

SPIRE

FARMOTION

MARKETING

INFORMATION

Treviglio, August 2014

Subject: New LAMBORGHINI SPIRE (80 – 100 HP) with FARMotion engine



FARMOTION



Spire

Designed to meet Tier4i emissions standards, the latest SPIRE models are equipped with the new **FARMotion engines**.

The following brief introduction indicates the main data, innovations and technical specifications of the new FARMotion series engines.



The FARMotion engine is designed specifically for use in agriculture, that is to say compact, reliable, and with minimal maintenance requirements.

The entire package is geared to deliver higher performance than ever, constant power and torque curves even at low crankshaft speeds, and low fuel consumption.

The concepts underlying this new series of engines are:

- Optimized downsizing of displacement
- High pressure common rail fuel injection, electronically controlled
- EGR - external exhaust gas recirculation system
- DOC (Diesel Oxidation Catalyst) catalytic converter
- Simple maintenance



- **Downsizing**

With unitary displacement slightly reduced from that of the 1000 series to 962 cm³, these engines still guarantee top performance, and with the added benefits of lower fuel consumption and noise levels.



- **Common rail**

Efficiency remains high whatever the conditions, courtesy of a **Common Rail fuel injection system** operating at an **injection pressure of 2000 bar**. This high pressure also helps to reduce emissions, as a result of the fuel being atomized more thoroughly and favouring better combustion.

- ✓ High pressure injection enables the engine to respond with greater immediacy to varying load conditions.
- ✓ The high pressure jet and the electronically controlled burst time combine to improve performance and reduce fuel consumption.

- **New injectors**

New injectors with **7 holes** (compared to 5 previously) for better atomization of fuel.

Each injection cycle includes **3 stages**:

- 1° PILOT: a pre-injection burst before the main burst. It is used to have a gradual increase in pressure in the combustion chamber and, consequently, to reduce the noise
- 2° MAIN: the main burst of fuel
- 3° POST: a third burst following the main burst. It is used to reduce particulate exhaust

All designed to give **more efficient combustion!**

- **Cylinders**

The thickness of the cylinder liners has been increased so as guarantee reduced vibration, greater resistance to cavitation, and less fatigue from mechanical and thermal stresses.

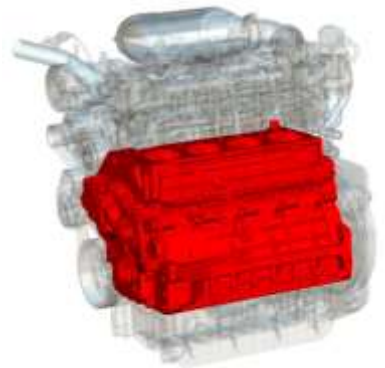


- **Crankshaft**

The crankshaft features a new design and is made of forged steel for increased strength.

- **Crankcase**

The crankcase is reinforced to withstand higher pressure in combustion chamber than engines of the 1000 series, and consequently deliver higher efficiency, performance, durability, reliability and strength.

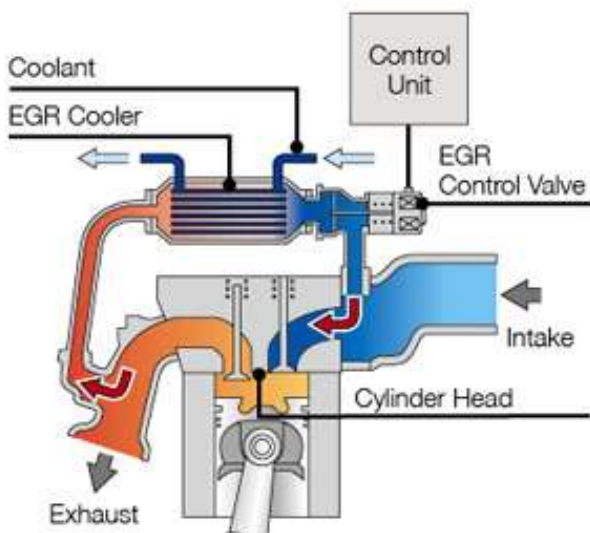


- **EGR**

Unlike the 1000 series, where exhaust gases are recirculated internally, the new **FARMotion** engines feature an **external cooled** EGR system by which NOx gases are reduced more effectively.

A small proportion of the exhaust gas is cooled and "recycled" in the inlet manifold, where it mixes with the intake air flow.

The system is monitored electronically by the engine ECU, which ensures that the amount of gas recirculated is always proportioned correctly to the engine load.



• DOC

The DOC (Diesel Oxidation Catalyst) device is a special catalytic converter that reacts by contact with the engine exhaust gases (consisting of particulates and NO_x) and renders them harmless.



The DOC catalytic converter **is not a filter** and consequently will neither create dangerous exhaust back-pressures nor clog. In effect, the component is guaranteed effective for the entire service life of the engine, requiring no maintenance or active regeneration procedures.

Benefits:

- ✓ Compact system
- ✓ No power absorbed
- ✓ No maintenance
- ✓ No active regeneration
- ✓ No use of AdBlue

Catalizzatore DOC

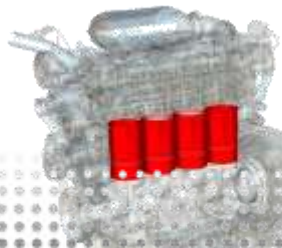
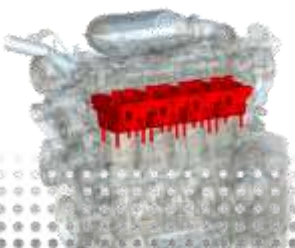


• Maintenance

The individual cylinder heads and removable liners guarantee optimum cooling and extremely simple maintenance.

Another feature of the new engines is the hydraulic lifters providing automatic valve adjustment, guaranteed to operate maintenance-free as long as the engine stays in service.

The timing belt is tensioned automatically and will stay at the correct tension with no attention required.



Modular engine concept

FARMotion Tier 4i - 3 and 4 cylinders

Improved engine oil cooler

New displacement

DOC

3 cylinder = 2,887 cc



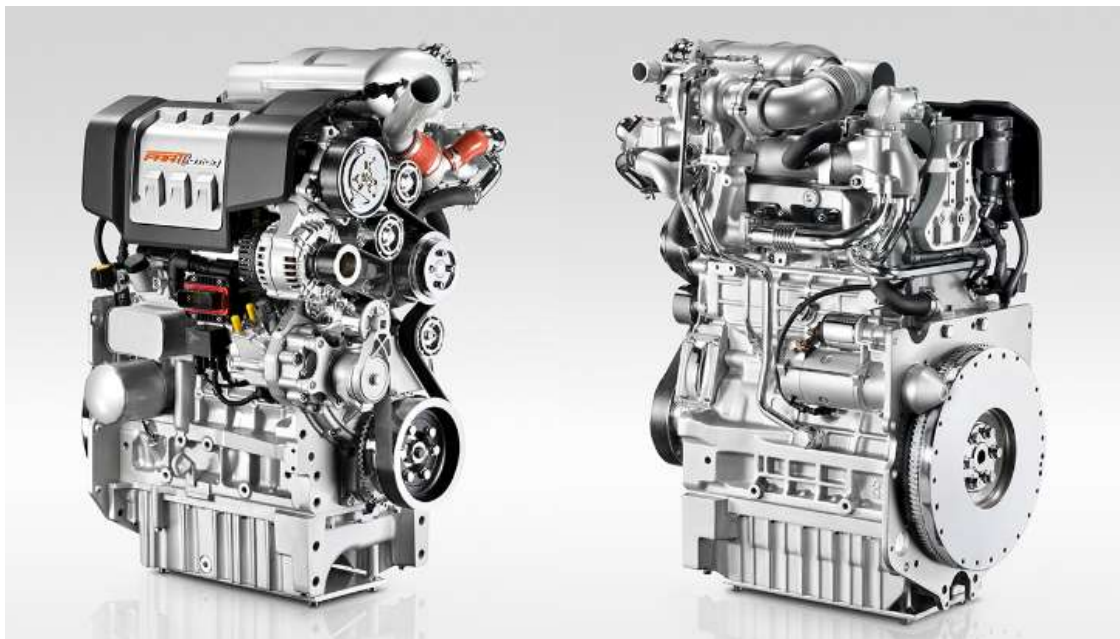
aftertreatment

4 cylinder = 3,849 cc

system

Hydraulic adjustment of valve clearance

Bosch Common Rail system rated 2000 bar



On the following pages, the performance of FARMotion engines is compared with that of engines in the 1000 series.

It will be seen that per unit of rated power, all power, torque and specific fuel consumption data reflect a superiority of FARMotion engines over engines of the 1000 series (even when comparing the 3-cylinder FARMotion unit with the 4-cylinder series 1000 4 engine – graph 2).

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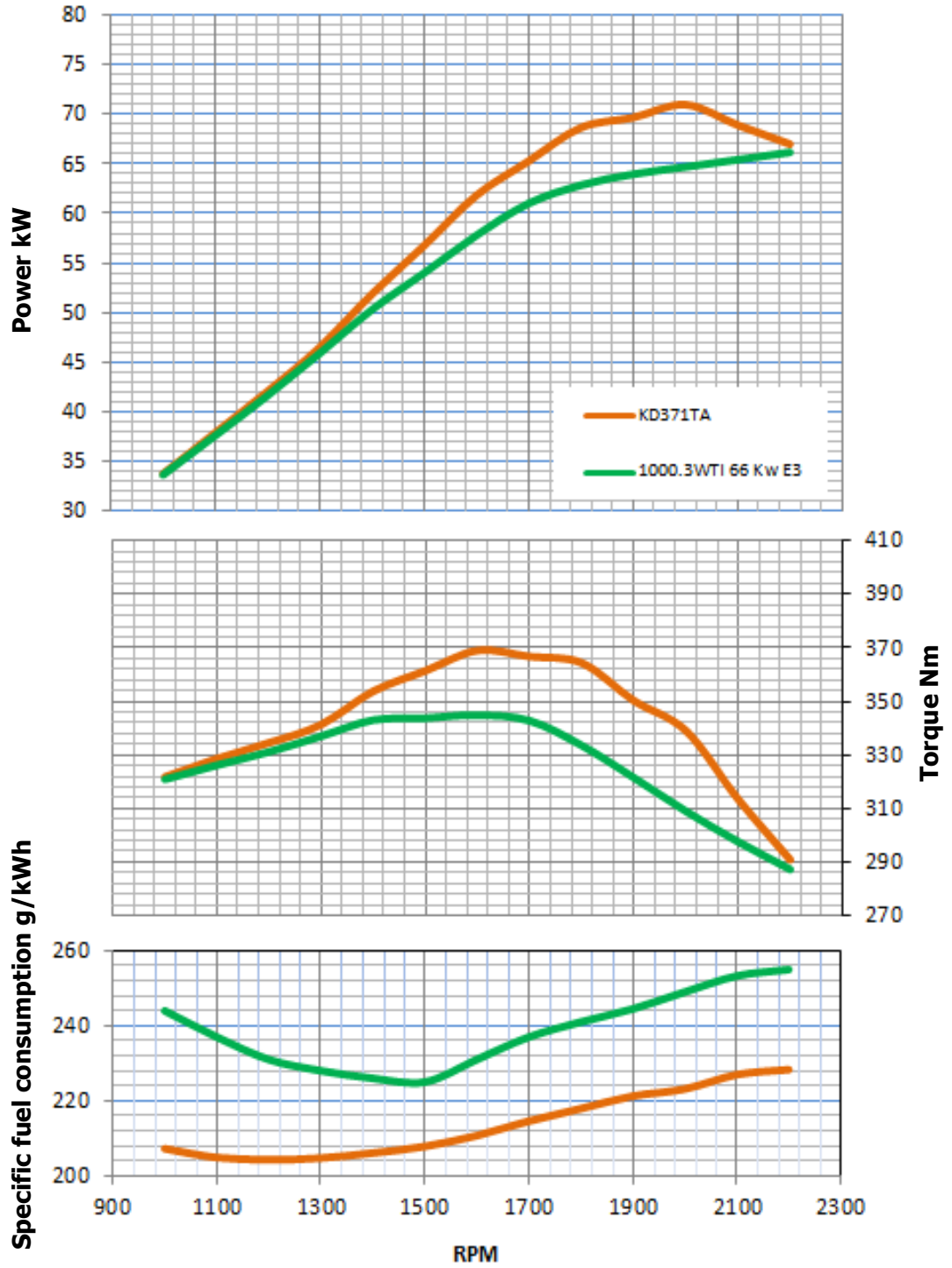
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Graph 1

3-cylinder FARMotion engine vs SDF 1000.3 series engine

Rated power 66 kW (90 HP)



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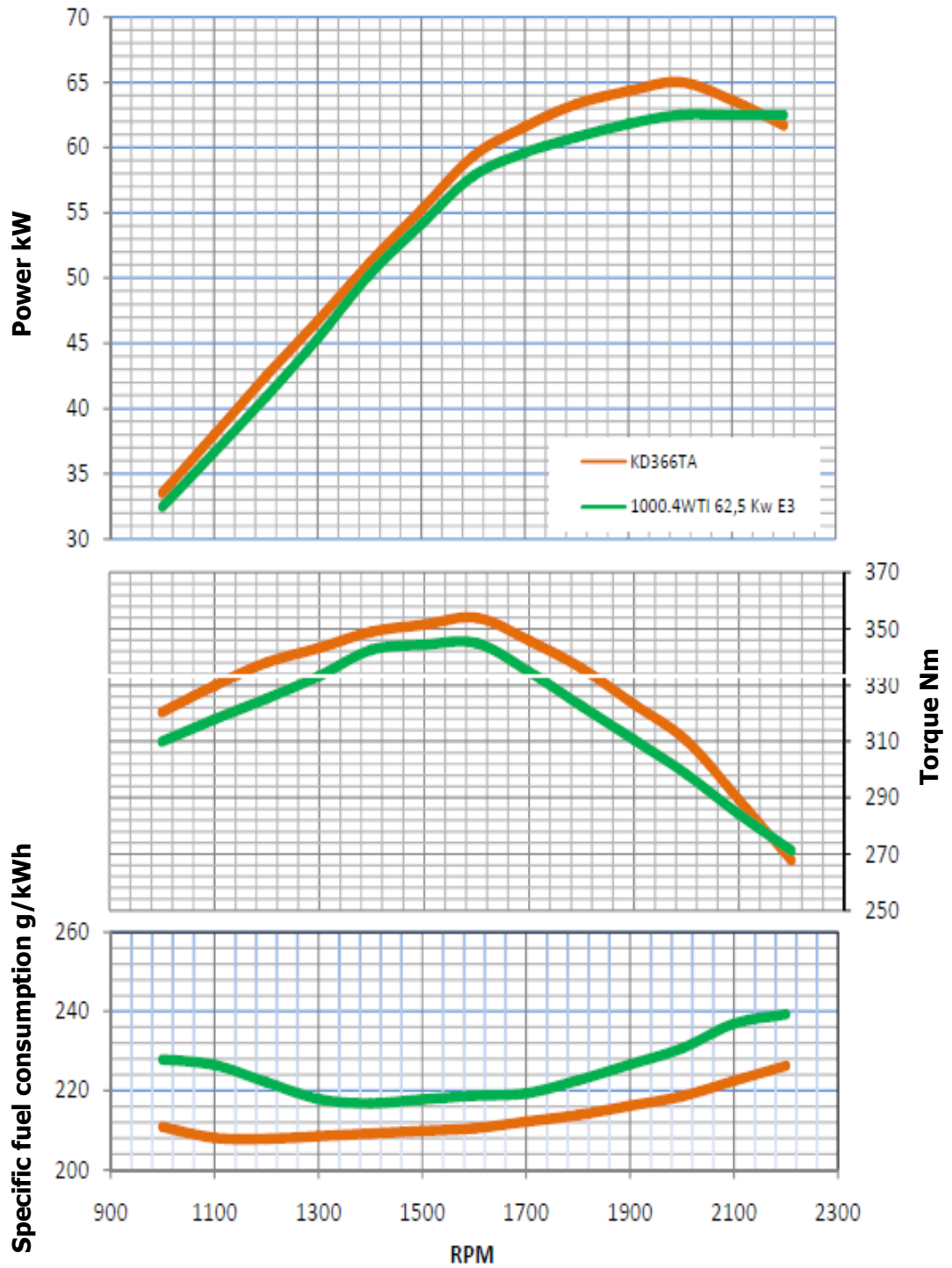
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Graph 2

3-cylinder FARMotion engine vs SDF 1000.4 series engine

Rated power 62.5 kW (86 HP)



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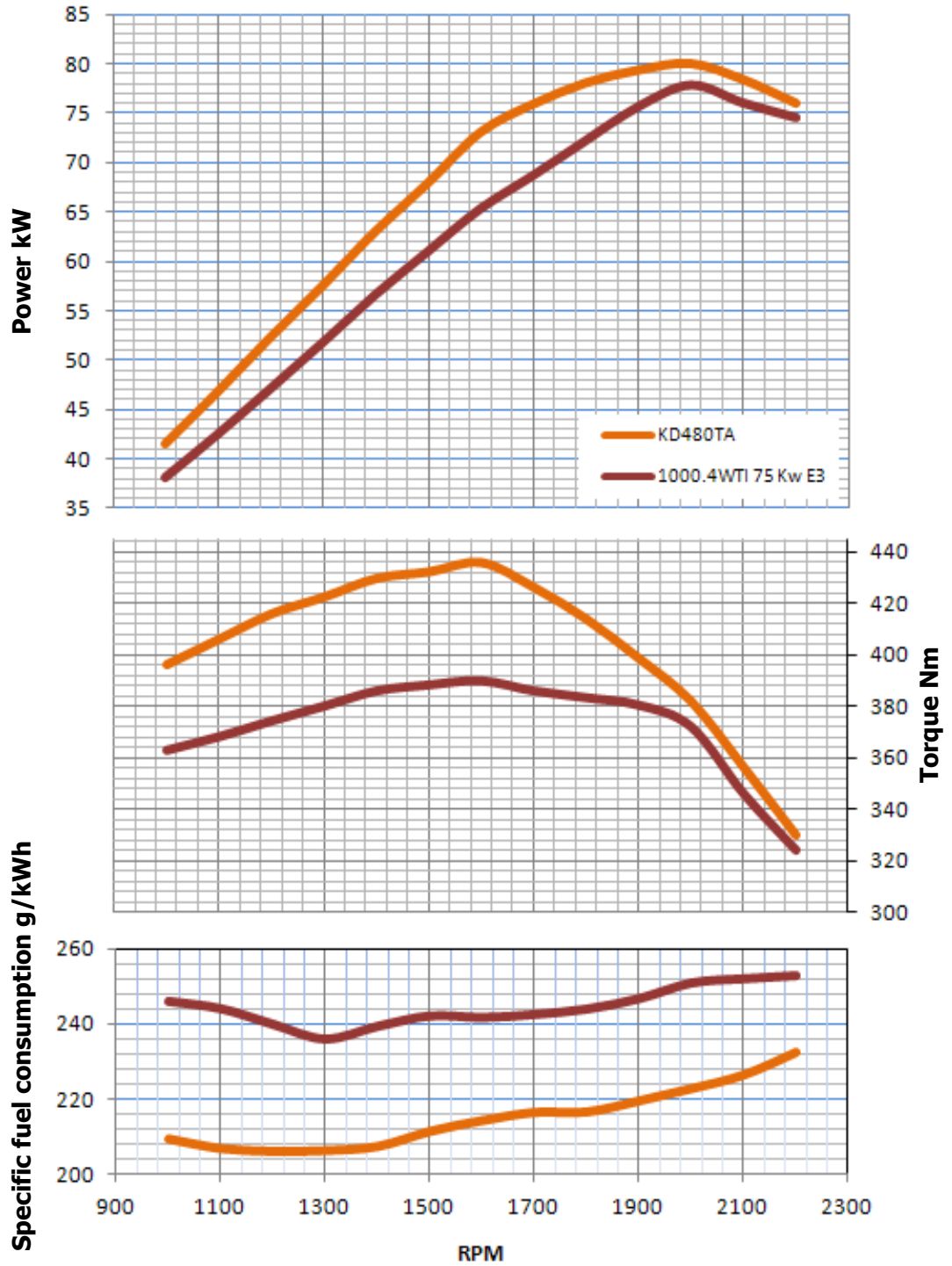
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Graph 3

4-cylinder FARMOTION engine vs SDF 1000.4 series engine

Rated power 75 kW (102 HP)



The new FARMotion engines have also been conceived and designed with a view to guaranteeing levels of vibration and noise distinctly lower than those of 1000 series engines.

The results achieved are truly impressive:

Comparison of 3-cylinder engines (FARMotion vs 1000 series)

- Vibrations generated by FARMotion engine 60% lower!
- Noise level: -4 dB(A)

Comparison of 4-cylinder engines (FARMotion vs 1000 series)

- Vibrations generated by FARMotion engine 25% lower!
- Noise level: -4 dB(A)

Comparison between 3-cylinder FARMotion and 4-cylinder 1000 series engines

- Vibrations generated by 3-cylinder FARMotion in line with those of a 4-cylinder 1000 series
- Noise level: -2.4 dB(A)



- ✓ Tier 4i
- ✓ Better performance
 - ✓ Higher Power
 - ✓ Higher Torque
 - ✓ Lower fuel consumption
- ✓ Less vibration
- ✓ Lower noise levels

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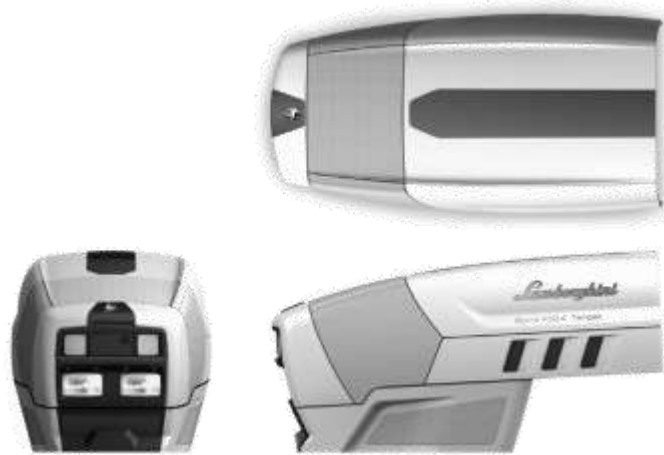
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Models and versions

Manufactured in compliance with the new Tier 4i regulation, the new family of LAMBORGHINI SPIRE machines is made up of 4 models covering the 80...100 horsepower range, equipped with the new 3-cylinder and 4-cylinder FARMotion engines.

Produced in three versions (Target - LS - GS), these models offer unique specifications not available hitherto in this particular market segment.

Model	80	NEW MODEL				100.4
		90		90.4		
SPIRE Target	4 WD	2 WD	4 WD	2 WD	4 WD	-
SPIRE LS	4 WD	2 WD	4 WD	2 WD	4 WD	-
SPIRE GS	4 WD	2 WD	4 WD	2 WD	4 WD	4 WD



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		SPIRE 80 Target	SPIRE 90 Target	SPIRE 90.4 Target
ENGINE		FARMotion TIER 4i		
Cylinders/Displacement/Injection	n° /cc	3 TI /2.887 Common Rail		4 TI /3.849 Common Rail
Maximum power (@ 2000 rpm)	kW/HP	55.4 / 75	65 / 88	65 / 88
Rated power (@ 2200 rpm)	kW/HP	55.4 / 75	61.6 / 84	61.6 / 84
Maximum torque (@ 1600 rpm)	Nm	342	354	354
Torque rise	%	40	32	32
Fuel tank capacity	l	75		
TRANSMISSION				
Top speed	km/h	40		
Mechanical shuttle		●	●	●
Speed	n°	10+10	10+10	10+10
Speed with creeper and splitter	n°	30+15	30+15	30+15
PTO				
PTO 540 / 540 ECO		●	●	●
PTO 540		○	○	○
PTO 540 / 540 ECO / 1000		○	○	○
PTO 540 / 540 ECO / ground speed		○	○	○
FRONT AXLE & BRAKES				
Differential lock and 4WD, mechanically operated		●	●	●
All-wheel braking		●	●	●
HYDRAULICS				
Pump flow rate	l/min	42		
Auxiliary spool valves, mechanically operated	ways	4 / 6	4 / 6	4 / 6
Lift, mechanically operated		●	●	●
Maximum lifting capacity (std/opt)	kg	2,650 / 3,600	2,650 / 3,600	2,650 / 3,600
CAB				
Seat, mechanical suspension		●	●	●
Seat, air suspension		○	○	○
Air conditioning		○	○	○
DIMENSIONS AND WEIGHTS		420/70 R30"	420/70 R30"	420/70 R30"
Wheelbase - 4WD	mm	2,100		2,230
Wheelbase - 2WD	mm	-	2,140	2,270
Maximum length with lift links	mm	3,997		4,257
Height at rear axle — cab	mm	1,785 (1,900 with Aircon)		
Minimum-maximum width*	mm	1,941 - 2,239		
Maximum permissible overall load, 4WD	kg	5,200		
Weight, 4WD	kg	3,200	3,200	3,300

● standard

○ optional

- not available

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		SPIRE 80	SPIRE 90	SPIRE 90.4	SPIRE 100.4
ENGINE		FARMotion TIER 4i			
Cylinders/Displacement/Injection	n° /cc	3 TI / 2,887 / Common Rail		4 TI / 3,849 / Common Rail	
Maximum power (@ 2000 rpm)	kW/HP	55.4 / 75	65 / 88	65 / 88	75 / 102
Rated power (@ 2200 rpm)	kW/HP	55.4 / 75	61.6 / 84	61.6 / 84	71.1 / 97
Maximum torque (@ 1600 rpm)	Nm	342	354	354	408
Torque rise	%	40	32	32	32
Fuel tank capacity	l	100			
TRANSMISSION					
Top speed	km/h	40 ECO			
Mechanical shuttle		●	●	●	-
Hydraulic power shuttle		○	○	○	●
MECHANICAL TRANSMISSION		●	●	●	-
Speed with creeper and splitter	n°	30+15	30+15	30+15	-
POWERSHIFT TRANSMISSION (HML)		○	○	○	●
Speed	n°	45+45	45+45	45+45	45+45
PTO					
PTO 540 / 540 ECO		●	●	●	●
PTO 540 / 540 ECO / 1000		○	○	○	○
PTO 540 / 540 ECO / ground speed		○	○	○	○
Front PTO 1000		○	○	○	○
FRONT AXLE & BRAKES					
Differential lock and 4WD, electrohydraulically operated		●	●	●	●
All-wheel braking		●	●	●	●
HYDRAULICS					
Pump capacity	l/min	54			
Auxiliary spool valves, mechanically operated	ways	6	6	6	6
Lift, mechanically operated		●	●	●	-
Lift, electronically operated		○	○	○	●
Maximum lifting capacity (std/opt)	kg	3,000 / 3,600	3,000 / 3,600	3,000 / 3,600	3,600
Front lift / Capacity		○ / 1,750			
CAB					
Seat, mechanical suspension		●	●	●	●
Seat, air suspension		○	○	○	○
Air conditioning		○	○	○	○
High-visibility roof		○	○	○	○
DIMENSIONS AND WEIGHTS		420/70 R30"	420/70 R30"	420/70 R30"	420/70 R30"
Wheelbase - 4WD	mm	2,100		2,230	
Wheelbase 2WD	mm	-	2,140	2,270	-
Maximum length with lift links	mm	3,997		4,257	
Height at rear axle — standard cab roof	mm	1,785 (1,900 with Aircon)			
Height at rear axle — high visibility cab	mm	1790 (1,860 with Aircon)			
Minimum-maximum width	mm	1,941 - 2,239			
Maximum permissible load, 4WD	kg	5,200			
Weight, 4WD	kg	3,200	3,200	3,300	3,300

● standard

○ optional

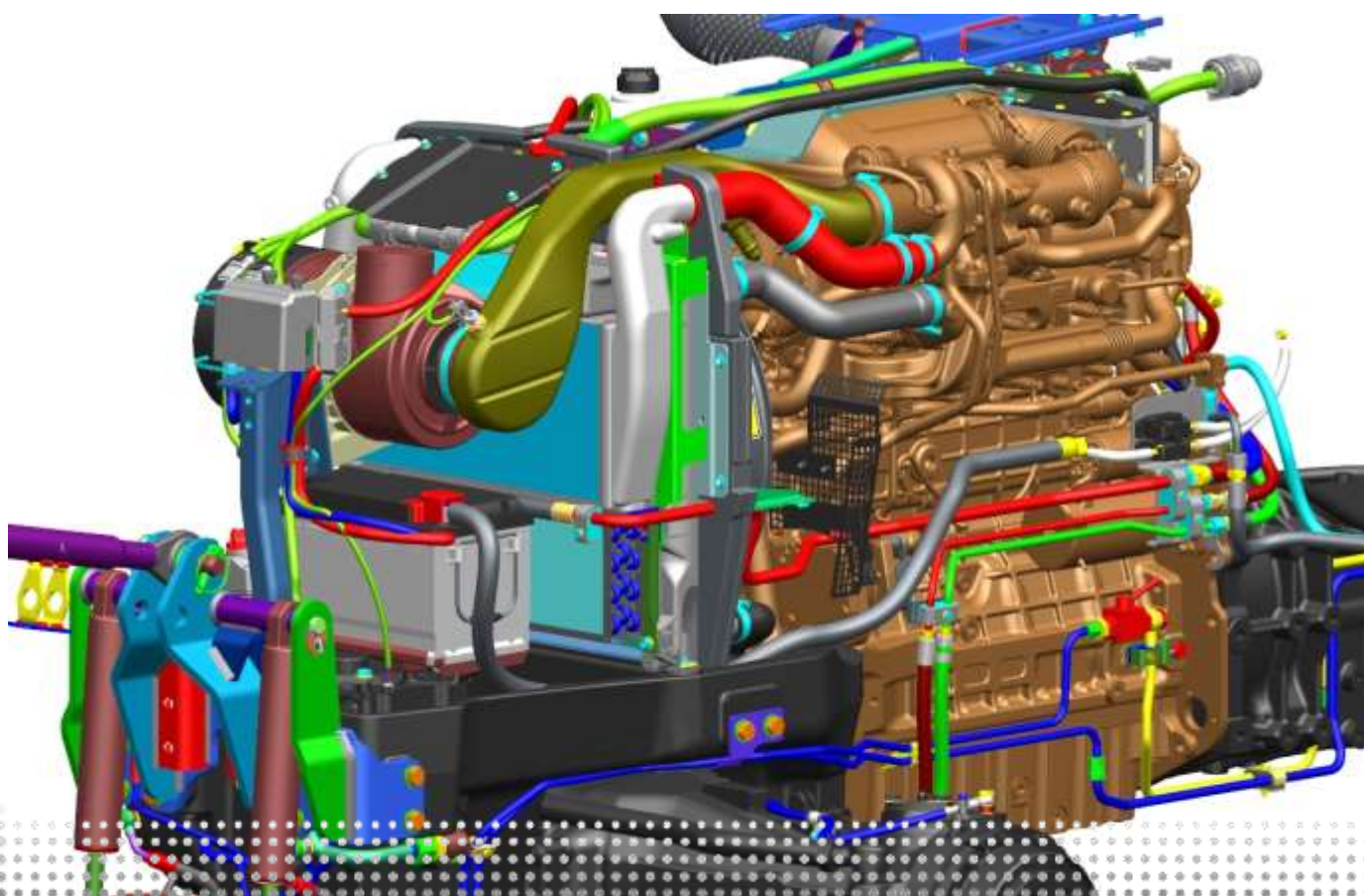
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Engine

SPIRE		80	90	90.4	100.4
Engine		FARMotion			
Cylinders / Displacement	n° /cc	3 T I / 2,887		4 T I / 3,849	
Injection @ pressure	type	Common Rail @ 2,000 bar			
Bore / Stroke	mm	103 / 115.5			
Maximum power @ rpm	HP@rpm	75@2,000	88@2,000	88@2,000	102@2,000
Rated power @ rpm	HP@rpm	75@2,200	84@2,200	84@2,200	97@2,200
Maximum torque @ rpm	Nm@rpm	353@1,400	354@1,600	354@1,600	408@1,600
Torque rise	%	40	32	32	32
Fuel tank capacity	l	75 (Target) / 100 (LS-GS)			



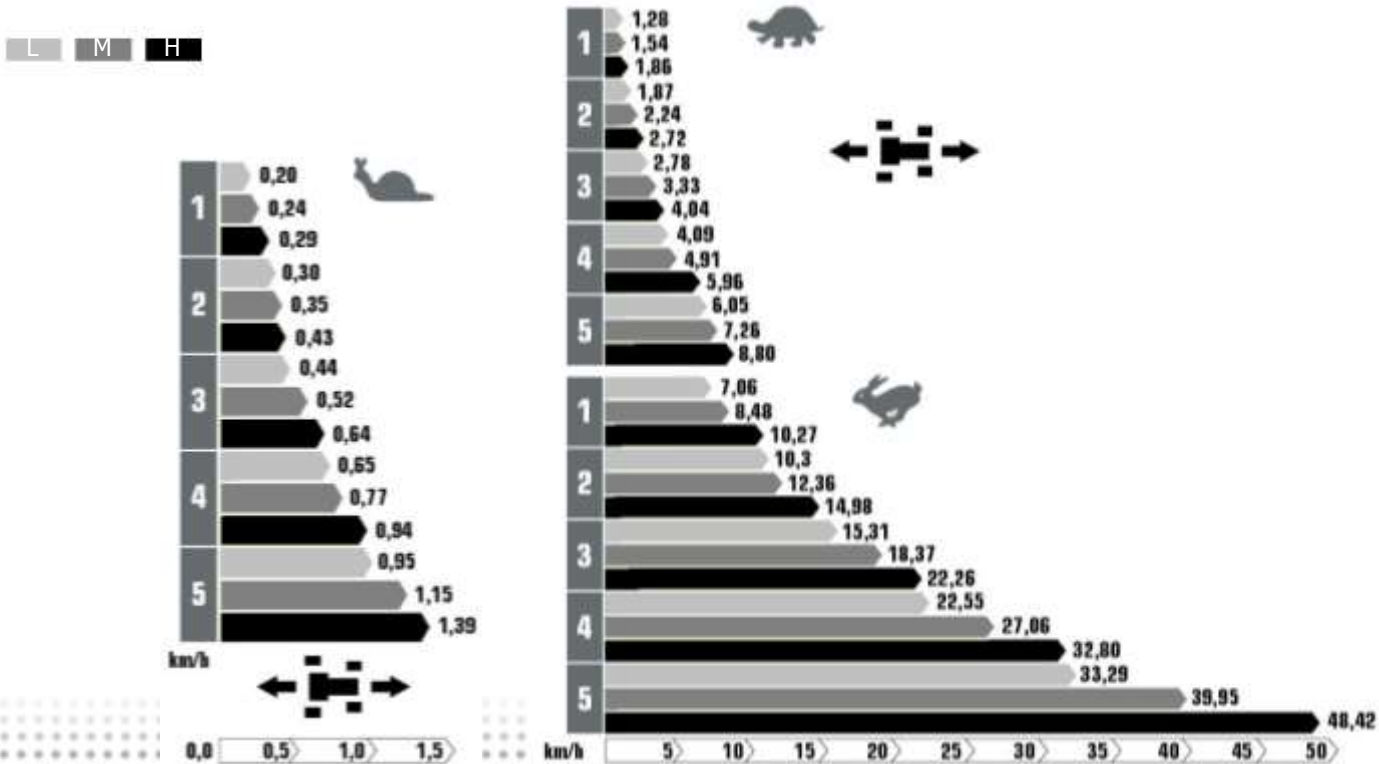
All other technical specifications (transmission, PTO, hydraulics, cab) and options are available as for Tier 3A engines.

A brief summary of the main technical specifications is given below.

Transmission

SPIRE transmissions are developed on 2 levels (mechanical or HML) and equippable with mechanical shuttle (Target / LS) or hydraulic power shuttle (GS).

N° speeds	Target	LS	GS	Power shift	Creep	Mini (splitter)	Top speed
10 + 10	X	-	-	-	-	-	40 Km/h
30 + 15	X	X	X	-	X	X	40 (Target) 40 ECO (LS-GS)
45 + 45	-	X	X	3 (H M L)	X	-	40 ECO



Hydraulic power shuttle (GS versions)

This is a true power shuttle, allowing reversal of direction on the go, under load, and with no loss of engine torque during the course of the manoeuvre.

The unit uses 2 electronically controlled "Long Life" oil-immersed multiple disc clutch assemblies (one for forward, one for reverse). Operating the lever, handily placed under the steering wheel, the change of direction occurs without any "jerking": the machine slows gradually to a halt and restarts in the opposite direction effortlessly and smoothly.

During the change of direction, as one clutch assembly releases, the other begins to engage proportionally, so that the entire shuttle sequence is completed with precision, free of kickback and without any loss of torque (even on gradients).

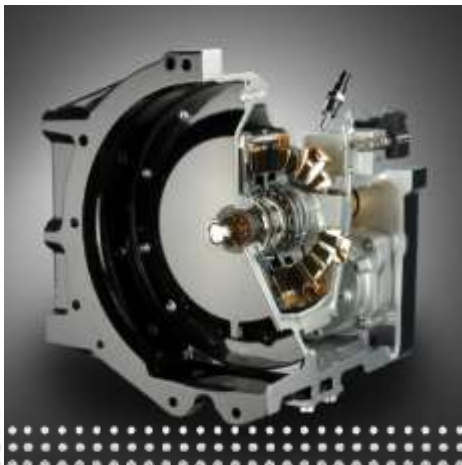
GS versions are also equipped with the "Stop&Go" feature, and a "Comfort Clutch" on the shift lever allowing the driver to change gear without using the clutch pedal.

The "**Stop&Go**" system expands the capabilities and potential of the power shuttle, offering the operator a level of functional advantage that remains effective even in restricted spaces.

With Stop&Go installed, the movement of the tractor can be controlled **using only the brake pedals**, without having to depress the clutch pedal.

With the system activated, depressing the brake pedals has the effect of putting the clutches of the power shuttle "on hold" as the tractor slows gradually to a halt. When the brakes are released, the exact opposite occurs: the clutches re-engage smoothly and progressively as the tractor moves off again in the opposite direction.

Cutaway of power shuttle



Power shuttle lever and Stop&Go button



Front axle

The 4WD coupler and differential lock are operated mechanically (on Target versions) or electrohydraulically (on LS and GS versions).



5090D and 5090.4D models
2WD front axle **with brakes**
Maximum permissible load: 1,400 kg



4WD front axle
Maximum permissible load: 2,300 kg

PTO

With **multiple PTO speeds** — either 2 (540 – 540 ECO) or 3 (540 – 540 ECO – 1000) — plus **ground speed PTO** and 1000 rpm **front PTO** (LS and GS versions only), the SPIRE is a truly versatile machine equipped to take on the widest range of tasks.

Target
Dry disc type PTO clutch, engaged mechanically by a lever.

LS & GS
Independent oil-immersed multi-disc type PTO clutch, engaged electrohydraulically by a pushbutton control.



Hydraulic system

2 hydraulic systems are specified, rated 42 l/min (Target) or 54 l/min (LS and GS), with a minimum of 4 to a maximum of 6 ports, mechanical controls and flow regulator.

Model	Pump	Flow rate l/min	N° spool valve ways	Control
SPIRE Target	Single	42	4 / 6	Mechanical
SPIRE LS & GS	Single	54	6	Mechanical

Rear lift

LAMBORGHINI rear implement linkages are renowned universally as being the best available in terms of precision, control, and practicality in the field.

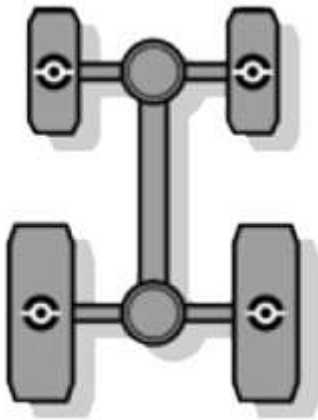
SPIRE machines are equipped as standard with a mechanically operated lift, but with the option (for LS and GS versions) of a **fully electronic monitoring and control** system, which will ensure that performance and quality of work are always second to none.

SPIRE		
Maximum lifting capacity STD	Kg	2,650 Kg (Target) / 3,000 Kg (LS/GS)
Maximum lifting capacity STD	Kg	3,600 Kg

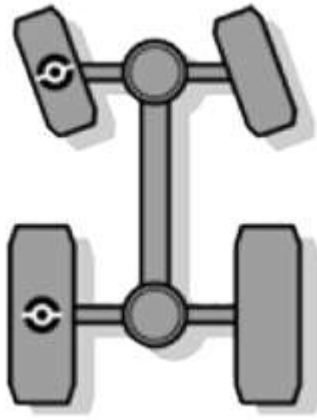
If requested, these new models (LS and GS versions only) can also be equipped with a front lift — **original and built-in** — of rated capacity 1,750 kg.

Braking system

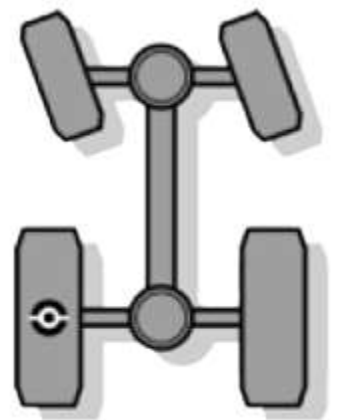
All SPIRE models are equipped as standard with an **all-wheel brake** system using oil-immersed multiple disc assemblies, and a "separate brakes" valve by which the braking action is distributed between front and rear.



All-wheel braking



Braking of both wheels on the same side



Single wheel braking

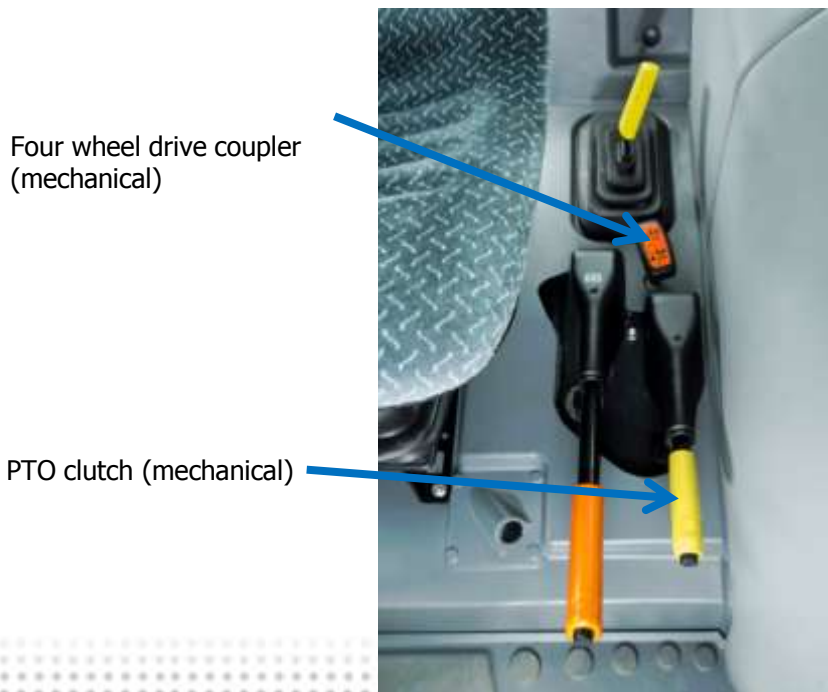
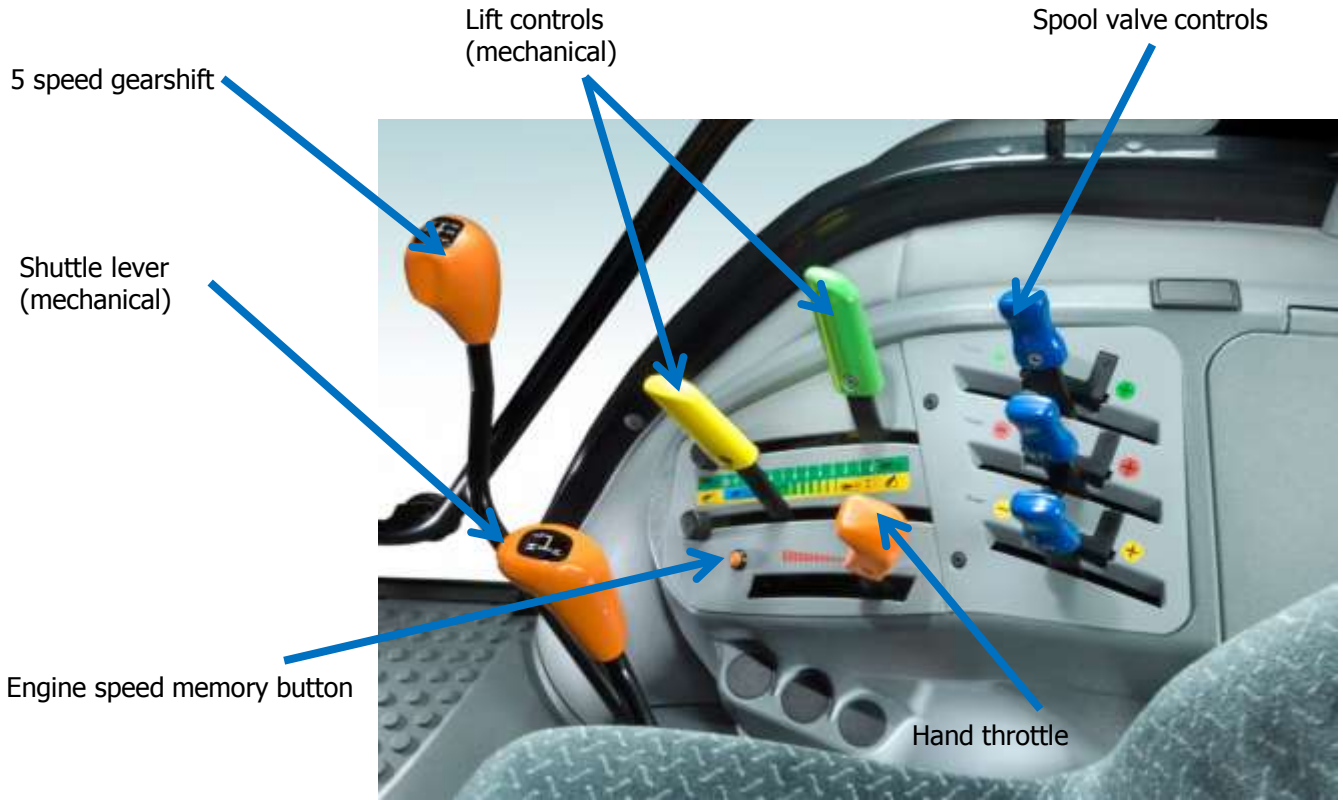


A conventional parking brake is fitted as standard to all versions.

Importantly, there is now the possibility of equipping the Target version with **both air braking and air conditioning systems** (a combination not available hitherto, for technical reasons, on machines with Tier 3A engines).

LS and GS versions will also be available with **air braking** system, an option not available formerly on models with Tier 3A engines.

SPIRE Target cab – Right hand console



SPIRE cab – Right hand console

Spool valve controls

Hand throttle

Lift controls
(mechanical)

Engine speed memory
button

5 speed gearshift

Powershift buttons

Shuttle lever
(mechanical - LS)



Differential lock

PTO engagement

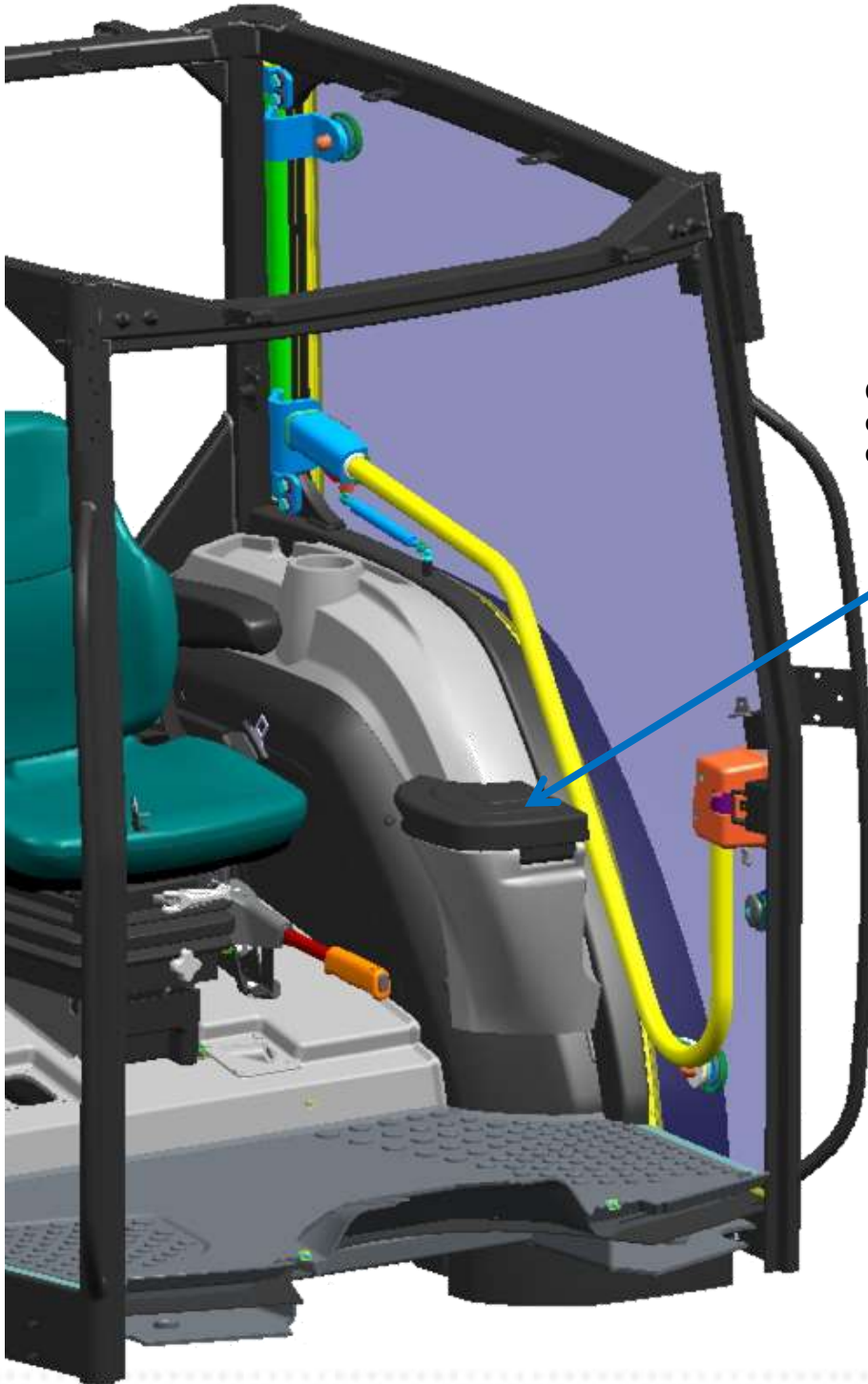
4WD engagement

Range shift lever

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SPIRE cab – Left hand console with "drinks can holder"



Options available include left hand console with ledge incorporating a drinks can holder



Safety

The aim of LAMBORGHINI has been to offer technological products that are reliable, but above all, made to the **highest safety standards**.

Which is why SPIRE models feature engineering solutions and equipment packages designed to maximize safety at work for our customers.

- **Reduction of noise and vibration**

With the new FARMotion engine and the SPIRE cab, levels of noise and vibration are reduced, increasing comfort and consequently minimizing fatigue and stress experienced by the operator.

- **Shorter braking distances**

The action of the oil-immersed disc brakes — operating in concert on all 4 wheels — is precise and modulated on every type of surface, and makes for shorter stopping distances.

- **Swift and safe changes of direction, with a genuine hydraulic power shuttle**

The oil-immersed multi-disc clutch assemblies afford a uniquely sensitive response when alternating between forward and reverse, without ever losing traction (there is no "neutral" stage), so that shuttle manoeuvres are guaranteed safe even on steep gradients.

- **All round visibility**

The modern structure of the cab, with 4 slimline posts, ensures optimum visibility in any work environment.

- **FOPS cab roof**

In the event of a load being shed accidentally when using the front loader, or during forestry work, maximum safety is always assured by the special Falling Objects Protection System incorporated into the cab roof.

- **Battery disconnect switch**

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Dimension & Weight



SPIRE	80	90	90.4	100.4
Wheelbase - 4WD	2,100 mm		2,230 mm	
Wheelbase - 2WD	-	2,140	2,270	-
Maximum length with lift links	3,997 mm		4,257 mm	
Height at rear axle — cab With standard roof	1,785 mm 1,900 with Aircon			
Height at rear axle — cab High visibility roof	1,790 mm 1,860 with Aircon			
Front track width (minimum-maximum)*	1,460 ... 1,760 mm.			
Rear track width (minimum-maximum)*	1,502 ... 1,800 mm.			
Minimum-maximum width*	1,941 ... 2,239 mm.			
Maximum permissible total load, 4WD (2WD)	5,200 kg			
Maximum permissible front end load, 4WD (2WD)	2,300 kg			
Maximum permissible rear end load	3,300 kg			
Weight, 4WD	3,200 kg		3,300 kg	

*with tyre sizes
420/70 R30" rear
360/70 R20" front

SPIRE and its unique features

FARMotion



FARMotion engines, Turbo, Intercooler, Common Rail

- ❖ 3 or 4 cylinders
- ❖ Displacement 2,887 cc (3) / 3,849 cc (4)
- ❖ Common Rail 2,000 bar
- ❖ New 3-cylinder model rated 88 HP (5090 D)



Front axle

- ❖ Oil-immersed front disc brakes
- ❖ Maximum permissible front end load: 2,300 kg (4WD)
- ❖ 2WD version with adjustable front brakes



SDF transmission

- ❖ 3 transmission levels: Target, LS and GS
- ❖ 40 Km/h at economy engine rpm (LS, GS)
- ❖ Shift-on-the-go hydraulic power shuttle (GS)
- ❖ 45+45 HML (3-ratio powershift) (LS, GS)
- ❖ "Stop & Go" system (GS)



Rear lift rated 3,600 kg

- ❖ Electronic monitoring and control (OPT)

We take this opportunity of extending our best regards.

Low-Medium Power Platforms
Product Manager

(D. Invernizzi)