 4

Base fuel	B7 EN590 Summer	
Additive	////	EPC Winter @1700ml/m3
Foam volume (ml)	118	38
Defoaming time (s)	57	3,5

As a key feature of the additive, **Excellium Pro Concentrate WINTER** dramatically prevents diesel foaming especially for FAME containing fuels. Results are brought below the stringent <50ml/5s barrier, ensuring no visible foam overflow. This is of interest for professionals able to treat diesel fuel tank prior to vehicle refueling: the tank filling is faster, fuller and cleaner.

Excellium Pro Concentrate WINTER

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 OneTech, Solaize, France	
Base fuel	B7 EN590 Winter #1	
Additive	////	EPC Winter @1700ml/m3
Induction period (h)	26,1	29,6

Base fuel	B7 EN590 Winter #2	
Additive	////	EPC Winter @1700ml/m3
Induction period (h)	29,3	>48h

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

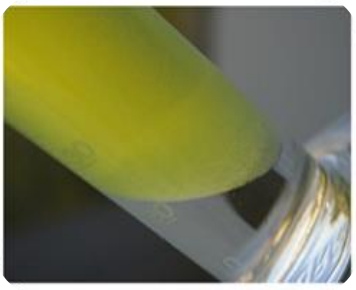
Excellium Pro Concentrate WINTER

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.

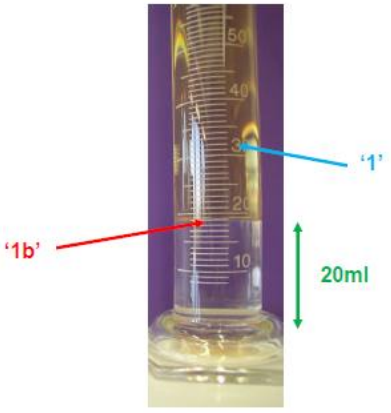
Water volume change and quality of the interface are then quoted after 5 minutes as required by ASTM procedure. Another popular rating is the necessary time to recover 15ml of clear water at the bottom of the probe.



WATER SEPARATION TEST (ASTM D1094)		
Laboratory	TotalEnergies OneTech, Solaize, France	
Base fuel	B7 EN590 Winter #1	
Additive	////	EPC Winter @1700ml/m3
ASTM rating after 5 min	0ml/4/3	17ml/2/3
Time for 15ml water (s)	>900	257

Base fuel	B0 CEC RF79	
Additive	////	EPC Winter @1700ml/m3
ASTM rating after 5 min	18ml/3/3	20ml/2/3
Time for 15ml water (s)	220	230

Excellium Pro Concentrate WINTER presents at least 'no-harm' regarding separation ability of diesel fuel and separation speed (for 15ml of water, pass when <300s), if not better performances. As such, **Excellium Pro Concentrate WINTER** properly handles eventual water ingress in the fuel system.



Excellium Pro Concentrate WINTER

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	B7 EN590 Winter #1	
Additive	////	EPC Winter @1700ml/m3
Conductivity (pS/m)	240	>2000

Base fuel	B7 EN590 Winter #2	
Additive	////	EPC Winter @1700ml/m3
Conductivity (pS/m)	293	>2000

EXLCELLIUM PRO CONCENTRATE WINTER 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 150pS/m minimum value which is in place for EN 590 diesel fuels.

Excellium Pro Concentrate WINTER

ADDITIONAL INFORMATION

MATERIALS COMPATIBILITY

Once diluted into gasoline, **Excellium Pro Concentrate WINTER** 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 WINTER** 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 WINTER**:

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

Excellium Pro Concentrate WINTER

ADDITIONAL INFORMATION

PRODUCT'S HANDLING & STORAGE

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

Excellium Pro Concentrate WINTER 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 WINTER** can be directly poured into the storage tank before filling with diesel.

SAFETY

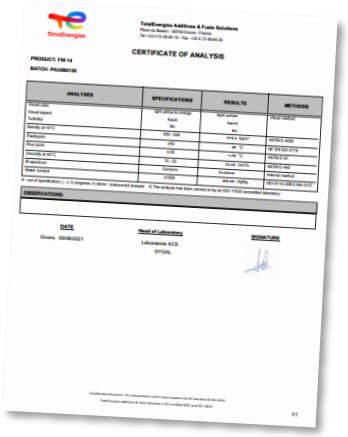
Excellium Pro Concentrate WINTER presents hazards usually associated to additives or petroleum products (risk-phrase H-304, H-317, H-336, H-351, H-411) and it is strongly recommended to avoid any contact with eyes and skin and not to inhale the vapours. Safety apparel (gloves, goggles) must be used when 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 WINTER

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 WINTER** 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 WINTER** 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)