



C13ETVP03.A395

G-DRIVE STAGE V



Brochure main description		@1500rpm	@1800rpm
Application & simbol		Power Generation	
Engine identification main		C13	
Engine identification rating	kW	395	450
Engine features		PG G-Drive	
Emission feature		Stage V	

Main characteristics		@1500rpm	@1800rpm
Emission certification		Stage V	
Commercial code (for order)		C13ETVP03.A395	
Other Commercial code		F3HGE615A	
Technical code (original plant engine code, on engine block)		F3HGE615A*V001	
Technical homologation code		F3HGE615A*V	
Stand-by power (gross) [mech]	kW	395	450
Specific power	kW/l	30,6	34,9
Electric commercial power (estimation alternator power output)	kWe [kVA]	355 [444]	400 [501]
BMEP	bar	25,03	23,53
Oil consumption on mission (average)	% fuel consumption	0,25	
Cycle		diesel - 4 stroke	
Air charging system pattern		Turbocharged aftercooled	
Number of cylinder		6	
Configuration (cylinder arrangement)		in line	
Bore	mm	135	
Stroke	mm	150	
Stroke / Bore		1,11	
Displacement	l	12,9	
Unit Displacement	l	2,14	
Bore pitch	mm	164	
Valves per cylinder		4	
Cooling system type		liquid	
Direction of rotation (looking flywheel)		anti-clockwise	
Compression ratio		16,5 : 1	
Firing order		1 - 4 - 2 - 6 - 3 - 5	
Injection type		direct - electronic common rail	
Be10		8000 h	
Cylinder Head		N/A	
Single / Multiple		single	
Material		cast iron	
Head air circulation		crossflow	
Intake valve dia.	mm	47	
Exhaust valve dia.	mm	46	
Camshaft		N/A	
Layout		SOHC	
Cam carrier		no	
Material and Heat treatment		50CrMo4 cod 22080/C53 cod 21048	
Drivetrain (timing system)		rear gears	
Valve actuation		roller rocker arms	



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Main characteristics		@1500rpm	@1800rpm
Variable valve actuation system			no
Cylinder block (crankcase)			No Structural
Material of cylinder block			cast iron
Type of liners			wet
Liners replaceable; (slip fit or interference fit)			yes
Bearing caps			machined cast iron
Crankcase Ventilation			closed
Oil separator			separator centrifugal
Crankshaft & counterweights			N/A
Material			52Mn5BY (Steel)
Acceptable Inertia (clutch)	kgm ²		1,25
Balancing			no
Turbocharger & EGR system			N/A
Turbocharger type			GT 45 - WG
Turbocharger supplier			HTT/Honeywell/Garrett
Turbocharger control			WG pneumatic control
Pressure after turbocharger compressor	mbar		1800 (max. 2500)
Max turbine inlet temperature	°C		740
Temperature after turbocharger compressor	°C		< 200
Method of cooling the turbocharger			oil lubricated
Turbo protection devices			(WG - Software strategy open loop)
Exhaust flap			N/A
Exhaust flap supplier			Klubert Schmidt
Actuation type			with cooled actuator
Exhaust flap cooling			yes
Switchability (1500-1800 rpm)			N/A
Emission level 1500 rpm			stageV
Emission level 1800 rpm			Tier4B
Front power take off			N/A
Power take off on gear train			N/A
References values			N/A
Engine dimension LxWxH (indicative values)	mm		1356 x 952 x 1212
G-Drive Dimension LxWxH (indicative values)	mm		2318 x 1223 x 1454
Max permissible engine inclination	deg		(all direction) 19
Engine Weight - Dry (no fluids, value purely indicative)	kg		1185
Engine Weight - Wet (with fluids, value purely indicative)	kg		1240
G-Drive Weight - Dry (no fluids, value purely indicative)	kg		1399
G-Drive Weight - Wet (with fluids, value purely indicative)	kg		1420
Center of gravity (FFOB or RFOB according to picture, standard engine layout)	mm		(from FFOB) x=564; y=9.44; z=226.9
Principal moment of inertia (reference on center of gravity ,standard engine layout)	kgm ²		I1=89.2; I2=181; I3=225
Principal moment of inertia (reference matrix based on center of gravity,standard engine layout)	kgm ²		Ixx Ixy Ixz = 89,7 -6,37 4,58 ; Iyx Iyy Iyz = -6,37 224 -2,75 ; Izx Izy Izz = 4,58 -2,75 181
Center of gravity (FFOB or RFOB according to picture, standard IPU/G-Drive layout)	mm		(from RFOB) x=10; y=226.5; z=555.8
Principal moment of inertia (reference on center of gravity ,standard IPU/G-Drive layout)	kgm ²		I1=134; I2=340; I3=381



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Main characteristics		@1500rpm	@1800rpm
Principal moment of inertia (reference matrix based on center of gravity, standard IPU/G-Drive layout)	kgm ²	Ixx Ixy Ixz = 381 0,273 -3,62 ; Iyx Iyy Iyz = 0,273 340 6,57 ; Izx Izy Izz = -3,61 6,57 134	
Mass moment of inertia - rotating components (excluding flywheel)	kgm ²	1,07	
Mass moment of inertia - standard flywheel	kgm ²	2,17 - 2,29	
Bending moment on the flywheel housing	Nm	within safety factor with lumped masses summary 806kg@max. X=-91mm; Y=-33mm; Z=-202mm	
Flywheel housing SAE sizing		SAE 1	
Flywheel SAE sizing		14	
Max static mounting surface load	N	N/A	
Crankshaft thrust bearing pressure limit		N/A	
Continuous load:	MPa	15	
Max bending moment available from front of the crankshaft:		N/A	
0 deg	Nm	100	
90 deg	Nm	270	
180 deg	Nm	270	
Environmental operating conditions		N/A	
Max altitude for declared performances	m	1000	
Max ambient temperature for declared performances	°C	40	
Min guaranteed temperature for cold start w/o any aid (stand alone engine)	°C	- 10	
Min guaranteed temperature for cold start with Air Heater (stand alone engine)	°C	- 15 (with grid heater and fuel heater)	
Min guaranteed temperature for cold start with grid heater and block heater (stand alone engine)	°C	- 30 (with grid heater, fuel heater and block heater)	
Time preheating for manifold heater	s	- 5°C = 3 ; - 30°C = 12	
Time post heating for manifold heater	s	- 5°C = 110 ; - 30°C = 1200	
Low idle continuous operation time (reccomended)	h	depending of Electrical Alternator. Not over 0,5	
Engine performance [*]		N/A	
Continuous power (gross) [mech]	kW	287	327
Prime power (gross) [mech]	kW	359	409
Stand-by power (gross) [mech]	kW	395	450
Fan consumption [mech]	kW	17	24
Continuous power (net) [mech]	kW	270	303
Prime power (net) [mech]	kW	342	385
Stand-by power (net) [mech]	kW	378	426
Typical generator output		400	430
Generator available power @ Prime power	kW	342	385
Generator available power @ Stand by	kW	378	426
Power limitation according to ambient conditions		N/A	
Ambient temperature above xx°C	%/5°C (xx°C)	2	
Altitude > 1000 < 3000m above sea level	%/500m	3	
Altitude > 3000m above sea level	%/500m	6	
Power limitation due to safety protections		N/A	
Pre-Warning: first advice of high coolant temperature [**]. Switch-on of the amber lamp	°C	102	
Warning: second advice of high coolant temperature [**]. Switch-on of the red lamp	°C	106	
Start of derating	°C	106	
Altitude level: gradual reduction of transient response by smoke map correction from	m	N/A	



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Fuel temperature	°C	70
Intake manifold air temperature	°C	70
ATS Max gas inlet temperature	°C	600
Max allowed exhaust temperature	°C	750
Turbine overheating protection	°C	N/A
Turbine overspeed protection	rpm	N/A
Oil temperature protection	°C	120
Oil pressure protection (min engine rpm)	bar	1

Fuel System

Fuel density	kg/l	(SAE EN590) 0,835
Injection system type		electronic common rail
Injection pump manufacturer		BOSCH
Injection model type		HRFN-22 with PLVS and Pressure Sensor
Injection model pump		CPN5-22/2
Injection pressure	bar	1800
Injector		CRIN3-22
Injector installation (sleeve, sealing flat or conical)		vertical, no sleeve, conical seat 120°
Injector nozzle		145° - 8x800
Engine fuel compatibility		see dedicated GOLD Book document
Fuel filter		Green Filter - cartridge with element filter replaceable
Fuel filter clogging sensor		yes
Max continuous allowable fuel temperature (without derating)	°C	70
Max relative pressure at gear pump inlet	bar	0,15
Min relative pressure at gear pump inlet	bar	0,6
Max back flow relative pressure	bar	0,8
Max back flow restriction	bar	1,8
Max heat rejection to return fuel	kW	0,96
Max fuel flow return line	kg/h	622
Min fuel tank venting requirement	m³/h	0,77
Prefilter / Water separator micron size	µm	20

Air Intake System

		@1500rpm	@1800rpm
Aftercooling system type		air to air	
RoA (Temperature raise between ambient and inlet to engine)	°C	≤ 20	
Filter air intake temperature (warm air ricirculatuion)	°C	≤ 5	
Max intake manifold temperature	°C	70	
Compressor inlet pressure (with new air filter)	hPa	-35	
Compressor inlet pressure (with dirty air filter)	hPa	-65	
Air filter type		Dry	
Loads on turbocharger on compressor intake	kg	0	
Loads on turbocharger on compressor outlet	kg	0	
Charge air flow (max)	kg/h	1761	2097

Exhaust System

		@1500rpm	@1800rpm
Max back pressure (after exhaust flap) @ rated power with clean system	hPa	290	
Max mechanical load on turbine flange	kg	negligible loads from misalignment, vibration, shock, thermal expansion - 0	
Max ambient temperature for exhaust flap actuator	°C	120	



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Exhaust System		@1500rpm	@1800rpm
Max exhaust temperature After Treatment System	°C	500	
Max exhaust flow rate	kg/h	2190	
Energy to exhaust	kW	285,8	354,7

After Treatment System	
After Treatment System	DOC + SCRoF + CUC
DPF	yes
DOC	yes
SCR	yes
Urea Dosing System	yes
AdBlue mixer	yes
ATS sensors	n°1 Temperature Sensor Us DOC, n°1 Temperature Sensor Ds DOC, n°1 Temperature Sensor Us SCRoF, n°1 Temperature Sensor Ds SCRoF, n°1 NOx sensor Us DOC, n°1 NOx sensor Ds SCRoF, n°1 Delta Pressure Sensor
DPF regeneration strategy	DeSox and periodic soot removal

Lubrication System		
Oil sump capacity, max level	l	28
Oil sump capacity, min level	l	20
Oil system capacity including filter	l	30,5
Oil pump type		volumetric
Oil pump drive arrangement		driven by gear
Min oil pump flow	l/min	(@ 600 rpm) 50
Max oil pump flow (@rated speed)	l/min	(@ 2100 rpm) 160
Min oil pressure @ low idle (engine oil temp at 120°C)	kPa (bar)	160 (1,6)
Min oil pressure @ rated speed (engine oil temp at 120°C)	kPa (bar)	400 (4,0)
Max oil pressure @ rated speed (engine oil temp at 120°C)	kPa (bar)	500 (5,0)
Max oil temperature @ full load (in main gallery)	°C	108 ± 5
Max oil pressure peak on cold engine	bar	(main gallery) 10 bar, (after pump) 20
Oil cooler type		plates oil cooler
Transducer for indicating oil temperature and pressure		available
Max engine angularity - longitudinal / transversal (std oil pan)	deg	19
Allowed engine gradability during installation on vehicle	deg	0
Oil servicing intervals	h	see goldbook documentation
Oil filter type		Green filter cartridge (full flow) with inorganic fibre filter
Oil filter capacity	l	3,6
Max oil content admitted in blow by gas (after filter)	g/h	0,5
Oil for cold condition mission (T° ambient < -25°C)		see dedicated GOLD Book document on fluids

Cooling system		@1500rpm	@1800rpm
Type (water to water or air to water)		air to water	
Recommended coolant		see dedicated GOLD Book document on fluids	
Min radiator cap pressure	kPa	100/120	
Warnnig setting first threshold	°C	102	
Air to boil (prime power, open genset configuration). For further information see GB document	°C	@1500rpm:58 °C	@1800rpm:54
Air flow (prime power, open genset configuration)	m³/s	N/A	



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Cooling system		@1500rpm	@1800rpm
Air to boil (stand by, open genset configuration). For further information see GB document	°C	@1500rpm:53,5 °C @1800rpm:49	
Air flow (stand by, open genset configuration)	m³/s	N/A	
Fan		N/A	
Diameter	mm	800	
Number of blades		12	
Drive ratio		1,38	
Speed		@1500rpm: 2070rpm	@1800rpm: 2484rpm
Air flow		N/A	
Power consumption		@1500rpm: 17kW	@1800rpm: 24kW
Radiator		N/A	
Core dimensions LxWxh	mm	402 x 1125 x 1328	
Dry weight	kg	95	
Radiator coolant capacity	l	10	
Optimum coolant temperature range @engine out (50% glycol)	°C	85 - 90	
Engine Water pump Type		centrifugal pump	
Engine water pump drive		driven by belt (12 ribs)	
Coolant capacity (engine only)	l	22	
Coolant capacity (radiator & hoses)	l	10 l (Rad) + 3,5 l (exp tnk) + 6 l (hoses) = 19	
Thermostat type		wax type	
Thermostat position		on cylinder head	
Thermostat opening / fully open temperature	°C	(opening) 84°C+/-2°C / (15 mm max) 94°C+/-2	
Recommended coolant circuit pressurization range (relative)	hPa	1400	
Coolant engine pressure outlet – inlet (delta pressure, open thermostat, high idle conditions)	hPa	< 0,2	
Min coolant pressure (no pressure cap and thermostat closed)	hPa	1000	
Coolant water pump inlet pressure (water temperature 60-100°C)	hPa	500	
Coolant flow to radiator @rated speed	l/h	550	
Min coolant expansion space (% total cooling system capacity)	%	Expansion Tank volume (and max level) must consider also coolant thermal expansion to avoid coolant loss in high temperature conditions. This can be checked in ATB Power Test	
Max coolant flow to accessories @ rated speed from cab heater	l/min	3500	
Engine out coolant to ambient @rated speed	delta °C	65,6 @1500rpm ; 65,8 @1800rpm	
Engine out coolant to ambient @torque speed	delta °C	65,6 @1500rpm ; 65,8 @1800rpm	
Charge air cooler outlet to ambient @max rpm - CAC dT	delta °C	24	
Pump water flow	l/min	486	583

Electrical, Electronic and Control Systems			
System voltage	V	24	
Engine control unit		MD1CE101	
ECU software		P1603v454	
ECU Vehicle connection		with CAN line	
ECU operating range	°C	- 30 ÷ +95	
Temperature of ECU case for <5' after power up	°C	<80	
ECU communication protocol		CAN (XCP Protocol)	
Min power supply for ECU operation	V	9	



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Electrical, Electronic and Control Systems

Max power supply for ECU operation	V	32
Battery wire connection resistance value @20°C (from battery to ECU)	mΩ	RT30 < 2mΩ; RT50 < 200
Diagnostic connector type		On board, Deutch Connector (9 poles)
Min cranking speed TDC @-30°C	rpm	90
Average cranking speed	rpm	130
N° tooth pinion/crown gear		10/149
Min battery voltage	V	(24V a vuoto) 18
Mean battery voltage	V	(24 V a vuoto) 18,4
Min battery current	Ah	950CCA x 2pcs
Mean battery current	Ah	950CCA x 2pcs
Max starting circuit resistance (to starter)	mΩ	RT30 < 2mΩ; RT50 < 200

Cold starting

Without air preheating	°C	-10
With air preheating (if available)	°C	-15

Emission gaseus and particulates

NOx (Oxides of nitrogen) [NRSC]	g/kWh	see homologation certificates
HC (Hydrocarbons) [NRSC]	g/kWh	see homologation certificates
NOX+HC [NRSC]	g/kWh	see homologation certificates
CO (Carbon monoxide) [NRSC]	g/kWh	see homologation certificates
PM (Particlutes) [NRSC]	g/kWh	see homologation certificates
CO2 (Carbon Dioxide) [NRSC]	g/kWh	see homologation certificates
NOx (Oxides of nitrogen) [NRTC]	g/kWh	see homologation certificates
HC (Hydrocarbons) [NRTC]	g/kWh	see homologation certificates
NOX+HC [NRTC]	g/kWh	see homologation certificates
CO (Carbon monoxide) [NRTC]	g/kWh	see homologation certificates
PM (Particlutes) [NRTC]	g/kWh	see homologation certificates
CO2 (Carbon Dioxide) [NRTC]	g/kWh	see homologation certificates

Maintenance

Oil drain interval		see dedicated GOLD Book document on fluids
Oil filter change		see goldbook documentation
Oil refilling time		daily check to evaluate oil refill necessity
Approved engine oil specifications		10W40
CCV filter change		see goldbook documentation
Fuel filter change		1200h / 2y
Fuel pre-filter change		see goldbook documentation
Belt replacement		see goldbook documentation
Valve lash check /adjustment		1200h
AdBlue filter Change		3000
DPF filter service		see goldbook documentation
Coolant change		600h

Engine Noise

Overall sound pressure (engine only)	dBA	99
Overall sound pressure (with accessories only)	dBA	N/A
Exahust noise (w/o Muffler)	dBA	N/A



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Engine Noise

Noise spectrum (octave analysis performed at the position of maximum noise) - diagram	Table dB-Hz	N/A	
A-weight sound power level LW function of power (value calculated respecting standard ISO 3744 and 3746. For further information see GB document)		N/A	
0% (no load)	dBA	N/A	
75% (partial load)	dBA	N/A	
100% (full load)	dBA	N/A	
110% (overload)	dBA	N/A	

Step Load (for further information see GB document)

		@1500rpm	@1800rpm
G1 (% of PrP) [open flap]	%	100	75
G2 (% of PrP)[open flap]	%	60	73
G3 (% of PrP)[open flap]	%	50	56
G1 (% of PrP) [closed flap]	%	100	61
G2 (% of PrP) [closed flap]	%	55	61
G3 (% of PrP) [closed flap]	%	50	54

Maximum Rating Performance Data

		@1500rpm	@1800rpm
Torque	Nm	2515	2387
Ambient Temperature	°C	23,3	23,28
Fuel Flow	g/s	21,7	25,5
Fuel consumption (BSFC) (prime power)	(kg/h) [g/kWh]	(69,54) [193,6]	(82,3) [200,9]
Fuel consumption (BSFC) (stand by)	(kg/h) [g/kWh]	(78,2) [193,9]	(92) [202,4]
Fuel consumption (BSFC) (80% prime power)	(kg/h) [g/kWh]	(55,5) [193,4]	(65) [198,8]
Fuel consumption (BSFC) (50% prime power)	(kg/h) [g/kWh]	(35,4) [198,6]	(41,9) [206,9]
Fuel consumption (BSFC) (25% prime power)	(kg/h) [g/kWh]	(19,6) [223,6]	(23,8) [238,8]
AdBlue consumption (prime power)	% of fuel cons	10,5	10,4
AdBlue consumption (stand by)	% of fuel cons	10,9	10,7
AdBlue consumption (80% prime power)	% of fuel cons	10	9,9
AdBlue consumption (50% prime power)	% of fuel cons	11	9,1
AdBlue consumption (25% prime power)	% of fuel cons	8	6,7
Exhaust Gas Flow	kg/h	1839	2098

Design air handling system data

		@1500rpm	@1800rpm
Boost pressure (compressor outlet)	kPa	207,3	212
Pressure drop on charge air cooling system	kPa	5,9	10,9
Max temperature after HP-Compressor	°C	N/A	N/A
Boost temperature (includes EGR effect)	°C	176,1	183
ATS back pressure	kPa	16,1	21,6
Exhaust Gas Temp between HP-TC	°C	N/A	N/A
Max Exhaust Gas Temp (after TC)	°C	536	560
Max admitted back pressure after SCR	kPa	N/A	N/A
Max admitted back pressure after TC	kPa	29	29
Power engine coolant without EGR & CAC (prime power)	kW [kcal/kWh]	N/A	N/A
Power engine coolant without EGR & CAC (stand by)	kW [kcal/kWh]	N/A	N/A
Total Power to coolant (prime power)	kW [kcal/kWh]	144,3	164,8
Total Power to coolant (stand by)	kW [kcal/kWh]	154,2	177,7
Total pump water flow	l/s	8,1	9,7



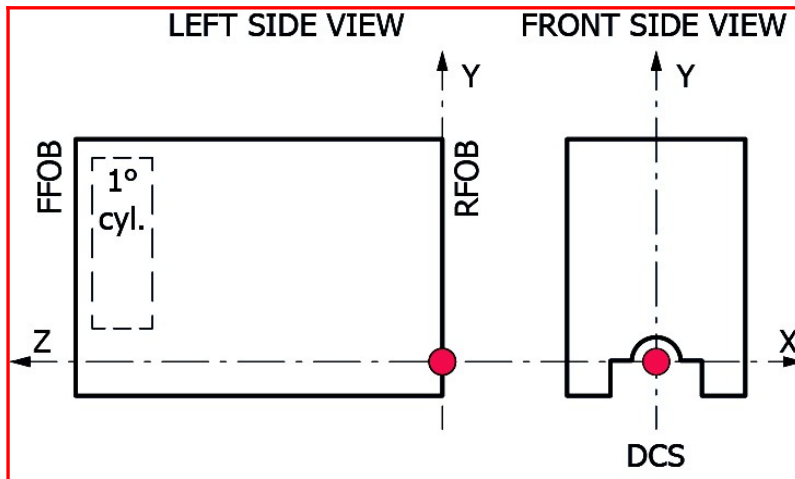
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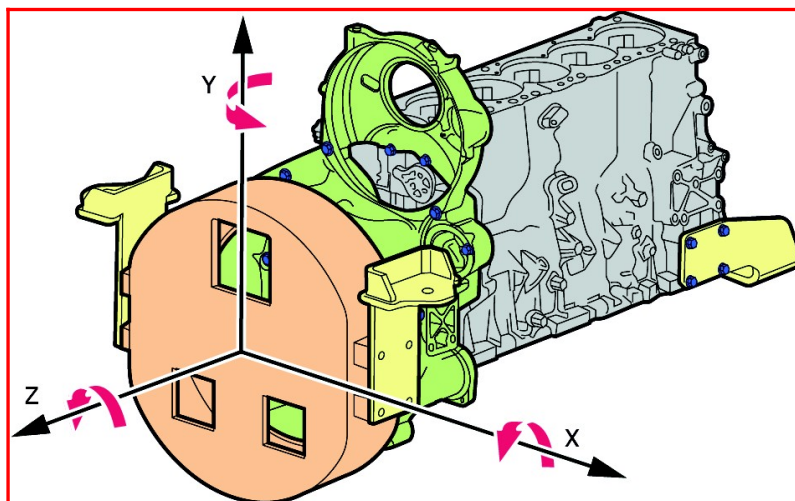


Design air handling system data		@1500rpm	@1800rpm
Radiator Coolant Flow (5% less if continuous deaerating system, coolant according to FPT norms)	l/min	N/A	N/A
LP-CAC water flow (for $\Delta T=6^{\circ}C$)	l/s	N/A	N/A
Power in CAC (air to air) (prime power)	kW [kcal/kWh]	58,1	75,6
Power in CAC (air to air) (stand by power)	kW [kcal/kWh]	65,1	80
Power Radiated	kW	24,6	28,9
Charge Air Flow	g/s	489	557
[*] Power at flywheel according dir. 97/68 EC (w/o fan), after 50 hours of run-in, tolerance $\pm 5\%$, fuel EN 590; Test according ISO 3046/1, turbo air inlet temperature $25^{\circ}C$, atmospheric pressure 100 kPa, humidity 30 %		N/A	
[**] according to temperature sensor tolerance		N/A	

Images



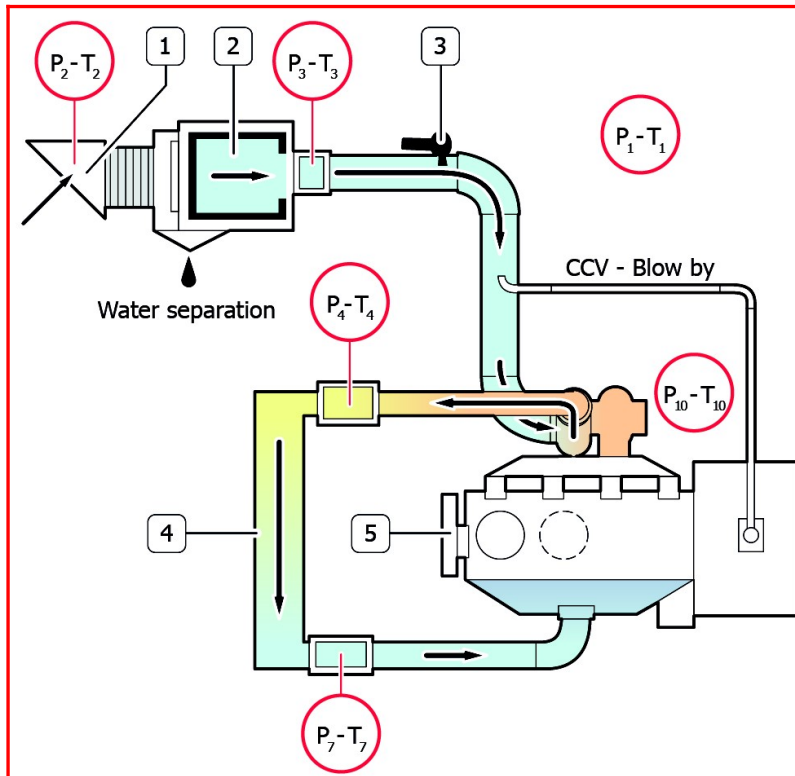
Principal Moment of Inertia



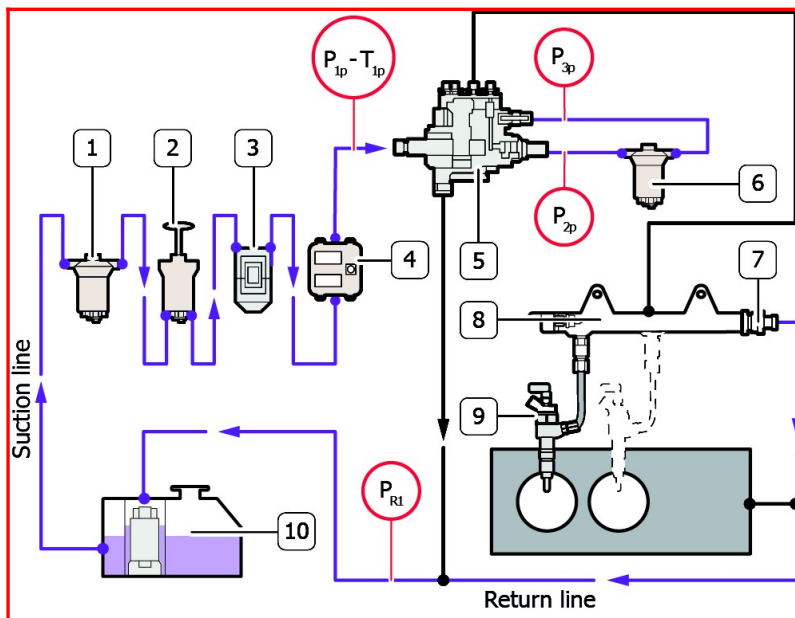
Components



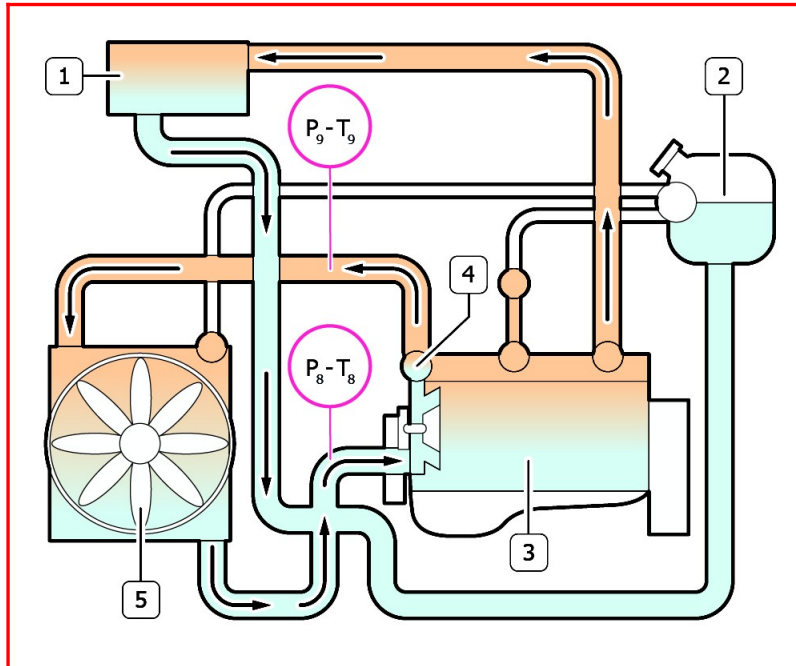
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1.Snorkel 2.Air Filter 3.Humidity sensor 4.Intercooler



1.Inspection glass with strainer 2.Prime pump 3.Pre-filter with water separator 4.ECU 5.High Pressure pump 6.Fuel Filter 7.Overpressure valve 8.Common Rail 9.Injectors 10.Fuel tank



1.Heating element 2.Expansion tank 3.Engine 4.Thermostat 5.Radiator



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G-DRIVE STAGE V



ACRONYMS LIST

Acronyms	Description
-	Not Needed
2stTC	Two Stage Turbo (sequential)
Ag	Agricultural
ASC	Ammonia Slip Catalyst (same as CUC)
ATS	After Treatment System
BSFC	Brake Specific Fuel Consumption
CAC	Charge Air Cooler
CCDPF	Close Coupled DPF
CCV	Crankcase Ventilation
CE	Construction Equipment
CI	Cast Iron
CRS	Common Rail System
CRSN	Common Rail System NKW (Commercial vehicles)
CUC	Clean Up Catalyst for ammonia (same as ASC)
DAVNT	Dual Axis Variable Nozzle Turbine
DCS	Drawing Coordinate System
DI	Direct Injection
DOC	Diesel Oxidation Catalyst
DOHC	Double Over Head Camshaft
DPF	Diesel Particulate Filter
ECEGR	External Cooled EGR
ECU	Engine Control Unit
EEGR	External EGR
EGR	Exhaust Gas Recirculation
epWG	Electro pneumatic WG
eVGT	Electrical VGT
eWG	Electrical WG
FFOB	Front Face of Block
FGT	Fixed Geometry Turbocharger (no WG)
FIE	Fuel Injection System
HD	Heavy Duty
HLA	Hydraulic Lash Adjusters
IDI	Indirect Injection

Acronyms	Description
IEGR	Internal EGR
IPU	Industrial Power Unit
ISC	Interstage Cooling
LD	Light Duty
LDCV	Light Duty Commercial Vehicles
LH	Left Hand Side
LWR	Laser Welded Rail
MD	Medium Duty
n/a	Not Available
NA	Natural Aspirated
NS	Non Structural
OHV	Over Head Valves
OPT	Option
PCP	Peak Cylinder Pressure
PTO	Power Take Off
RFOB	Rear Face of Block
RH	Right Hand Side
S	Structural
SAPS	Sulphated Ash, Phosphorus, Sulphur
SCR	Selective Catalytic Reduction catalyst
SCRoF	SCR on filter
SOHC	Single Over Head Camshaft
STD	Standard
TC	Turbocharged
TCA	Turbocharged, Charge Air Cooled
THM	Thermal Management
UFDPF	Under Floor DPF
UQS	Urea Quality Sensor
VE	Bosch Distributor Mechanical Pump
VFT	Variable Flow Turbine
VGT	Variable Geometry Turbocharger
WG	Waste Gate Turbocharger
XPI	Extra high Pressure Injection (Scania, Cummins)

Unit of misure according to international system of unit. Engine accessories and Options available on Option List. All data is subject to change without notice.

UPDATING

Revision	Description	Date
Revision 1.3_Dec 2021		December/2021
Revision 2.0_Sep 2022		September/2022
Revision 2.1_Oct 2022		October/2022
Revision 3.0_Jan 2023		January/2023



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2023

February/2023

Revision 3.2_Apr
2023

April/2023
