PORSCHE



AfterSales Training

General Servicing & Repair – Cayenne

P002

Porsche AfterSales Training

Student Name: _____

Training Center Location: _____

Instructor Name: _____

Date: _____

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We have attempted to render the text within this publication to American English as best as we could. We reserve the right to make changes without notice.

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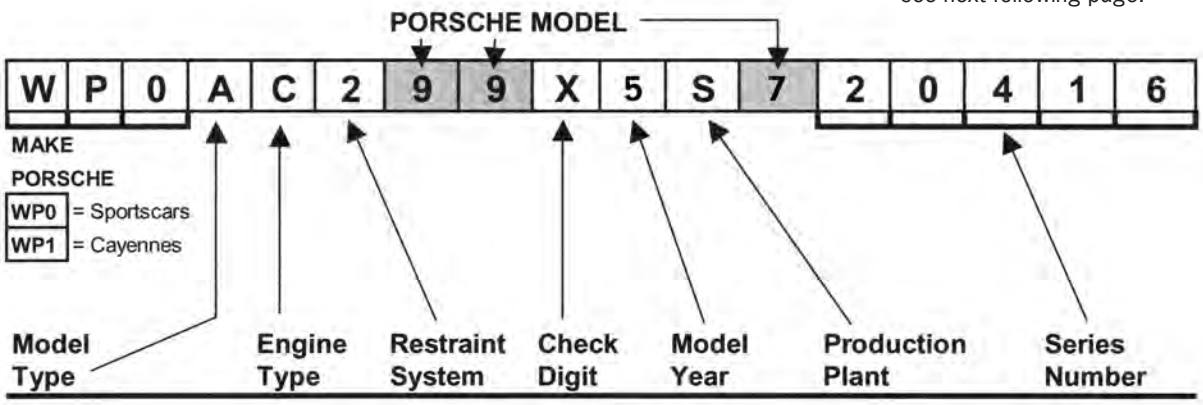
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Part Number - PNA P00 202 Edition -5/07

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Porsche Vehicle Identification Number (VIN) Structure

Example
980 = Carrera GT
986 = Boxster
987 = Boxster/Cayman
996 = 911 Carrera (996)
997 = 911 Carrera (997)
9PA = Cayenne
For additional model information see next following page.



Model Type

- **A**
  - 911 Coupe
  - 911 Carrera 2,4
  - 911 Turbo Coupe
  - 924S Coupe
  - 928 S4 Coupe ('91 MY)
  - 944 Coupe
  - 944 S Coupe
  - 944 S Turbo Coupe
  - 911GT2
  - Cayenne S
  - Cayenne Turbo
- **B**
  - 911 Carrera 2,4 Targa
- **C**
  - 911 Carrera 2,4 Cabriolet
  - Boxster
- **D**
  - 911 Targa ('96MY →)
- **E**
  - 911 Targa + Cabriolet
  - 911 Turbo, Targa, Cabriolet (Prior to '99MY)
- **J**
  - 928 S4 Coupe
  - 911 Turbo Coupe

Engine Type

- **A**
- **B**
- **C**

A= Normally Aspirated
B= Normally Aspirated
C=Turbo
Note: Letters D, E, F, etc. have also been used in various years and they are not necessarily model specific.

Restraint System

- **0** Active
- **2** Passive

Check Digit

Per NHTSA Code

Model Year

- B = 1981
- C = 1982
- D = 1983
- E = 1984
- F = 1985
- G = 1986
- H = 1987
- J = 1988
- K = 1989
- L = 1990
- M = 1991
- N = 1992
- P = 1993
- R = 1994
- S = 1995
- T = 1996
- V = 1997
- W = 1998
- X = 1999
- Y = 2000
- 1 = 2001
- 2 = 2002
- 3 = 2003
- 4 = 2004
- 5 = 2005
- 6 = 2006
- 7 = 2007
- 8 = 2008
- 9 = 2009
- A = 2010

Production Plant

- **N** Neckarsulm
- **S** Stuttgart
- **U** Finland Production (Boxster)
- **L** Leipzig (Cayenne Models)

Model Year 1981-on USA Model Designations Used In The 17 Digit VIN

911 .....911 (Various models 1981-89)
924 .....924 (Various models 1981-88)
928 .....(Various models 1981-95)
930 .....911 Turbo (1981-1989)
931 .....924 Turbo (1981-82)
944 .....(Various models 1985-91)
951 .....944 Turbo (1986-89)
964 .....911 Carrera (Various models 1989-94)
968 .....968 (1992-1995)
980 .....Carrera GT (2004-on)
986 .....Boxster (Various models 1997-04)
987 .....Boxster (Various models 2005-on)
987 .....Cayman (Various models 2006-on)
993 .....911 Carrera (Various models 1995-98)
996 .....911 Carrera (Various models 1999-05)
997 .....911 Carrera (Various models 2005-on)
9PA .....Cayenne (Various models 2003-06)
9PA .....Cayenne – Second Generation (Various models 2008)

Engine Number Identification

Cayenne S/T – V8

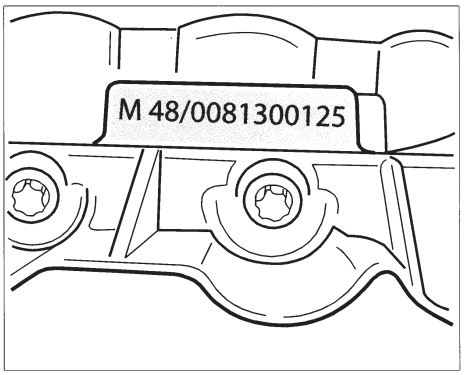
Digit:	**1 2 3**	**4 5 6 7 8**
Example:	8 1 3	0 0 5 0 1

Engine Type: (8 = 8 Cyl. Engine)

Engine Version:

Model Year:

Serial Number:



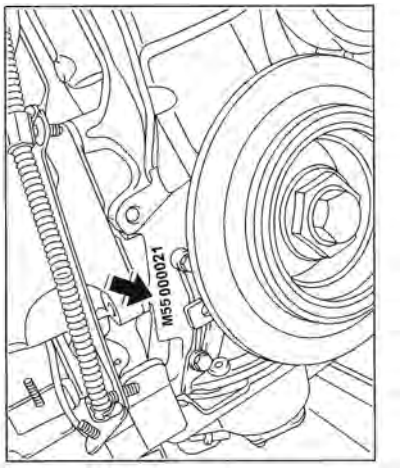
V8 – The engine number is located on the bottom of the crankcase, left side (5-8 cylinder bank), by the oil pan sealing surface. **Note:** Underside paneling needs to be removed.

Cayenne – V6

Digit:	**1 2 3**	**4 5 6 7 8**
Example:	M 5 5	0 0 5 0 1

Engine Version:

Serial Number:

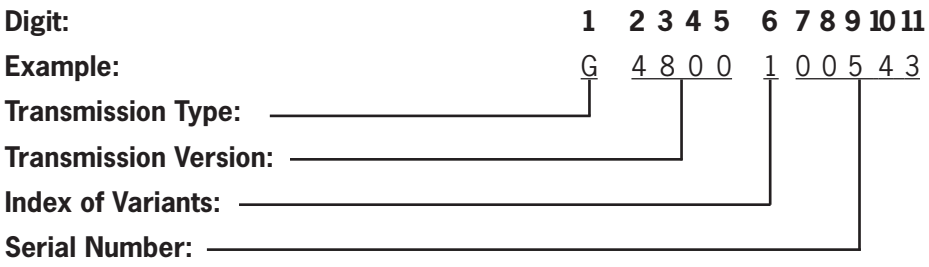


V6 – The engine number is located on the front right of the crankcase next to the crankshaft pulley.

Cayenne/S/T Engine Type Designations Since Model Year 2003

Model Year	Engine Type	Displ. Liters	Engine Power kW / HP	Installed In
2003	M48.00	4.5 V8	250/340	Cayenne S
	M48.50	4.5 V8	331/450	Cayenne Turbo
2004	M02.2Y (BFD)	3.2 V6	184/250	Cayenne
	M48.00	4.5 V8	250/340	Cayenne S
	M48.50	4.5 V8	331/450	Cayenne Turbo
2005	M02.2Y (BFD)	3.2 V6	184/250	Cayenne
	M48.00	4.5 V8	250/340	Cayenne S
	M48.50	4.5 V8	331/450	Cayenne Turbo
2006	M02.2Y (BFD)	3.2 V6	184/250	Cayenne
	M48.00	4.5 V8	250/340	Cayenne S
	M48.50	4.5 V8	331/450	Cayenne Turbo
2008	M55.01	3.6 V6	213/290	Cayenne
	M48.01	4.8 V8	283/385	Cayenne S
	M48.51	4.8 V8	358/500	Cayenne Turbo

Transmission Number Identification



Cayenne Transmission Type Designations Since Model Year 2003

Model Year	Transmission Type	Technical Data	Installed In
2003	A48.00	6-Speed A/T	Cayenne S
	A48.50	6-Speed A/T	Cayenne Turbo
	G48.00	6-Speed M/T	Cayenne S
2004	A48.00	6-Speed A/T	Cayenne S
	A48.20	6-Speed A/T	Cayenne (V6)
	A48.50	6-Speed A/T	Cayenne Turbo
	G48.00	6-Speed M/T	Cayenne S
	G48.20	6-Speed M/T	Cayenne (V6)
2005	A48.00	6-Speed A/T	Cayenne S
	A48.20	6-Speed A/T	Cayenne (V6)
	A48.50	6-Speed A/T	Cayenne Turbo
	G48.00	6-Speed M/T	Cayenne S
	G48.20	6-Speed M/T	Cayenne (V6)
2006	A48.00	6-Speed A/T	Cayenne S
	A48.20	6-Speed A/T	Cayenne (V6)
	A48.50	6-Speed A/T	Cayenne Turbo
	G48.00	6-Speed M/T	Cayenne S
	G48.20	6-Speed M/T	Cayenne (V6)
2008	A48.02	6-Speed A/T	Cayenne S
	A48.22	6-Speed A/T	Cayenne (V6)
	A48.52	6-Speed A/T	Cayenne Turbo
	G48.02	6-Speed M/T	Cayenne S
	G48.22	6-Speed M/T	Cayenne (V6)

Cayenne/S/T – ID Number Locations



Vehicle Identification

When ordering spare parts or making inquiries, please always quote the vehicle identification number.

This label contains the following information:

1. Vehicle Identification No.
2. Type/Type description
3. Engine code/Transmission code
4. Paint No./Interior
5. Optional equipment

A duplicate of this label is in your Maintenance Booklet.

Note

The data bank can not be reordered when lost or damaged.



Vehicle identification number

In accordance with Federal Safety Regulations, the vehicle identification number of your car is located at the bottom left of the windshield frame and can be seen from the outside and in the luggage compartment on the right in front of the tool box.



Safety compliance sticker

The safety compliance sticker is your assurance that your new Porsche complies with all applicable Federal Motor Vehicle Safety Standards which were in effect at the time the vehicle was manufactured.

The sticker also shows the month and year of production and the vehicle identification number of your car (perforations) as well as the **G**ross **V**ehicle **W**eight **R**ating and the **G**ross **A**xle **W**eight **R**ating.

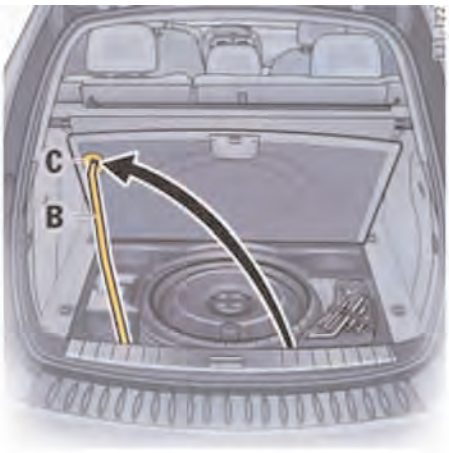


Tire pressure plate

The tire pressure plate is fitted to the driver's door.

Cayenne/S/T – Rear Load Space







Loadspace

The maximum permissible load on the loadspace floor is 400 kg or 880 lbs. The weight must be distributed evenly over the entire loadspace.

▷ Please observe the chapter "STOWING LOAD" on Page 183.

Opening loadspace floor

1. Pull handle **A** and lift the loadspace floor.
2. Unclip prop **B** and insert it into receiver **C** in the loadspace floor.

Closing loadspace floor

1. Lift the loadspace floor slightly and clip prop **B** into its holder.
2. Close the loadspace floor.

Tie-down rings

You can secure the load in the luggage compartment against slipping. Tie-down straps or the luggage net can be fastened to tie-down rings **D**.

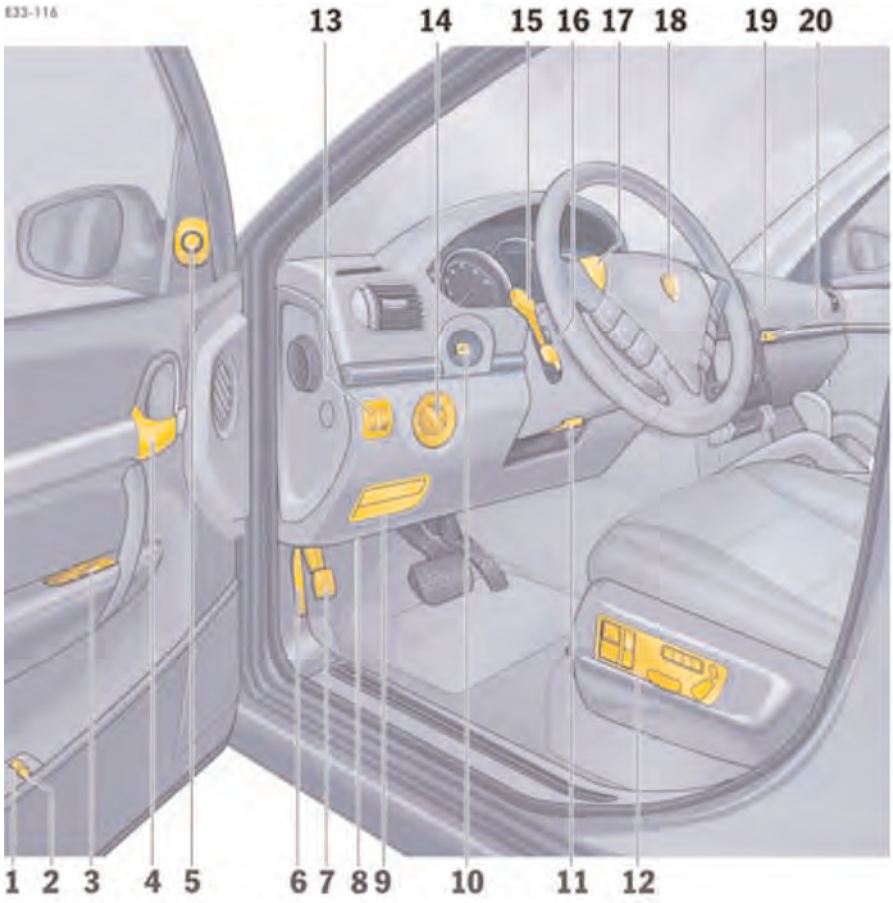
▷ Make sure that all rings are equally loaded when securing a load.

Note on operation

The tie-down rings are not designed to restrain a heavy load in an accident.

Notes:

Cayenne/S/T – Interior Controls (May Vary Depending on Model and Equipment)



1 Filler flap release
2 Rear lid release
3 Power windows
4 Inner door handle
5 Door mirror adjustment
6 Engine compartment lid release
7 Parking brake
8 Diagnostic socket
9 Parking brake release
10 Ignition lock/steering lock
11 Steering wheel adjustment
12 Seat adjustment
13 Instrument lighting knob
14 Light switch
15 Turn signal/high, dipped beam/headlight flasher stalk
16 Operating lever for cruise control
17 Rocker switches for Tiptronic
18 Horn
19 Hazard warning light switch
20 Glove compartment

Notes:

Maintenance Sheets

With the introduction of the second generation Cayenne, the maintenance schedule has changed. There are now separate minor and major maintenance sheets for first and second generation Cayenne vehicles.

Part Number	Application	Pad Qty.
PNA 000 162 CA	Cayenne V6 & V8 - Minor Maintenance (M.Y. 2003-06)	25 Sheets
PNA 000 162 CD	Cayenne V6 - Minor Maintenance (M.Y. 2008)	25 Sheets
PNA 000 162 CE	Cayenne V8 - Minor Maintenance **1** (M.Y. 2008)	25 Sheets
PNA 000 162 CF	Cayenne V8 - Minor Maintenance **2** (M.Y. 2008)	25 Sheets
PNA 000 162 CB	Cayenne V6 & V8 - Major Maintenance (M.Y. 2003-06)	25 Sheets
PNA 000 162 CG	Cayenne V6 - Major Maintenance (M.Y. 2008)	25 Sheets
PNA 000 162 CH	Cayenne V8 - Major Maintenance (M.Y. 2008)	25 Sheets
PNA 000 162 CC	Cayenne (V6) - Oil Change Service Checklist	25 Sheets

Note!

The examples used thoughout this workbook are based on the 1st generation minor and major maintenance sheets.

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Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

❑ Diagnosis system: Read out fault memory; reset maintenance interval

❑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Check drive belt

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

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Minor Maintenance Checklist – Cayenne V6 (M.Y. 2008)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 18,000, 54,000, 90,000, 126,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

❑ Diagnosis system: Read out fault memory; reset maintenance interval

❑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ PDCC: Check fluid level

❑ Check drive belt

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

❑ Drive shafts: Visual inspection of the sleeves for leaks & signs of damage)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance every 36,000 miles / 60,000 km or 4 years (Labor Operation 03 81 00 ..)

❑ Replace spark plugs

Additional Maintenance every 54,000 miles / 90,000 km or 6 years (Labor Operation 03 83 00 ..)

❑ Replace PDCC reservoir

Additional Maintenance every 72,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 144,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CD

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CD

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Minor Maintenance 1 Checklist – Cayenne S/T V8 (M.Y. 2008)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 12,000, 48,000, 84,000, 120,000 miles etc. / 20,000, 80,000, 140,000, 200,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance 1 must be performed no later than after 1, 4, 7, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

❑ Diagnosis system: Read out fault memory; reset maintenance interval

❑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter

❑ PDCC: Check fluid level

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne S every 36,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 24,000 miles / 40,000 km or 4 years

Additional Maintenance every 48,000 miles / 80,000 km or 6 years (Labor Operation 03 82 00 ..)

❑ Replace PDCC reservoir

Additional Maintenance every 72,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 144,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CE

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CE

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Minor Maintenance 2 Checklist – Cayenne S/T V8 (M.Y. 2008)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 24,000, 60,000, 96,000, 132,000 miles etc. / 40,000, 100,000, 160,000, 220,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance 2 must be performed no later than after 2, 5, 8, 11..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

❑ Diagnosis system: Read out fault memory; reset maintenance interval

❑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter

❑ Check drive belt

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

❑ Drive shafts: Visual inspection of the sleeves for leaks & signs of damage)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne S every 36,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 24,000 miles / 40,000 km or 4 years

Additional Maintenance every 48,000 miles / 80,000 km or 6 years (Labor Operation 03 82 00 ..)

❑ Replace PDCC reservoir

Additional Maintenance every 72,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 144,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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PORSCHE

Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

❑ Diagnosis system: Read out fault memory; reset maintenance interval

❑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Pollen filter: Replace filter element

❑ Check drive belt

❑ Steering gear: Visual inspection of the dust boots for signs of damage
Tie rod ends: Check play and dust boots

❑ Power steering: Check fluid level

❑ Fuel system lines and connections: Visual inspection

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection levels

❑ Parking brake: Check free play

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the for leaks & signs of damage

❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Hydraulically detachable off-road sway bar: Check fluid level and function

❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Lubricate door latch and fastening bolts

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level

❑ Check wiper blades

❑ Seat belts: Check operation and condition

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Trailer coupling: Check operation

❑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

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Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CB

PORSCHE

Major Maintenance Checklist – Cayenne V6 (2008)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 36,000, 72,000, 108,000, 144,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

❑ Diagnosis system: Read out fault memory; reset maintenance interval

❑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ PDCC: Check fluid level

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Pollen filter: Replace filter element

❑ Check drive belt

❑ Steering gear: Visual inspection of the dust boots for signs of damage
Tie rod ends: Check play and dust boots

❑ Power steering: Check fluid level

❑ Fuel system lines and connections: Visual inspection

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection levels

❑ Parking brake: Check free play

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the for leaks & signs of damage

❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage

❑ Drive shafts: Visual inspection of the sleeves for leaks & signs of damage

❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Lubricate door latch and fastening bolts

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level

❑ Check wiper blades

❑ Seat belts: Check operation and condition

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Trailer coupling: Check operation

❑ Airbag system: Check operation and condition (see additional maintenance)

Additional Maintenance every 36,000 miles / 60,000 km or 4 years (Labor Operation 03 81 00 ..)

❑ Replace spark plugs

Additional Maintenance every 54,000 miles / 90,000 km or 6 years (Labor Operation 03 83 00 ..)

❑ Replace PDCC reservoir

Additional Maintenance every 72,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

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Additional Maintenance every 144,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation
❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CG

PORSCHE

Major Maintenance Checklist – Cayenne S/T V8 (2008)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 36,000, 72,000, 108,000, 144,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 3, 6, 9, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

❑ Diagnosis system: Read out fault memory; reset maintenance interval

❑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter

❑ PDCC: Check fluid level

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Pollen filter: Replace filter element

❑ Check drive belt

❑ Steering gear: Visual inspection of the dust boots for signs of damage
Tie rod ends: Check play and dust boots

❑ Power steering: Check fluid level

❑ Fuel system lines and connections: Visual inspection

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection levels

❑ Parking brake: Check free play

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the for leaks & signs of damage

❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage

❑ Drive shafts: Visual inspection of the sleeves for leaks & signs of damage

❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Lubricate door latch and fastening bolts

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level

❑ Check wiper blades

❑ Seat belts: Check operation and condition

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Trailer coupling: Check operation

❑ Airbag system: Check operation and condition (see additional maintenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne S every 36,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 24,000 miles / 40,000 km or 4 years

Additional Maintenance every 48,000 miles / 80,000 km or 6 years (Labor Operation 03 82 00 ..)

❑ Replace PDCC reservoir

Additional Maintenance every 72,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

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Additional Maintenance every 144,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance after 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation
❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CH



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Notes:



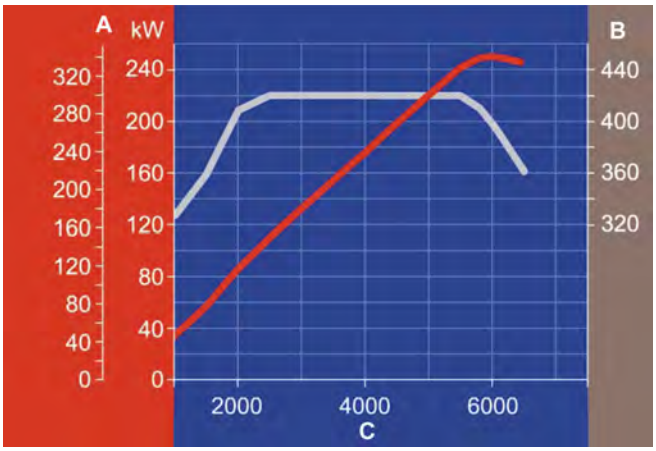
General

The completely new developed V8 engines are a naturally aspirated engine for the Cayenne S and a turbocharged version for the Cayenne Turbo, each with a displacement of 4.5 liters. They are 8-cylinder, 32-valve gasoline engines, with the cylinder banks arranged at 90 degrees and two camshafts per cylinder bank. Particular attention was paid during the development of these new engines to achieving the maximum specific output while at the same obtaining outstanding emissions and fuel consumption characteristics.

Important features of the engine are:

- Two-piece closed deck aluminum crankcase with integrated cast-iron bearing blocks
- Two-piece cylinder heads with separate camshaft housing
- Continuously variable camshaft adjustment on the intake side (VarioCam)
- Cylinder-selective exhaust cam contours
- Integral dry-sump lubrication
- Two-stage oil scavenging, additional turbocharger scavenge pump for V8 twin-turbo engine
- Spray cooling of pistons (V8 twin-turbo engine only)
- Oil to water heat exchanger
- Cross-flow cooling of cylinder heads, longitudinal flow through crankcase

Full-load Curve – Cayenne S



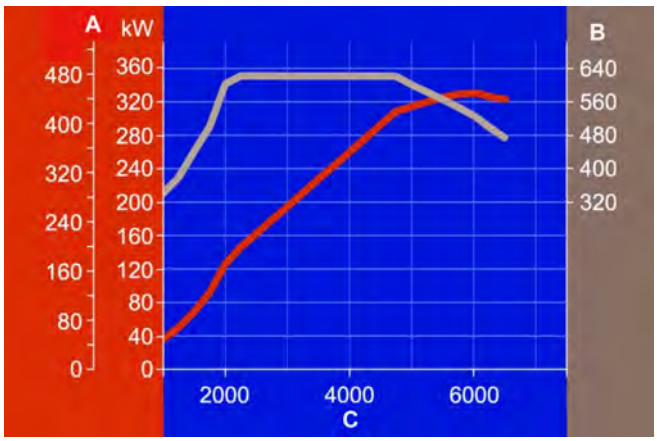
Engine Data

Engine Type	M48.00
Number of Cylinders	8
Bore	93 mm
Stroke	83 mm
Displacement	4.5 Liter
Compression Ratio	11.5
Max. Power	250 kW (340 hp)
at Engine Speed	6000 rpm
Max. Torque	420 Nm (310 ft lb)
at Engine Speed	2500 – 5500 rpm
Governed Engine Speed Tiptronic	6500 rpm
Engine Weight	227 kg (500 lbs)
Firing Order	1 - 3 - 7 - 2 - 6 - 5 - 4 - 8

Notes:

Engine – Cayenne S/T – 1st Generation

Full-load Curve – Cayenne Turbo

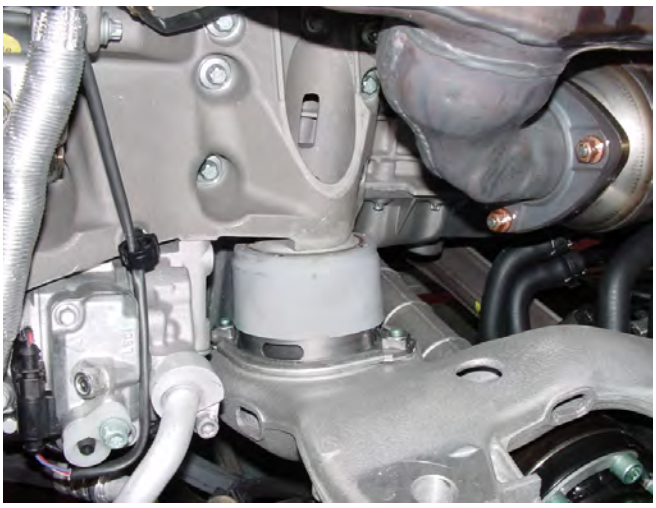


Engine Data

Engine Type	M48.50
Number of cylinders	8
Bore	93 mm
Stroke	83 mm
Displacement	4.5 Liter
Compression Ratio	9.5
Max. Power	331 kW (450 hp)
at Engine Speed	6000 rpm
Max. Torque	620 Nm (458 ft lb)
at Engine Speed	2250 - 4750 rpm
Governed Engine Speed Tiptronic	6500 rpm
Engine Weight	253 kg (558 lbs)
Firing Order	1 - 3 - 7 - 2 - 6 - 5 - 4 - 8

Notes:

Engine Mounts



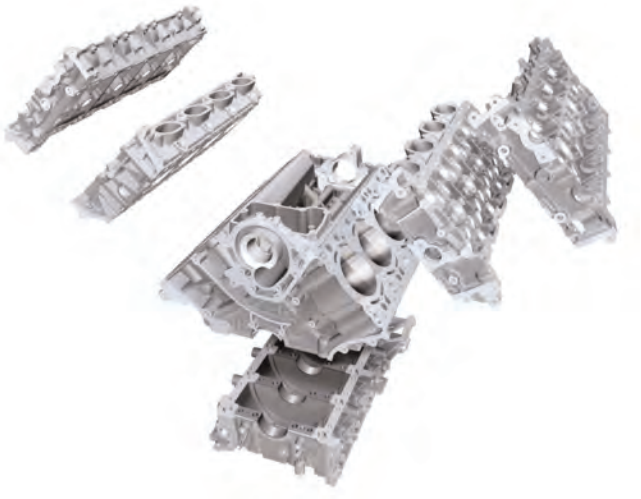
Engine Mount

The engine mounts consist of two hydraulic mounts attached to an engine cross member and an elastic mount in the center of the transmission. The hydraulic mounts absorb low-frequency vibrations with their rubber bearing, and also suppress high-frequency vibrations with their damping section. This ensures that no undesirable vibration and noise is conducted into the body. To limit loads on the rubber body that occur the engine mounts have stops. The engine cross-member is formed as a hollow profile for weight reduction and rigidity.



An additional torque strut on the cylinder head absorbs the high torque produced by the V8 engines.

Crankcase



Engine Components

The crankcase in the Porsche Cayenne is a two-piece "closed deck" design, made of a light-weight alloy (AlSi17Cu4Mg). In closed deck construction, the sealing surface of the crankcase to the cylinder head is largely closed, only the bores and passages for oil and coolant are present. This design will strengthen the entire structure. The result is less cylinder distortion and benefits in oil consumption.

The alloy for the crankcase housing is a so-called hypereutectic alloy, in which silicon crystals are formed. To create a wear-resistant surface on the cylinder walls, these silicon crystals are uncovered by multiple special honing procedures. To minimize thermal changes in bearing clearance and thus reduce mechanical noise, the lower section of the crankcase is furnished with cast-in cast iron bearing blocks. Another advantage is that when the engine is at operating temperature, oil flow at the main bearings does not increase substantially as a result of the constant bearing clearance (approximately the same coefficient of thermal expansion between steel/crankshaft and cast iron/bearing block).

Crankshaft

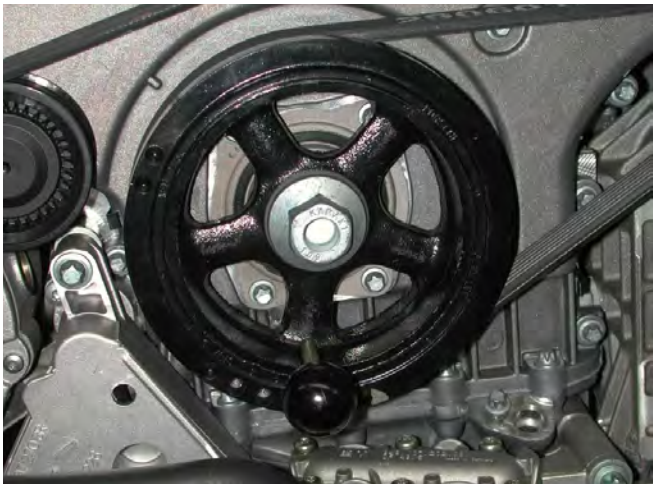


Crankshaft

The drop-forged crankshaft runs in five bearings and has eight counterweights. Main bearing number 3 is designed as a thrust bearing. Axial play is determined by two thrust washers, which are set into the bearing housing halves. The main bearings are dual material bearings and are 64 mm in diameter. The connecting rod bearings are triple material bearings and are 54 mm in diameter.

Vibration Damper

A vibration damper is used to reduce torsional vibration at the crankshaft and additionally reduce component loads.



Vibration Damper

Notes:

Connecting Rods



Connecting Rod

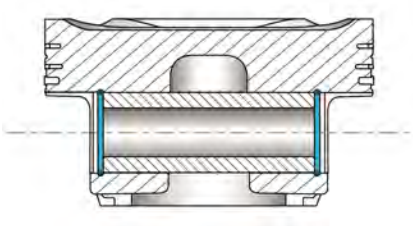
After machining, the forged connecting rods are broken apart at the rod bearing (cracked). The two parts are centered to one another by means of the resulting fracture pattern. To prevent incorrect assembly, the connecting rods are marked with additional matching pairs of numbers and the bores for the big-end bolts are offset.

Pistons

The pistons for the naturally aspirated engines are cast.



Cayenne S Piston

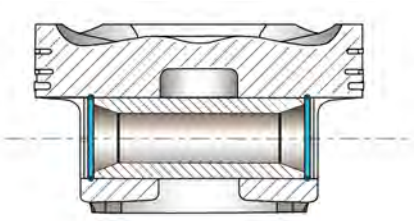


Cayenne S Piston Cross Section

The pistons for the turbocharged engines are forged.



Cayenne Turbo Piston



Cayenne Turbo Piston Cross Section

The pistons of the naturally aspirated engine have different combustion bowls than the turbocharged engine. The bowls in the pistons for the turbo engine are much deeper in order to reduce the compression ratio.

Notes:

Cayenne S Cylinder Head



The cylinder head for the Cayenne S is designed in two pieces. It consists of the cylinder head and the camshaft housing with the lifter guides and the camshaft bearings. This multi-piece construction offers the best design for the use of high-heat resistant aluminum alloys to handle maximum specific loads. The exchange of gases is managed by 4 valves per cylinder, which are operated directly by hydraulic self-adjusting lifters. The two intake and two exhaust valves are arranged in a V, with a valve angle of 29.6º.

Cayenne Turbo Cylinder Head

The cylinder head design of the Cayenne Turbo is identical in principle to that of the Cayenne S, however, due to higher loading a special high-heat resistant aluminum alloy is used. The intake ports in the cylinder head have been reworked with respect to different gas velocities compared to the naturally aspirated engine.

Valves and Valve Springs

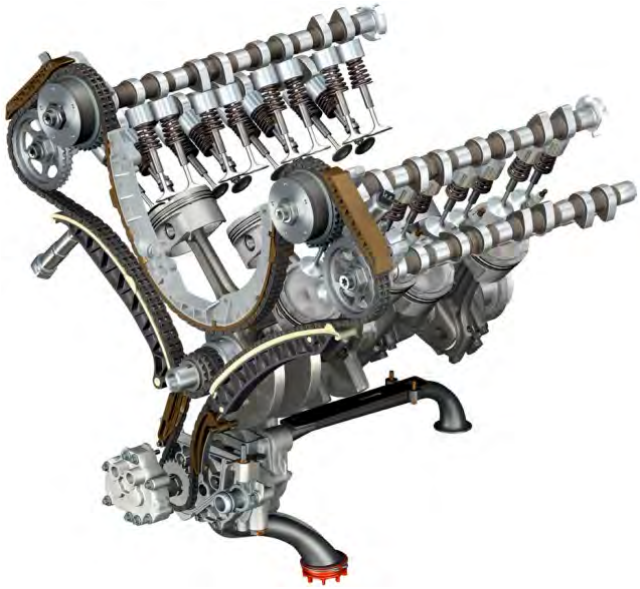
The valve stem diameter for the intake and exhaust valves on the Cayenne S and the Cayenne Turbo is 6 mm. The intake and exhaust valves are bi-metallic, this means different materials are used for the valve head and the lower part of the stem than for the upper part of the valve stem.

The exhaust valves for the Cayenne Turbo are sodium-filled. The diameter of the intake valve heads is 37.1 mm and that of the exhaust valve heads is 32.5 mm for both engine versions.

The intake and exhaust valve springs on the Cayenne S and the intake valve spring on the Turbo are single helical springs. To ensure proper closing of the exhaust valves even at higher pressures in the exhaust system, dual valve springs are installed on the exhaust side on the Cayenne Turbo.

Notes:

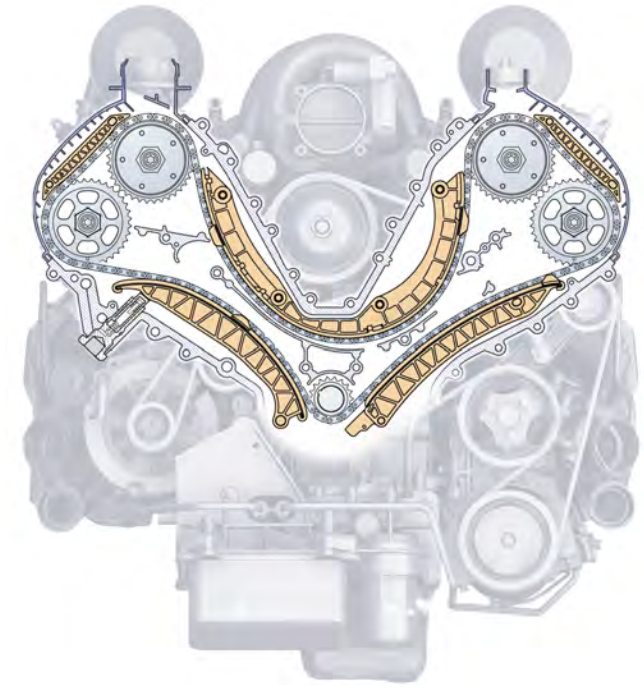
Camshafts with Cylinder Specific Cam Contours



The intake and exhaust camshafts for both engine versions have a base diameter of 38 mm. Intake valve lift is 10 mm. Exhaust valve lift for cylinders 1, 2, 6 and 8 is 8 mm, for cylinders 3, 4, 5 and 7 exhaust valve lift is 9.85 mm.

The engine design with a V8 crankshaft and 90° throws ensures outstanding balancing of masses and forces. However, with this engine design and a layout with conventional cam contours (equal cam lift) individual cylinders would hamper each other as gas flows out into the exhaust manifold. The reason is that the exhaust lead impulse of the particular cylinder on the exhaust stroke (e.g. cylinder number 2) gets into the crossover phase of the following cylinder (cylinder number 3). This would have a detrimental effect on cylinder filling. In addition, excess residual gases have a negative effect on the knock limit. Because of the Cayenne's firing order (1 – 3 – 7 – 2 – 6 – 5 – 4 – 8), cylinders 3 and 4 as well as 5 and 7 would be at a disadvantage in their charge. These cylinders are given higher cam lift. This step achieves equal filling of the cylinders, which results in an optimized torque curve across the entire rpm range.

Chain Drive



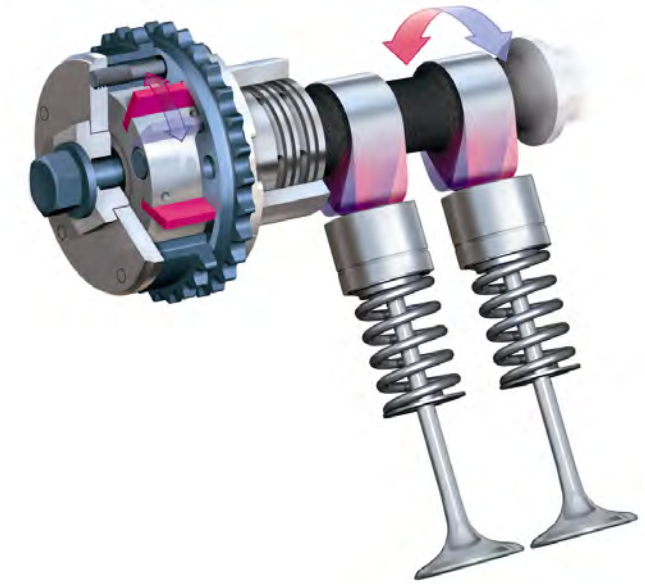
The chain drive consists of a duplex roller chain driving both intake and exhaust camshafts. The chain has specially coated guides. The lower guide on cylinder bank 1 – 4 is designed to be a tensioner at the same time. The chain tensioner is hydraulic and maintenance-free.

Belt Drive

A poly-rib belt drives accessories such as the alternator, coolant pump, power steering pump and air-conditioning compressor by the vibration damper. A maintenance-free, hydraulic belt tensioner maintains correct tension.

Notes:

Camshaft Adjustment

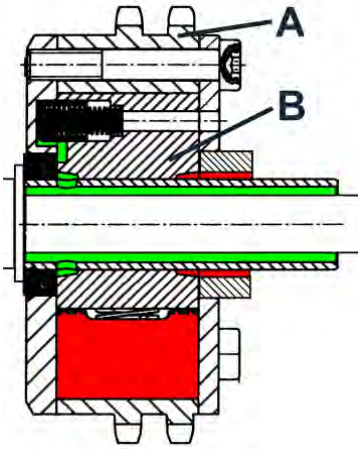


Camshaft adjustment at the intake camshaft is based on the operation of a vane-type adjuster. The DME control unit determines the current position of the camshaft to the crankshaft (actual angle) from the engine speed sensor and Hall sensor signals. The position control in the DME control unit determines the desired specified angle via the programmed map values (rpm, load, engine temperature). If there is a difference between the specified and actual angle, a regulator in the DME actuates a hydraulic solenoid valve according to the desired adjustment.

Adjustment angle is 50° crankshaft angle (25° camshaft angle).

Notes:

Vane-Type Adjuster



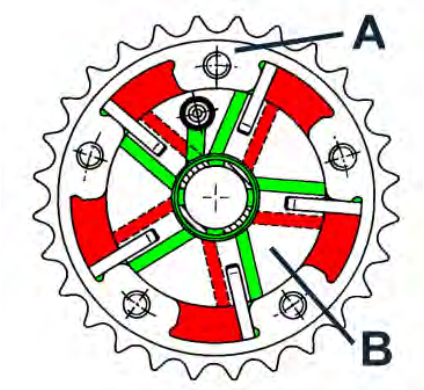
A - Stator
B - Rotor

The vane-type adjuster consists of the stator (A), attached to the crankshaft through a sprocket, the rotor (B), attached to the camshaft; the vanes and two covers. The sprocket is attached to the outer diameter of the stator. It is a positive fit to the crankshaft through the chain drive. The rotor is bolted to the camshaft. Rotation between rotor and stator is possible (inner mounting of the adjuster). This rotation is limited by the vanes mounted in the rotor and by the stops on the stator. The vanes also divide each of the recesses on the stator into two chambers.

These chambers can be filled with oil through oil orifices and oil lines in the rotor. A cover attached to the sprocket seals the chambers laterally. The adjuster is locked to a stop (retard). To do this, a spring-loaded pin in the retard position of the adjuster moves into a hole in the cover. A positive connection is created between stator and rotor for starting the engine. This prevents noise during the time when the oil pmp is starting to turn.

Notes:

Vane-Type Adjuster (cont'd)



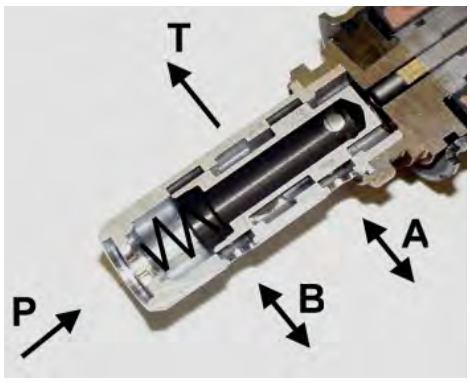
A - Stator
B - Rotor

Operation

Two chambers acting in different directions are provided in the adjuster. Filling one chamber causes the rotor to rotate in one direction. By filling the other chamber, the rotor and the camshaft can be rotated back to its initial position. The oil from the non-pressurized chamber flows to the hydraulic solenoid valve back into the crankcase.

If the oil feed and the oil return at the hydraulic solenoid valve is interrupted while one chamber is being filled (middle position of the valve), the adjuster stops in the position it has just reached. The chambers lose oil due to leakage so that the adjuster leaves its position. The hydraulic solenoid valve is actuated accordingly through the DME and the adjuster returns to the desired position again.

Hydraulic Solenoid Valve

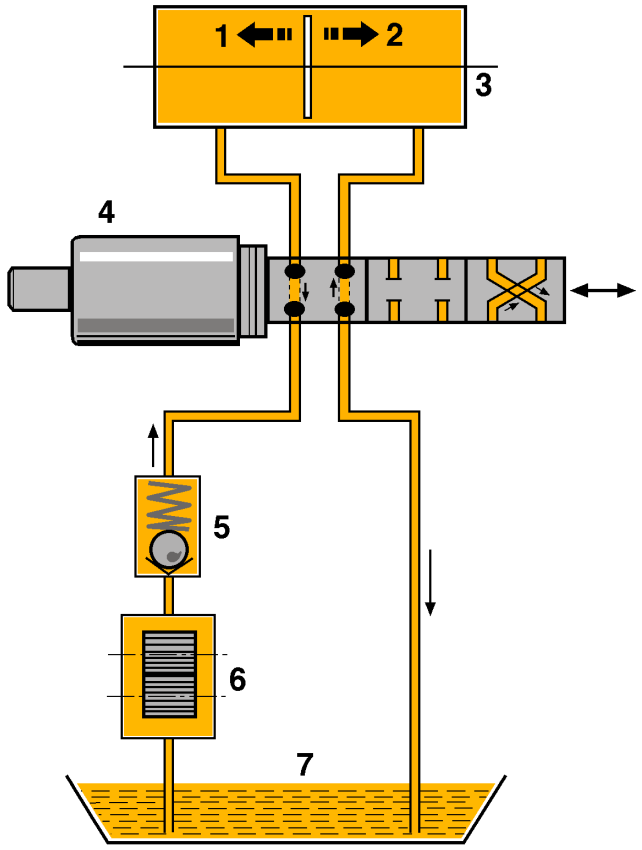


The hydraulic solenoid valve is designed as a four-way proportioning valve and, depending on the setting from the DME, opens one of the two control lines (A/B) to the oil pressure supply line (P) and opens the other line to allow the oil to flow out to return to the crankcase (T-line). If oil pressure is applied to the A-line, the adjuster is rotated in the direction of early. If oil pressure is applied to the B-line, the adjuster is rotated in the direction of later timing. In the middle position both control lines are closed. The camshaft is held in the interim position.

So, it is not only possible to adjust the position very quickly, but also very slowly in the event of minor deviations of the valve from the middle position.

Notes:

Non-Return Valve



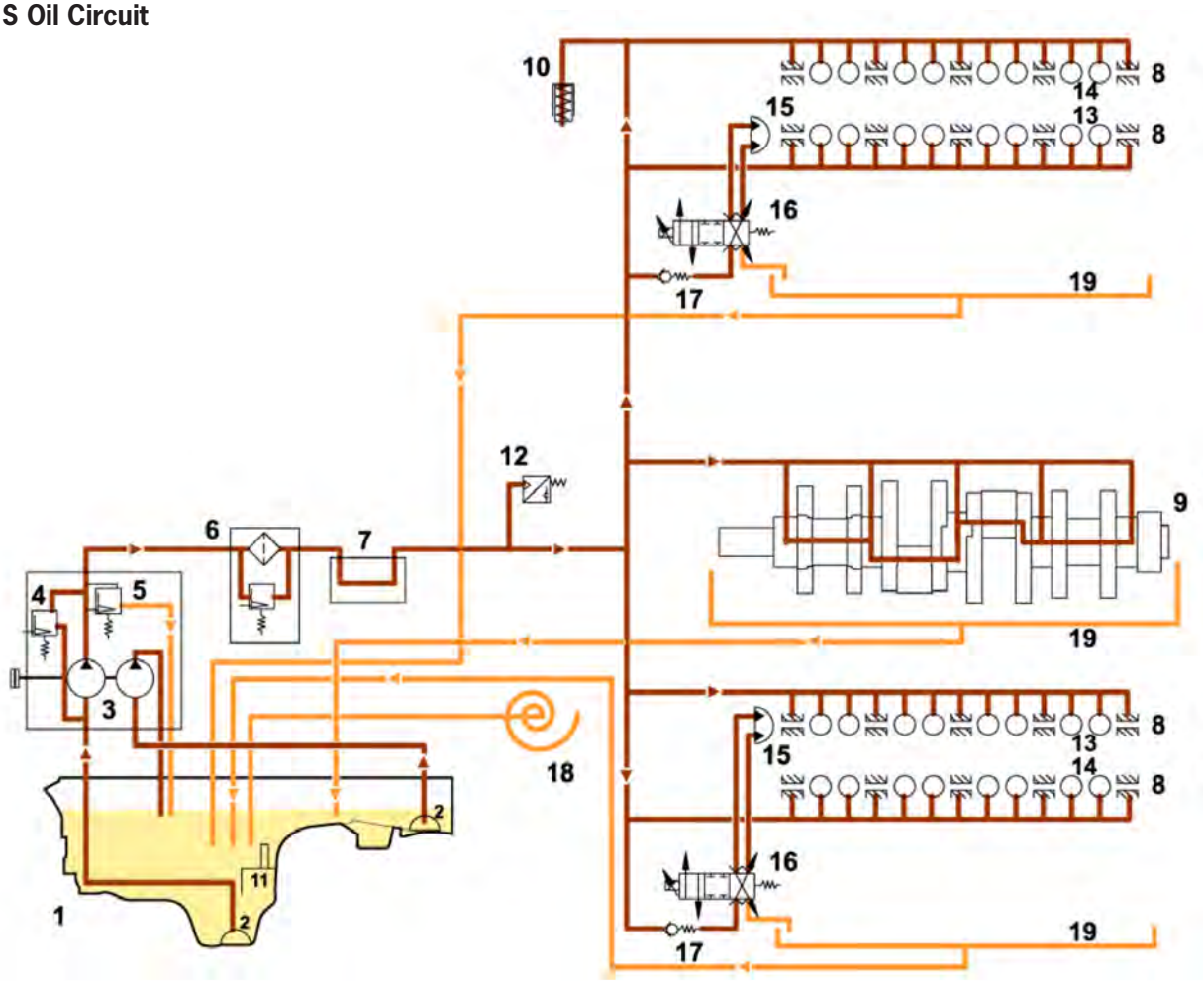
1 - Adjustment Direction Late
2 - Adjustment Direction Early
3 - Camshaft Adjuster
4 - Hydraulic Solenoid Valve
5 - Non-return Valve
6 - Oil Pump
7 - Oil Pan

Occasionally the camshaft requires high drive torque for valve operation, at other times the camshaft continues to run independently (alternating torque). If a non-return valve is placed in the P-line and current is applied to the hydraulic solenoid valve (adjustment toward early valve timing) with the camshaft advancing, the adjuster sucks oil by itself through the feed line, the hydraulic solenoid valve and the non-return valve. If the camshaft then wants to lag behind because of the high drive torque, the non-return valve closes and the oil cannot escape. During this time the camshaft is driven through the oil cushion by the sprocket, as happens when it is free-wheeling. The camshafts repeatedly advance and are then driven, so that the camshaft gradually runs at early valve timing by itself.

Since the principle just described works only with very tightly sealed adjuster systems and low friction valve gear, oil pressure is required. To avoid the need for an extremely large oil pump, the principle described can be taken advantage of with a hot engine and low oil pressure by using the non-return valve. The non-return valve serves to increase adjustment speed under conditions of low oil pressure.

Notes:

Cayenne S Oil Circuit

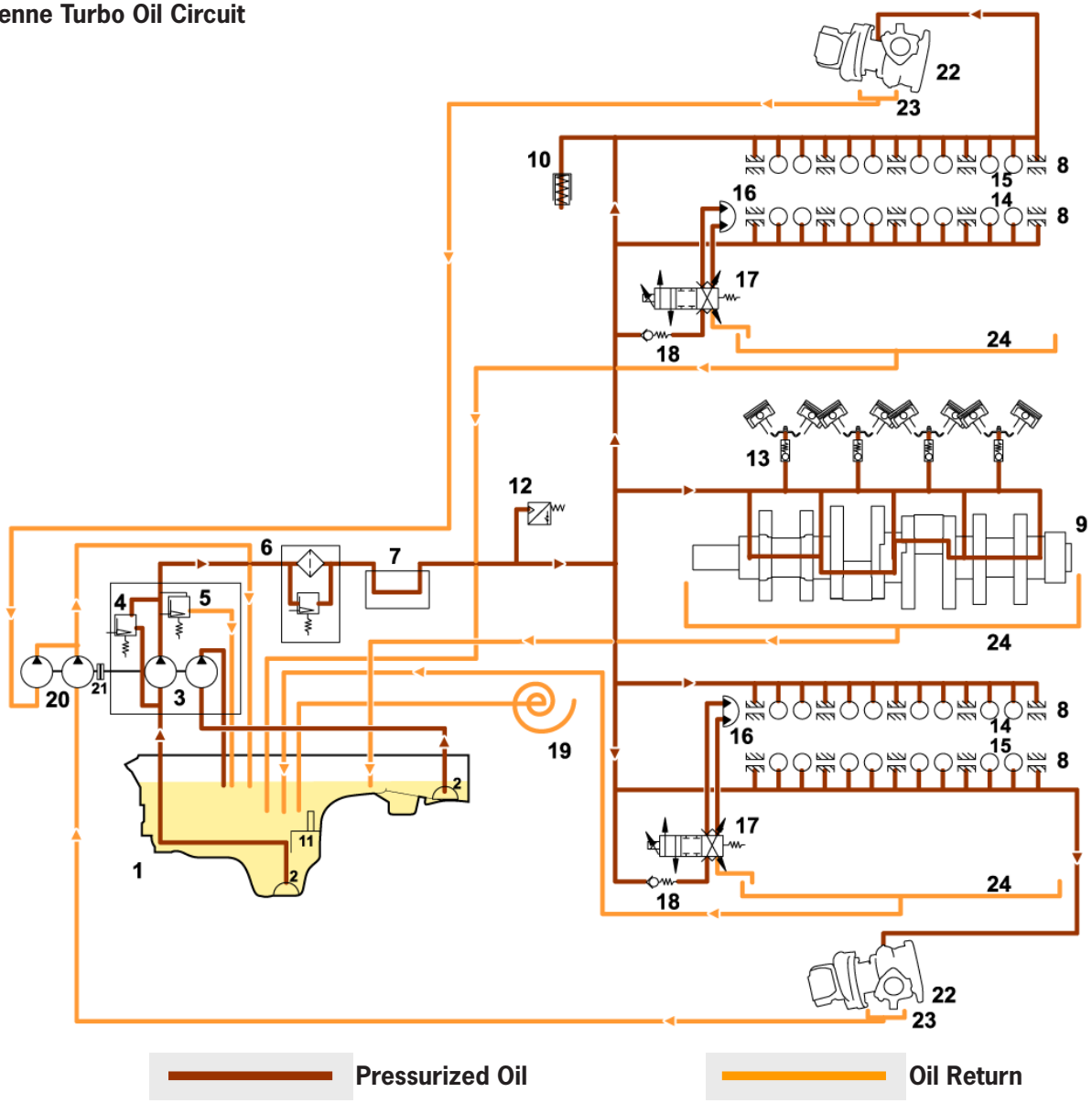


Pressurized Oil

Oil Return

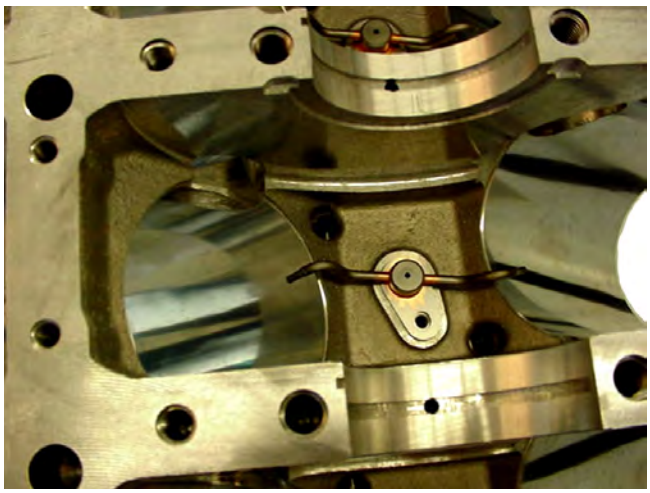
1 - Oil pan
2 - Suction tube with screen
3 - Oil pumps
4 - Control valve (regulates oil pressure to about 5 bar)
5 - Safety valve (opens at 10 bar)
6 - Full-flow oil filter with pressure relief valve
7 - Oil to water heat exchanger
8 - Camshaft
9 - Crankshaft
10 - Chain tensioner
11 - Oil level detector and oil temperature sensor
12 - Oil pressure sensor
13 - Hydraulic lifters, intake
14 - Hydraulic lifters, exhaust
15 - Camshaft adjuster
16 - Hydraulic solenoid valve
17 - Non-return valve
18 - Oil mist separator
19 - Oil return passages

Cayenne Turbo Oil Circuit



1 - Oil pan
2 - Suction tube with screen
3 - Oil pumps
4 - Control valve (regulates oil pressure to about 5 bar)
5 - Safety valve (opens at 10 bar)
6 - Full-flow oil filter with pressure relief valve
7 - Oil to water heat exchanger
8 - Camshaft
9 - Crankshaft
10 - Chain tensioner
11 - Oil level detector and oil temperature sensor
12 - Oil pressure sensor
13 - Piston oil spray nozzle (opening pressure 1.8 bar)
14 - Hydraulic lifter, intake
15 - Hydraulic lifter, exhaust
16 - Camshaft adjuster
17 - Hydraulic solenoid valve
18 - Non-return valve
19 - Oil mist separator
20 - Suction pump, turbocharger
21 - Equalizer clutch
22 - Turbocharger
23 - Suspended oil container
24 - Oil return passages

Oil Spray Jets



Oil Spray Jets

To reduce piston temperatures the engine in the Cayenne Turbo has oil-cooled pistons. The spray nozzles are mounted on the crankcase and spray on the bottom of the piston. To guarantee engine oil pressure at low engine rpm and high engine oil temperatures, opening pressure for the nozzles is set at 1.8 bar.

Oil Pump

To ensure a reliable supply of oil, even under extreme longitudinal and lateral acceleration, as well as in off-road operation on grades/descents and tilt angles up to 45°, integral dry sump lubrication is introduced on the Cayenne. Also, a second suction point is provided in the forward area of the oil pan. A separate bulkhead guarantees an adequate volume of oil in the forward area of the oil pan.

From there the engine oil is carried over the main pickup point to the oil pump and into the oil filter and the oil to water heat exchanger bolted to the oil gallery housing and is finally made available to the lubrication circuit. The oil pump is driven by a chain drive from the crankshaft.

Cayenne Turbo

The Cayenne Turbo receives additional lubrication and suction for the exhaust turbocharger. An additional oil suction pump is provided for this purpose.

Notes:

Cayenne S Crankcase Ventilation



The crankcase is vented though the timing case and into the valve covers. Cast contours in the timing case cover direct the blow-by gases and partially scrape off the oil slung off the timing chain. This causes an advanced separation of engine oil to reduce the load on the ventilation system.

In addition, the blow-by gases are carried by way of the crankcase and the cylinder heads into the valve covers. Here further separation of the engine oil takes place by means of an integral intermediate panel. From there the oil vapors are taken through a spiral oil separator then taken over a pressure control valve behind the throttle valve to the intake system. To ensure the efficiency of the ventilation system in off-road operation, an additional connecting line was used between the valve covers.

Cayenne Turbo Crankcase Ventilation

To meet the turbo-specific requirements for the crankcase ventilation system, separate ventilation paths were provided for the intake and boost pressure areas. In the intake area, ventilation takes place similar to the Cayenne S, so non-return valves are installed between the pressure control valve and the injection point in the intake system.

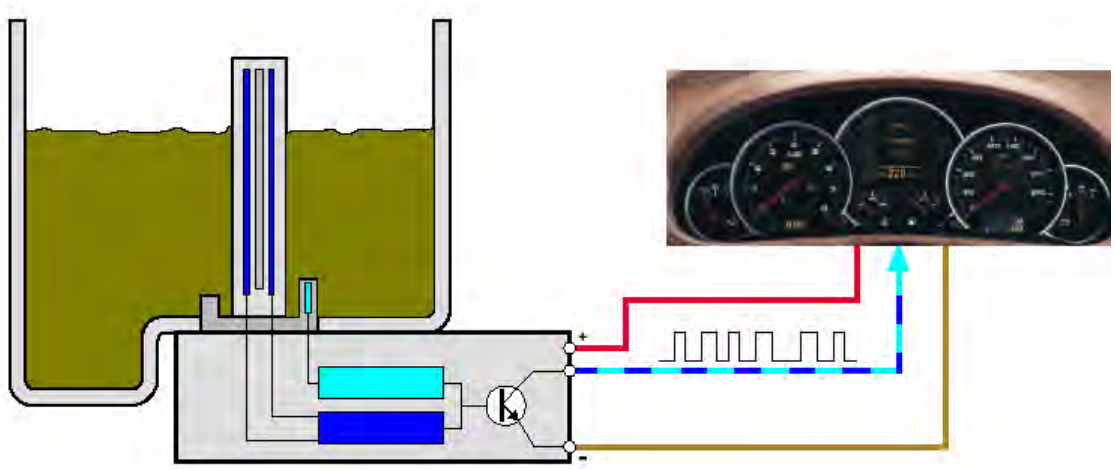
When boost pressure builds up, the ventilation system switches over by way of the non-return valves, and the gases are injected ahead of the compressor stage of the turbocharger. In addition, the ventilation for the oil catch container is connected to the ventilation system.

Oil Filter

A replaceable cartridge is used as the oil filter. Oil capacity is 8.5 liters (approx 9 quarts). The engine oil change interval for the Cayenne S and the Cayenne Turbo is 20,000 miles (30,000 km).

Notes:

Oil Level and Temperature Sensor

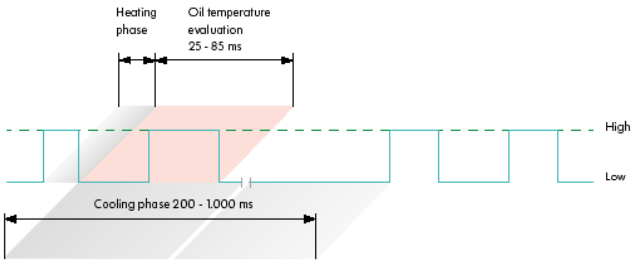


The Cayenne uses a new oil level and temperature sensor. The sensor bolts into the oil pan and sends oil level and temperature information to the instrument cluster.

The oil level/oil temperature sender is a thermal oil level sensor. While the engine is running, the engine oil temperature is continuously measured and the engine oil level is calculated. Both parameters are sent via a common pulse-width modulated signal to the instrument cluster.

A separate temperature sensor with integrated electronics detects the oil temperature. The measuring element for oil level also works with temperature measurement. The electronics therefore heat it up quickly above the current oil temperature. After the heater voltage is switched off, the measuring element is cooled down by the engine oil to the oil temperature level. The oil level is calculated from the length of time of the cooling phase.

long cooling phase	low oil level
short cooling phase	normal



The signal indicates the heating phase as high voltage and the cooling phase as low voltage. During the cooling phase, engine oil temperature information is transferred as a separate high signal.

Notes:

Cooling System

Coolant is circulated by the water pump (15) through a plastic pipe located in the internal V of the engine to the distribution pipe (12) on the transmission side of the engine. The coolant flow is separated in the distribution pipe, about 20% of the coolant is fed into the water jacket of the crankcase and passes through it in the longitudinal direction. About 80% of the coolant volume is fed into the cylinder heads on the cross-flow principle to achieve optimal temperature distribution and passes through them from the hotter (outlet) to the cooler side.

Ahead of the thermostat housing (3) the coolant flows are brought together again, and, with the thermostat closed (reduced circulation), taken directly to the water pump again.

The thermostat starts to open at 181° F (83° C), lift is 9.8 mm at 208° F (98° C), and it reaches its maximum opening at 221 F (105° C). Coolant temperature is measured at the engine block inlet. With the thermostat open (full circulation), the coolant is brought by way of the radiator at the front of the vehicle back to the intake side of the water pump.

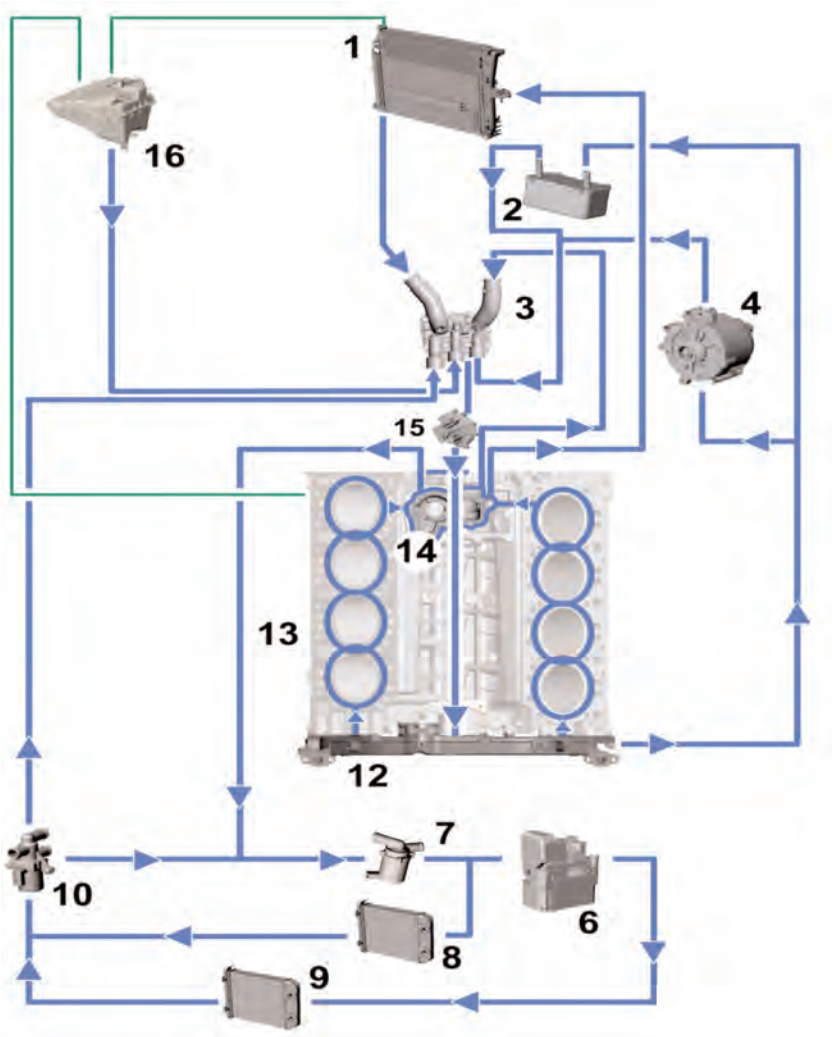
Heat from the engine oil is given off (2) into the coolant by means of an oil to water heat exchanger. Partial volume flow for this and the liquid-cooled alternator (4) are diverted at the distribution pipe. Volume flow for heater core is taken off at the thermostat housing. The return for both flows is into the thermostat housing.

A supplementary electrical run-on pump (7) provides circulation in the coolant circuit even after the engine has been switched off. Depending on coolant temperature and the last driving cycle (map derived from fuel consumption) this pump is actuated by the DME control unit through a relay.

On the Cayenne Turbo the two turbochargers (5 and 11) additionally have coolant directed around them. This greatly reduces oil coking in the turbine bearing housing.

Notes:

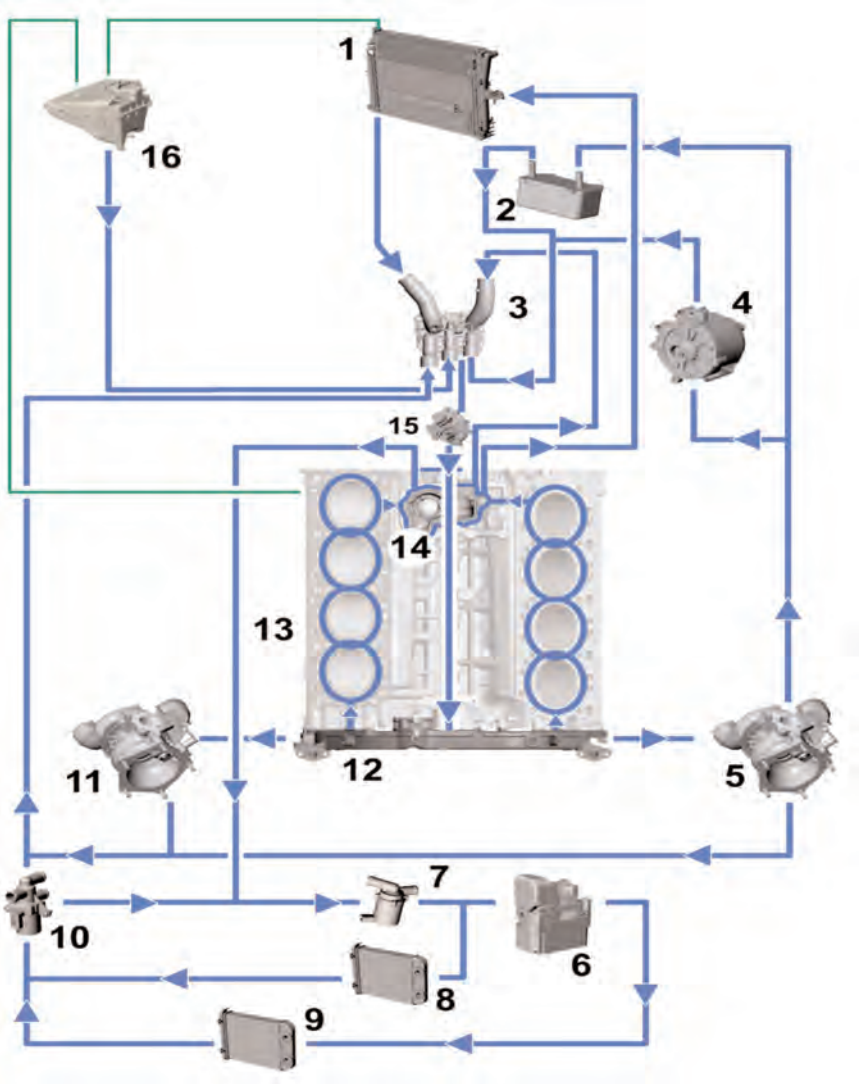
Cayenne S Coolant Circulation



Ventilation Line Coolant Line

1 - Radiator
2 - Oil to water heat exchanger
3 - Thermostat housing
4 - Alternator
6 - Auxiliary heating
7 - Electrical run-on pump
8 - Rear heater core
9 - Front heater core
10 - 3/2-way valve
12 - Coolant distribution pipe
13 - Engine
14 - Coolant collection pipe
15 - Water pump
16 - Coolant overflow reservoir

Cayenne Turbo Coolant Circulation



Ventilation Line Coolant Line

1 - Radiator
2 - Oil to water heat exchanger
3 - Thermostat housing
4 - Alternator
5 - Exhaust turbocharger
6 - Auxiliary heating
7 - Electrical run-on pump
8 - Rear heater core
9 - Front heater core
10 - 3/2-way valve
11 - Exhaust turbocharger
12 - Coolant distribution pipe
13 - Engine
14 - Coolant collection pipe
15 - Water pump
16 - Coolant overflow reservoir

Engine – Cayenne S/T – 1st Generation

Service Position

The Cayenne has an added feature of allowing the front end to be moved forward into a service position for maintance and repair. The service position can be achieved without draining the fluids or air conditioning system refrigerant.

Engine Removal



In the event that the engine needs to be removed,a new special tool has been provided. The lifting table will safely remove the engine, transmission, transfer case and sub frame as an assembly. The lifting table will have the ability to be converted for use on the 911 Carerra (996) and Boxster models.

Notes:



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Notes:



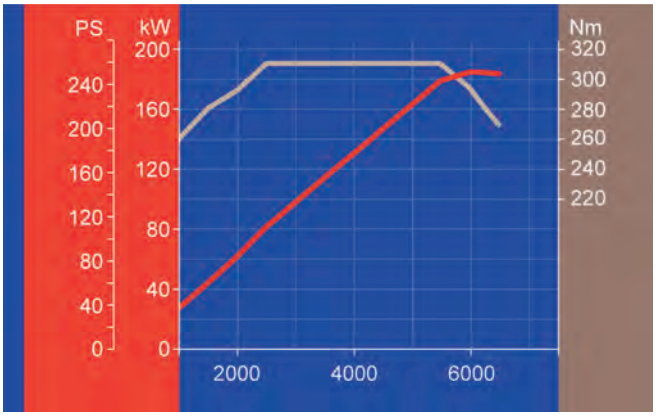
General

In addition the 4.5 liter V8 naturally-aspirated and turbo engines, the Porsche Cayenne now has a third engine option. The 3.2 liter V6 gasoline engine offers a wide engine speed range with high power output and the long stroke creates high torque at low RPMs while maintaining good consumption and emission values.

Important features of the engine are:

- Weight-optimized grey cast iron crankcase (15° V)
- One-piece die-cast aluminum cylinder head
- Four valves per cylinder, operated via roller cam followers
- Continuously variable intake/exhaust camshaft timing
- Wet-sump lubrication
- Oil-spray piston cooling
- Oil-to-coolant heat exchanger
- Inclinations up to 45° to all sides possible
- Longitudinal cooling flow of cylinder head and crankcase

Full-load Curve Cayenne



Engine Data

Engine Type	M02.2Y (BFD)
No. of Cylinders	6
Bore	84.0 mm
Stroke	95.9 mm
Displacement	3.2 Liter
Compression Ratio	11.5
Max. Power	250 HP (184 kW)
At Engine Speed	6000 rpm
Max. Torque	229 ft lb (310 Nm)
At Engine Speed	2500 - 5500 rpm
Governed Speed	6700 rpm
Engine Weight with M/T)	423 lbs (192 kg) (w/dual-mass flywheel, w/o clutch)
Engine Weight (Tiptronic)	397 lbs (180 kg) (with converter plate)
Firing Order	1 – 5 – 3 – 6 – 2 – 4

Notes:

Crankcase

The weight-optimized crankcase with the cylinders is manufactured from grey cast iron. The cylinders are arranged in a “V” at an angle of 15°, cylinder number 1 is located on the front passenger side. Bores are at 7.5° to gasket face.



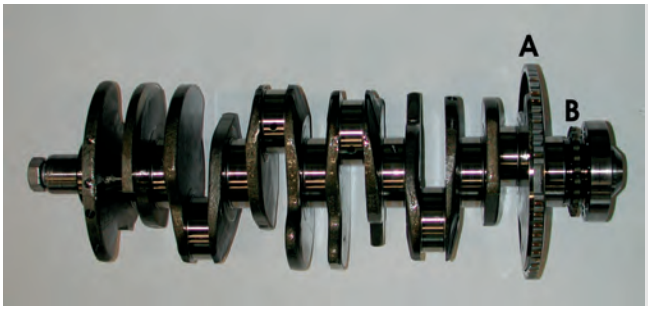
Arrow shows the direction of travel.

Crankshaft

The drop-forged crankshaft is carried on seven bearings. Main bearing number 4 is designed as an axial-thrust bearing. The axial clearance is determined by two axial-thrust washers, which are seated in the bearing pedestal. The bimetal main bearings have a diameter of 60 mm.



Main bearing cap number 4.



The pulse generator wheel for the engine speed and reference mark sender (A) along with the chain drive sprocket for the intermediate shaft (B) are on the crankshaft.

Notes:

Bearing Assignment

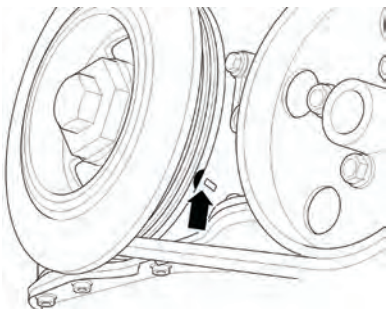
Markings are provided on both the crankcase and the crankshaft to indicate which bearing tolerances are installed.



Torsional Vibration Damper

A torsional vibration damper is used to reduce torsional vibration at the crankshaft reduce component stress.





The torsional vibration damper has a TDC marking (arrow).

Connecting Rods and Pistons

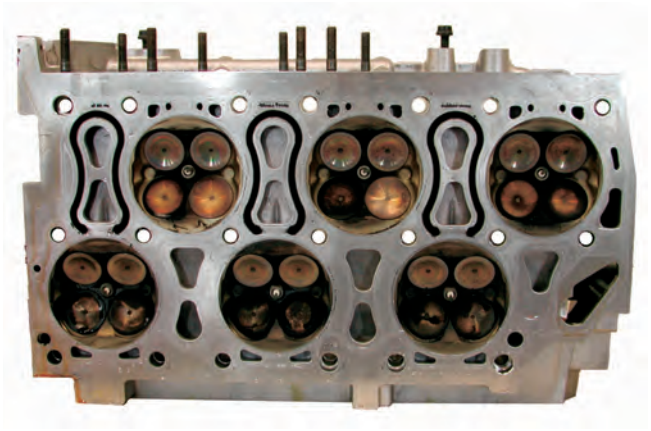
The connecting rod upper and lower halves each have a pairing number and are secured with reamed bolts. The bimetal connecting rod bearings have a diameter of 54 mm.



The pistons are alloy cast and are Graphal coated on the sliding surfaces to reduce noise. The full-floating wrist pin is lubricated with oil spray.

Cylinder Head

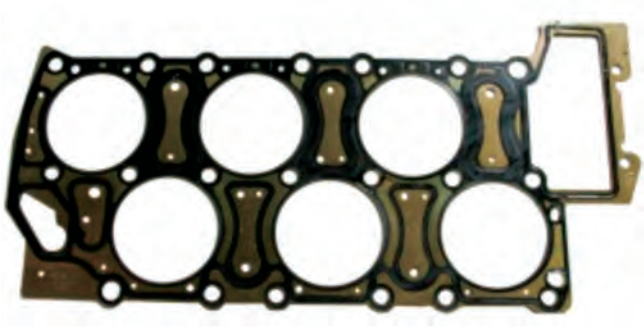
The cylinder head is manufactured in one-piece from die-cast aluminum. The timing of the charge exchange takes place through four valves per cylinder, which are operated via roller cam followers with hydraulic valve clearance adjusters. The two intake and two exhaust valves are arranged in a “V” at a valve angle of 42.5°. The diameter of the valve head is 33.2 mm on the intake side and 30.2 mm on the exhaust side.



Cayenne V6 Cylinder Head

Cylinder Head Gasket

The cylinder head gasket consists of a sheet-metal layer, onto which a plastic coating is applied. This elastomer-coated (temperature-resistant, rubber-elasticized plastic) ensures a high quality seal in the water jacket areas. Additionally, this elastomer coating provides insulation of noise radiation upwards and reduces mechanical noise.



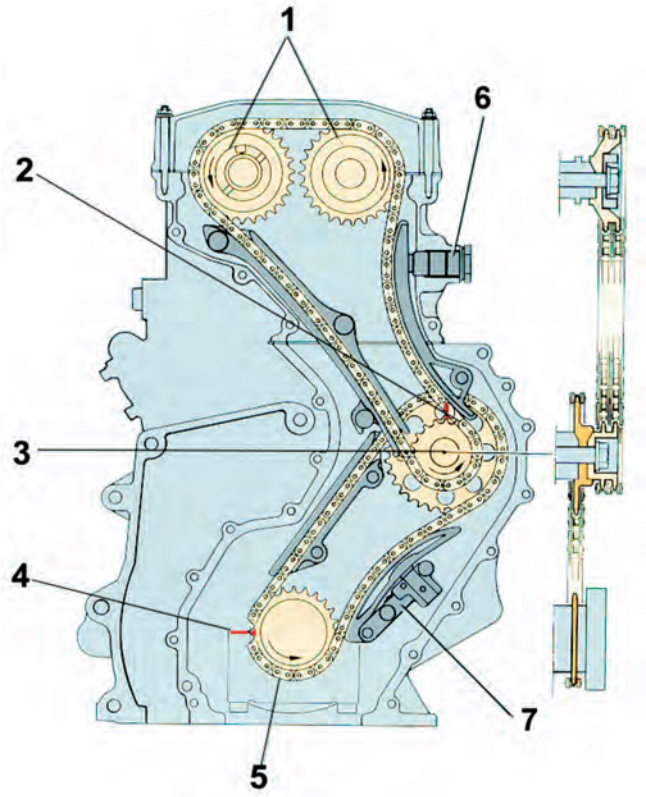
Notes:

Timing With Variable Camshaft Control

Chain Drive

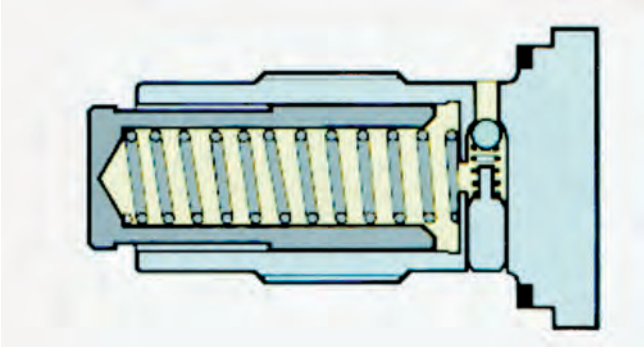
Engine timing takes place through two chain drives located at the flywheel end. Driven by the crankshaft (5), the lower chain drive drives the intermediate shaft and the chain sprocket for the upper chain drive. The intermediate shaft drives the oil pump. The upper chain drive drives both camshafts (1). It is designed as a duplex chain, due to the transmission ratio of crankshaft to camshaft (2:1), it has a greater torque to transmit than the lower chain drive.

Chain tensioning is provided by two maintenance-free chain tensioners (6 and 7). They are connected to the engine oil circuit. For assembly and valve timing purposes, one tooth of the crankshaft sprocket (4) and the large intermediate shaft sprocket (2) are marked. The camshafts are set using an adjusting fixture.



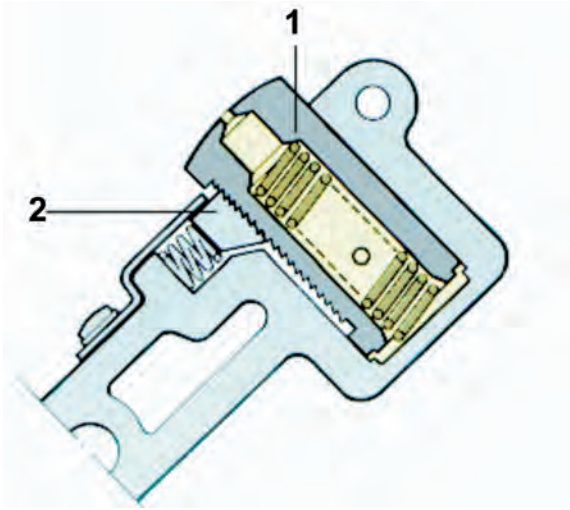
1 - Camshafts
2 - Marking on intermediate shaft sprocket
3 - Intermediate shaft
4 - Main bearing separation
5 - Crankshaft
6 - Chain tensioner, upper
7 - Chain tensioner, lower

The upper chain tensioner is connected to the engine oil circuit and is actuated hydraulically.



Upper Chain tensioner

Chain tensioning at the bottom is determined by the spring force of the chain tensioner. Together with the oil pressure, the spring prevents vibration of the chain during operation. The stop provides the basic setting of the chain when the engine starts.



1 - Spring
2 - Stop

Camshafts

The camshafts are not cast in one piece, but are made up of hollow shafts and cams. The cams are pushed onto a hollow shaft and the shaft is then hydraulically expanded thereby securing the cams.

The advantages of this are that the weight can be reduced and the materials for the shaft and the cams can be independently selected. This also reduces the production costs. The cam lift of the intake and exhaust camshaft is 10 mm.

Notes:

Variable Camshaft Control

General

The variable camshaft control of the inlet and exhaust shaft is based on the principle of the vane cell adjuster. The control unit determines the current position of the camshaft in relation to the crankshaft (actual angle) using the engine speed and hall sensor signal. The position control in the control unit receives the desired angle via the programmed map values (engine speed, load, engine temperature). If the desired angle and actual angle differ, a controller in the DME control unit actuates a solenoid hydraulic valve according to the desired position. The adjustment angle is 52° crankshaft angle on the intake side and 22° on the exhaust side.

Operation

When **idling**, the inlet camshaft is adjusted so that the inlet valves open late and consequently close late. The exhaust camshaft is adjusted so that the exhaust valves close well before TDC. This results in a stable idling speed due to the low residual gas content during combustion.

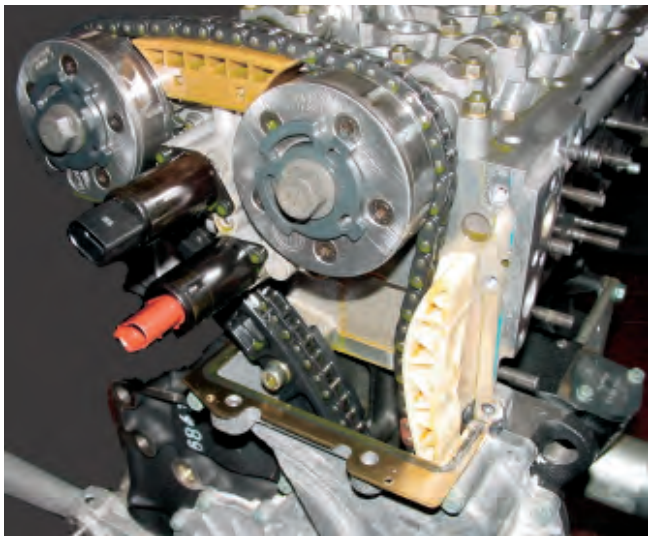
To achieve good **performance** at high engine speeds, the exhaust valves are opened late. This allows the combustion expansion to act on the piston longer. The intake valve opens after TDC and closes late after BDC. This utilizes the dynamic ram effect of the incoming air to increase power output.

To produce maximum **torque**, a high volumetric efficiency of the cylinders must be achieved. For this, the intake valves must be opened early. Since they open earlier, they also close earlier, which prevents expulsion of the fresh gases. The exhaust valve closes shortly before TDC.

During the adjustment of the intake and exhaust camshafts, an internal exhaust **gas recirculation** takes place. This produces an exhaust gas transfer from exhaust to intake port during valve overlap (inlet and exhaust valves are open). The amount of recirculated exhaust gas during the internal exhaust gas recirculation is determined by the amount of valve overlap. Therefore, the intake camshaft is adjusted so that the intake valves open well before TDC and the exhaust valves close shortly before TDC. Consequently, both valves are open and exhaust gas is recirculated.

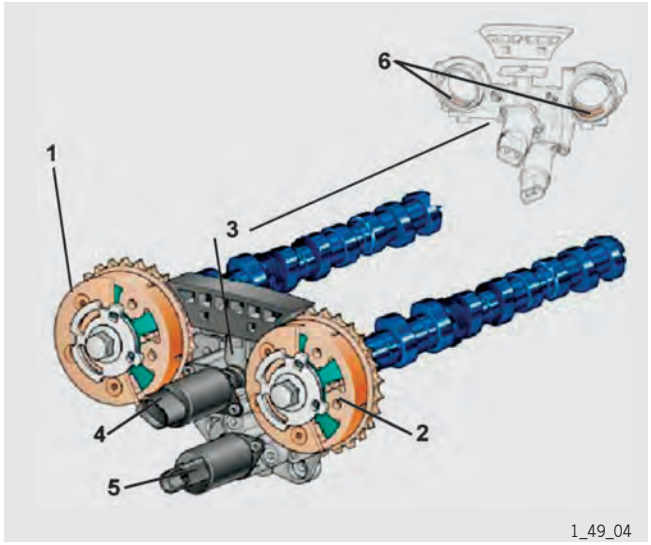
Notes:

Camshafts



The variable camshaft control system consists of the following components:

- Two vane cell adjusters
- Timing case
- Two electromagnetic valves



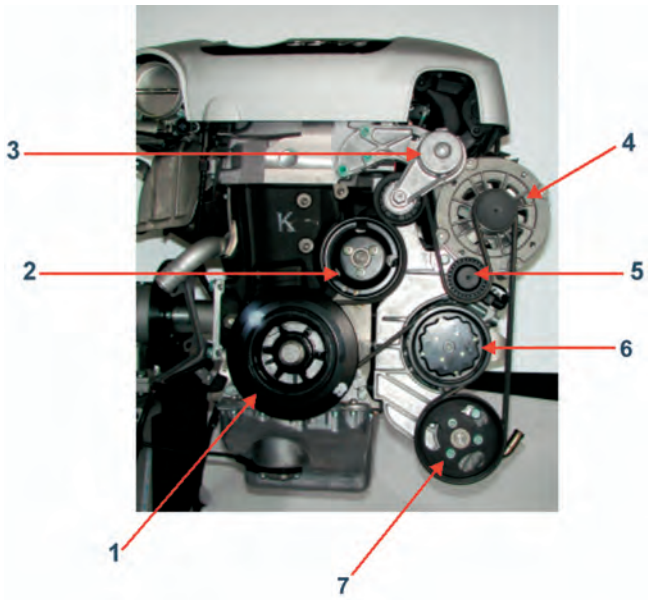
Camshaft Drive Components

1 - Vane cell adjuster, intake camshaft
2 - Vane cell adjuster, exhaust camshaft
3 - Timing case
4 - Valve for variable camshaft control, intake
5 - Valve for variable camshaft control, exhaust
6 - Oil channels to annular groove of camshafts

The Motronic control unit actuates electromagnetic valves 4 and 5 to adjust the camshafts. They open oil channels in the timing case. The engine oil then passes through the timing case and the camshaft into the vane cell adjusters. The vane cell adjusters turn thereby adjusting the camshafts according to the settings of the Motronic control unit.

Notes:

Belt Drive

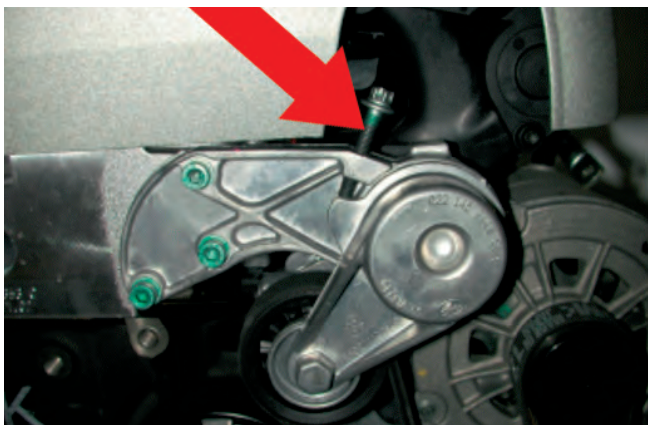


Belt Drive Components

1 - Torsional vibration damper
2 - Coolant pump
3 - Belt tensioner
4 - Alternator
5 - Idler pulley
6 - Air-conditioning compressor
7 - Servo pump

Belt Tensioner

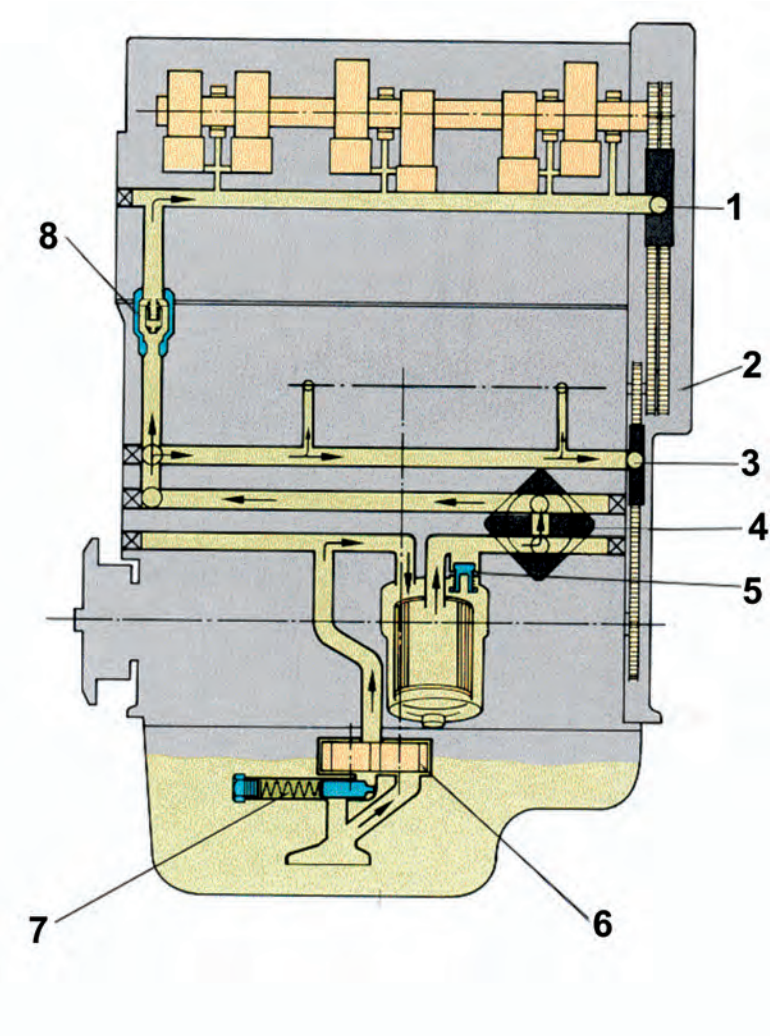
The alternator, coolant pump, servo pump and air-conditioning compressor are driven via a poly-rib belt from the torsional vibration damper. The correct tension is maintained throughout by a maintenance-free, mechanical belt tensioner.



Maintenance-Free Belt Tensioner

Notes:

Oil Lubrication System



1 - Upper chain tensioner
2 - Intermediate shaft
3 - Lower chain tensioner
4 - Oil-to-water heat exchanger
5 - Bypass valve
6 - Oil pump
7 - Pressure relief valve (opens at 5.5 bar)
8 - Oil retaining valve

Notes:

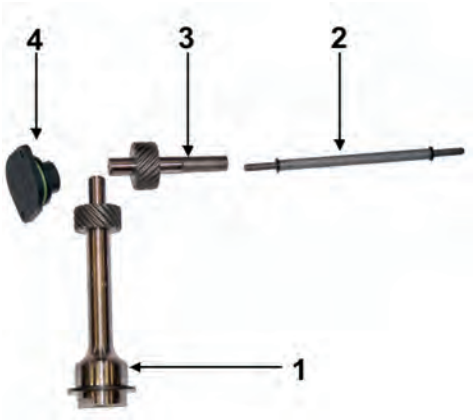
Oil Pump

The oil pump is a gear-type pump. The casing also contains the oil pressure control valve, which opens at 80 psi (5.5 bar).



Oil Pump

The oil pump is driven via a chain drive from the crankshaft to the intermediate shaft (1) and from there via a right-angle drive to shaft (3). The oil pump drive shaft (2) is hexagonal at both ends and drives the oil pump gear. The casing is closed and sealed by the cover (4). The cover also serves as a mount for the shaft (3).



Oil Pump Drive

Notes:

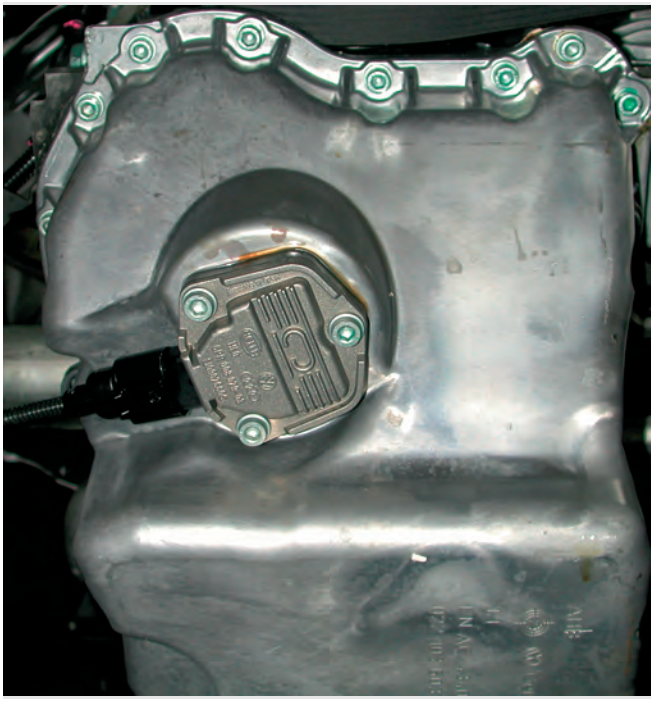
Oil Pan



Oil Pan

The Porsche Cayenne V6 has a wet-sump lubrication system developed for reliable operation under extreme conditions, as well as off-road capability at inclinations up to 45° to all sides. For this reason, the oil pan shape and the form of the ribs and oil baffles have been optimized to ensure a constant oil return to the oil pump at 45° inclinations and to minimize oil foaming through spraying oil and churning losses.

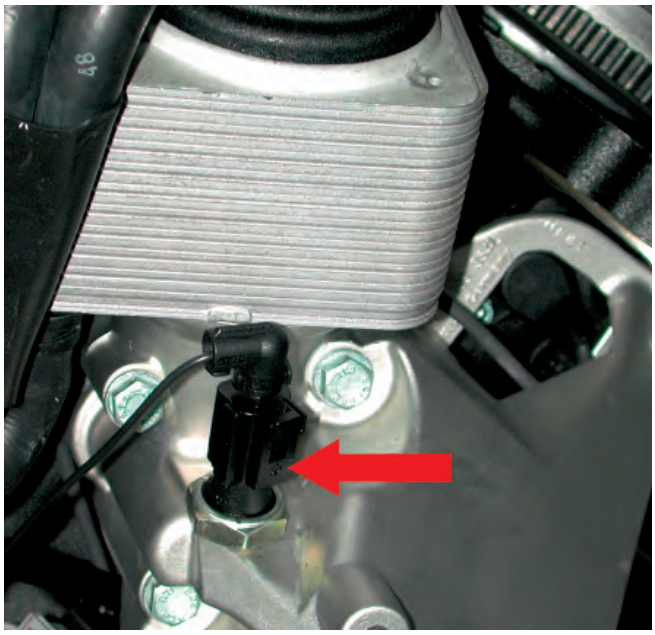
Oil Level Warning



Oil Level Warning Sensor

An oil level warning device is fitted at the bottom of the oil pan. If the oil level drops too low, this is indicated on the instrument cluster with the appropriate warning.

Oil Pressure Switch



Oil Pressure Switch (Arrow)

The oil pressure switch is located on the oil filter bracket and indicates on the instrument cluster if the oil pressure falls below a specified value.

Oil-Spray Piston Cooling

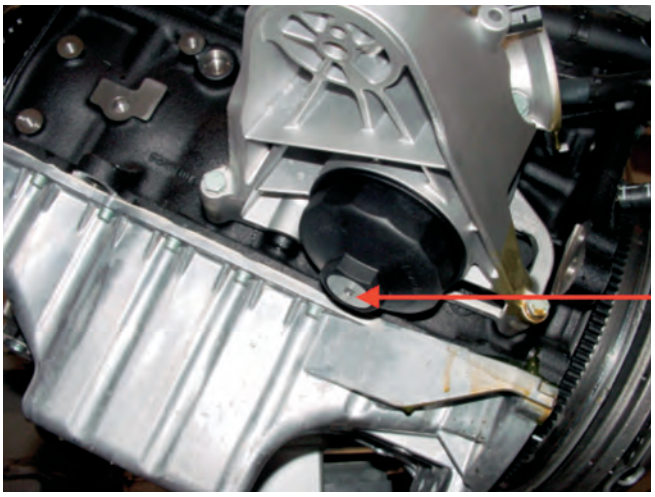
The Cayenne engine has oil-spray piston cooling to reduce the piston temperature. The spray jets are located in the main bearing pedestals. To ensure that the engine oil pressure is maintained at low engine speeds and high engine oil temperatures, the jets have an opening pressure of 29 psi (2 bar).

Crankcase Ventilation

Crankcase ventilation takes place via the timing case cover in the rocker cover. Design of the timing case cover prevents oil from being pulled along over the timing chain. This preseparation of the engine oil relieves the load on the ventilation system.

The oil vapor is also channeled through a stabilizing chamber in the rocker cover. At this point the engine oil is separated via an integrated condensation chamber. From there, the crankcase gases are channeled via a pressure control valve to the throttle valve of the intake system. To prevent freezing of the gases at extremely cold temperatures and high humidity levels, the inlet into the intake manifold is heated depending on the outside temperature. This ensures effective operation of the ventilation system throughout the entire operational range of the engine, including under extreme off-road conditions at inclinations of up to 45°.

Oil Filter



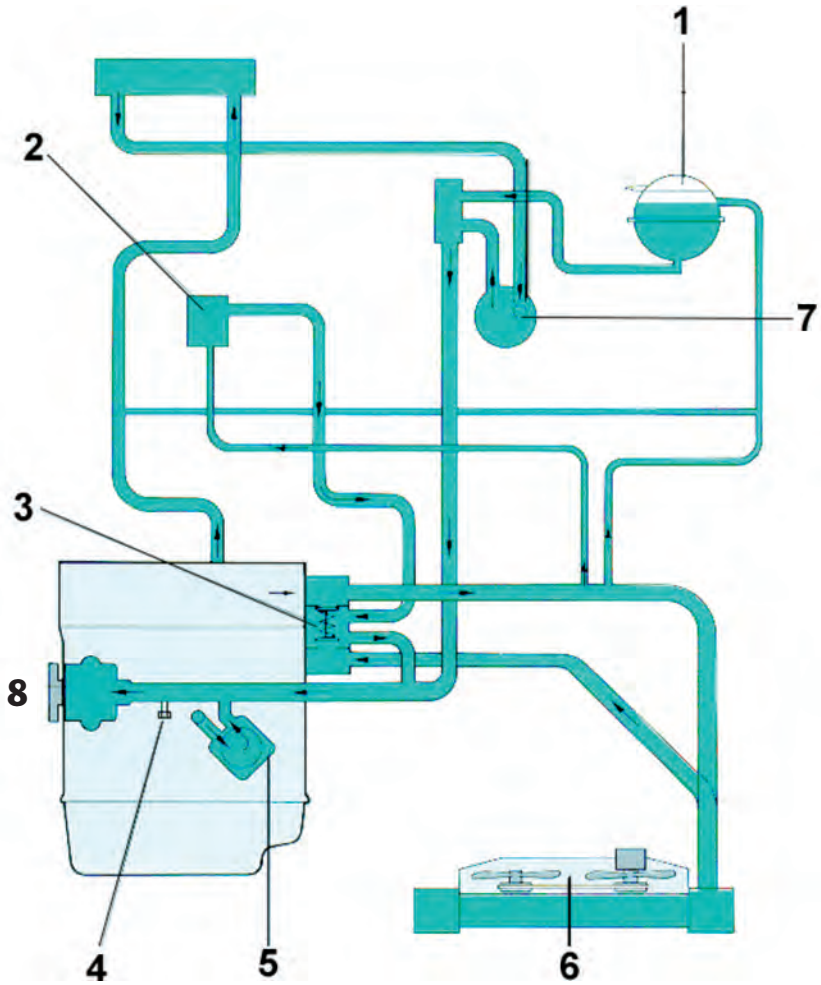
Oil Filter Cartridge Drain Plug (Arrow)

The oil filter is in the form of a replaceable filter cartridge. This is located on the mounting bracket and is removed from below. The oil can be drained from the cartridge via a drain plug.

Oil change volume without filter is 6.3 qts. (5.7 liters), 7 qts. (6.3 liters) with filter.

Notes:

Cooling System



1 - Expansion tank
2 - Throttle valve element
3 - Thermostat
4 - Coolant drain screw
5 - Oil-to-water heat exchanger
6 - Radiator with fan
7 - Crankcase vent
8 - Coolant pump

Coolant is passed from the coolant pump via the crankcase to the cylinder head. The coolant flows through the cylinder head longitudinally. From the cylinder head coolant flows to the thermostat housing, when the thermostat is closed, directly back to the coolant pump. At temperatures > 176° F. (80° C), the coolant is directed through the radiator at the front of the vehicle and back to the pump.

The coolant pump has been appropriately adapted with regard to efficiency and flow to cope with the high thermal loading of the cooling circuit when towing a trailer in hot climates. To ensure even distribution of temperature in the engine, the coolant, depending on the engine temperature, continues to be circulated by an electric post-run coolant pump according to the load profile present before the engine was switched off.

The coolant (identical to Cayenne S and Cayenne Turbo) is intended to be a lifetime fill and therefore does not require replacement. The filling capacity is approx. 14 - 20 qts. (13 - 18 liters) depending on equipment.

Notes:



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Notes:

1 - Engine M 48.01/51

General

Completely new engines have been developed for the Cayenne S and Cayenne Turbo for the 2008 model year.

The main development aims were:

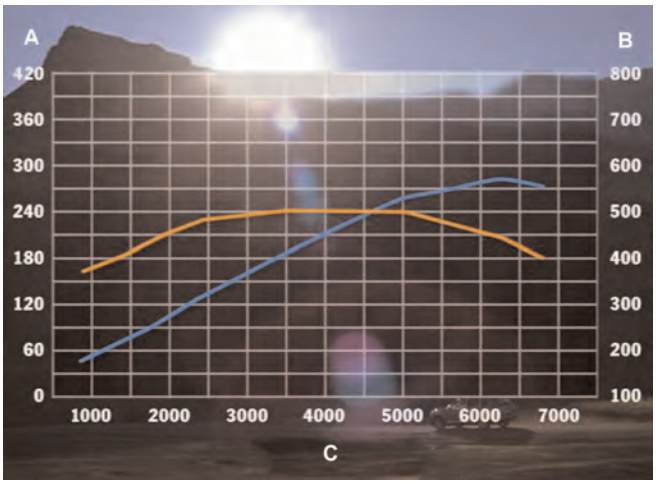
- More power and torque, while at the same time,
- Improving fuel economy and,
- Reducing the weight of the engine compared to previous engines.



These development aims have essentially been achieved due to the following enhancements and new technologies:

- Larger displacement
- Direct fuel injection (DFI)
- Sport button as standard
- VarioCam Plus
- Demand controlled oil pump

Cayenne S Full Load Curve



A - Power rating in kW
B - Torque in Nm
C - Engine speed

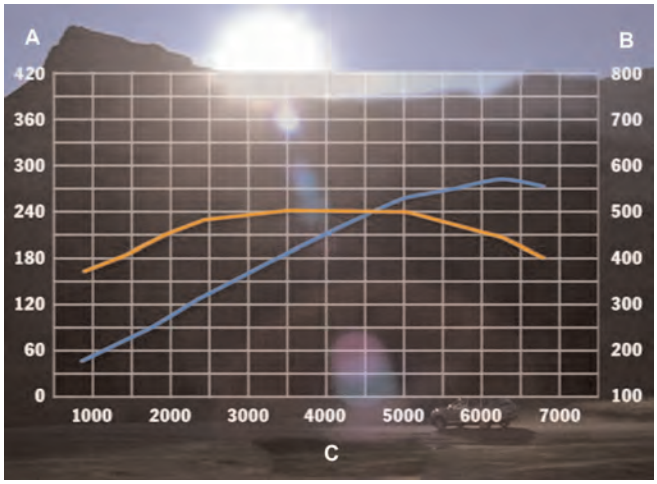
Engine Data – Cayenne S

Engine Type	M48.01
No. of Cylinders	8
Bore	96 mm
Stroke	83 mm
Displacement	4.8 Liter
V-angle	90
Compression Ratio	12.5
Max. Output	385 HP (283 kW)
At Engine Speed	6200 rpm
Max. Torque	370 ftlb. (500Nm)
At Engine Speed	3500 rpm
Governed Speed	6700 rpm
Engine Weight (manual transmission)	503 lbs (228 kg)
Engine Weight (Tiptronic transmission)	456 lbs (217 kg)
Firing Order	1-3-7-2-6-5-4-8

Notes:

Engine – Cayenne S/T – 2nd Generation

Cayenne Turbo Full Load Curve



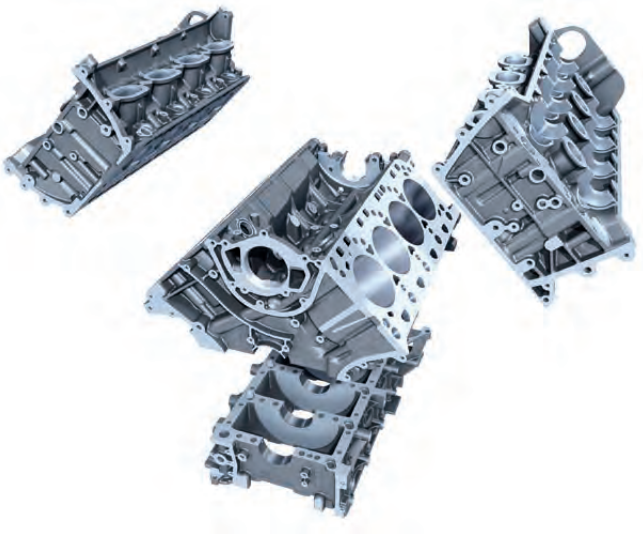
A - Power rating in kW
B - Torque in Nm
C - Engine speed

Engine Data – Cayenne Turbo

Engine Type	M48.51
No. of Cylinders	8
Bore	96 mm
Stroke	83 mm
Displacement	4.8 Liter
V-angle	90
Compression Ratio	10.5
Max. Output	500 HP (358 kW)
At Engine Speed	6000 rpm
Max. Torque	518 ftlb. (700Nm)
At Engine Speed	2250-4500 rpm
Governed Speed	6700 rpm
Engine Weight	520 lbs (236 kg)
Firing Order	1-3-7-2-6-5-4-8

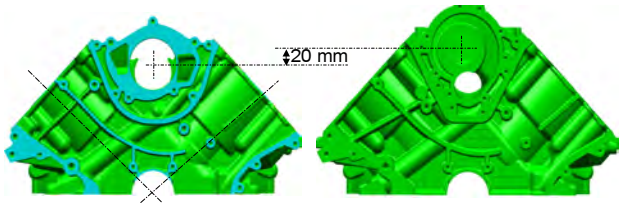
Notes:

Crankcase

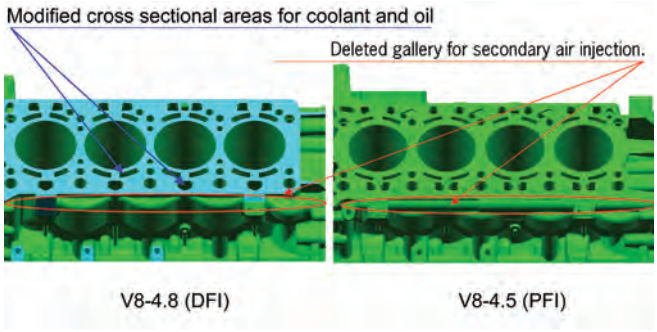


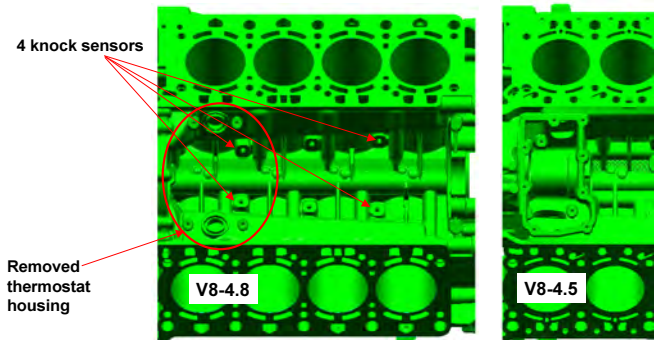
The crankcase in the Porsche Cayenne S and Cayenne Turbo is designed as a two-piece closed-deck component in a light metal alloy (AlSi17Cu4Mg). In the closed-deck design, the sealing surface of the crankcase is, for the most part, closed to the cylinder head, only the bores and channels for oil and coolant are exposed. The entire structure is additionally strengthened as a result of this design. This leads to less cylinder distortions and helps to reduce oil consumption.

The alloy used for the crankcase is known as a hypereutectic alloy in which silicon crystals form. These silicon crystals are exposed using several specialized honing processes in order to make the surface more durable. The crankcase has been lowered by 20 mm compared to the previous engine. As a result, the coolant pump and thermostat housing cover are also 20 mm lower and a modified water flow circuit was required.



V8 - 4.8 (2nd Generation) V8 - 4.5





The lower part of the crankcase is machined and paired together with the upper part. To keep the weight as low as possible, the spheroidal graphite iron inserts are no longer used and the wall thickness has been reduced.

A low-pressure chill-casting procedure is used to make the upper and lower part of the crankcase.

Crankshaft



The drop-forged crankshaft runs in five bearings and has eight counterweights. Main bearing 3 is designed as a thrust bearing. Axial play is determined by two thrust washers, which are inserted into the bearing halves. The main bearings are two-component bearings and have a diameter of 64 mm. Since the lower part of the crankcase is made of an all aluminum alloy, the main bearings are stronger than those used previously and the retaining lugs have been changed to avoid confusion. The main bearings are also “lead-free.”

Torsional Vibration Balancer



A torsional vibration balancer is used to reduce torsional vibrations on the crankshaft and to minimize component stress, e.g. on the belt drive. A shock absorber with the very best damping characteristics was selected because of the greater power impulses associated with direct fuel injection engines.

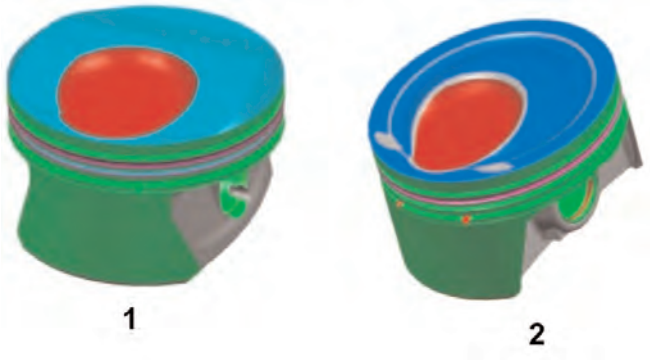
The viscous shock absorber has a floating flywheel in silicon oil in the housing. This allows the counter movement of the bearing mass to a not quite evenly rotating crankshaft.

Connecting Rods

Compared to the 4.5 liter engine, the connecting rods are 2.4 mm longer. This reduces piston lateral runout and is more efficient. The connecting rod bearings are “lead-free” three-component bearings with a diameter of 54 mm. Oil is supplied to the connecting rod bearings via a Y-bore in the crankshaft.

Notes:

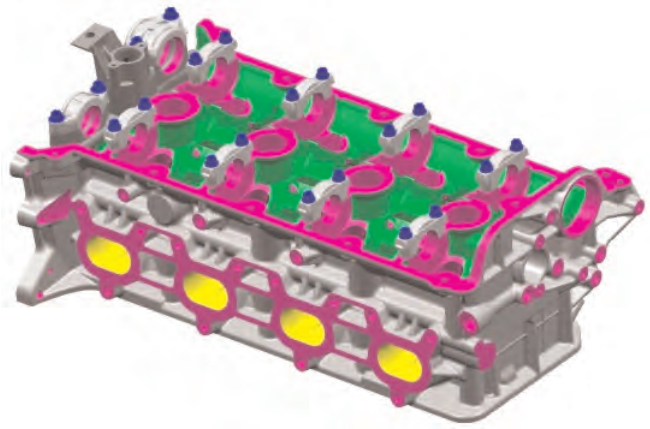
Pistons



1 - Piston (naturally aspirated engine)
2 - Piston (turbo engine)

The pistons are designed as recessed pistons made of aluminum alloy. They have an iron coating (Ferrocout) at the sides to improve friction characteristics. The pistons are different on cylinder bank 1 and 2 both in the Cayenne S and Cayenne Turbo. Another difference between the pistons in the Cayenne S and Cayenne Turbo is that the combustion cavities have different depths because the compression ratios of both engines are different. The piston ring packages for the turbo and naturally aspirated engines are the same.

Cylinder Head



The cylinder head and camshaft mount is one joined component and is identical for the Cayenne S and Cayenne Turbo.

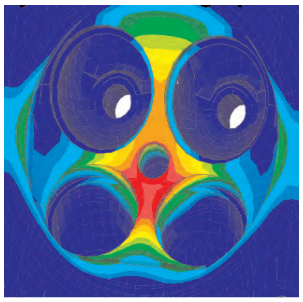
Technical Data, Valve Drive

Intake valve diameter	38.3mm
Intake valve lift, large	11.0mm
Intake valve lift, small	3.6mm
Exhaust valve diameter	33.0mm
Exhaust valve lift, cyl. 3, 4, 5, 7	9.2mm
Exhaust valve lift, cyl. 1, 2, 6, 8	8.0mm
Intake valve angle	13.5°
Exhaust valve angle	15.4°
Fuel injector installation angle	29.0°
Camshaft bearing diameter	28.0mm

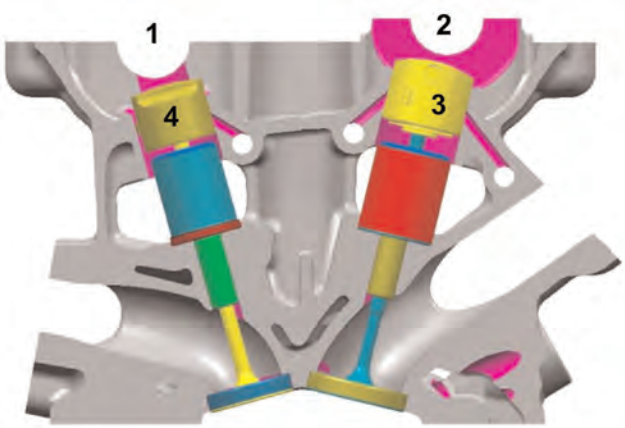
To ensure efficient gas exchange and valve lift control, the camshaft mount is 9 mm higher on the intake side compared to the outlet side. This arrangement meant that is was possible to optimize the intake port. The cooling system was designed in such a way that high temperature parts are optimally cooled. The cylinder head is made of AlSi7Mg.



Cylinder head water jacket.

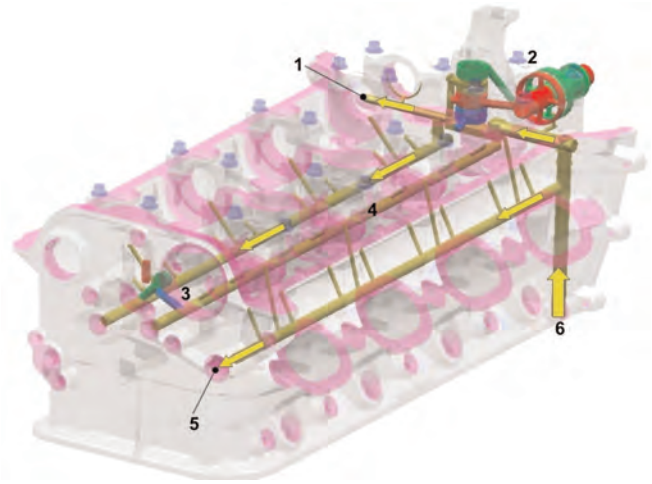


Combustion chamber stress area.



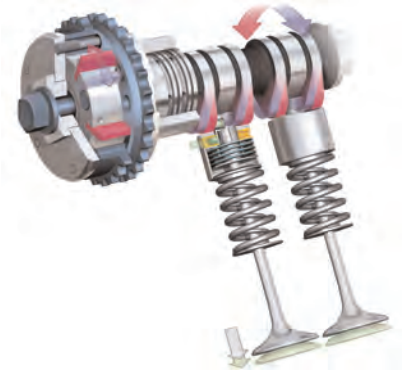
1 - Exhaust side
2 - Intake side
3 - Operating plunger
4 - Outlet valve tappet

Oil Supply in the Cylinder Head



1 - Oil supply to the chain tensioner
2 - Camshaft control system
3 - Valve lift control system
4 - Oil supply for valve lift control
5 - Oil supply for turbocharger
6 - Oil intake

Camshaft Control With Valve Lift Control (VarioCam Plus)



The requirements imposed on engine design with regard to higher performance combined with improved driving comfort, compliance with emission regulations and reduced fuel consumption give rise to conflicting design criteria.

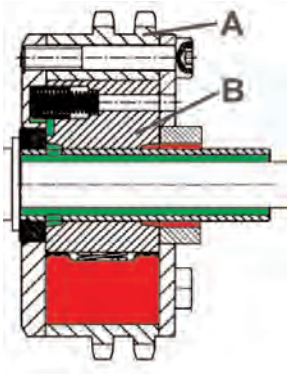
The development of the VarioCam Plus was therefore based on the idea of producing a variable engine, which can be optimized for maximum performance and also for regular driving in city traffic or on secondary roads. A control system for the intake camshaft to vary the opening and closing times in combination with a valve lift system is necessary.

Camshaft Control

Camshaft control on the intake camshaft is based on the principle of a vane controller. The DME control unit determines the current position of the camshaft in relation to the crankshaft (actual angle) on the basis of the speed sensor signal and the Hall sensor signal. The position control in the control unit receives the desired nominal angle via the programmed map values (speed, load, engine temperature). A regulator in the DME control unit activates a solenoid hydraulic valve according to the desired adjustment when there is a difference between the target angle and actual angle. The adjustment angle is 50° in relation to the crankshaft (25° in relation to the camshaft).

Notes:

Vane Controller



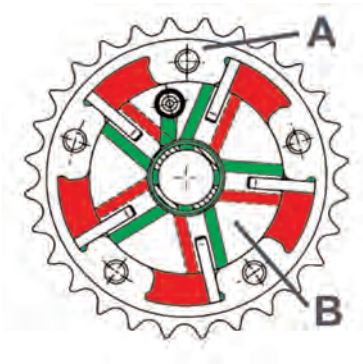
A - Stator
B - Rotor

The vane controller consists essentially of the stator **(-A-)**, which is installed on the crankshaft via the sprocket, the rotor **(-B-)**, which is installed on the camshaft, the inserted vanes and two lids. The sprocket is mounted to the outer diameter of the stator. It is interlocked with the crankshaft via the chain drive. The rotor is screwed securely to the camshaft. Rotation is possible between the rotor and stator (inner mounting of the controller). The rotation is limited by the vanes inserted in the rotor and by the stops on the stator. The vanes also divide the recesses on the stator into two separate chambers.

These chambers can be filled with oil via oil bores and oil passages in the rotor. To guarantee secure sealing, small springs are installed between the vanes and rotor. The chambers are each sealed off at the sides with a lid fixed to the sprocket. The controller is locked at a stop (retarded). To do this, a spring-loaded pin in the retarding device of the controller moves into a bore in the lid. An interlocked connection between the stator and the rotor is created for the engine's starting process. This locking prevents noises during the period before oil pressure is produced.

Function

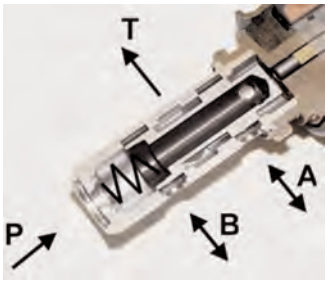
Two chambers, which act in different directions of flow, are contained in the controller. Filling of one chamber turns the rotor with respect to the stator. The rotor and the camshaft can be turned back into the original position by filling the other chamber. The oil of the non-pressurize chamber flows back into the chamber via the solenoid hydraulic valve.

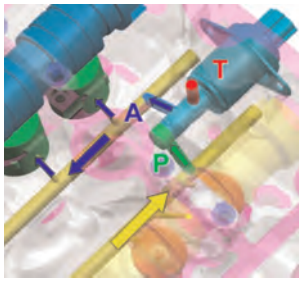


A - Stator
B - Rotor

If the oil supply and the oil return are interrupted at the solenoid hydraulic valve (center position of the valve) during the filling of a chamber, the controller remains at the position just assumed. The chambers lose oil through leakage so that the controller leaves its position. The solenoid hydraulic valve is controlled correspondingly by the control unit, and the controller returns to the desired position.

Solenoid Hydraulic Valve



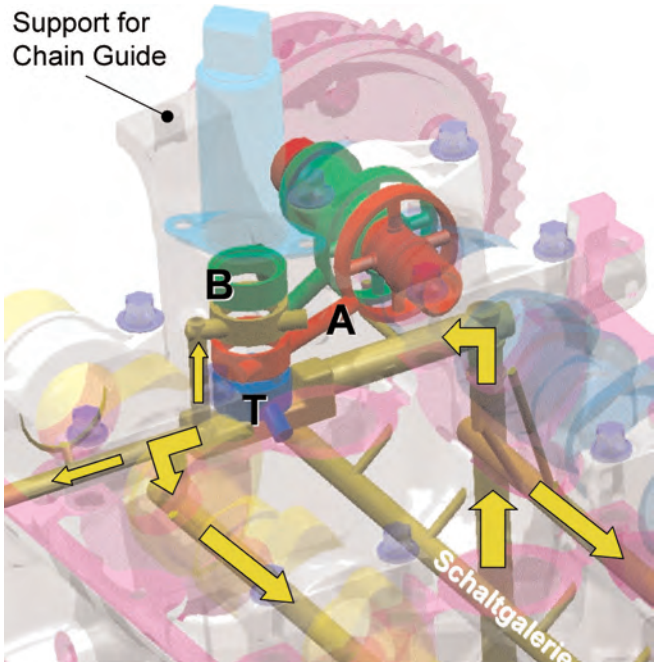


T - Solenoid hydraulic valve
P - Main oil pressure
A - Control pressure

The solenoid hydraulic valve is designed as a 4-way proportional valve, which connects one of the two control lines **(-A/B-)** to the oil pressure supply line **(-P-)** depending on the control unit specification and opens the other line so that the oil can flow into the crank chamber **(-T-line-)**.

If the **-A-** line is pressurized with oil, the controller will change direction to advance the valve timing. If the **-B-** line is pressurized with oil, the controller will change direction to retard the valve timing. Both control lines are closed in the center position. The camshaft is held in the desired position. In addition, any intermediate position between the three switch positions described above can be set via the control unit.

Therefore, it is possible not only to move the adjustment position very quickly but also to move it very slowly in the case of slight deviations of the valve from the central position. In this way, the solenoid hydraulic valve defines the adjustment direction and speed of the controller.



- Oil supply for cam phaser camshaft bearings and timing chain tensioner integrated in one bearing support.
- Screw connection of bearing support together with cam cap bolts.
- Oil Supply for first camshaft bearing (intake side) integrated in A-B oil supply for cam phaser (bleed > T).
- Advantage: no separate oil supply housing (V8 - 4.5) and no square section sealing rings necessary.

Tappet Evolution



Cayenne V8 engines use a “Ultra Leichtbau” lightweight 3CF bucket tappet.

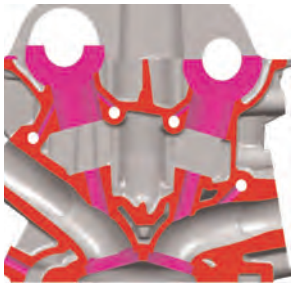
Advantages are:

- Reduced mass
- Increased rigidity

Cylinder Head Design



Previous Cylinder Head

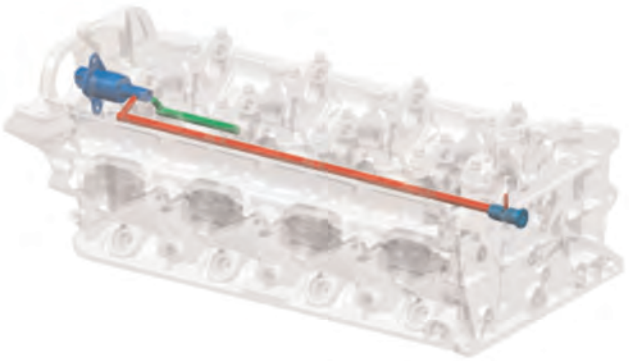


2nd Generation Cylinder Head

Additional weight savings were gained from the second generation V8 engine cylinder head design. On the left is the previous V8 4.5 liter cylinder head – fully machined, total weight including camshaft housing and bolts was 41 lbs (18.6 kg). On the right is the new second generation 4.8 liter head – fully machined, total weight including valve cover and DFI is 28 lbs (12.6 kg).

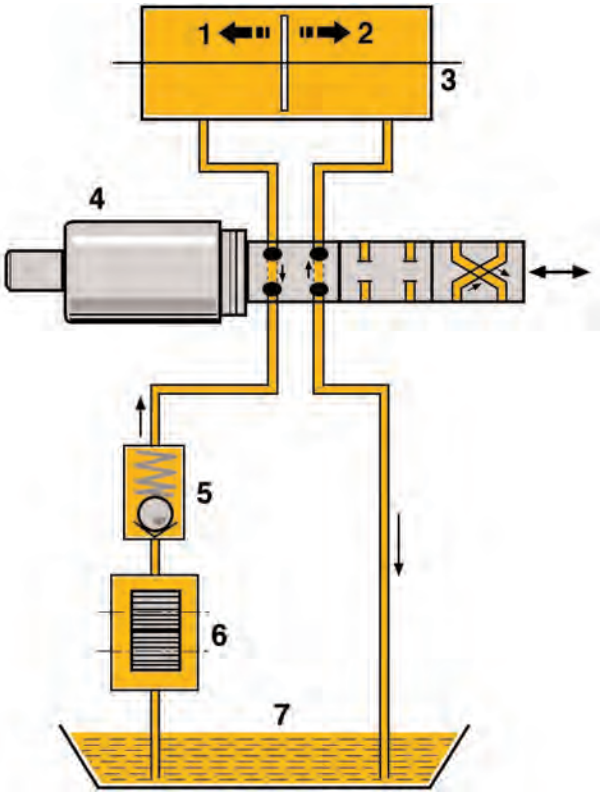
Notes:

Scavenging Concept



A scavenging restrictor is installed on the end of the control pressure line to keep the switching time to a minimum during valve lift control. This scavenging restrictor is used to bleed the line and reduce switching time.

Check Valve



1 - Adjustment direction retarded
2 - Adjustment direction advanced
3 - Camshaft controller
4 - Solenoid hydraulic valve
5 - Check valve
6 - Oil pump
7 - Oil pan

The camshaft requires a high drive torque at times due to the valve actuation, but the camshaft continues rotating unaided at other times (alternating torques). If a check valve is inserted into the P-line and the solenoid hydraulic valve is energized, for example (adjustment in direction of advanced valve timing), the controller automatically intakes oil via the feed line, the solenoid hydraulic valve and the check valve for an advancing camshaft. If the camshaft then tries to lag due to the high drive torque, the check valve closes and the oil cannot escape. The camshaft is driven by the oil cushion of the sprocket during this time, as with a freewheel. The advancing and lagging phases of the camshafts repeat so that the camshaft automatically shifts to advanced valve timing in stages.

As the principle described above only functions with well sealed adjustment control systems and low-friction valve drives, oil pressure is required. To ensure that an extremely large oil pump is not required, the principle described above is taken advantage of when the engine is hot and at a low oil pressure through the use of the check valve. The check valve serves to increase the adjustment speed at low oil pressures.

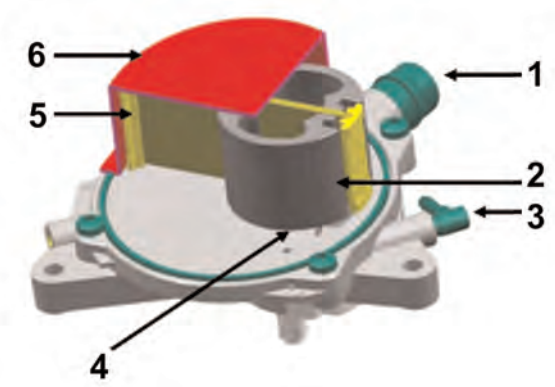
Valves, Valve Springs

The intake and exhaust valves on the Cayenne S and Cayenne Turbo have a shaft diameter of 6 mm. The intake and exhaust valves are bi-metallic, i.e. the materials used for the valve plate and the lower part of the valve stem are different to those used for the upper part of the valve stem. In addition, the exhaust valves on the Cayenne Turbo are filled with sodium.

The intake valve springs on the Cayenne S and Cayenne Turbo are identical. They are designed as a conical double valve spring set. This gives a very compact design. The exhaust valve springs on the Cayenne S are conical single valve springs. The Cayenne Turbo features cylindrical double-valve spring sets to ensure that the exhaust valves close, even at higher pressures in the exhaust system.

Vacuum Pump

Increased engine dethrottling means that the vacuum supply is no longer sufficient for unfavorable underlying conditions, e.g. low external air pressure at high altitudes and highly dynamic driving. A mechanical single-vane pump driven by the camshaft is used for this reason.



The pump delivery rate is 260cm/revolution.

1 - Intake opening
2 - Rotor
3 - Secondary load connection
4 - Outlet valve in crank chamber
5 - Vane with guide shoes
6 - Housing

Notes:

Timing Drive Mechanism





The chain is guided by two specially coated guide rails. The lower guide rail on cylinder row 1 to 4 is also designed as a tensioning rail. The hydraulic chain tensioner is connected to the engine oil circuit and is totally maintenance free.

Camshafts With Cylinder Specific Cam Contours

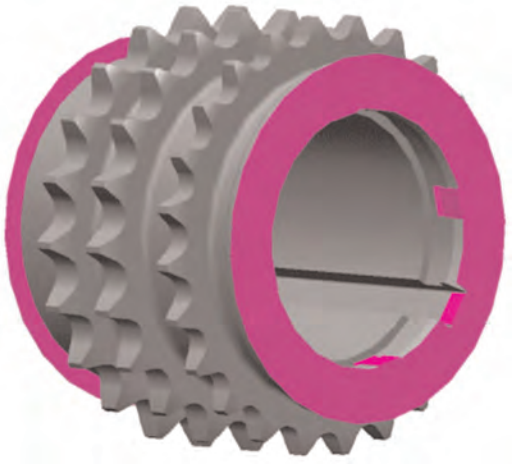
The intake and exhaust camshafts for both engines have a basic outer diameter of 38 mm. The intake valve lift is 3.6 mm and 11 mm. The exhaust valve lift on cylinders 1, 2, 6 and 8 is 8 mm, while the exhaust valve lift on cylinders 3, 4, 5 and 7 is 9.2 mm.

The engine design, with a V8 crankshaft and 90° throw, guarantees superb mass and torque balancing. In this engine design and a design with normal cam contours (same cam strokes), individual cylinders would be hindered during exhaust outflow into the exhaust manifold. The reason for this is that the surge of exhaust gas that emerges during the early (sooner than normal) exhaust valve opening for the respective cylinder (e.g. cylinder 2) goes into the overlap period of the next cylinder (cylinder 3). This would have a detrimental effect on the charging of the cylinders. Too many residual exhaust gases would also have a negative effect on the knock limit.

The firing order of the Cayenne (1-3-7-2-6-5-4-8) would put cylinders 3, 4, 5 and 7 at a disadvantage in terms of volumetric efficiency. These cylinders therefore have a larger cam stroke. This means that the cylinders are charged evenly, which results in an optimized torque curve in the entire rpm range.

Notes:

Sprocket



The lower sprocket, which drives the timing chain and the chain for the oil pump, has a friction disk on the front (facing the pulley) and rear (facing the crankshaft) for improved torque transmission.

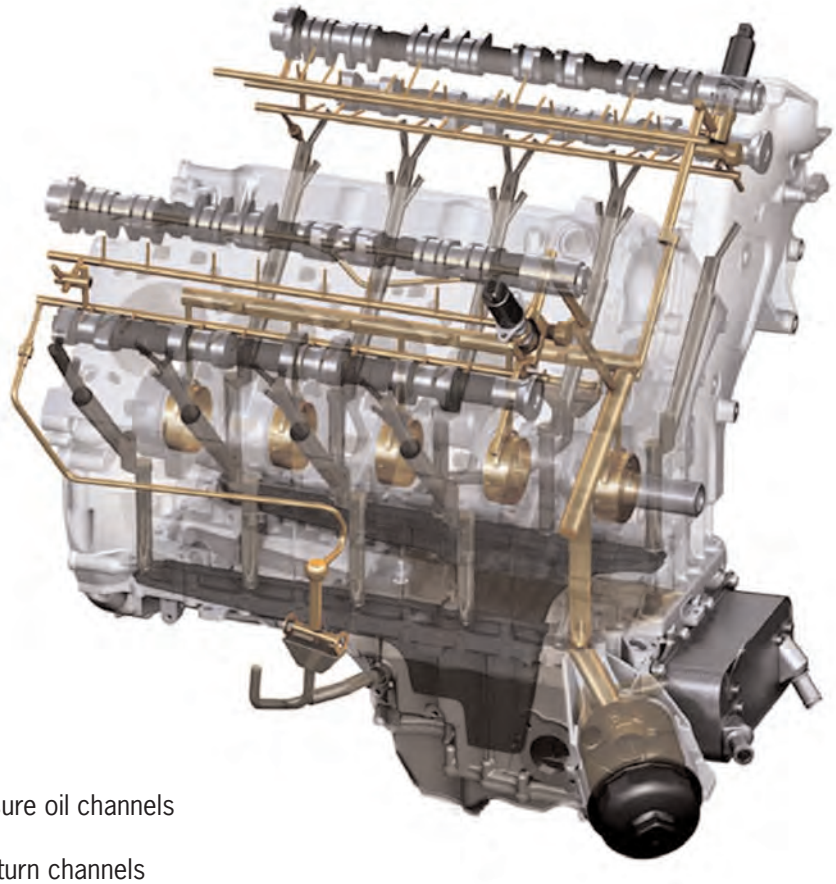


Illustration above shows the surface of the friction disk viewed under a microscope.

Belt Drive

The secondary units, such as the generator, coolant pump, power-steering pump and air conditioning compressor, are driven from the torsional vibration balancer via a polyrib belt. A maintenance free belt tensioner ensures the correct belt tension in all operating states.

Lubricating Oil System



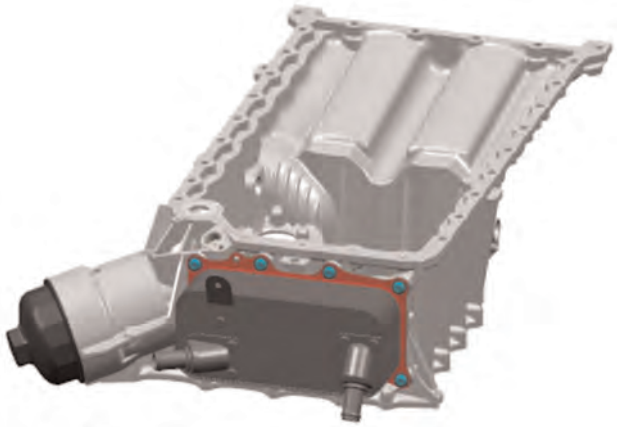
A - Pressure oil channels

B - Oil return channels

To ensure a reliable oil supply in all driving situations, the V8 engines in the Cayenne S and Cayenne Turbo have an integrated dry-sump lubrication system.

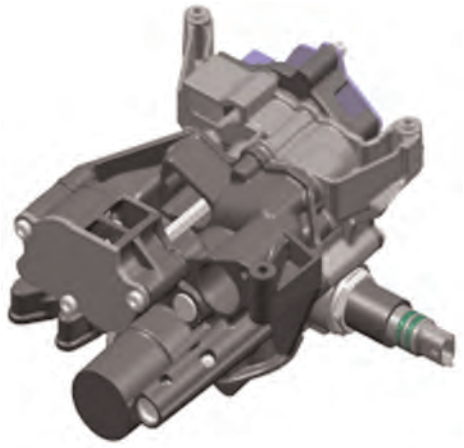


The oil pan is designed in two parts and has an upper and lower part. The oil-water heat exchanger and the oil filter are fitted directly on the upper part of the oil pan. To ensure a lightweight design, the windage tray, the oil return collection tank and the suction pipe are all together in a plastic housing fitted in the oil pan.

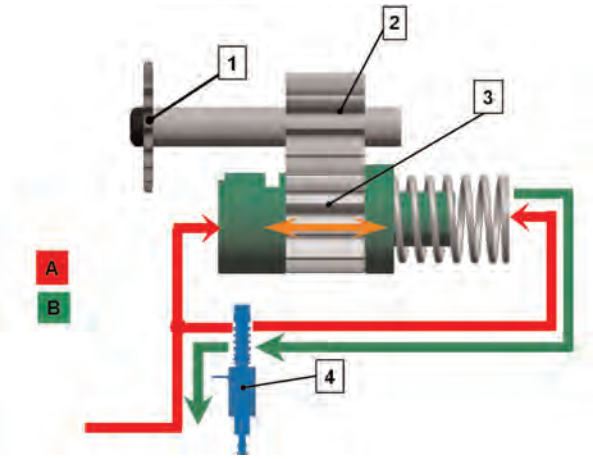


The oil pan wall is very thin so as to keep the weight as low as possible.

Oil Pump



The integration of VarioCam Plus, the mechanical vacuum pump and the fact that the lower part of the crankcase is fully aluminum means that oil throughput on the Cayenne S and Cayenne Turbo is very high. A relatively large and efficient pump must be used to guarantee the required oil supply. However, a lot of energy is required to drive such a pump and this energy requirement in turn increases fuel consumption. To counteract this, a variable oil pump is used for the first time in the Cayenne S and Cayenne Turbo.

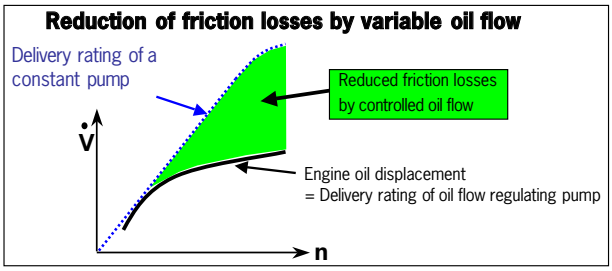


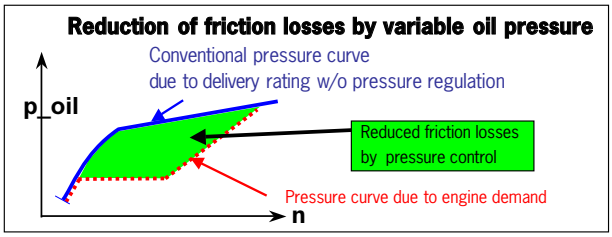
1 - Oil pump chain drive gear
2 - Oil pump driven gear
3 - Movable oil pump gear
4 - Oil pump control valve (lowers pressure on spring end of control piston)

Function

Depending on the input values for engine rpm, engine load, engine oil temperature and the expected change in engine rpm, a specific control valve position **(-4-)** is defined using a map in the DME control unit. The control valve position regulates the oil pressure for the spring piston on the gear wheel, which can move in axial direction. The oil pressure on the control piston is not regulated on the other side. The control valve is open fully in the non-energized state and as a result, the oil pressure is the same on both sides, which means that the gear wheel will not move.

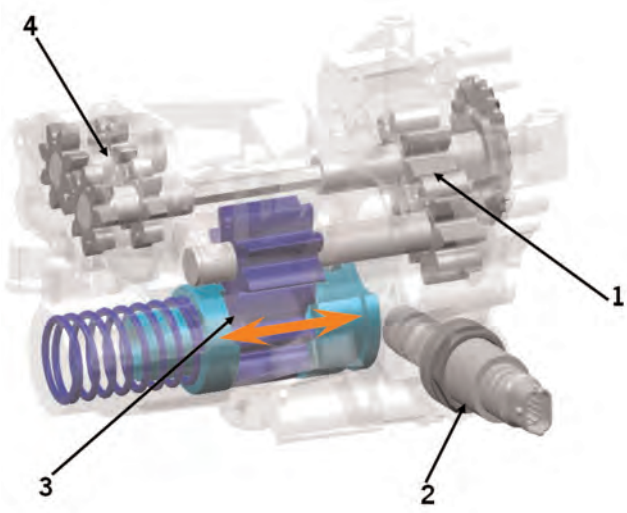
In other words: the pressure difference between the spring piston and the control piston can be used to control every position. When the gear wheel moves, the teeth are still only partially engaged and as a result, performance and friction as well as energy requirements are reduced.





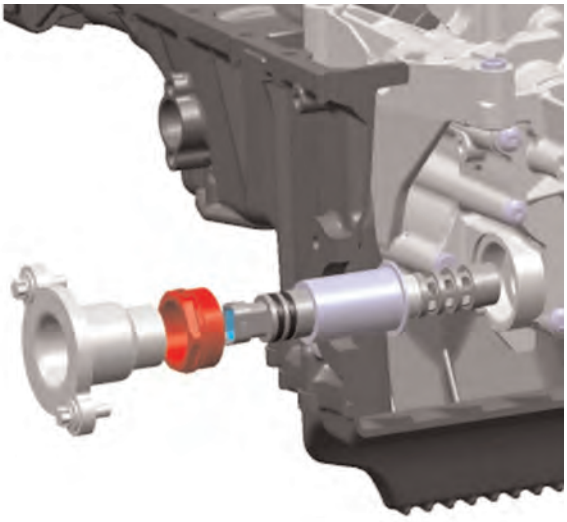
Notes:

Cayenne Turbo Oil Pump



1 - Intake stage
2 - Control valve
3 - Variable pressure stage
4 - Turbocharger suction pump

The Cayenne Turbo has an additional pressure oil line for turbocharger lubrication. A turbocharger suction pump **(-4-)** is integrated in the main oil pump for suctioning off the lubricating oil.



The control valve is fitted on the oil pump in such a way that it can be accessed from the outside.

Oil Spray Jets

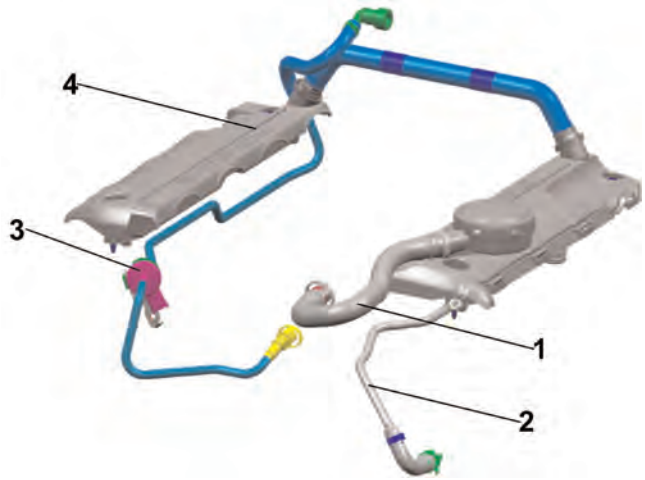
The temperature of the pistons in the Cayenne S and Cayenne Turbo engine is reduced by means of spray cooling. The spray jets are fitted on the upper part of the crankcase. The spray oil is also used for improved lubrication of the cylinder lining. To ensure the necessary engine oil pressure at low rpms and high engine oil temperatures, the spray jets have an opening pressure of approx. 1.8 bar.

Positive Crankcase Ventilation

During combustion, every engine blows some of the combustion gases past the piston towards the crankcase – these gases are called blow-by gases. If these gases are not drawn off, the pressure in the crankcase would increase considerably. A vent connection is installed in the crankcase for this reason. For environmental protection reasons, these gases are not released into the atmosphere, but are sent back to the engine for combustion via the intake system. Of course, these positive crankcase ventilation gases contain a high proportion of engine oil and other combustion residues as well as fuel residues in some cases. If these gases get into the intake duct, they will contaminate the intake air and can then impair running smoothness, exhaust emissions and reduce knock resistance. For these reasons effective oil separation is important for the engine.

Notes:

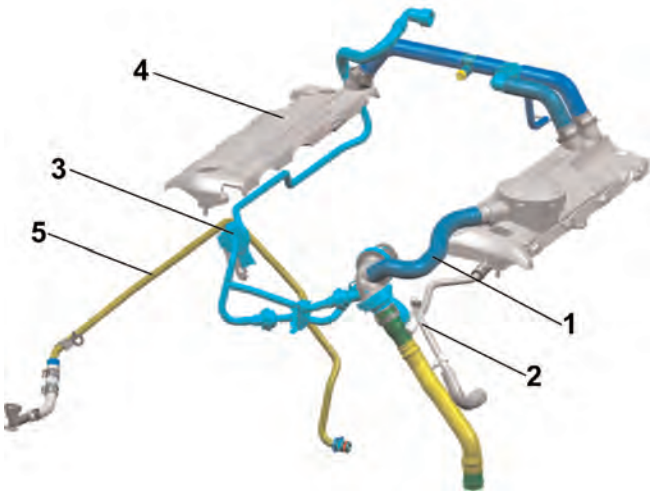
Positive Crankcase Ventilation – Naturally Aspirated Engine



1 - Return connection for blow-by gases
2 - Return line
3 - Tank vent
4 - Positive crankcase ventilation

Positive Crankcase Ventilation - Turbo Engine

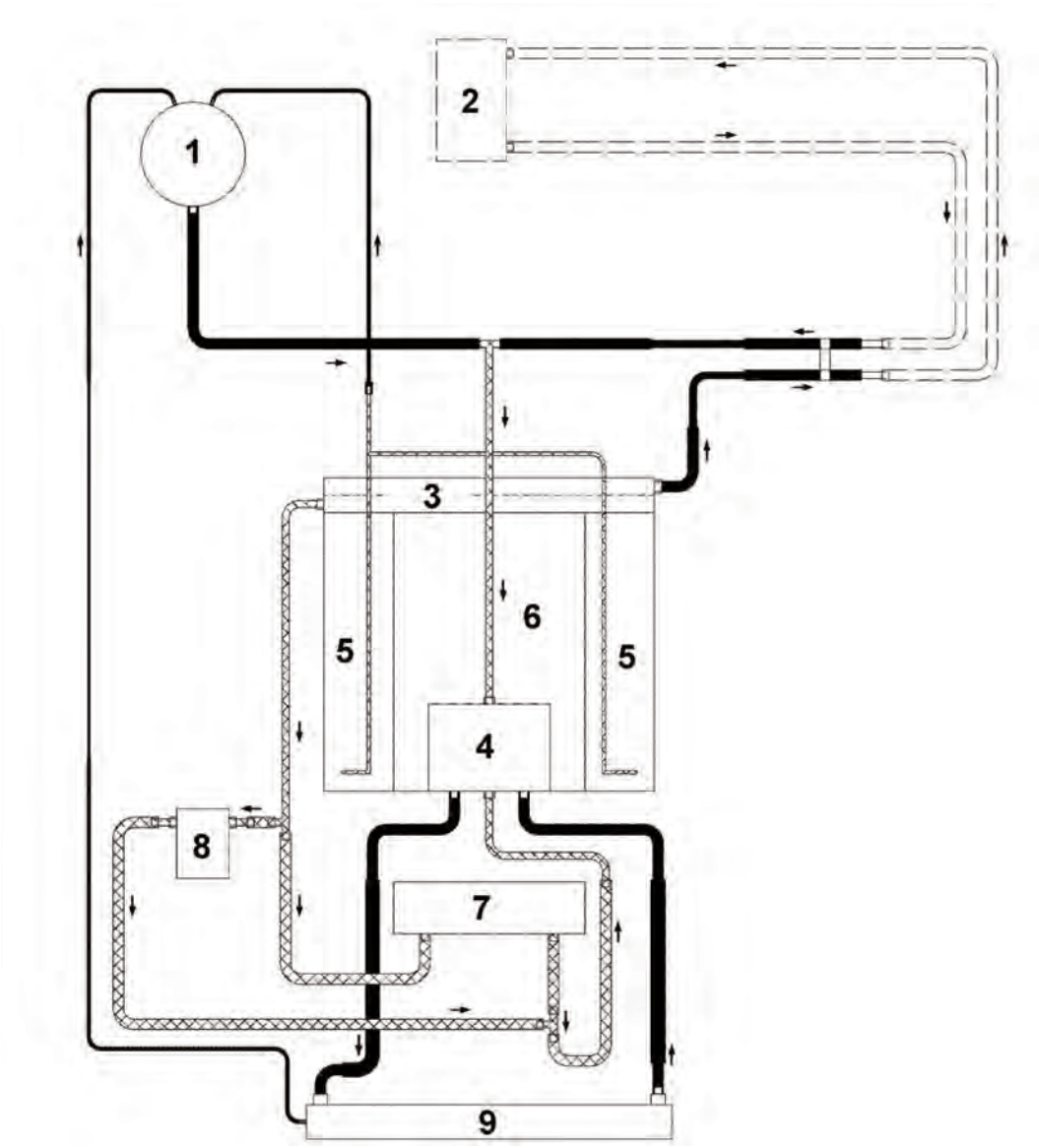
The positive crankcase ventilation system in the Cayenne Turbo can reduce the amount of fuel that goes into the engine oil during combustion. The aeration and ventilation system (Positive Crankcase Ventilation-PCV) ventilates the crankcase with a steady stream of fresh air, which accelerates the evaporation of fuel that is carried in.



1 - Return connection for blow-by gases
2 - Return line
3 - Tank vent
4 - Positive crankcase ventilation
5 - PCV connection

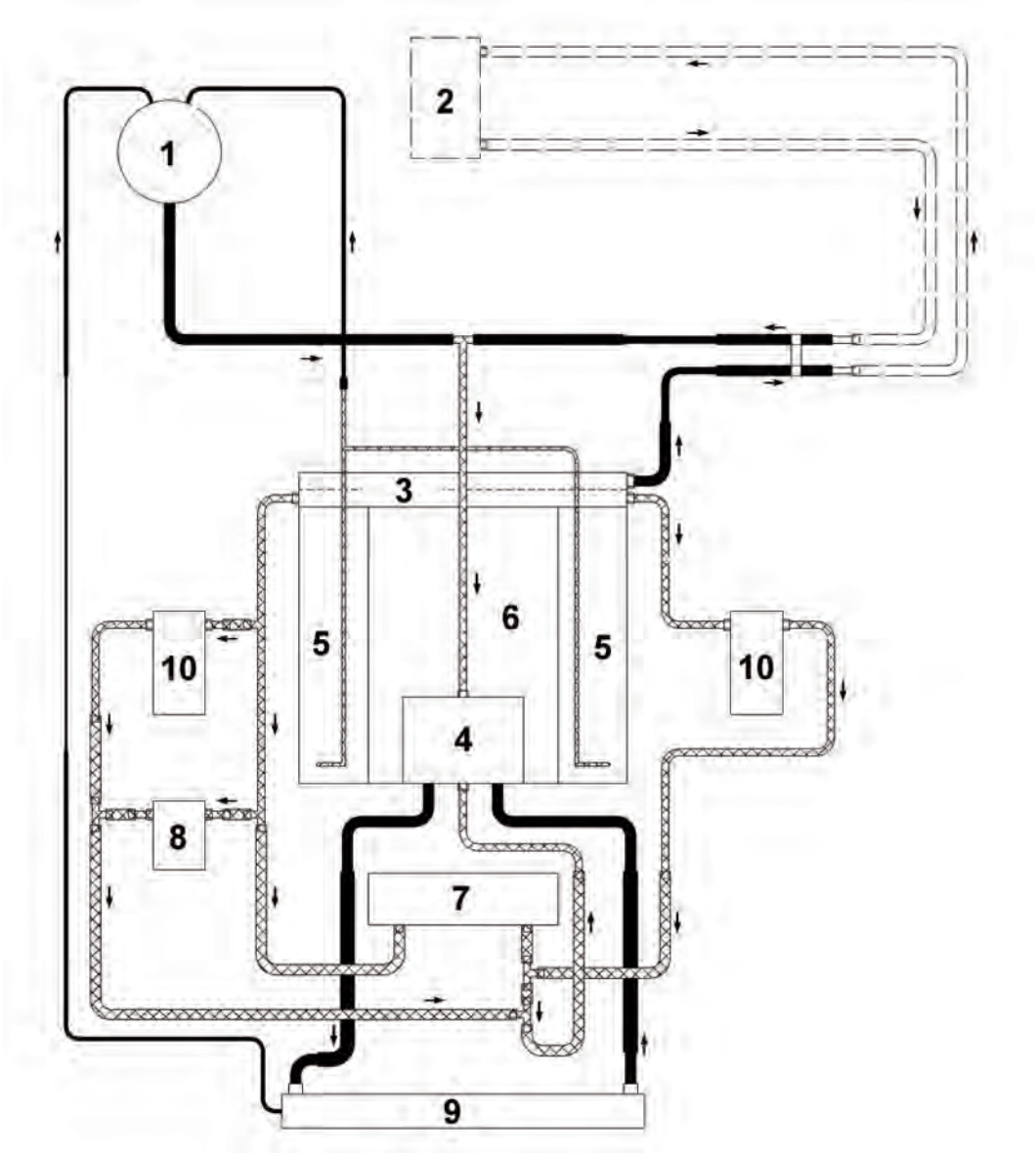
For this purpose, fresh air is removed between the charge air cooler and throttle valve and is delivered to the crank chamber via a line. The pressure that exists at any time between the removal position and the crankcase causes a steady flow of fresh air through the crankcase. To ensure enough vacuum in the crankcase in all operating states, the vacuum in the intake manifold is used in the part-load ranges. A pressure regulating valve regulates this vacuum until the required value is reached. The vacuum from the compressor is used in the boost range (no vacuum present).

Cayenne S Cooling System



1 - Coolant reservoir
2 - Heat exchanger
3 - Coolant collection pipe
4 - Coolant pump/thermostat housing
5 - Cylinder head
6 - Crankcase
7 - Oil-water heat exchanger
8 - Generator
9 - Radiator

Cayenne Turbo Cooling System



1 - Coolant reservoir
2 - Heat exchanger
3 - Coolant collection pipe
4 - Coolant pump/thermostat housing
5 - Cylinder head
6 - Crankcase
7 - Oil-water heat exchanger
8 - Generator
9 - Radiator
10 - Turbocharger



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Notes:

1 - Engine M 55.01



General

The Cayenne engine is designed as a 6-cylinder, direct fuel injection V engine. The 3.6 liter V6 cylinder engine offers a wide rpm range improved power output and torque combined with low fuel consumption and emission values. Being a long-stroke engine, the V6 generates high torque even at low rpms.

Engine Data – Second Generation V6

Engine type	M55.01
No. of cylinders	6
Bore	89 mm
Stroke	96.4 mm
Displacement	3.6 Liter
V-angle	10.6°
Compression ratio	12.0
Max. output	290 HP (213 kW)
At engine speed	6200 rpm
Max. torque	285 ftlb. (385 Nm)
At engine speed	3000 rpm
Governed speed	6700 rpm
Engine weight (manual transmission)	417 lbs (189 kg)
Engine weight (Tiptronic)	390 lbs (177 kg)
Firing order	1-5-3-6-2-4

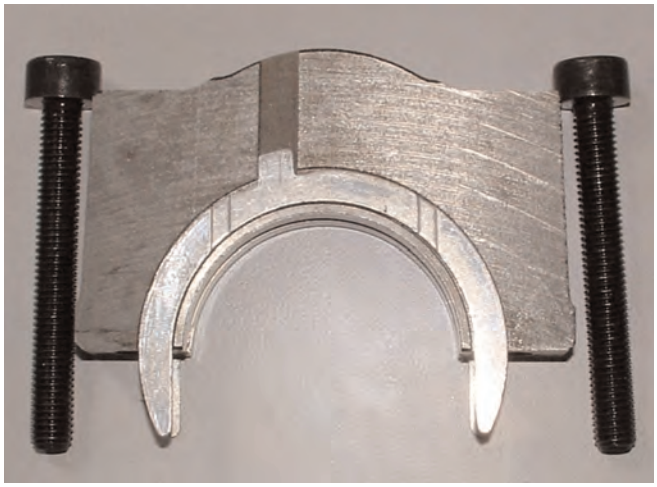
Crankcase



The crankcase with the cylinders is made of grey cast iron with lamellar graphite in weight optimized design. The cylinders are arranged in a staggered configuration in the 10.6° V-angle. The cylinder number 1 is located on the passenger side.

Crankshaft

The drop-forged crankshaft runs on seven bearings. Main bearing 4 is designed as a thrust bearing. Axial play is determined by two thrust plates, which are inserted into the bearing supports. The main bearings are two-component bearings and have a diameter of 60 mm.



Located on the crankshaft are the pulse-generating wheel for the speed and reference mark transmitter **-A-** and the drive sprocket for the intermediate shaft **-B-**.



Notes:

Pistons

The pistons are designed as recessed pistons made of aluminum alloy. They have a graphite friction coating at the sides to improve friction performance of the piston. The pistons are different for cylinder bank 1 and cylinder bank 2. The valve recesses and combustion chamber troughs are arranged differently. The position and shape of the piston recess allows the injected fuel to be whirled around and mixed with the air that is drawn in.

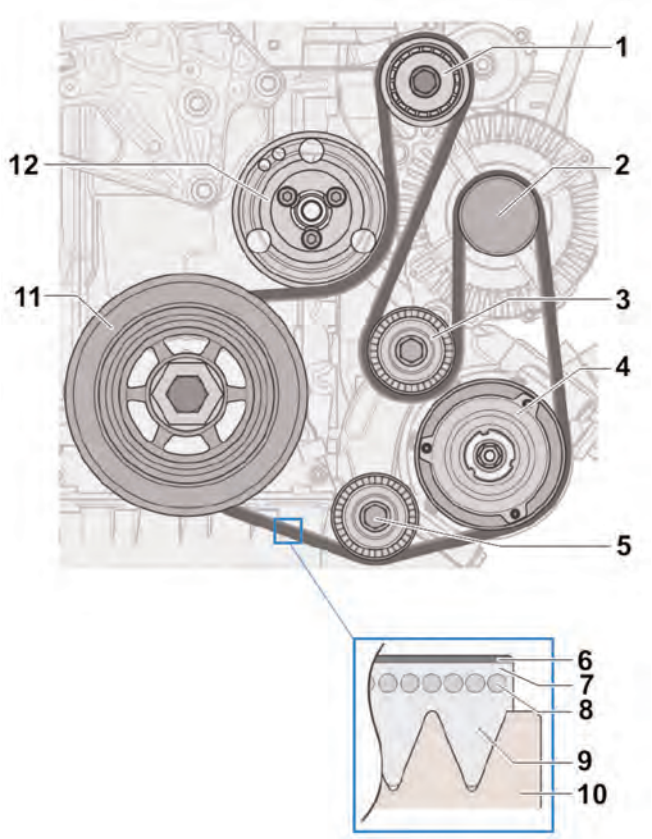


1 - Friction coating
2 - Piston recess

Connecting Rods

The connecting rods are cut rather than cracked. The conrod eye is trapezoid. The conrod bearings are two-component bearings with a diameter of 54 mm and are molybdenum coated, which ensures good friction characteristics and a high load capacity.

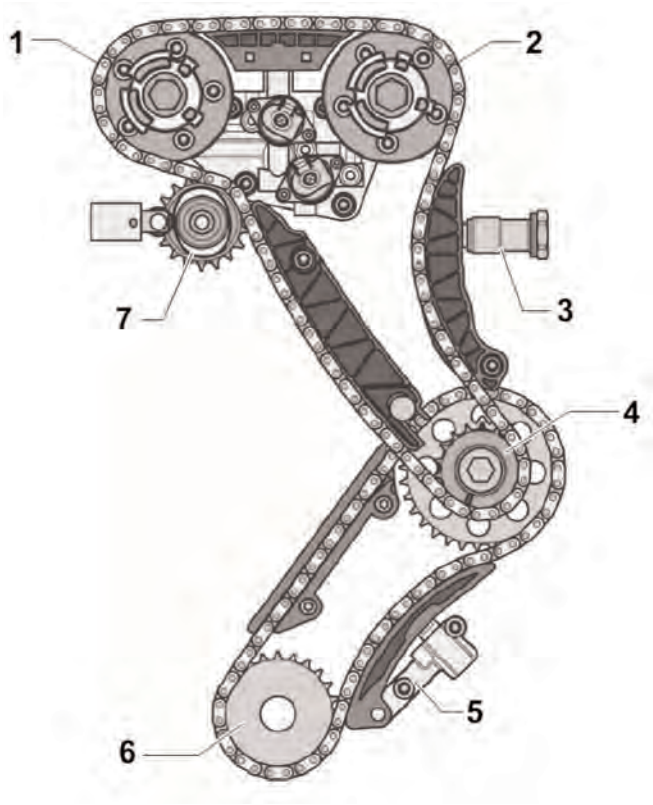
Belt Drive



1 - Tensioning roller
2 - Generator drive
3 - Deflection roller
4 - Air conditioning compressor drive
5 - Deflection roller
6 - Outer fabric
7 - Covering plate
8 - Polyester cord
9 - Substructure
10 - Poly V-belt pulley
11 - Crankshaft poly V-belt pulley
12 - Coolant pump drive

The poly V-belt is a single sided poly V-belt. The belt is driven by the crankshaft via the poly V-belt pulley with vibration damper. The air conditioning compressor, generator and coolant pump run in the belt drive. A belt tensioner ensures that the poly V-belt is always tensioned correctly.

Chain Drive



1 - Inlet camshaft drive
2 - Outlet camshaft drive
3 - Hydraulic chain tensioner
4 - Oil pump drive
5 - Hydraulic chain tensioner
6 - Crankshaft gear
7 - Fuel high pressure pump drive

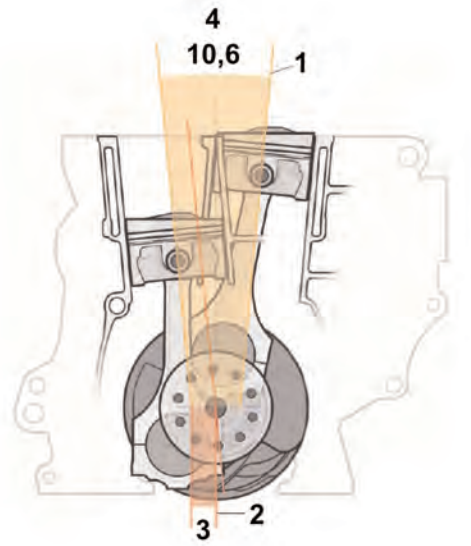
The chain drive is on the power output side of the engine. It consists of the primary roller-type chain and the camshaft roller-type chain. The primary roller-type chain is driven by the crankshaft. It drives the camshaft roller-type chain and the oil pump via a sprocket. The camshaft roller-type chain drives the two camshafts and the fuel high-pressure pump. The hydraulic chain tensioner guarantees the exact tensioning of the cam drive chain.

V-Angle

The V-angle of the cylinder block is 10.6° (previously 15°). This small V-angle ensures the required cylinder wall strengths without increasing the installation dimensions of the engine.

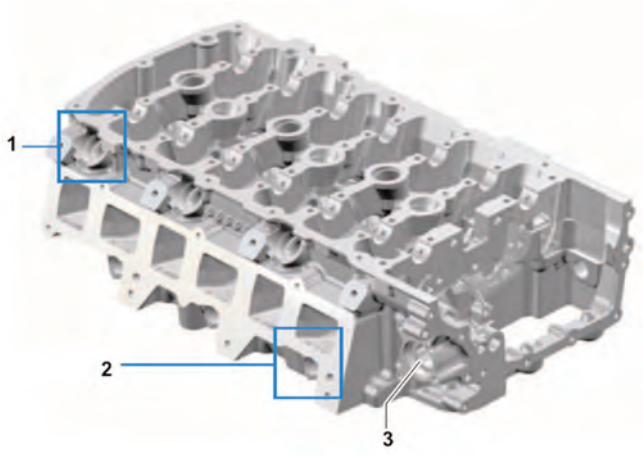
Articulation

The small V-angle causes the longitudinal axis of the cylinder to move outward with respect to the lower crankshaft. The distance between the longitudinal axis of the cylinder and the crankshaft center axis is the articulation. Accordingly, the small V-angle increases the articulation (in this case: 22 mm).



1 - Longitudinal axis of cylinder
2 - Crankshaft center axis
3 - Articulation
4 - V-angle

Cylinder Head



1 - Installation position of fuel injectors 1, 3, 5
2 - Installation position of fuel injectors 2, 4, 6
3 - Installation position of fuel high pressure pump

The one piece cylinder head is made of an aluminum silicon copper alloy. The cylinder head is used both for mounting the chain drive and for connecting the fuel high pressure pump. The fuel injectors for both cylinder banks are on the intake side of the cylinder head.

The bores for the fuel injectors for cylinders 1, 3 and 5 are above the intake manifold flange. The fuel injectors for cylinders 2, 4 and 6 are inserted below the intake manifold flange. This arrangement allows the fuel injectors for cylinders 1, 3 and 5 to run through the intake port on the cylinder head.

Camshaft Adjustment

The intake and exhaust camshafts are adjusted by way of a vane adjuster. The DME control unit determines the current position of the camshaft in relation to the crankshaft (actual angle) on the basis of the speed sensor signal and the Hall sender signal. The position controller in the control unit receives the desired nominal angle via the programmed map values (speed, load, engine temperature). A regulator in the DME control unit activates a solenoid hydraulic valve according to the desired adjustment when there is a difference between the nominal angle and actual angle. The adjustment angle is 52° in relation to the crankshaft on the intake side and 22° in relation to the crankshaft on the exhaust side.

When idling, the camshafts are set that the intake camshaft opens and closes late. The exhaust camshaft is adjusted that it closes well before TDC. This results in stable idling on account of the low residual gas content in the combustion process.

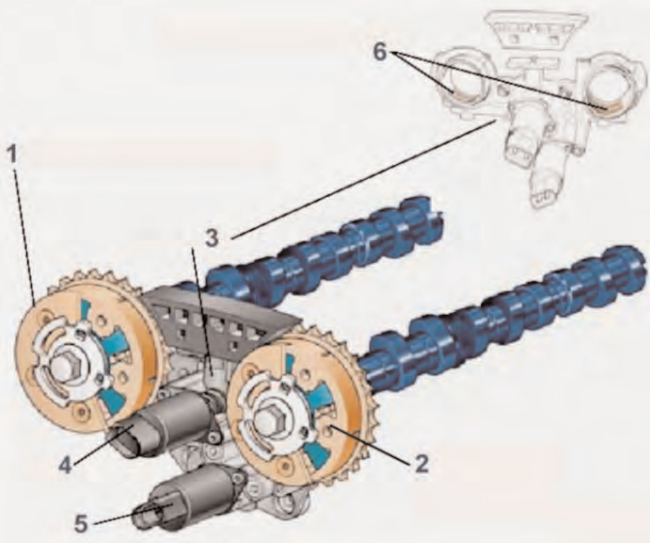
In order to attain a good power output at high rpms, opening of the exhaust valves is retarded. This allows the expansion effect of the combustion process to act on the piston for a prolonged period. The intake valve opens after TDC and closes late after BDC. This way, the dynamic ram effects of the inflowing air are utilized to increase power output.

In order to attain maximum torque, high volumetric efficiency is required for the cylinders. To this end, the intake valves must be opened early. As a result of early opening they also close early, thereby avoiding the expulsion of fresh gases. The exhaust camshaft closes shortly before TDC.

Internal exhaust gas recirculation is carried out while the intake and exhaust camshafts are being adjusted. This results in an overflow of the exhaust gas from the exhaust port into the intake port during valve overlap (intake and outlet valves open). The size of valve overlap determines the quantity of exhaust gas returned in the course of internal exhaust gas recirculation. To this end, the intake camshaft is set such that it opens well before TDC while the exhaust camshaft closes only shortly before TDC. Both valves are thus open and exhaust gas is recirculated. The advantages of internal exhaust gas recirculation as opposed to the external alternative are the fast response of the system and uniform distribution of the recirculated exhaust gases.

The camshaft adjustment system comprises the following components:

- Two vane adjusters
- Two electromagnetic valves
- Timing chain housing

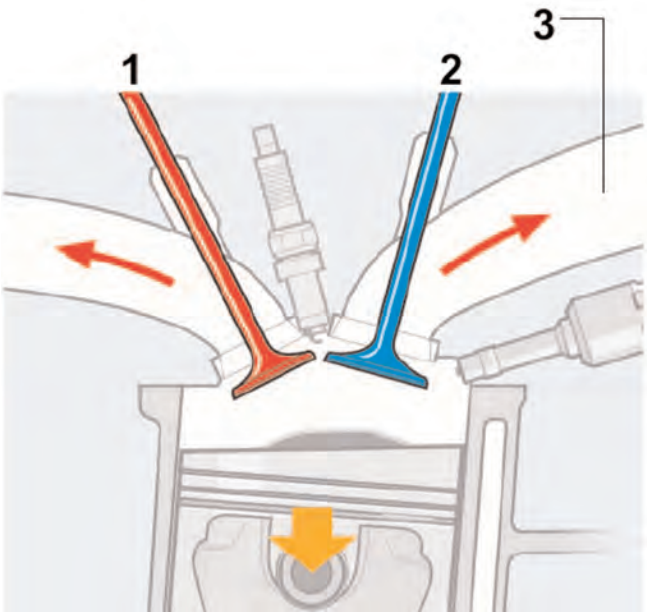


1 - Vane adjuster for intake camshaft
2 - Vane adjuster for exhaust camshaft
3 - Timing chain housing
4 - Valve for intake camshaft adjustment
5 - Valve for exhaust camshaft adjustment
6 - Oil ducts for the ring passage in the camshafts

Notes:

The DME control unit actuates electromagnetic valves 4 and 5 to adjust the camshafts. The valves subsequently open oil passages in the timing chain housing. The engine oil then flows via the timing chain housing and the camshaft into the vane adjuster. The vane adjusters turn, adjusting the camshafts in accordance with the instructions from the DME control unit.

Exhaust Gas Recirculation

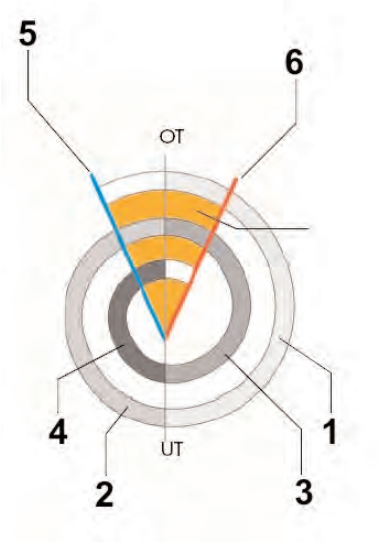


1 - Exhaust valve
2 - Intake valve
3 - Intake manifold vacuum

Internal exhaust gas recirculation counteracts the formation of nitrogen oxides NOx. Just like external exhaust gas recirculation, the formation of NOx is based on the fact that the combustion temperature is reduced through the introduction of combustion exhaust gases. The combustion gases in the fresh air/fuel mixture cause a slight lack of oxygen, whereby the combustion does not become as hot as it would if there was surplus oxygen. Nitrogen oxides are only formed in a greater concentration at a relatively high temperature. The reduced combustion temperature in the engine and the lack of oxygen prevent the formation of NOx.

Function

Both the intake and exhaust valves are open during the exhaust stroke. The high intake manifold vacuum causes some of the combustion gases from the combustion chamber to be sucked back into the intake port and then flushed back into the combustion chamber for the next combustion with the next intake stroke.

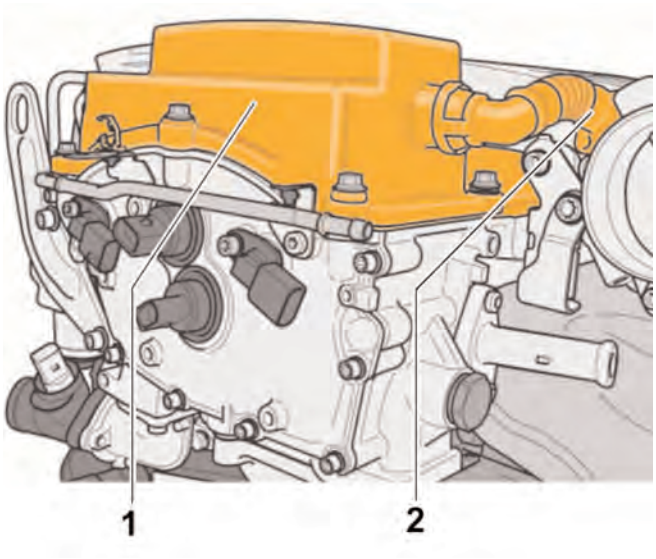


1 - Stroke 1
2 - Stroke 2
3 - Stroke 3
4 - Stroke 4
5 - Intake valve opens
6 - Exhaust valve closes

This has the following advantages:

- Reduced consumption due to reduced gas exchange work.
- Increased part-load range with exhaust gas recirculation.
- Smoother running.
- Exhaust gas recirculation is possible even when the engine is cold.

Positive Crankcase Ventilation

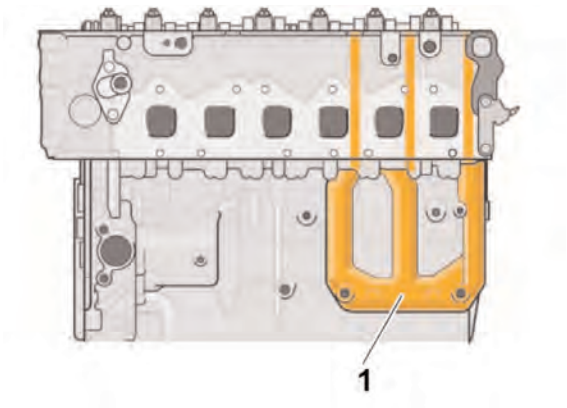


1 - Cyclone oil separator
2 - Positive crankcase ventilation heating

Positive crankcase ventilation prevents hydrocarbon-enriched vapors (blow-by gases) from the crankcase from getting into the outer atmosphere. The positive crankcase ventilation system includes vent ducts in the cylinder block and cylinder head, the cyclone oil separator and positive crankcase ventilation heating.

The blow-by gases in the crankcase are drawn in by the intake manifold vacuum via:

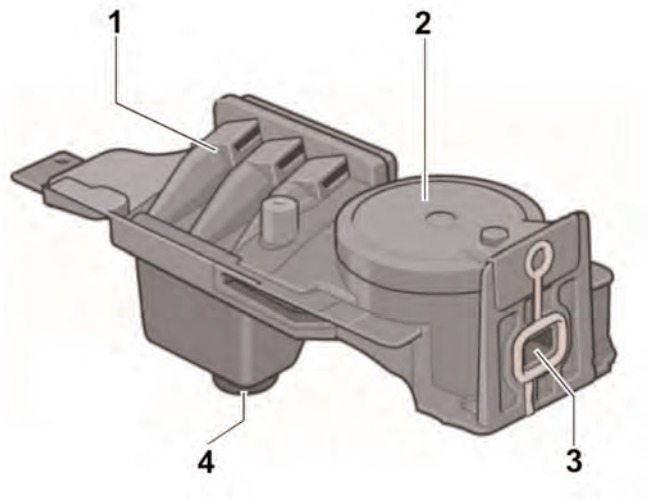
- the vent ducts in the cylinder block,
- the vent ducts in the cylinder head,
- the cyclone oil separator and
- the positive crankcase ventilation heating system and are then introduced back into the intake manifold.



1 - Vent ducts in the cylinder block and cylinder head.

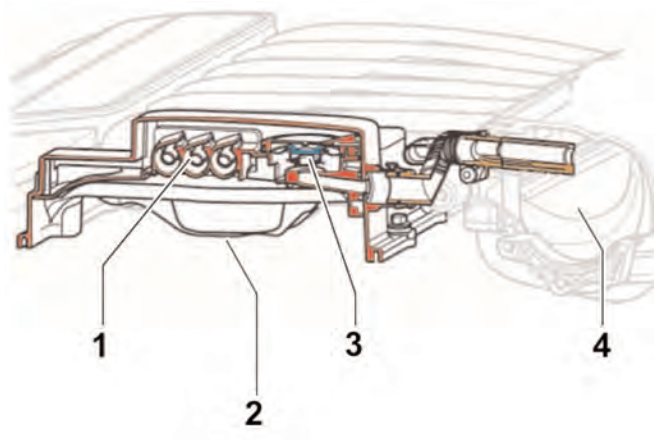
Notes:

Cyclone Oil Separator



1 - Cyclone oil separator
2 - Pressure regulating valve
3 - To intake manifold
4 - Oil discharge opening

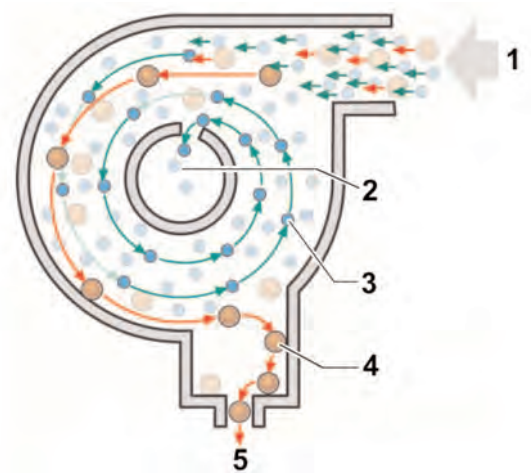
The cyclone oil separator is in the cylinder head cover. Its main function is to separate oil from the blow-by gases in the crankcase and return it to the oil circuit. A pressure regulating valve limits the intake manifold vacuum from approx. 700 mbar to approx. 40 mbar. This prevents the entire intake manifold vacuum and the internal crankcase pressure from affecting positive crankcase ventilation, thereby drawing in engine oil or damaging seals.



1 - Cyclone oil separator
2 - Oil-discharge opening
3 - Vacuum valve
4 - Intake manifold

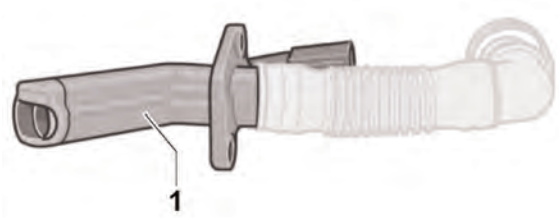
Function

The cyclone oil separator separates the oil from the oil vapor that is drawn in. It works according to the principle of centrifugal separation. The cyclone design of the oil separator means that the oil vapors are moved in a rotating movement. The centrifugal force that is created flings the oil onto the partition wall, where it combines to form larger drops. While the separated oil drips into the cylinder head, the gas particles are fed into the intake manifold through a flexible pipe.



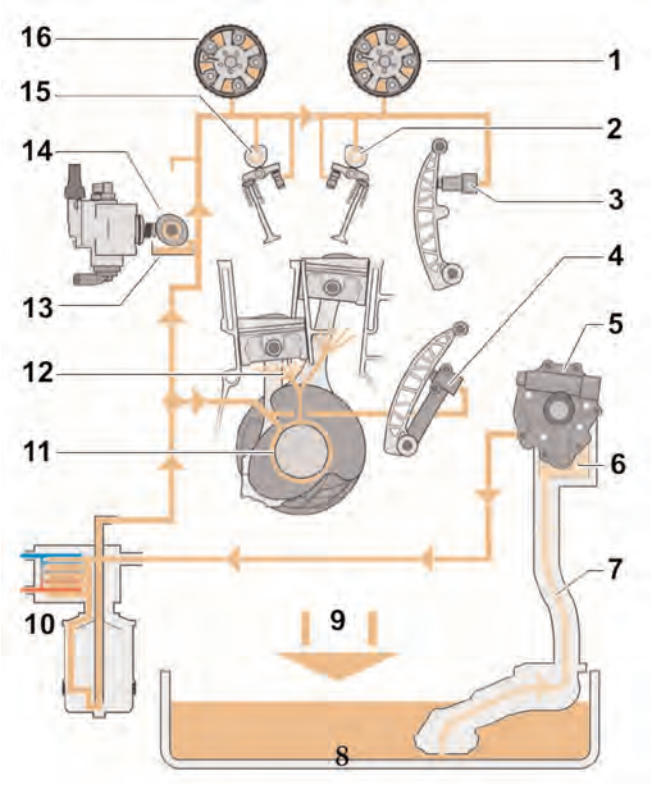
1 - Intake
2 - Gas feed to intake manifold
3 - Gas particles
4 - Oil drops
5 - Oil-discharge opening in crankcase

Positive Crankcase Ventilation Heating



The heating element **-1-** is inserted in the flexible pipe connecting the cyclone oil separator to the intake manifold and prevents the incoming blow-by gases from freezing when the intake air is very cold.

Oil Circuit

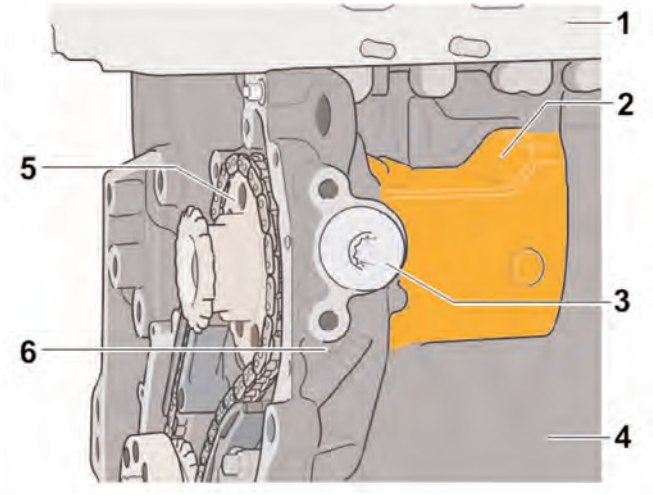


1 - Camshaft adjuster
2 - Camshaft bearing
3 - Chain tensioner
4 - Chain tensioner
5 - Oil pump
6 - Oil reservoir
7 - Intake duct
8 - Oil pan
9 - Oil return
10 - Oil filter / oil/water heat exchanger
11 - Crankshaft bearing
12 - Piston spray nozzles
13 - Oil reservoir
14 - Fuel high-pressure pump drive
15 - Hydraulic tappet
16 - Camshaft adjuster

The oil pressure is generated by a self-priming oil pump **-5-**. This is mounted in the cylinder block and is driven by the chain drive. The installation position ensures a long suction route **-7-**, which lasts for the duration of time required to supply initial oil to the components. For this reason, oil is taken from a reservoir **-6-** behind the oil pump to guarantee the initial oil supply. The oil pump draws the oil from the oil pan **-8-** and then pumps it to the oil filter and oil/water heat exchanger **-10-**.

Oil Pump With Oil Reservoir

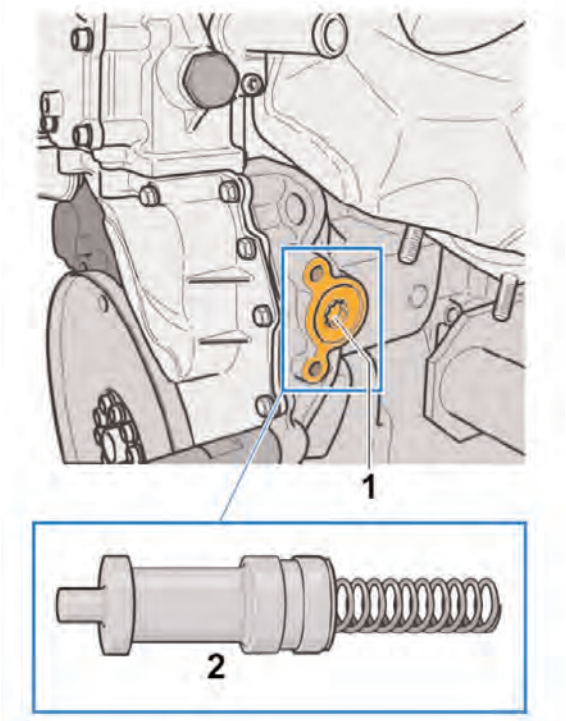
The oil reservoir is formed in the cylinder block by a cavity behind the oil pump. It has a volume of approx. 280 ml and is retained even after the engine is stopped.



1 - Cylinder head
2 - Oil reservoir
3 - Service opening
4 - Cylinder block
5 - Drive gear
6 - Oil pump

Notes:

Service Opening



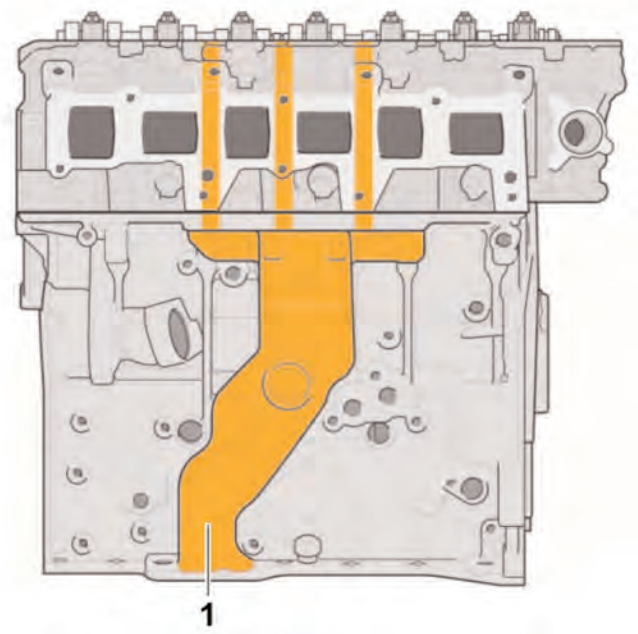
1 - Cover screw
2 - Pressure piston

The service opening allows access to the oil pressure regulating piston in the oil pump when the engine is installed. The pressure piston in the oil pump can be removed through the opening without having to remove the chain drive by unscrewing the cover screw and a second inner screw.

Oil/Water Heat Exchanger With Oil Filter

The oil/water heat exchanger and the oil filter with bypass valve form one unit.

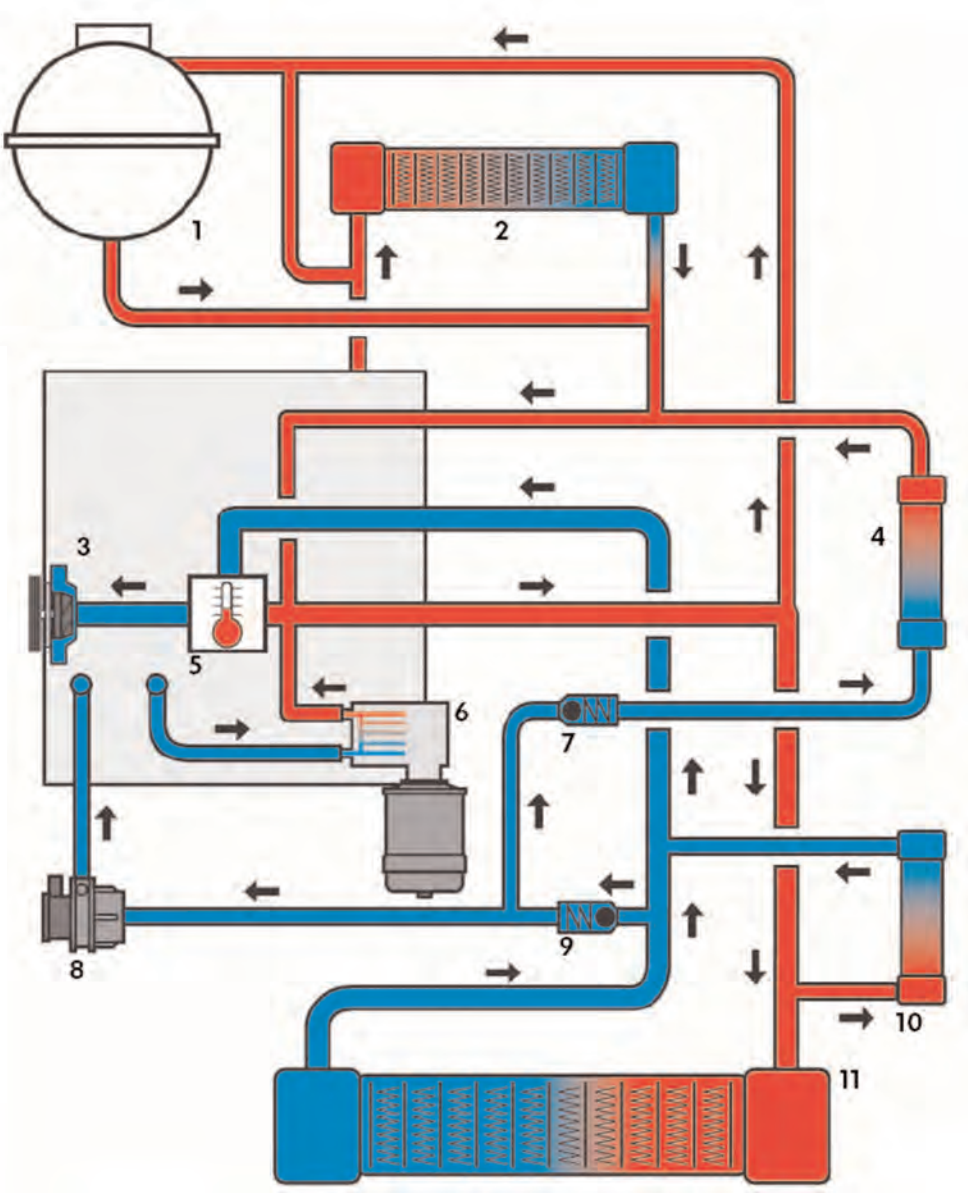
Oil Return



The oil that flows back is routed into a central oil return duct **-1-** in the cylinder block via three return ducts in the cylinder head. The oil then flows back under the oil level into the oil pan. In addition to the central oil return system, oil at the front is also returned to the oil pan via the chain drive housing.

Notes:

Cooling System



1 - Reservoir
2 - Heat exchanger
3 - Coolant pump
4 - ATF/water heat exchanger
5 - Coolant thermostat
6 - Oil/water heat exchanger
7 - Check valve
8 - Electric additional coolant pump
9 - Check valve
10 - Additional radiator
11 - Vehicle radiator

Coolant is circulated by the mechanical coolant pump. The pump is driven by the poly V-belt. The circuit is controlled by the thermostat. The check valves are integrated into the circuit in such a way as to prevent coolant flowback.

The amount of coolant depends on the vehicle equipment and is generally between 14 qts (13.2 liters) and 18.6 qts (17.6 liters).

Notes:

Notes:

First Generation







Second Generation







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Checking Engine Coolant	69
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Engine Oil Level

- Please observe the chapter "EXERCISE EXTREME CAUTION WHEN WORKING ON YOUR VEHICLE" on Page 234.
- Please observe the chapter "WARNING LIGHTS AND WARNING MESSAGES" on Page 108.
- Check the oil level regularly. It is best to do this when refuelling and before extended journeys.

Warning!

Engine oil is hazardous to your health and may be fatal if swallowed.

- Keep engine oil out of children's reach.

Used engine oil contains chemicals that have caused cancer in laboratory animals.

- Always protect your skin by washing thoroughly with soap and water.

Oil-level warning

If the oil level is too low, this is indicated by the oil-level warning light coming on.

- Check the oil level using the oil dipstick as soon as possible and add engine oil if necessary.

Checking the oil level

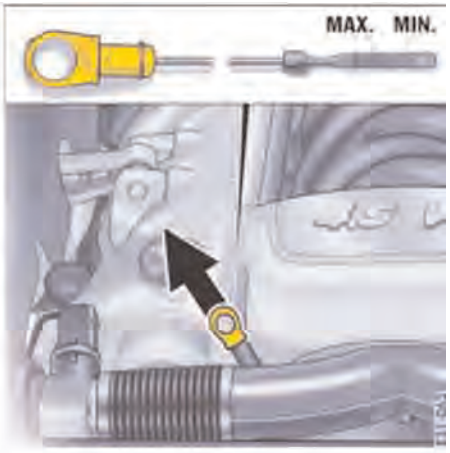
Warning!

Danger of injury. The radiator fans can start running as a function of temperature, even with the engine switched off.
Risk of burning from hot parts in engine compartment.

- Exercise extreme caution when working on the engine compartment.

Conditions for measuring the oil level correctly

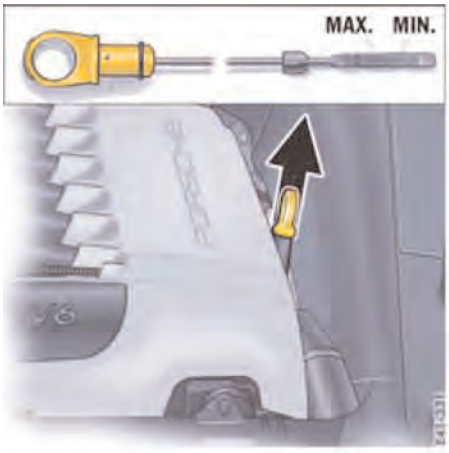
- Vehicle must be level.
- Engine must be switched off and at operating temperature.
- Before the oil-level measurement, allow the engine oil to flow back into the oil pan for around 3 minutes.



Engine oil dipstick Cayenne S/T

Checking oil level with the oil dipstick

1. Withdraw oil dipstick and wipe it with a clean, lint-free cloth.
2. Push oil dipstick fully home, withdraw again and read off the oil level.
   The oil level must never fall below or exceed the "Min." and "Max." marks on the dipstick.
   The difference between the marks is approx. 1.5 litres or 1.6 qt.
3. Push oil dipstick in as far as the stop.



Oil Dipstick Cayenne



Cayenne S/T



Cayenne

Topping off engine oil

Caution!

Fire hazard if engine oil comes into contact with hot engine parts.
Risk of damage if engine oil comes into contact with the drive belt.

- Exercise great care when adding engine oil.

1. Unscrew cap of the oil filler opening
2. Add engine oil carefully.
3. Measure oil level again after a few minutes.
   Never exceed the MAX mark on the oil dipstick.
4. Push oil dipstick in as far as the stop.
5. Carefully close cap of the oil filler opening.

Cayenne/S/T

Coolant Level

▷ Please observe the chapter "EXERCISE EXTREME CAUTION WHEN WORKING ON YOUR VEHICLE" on Page 234.

The coolant provides year-round protection from corrosion and freezing down to -31°F/-35°C (Nordic countries -40°F/-40°C).

▷ Use only anti-freeze authorized by Porsche.

▷ Check the coolant level regularly.

Checking coolant level/adding coolant

The expansion tank for the coolant is located under the engine-compartment cover in the engine compartment.

When the **engine is cold** and the car is level, the coolant level must lie between the minimum and maximum marks.





Checking when engine is cold

1. Remove cover.
2. Open cap of the expansion tank carefully and allow any overpressure to escape.
   Then unscrew cap completely.
3. Read the coolant level.
4. Top up with coolant if necessary.
   Do not exceed the max. mark.
   Only add a mixture of anti-freeze and water in equal parts.
   Antifreeze in coolant:
   50% provides anti-freeze protection down to -31°F/-35°C.
5. Screw the cap closed firmly and put on the cover.

Checking the coolant level when a warning messages is shown on the multi-purpose display of the instrument panel

Warning!

Danger of serious personal injury from scalding. Coolant is hazardous to your health, and may be fatal if swallowed.

▷ Do not open the cap of the expansion tank while the engine is hot.

▷ Allow the engine to cool down before opening the cap and protect your hands, arms and face from any possible escape of hot coolant.

▷ Keep coolant out of children's reach.

▷ Also, keep coolant away from your pets.They can be attracted to it should there be a spill, or to used coolant left in an open container. Coolant can be deadly to pets if consumed.

1. Remove cover.
2. If the engine is hot, cover the the expansion tank cap with a cloth.
   Open cap carefully and allow any overpressure to escape.
   Then unscrew cap completely.
3. Read the coolant level.
   Top up with coolant if necessary.
   Only add a mixture of anti-freeze and water in equal parts.
   Antifreeze in coolant:
   50% provides anti-freeze protection down to -31°F/-35°C.
   Do not exceed the max. mark.

Note on operation

▷ If the coolant level exceeds the max. mark when the engine is hot, check the coolant level again when the engine is cold.

4. Screw the cap closed firmly and put on the cover.
5. Have the cooling system checked by an official Porsche dealer.

Maintenance note

If in an emergency pure water has been added, the mixture ratio must be corrected at an official Porsche dealer.

Marked loss of coolant indicates leakage in the cooling system.
The cause should be remedied at an authoized Porsche dealer immediately.

PORSCHE

Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

- ☑ Diagnosis system: Read out fault memory; reset maintenance interval
- ☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
  Engine compartment: Visual inspection for damage
  Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels
- ☑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)
- ❑ Air filter/s: Check the air filter condition, and if necessary, replace
- ☑ Check drive belt
- ☑ Coolant hoses: Check condition
- ☑ Radiators and air intakes: Visual inspection for exterior debris and blockage
  Coolant: Check level and antifreeze protection level
- ❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear
- ❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level
- ❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage
- ❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)
- ❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)
- ❑ Tires, external spare wheel: Check condition and tire pressure
- ❑ Panorama roof: Adapt control module
- ❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades
- ❑ Vehicle lighting: Check operation
- ❑ All headlights: Check adjustment
- ❑ Horn: Check operation
- ❑ Batteries and ventilation hoses: Check condition
- ❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

- ❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
- ❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
- ❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

- ❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

- ❑ Change front differential oil
- ❑ Change rear differential drive oil
- ❑ Change transfer case oil
- ❑ Change manual transmission oil
- ❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

- ❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

- ❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

- ❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

- ❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

PORSCHE

Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

☑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Pollen filter: Replace filter element

☑ Check drive belt

❑ Steering gear: Visual inspection of the dust boots for signs of damage
Tie rod ends: Check play and dust boots

❑ Power steering: Check fluid level

❑ Fuel system lines and connections: Visual inspection

☑ Coolant hoses: Check condition

☑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection levels

❑ Parking brake: Check free play

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the for leaks & signs of damage

❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Hydraulically detachable off-road sway bar: Check fluid level and function

❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Lubricate door latch and fastening bolts

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level

❑ Check wiper blades

❑ Seat belts: Check operation and condition

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Trailer coupling: Check operation

❑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

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Part Number – PNA 000 162 CB

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CB

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Oil Change Service Checklist – Cayenne (V6), USA and Canadian Models Only

☑ **Oil Change Service** (Labor Operation 03 04 00 ..) See Technical Manual
Every 10,000 miles (15,000 km) or 1 year

Note: See Cayenne/S/T Minor Maintenance Checklist, part number, PNA 000 162 CA or Major Maintenance Checklist, part number, PNA 000 162 CB for complete maintenance requirements.

Oil Change Service Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CC



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Notes:

General



The newly developed 4.5-liter V8 naturally aspirated and V8 turbo engines in the Cayenne were specially designed for maximum specific power, as well as high torque over a broad rev band. The engine develops its power effortlessly and loves to rev, accompanied by a unique Porsche exhaust sound. It has outstanding emissions and fuel consumption characteristics and meets all applicable exhaust emission and noise regulations world-wide. It combines great reliability with a low need for service. Control of the electronic fuel injection using Motronic control module ME 7.1.1 permits continuously variable camshaft adjustment (VarioCam) and feedback with broad-band O2 sensors.

Development Objectives for the Cayenne:

- High specific output
- Outstanding torque curve
- Compliance with all emission regulations, world-wide
- Increased fuel efficiency

The following engineering content was implemented in the Cayenne S and the Cayenne Turbo:

- Utilization of Motronic 7.1.1
- Electronic throttle valve control (E-Gas)
- Engine drag torque control (MSR)
- Air-gap insulated exhaust system up to the primary catalytic converter
- Broad-band LSU Oxygen sensors ahead of the catalytic converters
- LSF Oxygen sensors behind the catalytic converters
- CAN networking and MOST media network
- VarioCam with continuous adjustment of the intake camshafts
- Immobilizer with transponder system
- Returnless fuel system
- OBD II or EOBD adapted to different regulations, world-wide

Cayenne S

- Maximum power 340 hp @ 6000 rpm
- Maximum torque 310 lb ft @ 2500 – 5500 rpm
- Idle speed 580 rpm
- Engine rpm limited to 6500 rpm with Tiptronic S (6700 rpm with manual transmission) through E-Gas and fuel cutoff.
- Intake manifold with variable induction charging
- Special spark plugs

Cayenne Turbo

- Maximum power 450 hp @ 6000 rpm
- Maximum torque 458 lb ft @ 2250 - 4750 rpm
- Idle speed 580 rpm
- Engine speed limited to 6500 rpm by E-Gas and fuel cutoff
- Special platinum spark plugs with 1 ground electrode
- Exhaust gas turbocharging
- Water-cooled turbocharger
- Supplementary turbocharger oil scavenging

Cayenne Turbo S (Option available as of M.Y. 2006)

As the new top model of the Cayenne series and with significantly enhanced performance specs compared with the Cayenne Turbo, the Cayenne Turbo S underlines once more the desire of Porsche to offer its customers the most sporty and powerful model in the Sport Utility Vehicles (SUV) segment.

Thanks to an increase in output power of 71 hp and specific differentiating features, the Cayenne Turbo S is positioned clearly above the Cayenne Turbo. The designation “S” for the Cayenne Turbo S again stands for even greater sportiness at a high level, and exudes a sense of extreme driving pleasure. The brake system and chassis were adapted to the increased engine power.

Engine Data for Cayenne Turbo S

The engine of the Cayenne Turbo S is a 4.5 liter V8 twin-turbo engine with an output power of 521 hp (383 kW) at 5,500 rpm. This is achieved by a significantly larger and power optimized charge air cooler, modified air guides and optimized engine control. The torque was increased by 74 ft lbs (100 Nm) compared with the Cayenne Turbo to a maximum value of 531 ft lbs (720 Nm) for the engine speed range between 2,750 rpm and 3,750 rpm. The power enhanced drive package is visually complemented by an exhaust system with polished chrome plated sport tailpipes in 4-pipe look.

Motronic DME ME 7.1.1



Electronic control of the Cayenne engine is by handled by the Motronic ME 7.1.1 The DME control module is located on the right side of the cowl.

The DME control module carries out the following tasks:

- Optimal fuel mixture under all operating conditions
- Increased fuel efficiency
- Combustion control
- Monitoring and regulation of exhaust gas readings

The Motronic control module was adapted to the specific requirements of the V8 engine and contains the following functions or controls:

- Static high-tension ignition distribution with individual ignition coils
- Knock control with automatic adaptation of the ignition map to fuel quality
- Newly developed software to actuate the vane-type camshaft adjuster (position control)
- Throttle valve controlled by electric motor (E-Gas)
- Engine idle speed control (via E-Gas)
- Cruise control system regulation (standard for USA)
- Engine drag torque control (MSR)
- Hot-film mass air flow sensing using 2 HFM 5 CL air flow sensors
- Sequential fuel injection
- Fuel tank leak testing with leak diagnosis pump (USA only)
- Two-channel O2 sensor feedback for independent control of the fuel-air mixture for both cylinder banks
- On Board Diagnostics
- Actuation of radiator fans
- Torque interface (via CAN) to Tiptronic S and PSM
- Actuation of secondary air injection

Cayenne Turbo (Additional)

- Absolute pressure-controlled boost pressure regulation
- Actuation of the electric run-on coolant pump
- Actuation of the vacuum pump to back up the brake pressure booster

“Check Engine” Warning Light



The Check Engine warning light is used to monitor emissions (on vehicles for the U.S. it is also activated in the event of leaks in the fuel tank system). Emissions monitoring provides early detection of malfunctions, which can result in increased output of pollutants or subsequent damage to the catalytic converters.

The Check Engine warning light and a message in the multi-function display in the instrument cluster indicates this. These malfunctions are stored in the trouble code memory of the DME control module. As a functional check, the warning light illuminates when the ignition is switched on and goes out about 4 seconds after the engine is started.

- Check Engine warning light comes on steady – emissions related error
- Check Engine light flashes – error leading to catalytic converter damage

CAN Networking of the Motronic Control Module
(in CAN drive)

Electronic networking allows the exchange of data and electronic information between the control modules. Data exchange in the drivetrain takes place over the two copper wires of the high-speed CAN. This CAN data bus combines the individual control modules into a total system. The K-wire is used for diagnosis.

The DME control module communicates with the following systems over the CAN data bus:

- ABS/PSM control module
- Steering angle sensor
- Tiptronic control module
- Airbag control module
- Air-conditioning control module
- Instrument cluster
- Rear control module (immobilizer) etc.

Immobilizer

The DME control module obtains the relevant information for arming the immobilizer over the CAN from the control module for convenience systems, which is installed in the right rear.

Fuel Shut-off

Depending on the impact angle and the impact speed, the airbag control module sends a signal whereby either the fuel pump is shut off by the DME control module (re-start possible), or the cutoff relay is opened directly (re-start possible only after re-activating the relay).

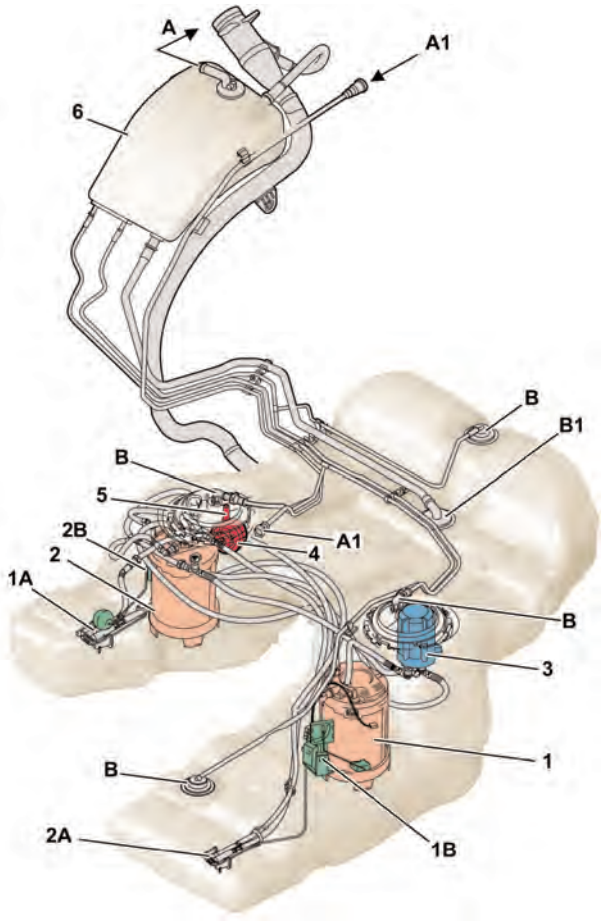
Fuel Supply

The use of the latest engine technologies makes possible improved fuel efficiency in relation to the performance and weight of the vehicle.

The engines were designed optimally for 93 Octane fuel with respect to power and fuel consumption. If 90 Octane fuel is used, ignition timing is automatically adjusted to a retarded ignition map by the control unit.

Notes:

Component Location in the Fuel Tank



1 - Left fuel pump
1A - Vacuum booster pump for the left fuel pump
1B - Left fuel tank sender
2 - Right fuel pump
2A - Vacuum booster pump for the right fuel pump
2B - Right fuel tank sender
3 - Fuel filter
4 - Fuel pressure regulator
5 - Fuel pressure line to the engine
6 - Percolation tank (for ventilation lines B and B1)
A - To activated charcoal filter
A1 - From activated charcoal filter to the fuel tank ventilation valve in the engine compartment
B - Operating ventilation (4 with roll-over valve)
B1 - Refueling ventilation (with fill level restriction)

Fuel Tank

The fuel tank is located ahead of the rear axle and is additionally protected from below by high-strength plastic covers. The fuel tank is made of high-density, multi-layer polyethylene with a capacity of approximately 26.5 gallons (of which approximately 4 gallons is reserve). The filler opening is located on the passenger side in the quarter panel above the rear wheel.

Returnless Fuel System (RLFS)

A returnless fuel system (RLFS = Return Less Fuel System) is used on the Cayenne. In this system the fuel pressure regulator as well as the fuel filter is integrated into the fuel tank. As a result, no return line from the fuel distributor in the engine compartment to the fuel is required with this system.

Only the quantity of fuel injected by the fuel injectors is pumped to the fuel distributor in the engine compartment. Doing away with the return line has the benefit that no fuel heated in the engine compartment is returned to the fuel tank to increase fuel temperature there. This further reduces the formation of fuel vapor in the tank.

Fuel Pumps (left and right side)

Two electric fuel pumps with integral pressure-side operated vacuum booster pumps are installed. Fuel pump 2 comes into operation depending on demand and fuel level in the tank. The operating principle is the same as that of the sports cars. In each case, a two-stage full-flow pump is combined in one, with a pre-stage for charging and a main stage for pressure build-up. The vacuum booster pump for fuel pump (1) is located in the right half of the fuel tank, the one for fuel pump (2) in the left half. So fuel is picked up at four different locations in the tank. This ensures a supply of fuel even in difficult terrain. With this cross-over delivery, the tank can be drained on a level road by each pump.

When the driver's door is first opened, the signal from the door contact switch (via CAN) is additionally used to briefly activate the fuel pump. Fuel pressure is already built up before the engine is started. In the event of an accident with airbag deployment, the fuel pumps are switched off.

Regulation of Fuel Quantity

As a result of the on-demand regulation of fuel flow capacity, fuel heating in the tank is reduced. The DME control module switches on fuel pump 2 only as required, while fuel pump 1 is always activated. Test procedures such as checking fuel pressure, holding pressure and flow capacity, and any required special tools are described in the Technical Manual. With the following switching criteria, fuel pump 2 is additionally switched on to increase flow capacity. At engine start and then 2 seconds run-on (with a hot start 5 seconds run-on). With a calculated fuel consumption of approximately > 13.2 gallons/hour the pump is switched on, and at about < 12 gallons/hour switched off again. With a fill level of approximately < 2.5 gallons in the tank, it is switched on and with about > 4 gallons it is switched off again.

Fuel Filter

The fuel filter does not need to be changed. It is integrated into the left-side sending unit. The connections at the fuel filter for the left-side and right-side fuel pumps are different in diameter.

Fuel Pressure Regulator

The pressure regulator is also built into the fuel tank below the right-side tank flange. Fuel pressure, which is present right up to the fuel injectors, is about 58 psi (4.0 bar) from idle to wide-open throttle. The quantity injected is dependent on intake manifold pressure, which is measured by the DME control module when calculating injection duration.

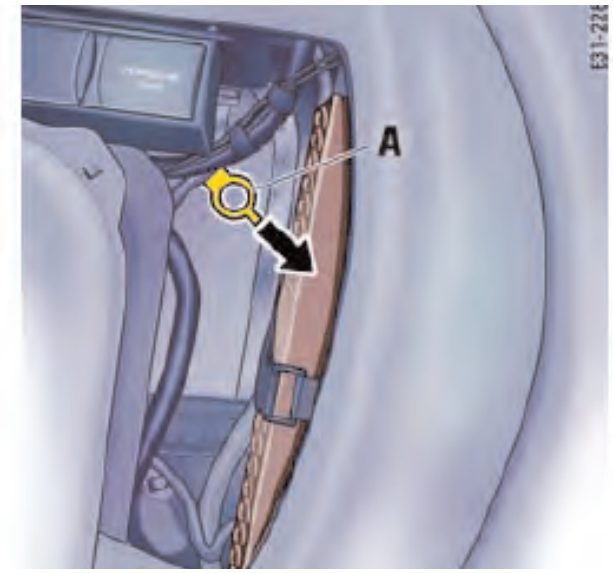
Fuel Supply Sender

The information from the two senders for the fuel supply is sent to the instrument cluster to calculate the fuel supply. To prevent corrosion and poor contact, the potentiometer sliding contacts are gold-plated

Fuel Gauge

With the ignition switched off, fuel tank contents are displayed. If the amount of fuel falls below about 4 gallons, the reserve warning light is activated.

Emergency Unlocking of the Fuel Filler Flap



If the power locking system should fail, the fuel filler flap can still be unlocked mechanically. Open the rear hatch, remove the cover from the right-side storage bin in the baggage compartment and pull the emergency release in the direction of the arrow (A), the filler flap will pop open.

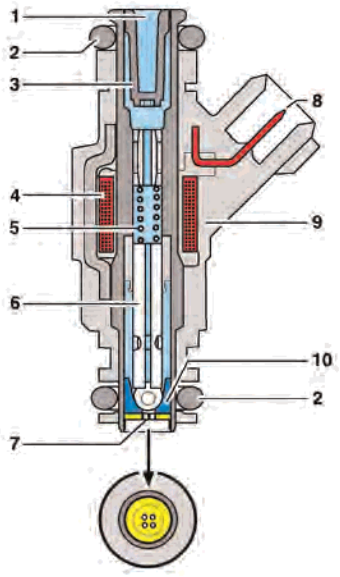
Notes:

Fuel Injector (EV-6)

Small external dimensions and low weight characterize this fuel injector. The risk of vapor lock with hot fuel is very low. As a result, it is well suited for use with returnless fuel systems, since fuel temperature in the fuel injector compared with systems with a return is higher.

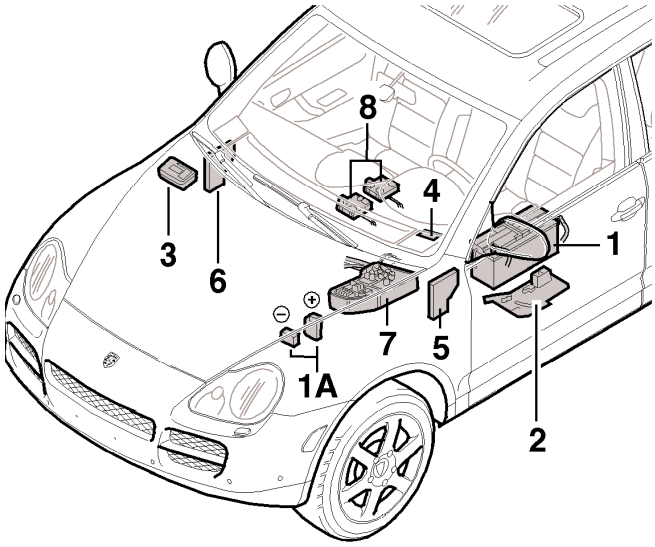
Fuel is atomized with a perforated disk (4 holes). The stamped injection orifices provide great consistency in the quantity of injected fuel as well as insensitivity to fuel deposits. A good tight seal in the area of the injector seat is ensured through the cone/sphere seal. In the Cayenne S, the fuel injectors are designed for a maximum injection volume of 210 g/min. In the Cayenne Turbo, this volume was adapted to 349 g/min due to the increased engine performance.

The DME control module activates each fuel injector sequentially. This allows injection of the fuel for each cylinder in a precisely defined time interval, even when driven in a sporting manner, which contributes to reducing fuel consumption and emissions.



1 - Fuel connection
2 - Seal ring (O-rings)
3 - Filter screen
4 - Winding
5 - Spring
6 - Needle valve with solenoid armature and sealing ball
7 - Perforated injection disk
8 - Electrical connection
9 - Injector housing
10 - Injector seat

DME Power Supply (Overview of Component Locations)



1 - Battery under the driver's seat
1A - Positive and negative connections in the engine compartment
2 - Current distributor with cut-off relay, under the driver's seat
3 - DME control module in the right cowl
4 - Diagnostic connection under the instrument panel in the left footwell
5 - Fuse carrier instrument panel left
6 - Fuse carrier instrument panel right
7 - E-Box in the cowl with fuse carrier,relay carrier 1, relay carrier 2
8 - Relay carrier 1 and 2 as needed (depending on equipment) below the instrument panel

Cut-Off Relay

The cut-off relay separates the battery from the electrical system in the event of an accident. **After it is triggered, it must be re-set manually.**

Starter

The DME control module interrupts actuation of the starter interlock relay and thus terminal 50 actuation to the solenoid if an RPM threshold is exceeded.

Notes:

Ignition System

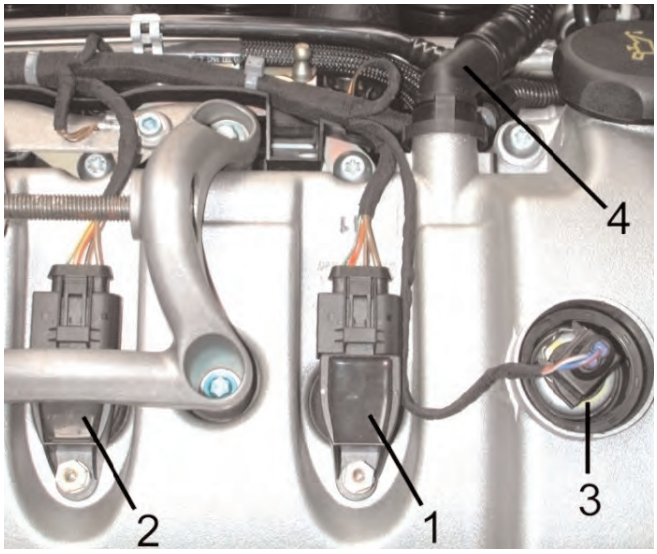
The Cayenne has static high-tension ignition distribution with individual coils, which are mounted directly to the spark plugs.

The benefits of this system are:

- Highly reliable ignition
- Minimal electromagnetic interference with other electronic components
- No need for spark plug wires and distributor

Ignition Coils

The Motronic ME 7.1.1 assumes control of the individual coils with the firing order 1-3-7-2-6-5-4-8. Through the steps described and with the benefits of the ignition system, reliable ignition is achieved, maximizing performance and minimizing emissions and fuel consumption.



1 - Igntion coil cylinder 1 (Bank 1 right front)
2 - Ignition coil cylinder 2
3 - VarioCam valve bank 1
4 - Crankcase ventilation

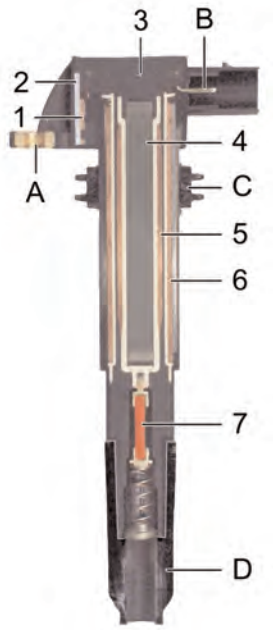
With this new coil design, the final stage electronics are combined in the ignition module housing. The housing is connected electrically and mechanically by the short high-voltage connector to the spark plug in the plug recess. There is a supplementary mechanical attachment through a threaded connector. The ignition coil is sealed at the 4-pin connector as well as in the plug recess against water.

Note:
The coil must be pulled straight out of the valve cover and not tipped to the side when it is removed or the coil may be damaged !

Ignition Coil Pin-out:

Pin 1 - Body ground
Pin 2 - Engine ground
Pin 3 - B+ terminal 15
Pin 4 - Ignition signal (trigger input)

Ignition Coil Construction



A - Mounting tab
B - Connector terminal
C - Plug recess gasket
D - High-voltage connector to spark plug
1 - Power output stage
2 - Cooling plate for power output stage
3 - Electronics board with integral diagnostic function and current limiter)
4 - Magnetic core
5 - Secondary winding
6 - Primary winding
7 - Electrical Resistance

Operation of Electrical Components in the Ignition Coil

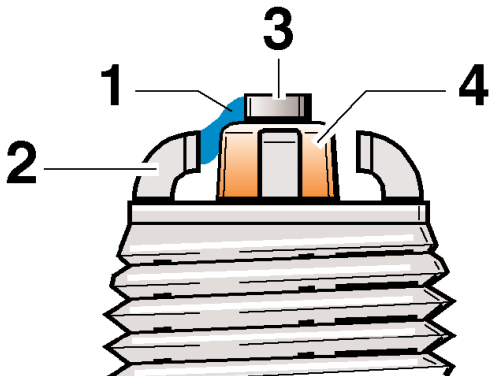
The ignition coil ensures optimal combustion of the air-fuel mixture in the engine combustion chamber. If the coil is triggered for an excessive time, the primary current in the coil is driven down, so that spark-free engine shutdown is ensured. Diagnostic functions are also integrated. When an error is detected, pin 4 (trigger input) is switched to high impedance. This is detected in turn by the DME and the error is entered in the trouble code memory.

Cayenne S Spark Plugs

With these glide spark plugs the 4 ground electrodes are located to the side of the ceramic insulator. As a result, the sparks (1) always glide over the surface of the insulator (4) and jump through a small gas path to the ground electrode (2), producing better ignition properties. The primary benefit of the glide spark plug lies in the self-cleaning effect of the insulator tip since any shunts occurring between the center electrode and ground electrode are eliminated through the sliding sparks, particularly during cold starts.

These spark plugs make possible a change interval of 60,000 miles (90,000 km) in the Cayenne S.

Construction of the Cayenne S Glide Spark Plug



1 - Glide spark path
2 - Ground electrode
3 - Center electrode
4 - Insulator

Cayenne Turbo Spark Plugs



Special platinum spark plugs with one ground electrode are used in the Cayenne Turbo, allowing a change interval of 40,000 miles (60,000 km). Through the use of a very thin center electrode, voltage requirements are correspondingly reduced, to ensure adequate voltage reserves for the ignition system over its entire service life.

The use of glide spark plugs is not possible especially with turbocharged engines, since ceramic nicks can be caused on the insulator tip by higher combustion pressures, which in turn can result in reduced change intervals or premature failure of the spark plug.

Notes:

Engine Speed Sensor

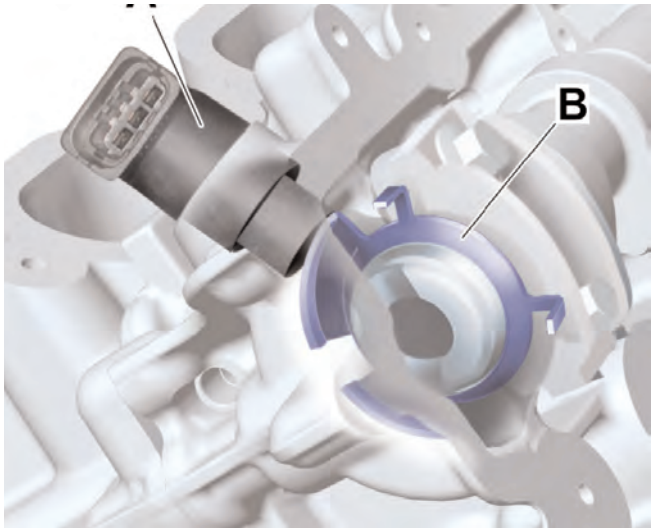


The inductive engine speed sensor on the bell housing registers engine RPM and the current position of the crankshaft by way of 57 openings in a flange on the flex plate. One opening is made wider to indicate crankshaft position to the DME control unit.

Hall Sensor

A modified rotor is mounted on the intake camshafts for both banks of cylinders. Based on the rotor position, the Hall sensor determines the current position of the intake camshaft 4 times per camshaft revolution and passes this value on to the control module. This way, the exact position of both intake camshafts is determined, which is the precondition for continuous camshaft adjustment.

Using the Porsche System Tester 2 in the "Actual Values" function the deviation, the required angle and the actual angle of the intake camshafts can be read.



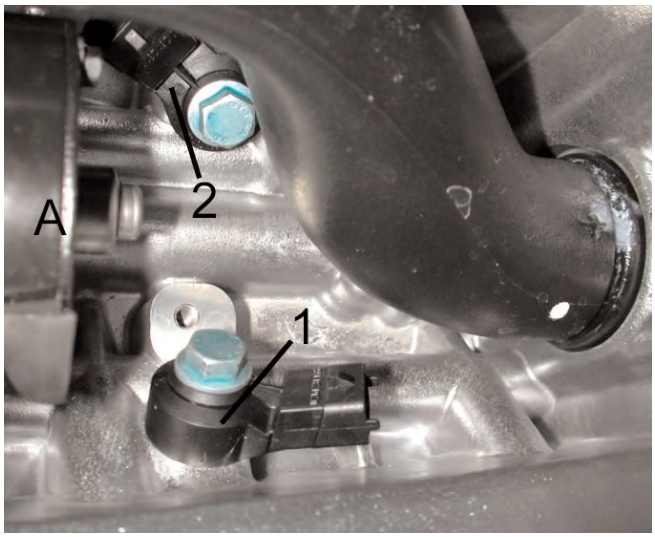
A - Hall sensor
B - Camshaft rotor

Knock Sensor Bank 1 and 2

The knock sensors are mounted on the crankcase below the intake manifold. They detect the structural acoustic oscillations of the crankcase. The mechanical vibrations are transmitted with the help of the piezoelectric effect as electrical voltage signals to the DME control module.

If the DME control module detects "knock," the ignition timing at the cylinder in question (cylinder-selective) is retarded. Retardation takes place in steps of 3° CA (crankshaft angle) and can be advanced again in stages of 0.75°, which takes place within 10 to 20 seconds. Maximum retardation of ignition timing is 18° of crankshaft angle up to 1600 RPM, over 1600 RPM it is limited to 15° of crankshaft angle.

If a knock sensor, Hall sensor or engine speed sensor fails, adjustment is retarded for safety. In this case, ignition timing up to 4400 RPM is retarded by 15º of crankshaft angle. Above 4400 RPM up to 6000 RPM retardation is reduced to 12º of crankshaft angle.

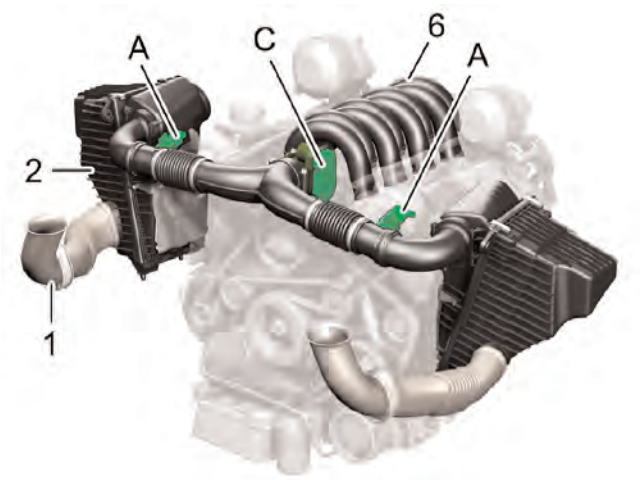


1 - Knock sensor Bank 1
2 - Knock sensor Bank 2
A - Starter

Notes:

Air Intake – Cayenne S

Air flow from the air duct (intake pipe) behind the front end, through an air filter on both the left and right to the two mass air sensors. Then the intake air flows together ahead of the throttle valve control unit (E-Gas) and is delivered to the engine through the intake manifold.



1 - Air duct (intake pipe)
2 - Air filter housing with filter element
6 - Composite intake manifold
A - Hot-film mass air flow sensor
C - Throttle valve control unit (E-Gas)

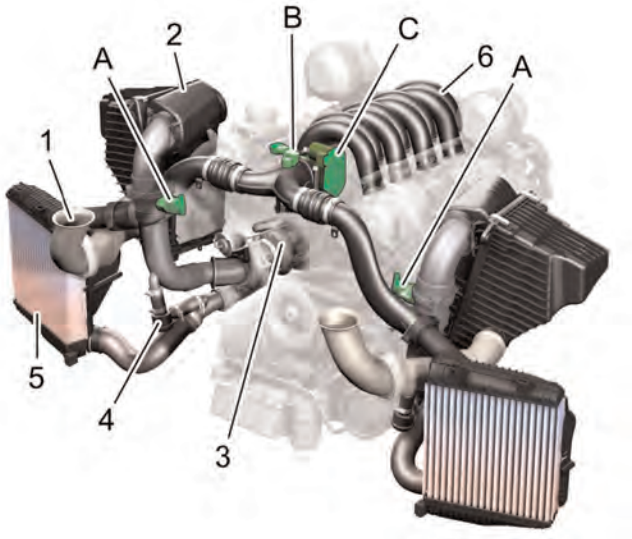
Note:
Fording depth is 19.6 inches. This means that when driving through water, a water depth of 19.6 inches must not be exceeded, otherwise there is a risk of damaging the engine and the accessories due to induction or entry of water.

Air Filter Elements

The two air filter elements for the Cayenne S and Cayenne Turbo must be changed every 75,000 miles (120,000 km). In dusty areas, the air filter elements should be changed more frequently.

Air Intake – Cayenne Turbo

Air flows from the air duct (intake pipe) behind the front end, through an air filter on both the left and right to the two mass air sensors. Then the intake air is delivered to the compressors of the two turbochargers. Then the compressed and heated charge air is re-cooled by means of a charge intercooler located in each of the wheel housings. Boost pressure and charge air temperature of the intake air that is being delivered to the engine is registered in the combined airflow ahead of the throttle valve control unit. Cooling the compressed charge air achieves good cylinder filling and low component temperatures. For information on boost pressure control refer to the Turbocharger section.



1 - Air duct (intake pipe)
2 - Air filter housing with filter element
3 - Exhaust turbocharger
4 - Deceleration air recirculation valve
5 - Charge air intercooler
6 - Composite intake manifold
A - Hot-film mass air flow sensor
B - Charge air/intake air temperature sensor

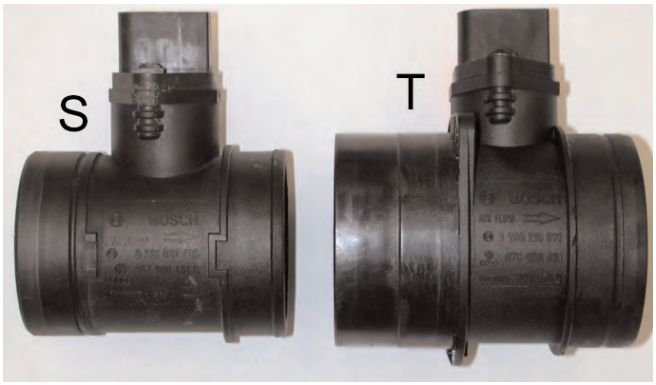
Notes:

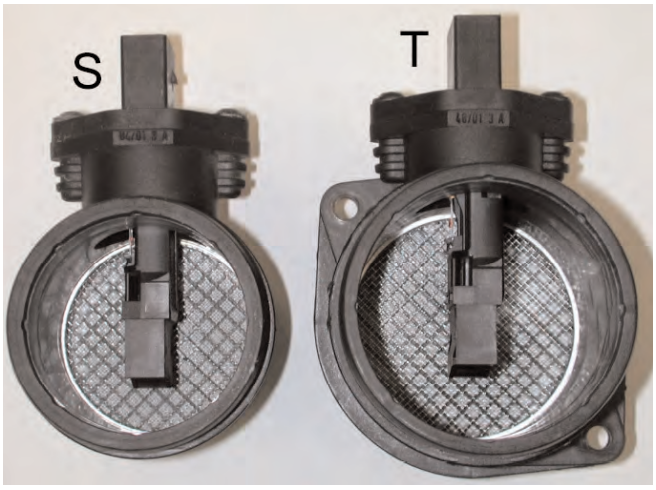
HFM CL Hot-film Air Mass Sensor

The venturi mass air sensors on the left and right are supplied as a replacement part with the measuring venturi. The mass air sensor must not be removed from the measuring venturi, since these parts were matched on a flow bench. The diameters of the measuring venturis are different based on the different air throughput between Cayenne S (low) and Cayenne Turbo (high).

On the Cayenne S the signal from the intake air temperature sensor is sent to the DME control module by a mass air sensor. On the Cayenne Turbo the mass air sensors and measuring venturis are matched to the high air throughput. Air temperature is registered by the boost pressure- charge air sensor, which is mounted ahead of the throttle valve. The values measured are made available to the DME control module.

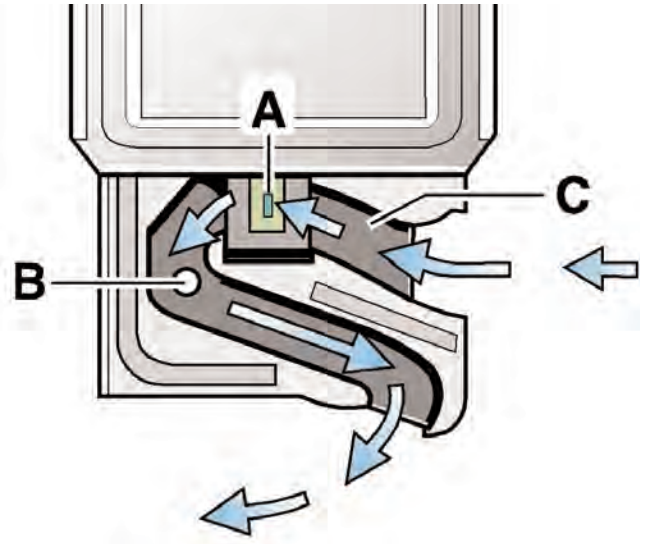
Venturi Mass Air Sensor





S - Cayenne S (small diameter)
T - Cayenne Turbo (large diameter)

As a result of the C-shaped air duct, these mass air sensors are less sensitive to dirt particles and water drops, since they reach the sensor element only after a reversal of the air stream. A transverse hole through the air passage serves to reduce pulsation errors.



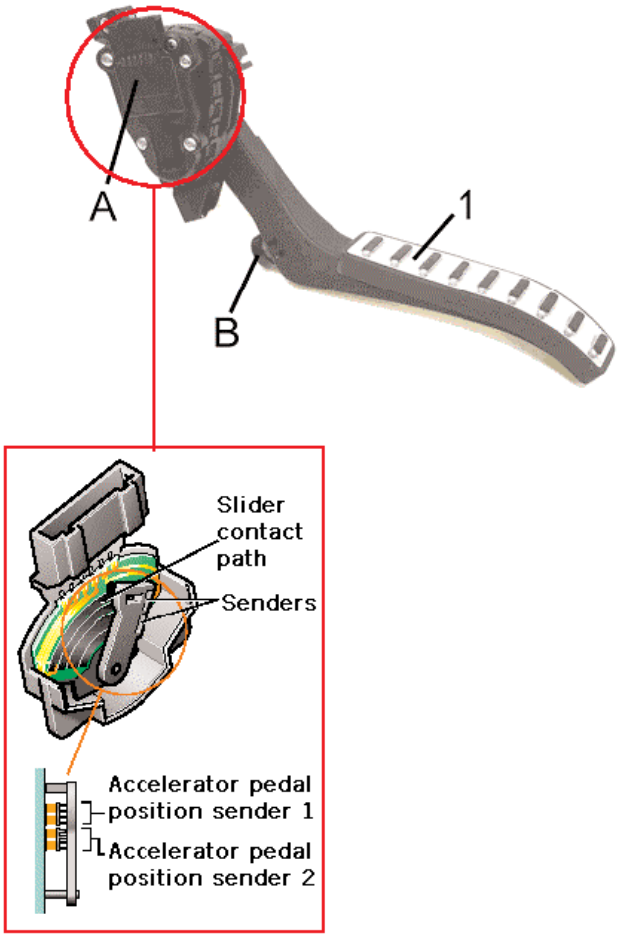
A - Sensor element
B - Cross drilling
C - C-shaped air passage

To calculate the total air mass, which serves as the primary load signal, the air mass from the left and right mass air sensors are added together in the control module. Should one or both mass air sensors fail (for example, as the result of an open or short circuit), or if the total air mass (sum of the two mass air sensors) deviates from a tolerance range calculated in the control module, an error is stored and a substitute value is created from throttle valve angle and engine speed.

Notes:

Accelerator Pedal

With the newly developed accelerator pedal in the Cayenne, the accelerator position sensor is integrated into the pedal assembly. Therefore no throttle cable is required. The characteristic curves of the two integral potentiometers are comparable with those of the ME 7.2 systems and act as an input signal (driver request) to calculate the torque-oriented operational logic, which triggers the engine management system accordingly.



1 - Accelerator pedal
A - Pedal potentiometer
B - Spring-pressure unit

The above illustration is for explanation purposes only. Do not open the pedal assembly or throttle assembly. Always refer to the latest technical information for repair information.

On vehicles with Tiptronic, Kickdown is recognized electrically by way of the characteristic curve of the potentiometers. A spring-pressure unit is installed for driver feedback.

Kickdown adaptation is necessary under the following circumstances:

- Service replacement of the engine control module (ECM)
- Service replacement of accelerator pedal module (part with different tolerances)

Kickdown adaptation can be performed as a short test using the Porsche System 2 Tester.

Learning Kickdown Adaption

In order to achieve reliable conformance between electrical recognition of Kickdown and the increase in power when the pedal is operated, adaptation must be carried out. The result of this adaptation is stored in the EEPROM of the DME control module and as a result it is retained even after disconnecting the battery terminals.

Notes:

Throttle Valve Control Unit (E-Gas)

The range of operation of E-Gas corresponds basically to the operation described for vehicles with Motronic ME 7.2 and ME 7.8. In the case of the electronic throttle valve control unit (E-Gas), the throttle valve is adjusted by an electric motor over a two-stage gear. This allows electronic control of the air inducted by the engine is possible over the entire load range.

Operating characteristics (relationship between engine torque and accelerator pedal position) are clearly established with E-Gas, which offers the following benefits:

- Increased driver comfort
- Engine speed can be better controlled and limited
- Reduction of engine emissions
- Improved cruise control operation
- Improved shift comfort with Tiptronic S
- Assistance for the traction control systems (e.g. PSM, MSR)
- Engine protection in the event of failures in the area of boost pressure control (Cayenne Turbo)

As the result of active intervention by the throttle valve control unit (E-Gas), the following functions are made possible:

- On deceleration, with unacceptably high engine braking when downshifting, engine drag torque control (MSR) prevents all the drive wheels from locking on a slippery road by slightly opening the throttle valve.
- If braking functions are not sufficient to stabilize the vehicle when PSM is activated, E-Gas intervenes in engine control. A change in engine torque is initiated by changing the ignition timing and intervening in throttle valve adjustment.

Throttle valve control unit (E-Gas) adaptation must be performed under the following circumstances:

- Following a reset (e.g. disconnecting the battery terminals)
- If the connectors at the DME control module were separated
- Following replacement of the throttle valve control unit (or disconnecting the connectors)

To perform adaptation, switch on the ignition for 1 minute (do not start the engine and do not operate the accelerator pedal), then switch off the ignition for at least 10 minutes. The throttle valve stop (close) is re-adapted.

Cruise Control

The Motronic control module implements this function by positioning the throttle valve control unit (E-Gas) accordingly. Cruise control is operated through the lower left lever on the steering column to select a speed between about 25 and 131 MPH.

Notes:

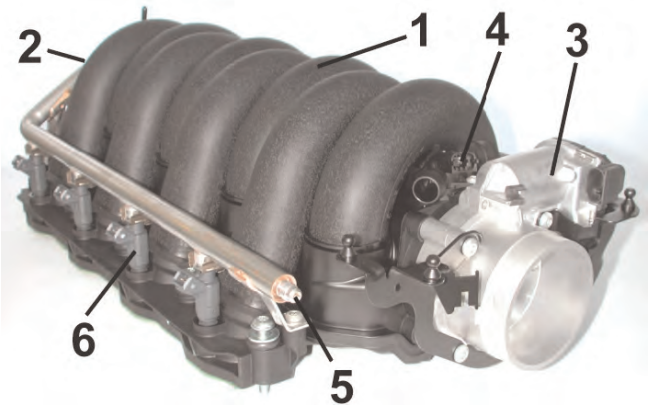
Intake Manifold

The principle of pulse manifold charging was followed when designing the intake manifold. Through proper layout of the intake runner lengths and intake runner diameters, in conjunction with optimized intake port geometry as well as continuous adjustment of the intake camshafts, it was possible to achieve a wide torque curve.

The benefits of the plastic intake manifold, manufactured in several steps (multi-process technology) are:

- Minimization of pressure losses
- Equal intake runner length
- High component rigidity with low weight

This manufacturing process brings benefits in pulse tuning and acoustics resulting from component rigidity. In addition, the optimal surface finish inside the intake manifold lowers pressure losses and improves torque.



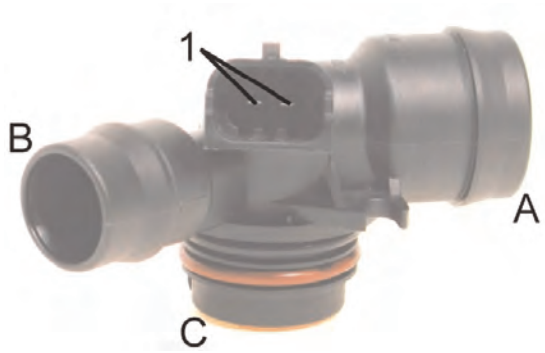
1 - Composite intake manifold
2 - Vacuum reservoir (at the rear integrated in the intake manifold)
3 - Throttle valve control unit (E-Gas)
4 - Heating element for crankcase ventilation
5 - Connection for measuring fuel pressure
6 - Fuel injector

A two-piece vacuum reservoir (which has a pre-stage with a calibration drilling as a buffer) is integrated in the rear section of the intake manifold. It is needed in the Turbo to activate the overrun recirculation air valves and to activate the leak diagnosis pump.

Electrically Heated Crankcase Ventilation

The crankcase ventilation on the Cayenne engines has an electric heating element that prevents icing of condensate in this area. This heating element is integrated in the connecting pipes for the crankcase ventilation. The connecting pipe is installed behind the throttle valve control unit.

The heated copper ring in the heating element contains a PTC with an electrical resistance of 5 – 13 ohms (at 68° F/20° C). As soon as outside temp falls below 37° F (3° C), the heating current is switched on by the DME control module and controlled through an outside temperature-dependent duty cycle between 3A and 0A. When it is first switched on, current draw may rise to 5A for a short period.

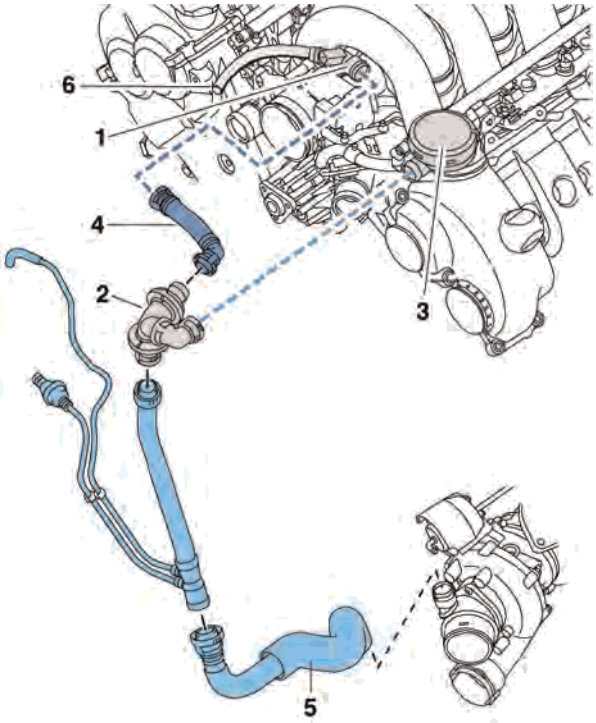


1 - Connector for electric heating
A - From engine ventilation (bank 2 left)
B - From fuel tank ventilation valve
C - Connection to composite intake manifold

Notes:

Fuel tank ventilation, as well the ventilation system for the turbocharger oil catch tank on the Turbo is taken to the intake system via the connecting pipe for the heated crankcase ventilation. Through the arrangement of the non-return valves, the airflow on the Cayenne Turbo reaches the intake manifold at idle and under boost pressure it reaches the intake side of the left turbocharger.

Cayenne Turbo Crankcase Ventilation

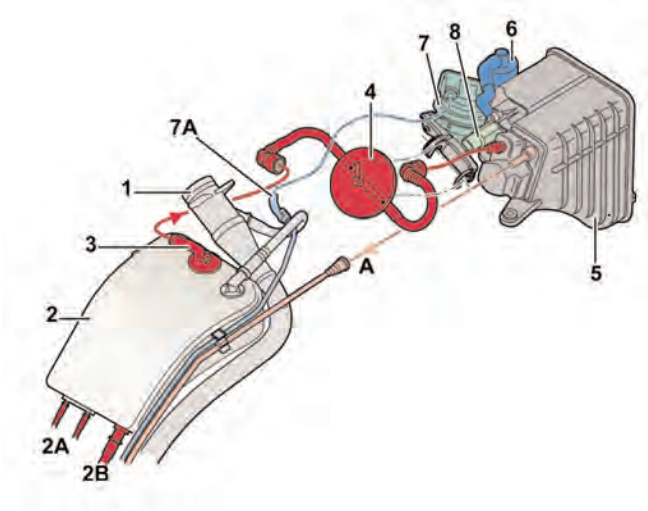


1 - Heating element for crankcase ventilation
2 - Non-return valves intake side/pressure side
3 - Oil vapor separator
4 - Tube to intake manifold
5 - Hose to intake side of the left turbocharger
6 - Connection for fuel tank ventilation

Fuel Tank Ventilation (ORVR)

The ORVR system (On-Board Refueling Vapor Recovery) ensures that the resulting HC vapors are directed into the carbon canister during refueling and do not escape into the environment. In addition, the OBD II system (On-Board Diagnostic System) monitors the fuel system for leaks with the aid of a leak diagnosis pump (LDP).

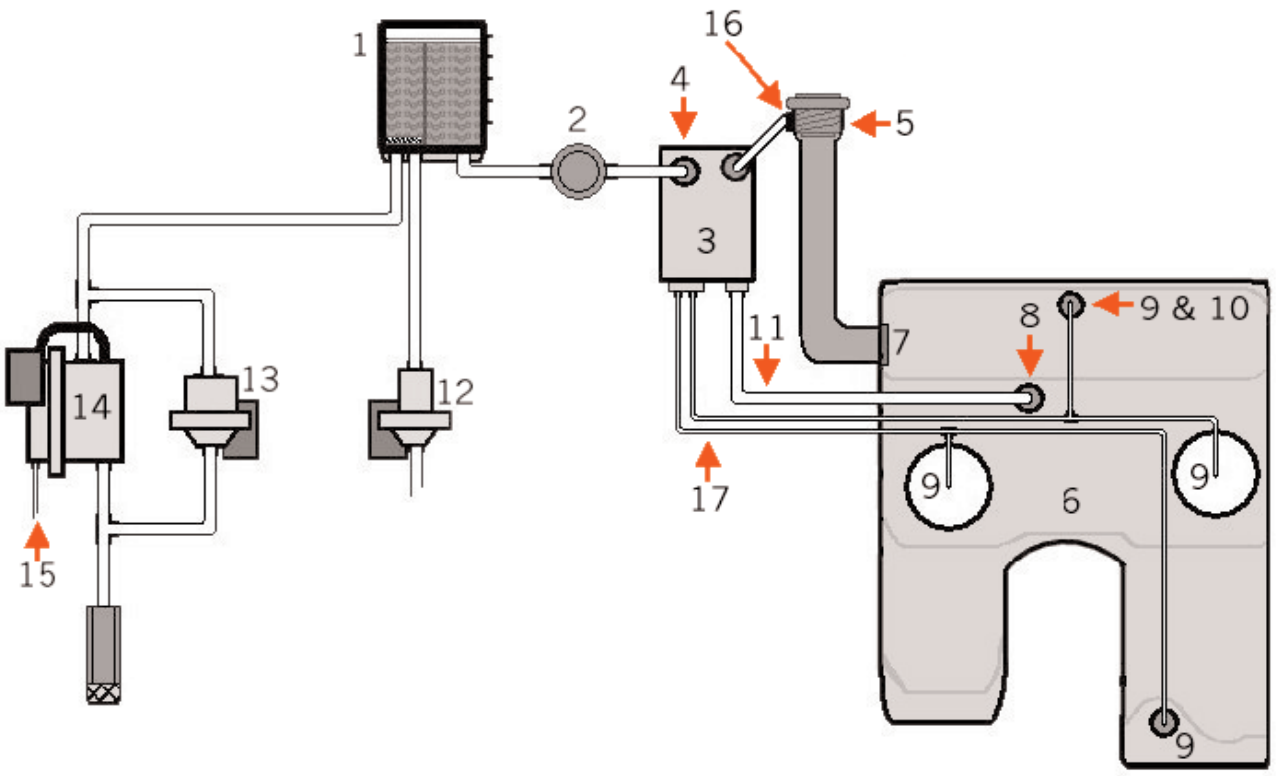
The LDP system performs leak checks regularly and can detect leaks smallerthan .5 mm in diameter.



1 - Filler neck
2 - Percolation tank (ORVR one-piece)
2A - Fuel tank operating ventilation
2B - Refueling ventilation
3 - Connection to carbon canister
4 - Pressure holding valve
5 - Carbon canister (ORVR with flange for leak diagnosis pump)
6 - Water separator with filter element and fresh air induction
7 - Leak diagnosis pump
7A - Vacuum line from intake manifold to leak diagnosis
8 - Shut-off valve
A - To fuel tank ventilation valve (in engine compartment)

Notes:

ORVR With LDP Diagram



1 - Carbon Canister
2 - Vacuum Limiting Valve
4 - Over Pressure Relief Valve
3 - Percolation Tank
5 - Filler Neck (with metal flap)
6 - Fuel Tank
7 - Spring Loaded Flap
8 - Fill Limit Venting Valve
9 - Roll Over Valves
10 - Over Pressure Valve
11 - Refueling Vent Line
12 - Evaporative Valve
13 - Evaporative Vent Shutoff Valve
14 - LDP
15 - Vacuum Inlet from Intake Vacuum Reservoir
16 - One Way Check Valve
17 - Tank Vent Lines

During normal venting operation the Hydrocarbon laden fumes from the fuel in the Fuel Tank (6) rise to the Percolation Tank (3) via the Tank Vent Lines (17) and Refueling Vent Line (11). The pressure in the tank is regulated to about 40 Millibar by the Vacuum-Limiting Valve (2) so as not to allow the fuel to boil in the low pressure.

The fumes are stored in the Carbon Canister (1) where they are purged to the engine by the DME controlled Evap Valve (12) during purging.

During refueling the fuel vapors rise to the Percolation Tank (3) via the Refueling Vent line (11) and Vent Lines (17) until the fuel level rises to close the float valve in the Fill Limit Vent Valve (8). The Fill Limit Vent Valve (8) closing causes the pressure in the Filler Neck (5) to rise and shut off the fuel filling nozzle.

Notes:

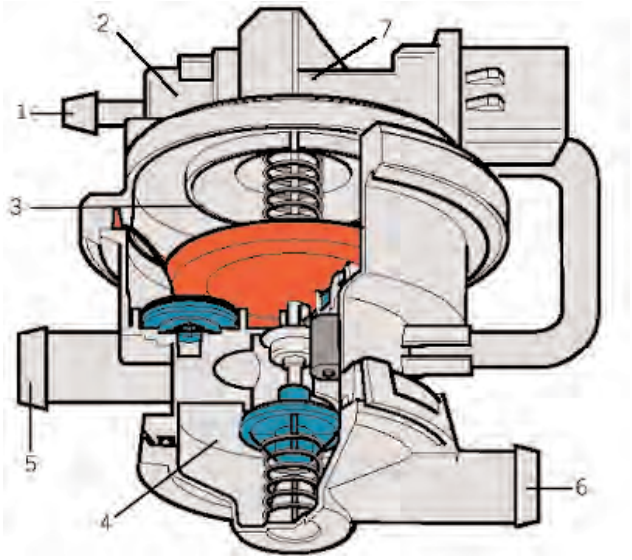
Leak Diagnosis Pump (LDP)

The leak diagnosis pump consists of a diaphragm pump and an electrical frequency valve. Intake manifold vacuum from the vacuum reservoir integrated at the rear in the intake manifold reaches the vacuum side of the diaphragm pump through the electrically cycled valve, and positive pressure in the millibar range is created. Depending on how quickly this positive pressure is built up, and the fuel tank provides counter-pressure, a reed switch on the diaphragm provides feedback to the DME. By evaluating the time differentials and pump strokes, the integrity of the fuel system or the size of the leak is recognized.

Leakages less than 0.5 mm in diameter are recognized as a minor leak and displayed through the “Check Engine” light after the leak is confirmed. Larger leakages, as well as an open fuel filler cap, are diagnosed as a gross leak. Testing for extreme small leaks (> 0.5 mm) takes place less often due to system restrictions and can be performed using a short test.

Following a lengthy shut-down phase (so that fuel temperature is as low as possible) the diagnostic sequence is started under constant driving conditions (e.g. interstate highway driving). Leak diagnosis can be performed once or twice each day during vehicle operation if conditions are met (differential of starting temperature to engine shut-down temperature > 108° F (42° C).

Cross Section of Leak Diagnosis Pump

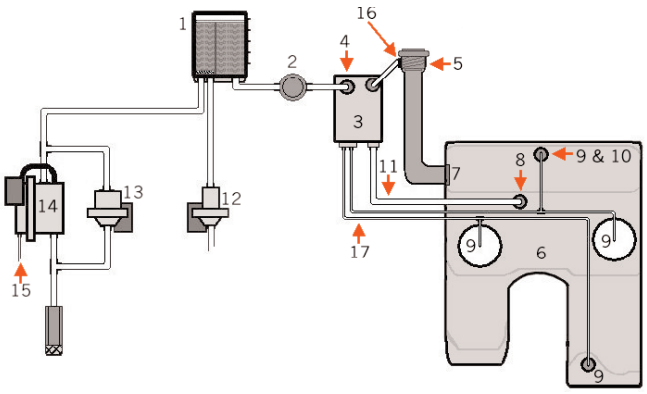


1 - Vacuum connection (from vacuum reservoir in intake manifold)
2 - Electric frequency valve for the diaphragm pump
3 - Vacuum side of the diaphragm pump
4 - Pressure side of the diaphragm pump
5 - Connecting pipe to the carbon canister (pressure side)
6 - Connecting pipe to the water separator/filter element
7 - Electrical Reed Switch

Evaporative Shut-off Valve

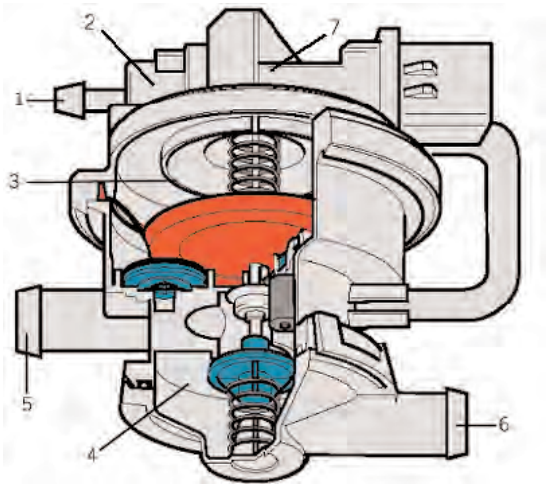
The shut-off valve (13) sits in a by-pass to the leak diagnosis pump and voltage is only applied during diagnosis, closing the by-pass. At the conclusion of diagnosis, the valve is opened again to dissipate the positive pressure built up in the fuel tank.

Notes:



Overview of Leak Diagnosis

During a leak diagnosis check the Evap Valve (12 above) and the Evap Vent Valve (13 above) are closed by the DME. The DME then cycles the Electric frequency valve for the diaphragm pump (2 below) allowing manifold vacuum to enter from vacuum reservoir in intake manifold (1 Below), this causes the Vacuum side of the diaphragm pump (3 below) to rise and draw air in the Connecting pipe to the water separator/filter element (6 below). The vacuum is then released as the pressure is built from this pumping action the Connecting pipe to the carbon canister (5 below) raises the pressure throughout the evap system. The rising pressure causes the Electrical Reed Switch (7 below) to make contact and send a signal to the DME.



1 - Vacuum connection (from vacuum reservoir in intake manifold)
2 - Electric frequency valve for the diaphragm pump
3 - Vacuum side of the diaphragm pump
4 - Pressure side of the diaphragm pump
5 - Connecting pipe to the carbon canister (pressure side)
6 - Connecting pipe to the water separator/filter element
7 - Electrical Reed Switch

If the pump cannot build enough pressure to keep the reed switch closed during the checking phase of the test, this indicates a minor leak to the DME.

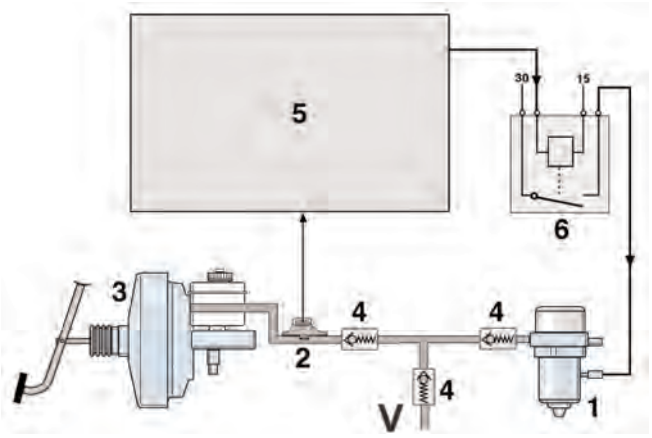
If the pump cannot build enough pressure to close the reed switch during the test phase of the test this indicates a major leak to the DME.

Notes:

Vacuum Pump to Assist the Brake Booster (Cayenne Turbo)

On the Cayenne Turbo an electric vacuum pump is installed to improve brake boost. It is located in the engine compartment on the right strut tower under the styled cover. Under engine operating conditions with reduced vacuum supply (e.g. catalytic converter heating following a cold start, parking maneuvers, driving at high altitudes), the vacuum pump is activated by the DME control module.

The DME control module acquires the pressure through a pressure sensor in the vacuum line from the brake booster and activates the vacuum pump, as required. Depending on the current ambient pressure, for example at 1000 mbar ambient pressure, the pump is switched on at a brake booster pressure of around 500 mbar and switched off again at about 300 mbar. On-time in normal operation without brake use is about 7 to 10 seconds, at high altitudes the switch-on point is lowered.



1 - Electric vacuum pump
2 - Pressure sensor
3 - Vacuum brake booster
4 - Non-return valves
5 - DME control module
6 - Relay V – Vacuum to engine

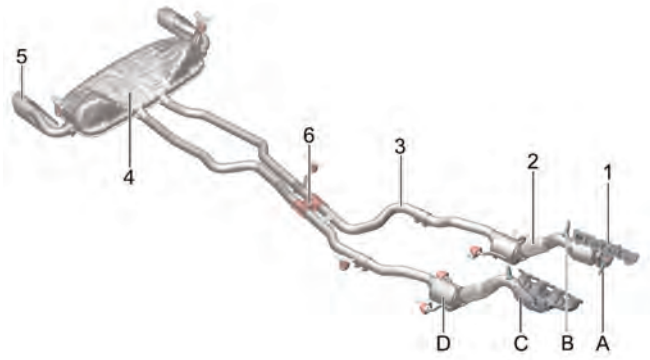
Exhaust System

The Cayenne S and Cayenne Turbo underscore the engine note through a typical Porsche load-dependent exhaust note, which was tuned through the rear mufflers and tail pipes and satisfies all applicable legal requirements.

To achieve long life and long-term attractive appearance, the entire exhaust system is made of stainless steel, which has particularly good corrosion resistance. The exhaust system consists of two exhaust tracts. Exhaust gases are taken through air-gap insulated exhaust headers with the shortest possible pipe length to the preliminary catalytic converters. The short pipe lengths not only speed up heating of the catalytic converters, but also reduce energy losses in the exhaust gases. By arranging the flex pipes between the pre-catalytic converters attached to the engine and the main catalytic converters attached to the body, the transmission of engine vibration to the body was effectively eliminated. The left and right exhaust tracts come together again in the rear muffler.

Cayenne S Exhaust System

By way of a cross-connection (cross-over point only on Cayenne S), that is, a pipe which connects both exhaust tracts, the two exhaust tracts, or the oscillating exhaust gas columns, are linked together after the primary catalytic converters This positively influences the torque curve in the lower RPM range. The rear muffler in the Cayenne S has individual tail pipe tips on the left and right.

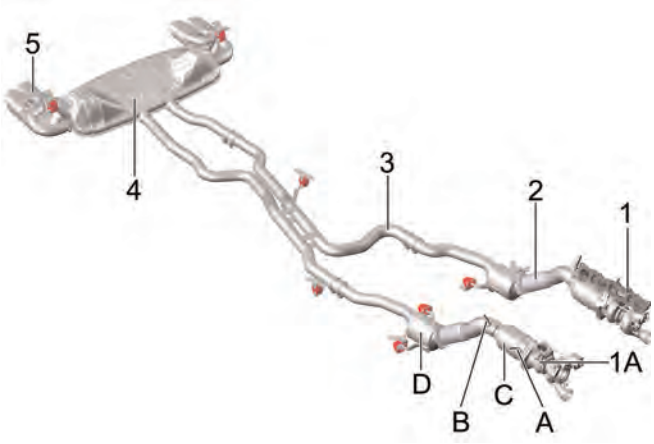


1 - Exhaust header
2 - Decoupling element
3 - Exhaust pipe
4 - Rear muffler
5 - Tail pipe enclosure
6 - Cross connection (cross-over, only Cayenne S)
A - LSU O2 sensor (ahead of catalytic converter)
B - LSF O2 sensor (after the catalytic converter)
C - Preliminary catalytic converter
D - Main catalytic converter

Cayenne Turbo Exhaust System

The exhaust system on the Cayenne Turbo was matched to the increased requirements and different exhaust gas velocities and exhaust gas pulsations through exhaust pipes with a larger cross section. As a result of the smoothing of the exhaust gas pulsations in the turbochargers, the demands on the rear muffler are different than the Cayenne S. An optimal exhaust note is achieved through specific damping and pipe routing inside the rear muffler together with the tail pipes.

Differing from the Cayenne S, the exhaust pipes for the Cayenne Turbo do not have a crossover pipe.



1 - Exhaust header
1A - Exhaust turbocharger
2 - Decoupling element
3 - Exhaust pipe
4 - Rear muffler
5 - Tail pipe enclosure
A - LSU O2 sensor ahead of converter
B - LSF O2 sensor after the converter
C - Preliminary catalytic converter
D - Main catalytic converter

The rear muffler on the Cayenne Turbo is also installed as a visible design element. Exhaust gases leave the Cayenne Turbo through two tail pipe tips on the outer left and right, whose design differs from the Cayenne S.

Exhaust Treatment

Contributing factors to the excellent emissions numbers for the Cayenne include the modern control concept of the DME, the On-Board Diagnostic System (OBD II and EOBD) as well as the exhaust system with metallic catalytic converters and two-channel oxygen sensor feed back. Two oxygen sensors per cylinder bank handle monitoring of exhaust gases and functional monitoring of the catalytic converters. They provide the information to the DME control module for regulating exhaust gas figures. The lowest possible emission of pollutants is achieved through this two-channel oxygen sensor feedback.

To reduce pollutants during warm-up, the catalytic converters are heated up rapidly as the result of measures in the engine management system, such as, retarded ignition and injection of secondary air in the exhaust tract for afterburning. The corresponding opening of the throttle valve control unit compensates for the associated reduction in torque.

Emissions Standard

In Europe the Cayenne S and Cayenne Turbo are classified as Stage 4 (EU4) and in the U.S. as an LEV I (Low Emissions Vehicle). Both Cayenne engines are substantially below the threshold values of the EU4 guideline, which goes into effect in 2005 as well as all other applicable legislative directives.

EU4 – Europe: These vehicles meet EOBD (European On Board Diagnosis) and have four oxygen sensors (the oxygen sensors downstream of the catalytic converter run the control system), 3-way catalytic converter systems with two preliminary and two primary catalytic converters, as well a secondary air system for each cylinder bank.

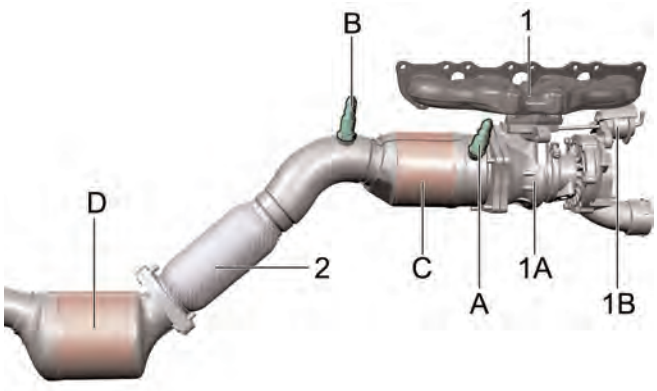
LEV I – USA: Unlike EU4 these vehicles satisfy OBD II (On Board Diagnostics II) and ORVR (on-board recovery of vapors during refueling)

Preliminary and Primary Catalytic Converters

The preliminary and primary catalytic converters are made of metal. This allowed the coated inner walls to be of a thinner design than, for example, ceramic catalytic converters and the result is a greater total surface area for the catalyzing passages. This ensures faster warm-up, long life and greater efficiency in the conversion of pollutants.

Metallic converter substrates have only about 1/3 the wall thickness of ceramic substrates. They are more compact and have more active surface to convert pollutants. In the warm-up phase, the operating temperature for exhaust gas treatment is reached more quickly. In addition, a metallic catalytic converter is less sensitive to heat, impacts and ages more slowly. Because of lower exhaust gas pressure, increased engine performance is achieved.

Cayenne Turbo



A - LSU O2 sensor (ahead of preliminary catalytic converter)
B - LSF O2 sensor (after the preliminary catalytic converter)
C - Preliminary catalytic converter
D - Main catalytic converter
1 - Exhaust header
1A - Exhaust turbocharger
1B - Boost pressure control valve
2 - Decoupling element

Since the high temperatures that a catalytic converter needs to effectively begin the process of exhaust gas treatment as quickly as possible after a cold start, the exhaust gases are delivered to the pre-catalytic converters through double-walled, air-gap insulated exhaust headers with the shortest possible pipe lengths for rapid heating. As far as the main catalytic converter, which is designed as an underfloor converter, all exhaust pipes are air-gap insulated to reduce heat losses. In addition, heating of the pre-catalytic converters after a cold start is improved by means of secondary air injection.

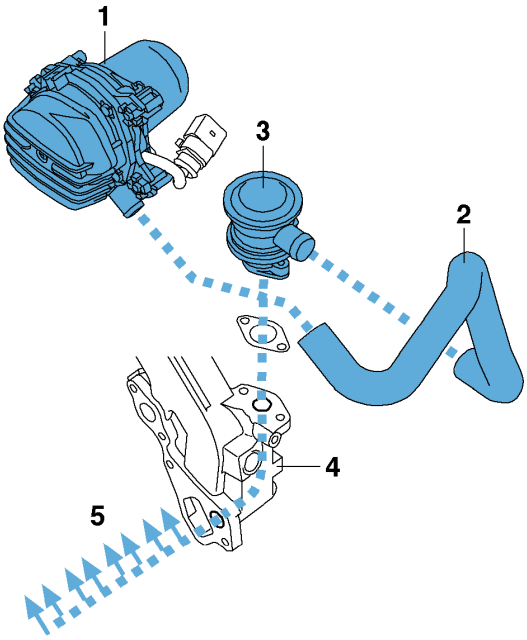
Notes:

Secondary Air System

The V8 engines in the Cayenne have separate secondary air systems for the left and right cylinder bank, mounted at the rear of the appropriate cylinder head. The secondary air blower for banks 1 and 2 are activated through relays by the DME control module. This builds up pressure over the connecting hoses up to the secondary air valves. At about 80 mbar delivery pressure from the blower, the diaphragm in the secondary air valves is opened; as a result, the injected secondary air arrives behind the exhaust valves through the distribution pipe in the appropriate cylinder head. The injection of secondary air after the exhaust valves results in a reduction of CO and HC, which are generated in greater amounts in the cold start phase with lambda < 1.

Additionally, the catalytic converters reach their light-off temperature of about 662° F (350° C) as a result of the heat released during afterburning. During the first cold start, the condition for air injection is reached when coolant temperature is between 14° F (–10° C) and 86° F (30° C). In the range close to idle, secondary air injection runs for up to about 100 seconds, at part throttle this is reduced to about 40 seconds. If the inducted volume of air of about 340 kg/h is exceeded during secondary air injection, secondary air injection is switched off. A supplementary non-return valve is integrated in the secondary air valve of the Cayenne Turbo, which prevents opening as the result of pressure spikes in the exhaust system. End stage diagnostics monitors the relays, the operation of the secondary air system is monitored by closed loop oxygen sensor control.

Notes:



1 - Secondary air blower (left and right)
2 - Connecting hose
3 - Secondary air valve
4 - Flange with air passage
5 - Air flow behind the exhaust valves

Two Channel Closed Loop Control

Both banks of cylinders have a separate oxygen sensor control loop, through which the optimal mixture composition is determined for each one individually. The left and right exhaust tracts are equipped with two oxygen sensors for monitoring the operation of the catalytic converters. In addition to the conventional jump oxygen sensors (LSF), which are installed after the pre-catalytic converters, the more sensitive broad-band oxygen sensors (LSU) are installed ahead of the pre-catalytic converters. This keeps fuel consumption and exhaust emissions as low as possible under all operating conditions.

LSF Oxygen Sensor After The Pre-Catalytic Converters

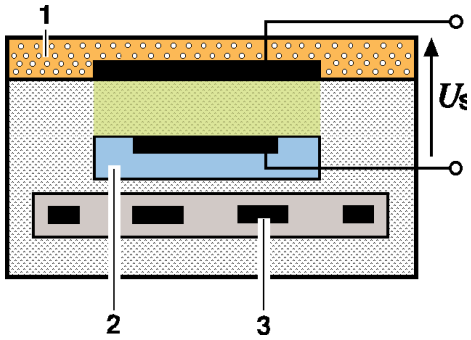
The planar LSF oxygen sensor is a further development of the heated oxygen sensor. Functionally it corresponds to the LSH heated oxygen sensor, with a jump curve from 0 to 0.9 volts at lambda 1. In contrast to the LSH, ceramic films form the solid body electrolyte in the LSF oxygen sensor. LSF means Flat Oxygen Sensor.

Special properties of the LSF oxygen sensor:

- Reaches operational status quickly
- Low heating requirements
- Stable control characteristics
- Small size, low weight

The sensor element of the planar oxygen sensor is constructed from ceramic films and has the shape of an elongated plate with a rectangular cross section. The individual functional layers (electrodes, protective layers, etc.) are produced using the silk-screen process. Laminating the different printed films on top of each other allows for the integration of a heating element in the sensor element.

Oxygen Sensor Construction

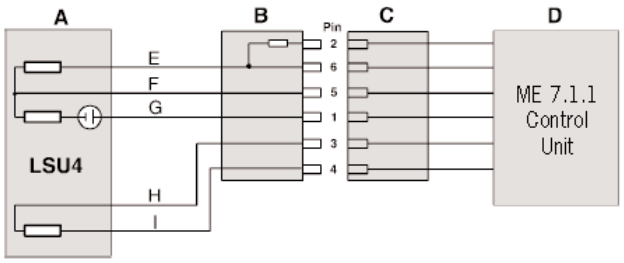


1 - Exhaust
2 - Reference air passage
3 - Heating element
Us - Oxygen sensor voltage

Notes:

Broad-Band Oxygen Sensor Ahead of the Pre-Catalytic Converters

An LSU4 wide-band oxygen sensor is installed on each cylinder bank upstream of the catalytic converters. In the engine compartment, a sensor-specific, laser calibrated trimmer resistor is attached to the plug connection of these oxygen sensors. This resistor is specially calibrated to each individual sensor during production. Six cables lead off from the ME 7.1.1 control unit to the plug connector in the engine compartment. Five cables then lead off from the plug connection to the LSU4 wide-band oxygen sensor.



A - Wide-band oxygen sensor LSU4
B - Plug connection (oxygen sensor) with integrated trim resistor
C - Plug connection (engine wiringharness)
D - ME 7.1.1 control unit
E - Pump current
F - Ground
G - Nernst voltage (Vn)
H - Sensor heating (Battery voltage)
I - Ground for sensor heating (regulated via ME 7.1.1)

The sensing element of the LSU4 wide-band oxygen sensor is a combination consisting of a Nernst concentration cell (sensor cell) and an oxygen pump cell which transports oxygen ions. The LSU4 wide-band oxygen sensor can be used from lambda > 0.7 to infinity (pure air). Accurate measurement is thus possible in both the rich and lean range. Used in conjunction with the regulating electronics, it supplies a clear and constant signal across a broad lambda range. To reduce emissions, the engine is run with a stochiometric air/fuel mixture of lambda 1 as soon as the operating behavior of the engine and the temperature of the components permit this.

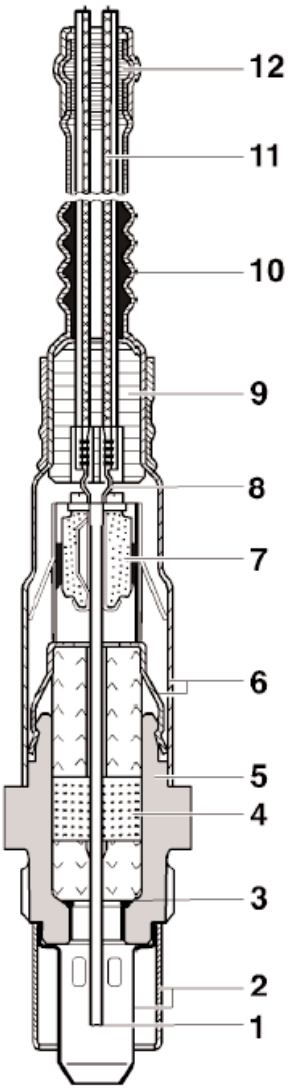
However, the LSU4 wide-band oxygen sensors used in this oxygen sensing system allow the air/fuel mixture to be adjusted to a certain setpoint value(which may deviate from lambda 1) in both the warm-up phase and the full-load range. As a result, the exhaust gas and running behavior fluctuate only slightly since the ME 7.1.1 control unit also regulates these ranges.

Benefits of the Broad-Band LSU Oxygen Sensor:

- Constant characteristic curve
- Precise measurement in broad lambda range from > 0.7 to infinity (air).
- Short response times < 100 ms .
- Fast availability

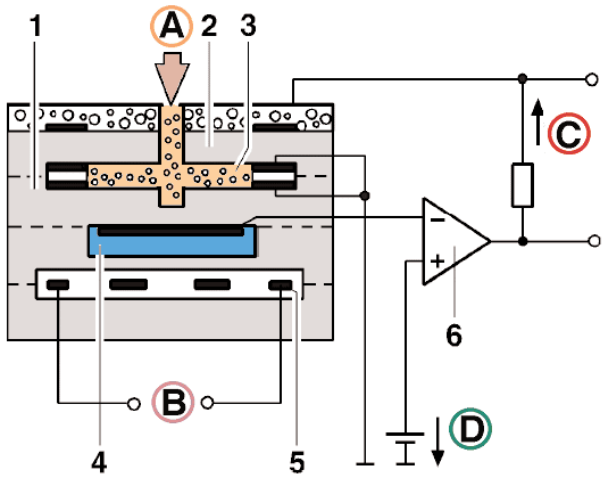
Notes:

Broad-Band LSU Oxygen Sensor Construction



1 - Sensing element (combination comprising Nernst concentration cell and oxygen pump cell)
2 - Double protection tube
3 - Sealing ring
4 - Sealing package
5 - Sensor housing
6 - Protective sleeve
7 - Contact holder
8 - Contact clip
9 - Grommet
10 - Molded hose
11 - Five connecting cables
12 - Seal

In the ME 7.1.1 control unit, a special operating electronics system is integrated for each wide-band oxygen sensor. This system contains the regulating electronics for the oxygen pump cell and the Nernst concentration cell used to generate the sensor signal. In addition, it also includes the regulating electronics for keeping the temperature at the LSU4 wide-band oxygen sensor at approx. 1382° F (750° C). In the ME 7.1.1 control unit, the current for the oxygen pump cell is regulated to ensure that the composition of the gas in the diffusion gap of the oxygen sensor reaches the predefined lambda value.



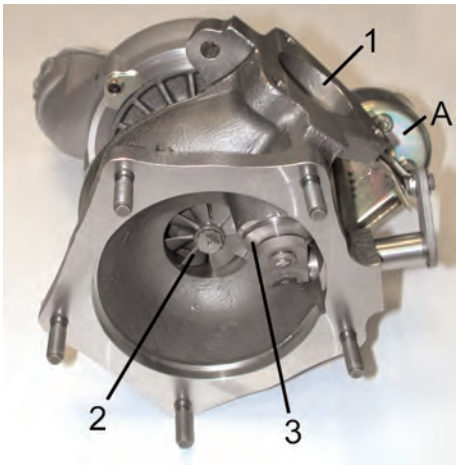
A - Opening for exhaust gas
B - Heater current
C - Pump current
D - Oxygen sensor voltage/reference voltage
1 - Nernst concentration cell (for generating voltage)
2 - Oxygen pump cell
3 - Measurement cell (diffusion slot)
4 - Reference air passage
5 - Oxygen sensor heater
6 - Closed loop circuit

Notes:

Exhaust Turbocharging – Cayenne Turbo

The two turbochargers, which are arranged in parallel, provide effortless power with the appropriate boost pressure control. Air flows into these turbochargers at a radial and an axial angle, due to the mixed flow turbines which also have a low moment of inertia. These innovative turbochargers are manufactured by IHI. As the result of low intake manifold volume, short exhaust headers and the Mixed Flow Turbines excellent response characteristics are achieved.

These turbochargers are designed for a maximum speed of 160,000 RPM (continuous operation). So that the maximum RPM is not exceeded, the DME control module reduces boost pressure as needed above an altitude of 2,200 meters. A cast steel turbine housing was used to achieve high turbine entry temperatures and consequently optimal wide open throttle consumption. By water cooling the turbochargers, Coking in the turbine bearing housing under high thermal loads is prevented (coking is when the oil is overheated until it becomes a solid and blocks the lubrication passages). To cool the turbochargers while the engine is not running, the electric coolant circulation pump, which is installed behind the wheel house cover at the left front, can be switched on. The electric coolant circulation pump is switched on as needed in run-on operation together with the electric cooling fans by the DME control module. Oil supply and oil scavenging from the turbochargers on the Cayenne Turbo was designed for universal operating conditions (e.g. up to a 45° slope) for the vehicle.

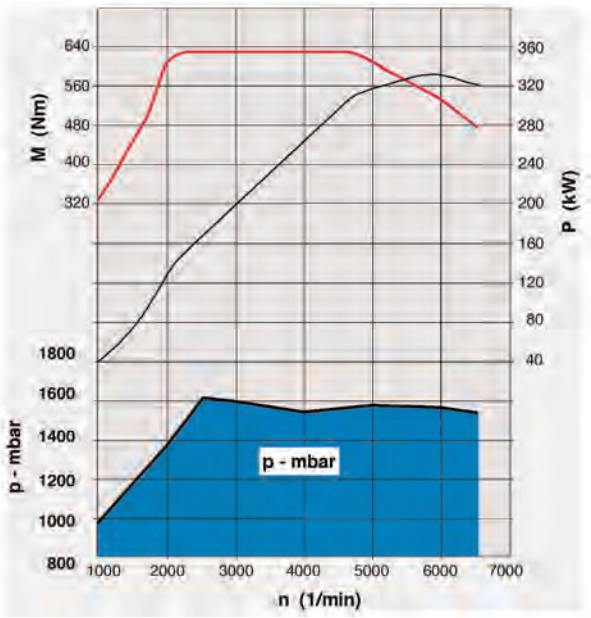


1 - Flange to exhaust heade
2 - Exhaust turbine
3 - Bypass valve (wastegate)
A - Pressure unit for boost pressure control

Boost Pressure Control

Depending on driving style, the boost pressure is regulated ahead of the throttle valve. With a steady or not very lively driving style, engine tuning at part throttle is constantly optimized in the direction of low fuel consumption by permitting only low pressure ahead of the throttle valve. It is opened correspondingly wide to bring about a low pressure drop. With a very brisk driving style, a higher boost pressure is set ahead of the throttle valve. The effect is that when the throttle valve is opened at part-throttle operation, the turbochargers are already running at higher speed and thus full-throttle boost pressure is attained very quickly. This principle can minimize "turbo lag." The required engine torque of the engine is calculated depending on the accelerator pedal potentiometer (driver request), engine RPM and other factors in the torque-oriented operational construct in the DME control module.

Boost pressure in the Cayenne Turbo is controlled by absolute pressure. Maximum torque can be kept constant for a long period with respect to geographical altitude and temperature. The diagnostic capability of the system was expanded to include leak detection in the intake system. The engine charge required for a particular torque is determined through the calculation of mass air and implemented by specifying and controlling boost pressure.

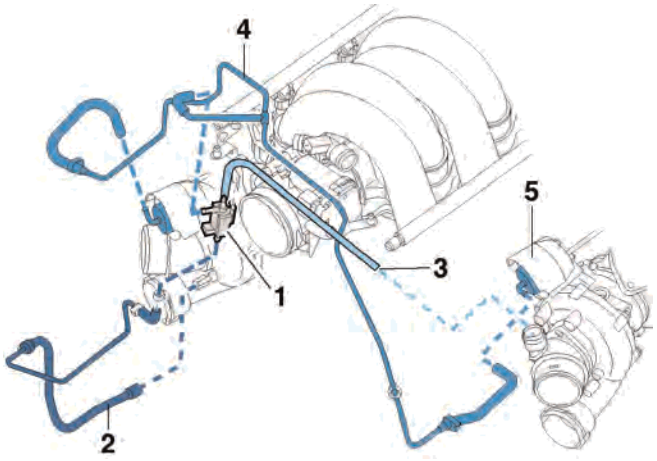


p - Boost pressure in mbar absolute (pressure)
n - Engine speed (rpm)
M - Torque in Nm
P - Power in kW

In the Cayenne Turbo, boost pressure is registered by the pressure sensor and controlled to the required boost pressure calculated by the DME control module. The electric frequency valve for boost pressure control is activated by an appropriate duty cycle, by which pressure is applied to the boost pressure control valves on the turbochargers, and the bypass valves (waste gate) in the turbochargers open. Turbocharger RPM is reduced, and boost pressure is limited. The electric frequency valve is activated by the DME control module when accelerating at a maximum 95% and a steady state at about a 60% to 80% duty cycle. Maximum boost pressure at wide-open throttle is up to about 24 PSI (1650 mbar) and is already reached at a speed of 2500 RPM. In the remainder of the RPM curve, boost pressure is cut back and at rated power (450 hp/331 kW @ 6000 RPM) it is about 22 PSI (1500 mbar).

Notes:

Boost Pressure Control Components



1 - Frequency valve for boost pressure right control
2 - Pressure side (boost pressure from right turbocharger)
3 - Pressure (from the intake side of the left turbocharger)
4 - Regulated control pressure to the boost pressure control valves
5 - Pressure unit on the turbochargers

The cross sectional opening of the frequency valve for boost pressure control is dependent on the boost pressure requested. The frequency valve for boost pressure control changes its opening time to atmospheric pressure in accordance with its activation (duty cycle) through the DME control module. From boost pressure and atmospheric pressure, a control pressure is modulated, which actuates the pressure units of the boost pressure control valves accordingly and thereby opens the waste gates on the turbochargers. In a de-energized state, the frequency valve for boost pressure control is switched so that boost pressure acts directly on the pressure units and thus the boost pressure control valves open the waste gates at a low boost pressure.

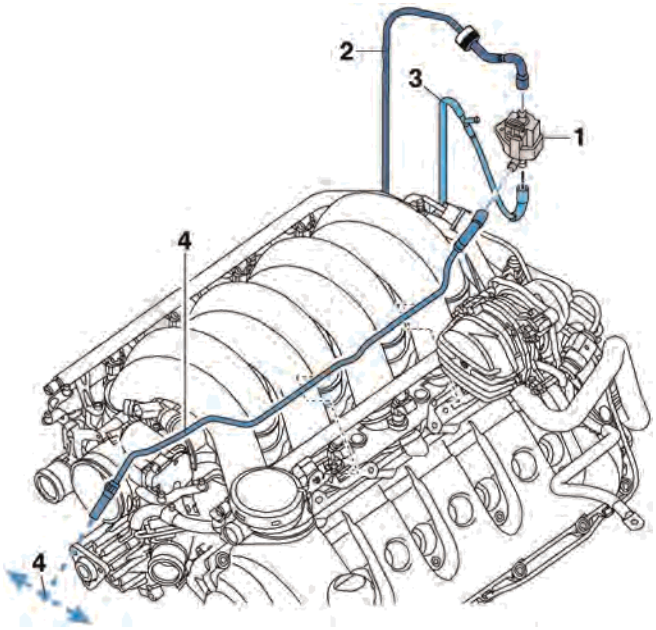
Boost Pressure Adaption

The Cayenne Turbo has adaptive boost-pressure control. For diagnosis the adapted value among the actual values of the DME can be read out as “boost pressure adaptation.” The adaptation range of boost pressure control is 0 ± 25 %. Above a deviation of more than about 25% the switch to open-loop is made and a trouble code is stored. In open-loop, boost pressure is lowered by about 20%, reaching a maximum of 20 psi (1400 mbar). Should the frequency valve for boost control fail, basic boost pressure is reduced even further for safety reasons. The consequence is a noticeable lack of power and performance.

Electrical Switching Valve for Recirculating Air On Deceleration

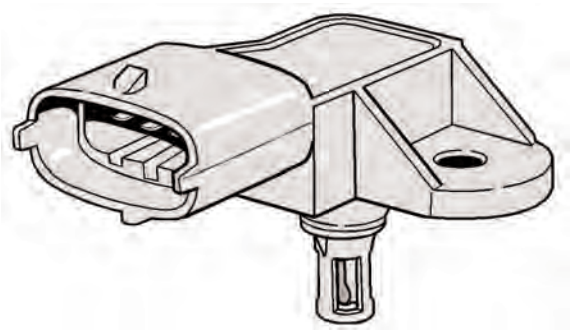
To prevent the turbochargers from slowing on a sudden transition from high load to deceleration, an electrical switching valve is used to control recirculating air. The DME can activate this electric switching valve, which actuates the recirculating air valves independently of intake manifold pressure. Controlled opening of the recirculating air valves reduces noise in the induction system and has positive effects on fuel consumption. Through the electric recirculating air valve in conjunction with the vacuum reservoir, operation of the recirculating air valves independently of intake manifold pressure can be achieved. The system is designed so that if the electric switching valve should fail, the decel recirculating air valves can continue to be opened through manifold pressure.

Connections for Recirculating Air



1 - Electrical switch valve for recirculating air on deceleration
2 - Intake manifold pressure
3 - Vacuum from vacuum reservoir
4 - Actuation for recirculating air left and right

Pressure Sensor With Temperature Sensor



The pressure sensor registers pressure and air temperature ahead of the throttle valve control unit and makes these signals available to the DME control modules.

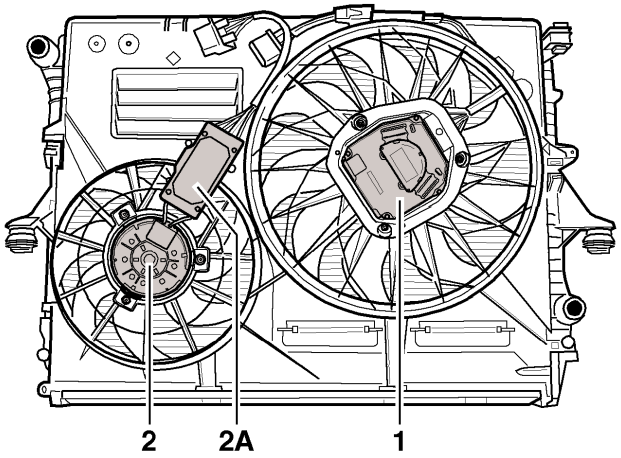
Coolant Temperature Gauge/Coolant Warning Light

The coolant temperature sensor (NTC), which is threaded into the coolant distribution pipe at the right rear of the engine, sends its signal to the DME control module, which passes on this information over CAN. The temperature is displayed in the instrument cluster by the coolant temperature gage. At a coolant temperature of > 255° F (124° C) the coolant warning light is additionally switched on and switched off again at < 246° F (119° C).

Notes:

Electric Fans 1 and 2 For The Cooling System

Electric fan 1 has a maximum power of 600 watts, electric fan 2 of 300 watts. For continuous control, the DME control module changes the duty cycle for the end stages of fans 1 and 2.



1 - Electric fan 1 (with integral output stage)
2 - Electric fan 2 (with external output stage)
2A - Output stage for electric fan

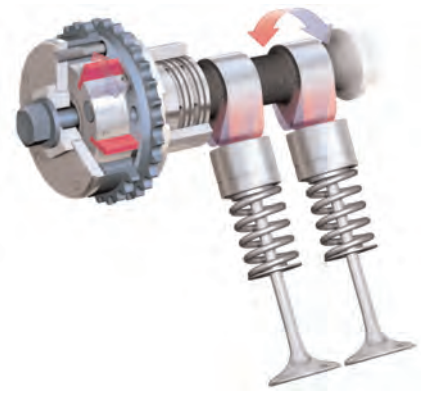
Control of fan speed is dependent on coolant and ambient temperature. The coolant thermostat begins to open at about 182° F (83° C) coolant temperature and reaches its maximum opening at about 210° F (98° C). The two stepless fans 1 and 2 are activated at about 200° F (93° C) and reach their full performance at about 220° F (105° C).

With the air-conditioning switched on, the fans are also activated, above a pressure of about 294 psi (20 bar) in the air-conditioning system maximum fan demand is reached. Above a coolant temperature of > 245° F (118° C) the air-conditioning compressor is switched off (zero delivery). Above 78 mph (125 km/h), the speed of both fans is reduced and at 87 mph (140 km/h) they are completely switched off, however whenever coolant temperature rises above 245° F (116° C), they are switched on again and off again at below 220° F (105° C).

Fan Run-On

To cool the engine compartment the fans are switched on with the ignition OFF, depending on coolant temperature and the last driving cycle (map on fuel consumption). The switch-on threshold is between 195° F (90° C) and 200° F (93° C) and running time is between 15 seconds and a maximum of 13 minutes. Once fan run-on is concluded, the fans will not start again with "Engine OFF." In the Cayenne Turbo, the electric coolant run-on pump, which provides cooling for the turbocharger (to prevent oil coking), is activated through this function. The run-on pump is located behind the left front wheel wheelhouse liner. In addition, this pump is activated on the Cayenne S and Cayenne Turbo by the air-conditioning control module to utilize residual engine heat.

VarioCam



To reduce fuel consumption and increase maximum torque, a continuous variable, stepless camshaft adjuster (VarioCam) is used on the intake camshafts. The DME control module regulates the position of the intake camshafts under the control a map. The vane-type adjusters can shift the intake camshafts for cylinder banks 1 and 2 between 0º to 50º crankshaft angle (25º camshaft angle). The variable position of the camshaft can be regulated from high torque at low RPM up to maximum power at high RPM, which also achieves a reduction in fuel consumption.

Activation of the Hydraulic Solenoid Valves for Stepless Adjustment of Valve Timing

The control module determines the current position of the intake camshafts (actual angle) to the crankshaft from the RPM sensor signal and the Hall sensor signal. The position control in the control module receives the desired specified angle via the programmed map values (rpm, load, engine temperature). If there is a difference between the specified angle and the actual angle, the electronic controls in the control module activates the hydraulic solenoid valve to actuate the positioner for the intake camshaft in accordance with the direction requested. Actuation of the valve is carried out through a pulse-width modulated square signal. Voltage is switched between 0 volts and 12 volts in a 4ms cycle (250 Hz), with the ratio of on-time and off-time being changed. Depending on conditions, a control current is set which determines piston position in the hydraulic solenoid valve (and thus opens the different oil lines), allowing a range of adjustment from 0º to about 50º of crankshaft angle.

The stepless VarioCam system with the vane-type adjuster provides the following benefits:

- Higher torque in the lower RPM range for better pulling performance
- Reduction of raw emissions for better exhaust gas numbers
- Maximization of catalytic converter heating for better exhaust gas numbers

Idle

The engine runs with small valve overlap. This provides great idle stability at low RPM. This idle stability is achieved through good cylinder charging and associated even combustion. Valve overlap means that intake and exhaust valves are open together. The effect is that fresh gases flow in while exhaust gases flow out at the same time.

Part Throttle

At part throttle, operation with high residual gas content in the combustion chamber, meaning already burned air-fuel mixture, is optimal for reducing charge cycle losses and for improving combustion uniformity. In addition to reducing fuel consumption this results in better emissions characteristics.

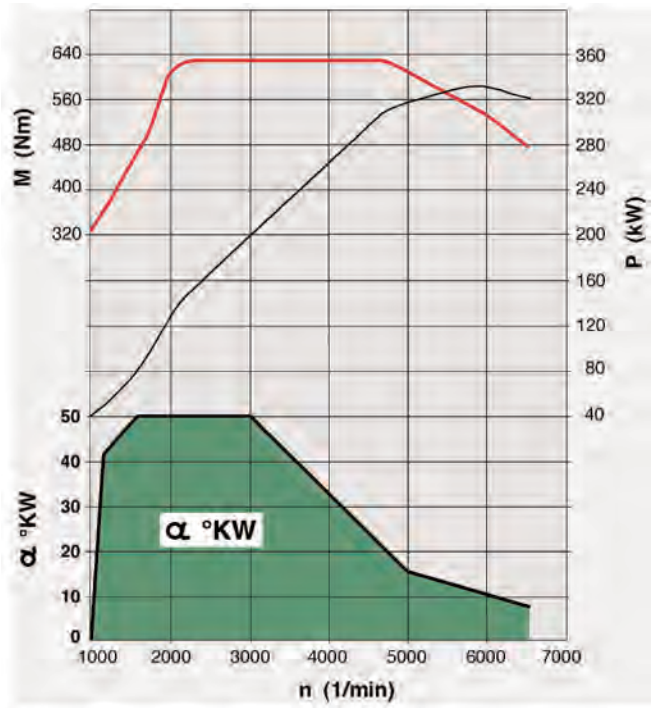
In the part-throttle range the engine is load-dependent, that is, it is operated with different degrees of valve overlap depending on engine RPM and accelerator pedal position. The movement of the charge, which provides good turbulence in the cylinders, promotes combustion.

Wide-open Throttle

With the throttle valve fully open, the optimal closing timing for the intake valves is permanently set for any RPM with the continuously adjustable intake camshaft (vane-type VarioCam). This prevents the backflow of fresh gases from the combustion chamber. At medium RPM and at wide-open throttle, the engine is running with the greatest valve overlap and early closing of the intake valve.

At high RPM and at wide-open throttle, the engine is operating with small valve overlap and late closing of the intake valve. It is imperative not to permit any discrepancies in valve timing between the two intake camshafts on both banks of cylinders.

Cayenne Turbo VarioCam Shift Graph



a - VarioCam adjustment angle in ° KW. (KW = ° crankshaft rotation)
n - Engine speed in rpm
M - Torque in Nm
P - Power in kW

Notes:

PORSCHE

Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

☑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Check drive belt

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

☑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

☑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
☑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
☑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

☑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

PORSCHE

Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

- ☑ Diagnosis system: Read out fault memory; reset maintenance interval
- ☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
  Engine compartment: Visual inspection for damage
  Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels
- ❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)
- ☑ Air filter/s: Check the air filter condition, and if necessary, replace
- ❑ Pollen filter: Replace filter element
- ❑ Check drive belt
- ❑ Steering gear: Visual inspection of the dust boots for signs of damage
  Tie rod ends: Check play and dust boots
- ❑ Power steering: Check fluid level
- ☑ Fuel system lines and connections: Visual inspection
- ❑ Coolant hoses: Check condition
- ❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
  Coolant: Check level and antifreeze protection levels
- ❑ Parking brake: Check free play
- ❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear
- ❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level
- ❑ Axle shafts: Visual inspection of the for leaks & signs of damage
- ❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage
- ❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)
- ❑ Hydraulically detachable off-road sway bar: Check fluid level and function
- ☑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts
- ❑ Tires, external spare wheel: Check condition and tire pressure
- ❑ Lubricate door latch and fastening bolts
- ❑ Panorama roof: Adapt control module
- ❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level
- ❑ Check wiper blades
- ❑ Seat belts: Check operation and condition
- ❑ Vehicle lighting: Check operation
- ❑ All headlights: Check adjustment
- ❑ Horn: Check operation
- ☑ Batteries and ventilation hoses: Check condition
- ❑ Trailer coupling: Check operation
- ❑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

- ☑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
- ☑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
- ☑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

- ☑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

- ❑ Change front differential oil
- ❑ Change rear differential drive oil
- ❑ Change transfer case oil
- ❑ Change manual transmission oil
- ❑ Change Tiptronic transmission oil and ATF filter

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Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CB



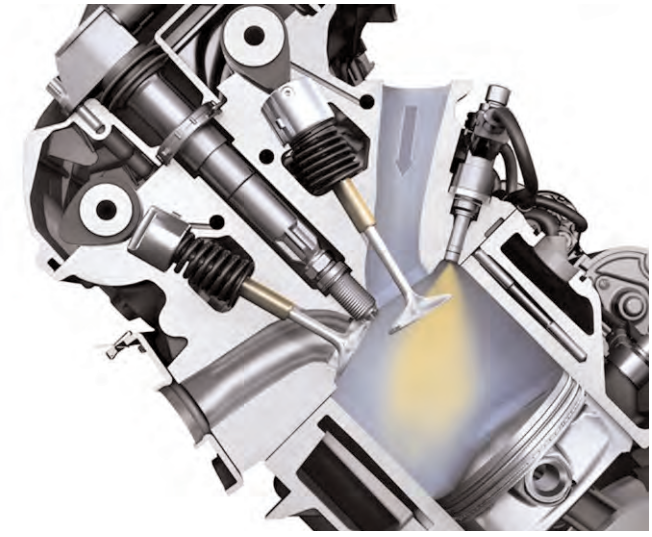




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Notes:

2 - Fuel & Ignition



Direct Fuel Injection (DFI)

A totally redesigned generation of engines with DFI is used for the new Cayenne models: a 3.6 l V6 engine for the Cayenne, a 4.8 l V8 naturally aspirated engine for the Cayenne S and a 4.8 l V8 bi-turbo engine for the Cayenne Turbo.

Development objectives for the new DFI engines:

- More power and torque.
- Reduced fuel consumption.
- Reduced weight.

These objectives have been achieved thanks to the following enhancements and new technologies:

- Increased displacement for more power and torque.
- Use of direct fuel injection (DFI).
- Higher compression ratio.
- Sport button as standard.
- VarioCam Plus (for V8 engines).
- Demand-controlled oil pump (for V8 engines).
- New intake systems adapted specifically for each engine.
- VarioCam Plus (for V8 engines) for controlling the intake camshaft and valve lift.
- New sports exhaust system (optional for Cayenne S with Tiptronic S).
- Demand controlled variable oil pump for improved engine efficiency (for V8 engines).

The most important technical components of the direct fuel injection system are:

- The fuel low pressure system.
- The fuel high pressure system.
- The fuel rail (central high pressure distribution pipe).
- The fuel injectors.
- Modifications to the cylinder head.
- Special recessed pistons for the relevant engine.

Porsche is using direct fuel injection (DFI) for the first time in its new generation of Cayenne engines. DFI offers numerous advantages compared to intake manifold injection. The main objective here is to achieve an air/fuel mixture adapted specifically to the respective operating and charge states of the engine using an injection system and mixture formation. This provides the perfect solution for meeting the various demands relating to economy, power, vehicle handling and emissions.

With direct fuel injection, the fuel is injected directly into the combustion chamber and mixture formation takes place almost completely in the combustion chamber.

The direct fuel injection system used in the new Cayenne models is characterized by the following:

- Homogeneous operation.
- Better cylinder filling.
- Reduced knock sensitivity.
- Higher compression ratio.
- High pressure stratified charge ignition.
- Dual injection.

The direct fuel injection system used in the new Cayenne engines is based on homogeneous operation. The mixture of air and fuel is distributed as evenly as possible in the combustion chamber, thereby allowing optimal combustion. With this system, the fuel is injected directly into the combustion chamber at a pressure of up to 1740 psi (120 bar).

Within the injector, the fuel jet creates a vortex (rotated around the longitudinal axis). This rotation forms a conical cloud of fuel. The fine atomization produced by this allows faster evaporation of the fuel. The fuel evaporation process takes the required heat energy from the air, thereby cooling the air. This reduces the cylinder charge volume and additional air is drawn in through the open intake valve, which in turn improves cylinder filling.

The reduced temperature level also helps to meet the prerequisites for the higher compression ratio in all new Cayenne engines since knock sensitivity has been improved. The higher compression ratio in turn increases engine efficiency.

Start Phase of DFI Engines

High pressure stratified charge ignition is used in the DFI systems of the new Cayenne engines in order to optimize cold starting with regard to fuel consumption and emissions. With this ignition system, fuel injection occurs very late – just before the end of the compression stroke – when starting the engine. The high pressure stratified charge ignition system injects fuel directly only once into the specially molded piston recess so that a stratification, which creates an ignitable mixture, is formed around the spark plug. The piston recess ensures that the injected fuel is directed straight to the spark plug. This reduces both the amount of fuel required and the emissions compared to intake manifold injection.

Catalytic Converter Heating Phase in DFI Engines

Once the high pressure stratified charge ignition system starts the engine, engine management switches to the catalytic converter heating phase. In this operating state, a dual injection system helps to bring the catalytic converter to the temperature required for optimal conversion as quickly as possible by increasing the exhaust emissions temperature.

The 2nd injection of fuel into the piston recess occurs just before the end of the compression stroke with the intake valves closed. The air/fuel mixture is ignited very late and this increases the exhaust emissions temperature. As a result, emissions during the start phase are reduced and the secondary air pumps are no longer required for all engines.

Upper Load Range of DFI Engines

Dual injection always occurs in the upper load range up approx. 3500 rpms. The amount of fuel required for combustion is distributed in two consecutive injection processes. In the upper load range, both injections occur during the intake stroke (intake synchronous injection) with the intake valves open, thereby ensuring reduced fuel consumption through improved homogenization.

Piston Recesses in DFI Engines

The piston recesses are important for high pressure stratified charge ignition and for dual injection during the catalytic converter heating phase. They allow late injection of fuel in order to create an ignitable air/fuel mixture around the spark plug for late ignition.

Note!

Intake manifold injection

> With the intake manifold injection system, the fuel is injected into the intake duct earlier and mixture formation takes place partly in the intake duct and partly in the combustion chamber. During the intake process, fuel is deposited on cylinder walls and valves and as a result, this fuel is no longer available for combustion. This is particularly the case during the start phase of the engine at low temperatures and the consequence of this is that the amount of fuel used exceeds the amount of fuel that is actually needed for combustion.

Sport Button



All new Cayenne models already have a Sport button as standard, which is located centrally in the center console under the shift lever or Tiptronic S gear selector. This button allows the driver to choose between the vehicle's fuel consumption tuning (normal mode) and sport tuning (sport mode). When the Sport button is pressed, a "SPORT" logo lights up in the instrument cluster.

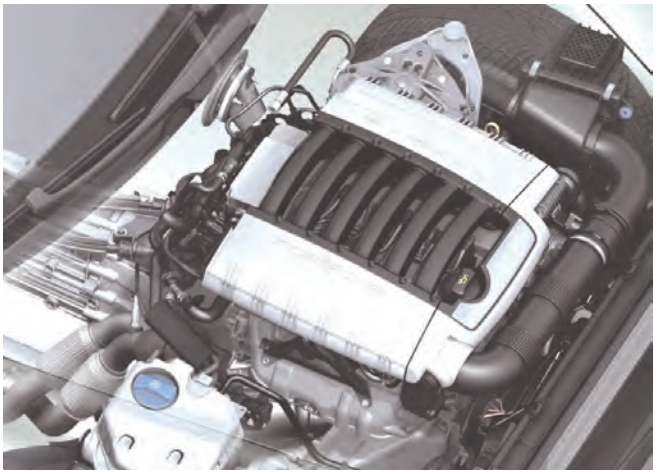
In the Motronic area, pressing the Sport button (in High-Range mode only) affects the following systems, depending on the vehicle equipment:

- When the Sport button is activated, a more sporty accelerator pedal characteristic produces a more spontaneous engine response, underpinning the sporty character. This is achieved via a steeper rise for the electronic throttle characteristic. This means that the throttle is opened further and faster with the same accelerator pedal travel when the Sport button is pressed.
- Maximum full-load torque is available at all times in the Sport button's sport mode. In normal mode, electronic engine management restricts the engine management functions in order to optimize fuel consumption. If full power is required in a certain driving situation (e.g. when passing), it can be achieved at any time by initiating a kick down. Engine management switches to the sport mode map at this time.
- The Sport button lends a sportier feel to the transitions between traction and deceleration, as well as between deceleration and traction. This means that throttle activation and ignition are switched to a more direct map when accelerating and particularly when decelerating, resulting in a more spontaneous and dynamic load cycle.
- The sports exhaust system available for the Cayenne S in combination with Tiptronic S is also activated using the Sport button.

Sport mode remains active until either the Sport button is pressed a second time or the driver switches off the ignition. This deactivates sport mode and the settings revert to normal mode.

Cayenne V6 DFI Engine

On the new Cayenne V6 engine, displacement has been increased by 0.4 liters to 3.6 liters with a compression ratio of 12.25. Engine power has increased by 40 HP to 290 HP, while the torque is now 285 ftlb. (385 Nm), an increase of +56 ftlb. (+75 Nm). Idling rpm is 680 and maximum engine rpm is 6700.



Significant modifications to the V6 DFI engine:

- Direct fuel injection (DFI).
- New engine control unit Bosch MED 9.1.
- New extended twin branch exhaust system and additional main catalytic converter.
- New cylinder head for DFI.
- New recessed pistons.
- Continuous camshaft adjustment on intake and exhaust side.
- Intake system with variable intake manifold.

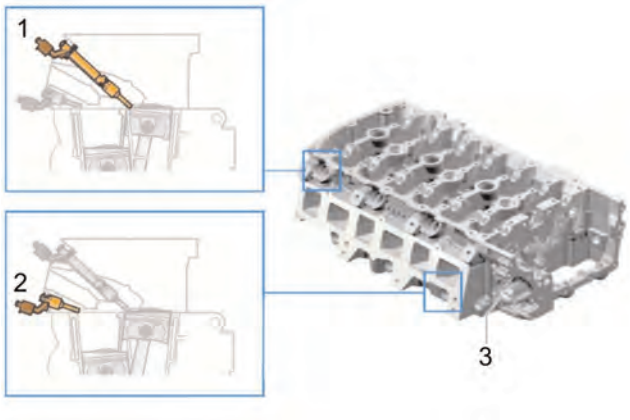
Notes:

Motronic Control Units MED 9.1



The new DME control unit MED 9.1 from Bosch has been specially adapted to suit direct fuel injection and the modified engine specifications of the V6 DFI engine. It can be programmed with the country-specific data records of the Cayenne V6.

Cylinder Head



The design of the direct fuel injection system, with two separate high pressure rails, the arrangement of the fuel injectors **-1-** (for cylinders 1, 3, 5) and **-2-** (for cylinders 2, 4, 6) as well as the high pressure pump **-3-**, has made it necessary to redesign the cylinder head.

Piston Recesses



The piston recesses **-1-** on the V6 engine have been adapted for the purpose of achieving optimal stratification of the air/fuel mixture during the late injection processes that characterize high pressure stratified charge ignition as well as during the catalytic converter heating phase.

The compression ratio has been increased from 11.5:1 to 12.25 due to improved inner cooling. This reduces fuel consumption and optimizes engine power.

Notes:

Cayenne V8 DFI Engines

The totally redesigned family of V8 engines includes a naturally aspirated engine for the new Cayenne S and a turbocharged version for the new Cayenne Turbo. Specific design work and tuning has resulted in an identical parts concept between the naturally aspirated and turbo engine.

Key changes:

- Direct fuel injection (DFI).
- Engine control unit Siemens EMS SDI 4.1.
- Increased displacement.
- New cylinder head for DFI.
- Special recessed pistons for Cayenne S and Cayenne Turbo.
- Use of VarioCam Plus.
- Demand controlled variable oil pump.

Motronic Control Unit EMS SDI 4.1

A completely new DME control unit EMS SDI 4.1 developed by Siemens is used for the V8 engines. This is designed specifically to meet the requirements for using the direct fuel injection system and VarioCam Plus. The control of fuel injectors, which are the main elements of the direct fuel injection system, is particularly important here. The DME control unit can be programmed for individual countries using the data records for Cayenne S and Cayenne Turbo.

Cayenne S DFI Engine



On the new V8 naturally aspirated engine in the Cayenne S, the displacement has been increased by 0.3 liters to 4.8 liters with a compression ratio of 12.5. Engine power has been increased by 45 HP to 385 HP, while the torque is now 370 ftlb. (500 Nm) – an increase of +59 ftlb. (+80 Nm). Idling rpm is 580 rpm (550 rpm for AT with transmission range engaged) and maximum engine rpm is 6700. The new DME control unit EMS SDI 4.1 has been specially adapted to suit direct fuel injection and the modified engine specifications of the V8 naturally aspirated engine.

- DFI direct fuel injection.
- Intake system with variable intake manifold.
- Enhanced exhaust system.
- New sports exhaust system (optional, in conjunction with Tiptronic S).

Piston Recess

The piston recesses are specifically designed to suit the characteristics of the V8 naturally aspirated engine during late injection with the high pressure stratified charge ignition system and during the catalytic converter heating phase.



The increase in the compression ratio from 11.5 to 12.5:1 on the V8 naturally aspirated engine as a result of DFI serves to optimize both engine power and fuel consumption.

Cayenne Turbo DFI Engine



On the new Cayenne Turbo, displacement has also been increased by 0.3 liters to 4.8 liters with a compression ratio of 10.5. Engine power has increased by 50 HP to 500 HP, while the torque is now 518 ftlb. (700 Nm – an increase of +56 ftlb. (+80 Nm). Idling rpm is 580 rpm (550 rpm for AT with transmission range engaged) and maximum engine rpm is 6700. The new DME control unit EMS SDI 4.1 has been specially adapted to suit direct fuel injection and the modified engine specifications of the V8 turbo engine.

- DFI direct fuel injection.
- New intake system.
- Adaptation of turbochargers and boost pressure control.

Piston Recess

The piston recesses are specially adapted to the characteristics of the V8 turbo engine. The increase in the compression ratio from 9.5 to 10.5:1 as a result of DFI serves to optimize both engine power and fuel consumption.



Fuel Supply

The engine is designed to provide optimum performance and fuel consumption if unleaded premium fuel with 93 octane () is used. If unleaded premium fuels with a lower octane number is used, the engine's knock controller automatically adapts the ignition timing. The maximum filling approx. 26 Gals. (100 liters), with a reserve of approx. 3 Gals. (12 liters).

Safety

Always read and follow the safety instructions in the Technical Manual, Group 2 when working on the fuel supply system.
> Fuel low-pressure system in DFI engines.

Technical Manual

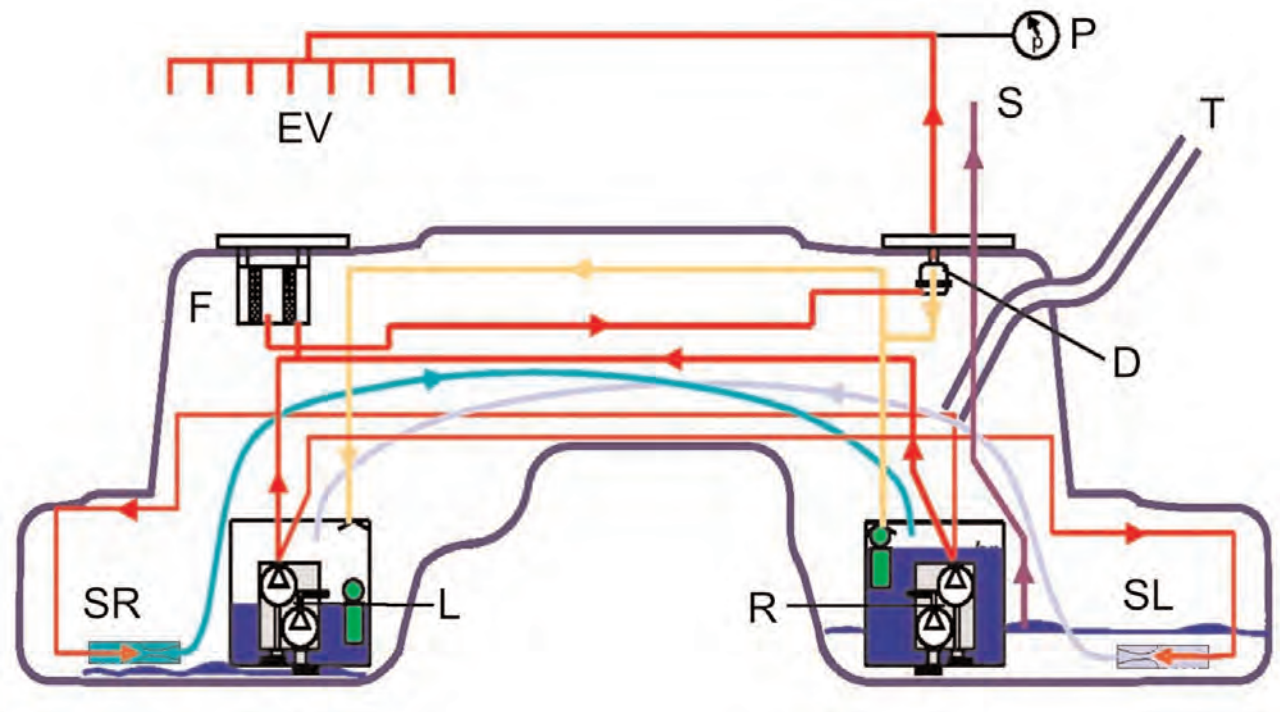
The procedure for checking the fuel pressure and the amount of fuel delivered by the fuel pumps is described in the Technical Manual.

- The low pressure system delivers the fuel from the fuel tank to the high pressure pump on the cylinder head.
- The new Cayenne vehicles have a returnless fuel system (RF).
- The demand control function of the fuel delivery rate reduces fuel heating in the tank by switching on the second fuel pump.

The fuel tank is not symmetrical. The left half of the tank has a higher volume than the right side. There is a "hump" in the middle so that both chambers are separated from each other once a certain fuel level is reached in the tank. When the tank is half full, the left fuel pump is activated because the left half of the tank has the higher volume. The fuel pumps are each supplied by one sucking jet pump whose hoses are routed diagonally and which "helps itself" to fuel from the other half of the tank.

The fuel pressure and the way in which the two fuel pumps are activated has changed compared to Cayenne vehicles up to model year 2006. On Cayenne vehicles up to M.Y. 2006, the left fuel pump was permanently activated and the right pump was only activated as required (for starting, higher delivery rate, etc.).

Functional diagram of the low pressure side in the fuel tank.



T - Tank filler neck
R - Fuel pump unit in right side of tank
L - Fuel pump unit in left side of tank
SL - Sucking jet pump for left fuel pump
SR - Sucking jet pump for right fuel pump

F - Fuel filter (does not need to be changed)
D - Fuel pressure regulator (approx. 80 psi/5.5 bar)
EV - Fuel injectors (cylinders 1 to 6 or 1 to 8)
P - Fuel pressure approx. 80 psi/5.5 bar

Fuel Pressure On The Low Pressure Side.

For DFI engines, the fuel pressure on the low pressure side has been increased to approx. 80 psi/5.5 bar (this was previously approx. 58 psi/4 bar). The left or right fuel pump is operated as the main pump in order to distribute the higher load to both fuel pumps, depending on the fuel level.

The fuel pumps are activated if the level of fuel in the tank is reduced and if the engine requires more fuel:

- Fuel level > 15.8 gal. (60 liters) to 26 gal. (100 liters): When the tank is relatively full, the right fuel pump is activated; if more fuel is required (> 13 gal./50 liters/h), the left pump is activated.
- Fuel level > 4 gals/15 liters to 15.8 gals/60 liters: When the tank is half-full, the left fuel pump is activated; if more fuel is required (> 13 gals/50 liters/h), the right pump is activated.
- Fuel level < 4 gals./15 liters: If the tank is relatively empty, both pumps run continuously.

Other switching functions include:

- If the ignition was switched off for more than 30 minutes, the left fuel pump is activated for approx. 1 to 2 seconds when the driver's door is first opened in order to build up fuel pressure even before the ignition is switched on.
- Both fuel pumps are activated while starting the engine and for several seconds after starting the engine.

Notes:

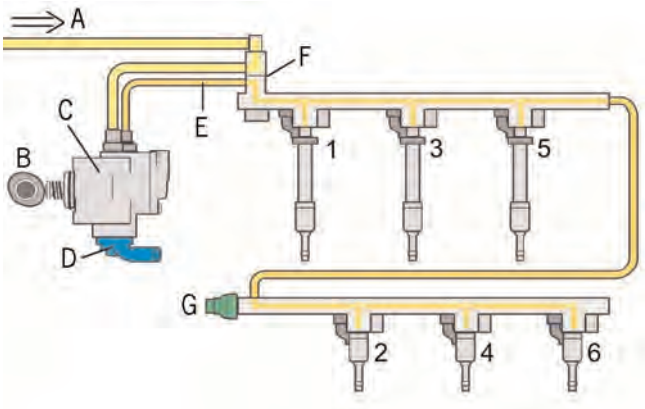
Fuel High Pressure System in DFI Engines

The fuel high pressure system generates an injection pressure of up to 1740 psi (120 bar) in the combustion chamber. The components of the V6 engine and the V8 engines are different.

The following pages describe the functions of the components of the V6 DFI engine first, and then those of the V8 DFI engines.

V6 DFI Engine

The fuel high pressure system in the V6 DFI engine is made up of the following parts/components.

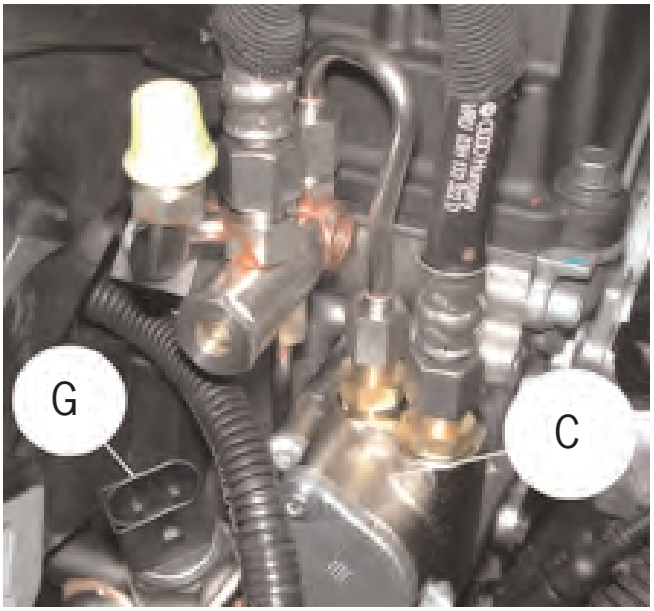


A - Low pressure (approx. 80 psi/5.5 bar from the fuel tank)
B - Camshaft
C - Fuel high pressure pump
D - Flow control valve (for fuel high pressure)
E - High pressure line
F - Pressure control valve (max. 1740 psi/120 bar)
G - Fuel pressure sensor
1, 3, 5 - Fuel injectors on high pressure rail, bank 1
2, 4, 6 - Fuel injectors on high pressure rail, bank 2

Notes:

Fuel High Pressure Pump

The fuel high pressure pump creates a high pressure of up to 1740 psi (120 bar), which is required for injection. It is controlled by demand and adapts the fuel quantity according to engine requirements via a flow control valve. This piston pump with one piston is located on the cylinder head. The high pressure pump is driven by the timing chain via a double-cam gear wheel. The double-cam gear wheel uses a roller to actuate the pump piston, which creates the fuel high pressure in the pump.



C - Fuel high pressure pump with flow control valve
G - DS Fuel pressure sensor

Note!

Pressure variations can occur on the low pressure side while measuring fuel pressure at idling speed due to the piston pump on the high pressure side with one piston.

Technical Manual

Always read and observe the specifications in the Technical Manual when securing all fuel lines in the high pressure area.

Flow Control Valve For Fuel High Pressure

The control valve for fuel high pressure located underneath the fuel high pressure pump operates as a flow control valve. The Motronic control unit maintains the fuel high pressure going to the fuel rails of cylinder bank 1 and 2 at a pressure of between 508 psi (35 bar) and 1450 psi (100 bar) via the control valve. If the control valve fails, the Motronic control unit goes into emergency operation, whereby the engine can still run in a limited way with low pressure (80 psi/5.5 bar).

Fuel Pressure Sensor

The fuel pressure sensor is installed on the lower fuel rail (cylinder bank 2) and informs the Motronic control unit about the current pressure in the fuel high pressure system. The Motronic control unit evaluates the signal and regulates the fuel high pressure via the fuel pressure control valve in the high pressure pump. If the fuel pressure sensor fails, the fuel pressure control valve is activated with a fixed value by the engine control unit.

Pressure Control Valve

The pressure control valve is located on the fuel rail of cylinder bank 1. The valve opens a connection to the fuel low pressure system if the fuel pressure in the high pressure system exceeds 1740 psi (120 bar).

Two High Pressure Rails



Two high pressure rails are used in the V6 engine. The fuel is pumped from the high pressure pump to the two distribution rails on cylinder bank 1 and 2 via the high pressure line. The same fuel pressure is available for all fuel injectors from there.

Fuel Injectors/High Pressure Injectors

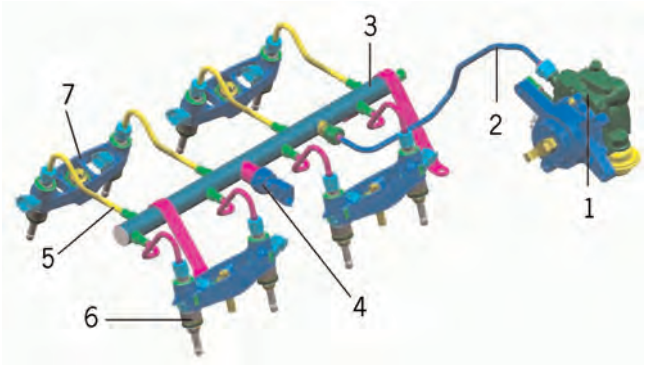


The electromagnetically operated fuel injectors are located in the cylinder head. They are activated by the Motronic control unit in accordance with the firing order. Following activation, they inject fuel directly into the combustion chamber at a pressure of 580 psi (40 bar) to 1740 (120 bar). The injectors for both cylinder banks are on the intake side of the cylinder head. This arrangement allows the injectors for cylinders 1, 3 and 5 to run through the inlet port on the cylinder head. The injectors for cylinder bank 1 are therefore longer than the injectors for cylinder bank 2.

Since the injectors are inserted from the same side for both cylinder banks, the piston recesses of cylinder bank 1 and 2 must be molded differently so that the injected fuel is whirled around and mixed perfectly with the air that is drawn in. This is necessary because the fuel injectors and intake valves on both cylinder banks are arranged in different angles.

In addition to the amount of fuel injected and the injection time, the shape and alignment of the fuel jet is also important here. A defective injector is detected by the misfire detection system and is not activated again.

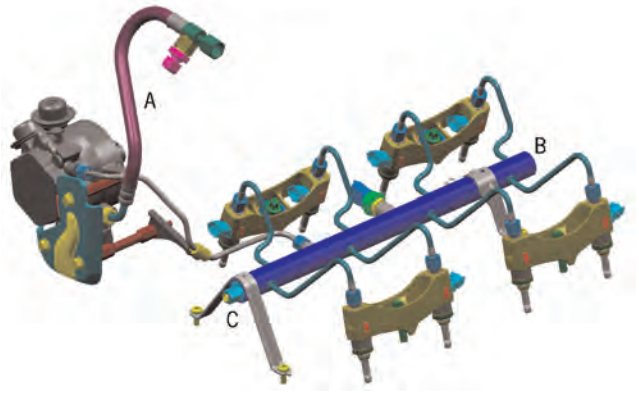
Fuel High Pressure System in V8 DFI Engines



The fuel high pressure system in V8 DFI engines is made up of the these parts/components.

1 - Fuel high pressure pump with flow control valve, pressure control valve and temperature compensator
2 - High pressure line
3 - Fuel rail
4 - Fuel pressure sensor
5 - Fuel line (for fuel injector on cylinder 1)
6 - Fuel injector (cylinder 5)
7 - Retainers for two fuel injectors

Fuel Temperature Sensor (on low pressure side)



A - Low pressure fuel line
B - Fuel rail
C - Test port

At start of production, all Cayenne V8 engines have a fuel temperature sensor on the low pressure side, which will be replaced by a temperature model in the DME in later production. Depending on the amount of fuel required and the fuel temperature, the DME control unit, together with the flow control valve, regulates the amount of fuel on the high pressure side upstream of the high pressure injectors.

Fuel High Pressure Pump

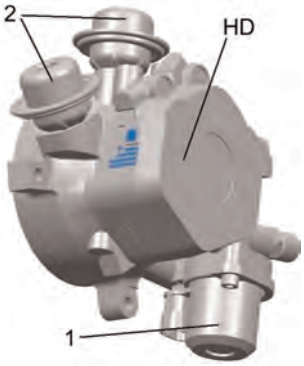
The fuel high pressure pump pumps the amount of fuel required for injection and builds up a fuel pressure of up to 1740 psi (120 bar). The axial piston pump is driven by the inlet camshaft. The Cayenne S and Cayenne Turbo are equipped with different high pressure pumps.

Cayenne V8 Naturally Aspirated Engine

The high pressure pump used in the Cayenne S is a three-piston pump with a maximum delivery rate of approx. 47.5 gals./180 liters/h at 1740 psi (120 bar). It builds up pressure and ensures flow control. The following components are integrated into the high pressure pump: Flow control valve with pressure reducing function for the fuel high pressure side, pressure control valve, bypass valve, a temperature compensator on the oil side and a fuel strainer on the inlet side with a mesh width of approx. 50 µm. Fuel is distributed via a central high pressure rail with separate lines leading to the fuel injectors.

Cayenne Turbo

The high pressure pump **-HD-** used in the Cayenne Turbo is a six-piston pump with a maximum delivery rate of approx. 58 gals./245 liters/h at 1740 psi (120 bar). It builds up pressure and ensures flow control.



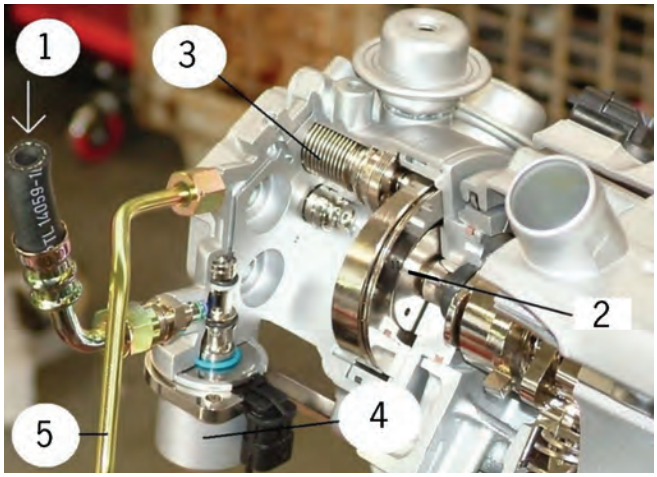
The following components are integrated into the high pressure pump:

Flow control valve **-1-** with pressure reducing function for the fuel high pressure side, pressure control valve, bypass valve, two temperature compensators on the oil side **-2-** and a fuel strainer on the inlet side with a mesh width of approx. 50 µm. Fuel is distributed in the same way as for the V8 naturally aspirated engine via a central high pressure rail with separate lines leading to the fuel injectors.

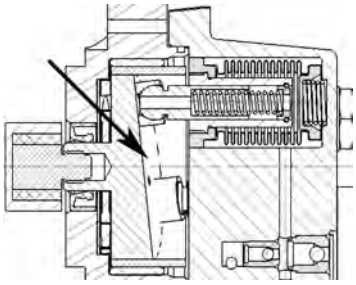
Flow Control Valve For Fuel High Pressure

The electric control valve for the fuel high pressure side **-1-** is located on the fuel high pressure pump and operates as a flow control valve. The Motronic control unit regulates the delivery rate of the high pressure pump in the fuel supply to the pump via the control valve. When the engine is switched off, the fuel high pressure is reduced by an integrated pressure reducing valve. The fuel pressure sensor monitors the required fuel pressure (approx. 580 psi/40 to 1740psi/120 bar).

- If the control valve fails, the Motronic control unit goes into emergency operation, whereby the engine can still run in a limited way with low pressure (80 psi/5.5 bar). In this case, the bypass valve in the pump opens and provides a direct route from the low pressure side to the high pressure side.
- The bypass valve is also activated for filling the empty fuel rail on new engines or following repairs in order to reduce starting times.

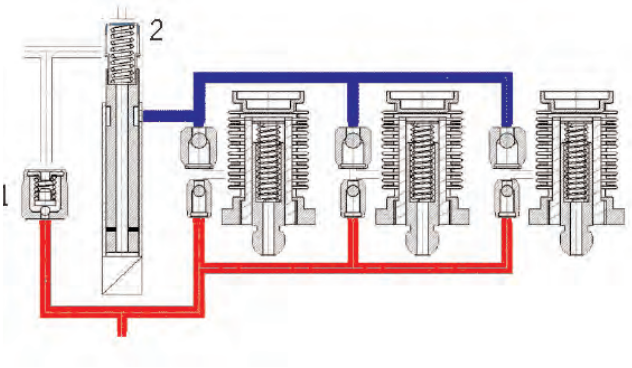


1 - Low pressure (approx. 80 psi/5.5 bar from the fuel tank)
2 - Wobble plate
3 - Fuel high pressure pump
4 - Flow control valve (for fuel high pressure)
5 - High pressure line to fuel rail



Arrow in illustration is wobble plate.

Bypass Valve (including pressure relief valve)



1 - Bypass valve, including pressure relief valve
2 - Volume control valve
Blue - Low pressure inlet from the in-tank fuel pump
Red - High pressure to the injectors

Pressure Control Valve

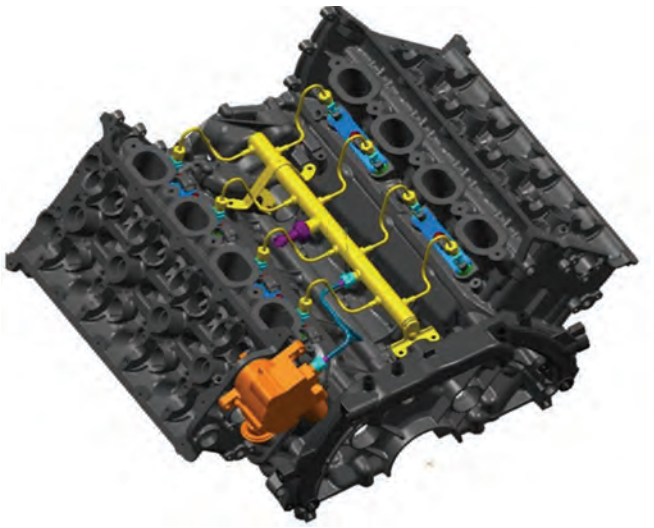
The pressure control valve is integrated into the fuel high pressure pump. This safety valve opens a connection to the fuel low pressure system if the fuel pressure in the high pressure system exceeds approx. 2030 psi (140 bar).

High Pressure Line

The high pressure line connects the high pressure pump to the fuel rail.

Notes:

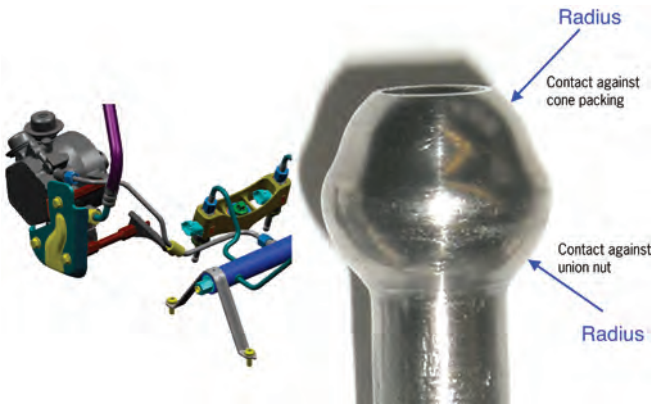
Central High Pressure Rail



The central high pressure rail in V8 engines is located in the engine's inner V. From here, the fuel is supplied via individual lines to the fuel injectors for cylinders 1 to 8. The high pressure rail provides the same pressure for all injectors. The volume of the high pressure rail is adapted according to the amount of fuel the engine needs (V8 naturally aspirated engine 100 cm^3, V8 Turbo 150 cm^3).

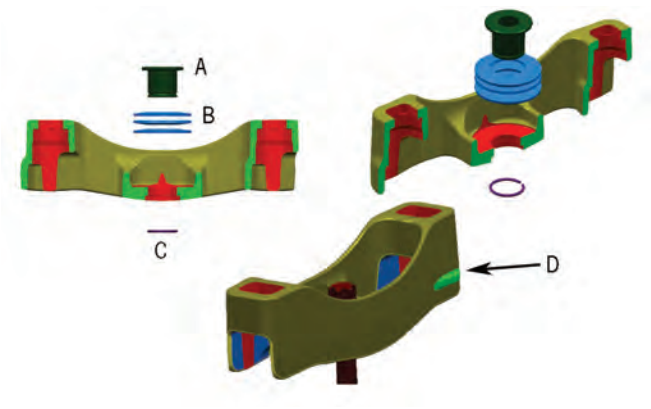
- The rail volume is determined by the required pressure variation behavior and the shortness of the starting time.

High Pressure Fuel Line



Sealing contact area of the high pressure fuel lines.

Fuel Injector Retainer Components



A - Buffer
B - Disc spring
C - Lock washer
D - Rib to prevent in correct assembly

Fuel Pressure Sensor

The fuel pressure sensor is installed on the central high pressure rail under the intake system and informs the Motronic control unit about the current pressure in the fuel high pressure system. The Motronic control unit evaluates the signal and regulates the fuel pressure on the high pressure side via the flow control valve.

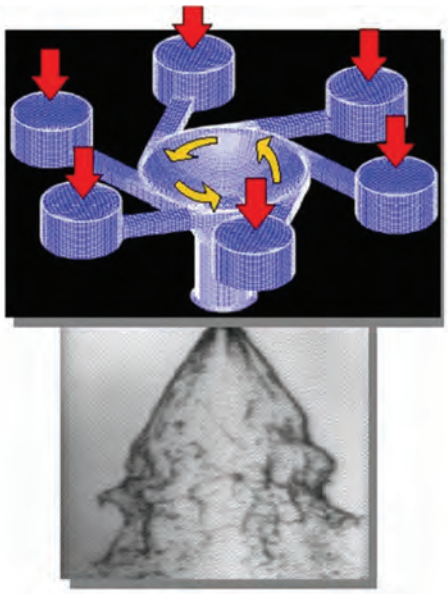
Notes:

Fuel Injectors/High Pressure Injectors



The electromagnetically operated fuel injectors are on the intake side of the cylinder head. They are activated by the DME control unit in accordance with the firing order. Following activation, they inject fuel directly into the combustion chamber at a pressure of 580 psi (40 bar) to 1740 psi (120 bar). During this process, a vortex is created even before the fuel emerges at the valve tip.

The Cayenne S and Cayenne Turbo are equipped with different injectors, designed specifically to suit the engine's fuel requirements. The injectors can be differentiated by their part numbers and a color marking. The piston recesses in the V8 naturally aspirated engine and the V8 Turbo are also different so that the injected fuel can be whirled around and mixed perfectly with the air that is drawn in.



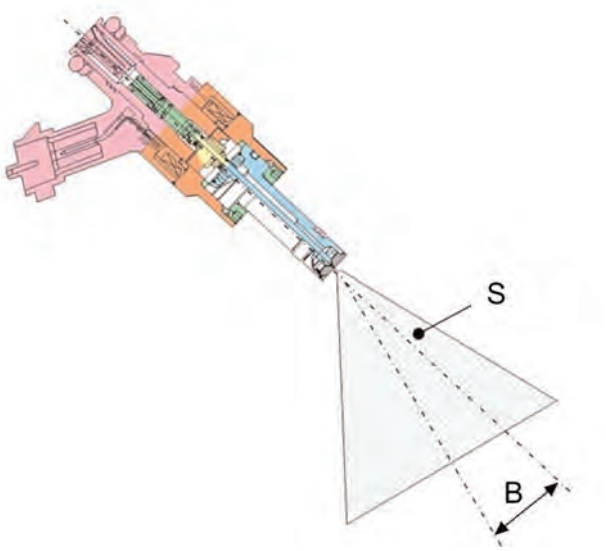
Fuel Injectors -V8 Naturally Aspirated Engine

At a fuel pressure of 580 psi (40 bar) and an injection time of 0.6 ms, the amount of fuel injected is approx. 5.5 mg/stroke. While at a fuel pressure of 1740 psi (120 bar) and an injection time of 5.8 ms, the amount of fuel injected is approx. 67 mg/stroke.

Fuel Injectors -V8 Turbo

At a fuel pressure of 580 psi (40 bar) and an injection time of 0.6 ms, the amount of fuel injected is approx. 7.8 mg/stroke. While at a fuel pressure of 1740 psi (120 bar) and an injection time of 6.1 ms, the amount of fuel injected is approx. 107 mg/stroke.

In addition to the amount of fuel injected and the injection time, the shape and alignment of the fuel jet is also important.

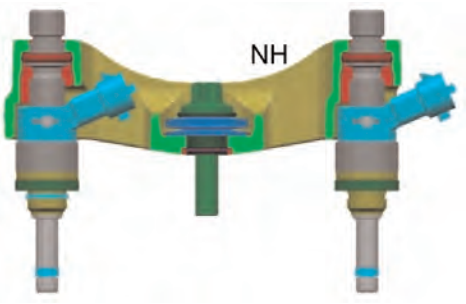


S - Spray angle (taper angle of the fuel jet, approx. 69° on the naturally aspirated engine, 68° on the turbo engine).

B - Bend angle (distance between the injection jet and the axis of the fuel injector; approx. 8.5° on the naturally aspirated engine, approx. 7.5° on the turbo engine).

Notes:

Retainers For Fuel Injectors



The four retainers **-NH-** for the two injectors ensure the following:

- Installation as a pre-assembled unit with injectors installed.
- Twist-lock protection for screwing on fuel lines.
- Exact installation position for aligning the fuel jet in the combustion chamber.
- Correct pretensioning of the fuel injectors in the cylinder head.
- Vibration damper for reducing the transmission of vibrations from the cylinder head to the injectors.

Notes:

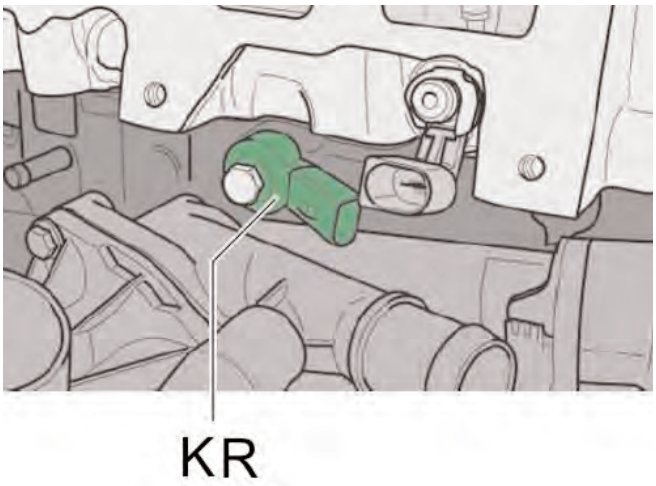
Ignition System

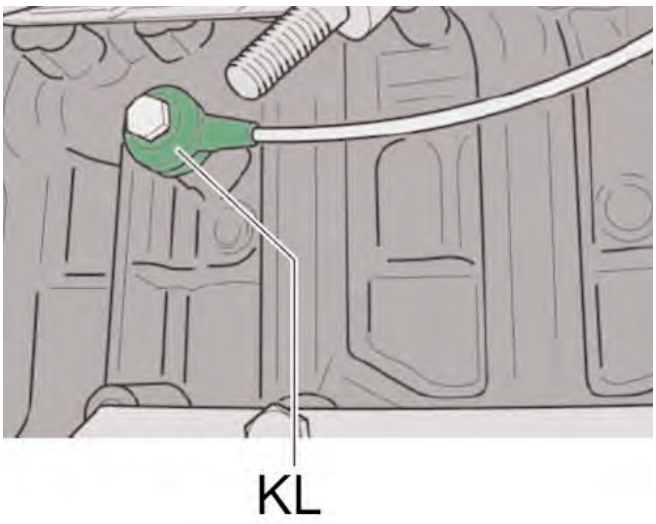
General

The ignition systems used in the V6 and V8 engines largely correspond to the systems used in previous engines. The ignition system map in the DME control unit has been designed to meet DFI specific requirements.

V6 DFI Engine

Knock Sensors





One knock sensor is bolted to the crankcase on the left **-KL-** and another on the right **-KR-**. They detect knocking in individual cylinders. To prevent knocking, the cylinder selective knock control system monitors the electronic ignition timing control system. Based on the signals from the knock sensors, the DME control unit adjusts the ignition timing angle for the knocking cylinder until the knocking stops.

If a knock sensor fails, the ignition timing angles of the affected cylinder group (1-3-5 or 2-4-6) are retarded. This means that a safety ignition timing angle is set to “late”. Knock control for the cylinder group of the remaining, intact knock sensors is unaffected. If both knock sensors fail, the DME control unit goes into knock control emergency operation during which the ignition timing angles are generally retarded, thereby reducing engine power considerably and increasing fuel consumption.

Ignition Coils – V6

The V6 engine still has static high-voltage ignition distribution with individual ignition coils directly on the spark plugs. The DME control unit activates the individual ignition coils individually in the firing order 1-5-3-6-2-4 for each cylinder. The individual ignition coils in the Cayenne V6 have an integrated output final stage, but unlike the Cayenne V8 engines, the diagnostic function is integrated in the Motronic control unit. If an ignition coil fails, fuel injection for the affected cylinder is deactivated. This can happen on up to two cylinders.

Spark Plugs

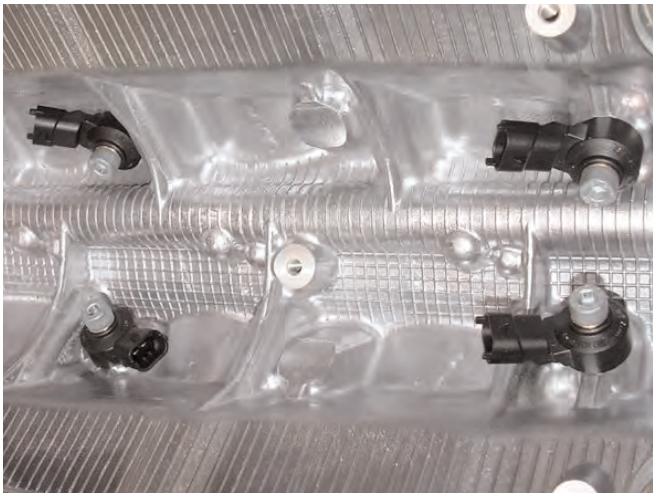
The V6 engine has air gap spark plugs with one ground electrode, which must be changed every 36,000 miles (60,000 km) or after 4 years according to the Technical Manual.

Note!

Spark plug replacement intervals have changed for M.Y. 2008 when compared to the 2003-2006 Cayenne models.

V8 DFI Engines

Knock Sensors



All V8 DFI engines have four knock sensors arranged in the V of the engine block. These four knock sensors are required for exact knock detection in V8 DFI engines since stronger vibrations are transmitted to the cylinder head via the fuel injectors during high pressure fuel injection.

Notes:

Ignition Coils



The Cayenne has static high-voltage ignition distribution with individual ignition coils attached directly to the spark plugs. The newly enhanced ignition coils in V8 DFI engines work according to the same principle as previous V8 ignition coils.

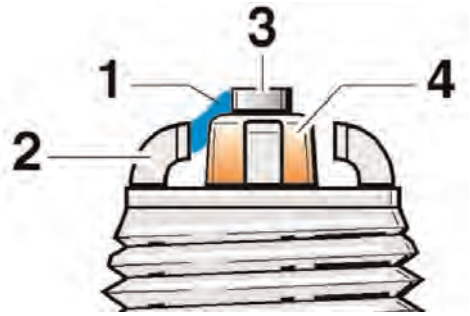
This system offers the following advantages:

- High level of ignition safety.
- Minimum electromagnetic interference with other electronic components.
- No requirement for ignition cables and distributor ignition.

The DME control unit activates the individual ignition coils individually in the firing order 1-3-7-2-6-5-4-8 for each cylinder. Safer ignition processes and therefore optimized power, together with minimized emissions and fuel consumption are obtained as a result of the measures and advantages described. All parts in this enhanced component are installed as a complete unit in a special rod ignition module housing. This is connected electrically and mechanically to the spark plug in the spark plug recess via the short high-voltage plug. The component is also secured mechanically using bolts. The ignition coil is sealed at the four-pin plug and in the spark plug recess to protect it from spray water.

Cayenne S Spark Plugs

The V8 naturally aspirated engine has nickelyttrium spark plugs with four ground electrodes, which must be changed every 36,000 miles (60,000 km) or after 4 years according to the Technical Manual.



Structure of the surface gap spark plug in the Cayenne S:
1 - Surface gap
2 - Ground electrode
3 - Center electrode
4 - Insulator Cayenne Turbo spark plugs

The four ground electrodes are arranged around the ceramic insulator in these surface gap spark plugs. The sparks **-1-** cross the surface of the insulator **-4-** and arc across a small gas gap to the ground electrode **-2-**, which improves the ignition properties. The main advantage of the surface gap spark plugs is the self cleaning effect of the insulator foot tip, since any shunts that occur between the center electrode and the ground electrode through the surface gaps, in particular during a cold start, are eliminated.

Cayenne Turbo Spark Plugs

The V8 turbo engine has air gap spark plugs with one double-platinum ground electrode, which must be changed every 24,000 miles (40,000 km) or after 4 years according to the Technical Manual.

Note!

Spark plug replacement intervals have changed for M.Y. 2008 when compared to the 2003-2006 Cayenne models.

Intake Air Side, Air Routing

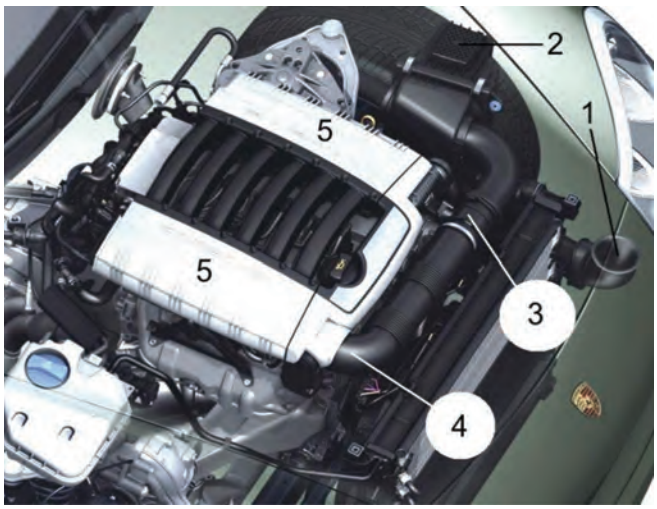
General

The intake systems in all new Cayenne models have been redesigned for direct fuel injection (DFI) in order to achieve a high torque curve. The air cleaner elements must be changed every 72,000 miles (120,000 km) or after 4 years according to the Technical Manual.

Note!

Air filter replacement intervals have changed for M.Y. 2008 when compared to the 2003-2006 Cayenne models.

Cayenne V6 Intake System



1 - Air intake behind the left headlight
2 - Air filter housing (with sound opening)
3 - Pipe mass air flow sensor
4 - To electronic throttle
5 - Intake system

The illustration shows the intake system, from the air intake behind the left headlight, the air filter housing with sound opening and the pipe mass air flow sensor to the electronic throttle.

The redesigned intake manifold charging system offers considerably improved filling for the V6 engine. This has resulted not only in an optimal torque curve, but has also improved performance.

Long Intake Manifold For High Torque



1 - Electronic throttle
2 - Torque accumulator
3 - Power accumulator
4 - Electropneumatic shift valve
5 - Vacuum unit
6 - Operating sleeves (sealed)

The operating sleeves in the intake system move into torque position when the engine is started and until an engine rpm of 4200 is reached and this is apparent from the repositioning of the operating sleeves (in direction of travel at the left front of the intake manifold). The vacuum unit pulls the lever to the left (in direction of travel). The operating sleeve seals the reflection point to the power accumulator, which renders the reflection point to the torque accumulator effective. The effective intake manifold length is approx. 610 mm in torque position.

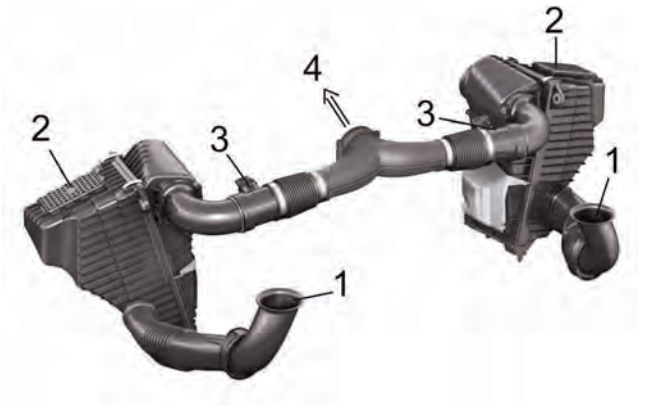
Notes:

Short Intake Manifold For High Power



If the engine rpm exceeds 4200, the power position is activated by opening the operating sleeves. The vacuum unit then presses the lever to the right (in direction of travel). The operating sleeve opens the reflection point to the power accumulator, which renders the short intake manifold effective with a length of approx. 235 mm. If activation does not occur, the system remains in power position.

Cayenne S Intake System



1 - Air intakes behind the left and right headlights
2 - Left and right air filter housings (with sound opening)
3 - Left and right pipe mass airflow sensors
4 - To electronic throttle 2

The illustration shows the intake system, from the air intakes behind the left and right headlights, the air filter housings with sound opening and the two pipe mass air flow sensors to the electronic throttle.

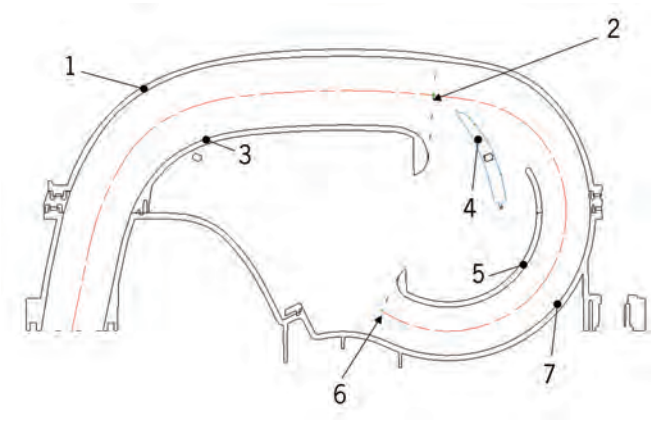
Variable Intake System



1 - Electronic throttle
2 - Variable intake system
3 - Diaphragm cell for switching flaps
4 - Connecting link
5 - Shaft for switching flap for cylinder bank 1
6 - Shaft for switching flap for cylinder bank 2

A new feature of the Cayenne S variable intake system is that intake manifolds of different lengths can be used due to a switching mechanism within the intake system. The variable intake system combines the advantage of long intake manifolds (for high torque in the lower rpm range) with short intake manifolds (for high specific power in the upper rpm range). A high torque curve is achieved, depending on the position of the intake manifold switching flap in conjunction with the optimized intake duct geometry.

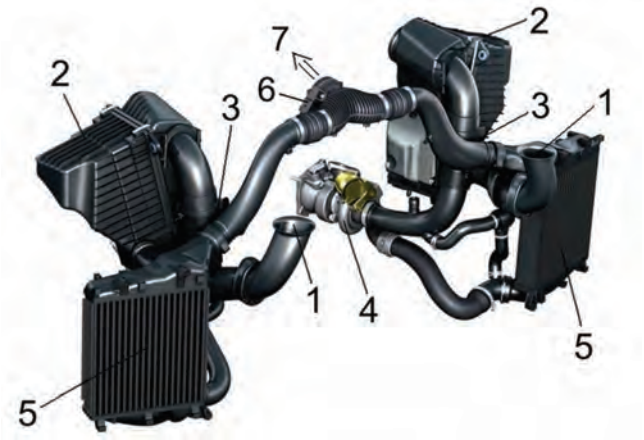
The DME control unit activates an electropneumatic shift valve, which switches a vacuum to the diaphragm cell. The switching flaps for cylinder bank 1 and 2 are actuated synchronously via a connecting link. In the torque setting up to approx. 4150 rpm, the long intake manifold is effective with a length of approx. 538 mm, while in the power setting, at an engine speed of more than approx. 4150 rpm, the short intake manifold is effective with a length of approx. 284 mm. If the electropneumatic shift valve is not activated, the variable intake manifold remains in power position.



1 - Upper shell
2 - Effective pipe length at power position (284.2 mm)
3 - Middle shell
4 - Sealed plastic flaps on a steel shaft
5 - Inlay
6 - Effective pipe length at torque position (538 mm)
7 - Lower shell

The variable intake system is made of a shell shaped fiber reinforced polyamide. A total of five plastic shells are welded together here. Four switching flaps are installed on a steel shaft for each bank and are coated with silicon for a reliable seal. The weight of the intake system in the 4.8 l naturally aspirated engine compared to the 4.5 l engine is reduced by approx. 10.5 oz (0.3 kg) despite the integration of the switching flaps for the variable intake manifold system.

Cayenne Turbo Intake System



1 - Air intakes behind the headlights
2 - Left and right air filter housings
3 - Leftand right pipe mass airflow sensors
4 - Left turbo (right turbo is behind the charge air cooler)
5 - Left and right charge air cooler
6 - Pressure sensor with temperature sensor
7 - To electronic throttle

The illustration shows the intake system, from the air intakes behind the left and right headlights, the air filter housings, the two pipe mass air flow sensors, the turbocharger and the charge air cooler to the electronic throttle. A sensor in front of the electronic throttle records the boost pressure and air temperature.

Turbo Pressure System



The pressure system in the new Cayenne Turbo is manufactured in a plastic shell design like the variable intake system in the Cayenne S. The pressure system comprises three shell elements, where the bottom shell is identical to the variable intake system. It is also made of plastic, for example, to ensure a low weight. Unlike the V8 naturally aspirated engine, the switching flaps are not required since the charge effect is produced by the two turbochargers. As a result, the low-loss short intake manifold lengths are effective for the entire map. The weight of the pressure system in the 4.8 l turbo engine compared to the 4.5 l engine is reduced by approx. 3.3 lbs. (1.5 kg).

Notes:

Positive Crankcase Ventilation – Cayenne Turbo

With the enhanced positive crankcase ventilation system, it was possible to reduce the amount of fuel produced during combustion and entering the engine oil through the combustion gases, which pass the piston rings and penetrate the crankcase (blow-by gases). The enhanced aeration and ventilation system (Positive Crankcase Ventilation - PCV) now ventilates the crankcase with a steady stream of fresh air, which accelerates the evaporation of fuel that is carried in. For this purpose, fresh air is removed between the charge air cooler and throttle valve and is delivered to the crank chamber via a line.

The pressure that exists at any time between the removal position and the crankcase causes a steady flow of fresh air through the crankcase in all map points. To ensure sufficient vacuum in the crankcase in all map points, the vacuum in the intake manifold is used in the partial load ranges. A pressure regulating valve regulates this vacuum until the required value is reached. In the operating range with accumulated boost pressure (full load) in which there is no vacuum in the intake manifold, the vacuum upstream of the compressor is used.

To prevent the PCV system from freezing during the winter, the blow-by gases on both naturally aspirated and turbo engines are supplied to the combustion air through a heated adapter.

Notes:

Exhaust System, Emission Control

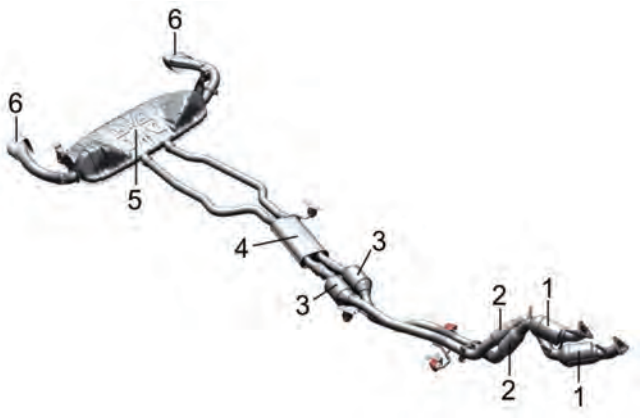
General

The exhaust systems in all new Cayenne models have been redesigned for direct fuel injection (DFI) in order to achieve maximum performance with minimum emissions.

All exhaust systems include the following:

- Two pre-catalytic converters.
- Two main catalytic converters.
- Two oxygen sensors (LSU) in front of the catalytic converters.
- Two oxygen sensors (LSF) behind the catalytic converters.
- Exhaust standard EU4 and LEV2 (USA emission standards).

Cayenne V6 Exhaust System



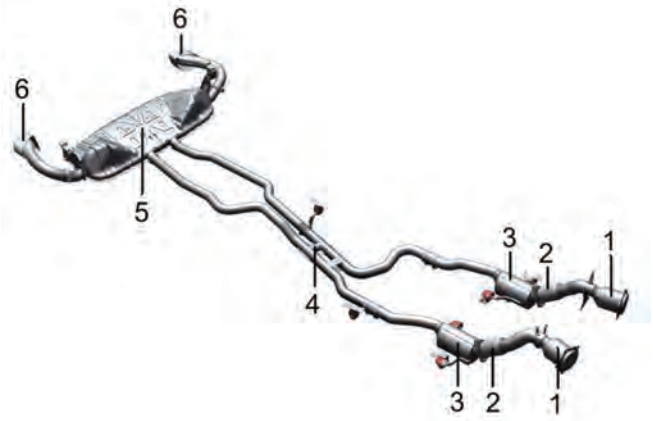
1 - Pre-catalytic converters (metal substrate)
2 - Decoupling elements
3 - Main catalytic converters (ceramic substrate)
4 - Front muffler with crossover pipe
5 - Main exhaust muffler
6 - Exhaust tailpipes with trim

The exhaust system has two pre-catalytic converters and new in the V6 engine, two main catalytic converters as well as a crossover pipe between the two exhaust tracts. The pre-catalytic converters installed in USA vehicles are different to those used in RoW vehicles.

The exhaust quality is monitored by two oxygen sensors (LSU) in front of the pre-catalytic converters and two oxygen sensors (LSF) behind the pre-catalytic converters. In addition, the V6 exhaust system as far as the rear

muffler has been designed as a dual flow system. This improves the gas cycle by reducing the exhaust back pressure and ensuring better matching of the gas oscillations in the exhaust system. Behind the two main catalytic converters, there is a crossover pipe in the front muffler that connects the exhaust tracts. As a result, the torque curve is positively influenced at the lower end of the rpm range by an improved gas cycle.

Cayenne S Exhaust System

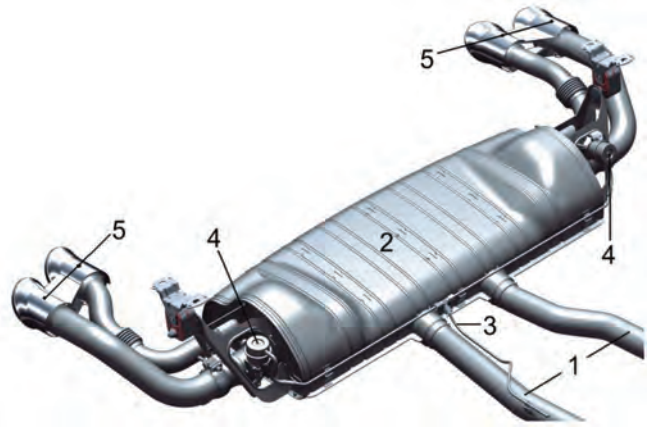


1 - Pre-catalytic converters (ceramic substrate)
2 - Decoupling elements
3 - Main catalytic converters (metal substrate)
4 - Crossover pipe
5 - Muffler
6 - Exhaust tailpipes with trim

The new Cayenne S features an enhanced exhaust system. To keep emissions to a minimum, it is important that the catalytic converter reaches its optimal operating temperature quickly. To achieve this, the exhaust manifolds in all Cayenne models are short in order to use the high exhaust emissions temperature to heat the catalytic converters.

The modified pipe guide on the exhaust manifold has also resulted in a significantly improved torque. The redesigned connection of the exhaust tracts to shorter, air gap insulated exhaust manifolds means that the catalytic converter heats up faster due to the reduced thermal mass. The weight of the entire system has also been reduced by other measures, e.g. the use of new pre-catalytic converters and pipes with thin walls.

Cayenne S Sports Exhaust System (Optional only for Tiptronic S)



1 - Dual flow exhaust system
2 - Sports exhaust system muffler
3 - Vacuum line for activation
4 - Diaphragm cell for switching
5 - Two tailpipes at the left and right with twin tailpipe trim

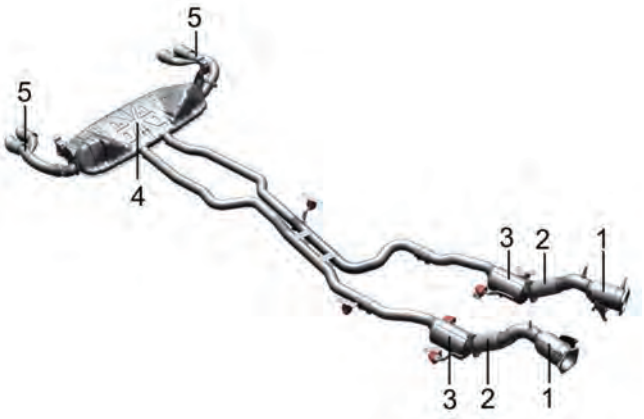
A sports exhaust system is offered for the first time for the new Cayenne S. The sports exhaust system is activated using the standard Sport button. The sound of the sports exhaust system is controlled while taking the load, speed, engine rpm and gear into account. Like the standard exhaust system up to the muffler, the sports exhaust system has two pre-catalytic converters and two main catalytic converters, the two exhaust tracts of which are linked together via a crossover pipe after the main catalytic converters.

The modified muffler in the sports exhaust system produces an sportier V8 sound. The design of the tailpipes resembles the standard dual tailpipes used on the new Cayenne Turbo. However, a connecting web gives them a unique look reserved exclusively for the Cayenne S with sports exhaust system.

Note!

Water fording depth is reduced when the sports exhaust system is installed. Consult vehicle owner's manual for specifics.

Cayenne Turbo Exhaust System



1 - Pre-catalytic converters (metal substrate)
2 - Decoupling elements
3 - Main catalytic converters (metal substrate)
4 - Muffler
5 - Tailpipe at the left and right with twin tailpipe trim

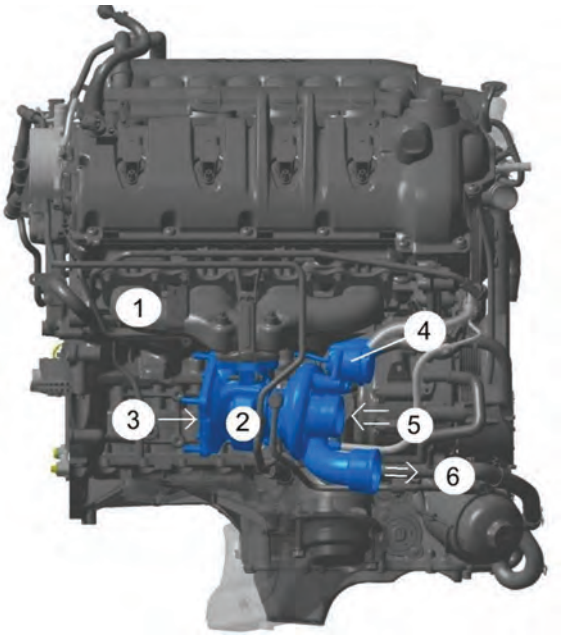
Compared to the previous model, this exhaust system has been designed specifically to suit the new DFI engine in the Cayenne Turbo.

Exhaust Manifold



This illustration shows the internal design of the Cayenne Turbo exhaust manifold. The internal design of the double-wall, air gap insulated exhaust manifold has been further enhanced compared to the 4.5 liter engine.

Turbocharger

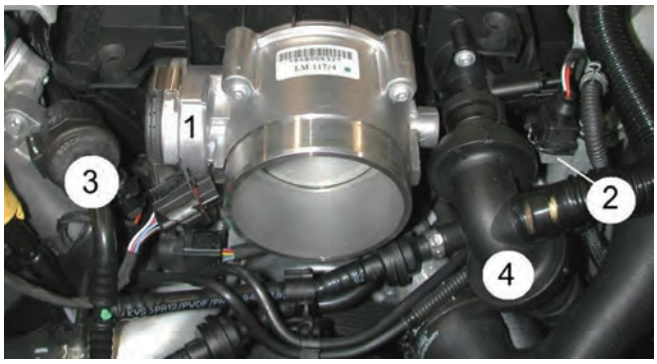


1 - Exhaust manifold
2 - Exhaust turbine
3 - Flange to pre-catalytic converter
4 - Pressure unit for boost pressure control through the bypass valve (wastegate)
5 - Intakeside (from air filter)
6 - Pressure side (to charge air cooler, electronic throttle)

The two turbochargers are arranged in parallel. A low intake manifold volume, short exhaust manifold and a redesigned turbocharger that has been adapted to suit the air consumption of the 4.8 liter DFI engine ensure a good response. A new larger radial turbine is used here compared to the previous 4.5 liter turbo engine. The illustration shows the water cooled turbocharger for the right cylinder bank with the pressure unit for boost pressure control as well as the lubricating oil supply and suction lines.

Notes:

Boost Pressure Control



1 - Electronic throttle
2 - Cycle valve for boost pressure control
3 - Tank vent valve
4 - Positive crankcase ventilation



The pressure sensor in front of the throttle valve reports the boost pressure to the DME control unit. Depending on the current required and actual boost pressure, the DME control unit activates the cycle valve for boost pressure control according to a pulse/duty factor. This modulates a control pressure, which adjusts the bypass valves (**-W-** wastegate) on the turbochargers via the pressure units for boost pressure control in order to regulate the boost pressure.

Other Functions Of The DME Control Unit

VarioCam Plus Control on V8 DFI Engines

VarioCam Plus technology is used for the first time in V8 engines in the Cayenne model range. This system, which may be familiar to you from the current sports car generation, enables intake valve lift switching in addition to intake camshaft adjustment. This ensures optimum running quality, low fuel consumption and low emissions as well as high power and torque ratings in conjunction with the intake system.

Variable Oil Pump on V8 Engines

The DME control unit is responsible for the demand controlled operation of the variable oil pump, while adjustment is performed hydraulically. Engine management uses the input values for engine speed, temperature and torque. Based on this information, the engaged gear wheel width and therfore the geometric displacement volume of the gear wheel set is changed through the axial movement of a gear wheel (moved hydraulically) and this in turn changes the oil pressure. The pump ensures that only the pumping action required for the relevant load range of the engine is initated. This reduces the energy consumption of the oil pump to a minimum and also ensures demand controlled lubrication.

Control of Electric Radiator Fans

The DME control unit also activates the two drivers for the electric radiator fans in order to achieve infinitely adjustable control.

Notes:

Notes:



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Tiptronic Transmission	3
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Transfer Case	7
Rear Final Drive	8
Front Final Drive	8
Maintenance Sheets (1st Generation, See Section 0 for 2nd Generation Versions)	9

Notes:

General



When first introduced, the Cayenne S and Cayenne Turbo came equipped with the six speed Tiptronic transmission as standard equipment. As the first model year progressed, a six speed manual transmission became standard equipment on the Cayenne and Cayenne S.

These newly developed transmissions address specific off-road requirements, in particular:

- The transfer case is bolted directly to the manual or Tiptronic transmission.
- The electronic front-rear differential, which is standard on all models, distributes power variably to the front and rear axles, in a basic ratio of 38% to 62%
- An integral reduction gear in the transfer case is standard on all models.
- Power is transmitted from the transfer case over the front driveshaft to the front axle without a mechanical differential lock.
- An electronically controlled rear axle differential lock is included in the optional “Advanced Off-Road Equipment Package”.

Manual Transmission, G48.00/02/20/22

As standard equipment, the Cayenne and the Cayenne S are equipped with a 6-speed manual gearbox. The manual transmission for the Cayenne and Cayenne S only differ in the clutch bell housing to adapt the gearbox to the different engine flange.

The following features distinguish this transmission:

- Self-adjusting clutch
- Die-cast aluminum transmission case
- Three-shaft transmission
- Low shifting forces through cable gearshift
- Single/double/triple synchronization
- Porsche Drive-Off Assistant

Also as with the sports cars, the proven cable shift mechanism is used on the Cayenne. The manual transmission is characterized by low shift effort with short throws. This is the result of the triple-cone synchronizers in 1st, 2nd and 3rd gears, a dual-cone synchronizer in 4th gear and a single-cone synchronizer in 5th and 6th gear.

Dual-mass Flywheel/Clutch

The working cycles and firing order of the engine cause speed fluctuations resulting in irregularities which lead to torsional vibrations along the entire drive train. These torsional vibrations may cause all moveable, non-driven parts with play to rattle, chatter or bounce (sliding gearwheels, parts of the synchronization system). This may result in annoying transmission noise, especially at low engine speeds and high transmission oil temperatures.

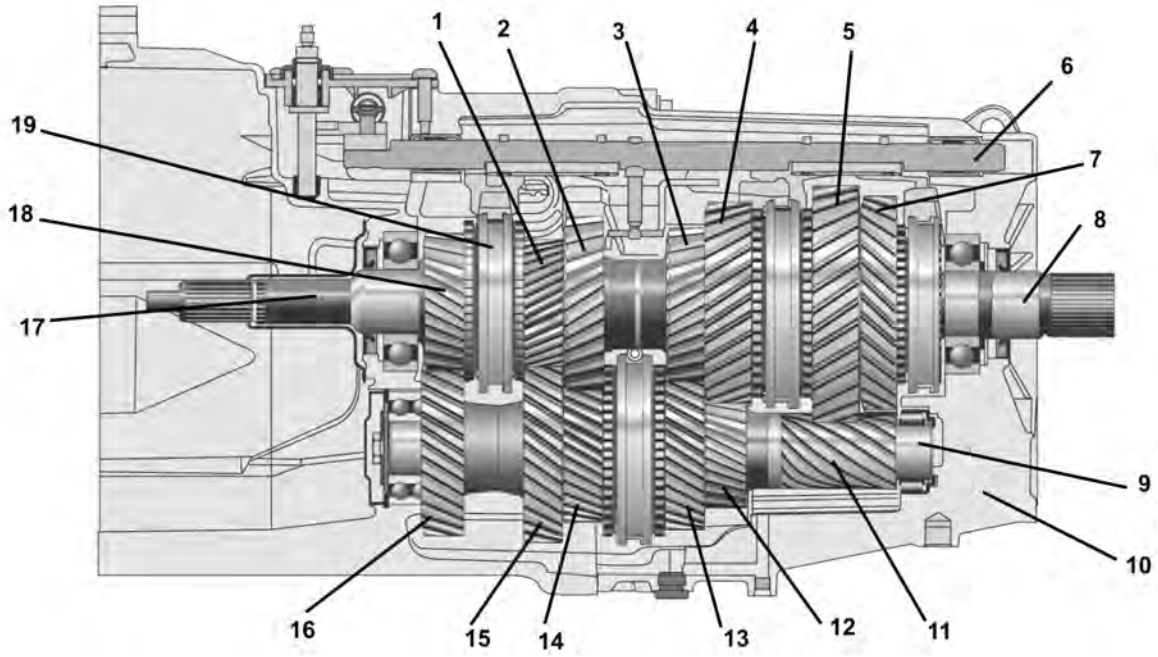
As with previous Porsche vehicles, the Cayenne has a dual-mass flywheel (DMF) to prevent these noises.

Clutch

To increase the service life of the clutch, the Cayenne is equipped with a self-adjusting system, whereby the clutch wear is compensated. Lining wear adversely affects the pedal properties and the pedal forces.

Additionally, the use of a self-adjusting system can greatly reduce the wear volume of the clutch linings.

Cross Section of Transmission

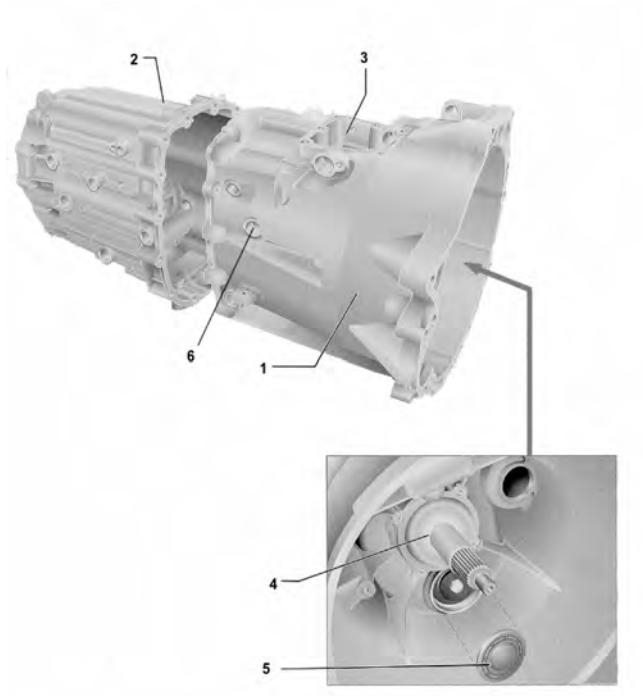


1 - Sliding gear, 6th gear
2 - Fixed gear, 3rd gear
3 - Fixed gear, 4th gear
4 - Sliding gear, 2nd gear
5 - Sliding gear, 1st gear
6 - Central selector shaft
7 - Fixed gear, 4th gear
8 - Sliding gear, 2nd gear
9 - Sliding gear, 1st gear mesh
10 - Central selector shaft
11 - Fixed gear 1/reverse gear
12 - Fixed gear, 2nd gear
13 - Sliding gear, 4th gear
14 - Sliding gear, 3rd gear
15 - Fixed gear, 6th gear
16 - Fixed gear, constant mesh
17 - Input shaft
18 - Input shaft gear, constant
19 - Sliding sleeve

The 6-speed manual transmission G48.00/02/20/22 is an in-line transmission with fully synchronized gears. It has an input shaft, a countershaft and an output shaft. All sliding gears have needle roller bearings and are positioned on the countershaft and output shaft. The 5th gear is directly connected. Gear shifting takes place through radial and axial movement of a central selector shaft with shift fingers, which engage in the respective selector forks.

Transmission Case

The transmission case is manufactured from die-cast aluminum and consists of two pieces, the clutch bell housing and the transmission rear section. The clutch bell housing flange is shaped differently depending on the engine type.



1 - Clutch bell housing
2 - Transmission rear section
3 - Mount for gearshift module
4 - Locating bearing
5 - Countershaft seal
6 - Mounts for bearing bolts for the selector forks

Note!

Do to changes in maintenance intervals between 1st and second generation Cayenne vehicles always refer the vehicle owner's manual for fluid capacities and the maintenance manual/sheets for exact maintenance intervals.

Tiptronic Transmission, A48.00/20/50/52

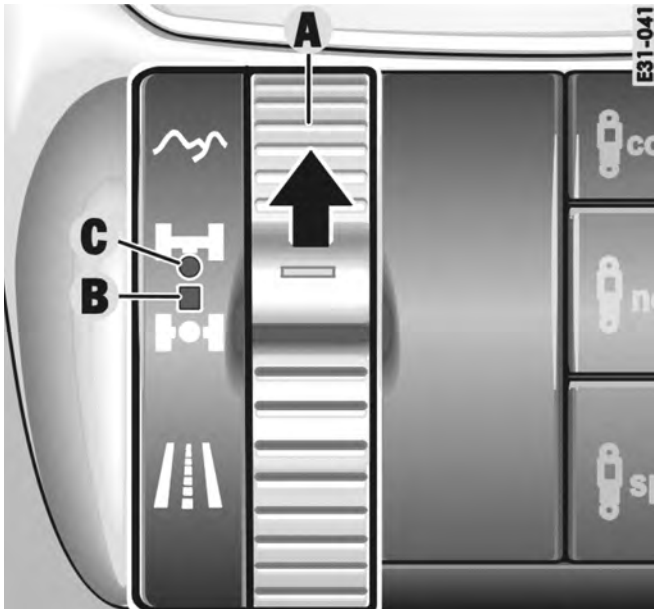
The Tiptronic with six speeds was developed to handle the high torque and power requirements.

Automatic six-speed transmission with Tiptronic functions.

Number of speeds:	6 forward, 1 reverse
Total weight: approx.	220 lb (100 kg) with converter and fluid

Notes:

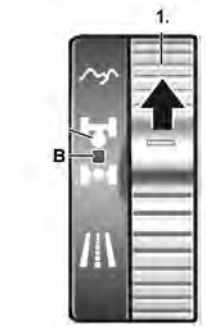
Operation of Off-Road Function



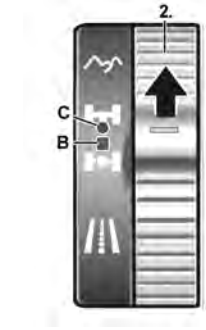
The toggle switch (A) located on the center console has a multi-stage function. Tapping it forward makes the vehicle one step more suitable for off-road operation each time. Tapping it to the rear makes it one step more suitable for road use. If the toggle switch (A) is moved from High Range (on-road operation) once in the direction of the arrow, it shifts into Low Range (off-road operation). All gears move into a low ratio of i = 2.69 and the display (B) on the toggle switch illuminates. Pushing it again in the direction of the arrow causes the center differential to engage 100%. There is no speed differential between the front and rear axles. The displays (B and C) illuminate. Pushing it further in the direction of the arrow causes the rear differential to engage 100%. There is no longer a speed differential between the two rear wheels either. The displays (B, C and D) illuminate.

Note!

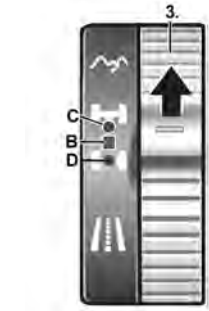
Shifting from High Range into Low Range or from Low Range into High Range must only be carried out with the vehicle stationary, the brake applied and the selector lever in position "N."



1. Selecting low range.



2. Selecting low range, plus front-rear differential lock.



3. Selecting low range, plus front-rear differential lock, and rear axle differential lock.

Shift On The Fly

In model year 2005, "Shift On The Fly" is available in all Cayenne models equipped with the Tiptronic S transmission.

This feature allows the transfer case gear selection to be activated or deactivated while the vehicle is moving.

The limit speeds are as follows:

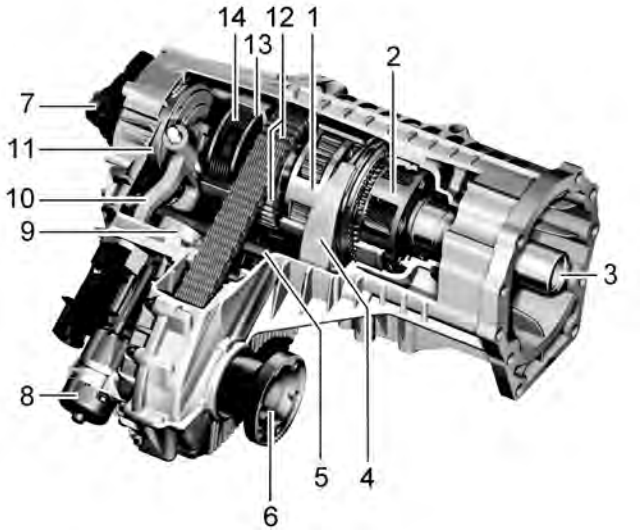
From high range to low range: below 9.5 mph (15 km/h)
From low range to high range: below 19 mph (30 km/h)

Notes:

Transfer Case, Types - Z48.00/02/20/21/50/52

The transfer case is bolted directly to the manual and Tiptronic transmissions. The purpose of this newly developed transfer case as used in the Cayenne is the permanent distribution of engine torque to the front and rear axles. It allows the driver the choice between the normal road final drive ratio (High Range) and a special final drive ratio in Low (Low Range). Basic distribution of engine torque over the transfer case differential is 38% to the front wheels and 62% to the rear wheels.

Transfer Case Operation with Reduction Gear and Differential Lock

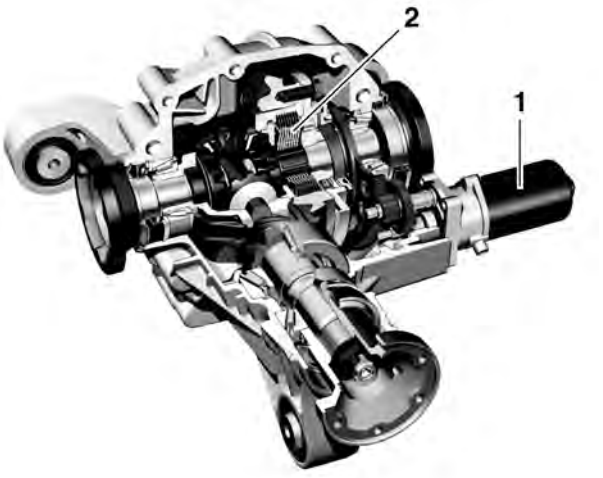


1 - Differential
2 - Planetary gear for Low Range
3 - Input shaft
4 - Shift fork
5 - Shift rod
6 - Output shaft to the front axle
7 - Output flange to rear axle
8 - Electric motor (for differential and High/Low Range switching
9 - Contoured disc
10 - Lever for differential lock
11 - Oil pump
12 - Drive chain to front final drive via sprocket
13 - Outer disc pack carrier (link to front axle)
14 - Inner disc pack carrier (link to rear axle)

Rear Final Drives, Types - H48.00/02/20/21/22/50/52

The rear final drive comes standard without a mechanical differential lock. The optional “Advanced Off-Road Package” contains an electronically controlled rear axle differential lock. The rear axle is attached to the rear axle subframe via three rubber mounts

Rear Final Drive (with Advanced off-Road Package)



Comparable to the control logic of the front-rear differential lock in the transfer case, a suitable degree of locking is set (in anticipation of the effects of the road and the driver). If a speed differential is detected at the rear axle through the wheel speed sensors, the electric motor (1) is activated and the clutch disc pack (2) is compressed until both rear wheels have attained the same speed again. Torque can now be transmitted to the road.

Function of the Third Actuation (Toggle Switch)

By moving the toggle switch on the center console forward three times, the differential lock is fully closed and no speed difference between the rear wheels is possible. “Rear Differential Lock On” is displayed briefly in the instrument cluster. s

Front Final Drive, Types - V48.00/02/20/21/22/23/50/52

The Porsche Cayenne models come standard equipped with a front final drive without a mechanical differential lock. Potential spinning of one front wheel is prevented by the automatic brake differential (ABD). The negative effects of a mechanical differential lock, such as increased weight, and limitations on steering and handling, can be avoided.

The final drive is an aluminum die casting and is attached via three rubber mounts to the front axle subframe on the right side. Both the bevel gear and the differential gear are carried in tapered roller bearings.

Notes:

PORSCHE

Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Check drive belt

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

☑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

☑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

☑ Change front differential oil
☑ Change rear differential drive oil
☑ Change transfer case oil
☑ Change manual transmission oil
☑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

PORSCHE

Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

- ☑ Diagnosis system: Read out fault memory; reset maintenance interval
- ☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
  Engine compartment: Visual inspection for damage
  Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels
- ❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)
- ❑ Air filter/s: Check the air filter condition, and if necessary, replace
- ❑ Pollen filter: Replace filter element
- ❑ Check drive belt
- ❑ Steering gear: Visual inspection of the dust boots for signs of damage
  Tie rod ends: Check play and dust boots
- ❑ Power steering: Check fluid level
- ❑ Fuel system lines and connections: Visual inspection
- ❑ Coolant hoses: Check condition
- ❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
  Coolant: Check level and antifreeze protection levels
- ❑ Parking brake: Check free play
- ❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear
- ❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level
- ☑ Axle shafts: Visual inspection of the for leaks & signs of damage
- ☑ Axle joints: Check play; visual inspection of the dust boots for signs of damage
- ☑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)
- ❑ Hydraulically detachable off-road sway bar: Check fluid level and function
- ❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts
- ❑ Tires, external spare wheel: Check condition and tire pressure
- ❑ Lubricate door latch and fastening bolts
- ❑ Panorama roof: Adapt control module
- ❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level
- ❑ Check wiper blades
- ❑ Seat belts: Check operation and condition
- ❑ Vehicle lighting: Check operation
- ❑ All headlights: Check adjustment
- ❑ Horn: Check operation
- ❑ Batteries and ventilation hoses: Check condition
- ❑ Trailer coupling: Check operation
- ❑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

- ❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
- ❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
- ❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

- ❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

- ☑ Change front differential oil
- ☑ Change rear differential drive oil
- ☑ Change transfer case oil
- ☑ Change manual transmission oil
- ☑ Change Tiptronic transmission oil and ATF filter

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Part Number – PNA 000 162 CB

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CB



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Notes:

General



On the Cayenne, similar to the Cayenne S and Cayenne Turbo, various demands are made on the development, such as sports car performance, demanding off-road use as well as full day-to-day suitability with optimum driving safety. The total vehicle harmonization of the individual systems such as axles, steering, tires, aerodynamics and drivetrain layout results in outstanding driveability in on-road and off-road operation.

The basic components of the chassis and suspension including braking system are generally adopted from current models. Do to of the different vehicle weights, the chassis and suspension tuning has been re-adapted in order to also achieve typical Porsche driveability along with the familiar high level driving dynamics on the Cayenne. The Cayenne is equipped with steel springs as standard and can, be ordered with the air suspension, including PASM.

The features of the Cayenne chassis and suspension are:

- Independent suspension with steel springs incorporating a large-based double wishbone front axle and a multilink rear axle (optional air suspension with PASM)
- Tubular stabilizers on front and rear axle or hydraulically decoupling offroad stabilizers (optional for all Cayenne models as part of the Porsche Traction Management Plus)
- Rack-and-pinion steering gear with variable ratio and hydraulic servo assistance (Servotronic optional)
- Extensive wheel and tire range from 17" to 20" (19" and 20" only for summer tires), high-performance summer tires, winter tires, all-season tires, and all-terrain tires
- Tire pressure monitor (TPM) (optional)
- Service brake adapted to the driving dynamics
- Porsche Stability Management (PSM)
- Porsche Traction Management (PTM) or optional Advanced Off-Road Technical Package with PTM Plus

Cayenne Second Generation (M.Y. 2008)

The chassis and suspension systems have been adapted to suit the increased performance of the new M.Y. 2008 Cayenne models and their features have been optimized further. For even greater performance and improved driving comfort, a new suspension system called Porsche Dynamic Chassis Control (PDCC) is available as an option.

To meet the high requirements with regard to the braking performance of a Porsche, all new Cayenne models have a brake system that is optimally designed to suit the relevant vehicle features. A higher performance turbo brake system is used, especially on the Cayenne Turbo. The new Tire Pressure Monitoring system (TPM) generation is standard equipment for all Cayenne models in the North American market.

Cayenne Turbo S (Option available as of M.Y. 2006)

The chassis of the Cayenne series was developed in order to meet the highest demands, and this concept was therefore able to be used without modifications for the new top model. The front axle with rack and pinion steering is designed as a double control arm axle and is supported by a suspension subframe; the rear axle comprises a complex multi-link system and is also supported by an auxiliary frame.

The Cayenne Turbo S is equipped with an air suspension which allows six different degrees of ground clearance. This therefore offers excellent preconditions for both high-speed and off-road driving. Thanks to the integrated level control system, this suspension also guarantees a constant vehicle position independently of the load condition.

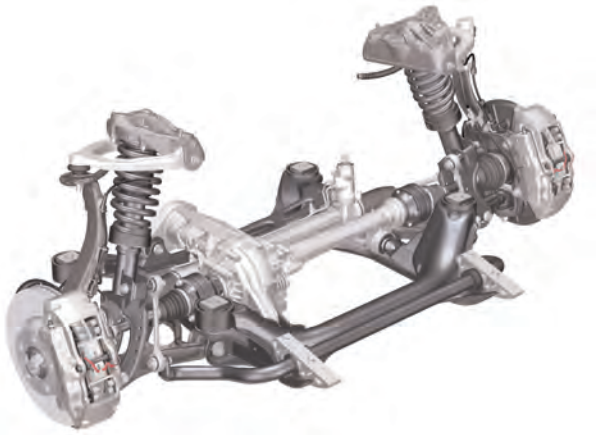
In view of the very high speeds possible with the Cayenne Turbo S, automatic vehicle lowering in two stages compared with normal level represents an important contribution to active safety. Porsche Active Suspension Management (PASM) is responsible for damping, and this system continuously controls the damping force as well as reducing the roll and pitch movements of the vehicle.

Running Gear

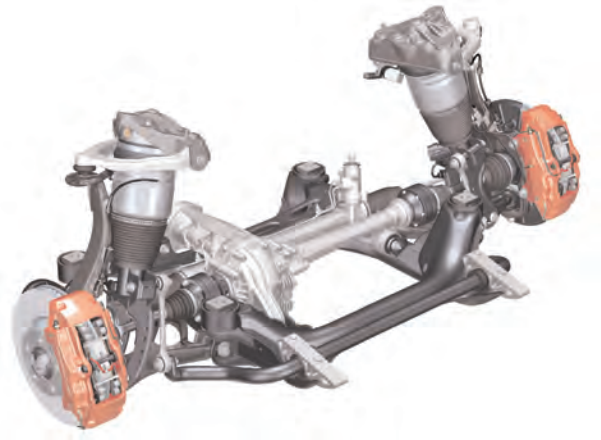
Front Axle, Cayenne

The front axle developed for the Cayenne is designed as a so-called “Wide based double wishbone axle” with subframe. The large distance between upper and lower lateral control arms allow the bearing forces to be kept minimal. This ensures precise wheel control. The subframe is resiliently attached to the body shell by large-format rubber mounts and carries the front axle differential, the steering gear, the stabilizer and the lower lateral control arms. This arrangement provides generous ground clearance and good off-road mobility.

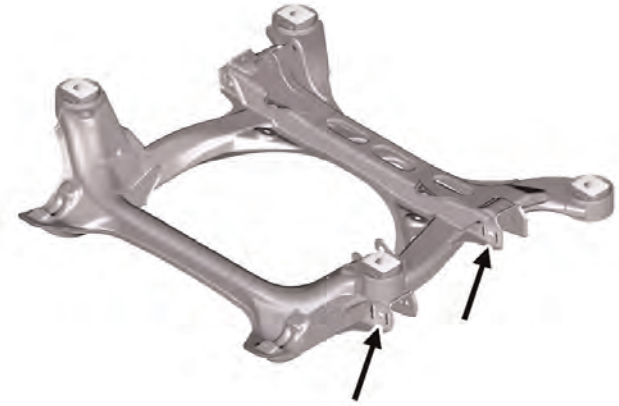
Cayenne/S



Cayenne Turbo



Subframe

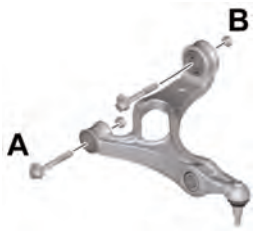


The high-strength steel subframe locates the following components:

- lower control arm, front axle differential, stabilizer bar mounts and the rubber mounts to the body.
- at the pickup points for the lower control arm supports (arrow) are attachments for the camber and caster adjustment cams.

Control Arms

For strength reasons the lower control arm is made from nodular graphite iron. The two inner bushings are bolted to the subframe and are moveable by means of the slotted holes. Caster can be adjusted by means of a cam at the front bushing (A) and caster can be adjusted at the rear bushing (B). The rear bushing is designed as a hydro bushing to provide damping in the axle system.



Cayenne Turbo S (Option available as of M.Y. 2006)



Special rubber mounts (A) are installed on the lower control arms instead of hydraulic mounts due to the larger brake discs. In addition, the air suspension characteristic and damper adjustment were optimized.

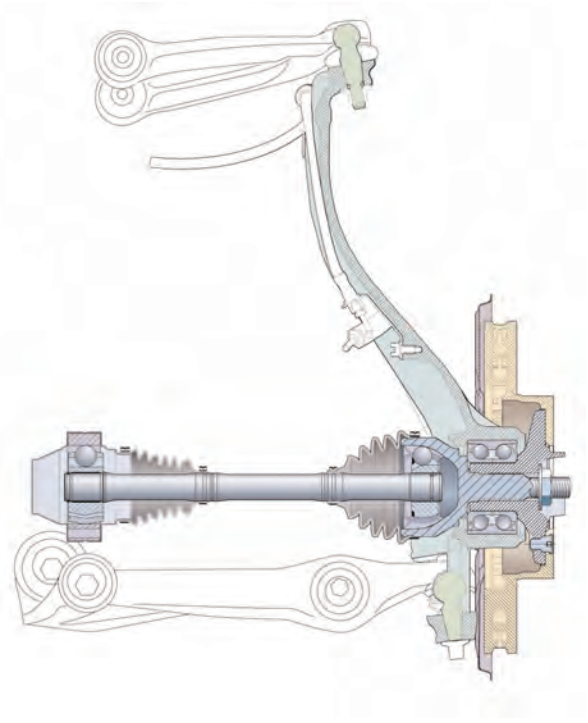
Control Arms (cont'd)

To save weight the upper control arm is made of aluminum. It is attached to the body by means of a mounting bracket into which the strut bearing is also threaded.



Steering Knuckle

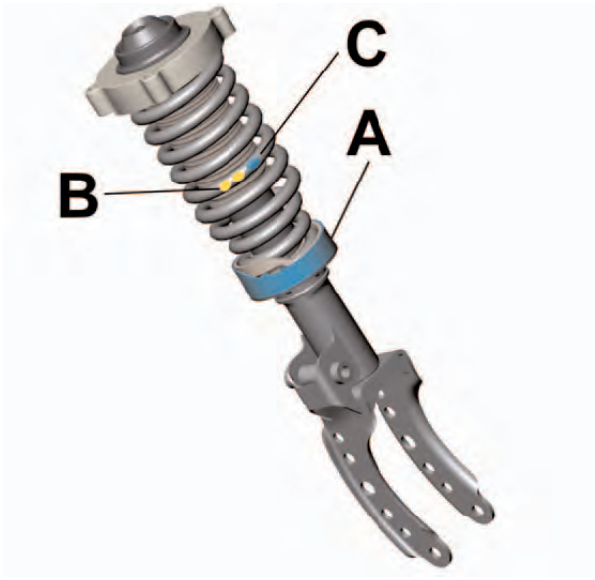
The nodular graphite iron steering knuckle locates the wheel bearing, the wheel speed sensor, the brake caliper, the pivot points for the control arms and the pivot point for the tie rod. The brake line is carried safely in the U-shaped upper part for protection against damage.



Note:
Since the speed signal is taken from the magnet-equipped radial seal ring for the wheel bearing, the latter must not come into contact with magnetized parts. During installation, make sure that the magnetic side points to the ABS sensor.

Suspension Strut, Cayenne

The suspension strut consists of a twin-tube, gas-filled shock absorber with suspension-strut yoke, a steel spring, the lower spring seat with compensator and the suspension strut mount. The springs and shock absorbers are adapted to the vehicle weight and the resulting driving dynamics. Due to height tolerances, the springs are provided with color coding (C). Compensators are inserted in accordance with this marking (A).



Springs, Cayenne/S

The springs are additionally provided with golden color marks (B). These color marks (up to two) identify the weight class of the vehicle, which depends on the vehicle specification. Refer to PET for weight groups.

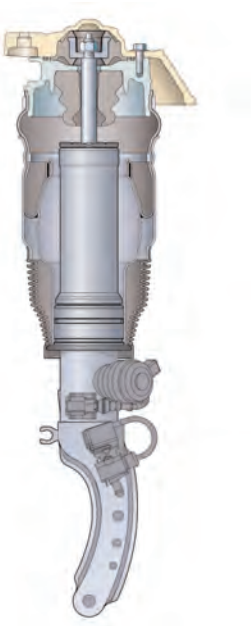
Notes:

Air-Suspension Strut (Optional Cayenne)

The suspension strut is designed for the specific driving dynamics of the Cayenne. A spring rate of 57/75 has been achieved through a modification to the inner rolling contour of the air bellows.

Suspension Strut, Cayenne Turbo (Optional Cayenne/S)

The strut consists of a fully load-bearing air strut with strut fork and integral twin-tube shock absorber with continuous damping force control. The upper strut bearing is set in a mounting bracket, which is bolted to the body.



Stabilizer Bar

The weight-optimized stabilizer bar of high-strength tubular material is mounted directly to the subframe via rubber bushings. Aluminum links provide the connection to the struts.



The benefits of this construction are:

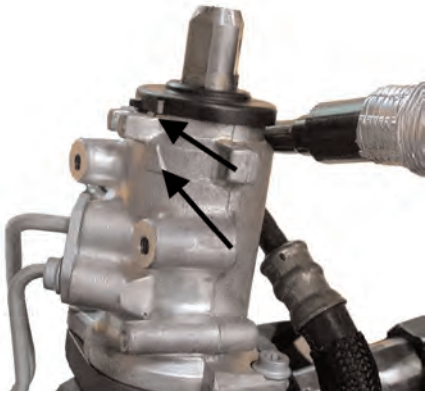
- Good transfer ratio, low tendency to roll
- Low noise transmission
- Corrosion resistant

Steering

The steering layout is identical for all Cayenne models. As in all Porsche models, standard rack and pinion steering with hydraulic assist is also used in the Cayenne. The steering ratio is variable, i.e. in the on-center position the ratio i = 16.7:1 and it becomes more direct with increasing steering lock (up to i = 13.3:1). This makes 2.65 turns of the steering wheel from lock to lock possible. A hollow rack and an aluminum die-cast housing provide the maximum in lightweight construction. The steering valve housing with the rotary slide valve and centrally stiffened torsion bar is bolted to the steering gear. Hydraulic pressure is approximately 1740 psi (120 bar). The steering gear is attached by means of a flexible mount under the front axle differential to the subframe behind the wheel center.



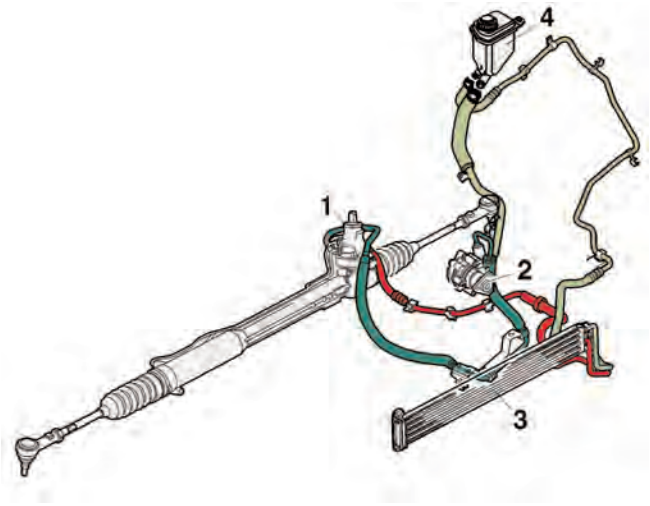
The steel tie rods are bolted to the rack through flexible elements in the axial couplings.



Since this is a variable steering gear,the steering gear must be exactly centered for installation or when adjusting toe settings. Markings for this are provided on the valve housing and on the dust cap.

Power Steering System

The power steering pump (2) is mounted at the front left of the engine and is driven by a polyrib belt (i = 1.13). The expansion tank (4) is on the left in the engine compartment. The system is filled with Pentosin. A radiator (3) is located in front of the condenser to cool the Pentosin. The power steering pump pulls the Pentosin from the expansion tank and sends it under pressure to the valve unit (1) on the steering. Then it flows back depressurized through the radiator (3) into the expansion tank.



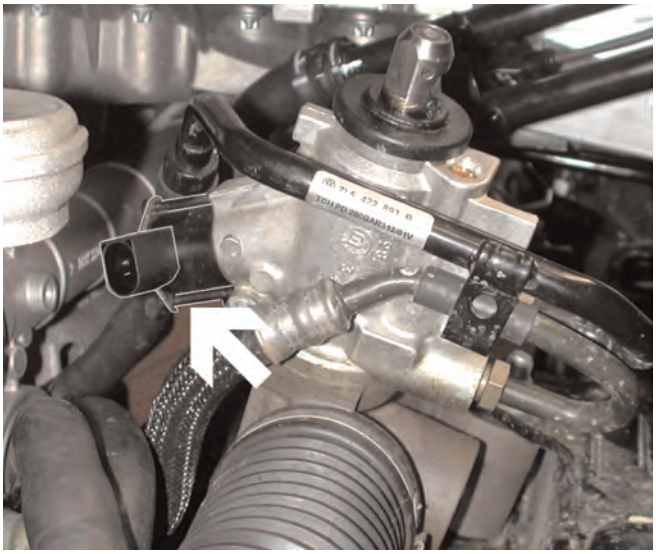
1 - *Steering gear with valve housing*
2 - *Power steering pump*
3 - *Radiator*
4 - *Expansion tank*

M.Y. 2005 Modification

An optimized radiator has been installed in all Cayenne models to reduce pressure losses in the power steering hydraulics.

Servotronic (Optional Cayenne/S, excludes Turbo)

Servotronic is vehicle speed-dependent power-assisted steering. It provides low steering effort (high assist) when parking, at low speeds and off-road. With increasing speed the power assist becomes less, i.e. steering effort increases. This provides good road surface contact. The base steering is used for Servotronic with a modified valve housing to accommodate the hydraulic converter.



Notes:

Checking Power Steering Fluid

Power Steering

Warning!

Risk of accident resulting in serious personal injury or death. When the engine is stationary (e.g. when on tow) or the hydraulic system fails, there is no assistance for steering. Therefore, substantially more force will have to be exerted.

- f Exercise great care when on tow.
- f Have the fault remedied at your nearest authorized Porsche dealer.

The flow noise heard at full steering lock is design-related and does not indicate a defect in the steering system.

Further important information concerning "maintenance" can be found in a separate chapter.

- f Please observe the chapter "EXERCISE EXTREME CAUTION WHEN WORKING ON YOUR VEHICLE" on Page 275.



Checking hydraulic fluid

- f Use only hydraulic fluid **authorized by Porsche**.
- f Check the fluid level with the engine stopped and cold (engine temperature approx. 68° F or 20° C).

1. Remove cover **A**.



2. Open the reservoir cap.
3. The fluid level should lie between the MIN and MAX marks on the dipstick.
   Add hydraulic fluid if necessary.
4. Close cap carefully.
5. Put on cover **A**.
6. Close engine compartment lid.

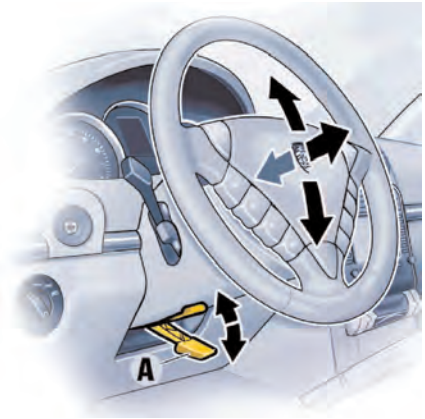
- f If the fluid level drops significantly, please have the cause remedied immediately by an authorized Porsche dealer.

Mechanically Adjustable Steering Column, Cayenne/S



The Cayenne and Cayenne S have a mechanically adjustable steering column as standard equipment. The electrically adjustable steering column of the Cayenne Turbo is available as an option, but only in conjunction with the comfort seating system and expanded seat memory.

The steering wheel is length-adjustable over a range of 50mm and height-adjustable over a range of 40 mm. Because of the high requirements for passive safety, the steering column makes several bends with three universal joints. In combination with the deformation element, which can absorb energy over a travel of 70 mm, a high degree of safety is achieved.

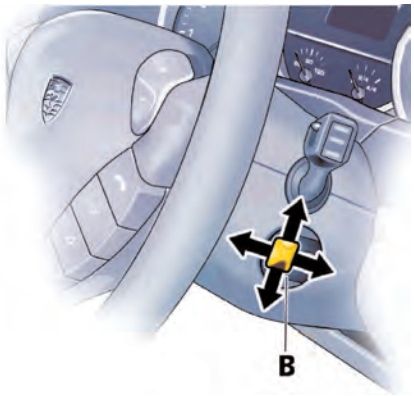


A locking lever (A) is mounted under the steering column on the right. If it is pushed down, the steering column unlocks.

Electrically Adjustable Steering Column, Cayenne Turbo



The Cayenne Turbo has a electrically adjustable steering column as standard equipment. The steering wheel is length-adjustable over a range of 50mm and height-adjustable over a range of 40 mm. With this version, the steering wheel is moved upward and toward the instrument panel by the “Easy Entry” function upon entry or exit. This makes it even easier to enter and leave the vehicle. The driver’s personal steering position can be stored through the memory function with the aid of the ignition key. After entry, the steering wheel then moves automatically into the stored position.

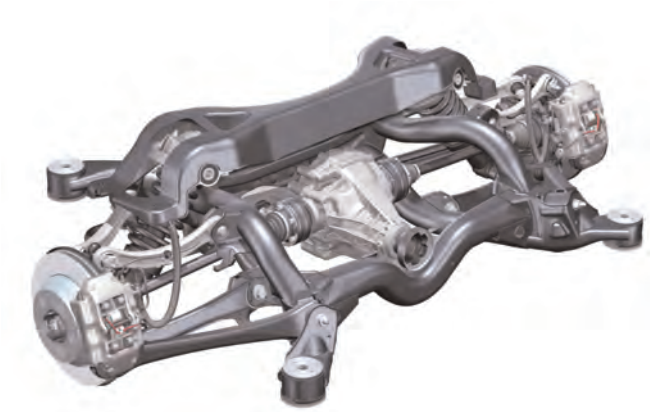


The adjustment itself is carried out by means of a control switch (B), which is mounted to the right of the steering column.

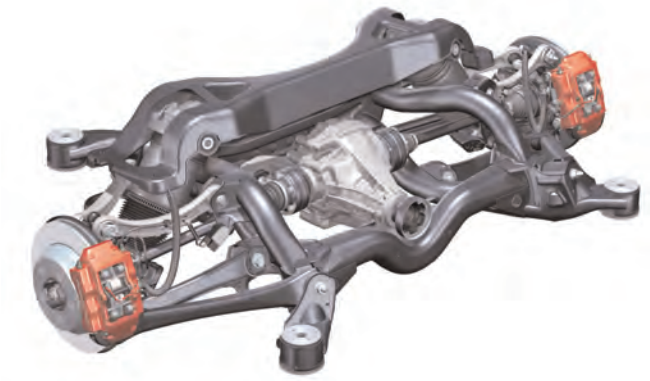
Rear Axle

To ensure typical Porsche handling characteristics, a sophisticated multi-link concept was developed which is designed for highway as well as off-road requirements. The elastokinetic suspension design provides stable tracking under acceleration and braking. Handling characteristics are stabilized during cornering and under load changes. Compensation for squat and dive is achieved through the arrangement of the lower control arm (A-arm), allowing the vehicle body to remain almost parallel to the road under braking and acceleration.

Cayenne/S



Cayenne Turbo



Notes:

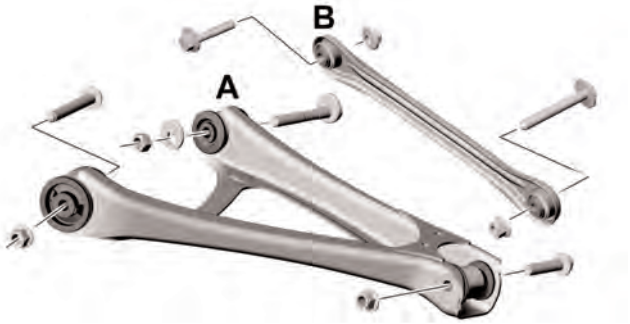
Subframe

The high-strength steel subframe locates the following components: The upper and lower control arms, upper strut bearing, rear axle differential, stabilizer bar bushing and the rubber mounts to the body. Supports (arrow) are attached at the pickup points for the lower control arms for the camber and toe cams.



Lower Control Arms

For production reasons the lower control arms are made of sheet steel. Camber adjustment is carried out at cam (A) and toe is adjusted at cam (B).



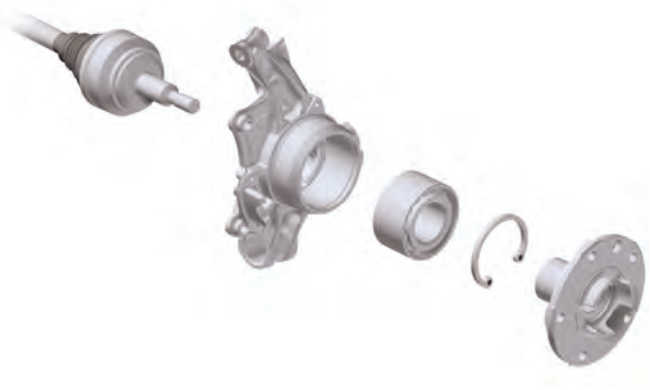
Upper Control Arms

The protected upper plane of the arm consists of light aluminum forgings.



Wheel Carrier

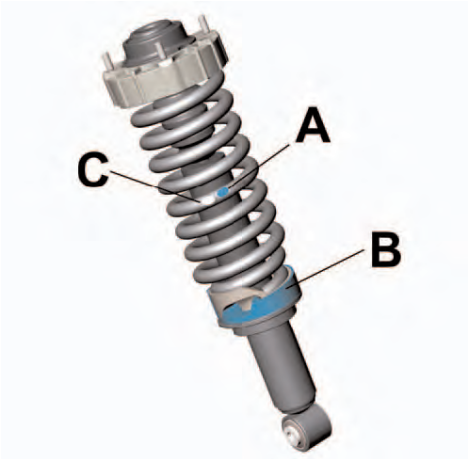
The cast iron steering knuckle locates the wheel bearing, the wheel speed sensor, the brake caliper, the parking brake, the pivot points for the cross member and the pivot point for the tie rod.



Note:
Since the speed signal is taken from the magnet-equipped radial seal ring for the wheel bearing, the bearing must not come into contact with highly magnetized parts. During installation, make sure that the magnetic side points to the ABS sensor.

Suspension Strut, Cayenne

The suspension strut consists of a twin-tube, gas-filled shock absorber, a steel spring adapted to the driving dynamics, the lower spring seat with compensator and the suspension strut mount. Due to tolerances, the springs are provided with color-coding (A). Compensators are inserted in accordance with this marking (B).



Springs, Cayenne/S

The springs are additionally provided with white color marks (C). These color marks (up to three) identify the weight class of the vehicle, which depends on the vehicle specification. Refer to PET for weight groups.

Suspension Strut, Cayenne Turbo (Optional Cayenne/S)

The strut consists of a fully load-bearing air strut with strut fork and integral twin-tube, gas-pressure shock absorber.



Stabilizer

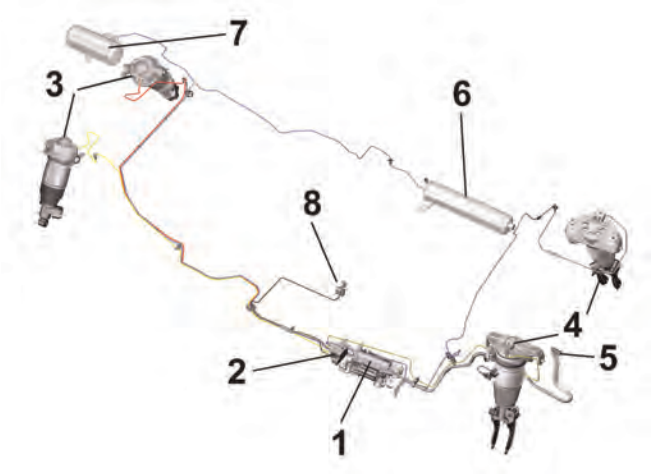
The stabilizer, optimized for the Cayenne and made from high-tensile tubular material, is mounted on the subframe and directly connected to the suspension struts through coupling rods (A).



Notes:

Porsche Active Suspension Management (PASM)
(Standard on Cayenne Turbo, optional Cayenne/S)

In conjunction with "Porsche Active Suspension Management" (PASM) controlled damping, the pneumatic suspension system with level control is standard on the Cayenne Turbo and optional on the Cayenne S. Active adaptation of the Cayenne's ground clearance to the conditions of vehicle use or load is made possible by a pneumatic suspension with level control. Greater ground clearance in terrain by manual adjustment to Off-Road level or automatic lowering at high speed ensures enjoyable driving and safety. Increasing and lowering the volume of air can make for different vehicle ride heights with different suspension characteristics, independently of load. The quantity of air needed for each air strut is determined by a control module and provided from an air supply consisting of a compressor, a solenoid valve body and two reservoirs.



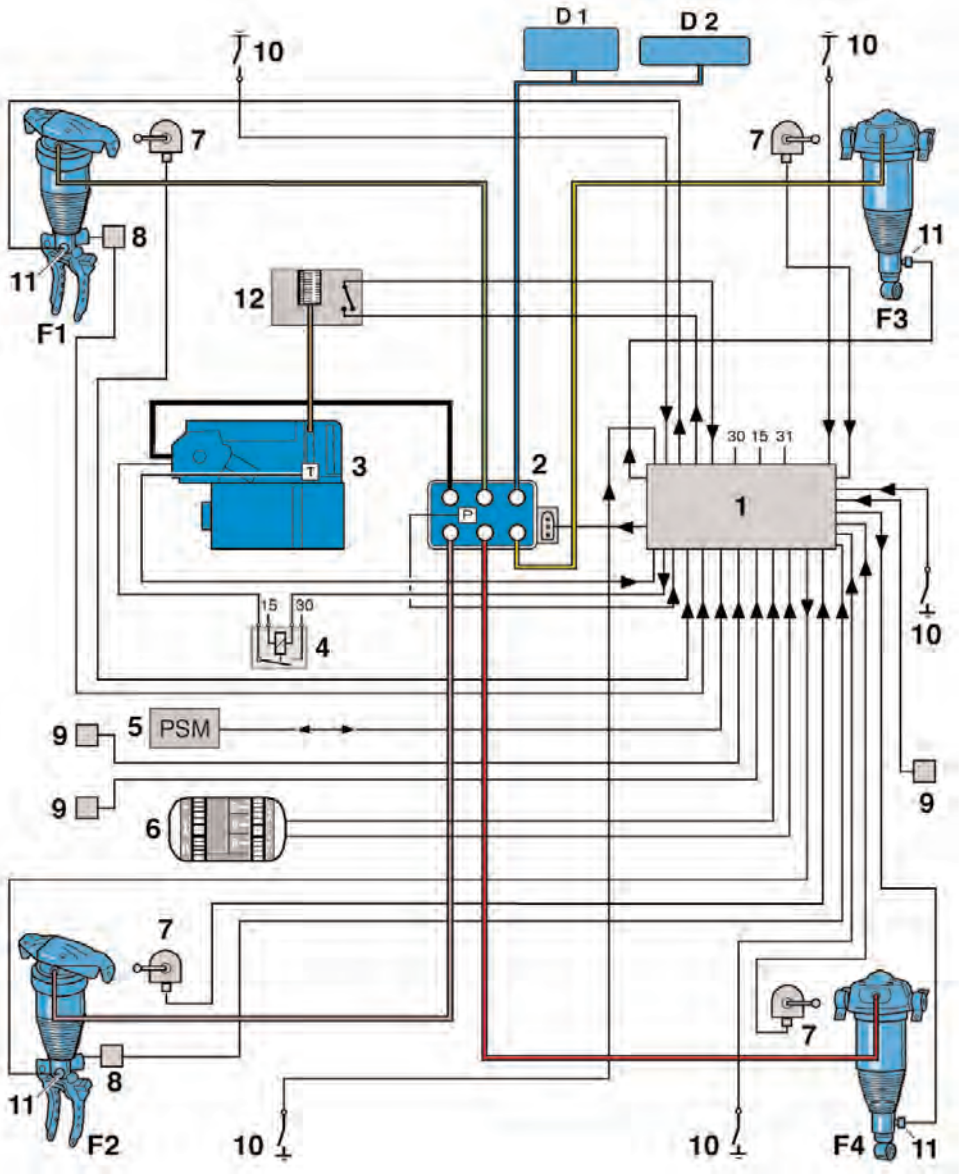
1 *- Compressor*
2 *- Valve body*
3 *- Rear struts*
4 *- Front struts*
5 *- Suction-vent line to the air filter*
6 *- Pressure reservoir (contents 5.2 l)*
7 *- Pressure reservoir (contents 4.8 l)*
8 *- Tire inflation connection*

The six following ride heights are possible with pneumatic suspension:

- **Normal Level**
  The vehicle is adjusted to a ground clearance of approximately 217 mm (DIN empty weight).
- **Loading Level** (for easier vehicle loading.)
  The vehicle is dropped to its lowest possible position, approximately 60 mm below the normal level. Loading level can only be selected manually with the vehicle stationary. If the vehicle is moving at a speed greater than 3mph (5 km/h), an automatic change to Normal level is made.
- **Low Level**
  At a speed of 78 mph (125 km/h), the vehicle is lowered approximately 27 mm below the Normal level (Low level). If speed drops below 25 mph (40 km/h), Normal level is resumed. Low level can be selected manually at any time. The Special Low level cannot be selected manually. It is also not shown in the multi-function display.
- **Special Low Level**
  Above approximately 130 mph (210 km/h), the vehicle is lowered by another 10 mm (Special Low level). When speed drops below approximately 106 mph (170 km/h), Low level is resumed.
- **Off-Road Level** (increased ground clearance for difficult conditions.)
  The vehicle is raised to a ground clearance of approximately 243 mm (26 mm above Normal level). Off-Road level can only be selected manually at speeds below 50 mph (80 km/h). If a speed in excess of 50 mph (80 km/h) is reached, the system automatically adjusts to Normal level. If the vehicle is in "Low Range" mode, it is possible to remain in Off-Road level up to 62 mph (100 km/h).
- **Special Off-Road Level** (normal ground clearance under the most difficult conditions.) The vehicle is raised by 56 mm compared with the Normal level to a ground clearance of approximately 273 mm. The Special Off-Road level is linked to the off-road gearing of the transmission. It can only be selected when speed is below 19 mph (30 km/h). If the vehicle is in Special Off-Road level, an automatic switch to Off-Road level is made if a speed of approximately 19 mph (30 km/h) is exceeded or "Low Range" mode is deactivated.

PASM Components

1 *- Control module*
2 *- Valve body*
3 *- Compressor with temperature sensor*
4 *- Air pump relay*
5 *- PSM control module*
6 *- Control unit*
7 *- Height sensor*
8 *- Accelerometer, wheel*
9 *- Accelerometer, body*
10 *- Switch doors/tailgate*
11 *- Proportioning valve on shock absorber*
12 *- Tire inflation connection with reed contact*
F1, F2 *- Air struts, front axle*
F3, F4 *- Air struts, rear axle*



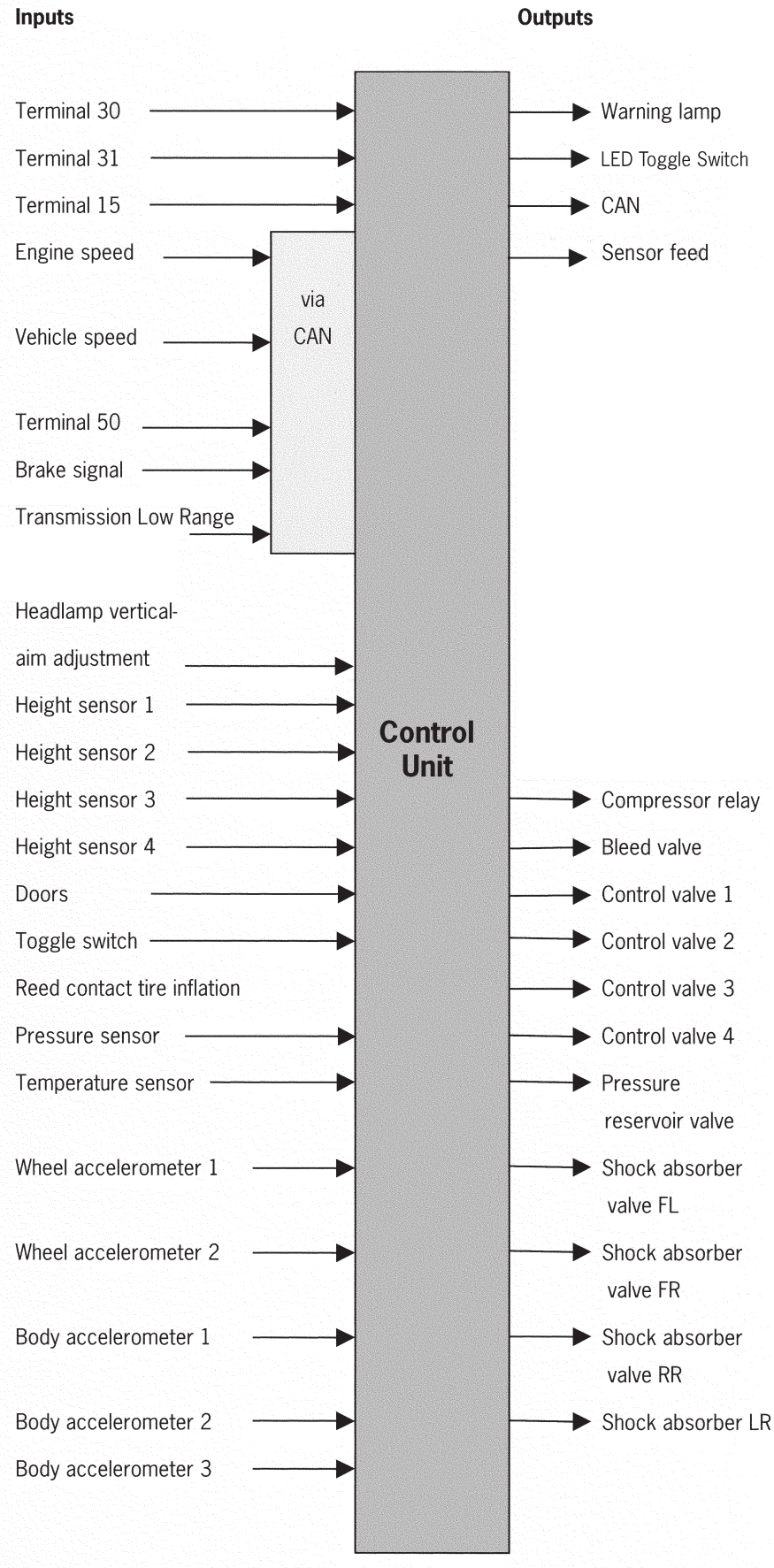
Manual selection of the individual levels is carried out by a toggle switch in the center console. The desired level is selected by moving the toggle forward or back. The currently selected level is displayed in the instrument cluster (multi-function display) and next to the toggle. After an engine restart, the system adjusts to the level last selected.

M.Y. 2005 Modification

An improved PASM setup in the “Comfort” and “Normal” programs has been made possible by a modification of the sensors. This modification was done in the course of model year 2005.

Control module for level control The control module is located in the right rear of the trunk, it:

- controls of the pneumatic suspension
- controls control of damping force regulation
- monitors the entire system
- diagnoses the entire system
- communicates over CAN


Inputs
Outputs
Terminal 30
Terminal 31
Terminal 15
Engine speed
Vehicle speed
via
CAN
Terminal 50
Brake signal
Transmission Low Range
Headlamp vertical-
aim adjustment
Height sensor 1
Height sensor 2
Height sensor 3
Height sensor 4
Doors
Toggle switch
Reed contact tire inflation
Pressure sensor
Temperature sensor
Wheel accelerometer 1
Wheel accelerometer 2
Body accelerometer 1
Body accelerometer 2
Body accelerometer 3
Control
Unit
Warning lamp
LED Toggle Switch
CAN
Sensor feed
Compressor relay
Bleed valve
Control valve 1
Control valve 2
Control valve 3
Control valve 4
Pressure
reservoir valve
Shock absorber
valve FL
Shock absorber
valve FR
Shock absorber
valve RR
Shock absorber LR

Input Signals and Their Function

Terminals 30 and 31 provide permanent energy supply

Terminal 15 is used to detect different states such as Run, Run-on and Stationary (Sleep) mode. The system is correspondingly active for level control when driving or in Run-on to adjust for temperature-dependent changes in level after the vehicle has been parked. In Sleep mode the system is switched to rest status with low power consumption.

Information About CAN

Engine load or idle, respectively, is recognized from the **Engine speed signal**. The compressor is either switched on or switched off, depending on this information.

Information about **Vehicle speed** is used to carry out the speed-dependent level adjustments. To prevent the vehicle electrical system from being subject to a load from the level adjustment system performing an adjustment while starting, no adjustment is carried out while starting **(Terminal 50).**

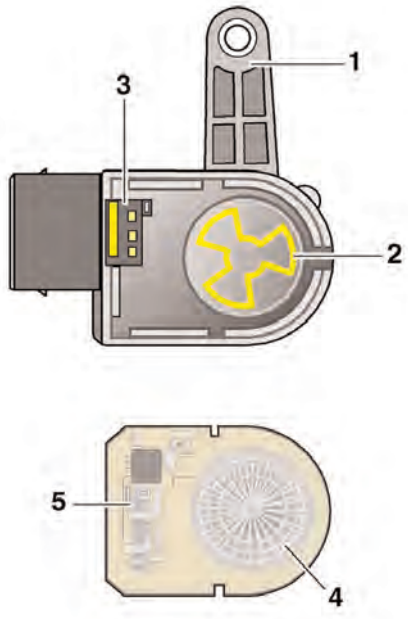
The **Brake signal** is used for damping regulation to prevent vehicle dive under braking. Shock absorber firmness is adjusted accordingly.

If the vehicle is in **Low Range**, it is raised to Off-Road level and lowered again to Normal level at a speed of approximately 62 mph (100 km/h).

Height Sensors

The level of the vehicle, or the distance between the body and the axles, is measured with four height sensors. A sensor is mounted at each wheel, between the upper control arm and the bodywork. Level changes are detected from the kinematics of the link bars and converted into changes in angle. This information is made available to the control module through a PWM signal proportional to the angle.

The sensor consists of the rotor with conductor loop, the stator with exciter and receiver coils and the electronics for control and evaluation. An alternating electromagnetic field (magnetic field) is generated around the exciter coils, which in turn induces a magnetic field in the conductor loop in the rotor. Depending on the position of the rotor, the inductance in the receiver coil is of varying strength. The evaluation electronics converts the output voltage from the receiver coils Into matching PWM signals and makes them available to the control module.



1 *- Actuating lever*
2 *- Rotor*
3 *- PCB contact*
4 *- Stator*
5 *- Control/Evaluation electronics*

Note: To prevent damage, no adjustment is initiated, or active adjustments are stopped, whenever (also while driving) a door or the tailgate is opened. When the door/tailgate is closed, the system activates itself again automatically after a 10-second delay.

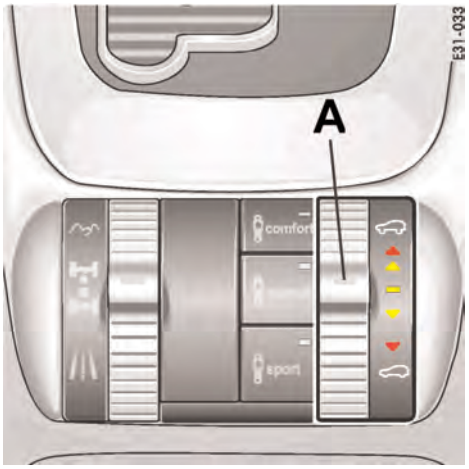
Doors/Tailgate

This is a ground signal from the door control module. It signals that a door or the tailgate is being opened and serves:

- as a wake-up for the transition from Sleep mode to Active mode.
- to interrupt a level adjustment when doors are open. If only the tailgate is open, adjustments can take place when loading or unloading.

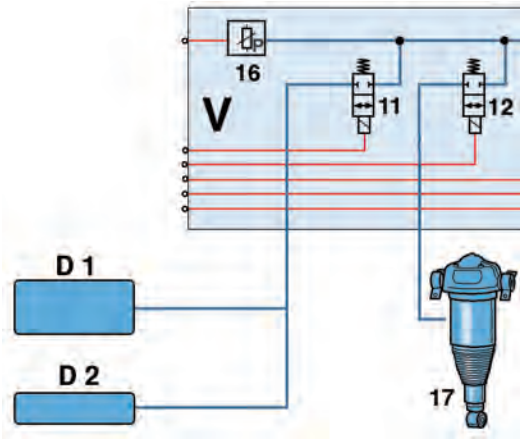
Toggle Switch

Moving the toggle switch (A) up or down selects the next available height. The LED (on the right next to the switch) for the level selected flashes during the adjusting action. It stays on permanently after the adjustment.



Pressure Sensor

The pressure sensor (16) is used to monitor pressure in the system and is integrated with the valve body. Information about air pressure is needed for a plausibility check of control functions and for diagnosis. Measurements of individual pressures are made during the bleeding or filling of the air springs or of the pressure reservoir.



V *- Valve body*
D1 *- Pressure reservoir 1*
D2 *- Pressure reservoir 2*
11 *- Pressure reservoir valve*
12 *- Control valve*
16 *- Pressure Hose*
17 *- Air strut*

Temperature Sensor

A temperature sensor is mounted on the compressor to ensure the air supply under all climatic and driving conditions. It is an NTC resistor. Above a maximum permissible compressor temperature (> 212° F./100° C.), the control module switches the compressor off, or prevents it from being switched on.

Wheel and Body Sensor



These sensors provide information to the control module about the vertical acceleration of the wheels and body. This means that the condition of the road is detected from wheel acceleration, and additionally the movement of the body is identified through the sensors distributed in the vehicle. From this, the damping force of the individual shock absorbers is calculated and adjusted in the shock absorber itself (for a description see section on Shock Absorber Control).

Front Suspension Strut Acceleration Sensors Have Been Discontinued

The acceleration sensors on the front suspension struts have been discontinued in mid model year 2004. Measurement of wheel acceleration is carried out by the self-leveling suspension sensors. The angle sensors are internally adapted accordingly.

Tire inflation Connection

A reed contact is located in the connector for the inflator and a magnet on the threaded coupling for the tire inflation connector. When the inflation connector is screwed in, the reed contact switches ground to the control module. With the ignition switched on, the pressure reservoir valve is opened and compressed air is available for inflating the spare tire. At every drop in pressure in the line, the compressor is switched on again.

Special Functions of Level Control

Loading and Unloading - If vehicle height with respect to the road changes as the result of loading or unloading, the control module readjusts the vehicle to the specified level (only with the tailgate open). Air is supplied over the solenoids to the appropriate air spring or vented through the bleed valve.

Switching Off Level Control - In particular situations it may be necessary to switch off level control, for example when changing a wheel or during operations on a hoist. Level control is switched off by pressing the toggle switch forward for approximately 5 to 10 seconds. The multi-function display indicates that level control has been switched off.

Activating Level Control - Level control is activated again by pressing the toggle switch forward for approximately 5 to 10 seconds or automatically by the control module recognizing a drive situation.

Hoist Without Previous Deactivation (Ignition Off) **-** If the vehicle is raised on a hoist without previously switching off level control, air is bled out of all four air springs until the control module recognizes this situation (hoist recognition). Hoist recognition is when a specific change in height was detected during a specific time. As a result, when the hoist is lowered, the vehicle can be sitting lower than before. With the ignition ON, or when driving, the vehicle is raised again to the Normal level automatically.

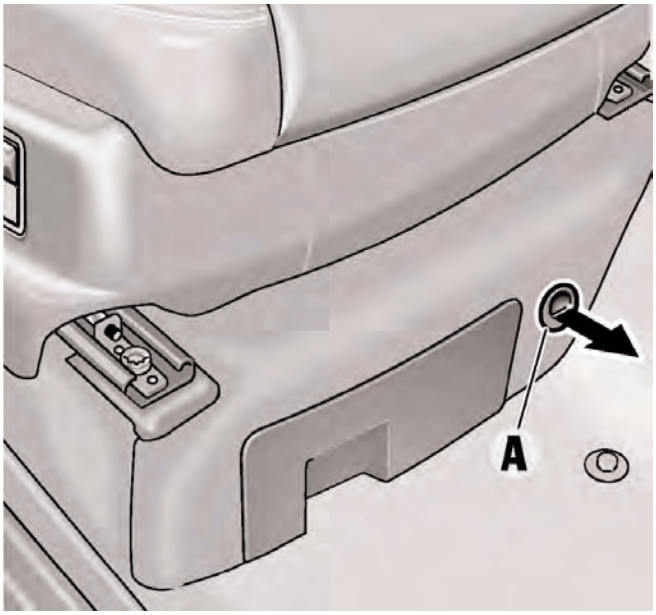
Recognizing a Snow Bank (only with engine running) **-** If the vehicle is driven onto a snowbank, for example (wheels are turning freely), the system recognizes a rapid change in height of the entire vehicle. Since the engine is running in this situation, the conditions for "hoist recognition" do not exist. So no air is released from the springs.

Action of Pneumatic Suspension Following "Ignition Off"

Loading and Unloading Procedures - Following "Ignition OFF", the control module remains active for one or two minutes and, with sufficient pressure in the pressure reservoir, can still complete level control procedures initiated, for example, by loading and unloading.

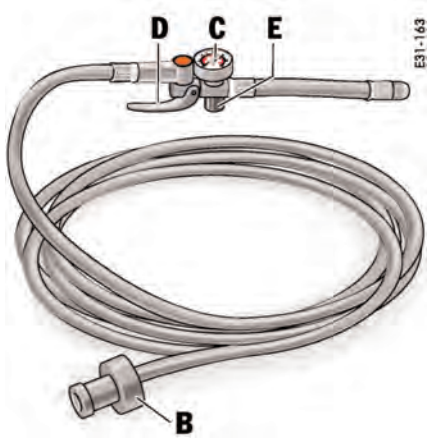
Gradual Changes in Level - To compensate for gradual changes in level which can be caused by heating of the air while driving and subsequent re-cooling after the trip is completed, the system is re-adjusted after approximately 15 minutes and after 2 hours to reach the optimal ride height.

Tire Inflation (Ignition On) **-** The compressed air connection is located at the left front of the right front seat. The tire inflation hose is under the left rear seat cushion. When the inflation hose is connected, a reed contact is signaled. The pressure reservoir is opened, so that a pressure of 116 psi (8 bar) is available. As soon a drop in system pressure is detected, the compressor is powered up.



To prevent the fill hose from being damaged, a maximum pressure of 116 psi (8 bar) is permitted (dynamic pressure monitoring). A static pressure test takes place every 15 seconds. The air supply is shut off at a pressure of approximately 58 psi (4 bar) to prevent the space-saver spare wheel from being destroyed.

To protect the compressor, it is switched off after running for 10 minutes or at a compressor temperature of approximately 212° F. (100° C). The compressor cannot be re-started until after a waiting period and cycling the ignition off/on.



Vehicle Transportation

When transporting the vehicle on a transporter, on car-trains and ferries, it must be tied down only at the wheels.

Damping Force Control

Standard equipment on the Cayenne Turbo includes the pneumatic suspension system, and the shock absorber system with damping force control continuously adjusted to the situation. The pneumatic suspension system with damping force control is optionally available on the Cayenne/S. Three damping programs are available. Comfort, Normal and Sport, which can be selected individually by a toggle switch. The control system for damping force control reads the condition of the road or the motion of the vehicle through two wheel and three body accelerometers. The characteristic curves for the individual shock absorbers are shifted in accordance with the calculated damping requirements. Continuous damping control is based on shock absorbers whose curves can be adjusted electrically.

Damping force is adjustable as a function of a map through the proportioning valve located at the shock absorber. In this way it is possible to adapt damping force to the driving situation and road condition within milliseconds. The system attempts to adjust damping force using the “skyhook control strategy” (body level).

Accelerometer

The accelerometers for the body are mounted at the front in the area of the left and right upper wheelhouse and at the right rear on the baggage compartment floor, at the height of the wheelhouse. The arrangement allows body lift, pitch and roll motions to be detected.

The accelerometers for the axles are mounted on the left and right front struts (these have been discontinued, see page 123). The wheel sensors measure the vertical acceleration of the front axle. Rear axle acceleration is simulated in the control module from these readings. The sensors operate on the “capacitive measurement principle” i.e. a mass oscillates between two condenser plates which changes the capacitance of the condensers. Internal electronics evaluate these signals, which are fed to the control module.

CDC Shock Absorbers (**CDC C**ontinuous **D**amping **C**ontrol)

Damping force in the jounce and rebound stage for the CDC twin-tube, gas-pressure shock absorber can be adjusted over wide ranges with an electrically controlled valve mounted at the shock absorber. By changing the current applied to the magnetic winding, oil flow through a valve and thus the damping force can be adapted within a few milliseconds to the momentary situation.

Type of Control - The following control regimens are carried out within the three programs:

- Comfort
- Normal
- Sport

Skyhook Control

This control is based on recognizing body movement and road input. The accelerometers on the body transmit the pitch, lift and roll motions to the control module. Vehicle speed, steering angle, braking and road dynamics and are additionally evaluated. The required damping force is calculated from this information and adjusted to the “Skyhook control strategy.” This means that the body is level as far as possible.

Yaw Control

To increase stability during steering maneuvers and lane changes, damping is increased when yaw is detected. From the information about steering angle and road speed, lateral acceleration is determined, any change in which constitutes the yaw signal.

Adaptive Controls

Adaptive Control is divided into the following modules:

Acceleration Module - Linear acceleration is determined from the CAN driver request signal and increased in accordance with damping pressure to prevent squat under acceleration.

Braking Module - Damping force is regulated from information about braking pressure and changes in braking pressure so that dive under braking is reduced and the driver's feeling of safety is increased.
Stationary Module - When the vehicle is stationary, the shock absorber valves are de-energized to conserve energy.

Diagnosis

The control module continuously monitors all the components, such as sensors, solenoids, compressor and pressure conditions in the air system and their functions. If fault detection responds, the air suspension and damper controls are not switched off completely following fault evaluation, instead closed-loop control goes to a specified emergency strategy. If need be, control activities are limited, in an extreme case the vehicle is lowered down to the shock absorber stops. The driver is informed of the failure by a warning lamp in the instrument cluster. Following fault detection, tests to restore the system are performed cyclically or after an ignition Off/On cycle. When complete functionality has been restored, the system self-regulates back to normal operation. Errors are saved in the memory and are stored there permanently.

Calibration

When working under the vehicle, it must first be secured against sinking! If a height sensor is replaced, it must be calibrated afterwards. Diagnosis is menu-guided, using the "Porsche System Tester 2."

Notes:

Porsche Dynamic Chassis Control (PDCC) (Optional as of M.Y. 2008)



The chassis control system Porsche Dynamic Chassis Control (PDCC), which is available on request for all new Cayenne models, can further optimize the already excellent driving dynamics.

PDCC is only available for vehicles with air suspension and PASM. The silver colored chassis control switches on the center console and the logo “PDCC” below the chassis control switches in the interior indicate that a vehicle has PDCC.



PDCC is an active chassis control system. Targeted intervention using active anti-roll bars optimizes the driving characteristics of the vehicle by reducing its tendency to roll.



A - Fast cornering without PDCC
B - Fast cornering with PDCC

The actual benefits of the system for customers are apparent in the following areas:

- Reduced lateral inclination (vehicle lean) during cornering.
- Greater agility.
- Improved driving performance.
- Increased driving comfort.
- Better off-road functionality.

Operating Principle

The entire system involves chassis components used to actively stabilize the vehicle. To create a definable force between body and wheel using additional energy in order to improve driving dynamics, driving comfort and safety.



Principle for creating definable forces between body and wheel using active roll stabilization.

During cornering, a rolling torque is build up via the vehicle rolling axis due to the centrifugal force affecting the center of gravity. This force causes the vehicle body to tilt towards the outer wheel during cornering so the vehicle can quickly reach its driving dynamic limits. The use of anti-roll bars is designed to counteract body tilt and the accompanying wheel load difference. The wheel at the outside of the corner is compressed during cornering, while the wheel at the inside of the corner rebounds. This causes the back of the anti-roll bar to turn (twist). The forces occurring in this way in the anti-roll bar bearing points produce a torque that counteracts the body tilt and distributes the load better on both wheels of an axle.

PDCC is an active roll stabilization system, which records the vehicle's lateral inclination during cornering right from the start and reduces this considerably. This is done using active anti-roll bars on the front and rear axle, which ensure stabilization torques on both axles.

This means that the active anti-roll bars build up specific forces to counteract the lateral inclination of the vehicle, depending on the steering lock and lateral acceleration. PDCC reduces the vehicle's lateral inclination by up to 2.5° compared with a vehicle without PDCC. This improves performance due to improved wheel/road contact.

At the same time, PDCC also records uneven road surfaces (bumps) and can compensate for these by evaluating sensor data from the chassis and speed. This significantly improves driving comfort on various types of road surfaces.

The sensor data is evaluated continuously and appropriate control operations are initiated over the vehicle's entire speed range in order to guarantee the horizontal positioning of the vehicle at all times. One sided destabilizing impulses caused by long undulations in the road surface (so-called copying of rolling motion) can be significantly reduced.

PDCC also offers additional driver benefits for off-road driving. Active anti-roll bar control in conjunction with an integrated surface detection system reduces body movements considerably, thereby ensuring significantly improved comfort. The best possible traction on various road surfaces is particularly important for off-road driving. When the driver activates Low Range mode using the rocker switch on the center console, PDCC switches to off-road mode. The swivel motors are enabled in this mode so that the vane controllers in the housing can turn freely and the anti-roll bar halves are decoupled. This results in maximum axle articulation. To prevent instability at higher speeds and during dynamic maneuvers in Low Range mode, the control system is activated again depending on vehicle speed

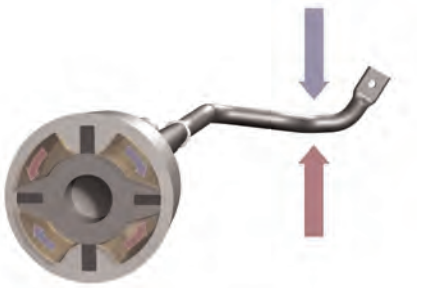
Transmission	Driving Mode	Vehicle Speed	PDCC
High Range	On-road mode	0-Vmax.	Continuous control
Low Range	Off-roadmode	<7.3 mph (35km/h)	Anti-rollbars can turn freely for max. axle articulation
Low Range	Off-road mode	7-35 mph (35-55km/h)	Stabilizing action
Low Range	Off-road mode	> 35 mph (55km/h)	Continuous control

Design/Components



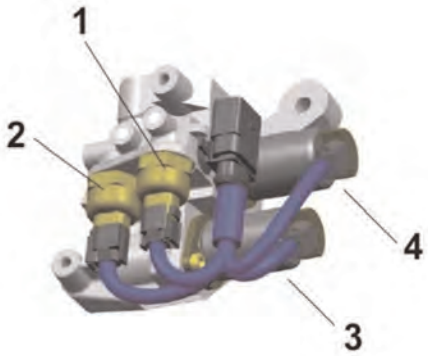
PDCC includes a two-piece anti-roll bar with a hydraulic swivel motor, a high pressure oil pump with lines and power distributor, valve blocks for activating the swivel motors and a control unit for each axle.

Anti-roll Bar With Swivel Motor



The core elements of the system are the active anti-roll bars with hydraulic swivel motors, which are integrated on front and rear axle instead of the conventional mechanical anti-roll bars. The hydraulic swivel motor is connected to one half of the anti-roll bar via the swivel motor housing and to the other half of the anti-roll bar via the swivel motor shaft. A vane controller divides the swivel motor into several chambers, which are filled with oil. A torque that affects the anti-roll bar is built up by specifically activating individual chambers and changing the oil pressure. The system has variable control over the oil pressure and oil flow in both rolling directions and can thus counteract lateral inclination forces in order to keep the vehicle horizontal.

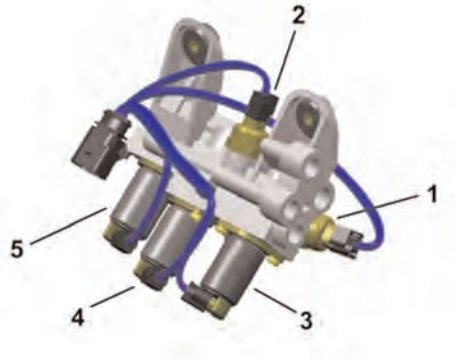
Rear-Axle Valve Block



1 - Pressure sensor
2 - Pressure sensor
3 - Pressure regulating valve
4 - Direction valve

The valve block comprises two pressure sensors (**-1-** and **-2-**), a pressure regulating valve (**-3-**) and the direction valve (**-4-**). The valve block is installed on the left rear-axle suspension subframe.

Front-Axle Valve Block



1 - *Pressure sensor*
2 - Pressure sensor
3 - Fail-safe valve
4 - Direction valve
5 - Pressure regulating valve

The valve block comprises two pressure sensors (**-1-** and **-2-**), a fail-safe valve (**-3-**), the direction valve (**-4-**) and a pressure regulating valve (**-5-**). The valve block is installed in the right front wheel housing.

Functions

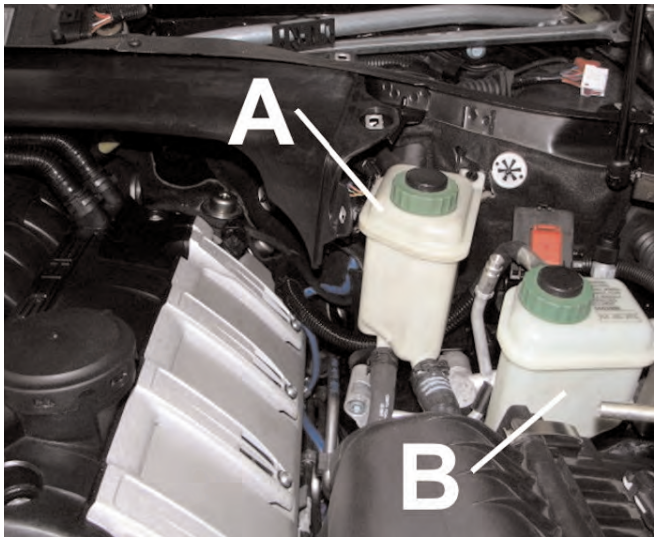
The pressure sensors record the current pressure in the chambers of the swivel motors. Depending on driving dynamics, the direction valves are switched in such a way that pressure is built up or reduced in the chambers in order to create specific forces on the anti-roll bars that will counteract the vehicle's lateral inclination. The pressure regulating valves are activated by the control unit so that the required pressure exists on the swivel motors. The fail-safe valve in the front-axle valve block is de-energized in the event of a fault and reverts to its normal position via spring force. This short circuits the pump hydraulic system and switches the system to a fail-safe mode. For a description, see . "Error message/Fail-safe mode".

Tandem Pump



A tandem pump driven by the drive belt for auxiliary units is responsible for supplying hydraulic pressure. A small fluid reservoir on the pump serves as a pressurized shock absorber. Pressure is controlled on the relevant valve blocks since the pressures in the swivel motors are different. The system is filled with Pentosin CHE 202.

Reservoir



A - PDCC reservoir
B - Power steering reservoir

The reservoir (**-A-**) is located in the left of the engine compartment, next to the power steering reservoir (**-B-**). A filter, which filters the oil flowing back in, is integrated in the reservoir. An oil dipstick for checking the oil level is fitted on the lid.

Technical Manual

Technical Manual Increased risk of accidents and material damage if too much Pentosin CHF 202 is filled in or if Pentosin CHF 202 comes into contact with the coolant hoses when filling or topping off.

Control Unit

The control unit is installed under the rear seat at the right. The input data is evaluated continuously and appropriate control operations are initiated in the valve blocks over the vehicleís entire speed range.

Analogue input signals:

- Level sensor, front left/right.
- Level sensor, rear left/right.
- Level sensor, rear right.
- Body acceleration sensor, front left/right.
- Body acceleration sensor, rear right.
- Rear-axle valve block: Pressure sensor 1, pressure sensor 2.
- Front-axle valve block: Pressure sensor 1, pressure sensor 2.
- PDCC button.

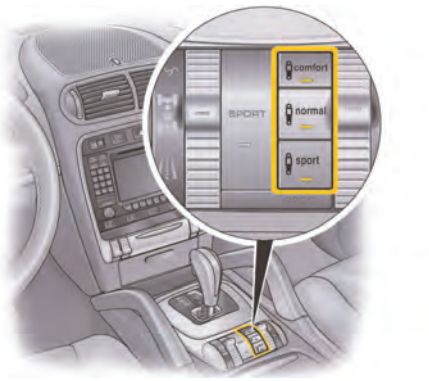
Input signals via drive CAN:

- Vehicle speed.
- Lateral acceleration.
- Yawing speed
- Steering angle.
- Engine speed.
- Nominal engine idle speed.
- Outside temperature.

Output signals:

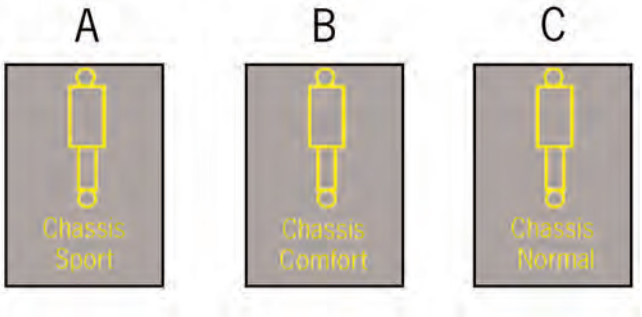
- Instrument cluster: Text, symbols.
- Rear-axle valve block: Direction valve, pressure regulating valve.
- Front-axle valve block: Direction valve, pressure regulating valve, failsafe valve.

Operation and Display Concept



Porsche Dynamic Chassis Control can be operated using the same chassis control switches Normal, Comfort and Sport that are used for PASM. PASM and PDCC are configured together, depending on which of the three chassis control programmes is selected.

In the Comfort setting, PDCC intervention occurs at reduced control speed so as not to change the character of the high comfort program. Active system intervention in the Sport program, on the other hand, occurs at maximum speed in order to optimize performance.



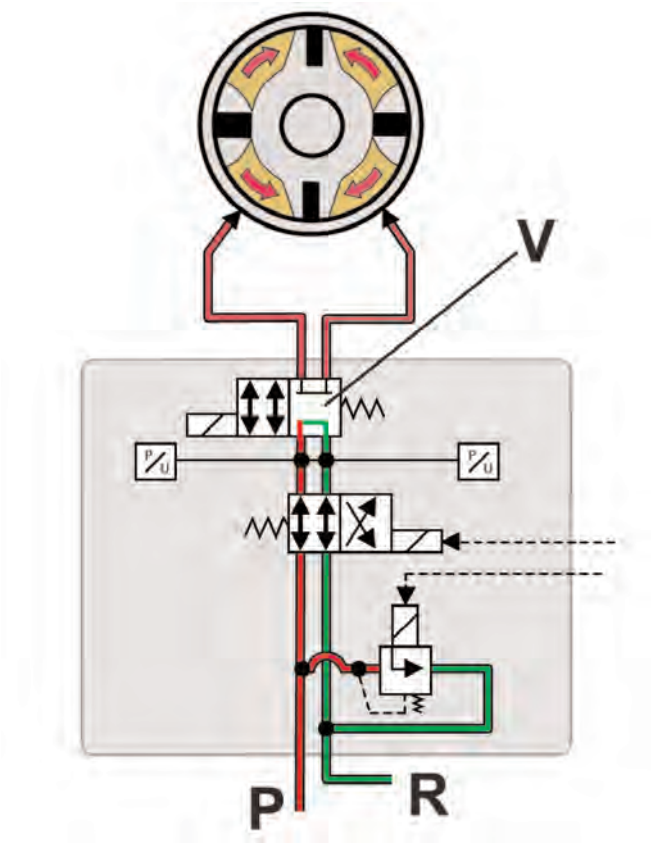
A - Sports chassis
B - Comfort chassis
C - Normal chassis

Enhanced off-road performance is also available automatically as soon as Low Range is activated.

Diagnostics

In addition to on-board diagnosis by the control units and checks on sensors and valves, the pressure that exists in the system is continuously monitored. Depending on the engine speed, the nominal pressure values that are worked out are compared with the current actual pressure values recorded by the four pressure sensors. If a fault is detected, PDCC switches to Fail-safe mode.

Error Message/Fail-Safe Mode



P - Hydraulic oil from the pump
R - Oil return to the reservoir
V - Fail-safe valve

If a fault occurs during PDCC operation, the driver is alerted to this by the message “Chassis system defective” on the on-board computer.



The entire system is switched to fail-safe mode to ensure safe driving. The fail-safe valve in the front-axle valve block is de-energized, which causes the pump hydraulic system to short circuit. The hydraulic oil from the pump flows directly back into the reservoir. At the same time, the connections for the swivel motor are closed so that the pressure in the swivel motor is maintained. The anti-roll bar remains in this position and continues to work in the conventional way.

The hydraulic system on the rear axle is completely depressurized so that the vane controllers in the housing can turn freely and the anti-roll bar halves are decoupled. This increases the vehicle’s lateral inclination during cornering. The vehicle responds by understeering slightly, but can be driven at an appropriate speed to the nearest authorized Porsche dealer.

Notes:

Hydraulically Decoupling Off-road Stabilizers
(Optional)

The driveability of the Cayenne is considerably influenced by the suspension, shock absorption and arrangement of the stabilizers. The stabilizer tuning is a compromise between an on-road and off-road configuration.

To further improve the off-road capability of the Cayenne, the vehicle can be optionally equipped with hydraulically decoupling off-road stabilizers on the front and rear axle as part of the Advanced Off-Road Technical Package. By decoupling the stabilizers on the front and rear axle, an approx. 60 mm greater wheel lift can be achieved. This results in improved off-road mobility and traction while also increasing off-road comfort.



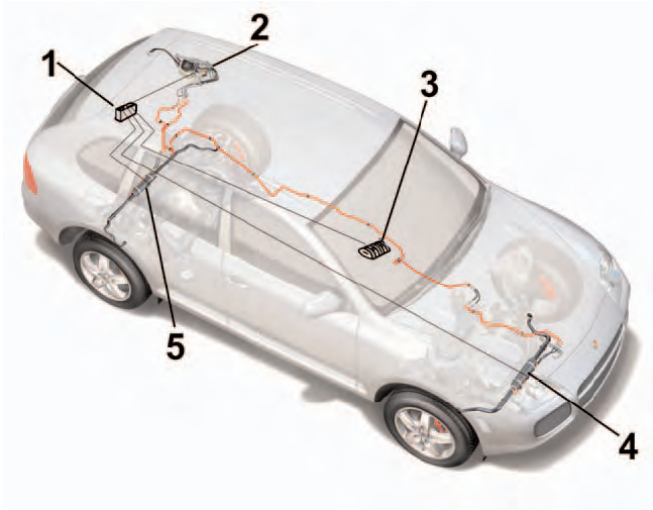
Function

The hydraulic decoupling is operated via a pushbutton in the center console. When off-road stabilizer is active, the LED in the button is on. Decoupling (off-road mode) is only possible in “Low Range”, at a speed of below 25 mph (40 km/h) and below a certain lateral acceleration (approx. 0.6 g). First the stabilizer on the rear axle is decoupled, followed by the front axle. Above a certain lateral acceleration or when a speed of 25 mph (40 km/h) is exceeded, the stabilizers are no longer switched, regardless of driver switch actuation.



At high lateral acceleration (extreme driving inclination or cornering) or on exceeding a speed of 30 mph (50 km/h), the stabilizers are switched to on-road mode (coupling), regardless of driver switch actuation. First the stabilizer on the front axle is coupled, followed by the rear axle.

System Components

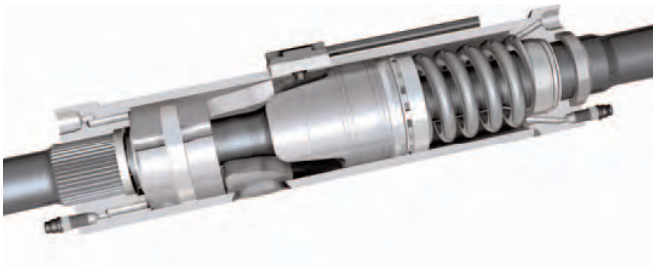


1 *- Control unit*
2 *- Hydraulic unit with pressure sensor*
3 *- Operating button*
4 *- Coupling mechanism, Front axle*
5 *- Coupling mechanism, Rear axle*

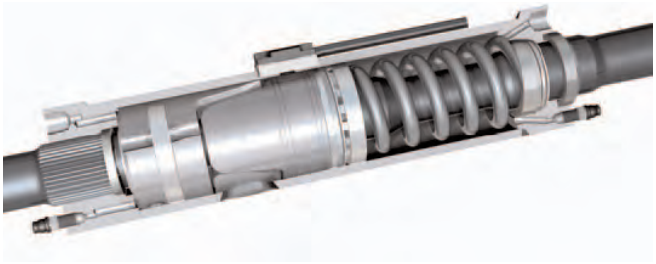
Coupling Mechanism

The coupling mechanism is in the form of a dog clutch and arranged in the center of the stabilizer. If the driver selects “Decouple system”, pressure is built up on the dog clutch through the hydraulic supply, which leads to separation of the stabilizers. For this, a valve on the hydraulic unit is switched so that on the one side (in illustration on left) pressure is built up, and on the other side the fluid can return to the compensating reservoir.

The coupling takes place through pressure reduction, so that the spring of the dog clutch closes and the transmission is re-established.



In the event of a pressure system failure, the de-energized valves are always switched so that no pressure can be built up, or any existing pressure is relieved. This ensures that in such situations the stabilizers are coupled.



Pentosin Reservoir Filler Hole

The filler hole for the Pentosin reservoir with oil dipstick (A) and vent hole (B) is located behind a cover on the D-pillar.



Tire Sealant System

As standard equipment, the Cayenne is supplied with a tire puncture sealing compound. A collapsible spare wheel or a full-size, externally mounted spare wheel and tire are available as options.

Externally Mounted Spare Wheel (Optional)



The external rear spare-wheel carrier, optionally available for all Cayenne models, is designed for a full-size wheel. The spare wheel carrier can be swung aside on body mounted hinges. The lock is integrated in the rear bumper cross member and can be unlocked electrically by means of a button.

Notes:

Tire Pressure Monitoring System (TPM) – Optional M.Y. 2003-2006

The low tire pressure warning system used by Porsche is a four-wheel system. Data is sent from the wheel sensors to the control module by radio transmission (433 MHz) operating in the high-frequency (HF) range. The exchange of information within the vehicle periphery takes place over the CAN bus.

At regular intervals, a radio signal is sent from each of the measuring and transmitting units mounted on the tire valves to the antenna mounted in the wheel wells and transmitted to the TPM control module. The TPM control module evaluates the tire pressures or the changes in pressure and transmits them to the vehicle computer. If there is a warning, the pressure differential to the specified pressure is displayed (e.g. specified 36 psi (2.5 bar), actual 32 psi (2.2 bar) = 4.3 psi (0.3), so that the driver can make up the pressure differential (4.3 psi/0.3 bar) independently of tire temperature or of the display on the airing equipment.

For safety reasons, the TPM menu can only be opened and used with the vehicle stopped. The unfiltered actual pressures can be displayed permanently in the main menu while driving.

The low tire pressure warning system provides the following benefits:

- Two-stage warning provides increased safety:
  1. early notice (“soft warning”, yellow) between 2.9 psi (0.2 bar) and 5.8 psi (0.4 bar) below specified pressure.
  2. immediate warning (“hard warning”, red) at > 5.8 psi (0.4 bar) below specified pressure or rapid loss of pressure
- Greater convenience by eliminating the regular (14-day) tire pressure checks. Adjusting tire pressure is only necessary when the appropriate display appears • longer tire life (low pressure of 4.3 psi (0.3 bar) can reduce tire life by up to 25%)
- Lower fuel consumption resulting from correct tire pressure
- Optimal handling
- Convenience: Searching for the correct pressures from the tire pressure sticker is eliminated The sets of tires mounted on the vehicle and the load status are selected in the menu. The proper pressures are automatically sent to the TPM control module (table calibration).
- Inaccurate readings from pressure gages are prevented by this table calibration. The display in the vehicle is considerably more precise.
- In the event of a warning, the tires can be inflated to the correct pressures even when warm, since the display of the difference to the specified pressures is temperature compensated (inflation information).
- The absolute pressure of the tires can be displayed while driving, and it is possible to track how tire pressures increase or drop depending on driving style, environment and temperature.
- All warnings are given relative to wheel position.

Note:
The Owner's Manual contains all the displays and functions of the TPM System.

The following situations are differentiated:

Gradual Loss of Pressure
Slight loss of pressure (2.9 psi/0.2 bar) below specified pressure), for example from tire permeability, is displayed visually and audibly to the driver at an early stage (“soft warning”) to check or to correct tire pressure at the next suitable opportunity.

Severe Loss of Pressure
In the event of a severe loss of pressure 5.8 psi (0.4 bar) below specified pressure) the driver is given an immediate visual warning. A warning buzzer sounds and the warning signal is activated simultaneously (“hard warning”). This display always appears with the ignition switched on, both with the vehicle stopped and while driving.

Components

The low tire pressure warning system consists of the following components:

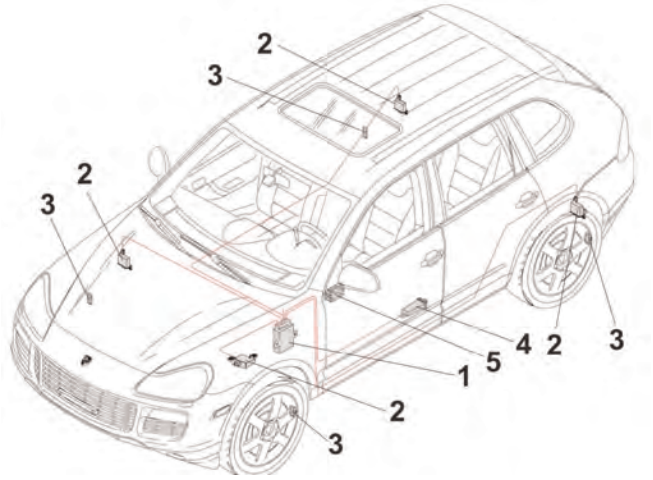
- 4 wheel sensors
- 4 antennas
- TPM control module

Tire Pressure Monitoring System (TPM) – Standard Equipment M.Y. 2008

The new Tire Pressure Monitoring system (TPM) generation is standard equipment for all Cayenne models in the North American market. The most important additional function in the system is the option for automatically and quickly detecting the wheels mounted on the vehicle (own wheels) and their installation position.

The radio signals from the wheel electronics units are requested by the control unit as required via the trigger senders. The system detects the vehicle's own wheels and the installation position of own wheels by evaluating the trigger location and performing a statistical evaluation of the wheel electronics information received.

The system comprises the following components.



1 - Control unit
2 - Trigger senders
3 - Wheel electronics
4 - Central digital antenna
5 - Left fuse carrier

Triggers (trigger senders)

The four triggers, which are located under the wheel housing liners in each of the four wheel housings, send a 125 kHz signal directly to the wheel electronics units in order to transmit the desired information to a central antenna immediately.

When the vehicle is unlocked, the control unit initiates the first 125 kHz signal for each trigger in the four wheel housings one after the other, starting at the left front in clockwise direction. Then, the wheel electronics units are only triggered approx. every 60 seconds while the vehicle is moving. Since the range of the trigger coils is limited to the relevant wheel housing, any possibility of interference affecting other wheels is almost totally eliminated. Depending on many and varied influences from the immediate environment, such as reflections (wet roads, metal grates, guide rails, etc.), external interference (external transmitters), a trigger signal can fail to reach the related wheel sensor or the feedback data protocol can get lost on its way to the central antenna.

The control unit responds immediately by re-triggering the trigger -repeatedly if necessary at the wheel position at which the expected protocol had failed to materialize as soon as the initiated trigger cycle from front left to rear right is completed. This concept reduces system interference and the wheel electronics units are detected much faster.

Central Antenna

The digital central antenna (reception frequency 315) is secured close to the center of the underside of the left side member under the vehicle and is protected from stone damage by the sill cover. The signals received from the wheel electronics units are digitalized in the antenna and forwarded to the control unit via two normal lines (LIN bus). The digital antenna has an integrated self-diagnosis facility. This means that when a fault is detected, it is stored in the control unit fault memory and displayed on the PIWIS Tester.

System Cannot be Switched Off, Warning can be Acknowledged

The TPM system can no longer be switched off. As a result, if the pressure is deliberately reduced well below the nominal pressure, e.g. for improved traction on extremely soft or sandy terrain, a flat wheel message will appear continuously in the display.

The hard (red) warning can be acknowledged with the new TPM generation. This clears the display so that any other messages and/or information can be shown. The TPM light in the instrument panel remains activated until the tire pressure is increased to the nominal pressure.

Each time the ignition is switched off and on again, the hard warning re-appears as a reminder and can be acknowledged again if necessary.

Porsche Approved Original Equipment
N-Specification Tire Information



Design and Testing

Porsche designs and manufacturers some of the highest performance vehicles in the world. Because of the essential role that tires play in vehicle performance, Porsche has integrated tires in the design process throughout vehicle development. Porsche original equipment tires must successfully pass the tire company's laboratory tests, road tests and race track evaluations to confirm that the prototype tires meet Porsche's noise, hydroplaning, handling and high-speed durability requirements. Only upon successful completion of these tests, will tires be released for production.

Branded as N-Spec

Production tires that have passed all of the tests and received Porsche's engineering department's release can be branded with an N-specification. The N-specification brandings include: N-0 (N-zero), N-1, N-2, N-3, N-4, N-5 or N-6. These markings on a tire's sidewall clearly and permanently identify them as approved by Porsche for their vehicles. The N-0 marking is assigned to the first approved version of a tire design. As that design is refined externally or internally, the later significant evolutions will result in a new generation of the tire to be branded with N-1, N-2, N-3, etc., in succession. When a completely new tire design is approved, it receives the N-0 branding and the succession begins again.

Mixing N-Spec Tires

Use only tire types tested by Porsche. Only tires with the same manufacturer and with the same specification code (e.g. "N0", "N1" …) should be mounted on the vehicle. Tires should be replaced no less than in pairs on one axle at a time. Only tires of the same tire make and type must be used. Since many Porsche vehicles are fitted with different sized tires on their front and rear axles, this requires matching the tire brand, tire name and N-specification front to rear.

While the tire manufacturers may also build other tires featuring the same name, size and speed rating as the N-specification tires for non-Porsche applications, these tires may not be branded with the Porsche N-specification because they do not share the same internal construction and/or tread compound ingredients as the N-specification tires. Mixing tires are not permissible and will affect vehicle performance, safety and can affect vehicle warranty.

Replacing N-Spec Tires

If a vehicle was originally delivered with N-specification tires that have been discontinued and are no longer available, it is recommended to replace all four tires to a higher numeric N-specification design appropriate for that vehicle.

In case of tire damage such as cuts, punctures, cracks or sidewall bulges that cause a single tire to be replaced for safety reasons, the remaining matching tire on that axle must not exceed 30 percent wear. If the remaining tire has more than 30 percent wear from new, it should also be replaced. This rule applies to all four tires on all wheel drive vehicles. Handling inconsistencies may result if this is not done.

Break-in of New Tires

Initially, new tires do not offer their full traction. Drivers should therefore drive at moderate speeds during the first 60-100 miles (100-200 km). If new tires are installed on only one axle, a noticeable change in handling occurs due to the different tread depth of the other tires. This happens especially if only rear tires are replaced. However, this condition disappears as new tires are broken in. Drivers should adjust their driving style accordingly.

Tire Aging

Additionally, even though only the world's highest performance tires can earn the Porsche N-Spec approval, eventually all tires will either wear out or age out. The chemical additives that make rubber elastic lose their effectiveness in the course of time and the rubber becomes brittle and cracks. Considering the performance capabilities of a Porsche, under no circumstances should tires older than 6 years be used.

How is a Tire Selected for a Porsche?

The tires selected for a Porsche are chosen based on the model (sports car or SUV), and the job the tires are asked to do.

The 911 Carrera (996/997), Boxster (986/987) and Cayman S (987) are examples of the world's finest exotic performance cars with some of the same capabilities found in previous generations of racecars. For these vehicles Porsche selects Maximum Ultra High Performance Summer tires from the world's leading tire manufacturers: Bridgestone, Continental, Michelin, Pirelli and Yokohama.

And since Cayenne puts the sport in sport utility vehicle, emphasis is placed on high limits of performance balanced with the utility demanded by the Cayenne owner. Pirelli Scorpion A/T All-Terrain tires are chosen for highway use in all weather conditions, including snow and cold climates, as well as for off-road use. Continental 4X4 Contact and Pirelli Scorpion Zero tires are designed for highway use in all weather conditions including snow and cold climates. Bridgestone Turanza tires target a balance of performance and ride comfort for highway summer conditions. Continental 4X4 SportContact, Michelin 4x4 Diamaris, and Pirelli PZero Rosso tires are chosen for sports car-like handling in both wet and dry summer conditions.

Porsche Dealers Have the Performance Tires You Need

Decades of engineering excellence and racing heritage are designed into each Porsche vehicle. All the technology and innovation has to work through the four small contact patches that allow the performance potential to be realized. Many vehicle owners forget these four critical performance points are so important to their driving expectations, pleasure and safety.



Brakes – General

As with the sports cars, the brake system in the Cayenne is specifically designed for its high performance and weight. With the Cayenne, the conversion of energy when braking from top speed at maximum gross weight is more than twice as great as with the Boxster. Because of the front-mounted engine, the higher center of gravity and the resulting weight transfer under braking, the front brakes in particular are under considerably greater stress. Do to the special requirements regarding contamination (for example, mud in off-road use) the brake rotors are not cross-drilled. All Cayenne models are standard equipped with Porsche Stability Management, which is networked with Porsche Traction Management.

M.Y. 2005 Modification

The brake pedal light switch has been removed.

Brake System, Cayenne

The brake system of the Cayenne is designed for the high performance and the weight of the vehicle. Therefore, 17˝ rotors front and rear, 6-piston aluminum fixed calipers on the front axle and 4-piston fixed calipers on the rear. All other components such as brake booster with brake master cylinder, rear wheel brakes and parking brake are the same as on the Cayenne S.

Brake System, Cayenne S and Cayenne Turbo

(Turbo up to M.Y. 2006)

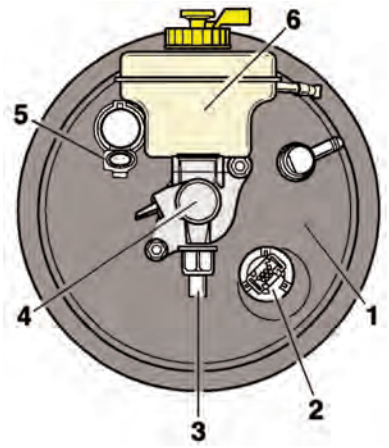
The brake system of the Cayenne S/T has 18˝ rotors on the front and 17˝ on the rear, with 6-piston fixed aluminum calipers on the front axle and 4-piston fixed aluminum calipers on the rear.

Brake System – Cayenne Turbo S (Option for M.Y. 2006)

The brake power was increased in order to match the higher driving performance. On the new Cayenne Turbo S, larger brake discs with larger calipers replace the brake system of the Cayenne Turbo. The diameter of the front brake discs was increased from 350 to 380 millimeters and the diameter of the brake discs on the rear axle from 330 to 358 millimeters. The heat dissipation was improved by 10% thanks to a new, further developed cooling duct design.

Brake Booster

The tandem master brake cylinder with the overflow reservoir and the vacuum brake booster are installed at the front. The tandem brake master cylinder has a diameter of 26.99 mm and a stroke of 18/18 mm. To keep operating effort to a comfortable level, a tandem vacuum brake booster (dual diaphragm) is used. Two connected pistons are arranged in tandem in a housing (diaphragm diameter 9 and 10 inches), which increases the working surface correspondingly. The boost factor is i=7. When the brake is applied, atmospheric pressure is brought to both diaphragms through a control valve and thus assist is built up behind the brake master cylinder. A magnetic winding, a metal piston, the trigger switch and a diaphragm travel sensor were integrated in the booster unit. A pressure sensor is mounted on the brake master cylinder. These components are required for PSM.

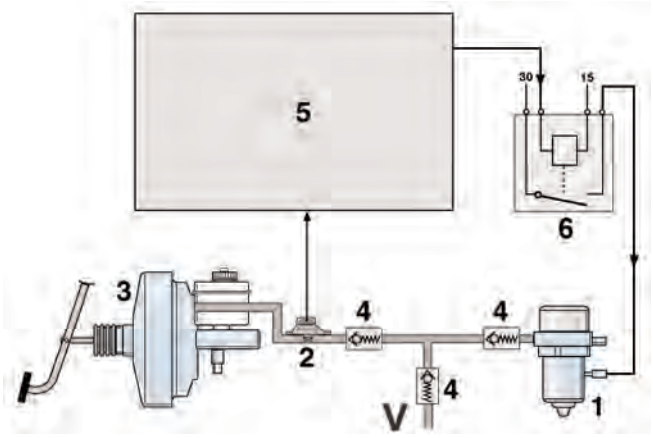


1 *- Brake booster*
2 *- Connector for trigger switch and magnetic winding*
3 *- Pressure sensor*
4 *- Brake master cylinder (tandem– brake master cylinder)*
5 *- Diaphragm travel sensor*
6 *- Overflow reservoir for brake fluid*

Notes:

Vacuum Pump For Brake Booster (Cayenne Turbo Only)

To improve brake boost assist, an electric vacuum pump is installed in the engine compartment, on the right on the strut tower. In engine operating conditions with reduced vacuum supply, such as catalytic converter heating following a cold start, parking or driving at altitude, the pump is activated by the DME control module. The DME control module reads pressure in the brake booster through a pressure sensor ahead of the booster and switches the pump on (see paragraph "Control Module Inputs" in the Fuel/Ignition System section).



1 *- Vacuum pump*
2 *- Pressure sensor*
3 *- Vacuum brake booster*
4 *- Non-return valve*
5 *– DME control module*
V *- Engine vacuum connection*

Brake Fluid

The Cayenne brake system is filled with "ATE Super DOT 4" brake fluid. The change interval is two years.

Front Brakes, Cayenne

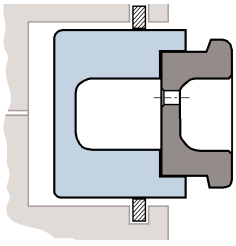


Cayenne calipers are painted Black.

The ventilated brake disk has a diameter of 17″ (330 mm) and is 32 mm thick. The monobloc aluminum fixed caliper is equipped with 6-pistons in the diameters of 34, 36 and 38 mm. The three outer pistons are provided with heat insulating, high-temperature-resistant plastic inserts to reduce the risk of vapor lock in the brake fluid. The brake linings, specially adapted for the Cayenne, are monitored for wear on both sides and provided with vibration dampers.

Front Brakes, Cayenne S/T (Turbo up to M.Y. 2006)

The internally vented brake rotor is 18″ (350 mm) in diameter and 34 mm thick. The rotor was not cross-drilled because of the requirement regarding contamination (mud in off-road use). The monobloc fixed aluminum caliper is fitted with 6 pistons of 30, 34 and 38 mm diameter.



The three outer pistons are fitted with heat insulating, high temperature resistant plastic inserts to reduce the risk of air bubbles forming in the brake fluid.

Caution:
When retracting the pistons. Improper handling can destroy the plastic insert.



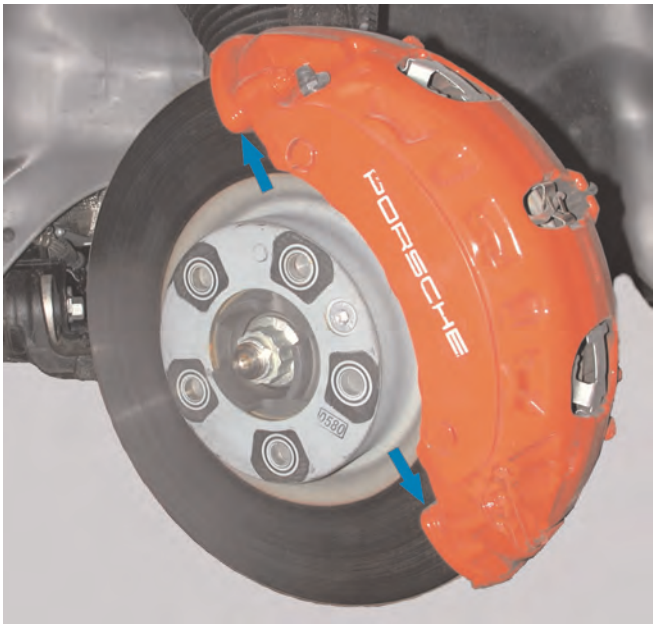
Cayenne S calipers are painted Silver.



Cayenne Turbo (up to M.Y. 2006) calipers are painted Red.

Notes:

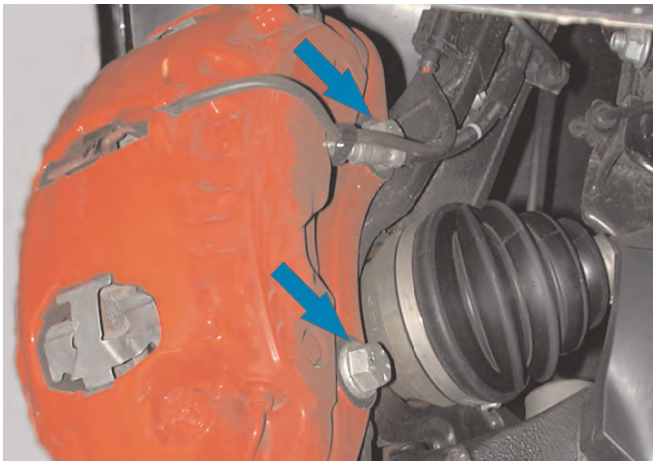
Cayenne Turbo M.Y. 2008



To achieve the best deceleration values even with the significantly improved performance of the new Cayenne Turbo, it now features an improved turbo brake system with the following enhanced components:

- Larger brake discs
- Reinforced brake calipers
- Optimized brake pads

The brake calipers on the Cayenne Turbo have also been reinforced. The correspondingly larger front brake calipers now have an additional reinforcement frame (**-arrows-**), which is bolted to the caliper housing in four places and serves to strengthen the structure.



The four bolts on the reinforcement frame must not be loosened. To replace the pads, loosen the two bolts for the wheel carrier.

Rear Brake

The radially internally vented brake rotor is 17″ (330 mm) in diameter and 28 mm thick. The rotor was not cross-drilled because of the requirement regarding contamination (mud in off-road use).



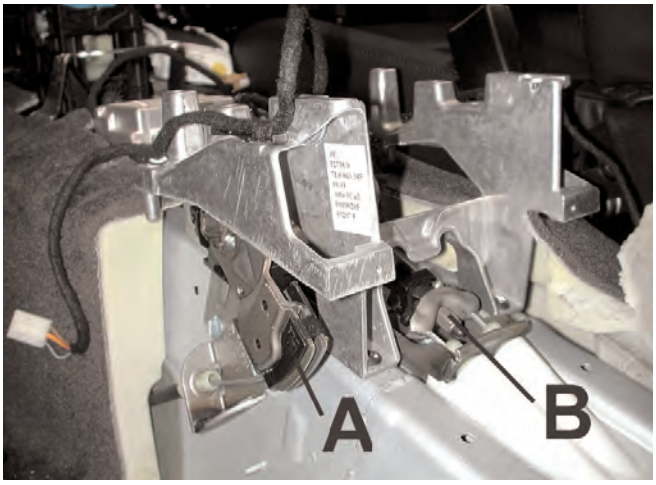
Cayenne calipers are painted Black.
Cayenne S calipers are painted Silver.
Cayenne Turbo calipers are painted Red.

The monobloc fixed aluminum caliper is fitted with 4 pistons of 28 and 30 mm diameter. The lower brake line is protected by a stone guard (A).

Notes:

Parking Brake

The special requirements of a sporty multi-purpose vehicle were taken into account in the design of the parking brake. Even fully laden, the Cayenne can be safely parked on a 55% slope.



To achieve the required force at the brake, it was designed as a foot-operated parking brake. From the foot lever, a cable leads to a bell crank (A), which redirects the force with a 3.1 ratio to a cable pivot (B). Two cables lead from the pivot to the parking brakes.



The duo-servo drum parking brake is integral with the rear brake rotor.

PSM (Porsche Stability Management)

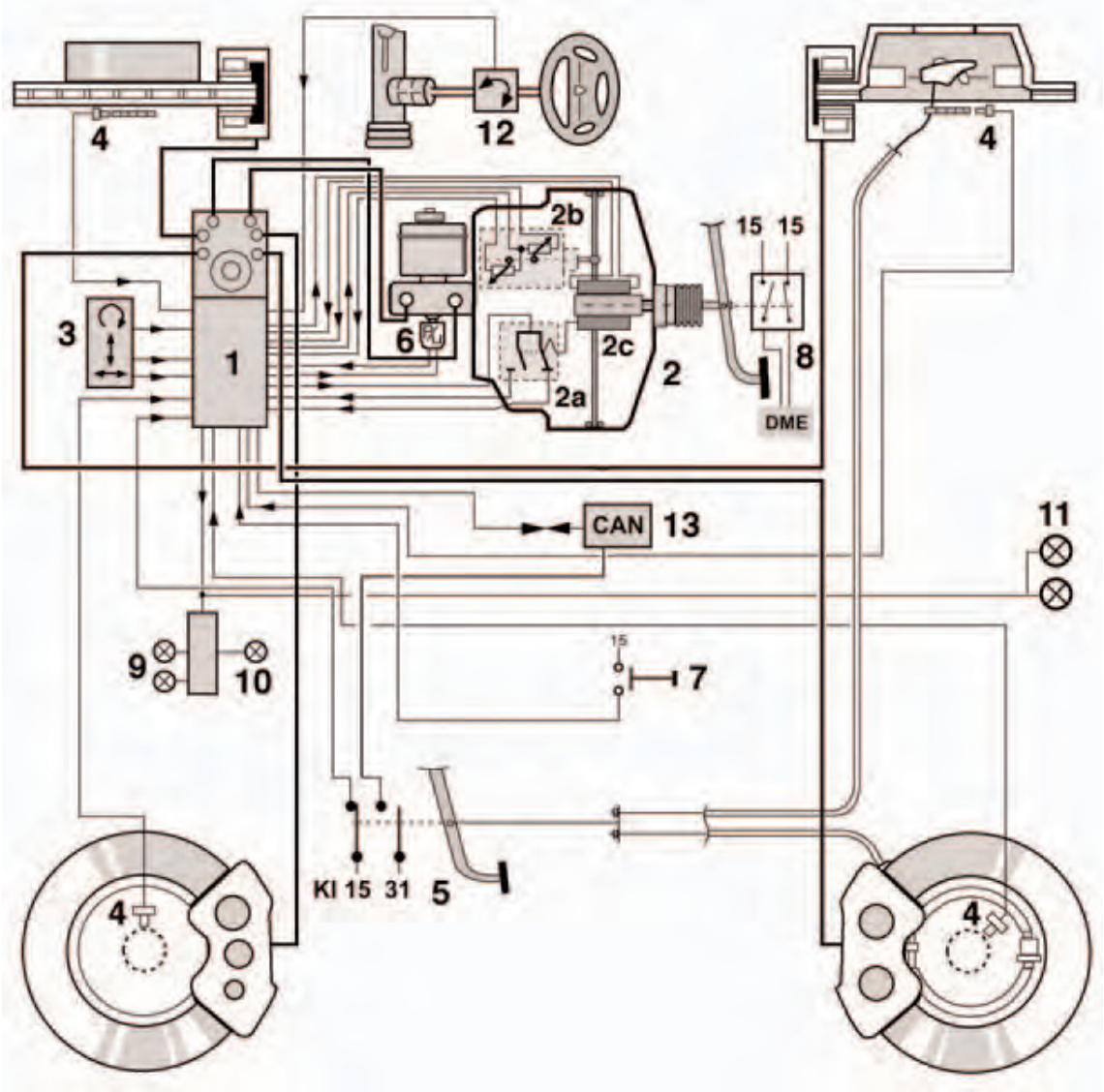
All Cayenne models are equipped with PSM, which is networked with the Porsche Traction Management (PTM). PSM is an outstanding electronic driving dynamics control system for stabilizing the vehicle when reaching handling limits and for increasing driving safety.

PSM (Porsche Stability Management) – M.Y. 2008

The new Cayenne models also feature enhanced Porsche Stability Management (PSM). PSM improves active safety thanks to the following additional functions:

- Enhanced braking readiness
- Brake assist function
- New ABS tuning for braking on loose surfaces

PSM Diagram



1 *- PSM control unit*
2 *- Active brake servo*
2a *- Release switch (brake signal)*
2b *- Diaphragm travel sensor*
2c *- Solenoid coil*
3 *- Multifunction sensor (longitudinal/lateral acceleration, rotation rate)*
4 *- Speed sensor*
5 *- Switch for parking brake*
6 *- Pressure sensor*
7 *- PSM OFF switch*
8 *- Brake light switch*
9 *- ABS warning light*
10 *- PSM warning light*
11 *- Brake lights*
12 *- Steering angle sensor*
13 *- CAN*

In addition to the already familiar functions such as ABS, ABD, ASR, EBD, MSR and VDC, the following functions have been used since Model Year 2003:

Off-road ABS

To shorten the off-road braking distance, the off-road ABS briefly blocks the front wheels. The resultant wedge effect in front of the wheels assists the braking.

The off-road ABS operates only:

- When low range is selected
- At speeds below 30 mph (50 km/h)
- When driving straight ahead. If the steering wheel is turned (cornering), the off-road ABS is automatically switched off to maintain steering capability.

Off-road Vehicle Dynamics Control (VDC)

With low range selected and at a speed of below 22 mph (35 km/h), the vehicle dynamics control, in particular the braking, are performed with a delay. The advantage of this is that, for example, when driving downhill on loose ground with sharply turned wheels (understeer), the cornering force is not lost through further free-rolling wheels.

Porsche Hill Control (PHC)

Porsche Hill Control is the designation of an auxiliary system that assists the driver when driving downhill off-road and when starting off on a hill (on vehicles with manual gearbox). This term PHC covers engine-brake torque assistance (MBU) and Porsche Drive-Off Assistant (PDOA).

M.Y. 2005 Modification

For off-road use, the ABD has been expanded by a traction-oriented off-road control strategy. A special control strategy has been implemented in high range mode that delivers a noticeable improvement in traction, particularly when driving on sand. Starting out or driving on sand and also the transmission of torque on gravel has been further improved through the ABD optimization.

Engine Brake Torque Assistance (MBU)

When moving off slowly downhill (forwards or backwards), the engine-brake torque works against the downgrade force and brakes the vehicle. If one or more wheels lose grip while driving downhill (especially off-road), the engine brake torque effect would be lost. The PSM initiates braking on the wheels that have good ground contact. The vehicle acceleration caused by the downgrade force is prevented and the vehicle speed remains constant.

MBU can currently still be deactivated via the PSM-OFF button. During model year 2004, MBU is also available when PSM is deactivated.

MBU operates only when:

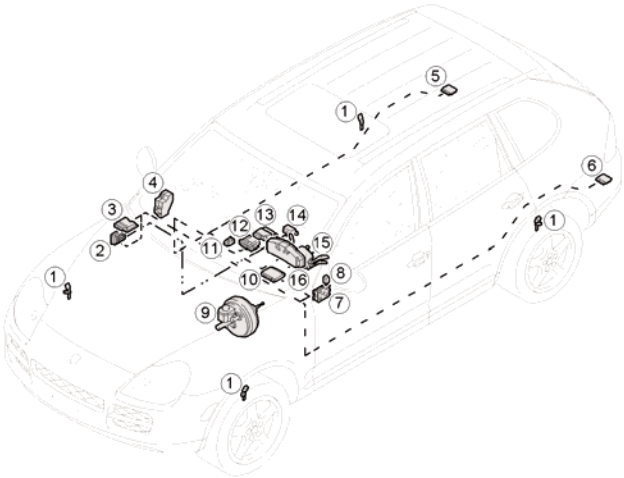
- Gas pedal not pressed
- PSM active
- Speed below 12 mph (20 km/h)
- A gear is engaged

PSM OFF Switch



To allow the driver to control the car more actively the PSM can be switched off with a switch in the center console. When the PSM is switched off, the wheel-selective brake application (VDC) and anti-slip regulation are deactivated. **Reaching handling limits can lead to wheel-selective brake application.** The ABD function, which is also accessed by the PTM, is retained. Switching off of the system is indicated by a indicator lamp in the PSM switch and in the instrument cluster. PSM continues to monitor the vehicle yaw motions, however, to ensure reliable ABS control an active control intervention is only carried out when the brakes are applied.

Component Location



1 - Speed sensor (wheel)
2 - PSM control module and hydraulic unit
3 - DME control module
4 - Fuse carrier, right
5 - Control module for level control
6 - Control module for rear axle differential lock
7 - Brake light suppression relay
8 - Servotronic control module
9 - Active brake booster with components (in the cowl on the left side)
10 - Control module for vehicle electrical system
11 - PSM OFF switch
12 - Tiptronic control module
13 - Transfer case control module
14 - PSM multiple sensor
15 - Steering angle sensor
16 - Instrument cluster

The following customer benefits are realized through PSM:

- The best possible traction and tracking when accelerating even on roads with different coefficients of friction (road surfaces)
- Compensation for weight transfer reaction during deceleration or partial braking in curves, up to the maximum lateral acceleration on all road surfaces.
- Prevention of dynamic oversteer, for example, with rapid steering movements, under deceleration, during lane changes or in S-bends.
- Reduction of understeer when entering curves at speed, particularly on low coefficients of friction
- Reduction of braking distance with improved stability during braking, particularly in curves and changing coefficients of friction.
- Sports car-like tuning of the total system for great safety, while retaining outstanding agility and superior handling characteristics, even during sporty driving.
- The ability to switch the system off to deliberately increase individual participation in the driving experience

Notes:

PORSCHE

Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

- ☑ Diagnosis system: Read out fault memory; reset maintenance interval
- ☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
  Engine compartment: Visual inspection for damage
  Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels
- ❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)
- ❑ Air filter/s: Check the air filter condition, and if necessary, replace
- ❑ Check drive belt
- ❑ Coolant hoses: Check condition
- ❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
  Coolant: Check level and antifreeze protection level
- ☑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear
- ☑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level
- ❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage
- ❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)
- ☑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)
- ☑ Tires, external spare wheel: Check condition and tire pressure
- ❑ Panorama roof: Adapt control module
- ❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades
- ❑ Vehicle lighting: Check operation
- ❑ All headlights: Check adjustment
- ❑ Horn: Check operation
- ❑ Batteries and ventilation hoses: Check condition
- ❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

- ❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
- ❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
- ❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

- ❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

- ❑ Change front differential oil
- ❑ Change rear differential drive oil
- ❑ Change transfer case oil
- ❑ Change manual transmission oil
- ❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

- ☑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

- ☑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

- ☑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

- ❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

PORSCHE

Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

- ☑ Diagnosis system: Read out fault memory; reset maintenance interval
- ☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
  Engine compartment: Visual inspection for damage
  Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels
- ❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)
- ❑ Air filter/s: Check the air filter condition, and if necessary, replace
- ❑ Pollen filter: Replace filter element
- ❑ Check drive belt
- ☑ Steering gear: Visual inspection of the dust boots for signs of damage
  Tie rod ends: Check play and dust boots
- ☑ Power steering: Check fluid level
- ❑ Fuel system lines and connections: Visual inspection
- ❑ Coolant hoses: Check condition
- ❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
  Coolant: Check level and antifreeze protection levels
- ☑ Parking brake: Check free play
- ☑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear
- ☑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level
- ❑ Axle shafts: Visual inspection of the for leaks & signs of damage
- ❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage
- ❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)
- ☑ Hydraulically detachable off-road sway bar: Check fluid level and function
- ❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts
- ☑ Tires, external spare wheel: Check condition and tire pressure
- ❑ Lubricate door latch and fastening bolts
- ❑ Panorama roof: Adapt control module
- ❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level
- ❑ Check wiper blades
- ❑ Seat belts: Check operation and condition
- ❑ Vehicle lighting: Check operation
- ❑ All headlights: Check adjustment
- ❑ Horn: Check operation
- ❑ Batteries and ventilation hoses: Check condition
- ☑ Trailer coupling: Check operation
- ❑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

- ❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
- ❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
- ❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

- ❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

- ❑ Change front differential oil
- ❑ Change rear differential drive oil
- ❑ Change transfer case oil
- ❑ Change manual transmission oil
- ❑ Change Tiptronic transmission oil and ATF filter

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Part Number – PNA 000 162 CB

Additional Maintenance every 2 years

☑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

☑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

☑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

❑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CB



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Notes:

General



The Cayenne has a fully galvanized, unitized steel body with four doors, a rear gate and seating for five. The vehicle fulfills all worldwide safety regulations with respect to front, side and rear impact as well as rollover and front and rear impact.

Aerodynamics

Development of the Cayenne overcame specific aerodynamic challenges, including:

- A large cross-sectional area to accommodate the interior space and comfort requirements.
- Greater ground clearance.
- Limited design tolerance of aerodynamic underbody components, due to the demands of off-road operation.
- Higher performance requirements at low speed resulting in increased demands on cooling of assemblies and components.

In order to meet these requirements, experience gained in sports cars was applied in optimizing all details of the new vehicle. The cool air inlets were placed in the area of the greatest dynamic pressure. Cool air routing, designed as closed channels, provides maximum airflow to the radiator. In this way, the cross sections of the air inlets could be reduced, thereby diminishing drag in the airflow. Aerodynamic measures leading to an optimal cW value in the tail area include a downward rake of the rear roof line and a slight inward tilt of the upper body optimized in the wind tunnel. The roof spoiler reduces the cW value significantly while increasing aerodynamic downforce on the rear suspension.

Drag coefficient c_W	= 0.39
Cross section A m^2	= 2.785 Cayenne/S
	2.78 Cayenne Turbo
c_W x A	= 1.09 Cayenne/S
	1.08 Cayenne Turbo
Lift coefficient VA c_{AV}	= 0.15 Cayenne/S
	0.15 Cayenne Turbo
Lift coefficient HA c_{AH}	= 0.02

The air flow around the front and rear wheels, guided by spoilers, results in reduced lift and together with optimized balance between front and rear suspension lift, contributes to the outstanding driving characteristics of the Cayenne, even at high speed. Even smaller details such as the small chin spoilers and the plastic underbody protection contribute to the vehicle's superior aerodynamic qualities.

The underbody splash shields aid in the cooling of components such as the front axle with specifically directed air inlets. Using a tuned system of air channels and spoilers, cooling air is guided to the brakes at the high level expected of a Porsche.



In addition to innovations in driving and thermodynamic characteristics, advances were made to improve comfort.

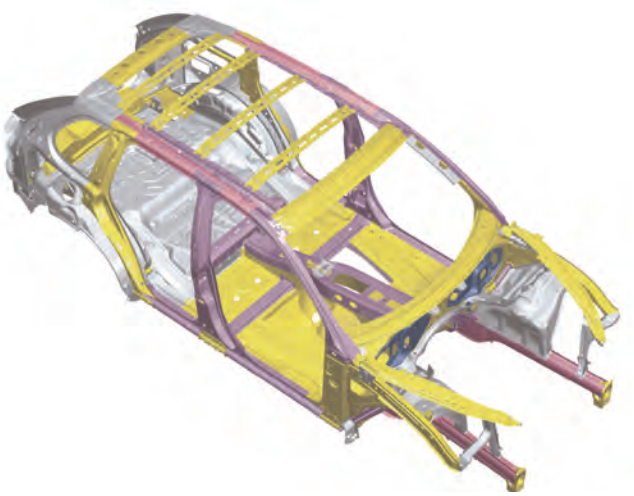
The following focal points should be mentioned:

- Reduction of dirt accumulation on side windows and mirrors by engineering the A-pillar, outside mirror and drip molding.
- By tuning the wind deflector, booming was suppressed and strong wind effects were prevented in vehicles with sunroofs open to various positions.
- Reduction of annoying wind noise by using hidden wipers, redesigning body sealing as well as eliminating exposed edges.

Body – 1st Generation

Body Shell

Through optimized design and use of the most modern materials, the Cayenne achieves enviable static and dynamic body stiffness. This is due to the particular competence of Porsche in the area of lightweight steel construction. The extraordinary body stiffness provides the ideal basis for precise suspension tuning since body twist and vibration caused by the road surface irregularities are minimized by the stiff body structure.



Structural and Material Concepts

A side and cross member structure intelligently distributes forces arising from a crash. Three tiers absorb deformation energy, distributing the forces to the rigid floor side member, body sill, tunnel and door frame areas, there by reducing passenger compartment deformation. The front chassis subframe made of high strength hydroformed steel tubes forms the bottom load absorbing tier. The center load absorbing tier consists of the joined front side member and the front bulkhead cross member. The top load-absorbing tier is made of the frame side member. The result is a tough passenger compartment offering a high level of rider protection.

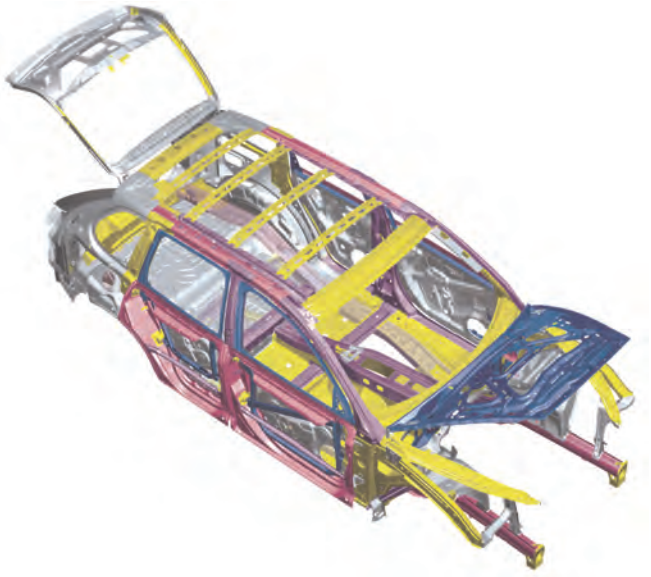
The high impact zones with limited allowable deformation in a crash, such as the doors and doorsills, the body are reinforced with high strength steel. The parts are made in a press quenching process. The sheet metal is hot-stamped and then cooled according to specification. The treated material then has superior shape and strength characteristics.



An innovation is the use of multi-phase steels in the body. These steels are used both when high strength is required and when complex drawn parts must be used. Examples include the rear area of the front cross member, the cross member in the front wall, the seat rail and heel cross members, the door sill inner section and tunnel crash reinforcement.

Notes:

Multi-phase steels, so-called dual phase and TRIP steels (TRransformation Induced Plasticity) have a higher rigidity than other steels and almost the same plasticity. The interior B-pillar and the reinforcement in the A and B-pillar are made of TRIP steel to provide roll-over protection. Highest strength multi-phase steels are used in the seat cross members and in the rear cross member. Similar to Porsche sports cars, the Cayenne uses custom made sheet metal called tailored blanks. This allows parts to be dimensioned so that they have specific characteristics depending where they are used; for example, the side member will have a varying thickness profile (for the crush zone and passenger compartment). Multi-phase steels allow the use of light yet extremely stable structures in the areas of the side members and side roof frames.



High-strength steel

High-strength steel

Sheet steel

Aluminum

Tailored Blanks

The body structure, including the roof frame and all pillars is completely designed as a three layer construction (interior and exterior shell, reinforcement). The layers in the roof frame are arranged to form a three box structure with high rigidity. The rigid layout of the roof frame and base allow the implementation of optional modular roof designs, such as a sunroof. One piece side sections allow styling features such as harmoniously joined sections of doors and pillars.



This design also minimizes production tolerances. Shell construction of the door sills is supplemented by a high strength tubular element to reduce intrusion into the vehicle during a side pole crash. In order to meet objectives for vehicle fording ability at a water depth of 19.6″ (500 mm) for a period of 10 minutes, the body structure had to be designed with a special sealing configuration. This design uses a “dry sill” concept (fully enclosed door sill). The difficulty of having to seal a “wet,” flooded doorsill to protect the passenger compartment is thereby avoided. Foam reinforcement in the form of barrier panels are installed on the A-pillar, B-pillar, and rear wheel housing, as well as in the junction between the doorsill and columns; while the body is in the baking oven, the foam expands to form a seal.

A high quality anti-corrosion surface is applied to the two-sided galvanized sheet metal to guarantee long term durability. In addition, sealing body cavities with wax likewise contributes to long term body integrity. In this process, body cavities are first filled with wax, then drained. Compared to usual spray wax procedures, this method offers superior wax penetration into the cracks and provides adequate sealing.

Luggage Compartment



The luggage compartment has a capacity of 540 liters and provides a level cargo area. Folding the rear seat forward expands the cargo area to 1800 liters. The luggage compartment is provided with a cargo net and cargo area cover.



An additional 20 liter storage capacity is located in the luggage compartment on the driver's side.

The standard ski sack allows skis or other long objects to be easily transported without folding down the rear seat.



The low gate sill allows ergonomically comfortable loading. The folding rear window enables loading of small objects. The rear gate is unlocked from the outside using micro switch on the handle.



Notes:

Underbody Protection



To prevent lift and protect against damage, the underbody is protected with four wide sections made of reinforced polypropylene. The front underbody piece protects the vehicle against stone impact as well as against possible damage while driving on steep inclines.

Front Hood



The front hood is made of aluminum, thus saving approximately 5 lbs (11 kg) compared to a steel hood. On the Cayenne Turbo, air scoops are built into the hood to provide cooling air for the turbocharger.

Doors



All four doors have integrated side impact protection. The door structure has longitudinal reinforcements made of high tensile boron steel. This design ensures high impact protection and safety for the occupants. The doors have modular construction. The doorframe is made of aluminum manufactured using the extrusion process. Mounted on one side of the door frame is the door body with integrated side impact protection; on the inside is the mounting structure. The modular assembly mount is set on this structure. The motor for the power windows is attached here. The modular assembly mount is covered by the interior trim.

Door Handle

The doors are equipped with D-handles. The outside has a shiny appearance and the inside has a rubberized surface for a pleasant feel.

Notes:

Panorama Roof

In addition to the electric sliding/lifting roof, a new, electrically operated, continuously adjustable Panorama roof system is available as an option for the Cayenne. This four-segment glass roof extends lengthways over the entire exterior roof skin from front to rear transverse frame and crossways over the surface between the holding rails for the roof transport system.



The entire glass surface of the Panorama roof system is around (approx. 63″ x 35″), making it almost four times as large as the optional sliding/lifting roof with a glass surface of around (approx. 18″ x 32″). The Panorama roof system allows a maximum opening area of 32″ x 32″. The design team went for a particularly high-quality look.

This objective was achieved impressively by implementing the following measures:

- Flush transitions
- Concealed mechanism
- Use of tinted glass
- Minimum number of joints

The fixed glass element and solid attachment to the bodyshell help to ensure that torsional forces are absorbed by the structure. Large profile cross-sections and bodyshell reinforcements in the roof area have also ensured that the roof can always be opened as far as possible while maintaining the best possible body rigidity.

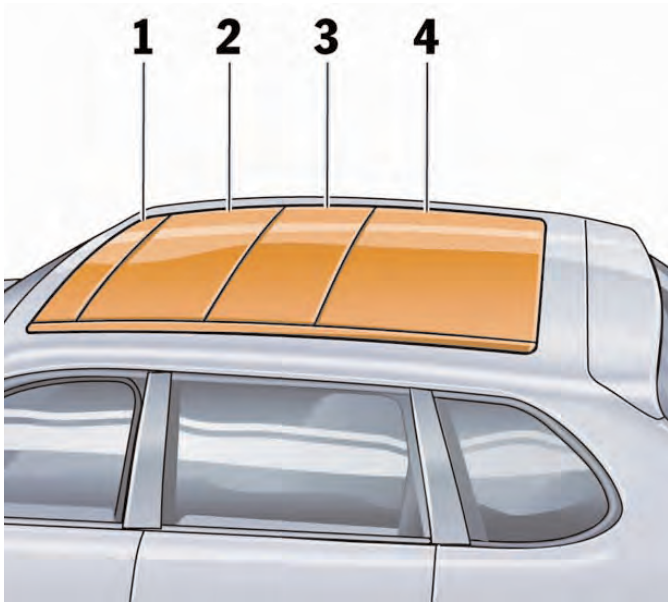
Another safety aspect is that the Panorama roof system is made from laminated safety glass, which reduces the risk of possible injury to passengers from glass splinters in the event of roof damage.

The glass used in the Panorama roof system is tinted grey and has the following properties:

- UV transmission: 8%
- Infrared transmission: 10 %
- Energy transmission: 15 %
- Light transmission: 17 %

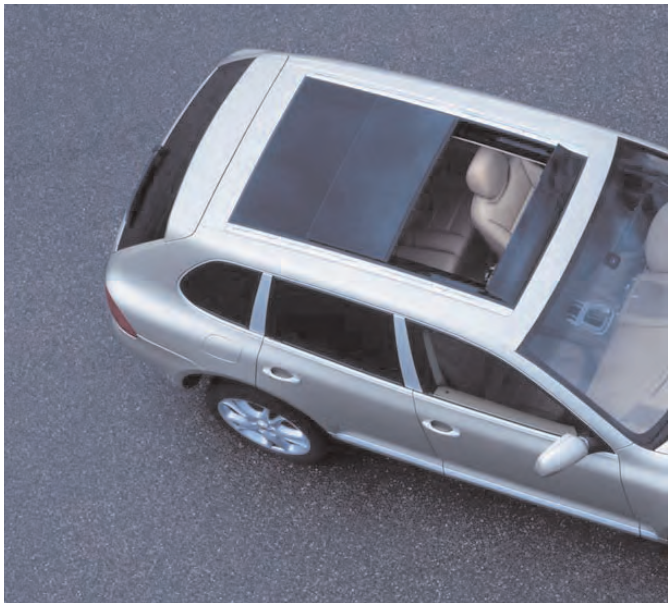
The Panorama roof system cannot be supplied in conjunction with the optional roof rail or the roof rail including drip mouldings, which is also available on request.

The Panorama roof system for the Cayenne offers particularly high variability in terms of the different opening positions of the various segments.

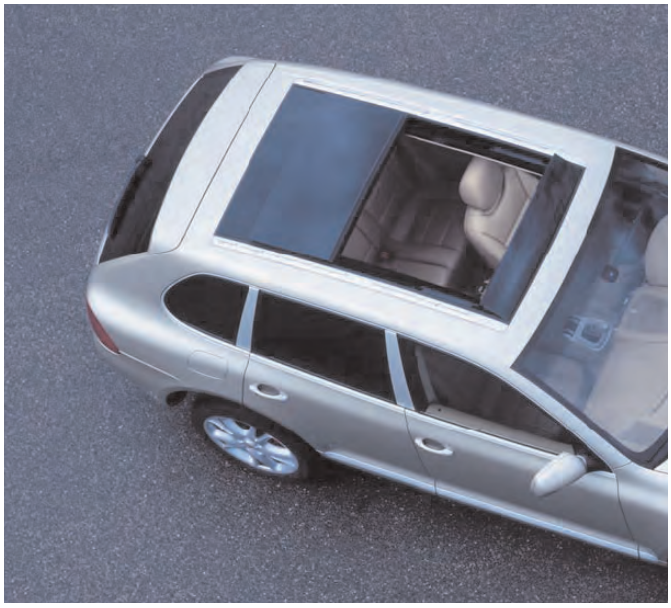


1 *- Air deflector*
2 *- Sliding roof element*
3 *- Sliding/lifting roof element*
4 *- Fixed glass element*

The segment at the very front (in direction of travel) - segment 1 - acts as a front air deflector. This adjusts itself according to speed and helps protect against the disturbing effects of the wind when the Panorama roof system is open.



Segments 2 and 3 are behind this and can be moved lengthways. This means that the roof can be opened either only over the first or second row of seats, or both segments can be pushed back over or under the fixed glass section (segment 4) to open the roof over both rows of seats.



Segment 3 can also be opened in lift position for improved ventilation of the interior. When segment 3 is in lift position, the air deflector (segment 1) remains closed. Before one of the sliding segments is moved backwards however, the air deflector (segment 1) swivels upwards. To deflect air, even with a very small opening, the segment is moved mechanically and is not pressed upwards in the normal way by a spring.

Furthermore, the air deflector (segment 1) is controlled in accordance with the speed if segment 3 is moved. This helps reduce air turbulence and wind noise at freeway speeds.

Roof element 4 is a fixed glass element and completes the Panorama roof system. An electrically controlled shade, which comes as standard, protects the interior from both direct sunlight and cold. If the shade is closed or in an intermediate position, it is also activated automatically when you open the glass segments.



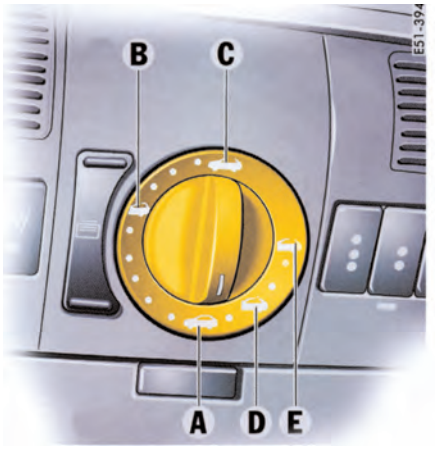


The glass segments can be controlled - in the same way as the electric sliding/lifting roof - using an illuminated rotary switch, which is part of the console in the front roof area.

The Panorama roof system can be operated in the following situations:

- When the ignition is switched on.
- When the ignition key is removed until such a time as the door is opened, but only for max. 10 minutes.

The Panorama roof system stand-by function switches off after 10 minutes. If the vehicle is unlocked, the vehicle electronics switch off after 10 minutes in order to save the battery. As a result, the roof elements can no longer be operated. The power supply is restored when the ignition is switched on again.

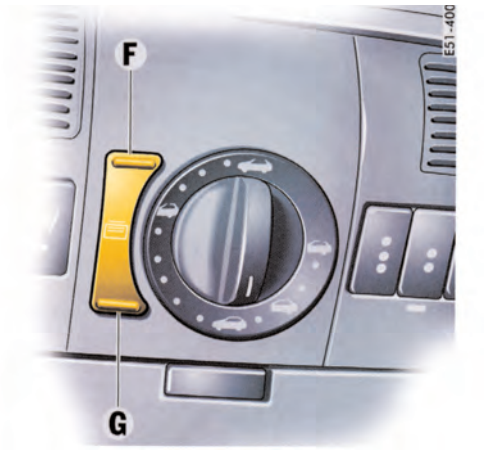


A - Closing the Panorama roof system fully.
B - Opening the sliding roof element fully.
C - Opening the Panorama roof system fully.
D - Sliding/lifting roof element in lift position.
E - Opening the sliding/lifting roof element fully.

The automatic presetting system allows you to control every usable roof position directly using a corresponding rotary switch setting. A separate rocker switch for the electric shade on the Panorama roof system is located next to the rotary switch in the roof console.

Notes:

This switch has two settings:



- If the rocker switch is pressed to the first setting, the shade opens or closes in stages as you press the rocker switch.
- If the rocker switch is pressed fully, the shade opens or closes to the end position.

To open the shade – Press rear of rocker switch F

To close the shade – Press front of rocker switch G

Shade Cleaning Position

1. Close the Panorama roof system and shade fully.
2. Turn the rotary switch to position C. The Panorama roof system opens fully.
3. Once the Panorama roof system has reached the end position, press the front of the rocker switch G and keep it pressed for more than 3 seconds until the shade is fully closed.
4. Remove any dirt (e.g. leaves).
5. Press the rear of the rocker switch F and keep it pressed until the shade is completely open.
6. Close sliding roof element.

Comfort Function

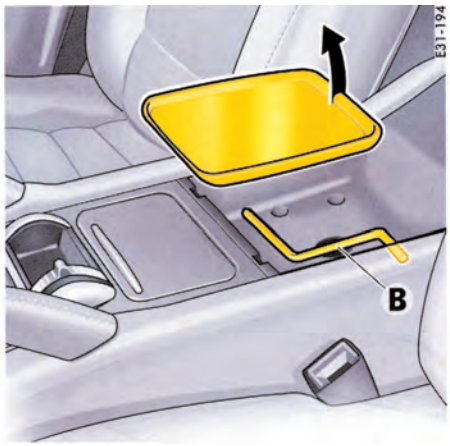
If the vehicle key in the door lock is turned towards "Open" or "Close" for more than two seconds, the Panorama roof system will open or close while the key is turned in the respective direction. The shade will operate automatically, if necessary (e.g. when you open the roof while the shade is closed).

The Panorama roof system opens from the closed position to the maximum open position in the following three steps:

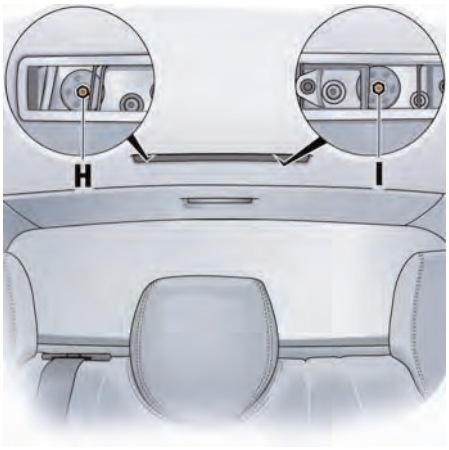
1. Air deflector (segment 1) swivels upwards.
2. Segment 2 moves back over segment 3.
3. Segment 2 moves further back over segment 4, while segment 3 moves under segment 4.

Like the glass electric sliding/lifting roof, the Panorama roof system also comes with an anti-pinch protection feature. If the roof senses resistance while closing, it automatically goes back. Electric and manual emergency closing function The Panorama roof system has an anti-pinch protection feature both for opening and closing. The anti-pinch protection feature stops the roof from moving if a segment is obstructed while closing or opening the Panorama roof system.

If the moveable segments cannot move freely due to ice/snow, sand or other debris, the roof's opening or closing action may also be interrupted. The electric emergency closing function allows you to disable anti-pinch protection so that the Panorama roof system can be closed fully. The electric emergency closing function can be activated by pressing and holding down the presetting switch in "Roof closed" position.



If the electric drive mechanism fails, the roof can also be closed manually using the Allen key (Item B). You will find this key underneath the rubber mat in the lower oddments tray in the center console.



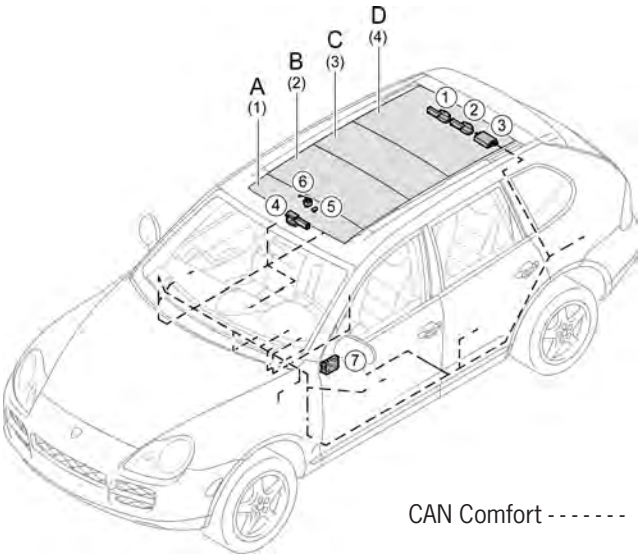
1. *Unclip cover.*
2. *Insert the key into opening H or I until it clicks firmly into place.*

This may requires some effort.

If the Panorama roof system malfunctions or if the roof is closed manually, the system must complete the learning phase again with the roof closed. This involves pressing and holding down the presetting switch in the "Roof closed" position for more than five seconds. A reset sequence begins, in which first the shade, then segment 1, segment 2 and finally segment 3 is closed.

Notes:

Components – Panorama Roof System



1 *- Motor adjustment for roof segment A and B (motor, cover 1 and 2)*
2 *- Motor adjustment for roof segment C (motor, cover 3)*
3 *- Control unit*
4 *- Motor adjustment for shade*
5 *- Rocker switch*
6 *- Rotary switch*
7 *- Fuse carrier on left of dashboard (fuse F42, 30 A)*

Notes:

PORSCHE

Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Check drive belt

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Tires, external spare wheel: Check condition and tire pressure

☑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

☑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

PORSCHE

Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

- ☑ Diagnosis system: Read out fault memory; reset maintenance interval
- ☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
  Engine compartment: Visual inspection for damage
  Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels
- ❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)
- ❑ Air filter/s: Check the air filter condition, and if necessary, replace
- ❑ Pollen filter: Replace filter element
- ❑ Check drive belt
- ❑ Steering gear: Visual inspection of the dust boots for signs of damage
  Tie rod ends: Check play and dust boots
- ❑ Power steering: Check fluid level
- ❑ Fuel system lines and connections: Visual inspection
- ❑ Coolant hoses: Check condition
- ❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
  Coolant: Check level and antifreeze protection levels
- ❑ Parking brake: Check free play
- ❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear
- ❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level
- ❑ Axle shafts: Visual inspection of the for leaks & signs of damage
- ❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage
- ❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)
- ❑ Hydraulically detachable off-road sway bar: Check fluid level and function
- ❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts
- ❑ Tires, external spare wheel: Check condition and tire pressure
- ☑ Lubricate door latch and fastening bolts
- ☑ Panorama roof: Adapt control module
- ❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level
- ❑ Check wiper blades
- ☑ Seat belts: Check operation and condition
- ❑ Vehicle lighting: Check operation
- ❑ All headlights: Check adjustment
- ❑ Horn: Check operation
- ❑ Batteries and ventilation hoses: Check condition
- ❑ Trailer coupling: Check operation
- ☑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

- ❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
- ❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
- ❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

- ❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

- ❑ Change front differential oil
- ❑ Change rear differential drive oil
- ❑ Change transfer case oil
- ❑ Change manual transmission oil
- ❑ Change Tiptronic transmission oil and ATF filter

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Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

☑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CB



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Notes:

General



The second generation Cayenne models feature a new attractive dynamic design and include the following development goals:

- Increased performance and less consumption.
- Improved active and passive safety.
- Improved everyday suitability and new attractive features.



Additional features and options for the second generation Cayenne include:

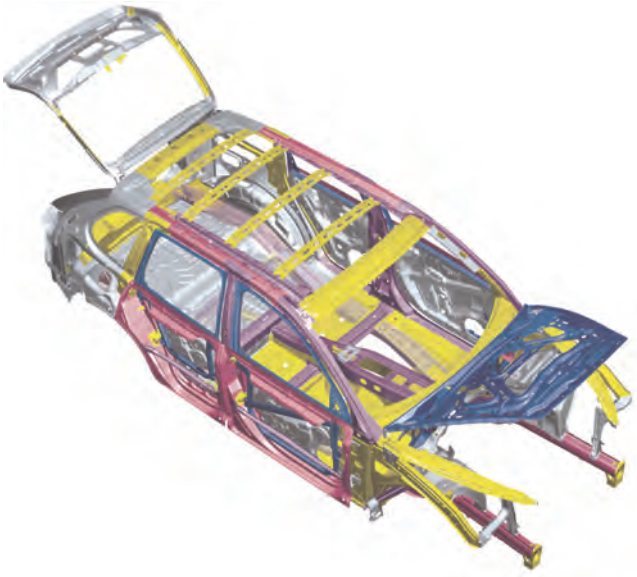
- Hydrophopic side windows.
- Automatic tailgate (Standard).
- New management system for the luggage compartment (optional).

Body Shell

The exterior body panelling received new design elements while the underling body shell structure components basically remained unchanged from the previous model.

The second generation Cayenne's design criteria carried over from the previous models:

- Excellent static and dynamic body stiffness.
- Excellent passive safety.





Body – 2nd Generation

Body – Front

The front end changes included new front lights that have a flatter basic shape, which makes all new Cayenne models look wider. The fact that the mid-point of the outer light unit for the headlights has been shifted further out also adds to this look. See section 9 for complete details on the new light systems and features.

Additional design changes include:

- New designed front end and air inlets.
- Stronger contoured front fenders.



Cayenne/S front view.



Cayenne Turbo front view.

Body – Rear

The rear end changes included new tail lights that have also been redesigned with LED technology. In addition to the white backup lights, the shape of the rear lights has also been adapted to suit the new rear end design. See section 9 for complete details on the new light systems and features.

Additional design changes include:

- Integrated tailpipes.
- Lower rear diffusor panel.
- Redesigned and enlarged roof spoiler.
- Sharper contoured rear quarter panels.
- New design of the rear cargo compartment.



Cayenne/S rear view.



Cayenne Turbo rear view.

Doors & Rear Lid

Automatic Rear Lid

The new automatic rear lid, which is much more convenient and highly practical for loading the vehicle, is available as an option for all Cayenne models. The rear lid can be both opened and closed fully automatically at the touch of a button with this option.

Opening The Rear Lid Automatically

When towing a trailer, the rear lid can only be opened using the release button on the rear lid.

The rear lid can be opened in three different ways:



Option 1 – Press the release button on the rear lid. The vehicle must be unlocked in this case. The vehicle does not have to be unlocked if it has Porsche Entry & Drive. You simply need to have the vehicle key with you, e.g. in your pocket.



Option 2 – Press the button on the key for approx. 1 second. If the vehicle is locked, the doors will remain locked when you open the rear lid.



Option 3 – With the ignition switched on, pull the switch in the driver's door and hold it until the rear lid is fully open. The process for opening the rear lid will be interrupted if you release the switch too soon.

Notes:

Closing The Rear Lid Automatically

Make sure that the load is not too close to the rear lid when closing it because otherwise the process for closing the rear lid will be aborted and the rear lid will stop and not fully close and lock.



Press the button in the rear lid trim. Interrupting the opening/closing process in dangerous situations.

The opening/closing process is interrupted immediately if one of the following buttons/switches is actuated:

- Pressing the button on the key,
  or releasing the switch in the driver's door,
  or pressing the button in the rear lid trim,
  or pressing the release button on the rear lid.

Automatic opening/closing can be resumed at any time. To do this, simply actuate the relevant button/switch.

Obstacle Detection While Opening The Rear Lid

If the opening process is blocked by an obstacle, the rear lid will not open. An alarm sounds. Once the obstacle is removed, the rear lid can be opened by pressing the button on the key or pulling the switch in the driver's door or pressing the release button on the rear lid.

Obstacle Detection When Closing The Rear Lid

If the closing process is blocked by an obstacle, the closing process is aborted. An alarm sounds and the rear lid remains partially open. Once the obstacle is removed, the rear lid can be closed by actuating a button/switch.

Setting The Opening Height Of The Rear Lid

The opening height of the rear lid can be set individually, for example, so that the rear lid will not hit the garage ceiling. The vehicle height depends on the level settings for vehicles with level control.

Use these steps:

1. Stand behind the vehicle and open the rear lid.
2. Use the button on the key to stop the automatic opening process at about 2/3 of the opening height.
3. Then move the rear lid up with your hand until it is at the required opening height. When doing so, make sure the lid is far enough away from any obstacles.
4. Press the button in the rear lid trim and hold it for approx. 3 seconds. An acknowledge tone sounds and the direction indicators flash once. The opening height for the rear lid is now programmed. The rear lid can now be closed by pressing the button. This setting cannot be deleted. If a different setting is required, repeat the procedure from Step 1 to 4.

Malfunction Of The Rear Lid Drive

The automatic function is not active if the battery voltage is too low. Actuating a button releases the lock on the rear lid and a warning beep sounds for 3 seconds. The rear lid can now be opened manually.

Notes

A warning beep sounds while the automatic rear lid is moving on vehicles designed specifically for the USA and Mexico.

Rear Lid Emergency Operation

If the automatic opening/closing process is interrupted due to a fault, a warning beep sounds for approx. 3 seconds. Open and close the rear lid manually.

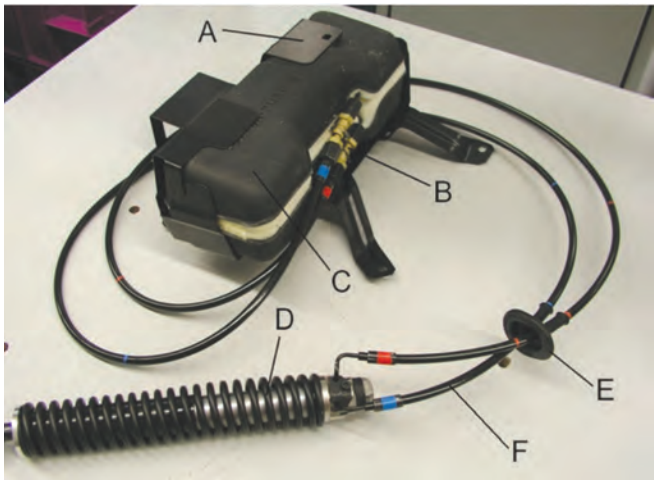
System Overview

The automatic rear lid has an actuating unit with a hydraulic pump and a spring-supported hydraulic cylinder.



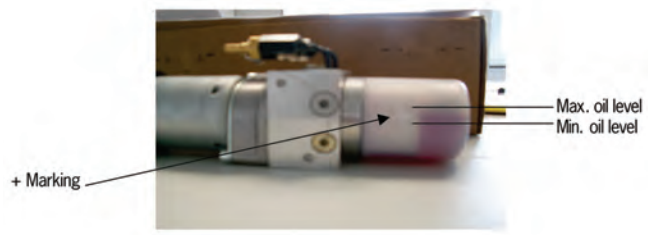
A - Hydraulic cylinder with spring
B - Hoses
C - Hydraulic pump
D - Support

Component Overview



A - Support
B - Quick-connectors
C - Sound capsule
D - Hydraulic cylinder
E - Grommet
F - Hoses

Checking Hydraulic Oil Level



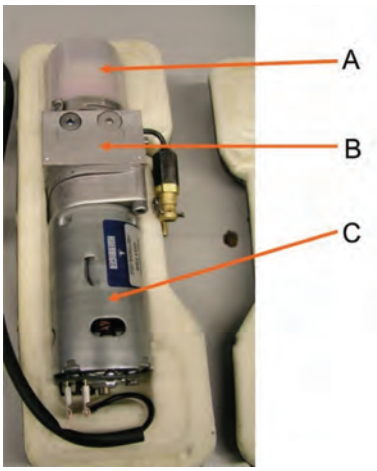
Before checking oil, open and close rear lid 2-3 times automatic to remove any air in the system.

- High oil level – Pressure in the tank could be too high during manual operation!
- Low oil level – Pump noises due to air in system, incomplete opening and closing function!

Hydraulic Pump

The hydraulic pump comprises an electric motor, the actual pump and an oil tank. The pump is packed in a sound capsule to reduce noise and is secured in the rear left wheel housing by a support.

A - Tank
B - Pump
C - Electric motor



The spring-supported hydraulic cylinder is connected to the pump by quick connectors. Pressure loading of the cylinder on the piston side drives the cylinder out. Pressure is applied to the rod side by reversing the poles of the electric motor. The control unit for rear lid hydraulics reverses the poles. A maximum pressure of up to 2900 psi (200 bar) exists in the system. The pressure in the system must not exceed 72 psi (5 bar) when removing/installing the quick connectors, otherwise the connectors can be damaged. The automatic rear lid system also has diagnostic capabilities.

Notes:



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Notes:

General

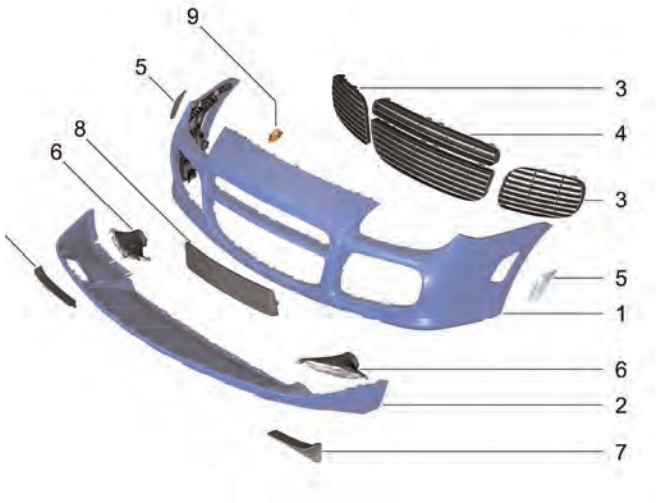


The Cayenne's exterior has many of the characteristics of typical Porsche design. The air intakes at the front are optically similar to those of the 911. The round/oval headlights in Porsche look detail the side contour of the front hood, as in the sports cars. The V-shaped hood and the design of the front fenders are typical "Porsche". The design of the side windows with round and straight lines is a creative combination of elegance and sportiness.

Notes:

Front Bumper Cover

The front of the Cayenne is made of three parts. The main part is assembled together with the spoiler. The desired aerodynamic correction values (air resistance and excess lift) are reached due to this spoiler and the focused rerouting of the cooling air. The bumper is clipped onto the above-mentioned parts. The license plate holder is integrated into the middle of the bumper. The front of the Cayenne S and the Cayenne Turbo have different air intakes, Turbo has larger air intakes. The integrated sensors for the parking assistant are clipped onto the main part and are painted the same color as the vehicle.



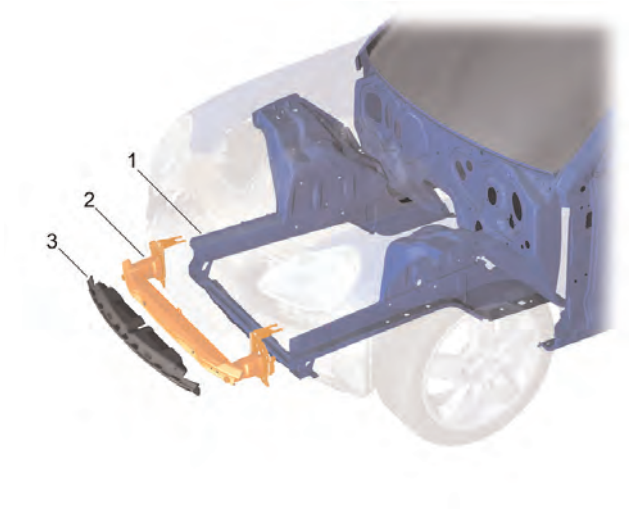
The front fascia is composed of the following main parts:

1 - Fascia
2 - Bottom part of facing
3 - Grill side
4 - Grill middle
5 - Side marker lights
6 - Fog lights
7 - Spoiler
8 - License plate holder
9 - Porsche emblem

Body, Exterior

Bumper System

In designing the bumper systems, a cost effective full-coverage insurance level was in the forefront. If a crash at low speeds takes place, the energy involved will be compensated for in the bumper system, without any damage taking place on the shell. The frontal bumper system is made of steel that is assembled out of a highly stable crossbeam and two deformation elements.



The bumper system is made up of the following parts:

1 - Longitudinal beam
2 - Bumper
3 - Inlay

The crossbeam has holes with threads to screw in the towing lugs. The towing lugs can be screwed in at the front or at the back. An advantage of these lugs being outside of the vehicle profile is that if they are used, there is no damage to the vehicle or any parts thereof. When deciding on the strength of the towing lugs, specific towing power was taken into consideration. Up to 6,600 lbs (3,000 kg) can be towed if using one lug, if two are used, 12,000 lbs (5,500 kg) can be pulled. The rear bumper system is made of aluminum for weight reasons. The rear bumper has an inlay for USA vehicles.

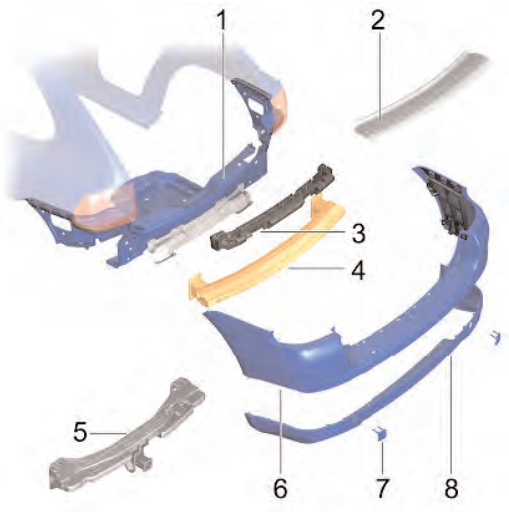
Rear Bumper Cover



The entire back end of the vehicle is composed of two components and fulfills complex aerodynamic and thermo-dynamic demands. Both ends of the vehicle are repair friendly and can be taken apart quickly should any damage occur. The sensors for the parking assistant are clipped on and painted the same color as the vehicle.

Trailer Hitch (Towing Package)

One hitch is offered as an option. A hitch made up of a stiff steel crossbar with steel deformation elements. The USA version has a maximum towing capacity of 7716 lbs (3500 kg) (trailer with brakes) and a maximum supporting capacity of 617 lbs (280 kg).



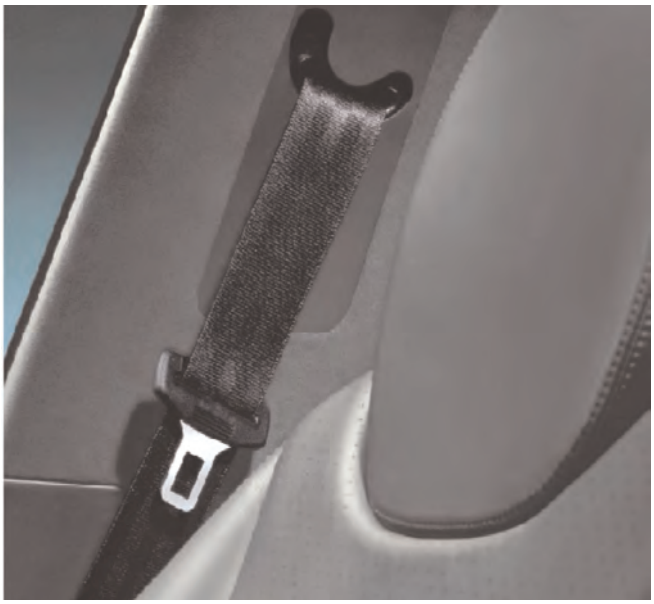
1 - Endplate
2 - Kickplate
3 - Foam part
4 - Bumper
5 - Hitch
6 - Rear covering
7 - Towing lug covering
8 - Bottom part of rear covering

Passenger Protection



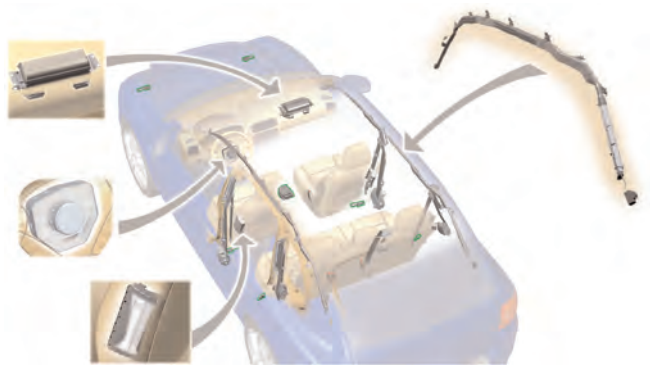
A high level of passenger protection can be reached due to the safety systems that were made especially for this vehicle. The Cayenne has three point safety belts for all seats. There are also driver and passenger side full size front airbags and side airbags for thorax protection. The Cayenne also has curtain airbags for both seat rows for head protection in the case of a side collision.

Seat Belts



The Cayenne has pyrotechnical belt tighteners for the front seats and the outside seats in the back. These belt tighteners have belt power limiters for very low passenger strain levels. The middle seat has a two point seat belt.

Airbag System – 1st Generation



The standard airbags for the driver and passenger are full-size airbags. The driver airbag has an acid free gas generator technology with organic fuel. The two level gas generator enables an improved balance of the air-bag system for further decrease of passenger strain. The sensors that are connected to the airbag control unit can vary the deployment at two levels, depending on the power of the crash. There are two additional sensors near the front bumper. The passenger side airbag module is built into the upper area of the control panel and has an integrated cover. The passenger side airbag also has two levels of deployment and uses acid free gas generator technology.

Side Airbags

A new side collision protection system is offered with the Cayenne. This system is made up of a seat integrated thorax airbag and a so called curtain airbag that is built into the roof frame. The air bag of the seat airbag has a volume of approx. 10 liters and is filled with an acid free gas generator. The curtain airbag is effective for the front seats as well as for the rear outside seats. The air sack of the curtain airbag creates a flat pillow between the front and rear roof columns. If needed, it unfolds between the head of the passengers and the side of the vehicle. It's volume is approx. 30 liter. It is filled with a cold gas generator of the most current technology. The side airbags are activated by four additional sensors, that are near the B-columns and the rear wheel housings.

Airbag System – 2nd Generation



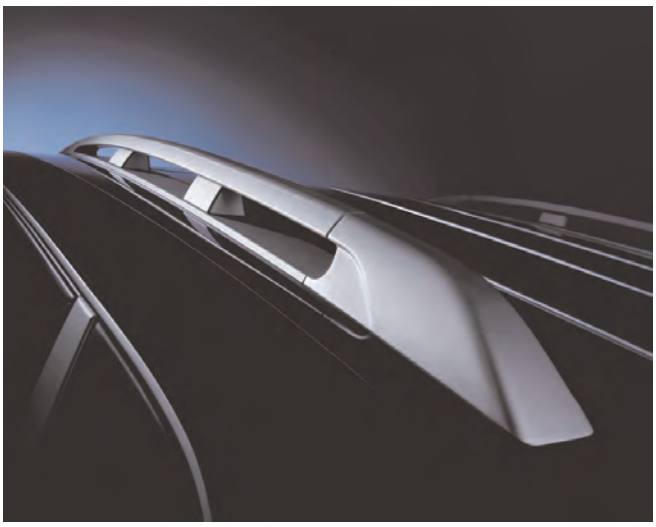
All Cayenne models are equipped with dual front Advanced Airbags that offer upper-body protection with an added degree of intelligence. A weight sensor in the passenger seat automatically switches the passenger side bag off when unoccupied or fitted with a child seat. These are augmented by a side-impact protection system featuring a thorax airbag in each front seat. Curtain type airbags on each side of the roof provide optimal head protection for both rows of seats. When these are deployed, they form a protective cushion along the side of the vehicle.

To provide better detection of a head-on collision, two additional impact sensors are located at the front of the new Cayenne. As a result, the front airbags can be more accurately deployed in response to the specific characteristics of what can often be a complex impact scenario.

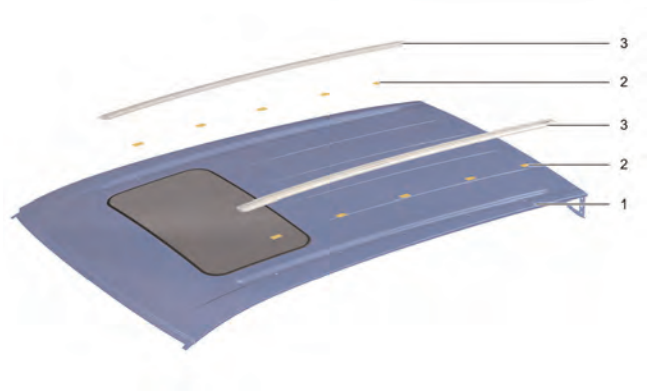
The driver and front passenger airbags use a gas generant based on an organic propellant. The airbags are therefore lighter more compact and easier to recycle.

A rollover detection system provides additional protection in the event that the vehicle overturns. Using sensor acquired data, the rollover detection system enables early deployment of the curtain airbags and triggers the seatbelt pretensioners.

Roof Transport System



The Cayenne also offers the option of a roof transport system (RTS). The design is specially created for the profile of the Cayenne. The profile track for the various constructions is installed flat in the side roof ducts and made of aluminum.



To assemble the roof transport system, the supports are set on the profile track near the B-column with the fasteners. The optimized construction means that the track and the surface will not be damaged. The supports are then moved into the desired position until the fasteners click into the holes in the track. The final fixing of the roof transport system takes place with a clamping device. The support system can be secured with locks against theft. The stable construction of the system allows a roof burden of 220 lbs (100 kg).



The modules currently offered for roof transport systems by Porsche, can also be used with the Cayenne. For vehicles with a sun roof, all openings can still be used, even when the roof transport system is installed.

Notes:

Notes:



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Door Trim, Front	3
Door Trim, Rear	4

Notes:

General



For the interior four standard equipment colors are available: black (solid), palm green (solid) and the two-tone combinations, steel gray/ stone gray and Havana / sand beige. Optional on the Cayenne/S is a full leather treatment in available interior colors. The carpeting in the passenger compartment is wear resistant and of high quality. Three different headliner colors are coordinated with the interior colors.

Instrument Panel

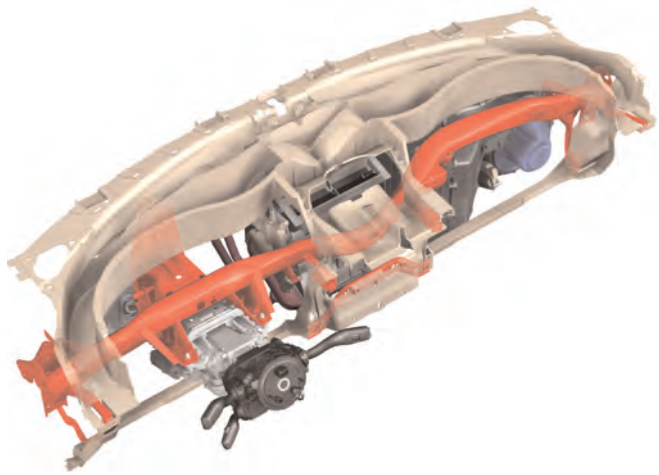


Combining traditional Porsche form with off-road specific design led to a distinctive instrument panel reminiscent of the sports cars.

The following typical Porsche elements can be found in the Cayenne's interior:

- Ignition on the left
- Circular instruments with a central multi-function display
- Three-spoke steering wheel with Porsche emblem

The lower section of the instrument panel consists of the support frame to which are attached assemblies such as air vents, steering column lever, fans, etc. The support frame is bolted onto the side to the vehicle body.



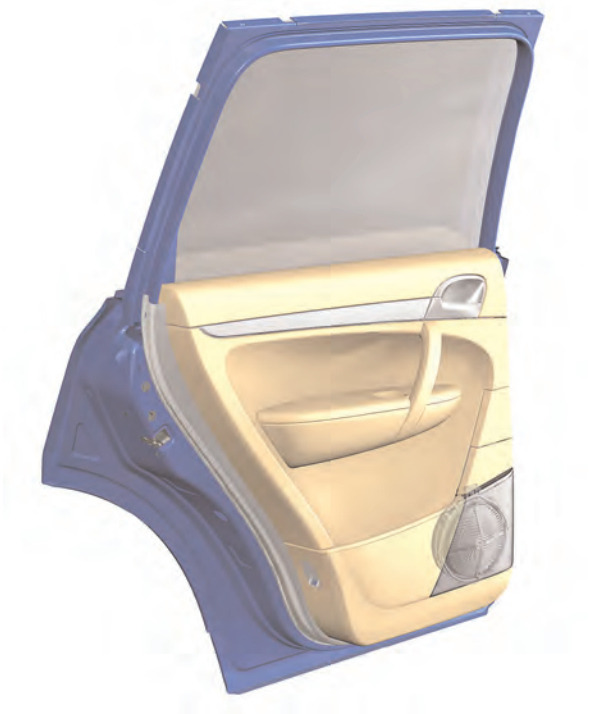
Door Trim, Front



The following are attached to the front door trim:

- Door opener with handle plate
- Air vent
- Armrest with door grip handle
- Lower storage compartment with loudspeaker

Door Trim, Rear



The following are attached to the rear door trim:

- Door opener with handle plate
- Armrest with door grip handle
- Lower storage compartment with loudspeaker

Notes:



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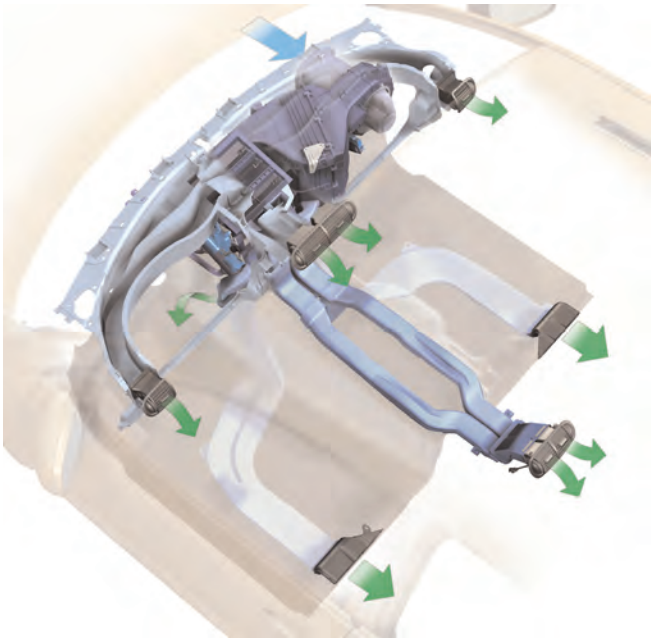
Notes:

General

The Cayenne has a heating system in conjunction with manual air conditioning for climate control of the passenger compartment, satisfying the highest demands in comfort. Air conditioning with 2-zone or 4-zone control, is available as a option.

The Cayenne S and Cayenne Turbo have 2-zone air conditioning as standard equipment, with 4-zone being available as a option.

Air Ducting



The components of the Cayenne air ducting (air distribution) are, apart from the heater unit itself, largely identical with those of the 2-zone air conditioning. Before the air enters the passenger compartment, an activated charcoal filter cleans the fresh air of particles and pollen, prior to the air is passing through the air ducting. The filter is integrated in the heater unit. It is located directly in front of the evaporator and, for service purposes, it can be pulled out from the heater unit from below into the passenger footwell.

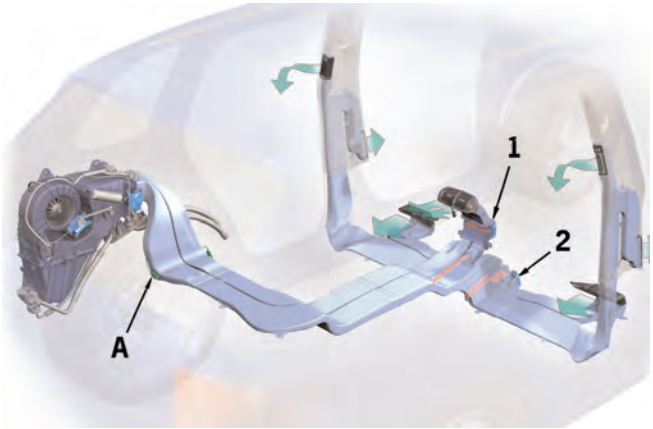
The fresh or recirculating air entering the heater unit is conditioned according to the temperature selected and then passed into the passenger compartment. This is carried out by a system of fixed and individually adjustable air vents. For air circulation, middle and side air vents for the driver and passenger are in the switch panel. Vents are also installed in the switch panel for defrosting of windshield. The footwells are supplied by fixed and non-adjustable air vents. Additional and individually adjustable passenger air vents are installed in the rear center console and behind the B-pillar trim. The air supply to the B-pillar vents is via air ducts, which are located in the front doors and connected to the front air ducts of the side air vents (these air vents are not shown in illustration on next page). There are also fixed footwell vents below the front seats to ventilate the rear.

The heater unit of the manual air conditioning is different in two areas compared to the 2-zone air conditioning system:

- The distributor flaps for the middle vents are powered together with the nozzles for the side vents by the actuator motor for passenger vents.
- Both temperature blender flaps are permanently interlinked and are operated by an actuator motor through a common axis.

4-Zone Climate Control Ducting

With 4-Zone Climate Control, the following diagram shows the additional air ducts that enable air distribution in all zones.



1 - Flap Motor for the Middle Vent (covered, right side)
2 - Flap Motor for the Floor and B-column vents (right side)
A - Air Duct for Temperature Sensor (right side)

Air Conditioning, Cayenne (V6)

All Cayenne Models have air conditioning that operates with the environmentally friendly refrigerant R134a.

Manual air conditioning is used on the Cayennne. The structural design of the manual air conditioning is basically the same as the 2-zone air conditioning. Due to the requirements of manual air conditioning compared to the 2-zone unit, certain actuator motors are not required. Air conditioning with zone control is available as a option.

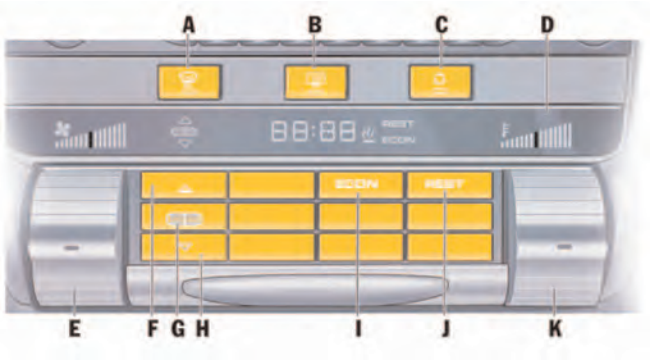
Function

Air flow (blower), air distribution and temperature can be set on the manual air conditioning control panel. The following individual settings can be displayed in the air conditioning display:

- Air flow (blower)
- Air distribution
- Temperature adjustment
- Time synchronous to PCM or instrument cluster
- Suppression of compressor function (ECON)
- Residual engine heat utilization
- Auxiliary heater function

Notes:

Operation



A - Front windshield defrost
B - Rear window defrost
C - Recirculated air
D - Air conditioning display
E - Air flow button (blower)
F - Air distribution to front screen
G - Air distribution to middle and side vents
H - ECON button (air conditioning compressor on/off)
I - REST button (residual engine heat)
J - PSM OFF switch
K - Temperature button

Climate Control

The following varieties of climate control are available:

2-Zone Climate Control – Standard equipment on Cayenne S and Cayenne Turbo, optional on the Cayenne (V6)
4-Zone Climate Control – Optional on all Cayennes

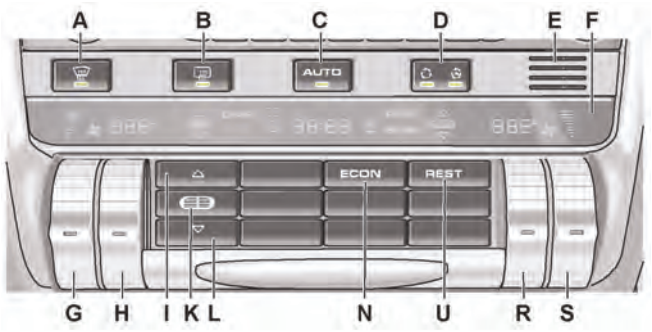
2-Zone Climate Control, Cayenne S/T

With 2 zone climate control, the temperature for the driver and the passenger can be set separately and the volume of air (fan) for each side are the same. The two buttons are used on the edge of the control/button panel. The button panel is under a hinged covering. The outside buttons controls the fan speed. This is the same for the right and left side. The buttons on the inside control the temperature separately for the passenger and the driver. An auto button is integrated in the control panel for the climate control – in the button bar over the liquid crystal display – that can switch on automatic operation. An LED

in the button confirms that automatic operation is on. Depending on various factors (for example, amount of sun light, external temperature, air quality, etc.) the climate control will automatically control the chosen internal temperature.

After the vehicle is turned off, the 2 zone climate control has an extra button that will use heat left in the heater core to further heat the passenger area for a maximum of 20 minutes. This is displayed with the word “REST”. Should the outside air quality become extremely bad, one can manually switch over to circulating air. There is also an air quality sensor located in the external air entrance duct that has standard values for “automatic switch to circulating air” (AUTO Circulating Switch). Based on these standard values, if the air becomes worse (exhaust gases), the circulating air will be automatically switched on.

Operation

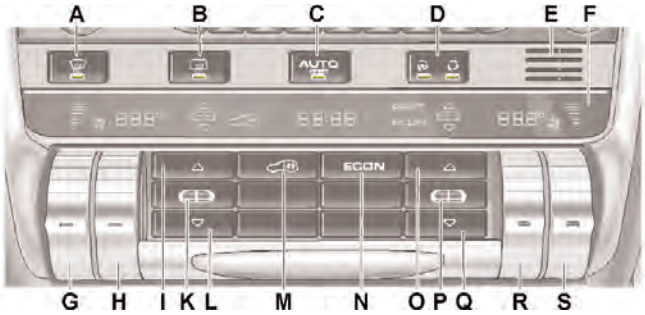


A - Defost Front Windshield
B - Defrost Rear Window
C - Auto Button (Automatic Operation)
D - Automatic Circulating Air, Circulating Air
E - Temparature Sensor is ventilatedby a motor (behind the slits)
F - Climate Control Display
G - Button for Air Volume (fan), left side
H - Button for Temperature, left side
I - Air Distribution for Front Windshield
K - Air Distribution for Middle and Side Vents
L - Air Distribution for Floor
N - ECON Button (Climate Compressor off/on)
U - REST Button (residual heat from the motor used with vehicles with 2 zone climate control)
R - Button for Temperature right side
S - Air Volume Button, right side

4-Zone Climate Control (Optional)

Rear climate control is available on all Cayenne models The additional climate control functions independently of the front climate control. The temperature, air volume (fan) and air distribution can be set individually for the left and right sides (zones). In combination with the 2 zone climate control in front, the climate in the inside of the vehicle can be set separately for all 4 zones. Setting all 4 zones can be done from the front control panel. For both rear zones there is an extra button, under the hinged cover, on the front control panel. After shortly pressing this button, the settings for the rear area can be carried out. It is also possible to control the rear climate from the back seats on the rear control panel (see rear control panel in the next section).

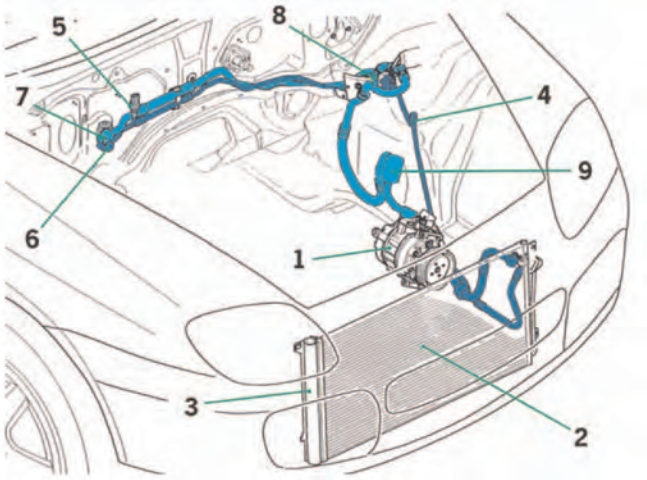
Operation



A - Defrost Front Windshield
B - Defrost Rear Window
C - Auto Button (automatic operation), REST Button (motor residual warmth for vehicles with 4 zone climate control)
D - Automatic Circulating Air, Circulating Air
E - Temperature Sensor is Ventilated by a Motor (behind the slits)
F - Climate Control Display
G - Button for Volume of Air (fan), left side
H - Button for Temperature, left side
I - Air Distribution for the Front Windshield
K - Air Distribution for the Middle and left Vents
L - Air Distribution for Floor, left side
M - Setting for Additional Climate Control for Rear Passengers
N - ECON Button (Climate Compressor off/on)
O - Air Distribution to Front Windshield, right
P - Air Distribution for Middle and right vents
Q - Air Distribution to Floor, right side
R - Button for Temperature, right side

Refrigeration Circuit, Cayenne (V6)

The following illustration shows the refrigeration circuit of the Cayenne with manual air conditioning.



The following section/components are installed and listed in order of the refrigeration circuit:

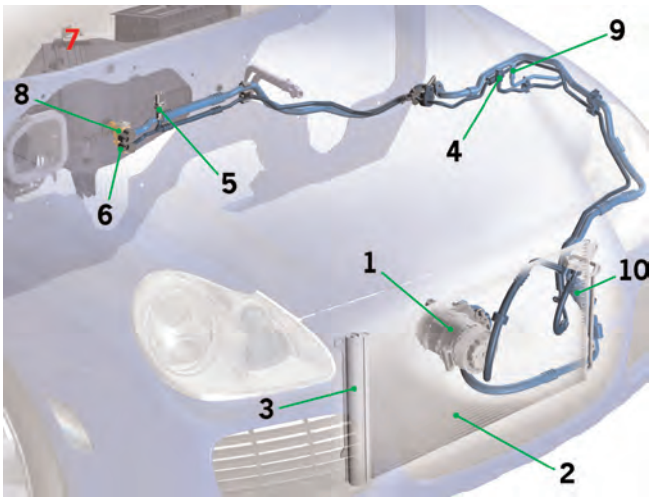
1 - Adjustable air conditioning compressor (front of engine)
2 - Condenser (sandwich design with engine radiator)
3 - Mounting (pipe) for the drier cartridge (replaceable cartridge; integrated)
4 - Service connector (high pressure)
5 - Pressure sensor is on high-pressure side
6 - Expansion valve (supply flow)
7 - Expansion valve (return flow)
8 - Service connector (low pressure)
9 - Pressure damper (low pressure side just in front of compressor, near left wheel arch)

Notes:

Refrigeration Circuit, 2-Zone Climate Control

The cold air circulation in the Cayenne is set up so that the compressor and the expansion valve are the classic separations between upper and lower pressure sides.

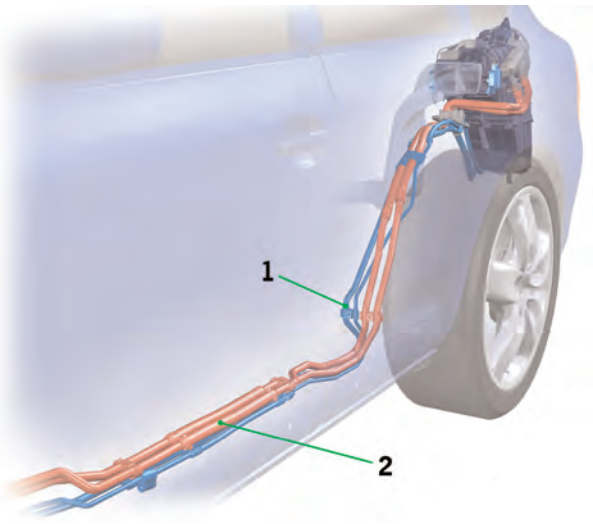
The following sections/components are built in and shown in the direction of the cold air circulation:



1 - Compressor (front side of the motor)
2 - Condenser (sandwich design with radiator)
3 - Receptacle (pipe) for the drying cartridge (replaceable cartridges, integrated on the right outside of the capacitor)
4 - Service connection (high pressure)
5 - Pressure sensor is on the high pressure side
6 - Expansion valve (flow)
7 - Evaporator (evaporator cannot be seen in diagram)
8 - Expansion Valve (return)
9 - Service connection (low pressure)
10 - Pressure damper (low pressure side right in front of the compressor near the left wheel housing)

Notes:

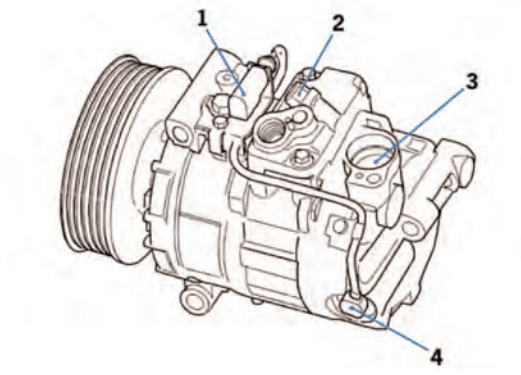
Additional Refrigeration Circuit, 4-Zone Climate Control



1 - Refrigerant lines for the rear evaporator
2 - Line for the heating circulation for the rear heat exchanger

Compressor, Cayenne (V6)

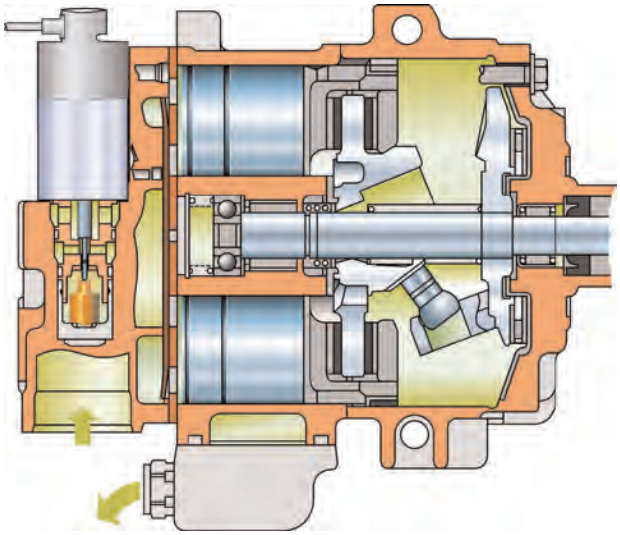
On the manual air conditioning, the air blending swash-plate (adjustable) compressor, similar to the 2-zone air conditioning, is used. The swash plate is adjusted through an electronic control valve integrated in the compressor. The control valve is actuated by a variable PWM signal from the air conditioning control unit (control panel). The variation of the PWM signal is basically caused by the vaporizer temperature sensor. As the compressor works with a variable delivery rate and zero delivery (delivery rate dd5%) is theoretically possible, it is not necessary to control the air conditioning cooling output through the switching on and off of a compressor relay (the compressor always runs if the engine is running).



1 - Plug connector (electronic control valve)
2 - Pressure relief valve
3 - Connector opening, low pressure side
4 - Electronic control valve

Compressor, 2-Zone & 4-Zone

The Cayenne is equipped with a swash plate (regulated) compressor controlled on the low side that is similar in function and design to a compressor in a sports car. The refrigerant has a pressure of 145-435 psi (10-30 bar) after exiting the compressor and a temperature of about 212° F. (100° C). The compressor runs whenever there are RPMs .



Through an electronic control valve, integrated into the compressor, the intake pressure (low pressure side, about 14.5-3.5 psi/1-3 bar) in the compressor housing has an effect on the swash plate. The control valve is triggered by a PWM signal from the control module of the climate control. The basis for the triggering of the control valve is taken from the signal of the evaporator temperature sensor. The basis frequency for the valve is 400 Hz.

The piston stroke can be continuously varied, a large stroke for large refrigerant capacity and a smaller stroke for smaller capacity. Because the compressor works with a variable capacity demand, there is no compressor relay. This means that the compressor is always turning but there is no output at the lowest portion of the compressor stroke.

Notes:

Drier Cartridge, Cayenne/S/T

The replaceable drier cartridge is in a special pipe. This receptacle pipe is integrated into the right side of the condenser.



To change the drier cartridge, the refrigerant system must be discharged. After the rubber cover is removed, the safety ring can be removed. With a special tool out of the Porsche “slide hammer pulling kit”, the sealing covers can be pulled up and removed.

After the covers have been removed, the drying cartridge can be pulled out on the spacer stick. The cartridge unit is approximately 380 mm long. It is composed of a spacer and a sleeve with a netted insert that contains a moisture binding material. Until saturated, the drying cartridge can chemically bind 6-12 grams of water.



1 - Sleeve with netted insert
2 - Spacer stick

Notes:

Notes:

PORSCHE

Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Check drive belt

☑ Coolant hoses: Check condition

☑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

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Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

☑ Pollen filter: Replace filter element

❑ Check drive belt

❑ Steering gear: Visual inspection of the dust boots for signs of damage
Tie rod ends: Check play and dust boots

❑ Power steering: Check fluid level

❑ Fuel system lines and connections: Visual inspection

☑ Coolant hoses: Check condition

☑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection levels

❑ Parking brake: Check free play

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the for leaks & signs of damage

❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Hydraulically detachable off-road sway bar: Check fluid level and function

❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Lubricate door latch and fastening bolts

❑ Panorama roof: Adapt control module

❑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level

❑ Check wiper blades

❑ Seat belts: Check operation and condition

❑ Vehicle lighting: Check operation

❑ All headlights: Check adjustment

❑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Trailer coupling: Check operation

❑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

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Part Number – PNA 000 162 CB

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

❑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CB



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Notes:

Wiring Diagrams

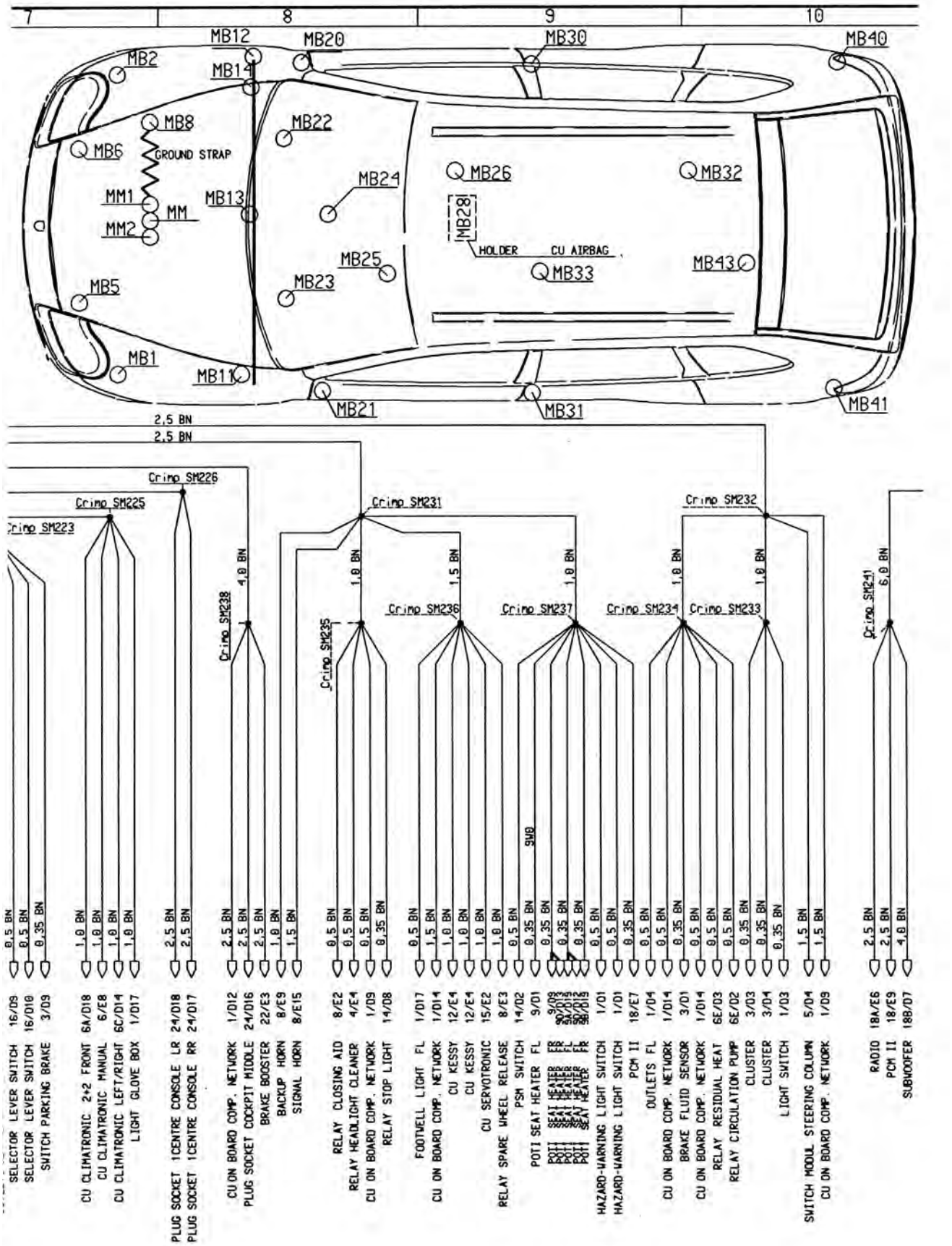
The wiring diagram consists of individual wiring diagrams and overview sheets for ground points, components, plug connections, connection points, relay carriers and fuses.

General Guidelines

- The individual wiring diagrams are subdivided into coordinate fields.
- The ground points are identified with “GP” and their locations are shown in a vehicle diagram.
- The plug connections are identified with X and a number.
- In the case of wires that branch off onto another sheet, the coordinates and, in some cases, the terminal designations are specified.

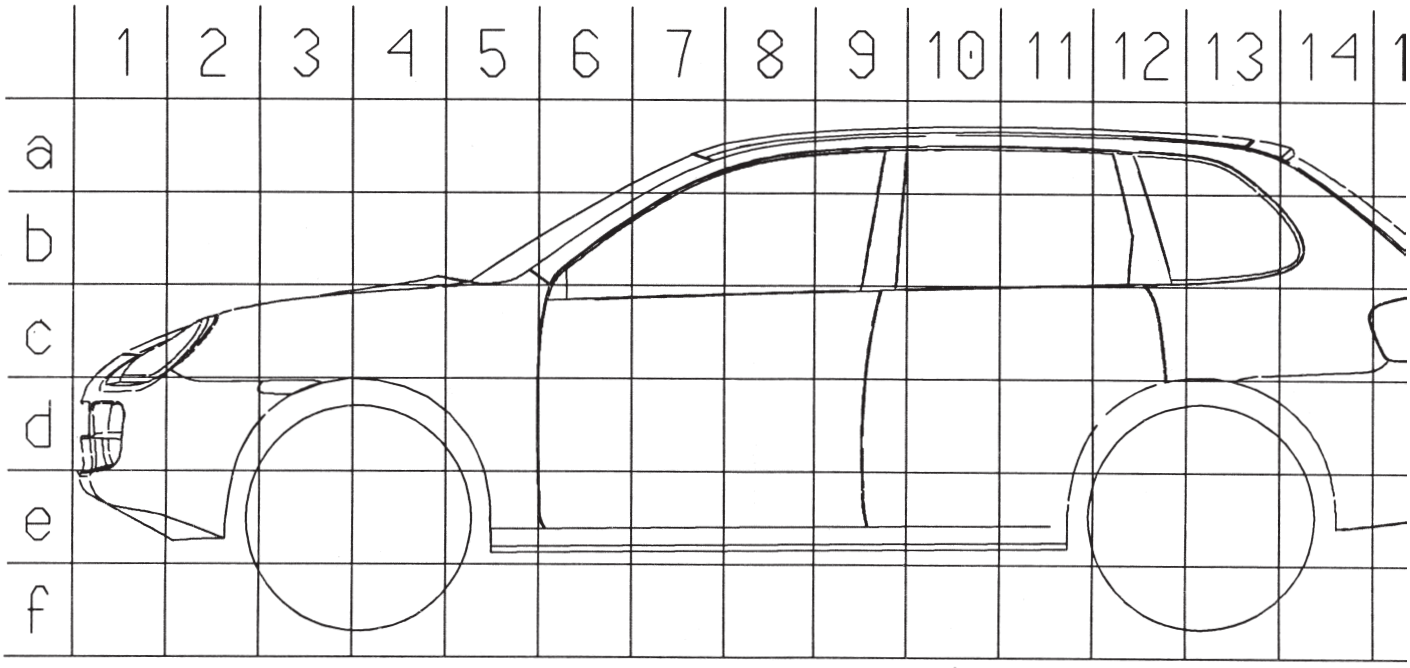
Circuit diagram for Model Year '04 Cayenne (9PA)

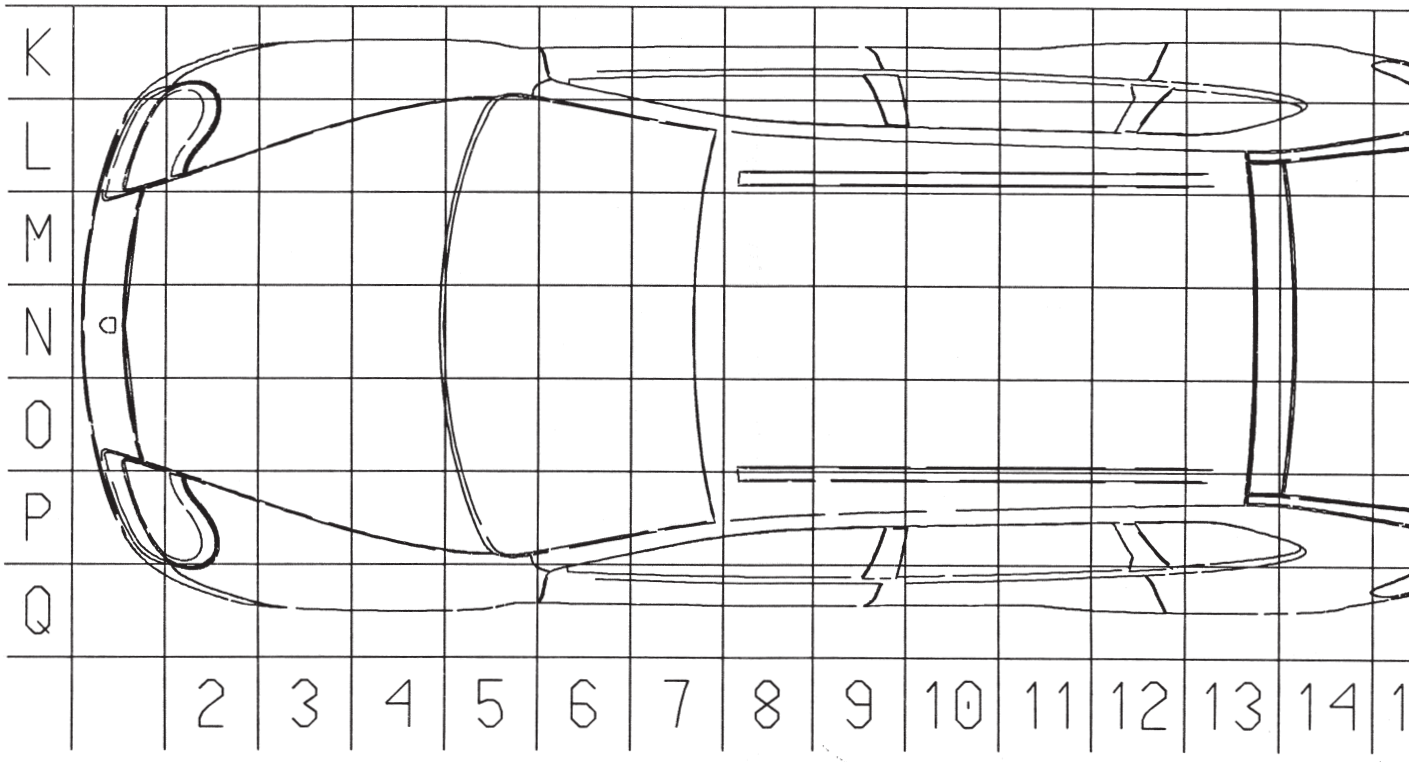
	Contents
Sheet 1	"Vehicle electrical system control unit" with light switch and interior lighting
Sheet 1A	Manual headlight beam adjustment
Sheet 1B	Automatic headlight beam adjustment with levelling system
Sheet 1C	Automatic headlight beam adjustment with steel springs
Sheet 2	Roof console
Sheet 3	"Instrument cluster" with sensors
Sheet 4	Wiper/rain sensor
Sheet 5	Steering column switch module
Sheet 6	Manual air conditioning
Sheet 6A	Climatronic 2+2 (4 zones) front
Sheet 6B	Climatronic 2+2 (4 zones) rear
Sheet 6C	Climatronic, right-hand drive (2 zones)
Sheet 6D	Auxiliary water heating
Sheet 6E	Air conditioning - supplement
Sheet 7	"Driver's door" mirror, lock, Kessy, switches
Sheet 7A	"Passenger's door" mirror, lock, Kessy, switches
Sheet 7B	"Rear doors" lights, switches, lock
Sheet 8	"Control module for rear convenience systems (rear control module)" rear loads, tilt sensor
Sheet 8A	Front end
Sheet 9	12-way seat load, front
Sheet 9A	"Driver's seat memory" with seat heating and seat belt height adjustment
Sheet 9B	"Passenger's seat memory" with seat heating and seat belt height adjustment
Sheet 9C	Rear seat heating
Sheet 9D	Seat memory with seat heating
Sheet 10	Panorama roof system (PDS)
Sheet 10A	Sliding roof
Sheet 11	Level regulation with damper control and sensors
Sheet 12	"Kessy" sensors, antennae, electronic steering column lock, switches
Sheet 13	"Airbag control unit", airbag units, seat-belt tensioner
Sheet 14	"PSM", sensors

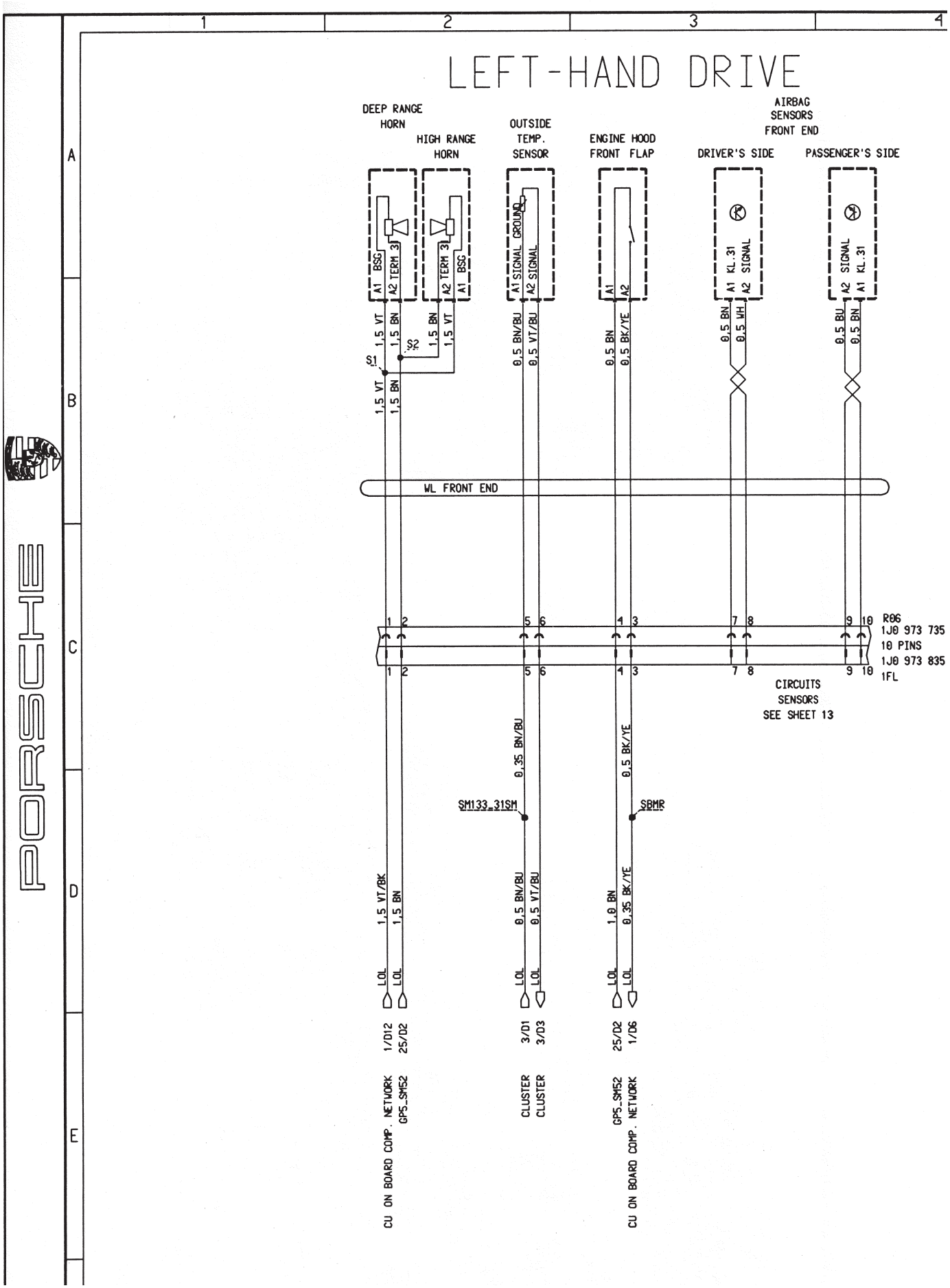

7
8
9
10
MB12
MB20
MB30
MB40
MB2
MB14
MB8
MB22
MB6
GROUND STRAP
MB24
MB26
MB32
MM1
MB13
MM
MB28
MM2
HOLDER CU AIRBAG
MB25
MB33
MB43
MB5
MB23
MB1
MB11
MB21
MB31
MB41
2,5 BN
2,5 BN
Crimp SM226
Crimp SM225
Crimp SM223
Crimp SM231
Crimp SM232
Crimp SM238
4,0 BN
1,0 BN
1,5 BN
1,0 BN
Crimp SM235
Crimp SM236
Crimp SM237
Crimp SM234
Crimp SM233
Crimp SM241
6,0 BN
0,5 BN 16/D9 SELECTOR LEVER SWITCH
0,5 BN 16/D10 SELECTOR LEVER SWITCH
0,35 BN 3/D9 SWITCH PARKING BRAKE
1,0 BN 6A/D18 CU CLIMATRONIC 2+2 FRONT
1,0 BN 6/E8 CU CLIMATRONIC MANUAL
1,0 BN 6C/D14 CU CLIMATRONIC LEFT/RIGHT
1,0 BN 1/D17 LIGHT GLOVE BOX
2,5 BN 24/D18 PLUG SOCKET 1CENTRE CONSOLE LR
2,5 BN 24/D17 PLUG SOCKET 1CENTRE CONSOLE RR
2,5 BN 1/D12 CU ON BOARD COMP. NETWORK
2,5 BN 24/D16 PLUG SOCKET COCKPIT MIDDLE
2,5 BN 22/E3 BRAKE BOOSTER
1,0 BN 8/E9 BACKUP HORN
1,5 BN 8/E15 SIGNAL HORN
0,5 BN 8/E2 RELAY CLOSING AID
0,5 BN 4/E4 RELAY HEADLIGHT CLEANER
0,35 BN 1/D9 CU ON BOARD COMP. NETWORK
0,35 BN 14/D8 RELAY STOP LIGHT
0,5 BN 1/D17 FOOTWELL LIGHT FL
1,5 BN 1/D14 CU ON BOARD COMP. NETWORK
1,0 BN 12/E4 CU KESSY
1,0 BN 12/E4 CU KESSY
1,0 BN 15/E2 CU SERVOTRONIC
1,0 BN 8/E3 RELAY SPARE WHEEL RELEASE
0,5 BN 14/D2 PSM SWITCH
0,35 BN 9/D1 POTI SEAT HEATER FL
0,35 BN 9/D3 POTI SEAT HEATER FR
0,35 BN 9A/D15 POTI SEAT HEATER FL
0,35 BN 9B/D13 POTI SEAT HEATER FR
0,5 BN 1/D1 HAZARD-WARNING LIGHT SWITCH
0,5 BN 1/D1 HAZARD-WARNING LIGHT SWITCH
0,35 BN 18/E7 PCM II
0,5 BN 1/D4 OUTLETS FL
0,5 BN 1/D14 CU ON BOARD COMP. NETWORK
0,35 BN 3/D1 BRAKE FLUID SENSOR
0,5 BN 1/D14 CU ON BOARD COMP. NETWORK
0,5 BN 6E/D3 RELAY RESIDUAL HEAT
0,35 BN 6E/D2 RELAY CIRCULATION PUMP
0,35 BN 3/D3 CLUSTER
0,35 BN 3/D4 CLUSTER
0,35 BN 1/D3 LIGHT SWITCH
1,5 BN 5/D4 SWITCH MODUL STEERING COLUMN
1,5 BN 1/D9 CU ON BOARD COMP. NETWORK
2,5 BN 18A/E6 RADIO
2,5 BN 18/E9 PCM II
4,0 BN 18B/D7 SUBWOOFER

CODE WIRE CONNECTOR	WIRE COLOR	DESIGNATION, FUNCTION	FIELD LHD	SEE SHEET /FIELDNO.
S1	VT	SIGNAL TWO-TONE HORNS	1eP	1/B16
S2	BN	TERM 31 TWO-TONE HORNS	1eP	1/B16
SEP1	BN/BK	GND PDC-SENSOR REAR	15dP	20/D4
SEP4	BN/BK	GND PDC-SENSOR FRONT	2eK	20/D2
SEP5	RD/BK	SUPPLY PDC-SENSOR REAR	15dP	20/D5
SEP8	RD/YE	SUPPLY PDC-SENSOR FRONT	2eK	20/D3
5V	RD/VT	OUTPUT +5V MFI+DI CONTROL UNIT (VR6)	3cN	17c/B14
Crimp SAIRB1	BN	TERM 31	5dN	25/C13
Crimp SAIRB2	BN	TERM 31	5dN	25/C13
Crimp SAIRB3	BN	TERM 31	8dN	25/C14
Crimp SAIRB4	BN	TERM 31 FRONT AIRBAG	1eP	13/C4
Crimp SM311	BN	TERM 31	11eP	25/C15
Crimp SM312	BN	TERM 31	8eP	25/C16
Crimp SM402	BN	TERM 31	13cL	25/C17
Crimp SM403	BN	TERM 31	14dL	25/C17
Crimp SM404	BN	TERM 31	14dL	25/C17
Crimp SM405	BN	TERM 31	12bL	25/C17
Crimp SM411	BN	TERM 31	14dP	25/C18
Crimp SM412	BN	TERM 31	14dP	25/C18
Crimp SM413	BN	TERM 31	12cP	25/C18
Crimp SM415	BN	TERM 31	14dP	25/C19
Crimp SP40	RD	TERM.30 FUSE BOX LEFT	6dP	24/A10
Crimp SP41	RD	TERM.30 MAIN FUSE BOX FUSE F2	5eL	24a/A9
Crimp SP42	BK	TERM.15a FUSE BOX LEFT	5dP	24/B5
Crimp SP43	BK	TERM.15 FUSE BOX LEFT	5eL	24a/B5
Crimp SP44	RD	TERM.30 FUSE BOX LEFT	6dP	24/B16
Crimp-SM19	BN	TERM 31	5c0	25a/C4
Crimp-SM2	BN	TERM 31	5cL	25a/C5
Crimp-SM213	BN	TERM 31	5cP	25/C5
Crimp-SM214	BN	TERM 31	6cP	25/C5
Crimp-SM221	BN	TERM 31	5cL	25/C6
Crimp-SM222	BN	TERM 31	5cL	25/C6
Crimp-SM223	BN	TERM 31	5cL	25/C7
Crimp-SM224	BN	TERM 31	6dP	25/B6
Crimp-SM225	BN	TERM 31	5cL	25/B7
Crimp-SM226	BN	TERM 31	5cL	25/B8
Crimp-SM231	BN	TERM 31	6cP	25/B8
Crimp-SM232	BN	TERM 31	5cP	25/B10
Crimp-SM233	BN	TERM 31	6cP	25/C10
Crimp-SM234	BN	TERM 31	5dN	25/C9
Crimp-SM235	BN	TERM 31	5cN	25/C8
Crimp-SM236	BN	TERM 31	5cN	25/C9
Crimp-SM237	BN	TERM 31	5cN	25/C9
Crimp-SM238	BN	TERM 31	6cP	25/C8
Crimp-SM241	BN	TERM 31	5cN	25/C10
Crimp-SM243	BN	TERM 31	13cL	25/C11
Crimp-SM245	BN	TERM 31	8eN	25/C11
Crimp-SM246	BN	TERM 31	13cL	25/C11
Crimp-SM248	BN	TERM 31	13cL	25/C11
Crimp-SM261	BN	TERM 31	8eM	25/C11
Crimp-SM262	BN	TERM 31	8eM	25/C12
Crimp-SM263	BN	TERM 31	8eM	25/C12
Crimp-SM265	BN	TERM 31	8eL	25/C12
Crimp-SM30_1	BN	TERM 31	11eL	25/C14
Crimp-SM311_1	BN	TERM 31	11dP	25/C15
Crimp-SM51	BN	TERM 31	3cQ	25/C1
Crimp-SM52	BN	TERM 31	3cQ	25/C2
Crimp-SM53	BN	TERM 31	3cQ	25/C1
Crimp-SM61	BN	TERM 31	3cL	25/C4
Crimp-SM62	BN	TERM 31	3cL	25/C3
Crimp-SM63	BN	TERM 31	3cL	25/C4
Crimp-SR3	RD	TERM.30 FUSE BOX LEFT	6cN	24/D7
S04	RD/YE	TERM.30	6cL	2/C12, 24a/C6
S-1	RD/GY	TERM.86 SECONDARY AIR PUMP RELAY	4c0	17b/D5, 17b/D2, 24c/D6
S-10	RD/BU	EXTERNALLY CONTROLLED COMPRESSOR	4cP	6e/C2, 17c/C18
S-11	GN	TERM 31 MFI+DI CONTROL UNIT	4cL	17/C4
S-12	BK/YE	OUTPUT +5V MFI+DI CONTROL UNIT	4cL	17/C4
S-14	RD/WH	TERM.87 OXYGEN SENSOR 1 AND 2 BEHIND CAT.	5cN	24c/D3
S-15	RD/GY	TERM.87 OXYGEN SENSOR 1 AND 2 UPSTR.CAT.	5cN	42c/D4
S15A	BK/BU	TERM.15a	5cN	4/D2, 24a/C4
S-18	GN/BU	FUEL PUMP 2	4cP	17/C5, 1/D12
S-2	BN/YE	TERM.85 SECONDARY AIR PUMP RELAY -	4cP	17b/B2
S-20	BN/GY	PWM COOLING WATER BLOWER	4cP	17d/C2, 17d/C3

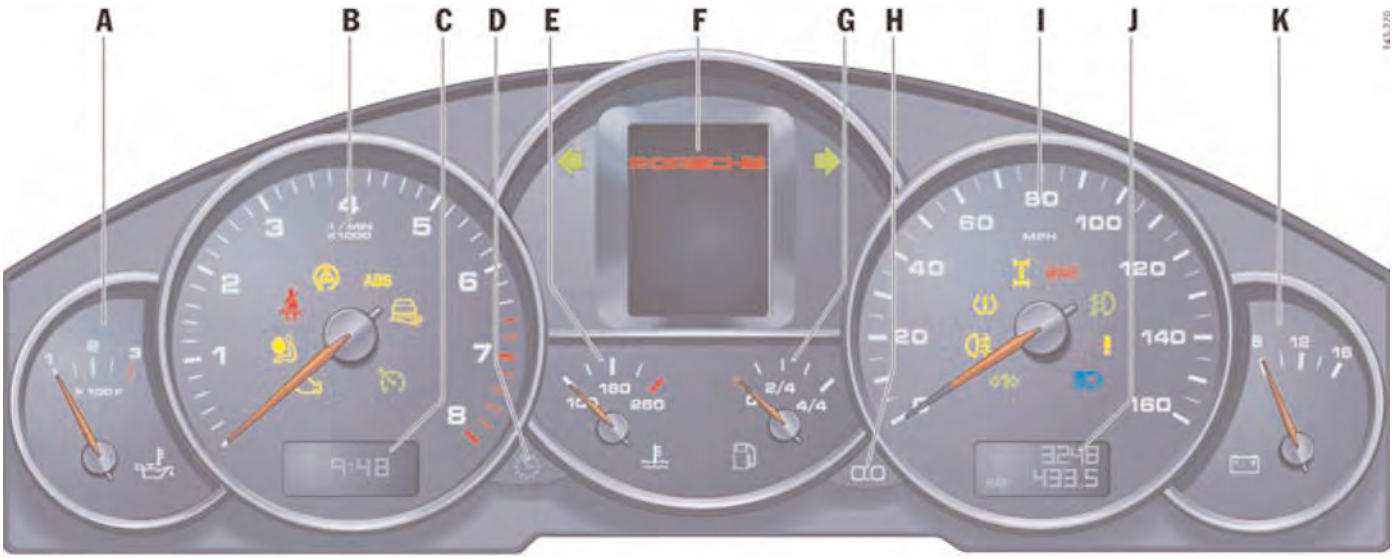
Location Grids






LEFT-HAND DRIVE
DEEP RANGE HORN
HIGH RANGE HORN
OUTSIDE TEMP. SENSOR
ENGINE HOOD FRONT FLAP
AIRBAG SENSORS FRONT END
DRIVER'S SIDE
PASSENGER'S SIDE
WL FRONT END
R06
1J0 973 735
10 PINS
1J0 973 835
1FL
CIRCUITS SENSORS SEE SHEET 13
SM133_31SM
SBMR
CU ON BOARD COMP. NETWORK
GP5_SM52
CLUSTER
CLUSTER
GP5_SM52
CU ON BOARD COMP. NETWORK

Cayenne/S Instrument Panel



Instrument Panel USA Models

Warning and indicator lights on the tachometer

- Emission Control warning light (Check Engine)
- Airbag warning light
- Safety belt warning light
- PSM warning light
- ABS warning light
- Cruise control readiness
- Disengageable anti-roll bars Indicator light

Indicator lights in central instrument panel

- Turn signal light, left Indicator light
- Turn signal light, right Indicator light

Warning and indicator lights on the speedometer

- Trailer turn signal Indicator light
- Rear fog light indicator light
- Tire pressure warning light
- Differential locking indicator light
- Brake warning light
- Fog light indicator light
- General warning Observe warning message on the multi-purpose display!
- High beam indicator light

A Oil temperature gauge
B Tachometer
C Clock
D Clock reset button
E Cooling system temperature gauge
F Multi-purpose display
G Fuel gauge
H Reset button for trip counter display
I Speedometer
J Mileage displays
K Voltmeter

Note!

The Gateway control unit has been removed from the instrument cluster beginning with M.Y. 2005. It has been relocated to the passenger side under the dash/glove box. See page 26 for additional information.

Cayenne Turbo Instrument Panel



Instrument Panel USA Models

Warning and indicator lights on the tachometer

- Emission Control warning light (Check Engine)
- Airbag warning light
- Safety belt warning light
- PSM warning light
- ABS warning light
- Turn signal pilot light, left
- Cruise control readiness
- Hydraullically engageable anti-roll bars

Warning and indicator lights on the speedometer

- Rear fog light indicator light
- Turn signal pilot light, right
- Trailer turn signal Indicator light
- Differential locking indicator light
- BRAKE Brake warning light
- Fog light indicator light
- Tire pressure warning light
- High beam indicator light

A Oil temperature gauge
B Tachometer
C Clock reset button
D Cooling system temperature gauge
E Multi-purpose display
F Digital speedometer, Outside temperature, Clock, Mileage displays
G Fuel gauge
H Reset button for trip counter display
I Speedometer
J Engine boost pressure display

Note!

The Gateway control unit has been removed from the instrument cluster beginning with M.Y. 2005. It has been relocated to the passenger side under the dash/glove box. See page 26 for additional information.

Cayenne/S/T Fuses

Changing fuses

In order to prevent damage to the electrical system due to short circuits and overloads, the individual circuits are protected by fuses.

One fuse box is in the engine compartment. Two additional fuse boxes are located in the outer ends of the dashboard.

1. Switch off the consumer with the defective fuse. Before replacing a fuse, switch off all electrical consumers and remove the ignition key.
2. Open the fuse-box lid.
3. Remove the corresponding fuse from its slot to check it using the plastic gripper.
   A blown fuse can be identified by the melted metal strip.
4. Replace only with fuses of the same rating.

Note

If a fuse blows repeatedly, please consult an official Porsche dealer immediately, so that the short circuit can be located and corrected.

Never try to "repair" fuses: you may cause serious damage to other parts of the electrical system.



Cover of engine-compartment fuse box

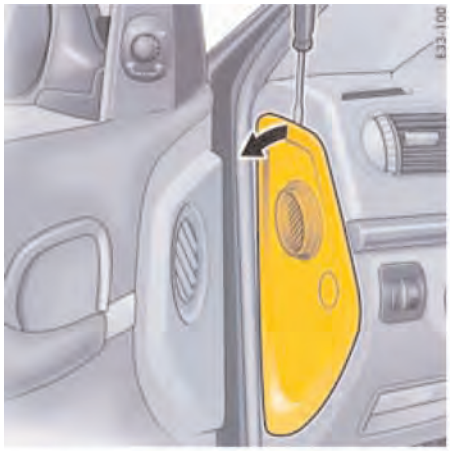
Opening fuse-box lid in engine compartment

1. Rotate the turn-locks 90° anti-clockwise with a screwdriver and remove the cover.



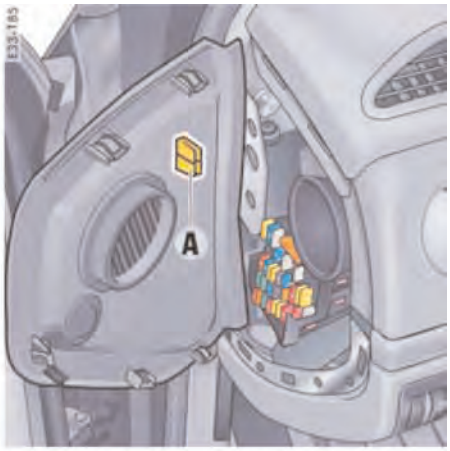
Fuse box in engine compartment

2. Rotate the turn-locks of the fuse-box lid 90° anti-clockwise with a screwdriver and remove the lid.



Opening fuse-box lid in the dashboard

1. Carefully lever off the plastic cover with a screwdriver (**arrow**) and remove.



A - *Fuse puller*

2. Remove the fuses carefully with the fuse puller.

PCM



General

The TFT color monitor has an effective diagonal measurement of 6.5 inches in 16:9 format. The keyboard treatment was adapted to the appearance of the Cayenne interior.

Except for the modification described below, the PCM in the Cayenne is identical to that of the sports cars.

- 6.5" screen in 16:9 format (sports car 5.8" in 16:9 format)
- Optically adapted user interface
- The menu choices are customized to the Cayenne and are considerably different from the PCM in the sports car.
- An additional function button “AV” in the menu bar below the screen will be used for functions to be added later.
- With the optionally available multifunction steering wheel, the driver can operate selected PCM functions (e.g., louder/softer, mute, station selection, CD title selection) from the steering wheel.

Radio/Audio Components in PCM

Innovations in audio domain of the PCM, compared to the previous generations:

- Top-double-tuner radio with very good reception characteristics, as well as channel selection via a channel list, three memory levels including Auto-Store and extensive individual adjustment options via the operating surface.
- CD ROM drive, which can also play audio CD’s. The drive serves for retaining the navigation CD ROM, which can be removed after the route has been mapped out and replaced by an audio CD.
- Driver information display in dot matrix instrument cluster (standard for PCM) as parallel display for basic information such as e.g. channel names, CD track, etc.
- Two unit versions for each, USA or RoW (with or without integrated amplifier) (same as for CDR 23)
- Menu domain buttons for separate operation of the audio sources and amplifier. This results in reduced menu depth and therefore more operating comfort.
- Audio for tuners, CDS (CD single), CDC (CD changer)
- Sound for sound adjustment, balance and fader
- Fiber optic network to the sound packages, CD changer, etc. via MOST

Notes:

Function overview of the new PCM for audio-menu pages:

Audio Equipment General		**PCM**
Operation of tuner, CDS, CDC and amplifier via uniform surface		new
Menu operation via turning reset button (right)		X
10 direct selection buttons for radio channels in FM and AM (3 memory levels for each) as well as selection of CDs in changer (via button 1 – 6)		new
Automatic 2 directional search function (FM, AM or title for CDS and CDC)		new
Display of audio information via the full graphic color display		X
Display of the most important audio information in instrument panel on demand		new
Separate SOUND-menus for sound adjustments including sound package amplifier as well as balance, fader		new

Tuner

Global-double tuner adjustable to country parameters (via PST 2)		new
FM		X
AM		X
Permanent memory per wave frequency	FM: FM – A (10), FM – B (10) MW: AM – A (10), AM – B (10)	 new new
AutoStore memory options:	FM – AS (10) AM – AS (10)	new new
Channel selection from channel list, compiled by reception strength, alphabetical or user defined		new
Tuning out channels in channel list (via “SET” – button)		new
Channel list with default of the PTY (Program Type via “SET” – button)		new
RDS for RoW or RBDS for USA		new
Display of channel name for RDS channels		X
RDS-function “EON“ (RoW)		X
RDS function “PTY” (Program Type)		new
Search function “Seek”		X
Search function channel scanning “Scan”		X
Hand adjustment (manual) via the right turning reset button or the 10-button strip (menu “Frequency Selection”)		new
Direct input of the frequency via the 10-button strip (menu “Frequency Selection”)		new

Electrics

Single CD (new)

CD-ROM drive useable for audio CD's (see also chapter "Copyright")	new
Title skip up and down (FF and FR)	X
Play title "Scan"	X
Title sequence by chance "random"	X
Display of CD text	new
Burning CD's	new
Title selection via list	new

Traffic Information (RoW)

Evaluation via RDS and RBDS	X
Automatic and manual selection of the traffic information channel	new
Traffic information connection without music function (Mute)	x
Traffic information also for AM and CD operation	new
Volume increase for traffic information during announcement or adjustable via menu	new
Evaluation of RDS-TMC (Digital Traffic Information) for display and route dependancy	new

X = Known function

Notes:

Driving Data Display (TRIP) in PCM

Three optionally adjustable speed warning limits can be switched on or off. The limit gong is integral with the audio function, therefore a complete interruption of the current audio-output does not occur.

Instrument cluster (on-board computer) driving data can also be displayed on the monitor of the PCM for a better overview, and reset simultaneously.

Main function button "TRIP" for accessing driving data is allocated in the lower menu list.

Navigation Unit with PCM

Innovations compared to the previous generation:

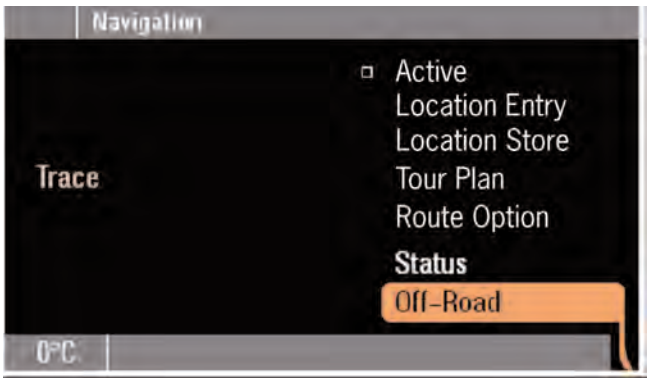
- Substantially enlarged 5.8" monitor with precise representation and noticeably enhanced map
- Display of the complete route including present location and target destination
- Display of TMC-messages (Traffic Message Channel). The current traffic congestions, which are received via a TMC traffic information channel, as well as the length and progression are displayed on the map. This function allows dynamic navigation, at least on highways. Therefore, the messages are processed in the route calculations within seconds. Also, all traffic congestion messages can be displayed. For active target guidance, only the congestion regarding this route will be displayed. (RoW)
- Very fast map setup. Moreover, an intersection zoom is integrated in the active target guidance. Here, the turning situation at intersections is enlarged automatically and intelligently, supporting and relieving the driver in a targeted manner, especially in complex situations.
- Very flexible in the display, configurability and selection of navigation functions regarding the POIs (Points Of Interest), also in the map display. For example, it is possible to display only parking garages, restaurants, etc.
- Separate navigation menu adjustment options for distinctly simplified operation.
- The separate "INFO" button on the operating panel allows quick access to current traffic congestion information, which is displayed in text form. (RoW)
- It is possible to store the navigation as a target point or actual position via a line cross. A target point can be selected and stored by moving the map, scrolling and setting without having to enter the specific address. POIs, e.g. gas stations, can also be searched for and entered as a target via this function.
- The target memories was expanded considerably. "Last Targets" and "Most Frequent Targets" now have 50 memory positions. A connection to the PCM-address book can also be used for target input.
- "Tour Planning" is possible by entering at least four targets in sequence.
- Expansion of route establishment for preference or avoidance of dynamic fast or short route such as highway, ferry and tolls.
- Supplement of current altitude readings. It is an enhancement of the position specifications, e.g. when driving on passes in the mountains.
- Display in 7 languages with two voices for each (woman/man) selectable via the operating menu. The navigation directions are perfectly blended into the current audio channel. Therefore, unpleasant interruptions no longer occur during voice output. Volume adjustment for mixing ratio can be changed as desired.
- Navigation-CD ROM: USA 2 CD's

Off-road Navigation

For Model Year 2004 Off-road navigation became available as a option. Off-road navigation facilitates navigation also in non-digitalized areas.

Particular features of the off-road navigation system:

- Navigation in non-digitalized areas, such as off-road
- Navigation to cardinal points using vehicle based sensors and GPS
- Navigation to a previously entered waypoint list "waypoint navigation"
- Recording of route progression when off-road "backtrace"
- Manual setting of key points during route display "trace display"
- Navigation along a previously marked route "backtrace navigation"

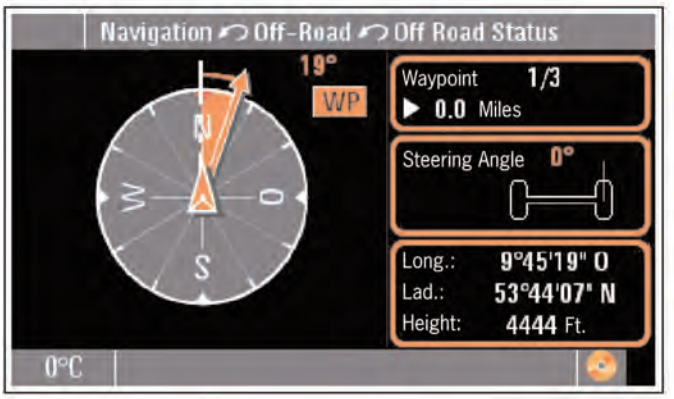


Entry into the off-road navigation mode is via the navigations main menu.

Off-road Status



The off-road status menu indicates the direction to drive in to reach the next (intermediate) destination when using active waypoint navigation or to follow the trace when using active backtrace navigation.



Current Destination

- Straight-line distance
- Number of intermediate destination /key point

Steering Angle

Position

- Coordinates
- Height

Compass

- Vehicle direction
- North direction
- Direction of current destination
- Angle deviation to current destination

If waypoint navigation and back trace navigation is not active, only the vehicle symbol with vehicle longitudinal axis and the compass dial are visible in the compass.

The map display shows where the vehicle is in relation to the complete route.



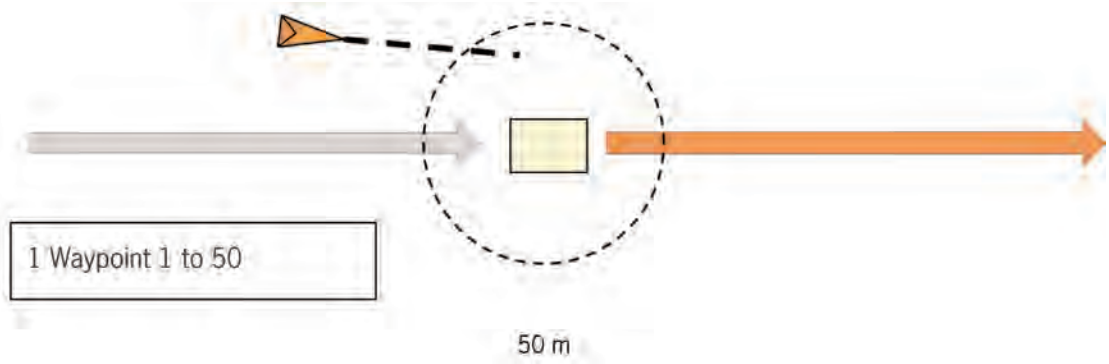
Waypoint Navigation

If the vehicle is currently within the digitalized map limits, for example, USA, then all destination input variations are possible. If the vehicle is outside the digitalized map limits, known as “off-map”, then destination input is only possible via coordinates.

New routes can be entered via the menu item “new route”. Entry of up to 5 routes each with 50 manually set waypoints is possible.

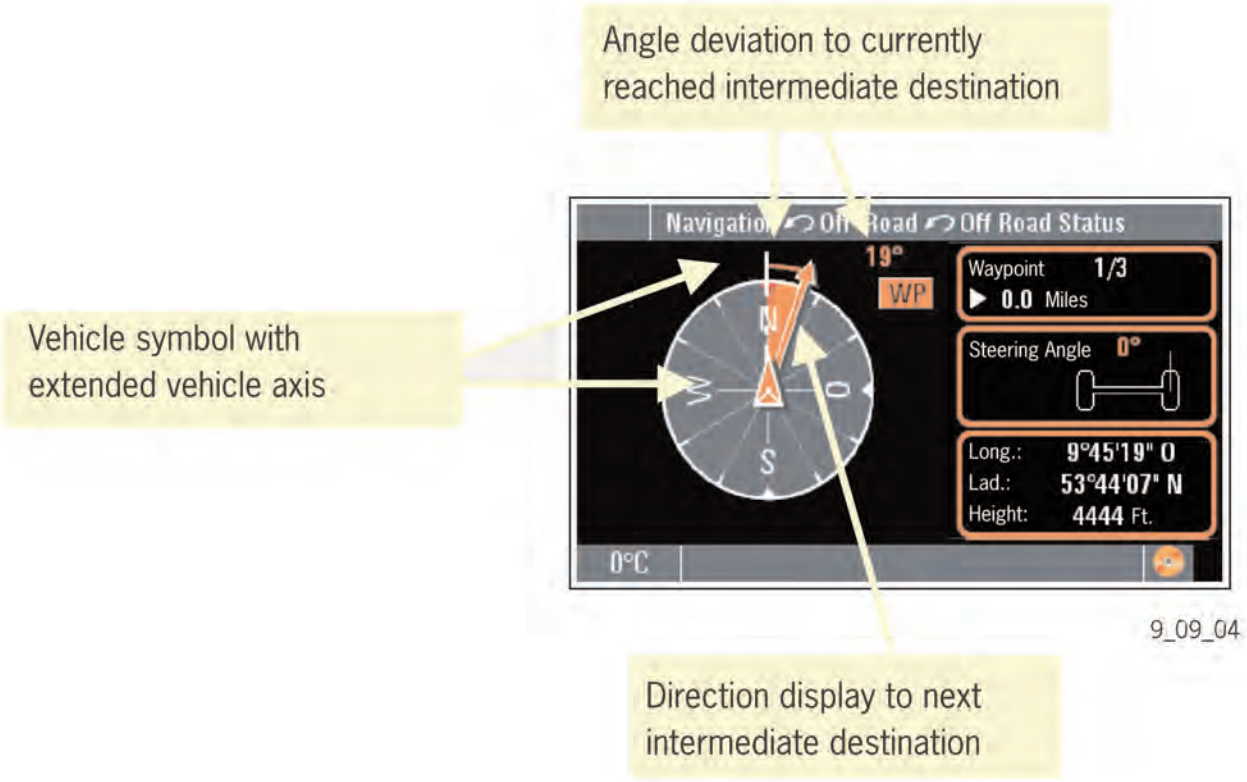
Intermediate Destination During Waypoint Navigation

To reach a destination, the vehicle must approach within approx. 55 yards (50 meters) of the destination. The route calculation to the next intermediate destination starts when the vehicle drives within the catchment radius (R = 50 meters) and then departs from the destination.



During active waypoint navigation, an orange colored arrow points in the direction of the next intermediate destination with corresponding change of direction as orange colored segment.

Notes:



The following voice announcements are given during active waypoint navigation:

Automatic Voice Announcement

The direction guidance voice announcement gives instruction on the direction to be taken towards the next intermediate destination.

On reaching an intermediate destination, the following voice announcement is given:

"Destination ... reached", "Now left/bear left/straight on/bear right/right"

Voice Announcements After Pressing The Repeat Button

The direction guidance voice announcement gives instruction on the direction towards the next intermediate destination:

"Please take direction one, two, ... eleven o-clock / follow this direction"

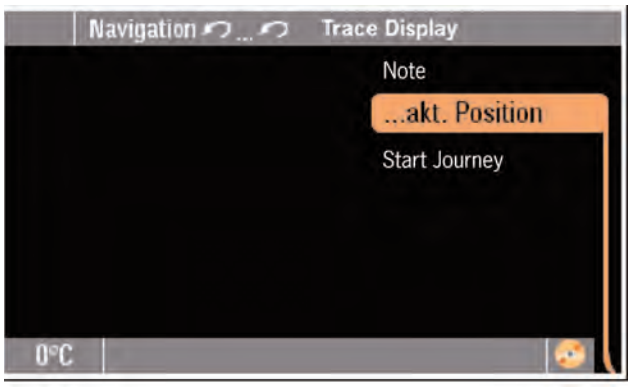
Notes:

Recording of Route Progression When Off-road "backtrace"

"Trace display" can be activated at the menu item "backtrace" in the off-road main menu.



The start point of the trace display can be selected in the subsequent menu.

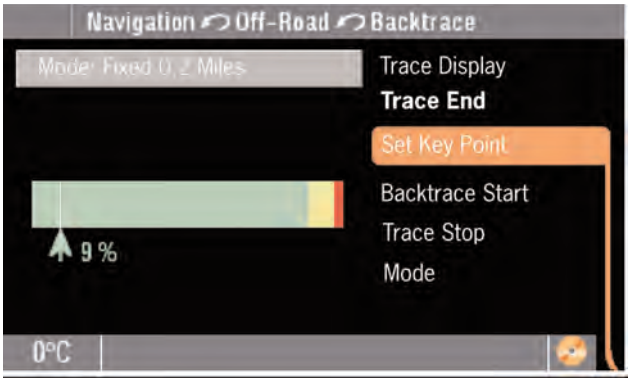


The start point of the trace display option "... start of journey" is moved during a trip, if:

- a trace display had been started and ended earlier.
- the "trace delete" function has been carried out.
- a different country CD has been loaded.
- a system update has been carried out.

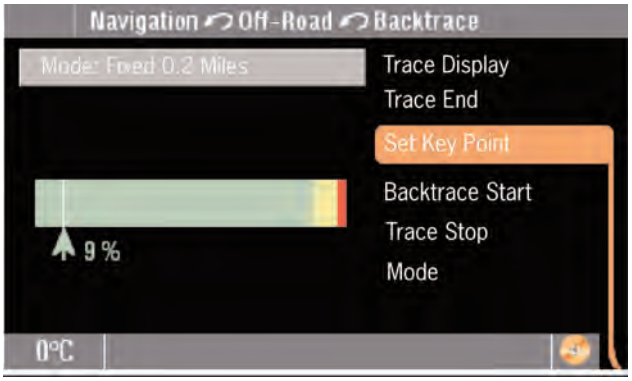
Trace display can only be started when route guidance is inactive. Route guidance can only be started if the trace display has previously been ended.

The trace display is ended at the current position with the menu item "end trace". To save the trace display, this must be confirmed with "yes" in the selection.



Key Points With Trace Display

The system automatically sets key points to reproduce the route covered. In the "optimizing" mode, the key points are matched to the route and in the "fixed..ml" mode placed in a set grid between 0.1 ml and 1 ml. Additionally, key points can be manually set on the route using the menu item "set key point".

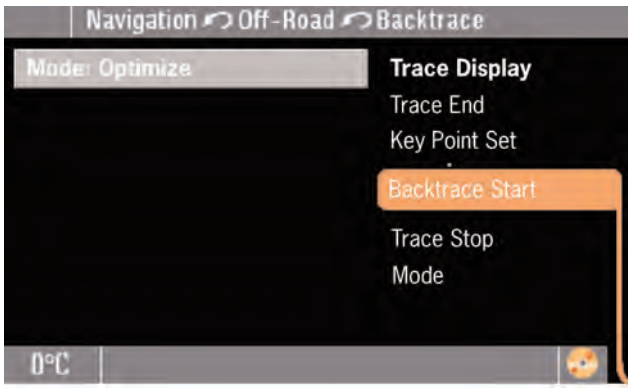


Notes:

Backtrace Navigation

The backtrace navigation will guide the customer back along a trace previously displayed. If the customer deviates from the backtrace, then he can always be guided to the nearest backtrace key point using the function “start backtrace” - “start from ...” “... current position”.

If the deviation from the backtrace is only a short distance, then the system calculates cyclic to the nearest key point and navigates to this destination.



Procedure

The 8 nearest key points from the last reached key point are used. Cyclic testing determines which of these 8 points is nearest to the vehicle. If, for example, point 5 is calculated as the nearest navigable key point, then points 1 to 4 are automatically removed from the list and the list is again completed to 8 points. This process is repeated until the vehicle is back on the backtrace route.

A manually set key point along with the start point are not automatically skipped. If a manually set key point or the start point is to be skipped, then this can be carried out in the “start from ...” “... current position” option.

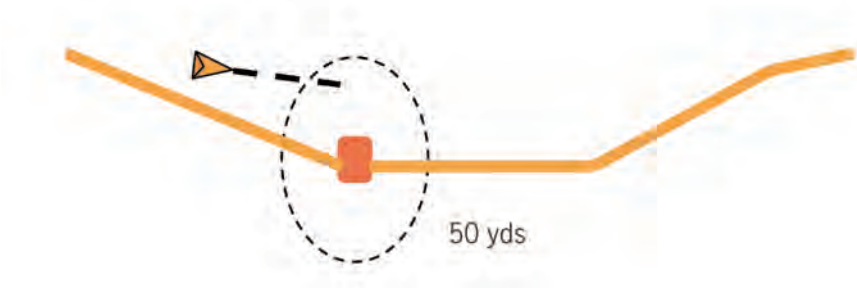
The start point of the trace display option “... start of journey” is moved during a trip, if:

- a trace display had been started or ended earlier.
- the “trace delete” function has been carried out.
- a different country CD has been loaded.
- a system update has been carried out.

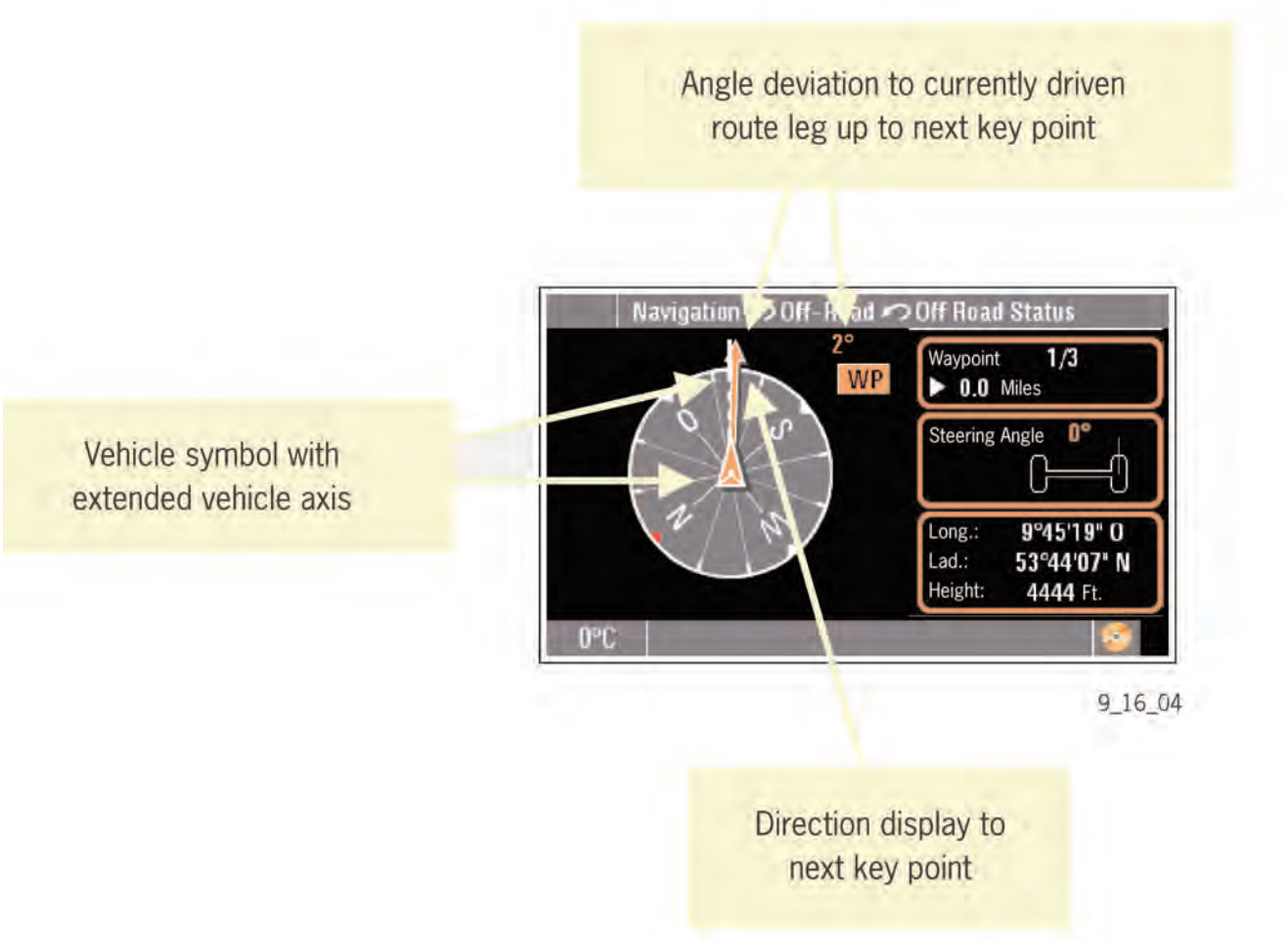
Notes:

Key Point During Backtrace Navigation

To reach a key point, the vehicle must approach within 55 yards (50 meters) of the key point. The route calculation to the next navigable key point starts when the vehicle drives within the catchment radius (R = 50 yards).



During active backtrace, an orange colored arrow points in the direction of the next key point with corresponding change of direction as orange colored segment.



The following voice announcements are given during active backtrace:

Automatic Voice Announcement

On arriving at the start point or a manually set key point, the announcement follows:

“Arrived at ... point”

The direction guidance voice announcement gives instruction on the new direction to be taken to continue following the trace.

“Please take direction one, two, ... eleven o-clock / follow this direction”.

If the direction of travel after reaching a key point used for navigation varies by more than 30 degrees from the direction to the next key point, the system announces:

“Please take direction one, two, ... eleven o-clock / follow this direction”.

The direction guidance voice announcement gives instruction on the new direction to be taken to return back to the trace (towards the destination).

Voice Announcement After Pressing The Repeat Button

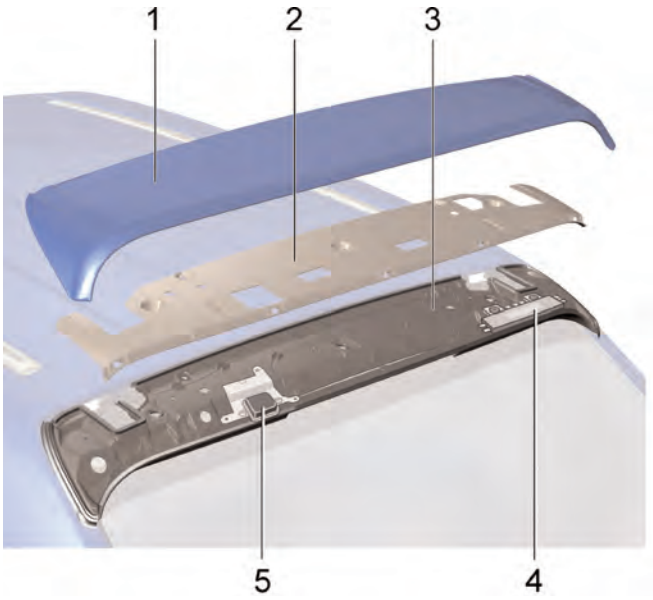
The direction guidance voice announcement gives instruction on the direction to be taken to follow the trace or to return to the trace.

“Please take direction one, two, ... eleven o-clock / follow this direction”

Notes:

Integrated Antenna System

The Cayenne employs an integrated antenna system for audio, central locking system, navigation, telephone and parking heater. There are differences between two available antenna systems: the Basic System and the Diversity System. The central locking antenna is always part of every system. However, antennas for the parking heater remote control, the navigation system and telephone antenna can be installed depending upon vehicle equipment. Up to 13 non-visible antennas can be installed in the rear area of the Cayenne. Electronic components such as antenna amplifier, diversity control module and GPS antenna are located in the rear spoiler. All components in the rear spoiler are waterproof. Components, particularly the GSM and GPS antenna, have been optimally located in the spoiler. The high placement considerably enhances the signal reception. This results in wider range and less interference.



1 - Roof spoiler upper section
2 - Roof spoiler center section
3 - Roof spoiler lower section
4 - Antenna amplifier
5 - GPS antenna

Base Antenna System

The base antenna system consists of a 70 cm long antenna injected into the lower shell of the spoiler. The related AM/FM antenna is positioned to the right in the spoiler.

Antenna Diversity

Antenna Diversity belongs to the PCM product range. The system is made up of the base system AM/FM antenna as well as 3 additional FM antennas integrated into the rear window. Antenna Diversity has a single standard AM amplifier and 2 FM antenna amplifiers. Two modules are integrated into the spoiler. On the right is the Antenna Diversity control module, and on the left is the second module with the 2 FM antenna amplifiers. This system ensures that the best positioned antenna always receives the FM signals. The system is not designed for AM reception, since switching the antennas would create audible interference. If one antenna does not have an adequately usable signal or has too much interference, the switch is made to another antenna. One of the antennas is specified as the primary antenna and is activated directly. Quality fluctuations in this wave band are further minimized in this way.

Notes:

Introduction To The CAN Data Bus

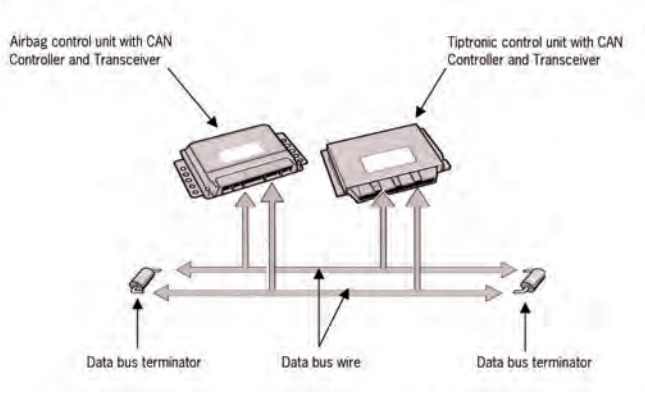
Design and Functionality

The CAN bus is a serial bus system on which all connected systems have equal rights, i.e. each control unit can send and receive. Simply expressed, the connected control units can “talk” to each other via the bus and exchange information. Because of the linear construction of the network, the bus system remains fully available for all other devices should one device fail.

CAN Bus Components

The CAN data bus consists of the following components:

- Controller
- Transceiver
- Two data bus terminators
- Two data bus wires.



CAN Controller

The CAN controller receives the data to be sent from the microcomputer in the control unit. It prepares the data and gives it to the CAN transceiver. The data is converted in the controller to a high frequency square wave voltage modulated with a small DC voltage (e.g. 5 V). The controller also receives data from the CAN transceiver, prepares it and gives it to the microcomputer in the control device.

CAN Transceiver

The CAN transceiver consists of a transmitter and a receiver. It converts the data from the CAN controller and sends it to the data bus lines. In exactly the same way, it receives data and converts it for the CAN controller.

Data Bus Terminators

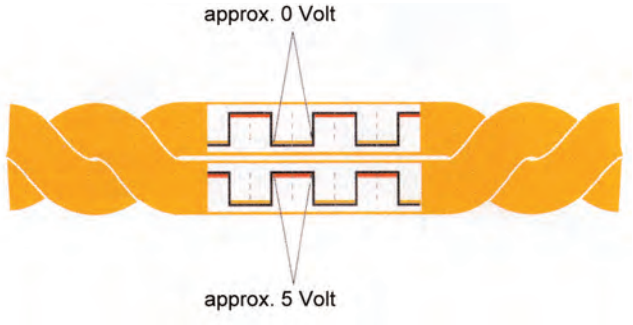
The data bus terminator is a resistor that prevents sent data from being returned as an “echo” and corrupting data. This resistor is also needed for diagnostic purposes.

Data Bus Wires

The data bus wires are bi-directional and are used for the transmission of data. They are defined as CAN-High (for 1) and CAN-Low (for 0). To prevent interference from affecting data transmission, the two wires take the form of a twisted pair. This also prevents the data bus line from radiating interference.

Both wires carry an counter opposing voltage, i.e. when the voltage on one wire is 5 V, then the other wire carries a voltage of 0 V and vice-versa.

The sum of the voltages is kept constant and the electro-magnetic fields of both wires cancel each other out.



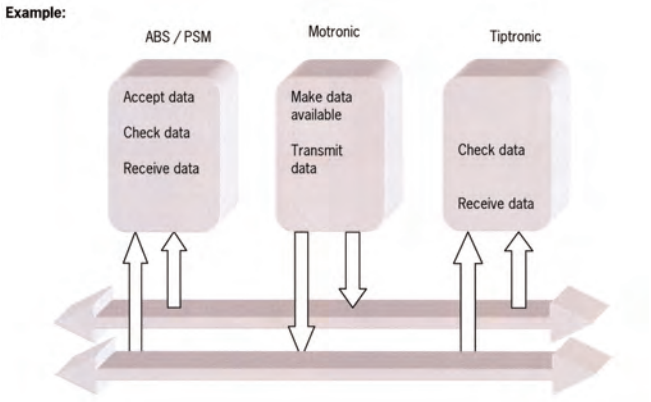
Notes:

Data Transmission

In CAN bus data transfers, data from all components (control units) is sent on the bus and all components receive and decoded data.

Data Transfer Process

- Data availability – The control unit makes the data available to the CAN controller for transmission.
- Transmitting data – The CAN transceiver receives the data from the CAN controller, converts it into electrical signals and transmits it.
- Receiving data – All other control units connected to the bus receive the data.
- Checking data – The control unit checks whether the data received is needed by the control unit to carry out its function or not.
- Accepting data – If the data is relevant, it is accepted and processed, otherwise it is ignored.



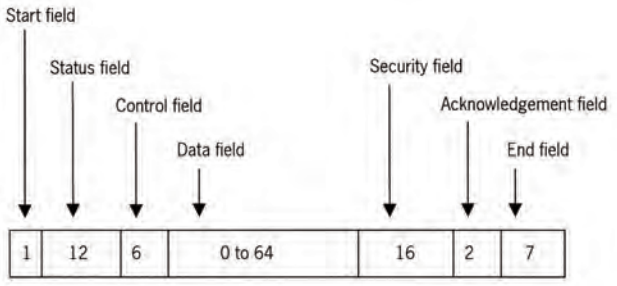
CAN Protocol

The CAN data bus carries, at short time intervals, a data protocol between the control units. The data protocol consists of a large series of bits following one another. A bit (binary digit) is the smallest unit of information (one switched condition per time interval) in digital technology and in a data processing system.

In electronics, this information can only have the value of a logical 1 (“yes”) or a logical 0 (“no”). Eight bits together form one byte. In a byte, there are 256 different bit

patterns possible and therefore 256 different pieces of information can be coded or represented.

In a CAN system, the information is exchanged with the help of messages. The CAN transmitters and receivers know the exact structure of the message and can therefore correctly interpret the individual bits and bytes in a bit stream being received. The following illustration shows the structure of a data protocol ("data frame"), this being identical for both wires.



Start field (1 bit)

The start field marks the beginning of the data record or message. A bit is sent with 5 V on the CAN-High line and 0 V on the CAN-Low line. When all stations connected to a bus system recognize a start bit, they switch to receive.

Status field (12 bit)

The status field determines the priority of the data or message. If, for example, two control units attempt to transmit their data message at the same time, the one with the highest priority will take precedence.

Control field (6 Bit)

The control field contains the number of data bits contained in the data field. Each receiver can thus check if it has received all the data.

Data field (max. 64 Bit)

The data field contains the information transmitted to the other control units.

Security field (16 Bit)

This field is used to recognize transmission failures.

Acknowledgement field (2 Bit)

In the acknowledgement field, the receiver signals the transmitter that it has correctly received the data message. If a failure has been recognized, it is immediately sent to the transmitter. The transmitter then repeats the transmission.

End field (7 Bit)

The end field marks the end of the data message. This is the final way of announcing a failure, leading to a retransmission of the data.

A light switch can serve as an **example** of how the values "0" or "1" can be generated:

It allows the light to be switched on or off, i.e. there are two different statuses of the light switch.



Status of light switch with value "1"
- Switch closed
- Light on

Status of light switch with value "0"
- Switch open
- Light off

The CAN data bus also works on this principle. The transceiver can also generate two different statuses of a bit.

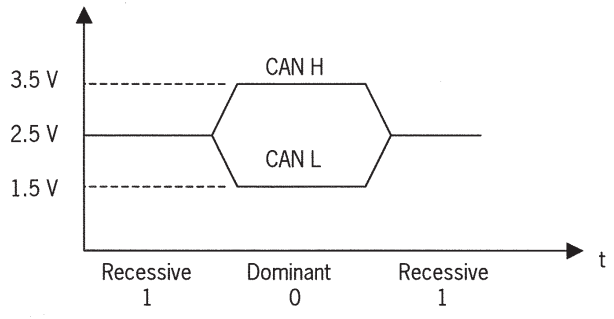


Notes:

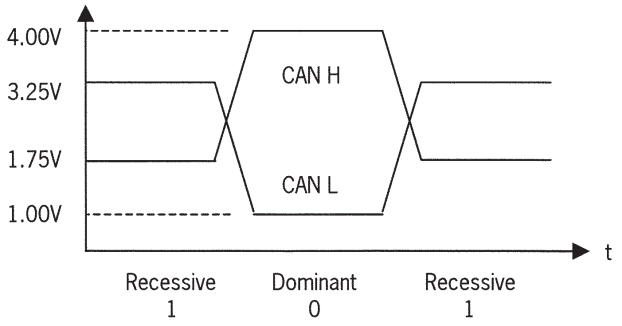
Bus Signal Level

To guarantee reliable transmission in the vehicle which is at the same time free from electromagnetic interference (EMI), data transmission on the CAN lines is carried out by means of differential signals. Drive CAN (high speed) and Convenience & Infotainment CANs (low speed) use different kinds of differential signals.

The following diagram shows the signal level of a high-speed bus.



In comparison, here is the signal level of a low-speed bus.



Networking/Data Communication

- CAN (Controller Area Network)
- MOST (Media Oriented System Transport)

Electronic networking of the Cayenne enables data exchange among various control devices throughout the vehicle.

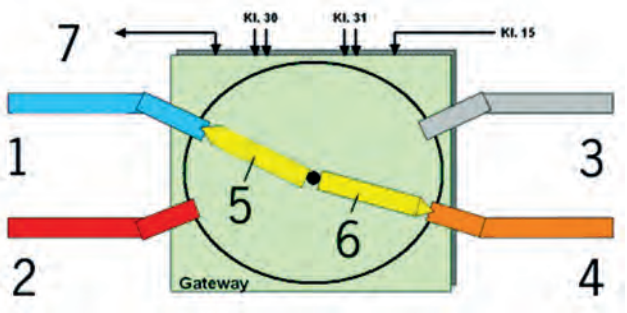
Compared to that of the Sports Cars, the data bus system is more exten-sive and consists of the following subsystems:

- CAN – drive bus, 500 kBit/s (in the event of a data line failure, e.g., short circuit or interruption, data transmission is impossible or lim-ited).
- CAN – Infotainment, 100 kBit/s (in the event of a data line failure, e.g., short circuit or interruption, data transmission is possible only via a single line - single wire operation).
- CAN – Convenience, 100 kBit/s (in the event of a data line failure, e.g., short circuit or interruption, data transmission is possible only via a single line - single wire operation).
- MOST optical data bus, 21.2 MBit/s (if one user cannot relay the data, no further communication is possible, due to the ring structure of the network).

To enable communication among the individual bus systems, a so-called Gateway Control Module, implemented as software, is located in the instrument cluster. Diagnosis is performed using the K-lead.

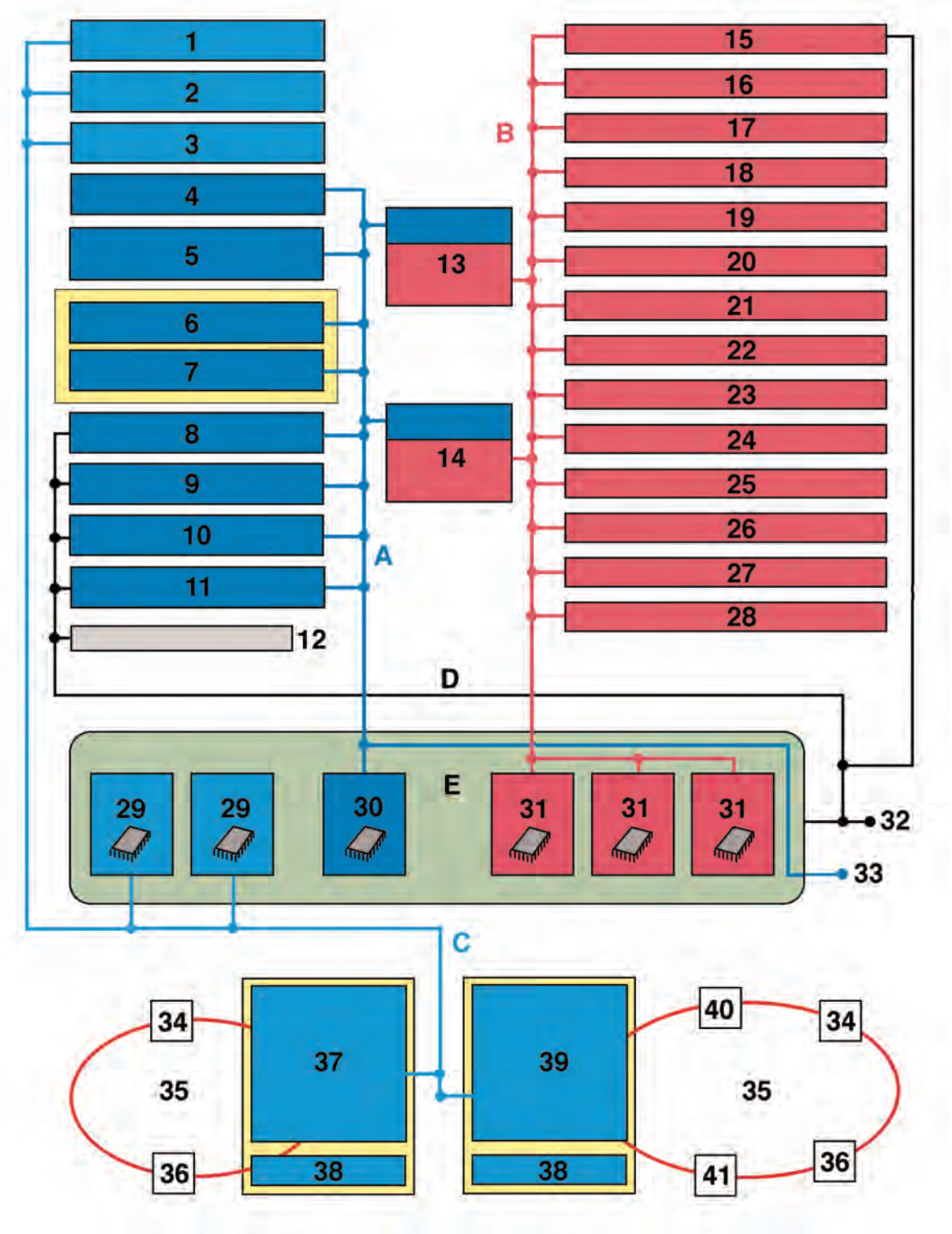
Gateway Controller

The gateway controller is a separate unit on the Cayenne as of model year 2005 rather than being integrated into the instrument cluster. It relays all messages and signals which are transmitted by control units for transmission via various buses. The transfer protocol of the gateway controller is defined in a so-called routing table. It also supports the test unit in diagnosing the vehicle by transmitting, collecting and supplying numerous items of information on the vehicle.



1 - CAN display
2 - CAN Comfort
3 - CAN diagnosis
4 - CAN drive
5 - Source network
6 - Target network
7 - Wake-up line

Cayenne Data Bus Layout

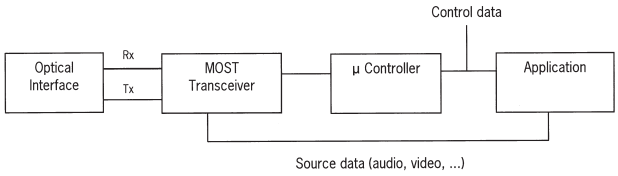


Network Layout

1 – Control module wiper	25 – Control module parking aid
2 – Compass sensor	26 – Control module tire pressure monitor
3 – Control module parking heater	27 – Control module seat memory driver
4 – Control module airbag	28 – Control module seat memory passenger
5 – Control module PSM	29 – Gateway CAN Infotainment
6 – Control module automatic level system	30 – CAN drive unit
7 – Damping control module	31 – Gateway CAN convenience
8 – Control module center differential lockup	32 – CAN drive unit external
9 – Control module axle differential lock	33 – K-lead
10 – Transmission control module	34 – Amplifier
11 – DME control module	35 – MOST bus
12 – Xenon control module	36 – CD changer
13 – Steering column control module	37 – Radio CDR 23
14 – KESSY/Immobilizer control module	38 – Gateway Radio/PCM
15 – Rear control module	39 – PCM2
16 – Control door rear left	40 – Navigation module
17 – Control door rear right	41 – Telephone
18 – Control driver's door	
19 – Control front passenger door	
20 – Trailer control module	A – CAN drive unit
21 – Vehicle electrical system control module	B – CAN convenience
22 – Climate control element front	C – CAN infotainment
23 – Climate control element rear	D – K-lead
24 – Control roof	E – Gateway instrument cluster

Introduction To The MOST Bus

MOST Hardware



Basic Structure of a MOST Control Unit:

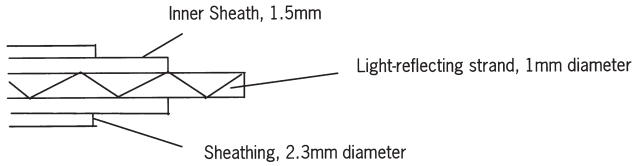
A gateway to the Comfort CAN bus is implemented in the head unit to allow exchange of data between control units on the MOST network and those on the CAN network.

MOST Transceiver

Each MOST control unit contains at least one MOST transceiver or a manufacturer-specific chip with integrated MOST transceiver functionality. These chips generate the MOST protocol. In the transceiver, the source data (audio, video,...) and the control data is either added or read out of the transceiver.

Integrated into MOST transceivers is all important network management functions such as determination of the node position, data delay with regard to the timing master and fault recognition mechanisms with automatic message repeating, etc.

Electro-optic and Opto-electric Converters



Transmission of the MOST protocols from one control unit to another is done by means of a plastic fiber-optic cable. So-called FOT (Fiber Optic Transmitting)units are used for electro-optic and opto-electric conversion.

An optical interface consists of a transmitter and a receiver. An optical wake-up function to wake the network up is integrated into the receiver. As soon as light is received at the receiver input, the receiving unit switches its status outputs to 0 volts. The optical output power can be set by adjusting the current flowing through the transmitter diode by means of the transmitting unit's control input.

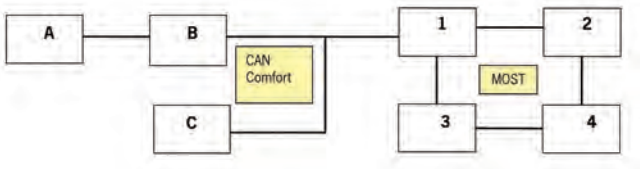
Control Data Channel

Telegrams are sent via the MOST transceiver's control data channel for control of individual components in the MOST loop. The control data is mainly used for communication between the individual bus components.

Commands, status and diagnostic messages and gateway messages are transmitted. To make a complete control message, 2 bytes per frame from each of 16 sequential frames are put together to form one block. This gives a control message with a length of 32 bytes. A faulty message is rejected by the

MOST receiver when it recognizes a transmission fault. The transmitter then independently repeats the transmission. A transmission fault is only indicated when a defined maximum number of repeat attempts have been made without success.

MOST Network Components



A - Diagnostics Tester
B - Instrument Cluster
C - Air Conditioner
1 - Radio/PCM
2 - Amplifier
3 - Telephone
4 - CD Changer

Notes:

Notes:

PORSCHE

Minor Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Minor Maintenance** (Labor Operation 03 24 00 ..) See Technical Manual
After 20,000, 60,000, 100,000, 140,000 miles etc. / 30,000, 90,000, 150,000, 210,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, minor maintenance must be performed no later than after 2, 6, 10..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Check drive belt

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection level

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the dust boots for leaks & signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Check tightness of bolts on the suspension adjustment system at the front and rear (only applies to the first service)

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Panorama roof: Adapt control module

☑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level, check wiper blades

☑ Vehicle lighting: Check operation

☑ All headlights: Check adjustment

☑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

☑ Electrical equipment as well as indicator and warning lights: Check operation

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)

Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

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Part Number – PNA 000 162 CA

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ___/___/___

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

Technician Name: _____

Technician Signature: _____

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Part Number – PNA 000 162 CA

PORSCHE

Major Maintenance Checklist – Cayenne/S/T (2003-06)

Required Maintenance and Lubrication Service

❑ **Major Maintenance** (Labor Operation 03 26 00 ..) See Technical Manual
After 40,000, 80,000, 120,000, 160,000 miles etc. / 60,000, 120,000, 180,000, 240,000 km etc.

Note: If the mileage for scheduled maintenance is not reached, major maintenance must be performed no later than after 4, 8, 12..... years.

The terms 'check' and 'inspection' include all necessary subsequent work such as adjusting, readjusting, correcting and topping off, but do not include repairing, replacing and reconditioning parts or assemblies.

☑ Diagnosis system: Read out fault memory; reset maintenance interval

☑ Underside of vehicle and engine compartment: Visual inspection for leaks (oil and fluids)
Engine compartment: Visual inspection for damage
Underbody covers: Visual inspection, check that all are securely fastened – replace any damaged or missing panels

❑ Change engine oil and oil filter (Except Cayenne V6 which is 10,000 miles/15,000 km, see separate Oil Change Sheet, PNA 000 162 CC)

❑ Air filter/s: Check the air filter condition, and if necessary, replace

❑ Pollen filter: Replace filter element

❑ Check drive belt

❑ Steering gear: Visual inspection of the dust boots for signs of damage
Tie rod ends: Check play and dust boots

❑ Power steering: Check fluid level

❑ Fuel system lines and connections: Visual inspection

❑ Coolant hoses: Check condition

❑ Radiators and air intakes: Visual inspection for exterior debris and blockage
Coolant: Check level and antifreeze protection levels

❑ Parking brake: Check free play

❑ Brake system: Visual inspection of the brake pads and brake discs for signs of wear

❑ Brake hoses and lines: Visual inspection for damage, correct routing and corrosion Check brake fluid level

❑ Axle shafts: Visual inspection of the for leaks & signs of damage

❑ Axle joints: Check play; visual inspection of the dust boots for signs of damage

❑ Drive shafts: Visual inspection of the sleeves (dust boots M.Y. '03) for leaks & signs of damage (M.Y. '03 also check center bearing for damage)

❑ Hydraulically detachable off-road sway bar: Check fluid level and function

❑ Exhaust system: Visual inspection for leaks and signs of damage; check mounts

❑ Tires, external spare wheel: Check condition and tire pressure

❑ Lubricate door latch and fastening bolts

❑ Panorama roof: Adapt control module

☑ Windshield wiper/washer system, headlight washer: Check function, fluid level, nozzle adjustment, and antifreeze protection level

☑ Check wiper blades

❑ Seat belts: Check operation and condition

☑ Vehicle lighting: Check operation

☑ All headlights: Check adjustment

☑ Horn: Check operation

❑ Batteries and ventilation hoses: Check condition

❑ Trailer coupling: Check operation

❑ Airbag system: Check operation and condition (see additional mainenance)

Additional Maintenance – Replace Spark Plugs (Labor Operation 03 81 00 ..)

❑ Replace spark plugs: Cayenne every 40,000 miles / 60,000 km or 4 years
❑ Replace spark plugs: Cayenne S every 60,000 miles / 90,000 km or 4 years
❑ Replace spark plugs: Cayenne Turbo every 40,000 miles / 60,000 km or 4 years

Additional Maintenance every 80,000 miles / 120,000 km or 4 years (Labor Operation 03 85 00 ..)
Air filter element/s should be changed more often dependent on vehicle use and operation in dusty environments.

❑ Air filter element/s (1 or 2 dependent on options)

Additional Maintenance every 160,000 miles / 240,000 km or 16 years

❑ Change front differential oil
❑ Change rear differential drive oil
❑ Change transfer case oil
❑ Change manual transmission oil
❑ Change Tiptronic transmission oil and ATF filter

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Additional Maintenance every 2 years

❑ Change brake fluid (use only Original Porsche Brake Fluid)

Additional Maintenance every 4 years

❑ Replace tire sealant

Additional Maintenance every 4 years – then every 2 years

❑ Check battery for tire pressure monitoring system

Additional Maintenance after 10 years – then every 2 years

❑ Airbag system: Check operation and condition

Inspection Performed - Technician Signature: _____

Road Test Check

☑ Remote control, front seats, foot brake and parking brake (also operating travel), engine, clutch, steering, transmission, ParkAssist, automatic speed control, PSM switches, heater, air-conditioning system and instruments: Check operation

☑ Oils, fluids: Visual inspection for leaks

Road Test Performed - Technician Signature: _____

Customer Name: _____ **Date:** ____/____/____

VIN: WP1 _____

Mileage (check one) ❑ **Miles** ❑ **Kilometers:** _____

Dealer Name: _____ **Dealer Code:** _____

Repair Order #: _____

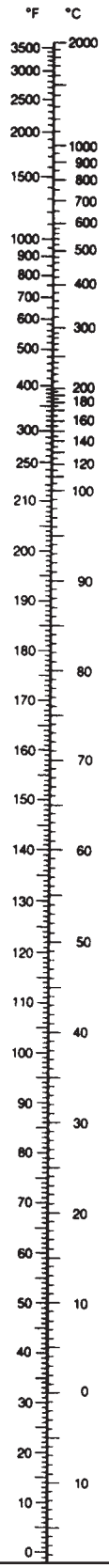
Technician Name: _____

Technician Signature: _____

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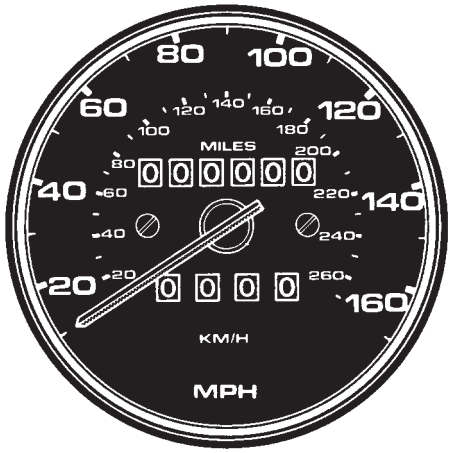
Part Number – PNA 000 162 CB

Temperature Conversion



Metric Conversion Formulas

INCH	X	25.4	=	MM
MM	X	.0394	=	INCH
MILE	X	1.609	=	KILOMETER(KM)
KM(KILOMETER)	X	.621	=	MILE
OUNCE	X	28.35	=	GRAM
GRAM	X	.0352	=	OUNCE
POUND(lb)	X	.454	=	KILOGRAM(kg)
kg(KILOGRAM)	X	2.2046	=	lb(POUND)
CUBIC INCH	X	16.387	=	CUBIC CENTIMETER(cc)
cc(CUBIC CENTIMETER)	X	.061	=	CUBIC INCH
FOOTPOUND(ft lb)	X	1.3558	=	NEWTON METER(Nm)
Nm(NEWTON METER)	X	.7376	=	ft lb(FOOT POUND)
HORSEPOWER(SAE)	X	.746	=	KILOWATT(Kw)
HORSEPOWER(DIN)	X	.9861	=	HORSEPOWER(SAE)
Kw(KILOWATT)	X	1.34	=	HORSEPOWER(SAE)
HORSEPOWER(SAE)	X	1.014	=	HORSEPOWER(DIN)
MPG(MILES PER GALLON)	X	.4251	=	Km/l(KILOMETER PER LITER)
BAR	X	14.5	=	POUND/SQ. INCH(PSI)
PSI(POUND SQUARE INCH)	X	.0689	=	BAR
GALLON	X	3.7854	=	LITER
LITER	X	.2642	=	GALLON
FAHRENHEIT	-	32÷1.8	=	CELSIUS
CELSIUS	X	1.8+32	=	FAHRENHEIT



Notes:



WE SUPPORT VOLUNTARY TECHNICIAN CERTIFICATION THROUGH

National Institute for

AUTOMOTIVE SERVICE EXCELLENCE