


Diagnosis – Trouble Code Description

➤ 1		Hot film MAF sensor (B2/6, B2/7)
1	OBD trouble code	P0100 Right cylinder bank P1146 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Hot film MAF sensor signal threshold values
5	Lower threshold value Upper threshold value Plausibility Test duration per threshold value	approx. 0.2 V approx. 5.4 V The air mass can not deviate more than approx. 130% from the theoretically required air mass (stored map, engine rpm dependent) < 5 seconds


Diagnosis – Trouble Code Description

➤ 2	Pressure sensor (B28/1, B28/2)	
1	OBD trouble code	P0105 Right cylinder bank P1149 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Pressure sensor signal threshold value (intake manifold pressure)
5	Lower threshold value Upper threshold value During deceleration	approx. 0.27 V approx. 4.9 V > approx. 2.5 V
	Test duration per threshold value	< 5 seconds

Diagnosis – Trouble Code Description

≥ 3	IAT sensor (B17/5, B17/6)	
1	OBD trouble code	P0110 Right cylinder bank P1148 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Intake air temperature threshold values
5	Lower threshold value Upper threshold value Test duration per threshold value	> 300 kΩ (approx. -50 °C) < 150 Ω (approx. +125 °C) < 1 second
6		In case of a fault driving continues with the substitute value of +20 °C. If the signal is plausible again, a switchover to the signal of the IAT sensor occurs.


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➤ 4	ECT sensor (B11/9, B11/10)	
1	OBD trouble code	P0115 Right cylinder bank P1147 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Engine coolant temperature threshold values
5	Lower threshold value Upper threshold value Test duration per threshold value Plausibility	> 50 kΩ (approx. -38 °C) < 50 Ω (approx. +160 °C) < 1 second The temperature rise after the cold start is compared to a stored temperature pattern (map). After a predetermined time a temperature of at least +38 °C must be reached.
6		In case of a fault driving continues with the substitute value from the temperature pattern. If the signal is plausible again, a switchover to the signal of the ECT sensor occurs.


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≥ 5	Actual value potentiometer in EA/CC/ISC actuator (M16/3, M16/4)	
1	OBD trouble code	P0120 Right cylinder bank P1162 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Threshold value of actual value potentiometers r1 or r2
5	Reference potentiometer r1 Lower threshold value Upper threshold value Actual value potentiometer r2 Lower threshold value Upper threshold value	<0.355 V >4.765 V <0.295 V >4.63 V

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➤ 6	O ₂ sensor signal	
1	OBD trouble code	P0130 Right O2S 1 (before TWC) (G3/4) P0136 Right O2S 2 (after TWC) (G3/6) P0140 Right O2S 1 heater (before TWC) (G3/4) P0150 Left O2S 1 (before TWC) (G3/3) P0156 Left O2S 2 (after TWC) (G3/5) P0160 Left O2S 1 (before TWC) (G3/3)
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	A. O ₂ sensor signal threshold value B. Change of O ₂ sensor condition
5	A. O ₂ sensor signal threshold value Lower threshold value Upper threshold value Test duration B. Change of O ₂ sensor condition	< - 0.15 V > 1.5 V < 5 seconds After approx. 220 seconds with energized O ₂ sensor heater, the O ₂ sensor signal must not remain longer than 5 seconds in the voltage window of 0.4 – 0.6 V.
6	Prerequisite for test	– Engine speed approx. 1000 – 2000 rpm – Load approx. 15 – 50% – TWC temperature > approx. 300 °C – Lambda control released
7		All electrical connection faults of the O ₂ sensors before TWC or after TWC (open or short circuit towards ground or battery voltage) are recognized with this test.


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➤ 7		A. O₂ sensor ageing correction value exceeded B. O₂ sensor ageing time period too long
1	OBD trouble code	P0133 Right O ₂ S 1 (before TWC) (G3/4) P0153 Left O ₂ S 1 (before TWC) (G3/3)
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	A. Correction value exceeded B. Time period too long
5	A. Correction value threshold value B. Time period threshold value Test duration	Approx. ± 1.2 seconds < approx. 7.5 seconds (average value from 9 measurements) < 80 seconds
6	Prerequisite for test	– Engine speed approx. 1000 – 2000 rpm – Load approx. 15 – 50% – TWC temperature > approx. 300 °C – Lambda control released – No fault with TWC operation – No fault with O ₂ sensor heater
7	Test sequence	The O ₂ sensors after the TWC are required for the monitoring of the catalyst effectiveness and improvement of the lambda control (two sensor control). The lambda mean value is established from O ₂ sensor signals and from it a correction value is determined for the lambda control. With the correction value (value for new O ₂ sensor approx. 0) the aging of the O ₂ sensor before the TWC is compensated for to a certain degree. If the correction value exceeds the threshold value the O ₂ sensor before the TWC must be replaced. Additionally, the time period of the O ₂ sensor signal is evaluated.
8		Time period of the O ₂ sensor before TWC too long: O ₂ sensor after TWC is no longer monitored. Correction value of the O ₂ sensor before TWC exceeded: O ₂ sensor after TWC is further monitored. If faults are recognized simultaneously for the O ₂ sensor before TWC and after TWC, only the O ₂ sensor after TWC is defective in most cases.



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➤ 8	O ₂ sensor heater	
1	OBD trouble code	P0135 Right O ₂ S 1 (before TWC) (G3/4) P0141 Right O ₂ S 2 (after TWC) (G3/6) P0155 Left O ₂ S 1 (before TWC) (G3/3) P0161 Left O ₂ S 2 (after TWC) (G3/5)
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Calculated resistance value of O ₂ sensor heater
5	Lower threshold value Upper threshold value	< approx. 4.4 Ω (corresponds to approx. 2.7 A at 12 V) > approx. 18.4 Ω (corresponds to approx. 0.65 A at 12 V)
6	Prerequisite for test	O ₂ sensor heater ON and heating period of approx. 220 seconds expired.


Diagnosis – Trouble Code Description

➤ 9		A. Self adaptation of fuel mixture "partial load" at limit from engine control module (N3/11, N3/12) B. Self adaptation of fuel mixture "CTP" at limit from engine control module (N3/11, N3/12)
1	OBD trouble code	P0170 Right cylinder bank P0171 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	The DTC storage takes place immediately. Activation of the CHECK ENGINE MIL takes place after two consecutive trips with fault.
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Self-adaptation of fuel mixture threshold value
5	A. CTP threshold value B. Partial load threshold value	Approx. ± 1.0 ms (corresponds to approx. 20% of the injection duration at idle) 0.77 – 1.28 factor
6		In order to obtain a new value for the self-adaptation of the fuel mixture a trip of approx. 30 minutes is required. When starting the engine the ECT must be < 60 °C.


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➤ 10	Injectors (Y62)	
1	OBD trouble code	P0201 – P0212
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Current/voltage test at the individual injector
5	Current draw threshold value Voltage threshold value	> 4.2 A < 2.5 V
	Test duration	< 5 seconds
6		The activation of each injector is tested for open and short circuit (towards ground or battery). In case of a fault the final stage is immediately no longer activated.
7		With a short towards ground the corresponding injector remains continuously open.

Diagnosis – Trouble Code Description

➤ 11		A. Misfire B. Misfire, TWC damaging
1	OBD trouble code	P0300 Misfires P0301 – P0312 Misfire, assigned to each individual cylinder
2	Storage of DTC and activation of CHECK ENGINE MIL	A. Misfire (emission limit) Ignition misfire within 1000 engine revolutions. CHECK ENGINE MIL is activated (illuminated) after two consecutive trips with fault B. Misfire "TWC damaging" Ignition misfire within 200 engine revolutions. CHECK ENGINE MIL is activated (illuminated via blinking) immediately with ignition misfire.
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Number of recognized ignition misfires (recognition via engine smooth running evaluation)
5	Threshold values	A. > 20 misfires within 1000 engine revolutions B. > 6 misfires within 200 engine revolutions (map dependent from engine rpm and load)
6	Prerequisite for test	<ul style="list-style-type: none"> – Engine speed approx. 500 – 4000 rpm – Load change < 100% per second – Engine was started at least 5 seconds previously – No ESP control function – VSS adaptation during deceleration already took place – Body acceleration sensor signal below threshold value (approx. 0.5 g) – No fault signal from camshaft Hall-effect sensor – No transmission range change – No deceleration shut-off
7		If the threshold value for misfire "TWC damaging" is exceeded, the CHECK ENGINE MIL blinks immediately. If too many misfires occur on one cylinder, this cylinder is turned off (cylinder selective fuel shut-off). After turning off of cylinders the CHECK ENGINE MIL changes from blinking to continuous illumination after the next engine start. If ignition misfires are recognized with a low fuel tank level (fuel reserve indicator lamp ON) the DTC P0452 is indicated. Combustion misfires caused by lack of fuel are recognized via this additional information.

Diagnosis – Trouble Code Description

➤ 12	Knock sensor	
1	OBD trouble code	P0325 Right KS 1 (A30g1) P0330 Right KS 2 (A30g2) P1384 Left KS 1 (A29g1) P1385 Left KS 2 (A29g2)
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Knock sensor signal (in engine control module (ME-SFI) calculated comparison value)
5	Lower threshold value Upper threshold value	Approx. 0.19 V Approx. 4.98 V
6	Prerequisite for test	– Engine at operating temperature – Engine speed > 3600 rpm – Load > 40% – Knock control not activated
7		The safety retard adjustment occurs on all cylinders in case of a fault.


Diagnosis – Trouble Code Description

➤ 13		CKP sensor (L5/4, L5/5)
1	OBD trouble code	P0335 Right cylinder bank P1300 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	CKP sensor signal (counting of teeth on flywheel)
5	Lower threshold value Upper threshold value Test duration	(60 – 2 teeth) – 1 tooth (60 – 2 teeth) + 1 tooth < 5 seconds


Diagnosis – Trouble Code Description

➤ 14		Camshaft Hall-effect sensor (B6/2, B6/3)
1	OBD trouble code	P0341 Right cylinder bank P1397 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Camshaft Hall-effect sensor signal
5	Plausibility No signal Number	The signal must change within 2 engine revolutions from 0 – 1 to 1 – 0 Maximum 1 signal change per engine revolution
6	Prerequisite for test	– Engine revolutions 25 – 6300 rpm – No CKP sensor fault


Diagnosis – Trouble Code Description

➤ 15	AIR system malfunction (logic chain)	
1	OBD trouble code	P0410 Right cylinder bank P1463 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Once per trip
4	Checked signal or condition	O ₂ sensor signal before TWC
5	Threshold value Test duration	Lambda control factor approx. 25% (lean mixture recognized, engine control module at "rich" stop) < 15 seconds
6	Prerequisite for test	<ul style="list-style-type: none"> – Engine at CTP (idle) – Vehicle stationary – AIR pump activated at least once after starting engine – No fault for voltage supply of purge switchover valve, AIR pump switchover valve and electrical AIR pump or electromagnetic AIR pump clutch – No fault in purge system – No fault of EA/CC/ISC actuator – No combustion misfire – No fault of O₂ sensor before TWC ageing – No fault in CAN data bus – Self-adaptation of fuel mixture not at threshold value – Atmospheric pressure above approx. 780 mbar (e.g. no test is performed above approx. 8,000 ft altitude) – Engine coolant temperature < approx. 90°C – Lambda control released
7	Test sequence	With the start of the logic chain all functions for the automatic mixture adaptation are blocked, the purge switchover valves are closed and the actual lambda control factor is recorded. Subsequently AIR injection takes place. The mixture must become leaner. Correspondingly the lambda control factor reacts with an increase of approx. + 25%.
8		If a prerequisite changes during the test, the test is canceled and started later again.

Diagnosis – Trouble Code Description

➤ 16	TWC efficiency below threshold	
1	OBD trouble code	P0422 Right P0432 Left
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Voltage ratio (amplitudes) O ₂ sensor signal after TWC to O ₂ sensor signal before TWC
5	Threshold value	O ₂ sensor signal after TWC maximum 50% of O ₂ sensor signal before TWC (at more than 2 of 9 measurements)
	Test duration	Approx. 210 seconds
6	Prerequisite for test	<ul style="list-style-type: none"> – Engine speed approx. 900 – 2000 rpm – Load approx. 10% to 45% – TWC temperature > approx. 350 °C – Lambda control released and lambda > 0.4 – No fault in O₂ sensors (signal, heater, aging) – No combustion misfire
7		<p>The TWC is evaluated via its oxygen storage capability. Within the specified engine speed and load range several measurements must take place. The results are compared with a map and if necessary a fault is recognized.</p> <p>The amplitude of the O₂ sensor voltage after TWC can be at the most half as large as the amplitude of the O₂ sensor voltage before TWC (Note: If, for example, no monolith would be installed in the TWC, the O₂ sensor signals before and after the TWC would be identical).</p> <p>If the DTCs for the catalyst and the O₂ sensor before TWC are displayed simultaneously, replace the O₂ sensor before TWC first.</p> <p>If subsequently no TWC fault is displayed any more, the effectiveness of the TWC is slightly reduced but it does not have to be replaced at this time.</p>

Diagnosis – Trouble Code Description

➤ 17		EVAP system (logic chain) Only (USA) Model 140 only, Model 129 as of 09/97
1	OBD trouble code	P0440 leaking P0442 small leak P0455 large leak
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Once per trip
4	Checked signal or condition	Fuel tank pressure sensor pressure values
5	Large leak test Small leak test Test duration	A vacuum buildup of 0.3 mbar per second can not be obtained. With the system closed, the vacuum loss is larger than approx. 15% of the vacuum obtained at the large leak test. < 30 seconds
6	Prerequisite for test	<ul style="list-style-type: none"> – Engine at CTP (idle) – Vehicle stationary – The time purge system is inoperative after starting engine has elapsed (approx. 16 minutes) – Lambda control released – Air injection not active – Atmospheric pressure above approx. 780 mbar (e.g. no test is performed above approx. 8,000 ft altitude) – Charcoal canister only slightly saturated – Lambda reading during the test > approx. 0.9 – With the fuel reserve indicator lamp ON or full tank only the large leak test takes place – Severe sloshing of fuel in the tank (inadmissible pressure fluctuations), the fuel tank pressure sensor (B4/3) recognizes it and interrupts the test – No fault at activated charcoal canister shut-off valve – No fault at fuel tank pressure sensor
7		With defective fuel tank pressure sensor DTC P0455 is displayed



Diagnosis – Trouble Code Description

➤ 18	EVAP not functioning	
1	OBD trouble code	P0441 Right cylinder bank P1443 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Once per trip
4	Checked signal or condition	Pressure variations in line from charcoal canister to purge control valve
5	Fault Test duration	Pressure deviation difference less than approx. 27 mbar < 15 seconds
6	Prerequisite for test	<ul style="list-style-type: none"> – Engine at CTP (idle) – Load approx. 10 – 25% – Activation of purge control valve with an on-off ratio between approx. 5 – 25%


Diagnosis – Trouble Code Description

➤ 19		Purge control valve
1	OBD trouble code	P0443 Right cylinder bank P1490 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Once per trip
4	Checked signal or condition	Voltage and current at respective purge control valve
5	Threshold values Short circuit to ground Short circuit to approx. + 12 V Open circuit	Voltage < 4 V Current > approx. 4.2 A No voltage (approx. 4 V – 8 V)


Diagnosis – Trouble Code Description

<p>➤ 20</p>		<p style="text-align: right;">Only  Model 140 only, Model 129 as of 09/97</p> <p>A. Charcoal canister shut-off valve, output stage B. Charcoal canister shut-off valve (Y58/4)</p>
<p>1</p>	<p>OBD trouble code</p>	<p>P0446</p>
<p>2</p>	<p>Storage of DTC and activation of CHECK ENGINE MIL</p>	<p>After two consecutive trips with fault</p>
<p>3</p>	<p>Monitoring time and frequency of test</p>	<p>Once per trip</p>
<p>4</p>	<p>Checked signal or condition</p>	<p>Voltage supply at charcoal canister shut-off valve and fuel tank pressure</p>
<p>5</p>	<p>Voltage supply threshold values Short circuit to ground Short circuit to approx. + 12 V Open circuit</p> <p>Fuel tank pressure</p> <p>Test duration</p>	<p>Voltage < 4 V Current > approx. 4.2 A No voltage (approx. 4 V – 8 V)</p> <p>> approx. 3.5 mbar</p> <p>< 10 seconds</p>
<p>6</p>	<p></p>	<p>With closed charcoal canister shut-off valve at least approx. 3.5 mbar vacuum must be registered by the fuel tank pressure sensor.</p>


Diagnosis – Trouble Code Description

➤ 21		Fuel tank pressure sensor (B4/3) Only (USA) Model 140 only, Model 129 as of 09/97
1	OBD trouble code	P0450
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Once per trip
4	Checked signal or condition	Fuel tank pressure sensor (B4/3) signal
5	A. Upper threshold value Lower threshold value Test duration B. Lower threshold value Upper threshold value Test duration	> approx. 4.7 V (corresponds to approx. 35 mbar pressure) < approx. 0.1 V (corresponds to approx. 60 mbar vacuum) 10 seconds approx. 0.27 V approx. 4.9 V < 5 seconds
6	Prerequisite for test	The time purge system is inoperative after starting engine has elapsed (approx. 10 seconds)
7		Map for fuel tank pressure sensor (B4/3): – 50 mbar approx. 0.5 V; 0 mbar approx. 3.0 V; + 30 mbar approx. 4.5 V

Diagnosis – Trouble Code Description

➤ 22		Purge monitoring pressure sensor (B4/4)	Only  Model 129 up to 08/97
1	OBD trouble code	P0450	
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault	
3	Monitoring time and frequency of test	Once per trip	
4	Checked signal or condition	Purge monitoring pressure sensor (B4/4) signal	
5	A. Upper threshold value Lower threshold value Test duration B. Lower threshold value Upper threshold value Test duration	> approx. 4.7 V (corresponds to approx. 35 mbar pressure) < approx. 0.1 V (corresponds to approx. 60 mbar vacuum) 10 seconds approx. 0.27 V approx. 4.9 V < 5 seconds	
6	Prerequisite for test	The time purge system is inoperative after starting engine has elapsed (approx. 10 seconds)	

Diagnosis – Trouble Code Description

<p>➤ 23</p>		<p>A. VSS left front B. VSS left rear</p>
<p>1</p>	<p>OBD trouble code</p>	<p>P0500</p>
<p>2</p>	<p>Storage of DTC and activation of CHECK ENGINE MIL</p>	<p>Storage of DTC after two consecutive trips with fault No activation of CHECK ENGINE MIL</p>
<p>3</p>	<p>Monitoring time and frequency of test</p>	<p>Continuously</p>
<p>4</p>	<p>Checked signal or condition</p>	<p>A. VSS left front B. VSS left rear</p>
<p>5</p>	<p>Threshold value Test duration Plausibility Test duration</p>	<p>The VSS (digital signal from ESP control module) must be recognized as of approx. 7 mp/h < 5 seconds As of approx. 40 km/h is valid: Speed front minus speed rear < ± 30 km/h < 30 seconds</p>
<p>6</p>	<p>Prerequisite for test</p>	<ul style="list-style-type: none"> - Engine speed approx. 2500 – 4500 rpm - Load > approx. 40% - Transmission range D
<p>7</p>	<p></p>	<p>The wheel revolutions are registered and evaluated by the ESP control module. The engine control module (ME-SFI) receives a processed digital speed signal. After DTC recognition (e.g. driving on a dynamometer) the DTC memory of the ME and ESP control modules must be read.</p>


Diagnosis – Trouble Code Description

➤ 24	Idle speed control system	
1	OBD trouble code	P0507
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Engine rpm
5	Upper threshold value Lower threshold value Test duration	Nominal value + 300 rpm Nominal value – 250 rpm < 30 seconds If the actuation of the actuator motor in the EA/CC/ISC actuator is changed by the engine control module the new nominal value must be obtained within approx. 25 seconds.
6	Prerequisite for test	<ul style="list-style-type: none"> – Engine temperature > approx. 20 °C – Automatic A/C OFF – Vehicle stationary


Diagnosis – Trouble Code Description

➤ 25	Voltage supply to engine control module (N3/10)	
1	OBD trouble code	P0560 for right cylinder bank P1587 for left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Battery voltage
5	Lower threshold value Upper threshold value	approx. 8 V approx. 17.5 V
	Test duration	< 5 seconds
6	Prerequisite for test	Waiting time of approx. 180 seconds after starting engine has elapsed


Diagnosis – Trouble Code Description

➤ 26		CAN bus interrupted
1	OBD trouble code	P0600 CAN from ESP control module P1641 CAN to left engine control module (N3/11) P1747 CAN from ETC control module
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	CAN communications
5	Test duration	< 15 seconds
5		The data exchange between the control modules is monitored via the CAN element in the engine control module (ME-SFI).


Diagnosis – Trouble Code Description

➤ 27		Transmission range implausible or transmission slips
1	OBD trouble code	P0700
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Calculated transmission ratios outside tolerance
5	Permissible ratios Test duration	1.986 – 2.389 2nd gear 1.355 – 1.455 3rd gear 0.970 – 1.030 4th gear 0.476 – 0.536 5th gear (calculated value) 1.726 – 2.126 reverse gear < 2 seconds
6	Prerequisite for test	– Engine speed > 400 rpm – Output shaft speed > 150 rpm (> approx. 20 km/h) – No gear change
7	Test sequence	If no gear change occurs, the ETC control module recognizes the engaged driving range on the gear ratio. If the gear ratio is outside the tolerance or the driving range is implausible the modulating pressure is adjusted to its highest value after approx. 0.5 seconds. Remains the gear ratio outside the tolerance or the driving range implausible a fault is recognized after approx. 1 second.
8		The gear ratios are calculated from the following values: rpm signal n2, rpm signal n3 and output shaft rpm (via rear wheel rpm). Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code 05!).


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➤ 28		Command valve binds in pressure position
1	OBD trouble code	P0700
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Calculated transmission ratios outside tolerance
5	Permissible ratios Test duration	1.986 – 2.389 2nd gear 1.355 – 1.455 3rd gear 0.970 – 1.030 4th gear 0.476 – 0.536 5th gear (calculated value) 1.726 – 2.126 reverse gear < 2 seconds
6	Prerequisite for test	– Engine speed > 400 rpm – Output shaft speed > 150 rpm (> approx. 20 km/h)
7	Test sequence	After each gear change process the shift pressure is slowly reduced. If shift components slip during pressure reduction, the command valve binds in the pressure position. Slipping shift components are recognized on the respective transmission ratio.
8		The gear ratios are calculated from the following values: rpm signal n2, rpm signal n3 and output shaft rpm (via rear wheel rpm). Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code P0700).


Diagnosis – Trouble Code Description

➤ 29		ETC control module
1	OBD trouble code	P0702
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Failure in ETC control module – CAN communication – Impermissible version coding – Internal memory (RAM, ROM, EEPROM)
5		Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory, see Diagnostic Manual, Chassis and Drivetrain (Failure code P056, P058, P059, P062, P063, P064).


Diagnosis – Trouble Code Description

➤ 30		Voltage supply to transmission solenoid valves
1	OBD trouble code	P0702
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Voltage supply to transmission solenoid valves
5	Lower threshold value Upper threshold value	< battery voltage – 2 V (longer than approx. 0.1 seconds) > battery voltage + 2 V (longer than approx. 0.1 seconds)
6	Test sequence	The solenoid valves are supplied with battery voltage by the ETC control module. The difference between battery voltage and supply voltage to the solenoid valves is monitored by the ETC control module.
7		Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code P0702).


Diagnosis – Trouble Code Description

➤ 31	Voltage supply and function of RPM sensors	
1	OBD trouble code	P0715
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	<ul style="list-style-type: none"> – voltage supply for RPM sensors – RPM signal n2 – RPM signal n3
5	Voltage supply for RPM sensors Lower threshold value Upper threshold value RPM signal n2, n3 Test duration	<ul style="list-style-type: none"> < approx. 4.8 V > approx. 7.2 V Signals recognized and plausible < 1 second
6	Prerequisite for test RPM signal n2 Prerequisite for test RPM signal n3	<ul style="list-style-type: none"> – Engine speed > 450 rpm – Right rear wheel revolutions > 250 rpm – Left rear wheel revolutions > 250 rpm – 3rd or 4th gear recognized – Output shaft revolutions > 150 rpm (> approx. 20 km/h) – No transmission range change
7	Test sequence	Starting at a certain engine and wheel rpm the RPM signals must be recognized. For the RPM signal n3, the 3rd or 4th gear must be engaged additionally.
8		Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code P0711, P0712, P0713).


Diagnosis – Trouble Code Description

➤ 32		Fault recognition CAN: Left rear and right rear wheel rpm (from ESP) implausible or communication interrupted
1	OBD trouble code	P0720
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	The ETC control module monitors the wheel rpm signal from the EPS control module via CAN data bus for plausibility.
5	Test duration	< 1 second
6		Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code 022, 023, 030).


Diagnosis – Trouble Code Description

➤ 33		Transmission range comparison (repeatedly) negative
1	OBD trouble code	P0730
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Comparison of recognized gear and engaged gear (calculated gear ratio) at least 6x negative.
5	Prerequisite for test	<ul style="list-style-type: none"> – 2nd, 3rd, 4th or 5th gear recognized – Engine speed > 400 rpm – Output shaft revolutions > 150 rpm – No transmission range change
6		<p>The gear ratios are calculated from the following values: rpm signal n2, rpm signal n3 and output shaft rpm (via rear wheel rpm).</p> <p>Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module.</p> <p>Additionally read ETC control module DTC memory (Failure code 055).</p>


Diagnosis – Trouble Code Description

➤ 34	Torque converter lock-up clutch	
1	OBD trouble code	P0740
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Friction coefficient of torque converter lock-up clutch
5	Test sequence	With the torque converter lock-up clutch engaged the friction coefficient is calculated via rpm comparisons. If it is several times out of tolerance a fault is recognized.
6		Faults are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code 053).


Diagnosis – Trouble Code Description

➤ 35		PWM solenoid valve, torque converter lock-up
1	OBD trouble code	P0743
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	On-off ratio for activation of PWM solenoid valve
5	Lower threshold value Upper threshold value Test duration	< 5% >94% < 1 second
6		Faults (open and short circuits) are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code 005).


Diagnosis – Trouble Code Description

➤ 36	Modulating pressure regulating solenoid valve	
1	OBD trouble code	P0748
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Activation of modulating pressure regulating solenoid valve, modulation pressure
5	Threshold values Short circuit to ground Lower threshold value, voltage Upper threshold value, voltage Lower threshold value, current Upper threshold value, current Test duration	< 0.4 V approx. 8.5 V approx. 15 V approx. 0.300 A approx. 0.700 A approx. 1 second
6		Faults (activation, open and short circuits, short circuit in valve) are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code 005).


Diagnosis – Trouble Code Description

➤ 37	Shift pressure regulating solenoid valve	
1	OBD trouble code	P0748
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Activation of shift pressure regulating solenoid valve, shift pressure
5	Threshold values Short circuit to ground Lower threshold value, voltage Upper threshold value, voltage Lower threshold value, current Upper threshold value, current Test duration	< 0.4 V approx. 8.5 V approx. 15 V approx. 0.300 A approx. 0.700 A approx. 1 second
6		Faults (activation, open and short circuits, short circuit in valve) are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code P0748).


Diagnosis – Trouble Code Description

➤ 38		1-2/4-5 shift solenoid valve
1	OBD trouble code	P0753
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Voltage supply
5	Threshold values Short circuit to ground Lower threshold value, voltage Upper threshold value, voltage Lower threshold value, current Upper threshold value, current Test duration	< 0.4 V approx. 8.5 V approx. 15 V approx. 0.300 A approx. 0.700 A approx. 1 second
6		Faults (activation, open and short circuits, short circuit in valve) are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code 002).


Diagnosis – Trouble Code Description

➤ 39		2-3 shift solenoid valve
1	OBD trouble code	P0758
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Voltage supply
5	Threshold values Short to ground Lower threshold value, voltage Upper threshold value, voltage Lower threshold value, current Upper threshold value, current Test duration	< 0.4 V approx. 8.5 V approx. 15 V approx. 0.300 A approx. 0.700 A approx. 1 second
6		Faults (activation, open and short circuits, short circuit in valve) are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory (Failure code 003).

Diagnosis – Trouble Code Description

➤ 40		3-4 shift solenoid valve
1	OBD trouble code	P0763
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Voltage supply
5	Threshold values Short to ground Lower threshold value, voltage Upper threshold value, voltage Lower threshold value, current Upper threshold value, current Test duration	< 0.4 V approx. 8.5 V approx. 15 V approx. 0.300 A approx. 0.700 A approx. 1 second
6		Faults (activation, open and short circuits, short circuit in valve) are recognized by the ETC control module and transmitted via the CAN data bus to the engine control module. Fault storage and activation of the CHECK ENGINE MIL is accomplished by the engine control module. Additionally read ETC control module DTC memory.


Diagnosis – Trouble Code Description

➤ 41		Knock sensor control in engine control module (N3/10) hardware failure
1	OBD trouble code	P1386 for right cylinder bank P1589 for left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Each time the knock sensor control is turned off
4	Checked signal or condition	Internal hardware test of knock sensor control
5	Prerequisite for test	– Engine at operating temperature – Load diminishes (knock sensor control shut-off)
6		Failure must occur at least 10 times

Diagnosis – Trouble Code Description

➤ 42	AIR injection	
1	OBD trouble code	P1420 AIR pump switchover valve (Y32) P1453 AIR relay module (K17)
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	The voltage supply of the AIR relay module (K17) and AIR pump switchover valve (Y32) is evaluated via a current measurement in the respective end stage.
5	Lower threshold value Upper threshold value	approx. 3 V approx. 9 V
6	Prerequisite for test	– AIR injection operating


Diagnosis – Trouble Code Description

➤ 43	Adjustable camshaft timing solenoid (logic chain)	
1	OBD trouble code	P1519 Right cylinder bank P1522 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	Failure storage after two consecutive trips with fault No activation of CHECK ENGINE MIL
3	Monitoring time and frequency of test	Once per trip
4	Checked signal or condition	Intake MAP sensor signal
5	Fault Test duration	Pressure changes by less than approx. 20 mbar. < 10 seconds
6	Prerequisite for test	<ul style="list-style-type: none"> – Deceleration shut-off activated – Engine speed approx. 1000 – 1500 rpm – Engine at operating temperature – No fault at adjustable camshaft timing solenoid voltage supply
7	Test sequence	<p>With the start of the logic chain the momentary intake manifold pressure is determined after approx. 1 second.</p> <p>Subsequently the adjustable camshaft timing solenoids are activated for approx. 2 seconds and the intake manifold pressure is further evaluated for approx. 6 seconds. A failure is recognized, if the intake manifold pressure does not change by at least approx. 20 mbar when the camshaft is adjusted from "advanced" to "retarded" or vice versa.</p>
8		If a prerequisite changes during the test, the test is interrupted and restarted later.

Diagnosis – Trouble Code Description

➤ 44	Adjustable camshaft timing solenoid	
1	OBD trouble code	P1525 Right cylinder bank P1533 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Voltage or current at respective adjustable camshaft timing solenoid
5	Threshold values Short circuit to ground Short circuit to approx. 12 V Open circuit	Voltage < 4 V Current > approx. 4.2 A No voltage (approx. 4 V – 8 V)
6	Prerequisite for test	– Camshaft adjustment activated

Diagnosis – Trouble Code Description

➤ 45	Pedal value sensor (B37)	
1	OBD trouble code	P1542
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Comparison of nominal value potentiometer 1 and 2 voltage signals
5	Difference at idle Difference at full load Plausibility Test duration	< approx. 8% < approx. 25% Comparison of nominal value potentiometer 1 and 2 voltage signals to air mass < 1 second
6		For comparison multiply the nominal value potentiometer 2 voltage signal by 2, because the supply voltage is only 2.5 V instead of 5.0 V. A turning angle up to approx. 10% is defined as CTP, full load as of a turning angle as of approx. 55%. At the idle speed stop a high ohm reading is permissible for a brief period.

Diagnosis – Trouble Code Description

➤ 46		EA/CC/ISC actuator (M16/1)
1	OBD trouble code	P1580 Right cylinder bank P1581 Left cylinder bank
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Voltage comparison of actual value potentiometer 1 and actual value potentiometer 2
5	Plausibility	<ul style="list-style-type: none"> – Voltage difference can correspond to maximum 1° throttle valve angle – Comparison from throttle valve angle to air mass and pedal value sensor position

Diagnosis – Trouble Code Description

➤ 47		Body acceleration sensor (B24) only until 06/96
1	OBD trouble code	P1605
2	Storage of DTC and activation of CHECK ENGINE MIL	After two consecutive trips with fault
3	Monitoring time and frequency of test	Continuously
4	Checked signal or condition	Threshold values of body acceleration sensor signal
5	Lower threshold value Upper threshold value Acceleration Test duration	approx. 0.1 V approx. 4.9 V > approx. 3.4 m/s ² < 5 seconds
6	Prerequisite for test	– Vehicle stationary – Delay time of approx. 2 seconds elapsed