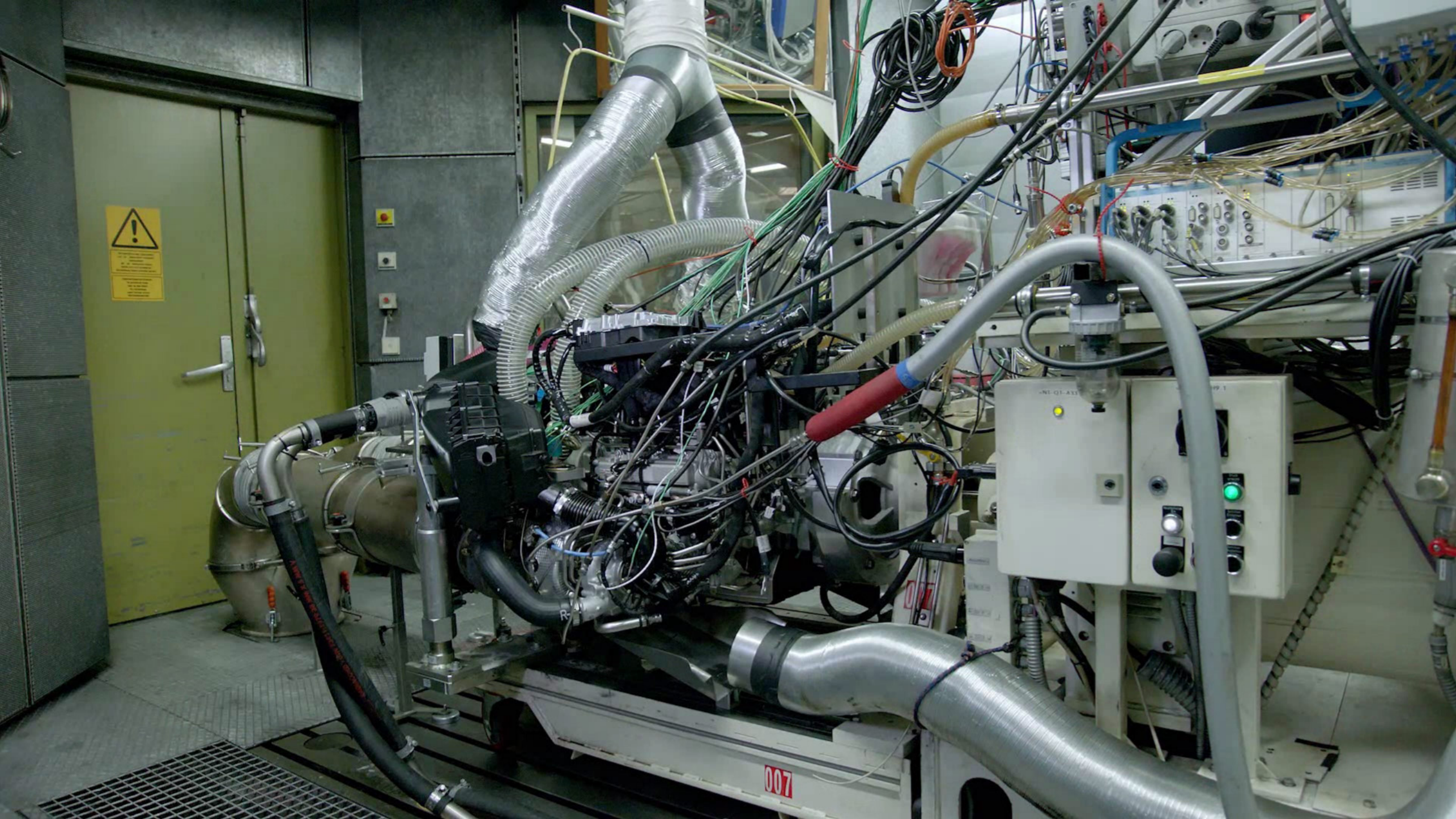


**PORSCHE**

**The new 911 Carrera  
Technology Workshop**

Powertrain





007

**PORSCHE**

The new 911 Carrera – Motivation and challenge

**PERFORMANCE**



**EMOTION**

**EFFIZIENZ**



# PORSCHE

## The new flat-six engine (9A2 evo)



### 911 Carrera S

Displacement	2,981 cm <sup>3</sup>
Bore	91.0 mm
Stroke	76.4 mm
Compression	10.2:1
Power output	331 kW (450 hp)
Max. torque	530 Nm
Max. engine speed	7,500 min <sup>-1</sup>

### New engine mounts

- Engine mount bracket directly on cylinder head, cylinder head cover

### Valvetrain

- Four valves per cylinder technology with Vario Cam Plus technology
- Intake/exhaust stroke switchover
- Intake/exhaust camshaft adjuster
- Asymmetrical small stroke



### CO<sub>2</sub> measures

- Reduced friction
- Optimised mixture formation
- Higher compression ratio
- Reduced number of vacuum consumers

### Crankcase

- Aluminium closed deck
- PTWA Fe-coated running surfaces



### Modular charging technology

- Biturbo (wastegate) with
- cast manifold,
  - electric wastegate adjuster and recirculation air,
  - encapsulated wastegate kinematics

### Fulfilment of legislation worldwide

- Petrol particulate filter (PPF)
- New turbochargers (catalytic converter heat optimisation)
- Optimised fuel system
- Electric exhaust flaps

### Oil circulation

- Integrated dry sump
- Fully-variable, optimised oil pump

### Fuel direct injection

- Central injector position
- Piezo injector (200 bar)

### One-piece cylinder head

- Cross-flow cooling
- Exhaust side downward





### **Piezo injector (A-nozzle)**

- Multiple injections possible (up to 5)
- High-quality atomisation and rate of evaporation – good mixture formation even with very late injection
- Precise metering of small volumes and high flow-through

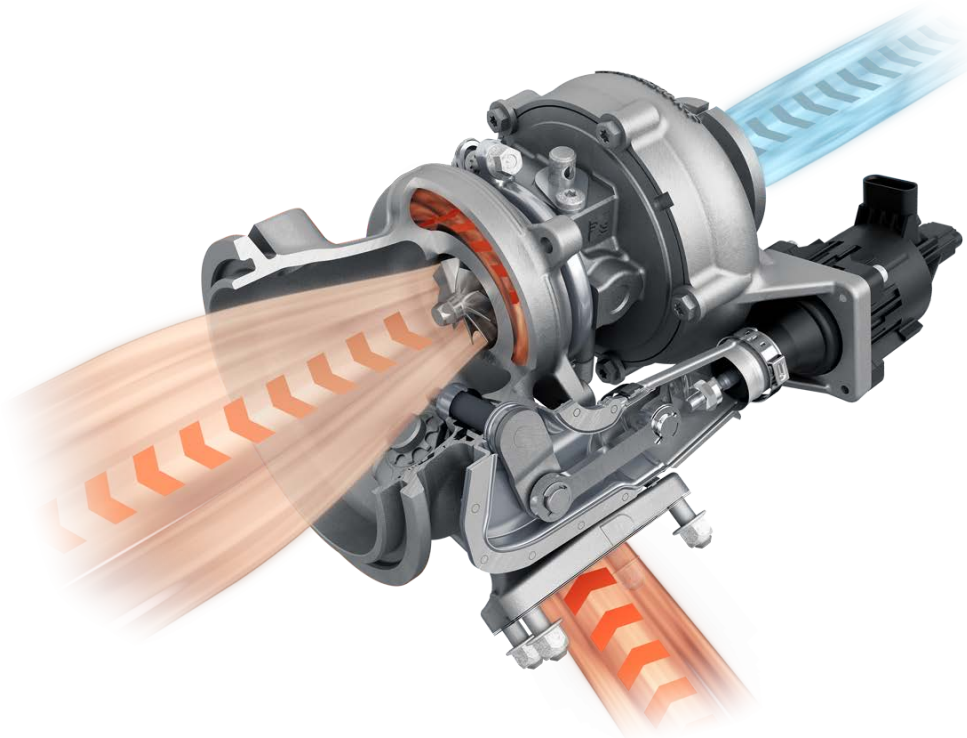
### **Asymmetrical (small) valve stroke**

- Optimised Vario Cam Plus valve timing with different valve strokes of 2 mm and 4.5 mm for the small stroke.
- Intake valve can close earlier → dethrottling

### **Higher compression**

Effective compression increase

→ **Efficiency boost, smooth running, lower emissions**



### Symmetrical turbocharger layout

- Electric wastegate
- Optimised catalytic converter intake flow
- Turbine wheel 48 mm (+ 3 mm)
- Compression wheel 55 mm (+ 4 mm)

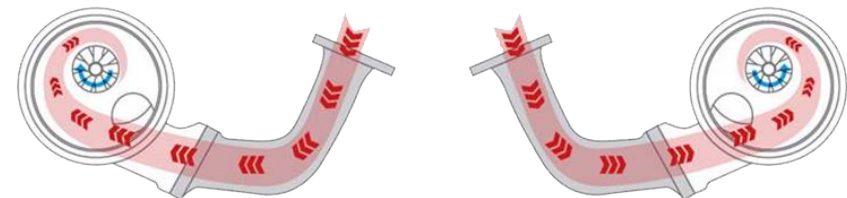
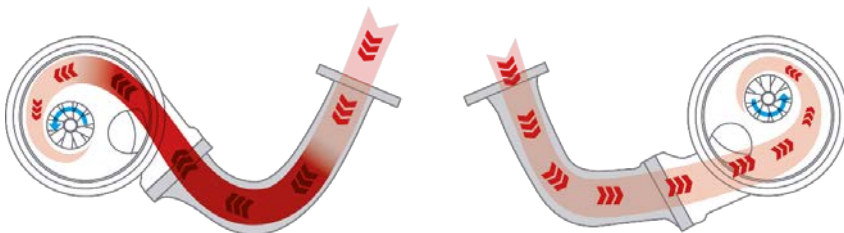
### New exhaust manifold

- Cast iron manifold instead of sheet metal
- Air cooled instead of air gap insulated

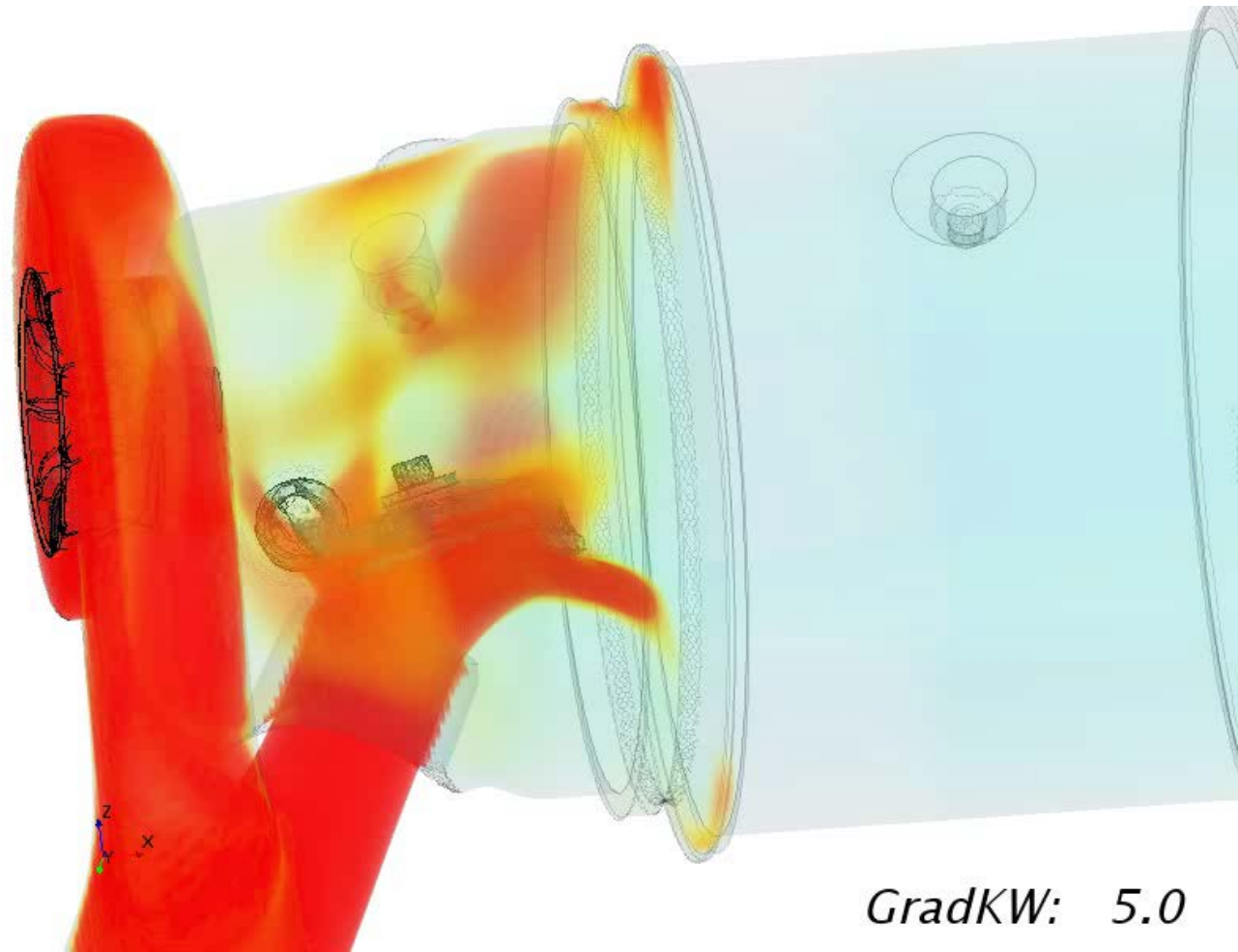
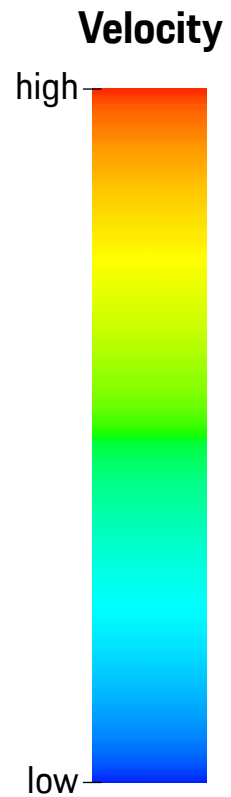
→ Lower full-load fuel consumption

→ Better cold-start heating of catalytic converter

→ Faster response of turbochargers

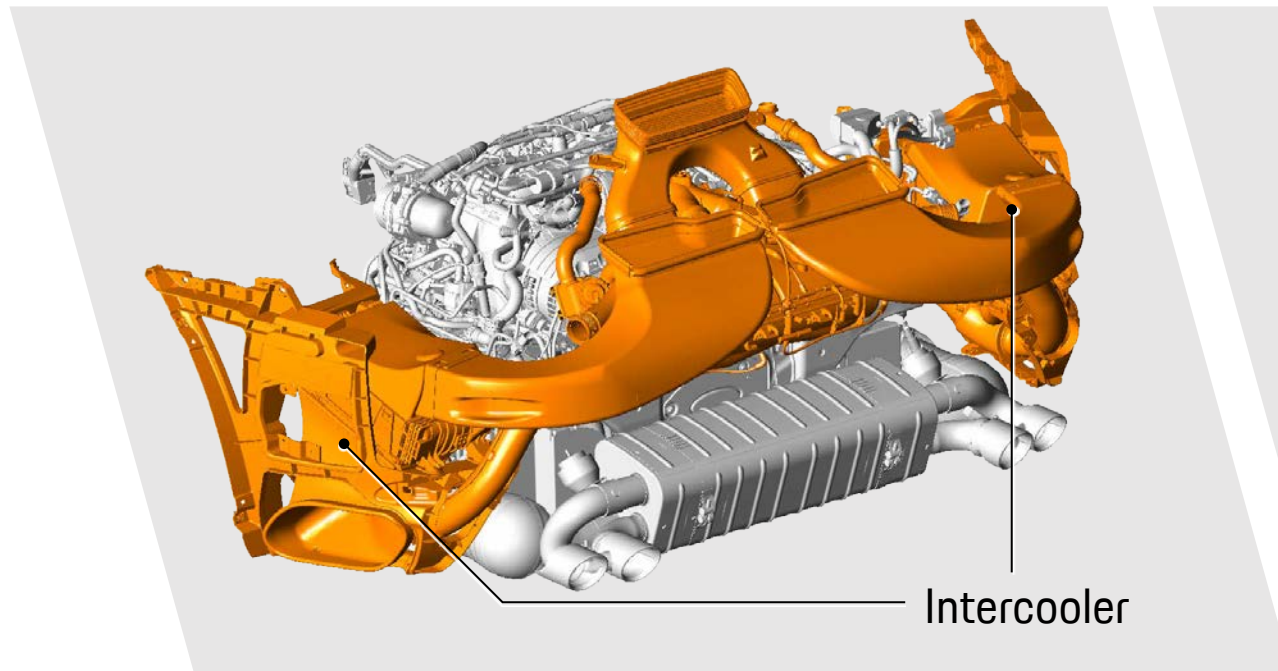


**Exhaust air mass flow, catalytic converter inflow** (wastegate 37.5° open, catalytic converter heating)

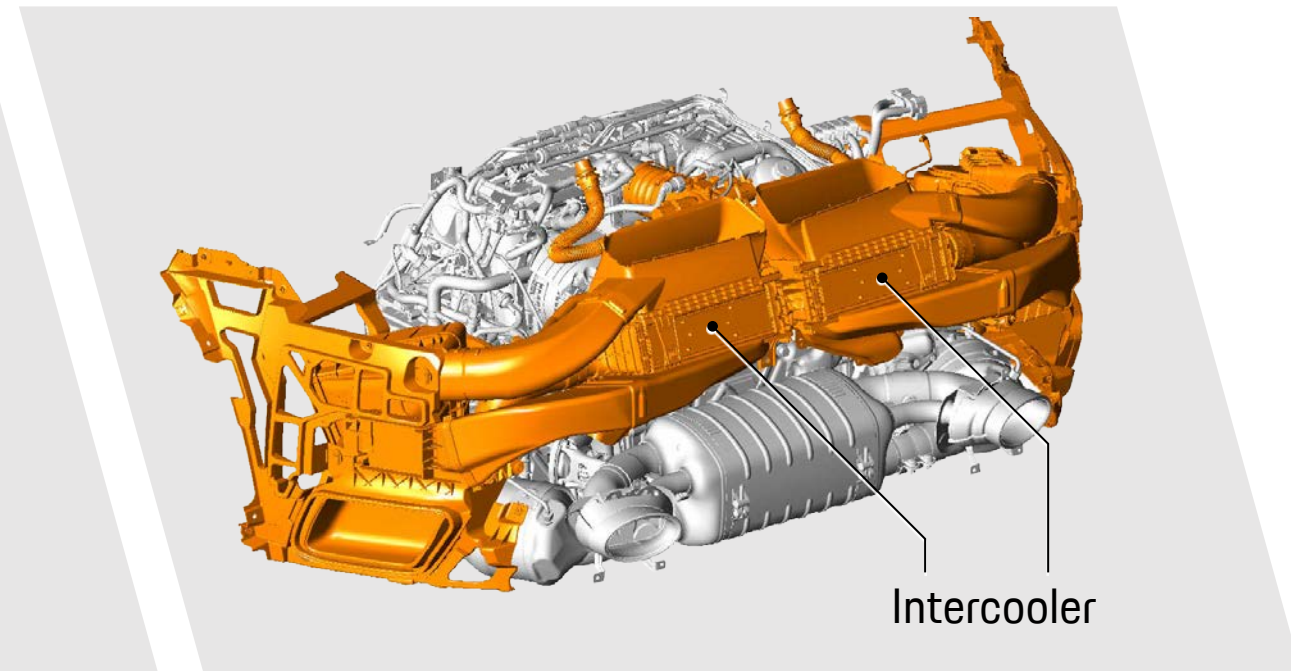




991 II



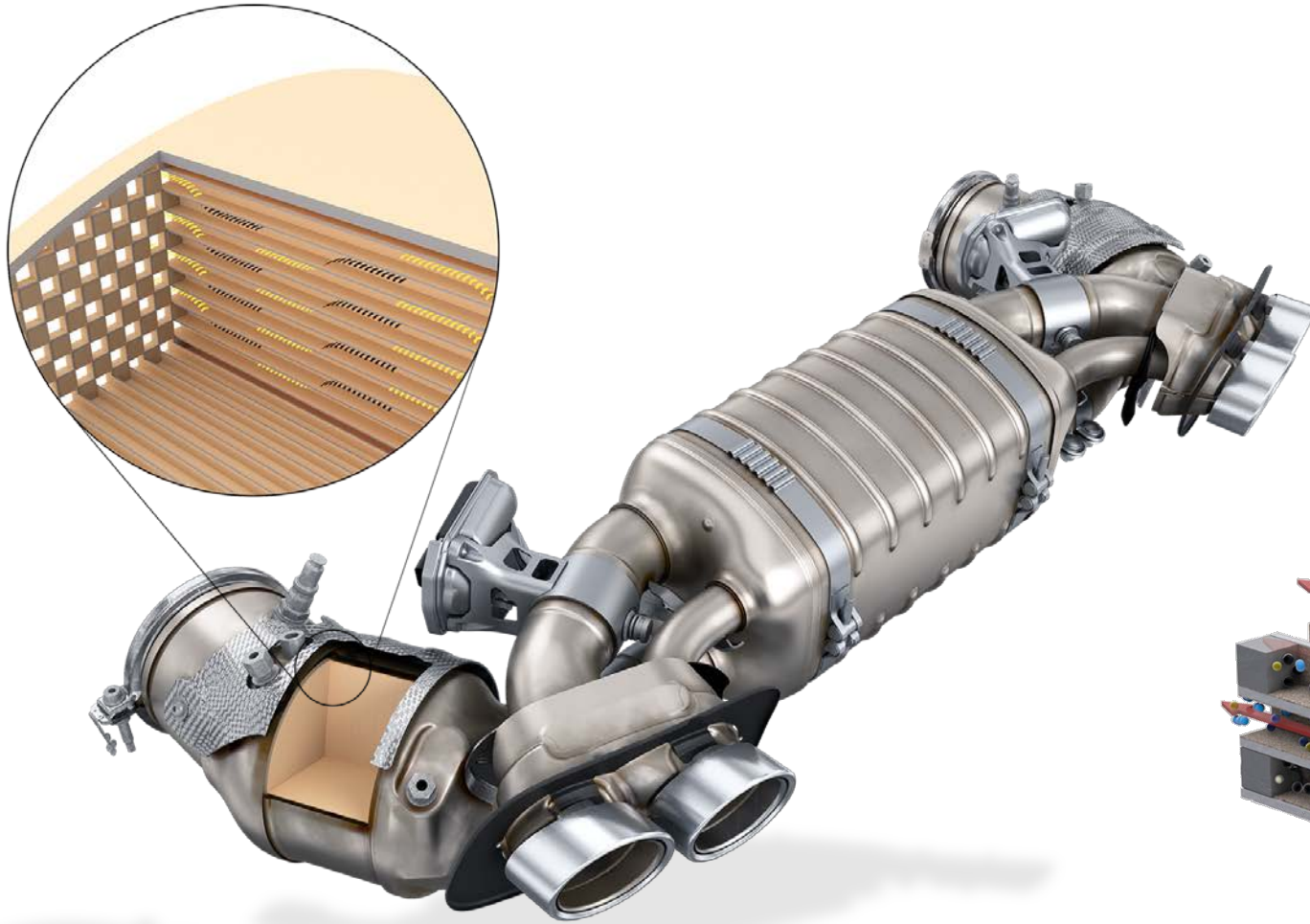
992



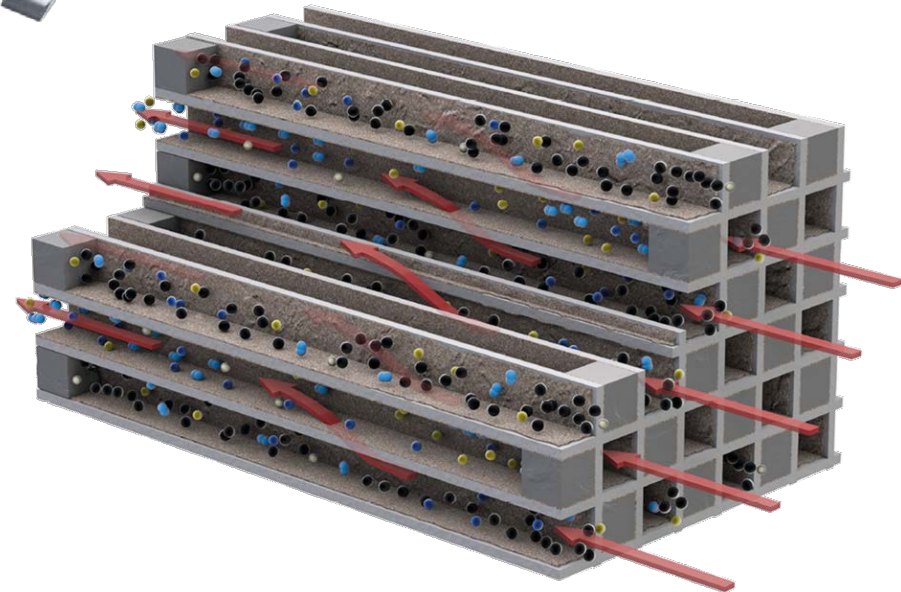
- Higher cooling air throughput due to new position
- 14% bigger intercooling
- 50% dethrottled process air path

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## The new 911 Carrera – particulate filter (PF)



- PF integrated in tight engine compartment
- No noticeable effects for customer
- Exhaust back-pressure is compensated
- Emotional sound

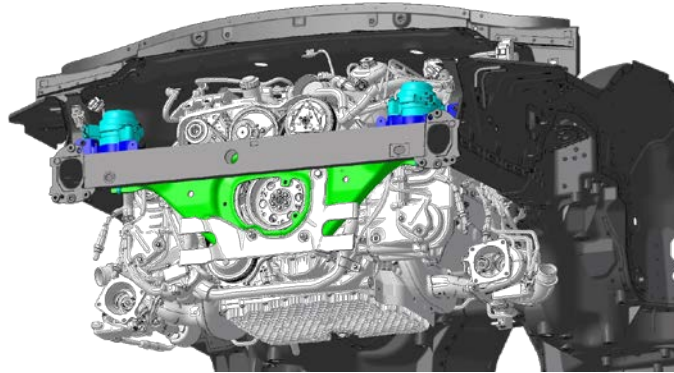


# PORSCHE

## 991 II

### Engine blade

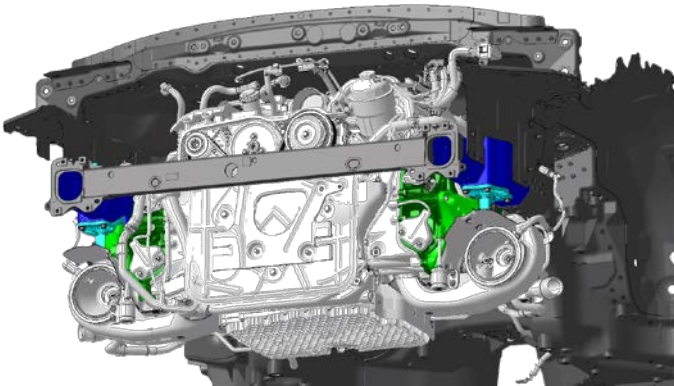
- Soft mount via bracket on crankcase



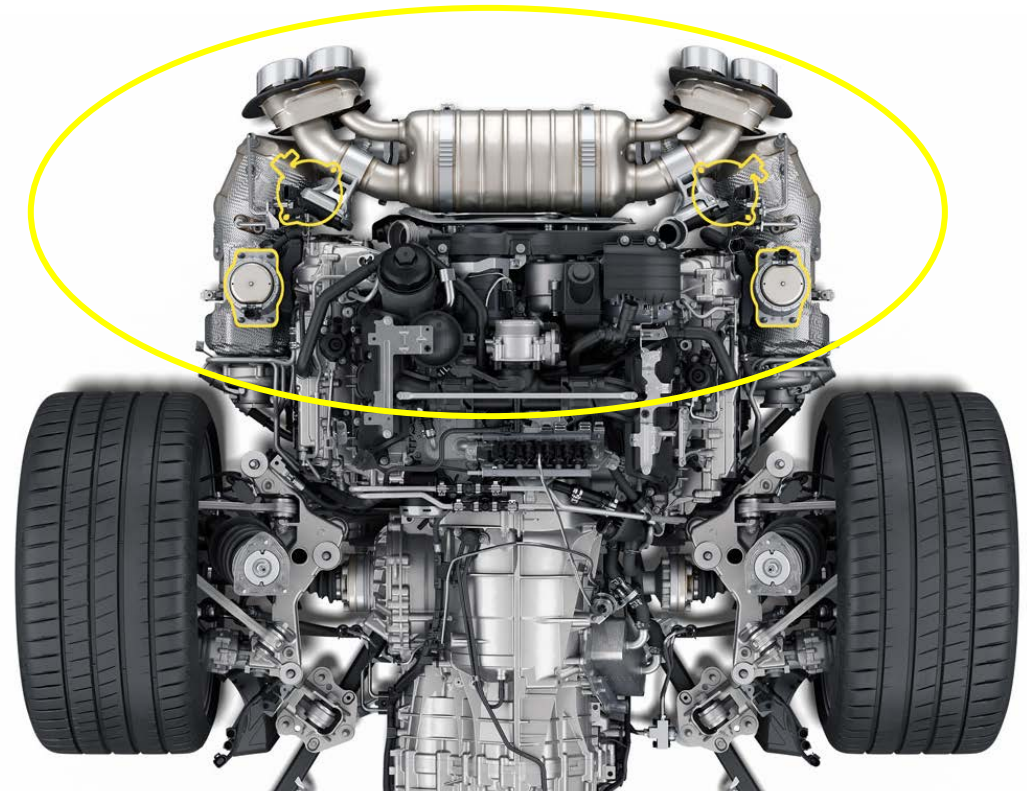
## 992

### Engine bracket

- Stiff/short mount via cylinder head
- Engine mount shifted forward



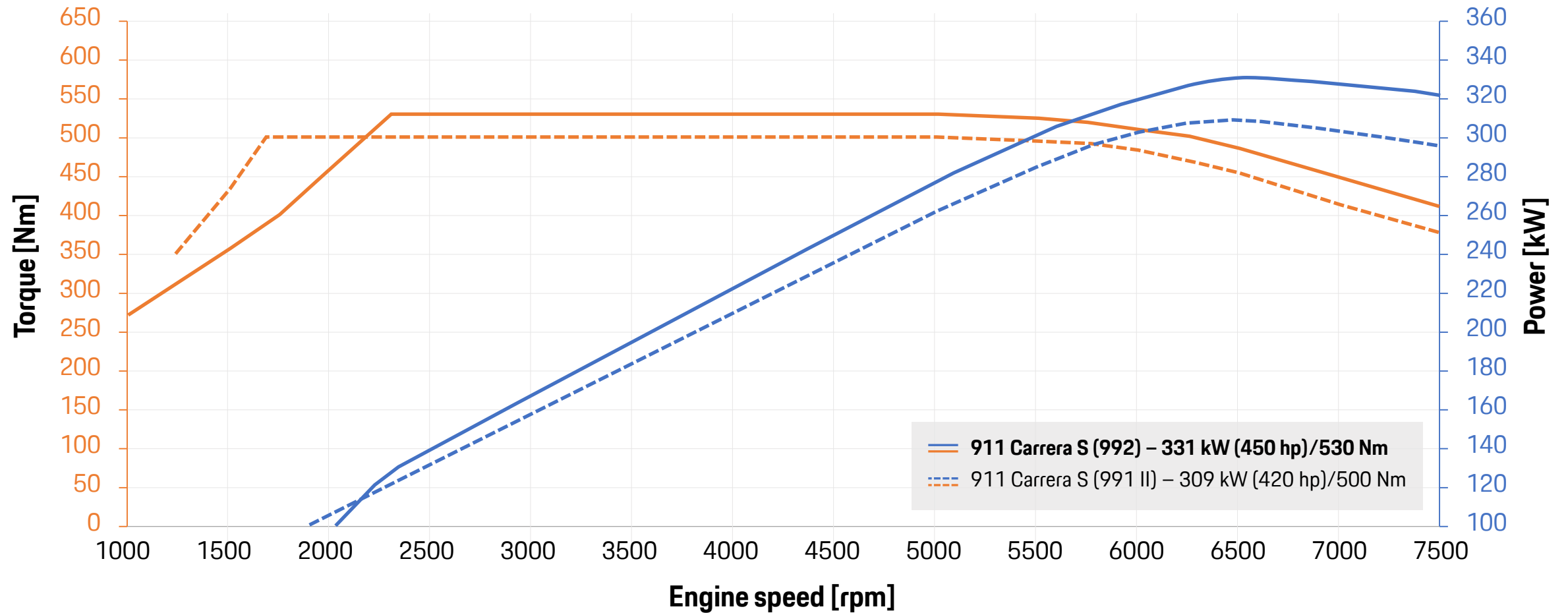
## The new 911 Carrera – Optimised engine mounts



→ Potential for PADM and chassis tuning can be better exploited

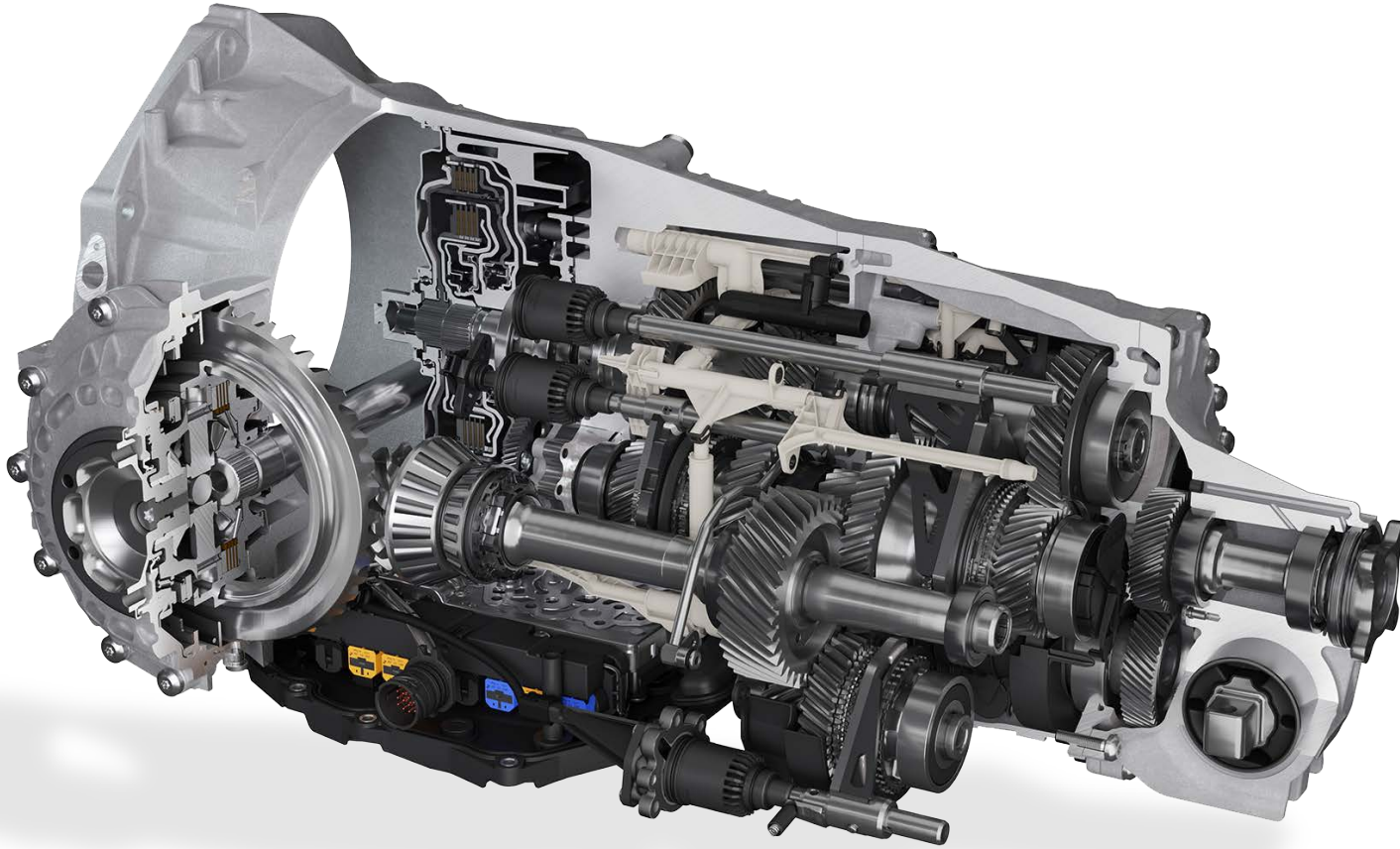
→ Spread between better ride comfort and more sportiness has been further increased

### Comparison of 3.0-litre B6 Biturbo 991 II vs. 992



# PORSCHE

## The new eight-speed Porsche dual-clutch transmission

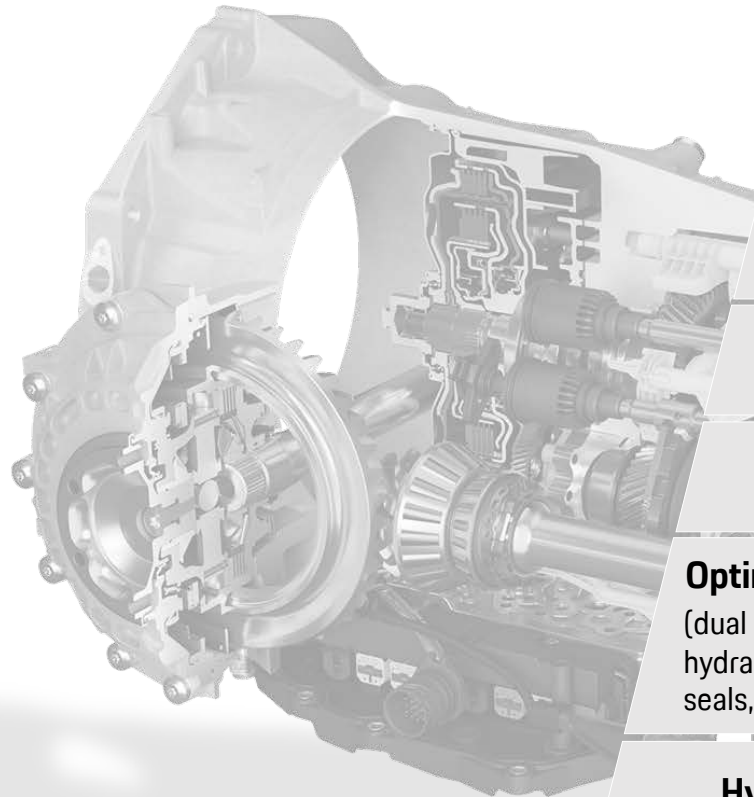


Efficiency

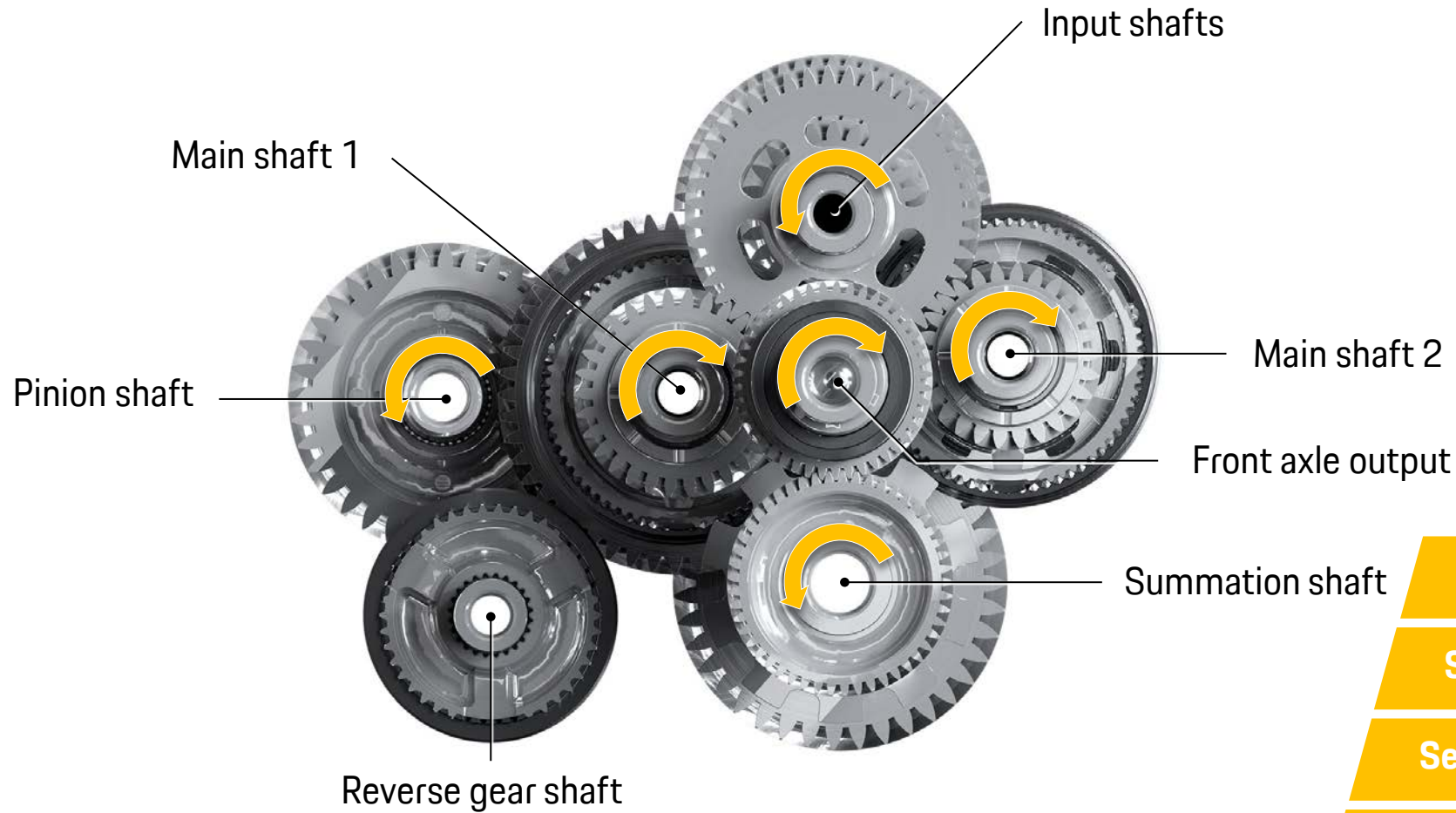
Performance

Comfort

Modularity



Efficiency		Performance	Comfort
Eight speeds with an 8.06 spread of ratios			
Optimised shifting strategy			
System pump with demand-based control	Torque capacity > 800 Nm	Full shift-by-wire	
New low-viscosity transmission fluids	Actuating torque of up to 1000 Nm in differential lock control	Starting performance with engine speed control	
Optimisation of efficiency (dual clutch, synchronisation, hydraulics, direct lubrication, seals, etc.)	3-fold synchronisations of gears 1-4 for enhanced shifting performance	<b>Modularity</b>	
Hybridisation option	Improved speed shift	<b>Modular transmission system</b> <ul style="list-style-type: none"> <li>▪ First use in Panamera (gear set and hydraulics concept, dual clutch family, shifting actuators, pump, etc.)</li> <li>▪ Also used in Group vehicles</li> <li>▪ Other uses in 911 derivatives</li> </ul>	
	Wet Mode		

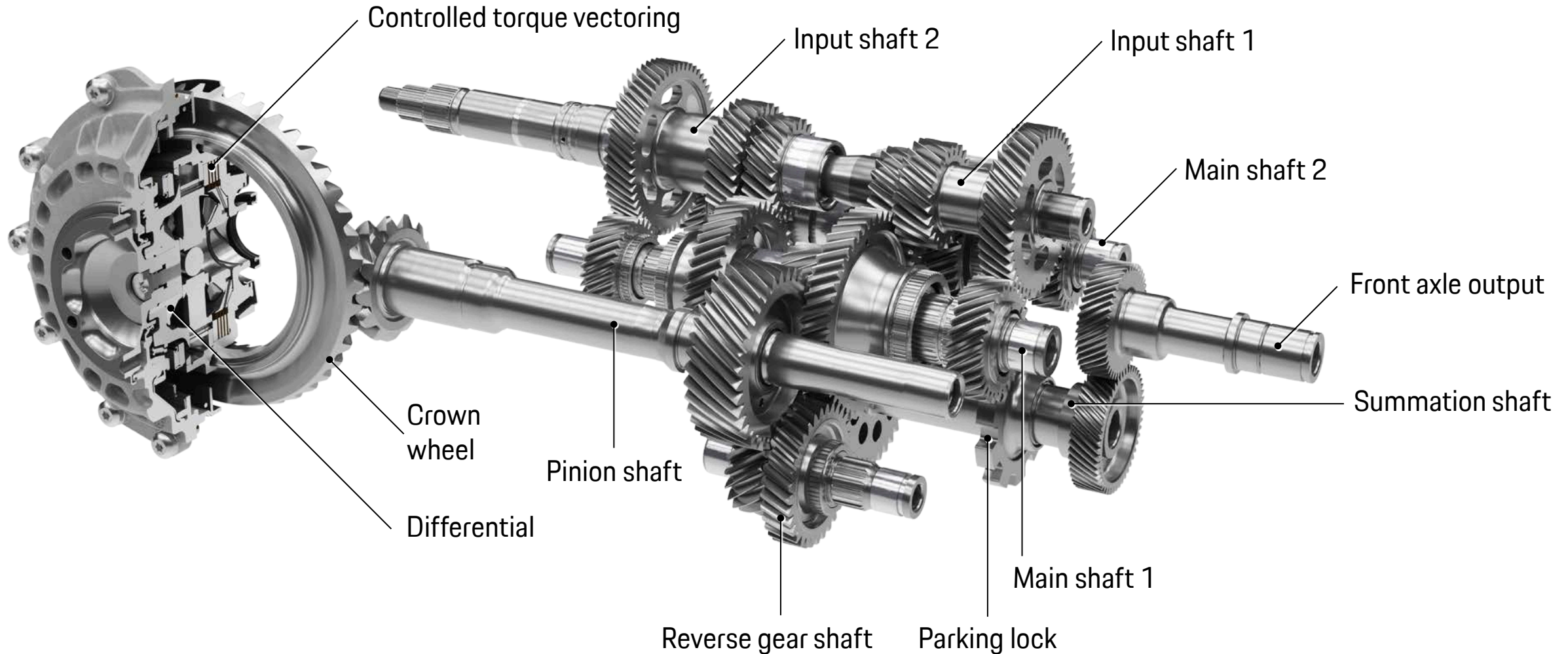


Four-shaft gear set

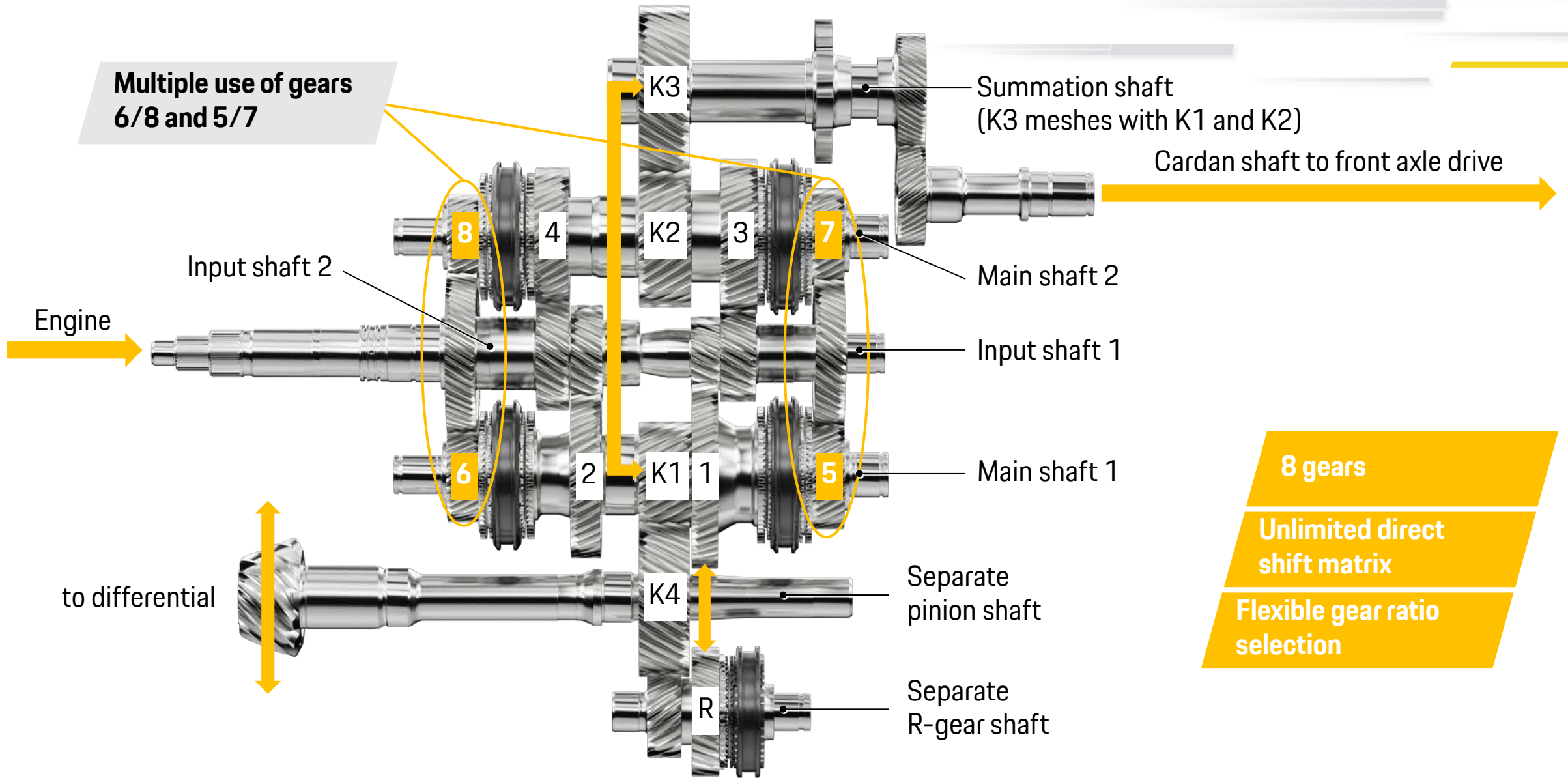
Separate reverse gear

Separate pinion shaft

Front axle output via spur gear stage



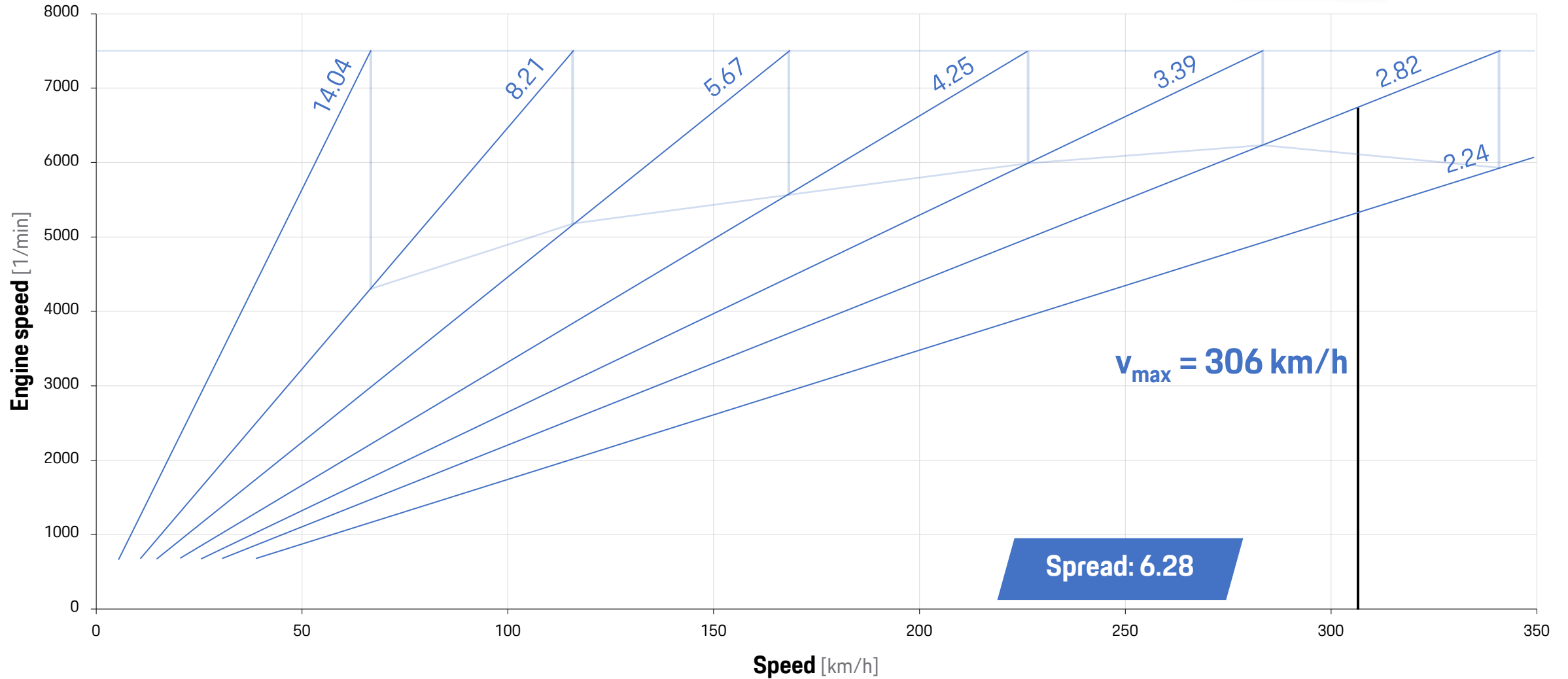


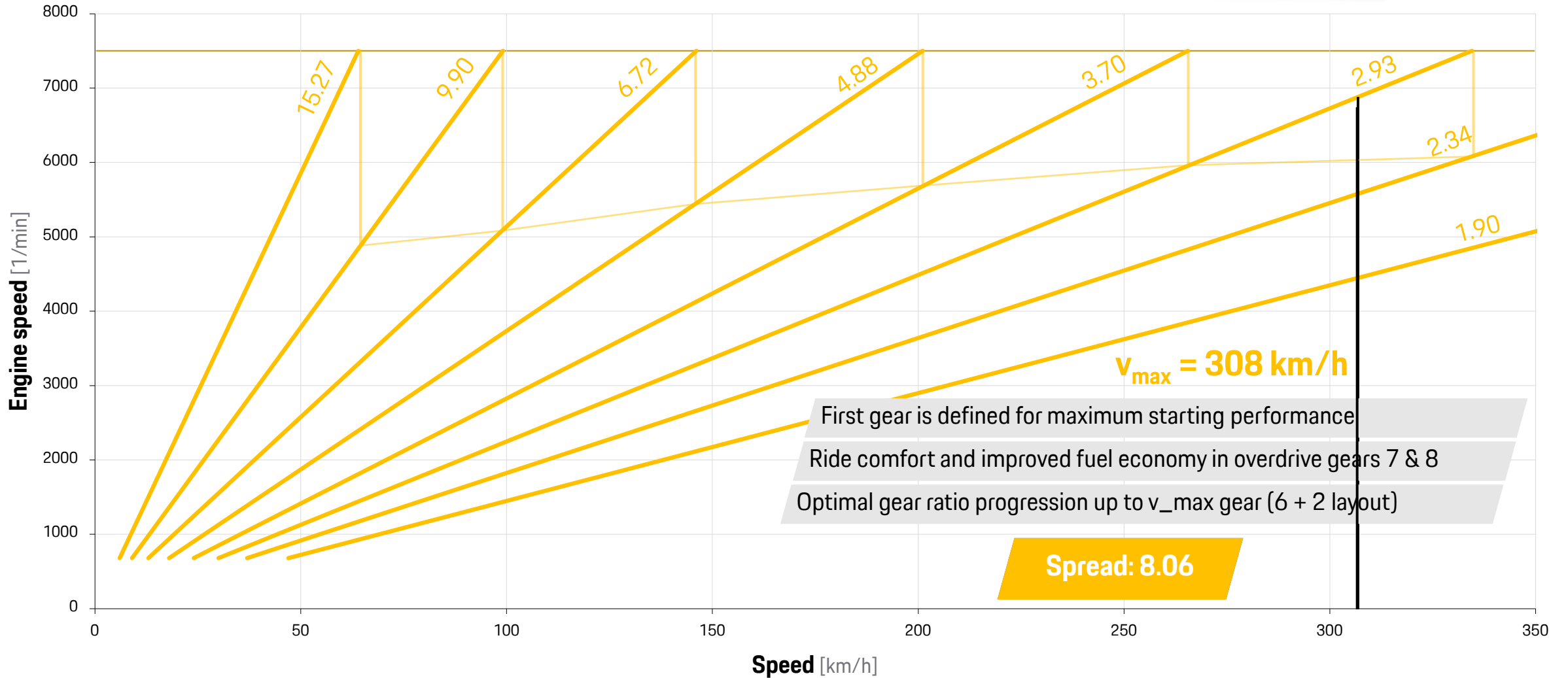


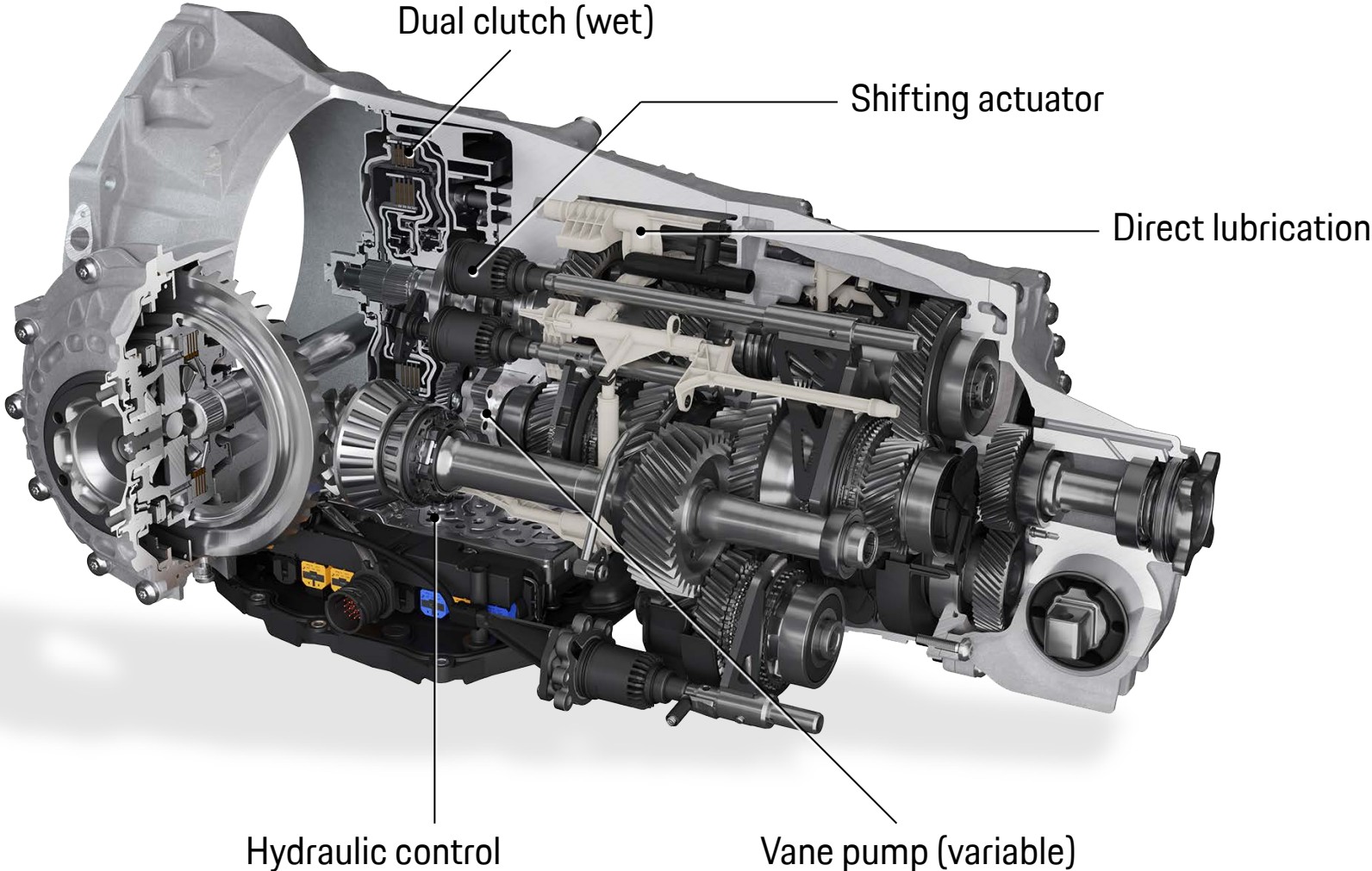
8 gears

Unlimited direct shift matrix

Flexible gear ratio selection

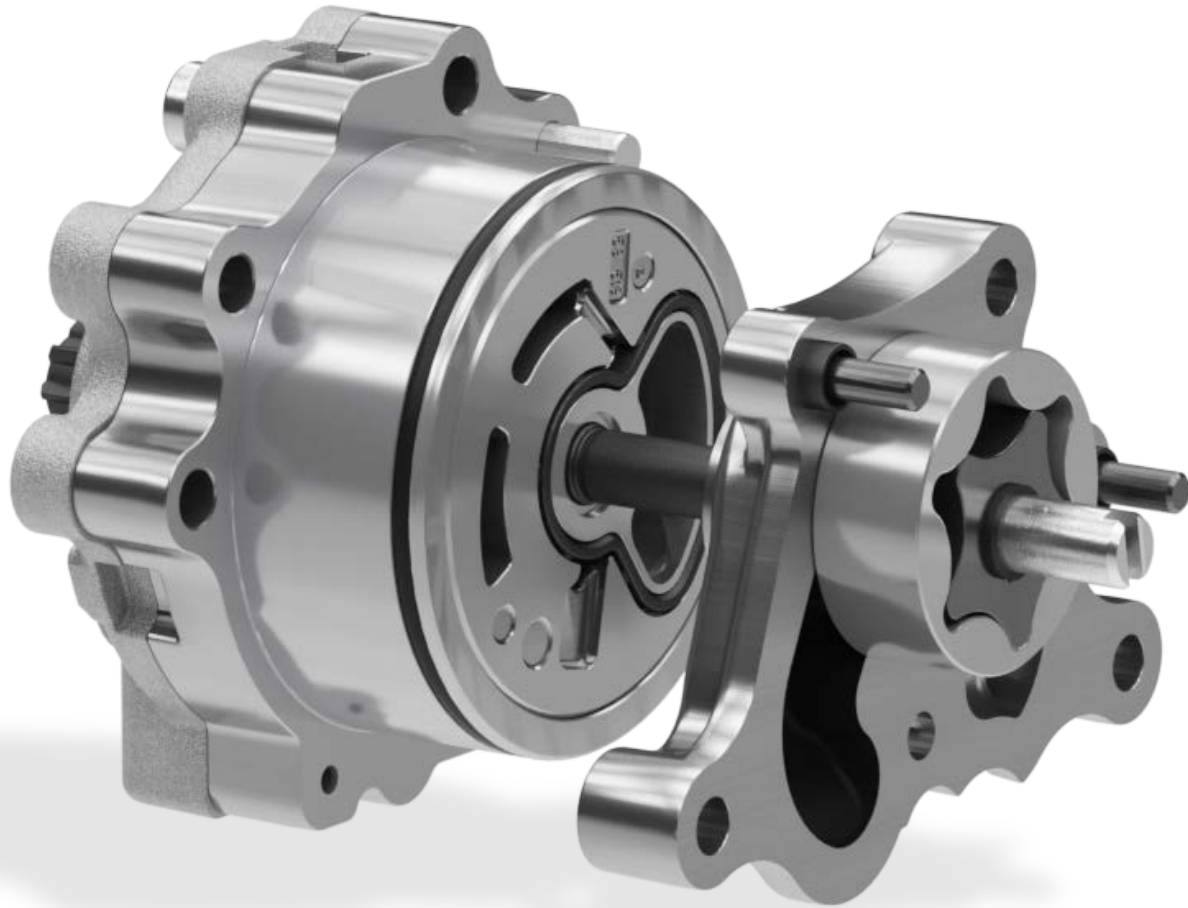






# PORSCHE

## The new eight-speed PDK – Innovative pump concept



### **Adjustable vane pump to control volume flow (engine-driven)**

- Very low hydraulic energy consumption
- Allows strategies (Normal, Sport, Sport Plus)
- Losses 77% lower than 1st generation

### **Auxiliary gerotor pump**

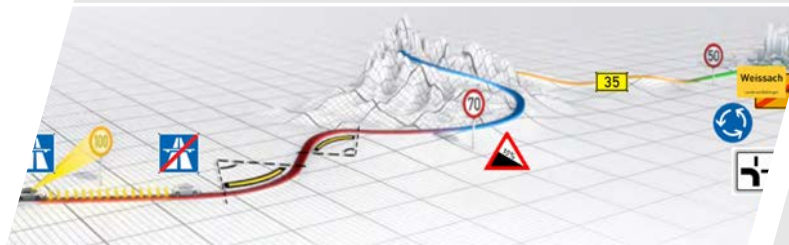
- Lubrication and cooling of gear set
- Tandem layout via Oldham clutch
- 37% lower losses compared to 1st PDK

### Optimisation of existing functions

- Adapts to driving style, driving situation and environment
- Special functions for low friction (wheel slip and yaw rate)
- Support of PSM control interventions

### Use of predictive information from ACC and route data

- Information on traffic ahead
- Road classes and municipalities
- Junctions
- Predicted inclines
- Distance to next bend
- Predicted transverse acceleration (bend curvature and vehicle speed)



### Functions based on predictive data

- a) Use of engine overrun instead of upshifting with slow-moving vehicle ahead
- b) Upshift preventer before start of hill
- c) Earliest possible upshifting at end of a hill
- d) Driving style / sport factor
  - Quicker reduction of sport factor when "long straight section" is detected
  - Sport factor is limited in municipalities
- e) Bend upshift preventer with approaching bend

Information  
Route data

Functions based  
on predictive data

a) Use of engine thrust instead of upshifting with slow-moving vehicle ahead

b) Upshift preventer before start of hill

c) Earliest possible upshifting at end of a hill

d) Driving style / sport factor

- Quicker reduction of sport factor when "long straight section" is detected
- Sport factor is limited in municipalities

e) Bend upshift preventer with approaching bend

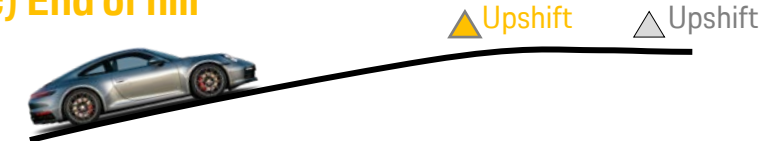
a) Slower vehicle ahead



b) Start of hill



c) End of hill

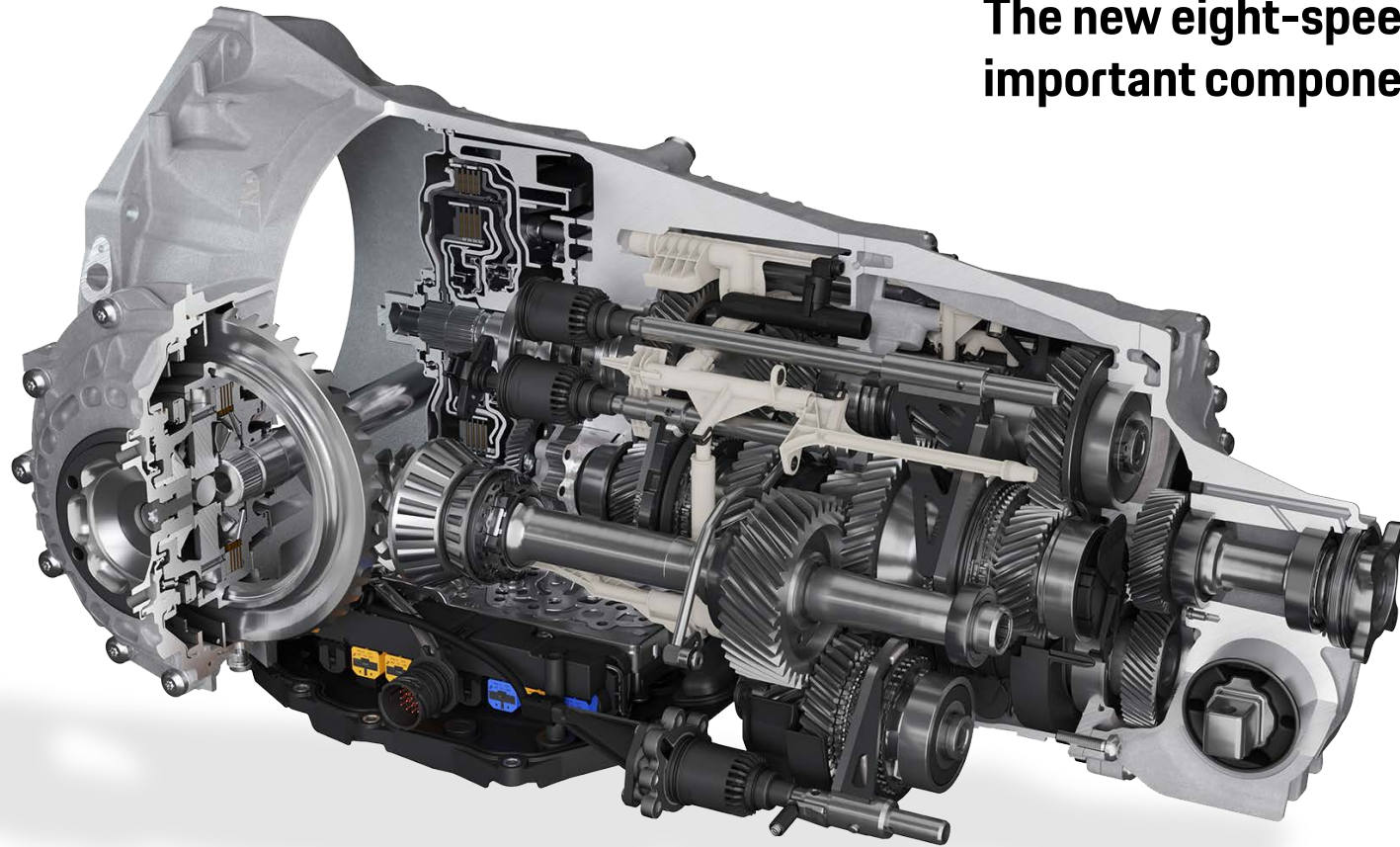


d) Straight section / within municipalities



e) Bend ahead



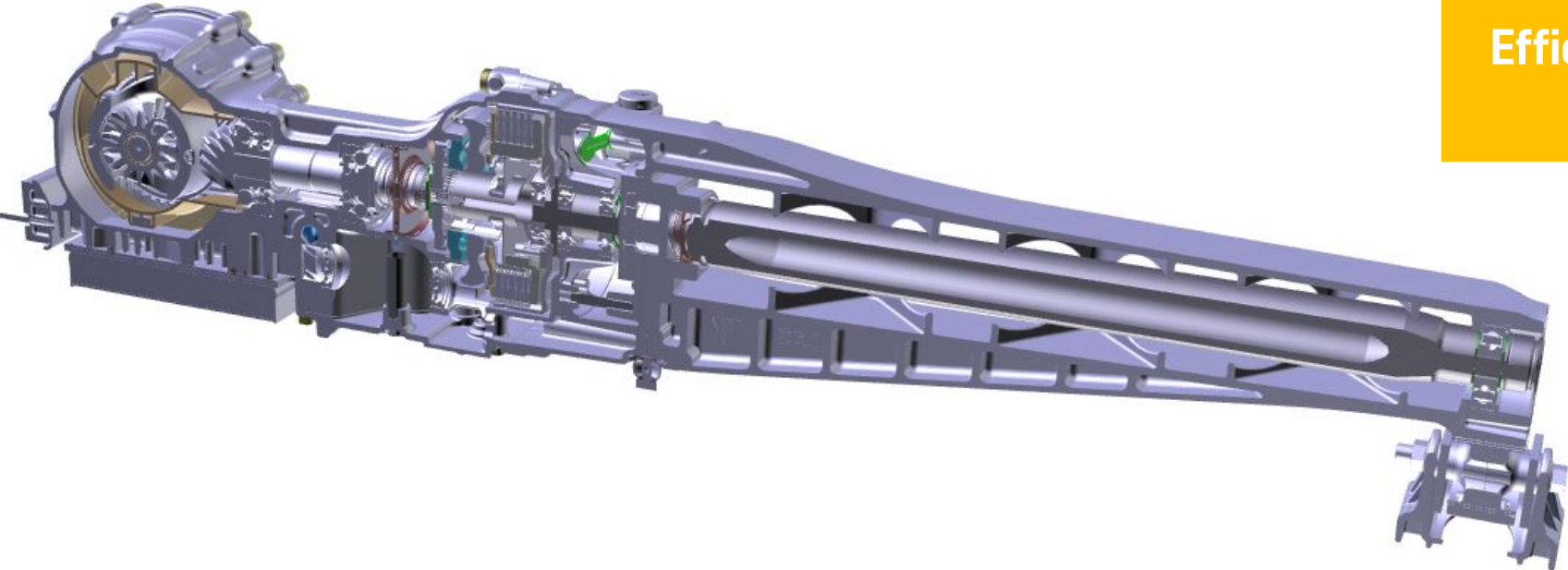


**The new eight-speed PDK in the 911 –  
important component of a future-oriented drivetrain**



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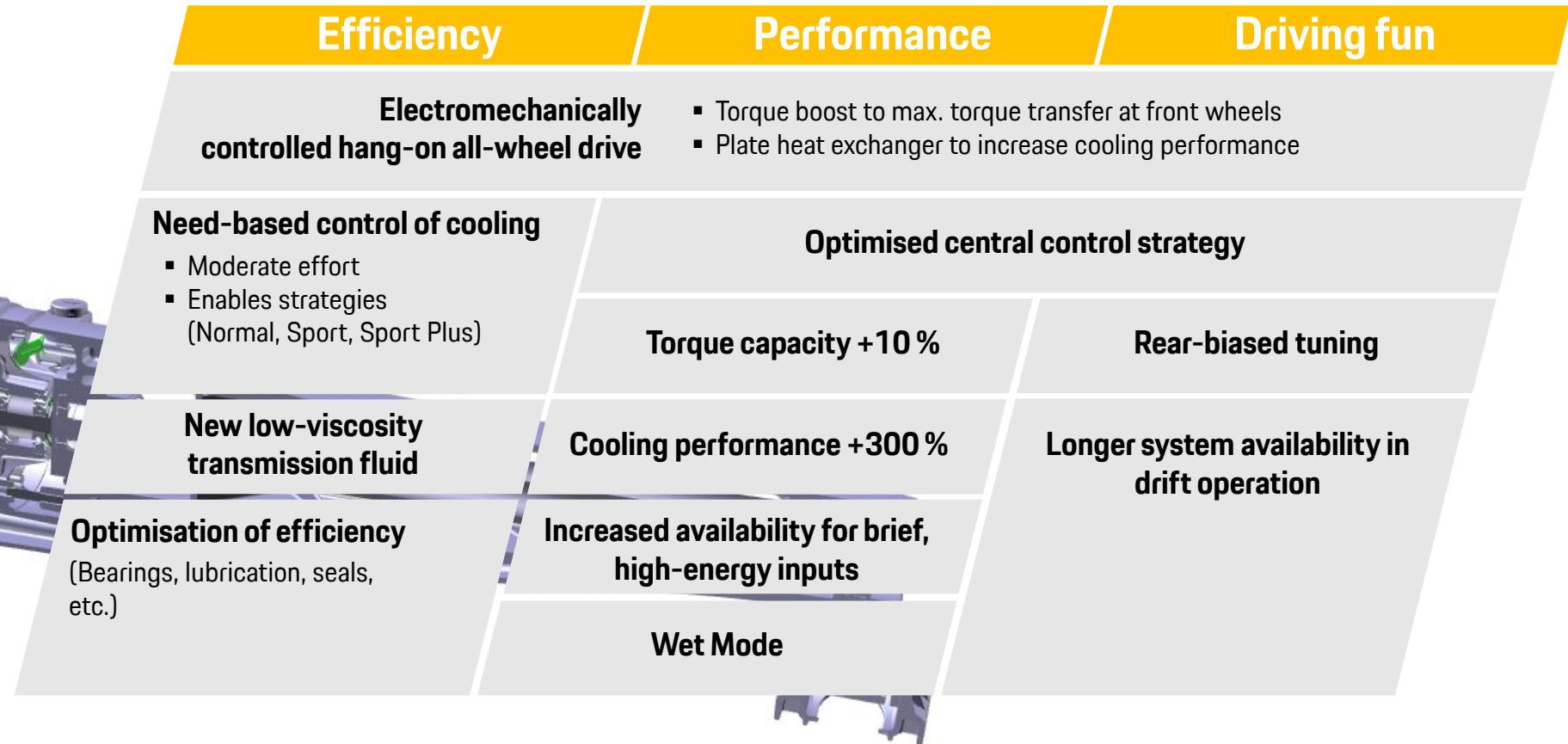
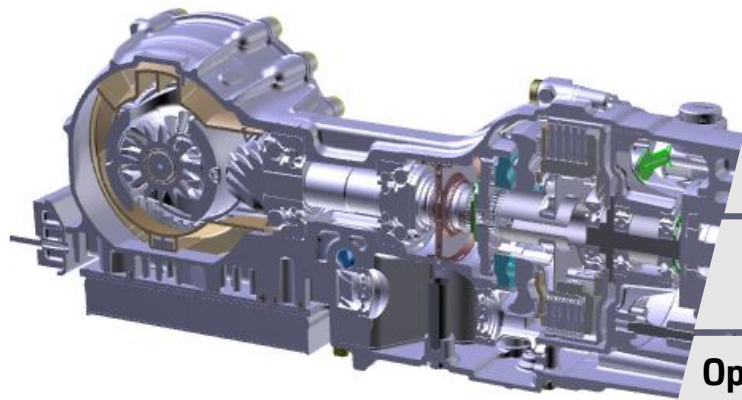
The new front axle drive in the 911 Carrera 4S

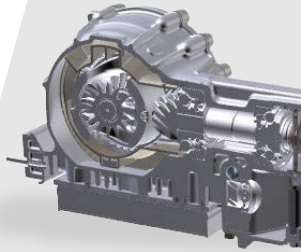


Efficiency

Performance

Driving fun





**New front axle drive**



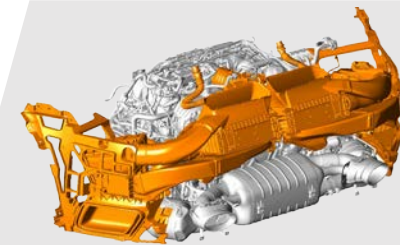
**Optimised B6 biturbo engine with optimised combustion**



**New turbocharging**



**New eight-speed PDK**



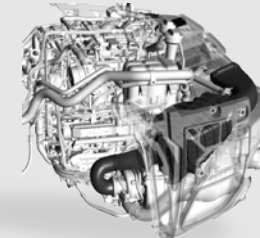
**Mid-positioned intercooler**



**New, higher performance engine cooling**



**Particulate filter**



**Lateral air filters**

911 Carrera S (991 II)

Improvement

911 Carrera S (992)

