TECHNICAL TRAINING

COMPONENT DIAGNOSIS SID 803 / 803A EDC16C34

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AFTER SALES DIVISION

SUMMARY OF BROCHURE CONTENTS

The aim of this brochure is to present the features of the major sensor and actuators on the DV6TED4 and DW10BTED4 engines.

This document covers the following topics:

- the features of the fuel system and air circuit components,
- indicative values for the DV6TED4 and DW10BTED4 engines,
- fuel system and air circuit checking methods,
- a summary of the FAP (particle filter).

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1. SID 803 / 803A ECU INPUTS AND OUTPUTS

1.1. Outline diagram

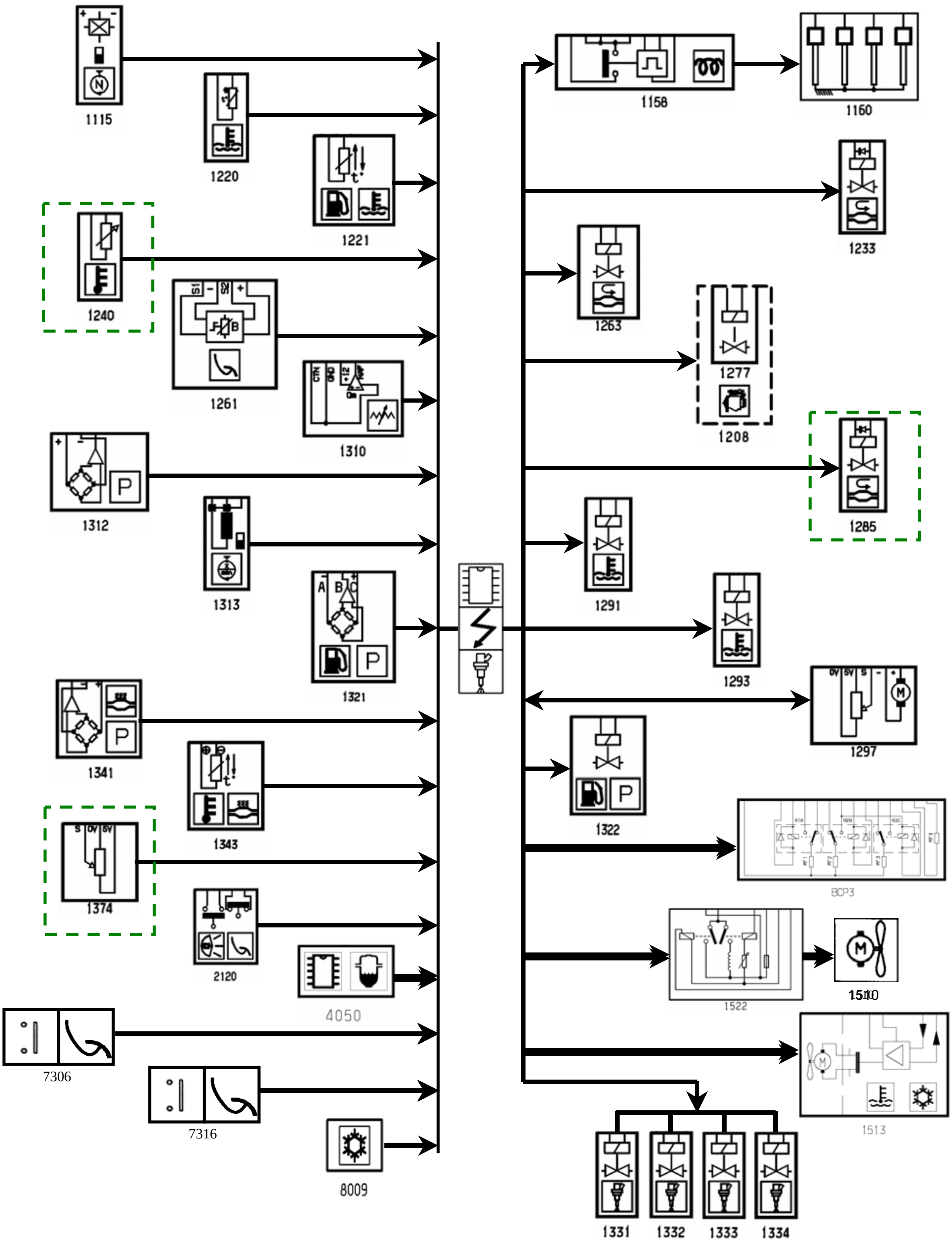

Figure 1: SID 803 / 803A outline diagram

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Components list	
Electrical reference	**Component description**
1115	Cylinder reference sensor
1158	Glow plug control unit
1160	Glow plugs
1208	High Pressure diesel pump (DCP)
1220	Coolant temperature sensor
1221	Fuel temperature sensor
1233	Turbo pressure regulation electrovalve
1240	Inlet air temperature sensor - downstream of intercooler (present depending on equipment)
1261	Accelerator pedal position sensor
1263	EGR throttle valve control electrovalve
1277	Fuel flow regulator (VCV - volumetric control valve)
1285	Inlet air heater throttle valve control electrovalve (present depending on equipment)
1291	S2RE (electronic cooling system) degassing electrovalve
1293	S2RE proportional coolant by-pass electrovalve
1297	Electric EGR valve with position feedback signal (copy potentiometer)
1310	Air flowmeter and air temperature
1312	Inlet air pressure sensor (downstream of intercooler)
1313	Engine speed sensor
1321	Fuel high pressure sensor
1322	High Pressure fuel regulator (PCV - pressure control valve)
1331	Injector - cylinder N° 1
1332	Injector - cylinder N° 2
1333	Injector - cylinder N° 3
1334	Injector - cylinder N° 4
1341	Particle Filter (FAP) differential pressure sensor.
1343	Exhaust gas temperature sensor (downstream of catalyser)
1374	Turbocharger position copy sensor (present depending equipment)
1510	Cooling fan (GMV) (Citroën C4)
1513	Variable speed cooling fan (GMV) (Citroën New Look C5)
1522	Two speed cooling fan control unit
2120	Dual-function brake switch
4050	Water in fuel sensor
7306	Cruise control safety switch (clutch)
7316	Vehicle speed limiter safety switch (kick-down point on accelerator pedal)
8009	Refrigerant pressure sensor
BCP3	3 relay fuse box (additional heater – burner or CTP)

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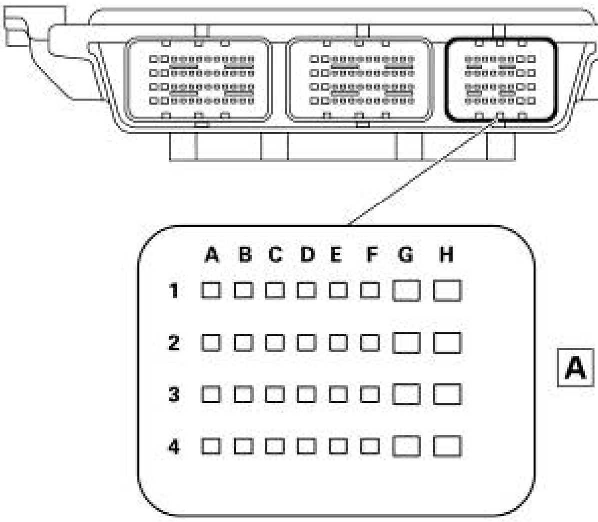
1.2. SID 803 / 803A ECU PIN LAYOUT



Black 32-pin connector (CH)

A1	Not Used	A2	Not Used	A3	CAN_L	A4	CAN_H
B1	Additional heating 1	B2	Radiator fan 1 (C4 C5)	B3	Not Used	B4	K line
C1	Additional heating 2	C2	Pedal track 2 signal	C3	RCD signal	C4	Radiator fan (Diag' line)
D1	Crank-up command line	D2	Not Used	D3	Not Used	D4	Radiator fan 2 (C4)
E1	Not Used	E2	Not Used	E3	Clutch switch	E4	Brake light switch (redundant)
F1	Not Used	F2	Air conditioning pressure sensor supply	F3	Not Used	F4	Air conditioning pressure sensor earth
G1	Not Used	G2	Pedal 5V power supply	G3	Pedal track 1 signal	G4	Earth
H1	Not Used	H2	Air conditioning pressure info'	H3	Pedal sensor earth	H4	Earth

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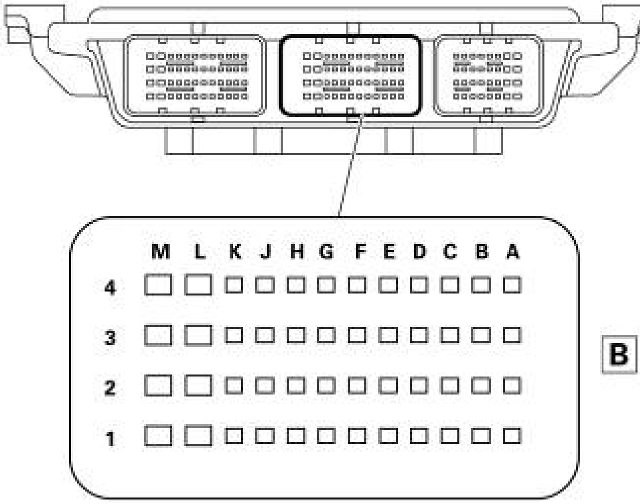

48-pin brown connector (CMI)

A1	Speed limiter switch	A2	Turbocharger air temperature sensor	A3	Not Used	A4	Not Used
B1	Not Used	B2	FAP differential pressure sensor signal	B3	Not Used	B4	Exhaust gas temperature sensor (downstream of catalyser)
C1	Flowmeter air temperature	C2	Differential pressure sensor power supply	C3	EGR valve position sensor power supply	C4	Turbo position sensor signal
D1	Turbo position sensor power supply	D2	EGR valve position sensor signal	D3	Differential pressure sensor earth	D4	Glow plug relay (diagnostic line)
E1	Glow plug relays	E2	EGR valve position sensor earth	E3	Not Used	E4	Turbo position sensor earth
F1	Not Used	F2	Not Used	F3	Speed limiter switch	F4	Not Used
G1	S2RE by-pass electrovalve	G2	Flowmeter earth	G3	Turbocharger air temperature sensor	G4	Battery voltage
H1	RTE solenoid	H2	Not Used	H3	Power relays	H4	Alternator charge info
J1	S2RE degassing electrovalve	J2	Exhaust gas temperature sensor earth (downstream of catalyser)	J3	Main relay	J4	Not Used
K1	Not Used	K2	Earth	K3	Not Used	K4	Not Used
L1	Not Used	L2	EGR control	L3	RAS (air cooling system) electrovalve	L4	Pressure control valve (PCV)
M1	Turbo electrovalve	M2	EGR control	M3	EGR flap electrovalve	M4	Volume control valve (VCV)

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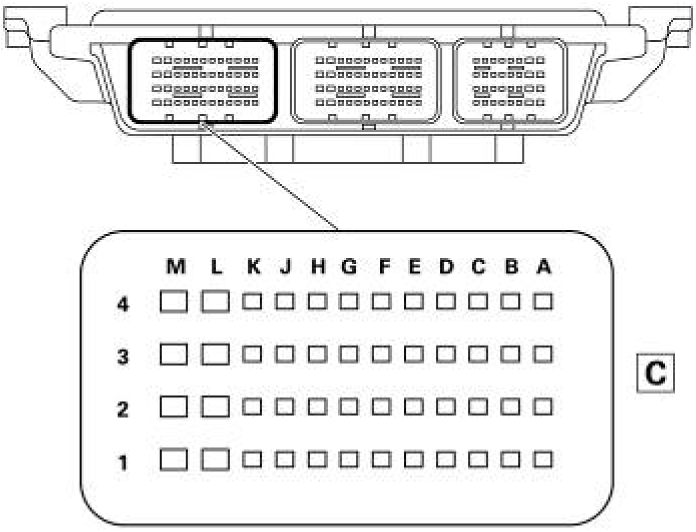

48-pin grey connector (CME)

A1	Not Used	A2	Coolant temperature sensor signal	A3	Fuel temperature sensor signal	A4	Rail pressure sensor power supply
B1	Turbo pressure sensor signal	B2	Rail pressure sensor signal	B3	Rail pressure sensor earth	B4	Engine speed sensor signal
C1	Camshaft sensor (cylinder reference) signal	C2	Not Used	C3	Not Used	C4	Not Used
D1	Turbo pressure sensor earth	D2	Not Used	D3	Not Used	D4	Camshaft sensor (cylinder reference) earth
E1	Not Used	E2	Turbo pressure sensor supply	E3	Camshaft sensor (cylinder reference) supply	E4	Not Used
F1	Engine speed sensor earth	F2	Not Used	F3	Not Used	F4	Engine speed sensor supply
G1	Coolant temperature sensor earth	G2	Not Used	G3	Not Used	G4	Not Used
H1	Not Used	H2	Water in diesel filter (signal)	H3	Flowmeter signal	H4	Earth
J1	Fuel temperature sensor earth	J2	Not Used	J3	+ Relay R2	J4	Earth
K1	Not Used	K2	+ Relay R2	K3	+ Relay R2	K4	Earth
L1	Injector cylinder + 2	L2	Injector cylinder + 3	L3	Injector cylinder + 1	L4	Injector cylinder + 4
M1	Injector cylinder - 4	M2	Injector cylinder - 2	M3	Injector cylinder - 1	M4	Injector cylinder - 3

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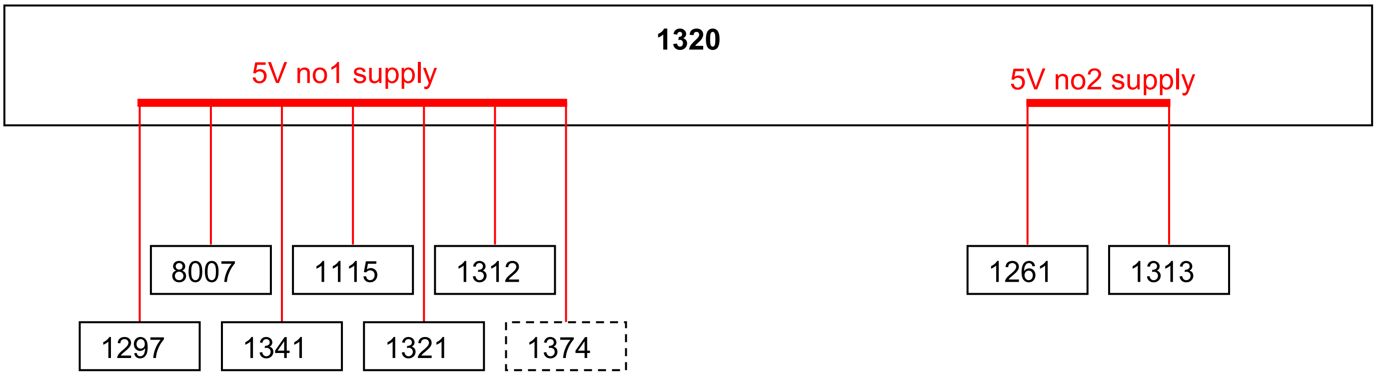
1.3. Special features of the 5V power supplies

The injector ECU powers certain components with 5 V. Some of these power supplies are connected to equi-potential terminals inside the ECU.



1115	Cylinder reference	1313	Engine speed	8007	Pressure switch
1261	Accelerator pedal position:	1321	Diesel high pressure		
1297	EGR electrovalve	1341	FAP differential pressure		
1312	Inlet air pressure	1374	Turbo position return signal		

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2. INDICATIVE VALUES

2.1. Remarks

These charts provide average indicative values measured on various vehicles (4 DW10BTED4s and 3 DW10UTED4s).
This testing was conducted on vehicles with mileage of less than 6000 miles and at an altitude of less than 200 m.
Static testing was carried out at an ambient temperature of 20°C and dynamic tests at temperatures of between 8 and 17°C.
In order to guarantee measurement reliability, check the condition of the air filter and change it if necessary.

For certain static tests, the EGR must be inhibited by disconnecting the EGR valve connector.

2.2. Full load dynamic testing

Test conditions
Coolant temperature: at least 80°, road profile: flat, vehicle weight: in functional order, tyre pressures: nominal pressure, no power consumers on and air-conditioning switched off.
From approximately 2000 rpm, press foot flat down on the accelerator pedal:

- to reach maximum fuel pressure, it is necessary to reach an engine speed of around 4000 rpm (in third gear, for example).
- to reach maximum turbo pressure, it is better to use a gear higher than 3rd, at mid-range engine speed.

SID 803 / 803A		
Parameters	Full load	
	DW10 BTED4	DW10 UTED4
Fuel circuit info parameters		
Fuel reference pressure (bar)	$1630^{\pm 30}$	$1630^{\pm 30}$
Measured fuel pressure (bar)	$1630^{\pm 30}$	$1630^{\pm 30}$
RCO Pressure regulator (%)	$35^{\pm 5}$	$35^{\pm 5}$
RCO Flow regulator (%)	$37^{\pm 5}$	$33^{\pm 5}$
Air intake circuit info parameters		
Reference turbo pressure (mbar)	$2280^{\pm 40}$	$2280^{\pm 40}$
Turbo pressure (mbar)	$2280^{\pm 50}$	$2301^{\pm 50}$
Turbo pressure solenoid valve OCR (%)	$57^{\pm 10}$	$52^{\pm 10}$
Turbo position instruction (%)	$57^{\pm 10}$	$52^{\pm 10}$
Turbo recopy position (%)	$56^{\pm 10}$	
EGR valve position information (%)	0	0
EGR valve electrovalve OCR (%)	0	0
EGR valve recopy position (%)	0	0
RCO EGR throttle solenoid (%)	9	10
RCO air intake throttle heater solenoid (%)	5	6
Airflow setting (mg/stroke)	$1180^{\pm 50}$	$1182^{\pm 30}$
Measured air flow (mg/stroke)	$1180^{\pm 50}$	$1182^{\pm 30}$

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2.3. STATIC TESTING (NO LOAD)

Test conditions

Coolant temperature: at least 80°C, no power consumers, air conditioning off. Check the condition of the air filter, change it if necessary.

The values measured in the air circuit are affected by atmospheric pressure, notably for measurements taken at idle and at 1500 rpm.

SID 803 / 803A with DW10 BTED4					
Parameters	**Cranking engine**	**Idling**	**1500 $^{\pm 50}$ rpm**	**2500 $^{\pm 50}$ rpm**	**4000 $^{\pm 50}$ rpm**
Fuel circuit parameters					
Fuel reference pressure (bar)	270 $^{\pm 50}$	255 $^{\pm 30}$	404 $^{\pm 30}$	440 $^{\pm 30}$	569 $^{\pm 30}$
Measured fuel pressure (bar)	> 150	251 $^{\pm 30}$	404 $^{\pm 30}$	443 $^{\pm 30}$	569 $^{\pm 30}$
RCO Pressure regulator (%)	22 $^{\pm 5}$	14 $^{\pm 5}$	17 $^{\pm 5}$	18 $^{\pm 5}$	20 $^{\pm 5}$
RCO Flow regulator (%)	35 $^{\pm 5}$	24 $^{\pm 5}$	23 $^{\pm 5}$	21 $^{\pm 5}$	22 $^{\pm 5}$
Air circuit parameters with EGR inhibited					
Reference turbo pressure (mbar)		1001 $^{\pm 40}$	1012 $^{\pm 40}$	1033 $^{\pm 40}$	1086 $^{\pm 40}$
Turbo pressure (mbar)		1001 $^{\pm 40}$	1023 $^{\pm 40}$	1023 $^{\pm 40}$	1118 $^{\pm 40}$
Turbo pressure solenoid valve OCR (%)		88 $^{\pm 5}$	79 $^{\pm 5}$	64 $^{\pm 5}$	59 $^{\pm 5}$
Turbo position instruction (%)		88 $^{\pm 5}$	79 $^{\pm 5}$	64 $^{\pm 5}$	59 $^{\pm 5}$
Turbo recopy position (%)		88 $^{\pm 5}$	78 $^{\pm 5}$	64 $^{\pm 5}$	59 $^{\pm 5}$
EGR valve position information (%)					
EGR valve electrovalve OCR (%)					
EGR valve recopy position (%)					
RCO EGR throttle solenoid (%)					
RCO air intake throttle heater solenoid (%)					
Airflow setting (mg/stroke)		480 $^{\pm 20}$	501 $^{\pm 20}$	504 $^{\pm 20}$	518 $^{\pm 20}$
Measured air flow (mg/stroke)		482 $^{\pm 20}$	501 $^{\pm 20}$	498 $^{\pm 20}$	520 $^{\pm 20}$
Air circuit parameters with EGR					
Reference turbo pressure (mbar)		1001 $^{\pm 40}$	1001 $^{\pm 40}$	1023 $^{\pm 40}$	1086 $^{\pm 40}$
Turbo pressure (mbar)		991 $^{\pm 50}$	991 $^{\pm 50}$	1062 $^{\pm 50}$	1108 $^{\pm 50}$
Turbo pressure solenoid valve OCR (%)		88 $^{\pm 5}$	78 $^{\pm 5}$	64 $^{\pm 5}$	59 $^{\pm 5}$
Turbo position instruction (%)		88 $^{\pm 5}$	79 $^{\pm 5}$	64 $^{\pm 5}$	59 $^{\pm 5}$
Turbo recopy position (%)		90 $^{\pm 5}$	79 $^{\pm 5}$	63 $^{\pm 5}$	59 $^{\pm 5}$
EGR valve position information (%)		45 $^{\pm 30}$	74 $^{\pm 30}$	21 $^{\pm 30}$	0
EGR valve electrovalve OCR (%)		45 $^{\pm 30}$	74 $^{\pm 30}$	21 $^{\pm 30}$	0
EGR valve recopy position (%)		45 $^{\pm 30}$	73 $^{\pm 30}$	21 $^{\pm 30}$	0
RCO EGR throttle solenoid (%)		9	9	9	9
RCO air intake throttle heater solenoid (%)		5	5	5	5
Airflow setting (mg/stroke)		251 $^{\pm 50}$	235 $^{\pm 50}$	436 $^{\pm 80}$	512 $^{\pm 50}$
Measured air flow (mg/stroke)		248 $^{\pm 50}$	240 $^{\pm 50}$	439 $^{\pm 100}$	506 $^{\pm 50}$

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SID 803 / 803A with DW10 UTED4

Parameters	Cranking engine	Idling	$1500^{\pm 50}$ rpm	$2500^{\pm 50}$ rpm	$4000^{\pm 50}$ rpm
Fuel circuit parameters					
Fuel reference pressure (bar)	$312^{\pm 50}$	$271^{\pm 30}$	$478^{\pm 30}$	$686^{\pm 30}$	$779^{\pm 30}$
Measured fuel pressure (bar)	> 150	$274^{\pm 30}$	$471^{\pm 30}$	$683^{\pm 30}$	$769^{\pm 30}$
RCO Pressure regulator (%)	$24^{\pm 5}$	$15^{\pm 5}$	$19^{\pm 5}$	$22^{\pm 5}$	$23^{\pm 5}$
RCO Flow regulator (%)	$26^{\pm 5}$	$24^{\pm 5}$	$21^{\pm 5}$	$22^{\pm 5}$	$24^{\pm 5}$
Air circuit parameters with EGR inhibited					
Reference turbo pressure (mbar)		$1012^{\pm 40}$	$1022^{\pm 40}$	$1150^{\pm 40}$	$1299^{\pm 40}$
Turbo pressure (mbar)		$1012^{\pm 50}$	$1065^{\pm 50}$	$1193^{\pm 50}$	$1281^{\pm 50}$
Turbo pressure solenoid valve OCR (%)		$80^{\pm 5}$	$79^{\pm 5}$	$78^{\pm 5}$	$58^{\pm 5}$
Turbo position instruction (%)		$80^{\pm 5}$	$79^{\pm 5}$	$78^{\pm 5}$	$58^{\pm 5}$
Turbo recopy position (%)					
EGR valve position information (%)					
EGR valve electrovalve OCR (%)					
EGR valve recopy position (%)					
RCO EGR throttle solenoid (%)					
RCO air intake throttle heater solenoid (%)					
Airflow setting (mg/stroke)		$480^{\pm 20}$	$507^{\pm 20}$	$616^{\pm 20}$	$623^{\pm 20}$
Measured air flow (mg/stroke)		$483^{\pm 40}$	$507^{\pm 40}$	$613^{\pm 40}$	$616^{\pm 40}$
Air circuit parameters with EGR					
Reference turbo pressure (mbar)		$1012^{\pm 40}$	$1012^{\pm 40}$	$1150^{\pm 40}$	$1310^{\pm 40}$
Turbo pressure (mbar)		$1012^{\pm 50}$	$1012^{\pm 50}$	$1155^{\pm 50}$	$1310^{\pm 50}$
Turbo pressure solenoid valve OCR (%)		$80^{\pm 5}$	$79^{\pm 5}$	$77^{\pm 5}$	$58^{\pm 5}$
Turbo position instruction (%)		$80^{\pm 5}$	$79^{\pm 5}$	$77^{\pm 5}$	$58^{\pm 5}$
Turbo recopy position (%)					
EGR valve position information (%)		$52^{\pm 20}$	$50^{\pm 20}$	$44^{\pm 20}$	0
EGR valve electrovalve OCR (%)		$52^{\pm 20}$	$50^{\pm 20}$	$44^{\pm 20}$	0
EGR valve recopy position (%)		$53^{\pm 20}$	$50^{\pm 20}$	$44^{\pm 20}$	0
RCO EGR throttle solenoid (%)		10	10	10	10
RCO air intake throttle heater solenoid (%)		6	6	6	6
Airflow setting (mg/stroke)		$251^{\pm 30}$	$248^{\pm 30}$	$338^{\pm 30}$	$632^{\pm 30}$
Measured air flow (mg/stroke)		$251^{\pm 30}$	$248^{\pm 30}$	$327^{\pm 30}$	$632^{\pm 30}$

1) Beyond 1 to 6 minutes (depending on the system) operation at idle, the engine ECU cuts off the EGR function! By changing the engine speed, the EGR phase will cut in again.
2) The air flow setting, at idle, outside the EGR zone is exceptionally high on some ECU software (around 605 mg/stroke). The airflow measured cannot reach the setting. This is normal!!

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2.4. DEFINITION OF PARAMETERS (PROXIA TITLES)

Fuel reference pressure (bar)

Theoretical pressure to be reached in the common rail. It is calculated by the engine ECU based on the different information such as: engine speed, load, injection flow, etc.

Measured fuel pressure (bar)

Parameter determined by the engine ECU on the basis of the information supplied by the rail high pressure sensor.

Note: The “measured fuel pressure” parameter must be in line with the "fuel reference pressure ". Fuel pressure is regulated in a closed loop.

RCO Pressure regulator (%) (PCV)

Order transmitted by the engine ECU to the pressure control valve (PCV) located on the high pressure pump.

Note: The higher the fuel pressure reference, the more the pressure control valve OCR increases, the lower the fuel pressure loss in the HP circuit and the more the measured fuel pressure must increase.

RCO Flow regulator (%) (VCV)

Signal transmitted by the engine ECU to the fuel flow regulator (VCV) located on the high pressure pump.

Note: The higher the fuel pressure setting, the higher the pressure control valve OCR, the greater the quantity of fuel compressed by the HP pump and the more the measured fuel pressure must increase

Reference turbo pressure (mbar)

Theoretical pressure to be reached in the inlet manifold. It is calculated by the engine ECU as a function of the various information supplied, such as: engine speed, load and atmospheric pressure…

Note: the value indicated is expressed as an absolute value[1]. A turbo pressure setting that is equal to atmospheric pressure indicates zero turbocharger.

Turbo pressure (mbar)

Parameter determined by the engine ECU on the basis of the information supplied by the inlet air pressure sensor located on the inlet manifold.

Note: the value indicated is expressed as an absolute value. A turbo pressure setting that is equal to atmospheric pressure indicates zero turbocharger. The "measured turbo pressure" parameter must be in line with the "turbo pressure setting". Turbo pressure regulation is carried out in a closed loop, *except during the exhaust gas recycling phases*.

Turbo recopy position (%)

Parameter determined by the engine ECU on the basis of the information supplied by the turbo position copy sensor located on the turbocharger.

Note: this parameter must be in line with the ‘turbo position instruction’. The turbocharger position is regulated in a closed loop. Even in the exhaust gas recycling phases.

[1] **Absolute value, P_{atmo} ≈ 1013 mbar.**

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Turbo position instruction (%)

Theoretical position of the variable geometry to be achieved. It is calculated by the engine ECU as a function of parameters such as turbo pressure setting, engine speed, etc.
This parameter represents the positioning request for the turbo "variable geometry" system.

Examples:

- A 0 %, displacement is zero. The variable geometry system vanes are in the resting position, which means that the exhaust gas port cross section is large. This is the position that is used to limit turbo-charge pressure (high engine speeds).
- At 100%, displacement is at maximum. The variable geometry system vanes are in the maximum position, which means that the exhaust gas port cross section is small.

This is the position used to increase turbocharger pressure (engine under load at low engine speeds) or to pre-position the turbo variable geometry to achieve minimum response time when accelerating.

Note: The "variable geometry" device is controlled using a vacuum capsule. This is controlled by the engine ECU using an electrovalve.

Turbo pressure solenoid valve OCR (%)

Signal transmitted by the engine ECU to the electrovalve which controls the turbocharger in order to control the turbo variable geometry system. The OCR must enable the turbo position setting to be achieved.

Note: the percentage transmitted is proportional to the desired turbo pressure, as a function of engine speed. A high OCR generates major electrovalve opening and therefore a small gas exhaust port cross-section, which increases the turbo charging pressure. However, as the engine speed increases, the exhaust gas is sufficient for the pressure setting to be achieved without needing to be accelerated by turbo vane variation. The variable geometry system is above all used when high torque is required at low and mid-range engine speeds.

EGR valve position information (%)

Theoretical opening of the EGR valve to be achieved. It is calculated by the engine ECU as a function of engine speed, load and temperatures…

Note: The gas recycling rate is determined by the air flow setting. If the air flow setting is not reached, the ECU modifies the EGR valve position setting so that the required air flow is achieved.
Example: the air flow measured to too low in relation to the expected air flow setting: the engine ECU reduces the EGR valve position setting to admit less exhaust gas and therefore more air.

EGR valve OCR (%)

Signal transmitted by the engine ECU to the EGR electrovalve in order to adjust its opening. The OCR must enable the EGR valve position setting to be achieved.

Note: The valve is closed at rest. 0% = > closed; 100% => fully open. The valve is closed by means of a spring and by inverting polarity on the motor terminals. The signal to close the valve by inverting polarity is not visible in parameter measurements.

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EGR valve recopy position (%)

Parameter determined by the engine ECU on the basis of the information supplied by the EGR valve position sensor incorporated into the electrovalve.

Note: this parameter must be in line with the "EGR valve position setting". The EGR valve position regulation is carried out in a closed loop.

RCO EGR throttle solenoid (%)

Signal transmitted by the engine ECU to the electrovalve which operates the EGR throttle valve in order to control its closure.

Note: The percentage is proportional to the throttle closure. At rest, this valve is open. A high OCR value means that the valve closes to a great extent, and vice versa. This throttle valve is used in the EGR function but also each time the engine is shut off in order to counter crankshaft assembly inertia and thus reduce vibration (damping function). It can also be used during FAP regeneration (regulation function). 0% = > fully open; 100% => closed.

RCO air intake throttle electrovalve OCR (%)

Signal transmitted by the engine ECU to the electrovalve which operates the induction air heater flap valve in order to control its opening.

Note: - This flap valve is used only in the particle filter function. This flap valve is normally closed.
0% = > closed; 100% => fully open.

Airflow setting (mg/stroke)

The theoretical value to be reached, calculated by the engine ECU. This gives the theoretical mass of air circulating through the flowmeter during the measurement cycle, to obtain the best compromise between pollution and driveability.

Note: The air flow setting parameter is inversely proportional to the amount of exhaust gas recycled.

	Note that the air flow setting, at idle, outside the EGR zone is exceptionally high on some ECU software (around 605 mg/stroke). The airflow measured cannot reach the setting. This is normal – the ECU is thus obliged to close the EGR valve.

Measured air flow (mg/stroke)

Parameter calculated by the engine ECU on the basis of the information supplied by the flowmeter located on the inlet manifold duct.
This represents the mass of air circulating through the flowmeter during the measurement cycle.

Note: The air flow measured parameter must comply with the air flow setting in order to carry out “closed loop” EGR control. The difference between the measured air flow and the air flow setting leads to an EGR valve position setting in order to adapt the measured air flow to the air flow setting.

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3. SID 803 / 803A FUEL CIRCUIT

3.1. Fuel circuit diagram

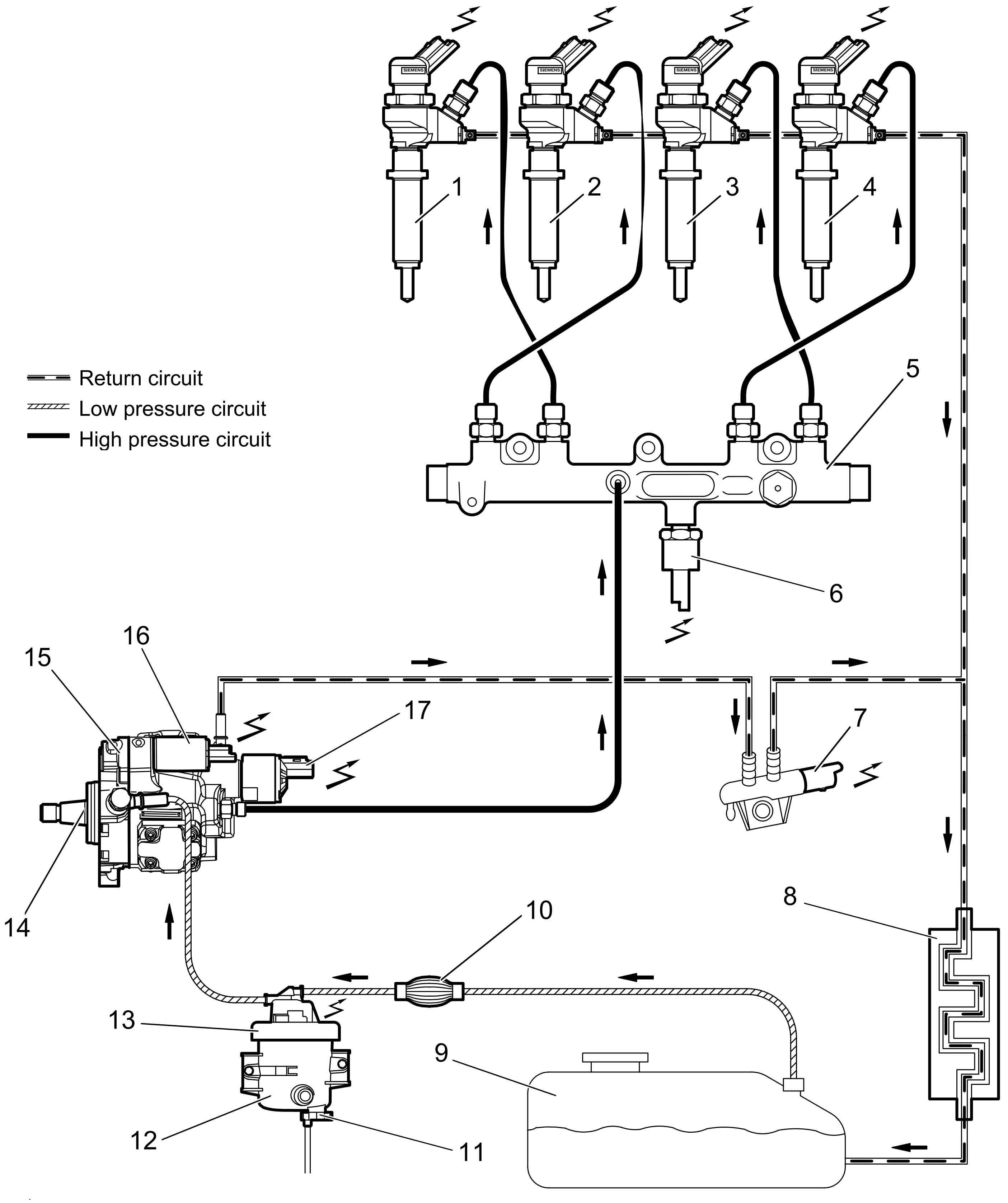

Figure 2: DW10 BTED4 fuel circuit (SID 803 / 803A)

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Components		
No.	**Description**	**Electrical references**
1 to 4	Electro-hydraulic injectors	1331 to 1334
5	High pressure common injection rail	-
6	Fuel high pressure sensor	1321
7	Fuel temperature sensor	-
8	Fuel cooler	-
9	Fuel tank	-
10	Manual fuel priming pump	-
11	Water bleed screw and pipe	-
12	Fuel filter and water in fuel filter	-
13	Fuel heater (electric)	1276
14	Fuel high pressure pump	-
15	Feed pump	-
16	Fuel Flow regulator (VCV – Volumetric Control Valve)	1208
17	High Pressure fuel regulator (PCV - Pressure Control Valve)	1322

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3.2. COMPONENT CHARACTERISTICS

3.2.1. Fuel flow regulator (VCV) (electrical reference: 1208 or 1277)

Electrical characteristics

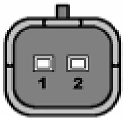
Connector view
Component side

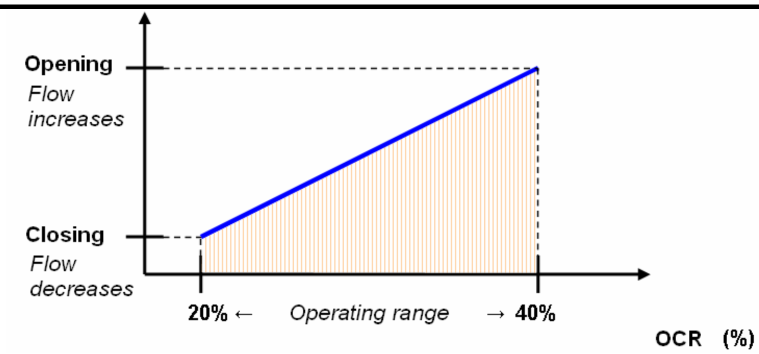
Pin 1 - 12 V power supply

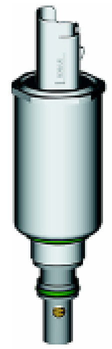
Pin 2 - Earth controlled by engine ECU (cyclic ratio**)**

Resistance at 20°C

5 +/-4Ω





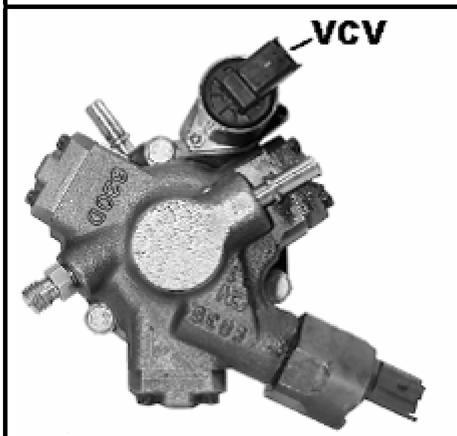


Note : This solenoid is normally closed

Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. Idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short circuit to earth (VCV open)	P0003	/		●	50 ms		●	●	- VCV signal = 7% - PCV operated in open loop	Gradual performance pick-up when fault disappears
+Short-circuit or coil short-circuit VCV closed)	P0004	/		●	50 ms		●	●	Engine cut-off VCV =7% PCV operated in open loop	Gradual performance pick-up when fault disappears
Open circuit (VCV closed)	P0001	/		●	50 ms		●	●	Engine cut-off VCV =7% PCV operated in open loop	Gradual performance pick-up when fault disappears
Excessive current draw	P0002	> 2A	●	●	1 s		●	●	Engine cut-off VCV control current limited…VCV signal = 7%	Gradual performance pick-up when fault disappears
Insufficient flow adaptation	P1198	> 5% at max adaptation stop		●	15 rev				Engine cut-off possible	Next engine crank-up

View of the component



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3.2.2. High Pressure fuel regulator (PCV) (electrical reference: 1322)

Electrical characteristics

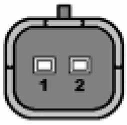
Connector view
Component side

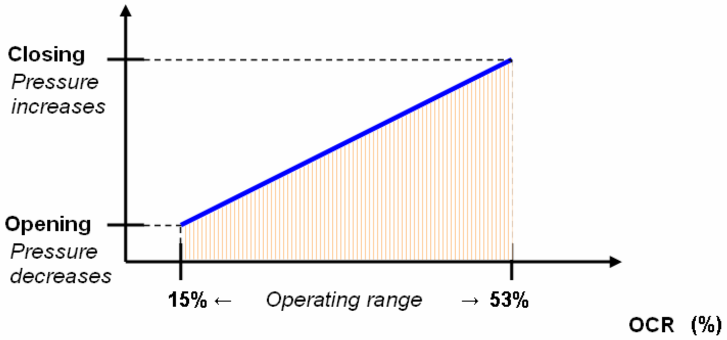
Pin 1 - 12 V power supply

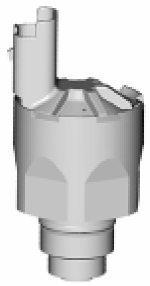
Pin 2 - Earth controlled by engine ECU (OCR)

Resistance at 20°C

5 +/-4Ω





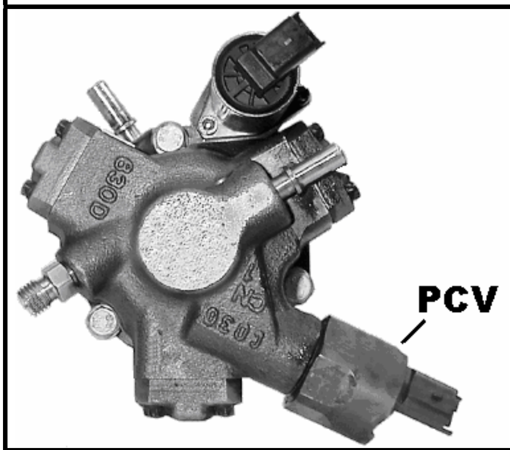


Note: The status (normally open or closed) of this electrovalve is dependent on the pressure in the rail. See chapter entitled 'component checking'.

Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short circuit to earth (PCV closed)	P0091	/		●	50 ms		●	●	PCV signal = 12.8% VCV signal in open loop. Rail pressure setting between 400 and 1400 bar	Gradual performance pick-up when fault disappears
short-circuit or +short-circuit Coil (PCV open)	P0092	/		●	50 ms		●	●	Engine cut-off, PCV signal = 12.8% VCV signal in open loop. Rail pressure setting between 400 and 1400 bar	Gradual performance pick-up when fault disappears
Open circuit (PCV open)	P1210	/		●	0,5 s		●	●	Engine cut-off, PCV signal = 12.8% VCV signal in open loop. Rail pressure setting between 400 and 1400 bar	Gradual performance pick-up when fault disappears
Excessive power consumption	P0089	2 Amperes	●	●	1 s		●	●	Engine cut-off PCV control current limited…PCV signal = 7%	Gradual performance pick-up when fault disappears

View of the component



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3.2.3. High pressure fuel sensor (electrical reference: 1321)

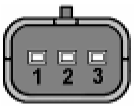
Electrical characteristics

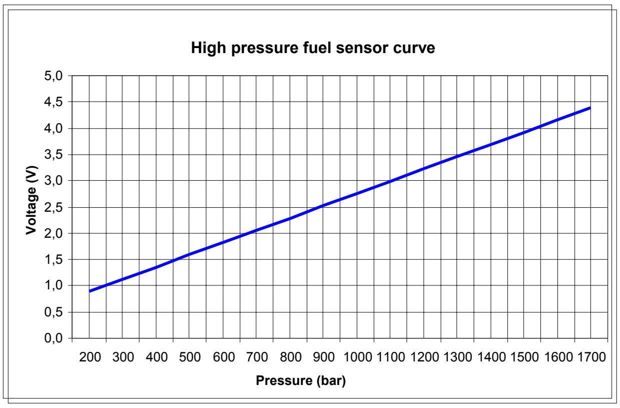
Connector view
Component side

Pin 1 - 0 to 5 V Analogue signal

Pin 2 - Earth

Pin 3 - 5V power supply

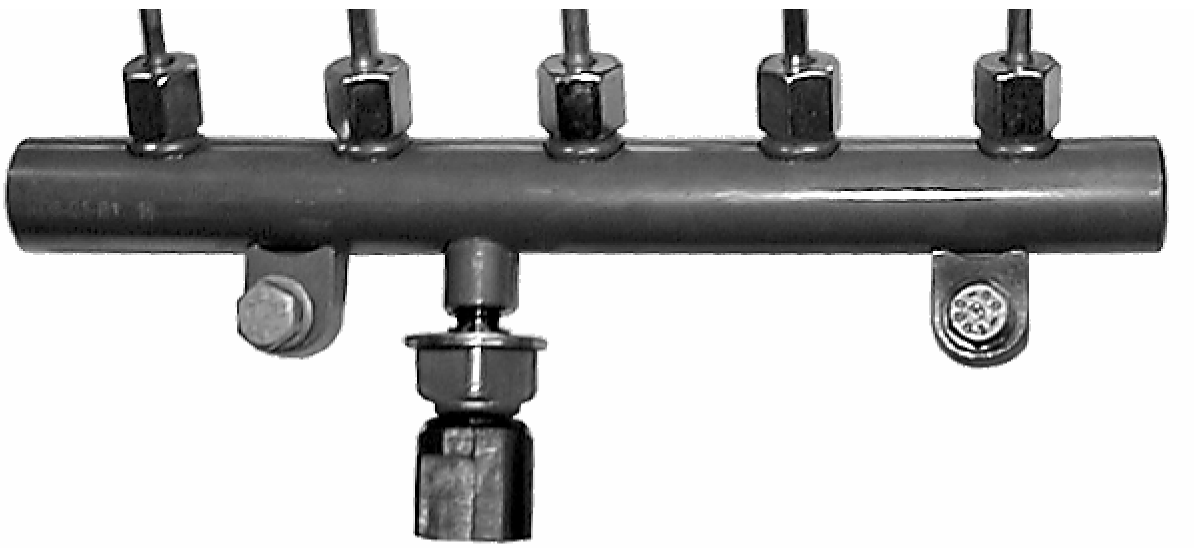




Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to earth	P0193	4.81V	●	●	Start: 40 ms 2 engine revs		●	●	345 bar	with disappearance of the fault
+short circuit or open circuit	P0192	0.19V	●	●	Start: 40 ms 2 engine revs		●	●	345 bar	with disappearance of the fault
Pressure slope too high	P0191	> 400bar / pressure measurement at TDC	●	●	1.5 engine rev or 30 ms (Test started at TDC)		●	●	345 bar	with disappearance of the fault
Measured rail pressure > setting	P1164	100bar	●		300 ms		●	●	345 bar	with disappearance of the fault

View of the component



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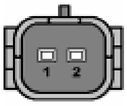
3.2.4. Fuel temperature sensor (electrical reference: 1221)

Electrical characteristics

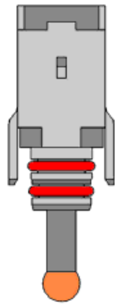
Connector view
Component side

Pin 1 - 0 to 5 V signal

Pin 2 - Earth



Temperature (°C)	Resistance min (Ω)	Resistance max (Ω)
-40	79000	109535
-30	41255	55556
-20	22394	29426
0	7351	9247
20	2742	3323
40	1141	1338
60	522	595
80	259	288
100	138	150
120	77	83
130	59	64



Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to earth	P0182	>142°C <0.10V	●	●	3s				90°C	As from return into tolerances
+short circuit or open circuit	P0183	<-44,5°C >4.92V	●	●	3s				90°C	As from return into tolerances
Slope test:	P0181	10°C/100ms	●	●	400 ms				90°C	As from return into tolerances

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3.3. FUEL CIRCUIT CHECKS

3.3.1. Precautions, instructions and prohibited operations

Certain precautions must be taken before any operation. These precautions concern operator and system safety and also authorised operations.

It is essential to consult the following service documentation prior to any operation:

- **SAFETY INSTRUCTIONS: HDI DIRECT INJECTION SYSTEM**
- **SAFETY AND HYGIENE INSTRUCTIONS: PRIOR TO ANY OPERATION**
- **SAFETY AND HYGIENE INSTRUCTIONS: PARTICLE FILTER**
- **PROHIBITED OPERATIONS: HDI DIRECT INJECTION SYSTEM**

3.3.2. General checks

Before implementing a method or carrying out a specific check, it is strongly recommended:-

- to carry out a visual inspection of the condition of the fuel circuit hoses (high and low pressure),
- to ensure that there is a sufficient quantity of fuel in the tank,
- to be sure of the quality of fuel in the tank.

3.3.3. Low pressure circuit

a) Supply pressure check

Consult the low pressure circuit checking procedure which is available in the service documentation (Citroën Service). **"CHECK: LOW PRESSURE FUEL SUPPLY CIRCUIT"**

b) Checking the vane pump flow

Tools required: toolkit H.1613L (part no. 9780 N2)

Disconnect the HP pump return tube.
Connect the plastic bottle (containing level indications) (H1613L).

Crank up the engine and allow it to idle for 10 seconds.

Minimum flow: D_{min} > 66 ml in 10 seconds, or 400 ml in a minute.

Average flow measured: $\text{Flow}_{average}$ = 120 ml in 10 seconds, or 720 ml in a minute.

Flow when starter motor is activated for 15 seconds (this may be in five, three second bursts if the system has a low pressure pump that is cut off by the engine ECU before that time):

Average flow measured: $\text{Flow}_{average}$ = 60 ml in 15 seconds, or 240 ml in a minute.

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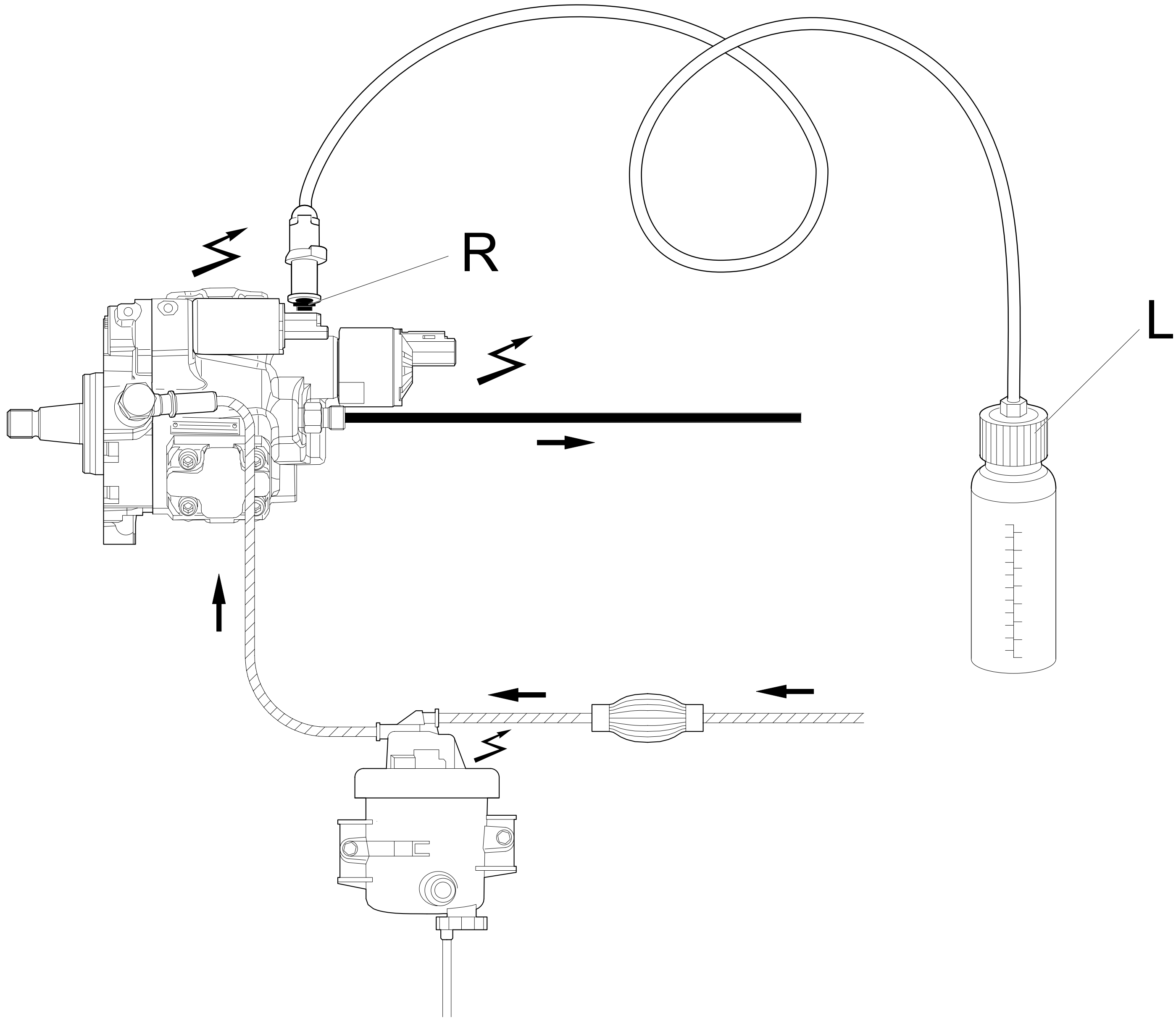

Low pressure circuit

High pressure circuit

L = Bottle (with increments indicated on the side) (H1613.L)
R = Return to the tank on pump

Figure 3: Checking HP pump flow (SID 803 / 803A)

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3.3.4 High pressure circuit

a) Maximum pressure check

If the engine is operational, it is possible to check the entire high pressure circuit by using the diagnostic tool during dynamic testing.
By reading the "fuel pressure measured" parameter, it is possible to know if, when the engine is under load, the system is able to provide maximum pressure.
On a flat road or on a slight upwards slope, from an engine speed of approximately 2000 rpm in a gear ≥ 3rd, accelerate hard (foot right down) to 4000 rpm.
The pressure measured must be close to 1600 bar, as described in chapter § **"2.2 Full load dynamic "p8.**

b) Fuel flow regulator (or VCV)

Seal test:
With the engine running, disconnect the VCV. The engine should stop (VCV normally closed). If this is not the case, change the HP pump (if the VCV is not available separately as a spare part).

Using the diagnostic tool:
The diagnostic tool is used to carry out the following checks:
- in parameter measurements, when the starter motor is activated, check that the OCR signal is $35^{\pm 5}$ % (this is a useful check if the engine will not start).
- in actuator tests, activate the component and listen to hear if it makes a noise.
- in oscilloscope mode, using the break-out box and the interface harnesses, measure the control voltage transmitted by the ECU with the starter motor activated or the engine idling,
- in multimeter mode, using the break-out box and the interface harnesses, check the line resistance and the resistance of the component on the ECU pins and the BSM. The value should be: $5^{\pm 4}$ Ω.

Checking the control signal using the oscilloscope with the starter motor actuated is a useful check if the engine will not start.

<u>Reference Curve:</u>

Engine speed: idling
Coolant temperature: > 80° C

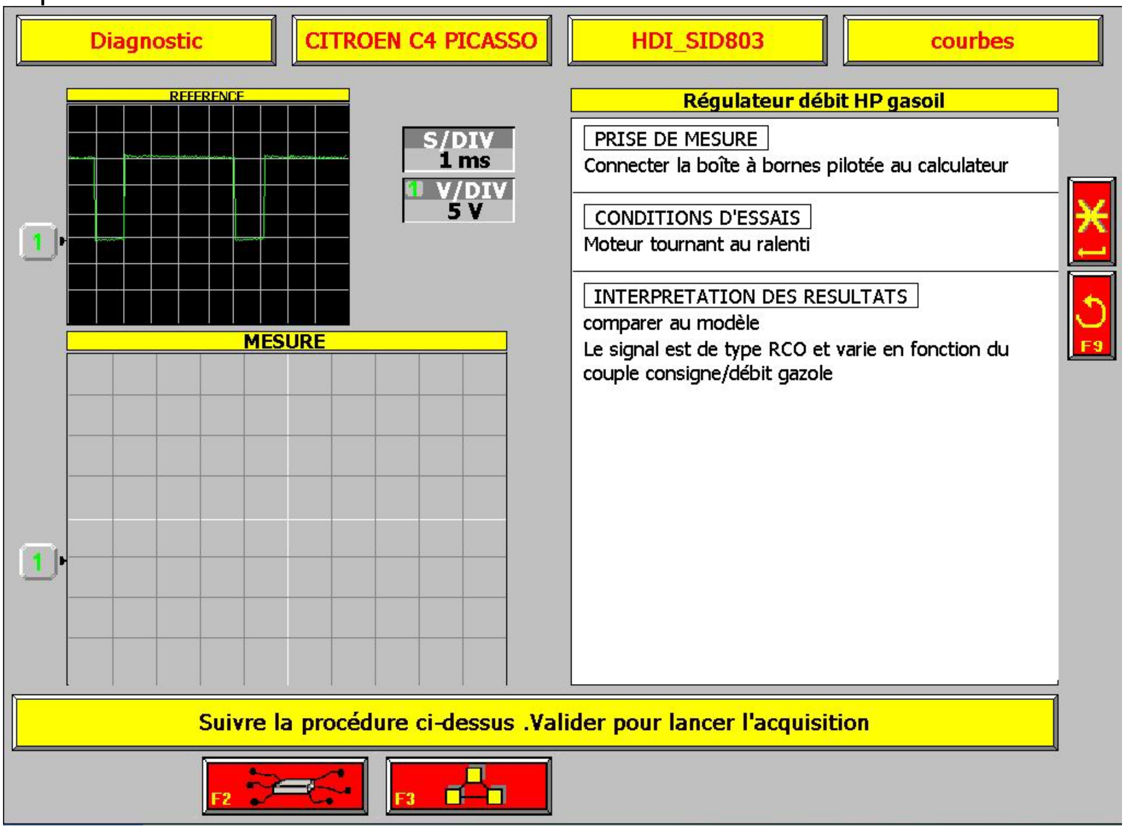

Figure 4: VCV (SID 803 / 803A) reference curve

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Engine speed: with starter motor activated

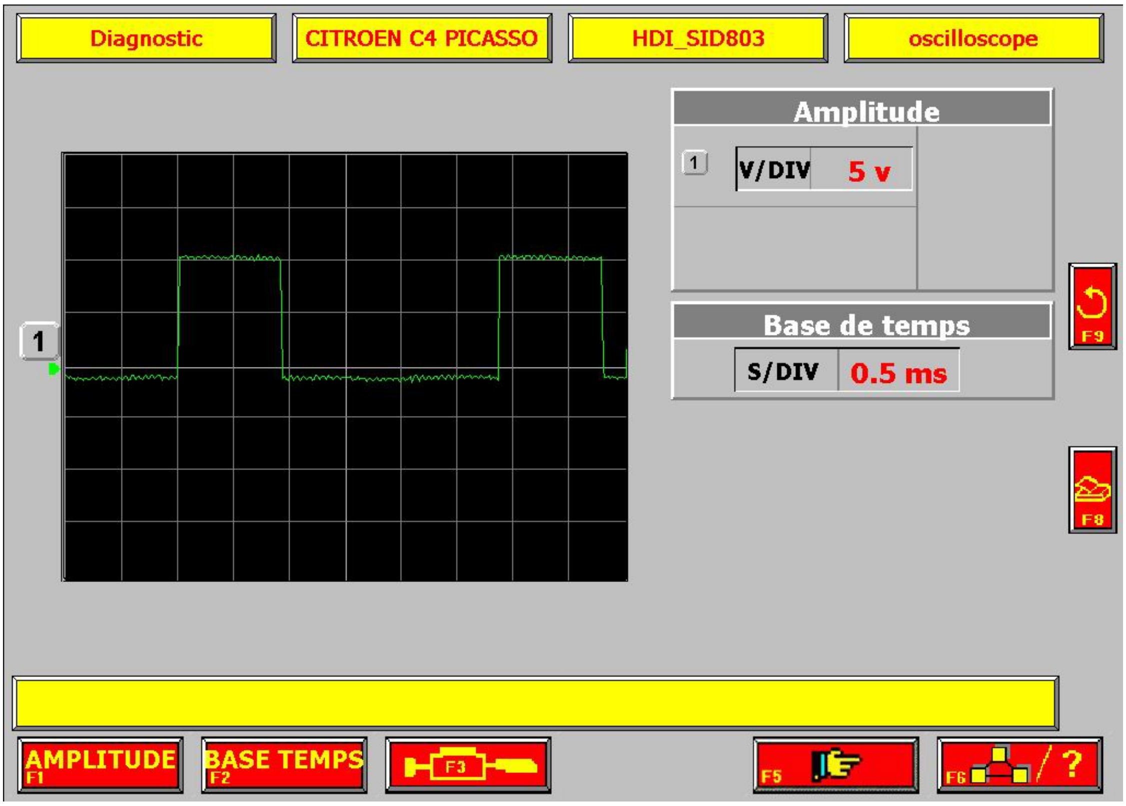

Figure 5: VCV (SID 803 / 803A) reference curve with starter motor activated

Harness electrical checks: (components disconnected)

- continuity
- insulation.

c) High Pressure fuel regulator (or PCV)

Seal test:
With the engine running, disconnect the PCV. The engine should stop. If this is not the case, change the HP pump (if the PCV is not available separately as a spare part). This check is useful in the event of lack of power.

Using the diagnostic tool:
The diagnostic tool is used to carry out the following checks:
- in parameter measurements, when the starter motor is activated, check that the OCR signal is $22^{\pm 5}$ % (this is a useful check if the engine will not start).
- in oscilloscope mode, using the break-out box and the interface harnesses, measure the control voltage transmitted by the ECU with the starter motor activated or the engine idling,
- in multimeter mode, using the break-out box and the interface harnesses, check the line resistance and the resistance of the component on the ECU pins and the BSM (engine ancillaries ECU). The value should be: $5^{\pm 4}\,\Omega$.

Checking the control signal using the oscilloscope with the starter motor actuated is a useful check if the engine will not start.

<u>Actuator test</u>
It is not possible to ascertain if the PVC is operational by carrying out an actuator test on the pressure control valve.

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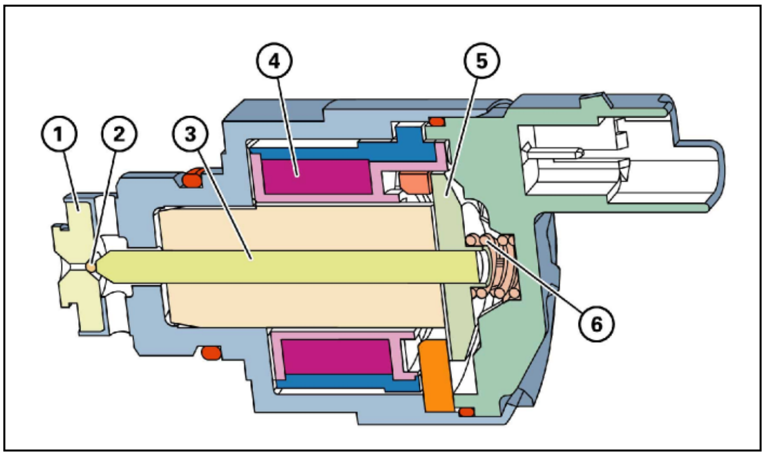
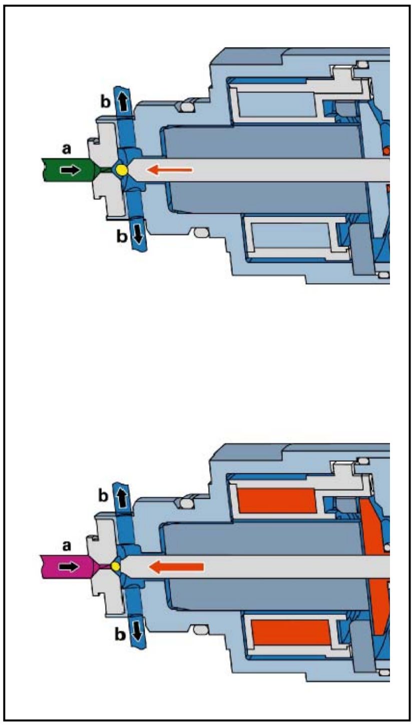
Reminder of PCV operation:

The pressure control valve acts on a ball that allows a controlled pressure loss.
At rest, a spring (6) (calibrated at 50 < T < 70 bar) maintains the ball (2) in its seat (1).
When the engine is running, as soon as the pressure exceeds the spring calibration value, the valve opens.
To regulate the pressure, electromagnetic force is added to the spring force, by means of a winding. Thus the value of the force produced by the winding will vary as a function of its supply.
As the actuator test is conducted with the engine off, there is not pressure in the pump and the spring keeps the valve closed. Thus powering the winding does not produce any perceptible noise.





Key:

1	: valve seat	a	: high pressure fuel
2	: valve ball	b	: tank return
3	: core		
4	: winding		
5	: armature		
6	: spring		

Reference Curve:

Engine speed: idling
Coolant temperature: > 80° C

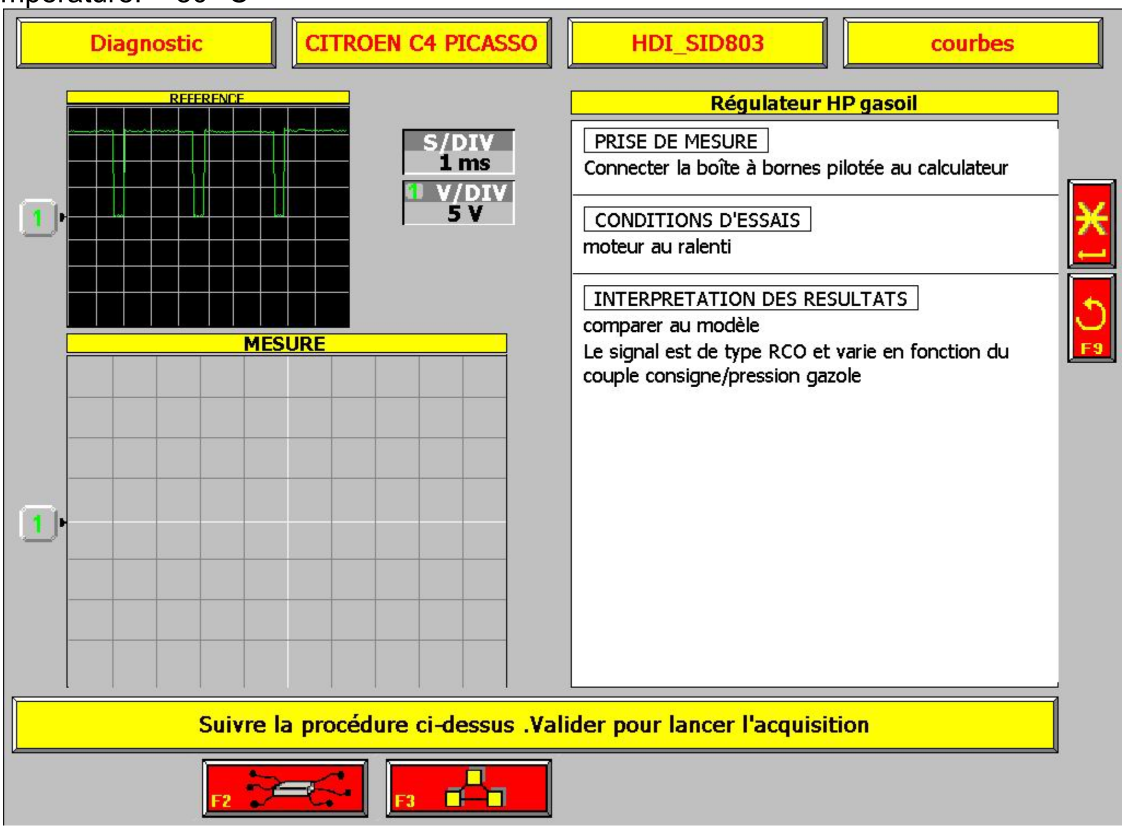


Figure 6: PCV (SID 803 / 803A) reference curve

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Engine speed: with starter motor activated

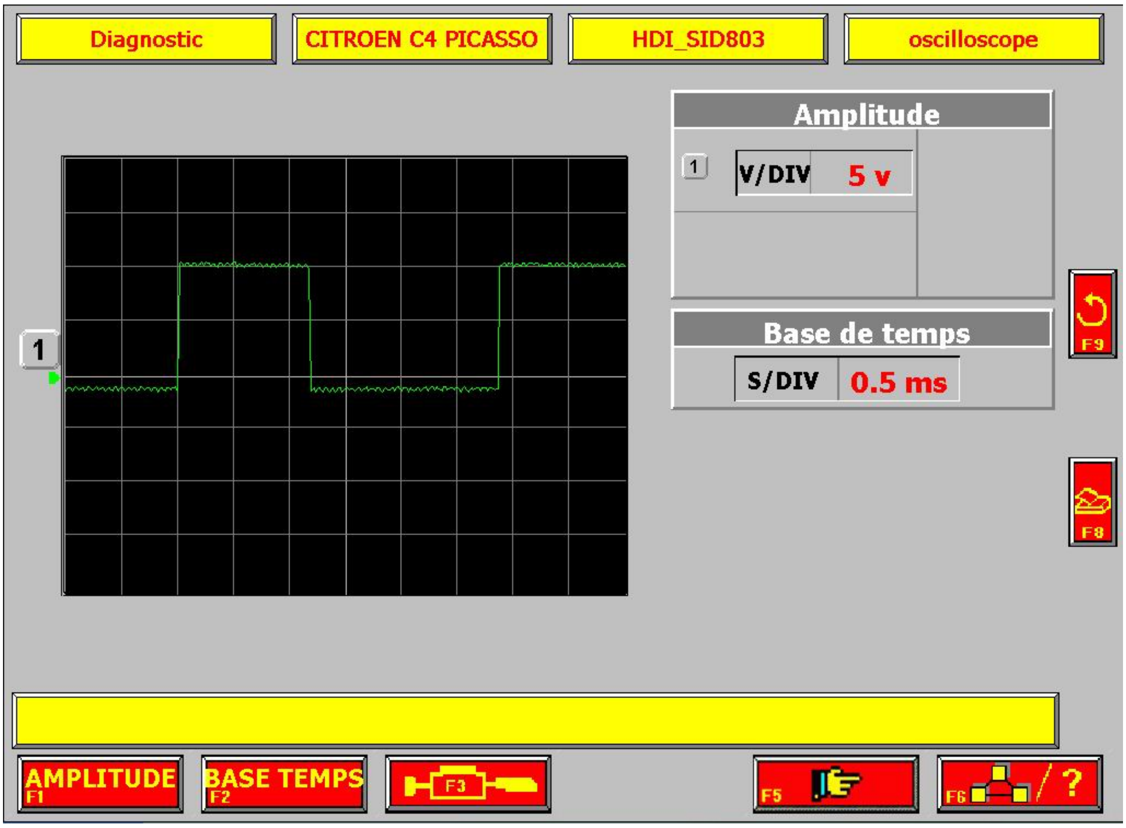

Figure 7: PCV (SID 803 / 803A) reference curve with starter motor activated

Harness electrical checks: (components disconnected)
- continuity
- insulation.

d) Fuel high pressure sensor

If the sensor is faulty, the engine will not start.
Disconnect the sensor and try to start the engine.
If the engine starts, the sensor is faulty. Given the lack of data from the sensor, the ECU goes into downgraded mode and adopts a default value which enables it to start and function with limited performance.

Harness electrical checks: (components disconnected)
- continuity
- insulation.

e) HP pipes

Use the manufacturer's recommended methods.

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f) Injectors

It is formally prohibited to disconnect the injectors with the engine running or to power them with 12 V using jumper wires.

Injector return flow check:
Apply the **"CHECK**: **FUEL HIGH PRESSURE CIRCUIT"** procedure.

Carry out the return flow check with the engine idling, as recommended, and then at 2500 rpm.

Using the diagnostic tool:
Using the injector flow correction parameter, it is possible to check the output of each cylinder.
At low engine speeds, the ECU corrects the flow in each injector in order to achieve consistent engine flywheel rotation (elimination of vibration).
This correction is accessible in measurement parameters, "fuel circuit data" under "cylinder injector X flow correction (%)".
The nominal flow rate for an injector is 100%. The system tolerates a correction of ± 40 % per injector. Above this value, a fault is logged.

In order to determine if a power problem is caused by the injector or the cylinder, change an injector to another cylinder and carry out a further parameter measurement.
If the problem is now found on the other cylinder, the injector is causing the lack of power.
If the problem remains on the same cylinder, the injector is not at fault and troubleshooting will then concentrate on the mechanical components.
It will then be necessary to carry out additional compression checking as outlined in the "**CHECKING COMPRESSION RATES**" procedures.

<u>Reference Curve:</u>

Engine speed: idling
Coolant temperature: > 80° C

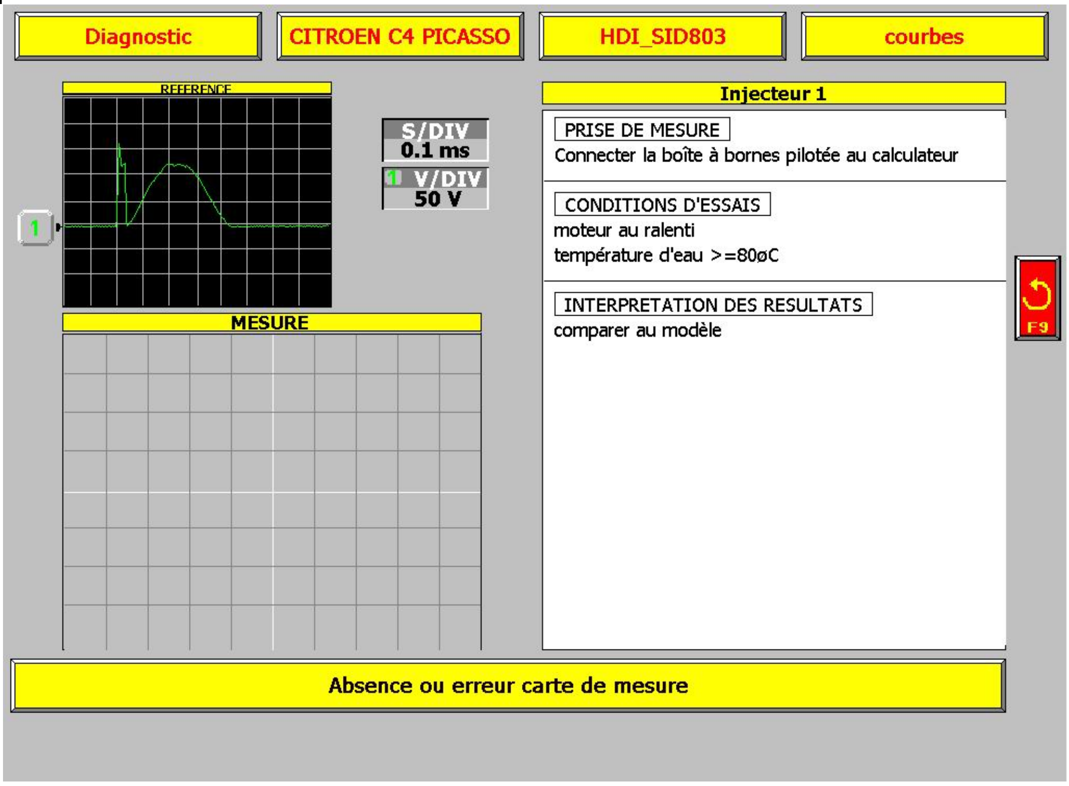

Figure 8: Injector reference curve (SID 803 / 803A)

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Diagnostic tool parameter definitions:

Injector flow correction (%):
Parameter calculated by the engine ECU during the idling phase, this is cylinder balancing.
This gives the flow correction applied to each injector. This correction is added or subtracted from the total theoretical flow (100 %) in order to compensate for the rotation differences in each cylinder.

Note:
- Cylinder balancing is de-activated for an engine speed of over 1500 rpm.
- a flow difference in excess of " ± 40%" in relation to the nominal 100 % is considered to be abnormal but not necessarily attributable to the injector.

Injector supply voltage (V):
Average injector control voltage

Harness electrical checks: (components disconnected)
Using a multimeter, it is possible to check:
- Capacity: $C > 3\ \mu F$ at a temperature of 20° C, 30 minutes (at least) after the engine has been switched off.
- Resistance: $150\ k\Omega < R < 250\ k\Omega$ at approximately 20° C, 30 minutes (at least) after the engine has been switched off.

⚠	**If one of these two values is incorrect, replace the injector.**

⚠	In order to be sure that the diagnostics are accurate, the above checks may be completed by the following procedure: **"CHECK**: **FUEL HIGH PRESSURE CIRCUIT"**

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3.3.4. Return circuit

a) Return circuit pressure

Set up an assembly as illustrated below.
In the engine compartment, connect pressure gauge reference 4073-T.A to the return pipe (green connector) using coupling 4218-T, then crank up the engine.
At idle, the pressure measured must be close to 0.

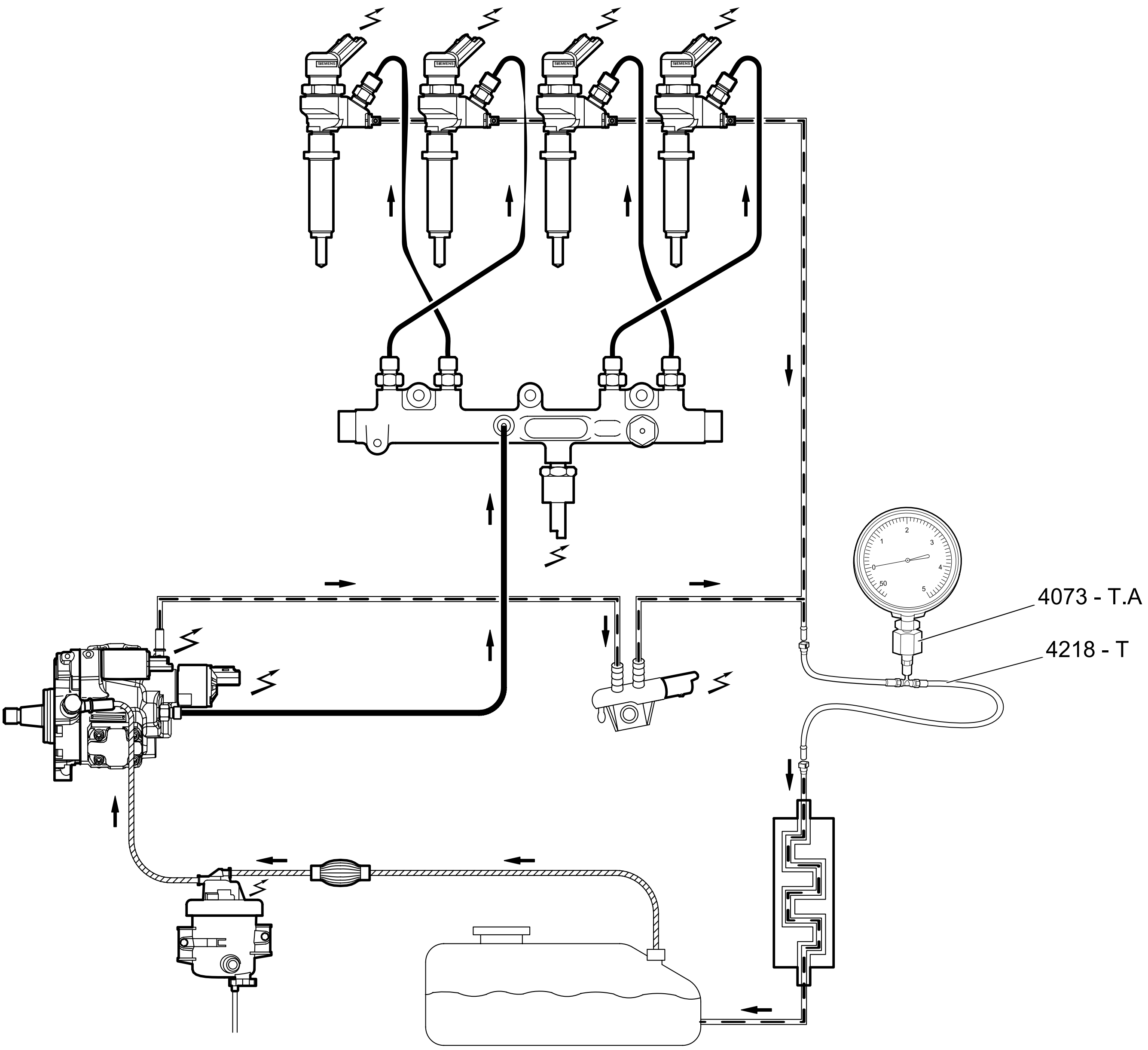

Figure 9: Fuel return pressure check (SID 803 / 803A)

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b) Diesel temperature sensor

Using the diagnostic tool:
In parameter measurements, check the value used by the engine ECU. When the engine is cold, the fuel and coolant temperatures must be identical. If in doubt, compare with an ohmmeter measurement (see table of values in the chapter entitled "component characteristics").

Diagnostic tool parameter definitions:

Fuel temperature (°C):
Parameter determined by the engine ECU on the basis of the information supplied by the fuel temperature sensor located on the fuel return line.

Harness electrical checks: (components disconnected)
- continuity
- insulation.

Note:
The engine ECU contains a fall-back strategy with respect to fuel temperature.
At full load, above a diesel temperature of 90°C, it limits fuel flow to prevent it from overheating.

c) Cooler

Check that no pipes are crushed and that there are no objects present which could hamper correct cooler operation.

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4. SID 803 / 803A AIR CIRCUIT

4.1. Double metering system air circuit diagram

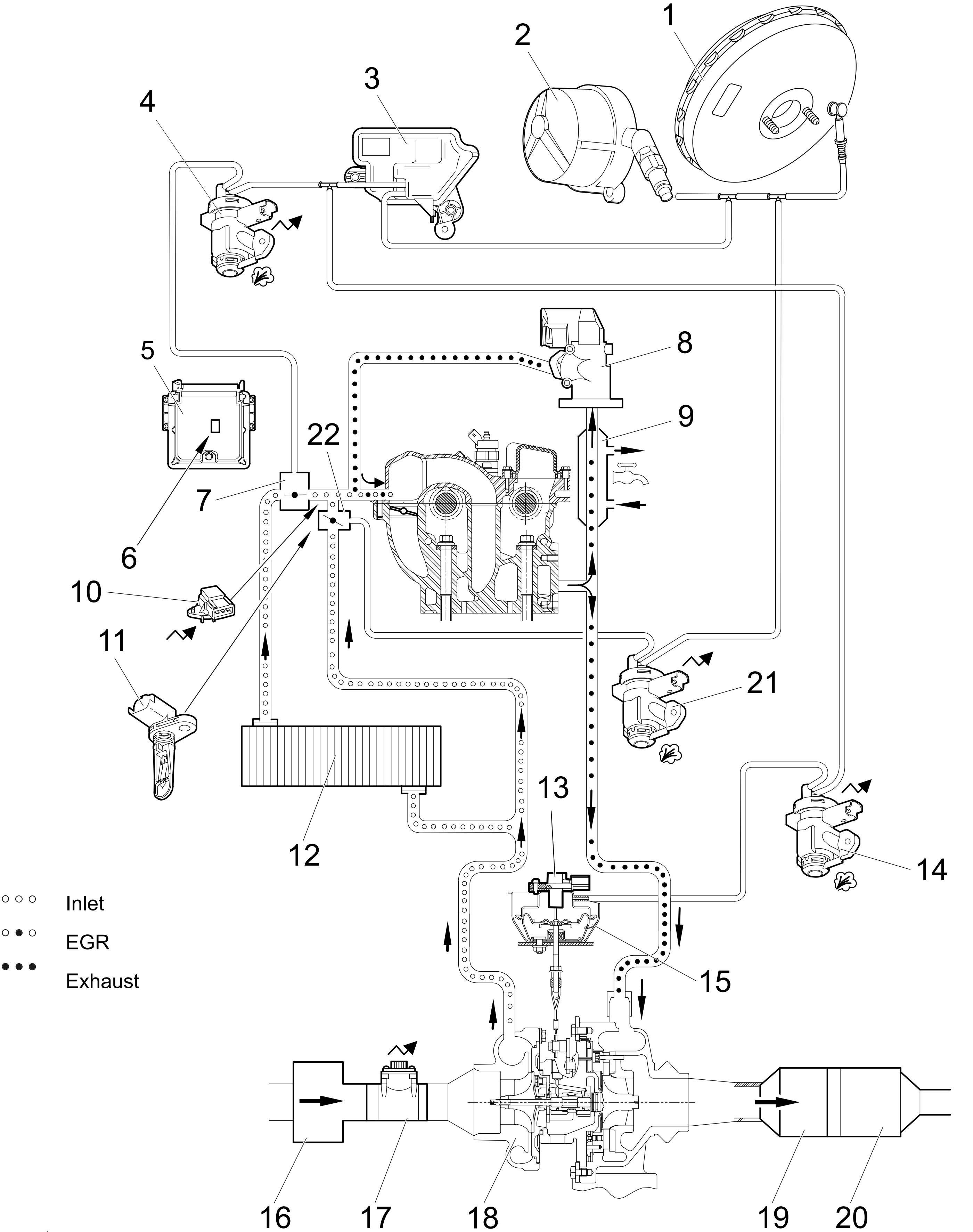

Figure 10: Air circuit, double metering system (SID 803 / 803A)

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Components		
No.	**Description**	**Electrical references**
1	Brake servo assistance	--
2	Vacuum pump	--
3	Vacuum reservoir	--
4	EGR throttle electrovalve	1263
5	Injection ECU	1320
6	Atmospheric pressure sensor	--
7	EGR flap valve	--
8	Exhaust gas recycling valve (EGR).	1297
9	Exhaust gas / water exchanger	--
10	Inlet manifold pressure sensor	1312
11	Inlet air temperature sensor (present with single metering system, as a function of engine variant and equipment level).	1240
12	Intercooler	--
13	Turbo position feedback sensor (present with single metering system, as a function of engine variant and equipment level).	1374
14	Turbo pressure control electrovalve	1233
15	Turbo pressure control vacuum capsule	--
16	Air filter	--
17	Air flowmeter + air temperature sensor	1310
18	Variable geometry turbocharger	--
19	Catalyser	--
20	Particle filter	--
21	Intercooler by-pass valve (control) electrovalve	1285
22	Intercooler by-pass valve	--

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4.2. Single metering system air circuit diagram

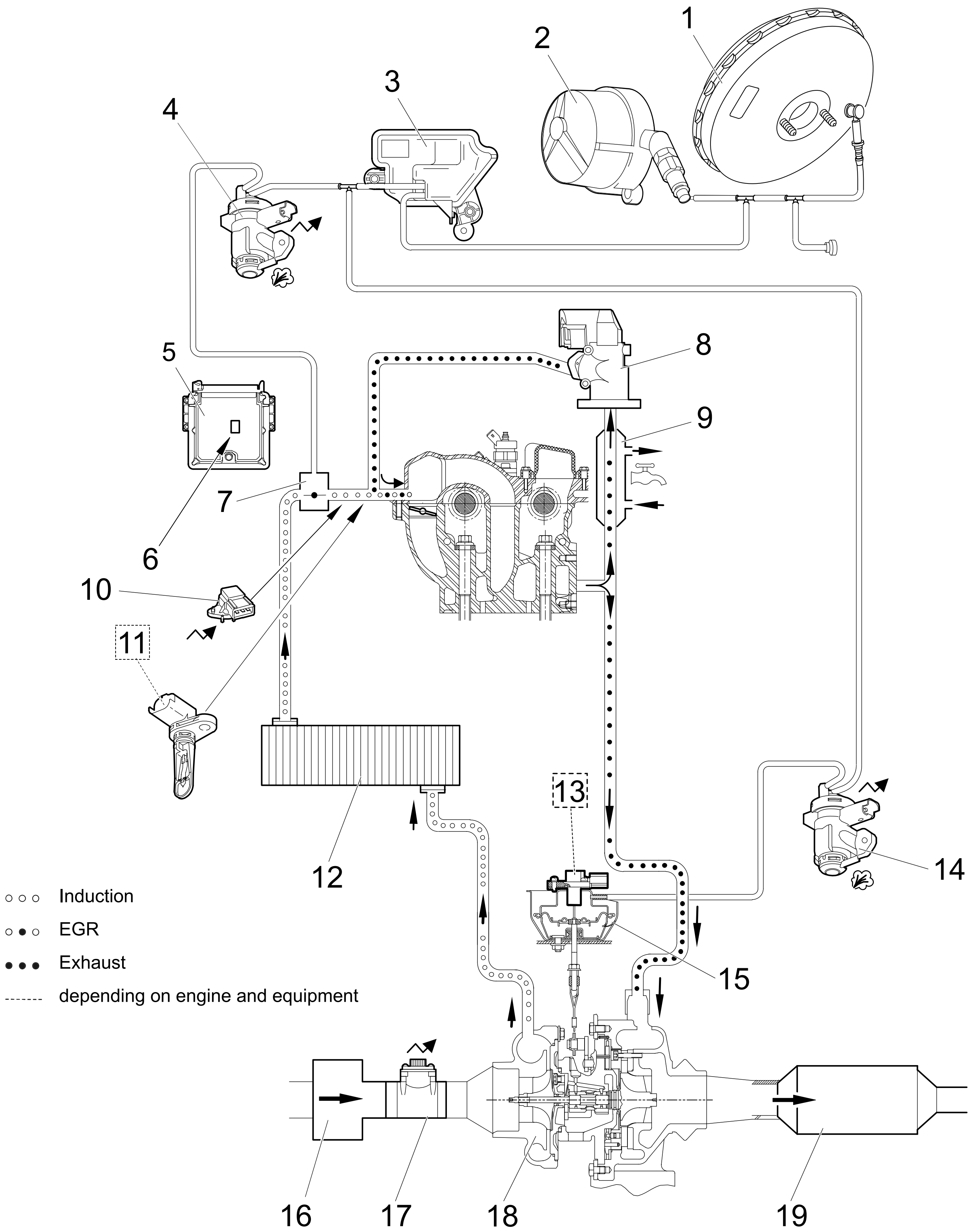

Figure 11: Air circuit, single metering system (SID 803 / 803A)

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Components		
No.	**Description**	**Electrical references**
1	Brake servo assistance	--
2	Vacuum pump	--
3	Vacuum reservoir	--
4	EGR throttle electrovalve	1263
5	Injection ECU	1320
6	Atmospheric pressure sensor	--
7	EGR flap valve	--
8	Exhaust gas recycling valve (EGR).	1297
9	Exhaust gas / water exchanger	--
10	Inlet manifold pressure sensor	1312
11	Inlet air temperature sensor (present with single metering system, as a function of engine variant and equipment level).	1240
12	Intercooler	--
13	Turbo position feedback sensor (present with single metering system, as a function of engine variant and equipment level).	1374
14	Turbo pressure control electrovalve	1233
15	Turbo pressure control vacuum capsule	--
16	Air filter	--
17	Air flowmeter + air temperature sensor	1310
18	Variable geometry turbocharger	--
19	Catalyser	--

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4.3. COMPONENT CHARACTERISTICS

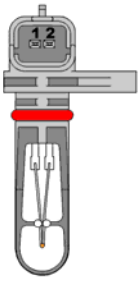
4.3.1. Inlet Air Temperature Sensor (electrical reference: 1240)

Electrical characteristics

Connector view
Component side

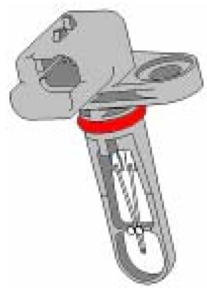
Pin 1 - Signal (0 to 5 volts)

Pin 2 - Earth



Resistance as a function of temperature

Temperature (°C)	Resistance min (?)	Resistance max (?)
-20	67728	75611
0	26682	29197
20	11702	12577
40	5612	5935
60	2904	3029
80	1604	1653
100	937	956
120	569	586
140	361	385
160	238	250



Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Engine cut-off indicator light	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to earth	P0112	<130°C <0.19V	●	●	5 s			●		40°C	As from return into tolerances
+short circuit or open circuit	P0113	> -40°C > 4.8V	●	●	5 s			●		40°C	As from return into tolerances
Slope test	P0111	10°C/100ms	●	●	300 ms			●		40°C	As from return into tolerances

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4.3.2. Inlet Air Pressure Sensor (electrical reference: 1312)

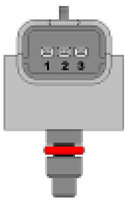
Electrical characteristics

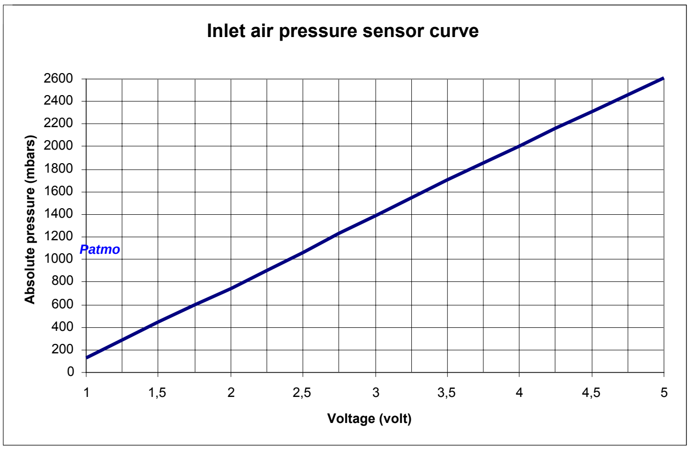
Connector view
Component side

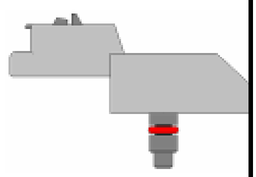
Pin 1 - 5V power supply

Pin 2 - Earth

Pin 3 - 0V to 5 V signal







Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
SC to +ve	P0238	> 2531mb 4.80V	●	●	2 s or 100 engine revs		●	●	1013 mb – inhibition of split injection Var. turbo and EGR cut-off	As from return into tolerances
short-circuit to earth or open circuit	P0237	< 117mb 0.98V	●	●	2 s or 100 engine revs		●	●	1013 mb – inhibition of split injection, variable turbo and EGR cut-off	/
Manifold pressure too high / atmos' pressure	P0069	> 200mb	●		1s		●	●	EGR cut off	As from return into tolerances
Manifold pressure too low / atmos' pressure	P0069	>200mb	●		1s		●	●	/	/
Slope test:	P0236	>200mb in 10ms	●	●	100 ms or 5 engine revs		●	●	1013 mb – inhibition of split injection, variable turbo and EGR cut-off	/
Measured pressure too high / setting	P0234	>100mb	●	●	10s		●	●	Variable turbo regulation cut off, post injection cut off	Next engine crank-up
Measured pressure too low / setting	P0299	>500mb			10s				Variable turbo regulation cut off, post injection cut off	Next engine crank-up

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4.3.3. Air flow meter (electrical reference: 1310)

Electrical characteristics

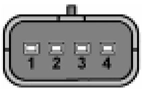
<u>**Connector view**</u>
Component side

Pin 1 - Air flow frequency signal (0 to 5 V)

Pin 2 – Air temperature Analogue signal (0 to 5 V)

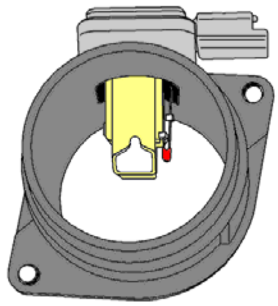
Pin 3 - Earth

Pin 4 - 12 V power supply



Resistance as a function of temperature

Temperature (°C)	Resistance min (?)	Resistance max (?)
-40	41255	47492
-20	14260	16022
-10	8716	9689
0	5497	6050
10	3553	3875
20	2353	2544
30	1613	1730
40	1114	1186
60	568	597
80	310	321



Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Period too long (signal electrical fault)	P0102	60µs 600µs	●	●	Start : 200ms			●	EGR cut off	As from return into tolerances
Air flow too high / theoretical value	P3008	>23kg/h / theoretical value	Engine running (special conditions*)		2.2s			●	EGR cut off	As from return into tolerances
Air flow too low / theoretical value	P3007	>-40kg/h / theoretical value	Engine running (special conditions*)		2.2s			●	EGR cut off	As from return into tolerances
Slope plausibility	P0101	400µs/ms	●	●	Start: 100ms			●	EGR cut off	As from return into tolerances

Special conditions: The air flow rate, measured when decelerating with the <u>EGR off</u>, is compared to the theoretical air flow rate calculated based on the following data:

- engine speed
- engine torque
- engine capacity (cc)
- inlet air temperature
- inlet air pressure

If the air flow measured is too high in relation to the theoretical value (see 'detection threshold' column), fault code, P3008, is raised.

If the air flow measured is too low in relation to the theoretical value (see 'detection threshold' column), fault code, P3007, is raised.

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4.3.4. Turbo pressure electrovalve (electrical reference: 1233)

Electrical characteristics

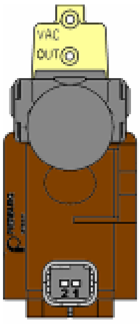
Connector view
Component side

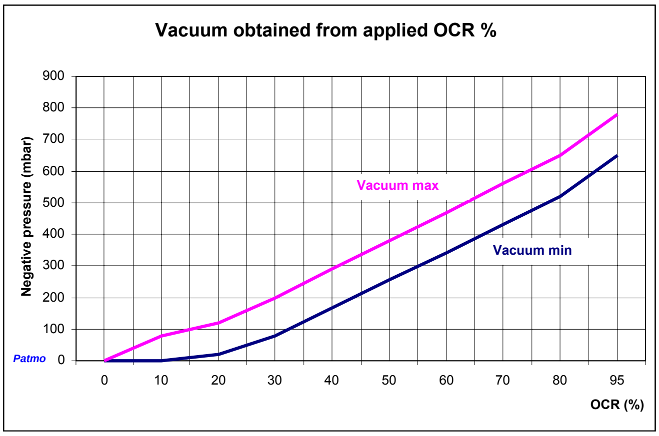
Pin 1 -12V power supply

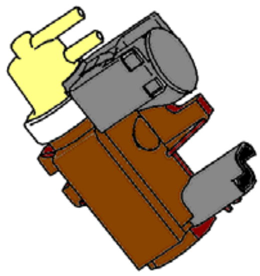
Pin 2 - Earth controlled by the engine ECU OCR from 0 to 100 %

Resistance at 20°C

15.5 ± 0,7 Ω







Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to positive	P0246	/		●	1 s				Variable turbo regulation, post injection cut off, cruise control and speed limiter cut off	Next engine crank-up
Short circuit to earth	P0245	/		●	1 s		●	●	Variable turbo regulation, post injection cut off, cruise control and speed limiter cut off	Next engine crank-up
Open circuit	P0243	/		●	1 s				Variable turbo regulation, post injection cut off, cruise control and speed limiter cut off	Next engine crank-up

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4.3.5. Inlet air heater electrovalve (RAA) (electrical reference: 1285)

Electrical characteristics

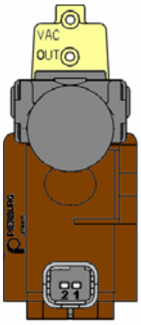
Connector view
Component side

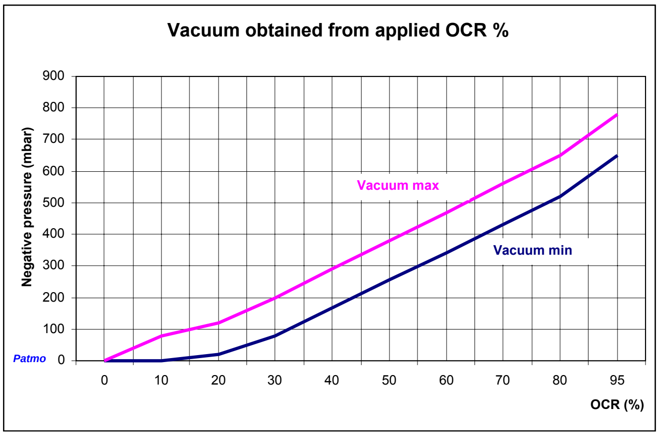
Pin 1 - 12 V power supply

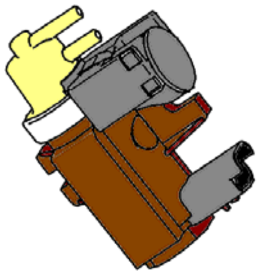
Pin 2 - Earth controlled by the engine ECU
OCR from 0 to 100 %

Resistance at 20°C

15.5± 0.7 Ω







Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to positive	P2123	/		●	1 s				/	/
Short circuit to earth	P2122	/		●	1 s		●	●	/	/
Open circuit	P2124	/		●	1 s				/	/

Note: The electrovalve may be represented differently on the vehicle. However, the pins and the pneumatic connections and the electrical characteristics are strictly identical (Pierburg system illustrated above, Bitron system also possible).

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4.3.6. EGR throttle electrovalve (electrical reference: 1263)

Electrical characteristics

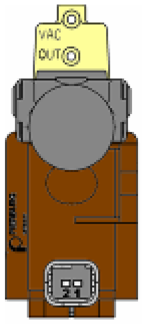
<u>Connector view</u>
Component side

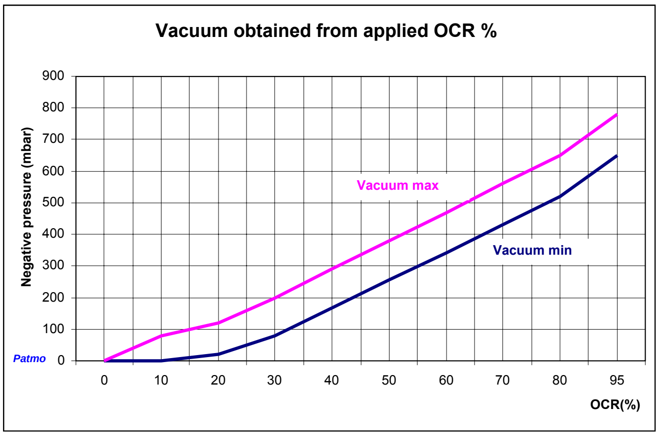
Pin 1 - 12 V power supply

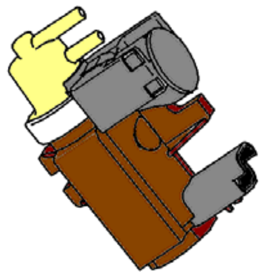
Pin 2 - Earth controlled by the engine ECU OCR from 0 to 100 %

<u>Resistance at 20°C</u>

15.5± 0.7 Ω







Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to positive	P2142	/		●	1 s				/	/
Short circuit to earth	P2141	/		●	1 s		●	●	EGR active and inlet heater throttle open	Next engine crank-up
Open Circuit	P1471	/		●	1 s				/	/

<u>Note:</u> The electrovalve may be represented differently on the vehicle. However, the pins and the pneumatic connections and the electrical characteristics are strictly identical (Pierburg system illustrated above, Bitron system also possible).

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4.3.7. Electric EGR valve (electrical reference: 1297)

Electrical characteristics

Connector view
Component side

Pin 1 - 5 V sensor power supply

Pin 2 - *Not used*

Pin 3 - In the opening phase, it is a power supply (12 V)
In the controlled closure phase, it is an earth

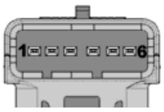
Pin 4 - In the opening phase, it is an earth.
- In the controlled closure phase, it is a power supply (12 V).

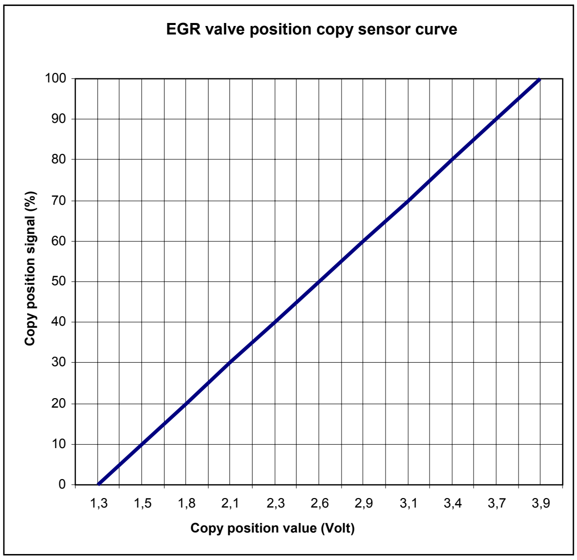
Pin 5 - Earth

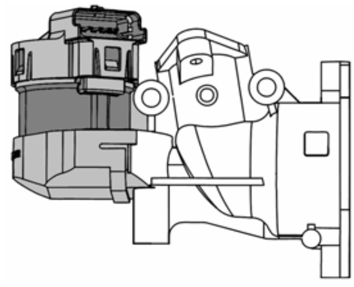
Pin 6 - Sensor Analogue signal (1 to 4 V)

Winding resistance:

3.1 Ω







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Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Feedback voltage higher than threshold	P0406	>4,80V	●	●	0.5s			●	EGR cut off	Next engine crank-up
Feedback voltage lower than threshold	P0405	<0.20V	●	●	0.5s			●	EGR cut off	Next engine crank-up
Fault cleaning position 0%	P0409	>15%	During power latch (Powered following ignition cut-off)		10ms			●	EGR cut off	/
Fault cleaning position 100%	P0409	<80%	During power latch (Powered following ignition cut-off)		10ms			●	EGR cut off	/
Power stage (valve motor control electrical fault)	P2144	/			●	2 s				EGR cut off

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4.3.8. Turbocharger position copy sensor (electrical reference: 1374)

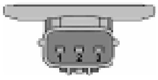
Electrical characteristics

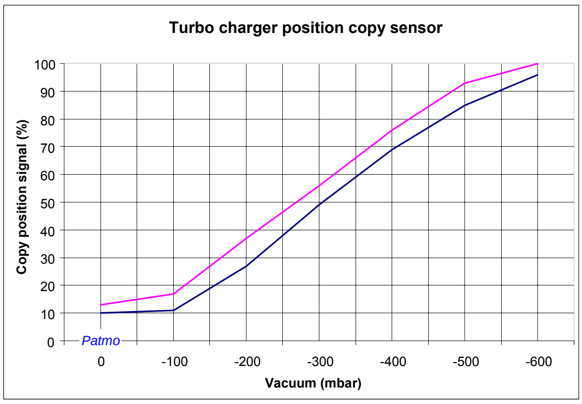
Connector view
Component side

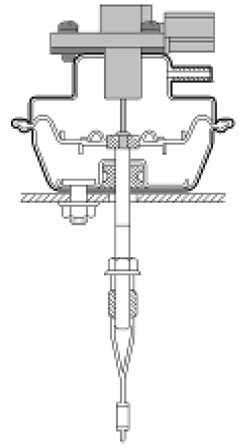
Pin 1 - Earth

Pin 2 - 5 V sensor power supply

Pin 3 - 0 to 5 V Analogue signal







Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Voltage higher than threshold	P2565	> 4.95V	●	●	0.5s			●	Variable turbo control cut off	Next engine crank-up
Position feedback too high compared to setting	P2563	>20%	Engine running		5s			●	Variable turbo control cut off	Next engine crank-up
Position feedback too low compared to setting	P2562	>30%	Engine running		5s				Variable turbo control cut off	Next engine crank-up

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4.4. AIR CIRCUIT CHECKS

4.4.1. General checks

	The air line begins at the air inlet and ends at the end of the rear silencer. *Air ingress, leakage or an obstacle in the air flow path at any point in the line may cause a fault in the air volume actually admitted to the engine, thus downgrading EGR and turbo functions.* *THE FAULT CODES FOR ABNORMAL AIRFLOW OR PRESSURE MAY BE GENERATED FOR THE ABOVE-MENTIONED REASONS.*

Prior to carrying out a specific check, conduct a visual check of the following components:

- **State of air filter:** remove air filter and inspect it. It must not show signs of deposits or any damage.

- **Air line state and seal:**
  - the joints between the various couplings on the line must be sealed and clamps must be tightened,
  - components on the air line (sensors, actuators) must be correctly secured,
  - no cracks in the ducts,
  - no signs of oil at joints (particularly the intercooler joints),
  - No signs of excessive soot on the exhaust line joints (particularly upstream of the catalyser)

- **Pneumatic circuit condition and connections:**
  - Check the vacuum circuit from the vacuum pump to the electrovalves, then to the control pumps, with particular attention to the quality of hose connection to couplings.
  - Check that the hoses are attached to the correct couplings! (see electrovalve checks below).

- **State of electrical connections:** connectors must be correctly attached, no apparent damage on harness.

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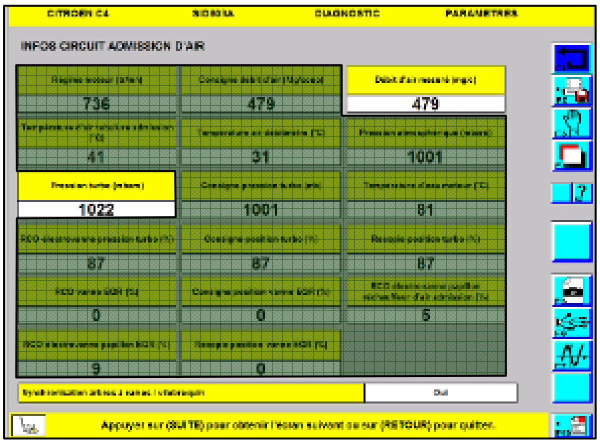
4.4.2. Air flow plausibility check

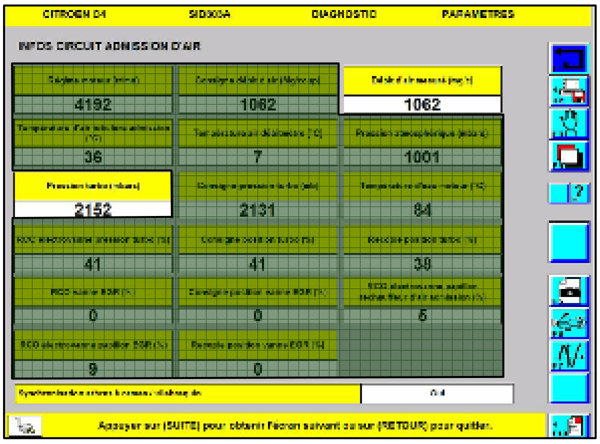
Aim: to decide if the value measured by the airflow meter is consistent, taking into account the known operating conditions.

Using indicative values:
In parameter measurements, select “air flow measured " (see table of indicative values) and compare the measurements with the values given in the table). Conditions: test with no load, engine coolant temperature > 80° C, air filter in good condition, no power consumers, EGR valve disconnected.

Without indicative values, a simple calculation can be made:
It is possible to make a good approximation of the air flow by carrying out a simple calculation based on:

- measured air flow
- engine capacity (cc)
- absolute pressure value in the inlet manifold.





At atmospheric pressure (when idling or at a stable engine speed with no load), the volume of air admitted (in mg/stroke) must correspond to the piston displacement (engine capacity (cc) divided by four).

Example: for the DW 10 engine, with a cubic capacity of close to 2000cc (1997cc), at atmospheric pressure, the quantity of air admitted must be close to 500 mg/stroke.
On the screen opposite, it is 479 mg/stroke.

Above atmospheric pressure, if the test is carried under load, the air flow measured must be divided by the absolute pressure value to obtain the value of 500 mg/stroke.

Example: on the screen opposite, the measured airflow divided by the absolute pressure value (in bar) gives:
1062 / 2.152 = 494 or a value very close to this.

If the measured value is too low:

- ✓ the EGR valve must be remaining open,
- ✓ an air leakage between the flow meter and the turbocharger is possible,
- ✓ an obstacle may be restricting air flow (intercooler or exhaust blocked, metering valve partially closed, hose compressed, etc)
- ✓ The air flowmeter data may be incorrect due to a fault in the harness or of the air flowmeter itself.

If the measured value is too high:

- ✓ Air leak after the turbocharger is possible (this fault will be more visible under load). In this case, to compensate for the lack of turbo pressure following the leak, the turbocharger is controlled to provide more air, which increases the value measured by the air flowmeter.
- ✓ The turbo compressor variable geometry can remain in the "maximum turbocharger" position.
- ✓ The air flowmeter data may be incorrect due to a fault in the harness or of the air flowmeter itself.

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4.4.3. EGR system

a) EGR valve check

Seal test:
Measure the air flow value with the EGR valve disconnected (it should be closed).
Then ensure that the EGR pipe that links the EGR valve to the inlet manifold is plugged. Use flexible but resistant material (see **Figure 12**).

Note: do not use a cloth or any other material likely to be sucked into the inlet.

Measure the air flow value again (the EGR valve is still disconnected)
Compare the air flow values measured, they should be identical. If not, the EGR valve is not sealed and must be replaced.

Figure 12: Isolation of the EGR pipe (SID 803 / 803A)

Checks with the diagnostic tool:
- In parameter measurements, check the value of the position feedback sensor. The value must be 0% when the ignition is on. When the engine is switched off, the stop values are 'learned'. The valve opens and closes five times in a row, which enables it to be ascertained that the feedback signal moves from 0 to 100%. If there is a fault in the feedback value, the valve itself may have a mechanical or electrical fault or the sensor data may be incorrect.
- Carry out an actuator test and listen to the valve noise.
- In oscilloscope mode, using the break-out box and interface harnesses, check the valve control voltage and the speed of the signal which is positive when open and negative when closed.
- In multimeter mode, using the break-out box and interface harnesses, check the electrical motor winding resistance = 3,1 Ω (brown connector disconnected) and the feedback sensor power supply = 5 V.

Electrical tests: (components disconnected)
- check continuity
- check insulation

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Curve measured on the EGR valve position feedback signal

With the engine idling, give a brief press on the accelerator.

Figure 13: Signal measured on valve feedback (SID 803 / 803A)

Curve measured on the EGR valve control signal

With the engine idling, give a brief press on the accelerator.

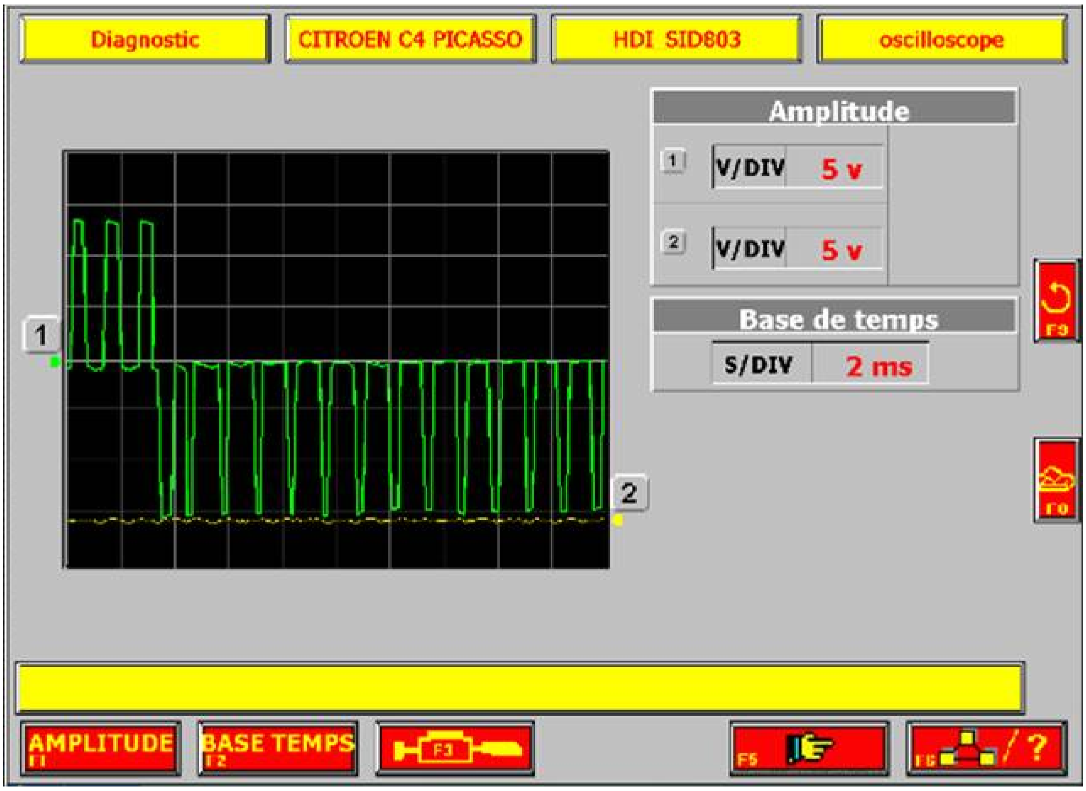

Figure 14: Signal measured on valve control signal (SID 803 / 803A)

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4.4.4. Turbo circuit

a) Maximum pressure measurement (see indicative value table)

Ensure that the system is able to deliver maximum pressure when the driver accelerates sharply, engine under load. From approximately 2000 rpm, press foot flat down on the accelerator pedal in 3rd gear or above.

Note: the higher the gear engaged, the longer the turbo charging pressure is maintained at a high level, and this can be easily observed.

If the value observed is too low, the causes could be the following:-

- ✓ clogged air filter
- ✓ EGR valve has remained open (loss of turbocharger power)
- ✓ Air leak between the turbocharger and the engine
- ✓ Variable geometry blocked in the minimum turbo charging position (in this case, the engine lacks pick-up at low engine speeds)
- ✓ an obstacle may be restricting air flow (intercooler blocked, metering valve partially closed, hose crushed, etc)
- ✓ The turbocharger pressure sensor data may be incorrect due to a fault in the harness or in the sensor itself.
- ✓ Incorrect position feedback sensor data (actual variable geometry position < to the position measured due to a fault in the harness or the sensor itself).
- ✓ Turbocharger damaged (high play level, vanes broken etc).

If the value observed is too high, the causes could be the following:-

- ✓ Variable geometry blocked in the maximum turbocharger position
- ✓ The turbocharger pressure sensor data may be incorrect due to a fault in the harness or in the sensor itself
- ✓ Incorrect position feedback sensor data (actual variable geometry vane position > to the position measured due to a fault in the harness or the sensor itself)
- ✓ Turbocharger damaged (micro sticking/jamming).

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b) Turbo pressure sensor check

Signal consistency:

Check consistency of the pressure value measured with a pressure gauge and that measured on the diagnostic tool, using toolkit C0171/2:

<u>Setting up the check:</u>

- Fit the inlet manifold pressure sensor (1) to tool C.0171-G2 (2).
- Connect the two parts of tool C.0171-G2 tool (2) to the pump (5), using the tubes (3).
- Position a plug on the T (4).

- Create pressure using the pump (5).
- Using the diagnostic tool, go into measurement parameters and check consistency between the pressure measured with the tool and that measured on the pump dial.

	The pump pressure gauge is calibrated to a given atmospheric pressure. Depending on atmospheric pressure variation, at rest, it is possible that the needle is not aligned exactly to zero. This variation must be taken into account when measuring!

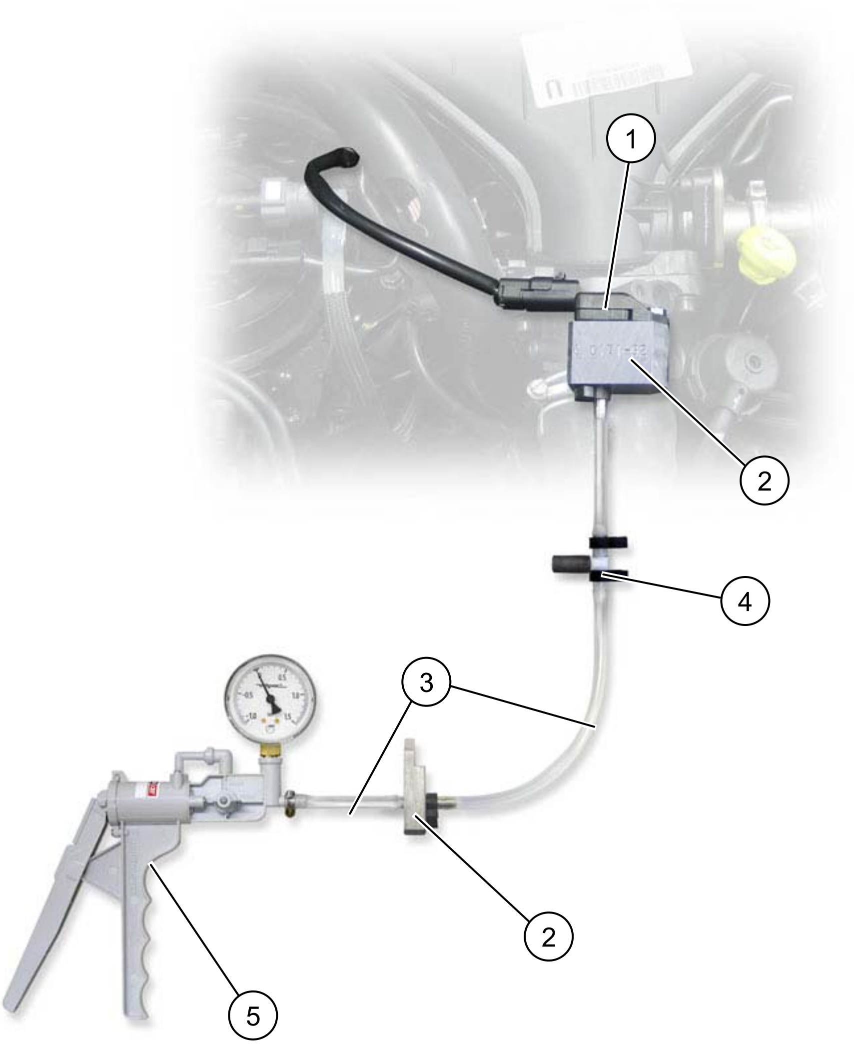

Figure 15: Connection diagram for turbo pressure sensor check (SID 803 / 803A)

Electrical tests: (components disconnected)

- check continuity
- check insulation

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c) Turbocharger position feedback sensor check

Signal consistency:
Apply a vacuum to the turbocharger pump in order to modify the position of the turbo geometry and compare it with the percentage on the feedback signal measured on the diagnostic tool (table provided in "component characteristics").

Note: to improve accuracy of the check, it is possible to use the data from the inlet air pressure sensor fitted as indicated below.

<u>Setting up the check:</u>

- Fit the inlet manifold pressure sensor (1) to tool C.0171-G2 (2).
- On the electrovalve (6), disconnect the turbocharger pump control tube (7)
- Connect the two parts of tool C.0171-G2 tool (2) to the pump (5), using the tubes (3).
- Connect the tube (7) to the tubes (3) via the T (4).

- Create a vacuum using the pump (5).
- Using the diagnostic tool, in parameter measurements, check the feedback value as a function of the vacuum applied.

Note:
The vacuum value applied must be read off the parameter measurements and not on the pump dial.
The engine must be idling so that the parameter screen is refreshed.

- Check that the values read off correspond to the sensor characteristic curve (**see p40).**

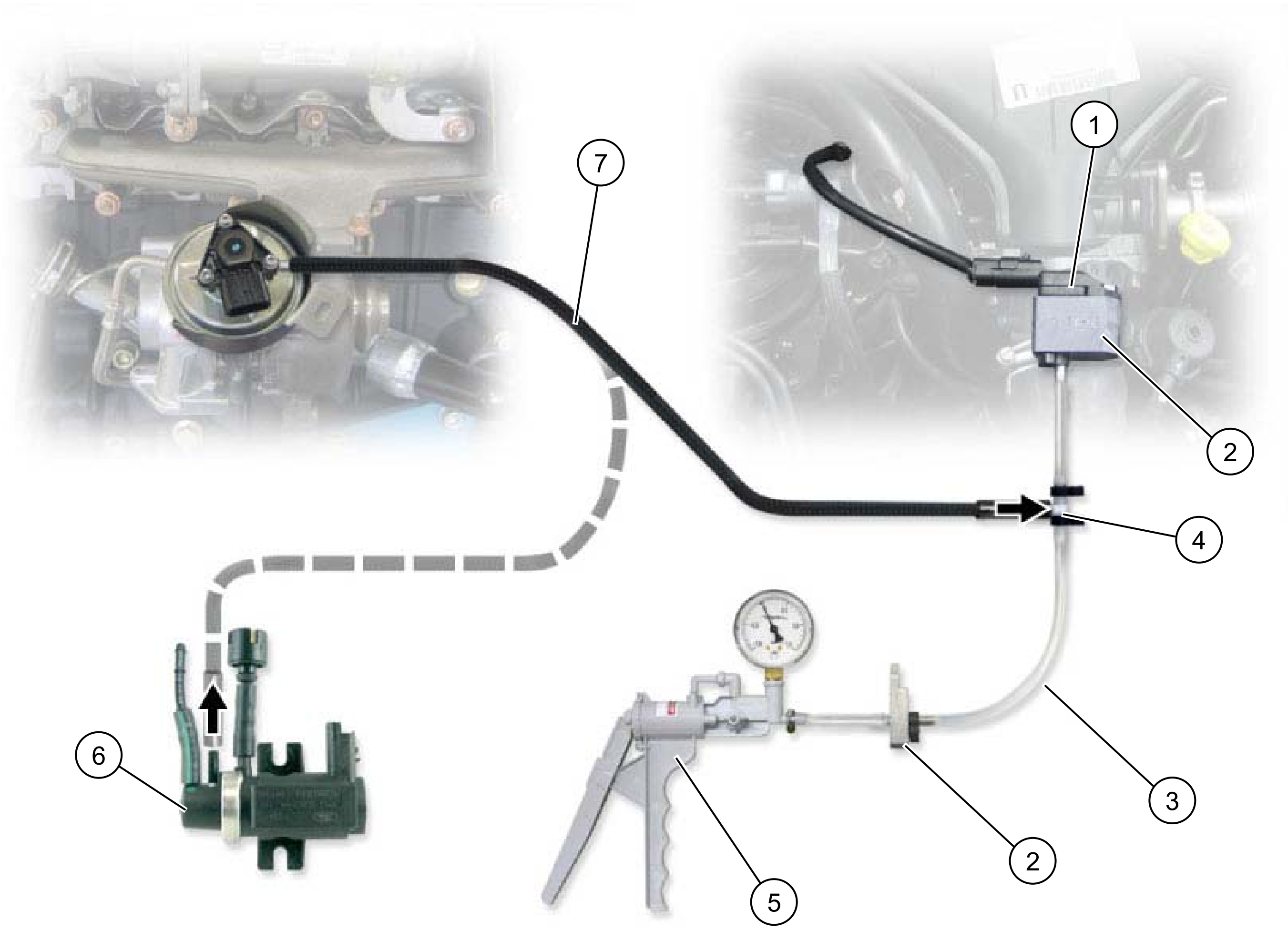

Figure 16: Connection diagram for turbo position feedback sensor check (SID 803 / 803A)

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4.4.5. Other air circuit components

a) Turbo electrovalve, EGR throttle electrovalve and inlet air heater electrovalve.

Checks with the diagnostic tool:

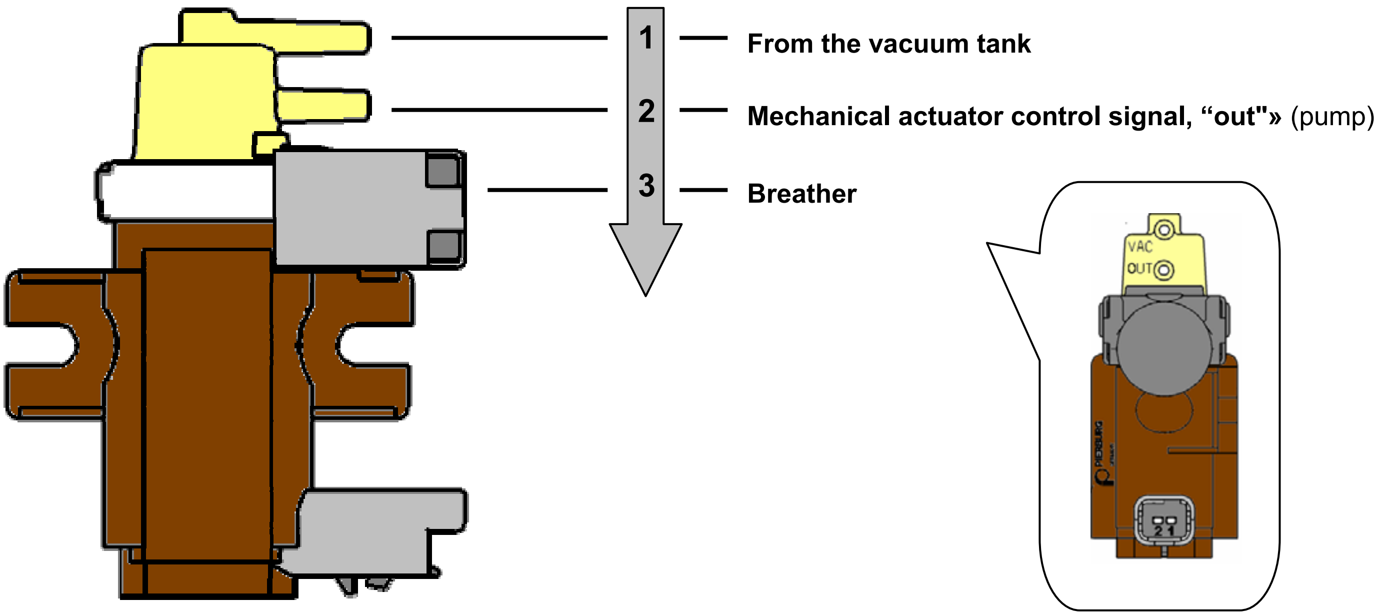
- Carry out an actuator test and listen to the electrovalve noise.
- In oscilloscope mode, using the break-out box and interface harnesses, check the control voltage of the electrovalve and the signal speed.
- In multimeter mode, using the break-out box and the interface harnesses, check the resistance of the electric motor windings = 15.5 Ω.

Electrical checks: (components disconnected)

- check continuity
- check insulation

b) Comments concerning electrovalves

1. The pneumatic solenoid valve output allocations are always in line with the order indicated in the following diagram, starting from the top:



2. The pipe connected to the "out" coupling includes a **coloured plastic ring** which differentiates it from the other pipes to facilitate connection.

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c) Pneumatic circuit check conducted using the couplings that have been specially made.

Given the difficult accessibility of the turbocharger electrovalve (between the engine and the bulkhead), it is preferable to make a coupling (**see § "3.3 Tooling to be made"**) from the diesel return couplings, for example, so that the following checks can be carried out.

If these coupling are not available, carry out the rest of the check described in **§: "d) Pneumatic circuit checks to be carried out in the absence of specially made couplings".**

<u>Vacuum pump check:</u>

Connect the pressure/vacuum pump to the vacuum pump outlet. The vacuum value must be 900 mbar (- 0.9 bar measured on the pressure gauge).

Condition: engine idling.

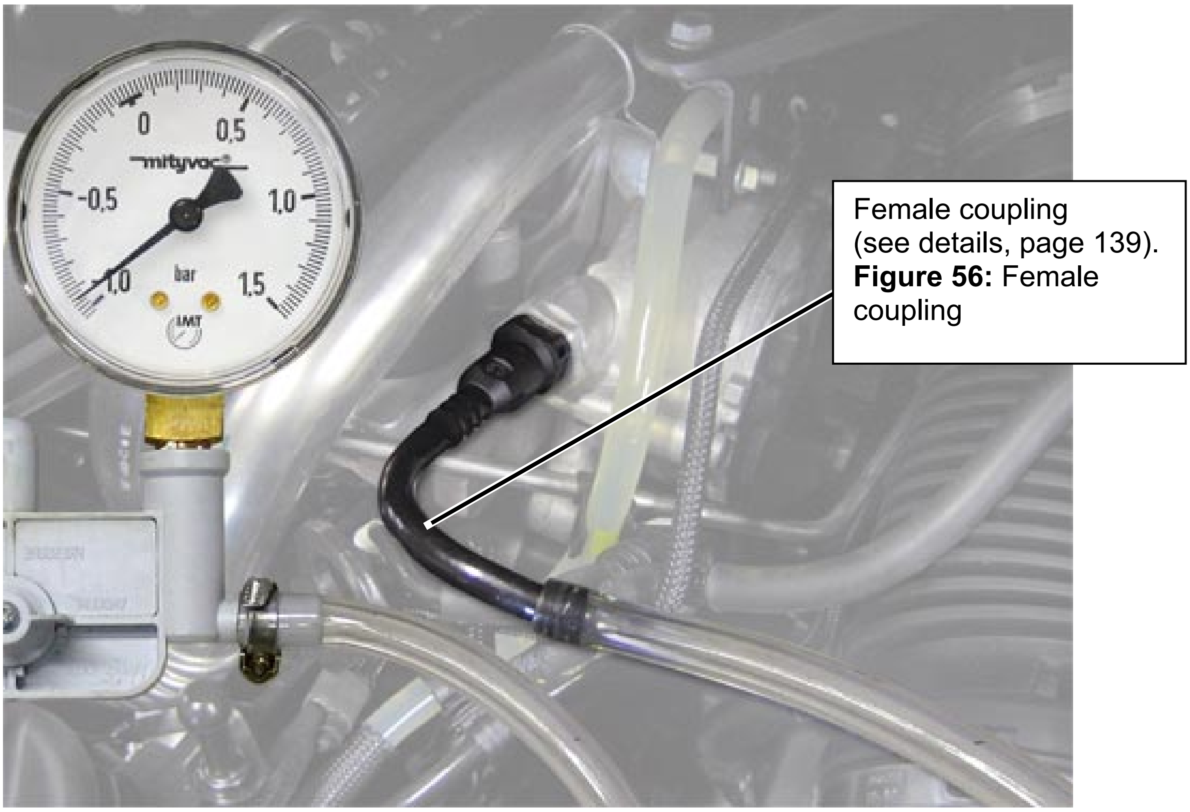

Figure 17: Vacuum pump check (SID 803 / 803A)

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Checking vacuum circuit seal

Connect pressure/vacuum pump to the vacuum circuit as illustrated below.

Start the engine, the vacuum value measured must be 900 bars. Check that the vacuum value does not drop more than 0.2 bars in 1 minute.

Condition: Engine off.

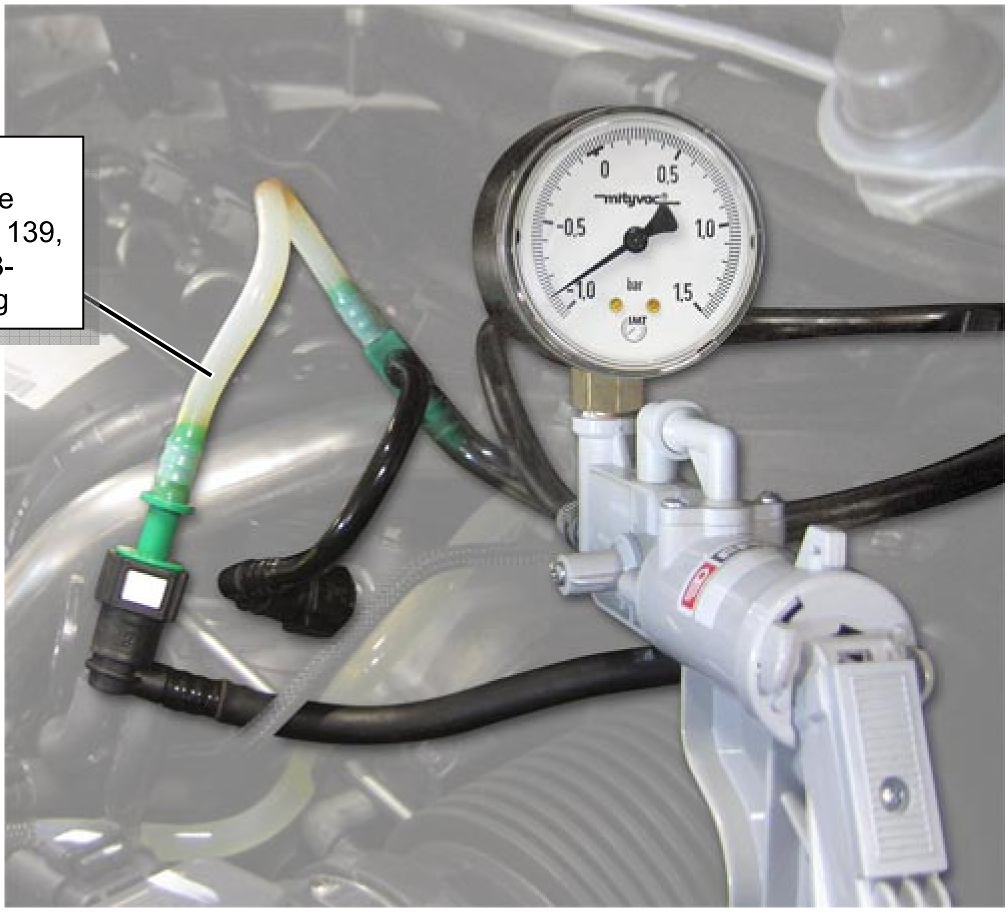

Figure 18: Vacuum circuit seal check (SID 803/80A)

	To be effective, this check must be carried out by connecting the vacuum pump as indicated.

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<u>Checking electrovalve activation</u>:

Connect pressure/vacuum pump to the vacuum circuit coupling.

Create a vacuum by starting the engine.

Stop the engine.

Using the diagnostic tool, carry out an actuator test on each electrovalve. The vacuum must drop in stages (the tool activates the electrovalve several times during the test).

It is possible that between two tests that you may have to crank the engine (to create vacuum reserve).

Condition: Engine off.

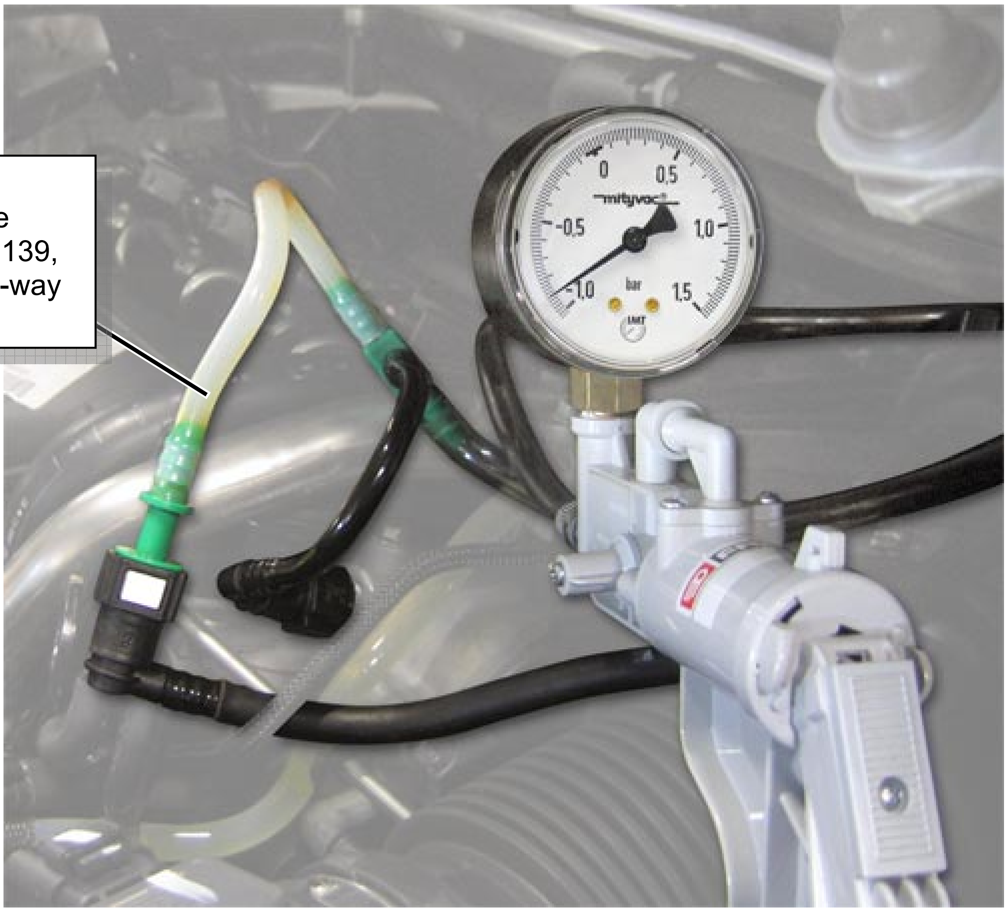

Figure 19: Electrovalve activation check (SID 803 / 803A)

⚠	To be effective, this check must be carried out by connecting the vacuum pump as indicated.

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d) Pneumatic circuit check conducted in the absence of specially made couplings.

Vacuum pump seal from the vacuum pump to the electrovalves. Application of the **"AIR INLET CIRCUIT CHECK"** procedure. Using a Mityvac connected in parallel (with a T piece) at the vacuum pump outlet then at the input of each of the electrovalves (marked "vac"), check that the pressure value is 800 mbar (-0.8 bar on the pressure gauge).

Condition: engine idling.

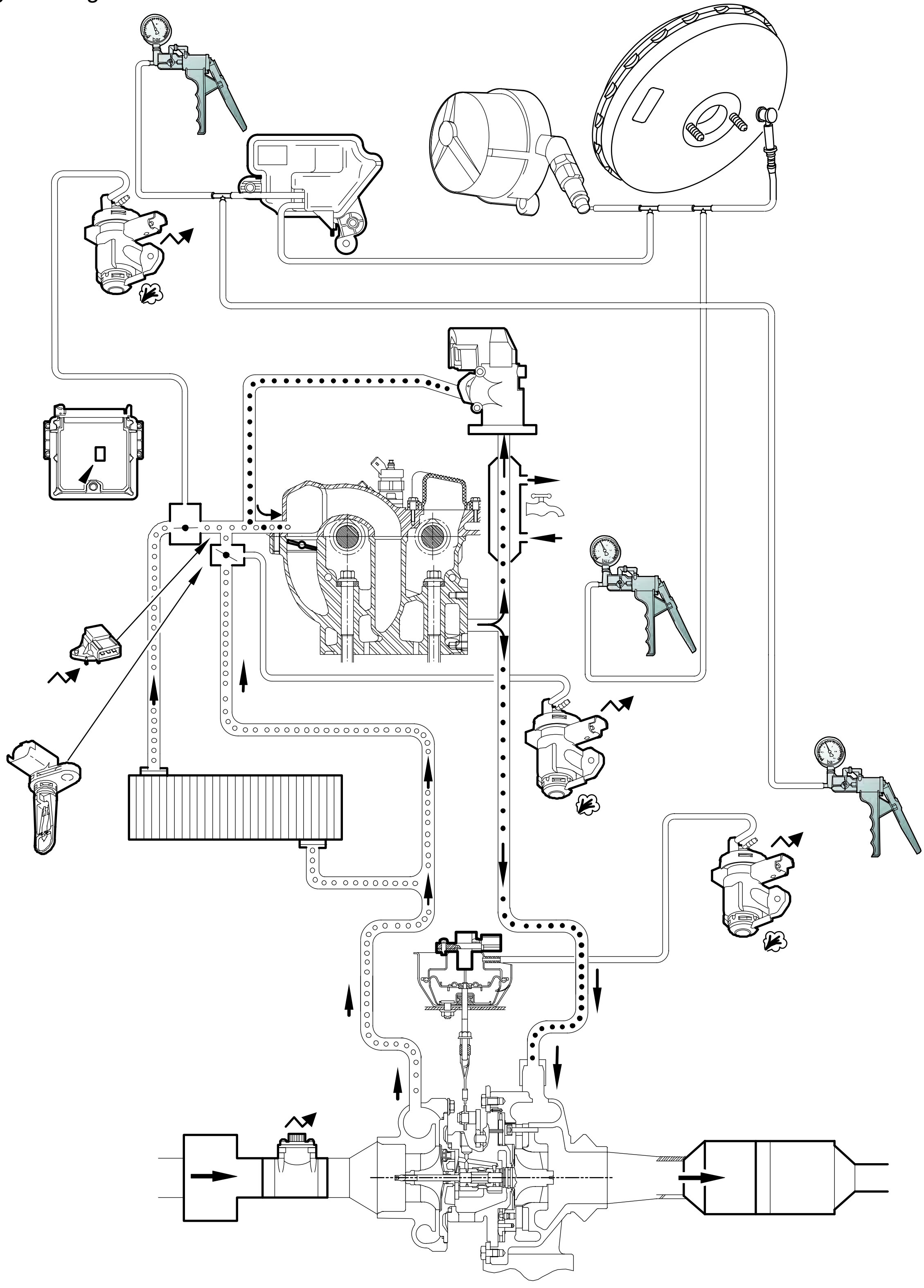

Figure 1 : Vacuum pump check without coupling (SID 803 / 803A)

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Control circuit seal from the electrovalve to the control pump
Connect the Mityvac directly to the pipe that goes from the electrovalve (coupling marked "out") to the vacuum control capsule of the actuator. Gradually activate the Mityvac and note the movement of the actuator which must be smooth and without any jolting.
Note also that the vacuum is maintained.

Condition: Engine off.

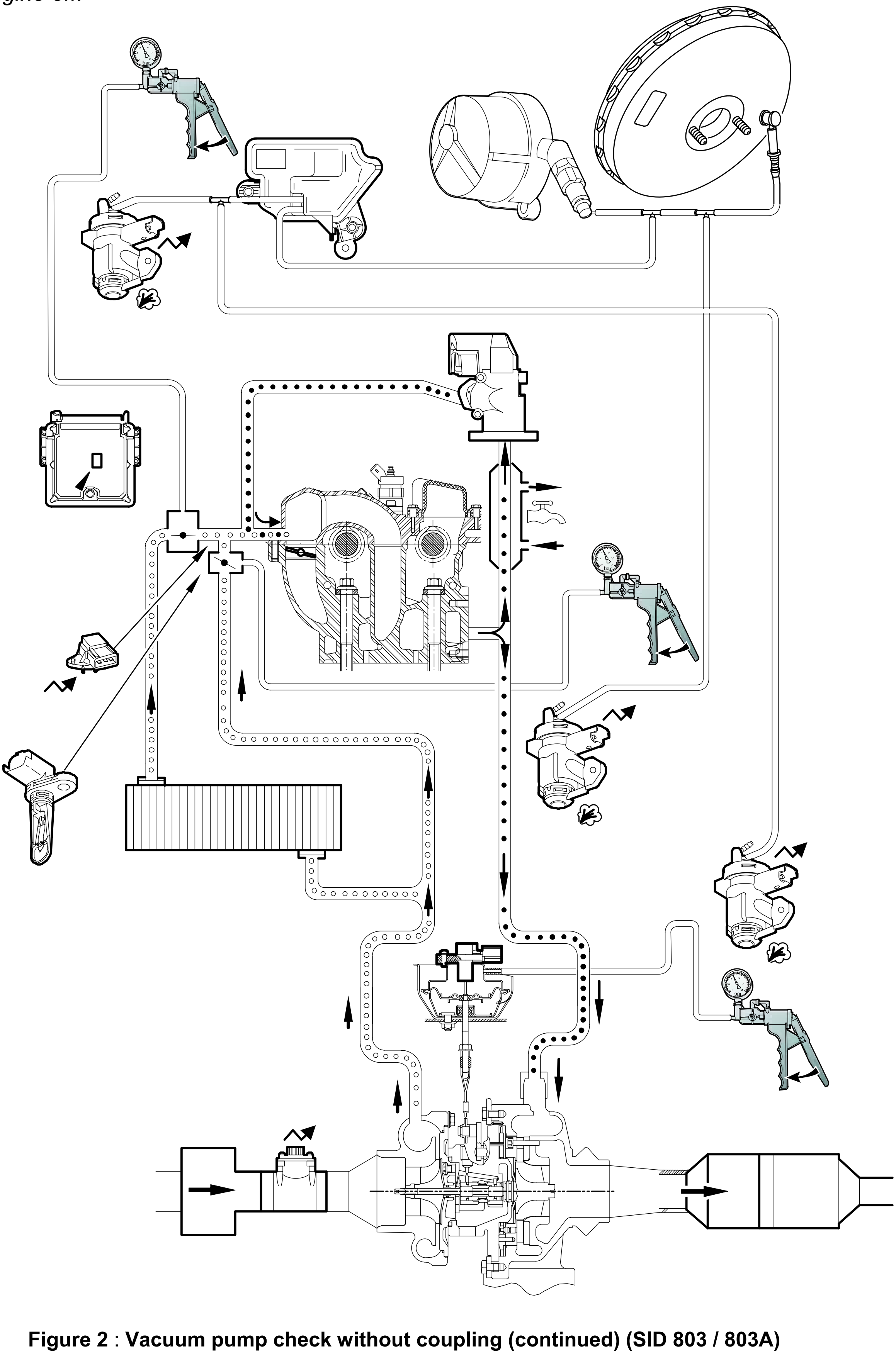

Figure 2 : **Vacuum pump check without coupling (continued) (SID 803 / 803A)**

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Breather

To check the quality of breathing process, it is necessary to ensure that the breather filter is not clogged (foam filter). On certain electrovalves, the breather is remotely located (e.g. turbo electrovalve) and on others it is encapsulated directly on to the solenoid (EGR throttle electrovalve and inlet heater electrovalve). A partially clogged filter causes a delay in controlling the control pump and may generate fault codes relating to excessive pressure or volume. A totally clogged filter prevents the control pump from returning to its normal position.

e) Checking the inlet manifold air temperature sensor

Using the diagnostic tool:

In parameter measurements, check the value displayed by the engine ECU. When the engine is cold, the temperature of the air flow meter and at the inlet manifold must be identical. If in doubt, compare with an ohmmeter measurement (see table of values in the chapter entitled "component characteristics").

Harness electrical checks: (components disconnected)

- continuity
- insulation.

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BOSCH

1. ECU EDC 16 C34 INPUTS/OUTPUTS

1.1. OUTLINE DIAGRAM

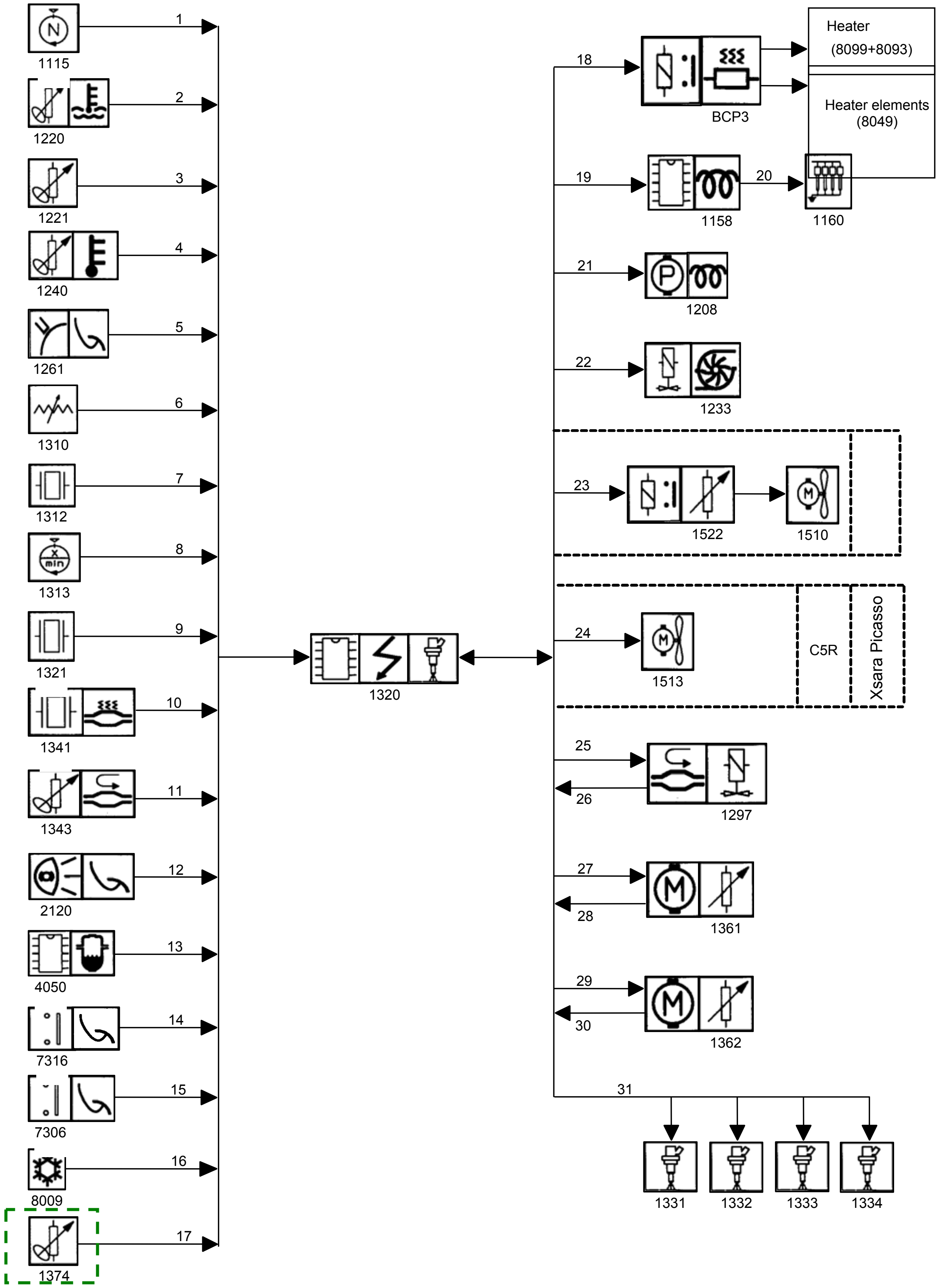

Figure 3 : EDC16 C34 outline diagram

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Components list

Electrical reference	Component description	Electrical reference	Component description
BCP3	3 relay fuse box (additional heater – burner or CTP)	1362	Electric EGR throttle valve
1115	Cylinder reference sensor	1374	Turbocharger position copy sensor (only on 9HY engine)
1158	Glow plug control unit	1510	Cooling fan unit (relays)
1160	Glow plugs	1513	Variable speed cooling fan (chopper)
1208	High Pressure diesel injection pump + fuel flow regulator (VCV)	1522	Two speed cooling fan control unit
1220	Engine coolant temperature sensor	2120	Dual-function brake switch
1221	Diesel temperature sensor	4050	Water in fuel sensor
1233	Turbo pressure regulation electrovalve	7306	Cruise control safety switch (clutch)
1240	Inlet air temperature sensor	7316	Vehicle speed limiter safety switch (kick-down point on accelerator pedal)
1261	Accelerator pedal position sensor	8009	Refrigerant pressure sensor
1297	Electric EGR valve electrovalve		
1310	Air flowmeter and air temperature		
1312	Inlet air pressure sensor		
1313	Engine speed sensor		
1320	Engine ECU		
1321	Fuel high pressure sensor		
1331	n° 1 cylinder injector		
1332	n° 2 cylinder injector		
1333	n° 3 cylinder injector		
1334	n° 4 cylinder injector		
1341	Particle filter (FAP) differential pressure sensor		
1343	Exhaust gas temperature sensor (downstream of catalyser)		
1361	Inlet air heater throttle valve		

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Signal list		
No.	**Signal**	**Type of signal**
1	Camshaft position data	Square signal (pulse)
2	Engine coolant temperature data	Analogue
3	Diesel temperature data	Analogue
4	Inlet air temperature data	Analogue
5	Accelerator pedal position data	Analogue
6	Inlet air quantity data	Analogue
	Inlet air temperature data	Analogue
7	Inlet air pressure data (after the intercooler)	Analogue
8	Engine speed data	Square signal (pulse)
9	Fuel pressure data	Analogue
10	Particle filter differential pressure data	Analogue
11	Downstream exhaust gas temperature data	Analogue
12	Brake switch data (depressed/released)	On/off
13	Water in fuel data	On/off
14	Speed limiter function switch data (LVV)	On/off
15	Clutch pedal data (depressed/released)	On/off
16	Refrigerant pressure data	Analogue
17	Turbocharger variable geometry position data	Analogue
18	3 relay fuse unit control	On/off
19	Glow plug heating module control	On/off
20	Glow plug control	On/off
21	Fuel flow regulator control signal	OCR
22	Turbocharger electrovalve control	OCR
23	Dual-speed electric fan unit control module control signal	On/off
24	Motor fan unit (chopper) control signal	Analogue
25	EGR electrovalve electric control signal	
26	EGR electrovalve position feedback signal	OCR
27	Inlet air heater throttle valve control signal	Analogue
28	Inlet air heater throttle valve position feedback signal	OCR
29	EGR throttle valve control signal	Analogue
30	EGR throttle valve position feedback signal	OCR
31	4 diesel injector control signal	Analogue

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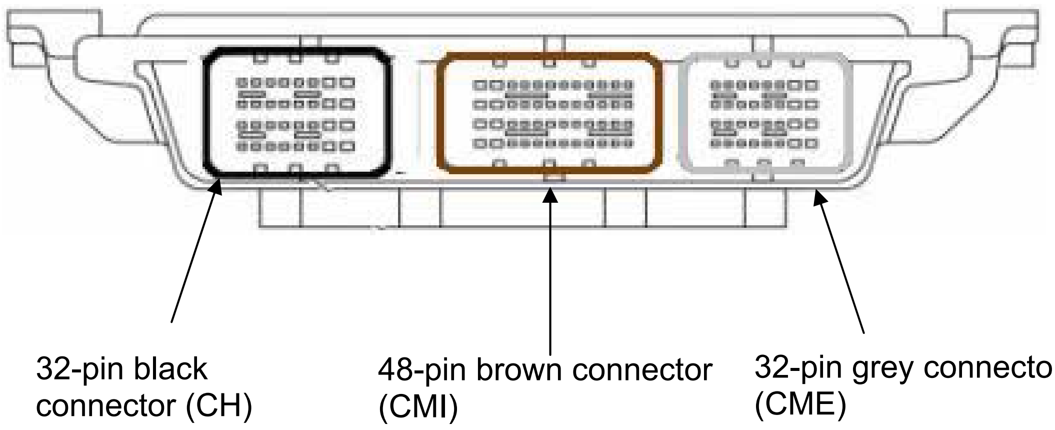
1.2. PIN LAYOUT

The injection ECU is connected to the injection harness by three modular connectors:

- CME connector (32-pin grey)
- CMI connector (48-pin brown)
- CH connector (32-pin black).



Connector fitting order:

1. Grey connector (CME)
2. Brown connector (CMI)
3. Black connector (CH).

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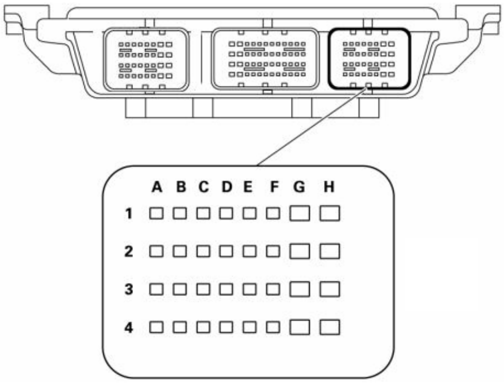
1.2.1. ECU pin layout details



32-pin grey connector (CME)

A1	Not Used	A2	Water in diesel filter (4050)	A3	Air flow data (+) (1310)	A4	Pre-heating relay diagnostic data (1158)
B1	Not Used	B2	Not Used	B3	Not Used	B4	Not Used
C1	Not Used	C2	Downstream exhaust gas temperature sensor (1343)	C3	Not Used	C4	Not Used
D1	EGR flap valve position feedback signal **earth (1361)** Inlet air heater flap valve position feedback signal **earth (1362)**	D2	Not Used	D3	EGR electrovalve position feedback signal **earth (1297)**	D4	EGR electrovalve position feedback signal **data (1297)**
E1	Turbocharger pressure control electrovalve control (1233)	E2	Glow/post heating module relay control	E3	Speed limiter (LVV) switch **earth** (7316)	E4	Not Used
F1	Diesel temperature sensor **earth** (1221) Water in diesel sensor **earth** (4050)	F2	Not Used	F3	Particle filter differential pressure sensor **earth** (1341)	F4	Not Used
G1	No. 4 cylinder injector	G2	No. 2 cylinder injector	G3	No. 1 cylinder injector	G4	No. 2 cylinder injector
H1	No. 1 cylinder injector	H2	N° 3 cylinder injector	H3	No. 4 cylinder injector	H4	N° 3 cylinder injector

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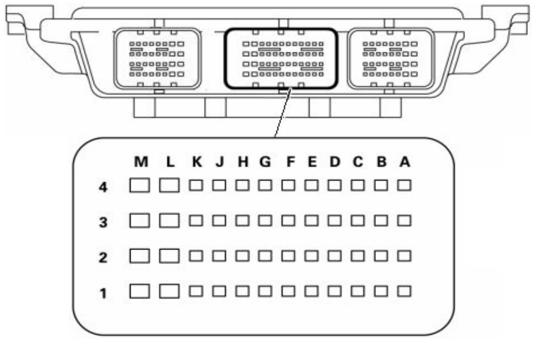

48-pin brown connector (CMI)

A1	Cylinder reference sensor **earth** (1115)	A2	Not Used	A3	Not Used	A4	EGR electrovalve position feedback signal **power supply (1297)**
B1	Engine speed sensor signal data (1313)	B2	Not Used	B3	Not Used	B4	Diesel pressure sensor power supply (1321)
C1	Engine speed sensor **earth** (1313)	C2	EGR electrovalve control	C3	Not Used	C4	Diesel pressure sensor **earth** (1321)
D1	Cylinder reference sensor signal data (1115)	D2	EGR electrovalve control	D3	Not Used	D4	Air inlet pressure sensor **earth** (1312)
E1	Main relay control (power latch)	E2	Flowmeter **earth**	E3	Not Used	E4	Inlet air pressure sensor power supply (1312)
F1	Inlet air temperature sensor signal data (1240)	F2	Engine coolant temperature sensor signal data (1220)	F3	Engine speed sensor power supply (1313)	F4	Cylinder reference sensor **power supply** (1115) Inlet air heater flap valve feedback signal **power supply (1361)** EGR flap valve feedback signal power supply (1362)
G1	Not Used	G2	Inlet air temperature sensor signal data (1310)	G3	Diesel pressure sensor signal data (1321)	G4	Particle filter differential pressure sensor power supply (1341)
H1	Engine coolant temperature sensor **earth** (1220)	H2	Diesel temperature sensor signal data (1221)	H3	Downstream exhaust gas temperature sensor signal data (1343)	H4	Not Used
J1	Speed limiter (LVV) switch data (7316)	J2	Inlet air heater flap valve position feedback signal data **(1361)**	J3	Not Used	J4	Not Used
K1	Particle filter differential pressure sensor signal data (1341)	K2	Inlet air pressure signal data (1312)r	K3	EGR flap valve position feedback signal data **(1362)**	K4	Not Used
L1	EGR flap valve control signal (1362)	L2	Not Used	L3	Not Used	L4	Inlet air temperature sensor **earth** (1240)
M1	Inlet air heater throttle valve control signal (1361)	M2	+ APC power supply	M3	Power relay control signal (BSM - engine ancillaries ECU)	M4	Fuel flow regulator (VCV) control signals **(1208)**

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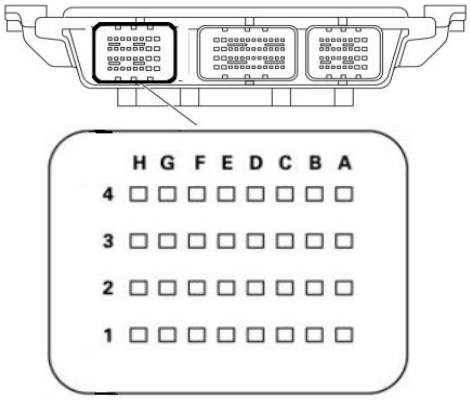

Black 32-pin connector (CH)

A1	+ APC(depending on assembly)	A2	Not Used	A3	Dialogue line Low speed Inter-systems CAN network	A4	Dialogue line: High speed Inter-systems CAN network
B1	Additional heater control (BCP3)	B2	Variable speed motor fan assembly control (1513) Dual-speed electric fan unit control module control 1 (1522)	B3	Not Used	B4	Diagnostic line (K line)
C1	Additional heater control (BCP3)	C2	Track 2 accelerator pedal sensor data (1261)	C3	RCD (remote wake-up) signal data	C4	Variable speed motor fan assembly diagnostic data (1513) Dual-speed motor fan unit control module diagnostic data (1522)
D1	+ APC (depending on assembly)	D2	Not Used	D3	Not Used	D4	Dual-speed electric fan unit control module control 2 (1522)
E1	Not Used	E2	Not Used	E3	Cruise control safety switch (clutch) signal data (7306)	E4	Secondary brake pedal data (2120)
F1	Not Used	F2	Refrigerant pressure sensor power supply (8009)	F3	Not Used	F4	Refrigerant pressure sensor **earth** (8009)
G1	Not Used	G2	Accelerator pedal sensor power supply (1261)	G3	Accelerator pedal (track no. 1) sensor signal data (1261)	G4	Body earth (MC11)
H1	Not Used	H2	Refrigerant pressure sensor signal data (8009)	H3	Accelerator pedal sensor **earth** (1261)	H4	Body earth (MC11)

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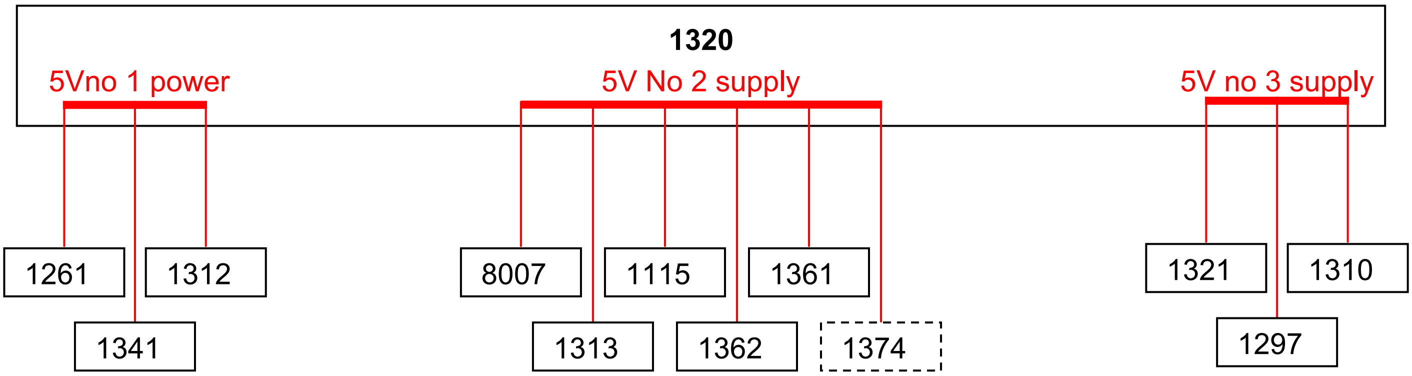
1.3. Special features of the 5V power supplies

The injector ECU powers certain components with 5 V. Some of these power supplies are connected to equi-potential terminals in the ECU.



1115	Cylinder reference	1312	Inlet air pressure	1361	RAA throttle
1261	Accelerator pedal position:	1313	Engine speed	1362	EGR flap valve
1297	EGR electrovalve	1321	Diesel high pressure	1374	Turbo position return signal
1310	Flow meter	1341	FAP differential pressure	8007	Pressure switch

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2. INDICATIVE VALUES

2.1. REMARKS

These charts provide average indicative values measured on various vehicles (3 DV6TED4, 110 bhp FAP). This testing was conducted on vehicles with mileage of less than 6000 miles and operating at an altitude of less than 200 m.
Static testing was carried out at an ambient temperature of 20°C and dynamic tests at temperatures of between 8 and 17°C.
In order to guarantee measurement reliability, check the condition of the air filter and change it if necessary.

For certain static tests, the EGR must be inhibited by disconnecting the EGR valve connector.

2.2. FULL LOAD DYNAMIC TESTING

Test conditions
Coolant temperature: at least 80°, road profile: flat, vehicle weight: in functional order, tyre pressure: nominal pressure, no power consumers, air conditioning off.
From approximately 2000 rpm, press foot flat down on the accelerator pedal:

- \- to reach maximum fuel pressure, it is necessary to reach an engine speed of around 4000 rpm (in third gear, for example).
- \- to reach maximum turbo pressure, it is better to use a higher gear than 3rd in mid range engine speeds.

EDC16 C34 with DV6 TED4	
Parameters	**Full load**
Fuel circuit parameters	
Fuel pressure setting (bar)	**1588 $^{\pm 30}$**
Fuel pressure measured (bar)	**1570 $^{\pm 30}$**
Fuel flow regulator opening control (%)	**25 $^{\pm 5}$**
Air circuit parameters	
Turbo pressure setting (mbar)	**2182 $^{\pm 40}$**
Turbo pressure measured (mbar)	**2229 $^{\pm 50}$**
Turbo electrovalve opening control (%)	**45 $^{\pm 10}$**
EGR throttle opening control (%)	**0**
EGR throttle position copy opening control (%)	**0 $^{+6}$**
Inlet air heater throttle opening control (%)	**0 $^{+1}$**
Inlet air heater throttle position copy opening control (%)	**0**
EGR valve opening control (%)	**0**
EGR valve position copy opening control (%)	**0**
Air flow reference value (mg/stroke)	**698 $^{\pm 110}$**
Air flow measured (mg/stroke)	**929 $^{\pm 50}$**

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2.3. TESTING WITHOUT LOAD (STATIC TESTING)

EDC16 C34 with DV6 TED4					
Parameters	**Cranking engine**	**Idling**	**1500 ± 50 rpm**	**2500 ± 50 rpm**	**4000 ± 50 rpm**
Fuel circuit parameters					
Fuel pressure reference (bar)	259 ± 50	258 ± 30	506 ± 80	494 ± 30	439 ± 30
Fuel pressure measured (bar)	> 150	258 ± 30	506 ± 80	498 ± 30	439 ± 30
Fuel flow regulator (VCV) opening control (%)	26 ± 5	19 ± 5	20 ± 5	20 ± 5	20 ± 5
Air circuit parameters with EGR inhibited					
Turbo pressure setting (mbar)		994 ± 40	1023 ± 40	1153 ± 40	1464 ± 40
Turbo pressure measured (mbar)		1041 ± 40	1170 ± 40	1341 ± 110	1300 ± 70
Turbo electrovalve opening control (%)		73 ± 5	68 ± 5	55 ± 5	37 ± 5
EGR throttle opening control (%)		0	0	0	0
EGR throttle position copy opening control (%)		0 + 1	0 + 1	0 + 1	0 + 1
Inlet air heater throttle opening control (%)		0	0	0	0
Inlet air heater throttle position copy opening control (%)		0 + 1	0 + 1	0 + 1	0 + 1
EGR valve position setting (%)					
EGR valve opening control (%)					
EGR valve position copy opening control (%)					
Air flow reference value (mg/stroke)		210 ± 20	211 ± 20	386 ± 20	516 ± 20
Air flow measured (mg/stroke)		361 ± 30	427 ± 30	462 ± 60	497 ± 60

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EDC16 C34 with DV6 TED4					
Parameters	**Cranking engine**	**Idling**	**$1500^{\pm 50}$ rpm**	**$2500^{\pm 50}$ rpm**	**$4000^{\pm 50}$ rpm**
Air circuit parameters with EGR					
Turbo pressure setting (mbar)		$1005^{\pm 40}$	$1029^{\pm 40}$	$1176^{\pm 40}$	$1482^{\pm 40}$
Turbo pressure measured (mbar)		$1018^{\pm 50}$	$1047^{\pm 50}$	$1282^{\pm 50}$	$1306^{\pm 80}$
Turbo electrovalve opening control (%)		$72^{\pm 5}$	$68^{\pm 5}$	$56^{\pm 5}$	$37^{\pm 5}$
EGR throttle opening control (%)		0	0	0	0
EGR throttle position copy opening control (%)		0^{+1}	0^{+3}	0^{+1}	0^{+1}
Inlet air heater throttle opening control (%)		0	0	0	0
Inlet air heater throttle position copy opening control (%)		0^{+1}	0^{+1}	0^{+1}	0^{+1}
EGR valve opening control (%)		$51^{\pm 30}$	$55^{\pm 30}$	$28^{\pm 30}$	0
EGR valve position copy opening control (%)		$51^{\pm 30}$	$58^{\pm 30}$	$28^{\pm 30}$	0
Air flow reference value (mg/stroke)		$214^{\pm 50}$	$221^{\pm 50}$	$398^{\pm 50}$	$516^{\pm 50}$
Air flow measured (mg/stroke)		$197^{\pm 50}$	$220^{\pm 50}$	$391^{\pm 50}$	$473^{\pm 50}$

1) Beyond 1 to 6 minutes (depending on the system) operation at idle, the engine ECU cuts off the EGR function! By changing the engine speed, the EGR phase will cut in again.

2) The air flow reference value, outside the EGR zone, on certain ECU software, corresponds to a value "with EGR". The airflow measured does not follow the setting. This is normal!!

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2.4. DEFINITION OF PARAMETERS (LEXIA)

Fuel pressure setting (bar)

Theoretical pressure to be reached in the high pressure common rail. It is calculated by the engine ECU based on different data such as (engine speed, load, injection flow, etc.).

Fuel pressure measured (bar)

Parameter determined by the engine ECU on the basis of the information supplied by the rail high pressure sensor.

Note: The "measured fuel pressure" parameter must be in line with the "fuel pressure setting". Fuel pressure is regulated in a closed loop.

Fuel flow regulator opening control (VCV) OCR (%)

Signal transmitted by engine ECU to the fuel flow regulator located on the high pressure pump.

Note: The higher the fuel pressure reference setting, the higher the fuel flow regulator opening control OCR (%), the greater the quantity of fuel compressed by the HP pump and the more the fuel pressure measured must increase.

Turbo pressure setting (mbar)

Theoretical pressure to be reached in the inlet manifold. It is calculated by the engine ECU as a function of various information such as: engine speed, load and atmospheric pressure…

Note: the value indicated is expressed as an absolute value[2]. A turbo pressure setting that is equal to atmospheric pressure indicates zero turbocharger.

Turbo pressure measured (mbar)

Parameter determined by the engine ECU on the basis of the information supplied by the inlet air pressure sensor located on the inlet manifold.

Note: the value indicated is expressed as an absolute value. A turbo pressure setting that is equal to atmospheric pressure indicates zero turbocharger. The “turbo pressure measured“ parameter must be in line with the "turbo pressure setting". Turbo pressure regulation is carried out in a closed loop, *except during the exhaust gas recycling phases*.

Turbo electrovalve opening control (%)

Signal transmitted by the engine ECU to the electrovalve which controls the turbocharger in order to control the turbo variable geometry system. The OCR must enable the turbo position setting to be achieved.

Note: the percentage transmitted is proportional to the desired turbo pressure, as a function of engine speed. A high OCR generates major electrovalve opening and therefore a small gas exhaust port cross-section, which increases the turbo charging pressure. However, as the engine speed increases, the exhaust gas is sufficient for the pressure setting to be achieved without needing to be accelerated by turbo geometry variation. The variable geometry system is above all used when high torque is required at low and mid-range engine speeds.

[2] **Absolute value, $P_{atmo} \approx 1013$ mbar.**

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EGR throttle opening control
Signal transmitted by the engine ECU to the electrovalve which operates the EGR throttle valve in order to control its closure.

Note: The percentage is proportional to the throttle closure. At rest, this valve is open. A high OCR value generates a high valve closure and vice versa. This throttle valve is used in the EGR function but also each time the engine is shut off in order to counter crankshaft assembly inertia and thus reduce vibration (damping function). It can also be used during FAP regeneration (regulation function). 0% = > fully open; 100% => closed.

EGR throttle position copy opening control (%)
Parameter determined by the engine ECU on the basis of the data supplied by the EGR throttle position sensor incorporated into the EGR throttle valve.

Note: This parameter must be in line with the "EGR throttle opening control". The EGR throttle valve position is managed in a closed loop.

Inlet air heater throttle opening control (%)
Signal transmitted by the engine ECU to the electrovalve which operates the inlet air heater throttle valve in order to control its opening.

Note: This throttle valve is used only in the particle filter function. This throttle valve is normally closed.
0% = > closed; 100% => fully open.

Inlet air heater throttle position copy opening control (%)
Parameter determined by the engine ECU on the basis of the data supplied by the inlet air heater throttle valve position sensor incorporated into the inlet air heater throttle valve.

Note: This parameter must be in line with the "inlet air heater throttle opening control". The EGR throttle valve position is managed in a closed loop.

EGR valve position setting (%)
Theoretical opening of the EGR valve to be achieved. It is calculated by the engine ECU as a function of engine speed, load and temperatures…

Note: The gas recycling rate is determined by the air flow setting. If the air flow setting is not reached, the ECU modifies the EGR valve position setting so that the required air flow is achieved.
Example: the air flow measured to too low in relation to the expected air flow setting: the engine ECU reduces the EGR valve position setting to admit less exhaust gas and therefore more air.

EGR valve opening control (%)
Signal transmitted by the engine ECU to the EGR electrovalve in order to adjust its opening. The OCR must enable the EGR valve position setting to be achieved.

Note: The valve is normally closed (at rest). 0% = > closed; 100% => fully open. The valve is closed by means of a spring and by inverting polarity on the motor terminals. The signal to close the valve by inverting polarity is not visible in parameter measurements.

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EGR valve position copy opening control (%)

Parameter determined by the engine ECU on the basis of the information supplied by the EGR valve position sensor incorporated into the EGR electrovalve.

Note: this parameter must be in line with the "EGR valve position setting". The EGR valve position regulation is carried out in a closed loop.

Air flow reference value (mg/stroke)

The theoretical value to be reached, calculated by the engine ECU. This gives the theoretical mass of air circulating through the flowmeter during the measurement cycle, to obtain the best compromise between pollution and driveability.

Note: The air flow setting parameter is inversely proportional to the amount of exhaust gas recycled.

Air flow measured (mg/stroke)

Parameter calculated by the engine ECU on the basis of the information supplied by the air flowmeter located on the inlet manifold duct.
This represents the mass of air passing through the air flowmeter during the measurement cycle.

Note: The air flow measured parameter must comply with the air flow reference value in order to carry out “closed loop” EGR control. The difference between the air flow measured and the air flow reference value leads to an EGR valve position setting in order to adapt the air flow measured to the air flow reference value.

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3. DV6 TED4 EDC16C34 FUEL CIRCUIT

3.1. Fuel circuit diagram

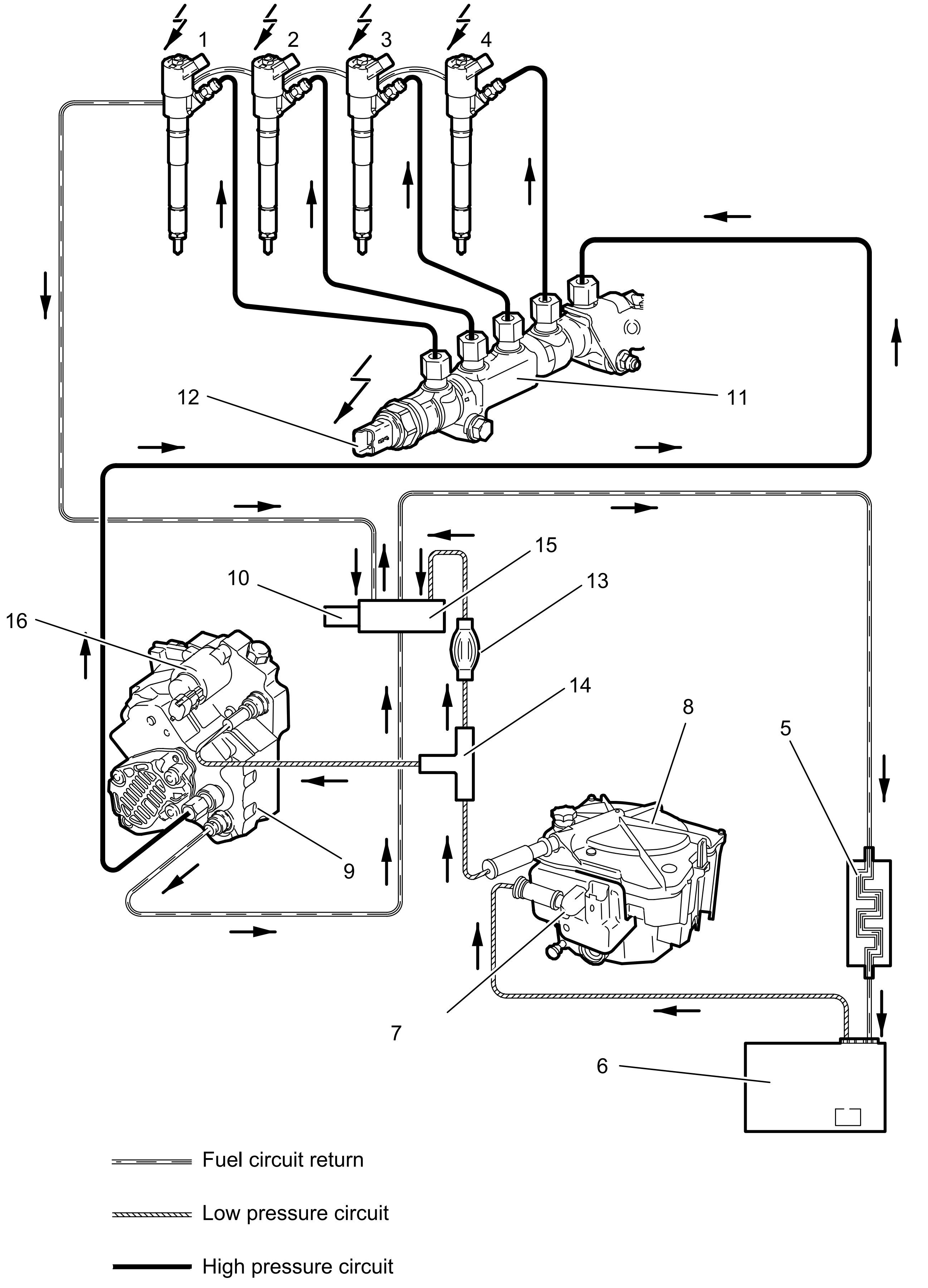

Figure 4 : DV6 TED4 (EDC 16 C34) Fuel circuit

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Components		
Identifier	**Description**	**Electrical references**
1 to 4	Diesel injectors (electro-hydraulic)	1131 - 1132 - 1133 - 1134
5	Fuel cooler	-
6	Fuel tank	-
7	Water in diesel sensor (depending on version)	4050
8	Fuel filter and water in fuel filter	-
9	Fuel high pressure pump	-
10	Fuel temperature sensor	1221
11	High pressure common injection rail	-
12	Fuel high pressure sensor	1321
13	Manual fuel primer pump	-
14	T coupling	-
15	4 channel union (3 inputs, 1 output)	-
16	Fuel flow regulator (VCV)	1208

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3.2. COMPONENT CHARACTERISTICS

3.2.1. Fuel flow regulator (MPROP) (electrical reference: 1208 or 1277)

Electrical characteristics

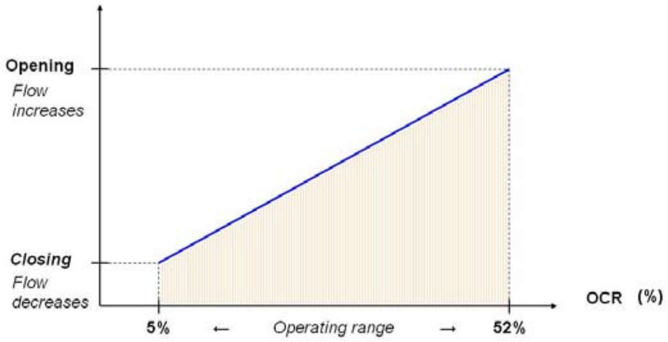
Connector view
Component side

Pin 1 - 12 V power supply

Pin 2 - Earth controlled by engine ECU (OCR)

Resistance at 20°C

$3^{\pm 2}\,\Omega$



Observation: this electric valve is « normally closed »

Possible fault codes

Fault	Fault code	Detection thresholds	Detection with +APC	Detection with starter motor on	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short circuit to earth = CP1H opening	P0003	/	/	/	/			●	Engine cut off	when the ignition is switched off
Short circuit to + ve = CP1H closure	P0004	/	/	/	/			●	Engine cut off	when the ignition is switched off
Open circuit	P0001	/	/	/	/			●	Engine cut off	when the ignition is switched off
Inconsistency of control current measurement - max	P0002	Current consumed > threshold	/	/	/			●	/	As from return into tolerances
Inconsistency of control current measurement - min	P0002	Current consumed < threshold	/	/	/			●	/	As from return into tolerances

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3.2.2. High pressure fuel sensor (electrical reference: 1321)

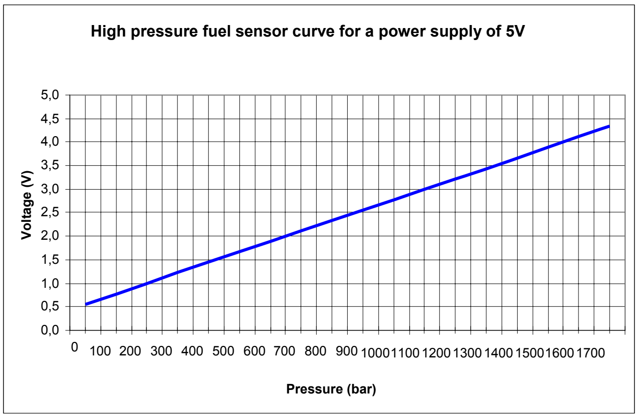
Electrical characteristics

Connector view
Component side

Pin 1 - 0 to 5 V Analogue signal

Pin 2 - Earth

Pin 3 - 5V power supply



Possible fault codes

Fault	Fault code	Detection thresholds	Detection with +APC	Detection with starter motor on	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to earth	P0193	>4,75V	/	/	/		●	●	Engine cut off	Ignition turned off
+short circuit or open circuit	P0192	<0,25V	/	/	/		●	●	Engine cut off	Ignition turned off
Rail pressure measured lower than setting	P0087	Delta > 350 bar if < 800 rpm delta> 200 bar if > 800 rpm	Engine running		/			●	/	Ignition turned off
VCV OCR too high in relation to rail pressure	P0093	Rail pressure < min threshold depending on engine speed and OCR	Engine running		/			●	Engine cut off	Ignition turned off
VCV OCR too low in relation to rail pressure	P0088	Rail pressure > max threshold depending on engine speed and OCR	Engine running		/			●	/	Ignition turned off
Rail pressure < min.	P1113	Depends on engine speed	Engine running		/			●	Engine cut off	Ignition turned off
Rail pressure > max.	P1166	/	Engine running		/			●	Engine cut off	Ignition turned off

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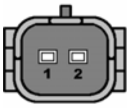
3.2.3. Fuel temperature sensor (electrical reference: 1221)

Electrical characteristics

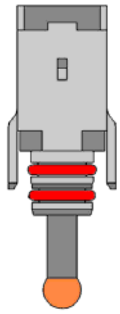
Connector view
Component side

Pin 1 - Signal (0 to 5 volts)

Pin 2 - Earth



Temperature (°C)	Resistance min (Ω)	Resistance max (Ω)
-40	79000	109535
-30	41255	55556
-20	22394	29426
0	7351	9247
20	2742	3323
40	1141	1338
60	522	595
80	259	288
100	138	150
120	77	83
130	59	64



Possible fault codes

Fault	Fault code	Detection thresholds	Detection with +APC	Detection with starter motor on	Required detection period	Accel. idling 1200 rpm	E. speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Engine cut-off indicator light	Replacement value or fall-back strategy	Condition for disappearance
Open Circuit or Short Circuit to +ve	P0183	T° C < -50° C	/	/	/	/				90°C	As from return into tolerances
Short Circuit to –ve	P0182	T° C > -150° C	/	/	/	/				90°C	As from return into tolerances

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3.3. FUEL CIRCUIT CHECKS

3.3.1. Precautions, instructions and prohibited operations

Certain precautions must be taken before any operation. These precautions concern operator and system safety and also authorised operations.

It is essential to consult the following service documentation:

- **SAFETY INSTRUCTIONS: HDI DIRECT INJECTION SYSTEM**
- **SAFETY AND HYGIENE INSTRUCTIONS: PRIOR TO ANY OPERATION**
- **SAFETY AND HYGIENE INSTRUCTIONS: PARTICLE FILTER**
- **PROHIBITED OPERATIONS: HDI DIRECT INJECTION SYSTEM**

3.3.2. General checks

Before implementing a method or carrying out a specific check, it is strongly recommended:-

- to carry out a visual inspection of the condition of the fuel circuit hoses (high and low pressure),
- to ensure that there is a sufficient quantity of fuel in the tank,
- to be sure of the quality of fuel in the tank.

3.3.3. Low pressure circuit

a) Supply pressure check

Consult the low pressure circuit checking procedure which is available in the service documentation (Citroën Service). **CHECK**: **LOW PRESSURE FUEL SUPPLY CIRCUIT**

b) Checking the vane pump flow

Tools required: toolkit H.1613L (part no. 9780 N2)
Disconnect the HP pump return tube.
Connect the bottle (containing level indications) (H1613L).

Crank up the engine and allow it to idle for 30 seconds.
Average flow measured: $Flow_{average}$ = 250 ml, or 500 ml in a minute.

Flow when starter motor is activated for 15 seconds.
Average flow measured: $Flow_{average}$ = 120 ml, or 480 ml in a minute.

Figure 5 : Checking HP pump flow (EDC16 C34)

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3.3.4. High pressure circuit

a) Maximum pressure check

If the engine is operational, it is possible to check the entire high pressure circuit by using the diagnostic tool during a (dynamic) road test.
By reading the "fuel pressure measured" parameter, it is possible to know if, when the engine is under load, the system is able to provide maximum pressure.
On a flat road or on a slight upwards slope, from an engine speed of approximately 2000 rpm in a gear ≥ 3rd, accelerate hard (foot right down) to 4000 rpm.
The pressure measured must be around1500 bar, as outlined in chapter **§ "2.2 Full load dynamic testing " p 63**

b) Flow regulator

Seal test:
With the engine running, disconnect the VCV. The engine should stop (VCV normally closed). If this is not the case, change the HP pump (if the PCV is not available separately as a spare part).

Using the diagnostic tool:
The diagnostic tool is used to carry out the following checks:
in parameter measurements, when the starter motor is activated, check that the OCR control signal is $26^{\pm 5}$ % (this check is useful when the engine will not start),in actuator tests, activate the component and listen to the noise it makes, in oscilloscope mode, using the break-out box and interface cables, measure the control voltage transmitted by the ECU when the starter motor is activated or with the engine idling, in multimeter mode, using the break-out box and interface cables, check line resistance and resistance of the component at ECU and BSM terminals. The value should be: $3^{\pm 2}\,\Omega$.

Checking the control signal using the oscilloscope with the starter motor actuated is a useful check if the engine will not start.

Reference Curve:

Engine speed: idling
Coolant temperature: > 80° C

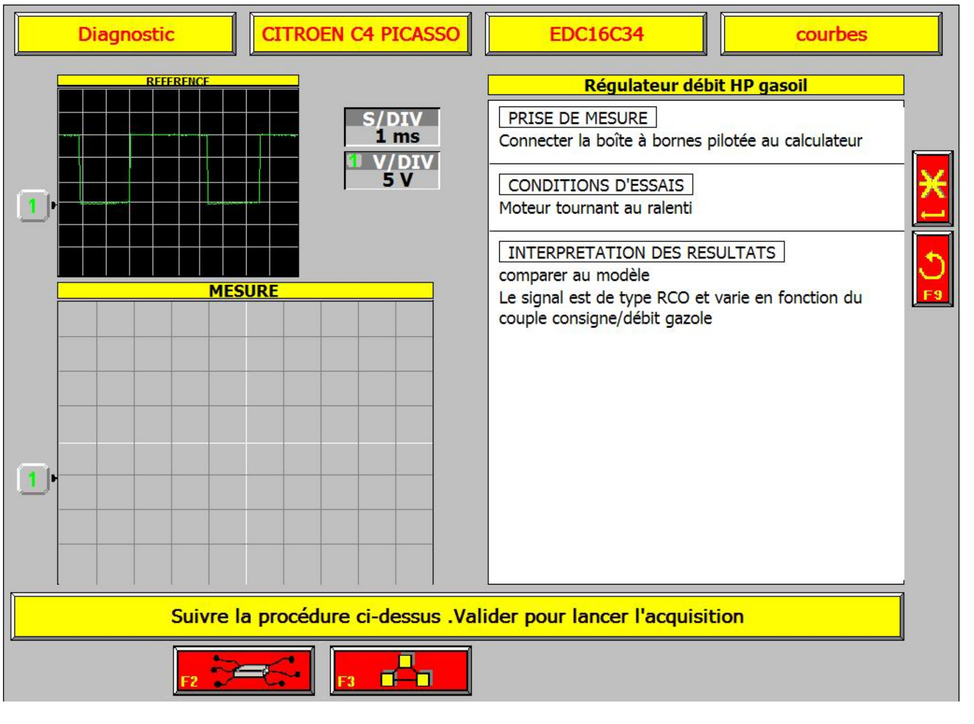

Figure 6 : VCV reference curve (EDC16 C34)

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Engine speed: with starter motor activated

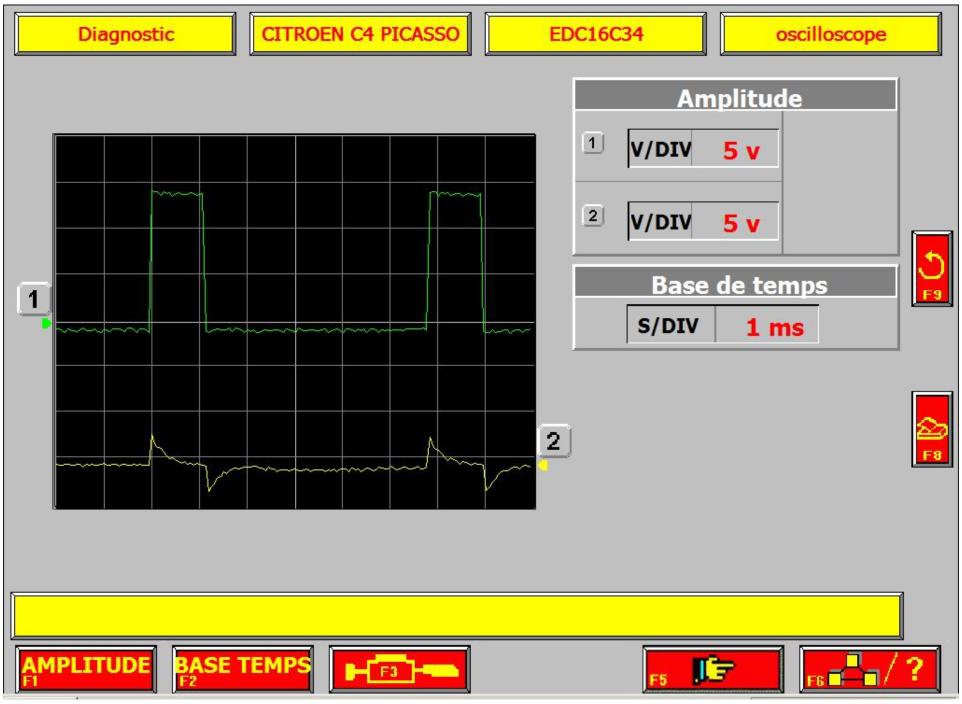

Figure 7 : VCV curve with starter motor activated (EDC16 C 34)

Harness electrical checks: (components disconnected)

- continuity
- insulation.

c) Fuel high pressure sensor

If the sensor is faulty, the engine will not start.

Harness electrical checks: (components disconnected)

- continuity
- insulation.

d) HP pipes

Use the manufacturer's recommended methods.

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e) Injectors

Injector return flow check:
Apply the "**FUEL HIGH PRESSURE CIRCUIT CHECK**" procedure.

Carry out the return flow check with the engine idling, as recommended, and then at 2500 rpm.

Using the diagnostic tool:
Using the injector flow correction parameter, it is possible to check the output of each cylinder.
At low engine speeds, the ECU corrects the flow in each injector in order to achieve consistent engine flywheel rotation (elimination of vibration).
This correction is accessible in measurement parameters, "fuel circuit data" under "cylinder injector X flow correction (mg/stroke)".
The system tolerates a correction of ± 5mg/stroke per injector.

In order to determine of the problem is caused by the injector or by the cylinder:
- disconnect each injector one by one to determine the defective cylinder,
- change the cylinder injector and carry out a new parameter measurement.

If the problem is now found on the other cylinder, the injector is causing the lack of power.
If the problem remains on the same cylinder, the injector is not at fault and troubleshooting will then concentrate on the mechanical components.
It will then be necessary to carry out additional compression checking as outlined in the "**CHECKING COMPRESSION RATE**" procedures.

<u>Reference Curve:</u>

Engine speed: idling
Coolant temperature: > 80° C

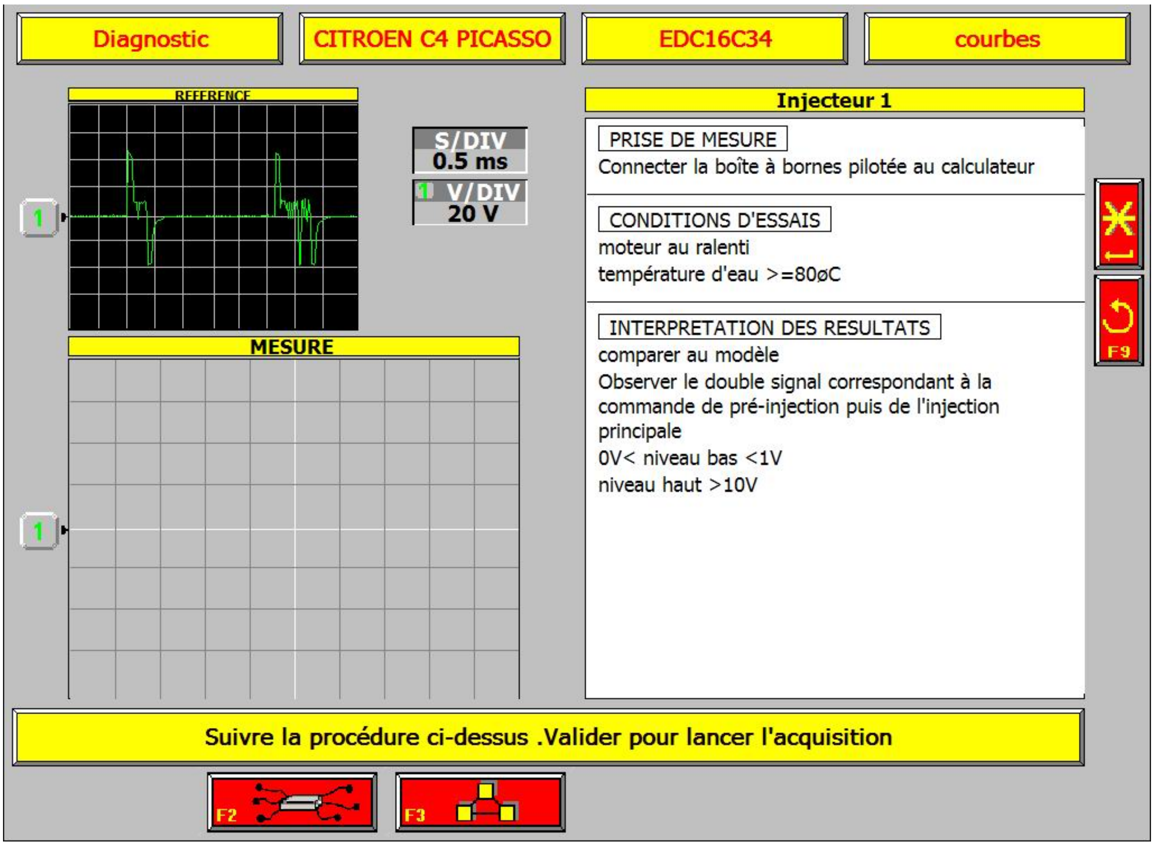

Figure 8 : Injector reference curve (EDC16 C34)

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Diagnostic tool parameter definitions:
Fuel flow correction (mg/stroke) :
Parameter calculated by the engine ECU during the idling phase, this is cylinder balancing.
This gives the flow correction applied to each injector. This correction is added or subtracted from the total theoretical flow in order to compensate for the rotation differences in each cylinder.

Note:
- Cylinder balancing is de-activated for an engine speed of over 1500 rpm.
- a flow difference in excess of "± 5 mg/stroke " in relation to the nominal rate, 0, is considered to be abnormal but not necessarily attributable to the injector.

Component electrical checks:
Using a multimeter, it is possible to check resistance: 0.5 Ω at approximately 20° C, 30 minutes (at least) after the engine has been switched off.

⚠	In order to be sure that the diagnostics are accurate, the above checks may be completed by the following procedure: **CHECK**: **FUEL HIGH PRESSURE CIRCUIT**

3.3.5. Return circuit

a) Return circuit pressure

Set up an assembly as illustrated below.
In the engine compartment, connect to the return pipe (green union) pressure gauge reference using interface 4218-T, then crank up the engine.
At idle, the pressure measured must be close to 0.

Figure 9: Fuel return pressure check (EDC16 C34)

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b) Diesel temperature sensor

Using the diagnostic tool:
In parameter measurements, check the value used by the engine ECU. When the engine is cold, the fuel and coolant temperatures must be identical. If in doubt, compare with an ohmmeter measurement (see table of values in the chapter entitled "component characteristics").

Diagnostic tool parameter definitions:
Fuel temperature (°C) :
Parameter determined by the engine ECU on the basis of the information supplied by the fuel temperature sensor located on the fuel return line.

Harness electrical checks: (components disconnected)
- continuity
- insulation.

Note:
The engine ECU contains a fall-back strategy with respect to fuel temperature.
At full load, above a diesel temperature of 120°C, it limits fuel flow to prevent it from overheating.

c) Cooler

Check that no pipes are compressed and that there are no objects present which could hamper correct cooler operation.

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4. DV6 TED4 EDC16C34 AIR CIRCUIT

4.1. Double metering system air circuit diagram

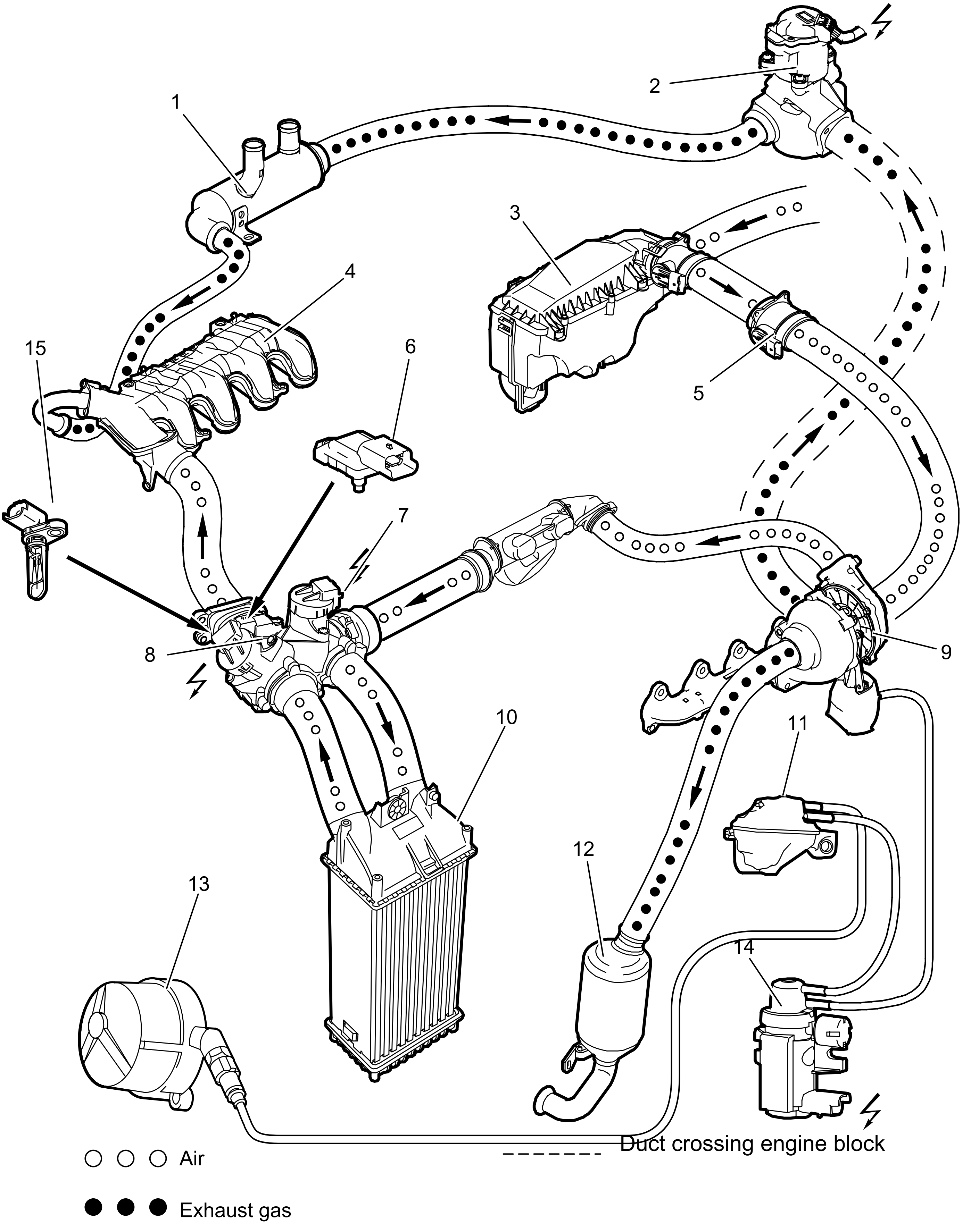

Figure 10 : Air circuit, double metering system (EDC16 C34)

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Components		
No.	**Description**	**Electrical reference**
1	EGR cooler	--
2	EGR control electrovalve.	1297
3	Air filter	--
4	Air inlet manifold	--
5	Air flowmeter	1310
6	Inlet air pressure sensor (turbo charging)	1312
7	Inlet air heater throttle valve	1361
8	EGR throttle flap valve	1362
9	Variable geometry turbocharger	--
10	Intercooler	--
11	Vacuum reservoir	--
12	Catalyser and Particle Filter	--
13	Vacuum pump	--
14	Turbo pressure control electrovalve	1233
15	Inlet Air Temperature Sensor	1240

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4.2. Single metering system air circuit diagram

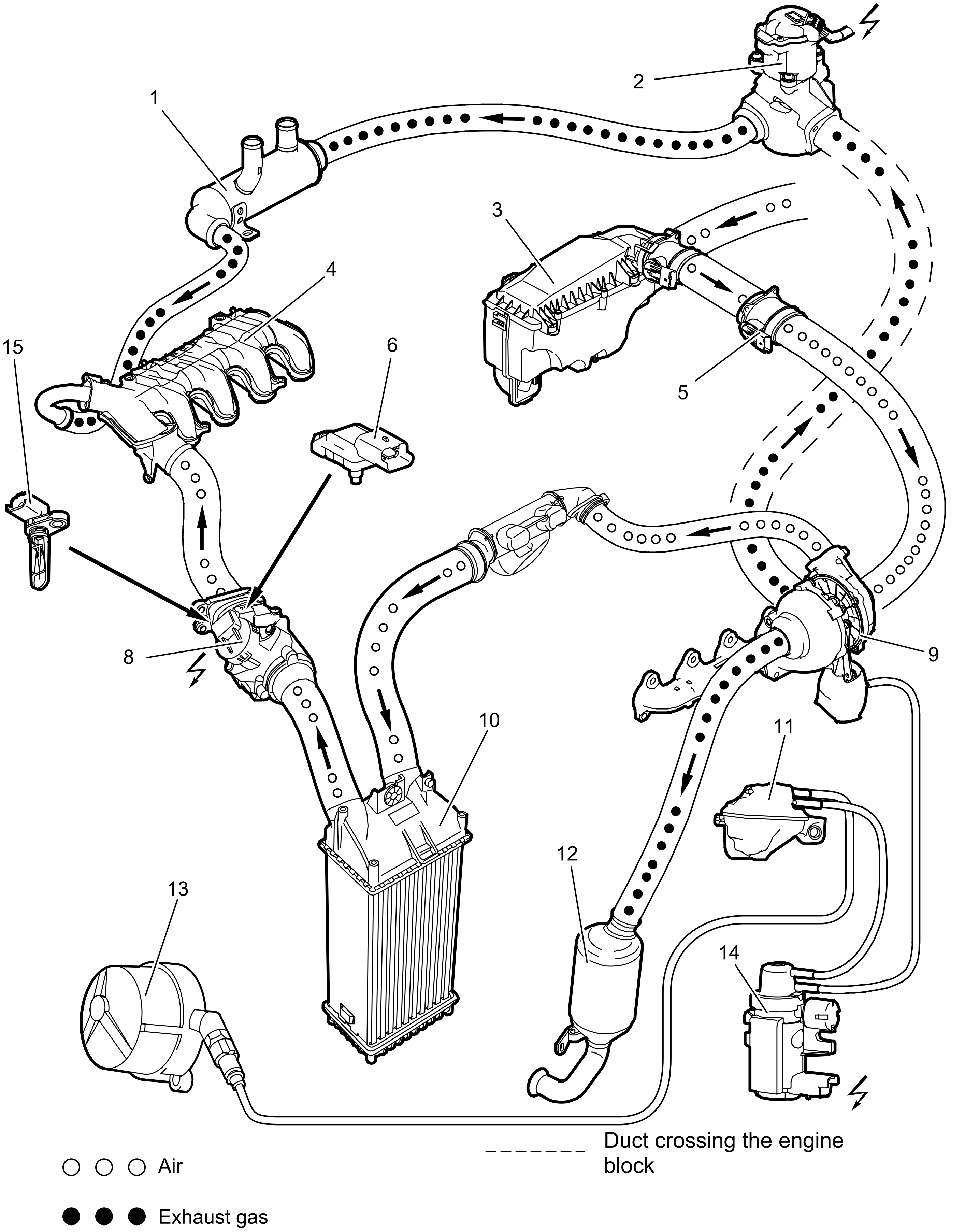

Figure 11 : Air circuit, single metering system (EDC16 C34)

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Components		
No.	Description	Electrical reference
1	EGR cooler	--
2	EGR control electrovalve.	1297
3	Air filter	--
4	Air inlet manifold	--
5	Air flowmeter	1310
6	Inlet air pressure sensor (turbo charging)	1312
7	Inlet air heater throttle valve	1361
8	EGR throttle flap valve	1362
9	Variable geometry turbocharger	--
10	Intercooler	--
11	Vacuum reservoir	--
12	Catalyser and Particle Filter	--
13	Vacuum pump	--
14	Turbo pressure control electrovalve	1233
15	Inlet Air Temperature Sensor	1240

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4.3. COMPONENT CHARACTERISTICS

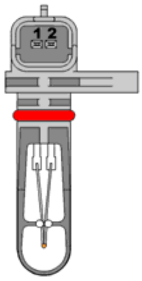
4.3.1. Inlet Air Temperature Sensor (electrical reference: 1240)

Electrical characteristics

Connector view
Component side

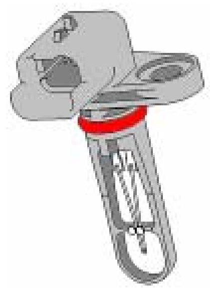
Pin 1 - Signal (0 to 5 volts)

Pin 2 - Earth



Resistance as a function of temperature

Temperature (°C)	Resistance min (?)	Resistance max (?)
-20	67728	75611
0	26682	29197
20	11702	12577
40	5612	5935
60	2904	3029
80	1604	1653
100	937	956
120	569	586
140	361	385
160	238	250



Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short-circuit to earth	P0097	< 0,15 V	/	/	500ms			●	50°c	/
+short circuit or open circuit	P0098	> 4,9 V	/	/	500ms			●	50°c	/

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4.3.2. Inlet Air Pressure Sensor (electrical reference: 1312)

*

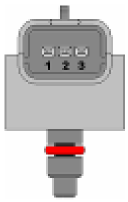
Electrical characteristics

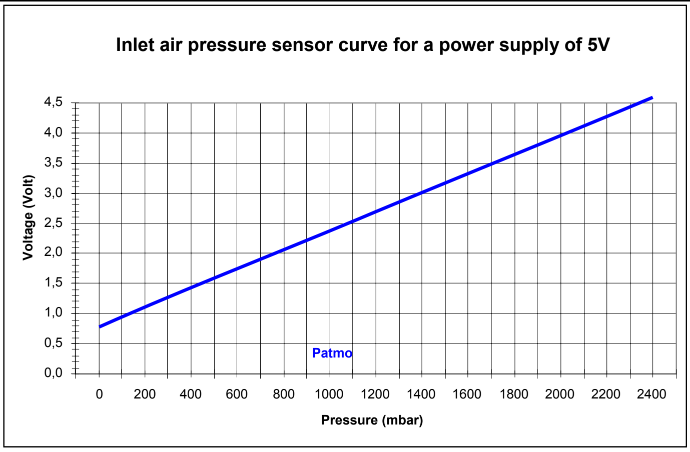
Connector view
Component side

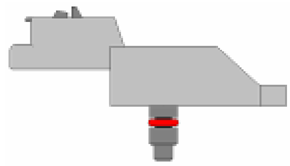
Pin 1 - 5V power supply

Pin 2 - Earth

Pin 3 - 0V to 5 V signal







Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
SC to +ve	P0238	>4,8v	/	/	1,2v		●	●	- overall regulation in open loop replacement value = atm. pressure - EGR cut off	As from return into tolerances
short-circuit to earth or open circuit	P0237	<0,9v	/	/	0,8s		●	●	- overall regulation in open loop replacement value = atm. pressure - EGR cut off	As from return into tolerances
Inconsistent with atmos' pressure	P0069	>120mbar	/	/	10s		●	●	- overall regulation in open loop replacement value = atm. pressure - EGR cut off	As from return into tolerances
***Measured pressure too low / setting**	P0299	>400 mbar	/	/	10s				Turbo reg. cut off	As from return into tolerances
***Measured pressure too high / setting**	P0234	>150 mbar.	/	/	10s		●	●	Turbo reg. cut off	As from return into tolerances

* Difference between pressure measured and pressure setting checked in the following load and engine speed conditions: above 32 mm3/stroke and 1800 rpm.

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4.3.3. Air flowmeter and air temperature sensor (electrical reference: 1310)

Electrical characteristics

Connector view
Component side

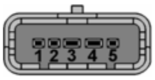
Pin 1 - Air temperature analogue signal (0 to 5 V)

Pin 2 - Earth

Pin 3 - *Not used*

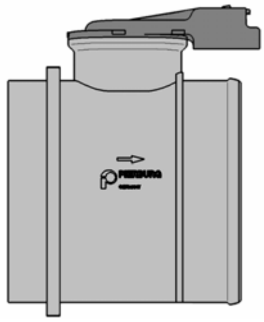
Pin 4 -12 V power supply

Pin 5 - Air flow frequency signal (0 to 5 V)



Resistance as a function of temperature

Temperature (°C)	Resistance min (Ω)	Resistance max (Ω)
-40	47760	51342
-20	15628	16441
0	5846	6074
25	2000	2060
40	1128	1166
60	564	587
80	302	316
120	103	110
140	64,8	70



Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Supply voltage too high	P1590	>17 V	/	/	1s			●	EGR cut off	As from return into tolerances
Supply voltage too low	P1589	<7,2 V	/	/	1s			●	EGR cut off	As from return into tolerances
Min frequency (=high flow)	P0103	Signal period = 1ms (=500 kg/h)	/	/	1.2s			●	EGR cut off	As from return into tolerances
Max frequency (=low flow)	P0102	Signal period = 1µs (= 9 kg/h)	/	/	1.2s			●	EGR cut off	As from return into tolerances
- +Short-circuit, -S/c or open-circuit	P0104	Signal : Min or max voltage threshold exceeded	/	/	1.2 s			●	EGR cut off	As from return into tolerances
***Air flow too high during deceleration**	P3008	Flow rate measured is higher than maximum admissible with foot off acc. pedal	/	/				●	EGR cut off	As from return into tolerances
***Air flow too low during deceleration**	P3007	Flow rate measured is lower than maximum admissible with foot off acc. pedal	/	/	10s			●	EGR cut off	As from return into tolerances
Max admissible air flow exceeded	P0100	Value measured exceeds max calibrated value	/	/	2s				EGR cut off	As from return into tolerances
SC –ve inlet air temp	P0112	**Voltage too low or T° C < - 40° C**	/	/	0.5s			●	**> without FAP: =** 50° C. **> with FAP: =** outside T° C	As from return into tolerances
SC + ve inlet air temp	P0113	**Voltage too high or T°C >130° C**	/	/	0.5s			●	**> with FAP: =** 50° C. **> with FAP: =** outside T° C	As from return into tolerances

* This troubleshooting operation is carried our when decelerating between 1400 and 2400 rpm when the engine is warm. The air flow is compared with the setting. There must not be a difference of greater than 25%.

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4.3.4. Turbo pressure electrovalve (electrical reference: 1233)

Electrical characteristics

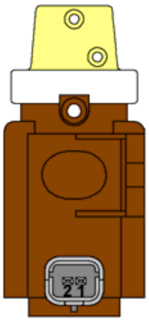
Connector view
Component side

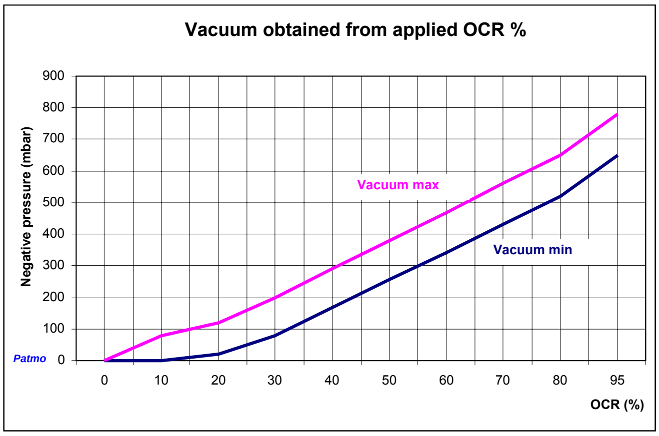
Pin 1 - 12 V power supply

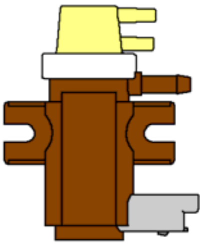
Pin 2 - Earth controlled by the engine ECU
OCR from 0 to 100%

Resistance at 20°C

15,5 ± 0,7 Ω







Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Short Circuit to +ve	P0246	/	/	/	2 s				OCR = 5%	Next engine crank-up
Short circuit to -	P0245	/	/	/	2 s		●	●	OCR = 5%	Next engine crank-up
Open circuit	P0243	/	/	/	2 s				OCR = 5%	Next engine crank-up

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4.3.5. Electric EGR throttle valve (electrical reference: 1362)

Electrical characteristics

Connector view
Component side

Pin 1 - 5 V sensor power supply

Pin 3 - Actuator 12 V power supply

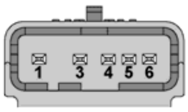
Pin 4 - Earth controlled by the engine ECU
OCR from 0 to 100%

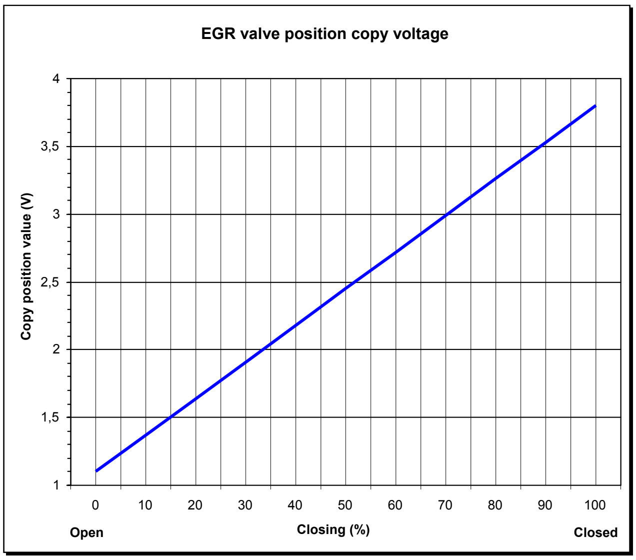
Pin 5 - Sensor earth

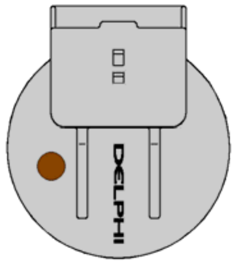
Pin 6 - Sensor signal

Actuator resistance at 20° C

2,7 Ω







Observation : The EGR throttle valve is normally open

Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Actuator SC = valve closed	P2141	/			200ms		●	●	**EGR cut off**	/
Actuator SC +ve = valve open	P2142	/			2s				**EGR cut off**	Next engine crank-up
Actuator O/C = valve open	P1471	/			200ms				**EGR cut off**	Next engine crank-up
***Feedback* SC-ve**	P0122	< 0.1 V			250ms			●	/	/
***Feedback* CO ou CC+**	P0123	> 4.75 V			250ms			●	/	/
***Feedback* Valve blocked**	P2111	Opening or closure time too long	During power latch		4s				/	/
***Feedback* Valve blocked**	P1161	/	Engine running		2s				/	/
***Feedback* signal lower than setting**	P0487	30 %	Engine running		10s		●	/	/	
***Feedback* signal higher than setting**	P0488	10 %	Engine running		10s		●	/	/	

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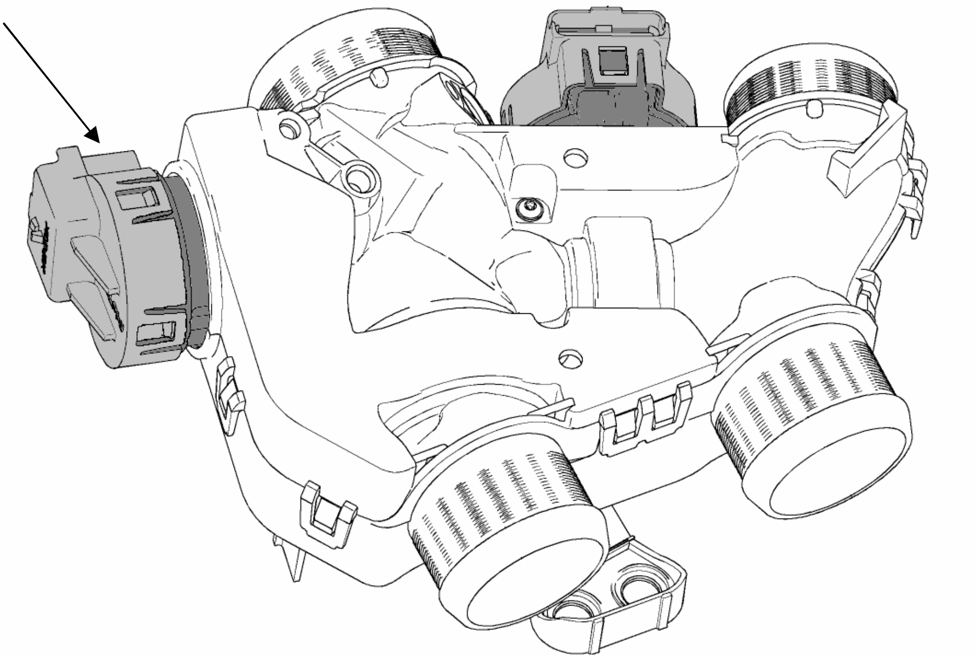
View of the component

Electric EGR throttle valve



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4.3.6. Inlet air heater electrovalve (RAA) (electrical reference: 1361)

Electrical characteristics

Connector view
Component side

Pin 1 - 5 V sensor power supply

Pin 3 - Actuator 12 V power supply

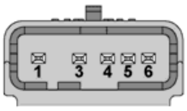
Pin 4 - Earth controlled by the engine ECU
OCR from 0 to 100%

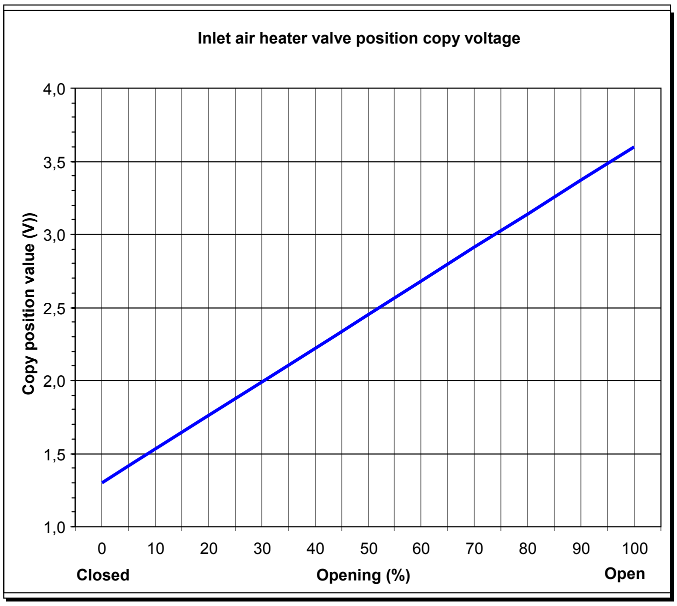
Pin 5 - Sensor earth

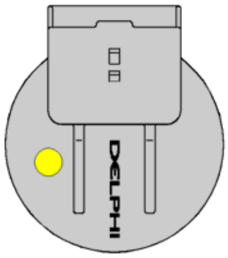
Pin 6 - Sensor signal

Actuator resistance at 20° C

2,7 Ω







Observation : The inlet air heater (RAA) throttle valve is normally open

Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Actuator SC + ve = valve closed	P2123	/			2s				/	/
Actuator SC -ve = valve open	P2122	/			200ms		●	●	EGR cut off	Next engine crank-up
Actuator open circuit = valve closed	P2124	/			200ms				/	/
***Feedback* OC or SC+**	P2128	> 4.75 V			250ms			●	/	/
***Feedback* SC-ve**	P2127	< 0.1 V			250ms			●	/	/
***Feedback* Valve blocked**	P1470	Opening or closure time too long	During power latch		4s			/	/	
***Feedback* Valve blocked**	P1152	/	Engine running		5s				EGR cut off	Next engine crank-up
***Feedback* signal lower than setting**	P2120	>30 %			10s				/	/
***Feedback* signal higher than setting**	P2121	>30 %			10s				/	/

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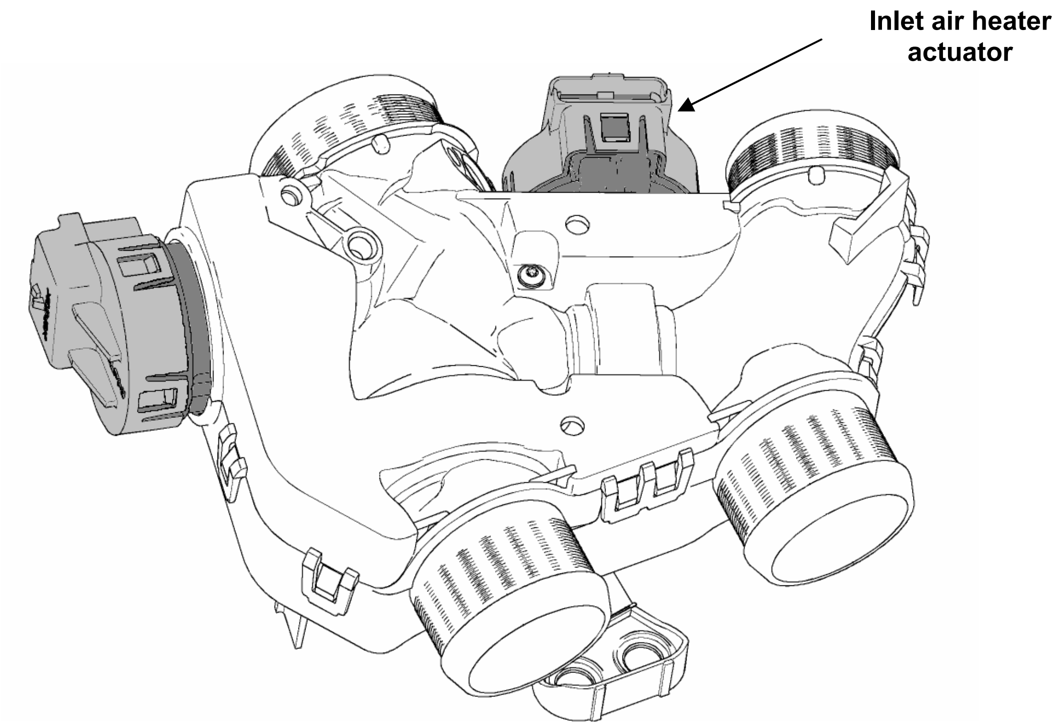
View of the component



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4.3.7. Electric EGR valve (electrical reference: 1297)

Electrical characteristics

Connector view
Component side

Pin 1 - 5 V sensor power supply

Pin 2 - In the opening phase, it is an earth
- In the controlled closure phase, it is a power supply (12 V)

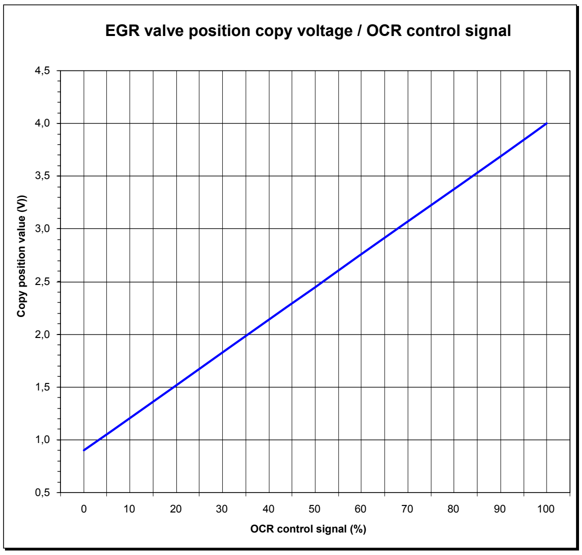
Pin 3 - In the opening phase, it is a power supply (12 V)
- In the controlled closure phase, it is an earth

Pin 4 - Sensor analogue signal (1 to 4 V)

Pin 5 - Sensor earth

Winding resistance:

10 Ω



Observation : this valve is "normally closed"

Possible fault codes

Fault	Fault code	Detection threshold	Detection with +APC	Detection cranking or engine running	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
Feedback voltage higher than threshold	P0406	> 4.7 V	/	/	250ms			●	EGR cut off	
Feedback voltage lower than threshold	P0405	< 0.5 V	/	/	250ms			●	EGR cut off	
Valve blocked	P0409	Opening or closure time too long	During power latch		4s			●	/	/
***Valve blocked**	P1162	/	Engine running		5s				/	/
+Short-circuit, or open-circuit	P2144	/	/	/	200ms				EGR cut off	with disappearance of the fault
Position measured too weak compared to setting	P0490	Delta > 30 %	Engine running		8 to 10 s				/	/
Position measured too strong compared to setting	P0489	Delta > 25 %	Engine running		8 to 10 s			●	/	/

* The cyclic ratio is modified by 10% (plus or minus depending on the direction of the loop delta) for 5 seconds. If the loop fault has not disappeared within 5 seconds, a valve blocked fault is flagged up.

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4.4. AIR CIRCUIT CHECKS

4.4.1. General checks

The air line begins at the air inlet and ends at the end of the rear silencer.
Air ingress, leakage or an obstacle in the air flow path at any point in the line may cause a fault in the air volume actually admitted to the engine, thus downgrading EGR and turbo functions.
THE FAULT CODES FOR ABNORMAL AIRFLOW OR PRESSURE MAY BE GENERATED FOR THE ABOVE-MENTIONED REASONS.

Prior to carrying out a specific check, conduct a visual check of the following components:

- **State of air filter:** remove air filter and inspect it. It must not show signs of deposits or any damage.

- **Air line state and seal:**
- the joints between the various couplings on the line must be sealed and clamps must be tightened,
- components on the air line (sensors, actuators) must be correctly secured,
- no cracks in the ducts,
- no signs of oil at joints (particularly the intercooler joints),
- No signs of excessive soot on the exhaust line joints (particularly upstream of the catalyser)

- **Pneumatic circuit condition and connections:**
- Check the vacuum circuit from the vacuum pump to the turbo electrovalve, then to its control pump, with particular attention to the quality of hose connections to couplings.
- Check that the hoses are attached to the correct couplings! (see electrovalve checks below).

- **State of electrical connections:** connectors must be correctly attached, no apparent damage on harness.

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4.4.2. Air flow plausibility check

Aim: to decide if the value measured by the airflow meter is consistent, taking into account the known operating conditions.

Using indicative values:
In parameter measurements, select "measured air flow" (see table of indicative values) and compare the measurements with the values given in the table). Conditions: test without load, engine coolant temperature > 80° , air filter in good condition, no power consumers, EGR valve or EGR throttle valve disconnected so as not to distort the value measured.

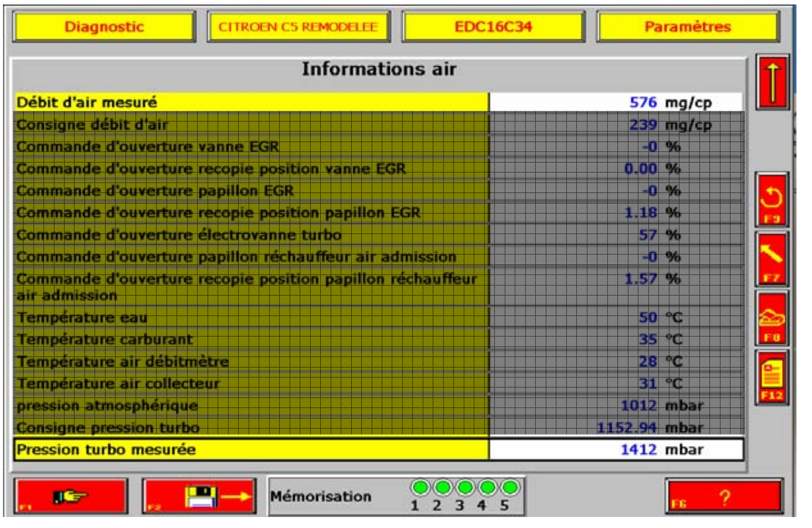
Without indicative values, a simple calculation can be made:
The method is the same as the one indicated in the Siemens chapter. Still, to improve the reliability of the measurement, accelerate to **2.000 rpm**.

<u>Example</u> *on the screen to the right, the measured air flow divided by the absolute pressure (in bar) is:*

576 / 1.412 = 407 mg/stroke

i.e. a value close to the cylinder displacement of a DV6 engine:

1560/4 = 390cm^3.



If the measured value is too low:

- ✓ the EGR valve may be remaining open,
- ✓ air ingress between the flow meter and the turbocharger is possible,
- ✓ an obstacle may be restricting air flow (intercooler or exhaust blocked, EGR throttle valve partially closed, hose compressed, etc)
- ✓ The air flowmeter data may be incorrect due to a fault in the harness or of the air flowmeter itself.

If the measured value is too high:

- ✓ air ingress after the turbocharger is possible (this fault will be more visible under load). In this case, to compensate for the lack of turbo pressure following the leak, the turbocharger is controlled to provide more air, which increases the value measured by the air flowmeter.
- ✓ The variable geometry turbocharger may remain in the "maximum turbocharger" position.
- ✓ The air flowmeter data may be incorrect due to a fault in the harness or of the air flowmeter itself.

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4.4.3. EGR system

a) EGR valve check

Seal test:
Measure the air flow value with the EGR valve disconnected (should be closed).
Then ensure that the EGR pipe that links the EGR valve to the inlet manifold is plugged. Use a flexible but resistant material **(see Figure 12: Plugging the EGR tube (EDC16 C34)**

Note: do not use a cloth or any other material likely to be sucked into the inlet.

Measure the air flow values again (the EGR valve is still disconnected)
Compare the air flow values measured, they should be identical. If not, the EGR valve is not sealed and must be replaced.

Figure 12: Plugging the EGR tube (EDC16 C34)

Checks with the diagnostic tool:
- In parameter measurements, check the value of the position feedback sensor. The value must be 0% when the ignition is on.
- Carry out an actuator test and listen to the valve noise.
- In oscilloscope mode, using the break-out box and interface harnesses, check the valve control voltage and the speed of the signal which is positive when open and negative when closed.
- In multimeter mode, using the break-out box and interface harnesses, check the electrical motor winding resistance = 10 Ω (brown connector disconnected) and the feedback sensor power supply = 5 V.

Electrical checks: (components disconnected)
- check continuity
- check insulation

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<u>Curve measured on the EGR valve position feedback</u>

With the engine idling, give a brief press on the accelerator.

Figure 13 : Signal measured on valve feedback (EDC16 C34)

<u>Curve measured on the EGR valve control signal</u>

With the engine idling, give a brief press on the accelerator.

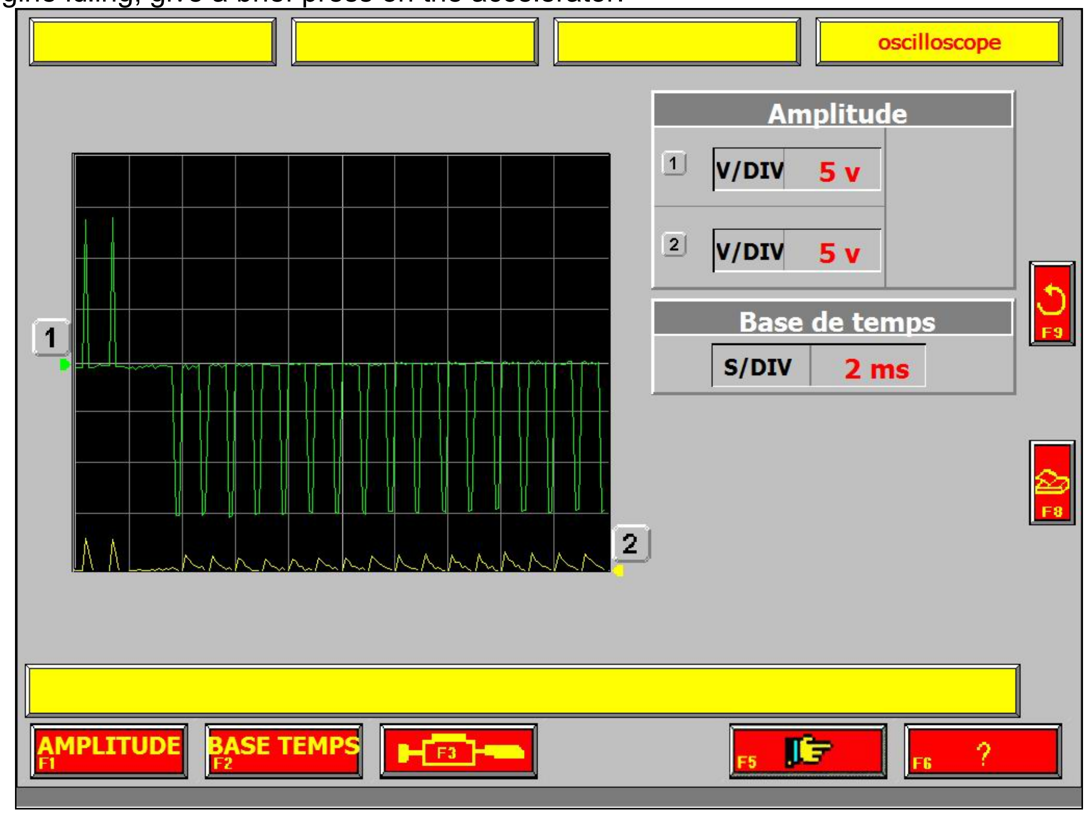

Figure 14 : Valve control signal measured (EDC16 C34)

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4.4.4. Turbo circuit

a) Maximum pressure measurement (see indicative value table)

Ensure that the system is able to deliver maximum pressure when the driver accelerates sharply, engine under load.
From approximately 2000 rpm, press foot flat down on the accelerator pedal in 3rd gear or above.
The values measured can be compared to those in the table in **§"2.2 Full load dynamic testing" p64.**
<u>Note</u>: the higher the gear engaged, the longer the turbo charging pressure is maintained at a high level, and this can be easily observed.

If the value observed is too low, the causes could be the following:-
- ✓ clogged air filter
- ✓ EGR valve has remained open (loss of turbocharger power)
- ✓ Air leak between the turbocharger and the engine
- ✓ Variable geometry blocked in the minimum turbo charging position (in this case, the engine lacks pick-up at low engine speeds)
- ✓ an obstacle may be restricting air flow (intercooler blocked, metering valve partially closed, hose compressed, etc)
- ✓ The turbocharger pressure sensor data may be incorrect due to a fault in the harness or in the sensor itself.
- ✓ Incorrect position feedback sensor data (actual variable geometry position < to the position measured due to a fault in the harness or the sensor itself).
- ✓ Turbocharger damaged (excessive play, vanes broken etc).

If the value observed is too high, the causes could be the following:-
- ✓ Variable geometry blocked in the maximum turbocharger position
- ✓ The turbocharger pressure sensor data may be incorrect due to a fault in the harness or in the sensor itself
- ✓ Incorrect position feedback sensor data (actual variable geometry position > to the position measured due to a fault in the harness or the sensor itself)
- ✓ Turbocharger damaged (micro sticking/jamming).

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b) Turbo pressure sensor check

Signal consistency:
Check consistency of the pressure value measured with a pressure gauge and that measured on the diagnostic tool, using toolkit C0171/2:

<u>Setting up the check:</u>

- Fit the inlet manifold pressure sensor (1) to tool C.0171-G2 (2).
- Connect the two parts of tool C.0171-G2 tool (2) to the pump (5), using the tubes (3).
- Position a plug on the T (4).

- Create pressure using the pump (5).
- Using the diagnostic tool, go into measurement parameters and check consistency between the pressure measured with the tool and that measured on the pump dial gauge (there is a 10 second window before a fault is logged and the default value displayed).

	The pump pressure gauge is calibrated to a given atmospheric pressure. Depending on atmospheric pressure variation, at rest, it is possible that the needle is not aligned exactly to zero. This variation must be taken into account when measuring!

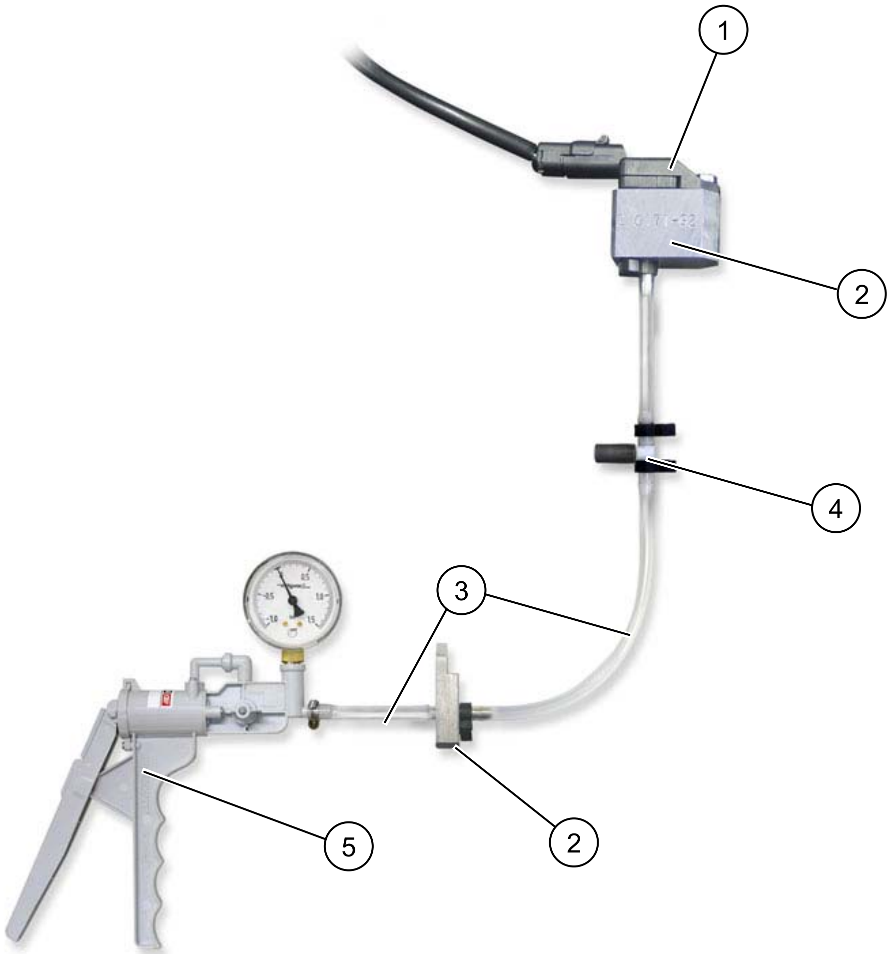

Figure 15 : Connection diagram for turbo pressure sensor check (EDC16 C34)

Electrical checks: (components disconnected)
- check continuity
- check insulation

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4.4.5. Other air circuit components

a) EGR throttle electrovalve

Checks with the diagnostic tool: (components disconnected)

- Check the control:
  - Perform an actuator test and listen to the throttle electrovalve (clicking).
  - In multimeter mode, with the BBP and the test harnesses, check the electric motor coil resistance = 3 Ω (brown connector disconnected) and the feedback sensor power supply = 5 V.

- Check the feedback line:
  - In Parameter Measurements, check the feedback position sensor value. This value must fall down to 0% with the ignition on.
  - Using the BBP and the test harnesses, check the sensor feedback voltage. Disconnect the air pipe from the intercooler (RAS) to the metering throttle valve body and manually fully close the EGR throttle valve **(ref Figure 16)** :

=> in parameter measurements, the value varies from 0 to 100 %

=> in voltmeter or oscilloscope mode, the voltage varies from 1.1 V to 3.8 V

Figure 16 : Manual operation of the EGR flap (EDC16 C34)

Electrical checks: (components disconnected)

- Check continuity
- Check isolation

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b) Inlet air heater throttle valve

Checks with the diagnostic tool: (components disconnected)

- Check the control:
  - Perform an actuator test and listen to the throttle valve (clicking).
  - In multimeter mode, with the BBP and the test harnesses, check the electric motor coil resistance = 5 Ω and the feedback sensor power supply = 5 V.

- Check the feedback line:
  - In Parameter Measurements, check the feedback position sensor value. This value must fall down to 0% with the ignition on.
  - Using the BBP and the test harnesses, check the sensor feedback voltage. Disconnect the air pipe from the intercooler (RAS) to the metering throttle valve body and manually fully open the inlet air heater throttle valve (RAA) (**ref Figure 17**) :
    - => in parameter measurements, the value varies from 0 to 100 %
    - => in voltmeter or oscilloscope mode, the voltage varies from 1.3 V to 3.6 V

Figure 17 : inlet air heater throttle valve (RAA) operation (EDC16 C34)

Electrical checks: (components disconnected)

- Check continuity
- Check isolation

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c) Turbocharger electrovalve

Checks with the diagnostic tool:

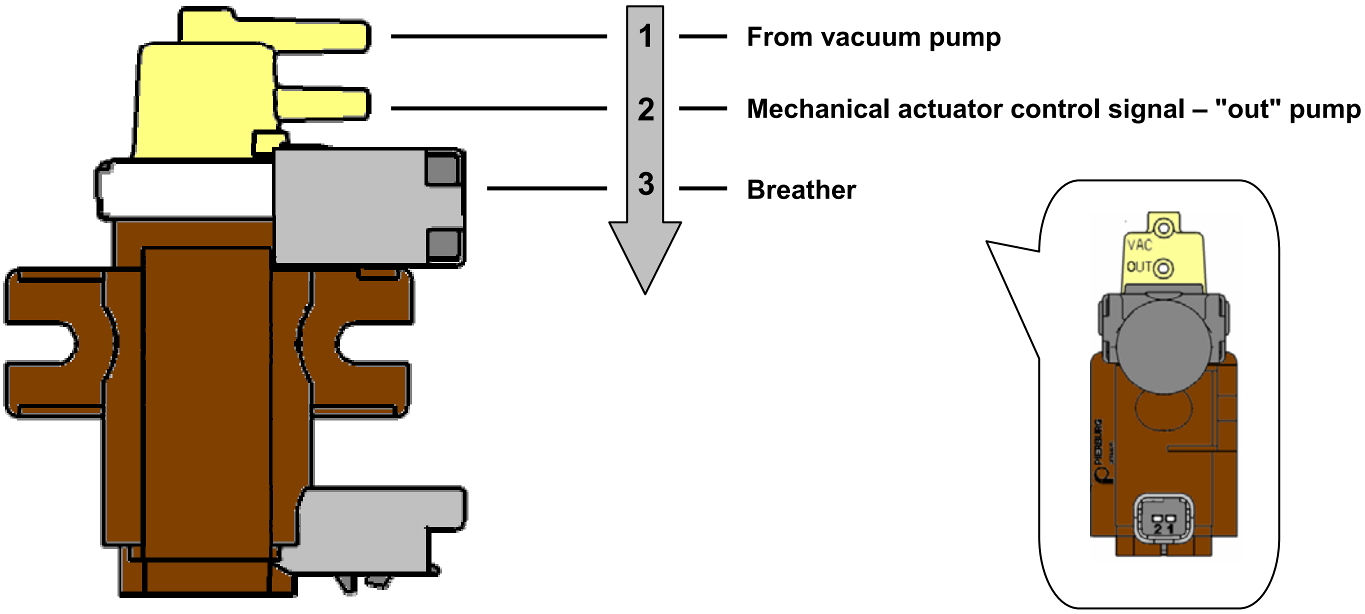
- Carry out an actuator test and listen to the electrovalve noise.
- In oscilloscope mode, using the break-out box and interface harnesses, check the control voltage of the electrovalve and the signal speed.
- In multimeter mode, using the break-out box and the interface harnesses, check the resistance of the electric motor windings = 15.5 Ω.

Electrical checks: (components disconnected)

- check continuity
- check insulation

d) Comments concerning electrovalves

1. The pneumatic electrovalve output allocation is always in line with the order indicated in the following diagram, starting from the top:



2. The pipe connected to the "out" coupling includes **a coloured plastic ring** which differentiates it from the other pipes to facilitate connection.

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e) Pneumatic circuit check conducted using specially fabricated couplings.

Given the difficult accessibility of the turbocharger electrovalve (between the engine and the bulkhead), it is preferable to fabricate a coupling **(see § "3.3 Tooling to be made")** from the diesel return couplings, for example, so that the following checks can be carried out. If these coupling are not available, carry out the rest of the check described in **§ d) Air circuit checks to be carried out in the absence of specially fabricated couplings**

Vacuum pump check:

Connect the pressure/vacuum pump to the vacuum pump outlet. The vacuum value must be 900 mbar (-0.9 bar measured on the pressure gauge).

Condition: engine idling.

Female coupling (see details page 139, Figure 56)

Figure 37: Vacuum pump check (EDC16 C34)

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Checking vacuum circuit seal

Connect pressure/vacuum pump to the vacuum circuit coupling as illustrated below. Create a vacuum of 900 mbar and check that the value does not drop more than 0.2 bar in 1 minute.

Condition: engine off.

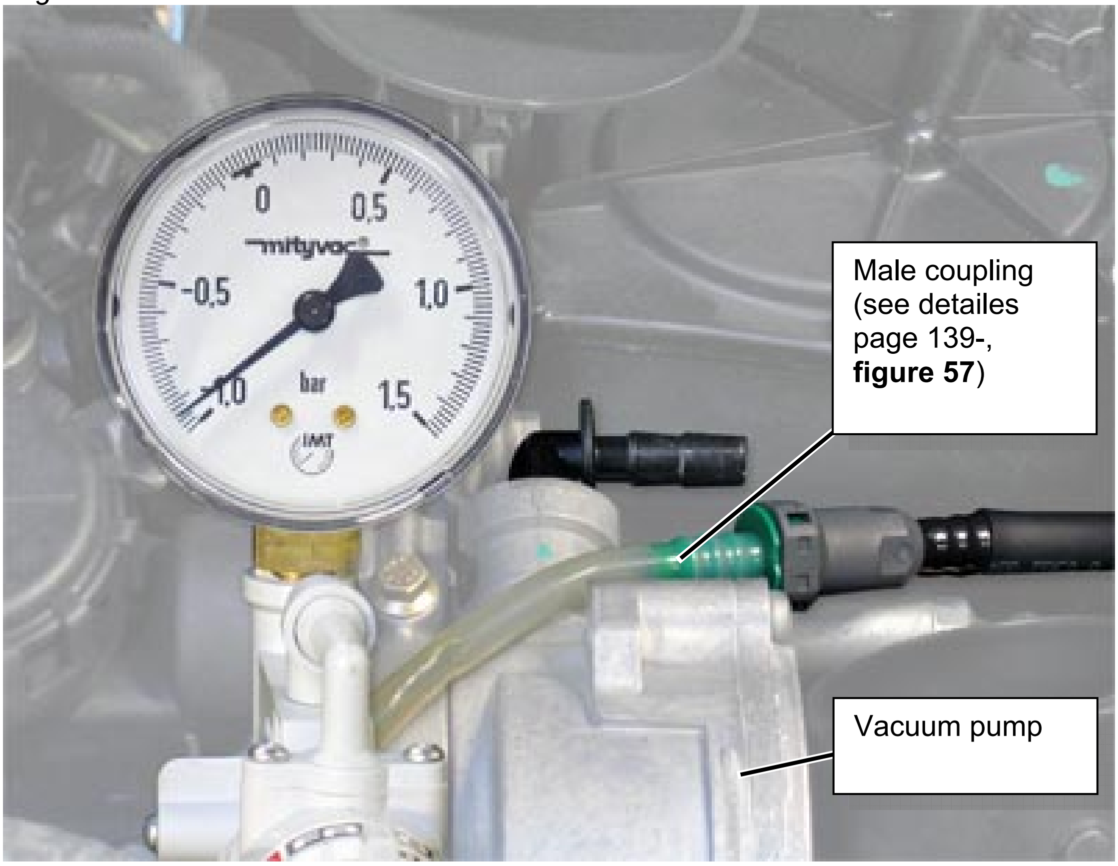

Figure 38: Checking vacuum circuit seal (EDC16 C34)

⚠	To be effective, this check must be carried out by connecting the vacuum pump as indicated.

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Checking variable geometry turbo activation:
Connect pressure/vacuum pump to the vacuum circuit coupling. Create a negative pressure of 900 mbar. Using the diagnostic tool, carry out an actuator test:

- the negative pressure value should drop in stages (the tool activates the solenoid several times during the test).
- the variable geometry control pin should move freely.

Condition: engine off.

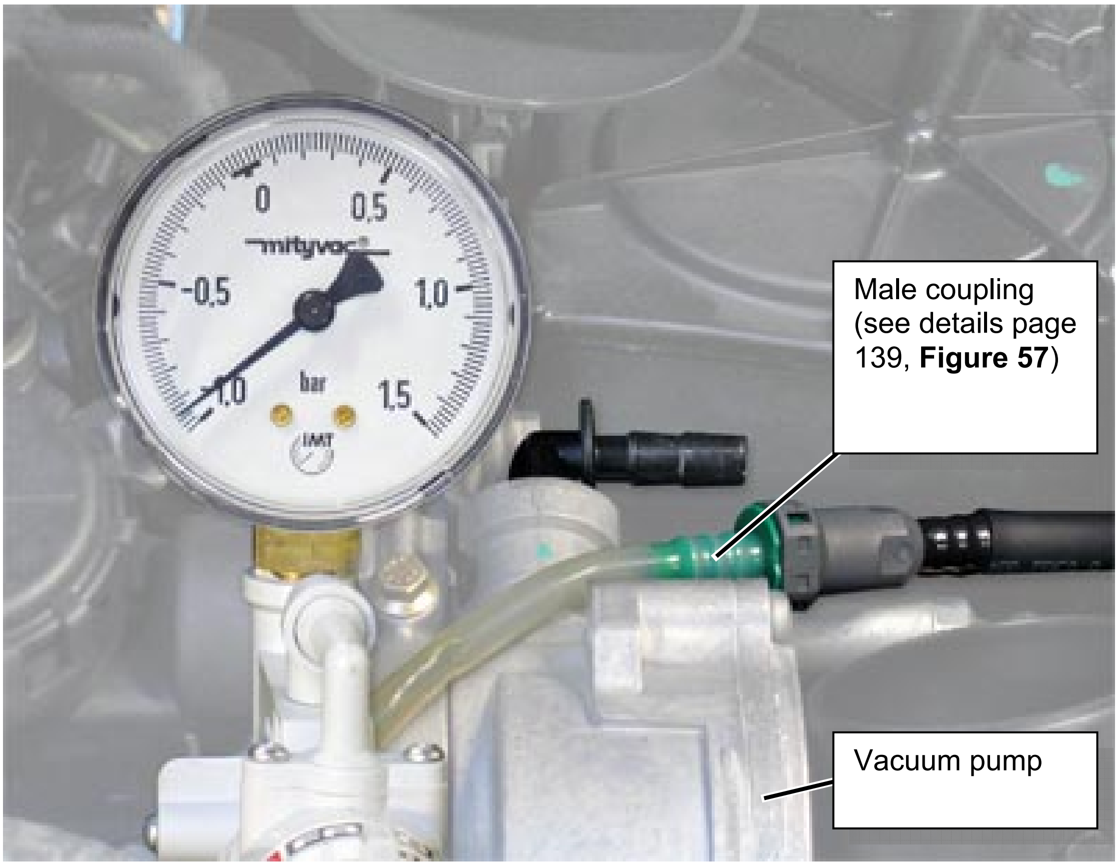

Figure 39: Activating the variable geometry turbo (EDC16 C34)

	To be effective, this check must be carried out by connecting the vacuum pump as indicated.

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f) Air circuit check conducted in the absence of specially produced couplings.

Vacuum pump seal from the vacuum pump to the electrovalves Application of the "AIR INLET CIRCUIT CHECK" procedure. Using a Mityvac connected in parallel (with a T piece) at the vacuum pump outlet then at the input of each of the electrovalves (marked "vac"), check that the pressure value is 900 mbar (-0.9 bar on the pressure gauge).

Condition: engine idling.

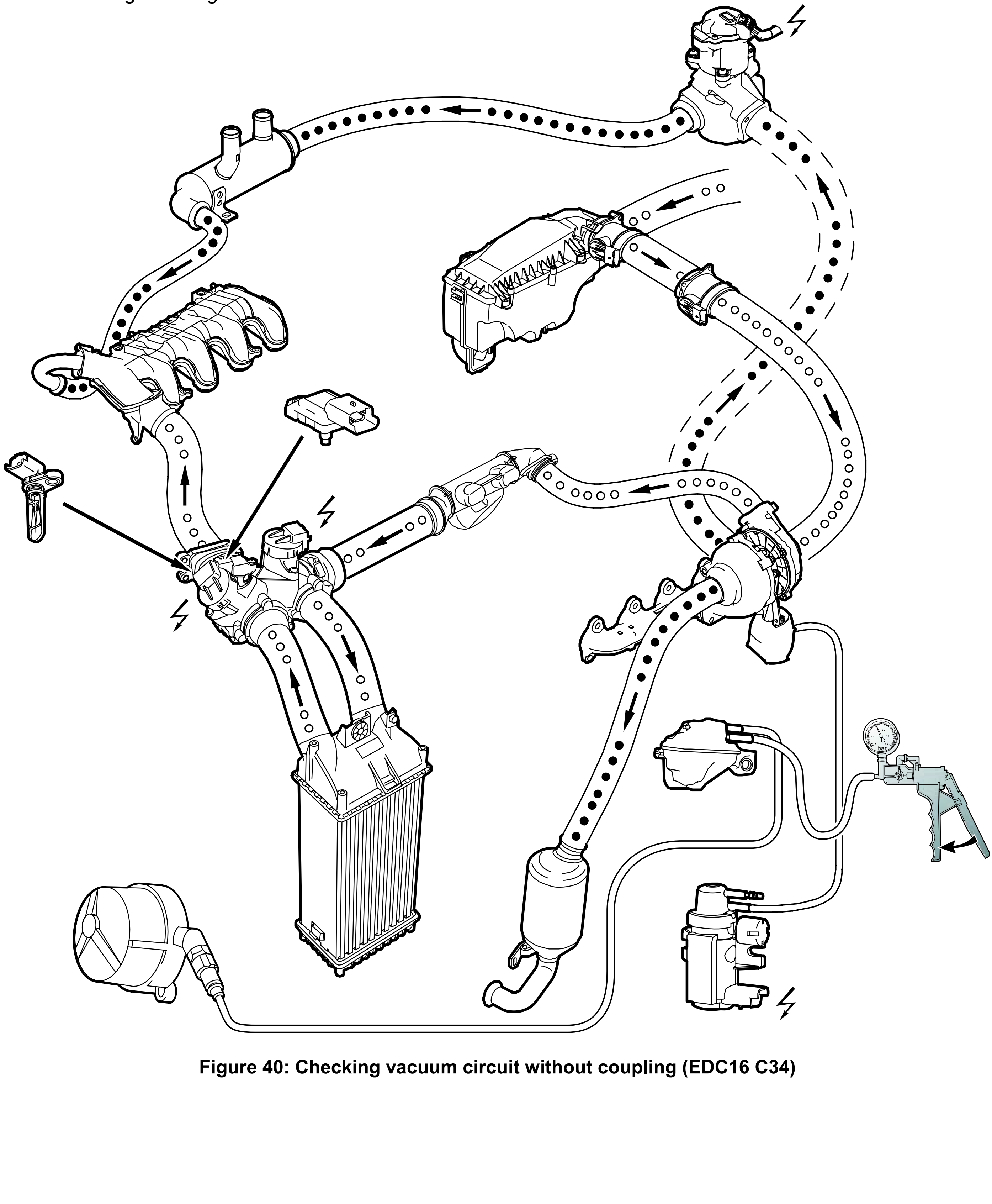

Figure 40: Checking vacuum circuit without coupling (EDC16 C34)

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Control circuit seal from the electrovalve to the control pump
Connect the Mityvac directly to the pipe that goes from the solenoid (coupling marked "out") to the pneumatic vacuum capsule. Gradually activate the Mityvac and note the movement of the actuator which must be smooth and without any jolting. The pin movement must be 12 $^{\pm 2}$ mm for a negative pressure value of 800 mbar.
Note also that the vacuum is maintained.

Condition: engine off.

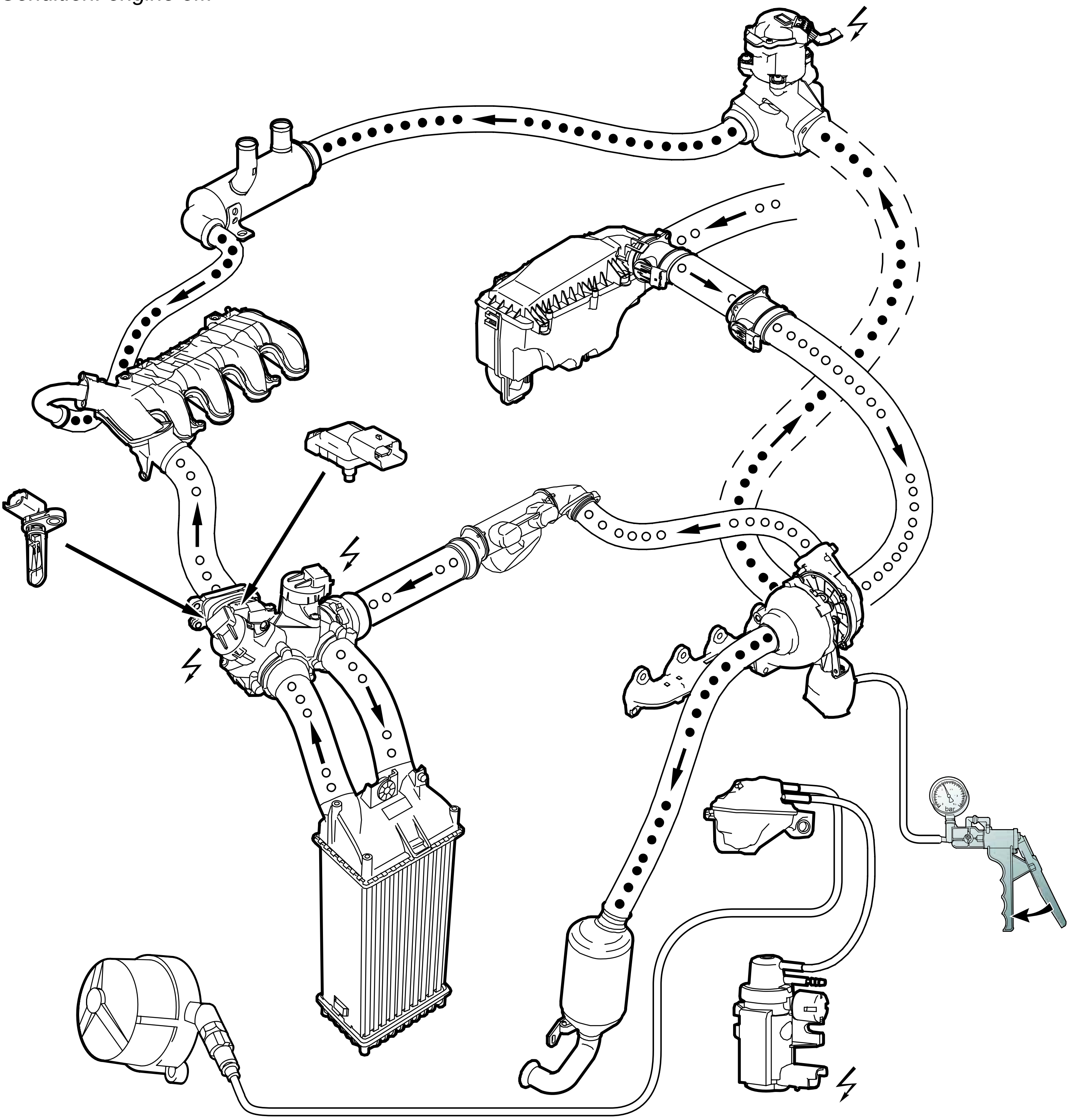

Figure 41: Checking vacuum circuit without coupling (continued) (EDC16 C34)

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Breather

To check the quality of breathing process, it is necessary to ensure that the breather filter is not clogged (foam filter). This is located on the cylinder head cover. A partially clogged filter causes a delay in controlling the control pump and may generate fault codes relating to excessive pressure or volume. A totally clogged filter prevents the vacuum capsule from returning to its normal position.

- Checking the inlet manifold air temperature sensor

Using the diagnostic tool:

In Parameter Measurements, check the value displayed by the engine ECU. When the engine is cold, the temperature of the air flow meter and at the inlet manifold must be identical. If in doubt, compare with an ohmmeter measurement (see table of values in the chapter entitled "component characteristics").

Harness electrical check:

- continuity
- insulation.

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PARTICLE FILTER

1. PRINCIPLES OF OPERATION OF THE FAP

The role of the FAP is to reduce the amount of carbon particles in the exhaust gas.

Soot is trapped in a ceramic slab which allows the gas to flow through but traps the particles

To ensure that the exhaust line is not obstructed, the particles have to be destroyed at regular intervals. Pyrolysis is used to eliminate the particles trapped in the filter. When heated to a temperature of around 550°C, the particles are burned off.

Various techniques are used to reach the temperature required for the particles in the FAP to be burned off.

- post-injection (post-combustion in the catalyser = increase in gas temperature),
- power consumer activation (thus artificially increasing engine load = increase in gas temperature),
- air induction without passing through the intercooler,
- addition of fuel additives (reduction in particle flash-point to around 450°C).

Implementation of these strategies enables the FAP to be regenerated, but the driving conditions must be favourable so that the driver is not aware that the regeneration process is taking place.
Moreover, the particles only are destroyed during the regeneration process – the additive remains in the FAP.
It is the additive that causes the FAP to clog up over a longer period of time and this is why it has to be replaced at regular intervals.

The additive plays a dual role.
- it reduces the temperature threshold, at which the particles are burned off,
- it facilitates particle adhesion (so that they are easily trapped in the filter).

The additive is mixed with diesel in the tank, prior to combustion. The additive system[3], injects the additive each time the tank is filled.
The tank filler cap contains a sensor which enables the additive system to detect if the tank has been filled up.
The filler cap absent signal means that the tank is being filled up. When the filler cap is present, the filling operation is complete.
When the fuel filler cap has been detected as being present, the additive system interrogates the BSI to find out the variation in fuel level. It then injects a quantity of additive in proportion to the quantity of fuel that has been added to the tank.

[3] Depending in the vehicle generation, the additive system is hosted by a dedicated ECU (ADGO ECU, 1282) or integrated in the engine ECU. For further details, please consult the following chapters.

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2. FAP SUMMARY

2.1. Different generations of regeneration supervisor

The regeneration supervisor is an electronic module integrated into the engine injection ECU which manages the particle filter load and regeneration.

There are two generations of regeneration supervisor:

- Supervisor FAP 1 (Bosch EDC 15 C2)
- Supervisor FAP 2 (Bosch EDC 16 C34 and EDC 16 CP39, SIEMENS SID 803 and SID 201, DELPHI DCM 3.4…).

	FAP1	FAP2
Differential pressure sensor.	**X**	**X**
Inclusion of mileage data	**X**	**X**
Inclusion of quantity of soot in FAP		**X**
Inclusion of driving conditions		**X**
Optimisation of regeneration process to limit excess fuel consumption		**X**
Optimisation of regeneration success rate		**X**

2.2. Different generations of additive system

2.2.1. With additive ECU (ADDGO)

There are three generations of additive ECU:
Magneti Marelli (Marwall) EAS 100
Magneti Marelli (Marwall) EAS 200
Magneti Marelli (Marwall) EAS 300

a) EAS 100

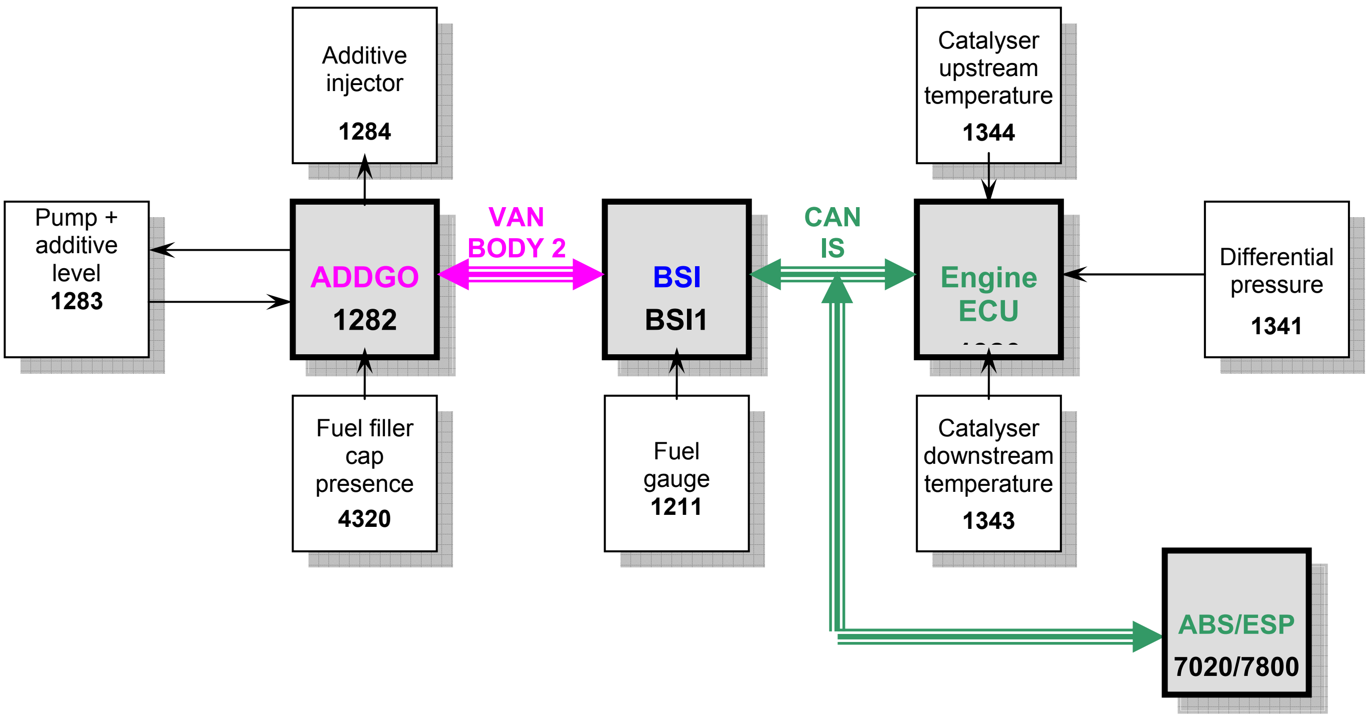

Figure 42: EAS 100 electrical architecture

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b) EAS 200

The additive injector, temperature sensor upstream of catalyser and minimum additive level sensor were discontinued.

A metering pump, a fuel additive valve and a second additive counter were added.

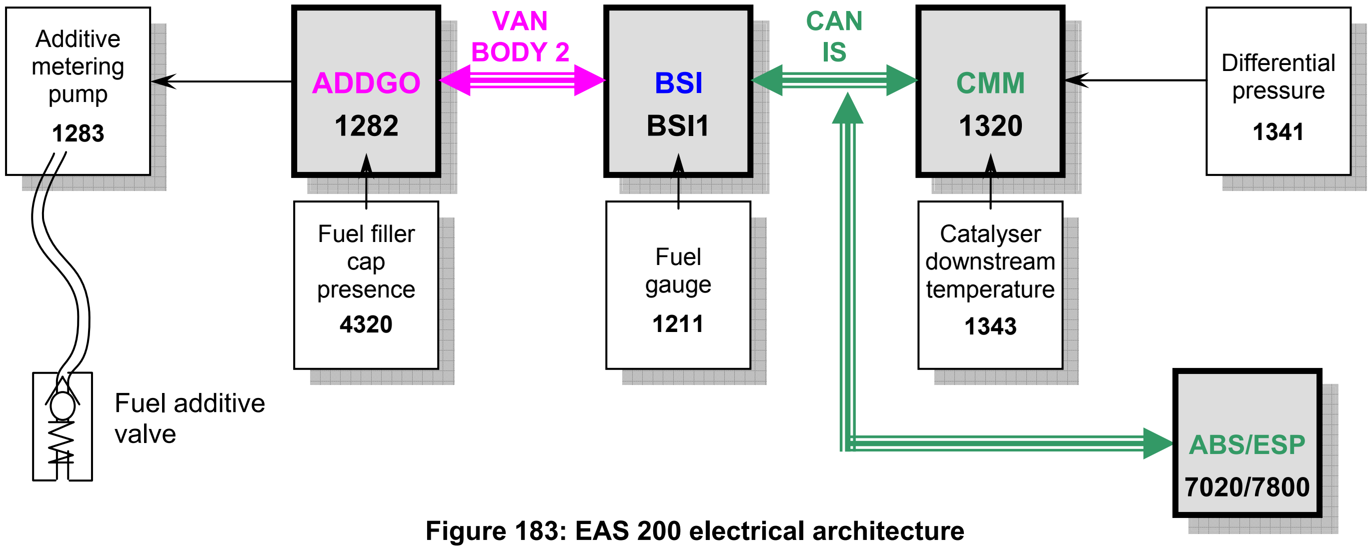

Figure 183: EAS 200 electrical architecture

c) EAS 300

ADDGO ECU on the CAN BODY network.

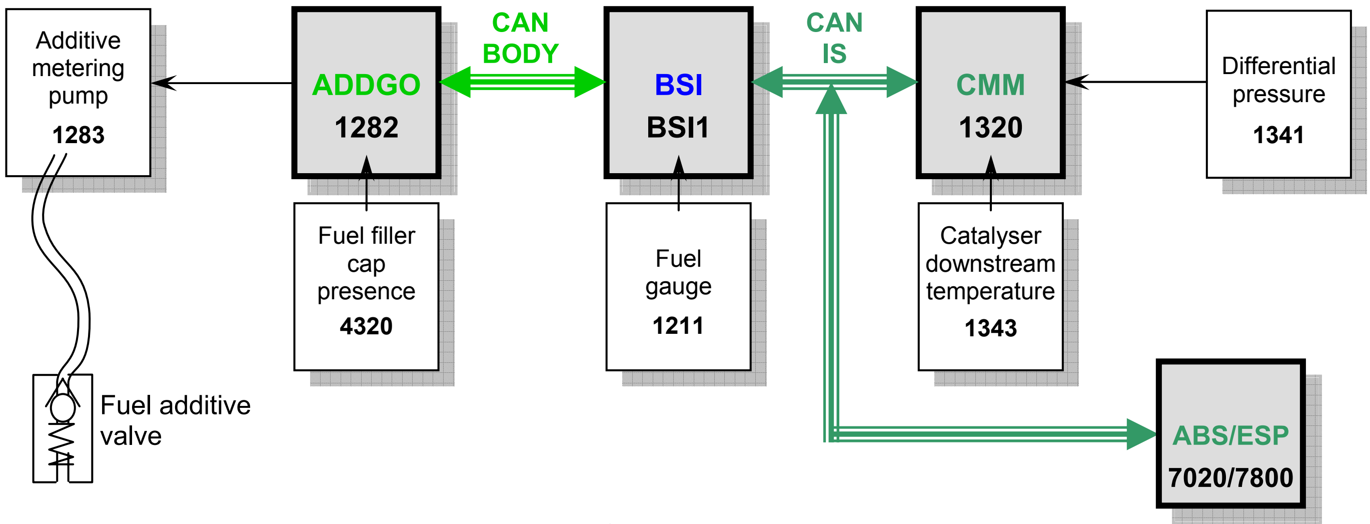

Figure 44: EAS 300 electrical architecture

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d) Special assemblies

C-CROSSER

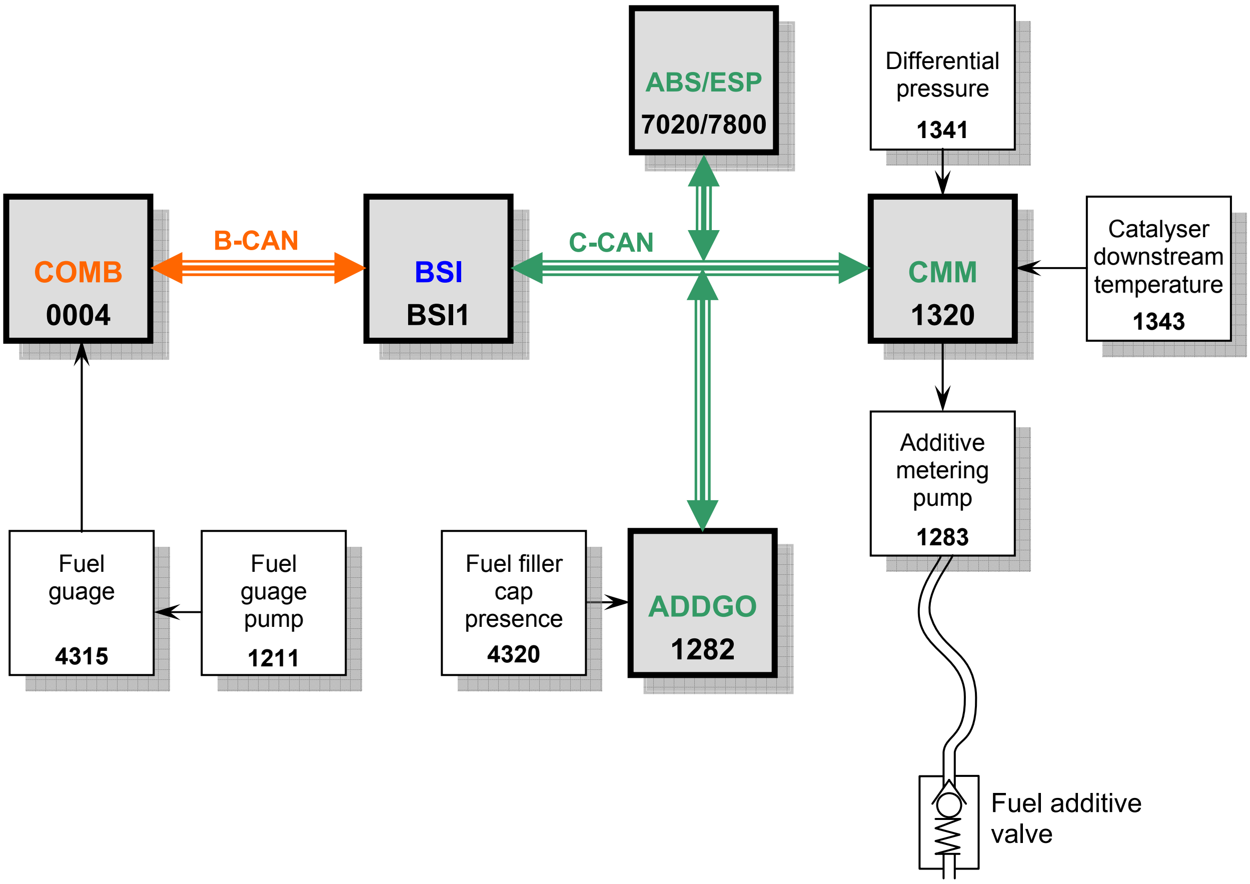

Figure 45: C-CROSSER specific electrical architecture

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2.2.2. Without additive ECU (ADDGO)

a) Hard-wired metering pump

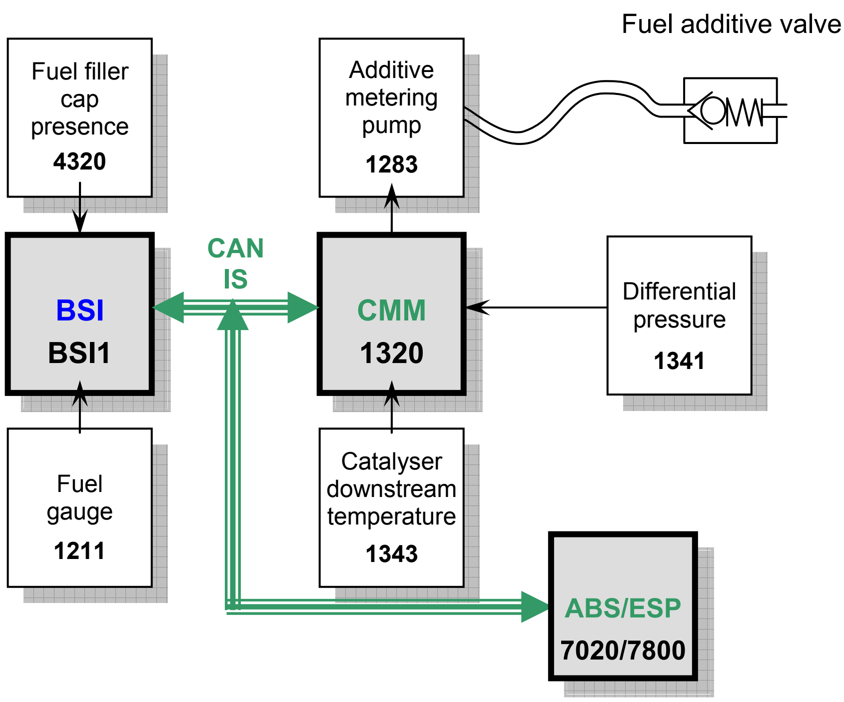

Figure 46: Hard-wired metering pump electrical architecture

b) Multiplexed metering pump

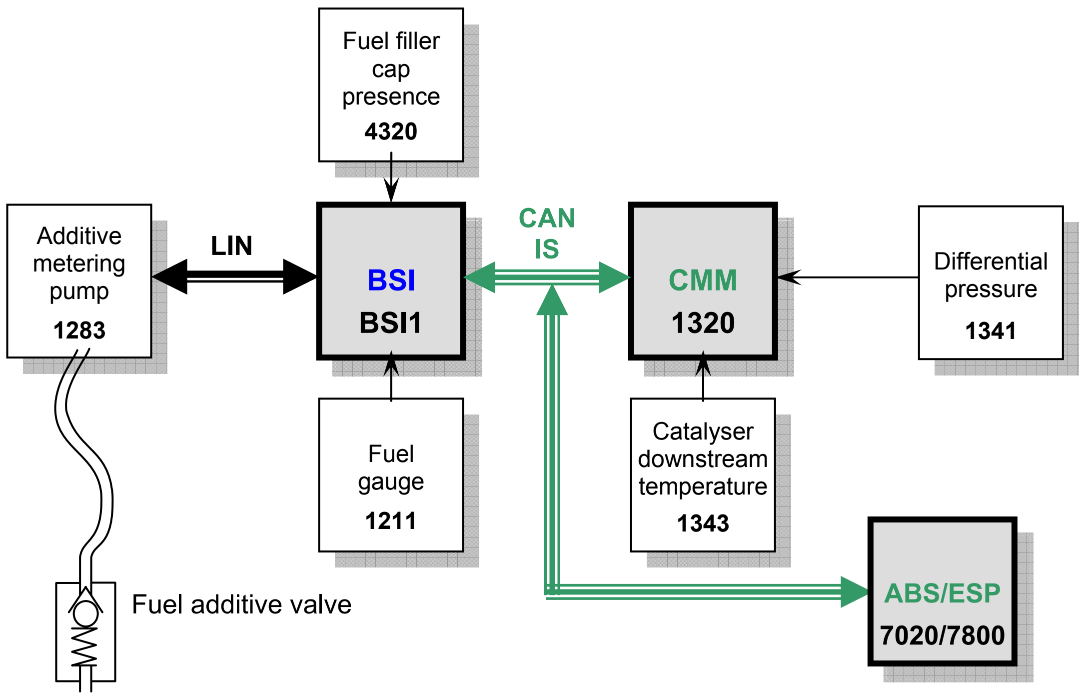

Figure 47: Multiplexed (LIN) metering pump electrical architecture

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c) Allocations

Vehicle	**Xsara Picasso**
Engine	DV6 TED4 9HZ
RPO	--
Injection	EDC16 C34
Regeneration supervisor	FAP 2
ADDGO ECU generation	**EAS 200**
Type of additive	**EOLYS 176** Green, clip-on
FAP replacement	- 75, 000 miles up to RPO 10373 **or** " TR PSA F007" on FAP -120,000 miles up to RPO 10374 **or** " TR PSA F010" on FAP
Additive top up	75, 000 miles

Vehicle	**C3 II**
Engine	DV6 TED4 9HZ
RPO	As from 10382
Injection	EDC16 C34
Regeneration supervisor	FAP 2
ADDGO ECU generation	**MULTIPLEXED METERING PUMP**
Type of additive	**EOLYS 176** Green, clip-on
FAP replacement	120,000 miles
Soft tank replacement	75,000 miles

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Vehicle	C4				
Engine	DV6 TED4 9HZ	DW10 BTED4 RHR	DV6 TED4 9HZ	DW10 BTED4 RHR	
RPO	Up to 10704	Up to 10704	As from 10705	As from 10705	As from 10936
Injection	EDC16 C34	SID 803 / 803A	EDC16 C34	SID 803 / 803A	DCM 3.4
Regeneration supervisor	FAP 2				
ADDGO ECU generation	**EAS 300**		**MULTIPLEXED METERING PUMP**		
Type of additive	**EOLYS 176** Green, clip-on				
FAP replacement	- 75, 000 miles up to 10373 - 120, 000 miles from 10374	- 75, 000 miles up to 10380 - 75, 000 miles **if** 10380 < RPO < 10388 **and** "TR PSA F008" on FAP - 120, 000 miles **if** 10380 < RPO < 10388 **and** "TR PSA F015" on FAP	120, 000 miles		
Additive filling/ replacement of soft tank	75, 000 miles				

Vehicle	C4 Picasso	
Engine	DV6 TED4 9HZ	DW10 BTED4(RHR)
RPO	Up to 10752	--
Injection	EDC16 C34	SID 803 / 803A
Regeneration supervisor	FAP 2	
ADDGO ECU generation	**MULTIPLEXED METERING PUMP**	
Type of additive	**EOLYS 176** Green, clip-on	
FAP replacement	100,000 miles	120,000 miles
Soft tank replacement	75,000 or 80,000 miles	

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Vehicle	C5				
Engine	DW10 ATED4 RHT		DW12 TED4 4HX		DW10 ATED4 RHS / DW12 TED4 4HX
RPO	Up to 09491	As from 09492	Up to 09491	As from 09492	As from 09870
Injection	EDC15 C2				
Regeneration supervisor	FAP 1				
ADDGO ECU generation	**EAS 100**				**EAS 200**
Type of additive	**DPX 42** White, clip-on	**EOLYS 176** Green, clip-on	**DPX 42** White, clip-on	**EOLYS 176** Green, clip-on	**EOLYS 176** Green, clip-on
FAP replacement	50, 000 miles	75,000 miles	50, 000 miles	75,000 miles	75,000 miles
Additive filling	50, 000 miles	75,000 miles	50, 000 miles	75,000 miles	75,000 miles

Vehicle	New Look C5 (C5 II)				
Engine	DV6 TED4 9HZ	DW10 BTED4 RHR / RHL	DV6 TED4 9HZ	DW10 BTED4 RHR	DW12 BTED 4HP/ 4HT
RPO	Up to 10933		As from 10934		As from 10704
Injection	EDC16 C34	SID 803 / 803A	EDC16 C34	SID 803 / 803A	EDC16 CP39
Regeneration supervisor	FAP 2				
ADDGO ECU generation	**EAS 300**		**HARD WIRED METERING PUMP**		
Type of additive	**EOLYS 176** Green, clip-on				
FAP replacement	-62,5000 miles up to RPO 10369 - 120, 000 miles as from RPO 10370	120,000 miles	120,000 miles	120,000 miles	120,000 miles
Additive filling	75,000 miles				

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Vehicle	**C6**	
Engine	DT17 TED4 UHZ	DW12 BTED 4HP/ 4HT
RPO	As from 10402	As from 10934
Injection	SID 201	EDC16 CP39
Regeneration supervisor	FAP 2	
ADDGO ECU generation	**HARD WIRED METERING PUMP**	
Type of additive	**EOLYS 176** Green, clip-on	
FAP replacement	120,000 miles	
Additive filling	75,000 miles	

<table>
<tr><th>Vehicle</th><th colspan="8">C8</th></tr>
<tr><td>Engine</td><td colspan="2">DW10 ATED4
RHS</td><td colspan="2">DW12 TED4
4HW</td><td>DW10 ATED4
RHT</td><td>DW12 TED4
4HW</td><td>DW10
ATED4
RHM</td><td>DW10 BTED4
RHR</td></tr>
<tr><td>RPO</td><td>Up to
09491</td><td>As from
09492</td><td>Up to
09491</td><td>As from
09492</td><td>As from 10376</td><td>As from
10376</td><td>As from
10615</td><td>As from 10787</td></tr>
<tr><td>Injection</td><td colspan="7">EDC15 C2</td><td>SID 803</td></tr>
<tr><td>Regeneration supervisor</td><td colspan="7">FAP 1</td><td>FAP 2</td></tr>
<tr><td>ADDGO ECU generation</td><td colspan="4">EAS 100</td><td colspan="3">EAS 300</td><td>HARD WIRED METERING PUMP</td></tr>
<tr><td>Type of additive</td><td>DPX 42
White, clip-on</td><td>EOLYS 176
Green, clip-on</td><td>DPX 42
White, clip-on</td><td>EOLYS 176
Green, clip-on</td><td colspan="4">EOLYS 176
Green, clip-on</td></tr>
<tr><td>FAP replacement</td><td>50,000 miles</td><td>75,000 miles</td><td>50,000 miles</td><td>- 75,000 miles up to 10247
- 120,000 miles from 10248</td><td>75,000 miles</td><td>120,000 miles</td><td>75,000 miles</td><td>120,000 miles</td></tr>
<tr><td>Additive filling</td><td>50,000 miles</td><td>75,000 miles</td><td>50,000 miles</td><td>75,000 miles</td><td colspan="3">75,000 miles</td><td>75,000 miles</td></tr>
</table>

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Vehicle	**New Dispatch (III)**
Engine	DW10 BTED4 RHR
RPO	As from 10766
Injection	SID 803 /803A
Regeneration supervisor	FAP 2
ADDGO ECU generation	**HARD WIRED METERING PUMP**
Type of additive	**EOLYS 176** Green, clip-on
FAP replacement	120,000 miles
Additive filling	75,000 miles

Vehicle	**C-CROSSER**
Engine	**DW12 MTED4** **4HN**
RPO	--
Injection	**EDC16 CP 39**
Regeneration supervisor	FAP 2
ADDGO ECU generation	**SPECIAL ASSEMBLY**
Type of additive	**EOLYS 176** Green, clip-on
FAP replacement	120,000 miles (TBC)
Additive filling	75,000 miles (TBC)

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2.2.3. Service operations

EAS 100

• *In the event of engine ECU being replaced or re-configured:*
- Program in the additive type – DPX 42 or EOLYS 176 (DPX 10)
- And if RPO up to 09491, carry out a forced regeneration.

• *If the ADDGO ECU is replaced:*
- Program the total quantity of additive deposited in the filter.

Base this on the counter in the previous ECU or the vehicle mileage
(please consult the "**MAINTENANCE: INJECTION SYSTEM"** procedures).

- And if RPO after 08638, configure "replacement of additive ECU"
- And if RPO after 09492, configure "Quantity of additive deposited in the filter since last fill-up", and the type of additive: EOLYS 176.

• *If the FAP is replaced:*
- And the ADDGO ECU software ≤ 2.27: reset the "Total quantity of additive deposited in the filter" counter.
- If RPO is after 08638, configure "Cleaning or replacement of particle filter".
- If RPO is up to 09491 and ADDGO ECU software ≥ 2.28: reset the two following additive counters: "Total quantity of additive deposited in the filter" and "Quantity of additive deposited in the filter since last fill-up" (replacement and filling at 80 000 km).
- If 09491 ≤ RPO ≤ 09869 and ECU software ≥ 2.28: reset the "Total quantity of additive deposited in the filter" counter (replacement at 50,000 miles and fill-up at 75,000 miles).

• *If the additive tank is topped up:*
- And if the ADDGO ECU software ≤ 2.28: reset the "Quantity of additive deposited in the filter since last fill-up" counter.

• *If the additive tank is replaced:*
- And if the ADDGO ECU software ≤ 2.28: reset the "Quantity of additive deposited in the filter since last fill-up" counter.
- reprime the additive circuit.

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EAS 200

• *In the event of engine ECU being replaced or re-configured:*
- Program in the additive type – DPX 42 or EOLYS 176 (DPX 10)

• *If the ADDGO ECU is replaced:*
- Configure:
  => "Additive ECU replacement",
  => "Total quantity of additive deposited in the filter",
  => "Quantity of additive deposited in the filter since last fill-up".

Base this on the counter in the previous ECU or the vehicle mileage
(please consult the "**MAINTENANCE: INJECTION SYSTEM"** procedures).

• *If the FAP is replaced:*
- Configure "Cleaning or replacement of particle filter".
- reset the "Total quantity of additive deposited in the filter" counter.

• *If the additive tank is topped up:*
- reset the following counter: "Quantity of additive deposited in the filter since last fill-up".

• *If the additive tank is replaced:*
- reset the following counter: "Quantity of additive deposited in the filter since last fill-up".
- reprime the additive circuit.

EAS 300

• *If the ADDGO ECU is replaced:*
- Configure:
  => "Additive ECU replacement",
  => "Total quantity of additive deposited in the filter",
  => "Quantity of additive deposited in the filter since last fill-up".

Base this on the counter in the previous ECU or the vehicle mileage
(please consult the Help section in the tool or the "**MAINTENANCE: INJECTION SYSTEM"** procedures).

• *If the FAP is replaced:*
- Configure "Cleaning or replacement of particle filter".
- reset the "Total quantity of additive deposited in the filter" counter.

• *If the additive tank is topped up:*
- reset the following counter: "Quantity of additive deposited in the filter since last fill-up".

• *If the additive tank is replaced:*
- reset the following counter: "Quantity of additive deposited in the filter since last fill-up".
- reprime the additive circuit.

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<u>Non-multiplexed pump assembly (tank)</u>

• *f the engine ECU is replaced or re-configured:*

- automatic "ECU replacement or configuration" configuration process (recording and re-writing of the counters in the engine ECU).
- Manual configuration of the "Quantity of additive in the particle filter" (only if communication with the ECU is faulty or impossible) (in engine ECU).

• *If the metering pump is replaced:*

- Configure "Tank and pump replacement" (in engine ECU).

• *If the FAP is replaced:*

- Configure "Particle filter replacement (in engine ECU).

• *If the additive tank is topped up:*

- Configure "Filling up the tank" in the engine ECU

• *If the additive tank is replaced or if there is any operation on the additive circuit:*

- Configure "Replacement of diesel additive tank or pipes between additive tank and fuel tank" in the engine ECU.

<u>Multiplexed pump (soft tank)</u>

• *f the engine ECU is replaced or re-configured:*

- automatic "ECU replacement or configuration" configuration process (recording and re-writing of the counters in the engine ECU).
- Manual configuration of the "Quantity of additive in the particle filter" (only if communication with the ECU is faulty or impossible) in engine ECU.

• *If the additive pump is replaced:*

- Configure "replacement of additive pump" in engine ECU.
- Configure the "volume of additive bag" in the diesel additive pump.
- configure the "percentage of additive remaining in bag" in the diesel additive pump in line with the parameter read off from the previous pump.

• *If the FAP is replaced:*

- Configure "Particle filter replacement (in engine ECU).

• *If the additive bag is replaced:*

- Configure: "Replacement of additive bag" in the engine ECU.
- Configure: "Replacement of additive bag in the diesel additive pump.

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2.3. Parameter measurements (LEXIA)

2.3.1. DW10 engine with SID 803 / 803A

PARTICLE FILTER MENU

- Particle filter soot load (%)
Parameter defined by the engine ECU, calculated as a function of various data such as: (differential pressure sensor reading, driving conditions, exhaust gas flow, fuel quantity consumed, etc.) This represents the theoretical load (degree of clogging), particles + cerine in the particle filter, which increases as the vehicle is driven.

Note: this value must be at 0%, following regeneration.

- Cat. converter downstream temperature (°C)
Parameter determined by the engine ECU on the basis of the information supplied by the catalyser downstream temperature sensor. This temperature corresponds to that of the gas entering the particle filter. It is used to validate regeneration conditions.

- Exhaust differential pressure (mbar)
Parameter determined by the engine ECU on the basis of the information supplied by the differential pressure sensor, which measures the difference in pressure between the particle filter inlet and output.

Note: The differential pressure varies with the distance the vehicle has covered driving conditions and quantity of additive consumed.
It acts as a safety feature with respect to the FAP in the event of the maximum filter clogging value being exceeded whereby it activates regeneration as soon as the conditions allow.

- Total additive quantity (g):
Parameter indicating the quantity of additive deposited in the particle filter. It determines the quantity of cerine injected into the fuel since the last FAP replacement. This quantity must be reset each time the FAP is replaced. This quantity is used by the engine ECU to manage the degree of filter clogging by cerine.

Note: This quantity may be communicated by the ADDGO ECU or calculated by the engine ECU (where the ADDGO ECU is not present). It represents the quantity of cerine trapped in the particle filter, as the cerine is the only compound in the additive which is retained by the particle filter.

- Consumer activation (no / yes):
Parameter given by the engine ECU, it tells us that activation of the electrical power consuming equipment is operational.

Note: This parameter does not tell us which power consumers are activated. It is the BSI "power loading" function which manages activation.

- Air flow volume (m^3/h):
Theoretical parameter determined by the engine ECU on the basis of the differential pressure, exhaust gas temperature, air flow, atmospheric pressure and engine speed signals. This parameter represents the exhaust gas flow.

Note: The engine ECU uses this parameter and the differential pressure parameter to determine the degree of clogging in the particle filter.

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- Driving type (engine off / harsh town / average town / open road / mountain / motorway)
Parameter determined by the engine ECU on the basis of the vehicle engine torque and speed.
This represents the type of vehicle usage. The type of driving is necessary for calculation of the quantity of particles in the particle filter.

Distance travelled since last regeneration (km):
Parameter determined by the engine ECU on the basis of the vehicle speed information and the "distance covered calculation" carried out by the instrument cluster. It provides the distance covered by the vehicle since the last regeneration.

Note: This parameter is stored and managed in the engine ECU, and is reset to zero after each particle filter regeneration, even during forced regeneration.
The higher the quantity of cerine in the particle filter the more frequent are the regenerations as there is less space available for the particles.

Average distance of last five regenerations (km):
The ECU stores the number kilometres covered between the last five particle filter regenerations. A significant difference between these recordings indicates a change in driving conditions or that there has been difficulty in regenerating the particle filter.

Regeneration status (no regeneration/regeneration)
Indicates if regeneration is underway. If regeneration is underway, certain parameters may adopt unusual values (closure of EGR valve and/or opening of the RAA).

ADDITIONAL PARTICLE FILTER INFORMATION MENU

Percentage of driving during previous hour in town - severe (%)
Percentage of driving during previous hour in town - average (%)
Percentage of driving during previous hour in town - fast (%)
Percentage of driving during previous hour on main road (%)
Percentage of driving during previous hour on motorway (%)
Parameters determined by the engine ECU on the basis of the "driving conditions" information. They represent the percentage of each type of driving during the last 60 minutes.
For each driving condition, the engine ECU calculates a particle mass and determines the type of regeneration request.

Percentage of driving done in town - severe (%)
Percentage of driving done in town - average (%)
Percentage of driving done in town - fast (%)
Percentage of driving done on main road %)
Percentage of driving done on motorway (%)
Parameters determined by the engine ECU on the basis of the "driving conditions" information. They represent the percentage of each type of driving during the last 6 hours.
For each driving condition, the engine ECU calculates a particle mass and determines the type of regeneration request.

Distance travelled since particle filter replacement (km)
Parameter determined by the engine ECU on the basis of the vehicle speed information (over the networks) and the "distance covered calculation" carried out by the instrument cluster. It provides the distance covered by the vehicle since the last time the particle filter was changed.

Note: This parameter is stored and managed in the engine ECU. It is reset to zero when a particle filter operation is notified to the engine ECU using the service maintenance tools.

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<u>Degrees of particle filter soot clogging</u> (%):
Parameter determined by the engine ECU depending on parameters such as "driving style", "total quantity of additive", "FAP volume" etc. It indicates the percentage of space in the FAP occupied by the particles.
For each type of driving the engine ECU calculates the accumulated particle mass. This value is added to the previous values to constitute a value representing the total accumulated particle mass since the last regeneration.

<u>Note</u>: The higher this parameter, the more imminent the regeneration. Regeneration is triggered by the engine ECU. It may be brought forward if conditions are favourable for good regeneration.

<u>Distance remaining until particle filter replacement (scheduled maintenance) (km):</u>
Parameter determined by the engine ECU based on various parameters, such as: particle filter volume, distance covered since PF was changed, and "total additive quantity", type of driving…

<u>Note</u>: This parameter gives the remaining distance before next time the particle filter is changed, on condition that the engine ECU has been informed of any previous replacement using the specific menu.
Its initial value represents the particle filter replacement interval in relation to its volume.

<u>Theoretical distance remaining before total filling of particle filter (km):</u>
Theoretical distance value which the particle filter can reach, before affecting operation.
This depends on the parameter "Remaining distance to theoretical replacement of particle filter"

<u>Note</u>: This parameter gives the remaining distance before next time the PF is changed, on condition that the engine ECU has been informed using the specific menu of any previous replacement.
Its initial value represents the PF replacement interval in relation to the type fitted.

<u>Particle filter load status (status correct /overloaded /clogged /perforated</u>):
Parameter determined by the engine ECU based on the differential pressure parameter. This gives a measure of the safety status of the particle filter in the event of overload, clogging or destruction.

<u>Particle filter regeneration possibility (impossible / not favourable / favourable / very favourable):</u>
The ECU continually defines the conditions for particle filter regeneration.
<u>Impossible:</u> The engine conditions (temperature too low, fault logged in the ECU) or vehicle conditions (speed too low) make regeneration impossible.
<u>Not favourable</u>: The engine conditions (temperature too low) or vehicle conditions (speed too low) make regeneration difficult. The ECU asks for the power consumers to be activated (heated rear screen, etc) so that regeneration can be carried out.
<u>Favourable:</u> The engine and vehicle conditions make regeneration possible by means of post-injection.
<u>Very favourable:</u> Regeneration is possible without post-injection.

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2.3.2. DV6 engine with EDC16 C34

- Particle filter soot load (%):
Parameter defined by the engine ECU, calculated as a function of various data such as: (differential pressure sensor reading, driving conditions, exhaust gas flow, fuel quantity consumed, etc.) This represents the theoretical load (degree of clogging) (particles + cerine) in the particle filter, which increases as the vehicle is driven.

Note: this value must be at 0%, following regeneration.

- Cat. converter downstream temperature (°C):
Parameter determined by the engine ECU on the basis of the information supplied by the catalyser downstream temperature sensor. This temperature corresponds to that of the gas entering the particle filter. It is used to validate regeneration conditions.

- Exhaust differential pressure (mbar):
Parameter determined by the engine ECU on the basis of the information supplied by the differential pressure sensor, which measures the difference in pressure between the particle filter inlet and output.

Note: The differential pressure varies with the distance the vehicle has covered (mileage), driving conditions and quantity of additive consumed.
It acts as a safety feature with respect to the FAP in the event of the maximum filter clogging value being exceeded whereby it activates regeneration as soon as the conditions allow.

- Air volume flow (m^3/h):
Theoretical parameter determined by the engine ECU on the basis of the differential pressure, exhaust gas temperature, air flow, atmospheric pressure and engine speed signals. This parameter represents the exhaust gas flow.

Note: The engine ECU uses this parameter and the differential pressure parameter to determine the degree of clogging in the particle filter.

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3. COMPONENT CHARACTERISTICS AND INSPECTION

3.1. TANK FILLER CAP SENSOR

a) Role

The tank filler cap sensor informs the additive ECU when the filler cap is open or closed.
This information enables the ECU that manages the additive to detect that fuel is about to be added to the tank.

b) Description

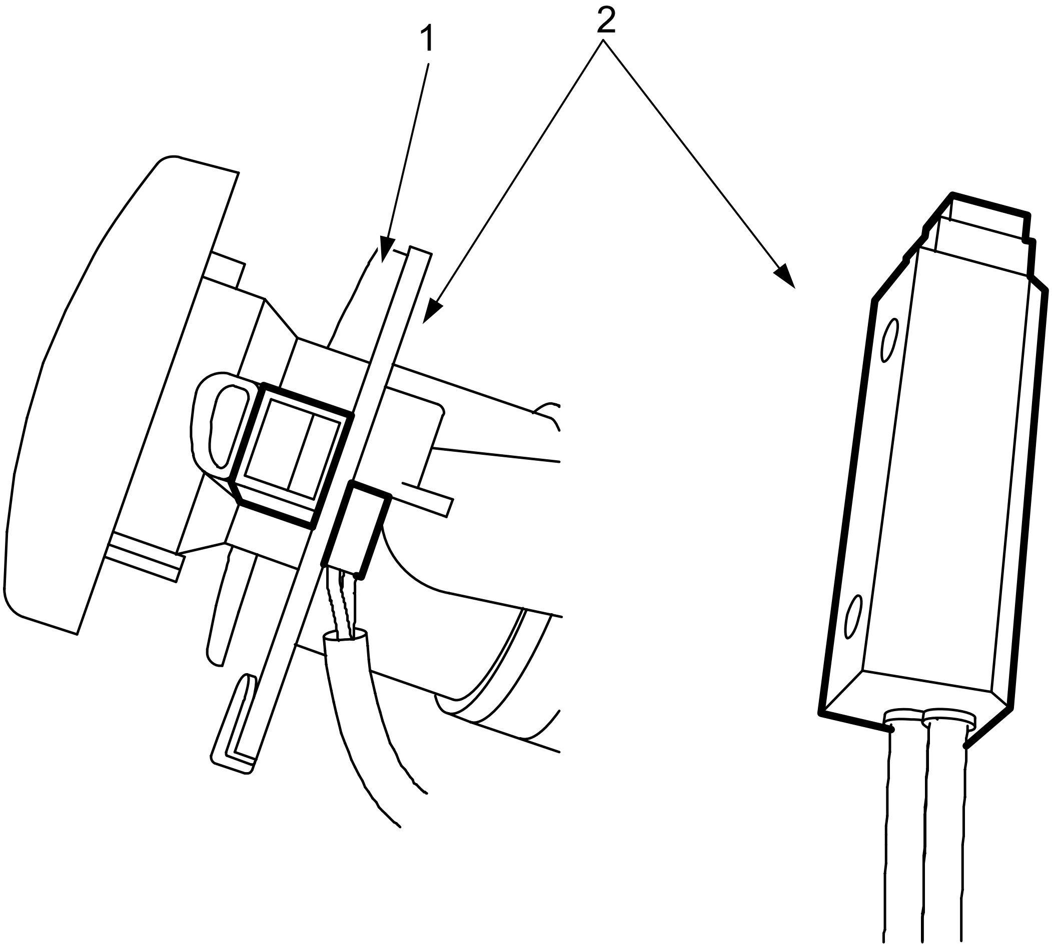

Figure 48: Description of fuel filler cap presence sensor

The cap contains a permanent magnet (1). When the cap is closed, the magnet is located opposite the switch (2).

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c) Special electrical features:

Power supply: Additive ECU
Connector pin layout:
Pin 1 5 V power supply
Pin 2 Signal

Type 1:
Magnet located opposite switch: Resistance = 150 000 Ω
Magnet not located opposite switch: Resistance = 15 Ω

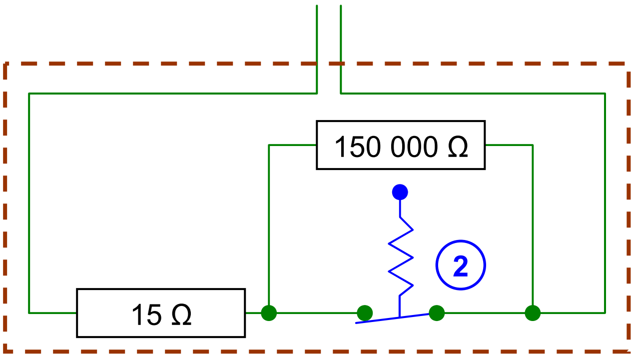

Figure 49: Cap absent

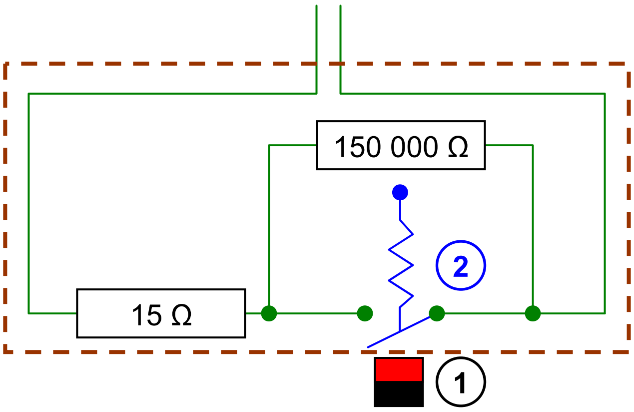

Figure 50: Cap present

Type 2 (C4 as from RPO 10734):
Magnet located opposite switch: Resistance = 685 Ω
Magnet not located opposite switch: Resistance = 15 Ω

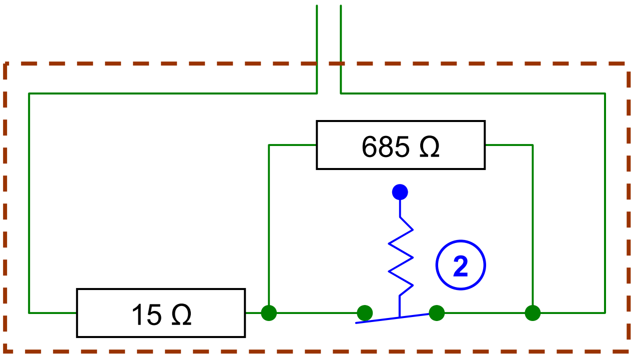

Figure 51: Cap absent

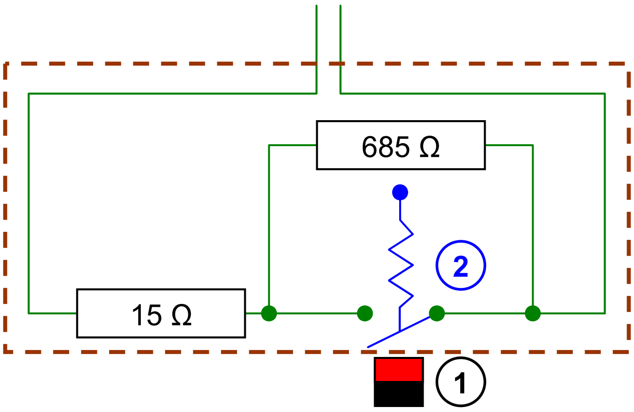

Figure 52: Cap present

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3.2. Catalyser downstream temperature sensor (Electrical reference: 1343)

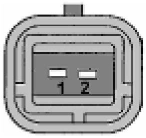
Electrical characteristics

Connector view

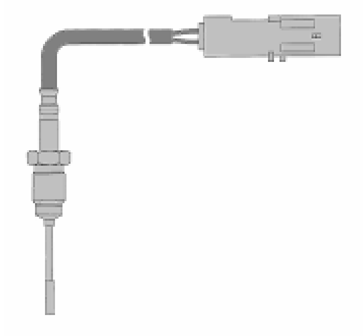
Component side

Pin 1 - 0 to 5 V signal

Pin 2 - Earth



Temperature (°C)	Resistance (Ω)
100	96000
150	32500
200	13500
250	6300
300	3300
350	1850
400	1150
450	755
500	514
550	362
600	268
650	198
700	151



Possible fault codes

Fault	Fault code	Detection thresholds	Detection with +APC	Detection with starter motor on	Required detection period	Accel. idling 1200 rpm	Engine speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
+short circuit or open circuit	P2033	Voltage or T°C > max threshold	/	/	2.5s			●	/	/
SC-ve	P2032	Voltage or T°C < min threshold	/	/	2.5s			●	/	/
Plausibility fault on starting (engine cold)	P2031	If T° C coolant < 25°C, Then T° C < 300°C.	●	/	/			●	/	/

a) Role

The temperature sensor notifies the injection ECU of the temperature of the exhaust gases upstream from the catalyser.
If the exhaust gas temperature becomes too high, the engine ECU shuts off particle filter regeneration.

b) Description

The sensor is composed of a Negative Temperature Coefficient (NTC) resistor.
The greater the temperature the lower the resistance value.

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3.3. DIFFERENTIAL PRESSURE SENSOR (ELECTRICAL REFERENCE: 1341)

Electrical characteristics

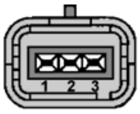
Connector view

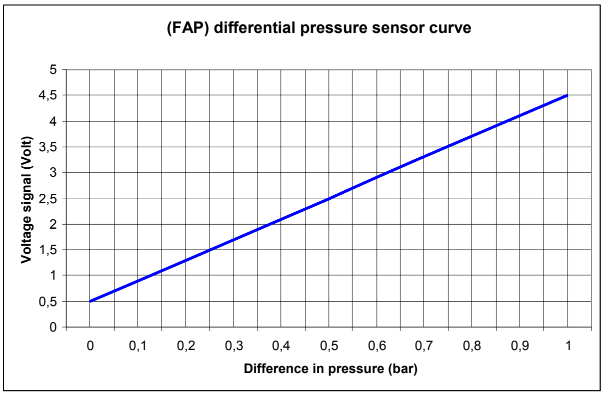
Component side

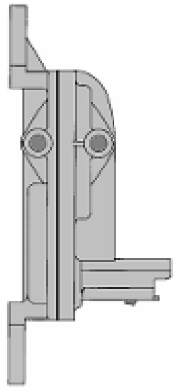
Pin 1 - 0 to 5 V signal

Pin 2 - Earth

Pin 3 - 5V power supply







Possible fault codes

Fault	Fault code	Detection thresholds	Detection with +APC	Detection with starter motor on	Required detection period	Accel. idling 1200 rpm	E. speed limited to 2750 rpm + reduced flow	Engine fault light (MIL)	Replacement value or fall-back strategy	Condition for disappearance
+short circuit or open circuit	P0473	Voltage or pressure difference > a threshold	●	●	3s			●	/	As from return into tolerances
SC-ve	P0472	Voltage or pressure difference < a threshold	●	●	3s			●	/	As from return into tolerances
Plausibility fault on engine start	P0470	Before start, measured P > threshold	●		400 ms			●	/	As from return into tolerances
Exceeding of limit values or permanent plausibility fault	P0470	/	Engine running		/		●	●	This fault generates reduced flow after 8 hours presence when driving	/
Number of regeneration requests > max	P0422	Number of aborted regeneration requests			/				/	/
FAP absent	P1457	/			/			●	/	/
FAP overloaded	P0420	/			/				/	/
FAP clogged	P1447	/			/		●	●	/	/

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3.4. CHECKING DIFFERENTIAL PRESSURE SENSOR

Tools required:

- Tool kit S1602, differential pressure gauge which was used to check pressure of LPG/NGV valves (ref: PR: 9780.04),
- Diagnostic tool

Implementation

Connect the differential pressure gauge as indicated below.

With engine idling, compare the value read on the pressure gauge to that indicated by the diagnostic tool in the FAP parameters.

Figure 53: Illustration of the differential pressure sensor check

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ADDITIONAL INFORMATION

1. CAMSHAFT/CRANKSHAFT SYNCHRONISATION

Measurement conditions:

when cranking engine

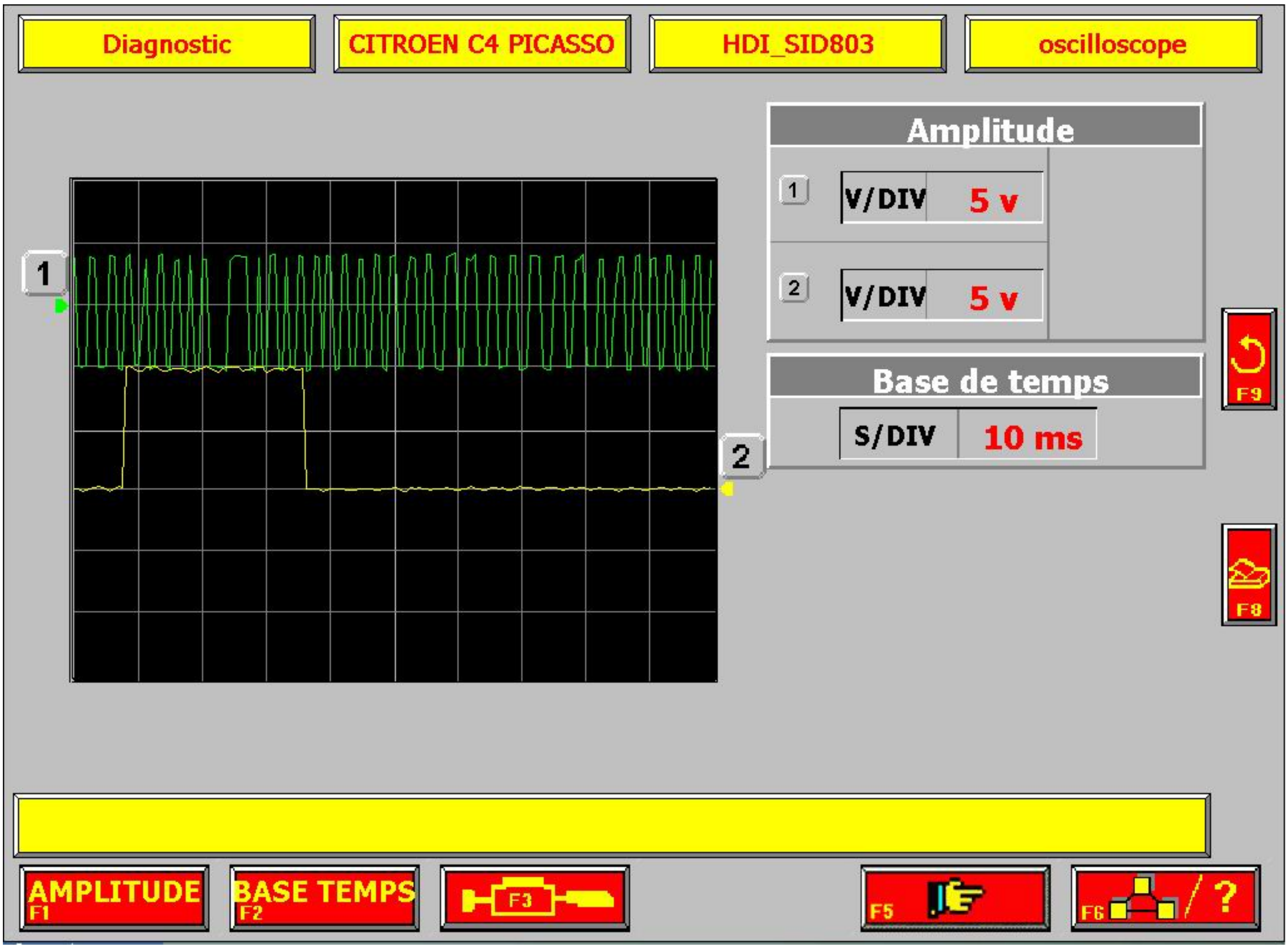

Figure 54: Camshaft / Crankshaft synchronisation

This measurement can only be carried out using the LEXIA type diagnostic tool.

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2. REMINDER OF FAULT CODES

✓ Detection of faults is based on voltage measurement

The fault must be present for a minimum length of time so that the ECU can choose to store it.

E.g. in order to be detected, fault code P0097, "short circuit to earth" (inlet air temperature sensor) must be present for 5 seconds.

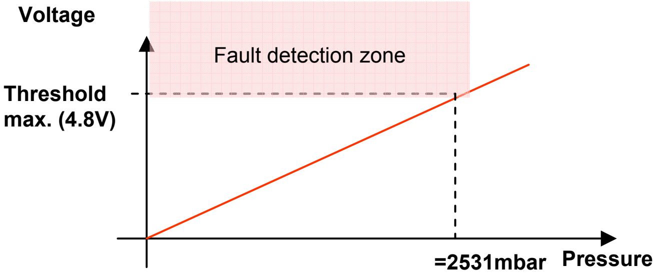
✓ The length of detection prevents fault codes being needlessly created

However, for parameters such as air flow and inlet air pressure, the length of time has an impact, as it affects the priority given to the appearance of one fault in relation to another.

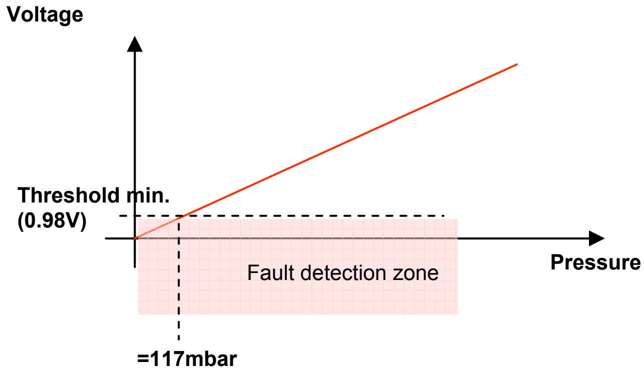
For example, on a DV6 engine, the detection time for the "air flow too high" fault, P0100 is 2 seconds, although it is 5 seconds for detection of "inlet air pressure measured" that is too high in relation to the reference (PO299). Therefore if fault code P0100 appears, it may very well be caused by an abnormally high turbo pressure, as the detection time of the air flow fault is shorter.

<u>Some examples of abnormal voltages that generate fault codes:</u>

1. Measured voltage is higher than the maximum threshold value



2. Measured voltage is lower than the minimum threshold value



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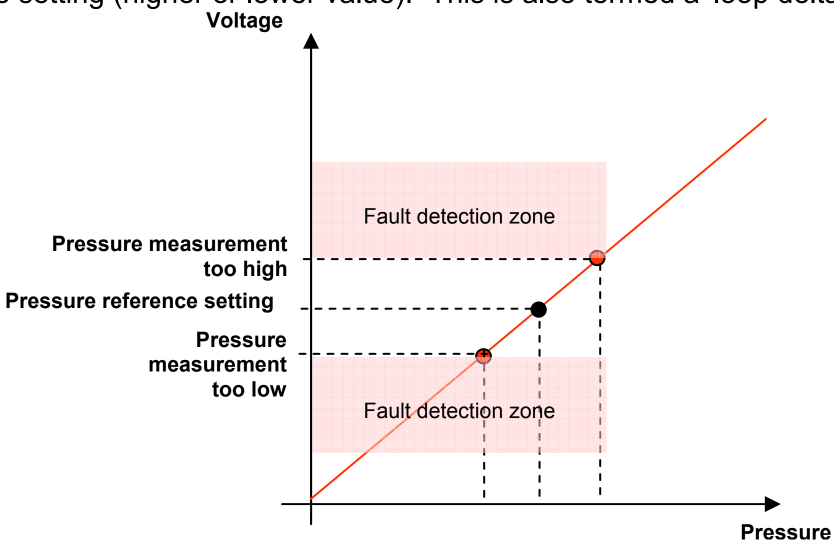
3. The voltage measured is within the range of minimum and maximum thresholds but it is too far away from the reference setting (higher or lower value). This is also termed a 'loop delta'.



4. The change in voltage over time is not plausible.
Example: a fuel temperature sensor which "sees" a 10° C temperature increase in 1 second.
This fault is also referred to as a 'slope fault'.

5. The voltage value measured is not consistent with that transmitted by other sensors.
For example; on turning on the ignition, the turbo pressure sensor data is compared to the atmospheric pressure sensor.

3. ACTUATOR TEST

Diagnostics associated with an actuator test allows the following types of faults to be detected on the relevant actuator:-

- ✓ Open circuit
- ✓ Short-circuit to positive.
- ✓ Short circuit to earth.

For actuators that transmit a feedback signal, such as electric EGR valves, the actuator test alone is not sufficient. The plausibility of the feedback signal is not tested as part of the actuator test.

Actuator tests on electrovalves are carried out by the diagnostic tool with an OCR of 0% and 100%. Thus, even if the actuator noise is audible during an actuator test, this does not exclude the possibility of line resistance.

Actuator tests carried out on electrovalves controlled by OCR are carried out by the diagnostic tool with a 100% OCR.

However, for some actuators, such as the HP pump electrovalves, which have a limited operating range (20 to 40% for the VCV), in the event of a line resistance fault, the actuator test may be conclusive and not flag up a fault (the voltage transmitted is higher and so the current consumed by the solenoid will be sufficient to activate the component, although it is insufficient between 20 and 40% under normal operating conditions).

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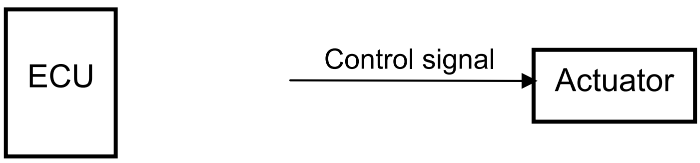
4. CONTROL

The purpose of this paragraph is to clarify the vocabulary found in documentation or in fault code wording relating to system management.

- ✓ Open loop management
- ✓ Closed loop management
- ✓ Overall management
- ✓ Local management

4.1. Open loop management

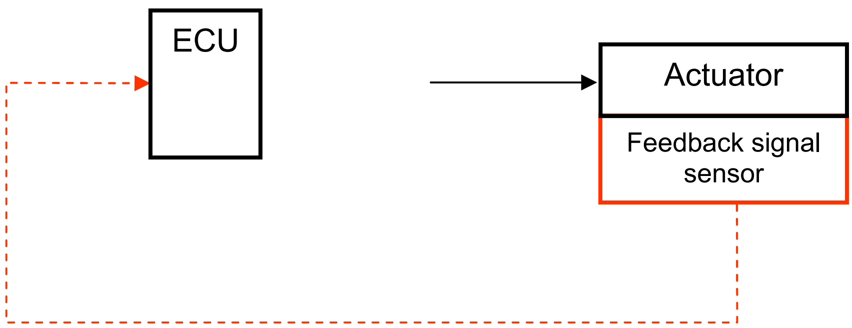
In open loop system management, the action is managed in line with the mapping.
In the case of the DV6 9HZ turbocharger, the variable geometry system is positioned by the mapping and there is no position feedback.



Advantage:	Disadvantage:
✓ Simplicity	✓ Inaccurate control, particularly as the system ages

4.2. Closed loop management

In closed loop management, the actuator control is combined with the data from a sensor and constantly readjusted to remain in line with the defined setting.



Advantage:	Disadvantage:
✓ Accurate control adjustment	✓ More complex ECU electronic management ✓ Additional component

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4.3. Overall Management

Overall management manages the function at system level;
Example: ON DW10BTED4, overall management is handled thanks to the air inlet pressure sensor.

To ensure that the system functions as a whole, the turbo pressure has to be measured. If it is correct, this means that the system components are each operating correctly.

Other examples of overall management:

- ✓ Fuel high pressure circuit (loop is closed by the fuel high pressure sensor)
- ✓ EGR mechanism (loop is closed by the flowmeter).

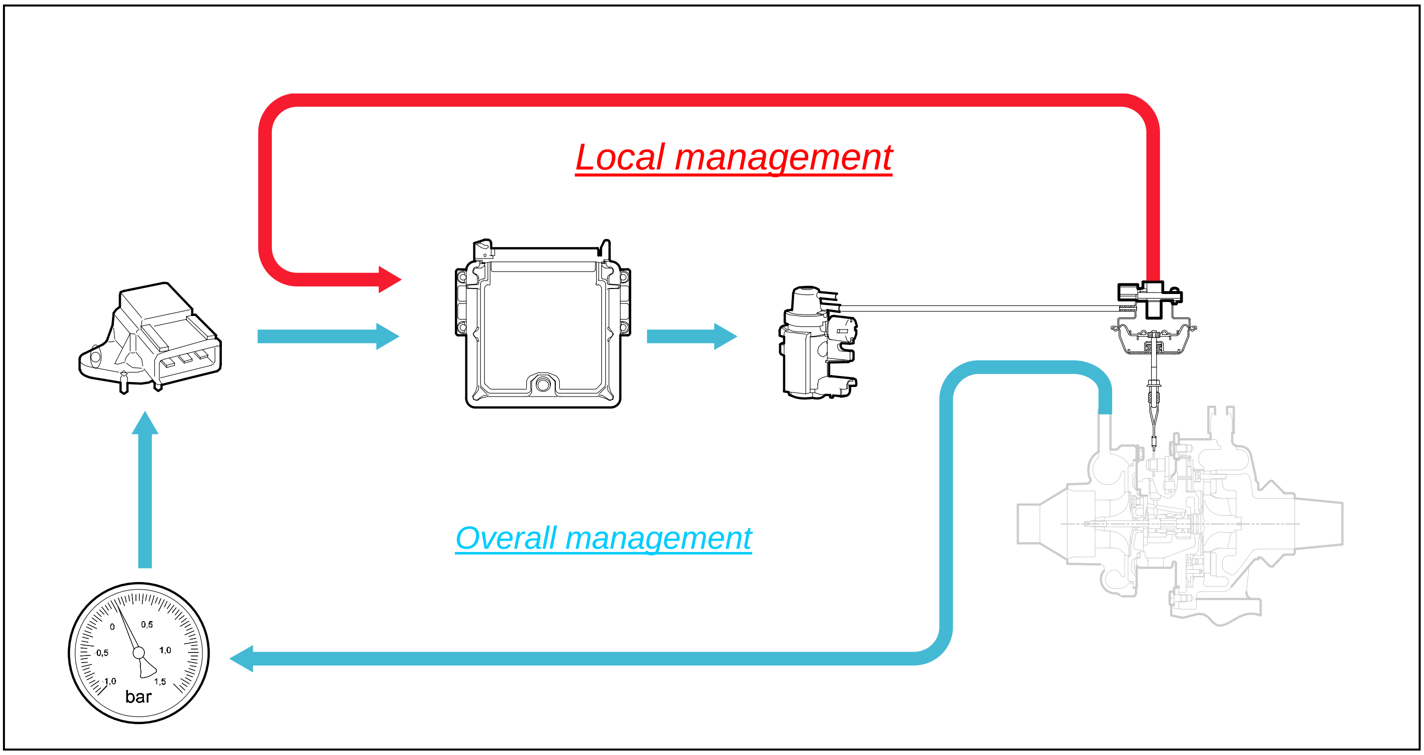
4.4. Local management

Local management manages the function at actuator level;
Example: on DW10BTED4, local management is carried out by using the variable geometry turbo position feedback sensor.

In order to obtain greater accuracy, actuators are sometimes managed using a sensor which provides data on their operation. This is also an advantage in terms of diagnostics.

Other examples of local management:

- ✓ electric EGR valve
- ✓ EGR and Inlet heater throttle valve (DV6).



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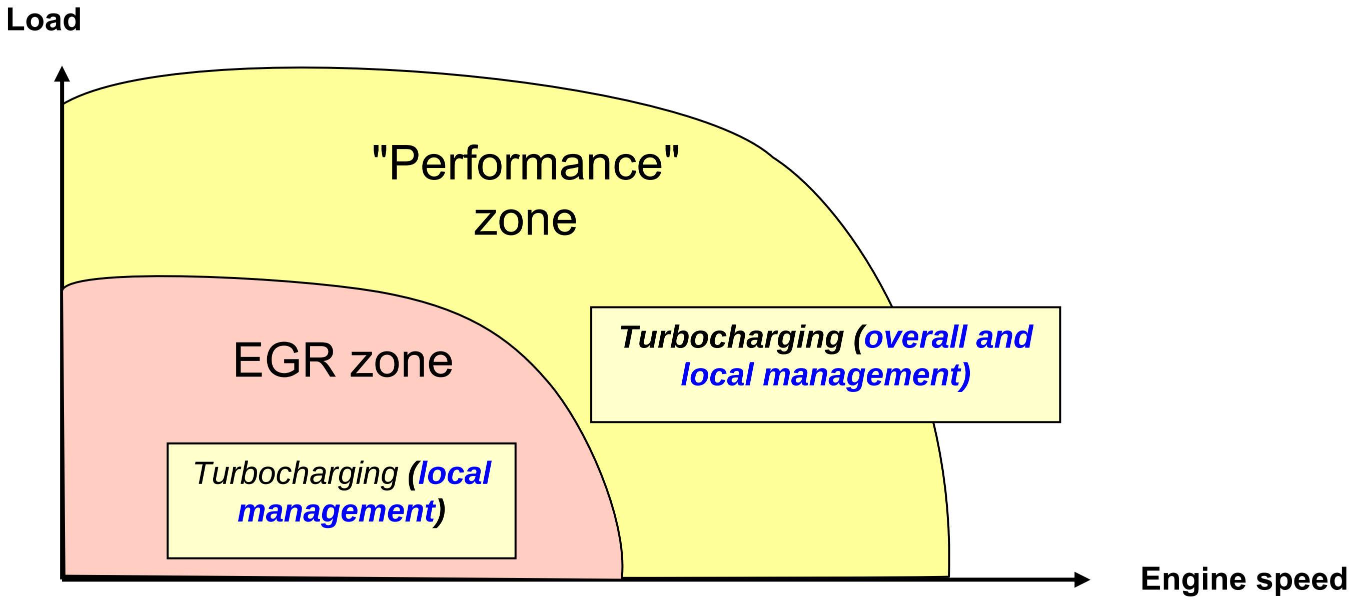
4.5. NOTE CONCERNING TURBO CONTROL

In the EGR zone, turbo charging is **managed locally only**, no account is taken of the inlet air pressure sensor data, in order to avoid interference between air pressure and volume control. Both the EGR and turbo management act on air and thus they have interactions. A change in airflow has an effect on its pressure and vice-versa. It is therefore extremely complex to provide overall turbo management during overall EGR management without having loop faults on either side.

Outside the EGR zone, turbo charging is **managed locally only + overall**.



It could be said that overall management is in "open loop" in the EGR zone and in "closed loop" in the turbo zone.

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TOOLS REQUIRED

1. ELECTRICAL TESTING

Additional harnesses:
- 4391-T (BSM)
- 4229-T (EDC16 C34 and SID 803 / 803A)
- 4340-T (SID 803 / 803A)

Expert pack diagnostic tools (Lexia / Proxia)

2. FUEL CIRCUIT CHECKS

1 - 10 mm coupling tube for low pressure circuit	4215-T
1 - 8 mm coupling tube for low pressure circuit	4218-T
1 - pressure gauge	4073-TA
1 - bottle with increments indicated on side	H-1613.L
1 - high pressure circuit test kit	H-1613
1 - pressure test kit	C-0171/2
1 - pump actuator diagnostic kit	H-1613/2

3. AIR CIRCUIT CHECKS

3.1. Manufacturer's tooling

1 differential pressure gauge kit	W -1602

3.2. Referenced tooling

FACOM DA16 manual pressure / vacuum pump (Mityvac).

Figure 55: Pressure/vacuum pump

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3.3. TOOLING TO BE MANUFACTURED

3.3.1. Ø 8 male and female couplings (of the diesel return circuit type).

These two tools can be made using a tube reference: PR: 1574 E5.

Figure 56: Female coupling

Figure 57: Male coupling

3.3.2. 3-way coupling

This tool can be made using a tube reference: PR: 157460

Figure 58: 3-way coupling

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GLOSSARY

4.

Acronym	French Origin	English translation
ADDGO	**ADD**itivation **G**az**O**le	Diesel Additive
BSI	**B**oîtier de **S**ervitude **I**ntelligent	**B**uilt-in **S**ystem **I**nterface
BSM	**B**oîtier de **S**ervitude **M**oteur	Engine Ancillary Unit
CC-	**C**ourt **C**ircuit à la masse	**S**hort **C**ircuit to earth
CC+	**C**ourt **C**ircuit au plus	**S**hort **C**ircuit to positive
CH	**C**onnecteur **H**abitacle (noir)	Passenger Compartment Connector (black)
CME	**C**onnecteur **M**odulaire **E**xterne (gris)	External Modular Connector (grey)
CMI	**C**onnecteur **M**odulaire **I**nterne (marron)	Internal Modular Connector (brown)
CMM	**C**alculateur **M**oteur **M**ultifonction	Multifunction Engine Control Unit
CO	**C**ircuit **O**uvert	**O**pen **C**ircuit
EGR	**E**xhaust **G**az **R**ecirculation (Recyclage des gaz d'échappement)	**E**xhaust **G**as **R**ecirculation
FAP	**F**iltre **A** **P**articules	Particle Filter
GPL	**G**az de **P**étrole **L**iquéfié	**L**iquid **P**etroleum **G**as (LPG)
GNV	**G**az **N**aturel **V**éhicule	**V**ehicle **N**atural **G**as (VNG)
MPROP	**R**égulateur de débit – pompe HP BOSCH (**M**etering **PROP**ortional)	Flow Regulator – BOSCH HP pump (**M**etering **PROP**ortional)
PCV	**P**ression **C**ontrol **V**alve (Régulateur de pression)	**P**ressure **C**ontrol **V**alve (high pressure fuel regulator)
RAA	**R**échauffeur **A**ir **A**dmission	Inlet Air Heater
RAS	**R**efroidisseur **A**ir **S**uralimentation	Intercooler
VCV	**V**olume **C**ontrol **V**alve (Régulateur de débit)	Fuel flow regulator (**V**olume **C**ontrol **V**alve)

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