GENETT ™ TECHNOLOGY

GAS TO LIQUIDE
DIESEL_EN590 process

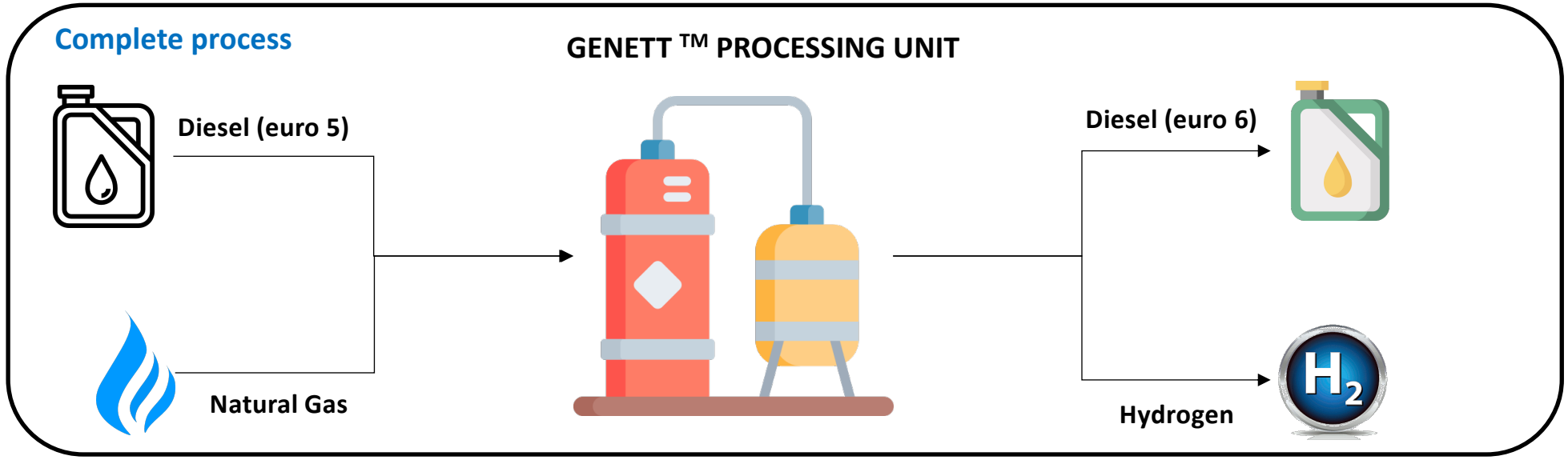
GENETT™ TECHNOLOGY

opens up the following new possibilities :

- **direct conversion of natural and petroleum gases into automotive fuel;**
- processing of various types of hydrocarbon and non-hydrocarbon raw materials;
- processing organic oxygen-containing raw materials: vegetable oils, UCO, alcohols into automotive fuels;
- processing CO2, extracted from various fuel combustion gases, into alternative fuels;
- generation of thermal and electric energy within the framework of an autonomous installation that can be offered to various customers, e.g. from commercial and industrial enterprises to owners of individual houses;
- ability to synthesize hydrocarbons within a technical system, similarly as it does occur in the Earth's interior;

GENETT ™ - DIESEL_EN590 process

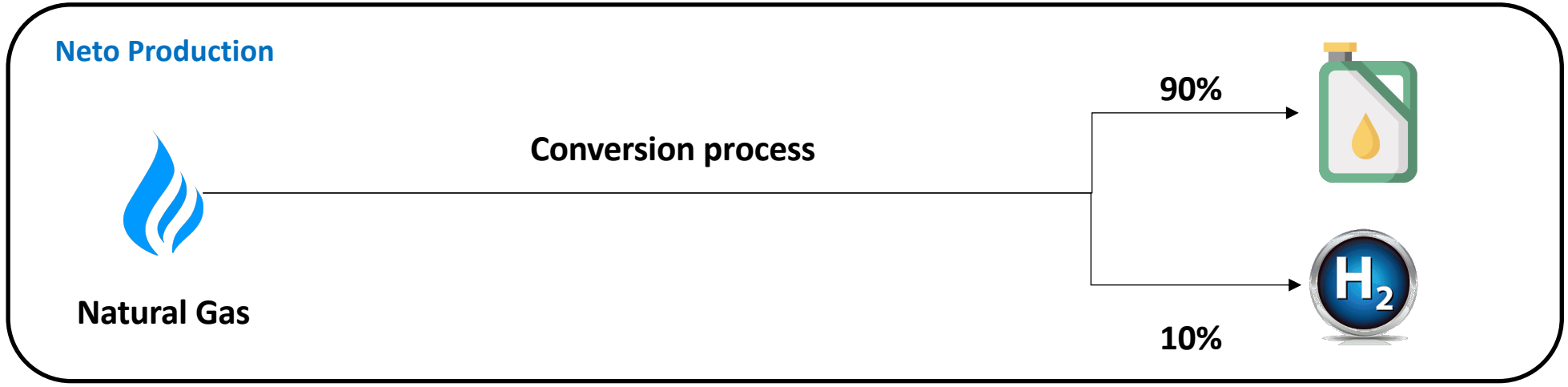
Complete process



SIMPLIFIED scheme of GTL (GAS TO LIQUIDE) process

GENETT™ - DIESEL_EN590 process

Neto Production



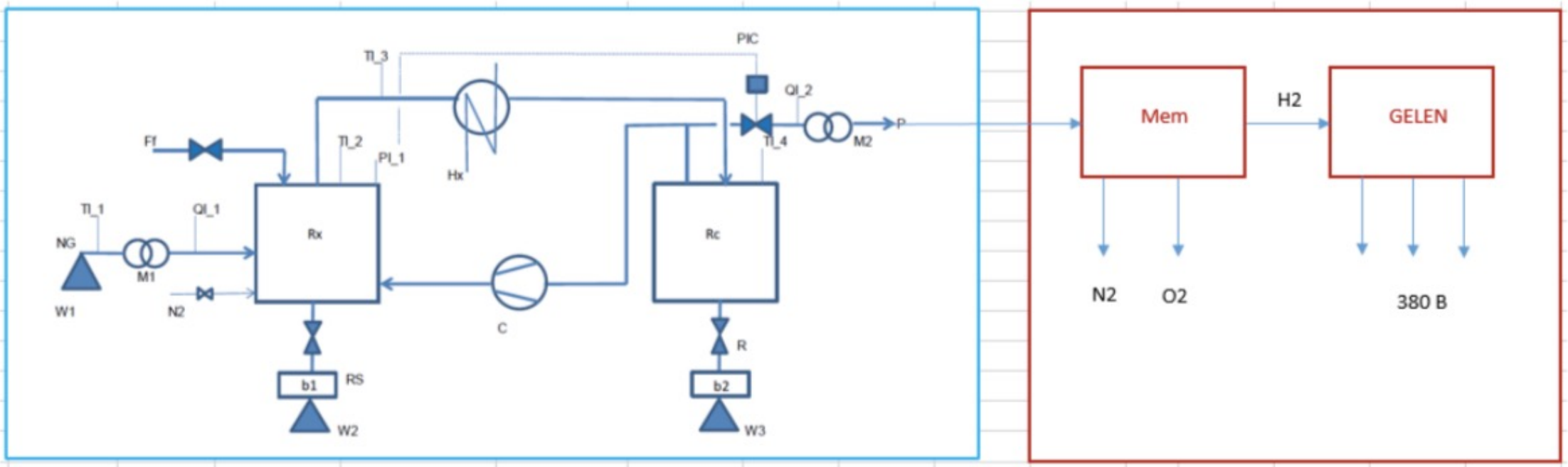
Direct conversion of natural gas into automotive fuel

Processing unit - Technical scheme

GENETT™ - DIESEL_EN590 process

Equipment Legend:

- W1 - gas source;
- R_x - gas conversion reactor;
- H_x - tubular heat exchanger for cooling the gas-liquid mixture from reactor R_x;
- R_c - gas-liquid separator;
- C - blower (gas fan);
- M_1 - inlet gas flow meter;
- M_2 - outlet gas flow meter;
- Mem - process gases separation membrane;
- GELEN - electric power generator;



Process description

GENETT^{TM} - DIESEL_EN590 process

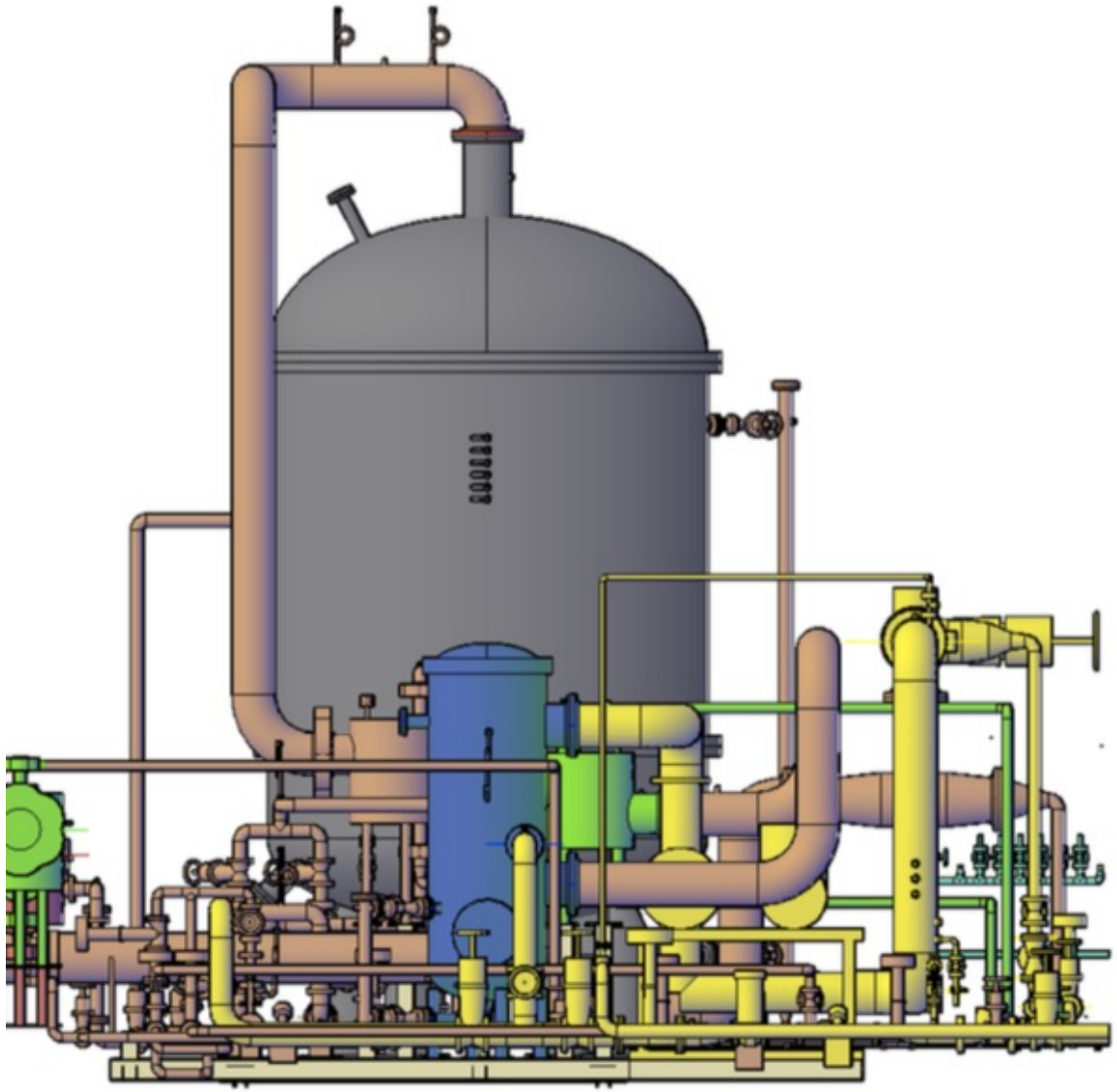
- The gas mixture, in which the main gas is methane from the source W1, enters the reactor Rx. The mixture is preheated and then gas fan C is started. In the reactor zone, methane and its homologs are converted to diesel fuel, based on the reactions taking place:

$$nCH_4=C_nH_{2n+2}+(n-1)H_2$$

- The gas-liquid mixture from the reactor enters the Hx heat exchanger for cooling, where it is cooled to the separation temperature in the separator Rc.

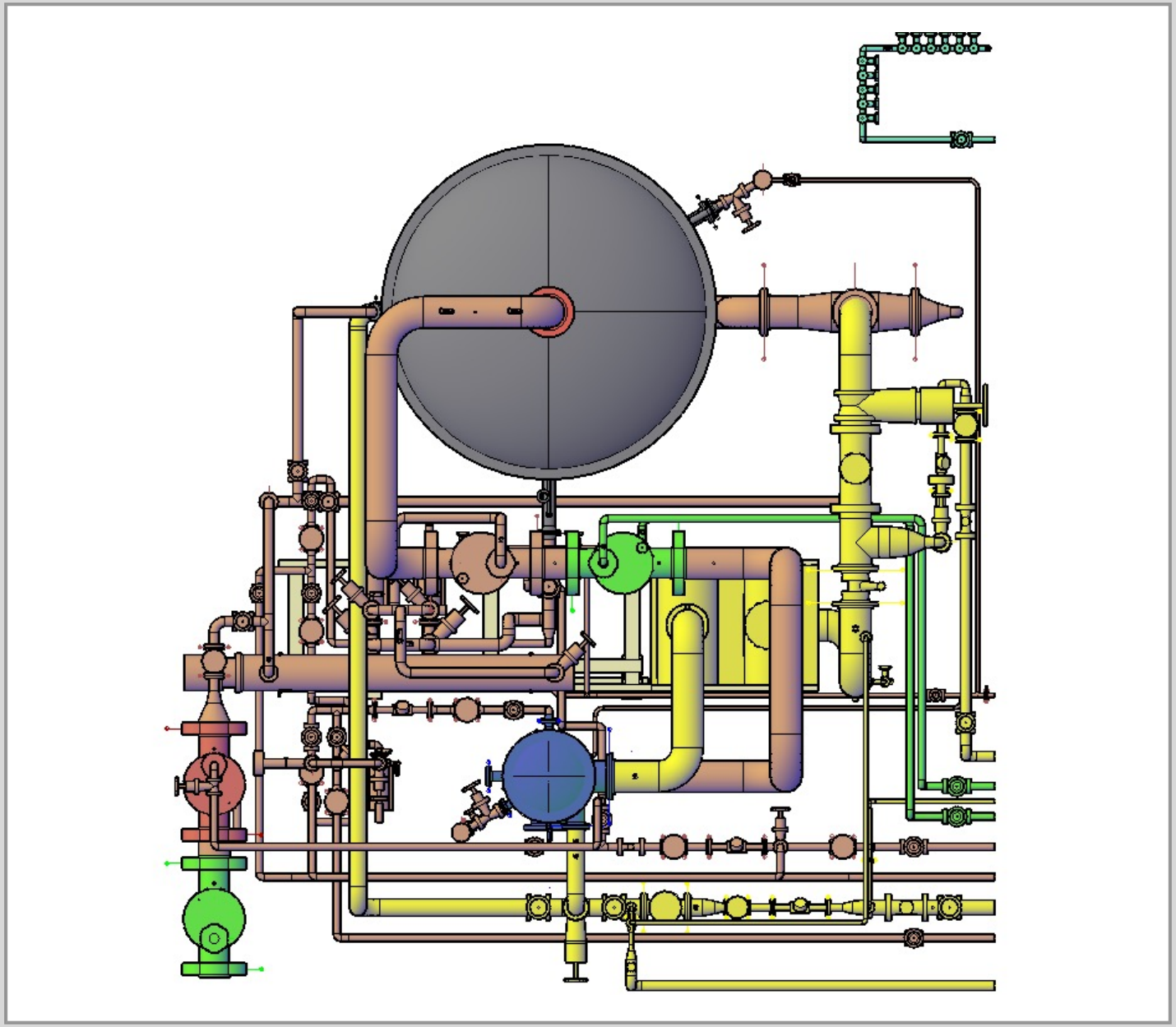
- The gas separated from the liquid phase is taken in by the blower C and sent to the reactor Rx.

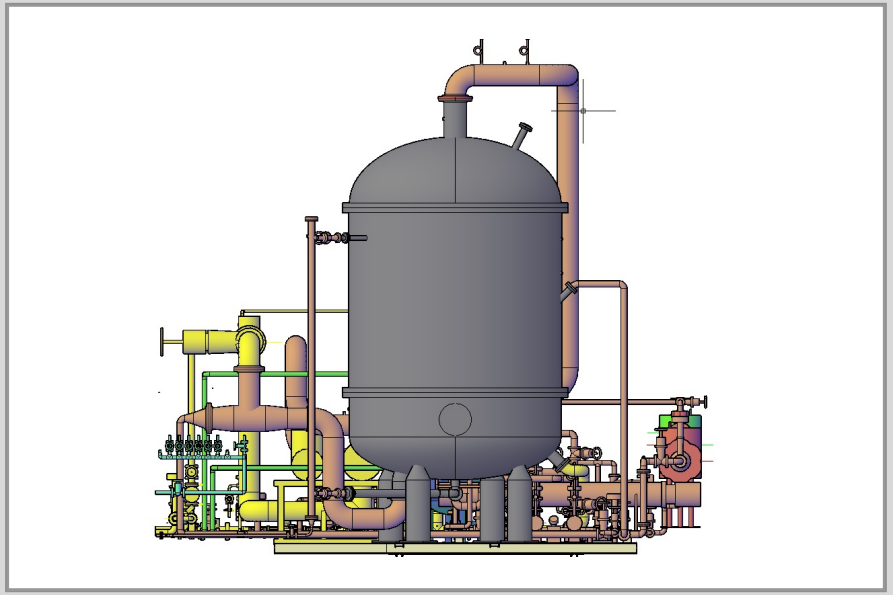
- At a pre-set concentration of molecular hydrogen, part of it is taken to the Mem membrane, where it is separated into nitrogen, oxygen and hydrogen. Further, hydrogen is processed / utilised at the electric power generator (GELEN), producing electric power. The required amount of electric power that the processor unit consumes is supplied from the GELEN and replaces the commercial electricity (initially supplied from the grid) needed at the start of the process. The excess electric power is transmitted (supplied/sold) through the electric power grid.

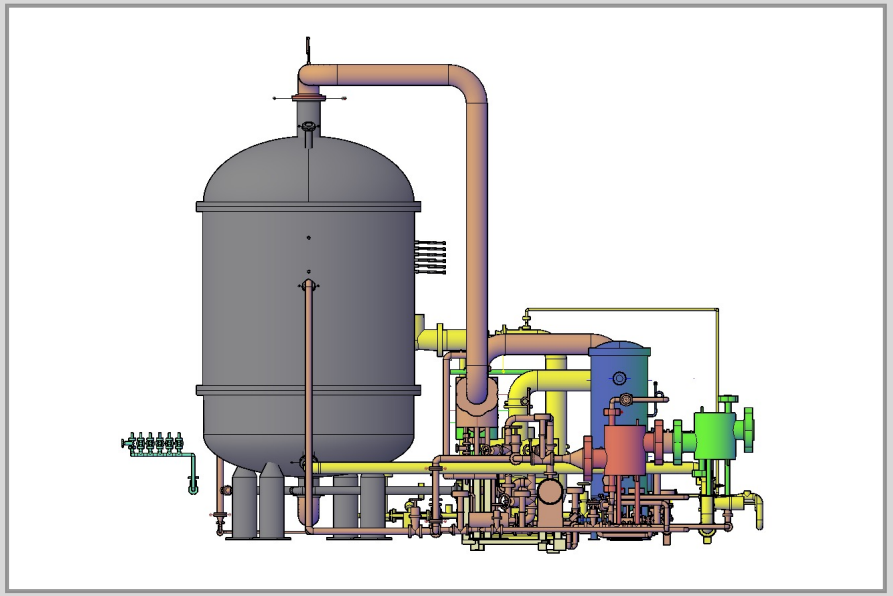


INDUSTRIAL PRODUCTION OF DIESEL FUEL FROM GAS-HYDROCARBON RAW MATERIALS

GENETT™ - DIESEL_EN590 process







Production is enabled by a complex of technological equipment

installed at a site, which meets the standards and requirements in force in the country of the Customer, namely:

Photo: Industrial installation equipment - Reactor

- a complex of one or more production units for processing the selected raw materials, installed under a canopy;
- operator's room, including: panel room, premises of the cooling machine*, social unit and control room;
- storage tanks for raw materials**;
- storage capacity for finished products**;
- loading and unloading car ramp **;
- gas separation module;
- module for the production of electric power from hydrogen;
- required gas supply (methane, nitrogen, air) at a pressure of (3-10) kG/cm2;
- electric power required - 615 kWh per one production unit;
- dimensions of one unit: L 13.34 m; W 9.745 m; H 9.64 m

* The refrigerating machine can be replaced by a module for generating electric power from the thermal energy of the process.

** Not included in delivery.

Nr.	Component/Parameter name	Unit	Parameter
1	Diesel fuel consumption	n.m3/h	29 616,00
2	Diesel fuel consumption	Kg/h	5996,00
3	**Diesel fuel consumption**	**t/day**	**143,90**
4	Natural gas consumption	n.m3/h	1 234,00
5	Natural gas consumption	t/h	0,88
6	**Natural gas consumption**	**t/day**	**21,15**
7	**Production of final product GENETT EN 590**	**t/day**	**162,94**
8	Production of final product GENETT EN 590	t/month	4 888,29
9	Hydrogen production	t/h	0,09
10	**Hydrogen production**	**t/day**	**2,12**
11	Energy value GENETT EN 590	MDJ/kg	45,79
12	El. energy consumption	Kwt/h	615,00
13	Electric heating	Kwt/h	332,00
14	Cooling module	Kwt/h	22,00
15	Pump	Kwt/h	11,00
16	Buster	Kwt/h	250,00
17	TOTAL EL. ENERGY CONSUMPTION	Kwt/h	615,00
18	Specific electricity consumption for heating per tonne of product	Kwt/t	48,2739
19	Specific electricity consumption for cooling module per tonne of product	Kwt/t	3,1989
20	Specific electricity consumption for pumps per tonne of product	Kwt/t	1,5994
21	Specific electricity consumption for buster per tonne of product	Kwt/t	36,3508
22	**Specific electricity consumption per tonne of product**	**Kwt/t**	**89,4230**

Industrial Production Pilot Project in Uzbekistan

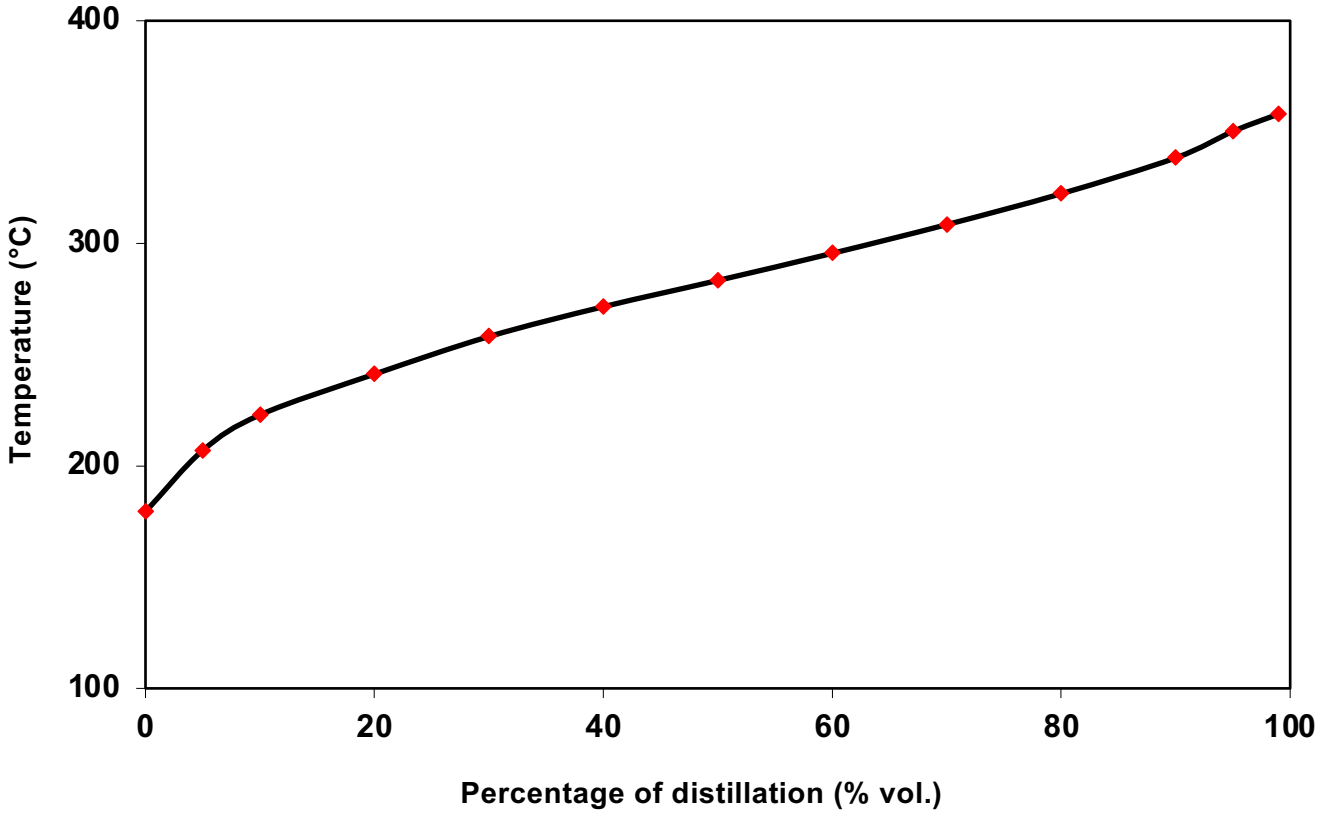
Project realization 4Q 2022

Unit Capacity: 6 t/h

PRODUCT PHOTO

GENETT™ - DIESEL_EN590 process

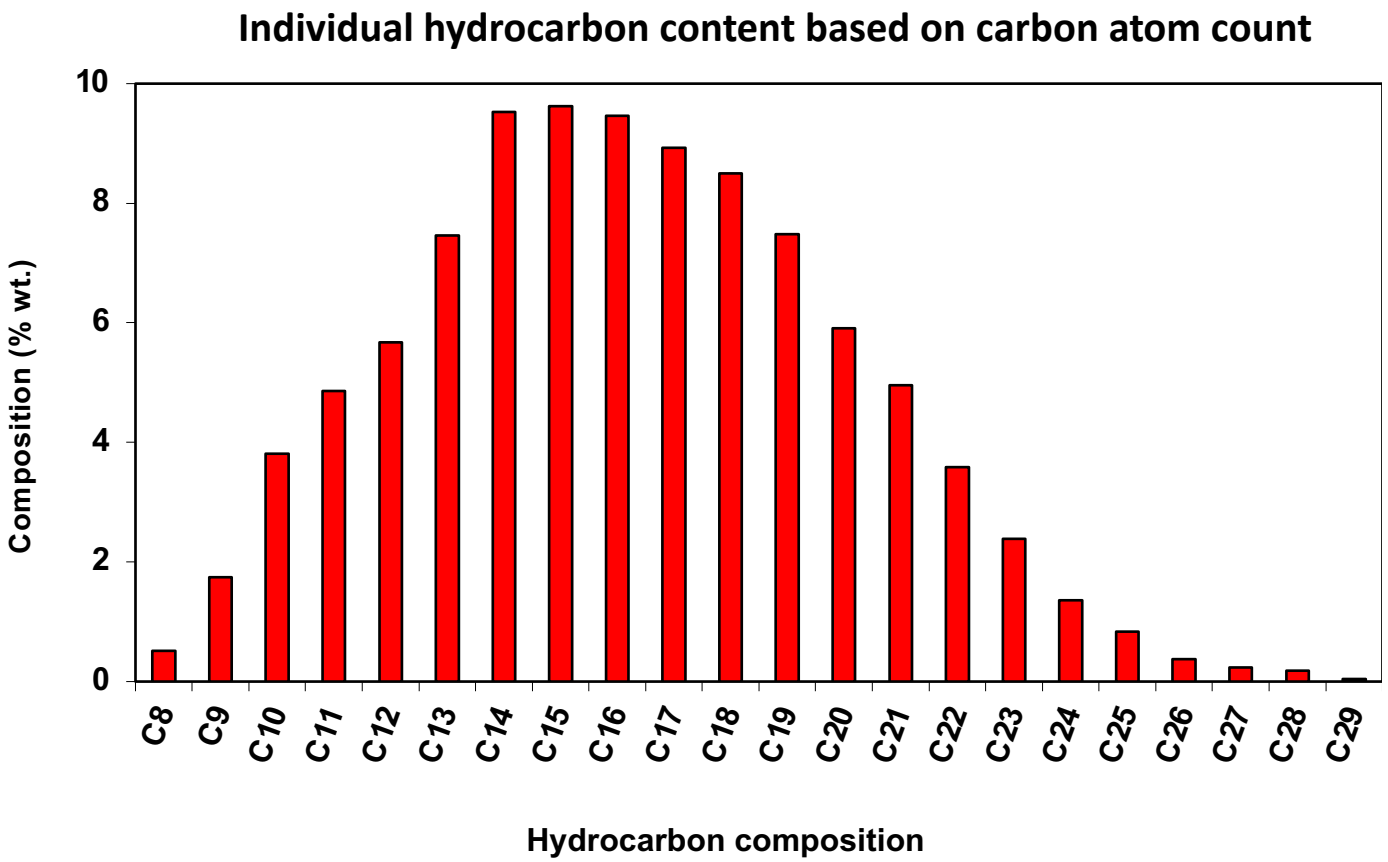
SAMPLE ANALYSIS



The gas chromatographic analysis shows that the sample is diesel fuel with a normal distribution of hydrocarbons, also containing 2.5 wt.% FAME (biocomponent). The full results of the standard distillation test (ČSN EN ISO 3405) are shown as a distillation curve in figure above.

Diesel fuel sample analysis protocol

Gas chromatographic analysis and determination of selected parameters were carried out for one sample of hydrocarbon fuel, produced from methane, designated as **"GENETT™ - DIESEL_EN590 process"**



Using gas chromatography, the distribution of individual hydrocarbon groups by the number of carbon atoms was determined. The results of this analysis are graphically shown in figure above.

Diesel fuel sample analysis protocol

Gas chromatographic analysis and determination of selected parameters were carried out for one sample of hydrocarbon fuel, produced from methane, designated as **"GENETT™ - DIESEL_EN590 process"**

At the same time, the cumulative values of the same analysis are shown in tabular format in presented table.

Individual hydrocarbons	Content (% wt.)
up to C8	0,5
up to C9	2,3
up to C10	6,1
up to C11	10,9
up to C12	16,6
up to C13	24,1
up to C14	33,6
up to C15	43,2
up to C16	52,7
up to C17	61,6
up to C18	70,1
up to C19	77,6
up to C20	83,5
up to C21	88,5
up to C22	92,0
up to C23	94,4
up to C24	95,8
up to C25	96,6
up to C26	97,0
up to C27	97,2
up to C28	97,4
up to C29	97,5
FAME	2,5

Total hydrocarbon content based on carbon atom count

Diesel fuel sample analysis protocol

Gas chromatographic analysis and determination of selected parameters were carried out for one sample of hydrocarbon fuel, produced from methane, designated as **"GENETT™ - DIESEL_EN590 process"**

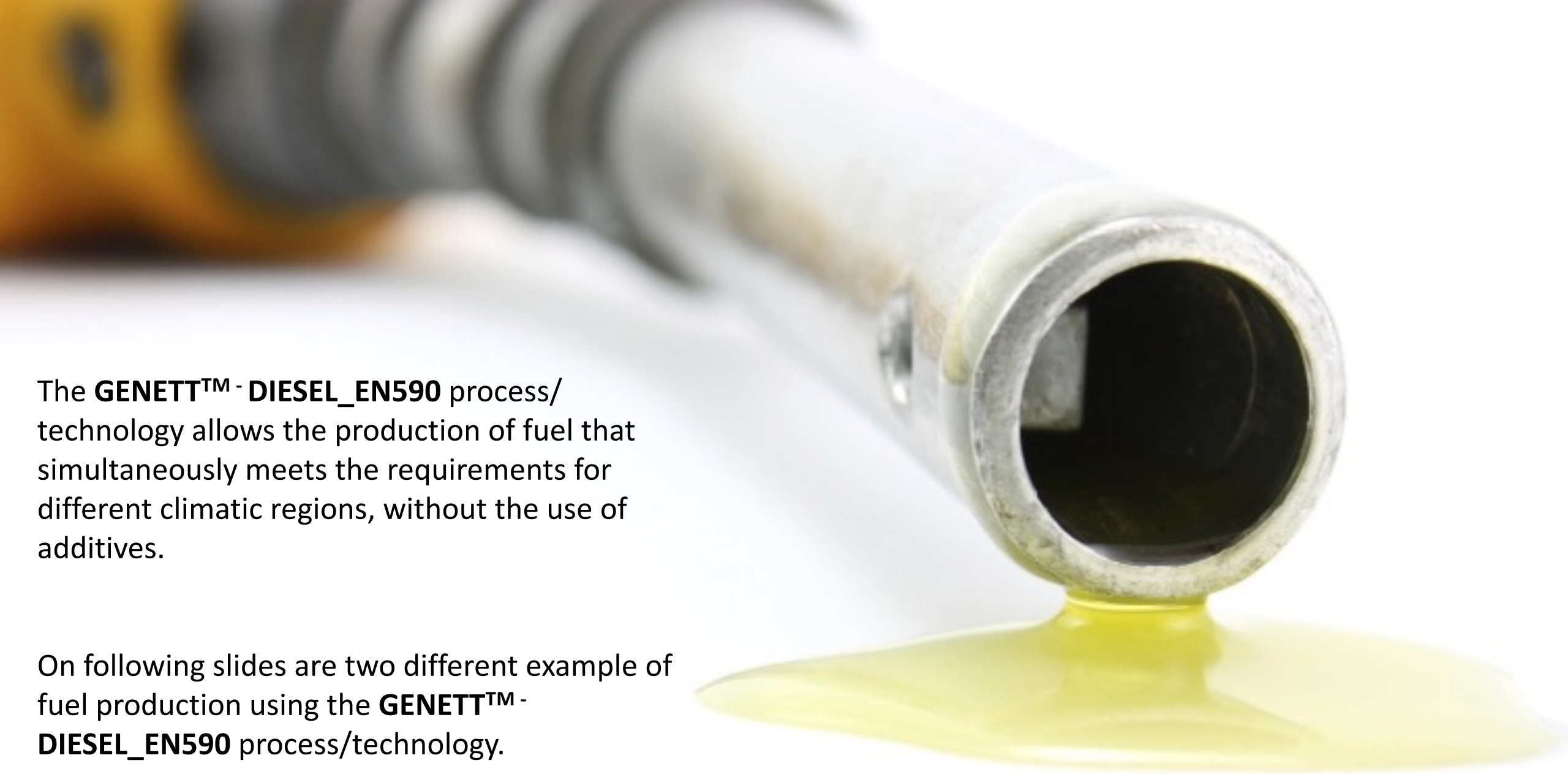
Parameter	Sample GENETT CH4_DIESEL_EN590	Standard requirements EN 590
Density at 15 °C (kg·м$^{-3}$)	836,7	820 - 845
Kinematic viscosity at 40 °C (мм^2·с$^{-1}$)	3,15	2,00 - 4,50
Up to 250 °C boil away (% vol.)	25,0	max. 65
Up to 350 °C boil away (% vol.)	95,0	min. 85
95 % volume boils at (°C)	350	max. 360
Cetane index	55,7	min. 46
Flash point - PM (°C)	69,5	min. 55
Monoaromatics content (% wt.)	13,5	-
Polyaromatics content (% wt.)	1,8	max. 8
Total Aromatics (% wt.)	15,3	-
FAME content (% vol..)	2,4	max. 7
Sulfur content (mg·kg^{-1})	1	max. 10
Filtration, cold filter - CFPP (°C)	-12	max. 0/-10/-20*

The results showing other physico-chemical properties of the analyzed sample are in presented table together with the requirements of the EN 590 standard for diesel fuels.

Its clear that the sample **"GENETT™ - DIESEL_EN590"** complies with the EN 590 standard requirements.

The analyzed fuel is applicable only as a motor fuel of class B (for the summer period from April 15 to September 30) and class D (off-season from October 1 to November 15 and from March 1 to April 14), and not as a winter diesel of class F (November 16 - February 29).

Prof. eng. Pavel Shimachek,
Higher School of Chemical Technology
Fuels Dept.



The **GENETT™ - DIESEL_EN590** process/ technology allows the production of fuel that simultaneously meets the requirements for different climatic regions, without the use of additives.

On following slides are two different example of fuel production using the **GENETT™ - DIESEL_EN590** process/technology.

Sample 18286
Class A,B & C

Raw materials for the process were provided by ČEPRO a.s,

Based on the analysis, it can be concluded that this fuel complies with the EN590 EURO-5 standard, sulfur content 8.5 mg / l.

Fuel can only be used for climatic regions with a temperature of at least minus 10 degrees C, class A, B, C of paragraph 5.5.2 of the EN590 standard, determined by the parameter of the maximum filterability temperature CFPP

L 1152.1

Testing laboratory no. 1152.1, accredited by Czech Accreditation Institute in accordance with ČSN EN ISO/IEC 17025:2005

LABORATORY REPORT no. 18286

Client

Client Order		SGS order	5662
Sample no., product	18286	diesel fuel	
Sample specification	Composite sample of drum No. 2 and drum No. 3, before entering the GDiesel production unit		
Quantity, sample bottle type			
Sampling date			
Sampling place			
Sampled by	Sampled by SGS employee		
Accredited sampling - method	SOP 97 (ČSN EN ISO 3170)		
Submitter	client		
Sample reception date			
Report approval date			
Report issued by	Luboš Chládek		

Issue date:

Approved by: Luboš Chládek
Classic Methods Specialist

Zkušební laboratoř č. 1152.1 SGS Czech Republic, s.r.o.

SGS Czech Republic, s.r.o.
Divize paliv a maziv, U Trati 42, 100 00 Praha 10 – Strašnice, Česká republika
fakturační adresa: K Hájům 1233/2, 155 00 Praha 5, Česká republika
IČ: 48589241, zapsána v OR MS Praha, odd. C, vl. 18205, dne 8.3.1993
t +420 274 021 310 f +420 274 817 287 e sgs_czech@sgs.com www.cz.sgs.com

Laboratory report no. 18286

Code	Test descriptions, parameters	Unit	Result	Date	Testing method
11	Sulfur	mg/kg	**8,5**	27.03.2018	SOP 101 (ČSN EN ISO 20846)
11	Flash point in closed cup (Pensky-Martens)	°C	**63,0**	26.03.2018	SOP 29 (ČSN EN ISO 2719)
11	Water by coulometric Karl Fischer titration method	mg/kg	**<30**	26.03.2018	SOP 51 (ČSN EN ISO 12937)
12	Kinematic viscosity at 40°C	mm^2/s	**2,541**	27.03.2018	SOP 40 (ČSN EN ISO 3104)
11	Cloud point	°C	**-7**	26.03.2018	SOP 38 (ČSN EN 23015)
12	Ash	% m/m	**<0,001**	27.03.2018	SOP 46 (ČSN EN ISO 6245)
11	Polyaromatic hydrocarbons	% m/m	**2,7**	27.03.2018	SOP 105 (ČSN EN 12916)
11	Copper strip corrosion (3 h at 50 °C)	rating	**class 1**	27.03.2018	SOP 49 (ČSN EN ISO 2160)
11	Total contamination of low viscosity fuels by filtration	mg/kg	**<6,0**	27.03.2018	SOP 33 (ČSN EN 12662)
12	Lubricity HFRR	µm	**430**	27.03.2018	SOP 148 (ČSN EN ISO 12156-1)
12	Cetane number on engine		**50,7**	27.03.2018	SOP 104 (ČSN EN ISO 5165)
12	Conradson carbonization residue of 10% residue	% m/m	**0,06**	28.03.2018	SOP 43 (ČSN ISO 6615, ČSN EN ISO 3405)
11	Distillation - Diesel			26.03.2018	SOP 26 (ČSN EN ISO 3405)
	Initial boiling point	°C	**176,7**		
	Recovered volume at 250 °C	% V/V	**45,5**		
	Recovered volume at 350 °C	% V/V	**94,8**		
	Recovered volume at 360 °C	% V/V	*		
	95% (V/V) recovered	°C	**351,6**		
	Total recovery	% V/V	**97,3**		
	Final boiling point	°C	**356,4**		
11	Cold Filter Plugging Point (CFPP)	°C	**-9,0**	26.03.2018	SOP 36 (ČSN EN 116)
11	Fatty acid methyl ester (FAME)	% V/V	**<0,30**	27.03.2018	SOP 91 (ČSN EN 14078)
11	Density at 15°C by oscillation U-tube method	kg/m^3	**831,8**	26.03.2018	SOP 27 (ČSN EN ISO 12185)
11	Cetane index		**51,3**	26.03.2018	SOP 35 (ČSN EN ISO 4264)
12	Oxidation stability of diesel fuel			28.03.2018	SOP 111 (ČSN EN ISO 12205)
	total insolubles	g/m^3	**2**		
11	Manganese	mg/l	**<0,1**	28.03.2018	SOP 135 (ČSN EN 16576)

First digit describes whether the test was performed within the accreditation range of the testing laboratory 1152.1: 1...=accredited test; 2...=unaccredited test
Second digit represents the testing location:...1=Prague laboratory, U Trati 42, Prague 10;...2=Kolín laboratory, Ovčárecká 314, Kolín 5;...3=mobile laboratory, U Trati 42, Prague 10;...9=outside contractor

Note	This laboratory report replaces laboratory report no. 18286 issued on 28.3.2018

Testing method	Commentary
SOP 101 (ČSN EN ISO 20846)	UV detection analyzer, extended measurement uncertainty - 0,5 mg/kg + 6% of result value.
SOP 29 (ČSN EN ISO 2719)	Extended measurement uncertainty - ±1 °C.
SOP 51 (ČSN EN ISO 12937)	Karl Fischer coulometric titration, extended measurement uncertainty for water content up to1000 mg/kg ±5 % of result value.
SOP 40 (ČSN EN ISO 3104)	Capillary viscometer Ubbelohde, extended measurement uncertainty is ±0,2% of result value.
SOP 38 (ČSN EN 23015)	Extended measurement uncertainty - ±1 °C.
SOP 46 (ČSN EN ISO 6245)	Extended measurement uncertainty ±3% of result value for results over 1 %m/m, ±6% of result value for results under 1 %m/m.
SOP 105 (ČSN EN 12916)	HPLC, extended measurement uncertainty - 0,2 %m/m + 7 % of result value.
SOP 49 (ČSN EN ISO 2160)	Visual test.
SOP 33 (ČSN EN 12662)	Extended measurement uncertainty - ±10 % of result value. Version 1998 used for FAME according CEN recommendation, 2014 used for other matrixes.
SOP 148 (ČSN EN ISO 12156-1)	High frequency reciprocating rig device, **evaluation by method "A". Determination at 60 °C for diesel and laboratory** temperature for gasoline. Extended measurement uncertainty 25 µm.
SOP 104 (ČSN EN ISO 5165)	Testing engine Waukesha CFR F-5, extended measurement uncertainty - ±1 unit of cetane number.
SOP 43 (ČSN ISO 6615, ČSN EN ISO 3405)	Extended measurement uncertainty - ±4 % of result value.
SOP 26 (ČSN EN ISO 3405)	Extended measurement uncertainty ±4 °C and ±2%V/V.
SOP 36 (ČSN EN 116)	Extended measurement uncertainty - ±1 °C.
SOP 91 (ČSN EN 14078)	Infrared spectrometry, extended measurement uncertainty ±0,3%V/V.
SOP 27 (ČSN EN ISO 12185)	Oscillating U-tube digital densimeter, extended measurement uncertainty - ±0.2 kg/m^3.
SOP 35 (ČSN EN ISO 4264)	Calculation based on density and distillating curve
SOP 111 (ČSN EN ISO 12205)	Oxidation apparatus with gravimetric evaluation of generated deposits, 16 h at 95 °C, 3 L oxygen/hour. Extended measurement uncertainty ±10% of result value.
SOP 135 (ČSN EN 16576)	ICP-OES method, extended measurement uncertainty is ±15% of result value.

Extended measurement uncertainty is a product of standard measurement uncertainty and an extension coefficient k=2 which corresponds to about 95% probability coverage for standard distribution. Standard measurement uncertainty was determined in accordance with document EA-4/02.

Sample 10565
Class A,B,C,D & F

Based on the analysis, it can be concluded that this fuel complies with the EN590 EURO-5 standard, the sulfur content is 4 mg / l.

The fuel can be used for climatic regions with a temperature of at least minus 20 degrees C, class A, B, C, D, E, F of paragraph 5.5.2 of the EN590 standard determined by the parameter of the maximum filterability temperature CFPP.

This fuel is an all-season type. In addition the product can be classified as class 0 winter fuel.

Testing laboratory no. 1152.1, accredited by Czech Accreditation Institute in accordance with ČSN EN ISO/IEC 17025:2005

LABORATORY REPORT no. 10565

Client	**Key Industry Engineering Group, s.r.o.** **Mojmírova 1710/15, 140 00 Praha 4 - Nusle**

Client Order		**SGS order**	5458
Sample no., product	10565	**diesel fuel**	
Sample specification	**GENETT EN590, 4.10.2017**		
Quantity, sample bottle type			
Sampling date			
Sampling place			
Sampled by	Sampled by client		
Accredited sampling - method	Sampling out of accreditation range		
Submitter	client		
Sample reception date	09.10.2017		
Report approval date	07.11.2017		
Report issued by	Luboš Chládek		

Issue date: 7.11.2017 **Approved by:** Luboš Chládek
Classic Methods Specialist

no. 10565

Code	Test descriptions, parameters	Unit	Result	Date	Testing method
11	Sulfur	mg/kg	**4,0**	10.10.2017	SOP 101 (ČSN EN ISO 20846)
11	Flash point in closed cup (Pensky-Martens)	°C	**56,5**	10.10.2017	SOP 29 (ČSN EN ISO 2719)
11	Water by coulometric Karl Fischer titration method	mg/kg	**70**	09.10.2017	SOP 51 (ČSN EN ISO 12937)
12	Kinematic viscosity at 40°C	mm^2/s	**2,248**	10.10.2017	SOP 40 (ČSN EN ISO 3104)
11	Cloud point	°C	**-21**	10.10.2017	SOP 38 (ČSN EN 23015)
12	Ash	% m/m	**<0,001**	10.10.2017	SOP 46 (ČSN EN ISO 6245)
11	Polyaromatic hydrocarbons	% m/m	**1,4**	10.10.2017	SOP 105 (ČSN EN 12916)
11	Copper strip corrosion (3 h at 50 °C)	rating	**class 1**	10.10.2017	SOP 49 (ČSN EN ISO 2160)
11	Total contamination of low viscosity fuels by filtration	mg/kg	**9,3**	10.10.2017	SOP 33 (ČSN EN 12662)
12	Lubricity HFRR	µm	**420**	10.10.2017	SOP 148 (ČSN EN ISO 12156-1)
12	Cetane number on engine		**51,0**	12.10.2017	SOP 104 (ČSN EN ISO 5165)
12	Conradson carbonization residue of 10% residue	% m/m	**0,01**	10.10.2017	SOP 43 (ČSN ISO 6615, ČSN EN ISO 3405)
11	Distillation - Diesel			10.10.2017	SOP 26 (ČSN EN ISO 3405)
	Initial boiling point	°C	**170,2**		
	Recovered volume at 250 °C	% V/V	**41,8**		
	Recovered volume at 350 °C	% V/V	*		
	Recovered volume at 360 °C	% V/V	*		
	95% (V/V) recovered	°C	**312,9**		
	Total recovery	% V/V	**97,7**		
	Final boiling point	°C	**320,6**		
11	Cold Filter Plugging Point (CFPP)	°C	**-23**	10.10.2017	SOP 36 (ČSN EN 116)
11	Fatty acid methyl ester (FAME)	% V/V	**<0,30**	11.10.2017	SOP 91 (ČSN EN 14078)
11	Density at 15°C by oscillation U-tube method	kg/m^3	**828,1**	09.10.2017	SOP 27 (ČSN EN ISO 12185)
11	Cetane index		**52,4**	10.10.2017	SOP 35 (ČSN EN ISO 4264)
12	Oxidation stability of diesel fuel			10.10.2017	SOP 111 (ČSN EN ISO 12205)
	total insolubles	g/m^3	**3**		
11	Manganese	mg/l	**<0,1**	10.10.2017	SOP 135 (ČSN EN 16576)

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Second digit represents the testing location:…1=Prague laboratory, U Trati 42, Prague 10;…2=Kolín laboratory, Ovčárecká 314, Kolín 5;…3=mobile laboratory, U Trati 42, Prague 10;…9=outside contractor

Note	

Testing method	Commentary
SOP 101 (ČSN EN ISO 20846)	UV detection analyzer, extended measurement uncertainty - ±7 % of result value.
SOP 29 (ČSN EN ISO 2719)	Extended measurement uncertainty - ±1 °C.
SOP 51 (ČSN EN ISO 12937)	Karl Fischer coulometric titration, extended measurement uncertainty for water content up to1000 mg/kg ±5 % of result value.
SOP 40 (ČSN EN ISO 3104)	Capillary viscometer Ubbelohde, extended measurement uncertainty is ±0,2% of result value.
SOP 38 (ČSN EN 23015)	Extended measurement uncertainty - ±1 °C.
SOP 46 (ČSN EN ISO 6245)	Extended measurement uncertainty - ±3% of result value for results above 1 %m/m, ±6% of result value for results under 1 %m/m.
SOP 105 (ČSN EN 12916)	HPLC, extended measurement uncertainty - ±7 % of result value.
SOP 49 (ČSN EN ISO 2160)	Visual test.
SOP 33 (ČSN EN 12662)	Extended measurement uncertainty - ±10 % of result value. Pro FAME použita dle doporučení CEN norma 1998, pro other 2014.
SOP 148 (ČSN EN ISO 12156-1)	High frequency reciprocating rig device. Determination by method „A“ at 60 °C for diesel and laboratory temperature for gasoline. Extended measurement uncertainty - 25 µm.
SOP 104 (ČSN EN ISO 5165)	Testing engine Waukesha CFR F-5, extended measurement uncertainty - ±1 unit of cetane number.
SOP 43 (ČSN ISO 6615, ČSN EN ISO 3405)	Extended measurement uncertainty - ±4 % of result value.
SOP 26 (ČSN EN ISO 3405)	Extended measurement uncertainty ±4 °C and ±2%V/V.
SOP 36 (ČSN EN 116)	Extended measurement uncertainty - ±1 °C.
SOP 91 (ČSN EN 14078)	Infrared spectrometry, extended measurement uncertainty ±0,3%V/V.
SOP 27 (ČSN EN ISO 12185)	Oscillating U-tube digital densimeter, extended measurement uncertainty - ±0.2 kg/m^3.
SOP 35 (ČSN EN ISO 4264)	Calculation based on density and distillating curve
SOP 111 (ČSN EN ISO 12205)	Oxidation apparatus with gravimetric evaluation of generated deposits, 16 h at 95 °C, 3 L oxygen/hour. Extended measurement uncertainty ±10% of result value.
SOP 135 (ČSN EN 16576)	ICP-OES method, extended measurement uncertainty is ±15% of result value.

Extended measurement uncertainty is a product of standard measurement uncertainty and an extension coefficient k=2 which corresponds to about 95% probability coverage for standard distribution. Standard measurement uncertainty was determined in accordance with document EA-4/02.

SGS Czech Republic, s.r.o.
Divize paliv a maziv
U Trati 42, 100 00 Praha 10
Inspection body type A No. 4015 accredited by Czech Accreditation Institute

Inspection report:	**3028/2017**	**Laboratory tests and evaluation of the results**
Subject of inspection:	**Diesel fuel**	**(evidence No. 10565, GDiesel, 4.10.2017)**
Type and date of sampling:	sample supplied by the client, 04.10.2017	
Client:		**Key Industry Engineering Group, s.r.o., Praha 4 - Nusle Mojmírova 1710/15**

Diesel fuel ČSN EN 590 (2014)	**Parameter**	Unit	Test method	**Measured value Sample no. 10565 ATL 1152.1 GDiesel, 4.10.2017**	Limit with inclusion of measurement uncertainty according to ČSN EN ISO 4259 min.	max.	Result of evaluation
	Flash point in closed cup (Pensky-Martens)	°C	SOP 29 (ČSN EN ISO 2719)	**56,5**	53,0		Meets
	Conradson carbonization residue of 10% residue	% m/m	SOP 43 (ČSN ISO 6615, ČSN EN ISO 3405)	**0,01**		0,36	Meets
	Total contamination of low viscosity fuels by filtration	mg/kg	SOP 33 (ČSN EN 12662)	**9,3**		28	Meets
class F	**Cetane number on engine**		SOP 104 (ČSN EN ISO 5165)	**51,0**	48,4		Meets
class F	**Cold Filter Plugging Point (CFPP)**	°C	SOP 36 (ČSN EN 116)	**-23**		-17	Meets
class F	**Cetane index**		SOP 35 (ČSN EN ISO 4264)	**52,4**	45,0		Meets
	Distillation - Diesel		SOP 26 (ČSN EN ISO 3405)				
	- Recovered volume at 250 °C	% V/V		**41,8**		<66,0	Meets
	- Recovered volume at 350 °C	% V/V		*	84,0		not evaluated
	- 95% (V/V) recovered	°C		**312,9**		365,0	Meets
class F	**Density at 15°C by oscillation U-tube method**	kg/m^3	SOP 27 (ČSN EN ISO 12185)	**828,1**	819,0	846,0	Meets
class F	**Kinematic viscosity at 40°C**	mm^2/s	SOP 40 (ČSN EN ISO 3104)	**2,248**	1,99	4,52	Meets
	Copper strip corrosion (3 h at 50 °C)	stupeň	SOP 49 (ČSN EN ISO 2160)	**TŘÍDA1**		TŘÍDA1	Meets
	Manganese	mg/l	SOP 135 (ČSN EN 16576)	**<0,1**		2,21	Meets
	Lubricity HFRR	µm	SOP 148 (ČSN EN ISO 12156-1)	**420**		520	Meets
	Fatty acid methyl ester (FAME)	% V/V	SOP 91 (ČSN EN 14078)	**<0,30**		7,3	Meets
	Oxidation stability of diesel fuel	g/m^3	SOP 111 (ČSN EN ISO 12205)	**3**		33	Meets
	Polyaromatic hydrocarbons	% m/m	SOP 105 (ČSN EN 12916)	**1,4**		8,6	Meets
	Ash	% m/m	SOP 46 (ČSN EN ISO 6245)	**<0,001**		0,013	Meets
	Sulfur	mg/kg	SOP 101 (ČSN EN ISO 20846)	**4,0**		12,0	Meets
class F	**Cloud point**	°C	SOP 38 (ČSN EN 23015)	**-21**		-6	not evaluated
	Water by coulometric Karl Fischer titration method	mg/kg	SOP 51 (ČSN EN ISO 12937)	**70**		260	Meets

Result of evaluation: in measured parameters meets | **requirements of ČSN EN 590 (2014)**

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Inspection report:	**3028/2017**	**Laboratory tests and evaluation of the results**
Subject of inspection:	**Diesel fuel**	**(evidence No. 10565, GDiesel, 4.10.2017)**
Type and date of sampling:	sample supplied by the client, 04.10.2017	
Client:		**Key Industry Engineering Group, s.r.o., Praha 4 - Nusle Mojmírova 1710/15**

Laboratory tests were carry out at accredited testing laboratory SGS Czech Republic, s.r.o., Oil, Gas & Chemicals, No. 1152.1,
Inspection activity was performed according to SIP 1 in accordance with ČSN EN ISO / IEC 17020: 2012

Date of completion of the inspection and issue of the report: 7.11.2017
The inspection was carried out by: Jan Špinka
Approved by: Bc. Jan Špinka, head of inspection body

EN 590 is the current standard for **all automotive diesel fuel sold** in the European Union member states and other European countries.

EN 590
Generally applicable requirements

Table 1 - Generally applicable requirements and test methods

Property	Unit	Limits		Test method [a]
		minimum	maximum	(See 2. Normative references)
Cetane number [b]		**51,0**	–	EN ISO 5165 EN 15195
Cetane index		46,0	–	EN ISO 4264
Density at 15 °C [c]	**kg/m³**	820,0	**845,0**	EN ISO 3675 EN ISO 12185
Polycyclic aromatic hydrocarbons [d]	**% (*m/m*)**	–	**11**	EN 12916
Sulfur content [e]	**mg/kg**	–	**50,0** until 2008-12-31	EN ISO 20846 EN ISO 20847 EN ISO 20884
			10,0	EN ISO 20846 EN ISO 20884
Flash point	°C	Above 55	–	EN ISO 2719
Carbon residue [f] (on 10 % distillation residue)	% (*m/m*)	–	0,30	EN ISO 10370
Ash content	% (*m/m*)	–	0,01	EN ISO 6245
Water content	mg/kg	–	200	EN ISO 12937
Total contamination	mg/kg	–	24	EN 12662 [g]
Copper strip corrosion (3 h at 50 °C)	rating	class 1		EN ISO 2160
Fatty acid methyl ester (FAME) content [h]	**% (*V/V*)**	**-**	**7,0**	**EN 14078**
Oxidation stability	g/m³ h	– 20	25 -	EN ISO 12205 EN 15751 [i]
Lubricity, corrected wear scar diameter (wsd 1,4) at 60 °C	µm	–	460	EN ISO 12156-1
Viscosity at 40 °C	mm²/s	2,00	4,50	EN ISO 3104
Distillation [k,l] % (*V/V*) recovered at 250 °C % (*V/V*) recovered at 350 °C **95 % (*V/V*) recovered at**	 % (*V/V*) % (*V/V*) **°C**	 85 	 < 65 **360**	EN ISO 3405

NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including Amendment 2003/17/EC [2]

[a] See also 5.6.1

[b] See also 5.6.4

[c] See also 5.6.2

[d] For the purposes of this European Standard, polycyclic aromatic hydrocarbons are defined as the total aromatic hydrocarbon content less the mono-aromatic hydrocarbon content, both as determined by EN 12916.

[e] See also 5.6.3

[f] See also 5.4.2 and Annex A

[g] Further investigation into the total contamination test method to improve the precision, particularly in the presence of FAME, is being carried out by CEN

[h] FAME shall meet the requirements of EN 14214

[i] For diesel fuel containing FAME above 2 % (*V/V*) this is an additional requirement. This is an interim requirement, under revision by CEN, when more technical data on oxidation stability and field performance of diesel fuels will be available.

[k] For the calculation of the cetane index the 10 %, 50 % and 90 % (*V/V*) recovery points are also needed.

[l] The limits for distillation at 250 °C and 350 °C are included for diesel fuel in line with EU Common Customs tariff.

5.5 Climate dependent requirements and related test methods

5.5.1 For climate-dependent requirements options are given to allow for seasonal grades to be set nationally. The options are for temperate climates six CFPP (cold filter plugging point) grades and for arctic or severe winter climates five different classes. Climate-dependent requirements are given in Table 2 (temperate climates) and Table 3 (arctic or severe winter climates). When tested by the methods given in Tables 2 and 3, automotive diesel fuel shall be in accordance with the limits specified in these Tables.

5.5.2 The cetane number limits for arctic or severe winter grades in Table 3 are lower than for the temperate class (Table 1), reflecting the correlation between ignition quality and density, and the low density of arctic or severe winter grades. The values for cetane number given in Table 3, included for correct vehicle operation, do not meet the requirements of the European Fuels Directive 98/70/EC [1], including Amendment 2003/17/EC [2]. These values are valid for use in countries where the European Fuels Directive 98/70/EC [1], including Amendment 2003/17/EC [2], does not apply or for countries where cetane number exceptions have been granted for arctic or severe winter grades.

Table 2 - Climate-related requirements and test methods - Temperate climates

Property	Unit	Limits						Test method [a]
		Grade A	Grade B	Grade C	Grade D	Grade E	Grade F	(See 2. Normative references)
CFPP	°C, max.	+5	0	-5	-10	-15	-20	EN 116

[a] See also 5.6.1

Table 3 - Climate-related requirements and test methods - Arctic or severe winter climates

Property	Units	Limits					Test method [a]
		class 0	class 1	class 2	class 3	class 4	(See 2. Normative references)
CFPP	°C, max.	-20	-26	-32	-38	-44	EN 116
Cloud point	°C, max.	-10	-16	-22	-28	-34	EN 23015
Density at 15 °C [b]	kg/m^3, min. kg/m^3, max.	800,0 845,0	800,0 845,0	800,0 840,0	800,0 840,0	800,0 840,0	EN ISO 3675 EN ISO 12185
Viscosity at 40 °C	mm^2/s, min. mm^2/s, max.	1,50 4,00	1,50 4,00	1,50 4,00	1,40 4,00	1,20 4,00	EN ISO 3104
Cetane number [c]	minimum	49,0	49,0	48,0	47,0	47,0	EN ISO 5165 EN 15195
Cetane index	minimum	46,0	46,0	46,0	43,0	43,0	EN ISO 4264
Distillation [d,e]							EN ISO 3405
% (*V/V*) recovered at 180 °C	% (*V/V*), max.	10	10	10	10	10	
% (*V/V*) recovered at 340 °C	% (*V/V*), min.	95	95	95	95	95	

[a] See also 5.6.1

[b] See also 5.6.2

[c] See also 5.5.2 and 5.6.4

[d] EU Common Customs Tariff definition of gas oil may not apply to the grades defined for use in arctic or severe winter climates.

[e] For the calculation of the cetane index the 10 %, 50 % and 90 % (*V/V*) recovery points are also needed