

STAGE V



Brochure main description		@1500rpm	@1800rpm
Application & simbol		Power G	
Engine identication main		F	36
Engine identication rating	kW	94	105
Engine features		PG G	-Drive
Emission feature	Tier4B_StageV		
			•
Main characteristics		@1500rpm	@1800rpm
Emission certification		Tier4B_	StageV
Commercial code (for order)		F36ETV	P03.A94
Other Commercial code		F5MG	L415A
Technical code (original plant engine code, on engine block)		F5MGL41	15A*V001
Technical homologation code		F5MGL	415A*V
Stand-by power (gross) [mech]	kW	94	105
Specific power	kW/I	26,2	29,2
Electric commercial power (estimation alternator power output)	kWe [kVA]	80 [100] (generator eff. 0,92)	92 [115] (generator eff. 0,92)
BMEP	bar	26,1	19,5
Oil consumption on mission (average)	% fuel comsumption	0.25	
Cycle	diesel 4 stroke		
Air charging system pattern		Turbocharge	d aftercooled
Number of cylinder		4	1
Configuration (cylinder arrangement)		in l	ine
Bore	mm	1()2
Stroke	mm	1′	10
Stroke / Bore		1,	07
Displacement		3	.6
Unit Displacement		0,9	90
Bore pitch	mm	1'	10
Valves per cylinder		4	1
Cooling system type		liq	uid
Direction of rotation (looking flywheel)		anti-clo	ckwise
Compression ratio		18,5	5:1
Firing order		1 - 3 -	- 4 - 2
Injection type		direct - electror	ic common rail
Engine brake configuration			
Be10		800	10 h
Cylinder Head			
Single / Multiple		sin	gle
Material		cast	iron
Head air circulation		revers	e-flow
Intake valve dia.	mm	32	.,5
Exhaust valve dia.	mm 32,5		
Camshaft			
Layout		Oł	ΗV
Cam carrier		on cylind	ler block
Material and Heat treatment			55 hrc on cammes
Valve train		OHV valve train with valve p	





gear tappet tappet & push rod no No Structural cast iron parent metall cylinder block no machined cast iron closed centrifugal GH 90-52-05 AS 15-2218 0,8 no fixed geometry with wastegate valve BorgWarner WG pneumatic control 2600 740 cont. / 760 peak
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WG pneumatic control 2600 740 cont. / 760 peak
2600 740 cont. / 760 peak
740 cont. / 760 peak
oil lubricated
wastegate and ECU derating
yes
external cooled EGR
-
Ø 21
water cooler
from engine ECU
no
-
-
-
StageV
Tier4B
-
-
-
-
-
-
-
783 x 689 x 846





Main characteristics		@1500rpm	@1800rpm
G-Drive Dimension LxWxH (indicative values)	mm	1111x689x1050	
Max permissible engine inclination	deg	35	
Engine Weight - Dry (no fluids, value purely indicative)	kg	330	
Engine Weight - Wet (with fluids, value purely indicative)	kg	365	
G-Drive Weight - Dry (no fluids, value purely indicative)	kg	450	
G-Drive Weight - Wet (with fluids, value purely indicative)	kg	470	
Center of gravity (FFOB or RFOB according to picture, standard engine layout)	mm	x = - 8 ; y = 14	0 ; z = 190
Principal moment of inertia (reference on center of gravity ,standard engine layout)	kgm ²	l1 = 14 kgm²; l2 = 23 k	gm²; I3 = 27 kgm²
Principal moment of inertia (reference matrix based on center of gravity,standard engine layout)	kgm ²		
Center of gravity (FFOB or RFOB according to picture, standard IPU/G-Drive layout)	mm	x = 6 ; y = 168	; z = - 281
Principal moment of inertia (reference on center of gravity ,standard IPU/G-Drive layout)	kgm²	l1 = 21 kgm²; l2 = 3	2 kgm²; I3 = 40
Principal moment of inertia (reference matrix based on center of gravity,standard IPU/G-Drive layout)	kgm ²		
Mass moment of inertia - rotating components (excluding flywheel)	kgm ²		
Mass moment of inertia - standard flywheel	kgm ²	1,189)
Bending moment on the flywheel housing	Nm		
Flywheel housing SAE sizing			
Flywheel SAE sizing			
Bending moment on PTO	Nm	-	
Max static mounting surface load	Ν	N/A	
Crankshaft thrust bearing pressure limit			
Intermittent load:	MPa	N/A	
Continuous load:	MPa	N/A	
Rear main bearing load	MPa	N/A	
Max bending moment available from front of the crankshaft:			
0 deg	Nm	100	
90 deg	Nm	300	
180 deg	Nm	300	
Environmental operating conditions			
Max altitude for declared performances	m	1000	
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	-	
Min guaranteed temperature for cold start with grid heater and block heater (stand alone engine)	°C	- 32	
Time preheating for manifold heater	S	-	
Time post heating for manifold heater	S	-	
Low idle continuous operation time (reccomended)	h	N/A	
Engine performance (Prime power and standby power defined according to ISO normative 8528-1)			
Continuous power (gross) [mech]	kW	75,2	84
Prime power (gross) [mech]	kW	94 105	
Stand-by power (gross) [mech]	kW	94	105





Main characteristics		@1500rpm	@1800rpm
Fan consumption [mech]	kW	3,36	5,8
Continuous power (net) [mech]	kW	72,4	79,3
Prime power (net) [mech]	kW	90.6	99.2
Stand-by power (net) [mech]	kW	90.6	99.2
Typical generator output		92%	92%
Generator available power @ Prime power	kW	83,4 (generator eff. 0,92)	91,3 (generator eff. 0,92)
Generator available power @ Stand by	kW	83,4 (generator eff. 0,92)	91,3 (generator eff. 0,92)
Power limitation according to ambient conditions			(generater em e,e_)
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			-
Max water temperature (Switch on of the MIL lamp)	°C	104	
Start derating: switch on of the warning coolant	°C	106	
temperature lamp (amber color)	C		0
Max derating (50% derating) switch on of the high coolant temperature lamp (redcolor)	°C	1'	10
Altitude level: gradual reduction of transient response by smoke map correction from	m	20	00
Fuel temperature	°C	7	0
Intake manifold air temperature	°C	7	0
ATS Max gas inlet temperature	°C	60	00
Max allowed exhaust temperature	°C	740*C (7	60 peak)
Turbine overheating protection	°C	N	/A
Turbine overspeed protection	rpm	Ν	/A
Oil temperature protection	C°	12	25
Oil pressure protection (min engine rpm)	bar		

Fuel System	ka/l	0.94
Fuel density	kg/l	0,84
Injection system type		electronic common rail
Injection pump manufacturer		BOSCH
Injection model type		common rail
Injection model pump		CP4N1
Injection pressure	bar	1600
Injector		CRI 2-160HW
Injector installation (sleeve, sealing flat or conical)		sealing flat
Injector nozzle		8 x 350
Engine fuel compatibility		See dedicated GOLD Book document on fluids
Feed pump on engine		integrated in high pressure pump
Max fuel flow supply line	l/h	
Nominal feed pressure	bar	1
Fuel filter		single Cartridge on left side
Fuel filter clogging sensor		no
Max continuous allowable fuel temperature (without derating)	°C	70
Max relative pressure at gear pump inlet	bar	N/A
Min relative pressure at gear pump inlet	bar	N/A
Max back flow relative pressure	bar	
Max back flow restriction	bar	
Max heat rejection to return fuel	kW	





POWERTRAIN TECHNOLOGIES

Fuel System kg/h Max fuel flow return line kg/h Min fuel tank venting requirement m²h Prefilter / Water separator micron size µm Air Intako System µm Aftercooling system type			
Min fuel tank venting requirement m³/h Prefilter / Water separator micron size µm Air Intake System Aftercooling system type Interstage cooling type RoA (Temperature raise between ambient and inlet to engine °C Filter air intake temperature (warm air ricirculatuion) °C °C Compressor inlet pressure (with new air filter) hPa Compressor inlet pressure (with new air filter) hPa Loads on turbocharger on compressor ontake kg kg Charge air flow (max) kg/h Exhaust System Max machanical load on turbine flange kg Max machanical load on turbine flange kg Max machanical load on turbine flange kg/h KW After Treatment System °C Max exhaust flow rate kg/h KW After Treatment System °C DPF DOC SCR Urea Dosing System AdBlue mixer ATS sensors DPF DOC SCR Ureation System DPF regeneration strategy I Oil sump capacity, max level I Oil sump capacity, max level I Oil sump capacity, min level I Oil pump type Oil pump tope I	@1500: 20,1 kg/h @	1800: 22 kg/h	
Prefilter / Water separator micron size μm Air Intake System Aftercooling system type Interstage cooling type RoA (Temperature raise between ambient and inlet to engine *C Rilter air intake temperature (warm air ricirculatuion) *C *C Max intake manifold temperature *C Compressor inlet pressure (with new air filter) hPa Compressor inlet pressure (with dirty air filter) hPa Air filter type Loads on turbocharger on compressor intake kg Loads on turbocharger on compressor outlet kg Kg Kg/h Exhaust System Max back pressure (after exhaust flap) @ rated power with clean system hPa Max mechanical load on turbine flange kg Kg/h Max machanical load on turbine flange kg/h Kg/h Energy to exhaust kW After Treatment System *C POC DPF DOC DPF DOC SCR Urea Dosing System AdBlue mixer ATS sensors DPF regeneration strategy I Oil sump capacity, min level 1 Oil sump capacity, min level 1 Oil sump capacity, min level 1 Oil pump drive arangement		0	
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Oil pump type Oil pump drive arrangement Min oil pump flow I/min	9		
Oil pump drive arrangement Min oil pump flow I/min	gear pum		
Min oil pump flow I/min	driven by ge		
	70		
Min oil pressure @ low idle (engine oil temp at 120°C) kPa (bar)			
Min oil pressure @ rated speed (engine oil temp at 120 C) kl a (bar) Min oil pressure @ rated speed (engine oil temp at 120 C) kPa (bar)			





Lubrication System		
Max oil pressure @ rated speed (engine oil temp at 120°C)	kPa (bar)	
Max oil temperature @ full load (in main gallery)	°C	125
Max oil pressure peak on cold engine	bar	
Oil cooler type		water cooler
Transducer for indicating oil temperature and pressure		signal from ECU
Max engine angularity - longitudinal / transversal (std oil pan)	deg	35
Allowed engine gradability during installation on vehicle	deg	± 4
Oil servicing intervals	h	600
Oil filter type		spin-on cartridge
Oil filter capacity		0,5
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		50% water and 50% coolant	(depending on mission)
Min radiator cap pressure	kPa	100	
Warnnig setting first threshold	°C	106	
Max additional restriction (cooling system)	Pa	N/A	
Air to boil (prime power, open genset configuration). For further information see GB document	°C	55°C @1500rpm ; 53°C @1800rpm	
Air flow (prime power, open genset configuration)	m³/s		
Air to boil (stand by, open genset configuration). For further information see GB document	°C	N/A	
Air flow (stand by, open genset configuration)	m³/s		
EGR Cooler water flow (for $\Delta T=6^{\circ}C$)	l/s	N/A	
LP-CAC water flow (for $\Delta T=6^{\circ}C$)	l/s	N/A	
Fan			
Diameter	mm	550	
Number of blades		10	
Drive ratio		1,3	
Speed		@1500rpm:1950rpm ; @1800rpm:2340rpm	
Air flow		@1500rpm: 2,5 m3/s ; @1800rpm: 3 m3/s	
Power consumption		@1500rpm:3,36kW ; @1800rpm: 5,8kW	
Radiator			
Core dimensions LxWxh	mm	625 x 267,5	5 x 840
Dry weight	kg	44,5	
Radiator coolant capacity	I	5,5	
Optimum coolant temperature range @engine out (50% glycol)	°C		
Engine Water pump Type		centrifugal	pump
Engine water pump drive		driven by	belt
Coolant capacity (engine only)		5	
Coolant capacity (radiator & hoses)		7	
Thermostat type		wax ty	De
Thermostat position		on cylinder	head
Thermostat opening / fully open temperature	°C	79 ± 2 / 9	4 ± 2
Recommended coolant circuit pressurization range (relative)	hPa		



F36ETVP03.A94





Cooling system		@1500rpm	@1800rpm	
Coolant engine pressure outlet – inlet (delta pressure, open thermostat, high idle conditions)	hPa	@1500rpm:132,8 hPa ; @1800rpm:182,4		
Coolant engine pressure outlet – inlet (only with remote thermostat, ex. retarder)	hPa	-		
Min coolant pressure (no pressure cap and thermostat closed)	hPa	-		
Coolant water pump inlet pressure (water temperature 60-100°C)	hPa			
Coolant flow to radiator @rated speed	l/h	N/.	A	
Min coolant expansion space (% total cooling system capacity)	%	N/	A	
Max coolant flow to accessories @ rated speed from cab heater	l/min	N/	A	
Engine out coolant to ambient @rated speed	delta °C	61	,6	
Engine out coolant to ambient @torque speed	delta °C	N/.	A	
Charge air cooler outlet to ambient @max rpm - CAC dT	delta °C	N/	A	
Pump water flow	l/min	105	134	
Electrical Electronic and Control Systems				
Electrical, Electronic and Control Systems System voltage	V	12	>	
Engine control unit	v	MD1C		
Engine control unit ECU software		P1738 MD1C		
ECU Vehicle connection		with CA		
ECU operating range	°C	- 40 ÷		
Temperature of ECU case for <5' after power up	0°	85	-	
ECU rated continuous temperature	0			
ECU communication protocol	C	80 SAE J1939		
Min power supply for ECU operation	V	SAE J 1939 10		
Max power supply for ECU operation	V	10		
Battery wire connection resistance value @20°C (from	 mΩ	16 ≤ 70		
battery to ECU)	11122		-	
Diagnostic connector type		ISO 1		
Min cranking speed TDC @-30°C	rpm	70		
Average cranking speed	rpm	11	-	
N° tooth pinion/crown gear		10 /	126	
Min battery voltage	V			
Mean battery voltage	V			
Min battery current	Ah	TB		
Mean battery current	Ah	10		
Max starting circuit resistance (to starter)	mΩ	<7	0	
Cold starting				
Without air preheating	°C	- 15		
With air preheating (if available)	°C			
Emission assous and particulates				
Emission gaseus and particulales NOx (Oxides of nitrogen) [NRSC]	g/kWh	coo homologoi	ion cortificato	
HC (Hydrocarbons) [NRSC]		see homologat		
NOX+HC [NRSC]	g/kWh g/kWh	see homologat see homologat		
CO (Carbon monoxide) [NRSC]	g/kWh	see homologat		
PM (Particlutes) [NRSC]	g/kWh	see homologation certificate		
CO2 (Carbon Dioxide) [NRSC]	g/kWh	see homologation certificate		









NOx (Oxides of nitrogen) [NRTC]	g/kWh	see homologation certificate		
HC (Hydrocarbons) [NRTC]	g/kWh	see homologation certificate		
NOX+HC [NRTC]	g/kWh	see homologation certificate		
CO (Carbon monoxide) [NRTC]	g/kWh	see homologation certificate		
PM (Particlutes) [NRTC]	g/kWh	see homologation certificate		
CO2 (Carbon Dioxide) [NRTC]	g/kWh	see homologation certificate		
Maintenance				
Oil drain interval		600h		
Oil filter change		600 h		
Oil refilling time		daily check to evaluate oil refill necessity		
Approved engine oil specifications				
CCV filter change		1800 h		
Fuel filter change		600 h		
Fuel pre-filter change		600 h		
Belt replacement		3000 h		
Valve lash check /adjustment		for life		
AdBlue filter Change		see dedicated GOLD Book document on fluids		
DPF filter service		600 h		
Coolant change		3000 h		
Engine Noise				
Overall sound pressure (engine only)	dBA	92,5		
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		
A-weight sound power level LW function of power (value calculated respecting standard ISO 3744 and 3746. For further information see GB document)				
0% (no load)	dBA			
75% (partial load)	dBA			
100% (full load)	dBA			
110% (overload)	dBA			
Step Load (for further information see GB				

Step Load (for further information see GB document)		@1500rpm	@1800rpm
G1 (% of PrP)	%	N/A	77
G2 (% of PrP)	%	61	66
G3 (% of PrP)	%	50	56
G1 (% of PrP) [open flap]	%	-	-
G2 (% of PrP)[open flap]	%	-	-
G3 (% of PrP)[open flap]	%	-	-
G1 (% of PrP) [closed flap]	%	-	-
G2 (% of PrP) [closed flap]	%	-	-
G3 (% of PrP) [closed flap]	%	-	-
Removal load (G1)	%	N/A	N/A
Removal load (G2)	%	N/A	N/A
Removal load (G3)	%	N/A	N/A
Emergency (xxx)	%	N/A	N/A
Emergency (xxx)	%	N/A	N/A



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STAGE V



Step Load (for further information see GB document)		@1500rpm	@1800rpm
Emergency (xxx)	%	N/A	N/A
Maximum Rating Performance Data		@1500rpm	@1800rpm
Torque	Nm	609	557
Ambient Temperature	°C	25	25
EGR Rate	%	<10	<10
Fuel Flow	g/s	5,6	6,1
Fuel consumption (BSFC) (prime power)	(kg/h) [g/kWh]	[210]	[210]
Fuel consumption (BSFC) (stand by)	(kg/h) [g/kWh]	[209]	[210]
Fuel consumption (BSFC) (80% prime power)	(kg/h) [g/kWh]	[205]	[204]
Fuel consumption (BSFC) (50% prime power)	(kg/h) [g/kWh]	[206]	[209]
Fuel consumption (BSFC) (25% prime power)	(kg/h) [g/kWh]	[234]	[243]
AdBlue consumption (prime power)	% of fuel cons	4,3	4,2
AdBlue consumption (stand by)	% of fuel cons	3,5	3,6
AdBlue consumption (80% prime power)	% of fuel cons	4,5	4,7
AdBlue consumption (50% prime power)	% of fuel cons	6,1	5
AdBlue consumption (25% prime power)	% of fuel cons	4	3
Exhaust Gas Flow	kg/h	401	446
	0		
Design air handling system data			
EGR flow	kg/h	58,5	55,7
EGR pressure	kPa	287	296,7
Boost pressure (compressor outlet)	kPa	278,5	265
Pressure drop on charge air cooling system	kPa	7,4	6,3
Max temperature after HP-Compressor	°C		
Boost temperature (includes EGR effect)	°C	170	161,2
ATS back pressure	kPa	117	121,3
Exhaust Gas Temp between HP-TC	°C		
Max Exhaust Gas Temp (after TC)	°C	507,6	517,6
Max admitted back pressure after SCR	kPa		
Max admitted back pressure after TC	kPa	117	121,3
Power engine coolant without EGR & CAC (prime power)	kW [kcal/kWh]		,.
Power engine coolant without EGR & CAC (stand by)	kW [kcal/kWh]		
Power high Temperature EGR Cooler (engine water) (prime power)	kW [kcal/kWh]		
Power high Temperature EGR Cooler (engine water) (stand by)	kW [kcal/kWh]		
Power to coolant due to EGR LP-Circuit (prime power)	kW [kcal/kWh]		
Power to coolant due to EGR LP-Circuit (stand by)	kW [kcal/kWh]		
Total Power to coolant (prime power)	kW [kcal/kWh]	56	58,5
Total Power to coolant (stand by)	kW [kcal/kWh]	56	58,5
Total pump water flow	l/s	1,75	2,06
Radiator Coolant Flow (5% less if continuous	l/min		
deareating system, coolant according to FPT norms)			
EGR Cooler water flow (for $\Delta T=6^{\circ}C$)	l/s		
LP-CAC water flow (for $\Delta T=6^{\circ}C$)	/s	10.4	40.0
Power in CAC (air to air) (prime power)	kW [kcal/kWh]	13,1	13,9
Power in CAC (air to air) (stand by power)	kW [kcal/kWh]	14,4	15,3
Power Radiated	kW	13	13,4













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



F36ETVP03.A94 STAGE V POWERTRAIN TECHNOLOGIES

ACRONYMS LIST

Acronyms	Description	Acronyms	Description
-	Not Needed	iEGR	Internal EGR
2stTC	Two Stage Turbo (sequential)	IPU	Industrial Power Unit
Ag	Agricultural	ISC	Interstage Cooling
ASC	Ammonia Slip Catalyst (same as CUC)	LD	Light Duty
ATS	After Treatment System	LDCV	Light Duty Commercial Vehicles
BSFC	Brake Specific Fuel Consumption	LH	Left Hand Side
CAC	Charge Air Cooler	LWR	Laser Welded Rail
CCDPF	Close Coupled DPF	MD	Medium Duty
CCV	Crankcase Ventilation	n/a	Not Available
CE	Construction Equipment	NA	Natural Aspirated
CI	Cast Iron	NS	Non Structural
CRS	Common Rail System	OHV	Over Head Valves
CRSN	Common Rail System NKW (Commercial vehicles)	ОРТ	Option
CUC	Clean Up Catalyst for ammonia (same as ASC)	РСР	Peak Cylinder Pressure
DAVNT	Dual Axis Variable Nozzle Turbine	ΡΤΟ	Power Take Off
DCS	Drawing Coordinate System	RFOB	Rear Face of Block
DI	Direct Injection	RH	Right Hand Side
DOC	Diesel Oxidation Catalyst	S	Structural
DOHC	Double Over Head Camshaft	SAPS	Sulphated Ash, Phosphorus, Sulphur
DPF	Diesel Particulate Filter	SCR	Selective Catalytic Reduction catalyst
ECEGR	External Cooled EGR	SCRoF	SCRon filter
ECU	Engine Control Unit	SOHC	Single Over Head Camshaft
EEGR	External EGR	STD	Standard
EGR	Exhaust Gas Recirculation	тс	Turbocharged
epWG	Electro pneumatic WG	ТСА	Turbocharged, Charge Air Cooled
eVGT	Electrical VGT	ТНМ	Thermal Management
eWG	Electrical WG	UFDPF	Under Floor DPF
FFOB	Front Face of Block	UQS	Urea Quality Sensor
FGT	Fixed Geometry Turbocharger (no WG)	VE	Bosch Distributor Mechanical Pump
FIE	Fuel Injection System	VFT	Variable Flow Turbine
HD	Heavy Duty	VGT	Variable Geometry Turbocharger
HLA	Hydraulic Lash Adjusters	WG	Waste Gate Turbocharger
IDI	Indirect Injection	XPI	Extra high Pressure Injection (Scan 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 1.6_Jul 2021		July/2021
Revision 2.0_May 2022		June/2022
Revision 2.1_Jul 2022		July/2022
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