COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Camshaft Control								
Electrical								
Bank 1 Intake	P0010	circuit continuity - open	Voltage	IC Internal -	engine speed	> 80 rpm	0.01 sec	two driving
	P2088	circuit continuity - ground			battery voltage	> 10 V		cycles
	P2089	circuit continuity - voltage			battery voltage	< 18.1 V		
Bank 1 Exhaust	P0013	circuit continuity - open			output activated and deactivated for complete checking			
	P2090	circuit continuity - ground						
	P2091	circuit continuity - voltage						
Bank 2 Intake	P0020	circuit continuity - open						
	P2092	circuit continuity - ground						
	P2093	circuit continuity - voltage						
Bank 2 Exhaust	P0023	circuit continuity - open						
	P2094	circuit continuity - ground						
	P2095	circuit continuity - voltage						
System - Control								
Bank 1 Intake	P0011	rationality - target error	difference to start test >	7.0 . . . 8.0 degrees	engine speed	> 520 rpm	approx.	two driving
Bank 1 Exhaust	P0014		(actual angle versus desired angle)	KFDWNWDMXE / 2	engine run time	> 1 sec	600 sec	cycles
Bank 2 Intake	P0021		(desired must remain above start value	KFDWNWDMXA / 2	camshaft control circuit test	complete - -		
Bank 2 Exhaust	P0024		for a complete evaluation)		error: camshaft control circuit	not set - -		
					cam-crank alignment adaptation	complete - -		
			difference (target error) <	1.5 degrees				
			(to detect slow response versus stuck cam if above this limit)					
			actual angle					
			< target angle within time	2 sec				
			(detects 4 sec slow [time constant])					
			error count >=	10 count				
			or					
			error count (cold start only) >=	4 count				
			(both error counters decrement upon activations where no difference is seen between desired					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			and actual)					
Bank 1 Intake	P000A	rationality - slow response	difference to start test >	7.0 . . . 8.0 degrees				
Bank 1 Exhaust	P000B		(actual angle versus desired angle)	KFDWNWDMXE / 2				
Bank 2 Intake	P000C		(desired must remain above start value	KFDWNWDMXA / 2				
Bank 2 Exhaust	P000D		for a complete evaluation)					
			difference (slow response) >	1.5 degrees				
			(to detect slow response versus stuck cam if above this limit)					
			actual angle					
			< target angle within time	2 sec				
			(detects 4 sec slow [time constant])					
			error count >=	10 count				
			or					
			error count (cold start only) >=	4 count				
			(both error counters decrement upon activations where no difference is seen between desired and actual) in both cam phase rotation					
System - Cam - Crank Alignment								
Bank 1 Intake	P0016	cam-crank adapted angle	adapted angle >	9.9 degrees	engine run time	> 50 sec	approx.	two driving
Bank 1 Exhaust	P0017	limit check	or adapted angle <	9.9 degrees	engine coolant temp	> 0 ° C	600 sec	cycles
Bank 2 Intake	P0018	(applies for each camshaft)	or actual angle with parked cams >	15 degrees	engine coolant temp	< 95.25 ° C		
Bank 2 Exhaust	P0019		and <	21 degrees	model: engine oil temp	< 120 ° C	fail after	
Bank 1 / Idler Sprocket	P0008		adapted angle for both cams >	6.0 degrees	error: camshaft sensor	not set - -	2 adaptation	
Bank 2 / Idler Sprocket	P0009		adapted angle for both cams <	6.0 degrees	error: camshaft control circuit	not set - -	cycles - required	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Air / Fuel Ratio Sensor Heating and Oxygen Sensor Heating heater circuits - electrical								
bank 1 sensor 2 (secondary)	P0036	circuit continuity - open	Voltage	IC Internal -	engine speed	> 80 rpm	0.5 sec	two driving
	P0037	circuit continuity - ground			battery voltage	> 9.9 V		cycles
	P0038	circuit continuity - voltage			battery voltage	< 18.1 V		
bank 2 sensor 2 (secondary)	P0056	circuit continuity - open			secondary O2 sensor heating	ready - -		
	P0057	circuit continuity - ground			secondary O2 sensor dew point	reached - -		
	P0058	circuit continuity - voltage			output activated and deactivated for complete checking			
High Pressure Fuel Control System Rationality								
	P0088	pressure deviation from desired: (higher pressure than commanded)	difference (desired minus actual fuel rail pressure) <	-2000 Kpa	error: electrical diagnosis of fuel volume control valve	not set - -	5 sec	two driving
					error: electrical diagnosis of fuel rail pressure sensor	not set - -		cycles
	P0087	pressure deviation from desired:	difference (desired minus actual fuel rail pressure) >	1000 Kpa	tester request for open fuel flow control valve	FALSE - -	5 sec	
		(lower pressure than commanded)			airbag deployed (see descriptions for details)	FALSE - -		
	P0089	C/L controller output value: above expected	controller output value (accumulated C/L correction) >	2000 Kpa	battery voltage	< 18.1 V	5 sec	
					battery voltage	> 9.9 V		
	P0089	C/L controller output value: below expected	controller output value (accumulated C/L correction) <	-2000 Kpa	fuel level	> 11 %	5 sec	
					engine speed (exceeded once during engine start)	> 600 rpm		
					for time	> 5 sec		
		(typical operating pressure when this diagnostic is active: 3,000 - 15,000 Kpa)	The pressure deviation test is useful for detecting larger		first engine start at assembly plant	FALSE - -		
			and sudden pressure deviations.		DFCO active	FALSE - -		
			Events detected by the controller test are longer term		engine start temperature	> -48 C		
			failures. Emissions are maintained under the LEVII, Bin5		maximum engine speed limitation	not active - -		
			limit at the failure threshold.					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
High Pressure Fuel Volume Control Valve Circuit rationality											
	P0092	feedback voltage - short to battery	voltage test pulse - on command >	4.502	V	battery voltage	>	9.9	V	2 sec	code set then 5 sec
	P0091	feedback voltage - short to ground	voltage test pulse - off command <	2.749	V	battery voltage	<	18.1	V		
	P0090	feedback voltage - open load	voltage test pulse - off command within range	2.749 < Voltage < 4.502	V	error: 5 volt supply	not detected	-	-		
Engine coolant temperature sensor	P0116	difference from Engine temperature model after soaking	filtered difference			Engine coolant model (cooled down)	<	50	° C	35	code set
			(ECT at key on - ECTmodel at key on) >	14.3	° C	Soaking time after shut down	>	19800	sec	for block heating	then 5 sec
						previous accumulated air mass	>	6000	g	check	approx.
			or			previous engine run time	>	600	sec		6 test
						or				One filter	average
						previous accumulated air mass	>	6000	g	update per	run length
			filtered difference			ECT at shut down	>	81.75	° C	cold start	(15°C delta)
			(ECT at key on - ECTmodel at key on) <	-14.3	° C						
						Controller Shut Down at end of last cycle	-	-	-	Filter Initialized	
						Error - Engine Off Timer	not detected	-	-	after powerfail	
						Powerfail during previous drive	not detected	-	-	or codeclear	
						Block Heater	not detected	-	-	to 13.0° C	
Engine coolant temperature sensor	P0117	range check high	coolant temperature >	140.3	° C	if Startup IAT	>	72	° C	0.1 sec	two driving cycles
						hot restart timer	>=	60	sec		
	P0118	range check low	coolant temperature <	-39	° C						
	P0119	intermittent (discontinuity)	delta coolant temp. during evaluation period <	-4.5	° C					0.1 sec	
			delta coolant temp. during evaluation period >	4.5	° C						
			weighted counter >	60000	count						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			(counter incremented by 5,000 w/jump detected; decremented by 1 with steady ECT signal) (fail counter initialized to 10000)								
Throttle Position Sensor 1 (primary)	P0121	range check poti voltage	sensor difference >	9	%	battery voltage	>	7	V	0.2 sec	two driving cycles
	P0122	plausibility to other poti	sensor circuit low voltage <	0.176	V	battery voltage	>	7	V	0.2 sec	code set
	P0123		sensor circuit high voltage >	4.629	V						then 5 sec
Sensor 2 (redundant)	P0221	range check poti voltage,	sensor difference >	9	%	battery voltage	>	7	V	0.2 sec	two driving cycles
	P0222	plausibility to other poti	sensor circuit low voltage <	0.156	V	battery voltage	>	7	V	0.2 sec	code set
	P0223		sensor circuit high voltage >	4.883	V						then 5 sec
Engine coolant Temperature sensor	P0128	Coolant Temperature Below Model Temperature (additional pinpointing for coolant sensor, failures detected would also be detected by Thermostat monitor)	calculated coolant temperature model minus measured temperature >	9.8	° C	error: engine coolant temp	not set	-	-	approx. 500 sec	two driving cycles
						engine speed	>	25	rpm		
			coolant temp. reference model calculation limit	40.5	° C						
			(detection of blockheater resets modeled engine coolant temperature calculation)								
		OR									
Engine Coolant Thermostat Monitoring		Coolant Temperature Below Thermostat Regulating Temperature (plausibility check)	(calculated reference model coolant temp minus measured coolant temperature) >	10.5	° C	error: engine coolant temp	not set	-	-	approx. 900 sec	two driving cycles
						error: vehicle speed sensor	not set	-	-		
						est. ambient temperature	>	-39	°C		
			reference model calculation limit	89.25	° C	est. ambient temperature	<	100	°C		
						vehicle speed	>=	9.375	mph		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			(development vehicles indicated steady thermostat regulating temperatures of 89°C, as measured by the engine coolant temp. sensor. The thermostat opening temp. is 82°C. The thermostat is fully open by 95°C. All critical OBD and emission functions are enabled above 60°C.)		engine speed coolant temperature at start integrated air mass	> 960 rpm < 70.5 °C > 3000 g		
Oxygen Sensor sensor circuit (secondary O2)								
bank 1 sensor 2 bank 2 sensor 2	P0137 P0157	short circuit to ground	secondary O2 sensor voltage <	0.06 V	engine speed battery voltage battery voltage engine coolant temperature following conditions met for time modeled exhaust gas temp. at Sec. O2 sensor Or normalized heating power for Sec. O2 heater secondary O2 dew point end Or Internal resistance of Secondary O2 sensor active commanded lambda short term fuel trim commanded lambda reached target value for time error: O2 sensor heater circuit error: Secondary O2 sensor open circuit	> 25 rpm > 10.4 V < 18.2 V > -9.8 ° C > 40 sec >= 700 ° C >= 0.5 ° C TRUE - - TRUE - - <= 1.005 - < 1.25 - TRUE - - > 10 sec not set - - not set - -	40 sec	two driving cycles
			Or secondary O2 sensor voltage <	0.06 V	engine speed battery voltage	> 25 rpm > 10.4 V	5 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						battery voltage	<	18.2	V		
						engine coolant temperature	>	-9.8	° C		
						following conditions met for time	>	40	sec		
						modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
						Or normalized heating power for Sec. O2 heater	>=	0.5	° C		
						secondary O2 dew point end	TRUE	-	-		
						Or Internal resistance of Secondary O2 sensor active	TRUE	-	-		
						time after engine start	>	5.1	sec		
						engine coolant temperature	<	40	° C		
						engine coolant temperature at ignition off	>	60	° C		
						error: O2 sensor heater circuit	not set	-	-		
						error: Secondary O2 sensor open circuit	not set	-	-		
			Or								
			secondary O2 sensor voltage <	0.06	V	following conditions met for time	>	3	sec		
			and average difference voltage data between loaded					0.6			
			pulse sensor and unloaded pulse sensor voltages <	0.015	V	Secondary O2 sensor voltage	<		V		
						Decel. Fuel cut-off	not set	not set	-		
			(3 sample data)			Catalyst clear-out mode after DCFO	not set	not set	-		
						engine speed	>	25	rpm		
						battery voltage	>	10.4	V		
						battery voltage	<	18.2	V		
						engine coolant temperature	>	-9.8	° C		
						following conditions met for time	>	40	sec		
						modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
						Or normalized heating power for Sec. O2 heater	>=	0.5	° C		
						secondary O2 dew point end	TRUE	-	-		
						Or Internal resistance of Secondary O2 sensor active	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
						error: Secondary O2 sensor open circuit	not set	-	-		
bank 1 sensor 2	P0138	short circuit to battery voltage	secondary O2 sensor voltage >	1.15	V	engine speed	>	25	rpm	5 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
bank 2 sensor 2	P0158					battery voltage	>	10.4	V		
						battery voltage	<	18.2	V		
						engine coolant temperature	>	-9.8	° C		
						following conditions met for time	>	40	sec		
						modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
						Or normalized heating power for Sec. O2 heater	>=	0.5	° C		
						secondary O2 dew point end	TRUE	-	-		
						Or Internal resistance of Secondary O2 sensor active	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
						error: Secondary O2 sensor open circuit	not set	-	-		
bank 1 sensor 2	P0140	sensor line disconnection	secondary O2 sensor voltage >=	0.401	V	engine speed	>	25	rpm	60 sec	
bank 2 sensor 2	P0160		and secondary O2 sensor voltage <=	0.519	V	battery voltage	>	10.4	V		
			Or secondary O2 sensor voltage <=	0.498	V	battery voltage	<	18.2	V		
			gas temperature >=	800	° C	engine coolant temperature	>	-9.8	° C		
						following conditions met for time	>	40	sec		
			Or			modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
			secondary O2 sensor internal resistance >	40000	Ohm	Or normalized heating power for Sec. O2 heater	>=	0.5	° C		
			when modeled exhaust gas temperature >	500	° C	secondary O2 dew point end	TRUE	-	-		
						Or Internal resistance of Secondary O2 sensor active	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
						error: O2 sensor heater circuit	not set	-	-		
			Or			following conditions met for time	>	6	sec		
			Secondary O2 sensor voltage >=	0.4	V	Secondary O2 sensor voltage	>=	0.4	V		
			and Secondary O2 sensor voltage <=	0.52	V	and Secondary O2 sensor voltage	<=	0.52	V		
			average loaded pulse Secondary O2 sensor			average loaded pulse primary O2 sensor voltage	>	0.28	V		
			voltage over 3 sample data >	0.28	V	engine speed	>	25	rpm		
						battery voltage	>	10.4	V		
						battery voltage	<	18.2	V		
						engine coolant temperature	>	-9.8	° C		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						following conditions met for time	>	40	sec		
						modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
						Or normalized heating power for Sec. O2 heater	>=	0.5	° C		
						secondary O2 dew point end	TRUE	-	-		
						Or Internal resistance of Secondary O2 sensor active	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
Oxygen Sensor Heating											
heater performance (secondary O2)											
bank 1 sensor 2 (secondary)	P0141	secondary O2 sensor	measured secondary O2 sensor internal			battery voltage	>	10	V	approx.	two driving
bank 2 sensor 2 (secondary)	P0161	internal resistance	resistance >			battery voltage	<	18.1	V	100 sec	cycles
		above threshold	nominal internal resistance	104 ... 128	Ohms	engine speed	>	240	rpm		
						engine speed	>	240	rpm		
			multiply times degradation factor	5.25 ... 7.75	factor	fuel cut off	FALSE	-	-		
						sec. O2 internal resistance	valid	-	-		
			for time	6	sec	intake air temperature	>	-30	C		
						modeled exhaust temp.	in range	300 . . . 700	C		
						at secondary O2 sensor					
						suspicion of secondary	FALSE				
						O2 sensor open circuit					
						secondary O2 voltage supply	ON				
						from the deactivation for time	>	120	sec		
Fuel Rail Pressure Sensor											
Rationality											
	P0191	rationality check low	Fuel pressure during power up init. <	120	KPa	engine speed	>	25	rpm	During	two driving
		(sensor skewed low in range)	AND			for time	>	30	sec	engine start only	cycles
			Fuel system fault exists: P0087 or P2188 or P2187								
			or								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		rationality check high (sensor skewed high in range)	Fuel pressure during power up init. > 1500 KPa AND Fuel system faults exist: P0088 or P2187 or P2177		engine speed > 25 rpm for time > 30 sec block heater active - FALSE - engine coolant at shutdown > 72 C engine coolant at start < 54.8 C difference : engine coolant at start - intake air temperature < 35.3 C difference : intake air temperature - engine coolant at start < 9.75 C engine off time during soak > 15000 sec		
			or					
		rationality check high (sensor skewed high in range)	Fuel pressure during power up init. > 1500 KPa AND Fuel pressure rise during fuel pump prime > 350 KPa		engine speed > 25 rpm for time > 30 sec block heater active - FALSE - engine coolant at shutdown > 72 C engine coolant at start < 54.8 C difference : engine coolant at start - intake air temperature < 35.3 C difference : intake air temperature - engine coolant at start < 9.75 C engine off time during soak > 15000 sec		
Fuel Rail Pressure Sensor Electrical								
	P0193	circuit continuity - high	Fuel pressure sensor output voltage > 4.80 V			0.5 sec	code set then 5 sec	
	P0192	circuit continuity - low	Fuel pressure sensor output voltage < 0.20 V			0.5 sec		
High Pressure Fuel Injection Valve Circuit Continuity - High side (HS) and Low								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Cylinder #1								
	P0201	circuit continuity - open LS or HS	Voltage	IC Internal	engine speed	> 80 rpm	0.01 sec	two driving
	P0261	circuit continuity - ground LS			battery voltage	> 9.9 v		cycles
	P0262	circuit continuity - battery LS			battery voltage	< 18.1 v		
	P2146	circuit continuity - ground or battery HS						
Cylinder #2								
	P0202	circuit continuity - open LS or HS						
	P0264	circuit continuity - ground LS						
	P0265	circuit continuity - battery LS						
	P2149	circuit continuity - ground or battery HS						
Cylinder #3								
	P0203	circuit continuity - open LS or HS						
	P0267	circuit continuity - ground LS						
	P0268	circuit continuity - battery LS						
	P2152	circuit continuity - ground or battery HS						
Cylinder #4								
	P0204	circuit continuity - open LS or HS						
	P0270	circuit continuity - ground LS						
	P0271	circuit continuity - battery LS						
	P2155	circuit continuity - ground or battery HS						
Cylinder #5								
	P0205	circuit continuity - open LS or HS						
	P0273	circuit continuity - ground LS						
	P0274	circuit continuity - battery LS						
	P216A	circuit continuity - ground or battery HS						
Cylinder #6								
	P0206	circuit continuity - open LS or HS						
	P0276	circuit continuity - ground LS						
	P0277	circuit continuity - battery LS						
	P216D	circuit continuity - ground or battery HS						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
SPI Communication	P062B	Internal SPI Communication Fault or Internal ADC Voltage Booster Failure		IC Internal IC Internal	engine speed battery voltage battery voltage	> 80 rpm > 9.9 v < 18.1 v	1.10 sec	
Diagnosis of Stuck Open Fuel Injector Rationality	P029D	fuel injector stuck open - cylinder #1	fuel pressure deviation from desired - under pressure (P0087) and cylinder # 1 misfire counts >	set 30 counts	misfire monitor active (see P0300 details) engine speed engine speed relative engine load misfire counters accumulate within period <	 > 1520 rpm < 6000 rpm < 190 % < 17 rev	approx. 20sec	two driving cycles
	P02A1	fuel injector stuck open - cylinder #2	fuel pressure deviation from desired - under pressure (P0087) and cylinder # 2 misfire counts >	set 30 counts				
	P02A5	fuel injector stuck open - cylinder #3	fuel pressure deviation from desired - under pressure (P0087) and cylinder # 3 misfire counts >	set 30 counts				
	P02A9	fuel injector stuck open - cylinder #4	fuel pressure deviation from desired - under pressure (P0087) and cylinder # 4 misfire counts >	set 30 counts				
	P02AD	fuel injector stuck open - cylinder #5	fuel pressure deviation from desired - under pressure (P0087) and cylinder # 5 misfire counts >	set 30 counts				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
	P02B1	fuel injector stuck open - cylinder #6	fuel pressure deviation from desired - under pressure (P0087) and cylinder # 6 misfire counts >	set 30	counts						
Misfire Emission Level											
Multiple Cylinder	P0300	crankshaft speed	emissions relevant misfire rate	1.17 (LLT)	%	engine speed	>	400	rpm	1000 revs	Fault during
Cylinder #1	P0301	fluctuation cylinder 1 to		2.40 (LNF)	%	engine speed	<	7000	rpm		1st interval:
Cylinder #2	P0302	cylinder 6				indicated torque (idle, no drive)	>	4	%	After	2 faults in
Cylinder #3	P0303			(GMX322 and		indicated torque (drive) (MISALUN)	>	6.02. . . 28.9	%	detection,	2 different
Cylinder #4	P0304			GMX295 LLT		engine speed gradient	<	2500 . . . 5500	rpm/sec	the	drive cycles.
Cylinder #5	P0305			use 2.4% limit)		volumetric efficiency gradient	<	225 . . . 1350	%/rev	diagnostic	
Cylinder #6	P0306					cylinder events after engine start	>	4	ignitions	can only	Fault during
						air temperature	>	-30	° C	pass if	remaining
						clutch switch press / release	transition	FALSE	-	similar	intervals:
						leak detection pull-down phase	off	-	-	conditions	8 faults in 2
						fuel cut off	not active	-	-	are	different
						fuel level	>	11	%	encountered	drive cycles
						OR fuel level	<	11	%		with at least
						AND solid misfire MIL	on	-	-		4 faults in
						OR fuel level error	set	-	-		each.
						error: throttle position	not set	-	-		
						error: crankshaft sensor	not set	-	-		
						error: ref.mark of crank sensor	not set	-	-		
						momentary re-enable delay:					
						(temporary delay until re-enablement AT:)	for	4	crank revs		
						(temporary delay until re-enablement MT:)	for	8	crank revs		
						barometric pressure (GMT001 & GMX001 ONLY) (disables for altitudes > 8,600ft based on data)	>	72.8	KPa		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			OR					
Catalyst Damaging Level			Catalyst damaging misfire rate		Includes all the above with the		1000 revs	First
Multiple Cylinder	P0300				following exceptions:		First interval	occurrence:
Cylinder #1	P0301				First interval extension		200 revs	immediate
Cylinder #2	P0302				engine coolant temperature	< 45 °C	all remaining	flashing
Cylinder #3	P0303				fuel level	>= 11 %	intervals	while error
Cylinder #4	P0304			53.3 . . . 5 %	OR fuel level	< 11 %		present, then
Cylinder #5	P0305			see Misfire	AND blinking MIL	blinking - -		no MIL
Cylinder #6	P0306			supplemental	AND NOT first blink event	- - -		with no error.
				data				
				(i) (2.5.1)				Second
								occurrence:
								immediate
								flashing
								while error
								present, then
								solid MIL
								with no error.
Knock Control								
Circuit	P0324	test pulse	test pulse integral <	4 V			0.1 sec	two driving
			for consecutive events	4 count	engine coolant temp.	> 60 ° C		cycles
					knock control	active - -		
					zero test , parity fault assumptions	not set - -		
		or			measuring window	> 1 ms		
		null test (zero test)	absolute value (integrator gradient) >	200 V / sec	engine coolant temp.	> 60 ° C		
					knock control	active - -		
			for consecutive events	4 count	test pulse , parity fault assumptions	not set - -		
		or						
		parity check	coefficient RAM errors in knock IC, per 250 working cycles	5 count	engine coolant temp.	> 60 ° C		
		or			test pulse fault assumption	not set - -		
		SPI communication	check word errors in knock IC, per 250 working cycles	25 count				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Bank 1					engine coolant temperature	> 60 ° C		
circuit check	P0326	short circuit to B+ or GND	faults detected on knock sensor pins, per 250 working cycles	25 count	engine speed	> 2200 rpm	approx.	two driving
Performance	P0327	range check low	reference voltage <	0.03 . . . 0.34 V	engine speed gradient (NGKRWN)	< 500 … 2300 rpm / sec	20 sec	cycles
				UDKSNU	engine load gradient	< 50 . . . 100 kPa / sec		
					error: knock control circuit (IC)	not set - -		
			for consecutive events	30 count				
	P0328	range check high						
			reference voltage >	1 . . . 29.5 V				
				UDKSNO				
			for consecutive events	30 count				
		short circuit to B+ or GND	faults detected on knock sensor pins, per 250 working cycles (zkrks) >	25 count				
Bank 2					engine coolant temperature	> 60 ° C		
circuit check	P0331	short circuit to B+ or GND	faults detected on knock sensor pins, per 250 working cycles	25 count	engine speed gradient (NGKRWN)	< 500 … 2300 rpm / sec	approx.	
Performance	P0332	range check low	reference voltage <	0.03 . . . 0.34 V	engine load gradient	< 50 . . . 100 kPa / sec	20 sec	
				UDKSNU	error: knock control circuit (IC)	not set - -		
			for consecutive events	100 count				
	P0333	range check high						
			reference voltage >	1 . . . 29.5 V				
				UDKSNO				
			for consecutive events	100 count				
Crankshaft Position Sensor	P0335	circuit continuity	no engine signal	0 rpm	camshaft revolutions detected	> 12 counts	approx.	code set
			but phase signals available				5 sec	then 5 sec
		rationality check	reference gap missing >	6 gaps				
			(sensor signal but no reference)					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P0336	rationality check	unexpected re-synchronization > (loss of reference mark)	2600	count				
		rationality check	intermittent loss of engine speed signal >	25	count				
	P0338	rationality check	difference in counted teeth between reference gap position events >	250	crankshaft teeth			approx. 2 sec	
Camshaft Position Sensor									
Bank 1 Intake	P0341	plausibility check	signal erratic or out of position	4	count	engine in synchronized mode	TRUE - -	10 revolutions	two driving cycles
	P0342	circuit low	signal permanently low	10	count	engine speed	< 2520 rpm		
	P0343	circuit continuity or high	signal permanently high	10	count				
Bank 2 Intake	P0346	plausibility check	signal erratic or out of position						
	P0347	circuit low	signal permanently low						
	P0348	circuit continuity or high	signal permanently high						
Bank 1 Exhaust	P0366	plausibility check	signal erratic or out of position						
	P0367	circuit low	signal permanently low						
	P0368	circuit continuity or high	signal permanently high						
Bank 2 Exhaust	P0391	plausibility check	signal erratic or out of position						
	P0392	circuit low	signal permanently low						
	P0393	circuit continuity or high	signal permanently high						
Ignition Coil circuit continuity									
Cylinder #1	P0351	circuit continuity - open	Voltage	IC Internal	-	engine speed	< 6000 rpm	approx. 1 sec	two driving cycles
	P2300	circuit continuity - ground				battery voltage	> 10 V		
	P2301	circuit continuity - voltage				battery voltage	< 18.1 V		
Cylinder #2	P0352	circuit continuity - open							
	P2303	circuit continuity - ground						engine	
	P2304	circuit continuity - voltage						cycle	
Cylinder #3	P0353	circuit continuity - open						frequency	
	P2306	circuit continuity - ground							
	P2307	circuit continuity - voltage							
Cylinder #4	P0354	circuit continuity - open							

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P2309	circuit continuity - ground						
	P2310	circuit continuity - voltage						
Cylinder #5	P0355	circuit continuity - open						
	P2312	circuit continuity - ground						
	P2313	circuit continuity - voltage						
Cylinder #6	P0356	circuit continuity - open						
	P2315	circuit continuity - ground						
	P2316	circuit continuity - voltage						
Ignition Coil Driver Circuit Serial Communication	P167D	Internal SPI communication fault	IC Internal	-	engine speed	< 6000 rpm	0.01 sec	
					battery voltage	< 18.1 V		
					battery voltage	> 9.99 V		
Evaporative System and Leak Monitor Small Leak - 0.020 "	P0442	natural pressure/vacuum	filtered fault index >	0.6 -	engine running gross leak test	not complete (see P0455 for details)	approx.	code set
		in tank			or gross leak test suspects small leak	0.020" leak (see P0455 for details)	600 sec	then 5 sec
			based on:		calculated ambient air temperature	> 1.5 ° C	each test	
			(peak pressure - peak vacuum) <	530 . . . 1430 Pa	calculated ambient air temperature	< 32.25 ° C		
				KFEONVPT	engine stop coolant temp	> 74.25 ° C	filtered	
					engine run time	> 600 sec	value	
					trip distance travelled	> 5.1 miles	exceeds	approx.
					fuel mixture contribution from purge vapor	< 26.7 %	threshold	6 test
					fuel level	> 14.7 %	then	average
					fuel level	< 86.4 %	4 sec	run length
					error: vehicle speed	not set - -	continuous	
					error: engine coolant temp	not set - -		(The MIL
					error: purge valve	not set - -		actually is
					error: fuel tank pressure	not set - -		requested
					error: system voltage	not set - -		during shut
					error: air mass meter	not set - -		down soak.

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					error: intake air temp	not set - -		It becomes
					error: canister vent valve	not set - -		visible on
					altitude adaption	valid - -		the
					start (coolant - intake air)	< 9.75 ° C		following
					start engine coolant temp	< 42 ° C		drive.)
					barometric pressure	> 68 kPa		
					battery voltage	> 9.9 V		
					vehicle odometer	> 12.5 miles		
Evaporative Emission System								
Purge Solenoid	P0443	circuit continuity - open	Voltage	IC Internal -	engine speed	> 80 rpm	0.01 sec	two driving
Control Circuit	P0458	circuit continuity - ground			battery voltage	> 9.99 V		cycles
	P0459	circuit continuity - voltage			battery voltage	< 18.1 V		
					output activated and deactivated for complete checking			
Evaporative System and Leak Monitor								
Canister Vent Valve	P0446	underpressure in tank	tank pressure <	-1000 Pa	fuel system status	closed loop - -	5 sec	two driving
					vehicle speed	< 1.9 mph		cycles
					engine idle speed control	active - -		
					battery voltage	> 10 V	One	
					battery voltage	< 18.1 V	test per	
					fuel tank pressure	> -2500 Pa	will be	
					fuel tank pressure	< 1300 Pa	completed.	
					ratio: (MAP Model / Baro)	< 0.812 -		
					calculated ambient air temperature	> 1.5 ° C	The test	
					calculated ambient air temperature	< 32.25 ° C	will attempt	
					fuel level	> 14.7 %	to run up	
					fuel level	< 86.4 %	to 10 times	
					engine start temp - amb. temp	< 9.75 ° C	until it	
					time after engine start	> 600 sec	successfully	
					or fuel mixture adaptation	stable - -	completes	
					amb pressure	> 68 kPa	a test	
					maximum number of attempts	< 10 -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					error: mass air flow	not set - -		
					error: coolant temp	not set - -		
					error: intake air temp	not set - -		
					error: fuel tank pres	not set - -		
					error: system voltage	not set - -		
					error: purge valve	not set - -		
					error: vehicle speed	not set - -		
					error: canister vent valve	not set - -		
					error: purge valve flow	not set - -		
					error: accelerator pedal	not set - -		
Evap Vent Solenoid	P0449	circuit continuity - open	Voltage	IC Internal -	engine speed	> 80 rpm	0.01 sec	two driving
Control Circuit	P0498	circuit continuity - ground			battery voltage	> 9.99 V		cycles
	P0499	circuit continuity - voltage			battery voltage	< 18.1 V		
					output activated and deactivated for complete checking			
Fuel Tank	P0450	rationality - signal oscillation	| delta pressure signal |	1406 Pa	calculated ambient air temperature	> -7.5 ° C	25.5	two driving
Pressure Sensor			(= current pressure - old pressure) >		vehicle speed >=	<= 18.75 mph	sec	cycles
					time after canister vent valve open	> 4 sec		
	P0451	rationality - signal range check	sensor signal >=	1594 Pa	time after engine start	> 25 sec		
			sensor signal >=	-3500 Pa	time after canister vent valve open	> 4 sec		
					engine idle speed control	active - -		
					vehicle speed	> 6.25 mph		
					after time	>= 30 sec		
					and integrated purge mass flow	>= 2 g		
					calculated ambient air temperature	> -7.5 ° C		
					ambient pressure	> 68000 Pa		
					fuel level	< 86.4 %		
					fuel level	> 14.7 %		
		or						
		rationality - drift check	| delta pressure signal |	688 Pa	Vent solenoid valve open	TRUE - -		
			(= current pressure		Canister purge flow (closed)	<= 0.0 g / sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			- reference pressure at start) >		ambient pressure	> 68000 Pa		
					fuel level	< 86.4 %		
					fuel level	> 14.7 %		
					fuel level	< 86.4 %		
					Or			
					fuel level valid for running			
					Evap. leak detection	TRUE - -		
					Vehicle speed	> 6.25 mph		
					after time	>= 30 sec		
					and integrated purge mass flow	>= 2 g		
					Vehicle speed	< 46.875 mph		
					Canister load	< 6 -		
					calculated ambient air temperature	<= 35.3 ° C		
					calculated ambient air temperature	>= 3.8 ° C		
					time	> 3 sec		
	P0452	circuit continuity - ground	sensor signal voltage <	0.2 V	engine speed	> 240 rpm	10 sec	two driving cycles
	P0453	circuit continuity - voltage	sensor signal voltage >	4.85 V				
Large leak	P0455	vacuum pulldown slope	integrated air mass flow >	0.42 .... 0.66 g	fuel system status	closed loop - -	< 30 sec	two driving cycles
			and vacuum pulldown >	-500 Pa	vehicle speed	< 1.9 mph		
			Or		engine idle speed control	active - -	One	
			integrated air mass flow >	0.75 g	battery voltage	> 10 V	test per	
			and vacuum pulldown >	-600 Pa	battery voltage	< 18.1 V	driving cycle	
					fuel tank pressure	> -2500 Pa	completed.	
					fuel tank pressure	< 1300 Pa	< 20sec	
					ratio: (MAP Model / Baro)	< 0.81 -	The test	
					calculated ambient air temperature	> 1.5 ° C	will attempt	
					calculated ambient air temperature	< 32.25 ° C	to run up	
					fuel level	> 14.7 %	to 10 times	
					fuel level	< 86.4 %	until it	
					engine start temp - amb. temp	< 9.75 ° C	successfully	
					time after engine start	> 600 sec	completes	
					fuel trim stabilized	TRUE - -	a test	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						accumulated fuel trim adaptation time	>	6.8	sec		
						change in adaptive value over 200ms period	<	3	%		
						amb pressure	>	68	kPa		
						error: mass air flow	not set	-	-		
						error: coolant temp	not set	-	-		
						error: intake air temp	not set	-	-		
						error: fuel tank pres	not set	-	-		
						error: system voltage	not set	-	-		
						error: purge valve	not set	-	-		
						error: vehicle speed	not set	-	-		
						error: canister vent valve	not set	-	-		
						error: purge valve flow	not set	-	-		
						error: accelerator pedal	not set	-	-		
Fuel Level Sensor Circuit fuel level sensor 1	P0461	rationality	fuel level change <	1.6	%	Primary fuel level	<	100.0	%	depending on time to reach total required drive distance	two driving cycles
			and			Secondary fuel level	<=	0.0	%		
			cumulative driving distance >	49	mi	Or					
						Primary fuel level	<	100.0	%		
						Secondary fuel level	>	0.0	%		
						and					
						battery voltage	>=	9.9	V		
						battery voltage	<=	18.1	V		
						engine speed	>	240	rpm		
						error: fuel level sensor/s electrical	not set	-	-		
			Or								
			cumulative driving distance >= (while indicated fuel level within un-readable zone)	49	mi	Primary fuel level	>	100.0	%		
						Secondary fuel level	<	0.0	%		
						battery voltage	>	9.9	V		
						battery voltage	<	18.1	V		
						engine speed	>	240	rpm		
						error: fuel level sensor/s electrical	not set	-	-		
	P0462	range check low	voltage <	0.25	V	battery voltage	>	9.9	V	60 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					battery voltage	< 18.1 V		
					engine speed	> 240 rpm		
	P0463	range check high	voltage >	3.2 V	battery voltage	> 9.9 V	60 sec	
					battery voltage	< 18.1 V		
					engine speed	> 240 rpm		
Cooling fan 1 relay	P0480	circuit continuity - open	Voltage	IC Internal -	engine speed	> 80 rpm	0.5	two driving
Control Circuit	P0691	circuit continuity - ground			battery voltage	> 9.9 V		cycles
	P0692	circuit continuity - voltage			battery voltage	< 18.1 V		
Cooling fan 2 relay	P0481	circuit continuity - open	Voltage	IC Internal -				
Control Circuit	P0693	circuit continuity - ground						
	P0694	circuit continuity - voltage						
Evaporative System and Leak Monitor								
Leaking purge valve	P0496	underpressure in tank	tank pressure loss gradient <	-60 Pa	fuel system status	closed loop - -	< 30 sec	two driving
					vehicle speed	< 1.9 mph		cycles
					engine	idling - -	One	
					battery voltage	> 9.9 V	test per	
					battery voltage	< 18.09 V	driving cycle	
					fuel tank pressure	> -2500 Pa	completed.	
					fuel tank pressure	< 1300 Pa		
					ratio: (MAP Model / Baro)	< 0.81 -	The test	
					fuel level	> 11.0 %	will attempt	
Stuck Closed Purge valve	P0497	vacuum pulldown slope	integrated air mass flow >	0.3 g	fuel level	< 86.4 %	to run up	
			tank vacuum >	-1.221 Pa	engine start temp - amb. temp	< 9.75 ° C	to 10 times	
					time after engine start	> 600 sec	until test	
					or fuel mixture adaptation	stable - -	completion	
					amb pressure	> 68 kPa		
					maximum number of attempts	< 10 -		
					est amb air temp	> 1.5 ° C		
					est amb air temp	< 32.25 ° C		
					error: mass air flow	not set - -		
					error: coolant temp	not set - -		
					error: intake air temp	not set - -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					error: fuel tank pres	not set - -		
					error: system voltage	not set - -		
					error: purge valve	not set - -		
					error: vehicle speed	not set - -		
					error: canister vent valve	not set - -		
					error: purge valve flow	not set - -		
					error: accelerator pedal	not set - -		
Idle Speed System (disabled during cold start)	P0506	functional check	desired rpm - actual rpm >	100 rpm	load (for underspeed and MT transmission only)	< 35 . . . 42 %	10 sec	two driving cycles
					coolant temp.	> -11.3 ° C		
	P0507		desired rpm - actual rpm <	-200 rpm	intake air temp	> -11.3 ° C		
			or		vehicle speed	= 0 mph		
			fuel cut off events due to overspeed >	3 count	engine idle speed control (no pedal input)	active - -		
					altitude factor (sea level = 1.0)	> 0.594 factor		
					time after engine start	> 3.8 sec		
					evap purge (high HC conc.)	not active - -		
					cold start idle speed control	not active - -		
					intrusive evap test	not active - -		
					error: throttle position	not set - -		
					error: vehicle speed	not set - -		
					error: coolant temperature	not set - -		
					error: intake air temperature	not set - -		
					error: evap system	not set - -		
					error: evap purge valve	not set - -		
Idle Speed System (enabled during cold start)	P050A	functional check	desired rpm - actual rpm > (during catalyst heating only)	100 rpm	load (for underspeed and MT transmission only)	< 59 . . . 80 %	7 sec	two driving cycles
					vehicle speed	= 0 mph		
			desired rpm - actual rpm < (during catalyst heating only)	-200 rpm	engine idle speed control (no pedal input)	active - -		
					altitude factor (sea level = 1.0)	> 0.594 factor		
					Engine coolant start temp.	< 65.3 ° C		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					catalyst heating cold start strategy	active - -		
					error: throttle position	not set - -		
					error: vehicle speed	not set - -		
					error: coolant temperature	not set - -		
					error: intake air temperature	not set - -		
					error: evap system	not set - -		
					error: evap purge valve	not set - -		
ECM monitoring	P0601	rationality	wrong ROM checksum during initialization reaches ROMRSTA_UM times.	5 times	checksum calculation at power down in the last driving cycle completely finished	TRUE - -	30 sec	code set then 5 sec
		rationality	wrong cyclic ROM checksum of critical regions	- -	partial checksum on critical variables		30 sec	
	P0602	rationality - programming incomplete	service ECU bit set in calibration	service ECU bit set -	-	- - -	1 sec	
	P0603	ETC monitoring controller reset	SW internal. Error from shut-down path test reaches DURNPRST_A times	3 times	power down calculation in the last driving cycle	completely - - finished	5 sec	
	P0604	functional check cyclic RAM-check	RAM writeability check read and write test writeability check of RAM		power down calculation in the last driving cycle	completely - - finished	5 sec	
	P0606	Electronic Throttle Control (ETC) checks ETC monitoring torque comparison ETC monitoring engine speed signal ETC monitoring volumetric efficiency signal ETC mon. vol. Eff., spark advance, A/D conv. grp. A, reaction crosscheck	SW internal	SW internal	power down calculation in the last driving cycle	completely - - finished	5 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		ETC monitoring throttle crosscheck ETC monitoring A/D conv group B, A/D converter supply voltage crosscheck ETC monitoring redundant pedal signal Electronic Throttle Control (ETC) checks SPI failure of throttle output stage	SW internal	SW Internal				
Fuel Pump Relay Control Circuit	P0627	circuit continuity - open	voltage <	2.74 V	pump command off	- - -	0.1 sec	two driving cycles
			voltage >	2.21 V	battery voltage	> 9.99 V		
	P0629	circuit continuity - voltage	voltage >	2.21 V	battery voltage	< 18.1 V		
	P0628	circuit continuity - ground	voltage <	2.21 V	pump command on	- - -	0.5 sec	
					battery voltage	> 9.99 V		
					battery voltage	< 18.1 V		
Electronic Throttle Control	P0638	motor control range check short term	| circuit duty cycle | > (absolute value)	80 %	battery voltage	> 7 V	0.6 sec (recoverable)	two driving cycles
		motor control range check long term					5.0 sec (latched)	
5V reference voltage monitoring	P0641	circuit continuity - open	Voltage	IC Internal -	ignition key on	TRUE - -	3 sec	code set then 5 sec
	P0642	circuit continuity - ground			ECM power relay	TRUE - -		
	P0643	circuit continuity - voltage						
	P0651	circuit continuity - open	Voltage	IC Internal -				
	P0652	circuit continuity - ground						
	P0653	circuit continuity - voltage						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P0697 P0698 P0699	circuit continuity - open circuit continuity - ground circuit continuity - voltage	Voltage	IC Internal -				
MIL Control Circuit	P0650	circuit continuity - open circuit continuity - ground circuit continuity - voltage	Voltage	IC Internal -	engine speed battery voltage battery voltage output	> 80 rpm > 9.9 V < 18.1 V activated and deactivated for complete checking	0.01 sec	no (but is shown in Mode $03)
Transmission Control Module MIL Illumination Request	P0700 (Specific TCM DTC shown in freeze frame)	OBD emission fault detected by the TCM	signal input	- -	-	- - -	0.01 sec	code set then 5 sec
Vehicle speed sensor Manual Transmission	P0501	rationality (high range check)	vehicle speed >	171.9 mph	-	- - -	2 sec	two driving cycles
	P0502	rationality (low range check)	vehicle speed <	3.1 mph	engine speed engine speed DFCO fuel shut off coolant temperature	> 1440 rpm < 3520 rpm active - - > 40 ° C	3 sec	
Clutch Pedal Position Sensor Manual Transmission	P0806	rationality - input clutch pos. state changes	detected clutch pedal press count <	1 count - sensor presses detected	gear changes detected (ratio of engine speed to vehicle speed -- range change) gear change detection allowed when:	> 15 count	approx. 500 sec	code set then 5 sec

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					delay between shift events	> 4 sec		
					vehicle speed	> 12.5 mph		
	P0807	Circuit Continuity - Ground	Voltage <	0.249 V				
	P0808	Circuit Continuity - Voltage	Voltage >	4.75 V				
Ignition Coil Driver Circuit Serial Communication								
	P167D	Internal SPI communication fault		IC Internal	battery voltage	< 18.1 v	0.01 sec	two driving cycles
					battery voltage	> 9 v		
					engine speed	< 6000 rpm		
Electronic Throttle Control								
	P2100	circuit switch-off	output circuits not deactivated as commanded	- -	-	- - -	0.1 sec	code set then 5 sec
	P2101	difference between set and actual position of throttle blade	difference between set and actual position of throttle blade [Table DWDKSBAMX]	4 . . . 50 % dep. on rate of	electronic throttle adaptation battery voltage	not - > 7 V	0.5 sec	
	P2105	Electronic Throttle Control (ETC) checks ETC monitoring watchdog shutdown path			power down processing in the last driving cycle	completely finished -	5 sec	
	P2119	functionality of return spring	throttle blade return response	0.56 sec	vehicle speed	<= 0 mph	0.56 sec	
					engine speed	< 40 rpm		
					engine coolant temperature	>= 5.25 ° C	once	
					engine coolant temperature	<= 100.5 ° C	per	
					intake air temperature	>= 5.25 ° C	ignition	
					intake air temperature	<= 143.8 ° C	on	
					battery voltage	> 10.0 V		
					accelerator pedal position	< 14.9 %		
Electronic Throttle Control								
	P2176	throttle exchange detection	range check poti1 value at lower		vehicle speed	= 0 mph	1 sec	code set

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
		learn fail	throttle potentiometer 1 voltage <	4.12	V	engine speed	<	40	rpm		then 5 sec
		or	or			engine coolant temperature	>	5.25	° C	once	
		initial throttle learn failed	throttle potentiometer 1 voltage >	4.55	V	engine coolant temperature	<	100.5	° C	per	
		or				intake air temperature	>	5.25	° C	ignition	
		learning prohibited due to	range check poti2 value at lower stop			intake air temperature	<	143.8	° C	on	
		secondary parameters not met	throttle potentiometer 2 voltage <	0.34	V	battery voltage	>	10.0	V		
		or	or			accelerator pedal position	<	14.9	%		
		minimum throttle position	throttle potentiometer 2 voltage >	0.99	V						
		out of range									
Fuel System Lean/Rich Multiplicative											
Bank 1	P2177	fuel trim limits exceeded	delta multiplicative lambda correction >	1.32	factor	engine torque	>=	12.5	%	approx.	two driving
	P2178	range - multiplicative				engine torque	<=	50	%	300 sec	cycles
		(torque within calibrated threshold and	or			engine speed	>=	1200	rpm	from engine	
Bank 2	P2179	engine speed within calibrated threshold)				engine speed	<=	3400	rpm	start (after	
	P2180		delta multiplicative lambda correction <	0.78	factor	intake air temperature	<=	60	°C	adaptation	
						command lambda	>	0.83	-	has	
						command lambda	<	1.2	-	begun)	
						catalyst heating cold start strategy	not active	-	-		
						deceleration fuel cut-off (DFCO)	not set	-	-		
						transient compensation	not set	-	-		
						wide open throttle	not set	-	-		
						integrated fuel mass	>	700	g		
						and empty-valid fuel level	not set	-	-		
						error: cam control diagnosis	not set	-	-		
						error: injection value fault	not set	-	-		
						error: catalyst damaging misfire	not set	-	-		
Fuel System Lean/Rich additive											
Bank 1	P2187	range - additive	delta fuel load correction >	6.0	%	engine torque	>=	0.0	%	approx.	two driving
	P2188	low speed and low load				engine torque	<=	23	%	300 sec	cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			or			engine speed	>=	520	rpm	from engine	
Bank 2	P2189					engine speed	<=	1000	rpm	start (after	
	P2190		delta fuel load correction <	-6.0	%	closed loop control	active	-	-	adaptation	
						engine coolant temperature	>	60	°C	has	
						intake air temperature	<=	60	°C	begun)	
						command lambda	>	0.83	-		
						command lambda	<	1	-		
						catalyst heating cold start strategy	not active	-	-		
						deceleration fuel cut-off (DFCO)	not set	-	-		
						transient compensation	not set	-	-		
						wide open throttle	not set	-	-		
						integrated fuel mass	>	700	g		
						and empty-valid fuel level	not set	-	-		
						error: cam control diagnosis	not set	-	-		
						error: inection value fault	not set	-	-		
						error: catalyst damaging misfire	not set	-	-		
Oxygen Sensor sensor circuit (secondary O2)											
bank 1 sensor 2	P2232	sensor line short circuit	secondary O2 sensor			engine speed	>	25	rpm	10 sec	two driving
bank 2 sensor 2	P2235	to heater output line	voltage gradient >	2	V	battery voltage	>	10.4	V		cycles
			within time after heater turn off <	0.04	sec	battery voltage	<	18.2	V		
			for occurrences >	4	count	time	>	0.2	sec		
			out of heater turn offs	6	count	engine coolant temperature	>	-9.8	° C		
						time	>	30	sec		
						time	>	10	sec		
						modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
						Or normalized heating power for Sec. O2 heater	>=	0.5	° C		
						secondary O2 dew point end	TRUE	-	-		
						Or Internal resistance of Secondary O2 sensor active	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Oxygen Sensor sensor response (secondary O2)						time	>	3	sec		
bank 1 sensor 2	P2270	oscillation check low	secondary O2 sensor voltage <	0.631	V	mean short term fuel trim	>=	0.94	-	approx.	two driving
bank 2 sensor 2	P2272		for time >	100	sec	mean short term fuel trim	<	1.05	-	600 sec	cycles
			then			time	>	3	sec		
			ramping in enrichment by	0.2		air mass flow	>	5.56	g/sec	additional	
			at gradient	0.017		air mass flow	<	33.33	g/sec	time if	
						time	>=	9	sec	fuel level	
			for time (after enrichment limit reached)	10		multiplicative long term fuel trim difference	<=	0.03	-	is low and	
						mean short term fuel trim difference	<=	0.045	-	not failed	
						And Secondary O2 sensor voltage	<	0.4	V	**200 sec**	
						Secondary O2 sensor voltage	>	0.51	V		
						Secondary O2 sensor voltage	>	0.06	V		
						time	>	0.5	sec		
						air mass flow	>	9.72	g/sec		
						Deceleration fuel cut-off (DFCO)	not set	-	-		
						time	>	10	sec		
						time	>	30	sec		
						time	>	0.6	sec		
						Secondary O2 sensor voltage	<=	1.15	V		
						and Secondary O2 sensor voltage	>=	0.52	V		
						Or Secondary O2 sensor voltage	<=	0.4	V		
						Secondary O2 sensor heater control on	TRUE	-	-		
						Secondary O2 sensor dewpoint end pass	TRUE	-	-		
						error: secondary O2 sensor	not set	-	-		
						and Primary O2 closed loop control	TRUE	-	-		
						time	>	1	sec		
						modeled exhaust gas temp at B1S2 and B2S2	>	250	° C		
						engine speed	<=	3480	rpm		
						engine speed	>=	1280	rpm		
						engine load	<=	65	%		
						engine load	>=	16.5 …	%		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						short term fuel trim	<	1.25	-		
						short term fuel trim	>	0.75 … 0.95	-		
						error: Evap system	not set	-	-		
						error: Air mass flow sensor	not set	-	-		
						Or time	>	40	sec		
						commanded lambda	<=	1.005	-		
						short term fuel trim	<	1.25	-		
						Secondary O2 sensor voltage	<	0.06	V		
						Or time	>	60	sec		
						secondary O2 sensor voltage	>=	0.401	V		
						and secondary O2 sensor voltage	<=	0.519	V		
						Or secondary O2 sensor voltage	<=	0.498	V		
						gas temperature	>=	800	° C		
						engine speed	>	25	rpm		
						battery voltage	>	10.4	V		
						battery voltage	<	18.2	V		
						time	>	0.2	sec		
						engine coolant temperature	>	-9.8	° C		
						time	>	30	sec		
						time	>	10	sec		
						model exhaust gas temp. Sec. O2 sensor	>=	700	° C		
						Or normalized heat. power Sec. O2 heater	>=	0.5	° C		
						secondary O2 dew point end	TRUE	-	-		
						Or Internal resistance of Sec. O2 sensor	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
		Unified Cycle or warm FTP (CVS-72) required for failure detection when on a specific driving cycle									
bank 1 sensor 2	P2271	oscillation check high	secondary O2 sensor voltage <	0.631	V	time	>	3	sec		
bank 2 sensor 2	P2273		for time >	100	sec	mean short term fuel trim	>=	0.94	-		
			then			mean short term fuel trim	<	1.05	-		
			ramping in enrichment by	0.2		time	>	3	sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			at gradient	0.017	air mass flow	>	5.56	g/sec		
			for time (after enrichment limit reached)	10	air mass flow	<	33.33	g/sec		
					time	>=	9	sec		
					multiplicative long term fuel trim difference	<=	0.03	-		
					mean short term fuel trim difference	<=	0.045	-		
					And Secondary O2 sensor voltage	<	0.4	V		
					Secondary O2 sensor voltage	>	0.51	V		
					Secondary O2 sensor voltage	>	0.06	V		
					time	>	0.5	sec		
					air mass flow	>	9.72	g/sec		
					Deceleration fuel cut-off (DFCO)	not set	-	-		
					time	>	10	sec		
					time	>	30	sec		
					time	>	0.6	sec		
					Secondary O2 sensor voltage	<=	1.15	V		
					and Secondary O2 sensor voltage	>=	0.52	V		
					Or Secondary O2 sensor voltage	<=	0.4	V		
					Secondary O2 sensor heater control on	TRUE	-	-		
					Secondary O2 sensor dewpoint end pass	TRUE	-	-		
					error: secondary O2 sensor	not set	-	-		
					and Primary O2 closed loop control	TRUE	-	-		
					time	>	1	sec		
					modeled exhaust gas temp at B1S2 and B2S2	>	250	° C		
					engine speed	<=	3480	rpm		
					engine speed	>=	1280	rpm		
					engine load	<=	65	%		
					engine load	>=	16.5 … 20.3	%		
					short term fuel trim	<	1.25	-		
					short term fuel trim	>	0.75 … 0.95	-		
					error: Evap system	not set	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
					error: Air mass flow sensor	not set	-	-		
					Or time	>	40	sec		
					commanded lambda	<=	1.005	-		
					short term fuel trim	<	1.25	-		
					Secondary O2 sensor voltage	<	0.06	V		
					Or time	>	60	sec		
					secondary O2 sensor voltage	>=	0.401	V		
					and secondary O2 sensor voltage	<=	0.519	V		
					Or secondary O2 sensor voltage	<=	0.498	V		
					gas temperature	>=	800	° C		
					engine speed	>	25	rpm		
					battery voltage	>	10.4	V		
					battery voltage	<	18.2	V		
					time	>	0.2	sec		
					engine coolant temperature	>	-9.8	° C		
					time	>	30	sec		
					time	>	10	sec		
					model exhaust gas temp. Sec. O2 sensor	>=	700	° C		
					Or normalized heat. power Sec. O2 heater	>=	0.5	° C		
					secondary O2 dew point end	TRUE	-	-		
					Or Internal resistance of Sec. O2 sensor	TRUE	-	-		
					error: O2 sensor heater circuit	not set	-	-		
Vehicle speed sensor										
Automatic Transmission	P2544	Communication with TCM - Static messages	CAN message: static rolling count	set -	automatic transmission	configured	-	-	0.01 sec	two driving cycles
		Communication with TCM - Protection value	CAN message: implausible signal (2s complement)	set -	CAN Bus	initialized	-	-		
			message validation failed		consisting of:	and ready				
					ignition on time	>	3	sec		
					battery voltage	>	9.8	V		
					battery voltage	<	18.1	V		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Real time clock Engine off timer Status	P2610	engine off timer signal check	engine off timer state >= (State 3 corresponds to engine off time which does not match the time from the ETC watchdog time, and a battery disconnection has not been detected)	3.0	engine speed real time clock active	> 240 rpm TRUE - -	0.1 sec	two driving cycles
Real time clock Engine off timer Rationality check	P2610	engine off timer incremental check	reference clock time delta - Engine Off Timer delta > reference clock time delta - Engine Off Timer delta < or reference clock and Engine Off Timer (EOT) required synchronization time > (reference clock is an independently captured time value based on the ECM processor clock)	6 counts 6 counts 6 seconds	engine speed failure counts engine speed failure counts ECM afterrun complete	> 240 rpm >= 3 3 > 240 rpm >= 3 counts TRUE - -	0.1 sec	two driving cycles
OBD ISO-15765 Communication Bus	U0073	ISO-15765 Bus Error	Invalid Message Received or Dual Port Ram Hardware Error; or No Communication / Bus Off		CAN Bus consisting of: ignition on for	initialized - - and - - ready > 3 sec	1 sec	code set then 5 sec

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					battery voltage > 9.9 V battery voltage < 18.1 V normal bus communication running - -			
	U0101	Communication with TCM	TCM Message Timeout	message missing, delayed, or invalid content	Automatic Transmission equipped - - CAN Bus initialized - - consisting of: and ready ignition on for > 3 sec battery voltage > 9.9 V battery voltage < 18.1 V normal bus communication running - -	2.5 sec	code set then 5 sec
Cold Start Emissions Reduction Strategy ***Note No active monitor- only here to remind CARB of Bosch Cold Start Emission Strategy	***	Cold start spark angle limitation (spark angle limitation imposed through torque reserve limit) Momentary spark angle limitation over-ride	commanded torque reserve forced to remain above limitation value: value = nominal torque reserve x FACTOR (determination of FACTOR: the reduced level of torque reserve that does not result in a measureable increase in FTP emissions as compared to baseline) over-ride allowed if requested torque reserve deviates below the limitation value	0.5 . . . 0.75 - 0 %	limitation active as long as cold start strategy is active time since engine start > 0.6 sec number of over-ride events < 4 counts time duration of current over-ride event < 0.5 sec above conditions present for time > 0.1 sec Cold start strategy extension with over-ride events time extension = number of over ride events x FACTOR FACTOR = 2 sec	- - -		See foot note in Column B

GENERAL MOTORS
2010 ENGINE DIAGNOSTIC LOOK-UP TABLES--Common to all applications

P0011, P0021 **KFDWNWDMXE** **KFDWNWDMXE2** (internal manufacturer cross reference)
P0021, P0024 **KFDWNWDMXA** **KFDWNWDMXA2** (internal manufacturer cross reference)

Maximum Allowed Deviation - Intake Camshaft Position

degrees crank	Modeled Engine Oil Temperature (° C)				
Engine Speed (rpm)	-30	20	95	110	120
800	8.00	8.00	8.00	8.00	8.00
1600	8.00	8.00	8.00	8.00	8.00
2500	8.00	8.00	8.00	8.00	8.00
3500	8.00	8.00	8.00	8.00	8.00
4500	8.00	8.00	8.00	8.00	8.00
6000	7.00	7.00	7.00	7.00	7.00

P0116 **KLTCWCSTAB** (internal manufacturer cross reference)

Engine coolant temperature model based on ambient temperature + engine off timer output

Time (seconds)	1000	7200	10800	14400	21600	32400	43200	50400
Coefficient:	0.996	0.488	0.301	0.227	0.141	0.086	0.035	0.008

P0141, P0161 **KFRINH / 2** (internal manufacturer cross reference)

Sensor Element (Ceramic) Impedance, Nominal Value - Secondary O2 Sensor

Ohms	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
O2 Heater Power (watts)	350	450	550	650	750
0.7	128	128	120	112	104
0.8	128	128	120	112	104
1.0	128	128	120	112	104

1

FRINH1 / 2 (internal manufacturer cross reference)

Multiplication Factor for Internal Resistance KFRINH Nominal Value - Secondary O2 Sensor

	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
	350	450	550	650	750
factor	7.75	7.00	6.75	6.25	5.75

P0327, P0332, P0328, P0333 **NGKRWN** (internal manufacturer cross reference)

RPM dynamic threshold for disabling knock diagnosis

RPM	400.0	800.0	1200.0	1600.0	2000.0	2400.0	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
RPM per second	500	600	800	1000	1200	1400	1600	1700	1800	1900	2000	2100	2100	2100	2300	2300

P0327, P0332 **UDKSNU** (internal manufacturer cross reference)

Reference voltage threshold for knock sensor diagnosis - Lower Limit

	Engine Speed (rpm)															
	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
Peak RMS Voltage (V)	0.032	0.036	0.040	0.044	0.048	0.052	0.056	0.067	0.087	0.107	0.107	0.150	0.151	0.219	0.278	0.345

P0328, P0333 **UDKSNO** (internal manufacturer cross reference)

Reference voltage threshold for knock sensor diagnosis - Upper Limit

	Engine Speed (rpm)															
	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
Peak RMS Voltage (V)	0.956	1.924	2.655	3.257	5.023	8.029	9.073	10.294	11.365	13.500	14.745	18.182	21.894	26.393	28.636	29.592

P0442 **KFEONVPT** (internal manufacturer cross reference)

Vacuum / Pressure Threshold for Fuel Tank Leak Detection

Vacuum / Pressure **(hPa)**	Ambient Temperature (Model) (C)								
Fuel Level (%)	0	3.8	8.3	12	15.8	20.3	24	27.8	32.3
10%	4.50	5.50	6.00	6.25	7.25	8.50	9.00	9.00	9.50
20%	4.50	5.00	6.00	6.25	7.25	8.50	9.00	9.00	9.50
30%	4.50	4.75	5.75	6.00	6.75	8.00	8.50	8.50	9.50
40%	4.50	4.75	5.75	6.00	6.75	8.00	8.50	8.50	9.25
50%	4.50	4.50	5.25	6.00	6.30	7.00	8.50	8.50	9.25
60%	4.00	4.50	4.00	5.00	6.30	7.00	8.25	8.25	9.00
68%	3.50	4.00	4.00	5.00	6.00	6.50	7.75	8.25	9.00
78%	2.50	3.75	4.00	5.00	6.00	6.00	7.50	8.00	8.50
88%	2.25	3.50	4.00	4.75	5.00	6.00	7.50	8.00	8.50

Tank Capacity **65.8 Liters**

Vacuum / Pressure **(Pa)**	Ambient Temperature (Model) (C)								
Fuel Level (%)	0	3.8	8.3	12	15.8	20.3	24	27.8	32.3
10%	450	550	600	625	725	850	900	900	950
20%	450	500	600	625	725	850	900	900	950
30%	450	475	575	600	675	800	850	850	950
40%	450	475	575	600	675	800	850	850	925
50%	450	450	525	600	630	700	850	850	925
60%	400	450	400	500	630	700	825	825	900
68%	350	400	400	500	600	650	775	825	900
78%	250	375	400	500	600	600	750	800	850
88%	225	350	400	475	500	600	750	800	850

P0455 **KLTLDSFS05** (internal manufacturer cross reference)

Vacuum Gradient Threshold for Fuel Tank Leak Detection

Fuel Level **liters**	0	8	16	24	32	40	48	56	64	72
hPa / sec	0.042	0.041	0.033	0.032	0.036	0.039	0.038	0.046	0.046	0.046
	Tank Capacity	82.5 Liters								
Fuel Level **(%)**	0	9.7	19.4	29.1	38.8	48.5	58.2	67.9	77.6	87.3
Pa / sec	4.2	4.1	3.3	3.2	3.6	3.9	3.8	4.6	4.6	4.6

P2101 **DWDKSBAMX** (internal manufacturer cross reference)

Maximum Throttle Angle Deviation per computation cycle

	Percent Throttle Opening (%)				
	0	0.3	1	5	15
Percent Throttle Delta (%)	4	6	11	20	50

1

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Primary O2 Sensor Heating heater circuits - electrical								
bank 1 sensor 1 (primary)	P0030	circuit continuity - open	voltage	IC Internal	battery voltage	> 10 V	5 sec	two driving cycles
bank 2 sensor 1 (primary)	P0050	circuit continuity - open			battery voltage	< 18.1 V		
bank 1 sensor 1 (primary)	P0031	circuit continuity - ground			engine speed	> 240 rpm		
bank 2 sensor 1 (primary)	P0051	circuit continuity - ground						
bank 1 sensor 1 (primary)	P0032	circuit continuity - battery						
bank 2 sensor 1 (primary)	P0052	circuit continuity - battery						
HO2S Signals Swapped sensors bank 1 sensor 2 bank 2 sensor 2 **(GMX521 Camaro only)**	P0041	Swapped secondary O2 sensors	HO2S sensor voltage B1S2 >= HO2S sensor voltage B2S2 <= or HO2S sensor voltage B1S2 <= HO2S sensor voltage B2S2 >=	0.6797 V 0.1816 V 0.6797 V 0.1816 V	time depending on catalyst aging factor air mass flow air mass flow following conditions met for time Primary O2 closed loop control following conditions met for time modeled exhaust gas temp at B1S2 and B2S2 short term fuel trim short term fuel trim error: Evap system error: Air mass flow sensor error: Secondary O2 sensor stuck check error: Primary O2 sensor heater performance error: Secondary O2 sensor heater performance error: Fuel system monitoring error: Canister purge valve power stage	> 1.3 …. 5.0 sec >= 8.33 g/s <= 33.33 g/s > 8 sec TRUE - - > 1 sec > 250 ° C < 1.25 - > 0.75 … 0.95 - not set - - not set - - not set - - not set - - not set - - not set - - not set - -	60 sec	two driving cycles
Mass Air Flow (MAF) Sensor Rationality	P0101	range check low	Maximum modeled mass air flow / measured mass air flow >	1 factor	battery voltage	> 10.5 V	2 sec	two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						for time	>	0.1	sec	modeled	cycles
		or				time after start	>	0.3	sec	range check	
						crankshaft revolution counter	>	150	rev		
		fuel trim limits exceeded	delta lambda correction >	0.18	factor	ambient pressure valid	TRUE	-	-	~ 200 sec	
		range - multiplicative				desired cam angle valid	TRUE	-	-	on cycle	
		and				long term fuel trim	TRUE	-	-	for adaptation	
		correction factor (modeled air	correction factor air mass <	0.8	factor	air flow mass	>	0.00	g/sec	diagnosis	
		mass at throttle / air mass				air flow change gradient	<	0.25	-	due to fuel	
		measured by air mass flow meter)				throttle angle change gradient	<	2	-	adaptation	
						engine speed	>	25	rpm	learn time	
						engine coolant temperature	>	9.8	° C		
		range check high	minimum modeled mass air flow / measured mass air flow <	1	factor	engine running time	>	1	sec		
						Air flow meter readiness	TRUE	-	-		
		or				pressure ratio over throttle	<	0.8	-		
						pressure ratio across throttle during fuel cut off	<	0.5	-		
		fuel trim limits exceeded				for time	>	0.5	sec		
		range - multiplicative	delta lambda correction <	-0.18	factor	error: throttle position sensor	not set	-	-		
		and				error: intake air temp. sensor	not set	-	-		
		correction factor (modeled air				error: MAF sensor electrical	not set	-	-		
		mass at throttle / air mass	correction factor air mass >	1.2	factor						
		measured by air mass flow meter)									
	P0100	open circuit check	sensor signal in period time	0.0	uS	battery voltage	>	9.9	V	5 sec	
						Key on	TRUE	-	-		
						for time	>	0.1	sec		
	P0102	range check low	sensor signal in period time	81.0	uS						
	P0103	range check high	sensor signal in period time	697.6	uS						
Intake Air Temperature Sensor Rationality											
	P0111	response check	temperature delta during evaluation period:			drive period - count	>=	10	count	~ 600 sec	two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			(max intake air temp. - min intake air temp.) <	1.5 ° C	each with		on cycle	cycles
					coolant temperature at start	<= 110.3 ° C		
					Intake Air Temperature Sensor 2 Electrical Failure	FALSE		
					Mass Air Flow	< 66.7 g / sec		
					Mass Air Flow	> 7.8 g / sec		
					Vehicle speed	> 18.75 mph		
					and			
					idle period - count	>= 3 count		
					each with			
					coolant temperature at start	<= 110.3 ° C		
					Mass Air Flow	< 7.8 g / sec		
					Vehicle speed	< 3.1 mph		
					engine coolant temperature	> 60 ° C		
Circuit Continuity Check								
	P0112	circuit continuity - high	intake air temperature sensor voltage >	4.87 V	Engine Coolant Temperature	> -9.8 ° C	5 sec	two driving
	P0113	circuit continuity - low	intake air temperature sensor voltage <	0.21 V	Mass air flow	< 27.8 g / sec		cycles
					Vehicle speed	< 2.5 mph		
Oxygen Sensor								
sensor circuit (primary O2)								
bank 1 sensor 1	P0130	sensor line short circuit	secondary O2 sensor		engine speed	> 25 rpm	5 sec	two driving
bank 2 sensor 1	P0150	to heater output line	voltage gradient >	2 V	battery voltage	> 10.4 V		cycles
			within time after heater turn off <	0.04 s	following conditions met for time	> 5 sec		
			for occurrences >	4 count	primary O2 heater control	TRUE TRUE -		
			out of heater turn offs	6 count	and Pri. O2 normalized heating power	> 0.9 -		
					dew-point end passed	TRUE TRUE -		
					error: injector circuit fault	not set not set -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			or								
			primary O2 sensor voltage >=	0.52	V	engine speed	>	25	rpm	5 sec	
			and primary O2 sensor voltage <=	1.15	V	battery voltage	>	10.4	V		
			and secondary O2 sensor voltage <	0.1	V	following conditions met for time	>	5	sec		
						primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
						following conditions met for time	>	30	sec		
						dew-point end passed	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.68	-		
						Or Primary exhaust gas temp. model	>	600	°C		
						Integrated air mass	>	220	g		
						Primary O2 sensor voltage	>=	0.548	V		
						Or following conditions met for time	>	5	sec		
						Secondary O2 sensor readiness	set	set	-		
						integrated air mass under Primary O2 sensor					
						voltage on rich or lean	>	220	g		
						Or error: Primary O2 sensor short to ground	not set	not set	-		
						Evap. Leak diagnosis active	not set	not set	-		
						Lambda closed loop control on	set	set	-		
						error: Prior primary O2 sensor short to ground	set	set	-		
						error: injector circuit fault	not set	not set	-		
			or			engine speed	>	25	rpm		
			primary O2 sensor voltage >=	0.06	V	battery voltage	>	10.4	V	5 sec	
			and primary O2 sensor voltage <	0.4	V	following conditions met for time	>	5	sec		
			and secondary O2 sensor voltage <	0.5	V	primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
						following conditions met for time	>	30	sec		
						dew-point end passed	TRUE	TRUE	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						and Pri. O2 normalized heating power	>	0.68	-		
						Or Primary exhaust gas temp. model	>	600	°C		
						Integrated air mass	>	220	g		
						Primary O2 sensor voltage	>=	0.548	V		
						Or following conditions met for time	>	5	sec		
						Secondary O2 sensor readiness	set	set	-		
						integrated air mass under Primary O2 sensor					
						voltage on rich or lean	>	220	g		
						Or error: Primary O2 sensor short to ground	not set	not set	-		
						Evap. Leak diagnosis active	not set	not set	-		
						Lambda closed loop control on	set	set	-		
						error: injector circuit fault	not set	not set	-		
bank 1 sensor 1	P0131	short circuit to ground	primary O2 sensor voltage <	0.06	V	engine running	>	25	rpm	5	two driving
bank 2 sensor 1	P0151		and Secondary O2 sensor voltage >	0.5	V	battery voltage	>	10.4	V		cycles
						following conditions met for time	>	5	sec		
						primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
						dew-point end passed	TRUE	TRUE	-		
						Integrated air mass	>	220	g		
						commanded lambda	<	1.005	lambda		
						lambda closed loop control on	TRUE	TRUE	-		
						active purge diagnosis	not set	not set	-		
						error: injector circuit fault	not set	not set	-		
			Or primary O2 sensor voltage <	0.06	V	engine running	>	25	rpm	0.1 sec	
						battery voltage	>	10.4	V		
						following conditions met for time	>	5	sec		
						primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
						dew-point end passed	TRUE	TRUE	-		
						time after engine start	>	1	sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						engine coolant temperature	<	40	°C		
						engine coolant temperature at ignition off	>	60	°C		
						error: air mass flow sensor	not set	not set	-		
						error: injector circuit fault	not set	not set	-		
			Or								
			primary O2 sensor voltage <	0.06	V	following conditions met for time	>	3	sec	0.1 sec	
			and Secondary O2 sensor voltage >	0.5	V			0.6			
			and average difference voltage data between loaded			Primary O2 sensor voltage	<		V		
			pulse sensor and unloaded pulse sensor voltages <	0.015	V	Decel. Fuel cut-off	not set	not set	-		
			(3 sample data)			engine start	>	240	rpm		
						engine running	>	25	rpm		
						battery voltage	>	10.4	V		
						following conditions met for time	>	5	sec		
						primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
						dew-point end passed	TRUE	TRUE	-		
						error: injector circuit fault	not set	not set	-		
bank 1 sensor 1	P0132	short circuit to battery voltage	primary O2 sensor voltage >	1.15	V	engine speed	>	25	rpm	5	two driving
bank 2 sensor 1	P0152					battery voltage	>	10.4	V		cycles
						following conditions met for time	>	5	sec		
						primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
						dew-point end passed	TRUE	TRUE	-		
						commanded lambda	>	0.995	lambda		
						error: injector circuit fault	not set	not set	-		
Primary O2 sensor slow response						closed loop control	active				
Bank 1	P0133	slow response	Continuously filtered normalized			engine speed	<	2520	rpm	approximately	two driving
Bank 2	P0153		switching cycle duration >	2.5	s	engine speed	>	1200	rpm	250 sec	cycles
						engine load	<	54.8	%		
			valid closed loop switching cycles >	15	count			12.8	%		
						engine load	>				
						exhaust gas temperature model	>	350	° C		
			(note: normalization of cycle duration					10	sec		
						purge off or has been on for time	>				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			revised with new enable window and failure threshold)			scheduled by System Manager	set	-	-		
						Primary O2 heater diagnosis					
						finished	set	-	-		
						high purge vapor concentration	not set	-	-		
						Evap. Leak diagnosis	not set	-	-		
						error: fuel adaptation	not set	-	-		
						error: purge valve	not set	-	-		
						error: misfire	not set	-	-		
						error: primary O2 heater	not set	-	-		
						error: secondary O2 heater	not set	-	-		
						error: secondary O2 slow sensor	not set	-	-		
						error: secondary O2 sensor	not set	-	-		
Oxygen Sensor sensor circuit (primary O2)											
bank 1 sensor 1	P0134	sensor line disconnection	primary O2 sensor voltage >	0.4	V	engine speed	>	25	rpm	10 sec	two driving cycles
bank 2 sensor 1	P0154		and primary O2 sensor voltage <	0.52	V	battery voltage	>	10.4	V		
			Or primary O2 sensor voltage <	0.55	V	following conditions met for time	>	5	sec		
			and mod. Exhaust gas temp. >	800	° C	primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
			or			time after	>	30	sec		
			primary O2 sensor voltage >	0.2	V	dew-point end passed	TRUE	TRUE	-		
			and secondary O2 sensor voltage >	0.2	V	and Pri. O2 normalized heating power	>	0.68	-		
			after decel. fuel cut-off (DFCO) for time >	3	sec	Or Primary exhaust gas temp. model	>	600	°C		
						Integrated air mass	>	220	g		
			or			Primary O2 sensor voltage	>=	0.548	V		
			primary O2 sensor internal resistance >	40000	Ohm	Or following conditions met for time	>	5	sec		
			and when modeled exhaust gas temperature >	600	° C	Secondary O2 sensor readiness	set	set	-		
						integrated air mass under Primary O2 sensor voltage on rich or lean	>	220	g		
						Or error: Primary O2 sensor short to ground	not set	not set	-		
						error: injector circuit fault	not set	not set	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			or								
			primary O2 sensor voltage >=	0.4	V	following conditions met for time	>	3	sec		
			and primary O2 sensor voltage <=	0.52	V	primary O2 sensor voltage	>=	0.4	V		
			average loaded pulse primary O2 sensor voltage >	0.28	V	and primary O2 sensor voltage	<=	0.52	V		
			(3 sample data)			average loaded pulse primary O2 sensor voltage	>	0.28	V		
						engine speed	>	25	rpm		
						battery voltage	>	10.4	V		
						following conditions met for time	>	5	sec		
						primary O2 heater control	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.9	-		
						time after	>	30	sec		
						dew-point end passed	TRUE	TRUE	-		
						and Pri. O2 normalized heating power	>	0.68	-		
						Or Primary exhaust gas temp. model	>	600	°C		
						Integrated air mass	>	220	g		
						Primary O2 sensor voltage	>=	0.548	V		
						Or following conditions met for time	>	5	sec		
						Secondary O2 sensor readiness	set	set	-		
						integrated air mass under Primary O2 sensor voltage on rich or lean	>	220	g		
						Or error: Primary O2 sensor short to ground	not set	not set	-		
						error: injector circuit fault	not set	not set	-		
Oxygen Sensor Heating heater performance (primary O2)											
bank 1 sensor 1 (primary)	P0135	primary O2 sensor	measured primary O2 sensor internal			battery voltage	>	10	V	approx.	two driving
bank 2 sensor 1 (primary)	P0155	internal resistance	resistance >	112 . . . 400	Ohms	battery voltage	<	18.1	V	100 sec	cycles
		above threshold	(nominal internal resistance map)	KFRINV / 2		engine speed	>	25	rpm		
						engine speed	>	240	rpm		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			multiply times degradation factor =	6.25 … 7.75	factor	fuel cut off	FALSE	-	-		
				FRINV1 / 2		pri. O2 internal resistance	valid	-	-		
						intake air temperature	>	-30	C		
						engine off soak time	>	0	sec		
						modeled exhaust temp.	<	750	C		
						suspicion of primary O2 sensor open circuit	FALSE	-	-		
						primary O2 voltage supply	ON	-	-		
						scheduled by System Manager for time	>	120	sec		
						primary O2 sensor dewpoint exceeded for	>	10	sec		
						no fault clear request during drive cycle	not set	-	-		
Oxygen Sensor (Secondary O2 sensor) Delayed response voltage during DCFO											
bank 1 sensor 2	P013E	secondary O2 sensor	time from start of DCFO till secondary O2 sensor	4	sec	deceleration fuel cut-off (DCFO)	active	-	-	4sec	two driving
bank 2 sensor 2	P014A	delayed response to DFCO	voltage below the lower threshold			Secondary O2 sensor voltage	>=	0.59	V		cycles
						following conditions met for time	>	6	sec		
			or			primary O2 heater control	TRUE	TRUE	-		
			the oxygen mass integration from start of DCFO	15	g	and Pri. O2 normalized heating power	>	0.9	-		
			exceeded upper threshold before the voltage below			dew-point end passed	TRUE	TRUE	-		
			the lower voltage threshold			exhaust gas mass flow rate	>	2.22	g/s		
						absolute exhaust gas mass flow change	<	2.78	g/s		
			lower voltage threshold	0.14	V	modeled exhaust gas temperature at	>	450	° C		
						secondary O2 sensor has measured lean and rich	TRUE	-	-		
						sensor voltage was above and below	> and <	0.631	V		
						for time	>	0.5	sec		
						time after DCFO	<	15	sec		
	P013A	secondary O2 sensor	time from secondary O2 sensor voltage crosses	0.8	sec	time expires from last DFCO	>	30	sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P013C	slow response to DFCO	upper threshold till it crosses lower voltage threshold		battery voltage > 10.4 V			
					following conditions met for time > 30.6 sec			
			upper voltage threshold	0.4 V	Secondary O2 sensor voltage <= 1.15 V			
					and Secondary O2 sensor voltage >= 0.52 V			
			lower voltage threshold	0.2 V	Or Secondary O2 sensor voltage <= 0.4 V			
					Secondary O2 sensor heater control on TRUE - -			
					Secondary O2 sensor dewpoint end pass TRUE - -			
					error: secondary O2 sensor not set - -			
					error: primary O2 sensor electrical checks not set - -			
					error: primary O2 sensor electrical checks not set - -			
		Unified Cycle required for failure detection when on a specific driving cycle						
Catalyst System								
Performance	P0420	oxygen storage of catalyst	EWMA filtered catalyst aging factor	0.1875 factor	exhaust gas mass flow > 4.4 … 6.7 g/sec		approx.	code set
	P0430		less than catalyst aging factor		exhaust gas mass flow < 15 … 20.8 g/sec		1000 sec	then 5 sec
			of a limit catalyst <		catalyst temp. model > 480 ° C		during	
					catalyst temp. model < 760 ° C		active	
					engine speed > 1040 rpm		driving	
					engine speed < 2360 rpm			
					engine load > 17.3 %		**Fast**	approx.
					engine load < 50.3 … 60 %		**Initialization**	3 tests
					catalyst temperature difference (versus filtered value) < 40 ° C		**phase:** 3 checks	average
					filtered catalyst temperature time constant = 10 sec		per driving cycle	run length
					delay time after catalyst temperature difference less than the limit > 5 sec		**Step Change**	(9 samples)
					calculated exhaust gas mass flow difference (versus filtered value) < 11 g/sec		**phase:** 3 checks per driving cycle	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					filtered exhaust gas mass flow time constant = 5 sec delay time after calculated exhaust gas mass flow difference less than the limit > 1 sec fuel system closed loop TRUE - - number of p-portion jump after function is enabled > 4 - time after secondary O2 sensor exceeded > 140 … 210 sec Secondary O2 sensor dewpoint TRUE - - ambient temperature > -30 ° C catalyst damaging misfire rate exceeded not set - - error: fuel system not set - - closed loop control at limit not set - - strong transient compensation intervention not set - - catalyst clear out active (after fuel cutoff) not set - - fast mixture adaptation completed set - - Trigger condition for step change Measured OSC < % of EWMA normalized filtered OSC < 0.68 -	**Stabilized** **phase:** 1 check per driving cycle	
Fuel Pump Control Module MIL Illumination Request **(excludes GMX295: STS)**	P069E	OBD emission fault detected by the FSCM	FSCM module MIL request by CAN message	- -	CAN Bus initialized - - consisting of: and ready ignition on for > 3 sec battery voltage > 9.9 V battery voltage < 18.1 V normal bus communication running - -		5 sec	code set then 5 sec
CAN Gateway Timeout Fuel Pump Control Module **(excludes GMX295: STS)**	U0109	Communication with CAN High Speed Gateway (FPCM - Fuel Pump Control Module)	CAN Gateway Message Timeout or Invalid Message Content	message missing, delayed,	CAN Bus initialized - - consisting of: and ready ignition on for > 3 sec		5 sec	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
				or	battery voltage	> 9.9 V		
				invalid	battery voltage	< 18.1 V		
				content	normal bus communication	running - -		
Engine Metal Overtemperature Protection (Limp Home Function Active)	P1258	engine coolant temperature too high	engine coolant temperature >	135.8 ° C	engine run time	> 30 sec	1 sec	code set then 5 sec
					error: engine coolant temp	not set - -		
Electronic Throttle Control	P1551	limp-home throttle position out of range	throttle position <	10.1 %	vehicle speed	<= 0 mph	5 sec	code set then 5 sec
			OR		engine speed	< 40 rpm		
			throttle position >	39.8 %	engine coolant temperature	>= 5.25 ° C		
					engine coolant temperature	<= 100.5 ° C		
					intake air temperature	>= 5.25 ° C		
					intake air temperature	<= 143.8 ° C		
					battery voltage	> 10.0 V		
					accelerator pedal position	< 14.9 %		
Fuel Level Sensor Circuit fuel level sensor 2	P2066	rationality	fuel level change <	4.6 %	Primary fuel level	>= 41.1 %	time necessary to complete drive distance	two driving cycles
			and		Secondary fuel level	>= 6.2 %		
			cumulative driving distance >	62 mi	Or			
					Primary fuel level	< 41.1 %		
					Secondary fuel level	> 6.2 %		
					and			
					battery voltage	>= 10.5 V		
					battery voltage	<= 18.1 V		
					engine speed	> 240 rpm		
					electrical fuel level sensor(s)			
					without failure	TRUE - -		
			Or					
			cumulative driving distance >=	100 mi	Primary fuel level	>= 41.1 %		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						Secondary fuel level	<	6.2	%		
						battery voltage	>=	10.5	V		
						battery voltage	<=	18.1	V		
						engine speed	>	240	rpm		
						electrical fuel level sensor(s) without failure	TRUE	-	-		
	P2067	range check low	voltage <	0.25	V	battery voltage	>=	10.5	V	60 sec	
						battery voltage	<=	18.1	V		
						engine speed	>	240	rpm		
	P2068	range check high	voltage >	3.2	V	battery voltage	>=	10.5	V	60 sec	
						battery voltage	<=	18.1	V		
						engine speed	>	240	rpm		
Secondary O2 Trim of primary O2 Sensor primary O2 sensor signal RICH / secondary O2 sensor signal LEAN						engine speed	<	3480	rpm	130 sec	two driving
Bank1	P2096	secondary O2 sensor fuel	secondary O2 sensor trim			engine speed	>	1280	rpm		cycles
Bank 2	P2098	trim - rich shift	integral control >	1	sec	engine load	<	65.3…. 65.3	%		
		- correction above threshold				engine load	>	16.5…. 20.3	%		
						closed loop control active	TRUE	-	-		
						for time	>	1	sec		
						exhaust gas temp. model	>	250	° C		
primary O2 sensor signal LEAN / secondary O2 sensor signal RICH						primary closed loop controller		-	-		
Bank 1	P2097	secondary O2 sensor fuel	secondary O2 sensor trim	-1	sec	at upper limit	not set				
Bank 2	P2099	trim - lean shift	integral control <			at lower limit	not set	-	-		
		- correction below threshold				secondary O2 sensor readiness	not set	-	-		
						catalyst clear out after DCFO	not set	-	-		
						error: catalyst monitoring	not set	-	-		
						error: purge valve	not set	-	-		
						error: secondary O2 sensor response	not set	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: primary O2 heater	not set	-	-		
						error: secondary O2 heater	not set	-	-		
						error: fuel system monitoring	not set	-	-		
						error : Evap. Leak	not set	-	-		
						error : air flow meter	not set	-	-		
Accelerator Pedal Position	P2122	range check low	voltage <	0.74	V	battery voltage	>	7	V	0.2 sec	code set
Sensor 1	P2123	range check high	voltage >	4.82	V						then 5 sec
Accelerator Pedal Position	P2127	range check low	voltage <	0.63	V	battery voltage	>	7	V	0.2 sec	
Sensor 2	P2128	range check high	voltage >	4.82	V						
Accelerator Pedal	P2138	plausibility	voltage difference >	0.25	V	-	-	-	-	0.24 sec	
Position 1 versus Position 2			idle range								
			voltage difference >	0.31	V						
			pedal partially pressed								
			voltage difference >	1.70	V						
			pedal fully pressed								
Barometric Pressure Sensor Rationality	P2227	range check high	sensor signal >	115	KPa	error : barometric pressure sensor electrical	not set	-	-	2 sec	two driving cycles
			or								
		range check low	sensor signal <	50	KPa	error : barometric pressure sensor electrical	not set	-	-		
			or								
		sensor jump test high	sensor output difference within 20 sec period >	10	KPa	error : barometric pressure sensor electrical	not set	-	-		
		sensor plausibility high	sensor output > pressure model (with tolerance)	2	KPa	error : barometric pressure sensor electrical	not set	-	-		
			AND			error: throttle position sensor	not set	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			sensor change from previous key cycle > (end of last to beginning of next drive cycle)	30 KPa	error: air flow mass meter engine running time	not set - - > 1 sec		
			OR sensor output change within 20 sec period >	10 KPa	Evap. leak detection	not active - -		
			or					
		sensor jump test low	sensor output difference within 20 sec period <	10 KPa	error : barometric pressure sensor electrical	not set - -		
		sensor plausibility low	sensor output < pressure model (with tolerance)	2 KPa	error : barometric pressure sensor electrical	not set - -		
			AND		error: throttle position sensor	not set - -		
			sensor change from previous key cycle > (end of last to beginning of next drive cycle)	30 KPa	error: air flow mass meter engine running time	not set - - > 1 sec		
			OR sensor output change within 20 sec period >	10 KPa	Evap. leak detection	not - -		
Barometric Pressure Sensor Electrical								
	P2228	range check low	voltage <	0.2 V			2 sec	
	P2229	range check high	voltage >	4.87 V				
Auxiliary Engine Coolant Pump Circuit Continuity **(GMX295 only)**	P2600	circuit continuity - open	Voltage	IC Internal	engine speed	> 80 rpm	0.01 sec	two driving cycles
	P2602	circuit continuity - ground	Voltage	IC Internal	battery voltage	> 9.9 V		
	P2603	circuit continuity - voltage	Voltage	IC Internal	battery voltage	< 18.1 V		
Rationality	P2601	monitoring of engine coolant	temperature change gradient during soak period >	-3 … -1 ° C	auxiliary coolant pump enabled (coolant temp.	TRUE - -	90 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		temperature profile during soak (engine off period)	DDTMOTMIN/F		at engine shutdown > 110 C) coolant temp. sensor fault (electrical) coolant temp. sensor fault (performance) coolant temp. sensor fault (intermittent) IAT sensor fault (electrical) IAT sensor fault (plaus) auxiliary coolant pump fault (electrical)	 FALSE - - FALSE - - FALSE - - FALSE - - FALSE - - FALSE - -	after-run when pump is enabled	

GENERAL MOTORS
2010 ENGINE DIAGNOSTIC LOOK-UP TABLES--applies only to LLT applications

P0135, P0155 **KFRINV / 2** (internal manufacturer cross reference)

Sensor Element (Ceramic) Impedance, Nominal Value - Secondary O2 Sensor

Ohms	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
O2 Heater Power (watts)	350	450	550	650	750
0.70	128	128	120	104	96
0.80	128	128	120	104	96
1.00	128	128	120	104	96

FRINV1 / 2 (internal manufacturer cross reference)

Multiplication Factor for Internal Resistance KFRINH Nominal Value - Secondary O2 Sensor

	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
	350	450	550	650	750
factor	7.75	7.00	6.75	6.75	6.25

P0141, P0161 **KFRINH / 2** (internal manufacturer cross reference)

Sensor Element (Ceramic) Impedance, Nominal Value - Secondary O2 Sensor

Ohms	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
O2 Heater Power (watts)	350	450	550	650	750
0.700	128	128	120	104	96
0.800	128	128	120	104	96
1.000	128	128	120	104	96

1

FRINH1 / 2 (internal manufacturer cross reference)

Multiplication Factor for Internal Resistance KFRINH Nominal Value - Secondary O2 Sensor

	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
	350	450	550	650	750
factor	7.75	7.00	6.75	6.75	6.25

P2601 **DDTMOTMIN**

Maximum Second Derivative of tmot in Post Run

tumg (degC)	-20.3	0	15	50.3
2nd derivative (degC)	-3	-2.5	-2	-1

DDTMOTMIF

Maximum Second Derivative of tmot in Post Run with Fans Active

tumg (degC)	-20.3	0	15	50.3
2nd derivative (degC)	-3	-2.5	-2	-1

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Air / Fuel Ratio Sensor Heating heater circuits - electrical bank 1 sensor 1 (primary)	P0030 P0031 P0032	circuit continuity - open circuit continuity - ground circuit continuity - voltage	Voltage	IC Internal -	engine speed battery voltage battery voltage output activated and deactivated for complete checking	> 240 rpm > 10.5 V < 18.1 V	5 sec	two driving cycles
heater performance bank 1 sensor 1	P0053	correction value for A/F sensor internal resistance measurement too high	absolute value of correction value for A/F sensor internal resistance >	45 Ohms	battery voltage battery voltage engine speed	> 10.5 V < 18.1 V > 240 rpm	40 sec	two driving cycles
Turbocharger Bypass Valve Actuator Circuit Continuity	P0035 P0034 P0033	circuit continuity - voltage circuit continuity - ground circuit continuity - open	voltage	IC Internal V	engine speed battery voltage battery voltage	> 80 rpm < 18.1 V > 10 V	0.01 sec	two driving cycles
Intake Air Temperature Sensor 2 (Boost Pressure Temperature Sensor) Rationality	P0096	response check	temperature delta during evaluation period: (max intake air temp. - min intake air temp.) <	0.75 ° C	drive period - count each with coolant temperature at start Intake Air Temperature Sensor 2	>= 10 count <= 88.5 ° C	~ 600 sec on cycle	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Electrical Failure	FALSE		
					Mass Air Flow	< 111.1 g / sec		
					Mass Air Flow	> 6.7 g / sec		
					Vehicle speed	> 21.88 mph		
					and			
					idle period - count	>= 4 count		
					each with			
					coolant temperature at start	<= 88.5 ° C		
					Intake Air Temperature Sensor 2			
					Electrical Failure	FALSE		
					Mass Air Flow	< 7.8 g / sec		
					Vehicle speed	< 9.4 mph		
					engine coolant temperature	> 60 ° C		
Intake Air Temperature Sensor 2 (Boost Pressure Temperature Sensor) Circuit Continuity Check	P0098	circuit continuity - high	Intake Air Temperature Sensor 2 Voltage >	4.76 V	Engine Coolant Temperature	> 60 ° C	2 sec	two driving cycles
	P0097	circuit continuity - low	Intake Air Temperature Sensor 2 Voltage <	0.156 V	Mass air flow	< 27.8 g / sec		
	P0099	intermittent (discontinuity)			Vehicle speed	< 2.5 mph		
			difference > (Intake Air Temperature Sensor 2 Raw Voltage - Intake Air Temperature Sensor 2 Filtered Voltage)	0.4 V	Intermittent (discontinuous) time	> 1 sec		
Mass Air Flow (MAF) Sensor Rationality	P0101	range check low	MAP Based Model / MAF sensor mass air flow >	1.16 -	battery voltage	> 9.9 V	5 sec	two driving cycles
		comparison to MAP based model			for time	> 0.1 sec	for MAP / MAF model	
					time after start	> 0.3 sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						crankshaft revolution counter	>	150	rev	check	
						turbocharger bypass valve closed	TRUE	-	-		
						no boost pressure oscillation	TRUE	-	-		
			or			change in boost pressure in time period of	=	0.09	sec		
		fuel trim limits exceeded	delta lambda correction >	20	%	less than	<	2	Kpa	~ 400 sec	
		range - multiplicative				greater than	>	-6	Kpa	on cycle	
		and				error - intake air temperature sensor #2	not set	-	-	due to fuel	
		correction factor (modeled air	correction factor air mass <	80	%	error : ambient pressure sensor electrical	not set	-	-	adaptation	
		mass at throttle / air mass				error : ambient pressure sensor rationality	not set	-	-	learn time	
		measured by air mass flow meter)				error : throttle position sensor	not set	-	-		
						error : boost pressure sensor electrical	not set	-	-		
		range check high -	MAP Based Model / MAF sensor mass air flow <	0.84	-	error : boost pressure sensor rationality	not set	-	-		
		comparison to MAP based model				error : MAP pressure sensor electrical	not set	-	-		
			or			error : MAP pressure sensor rationality	not set	-	-		
		fuel trim limits exceeded	delta lambda correction <	-20	%	desired cam angle valid	TRUE	-	-		
		range - multiplicative				long term fuel trim enabled	TRUE	-	-		
		and				fuel trim stabilized	TRUE	-	-		
		correction factor (modeled air	correction factor air mass >	120	%	accumulated fuel trim adaptation time	>	6.8	sec		
		mass at throttle / air mass				change in adaptive value over 200ms period	<	3	%		
		measured by air mass flow meter)				change in airflow evaluated over 200ms	<	40	%		
						throttle position gradient	<	2	Deg / sec		
						engine coolant temperature	>	9.8	° C		
						pressure ratio across throttle	<	0.8	-		
						for time	>	0.5	sec		
	P0100	open circuit check	sensor signal time period =	0	uS	battery voltage	>	9.9	V	2 sec	two driving cycles
						engine speed	>	240	rpm		
						Key on	TRUE	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
	P0102	range check low	sensor signal time period <	66	uS	for time	>	0.1	sec		
	P0103	range check high	sensor signal time period >	2480	uS						
Manifold Absolute Pressure Sensor											
Rationality											
	P0106	range check high	sensor signal >	255.0	KPa	error : MAP sensor electrical	not set	-	-	3 sec	two driving cycles
			or								
		range check low	sensor signal <	12.4	KPa	error : MAP sensor electrical	not set	-	-		
			or								
		rationality check low - model	sensor signal < model (with tolerance)	15	KPa	error : initial throttle learn failed	not set	-	-		
						error : throttle potentiometer fault	not set	-	-		
						error : intake air temperature sensor fault	not set	-	-		
			or								
		rationality check high - model	sensor signal > model (with tolerance)	15	KPa	error : purge valve min / max flow	not set	-	-		
						error : intake / exhaust camshaft control	not set	-	-		
						error : intake / exhaust camshaft electrical	not set	-	-		
						error : ambient pressure sensor electrical	not set	-	-		
						error : ambient pressure sensor rationality	not set	-	-		
						error : boost pressure sensor electrical	not set	-	-		
						error : boost pressure sensor rationality	not set	-	-		
						error : MAP sensor electrical	not set	-	-		
						crankshaft revolution counter since engine start	>	200	counts		
						block diagnosis if :					
						start-up coolant temperature	<	-7.5	C		
						until					
						engine coolant temperature	>	30	C		
						conditions met once during drive cycle					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						throttle position	<	25	%		
						engine speed	>	1500	rpm		
			or								
		rationality check high : 3 sensor check	sensor signal > median sensor output (with tolerance)	7.5	KPa	engine speed	<	400	rpm	200 ms	
			or			engine off timer	>	4	sec	during engine	
		rationality check low : 3 sensor check	sensor signal < median sensor output (with tolerance)	7.5	KPa	error : ambient pressure sensor electrical	not set	-	-	cranking	
						error : boost pressure sensor electrical	not set	-	-	only	
						error : MAP sensor electrical	not set	-	-		
Manifold Absolute Pressure Sensor											
Electrical											
	P0108	circuit continuity - voltage	MAP sensor output voltage >	4.805	V	engine speed	>	80	rpm	2.0 sec	two driving cycles
	P0107	circuit continuity - ground	MAP sensor output voltage <	0.1855	V						
Intake Air Temperature Sensor 1 (MAF Intake Air Temperature Sensor)											
Electrical											
	P0113	circuit continuity - high	Intake Air Temperature Sensor 1 Voltage >	4.76	V	Engine Coolant Temperature	>	60	° C	2 sec	two driving cycles
	P0112	circuit continuity - low	Intake Air Temperature Sensor 1 Voltage <	0.175	V	Mass air flow	<	27.8	g / sec		
						Vehicle speed	<	2.5	mph		
	P0114	intermittent (discontinuity)	Intake Air Temperature Sensor 1 Raw Voltage - Intake Air Temperature Sensor 1 Filtered Voltage	0.4	V	Intermittent (discontinuous) time	>	1	sec	2 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Air / Fuel Ratio Sensor (primary A/F) integrated circuit interface								
bank 1	P0130	A/F sensor voltage	absolute value of A/F sensor voltage		battery voltage	< 18.1 V	10sec	two driving cycles
		IC correction too high	IC corrective value >	0.15 V	battery voltage	> 10.7 V		
					engine speed	> 240 rpm		
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 (reference ground) below lower limit	IC Circuit Status shorted low	IC Internal -	battery voltage	< 18.1 V	20 sec	two driving cycles
					battery voltage	> 10.7 V		
		or A/F sensor signal at UN (reference voltage [Nernst voltage]) below lower limit	IC Circuit Status shorted low	IC Internal -	engine speed	> 240 rpm		
		or A/F sensor signal at IA (measuring current trim circuit) below lower limit	IC Circuit Status shorted low	IC Internal -				
bank 1 sensor 1 - high volt	P0132	A/F sensor signal at VM (reference ground) above upper limit	IC Circuit Status shorted high	IC Internal -				
		or A/F sensor signal at UN (reference voltage [Nernst voltage]) above upper limit	IC Circuit Status shorted high	IC Internal -				
		or A/F sensor signal at IA (measuring current trim circuit) above upper limit	IC Circuit Status shorted high	IC Internal -				
Air / Fuel Ratio Sensor (primary A/F) dynamic response								
Bank 1 Sensor 1	P0133	dynamic response slope slow or low amplitude	A/F sensor dynamic value <	0.3 ratio (versus	C/L lambda control	active - -	1.6 sec then	two driving cycles
					temperature of A/F sensor ceramic	> 680 °C		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
		(exponentially filtered running average			reference	C/L lambda control parameter: mean value	<	1.3	factor	dynamic	
		value.			sensor)	C/L lambda control parameter: mean value	>	0.75	factor	test	
						measured exhaust lambda	<	1.08	lambda	sample	
						measured exhaust lambda	>	0.92	lambda	count	
						engine speed	<	3520	rpm	>	
						engine speed	>	1520	rpm	40	
						volumetric efficiency	<	60	%	samples	
						volumetric efficiency	>	20	%		
						volumetric efficiency gradient	<	100	%/sec		
						A/F sensor housing model temp	<	600	°C		
						absolute value of forced amplitude	>	0.01	lambda		
						fuel mixture contribution from purge vapor	<	40	%		
						no active shutdown of fuel injectors	TRUE	-	-		
						error: A/F sensor circuit faults	not set	-	-		
						error: evap purge valve	not set	-	-		
						error: evap purge valve circuit	not set	-	-		
						A/F sensor heater output error (desired - measured)	<	100	°C		
Air / Fuel Ratio Sensor (primary A/F) delayed response Bank 1 Sensor 1	P0133	large A/F control parameter oscillation	C/L control parameter >	15	%	C/L lambda control	active	-	-	~ 400 sec	
			for time >	0.86	sec	temperature of A/F sensor ceramic	>	680	°C	during	
			followed by:			target C/L lamdba setpoint	=	1	-	Unified	
			C/L control parameter <	15	%	engine speed	>	1550	rpm	cycle	
			for time >	0.86	sec	engine speed	<	4000	rpm	demonstration	
			then increment fault counter by	1	count	volumetric efficiency	>	30	%		
						volumetric efficiency	<	110	%	~150 sec	
			Fault set when fault counter >	5	counts	volumetric efficiency gradient (20ms eval. Period)	<	9	%	minimum with	
						air mass gradient (20ms eval. Period)	<	6.9	g/sec	consecutive	
		Or				error: A/F sensor circuit faults	not set	-	-	time in enabling	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
		time difference between A/F sensor	from signal maximum:			error: camshaft control	not set	-	-	window	
		response and C/L control parameter	average peak-to-peak time difference >	750	ms	error: A/F sensor heater performance	not set	-	-		
		(difference calculated from time	with			error: A/F sensor heater electrical	not set	-	-		
		filtered C/L control parameter and	number of samples >	6	counts	error: secondary O2 sensor trim of primary A/F sensor	not set	-	-		
		from time filtered A/F signal -	Or			error: purge valve electrical	not set	-	-		
		calculation performed independently	from signal minimum:								
		at the signal maximum and	average peak-to-peak time difference >	750	ms						
		at signal minimum)	with								
			number of samples >	6	counts						
		* Unified Cycle required for failure detection when on a specific driving cycle									
heater performance (primary A/F)											
bank 1 sensor 1	P0135	A/F sensor calculated temperature	A/F sensor temperature calculation <	620	° C	battery voltage	>	10.5	V	70 sec	two driving
		too low				battery voltage	<	18.1	V		cycles
						error: A/F sensor heater control	not set	-	-		
						no active shutdown of fuel injectors	TRUE	-	-		
						A/F sensor heater control correction value	<	45	Ohm		
						expected - measured resistance					
						engine stop time	>	300	sec		
						engine temperature at start	>	-30	° C		
						engine speed	>	240	rpm		
						dew point end reached	TRUE	-	-		
heater performance (primary A/F)											
bank 1 sensor 1 (primary)	P0135	A/F sensor calculated	A/F sensor temperature calculation <	765	° C	A/F Heater at Maximum Power	TRUE	-	-	20 sec	two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
		temperature below threshold		TKERDCMN	modeled exhaust temp. at sensor	>	350	° C		cycles
					timer expires after either:	>	20	sec		
					fuel shut off >= 3 sec dur. ends	-	-	-		
					or initial A/F heater turn on	-	-	-		
					battery voltage	>	10.5	V		
					battery voltage	<	18.1	V		
					A/F heater control shut off	FALSE	-	-		
					error: vehicle speed sensor	FALSE	-	-		
					error: engine coolant temperature sensor	FALSE	-	-		
Oxygen Sensor (Secondary O2 sensor) Delayed response voltage during DCFO bank 1 sensor 2	P013E	secondary O2 sensor	time from start of DCFO until secondary O2 sensor	4 sec	deceleration fuel cut-off (DCFO)	active	-	-	4sec	two driving
		delayed response to DFCO	voltage falls below lower threshold		Prior to DCFO, secondary O2 sensor voltage exceeded voltage level	>	0.55	V		cycles
			or		battery voltage	>	9.9	V		
			the oxygen mass integration from start of DCFO	8 g	during drive, secondary O2 sensor voltage was between					
			exceeded upper threshold before the voltage below		voltage level	>	0.48	V		
			the lower threshold		voltage level	<	1.15	V		
					for time period lasting	>	0.6	sec		
			voltage lower threshold	0.15 V	modeled exhaust gas temperature at secondary O2 sensor	>	425	° C		
					secondary O2 sensor internal resistance	<	900	Ohms		
					secondary O2 sensor has measured lean and rich	TRUE	-	-		
					sensor voltage was above and below	> and <	0.6	V		
					for time period lasting (each direction)	>	0.5	sec		
					exhaust gas mass flow rate	>	2.78	g/s		
					temperature of A/F sensor ceramic	>	680	° C		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						primary A/F sensor measured lambda	>	3	lambda		
Slow response voltage during DCFO bank 1 sensor 2	P013A	secondary O2 sensor slow response to DFCO	time required for secondary O2 sensor voltage to transition from upper threshold to lower threshold	0.4	sec	Prior to DCFO, secondary O2 sensor voltage exceeded voltage level	>	0.55	V		
						dew-point end passed	TRUE	TRUE	-		
			upper voltage threshold	0.4	V	exhaust gas mass flow rate	>	2.22	g/s		
						absolute exhaust gas mass flow change	<	2.78	g/s		
						modeled exhaust gas temperature at	>	450	° C		
						secondary O2 sensor has measured lean and rich	TRUE	-	-		
			lower voltage threshold	0.2	V	sensor voltage was above and below	> and <	0.631	V		
						time	>	0.5	sec		
						time after DCFO	<	15	sec		
						time expires from last DFCO	>	30	sec		
						battery voltage	>	10.4	V		
						for time period lasting (each direction)	>	0.5	sec		
						primary A/F sensor measured lambda	>	3	lambda		
						temperature of A/F sensor ceramic	>	680	° C		
		Unified Cycle required for failure detection when on a specific driving cycle									
Turbocharger boost control system Rationality	P0234	actual boost pressure above desired	difference (actual - desired boost pressure) >	128…18 KLDLUL	kPa	error : electrical diagnosis of boost pressure sensor error : rationale diagnosis of boost pressure sensor	not set not set	- -	- -	3.2 sec	two driving cycles
	P0299	actual boost pressure below desired	time filtered deviation	20	kPa	error : electrical diagnosis of boost pressure sensor	not set	-	-	8 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			(desired versus actual boost pressure) >		error : rationale diagnosis of boost pressure sensor	not set - -		
					error : turbocharger boost control system	not set - -	both tests	
					error : limp home mode activated	not set - -	require boost	
					error : limp home mode activated with safety fuel cut-off	not set - -	control	
					engine speed	> 2600… 3520 rpm	activation	
					desired manifold pressure	> 30 KPa		
					ambient barometric pressure	> 65 KPa		
Boost Pressure Sensor Rationality								
	P0236	range check low	sensor signal <	13 KPa	error : boost pressure sensor electrical	not set - -	3 sec	two driving cycles
			or					
		rationality check low - baro comparison	sensor signal < baro pressure (with tolerance)	23 KPa	crankshaft revolution counter since engine start	> 3 counts		
					error : throttle potentiometer fault	not set - -		
			or		error : limp home mode	not set - -		
		rationality check high - baro comparison	sensor signal > baro pressure (with tolerance)	18 KPa	error : boost pressure sensor electrical	not set - -		
					error : ambient pressure sensor electrical	not set - -		
					error : ambient pressure sensor rationality	not set - -		
					engine speed	< 1000 rpm		
					throttle position	< 24 %		
			or					
		rationality check high - 3 sensor check	sensor signal > median sensor output (with tolerance)	9 KPa	engine speed	< 400 rpm	during engine	
					engine off timer	> 4 sec	cranking	
			or		error : ambient pressure sensor electrical	not set - -	only	
		rationality check low - 3 sensor check	sensor signal < median sensor output (with tolerance)	9 KPa	error : boost pressure sensor electrical	not set - -		
					error : MAP sensor electrical	not set - -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Boost Pressure Sensor Electrical								
	P0238	circuit continuity - voltage	Boost sensor output voltage >	4.85 V	engine speed	> 80 rpm	2.0 sec	two driving cycles
	P0237	circuit continuity - ground	Boost sensor output voltage <	0.1855 V				
Turbocharger Boost Control Actuator Circuit Continuity								
	P0246	circuit continuity - voltage	voltage	IC Internal V	engine speed	> 80 rpm	0.01 sec	two driving cycles
	P0245	circuit continuity - ground			battery voltage	< 18.1 V		
	P0243	circuit continuity - open			battery voltage	> 9.99 V		
Catalyst System Performance	P0420	oxygen storage of catalyst	EWMA filtered catalyst aging factor	0.2 factor	exhaust gas mass flow	> 10 g/sec	approx.	code set
			less than catalyst aging factor		exhaust gas mass flow	< 42 g/sec	1000 sec	then 5 sec
			of a limit catalyst <		catalyst temp. model	< 750 ° C	during	
					catalyst temp. model	> 525 ° C	active	approx.
					engine speed	> 1320 rpm	driving	3 test
					engine speed	< 2840 rpm		average
					engine load	> 21 ...	%	run length
					engine load	< 50 ... 68	%	(6 samples)
					catalyst temperature difference (versus filtered value)	< 12 ° C		
					filtered catalyst temperature time constant	= 5 sec	**Fast Initialization phase**	
					calculated exhaust gas mass flow difference (versus filtered value)	< 7 g/sec	Up to 4 samples per driving cycle	
					filtered exhaust gas mass flow time constant	= 5 sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						fuel system closed loop	active	-	-	**Step Change phase**	
						time after secondary O2 sensor exceeded	>	20	sec	Up to 4 samples per driving cycle	
						dewpoint ambient temperature	>	-15	° C		
						measured lambda	>	0.96	-	**Stabilized phase**	
						measured lambda	<	1.04	-	1 sample per driving cycle	
						catalyst damaging misfire rate exceeded	not set	-	-		
						error: fuel trim monitoring	not set	-	-		
						C/L lambda control parameter: mean value	<	1.3	factor		
						C/L lambda control parameter: mean value	>	0.75	factor		
						catalyst clear out active (after fuel cutoff)	not set	-	-		
						Trigger condition for step change					
						Measured OSC < % of EWMA normalized filtered OSC	<	0.73	-		
Brake Booster Pressure Sensor											
Rationality											
	P0556	range check - low	Brake Booster Pressure <	1.5	kPa	-	-	-	-	0.5 sec	two driving cycles
	P0556	range check - high	Brake Booster Pressure >	107.5	kPa	-	-	-	-		
	P0556	barometric Pressure Check	Brake Booster Pressure - Ambient Pressure >	3.5	kPa	-	-	-	-		
		or									
		manifold Pressure Check	Brake Booster Pressure - manifold absolute pressure	15	kPa	brake reservoir pressure increase (brake apply)	<	0.449	kPa		
						error: MAF sensor	not set				
						error: ambient pressure sensor	not set				
						ambient Pressure - Manifold Absolute					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					pressure	< 25 kPa		
*** GMX020 / 023 and GMT001 AT**								
Brake Booster Pressure Sensor Circuit Continuity								
	P0557	circuit continuity check - low	Brake Booster pressure sensor voltage <	0.195 V	-	- - -	2.0 sec	two driving cycles
	P0558	circuit continuity check - high	Brake Booster pressure sensor voltage >	4.85 V	-	- - -		
*** GMX020 / 023 Only**								
Air / Fuel Ratio Sensor (primary A/F) integrated circuit interface								
	P064D	A/F sensor IC operating voltage too low	low voltage	TRUE -	battery voltage	> 10.7 V	10 sec	two driving cycles
					battery voltage	< 18.1 V		
		A/F sensor IC SPI interface communication error	communication error	TRUE -	engine speed	> 240 rpm	0.1 sec	
		A/F sensor IC circuit write error at INIT register	write error	TRUE -			0.1 sec	
Electronic Throttle Control								
	P1551	limp-home throttle position out of range	throttle position <	13.1 %	vehicle speed	<= 0 mph	5 sec at key on	code set then 5 sec
			OR		engine speed	< 40 rpm		
			throttle position >	42.8 %	engine coolant temperature	>= 5.25 ° C		
					engine coolant temperature	<= 100.5 ° C		
					intake air temperature	>= 5.25 ° C		
					intake air temperature	<= 143.8 ° C		
					battery voltage	> 10.0 V		
					accelerator pedal position	< 14.9 %		
Oxygen Sensor (secondary O2) Trim of Air / Fuel Ratio Sensor (primary A/F)								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Bank 1	P2096	A/F sensor long term secondary trim - rich shift - correction below threshold	secondary O2 sensor trim integral control <	-0.03 lambda	engine speed secondary O2 oscillation test completed successfully see P2270 / P2271 accumulated learn time secondary O2 sensor has measured lean and rich	> 240 rpm TRUE - - > 60 sec TRUE - -	~ 300 sec	two driving cycles
Bank 1	P2097	A/F sensor long term secondary trim - lean shift - correction above threshold	secondary O2 sensor trim integral control >	0.03 lambda	sensor voltage was above and below for time period lasting (each direction) error: dynamic response of A/F sensor error: heater control of A/F sensor error: secondary O2 sensor response error error: A/F sensor circuit faults error: O2 sensor circuit faults	> and < 0.6 V > 0.5 sec not set - - not set - - not set - - not set - - not set - -		
Accelerator Pedal Position Sensor 1	P2122	range check low	accelerator potentiometer 1 voltage <	0.74 V	battery voltage	> 7 V	0.2 sec	code set then 5 sec
	P2123	range check high	accelerator potentiometer 1 voltage >	4.82 V				
Accelerator Pedal Position Sensor 2	P2127	range check low	accelerator potentiometer 2 voltage <	0.68 V	battery voltage	> 7 V	0.2 sec	
	P2128	range check high	accelerator potentiometer 2 voltage >	4.82 V				
Accelerator Pedal Position 1 versus Position 2	P2138	plausibility	voltage difference > idle range voltage difference pedal partially pressed > voltage difference > pedal fully pressed	0.18 V 0.29 V 1.72 V	- - -	- - - - - - - - -	0.24 sec	
Oxygen Sensor (secondary O2) Trim of Air / Fuel Ratio Sensor (primary A/F)								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Bank 1	P2195	A/F sensor offset calculation	A/F sensor offset correction <	-0.07	lambda	engine speed	>	240	rpm	~ 200 sec	two driving cycles
		rich shift				secondary O2 oscillation test completed successfully	TRUE	-	-		
		- correction below threshold				see P2270 / P2271					
						accumulated learn time	>	60	sec		
						secondary O2 sensor has measured lean and rich	TRUE	-	-		
Bank 1	P2196	A/F sensor offset calculation	A/F sensor offset correction >	0.07	lambda	sensor voltage was above and below	> and <	0.6	V		
		lean shift				for time period lasting (each direction)	>	0.5	sec		
		- correction above threshold				error: dynamic response of A/F sensor	not set	-	-		
						error: heater control of A/F sensor	not set	-	-		
						error: secondary O2 sensor response error	not set	-	-		
						error: A/F sensor circuit faults	not set	-	-		
						error: O2 sensor circuit faults	not set	-	-		
Intake Air Temperature Sensor 1 (MAF Intake Air Temperature Sensor)											
Rationality											
	P2199	Intake Air Temperature Correlation	Intake Air Temperature Sensor 1 - Intake Air								
		Check	Temperature Sensor 2 >	24.8	° C	mass air flow	>	6.7	g / sec	30 sec	two driving cycles
						mass air flow	<	83.3	g / sec		
						vehicle speed	>	34.4	mph		
						boost pressure to ambient pressure ratio	<	1.4	ratio		
		Intake Air Temperature Correlation	Intake Air Temperature Sensor 1 - Intake Air								
		Check	Temperature Sensor 2 <	20.3	° C						
Barometric Pressure Sensor											
Rationality											

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P2227				error : barometric pressure sensor electrical	not set - -	2 sec	two driving cycles
		range check high	sensor signal >	112 KPa				
			or					
		range check low	sensor signal <	60.5 KPa	error : barometric pressure sensor electrical	not set - -		
			or					
		sensor jump test high	sensor output difference within 20 sec period >	5 KPa	error : barometric pressure sensor electrical	not set - -		
			or					
		sensor plausibility high	sensor output > boost pressure sensor output (with tolerance)	5 KPa	error : barometric pressure sensor electrical	not set - -		
					error: throttle position sensor	not set - -		
			AND		engine speed	< 1000 rpm		
			sensor change from previous key cycle > (end of last to beginning of next drive cycle)	10 KPa	throttle position	< 23.99 %		
			OR					
			sensor output change within 20 sec period >	5 KPa				
		sensor jump test low	sensor output difference within 20 sec period <	5 KPa	error : barometric pressure sensor electrical	not set - -		
			or					
		sensor plausibility low	sensor output < boost pressure sensor output (with tolerance)	5 KPa	error : barometric pressure sensor electrical	not set - -		
					error: throttle position sensor	not set - -		
			AND		engine speed	< 1000 rpm		
			sensor change from previous key cycle < (end of last to beginning of next drive cycle)	10 KPa	throttle position	< 23.99 %		
			OR					
			sensor output change within 20 sec period >	5 KPa				
			or					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		rationality check high - 3 sensor check	sensor signal > median sensor output (with tolerance)	4.52 KPa	engine speed	< 400 rpm	200 ms	
					engine off timer	> 4 sec	during engine	
			or		error : ambient pressure sensor electrical	not set - -	cranking	
		rationality check low - 3 sensor check	sensor signal < median sensor output (with tolerance)	4.52 KPa	error : boost pressure sensor electrical	not set - -	only	
					error : MAP sensor electrical	not set - -		
Barometric Pressure Sensor Electrical								
	P2228	range check low	voltage <	0.32 V			2 sec	
	P2229	range check high	voltage >	4.78 V				
Air / Fuel Ratio Sensor (primary A/F) pumping current circuit open	P2237	lambda control factor change above threshold	absolute value of lambda control factor change from the point when the secondary conditions are met	0.075 lambda	battery voltage	< 18.1 V	1.5 sec	two driving cycles
					battery voltage	> 10.7 V		
					engine speed	> 240 rpm		
					A/F sensor voltage	< 1.51 V		
					A/F sensor voltage	> 1.48 V		
					engine run time	> 4 sec		
					time at idle	> 2.2 sec		
					A/F sensor heater output error (desired - measured)	< 100 °C		
					A/F sensor ceramic temperature	> 650 °C		
					lambda closed loop control	TRUE - -		
					for time period	> 1.5 sec		
					| fuel trim forced amplitude |	> 0.01 lambda		
					catalyst heating activity stable time since start or end of catalyst heating	> 1.5 sec		
Air / Fuel Ratio Sensor (primary A/F)								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
pumping current circuit open		A/F sensor voltage within upper	A/F sensor voltage <	1.51	V	battery voltage	<	18.1	V	approx.	two driving
	P2237	and lower thresholds	and A/F sensor voltage >	1.48	V	battery voltage	>	10.7	V	8 sec	cycles
		and desired lambda is outside				engine speed	>	240	rpm	once the	
		of upper or lower threshold				target lambda above upper limit	>	1.03	lambda	driving	
						or below lower limit	<	0.97	lambda	condition	
						closed loop control	TRUE	-	-	is met	
						A/F sensor heater output error (desired - measured)	<	100	°C		
						A/F sensor ceramic temperature	>	650	°C		
						error: A/F sensor dynamic response	not set	-	-		
						error: A/F sensor heating	not set	-	-		
						integrated exhaust gas mass	>	200	g		
Air / Fuel Ratio Sensor (primary A/F) pumping current circuit open		A/F sensor not lean enough	A/F sensor voltage <	1.7	V	battery voltage	<	18.1	V	2 sec	two driving
	P2237	during fuel shut off operation				battery voltage	>	10.7	V		cycles
						engine speed	>	240	rpm		
						time after fuel shut off begins	>	3	sec		
						A/F sensor heater output error (desired - measured)	<	100	°C		
Air / Fuel Ratio Sensor (primary A/F) reference voltage circuit open		A/F sensor voltage	A/F sensor voltage <	0.2	V	battery voltage	<	18.1	V	2 sec	two driving
	P2243	above upper threshold	A/F sensor voltage >	4.7	V	battery voltage	>	10.7	V		cycles
		or below lower threshold				engine speed	>	240	rpm		
						A/F sensor heater operational for time	>	10	sec		
						error: A/F sensor heater circuit	not set	-	-		
						A/F sensor certamic temperature	>	600	°C		
Air / Fuel Ratio Sensor (primary A/F) reference ground circuit open		A/F sensor voltage within range	A/F sensor voltage <	1.480	V	battery voltage	<	18.1	V	5sec	two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P2251		and		battery voltage > 10.7 V		once	cycles
			A/F sensor voltage >	1.35 V	engine speed > 240 rpm		conditions met	
					The following conditions met for > 5 sec			
					A/F sensor heater operational for time > 10 sec			
					A/F sensor internal resistance > 950 Ohms			
					error: A/F sensor heater circuit not set			
					The following conditions met for > 20 sec			
					dew-point end reached TRUE - -			
					engine speed > 240 rpm			
					battery voltage < 18.1 V			
					end of DFCO reached for > 2 sec			
					battery voltage > 11 V			
Turbocharger Bypass Valve (mechanical) Rationality	P2261	induction system pulsation monitor	detected pulsations >	7 counts	minimum time - bypass valve activation time > 1.6 sec		200 ms	two driving cycles
					bypass valve command on		once	
					boost versus ambient pressure ratio > 1.1…3.3 ratio		conditions met	
					battery voltage > 18.1 V			
					error : MAF electrical not set - -			
					error : MAF rationality not set - -			
					error : ambient pressure sensor electrical not set - -			
					error : ambient pressure sensor rationality not set - -			
					error : battery voltage not set - -			
					error : turbocharger bypass valve electrical not set - -			
					error : throttle valve potentiometer not set - -			
					error : boost pressure sensor electrical not set - -			
					error : boost pressure sensor rationality not set - -			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					error : intake air temperature sensor 2	not set - -		
					error : MAP sensor electrical	not set - -		
					error : MAP sensor rationality	not set - -		
Air / Fuel Ratio Sensor (primary A/F) sensor voltage	P2297	A/F sensor voltage exceeds threshold but not out of full range	A/F sensor voltage > 3.7 V and A/F sensor voltage < 4.81 V		A/F sensor heater output error (desired - measured) engine speed desired A/F no active shutdown of fuel injectors temperature of A/F sensor ceramic	< 100 °C > 240 rpm < 1.6 lambda TRUE - - > 680 °C	10 sec additional time if fuel level is low and not failed 60 sec	two driving cycles
			or AF sensor voltage > 2.5 V and A/F sensor voltage < 3.06 V (if engine running for less the 2 seconds)					
Brake Booster Vacuum Pump Circuit Continuity * GMX020 / 023 Only and GMT001 AT	P258A P258C P258D	circuit continuity - open circuit continuity - ground circuit continuity - voltage	Voltage	IC Internal IC Internal IC Internal	engine speed battery voltage battery voltage output activated and deactivated for complete checking	> 80 rpm > 10 V < 18.1 V	0.01 sec	two driving cycles
Brake Booster Vacuum Pump Rationality	P258B	Pressure change during pump activation	Pressure difference over evaluation period >	0.5 … 3.0 Kpa	brake reservoir pressure + offset < MAP no device control from Scan-Tool pump active for period of time	< 3 Kpa FALSE > 1.6 sec	1.60 sec	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
*** GMX020 / 023 Only and GMT001 AT**					Intake Air Temperature brake reservoir pressure increase (brake apply)	> -11.25 ° C < 0.45 Kpa		
Air / Fuel Ratio Sensor (primary A/F) measuring (trim) current circuit open	P2626	A/F sensor voltage above threshold	A/F sensor voltage >	4.81 V	battery voltage battery voltage engine speed decel fuel cut off modeled exhaust temp in front of catalyst A/F sensor heater output error (desired - measured)	< 18.1 V > 10.7 V > 240 rpm TRUE - - < 780 ° C < 100 °C	2 sec additional time if fuel level is low 60 sec	two driving cycles

GENERAL MOTORS
2010 ENGINE DIAGNOSTIC LOOK-UP TABLES--applies only to LNF applications

P0234 **KLDLUL** (internal manufacturer cross reference)

Pressure deviation for overboost detection

	Difference : Desired manifold pressure - base (mechanical) boost level (KPa)							
	-10	-5	0	25	50	75	100	120
Delta Pressure (kPa)	127.5	127.5	60	30	23	20	18	18

P258B **DPBKVPPBKV** (internal manufacturer cross reference)

Pressure difference for brake boost pump performance evaluation

	Reservoir pressure at beginning of evaluation (Kpa)			
	0	30	60	100
Delta Pressure (kPa)	0.5	0.5	2.5	3