F34 Tier 4 Final

Revision 1.0_Oct 2019

Brochure main description		@1800rpm
Application & simbol		Power Generation
Engine identication main		F34
Engine identication rating		54
Engine features		G-Drive
Emission feature		Tier4 final

Main characteristics		@1800rpm
Emission certification		Tier4 final
Commercial code (for order)		F34SNDZW055.A001
Technical code (Pregnana productions, if needed)		-
Technical code (original plant engine code, on engine block)		-
Stand-by power (gross) [mech]	kW	54
Specific power	kW/l	15.9
BMEP	bar	n/a
Oil consumption on mission (average)	% fuel consumption	0.25
Cycle		Diesel 4 stroke
Air charging system pattern		Turbocharged
Number of cylinder		4
Configuration (cyliinder arrangement)		in line
Bore	mm	99
Stroke	mm	110
Displacement	l	3.4
Unit Displacement	l	0.85
Valves per cylinder		2
Cooling system pattern		liquid
Direction of rotation (looking flywheel)		anti-clockwise
Compression ratio		16.5:1
Firing order		n/a
Injection type		Direct - Electronic Common Rail
Be10	h	(8000)
Cylinder Head		
Single / Multiple		Single
Material		cast Iron
Head air circulation		n/a
Camshaft		
Layout		n/a
Valve train		n/a
Drivetrain (timing system)		n/a
Valve actuation		n/a
Variable valve actuation system		no
Cylinder block (crankcase)		non structural
Material of cylinder block		grey cast Iron
Type of liners		block liners
Crankcase Ventilation		yes
Oil separator		n/a
Crankshaft & counterweights		
Material		forged Steel
Acceptable Inertia (clutch)	kgm^2	n/a
Balancing		n/a

(continue...)

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FPT POWERTRAIN TECHNOLOGIES

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Main characteristics	See Figure 1 and Figure 2	@1800rpm
Turbocharger & EGR system		
Turbocharger type		fix geometry / wastegate
Exhaust flap		
Exhaust flap supplier		-
Actuation type		-
Exhaust flap cooling		-
Switchability (1500-1800rpm)	yes/no	no
Emission level 1800 rpm		Tier4 final
References values		
Engine dimension LxWxH (indicative values)	mm	570x295x490
Max permissible engine inclination	deg	30 all direction
Engine Weight - Dry (no fluids, value purely indicative)	kg	253
Engine Weight - Wet (with fluids, value purely indicative)	kg	282
G-Drive Weight - Dry (no fluids, value purely indicative)	kg	470

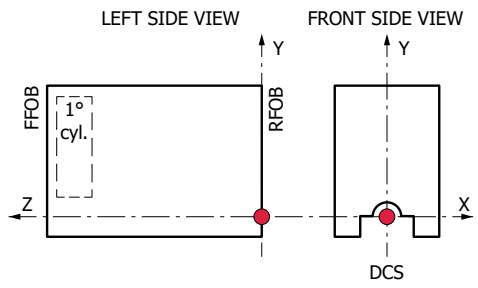

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Figure 1.

Center of gravity (FFOB or RFOB according to picture, standard engine layout)	X	mm	-8.2
	Y	mm	171.5
	Z	mm	-243.1
Principal moment of inertia (reference on center of gravity)	I_1	kgm^2	$3.89^{e}+07$
	I_2	kgm^2	$1.31^{e}+08$
	I_3	kgm^2	$1.57^{e}+08$
Principal moment of inertia (reference matrix based on center of gravity)	$I_1x;I_1y;I_1z$	kgm^2	$1.167^{e}+08$; $2.981^{e}+07$; $-3.089^{e}+07$
	$I_2x;I_2y;I_2z$	kgm^2	$2.981^{e}+07$; $1.380^{e}+08$; $4.198^{e}+07$
	$I_3x;I_3y;I_3z$	kgm^2	$-3.089^{e}+07$; $4.198^{e}+07$; $9.998^{e}+07$

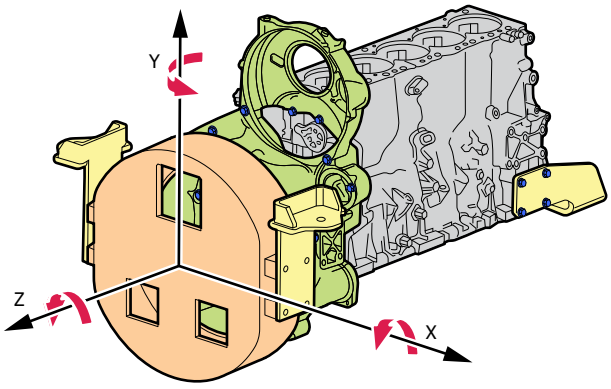

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Figure 2. ***Components***

COMPONENTS

Engine Block | Flywheel housing | Engine Supports | Bolts | Pump drive GearBox coupled with flywheel ousing

(continue...)

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Main characteristics		@1800rpm
Environmental operating conditions		
Max altitude for declared performances	m	1500
Max ambient temperaturefor declared performances	°C	40
Min guaranteed temperature for cold start w/o any aid (stand alone engine)	°C	-15
Min guaranteed temperature for cold start with grid heater (stand alone engine)	°C	-25
Min guaranteed temperature for cold start with grid heater and block heater (stand alone engine)	°C	-32
Time preheating for manifold heater	s	@ - 3°C : 0 ; -30°C : 21
Time post heating for manifold heater	s	@ - 3°C : 0 ; -20°C : 200
Low idle continuous operation time (recommended)	h	3

(*) Engine performance		@1800rpm
Continuous power (gross) [mech]	kW	39.4
Prime power (gross) [mech]	kW	49
Stand-by power (gross) [mech]	kW	54
Fan consumption [mech]	kW	2.2
Continuous power (net) [mech]	kW	37.2
Prime power (net) [mech]	kW	46.8
Stand-by power (net) [mech]	kW	51.8
Typical generator output	rend	0.91
Generator available power @ Prime power	kVA (kWe)	53 (39)
Generator available power @ Stand-by	kVA (kWe)	59 (43)
Power reduction due to ambient conditions		
Temperature above xx°C	%/5°C (xx°C)	2% (40)
Altitude > 1000 < 3000m	%/500m	3%
Altitude > 3000m	%/500m	6%

(*) Engine performance		@1800rpm
Power limitation due to safety protections		
Max water temperature (Switch on of the MIL lamp)	°C	104
Start derating: switch on of the warning coolant temperature lamp (amber color)	°C	106
Altitude level: gradual reduction of transient response by smoke map correction from	m	2000
Fuel temperature	°C	70
Intake manifold air temperature	°C	70
ATS Max gas inlet temperature	°C	550
Max allowed exhaust temperature	°C	-
Turbine overheating protection	°C	700
Oil temperature protection	°C	125
Oil pressure protection	bar	-

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Fuel System	See Figure 5		@1800rpm
Fuel density		kg/l	0.835
Injection system type			common rail
Injection model type			n/a
Injection model pump			Bosch CP4.1
Injection pressure		bar	n/a
Injector			Bosch CRI 2-16 OHW
Injector installation (sleeve, sealing flat or conical)			n/a
Injector nozzle			n/a
Engine fuel compatibility			see dedicated GOLD Book document on fluids
Feed pump			on engine
Max flow		l/h	195
Nominal feed pressure		bar	0.5-1
Fuel filter			cartridge
Delta pressure on fuel filter		bar	n/a
Max continuous allowable fuel temperature (without derating)	T_{1p}	°C	80
Max relative pressure at gear pump inlet	P_{1p}	bar	1
Min relative pressure at gear pump inlet	P_{1p}	bar	0.5
Max back flow relative pressure	P_{rl}	bar	1.2
Max back flow restriction		bar	1.2
Max heat rejection to return fuel		kW	n/a
Max fuel flow		kg/h	n/a
Min fuel tank venting requirement		m^3/h	n/a
Prefilter / Water separator micron size		µm	< 100

Air Intake System	See Figure 4		@1800rpm
Aftercooling type			air to air
RoA (Temperature raise between ambient and inlet to engine)	$T_7 - T_1$	°C	≤ 25
Filter air intake temperature (warm air ricirculatuion)	$T_2 - T_1$	°C	≤ 5
Max intake manifold temperature	T_7	°C	50
Compressor inlet pressure (with new air filter)	P_3	bar	≥ - 0.05
Compressor inlet pressure (with dirty air filter)	P_3	bar	≥ - 0.065
Air filter type			n/a
Loads on turbocharger on compressor intake		kg	0
Loads on turbocharger on compressor outlet		kg	0
Charge air flow (max)		kg/h	n/a

Exhaust System	See Figure 4		@1800rpm
Max back pressure (after exhaust flap) @ rated power with clean system	P_{10}	bar	0.05
Max mechanical load on turbine flange		kg	Approved after vehicle check
Max exhaust temperature After Treatment System		°C	500
Max exhaust flow rate		kg/h	700

After Treatment System	See Figure 3		@1800rpm
After Treatment System		l	DOC+PM CAT
POC			n/a

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Lubrication System		@1800rpm
Oil sump capacity	l	n/a
Max	l	8
Min	l	6
Oil system capacity including filter	l	n/a
Oil pump type		n/a
Oil pump drive arrangement		n/a
Min oil pump flow	l/min	n/a
Max oil pump flow (@rated speed)	l/min	n/a
Min oil pressure @ low idle (engine oil temp at 120°C)	kPa (bar)	n/a
Min oil pressure @ rated speed (engine oil temp at 120°C)	kPa (bar)	n/a
Max oil pressure @ rated speed (engine oil temp at 120°C)	kPa (bar)	n/a
Max oil temperature @ full load (in main gallery)	°C	n/a
Max oil pressure peak on cold engine	bar	n/a
Oil cooler type		n/a
Transducer for indicating oil temperature and pressure		n/a
Max engine angularity - longitudinal / transversal (std oil pan)	0/360°	n/a
Allowed engine gradability during installation on vehicle	0/360°	n/a
Oil servicing intervals	h	see dedicated GOLD Book document on fluids
Oil filter type		cartridge
Oil filter capacity	l	n/a
Max oil content admitted in blow by gas (after filter)	g/h	n/a
Approved engine oil specifications		see dedicated GOLD Book document on fluids
Oil for cold condition mission (T° ambient < -25°C)		see dedicated GOLD Book document on fluids

Cooling system	See Figure 6		@1800rpm
Type (water to water or air to water)			liquid
Recommended coolant			see dedicated GOLD Book document on fluids
Min radiator cap pressure		kPa (bar)	0.7
Warning setting first threshold		°C	102
Max additional restriction		Pa	n/a
Air to boil (prime power, open genset configuration)		°C	-
Air to boil (stand by, open genset configuration)		°C	53.9
Fan			
Diameter		mm	500
Number of blades			10
Drive ratio			1.3:1
Speed		rpm/1'	2340
Air flow		m^3/s	3.24
Radiator			
Core dimensions LxWxh		mm	584x226x770
Dry weight		kg	-
Radiator coolant capacity		l	-
Optimum coolant temperature range @engine out (50% glycol)		°C	83 ÷ 99
Water pump Type			centrifuge
Water pump drive			belt
Coolant capacity (engine only)		l	n/a
Coolant capacity (radiator & hoses)		l	-
Thermostat type			wax
Thermostat position			on cylinder head
Thermostat opening / fully open temperature		°C	80° ÷ 90°
Coolant engine pressure outlet – inlet (delta pressure, open thermostat, high idle conditions)	$P_9 - P_8$	bar	n/a
Coolant water pump inlet pressure (water temperature 60-100°C)	P_8	bar	1.45 ÷ 1.6
Coolant flow to radiator @rated speed		l/min	n/a
Max coolant flow to accessories @ rated speed from cab heater		l/min	n/a

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Electrical, Electronic and Control Systems		@1800rpm
System voltage	V	12V
Engine control unit		Bosch EDC17C49
ECU software		P1096 v606
ECU Vehicle connection		via body computer with CAN line
ECU operating range	°C	-30 / +95
Temperature of ECU case for <5' after power up	°C	n/a
ECU rated continuous temperature	°C	n/a
ECU communication protocol		SAE J1939
Min power supply for ECU operation	V	n/a
Max power supply for ECU operation	V	n/a
Battery wire connection resistance value @20°C (from battery to ECU)	mΩ	n/a
Min cranking speed TDC @-30°C	rpm	n/a
Average cranking speed	rpm	n/a
N° tooth pinion/crown gear		n/a
Min battery voltage	V	n/a
Mean battery voltage	V	n/a
Min battery current	Ah	n/a
Mean battery current	Ah	n/a
Max starting circuit resistance (to starter)	mΩ	n/a

Cold starting		@1800rpm
Without air preheating	°C	-15
With air preheating	°C	-25

Emission gaseus and particles		@1800rpm
NO_x	g/kWh	0.4
HC	g/kWh	0.19
NO_x+HC	g/kWh	0.59
CO	g/kWh	5
PT	g/kWh	0.02

Maintenance		@1800rpm
Oil drain interval	h	see dedicated GOLD Book document on fluids
Oil filter change	h	see dedicated GOLD Book document on fluids
Oil refilling time	h	daily check to evaluate oil refill necessity
CCV filter change	h (y)	n/a
Fuel filter change	h	see dedicated GOLD Book document on fluids
Fuel pre-filter change	h	see dedicated GOLD Book document on fluids
Belt replacement	h	n/a
Valve lash check /adjustment	h	n/a
AdBlue filter Change	h	n/a
DPF filter service	h	-
Coolant change	h	see dedicated GOLD Book document on fluids

(**) Engine Noise		@1800rpm
Overall sound pressure (engine only)	dBA	n/a
Overall sound pressure (with accessories only)	dBA	n/a
Exahust noise (w/o Muffler)	dBA	n/a
Noise spectrum (octave analysis performed at the position of maximum noise) - diagram	Table dB-Hz	n/a

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(***) Step Load		@1800rpm
G1 (% of PrP)	%	100
G2 (% of PrP)	%	100
G3 (% of PrP)	%	105
Removal load (G1)	%	-
Removal load (G2)	%	-
Removal load (G3)	%	-

(*) Maximum Rating Performance Data		@1800rpm
Torque	Nm	318
Ambient Temperature	°C	25
Fuel Flow	g/s	-
Fuel consumption (BSFC) (prime power)	(kg/h) [g/kWh]	(13.4) [228]
Fuel consumption (BSFC) (stand-by)	(kg/h) [g/kWh]	(14.7) [227]
Fuel consumption (BSFC) (80% prime power)	(kg/h) [g/kWh]	(10.8) [231]
Fuel consumption (BSFC) (50% prime power)	(kg/h) [g/kWh]	(7.1) [241]
Fuel consumption (BSFC) (25% prime power)	(kg/h) [g/kWh]	(4.3) [292]
Exhaust Gas Flow	kg/h	-

Design air handling system data	See Figure 4		@1800rpm
Max Exhaust Gas Temp (after TC)	T_{10}	°C	-
Max admitted back pressure after SCR		kPa	-
Radiator Coolant Flow (5% less if continuous deareating system, coolant according to FPT norms)		l/min	-

(*) Value measured (tolerance ±3%) at flywheel according to one of more of the norms: ISO 3046/1, dir. 97/68 EC (w/o fan), DIN 6271, BS 5514, SAE J1349. Test conditions: 50 hours of run-in, fuel EN 590, turbo air inlet temperature 25°C, atmospheric pressure 100kPa, humidity 30% and other engine conditions in accordance to FPT Datasheets and Installation Guidelines.

(**) The figures for total noise levels are measured in Prime Power rating in a absorber environment condition and measured at a distance of one metre from the periphery of the engine.

(***) The impact load values comply with requirements of Classification 3 & 4 of ISO 8528-12 and G2 operating limits stated in ISO 8528-5 (% of Prime Power). All tests were conducted using an engine installed and serviced to FPT recommendations, standard ambient condition. Generator powers are typical and are based on an average alternator efficiency and a power factor (cos. Θ) of 0.8 and are for guidance only.
kWe = kWm x gen. eff.
kVA = kWe / 0.8

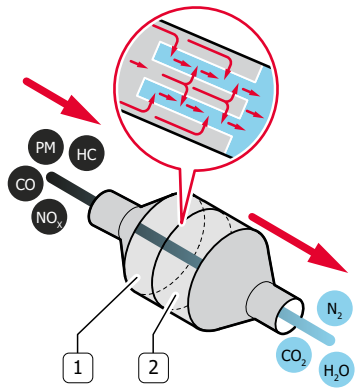

Figure 3. ***PM CAT*** 240036

1. DOC
2. PM CAT

PM Particulate matter
HC Unburnt Hydrocarbons
NO_x Nitrogen oxides
CO Carbon monoxide
N_2 Nitrogen
CO_2 Carbon dioxide
H_2O Water

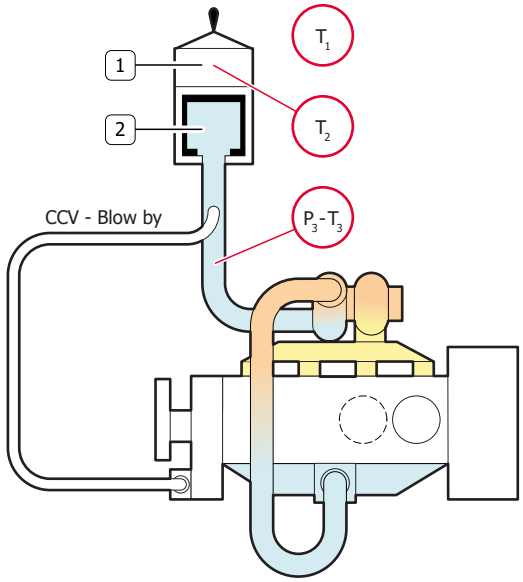

Figure 4. ***Generic Air Intake System layout*** 239959

1. Water separation
2. Air filter

Air temperature
T_1 Ambient
T_2 Filter air intake
T_3 After air filter

Air Pressure
P_1 Ambient
P_3 After air filter

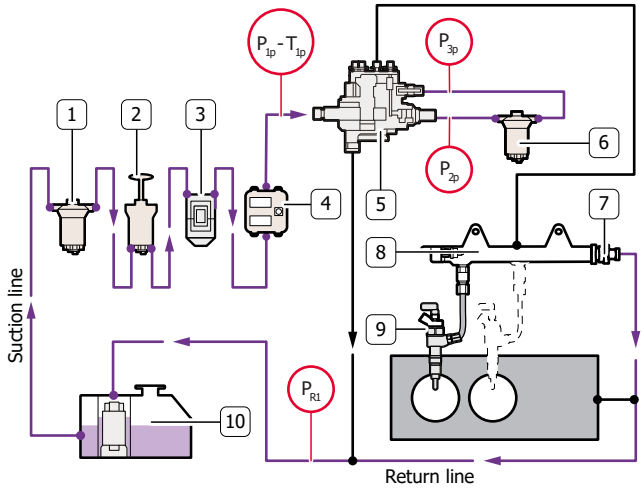

Figure 5. ***General fuel system scheme*** 270503

1. Inspection glass
2. Pre-filter
3. Prime pump
4. ECU/EDC
5. High pressure pump
6. Fuel filter
7. High pressure pump
8. Common rail
9. Injectors (as prescribed)
10. Fuel tank

Fuel temperature
T_{1p} Gear pump inlet
T_{2p} Fuel temp. before filter
T_{3p} Fuel temp. afer filter
T_{R1} Back flow

Fuel Pressure
P_{1p} Gear pump inlet
P_{2p} Fuel pressure before filter
P_{3p} Fuel pressure afer filter
P_{R1} Back flow

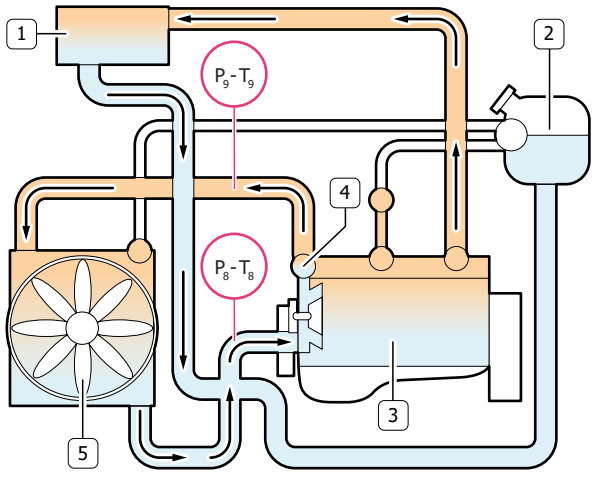

Figure 6. ***Cooling system with expansion tank (blue outline indicates rubber hoses)*** 270502

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

Cooling temperature
T_8 Water pump inlet
T_9 After thermostat

Cooling Pressure
P_8 Water pump inlet
P_9 After thermostat

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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
iEGR	Internal EGR

Acronyms	Description
ISC	Interstage Cooling
IPU	Industrial Power Unit
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	SCRon filter
SOHC	Single Over Head Camshaft
STD	Standard
TC	Turbocharged
TCA	Turbocharged, Charge Air Cooled
THM	Thermal Management
TWC	Three-Way Catalyst
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
1.0	First document release	Oct 2019