COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
Catalyst Bank 1	**P0420**	oxygen storage of catalyst	normalized oxygen storage	<1factor	exhaust gas mass flow	>8.33g/sec	approx.	0.01 sec	0.4 sec	two driving
			less than normalized		exhaust gas mass flow	<27.78g/sec	1000 sec		continuous	cycles each
			of a limit catalyst		catalyst temp. model	<700° C	during	one	or 4 sec	with: 0.4 sec
					catalyst temp. model	>390° C	active	completed	cumulative	continuous
					engine speed	>1040rpm	driving	test per		or 4 sec
					engine speed	<3520rpm		driving		cumulative
					engine load	>14 …. 17%	one test	cycle		
					engine load	<42….55%				
					modeled catalyst temp. gradient	<2.5° C / sec	(average			
					exhaust gas mass flow gradient	<8.33g/sec²	of 4			
					fuel system closed loop	active--	checks)			
					time after engine start	>235sec	per driving			
					ambient temperature	>-48° C	cycle			
					scheduled by System Manager	TRUE--				
					secondary O2 sensor	ready				
					fuel adaptation fault	FALSE				
					short term fuel trim (< max)	<1.25factor				
					short term fuel trim (> min)	>0.75factor				
					transient fuel control	FALSE				
					critical misfire rate detected	FALSE				
					cat. damaging misfire rate	FALSE				
					cat oxygen storage neutralization	FALSE				
Misfire		crankshaft speed	emissions relevant misfire	>1.4% (emission relevant	engine speed	>450rpm	1000 revs	cylinder	immediate	Fault during
Emission Level		fluctuation cylinder 1 to			engine speed	<6500rpm		firing		1st interval:
Multiple Cylinder	**P0300**	cylinder 6			indicated torque (idle, no drive)	>3.91%		frequency		2 faults in
Cylinder #1	**P0301**				indicated torque (drive)	>3.91 . . . 17.19%			After	2 different
Cylinder #2	**P0302**				engine speed gradient	<12800rpm/sec (not active)		continuous	detection,	drive cycles.
Cylinder #3	**P0303**				volumetric efficiency gradient	<768%/rev (not active)			the	
Cylinder #4	**P0304**				cylinder events after engine start	>6ignitions			diagnostic	Fault during
Cylinder #5	**P0305**				Enabling delay when Coolant temp is below –7 °C at start	>-7° C			can only	remaining
Cylinder #6	**P0306**				rough road	not detected--			pass if	intervals:
					traction control	off--			similar	8 faults in 2
					clutch switch press / release	transitionFALSE-			conditions	different
					leak detection	off--			are	drive cycles
					active handling	not active			encountered	with at least
					ABS	not active--				4 faults in
					engine drag control	not active--				each.
					fuel cut off	not active--				
					fuel level	> 5.93 %				
					OR fuel level	> 5.93 %				
					AND solid misfire MIL	on--				
					OR fuel level error	set--				
					error: throttle position	not set--				
					error: crankshaft sensor	not set--				
					error: ref.mark of crank sensor	not set--				
						--				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
						--				
						--				
						--				
			OR							
Catalyst Damaging Level			Catalyst damaging misfire	>16.2 . . . 6.8%	Includes all the above with the		1000 revs			First
Multiple Cylinder	**P0300**			see Misfire	following exceptions:		First interval			occurrence:
Cylinder #1	**P0301**			supplemental	First interval extention		200 revs			immediate
Cylinder #2	**P0302**			data	engine coolant temperature	<-48°C	all remaining			flashing
Cylinder #3	**P0303**			(h) (2.5.1)	fuel level	> 6.19 %	intervals			while error
Cylinder #4	**P0304**				OR fuel level	> 6.19 %				present, then
Cylinder #5	**P0305**				AND blinking MIL	blinking--				no MIL
Cylinder #6	**P0306**				AND NOT first blink event	---				with no error.
										Second
										occurrence:
										immediate
										flashing
										while error
										present, then
										solid MIL
										with no error.
evaporative system										
canister ventilation valve (AAV)	**P0446**	monitoring of tank pressure while	tank pressure too low because	< -10.50049 hPa	ambient temperature	>= -9.8 °C	< 20 sec	once per dcy	2,6 secs	2 dcy
		AAV is open and CPV is closed	canister vent. defective & closed		ambient temperature	<= 45 °C				
					ambient pressure	>= 680.00 hPa				
					vehicle speed	<= 1,86 mph				
					engine is in idle mode	true				
					unfiltered tank pressure	>= -18.00 hPa				
					and unfiltered tank pressure	<= 10.00 hPa				
canister purge valve (CPV)	**P0496**	monitoring of tank pressure while	final pressure too low because	< -1.00098 hPa	battery voltage	>= 10.45 V	ca. 10 sec	once per dcy		
		CPV and AAV are closed	CPV defective and open		and battery voltage	<= 18.00 V				
					lambda control is active	true				
					secondary air pump inactive	true				
					secondary air diagnosis inactive	true				
					air bag hasn't been triggered	true				
					no torque reduction (e.g. resulting from switched-off cylinder)	true				
	P0497	monitoring of tank pressure while	purge control stuck closed		critical misfire rate	false				
		CPV and AAV are closed			ratio intake manifold pressure /ambient pressure	< 0.602				
					fault of canister purge valve in	false				
tank leak large	**P0455**	AAV is closed and CPV is open	vacuum pressure built up gradient too low	FWD: < 0.450039 …0.750065 hPa/s	fault of canister ventilation valve in actual driving cycle	false	ca. 18 sec	once per dcy		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			because of large tank		tank fuel level	>= 3.900 l				
			(for example: open gas		and tank fuel level	<= 55.100 l				
					enabled by diagnostic scheduler	true				
					fuel system adaptation has	true				
					or time since engine start exceeds threshold	> 600 sec				
Fuel Evaporative System	**P0456**	Monitor fuel tank's pressure after engine shutdown			Engine off natural vacuum diagnosis has not been performed in this driving cycle.		100ms in	once per dcy	2.6 secs	2dcy
					Fuel evaporative system monitor (at engine on) didn't run nor detect large leak nor a tight system.		afterrun			
					Engine coolant temperature at start.	true				
					engine coolant temp. At start - intake air temp.	true				
					intake air temperature	true				
					intake air temperature	true				
					ambient air temperature	true				
					ambient air temperature	true				
					engine has been running for a cal. min. time	true				
					engine coolant temp. at engine stop	true				
					driving distance (in current dcy) covered	true				
					charcoal canister load factor	true				
					ambient pressure	true				
					driving distance (for vehicle lifetime) covered	true				
					the fuel tank's level isn't at its minimum					
					the fuel tank's level isn't at its maximum					
					battery's voltage	true				
					no refueling activity					
					the fuel tank pressure is within cal. range					
					no intake air temperature faults					
					no the purge control system faults					
					no faults of the purge control valve's power stage					
					no vehicle speed sensor faults					
					no engine coolant temperature sensor faults					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					no tank pressure sensor rationality faults					
					no tank pressure sensor range faults					
					no power supply voltage faults					
					no main load sensor faults					
					no canister vent valve faults					
					no canister ventilation valve's power stage faults					
					no ambient pressure sensor faults					
		Close canister ventilation valve.								
		Look for maximum								
		Abort if:								
		- max. pressure >= threshold.	max. pressure							
		- max. pressure - current pressure >= threshold.	max. pressure - current	>= 0.30029 hPa						
		- pressure stays in range near zero for a specific time.	pressure	>= -0.69946 hPa						
			pressure	<= 0.69946 hPa						
				500 s						
		- pressure <= threshold for a specific time (vacuum build-up instead of pressure build-up)	pressure	<= -0.74951 hPa						
				30.00 s						
		- pressure-phase-time >= threshold.	pressure phase time	>= 2400.00 s						
		- diagnostic-time >= threshold	diagnostic time	>= 2900.00 s						
		correct max. pressure.								
		open canister ventilation valve for a calibrated time.		400.00 s						
		Look for minimum								
		Abort if:								
		- min pressure <= threshold	min. pressure	<=						
		- diagnostic time >= threshold	diagnostic time	>= 2900.00 s						
		current pressure - min.								
		- pressure >= threshold	current pressure - min.	>= 0.30029 hPa						
		AND								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
		min. pressure <=								
		threshold	min. pressure	<= -0.69946 hPa						
		- pressure stays in	pressure	>= -0.69946 hPa						
		ambient range for a	pressure	<= 0.69946 hPa						
		specific time		500.00 s						
		- canister vent valve re-								
		opened for a more than N times	no. canister vent valve openings	> 2						
		because the pressure								
		exceeds a threshold	pressure	0.74951 hPa						
		Calculate difference								
		between corrected max.								
		pressure and min.								
		pressure.								
		Calculate normalized								
		result. First divide the								
		pressure difference by a								
		parameter. Then subtract								
		this result from 1.								
		Filter the normalized								
		result with an EWMA								
		filter.								
		Compare filtered result	Filtered result	> 0.399994						
		with threshold.								
		N results will be taken		4						
		into account in order to								
		determine a pass.								
		A fault will be indicated								
		immediately.								
Secondary air system	**P0411**	passive functional check	relative secondary air mass flow. Ratio from	< 0.844	start with catalyst heating		< 5s	one	2.6 sec	2 dcy
			calculated secondary air mass by pressure	> 1.156	secondary air system					
			sensor signal and secondary air mass model							
					intake air temperature	> 0 °C		test per dcy		
					intake air temperature	< 80.3 °C		(only, if		
					engine coolant temperature	> 5.3 °C		secondary-		
					engine coolant temperature	< 120 °C		air-system		
					ratio: (MAP Model / Baro)	< 0.7		was active)		
					no error on altitude detection					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					error: intake air					
					error: motor temperature					
					error: secondary air pump (power stage)					
					error: power supply voltage UB					
					enabled by the diagnostic					
					fuel cut off					
					steady state					
					mass airflow	> 6 kg/h				
					mass airflow	< 130 kg/h				
					change in air charge per working cycle	<= 6 %				
Pressure sensor	**P2432**	circuit continuity - low	measured sensor voltage	< 0,498 V			0.5 sec	continuous	0.2 sec	2 dcy
secondary air system	**P2433**	circuit continuity - high or open	measured sensor voltage	> 4,501 V						
	P2431	rationality -	during ECU init-	< -50 hPa	Barometric pressure signal VALID	TRUE				
		comparison between:	difference SAI pressure vs BARO pressure	> 50 hPa	secondary air injection during CAT heat executed	TRUE				
		SAI system pressure signal &			secondary air injection during CAT heat finished	TRUE				
		Barometric pressure signal								
Fuel System Rich/Lean	**P2191**	fuel trim limits exceeded	delta lambda correction	>1.175factor	fuel system status	closed loop--	approx.	0.1 sec	0.4 sec	two driving
Multiplicative	**P2192**	range - multiplicative	or delta lambda correction	<0.825factor	long term fuel trim status	active--	300 sec	continuous	continuous	cycles each
and Additive		(load > threshold and air flow > threshold)			engine coolant temperature	>50.3°C	from engine		or 4 sec	with: 0.4 sec
	P2187	range - additive	delta fuel load correction	>5.25%	purge control	not active--	start (after		cumulative	continuous
	P2188	low speed and low load	or delta fuel load correction	<-5.25%	intake air temperature	<=65.3°C	adaptation			or 4 sec
					fuel level	> 5.92 %	has		After	cumulative
					or fuel level error	set--	stabilized)		detection,	
					integrated air mass	>=2800g			diagnostic	
									can only	
									pass if	
									similar	
									conditions	
									are	
									encountered	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
demand controlled fuel supply										
(DECOS)	**P0088**	difference between measured	fuel rail pressure difference	< - 150 kPa	DECOS fuel pump is active	true	5 sec	continuous	0.2 sec	2 dcy
		and set-point fuel rail pressure			DECOS fuel control is enabled	true				
					time after engine start	> 1 sec				
	P0089	difference between actual	duty cycle difference	< -25 %	time after hot start	> 6 sec				
		necessary and pre-control			no fault of					
		duty cycle			- fuel pressure sensor					
					(DECOS)	true				
					- power stage of demand					
					controlled fuel pump	true				
	P0087	difference between measured	fuel rail pressure difference	> 150 kPa	DECOS fuel pump is active	true				
		and set-point fuel rail pressure			DECOS fuel control is enabled	true				
					time after engine start	> 1 sec				
	P0089	difference between actual	duty cycle difference	> 25 %	time after hot start	> 6 sec				
		necessary and pre-control			no fault of					
		duty cycle			- low pressure fuel sensor					
					(DECOS)	true				
					- power stage of demand					
					controlled fuel pump	true				
					no empty or					
					almost empty fuel tank	true				
fuel pressure sensor (DECOS)										
	P0193	circuit continuity - high or open	measured sensor voltage	> 4.7 V	fuel supply system is active	true	0.5 sec	continuous	0.2 sec	2 dcy
	P0192	circuit continuity - low	measured sensor voltage	< 0.3 V						
	P0193	range check - high	measured fuel pressure	> 680 kPa			5 sec			
	P0192	range check - low	measured fuel pressure	< 60 kPa	fuel supply system is active	true	5 sec			
					time after power fail	>= 360 sec				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
Diagnosis of Power Control Module					**general enabling conditions**		0.6 sec	continuous	0.2 sec	2 dcy
					battery voltage	< 18 V				
						> 10 V				
					locking request immobilizer	false				
	P0092	diagnosis short circuit to battery voltage			**special enabling condition**					
		only active if powerstage on	backward powerstage voltage of	> 3.9014 V	condition output duty cycle PCM	true				
			fuel pump diagnosis		for power on diagnosis					
			and							
			backward powerstage voltage of	> 2.7979 V						
			fuel pump diagnosis							
			and							
			duty cycle PCM	< 100 %						
		diagnosis short circuit to battery voltage			condition output duty cycle PCM	false				
		only active if powerstage off	backward powerstage voltage of	> 3.9014 V	for power off diagnosis					
			fuel pump diagnosis							
	P0091	diagnosis short circuit to ground			condition output duty cycle PCM	true				
		only active if powerstage on	backward powerstage voltage of	<= 2.3486 V	for power on diagnosis					
			fuel pump diagnosis							
			and							
			duty cycle PCM	> 0 %						
	P0090	diagnosis wire interruption			condition output duty cycle PCM	true				
		only active if powerstage on	backward powerstage voltage of	> 2.4414 V	for power on diagnosis					
			fuel pump diagnosis							
			and							
			duty cycle PCM	< 100 %						
			and							
			max-fault; powerstage diagnosis	false						
		diagnosis wire interruption	backward powerstage voltage of	> 2.4414 V	condition output duty cycle PCM	false				
		only active if powerstage off	fuel pump diagnosis		for power off diagnosis					
			and							
			backward powerstage voltage of	< 3.9014 V						
			fuel pump diagnosis							
	P0090	powerstage locked	condition fault message of PCM	true						
			powerstage is locked							

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Air / Fuel Ratio Sensor (primary A/F)										
sensor voltage		A/F sensor voltage	A/F sensor voltage	>3.7V	A/F sensor heater	TRUE--	10 sec	0.1 sec	0.4 sec	two driving
bank 1 sensor 1	**P0130**	exceeds threshold	and		at operating temperature			continuous	continuous	cycles each
		but not out of full range	A/F sensor voltage	<4.81V	engine starting	complete--	additional		or 4 sec	with: 0.4 sec
					desired A/F	<1.6lambda	time if		cumulative	continuous
			or		all injectors activated	TRUE--	fuel level			or 4 sec
					scheduled by System Manager	TRUE--	is low and			cumulative
			AF sensor voltage	>2.5V			not failed			
			and				600 sec			
			A/F sensor voltage	<3.06V						
			(if using rich calibration							
			curve characteristic)							
Air / Fuel Ratio Sensor (primary A/F)										
integrated circuit interface										
bank 1	**P0130**	A/F sensor voltage	A/F sensor voltage IC corrective value	>0.1V	battery voltage	<18V	10 sec	0.1 sec	0.4 sec	two driving
		IC correction too high			battery voltage	>10.7V		continuous	continuous	cycles each
					engine	running--			or 4 sec	with: 0.4 sec
					engine starting	complete--			cumulative	continuous
										or 4 sec
										cumulative
		A/F sensor IC operating	low voltage	=TRUE-	battery voltage	>10.7V	10 sec			
		too low			battery voltage	<18V				
				-	engine	running--				
				-	engine starting	complete--				
		A/F sensor IC SPI interface	communication error	=TRUE		>10.7V				
		communication error				<18V				
		A/F sensor IC circuit write error	write error	=TRUE		running--				
		at INIT register								
						complete--				
Air / Fuel Ratio Sensor (primary A/F)										
pumping current circuit open		lambda control factor change	absolute value of lambda control factor	>0.025lambda	battery voltage	<18V	1.5 sec	0.1 sec	0.4 sec	two driving
bank 1 sensor 1	**P2239**	above threshold	change from the point when the		battery voltage	>10.7V		continuous	continuous	cycles each

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			secondary conditions are met		engine	running--			or 4 sec	with: 0.4 sec
					engine starting	complete--			cumulative	continuous
					A/F sensor voltage	<1.51V				or 4 sec
					A/F sensor voltage	>1.49V				cumulative
					A/F sensor electrical trimming	not active--				
					A/F sensor heater at op.temp.	TRUE--				
					A/F sensor warm up control	complete--				
					lambda closed loop control	TRUE--				
					forced fuel trim amplitude	TRUE--				
					| fuel trim forced amplitude |	>0.015lambda				
					catalyst warm up control	stable--				
					sec. O2 sensor proportional trim	stable--				
					lean mixture inhibit	stable--				
					lambda closed loop control init	FALSE--				
					closed loop control startup	FALSE--				
Air / Fuel Ratio Sensor (primary A/F)										
pumping current circuit open		A/F sensor voltage within upper	A/F sensor voltage	<1.51V	battery voltage	<18V	approx.	0.1 sec	0.4 sec	two driving
bank 1 sensor 1	**P2237**	and lower thresholds	and A/F sensor voltage	>1.49V	battery voltage	>10.7V	8 sec	continuous	continuous	cycles each
		and desired lambda is outside			engine	running--	once the		or 4 sec	with: 0.4 sec
		of upper or lower threshold			engine starting	complete--	driving		cumulative	continuous
					target lambda above upper limit	>1.01lambda	condition			or 4 sec
					or below lower limit	<0.99lambda	is met			cumulative
					closed loop control	TRUE--				
					A/F sensor heater	TRUE--				
					at operating temperature					
					A/F sensor electrical trimming	not active--				
					A/F sensor dynamic response	not slow--				
					error: A/F sensor heating	not set--				
					integrated exhaust gas mass	>400g				
Air / Fuel Ratio Sensor (primary A/F)										
pumping current circuit open		A/F sensor not lean enough	A/F sensor voltage	<1.7V	battery voltage	<18V	5 sec	0.1 sec	0.4 sec	two driving
bank 1 sensor 1	**P2238**	during fuel shut off operation			battery voltage	>10.7V		continuous	continuous	cycles each
					engine	running--			or 4 sec	with: 0.4 sec
					engine starting	complete--			cumulative	continuous
					time after fuel shut off	>3sec				or 4 sec
					A/F sensor heater	TRUE--				cumulative
					at operating temperature					
Air / Fuel Ratio Sensor (primary A/F)										

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
reference voltage circuit open		A/F sensor voltage	A/F sensor voltage	<0.2V	battery voltage	<18V	2 sec	0.1 sec	0.4 sec	two driving
bank 1 sensor 1	**P2243**	above upper threshold	A/F sensor voltage	>4.7V	battery voltage	>10.7V		continuous	continuous	cycles each
		or below lower threshold			engine	running--			or 4 sec	with: 0.4 sec
					engine starting	complete--			cumulative	continuous
			for time	>1sec	A/F sensor heating normal	>10sec				or 4 sec
					operation range for time					cumulative
					error: A/F sensor heater circuit	not set--				
					A/F sensor internal resistance	>1500Ohms				
Air / Fuel Ratio Sensor (primary A/F)										
reference ground circuit open		measured A/F sensor internal	A/F sensor internal resistance	>1500Ohms	battery voltage	<18V	5 sec	0.1 sec	0.4 sec	two driving
bank 1 sensor 1	**P2251**	resistance above upper threshold			battery voltage	>10.7V		continuous	continuous	cycles each
					engine	running--			or 4 sec	with: 0.4 sec
			for time	>5sec	engine starting	complete--			cumulative	continuous
					A/F sensor voltage	<1.48V				
					A/F sensor voltage	>1.36V				
					error: A/F sensor heater circuit	not set				
					A/F sensor pump voltage shut off	FALSE--				
					A/F sensor warm up control	complete--				
					A/F sensor heater operation time	>28sec				
					engine run time	>28sec				
					battery voltage below heater					
					switch off voltage for time	>28sec				
					fuel cut in time	>28sec				
					for a fuel cut off time	>10sec				
					battery voltage exceed 11V time	>28sec				
Air / Fuel Ratio Sensor (primary A/F)										
measuring (trim) current		A/F sensor voltage	A/F sensor voltage	>4.81V	battery voltage	<18V	2 sec	0.1 sec	0.4 sec	two driving
circuit open		above threshold			battery voltage	>10.7V		continuous	continuous	cycles each
bank 1 sensor 1	**P2626**				engine	running--	additional		or 4 sec	with: 0.4 sec
					engine starting	complete--	time if		cumulative	continuous
					fuel cut off	TRUE--	fuel level			or 4 sec
					modeled exhaust temp	<750° C	is low and			cumulative
					in front of catalyst		not failed			
					A/F sensor heater	TRUE--				
					at operating temperature		600 sec			
Air / Fuel Ratio Sensor (primary A/F)										
general error	**P0130**	general A/F sensor electrical fault	A/F sensor internal resistance	>1500Ohms	A/F sensor heater operation time	>15sec	15 sec	0.1 sec	immediate	two driving
causing open loop					fuel cut in time	>15sec		continuous		cycles
					for a fuel cut off time	>3sec				

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					battery voltage	>10.7V				
					battery voltage	<18V				
					A/F sensor	ready				
					A/F sensor heater pwr. stage err.	FALSE				
					A/F sensor IC internal error	FALSE				
					A/F sensor pin short circuit error	FALSE				
					modeled exhaust gas temp. invalid	FALSE				
					modeled exhaust gas temperature	>0°C				
			calculated A/F sensor temperature	<640°C	A/F sensor heater operation time	>15sec	15 sec			
					fuel cut in time	>15sec				
					for a fuel cut off time	>3sec				
					battery voltage	>10.7V				
					battery voltage	<18V				
					A/F sensor	ready				
					A/F sensor heater pwr. stage err.	FALSE				
					A/F sensor IC internal error	FALSE				
					A/F sensor pin short circuit error	FALSE				
					modeled exhaust gas temp. invalid	FALSE				
					modeled exhaust gas temperature	>0°C				
			A/F sensor pin UN error	=TRUE						
				=TRUE						
			A/F sensor pin VM error	=TRUE						
				=TRUE						
			A/F sensor heater error set	=TRUE						
			after engine start	=TRUE						
			A/F sensor heater error set	=TRUE						
			maximum heater	=TRUE						
Air / Fuel Ratio Sensor (primary A/F)										
reference ground circuit; reference voltage circuit; or measuring current circuit										
bank 1 sensor 1 - low volt	**P0131**	A/F sensor signal at VM	IC Circuit Status shorted low	=TRUE-	battery voltage	<18V	25 sec	0.1 sec	0.4 sec	two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
		(reference ground) below lower limit			battery voltage	>10.7V		continuous	continuous	cycles each
		or A/F sensor signal at UN	IC Circuit Status shorted low	=TRUE-	engine	running--			or 4 sec	with: 0.4 sec
		(reference voltage [Nernst voltage]) below lower limit			engine starting	complete--			cumulative	continuous
		or A/F sensor signal at IA	IC Circuit Status shorted low	=TRUE-						or 4 sec
		(measuring current trim circuit) below lower limit								cumulative
bank 1 sensor 1 - high volt	**P0132**	A/F sensor signal at VM	IC Circuit Status shorted high	=TRUE-						
		(reference ground) above upper limit								
		or A/F sensor signal at UN	IC Circuit Status shorted high	=TRUE-						
		(reference voltage [Nernst voltage]) above upper limit								
		or A/F sensor signal at IA	IC Circuit Status shorted high	=TRUE-						
		(measuring current trim circuit) above upper limit								
Air / Fuel Ratio Sensor (primary A/F)										
response		dynamic response	for primary HO2S dynamic detection:		for primary HO2S dynamic detection:		dynamic	0.01 sec	0.4 sec	two driving
bank 1 sensor 1	**P0133**	slow or low amplitude	(		**(**		test	continuous	continuous	cycles each
			A/F sensor dynamic value	<=0.3ratio	(		sample		or 4 sec	with: 0.4 sec
			for		primary HO2S ready for operation, i.e.		count		cumulative	continuous
			number of valid dynamic measurements per driving cycle	>=35	(					or 4 sec
			)		engine speed (engine coolant temperature dependent) at least once after engine start	>640 to 840 rpm	>			cumulative
					temperature of primary HO2S ceramic	>715°C				
					)		35			
					actual A/F ratio (lambda)	<=1.051lambda	samples			
					actual A/F ratio (lambda)	>=0.95lambda				
					engine speed	>=1160rpm	then			
					engine speed	<=2800 rpm	2 sec			
					relative engine load	>17.25%				
					relative engine load	<45%	total time			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					change of engine load per 100 ms	<=3%	= approx.			
					temperature of primary HO2S hexagon	<570°C	600 sec			
					peak-to-peak amplitude of the A/F ratio variation	>0.01lambda				
					forced oscillation of A/F ratio controller	active--				
					(					
					maximum allowed value of A/F ratio controller factor (enrichment)-->1 + (a)	<=1.25factor				
					with upper limit A/F ratio controller (a)	0.25factor				
					)					
					minimum allowed value of A/F ratio controller (enleanment)	>=0.75factor				
					(					
					correction factor of carbon canister load adaptation for A/F ratio controller	<=15factor				
					engine temperature	>=39.8°C				
					canister purge active	FALSE--				
					)					
					canister purging with high canister load active	FALSE--				
					primary HO2S sufficiently heated, i.e.					
					(					
					difference between target and measured ceramic temperature of primary HO2S	<64.992K				
					target ceramic temperature primary HO2S	780°C				
					)					
					diagnosis primary HO2S wire bond IP, electrical check	TRUE--				
					diagnosis of secondary air system	FALSE--				
					all fuel injectors active	TRUE--				
					scheduled by System Manager (FID BDLSU)	TRUE--				
					for time	>=0.5sec				
					gradient of modeled A/F ratio value (reference curve)	>0.12sec				
					)					
					OR					
			for primary HO2S delay time detection:		for primary HO2S delay time detection:					
			(		**(**					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			detection of **large** delay:		(					
			(		primary HO2S ready for operation, i.e.					
			(		(					
			the following two conditions have to be fulfilled in alternating order:		engine speed (engine coolant temperature dependent) at least once after engine start	>640 to 840 rpm				
			A/F ratio controller	>=1.15factor	temperature of primary HO2S ceramic	>715°C				
			for a calibrated period of time	>=0.6sec	)					
			and		engine speed	>=1160rpm				
			A/F ratio controller	<=0.85factor	engine speed	<=2800 rpm				
			for a calibrated period of time	>=0.6sec	relative engine load	>=14%				
			)		relative engine load	<=72%				
			for number of counts	>=8	absolute value of high pass filtered mass airflow	<=20kg/h				
			)		absolute value of delta of engine load	<=10%				
			OR		time constant for lambda control mode	<=0.6sec				
			(							
			detection of **small** delays:		time constant for lambda control mode	>=0.02sec				
			(		diagnosis primary HO2S wire	TRUE--				
			detection of small delays maxima:		mixture lean-off is not forbidden	not active--				
			(		primary fuel control system status	closed loop				
			relative variance of delay between maxima	<=0.055	absolute value of forced oscillation of A/F ratio control	>=0.025				
			counter for single measurements reaches mean value between maxima	>=6	lambda set point is equal to one	TRUE--				
			mean value time shift between maxima	>0.37sec	lambda regulator output min.	<0.85				
			)		lambda regulator output max.	>1.15				
			or		minimum allowed value of A/F ratio controller (enleanment)	<0.75				
			detection of small delays minima:		maximum allowed value of A/F ratio controller factor (enrichment)	>1.25				
			(		)					
			relative variance of delay between minima	<=0.055	all for a calibrated period of time	>=3.1sec				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			counter for single measurements reaches mean value between minima	>=6	all for a number of counts	>24				
			mean value time shift between minima	>0.37sec						
					scheduled by System Manager (FID BDDEU)	TRUE--				
					)					
			)							
			)							
			)							
			)							
Oxygen Sensor (secondary O2) Trim of Air / Fuel Ratio Sensor (primary A/F)										
primary A/F signal RICH / secondary O2 signal LEAN										
Bank 1	**P2096**	A/F sensor long term secondary	secondary O2 sensor trim	<-0.03lambda	engine starting	complete- -	2 sec	0.1 sec	0.4 sec	two driving
		trim - rich shift	integral control		secondary O2 trim active	TRUE--		continuous	continuous	cycles each
		- correction below threshold			and secondary O2 oscillation	TRUE- -			or 4 sec	with: 0.4 sec
					check finished				cumulative	continuous
primary A/F signal LEAN / secondary O2 signal RICH					then timer	>25sec				or 4 sec
Bank 1	**P2097**	A/F sensor long term secondary	secondary O2 sensor trim	>0.03lambda	scheduled by System Manager	TRUE				cumulative
		trim - lean shift	integral control		sec. O2 trim - fast lean correction	FALSE				
		- correction above			sec. O2 trim - fast rich correction	FALSE				
					suspicion A/F sensor lean shift	FALSE				
					secondary O2 oscillation test	checked OK				
Oxygen Sensor (secondary O2) Trim of Air / Fuel Ratio Sensor (primary A/F)										
Bank 1	**P2195**	secondary O2 sensor operation	secondary O2 sensor voltage	>0.75V	A/F sensor measured lambda	>1.08008lambda	approx.	0.1 sec	0.4 sec	two driving
		too rich - strong correction			short term fuel trim	= MAX1.25factor	100 sec	continuous	continuous	cycles each
					A/F sensor	ready--			or 4 sec	with: 0.4 sec
		A/F sensor measured too lean	or		secondary O2 sensor	ready--			cumulative	continuous
					then					or 4 sec
					accumulated exhaust gas mass	>300g				cumulative

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			secondary O2 sensor voltage	>0.75V	A/F sensor measured lambda	>1.08008lambda				
					secondary O2 sensor fuel trim	>0.014008lambda				
					proportional trim dominating					
					secondary O2 aging diagnosis	complete--				
					secondary O2 circuit diagnosis	complete--				
					secondary O2 fuel trim active	TRUE--				
					A/F sensor	ready--				
					secondary O2 sensor	ready--				
					then					
					accumulated exhaust gas mass	>300g				
			secondary O2 sensor voltage	>0.75V	target lambda	>1.04lambda	0.9 sec			
					A/F sensor	ready--				
					secondary O2 sensor	ready--				
					lambda closed loop control	active--				
					secondary O2 circuit diagnosis	complete--				
					short term fuel trim (o.k.)	> MIN0.75factor				
					then					
					accumulated exhaust gas mass	>800g				
Oxygen Sensor (secondary O2) Trim of Air / Fuel Ratio Sensor (primary A/F)										
Bank 1	**P2196**	secondary O2 sensor operation	secondary O2 sensor voltage	<0.2012V	A/F sensor measured lambda	<0.92lambda	approx.	0.1 sec	0.4 sec	two driving
		too lean - strong correction			short term fuel trim	= MIN0.75factor	100 sec	continuous	continuous	cycles each
					A/F sensor	ready--			or 4 sec	with: 0.4 sec
		A/F sensor measured too rich			secondary O2 sensor	ready--			cumulative	continuous
					then					or 4 sec
					accumulated exhaust gas mass	>300g				cumulative
			secondary O2 sensor voltage	<0.2012V	A/F sensor measured lambda	<0.92lambda				
					secondary O2 sensor fuel trim	<0.014lambda				
					proportional trim dominating					
					secondary O2 aging diagnosis	complete--				
					secondary O2 circuit diagnosis	complete--				
					secondary O2 fuel trim active	TRUE--				
					A/F sensor	ready--				
					secondary O2 sensor	ready--				
					then					
					accumulated exhaust gas mass	>300g				
			secondary O2 sensor voltage	<0.2012V	target lambda	<0.96lambda	0.9 sec			
					A/F sensor	ready--				
					secondary O2 sensor	ready--				
					lambda closed loop control	active--				
					secondary O2 circuit diagnosis	complete--				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					short term fuel trim (o.k.)	< MAX1.25factor				
					then					
					accumulated exhaust gas mass	>800g				
Air / Fuel Ratio Sensor (primary A/F)										
electrical										
wire to wire short circuit		sensor short to heater	filtered maximum pump current variation	>0.00019A	all injectors activated	TRUE--	15 sec	0.01 sec	0.4 sec	two driving
bank 1 sensor 1	**P2231**		within every 10ms		battery voltage	<18V		continuous	continuous	cycles each
					battery voltage	>10.7V			or 4 sec	with: 0.4 sec
					A/F sensor IC diagnosis	complete--			cumulative	continuous
					error: A/F sensor IC	not set--				or 4 sec
					engine rpm	<1800rpm				cumulative
					modeled exhaust gas temperature	<800° C				
					heater duty cycle	>20%				
					heater duty cycle	<80%				
					A/F sensor heater at op.temp.	TRUE				
					after A/F sensor curve switching					
					for time	>0.06sec				
Diagnosis of Heater upstream HO2S										
	P0032	short circuit to battery voltage	Voltage	IC internal	for time	> 5 sec	5 sec	continuous	0.2 sec	2 dcy
					battery voltage via main relay	<= 18 V				
	P0031	short circuit to ground			battery voltage via main relay	>= 10,7 V				
					condition end of start	True				
	P0030	wire interruption			condition engine speed: n > NMIN	True				
A/F Sensor Heating										
heater performance (primary A/F)										
bank 1 sensor 1	**P0135**	A/F sensor calculated temperature	A/F sensor temperature calculation	<715° C	battery voltage	>10.7V	35 sec	0.1 sec	0.4 sec	two driving
		too low			battery voltage	<18V		continuous	continuous	cycles each
					internal resistance measurement	valid--			or 4 sec	with: 0.4 sec
					all injectors activated	TRUE--			cumulative	continuous
					A/F sensor internal resistance	FALSE--				or 4 sec
					excessive correction required					cumulative
					engine stop time	>5400sec				
					engine temperature at start	>-9.8° C				
					A/F sensor heating ready	TRUE--				
					A/F heater control shut off	FALSE--				
					scheduled by System Manager	TRUE--				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
heater performance (primary A/F)										
bank 1 sensor 1 (primary)	**P0135**	A/F sensor calculated	A/F sensor temperature calculation	<715° C	A/F Heater at Maximum Power	TRUE	60 sec	0.1 sec	0.4 sec	two driving
		temperature below threshold			modeled exhaust temp. at sensor	>300° C		continuous	continuous	cycles each
					timer expires after either:	>50sec			or 4 sec	with: 0.4 sec
					fuel shut off >= 3 sec dur. ends	---			cumulative	continuous
					or initial A/F heater turn on	---				or 4 sec
					battery voltage	>10.7V				cumulative
					battery voltage	<18V				
					A/F heater control shut off	FALSE--				
					modeled exhaust temp. valid	TRUE				
					scheduled by System Manager	TRUE--				
A/F Sensor Heating										
heater performance (secondary O2)										
bank 1 sensor 1	**P0053**	correction value for A/F sensor	absolute value of correction value for	>45Ohms	battery voltage	>10.7V	40 sec	0.1 sec	0.4 sec	two driving
bank 2 sensor 1		internal resistance measurement	A/F sensor internal resistance		battery voltage	<18V		continuous	continuous	cycles each
		too much			engine starting	complete--			or 4 sec	with: 0.4 sec
									cumulative	continuous
										or 4 sec
										cumulative
Oxygen Sensor										
sensor circuit (secondary O2)										
bank 1 sensor 2	**P0137**	short circuit to ground	secondary O2 sensor voltage	<0.06V	secondary O2 heating stable	> 10sec	0.1 sec	0.1 sec	0.4 sec	two driving
					and mod. exhaust gas temp.	>250° C		continuous	continuous	cycles each
					for time	>90sec			or 4 sec	with: 0.4 sec
					engine running	TRUE--			cumulative	continuous
					battery voltage	>10.7V				or 4 sec
					mod. exhaust-gas temp.	<800° C				cumulative
					time after start	<1sec				
					engine temp at stop	>60° C				
					engine temp	<40° C				
					error: engine coolant temp	not set--				
bank 1 sensor 2	**P0138**	short circuit to battery voltage	secondary O2 sensor voltage >	>1.08V	secondary O2 heating stable	> 10sec	5.1 sec			
					and mod. Exhaust-gas temp.	>250° C				
					for time	>90sec				
					engine running	TRUE--				
					battery voltage	>10.7V				
					mod. exhaust-gas temp.	<800° C				
bank 1 sensor 2	**P0140**	sensor line disconnection	secondary O2 sensor voltage	>0.401V	secondary O2 heating stable	> 10sec	600 sec			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			and secondary O2 sensor voltage	<0.499V	and mod. Exhaust-gas temp.	>250° C				
					for time	>90sec				
			or		engine running	TRUE--				
			secondary O2 sensor internal resistance	>40000Ohm	battery voltage	>10.7V				
			when modeled exhaust gas temperature	>600° C	mod. exhaust-gas temp.	<800° C				
Oxygen Sensor										
sensor circuit (secondary O2)										
bank 1 sensor 2	**P2232**	sensor line short circuit	secondary O2 sensor		secondary O2 heating stable	> 10sec	10 sec	0.01 sec	0.4 sec	two driving
		to heater output line	voltage gradient	>2V	and mod. Exhaust-gas temp.	>250° C		continuous	continuous	cycles each
			within time after heater turn off	<0.04sec	for time	>90sec			or 4 sec	with: 0.4 sec
			for occurrences	>4count	engine running	TRUE--			cumulative	continuous
			out of heater turn offs	=6count	battery voltage	>10.7V				or 4 sec
					mod. exhaust-gas temp.	<800° C				cumulative
					time after dew point exceeded	>10sec				
Oxygen Sensor Heating										
heater performance (secondary O2)										
bank 1 sensor 2 (secondary)	**P0141**	secondary O2 sensor	measured secondary O2 sensor internal		battery voltage	>10.7V	6 sec	0.1 sec	0.4 sec	two driving
		internal resistance	resistance		battery voltage	<18V		continuous	continuous	cycles each
		above threshold	nominal internal resistance	>88 . . . 408Ohms	engine running	TRUE--			or 4 sec	with: 0.4 sec
				KFRINH	engine starting	complete--			cumulative	continuous
			multiply times degradation factor	>3 . . . 20factor	fuel cut off	FALSE--				or 4 sec
				FRINH	sec. O2 internal resistance	valid--				cumulative
			for time	>6sec	intake air temperature	>-9.8C				
					engine off soak time	>120sec				
					modeled exhaust temp.	in range350 . . . 550C				
					at secondary O2 sensor					
					suspicion of secondary	FALSE				
					O2 sensor open circuit					
					secondary O2 voltage supply	ON				
					scheduled by System Manager					
					for time	>120sec				
sensor response (secondary O2)										
bank 1 sensor 2	**P2270**	oscillation check low	secondary O2 sensor voltage	<0.499 . . . 0.603V	secondary O2 sensor	ready - -	approx.	0.1 sec	0.4 sec	two driving
			for time	>5sec	for time	>10sec	600 sec	continuous	continuous	cycles each
			then		secondary O2 closed loop control	active - -			or 4 sec	with: 0.4 sec

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			ramping in enrichment by	=0.25lambda	all injectors activated	TRUE - -	additional		cumulative	continuous
			at gradient	0,0513 l / sec	engine air flow (intrusive test)	9.72g/sec	time if			or 4 sec
			for time (after enrichment limit reached)	>7sec	and engine air flow	33.33g/sec	fuel level			cumulative
					for time	>3sec	is low and			
					engine air flow (passive monitor)	9.72g/sec	not failed			
					sec. O2 trim - fast lean correction	FALSE	600 sec			
					sec. O2 trim - fast rich correction	FALSE				
					engine	running				
					scheduled by System Manager	TRUE				
bank 1 sensor 2	**P2271**	oscillation check high	secondary O2 sensor voltage	>0.499 . . . 0.603V	secondary O2 sensor	ready - -	approx.	0.1 sec	0.4 sec	two driving
			for time	>5sec	for time	>10sec	600 sec	continuous	continuous	cycles each
			then		secondary O2 closed loop control	active			or 4 sec	with: 0.4 sec
			ramping in enleanment by	=0.07lambda	all injectors activated	TRUE			cumulative	continuous
			at gradient	0,0513 l / sec	engine air flow (intrusive test)	9.72g/sec				or 4 sec
			for time (after enleanment limit reached)	>7sec	and engine air flow	33.33g/sec				cumulative
					for time	>3sec				
					engine air flow (passive monitor)	9.72g/sec				
					sec. O2 trim - fast lean correction	FALSE				
					sec. O2 trim - fast rich correction	FALSE				
					engine	running				
					scheduled by System Manager	TRUE				
bank 1 sensor 2	**P2271**	fuel cut off check high	secondary O2 sensor voltage	>0.202V	secondary O2 heating stable	> 10sec	0.2 sec	0.1 sec	0.4 sec	two driving
			time after fuel cut off	>2,5sec	secondary O2 dew point exceeded	TRUE - -		continuous	continuous	cycles each
					for time	>30sec			or 4 sec	with: 0.4 sec
					air passed after fuel cut off	>15g			cumulative	continuous
					modeled exhaust temp	>350° C				or 4 sec
					at secondary O2 sensor					cumulative
					scheduled by System Manager	TRUE - -				
					error: cam sensor	not set - -				
					error: evap canister purge sys.	not set - -				
					error: evap purge valve ckt	not set - -				
					error: battery voltage	not set - -				
bank 1 sensor 2	**P0139**	fuel cut off check high	secondary O2 sensor voltage	>0.152V	secondary O2 heating stable	> 10sec	0.2 sec	0.1 sec	0.4 sec	two driving
			time after fuel cut off	>3,0sec	secondary O2 dew point exceeded	TRUE - -		continuous	continuous	cycles each
			lambda actual value	lambda >2	for time	>30sec			or 9,5 sec	with: 0.4 sec
					air passed after fuel cut off	>20g			cumulative	continuous
					bank 1 sensor 2 voltage	>0,6 V				or 9,5 sec
					for time	> 3 sec				cumulative
					battery voltage	> 10,7V				
Camshaft Control System - Locking Pin										two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
Bank 1 Intake	**P0011**	rationality high	average of actual angle measurements	>10degrees	engine speed	>560rpm	10 sec	0.01 sec	0.4 sec	cycles each
Bank 2 Intake	**P0021**		versus locked position angle		engine run time	>1sec			continuous	with: 0.4 sec
					camshaft control circuit test	complete--			or 4 sec	continuous
					error: camshaft control circuit	not set--			cumulative	or 4 sec cum
System - Control	**P000A**	rationality low / high	difference to start test (filtered actual	> 6 . . . 11 degrees	engine speed	>560rpm	approx.	0.01 sec	0.4 sec	two driving
Bank 1 Intake	**P000C**		angle versus filtered desired angle)		engine run time	>1sec	20 sec	continuous	continuous	cycles each
Bank 2 Intake			(desired must remain above value		camshaft control circuit test	complete--			or 4 sec	with: 0.4 sec
			to test to complete the evaluation)		error: camshaft control circuit	not set--	(4 times		cumulative	continuous
			filtered actual angle remains	<	coolant temperature	< 143° C	for 4 sec			or 4 sec
			filtered desired angle from test start		coolant temperature	>-48° C	each)			cumulative
			within time	=3sec	engine oil temperature	<143° C				
			(detects 5 sec slow [time constant])		engine oil temperature	>-48° C				
					cam-crank alignment adaptation	complete--				
			for multiple activation occurrences	>4count						
			(decrements upon activations where	(same as stated in "time required" column)						
			no difference is seen between desired							
			and actual)							
			difference (filtered actual angle max	>3degrees						
			versus actual at test start)							
			(to detect slow response versus							
			stuck cam if above this limit)							
			at time	=4sec						
			(overlaps with time to detect above)							
			(passes after multiple good activations							
			in both cam phase rotation directions)							

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
System - Cam - Crank Alignment										
Bank 1 Intake	**P0016**	cam-crank adapted angle	adapted angle	>10degrees	engine run time >	>2sec	approx.	0.2 sec	0.4 sec	two driving
		limit check	or adapted angle	<-18degrees	engine coolant temp >	>9.8° C	600 sec	continuous	continuous	cycles each
Bank 2 Intake	**P0018**	(applies for each camshaft)	or actual angle with parked cams	>20degrees	engine coolant temp <	<105° C			or 4 sec	with: 0.4 sec
			and	<25degrees	model: engine oil temp <	<140° C	fail after		cumulative	continuous
Bank 1 / Idler Sprocket	**P0008**		adapted angle for both cams	>10degrees	error: camshaft sensor	not set--	2 adaptation			or 4 sec
Bank 2 / Idler Sprocket	**P0009**		adapted angle for both cams	<-18degrees	error: camshaft control circuit	not set--	cycles -			cumulative
							required			
Engine coolant	**P0117**	range check high	coolant temperature	>138.8° C	hot restart timer after engine start	>=60sec	0.1 sec	0.1 sec	0.4 sec	two driving
temperature sensor	**P0118**	range check low	coolant temperature	<-38.3° C	If Startup ECT+O155	<-38.3° C			continuous	cycles each
					| ECT-Startup ECT | (abs value)	<=2.3° C			or 4 sec	with: 0.4 sec
					integrated air mass increases	>=0g			cumulative	cont. or 4
					and air mass timer	>=30sec				sec cum.
	P0119	intermittent (discontinuity)	delta coolant temperature	<-20.25° C	ignition	=ON	approx.	0.01 sec	immediate	
			or				150 sec	continuous		
			delta coolant temperature	>20.25° C						
			(between A/D read sample count offset)	=3count						
Engine coolant	**P0116**	plausibility check (low side check)	calculated coolant temperature model	>9.8° C	the model temperature increases				or 0.4 sec	two driving
temperature sensor			minus measured temperature		depending on air flow				continuous	cycles each
		plausibility check (high side check)	measured temperature		measured temperature	<93.8° C				
			minus calculated coolant temperature model		engine speed	>520rpm			or 4 sec	with: 0.4 sec
					integrated air mass	> 3000g			cumulative	continuous
					no error engine speed					or 4 sec
					no error air mass flow meter					cumulative
Engine coolant	**P050C**	difference from intake air	filtered difference		key up IAT - previous min IAT	<1.5° C	160 sec	0.2 sec	immediate	two driving
temperature sensor		temperature after soaking	(ECT at key on - IAT at key on)	>15° C	key up IAT - previous min IAT	>-24.75° C	for block	continuous	additional	cycles each

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					previous accumulated air mass	>2000g	heating		after block	with: 0.4 sec
					previous accumulated air mass	>4000g			heater	cumulative
			or		previous engine run time	>500sec			check	
					or					
			filtered difference		ECT at shut down	>84.75° C				
			(ECT at key on - IAT at key on)	<-10° C	Controller Shut Down at end of	last cycle--				
					Strong Wind / Open Hood	not detected--				
					based on IAT rise at shut down					
					Block Heater	not detected--				
Engine Coolant	**P0128**	Coolant Temperature Below	(calculated reference model coolant temp	>5.3° C	debouncing time	>15sec	approx.	0.1 sec	0.4 sec	two driving
Thermostat Monitoring		Thermostat Regulating	minus measured coolant temperature)		error: engine coolant temp	not set--	900 sec	continuous	continuous	cycles each
		Temperature (plausibility check)			error: vehicle speed sensor	not set--			or 4 sec	with: 0.4 sec
			reference model calculation limit	71.25° C	est. ambient temperature	> -39.8°C			cumulative	continuous
					est. ambient temperature	<140°C				or 4 sec
					vehicle speed	>=3.125mph				cumulative
			Thermostat regulating temperature: 82°C		engine speed	>640rpm				
			All critical OBD and		coolant temperature at start	< 51.0°C				
			emission functions are enabled		integrated air mass flow	> 1000g				
			above 60°C.)							
Intake air temperature	**P0111**	response check	max intake air temperature -		drive period - count	>=5count	2 sec	0.1 sec	0.4 sec	two driving
sensor			min intake air temperature	>2.3° C	each with			continuous	continuous	cycles each
					vehicle speed	>=56.25mph			or 4 sec	with: 0.4 sec
					mass flow	<250g / sec			cumulative	continuous
					mass flow	> 25.6g/sec				or 4 sec
					coolant temperature at start	<=120° C				cumulative
					no fuel shut-off					
					idle period - count	>=4count				
					each with					
					vehicle speed	<=1.5625mph				
					coolant temperature at start	<=120° C				
					coolant temperature	>64.5° C				
					ECT decrease since prior shutdown	>0° C				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
	P0112	range check low	intake air temperature	>125.3° C						
	P0113	range check high	intake air temperature	<-35.3° C	time after start	> 15sec				
					then time in idle	>3sec				
					and intake air temperature	<-35.3° C				
					then | IAT change | (abs value)	<=2.3° C				
					while					
					integrated air mass increases	>=0g				
Mass air flow sensor	**P0101**	range check low	mass air flow	<1.83 . . . 78.9 g/sec	battery voltage	>10.5V	0.40 sec	0.01 sec	0.4 sec	two driving
		or	and	KFMLDMN	time after start	>0.4sec		continuous	continuous	cycles each
		fuel trim limits exceeded	delta lambda correction	>0.16factor	crankshaft revolution counter	>150rev			or 4 sec	with: 0.4 sec
		range - multiplicative			error: throttle position sensor	not set --			cumulative	continuous
		and				00				or 4 sec
		correction factor (modeled air	correction factor air mass	<0.83factor		0g/s				cumulative
		mass at throttle / air mass			ratio: MAP to Baro	<1 -				
		measured by air mass flow meter)			air mass flow					
					time after start					
		range check high	mass air flow	> 26.9 . . . 312.5 g/sec	errors:					
		or	and	KFMLDMX	throttle body	--				
		fuel trim limits exceeded	delta lambda correction	<-0.175factor	Leak upstream throttle					
		range - multiplicative								
		and								
		correction factor (modeled air	correction factor air mass	>1.1699factor						
		mass at throttle / air mass								
		measured by air mass flow meter)								
	P0102	circuit check low	mass air flow	>10.3g/sec	battery voltage	>7.5V	0.2 sec			
	P0103	circuit check high	mass air flow	>33.3g/sec						
pressure sensor										
upstream throttle valve	**P0238**	circuit continuity - high or open	measured sensor voltage	> 4.65 V			0.5 sec	continuous	0.2 sec	2 dcy
	P0237	circuit continuity - low	measured sensor voltage	< 0.45 V						
	P0238	range check - high	measured pressure	> 300 kPa	enabled by diagnostic		2 sec			
	P0237	range check - low	measured pressure	< 50 kPa	scheduler	true				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
	P0236	rationality -	measured fuel pressure lies below							
		comparison between measured	expected minimum pressure	true						
		pressure and expected								
		(calculated) pressure								
	P0236	rationality -	('measured') compression ratio exceeds							
		comparison between ('measured')	expected maximum compression ratio	true						
		compression ratio and expected								
		(calculated) compression ratio								
boost pressure control										
	P2281	comparison between	ratio between	> 0.098	engine speed	> 1520 rpm	1 sec	continuous	0.2 sec	2 dcy
		MAF based pressure ratio	MAF based pressure ratio	to	time after engine start	> 10 sec				
		over the throttle valve	over the throttle valve	1.297	no fault of					
		and	and		- pressure sensor					
		throttle body based pressure ratio	throttle body based pressure ratio		upstream throttle valve	true				
		over the throttle valve	over the throttle valve		- throttle position sensors	true				
					- MAF sensor	true				
		(detection of leakage)	(fine leakage)		boost pressure control					
					is active	true				
			ratio between	> 0.101			1 sec			
			MAF based pressure ratio	to						
			over the throttle valve	1.352						
			and							
			throttle body based pressure ratio							
			over the throttle valve							
			(coarse leakage)							
			ratio between	> 0.109	engine speed	> 1520 rpm	1.8 sec			
			MAF based pressure ratio	to	time after engine start	> 10 sec				
			over the throttle valve	1.398	no fault of					
			and		- pressure sensor					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			throttle body based pressure ratio		upstream throttle valve	true				
			over the throttle valve		- throttle position sensors	true				
					- MAF sensor	true				
			(coarse leakage)		- canister purge system	true				
					boost pressure control					
					is not active	true				
					for time	>				
					cruise control not active	true				
					setpoint canister purge rate	< 0.03				
					no dynamic engine condition					
	P0299	comparison between	difference (positive) between	25kPa	boost pressure control		6 sec			
		desired boost pressure	set-point boost pressure		is active	true				
		and	and		engine speed	> 2000 rpm				
		current boost pressure	current boost pressure			or				
						3120 rpm				
			(boost pressure to low)		atmospheric pressure	> 66 kPa				
					setpoint boost pressure	> base				
						boost				
						pressure				
						+				
						5 kPa				
	P0234	comparison between	difference (negative) between	> 22 kPa	pressure upstream throttle		1.2 s			
		desired boost pressure	set-point boost pressure	to	valve is valid	true				
		and	and	127.5 kPa						
		current boost pressure	current boost pressure							
			(boost pressure to high)							
			(Remark: for comparison the negative							
			value is converted to an absolute value)							
dump valve										
	P2261	counting of increased pulsation	normalized difference between		engine coolant temperature	> 50.3 °C	0.48 sec	continuous	0.2 sec	2 dcy
		in the intake manifold	measured MAF sensor value and		intake air temperature	> -10.5 °C				
			modeled value	> 0,352	pressure in front of					
		(increased pulsation may occur			throttle valve	> 60 kPa				
		when dump valve is jammed	for		supervision phase is active	true				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
		in closed position)								
			number of times	> 4 counts	conditions for an active					
					supervision phase are					
					- negative load gradient					
					detected	true				
					- ratio of pressure in front of	> 1.05				
					throttle valve to minimum	to				
					pressure after air filter	3.12				
					- dump valve is active	true				
Barometric Pressure Sensor	**P2227**	rationality	difference between barometric pressure				3 sec	0.1 sec	0.4 sec	two driving
(ambient air pressure sensor)		signal discontinuity	signal pressure and pressure in front of throttle	>15kPa	plausible pressure signal pressure sensor	TRUE			continuous	cycles each
					in front of throttle				or 4 sec	with: 0.4 sec
					and				cumulative	continuous
					throttle angle	<5%				or 4 sec
					and					cumulative
					engine speed	<1000rpm				
			or		enabled by scheduler for time	>3sec				
			barometric pressure signal pressure							
			jump from previous key off	>10kPa	Baro from previous drive	valid--				
					difference: Baro substitute	>15kPa				
			and		model versus sensor					
					engine speed lower	< 621 rpm				
			difference between barometric pressure	>10kPa	and					
			signal pressure and pressure in front of throttle		throttle angle	< 5%				
					both for time	>3sec				
	P2228	range check low	sensor signal	<45kPa	enabled by scheduler for time	>1sec	2 sec			
			sensor voltage	< 0,45V			0.5 sec			
	P2229	range check high	sensor signal	>115kPa	enabled by scheduler for time	>1sec	2 sec			
			sensor voltage	>4,8V			0.5 sec			
Idle Speed System										
(disabled during cold start)	**P0506**	functional check	desired rpm - actual rpm	>100rpm	load (for underspeed only)	<39.75%	10 sec	0.1 sec	0.4 sec	two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					coolant temp.	>64.5° C		continuous	continuous	cycles each
	P0507		desired rpm - actual rpm	<-200rpm	intake air temp	>-10.5° C			or 4 sec	with: 0.4 sec
			or		vehicle	at idle			cumulative	continuous
			fuel cut off due to overspeed	>3count	altitude factor (sea level = 1.0)	>0.703factor				or 4 sec
			during this idle		time after engine start	>0sec				cumulative
					cold start idle speed control	FALSE				
					intrusive evap test	not active				
Idle Speed System										
(enabled during cold start)	**P0506**	functional check	desired rpm - actual rpm	>100rpm	load (for underspeed only)	<39.75%	5 sec	0.1 sec	0.4 sec	two driving
			during catalyst heating on		Engine coolant start temp.	> -10 …. +40° C		continuous	continuous	cycles each
	P0507		desired rpm - actual rpm	<-200rpm	intake air temp	>40° C			or 4 sec	with: 0.4 sec
			during catalyst heating on		vehicle	at idle			cumulative	continuous
					altitude factor (sea level = 1.0)	>0.703factor				or 4 sec
					time after engine start	>0sec				cumulative
					idle speed control catalyst heating	TRUE				
					intrusive evap test	not active				
Vehicle speed sensor										
	P0500	rationality	vehicle speed	>171.875mph	-	---	2 sec	0.1 sec	0.4 sec	two driving
		(high range check)						continuous	continuous	with: 0.4 sec
		rationality	vehicle speed minus	=0mph	vehicle speed	>0mph			or 4 sec	continuous
		(stuck check)	previous vehicle speed		vehicle speed	<319.375mph			cumulative	or 4 sec
					time	>10sec				cumulative
		CAN wheel speed message check	CAN wheel speed message corrupt	=corrupt						
			or missing	=missing						
Crankshaft Position Sensor	**P0335**	circuit continuity	no engine signal	=0rpm	camshaft revolutions detected	>12counts	approx.	0.01 sec	0.4 sec	two driving
			but phase signals available				5 sec	continuous	continuous	cycles each
		rationality check	reference gap missing	>6gaps					or 4 sec	with: 0.4 sec
			(sensor signal but no reference)						cumulative	continuous
	P0336	rationality check	unexpected re-synchronization	>6count						or 4 sec
			(loss of reference mark)							cumulative
		rationality check	intermittent loss of engine speed signal	>14count						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
	P0338	rationality check	difference in counted teeth between	>8teeth			approx.	1 per rev		
			reference gap position events				2 sec	continuous		
Camshaft Position Sensor										
Bank 1 Intake	**P0341**	plausibility check	no cam position sensor signal	>5count	engine in synchronized mode	TRUE--	10	1 per rev	0.4 sec	two driving
	P0342	circuit low		>			revolutions	continuous	continuous	cycles each
	P0343	circuit continuity or high		>					or 4 sec	with: 0.4 sec
									cumulative	continuous
									cumulative	continuous
Bank 2 Intake	**P0345**	plausibility check	no cam position sensor signal	>5count						or 4 sec
	P0347	circuit low		>5count						cumulative
	P0348	circuit continuity or high		>5count						
fuel tank pressure sensor					barometric pressure	>= 68 kPa	14 sec	continuous	0.4 sec	2 dcy
	P0453	circuit continuity - high or open	fuel tank pressure	> 3781 Pa	vehicle speed	= 0 mph				
					fuel level	> 6,2 %				
					fuel level	< 87 %				
	P0452	circuit continuity - low	fuel tank pressure	< -4000 Pa	engine start finished	true				
					enabled by diagnostic scheduler	true				
	P0451	rationality -	fuel tank pressure difference	>= 813 Pa			25.5 sec	continuous	0.4 sec	2 dcy
		sensor signal change within time	within	= 1 sec	canister vent valve open	true				
		(oscillation check)	for integrated time	>= 25.5 sec	for time	> 3 sec				
					vehicle speed	<= 18.64 mph				
					enabled by diagnostic scheduler	true				
	P0451	rationality - sensor signal stuck (incremental check)	max-min difference of canister purge valve duty cycle	>= 39.84 %	vehicle speed	>= 6.22 mph	25 sec	continuous	0.4 sec	2 dcy
			and		canister purge is active	true				
			max-min difference of fuel tank pressure signal	< 80 Pa	ratio of intake manifold pressure to atmospheric pressure	<= 0.477 -				
			for number of checks	>= 2 counts	atmospheric pressure	>= 68 kPa				
					incremental check without result yet	true				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					fuel level	> 6,2 %				
					fuel level	< 87 %				
					enabled by diagnostic scheduler	true				
	P0327	Monitoring via knock-sensor- and	Cylinder individual signal value	< 0.7422 ... 6.8164 V	- Knock control is active.	true	0,3 sec	continuous	2.6 sec	no MIL
		cylinder-based basic reference noise	(depends on engine speed)		- engine coolant temperature	> 45 °C				
	P0328	signal (voltage).	Cylinder individual signal value	> 57.8908 ... 72.7541 V	- load	> 30 %				
			(depends on engine speed)		- Engine speed for strong signals.	> 2520 rpm				
					- Engine speed for weak signals.	> 2520 rpm				
					- No phase sensor faults during	true				
					engine start.					
					- Engine speed dynamics for	false				
					knock detection exist.					
					- Load dynamics for knock	false				
					detection exist.					
					- No ECM knock-control circuit	true				
					error.					
					- Engine speed limp home	false				
					function is active.					
	P0332	Monitoring via knock-sensor- and	Cylinder individual signal value	< 0.7422 ... 6.8164 V	- Knock control is active.	true	0,3 sec	continuous	2.6 sec	no MIL
		cylinder-based basic reference noise	(depends on engine speed)		- engine coolant temperature	> 45 °C				
	P0333	signal (voltage).	Cylinder individual signal value	> 57.8908 ... 72.7541 V	- load	> 30 %				
			(depends on engine speed)		- Engine speed for strong signals.	> 2520 rpm				
					- Engine speed for weak signals	> 2520 rpm				
					- No phase sensor faults during	true				
					engine start.					
					- Engine speed dynamics for	false				
					knock detection exist.					
					- Load dynamics for knock	false				
					detection exist.					
					- No ECM knock-control circuit	true				
					error.					
					- Engine speed limp home	false				
					function is active.					
Knock control sensor's evaluation IC							250 working	Zero and	2.6 s	2 dcy
		Response to Zero Pulse					cycles	Test pulse		
	P0324	monitor IC's integrator offset	integrator's value - 715mV	> 0.215 V	knock control active	true - -		alternate every		
					no dynamic condition on engine speed	true - -		250 working		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
					no dynamic condition on engine load	true - -		cycles.		
					no fault assumption from knock control					
					test pulse.	true - -				
					the engine speed is within a calibrated					
					range	true - -				
	P0324	monitor IC's integrator gradient	integrator gradient		same as for IC integrator's offset monitoring					
		Response to Test Pulse								
	P0324	integrator value check	integrator value of test pulse	< 3.691 V	the engine coolant temperature > calibration	true				
					no dynamic condition on engine speed	true				
					no dynamic condition on engine load	true				
					no fault assumption from the knock					
					control zero test.	true				
Transmission Control Module	**P0700**	OBD emission fault	signal input	=TCM MILFAULT	-	---	0.01 sec	0.01 sec	immediate	immediate
MIL Illumination Request		detected by the TCM						continuous		
	(Specific TCM DTC shown in freeze frame)									
fuel injector										
cylinder #1	**P0201**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	2 dcy
	P0261	circuit continuity - ground			battery voltage	> 9,99 V				
	P0262	circuit continuity - voltage			battery voltage	< 17,99 V				
cylinder #2	**P0202**	circuit continuity - open			output activated and					
	P0264	circuit continuity - ground			deactivated for complete					
	P0265	circuit continuity - voltage			checking	true				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
cylinder #3	**P0203**	circuit continuity - open								
	P0267	circuit continuity - ground								
	P0268	circuit continuity - voltage								
cylinder #4	**P0204**	circuit continuity - open								
	P0270	circuit continuity - ground								
	P0271	circuit continuity - voltage								
cylinder #5	**P0205**	circuit continuity - open								
	P0273	circuit continuity - ground								
	P0274	circuit continuity - voltage								
cylinder #6	**P0206**	circuit continuity - open								
	P0276	circuit continuity - ground								
	P0277	circuit continuity - voltage								
canister ventilation valve	**P0449**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	2 dcy
	P0498	circuit continuity - ground			battery voltage	> 9,99 V				
	P0499	circuit continuity - voltage			battery voltage	< 17,99 V				
					output activated and					
					deactivated for complete					
					checking	true				
canister purge valve	**P0443**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	2 dcy
	P0458	circuit continuity - ground			battery voltage	> 9,99 V				
	P0459	circuit continuity - voltage			battery voltage	< 17,99 V				
					output activated and					
					deactivated for complete					
					checking	true				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
downstream oxygen sensor heater										
Bank #1	**P0036**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	2 dcy
	P0037	circuit continuity - ground			battery voltage	> 9,99 V				
	P0038	circuit continuity - voltage			battery voltage	< 17,99 V				
					output activated and					
					deactivated for complete					
					checking	true				
secondary air pump	**P0418**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	2 dcy
	P2445	circuit continuity - ground			battery voltage	> 9,99 V				
	P2444	circuit continuity - voltage			battery voltage	< 17,99 V				
					output activated and					
					deactivated for complete					
					checking	true				
intake camshaft control										
Intake Bank #1	**P0010**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	2 dcy
	P2088	circuit continuity - ground			battery voltage	> 9,99 V				
	P2089	circuit continuity - voltage			battery voltage	< 17,99 V				
Intake Bank #2	**P0020**	circuit continuity - open			output activated and					
	P2092	circuit continuity - ground			deactivated for complete					
	P2093	circuit continuity - voltage			checking	true				
Dump valve turbo	**P0033**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	no MIL
	P0034	circuit continuity - ground			battery voltage	> 9,99 V				
	P0035	circuit continuity - voltage			battery voltage	< 17,99 V				
					output activated and					
					deactivated for complete					
					checking	true				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
Boost control valve	**P0244**	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	0.2 sec	no MIL
	P0245	circuit continuity - ground			battery voltage	> 9,99 V				
	P0246	circuit continuity - voltage			battery voltage	< 17,99 V				
					output activated and					
					deactivated for complete					
					checking	true				
Ignition Coil										
circuit continuity										
Cylinder #1	**P0351**	circuit continuity - open or signal not plausible	Voltage > during	>20revs	engine speed	>600rpm	approx.	engine	0.4 sec	two driving
			or minimum two fault counters		engine speed	<5000rpm	1 sec	cycle	continuous	cycles each
	P2300	circuit continuity - ground	Voltage > during	>20revs	battery voltage	>10V		frequency	or 4 sec	with: 0.4 sec
	P2301	circuit continuity - voltage	Voltage > during	>20revs	battery voltage	<18V			cumulative	continuous
Cylinder #2	**P0352**	circuit continuity - open or signal not plausible	Voltage > during	>20revs				continuous		or 4 sec
			or minimum two fault counters							cumulative
	P2303	circuit continuity - ground	Voltage > during	>20revs						
	P2304	circuit continuity - voltage	Voltage > during	>20revs						
Cylinder #3	**P0353**	circuit continuity - open	Voltage > during	>20revs						
			or minimum two fault counters							
	P2306	circuit continuity - ground	Voltage > during	>20revs						
	P2307	circuit continuity - voltage	Voltage > during	>20revs						
Cylinder #4	**P0354**	circuit continuity - open	Voltage > during	>20revs						
			or minimum two fault counters							
	P2309	circuit continuity - ground	Voltage > during	>20revs						
	P2310	circuit continuity - voltage	Voltage > during	>20revs						
Cylinder #5	**P0355**	circuit continuity - open	Voltage > during	>20revs						
			or minimum two fault counters							

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
	P2312	circuit continuity - ground	Voltage > during	>20revs						
	P2313	circuit continuity - voltage	Voltage > during	>20revs						
Cylinder #6	**P0356**	circuit continuity - open	Voltage > during	>20revs						
			or minimum two fault counters							
	P2315	circuit continuity - ground	Voltage > during	>20revs						
	P2316	circuit continuity - voltage	Voltage > during	>20revs						
Electronic Throttle Control										
	P0638	motor control range check	| powerstage duty cycle |	>80%	battery voltage	>7V	0.6 sec	0.01 sec	immediate	immediate
		short term	(absolute value)	>80%			(recoverable)	continuous		
		motor control range check					5.0 sec			
		long term					(latched)			
Electronic Throttle Control										
	P1551	limp-home throttle position	throttle position	<1.8006%	vehicle speed	<=0mph	5 sec	0.01 sec	immediate	immediate
		out of range	OR		engine speed	<40rpm		at key on		
			throttle position	>13.0785%	engine coolant temperature	>=5.25° C				
					engine coolant temperature	<=84.75° C				
					intake air temperature	>=5.25° C				
					intake air temperature	<=60° C				
					battery voltage	>9.99V				
					accelerator pedal position	<14.9%				
Electronic Throttle Control										
	P2100	powerstage circuit switch-	output circuits not	=deactivationfault	-	---	0.1 sec	0.01 sec	immediate	immediate
			as commanded					at key on		
	P2101	difference between set and	difference between set and	>4 . . . 50%	electronic throttle adaptation	not active--	0.5 sec	0.01 sec	immediate	immediate
		actual position of throttle blade	actual position of throttle blade	dep. on rate of change	battery voltage	>7V		continuous		
	P2107	amplifier adjustment of	amplification value	<3.9961V	vehicle speed	<=0mph	< 6 sec	0.01 sec	immediate	immediate
		throttle position	or		engine speed	<40rpm		once per throttle Adaption		
			amplification value	>4.3242V	engine coolant temperature	>=5.25° C				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			or		engine coolant temperature	<=84.75° C				
			offset value	<-0.1501V	intake air temperature	>=5.25° C				
			or		intake air temperature	<=60° C				
			offset value	>0.1501V	battery voltage	>9.99V				
					accelerator pedal position	<14.9%				
	P2119	functionality of return spring	throttle blade return response	>0.56sec	vehicle speed	<=0mph	0.56 sec	0.01 sec	immediate	immediate
					engine speed	<40rpm		at key on		
					engine coolant temperature	>=5.25° C	once			
					engine coolant temperature	<=84.75° C	per			
					intake air temperature	>=5.25° C	ignition			
					intake air temperature	<=60° C	on			
					battery voltage	>9.99V				
					accelerator pedal position	<14.9%				
Electronic Throttle Control										
	P2176	throttle exchange detection	range check poti1 value at lower stop		vehicle speed	<=0mph	1 sec	0.01 sec	immediate	immediate
		learn fail	throttle potentiometer 1 voltage	<0.212V	engine speed	<40rpm		at key on		
		or	or		engine coolant temperature	>=5.25° C	once			
		initial throttle learn failed	throttle potentiometer 1 voltage	>0.865V	engine coolant temperature	<=84.75° C	per			
		or			intake air temperature	>=5.25° C	ignition			
		learning prohibited due to	range check poti2 value at lower stop	0	intake air temperature	<=60° C	on			
		secondary parameters not met	throttle potentiometer 2 voltage	<4.14V	battery voltage	>9.99V				
		or	or		accelerator pedal position	<14.9%				
		minimum throttle position	throttle potentiometer 2 voltage	>4.84						
		out of range								
Throttle Position	**P0121**	range check poti voltage	sensor difference	>9%	battery voltage	>7V	continuous	0.1 sec	0.4 sec	two driving
Sensor 1 (primary)	**P0122**	plausibility to other poti	sensor circuit low voltage	<0.176V				continuous	continuous	cycles each
	P0123		sensor circuit high voltage	>4.629V					or 4 sec	with: 0.4 sec
									cumulative	continuous
Sensor 2 (redundant)	**P0221**	range check poti voltage,	sensor difference	>9%	battery voltage	>7V	continuous	0.1 sec		or 4 sec
	P0222	plausibility to other poti	sensor circuit low voltage	<0.156V				continuous		cumulative
	P0223		sensor circuit high voltage	>4.883V						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
function monitoring of microcontroller (PCM level 2 command check)	**P0606**	torque comparison	irreversible error of torque comparison (current and maximum allowed engine torque out of range)	true			5.5 sec	continuous	0.2 sec	2 dcy
		engine load comparison	irreversible error of engine load comparison (calculated and measured engine load out of range)	true						
		engine speed comparison	irreversible error of engine speed comparison (calculated and measured engine speed out of range)	true						
		accelerator pedal signal comparison	irreversible error of accelerator pedal signal comparison (synchronism between the two pedal sensors out of range)	true						
		monitoring of AD converter queue	irreversible error of AD-converter queue monitoring (queue not running)	true						
		range check of lower mechanical throttle valve position	irreversible error of lower mechanical throttle valve position limit check (position out of range)	true						
		check of variant coding	irreversible error of variant coding check	true						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			(coding is incorrect)							
		check of AD-converter signal	irreversible error of AD-converter signal							
			check	true						
			(converted low voltage test impuls							
			out of range)							
		check of ignition timing	irreversible error of comparison of							
			ignition timing value	true						
			(comparison of ignition timing value							
			with its one's complement is wrong)							
		verification of engine load value	irreversible error of engine load value							
			verification	true						
			(engine load value and verification							
			value are not identical)							
		function controller response check	monitoring module has detected a fault							
			of function controller	true						
		watchdog output signal check	WDA signal activated	true						
		overvoltage detection	internal supply voltage exceeded	true						
ECM Monitoring										
	P0605	rationality check -	wrong ROM checksum	true	PCM after-run time of the last		30 sec	at key off	2.6 sec	immediately
		verification of ROM checksum			driving cycle completely			once per		
					finished	true		dcy		
	P0605	rationality check -	wrong cyclic ROM checksum of	true			5 sec	0.04 sec	2.6 sec	immediately

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
		verification of ROM checksum	critical regions					continuous		
	P0604	writeability check of RAM	RAM read and write test failed	true	PCM after-run time of the last driving cycle completely finished	true	30 sec	at key off once per dcy	2.6 sec	immediately
	P0604	writeability check of RAM	cyclic RAM read and write test of critical regions failed	true			1 sec	0.04 sec continuous	2.6 sec	immediately
	P0606	rationality check - programming incomplete	shut down of power stages not possible	true			0.05 sec	at key on once per dcy	2.6 sec	immediately
	P0606	writeability check of Time Processing Unit (TPU) parameter RAM	TPU parameter RAM read and write test failed	true			0.05 sec	at key on once per dcy	2.6 sec	immediately
	P0606	rationality check - verification of Time Processing Unit (TPU) code RAM checksum	wrong TPU code RAM checksum	true			0.3 sec	0.1 sec continuous	2.6 sec	immediately
	P0606	rationality check - time difference check	difference between Time Processing Unit and PCM time	> 0.001 sec			0.3 sec	0.1 sec continuous	2.6 sec	immediately
accelerator accelerator position sensor		Voltage accelerator position sensor								
	P 2123	range check high	accelerator position sensor voltage 1	> 4.824 V	for time condition batterie voltage is sufficient for 5V accelerator sensor supply	> 0.2 sec true	immediately	continuously	0.2 sec	0.4 sec
	P 2122	range check low	accelerator sensor voltage 1	< 0.898 V	for time	> 0.2 sec				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
			and							
			accelerator sensor voltage 2	< 0.664 V						
			or							
			accelerator sensor voltage 1	< 0.898 V	for time	> 0.2 sec				
			and							
			synchronization between voltages 1 and 2 violated (see values of absolute difference in accelerator sensor voltages depending on ranges in FP1P absolute difference check below)	true						
			and							
			error reaction accelerator-travel sensor limphome	false						
			and							
			high contact resistance at accelerator voltage 1	false						
	P 2138	absolute difference check	absolute difference between both		condition lower limit violated (see min fault path of FP1P)	false				
		fault time	accelerator sensor voltages in the range		condition lower limit violated (see min fault path of FP2P)	false				
			below 1.25 V	> 0.215 V	error reaction accelerator-travel sensor limphome	false				
			or		condition batterie voltage is sufficient for 5V accelerator sensor supply	true				
			absolute difference between both							
			accelerator sensor voltages in the range							
			from 1.25 V to 3.496 V	> 0.273 V						
			or							
			absolute difference between both							
			accelerator sensor voltages in the range							
			above 3.496 V	> 1.035 V						
			and							
			fulfilled for the time	> 0.24 sec						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
	P 2128	range check high	accelerator sensor voltage	> 4.824 V	for time	> 0.2 sec				
		fault time			condition batterie voltage is sufficient for 5V accelerator sensor supply	true				
	P 2127	range check low	accelerator sensor voltage 1	< 0.898 V	for time	> 0.2 sec				
			and							
			accelerator sensor voltage 2	< 0.684 V						
			or							
			accelerator sensor voltage 2	< 0.684 V	for time	> 0.2 sec				
			and							
			synchronization between potentiometers 1 and 2 violated (see values of absolute difference in accelerator sensor voltages depending on ranges in FP1P absolute difference check below)	true						
			and							
			error reaction accelerator-travel sensor limphome	false						
			and							
			high contact resistance at accelerator voltage 2	false						
Diagnosis of CAN signal timeout –										
instrument panel	**U0212**	CAN signal missing	CAN message of Gateway ID 0x380/1 received	< 1.250 s	battery voltage	> 10 V		continuous	immediately	immediately
					battery voltage	< 18 V				
					condition ignition switch on for time	> 3 s	3 s			
					CAN-Status Enable normal message transmission	true				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	PRIMARY MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	FREQUENCY OF CHECKS	CRITERIA FOR CODE	MIL ILLUM.
OBD ISO-15765 Communication Bus										
	U0001	ISO-15765 Bus Error	Invalid Message Received	=invalid	CAN Bus	initialized	0.5 sec	0.01 sec	immediately	immediately
			or Dual Port Ram Hardware Error;	=error	consisting of:	and ready	0.01 sec	continuous		
			or No Communication / Bus Off	=bus off	ignition on for	>3sec	0.03			
					battery voltage	>10V				
					battery voltage	<18V				
					normal bus communication	running--				
	U0101	Communication with TCM	TCM Message Timeout	=message	Automatic Transmission	equipped--	2.5 sec	0.01 sec	immediately	immediately
	U0402		or Invalid Message Content	=missing,	CAN Bus	initialized--		continuous		
				delayed,	consisting of:	and ready				
				or	ignition on for	>3sec				
				invalid	battery voltage	>10V				
				content	battery voltage	<18V				
					normal bus communication	running--				
end										