2002 1.9L (L24, LL0) Z-car *(Saturn S-series cars)* ENGINE *and* TRANSMISSION DIAGNOSTIC PARAMETERS

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Heater Circuit open/ground short bank 1, sensor 2	P037	.170 - 2.260 amps detects a open or short to ground	O2 heater circuit Current < .1070 amps	Battery Voltage > 10.9 Volts for .5 seconds	5 failure/ignition cycle Continuous	DTC Type B
Heater Circuit Power Short bank 1, sensor 2	P038	.170 - 2.260 amps detects a power short	O2 heater Circuit Current > 2.26 amps	Battery Voltage > 10.9 Volts for .5 seconds	5 failure/ignition cycle Continuous	DTC Type B
Manifold Absolute Pressure/Throttle Position Rational	P0105	This DTC detects a skewed MAP/TP sensor Rationality Test	Predicted TP/MAP value in relation to actual TP/MAP vs engine speed > 1600 rpm or < 4000 rpm	No TP, MAP, EGR, IAC, P0601, P0602, P0606, P1635. P0336 DTC's Engine speed Delta < 50 rpm	5 failures within a 20 test sample after two consecutive trips - 10 samples per second Continuous	DTC Type B
Manifold Absolute Pressure Circuit Low Input	P0107	.20 volts to 4.24 volts This DTC detects a continuous short to low or open in either the signal circuit or the MAP sensor Range check	Raw MAP < .20 volts, RPM >1600, TP >15.2 RPM< 1600, TP > 0	No TP DTC's TP>=15.2% when engine speed >1600rpm or TP >= 0% when eng speed <=1600rpm	100 test failures within a 100 test sample** Continuous	DTC Type A
Manifold Absolute Pressure Circuit High Input	P0108	.20 volts to 4.24 volts This DTC detects a continuous short to high in either the signal circuit or the MAP sensor Rationality Check	Raw MAP > 4.24 volts RPM > 1600, TP < 9.8 RPM < 1600, TP < 2	No TP DTC's TP <= 9.8% when eng speed >1600rpm or TP <=2% when eng. speed <=1600 rpm	100 test failures within a 100 sample** Continuous	DTC Type A
Intake Air Temperature Circuit Low Input	P0112	.25 volts To 4.96 volts This DTC detects a continuous short to ground in either the IAT signal circuit or the IAT sensor Range Check	IAT < .20 volts	NA	20 test failures within a 20 test sample - 1 sample per sec Continuous	DTC Type A
Intake Air Temperature Circuit High Input	P0113	.25 volts To 4.96 volts This DTC detects a continuous short to high in the IAT signal circuit or the IAT sensor Range Check	IAT > 4.96 volts	No VSS & ECT DTC's VSS < 15 mph ECT>60 deg C airflow < 16gm/sec	20 test failures within a 20 test sample - 1 sample per sec Continuous	DTC Type A
Engine Coolant Temperature Circuit Low Input	P0117	.14 volts to 4.7 volts This DTC detects a continuous short to ground in the ECT signal circuit or the ECT sensor Range Check	Low Resistance Pullup - Coolant Temp < .14 volts High Resistance Pullup - Coolant Temp. < .14 volts	Engine run time>= 10 sec	3 test failures within 10 samples - 1 sample per sec Continuous	DTC Type A

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Engine Coolant Temperature Circuit High Input	P0118	.14 volts to 4.7 volts This DTC detects a continuous short to high or open in the ECT signal circuit or the ECT sensor Range Check	Low Resistance Pullup - Coolant Temp > 4.7 volts High Resistance Pullup - Coolant Temp > 4.7 volts	Engine run time >= 250 sec	3 test failures within 10 samples - 1 sample per sec Continuous	DTC Type A
Throttle Position Sensor A Circuit Low Input	P0122	.2 volts to 4.9 volts. This DTC detects a continuous short to low or open in either the signal circuit or the TP Range Check	TP < .20 volts	None	100 failures within a 100 test samples** Continuous	DTC Type A
Throttle Position Sensor A Circuit High Input	P0123	.2 volts to 4.9 volts. This DTC detects a continuous short to high in either the signal circuit or the TP Range Check	TP > 4.90 volts	None	100 failures within a 100 test samples** Continuous	DTC Type A
Insufficient Coolant Temperature for Closed Loop Fuel Control	P0125	This DTC detects if a stabilized minimum coolant temperature to allow closed loop is reached after engine start-up Rationality Check	If total air grams (see table below) + heat loss compensation factor of .04 grams/sec is exceeded and ECT < 0 Deg C	No Coolant, IAT, MAP, VSS, P0601, P0606, P1635 DTC's, Engine run time > 20 sec < 2000 sec Average airflow >= 12 grams/sec < 25 grams/sec Start up ambient air temp > -7 Deg C. Distance traveled > 2 Km	Exceed time after 2 consecutive trips - 1 sec Continuous	DTC Type B
			-40 Deg C = 504 -28 Deg C = 504 -16 Deg C = 504 -4 Deg C = 504 8 Deg C = 504 20 Deg C = 504 32 Deg C = 504 44 Deg C = 504 56 Deg C = 504 68 Deg C = 504 80 Deg C = 504 92 Deg C = 504 104 Deg C = 504 116 Deg C = 504 128 Deg C = 504 140 Deg C = 504 152 Deg C =504			
	P0128	This DTC detects if a stabilized minimum coolant temperature is reached after engine start-up Rationality Check	If total air grams (see table below) + heat loss compensation factor of .04 grams/sec is exceeded and ECT < 85 Deg C	No Coolant, IAT, MAP, VSS, P0601, P0606, P1635 DTC's, Engine run time > 20 sec < 2000 sec Average airflow >= 12 grams/sec < 25 grams/sec Start up ambient air temp > -7 Deg C. Distance traveled > 2 Km	Exceed time after 2 consecutive trips - 1 sec Continuous	DTC Type B

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			-40 Deg C = 2874 -28 Deg C = 2732 -16 Deg C = 2591 -4 Deg C = 2449 8 Deg C = 2307 20 Deg C = 2165 32 Deg C = 2024 44 Deg C = 1882 56 Deg C = 1740 68 Deg C = 1599 80 Deg C = 1457 92 Deg C = 1457 104 Deg C = 1457 116 Deg C = 1457 128 Deg C = 1457 140 Deg C = 1457 152 Deg C = 1457			
Front 02 closed loop rational	P0130	0 V to 1.1 V This DTC determines if the 02 sensor or 02 sensor circuit has developed an open Circuit Continuity Check	.3mVolt < = 02 voltage <= .6 mVolt	No MAP, CRK, IAT , ECT, TP, FUEL TRIM, MISFIRE, CAM EGR, CCP, VOLTAGE DTC'S engine run time > 60 secs Predictive front 02 temp > 549 DegC (pred. from RPM and Airflow) TPS > 6.3%	490 failures in a 500 sample test - .1 sec per sample Continuous	DTC Type B
Front O2 Sensor Circuit Low Voltage	P0131	0 to 1.1 V This DTC determines if the 02 sensor or circuit is shorted to low by checking for a lean condition during steady throttle and PE Range check Low	02 Voltage < .291 V & 02 Voltage <.291 V in PE mode	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP DTC's Closed loop 14.5 <= A/F ratio <= 14.8 above met for .5 secs In closed loop In drive (if auto)	900 failures in a 1000 sample test . 90 failures in a 100 sample test in PE mode - .1 sec , continuous	DTC Type B
O2 Sensor Circuit High Voltage	P0132	0 to 1.1 V This DTC determines if the 02 sensor or circuit is shorted to high by checking for a rich condition during steady throttle and DFCO Range Check High	02 Voltage > .787V 02 Voltage > .587 V in Decel fuel cut off	No MAP, CRK, IAT, ECT, TP, , Fuel Trim, Misfire, Cam, EGR, CCP DTC's Closed loop 14.5 <= A/F ratio <= 14.8 above met for .5 secs In closed loop In drive (if auto)	900 failures in a 1000 sample test . 90 failures in a 100 sample test in DFCO mode -.1 sec, continuous	DTC Type B
Front O2 Sensor Circuit Slow Response	P0133	0 to 1.1 V This DTC determines if the 02 sensor is functioning properly by checking its response time Functional Check	02 Average transition time lean/rich > 140 msec or rich/lean > 225 msec (see table below)	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP, DTC's Closed loop 02 Voltage low threshold .300 02 high threshold .600 V 7 g/sec < Airflow < 25 g/sec 1500 < rpm < 3200 453 < 02 temp model and > 549 for 5 sec	100 seconds after closed loop enable once per ignition	DTC Type B

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			0 grams/second air flow = 139.8438 2 grams/second air flow = 139.8438 4 grams/second air flow = 139.8438 6 grams/second air flow = 139.8438 8 grams/second air flow = 139.8438 10 grams/second air flow = 139.8438 12 grams/second air flow = 139.8438 14 grams/second air flow = 139.8438 16 grams/second air flow = 139.8438 18 grams/second air flow = 139.8438 20 grams/second air flow = 139.8438 22 grams/second air flow = 139.8438 24 grams/second air flow = 139.8438 26 grams/second air flow = 139.8438 28 grams/second air flow = 139.8438 30 grams/second air flow = 139.8438 32 grams/second air flow = 139.8438			
Front O2 Circuit No Activity Detected	P0134	0v to1.1v This DTC determines if the 02 sensor or the 02 sensor circuit has developed an open Circuit Continuity Check	.391 V <= 02 voltage <= .491V	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP, Voltage, DTC's engine run time > 60 secs. Predictive front 02 temp > 450 Deg C (pred. from RPM and Airflow)	900 failures in a 1000 sample test - .1 sec per sample Continuous	DTC Type B
Rear O2 Sensor Circuit Low Voltage	P0137	0 to 1.1 V This DTC determines if the 02 sensor or circuit is shorted to low by checking for a lean condition during steady throttle and PE Range Check Low	02 voltage < .022 V 02 voltage < .291 V in Power Enrichment	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP, DTC's Closed loop 14.5 <= A/F ratio <= 14.8 above met for .5 secs. In drive(if auto). In closed loop.	1000 failures in a 1000 sample test , 2 consecutive tests 90 failures in a 100 sample test in PE mode - .1 sec per sample, Continuous	DTC Type B
Rear O2 Sensor Circuit High Voltage	P0138	0v to 1.1v This DTC determines if the 02 sensor or circuit is shorted to high by checking for a rich condition during steady throttle and DFCO Range Check High	02 voltage > 1.065 V 02 voltage > .587 V in Decel fuel cut off	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP, DTC's closed loop 14.5 <= A/F ratio <= 14.8 above met for .5 secs. In closed loop. In drive (if auto).	1000 failures in a 1000 sample test , 2 consecutive tests 90 failures in a 100 sample test in PE mode - .1 sec per sample, Continuous	DTC Type B
Rear O2 Sensor Circuit No Activity Detected	P0140	0 V to 1.1 V This DTC determines if the 02 sensor or 02 sensor circuit has developed an open Circuit Continuity Check	.426 V <= 02 Voltage<=.461 V	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP, DTC's engine run time > 60 secs Predictive 02 rear temp > 426 Deg C (rpm/airflow)	1450 failures in a 1500 sample test - .1 sec per sample, continuous	DTC Type B

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Fuel System too Lean	P0171	Determines if the system is in a lean condition	Long Term Fuel > 15.4%	No ECT, CRK, MAP, IAT,IAC, TP, CCP, Map, TP,CAM, 02's, EGR Flow, Misfire, PCM DTC's 70 KPa< Baro 2< Airflow < 80 g/sec 30 < MAP < 90 KPa -20 < IAT < 80 Deg C 500 < RPM < 4000 TP < 75% 60 < ECT < 115 deg C	If lean counter > 3 seconds Continuous	DTC Type A
Fuel System Too Rich	P0172	Determines if the system is in a rich condition	Long Term Fuel > 21.1%	No ECT, MAP, CRK, IAC, CAM, IAT, TP, VSS, CCP, 02S DTC's 70 KPa< Baro 2< Airflow < 80 g/sec 30 < MAP < 90 KPa -20 < IAT < 80 Deg C 500 < RPM < 4000 TP < 75% 60 < ECT < 115 deg C	If rich counter > 3 seconds Continuous	DTC Type A
Random/Multiple Cylinder Misfire Detected	P0300	These DTC's will determine if a random misfire or a cylinder specific misfire is occurring by monitoring crankshaft velocity	Deceleration/Acceleration Spike vs Engine Speed vs Load vs Camshaft position vs Crankshaft position % Misfire FTP - 1.75%, IM - 1.75% (Calif) (see tables Pg. 368)	No TP, CRK, IAT, MAP, CAM, IAC, FUEL TRIM, ECT, V5B, Misfire DTC's 562 < Eng. Spd< 6500 rpm(DOHC) " " " 5500 (SOHC Man) 500 < Eng. Spd < 5500 (SOHC Auto) 8< ign. V<18 Coolant< -7 Deg C, delay until >= 20 deg C	Emission Level: 5 failed 200 revolution blocks out of 16 or four (5 of 16) 100 - engine cycle test after the first 16 tests Catalyst Damaging Level: 3 failed 200 revolution blocks out of 16 and the engine speed and load is inside the FTP region, or if the engine speed and load are outside the FTP region - 1 failed 200 revolution block Continuous	DTC Type B (emission Level) DTC Type B (Catalyst damaging) MIL still flashes but will not latch until 2nd trip
				ECT > -7 deg C Fuel Level > 1 gallon + or - throttle position delta < 6.25%/100ms		
Cylinder 1 Misfire Detected	P0301	same as above	same as above	same as above	same as above	same as above
Cylinder 2 Misfire Detected	P0302	same as above	same as above	same as above	same as above	same as above
Cylinder 3 Misfire Detected	P0303	same as above	same as above	same as above	same as above	same as above
Cylinder 4 Misfire Detected	P0304	same as above	same as above	same as above	same as above	same as above
Knock Sensor Circuit Check	P0324	This DTC determines if the knock detection IC in the PCM is responding	Knock IC in PCM is responding to knock signal	1400< RPM < 4000	2 failures/ Ign. cycle Continuous	DTC Type B

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Knock Sensor Input	P0327	This DTC will detect an open or short in the knock sensor circuit Range Check	ESC Noise accumulator less than diagnostic noise threshold calibration table which is a function of RPM (see table below)	1400< RPM < 4000	2 failures/ Ign. cycle Continuous	DTC Type B
			400 rpm = 10 800 rpm = 10 1200 rpm = 15 1600 rpm = 15 2000 rpm = 20 2400 rpm = 20 2800 rpm = 20 3200 rpm = 25 3600 rpm = 25 4000 rpm = 25 4400 rpm = 30 4800 rpm = 30 5200 rpm = 30 5600 rpm = 30 6000 rpm = 30 6400 rpm = 30 6800 rpm = 30			
Crankshaft Position Sensor Circuit Range/Performance	P0336	This DTC will detect an open or short in the crankshaft position sensor circuit Range Check	Low res Period > 6.41 & sync pulse missing	None	21 fails to turn on light** Continuous	DTC Type B
Camshaft position Sensor Circuit Malfunction	P0340	This DTC will detect if a cam signal is not present Circuit Continuity	Cam pulse not seen in 107 engine revolutions	MAP > 30 kPa	Once per ignition	DTC Type B
Camshaft Position Sensor Circuit Range/Performance	P0341	This DTC will determine if the Cam is synchronized correctly	If the cam signal falls in the wrong location 10 times	MAP > 30 kPa	Once per ignition	DTC Type B
Exhaust Gas Recirculation Flow Insufficient Detected	P0401	This diagnostic will determine if there is a reduction in EGR flow. Functional Check	With EGR valve open, the peak + MAP delta is monitored over a time of 1.0 seconds. This value is compared and subtracted with a threshold from Engine Speed vs Baro. The result is statistically filtered (EWMA) and compared to a decision limit. (see table Pg. 369)	No EGR pintle, TP, CAM, CRK, V5B, MAP, VSS, IAT, ECT, P1635, misfire, PCM or IAC DTC's 1250 rpm < eng. speed < 2600 rpm Throttle is closed 35 mph < vehicle speed ECT >70 deg C Baro< 9500 feet	Once per ignition cycle	DTC Type A
Exhaust Gas Recirculation Circuit Range/Performance	P0404	This Diagnostic will determine whether the EGR valve is within a certain operating range. Range Check	Error > 10%, if commanded EGR position is < 80% Error > 23.4%, if commanded EGR position is > 80% Error occurs for 10 seconds	Battery Voltage > 11 Volts	10 seconds Continuous every 100 mseconds	DTC Type B

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Exhaust Gas Recirculation Sensor "A" Circuit Low	P0405	Circuit Check	5 second timer EGR Voltage < 7 counts 7 A/D counts	Battery Voltage > 11 Volts	5 seconds Continuous every 100 mseconds	DTC Type B
Air Injection System Malfunction	P0410	This DTC will determine proper airpump function by detecting O2 sensor indications of insufficient time at a lean condition or excessive time at a rich condition during airpump operation. Functional Check	<u>Passive Test</u> During rich open loop operation, 02 Sensor > 600mV for more than 65% of the diagnostic run time and 02 sensor < 300 mV for less than 25% of the diagnostic run time <u>Active test</u> During Rich open loop operation at idle, 02 sensor > 600mV for more than 3.9 seconds and 02 sensor < 300mV for less than 1.5 seconds.	<u>Passive Test</u> No MAP, IAT ECT, TPS, 02, Fuel Trim, idle air, EGR, Misfire, P01635 CODES Traction control not in operation 11 < Batt Volt < 18 Engine Vacuum > 40 kPa 4 deg C < startup coolant < 79 deg C Mat > 0 deg C RPM < 3200 14>air/fuel ratio > 12 Map > 20 KPa	<u>Passive Test</u> During open loop operation one attempt/trip if airpump operated <u>Active Test</u> Maximum of 6 sec duration up to 5 times /trip if passive test fails or is inconclusive. Time between attempts limited to a minimum of 20 sec	DTC Type B
				Engine Air flow limit ranging from 8 to 19 grams/sec 02 sensor must be ready for 2 seconds <u>Active Test</u> Same as above, Closed loop operation Air flow < 8.5 g/s at idle Coolant > 75 deg C Same as above except for 4 seconds of sustained conditions as follows: In BLM cell1 (idle) 122<= fuel integrator <= 134 Commanded A/F = 14.7		
Catalyst System Efficiency Below Threshold	P0420	Oxygen Storage	Oxygen Storage Capacity (OSC) Time Difference > .5 sec OSC time difference = OSC worst Pass Threshold - OSC Compensation factor X (Post cat. O2 Response time - Precat O2 response time) OSC Worst Pass Threshold = 1.4 sec (see table Pg. 369)	No O2s, ECT, Fuel Trim, EGR, CAM, CRK, CCP, V5B, VSS, misfire, MAP, IAT, TP, low and high idle, c/l coolant, ECM A/D DTC's system C/L Delta Map < 6 kpa Test attempt this ign < 10	1 Test attempted/valid idle period. Max of 4 tests/trip until Catalyst i/m flag set or low O2 storage detected. Max 1 test/trip with passing OSC Frequency - 25 ms	DTC Type A
				Engine Run Time > 570 sec engine Rpm > 1200 for 30 sec 122 < int < 134 650 < rpm < 900 375 < cat Temp < 750 vehicle spped < 1 mph		

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Vehicle Speed Sensor Malfunction	P0500	This DTC detects a loss of vehicle speed signal Functional check	MAP > 23 Kpa and vehicle speed < 5 kph for 6.2 seconds	No P107, P0108 Not in park or neutral and rpm > 1500 RPM. In auto, this DTC will set when P0721 or P0722 is set.	2 failures/ignition cycle continuous	DTC Type A
Idle Control system RPM lower than expected	P0506	This DTC will determine if a low idle is the result of a IAC valve or circuit at normal operating temperature. Functional Check	Actual rpm < desired rpm + or - 100 rpm once operating temperature is reached	No TP, ECT, MAP, Misfire, VSS, EGR Pintle DTC's VSS=0 TP = 0 Baro > 70 Kpa 9<Voltage < 18 IAT > -25 Deg C	Continuous 17 seconds	DTC Type B
Idle Control System RPM higher than expected	P0507	This DTC will determine if a high idle is the result of a IAC valve or circuit at normal operating temperature. Functional Check	Actual rpm < desired rpm + or - 200 rpm once operating temperature is reached	Same as above	Same as above	DTC Type B
Internal Control Module Memory Check Sum Error	P0601	This DTC will determine when the ECM RAM is faulty Functional Check	Cal'd check sum does not equal stored check sum	none	1 failure/ Ign. cycle Continuous	DTC Type A
Control Module Programming Error	P0602	This DTC will check to see if the PCM is programmed properly Functional Check	Write patterns are not equal	none	1 failure / Ign. cycle on key up	DTC Type A
PCM internal error/illegal rest	P0606	This DTC detects an illegal reset in the PCM	This DTC will set when any one of the following reset conditions occur: external reset, cpu timeout, double bus fault, loss of clock	None	2 failures/ Ign. cycle Continuous	DTC Type A
Transmission Control System Electrical	P0702	This DTC checks for Power to the Transmission Actuators Circuit Continuity	The GFD feedbacks don't indicate voltage present at the Transmission Actuators	No 1660 DTC Engine Speed > 300 rpm 9.5 V <Ign voltage<18V A/D converter has not failed Fuel pump relay activated	2 failures/ign. cycle Continuous	DTC Type A
Transmission Range Sensor Circuit Malfunction (PRNDL Input)	P0705	This DTC checks for illegal shift range positions Functional Check	Any illegal shift positions for 500 msec	No P0708 DTC Ign. voltage> 9.5V	2 failures/ign. cycle Continuous	DTC Type A
Transmission Range Sensor Circuit Range/Performance	P0706	This DTC checks that parity = valid parity Range Check	Any parity descrepancies for 10 sec	No P0705, P0708 DTC Ign. Voltage > 9.5V	2 failures/ign. cycle Continuous	DTC Type A

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Transmission Range Sensor Circuit High Input	P0708	This DTC checks for a disconnected switch Range Check	All inputs from switch read high for 500 msec	Ign. voltage > 9.5V	2 failures/ign. cycle Continuous	DTC Type A
Transmission Fluid Temperature Sensor Circuit Malfunction	P0710	Functional Check	Transmission fluid temperature < ((ECT + IAT)/2) - 40 Deg C for >= 1,280 seconds	No ECT, IAT, P1623, P0712, P0713 or P1639 DTC's	2 failures/ign. cycle Continuous	DTC Type A
Transmission Fluid Temperature Sensor shifted high output	P0711	Range Check	Transmission Fluid Temperature > (IAT+ 9 deg C)	No ECT, IAT, P1623, P0710, P0712, P0713, P0714, P1635 or P1639 DTC's Vehicle has experienced a cold soak (i.e. coolant temp = IAT + or - 6 deg) ERT > 2 seconds IAT < 40 deg C	1 failures/ign. cycle Once per ignition cycle	DTC Type A
Transmission Fluid Temperature Sensor Circuit Low Input	P0712	Range Low Check	Transmission Fluid Temperature < .196 Volts for 30 seconds	No ECT, IAT, P1623, P1639 DTC's ECT < 100 deg C	2 failures/ign. cycle Continuous	DTC Type A
Transmission Fluid Temperature Sensor Circuit High Input	P0713	Range High Check	Transmission Fluid Temperature > 4.7 Volts for 30 seconds or more	No ECT, IAT, P1623, P1639 DTC's ECT > -17 deg C Engine Run Time > 240 seconds	2 failures/ign. cycle Continuous	DTC Type A
Transmission Fluid Temperature Sensor Circuit Intermittent	P0714	Circuit Continuity	Transmission Fluid Temperature changes > .196 Volts for 4 consecutive 1 second loop cycles	No P1639 DTC	2 failures/ign. cycle Continuous	DTC Type A
Turbine Speed Sensor Circuit Range/Performance	P0716	0 rpm to 7200 rpm This DTC detects an unrealistically large change in turbine speed Range Check	Delta Turbine speed > (The sum of last 8 turbine speed time/pulse)/8 * 1.72 or < (the sum of last 8 turbine speed time/pulse)/8 * .52. for 731 msecs	Turbine speed > 1400 RPM	2 failures/ign. cycle Continuous	DTC Type A
Turbine Speed Sensor Circuit No Signal	P0717	This DTC checks for Turbine speed equal to 0 Functional Check	Turbine speed = 0 and eng. speed > 3400 rpm for 2 secs or Output speed > 10 Km/hour for 2 seconds and turbine speed = 0	No P0722 or P0721 DTCs	2 failures/ign. cycle Continuous	DTC Type A
Output speed sensor circuit Range/Performance	P0721	0 rpm to 7200 rpm This DTC detects an unrealistically large change in output speed Range Check	Output speed delta > (filtered output speed time/pulse) * 1.44 or < (filtered ouput speed time/pulse) * .56 for 731 msecs NOTE: 8 pulses are received/360 degree revolution of turbine	Output speed > 24 KPH	2 failures/ign. cycle Continuous	DTC Type A
Output Speed Sensor Circuit No Signal	P0722	This DTC will detect a loss of output speed Functional Check	Turbine speed pull down when an upshift is commanded	No P0716, P0717 DTC's Turbine speed > 1400 rpm (turbine speed/ engine speed) < .78 Output speed < 5 kph TP delta < 11% for > 1.5 secs A forward drive gear is selected	2 failures/ign. cycle Continuous	DTC Type A

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Incorrect Gear Ratio (no forward gears available)	P0730	This DTC looks for the occurrence when no gears are available from an initial start Functional check	No turbine speed pulldown during commanded upshift	No P0716, P0717, P0727 DTC's	2 failures/ign. cycle Continuous	DTC Type A
Gear 1 Incorrect Ratio	P0731	This DTC looks for the commanded gear ratio Functional Check	Commanded gear ratio does not equal actual gear ratio for +/- .0152% for time period based on magnitude of slip (larger the magnitude of slip, the faster the diagnostic will trigger)	Eng. torque > a k value which is a function of gear. Output speed and turbine speed are not substituted A forward drive gear is selected	2 failures/ign. cycle Continuous	DTC Type A
Gear 2 Incorrect Ratio	P0732	same as above	same as above	same as above	same as above	DTC Type A
Gear 3 Incorrect Ratio	P0733	same as above	same as above	same as above	same as above	DTC Type A
Gear 4 Incorrect Ratio	P0734	same as above	same as above	same as above	same as above	DTC Type A
Torque Converter Clutch System Performance or Stuck Off	P0741	This DTC detects the inability to lock up the TCC Rationality Check	Delta speed = (engine speed - Turbine shaft speed) > 280 RPM	Transaxle Temperature > 20 Deg C Coolant Temperature > 50 Deg C	2 failures/ign. cycle Continuous	DTC Type A
Torque Converter Clutch System Stuck On	P0742	This DTC detects when the TCC is unable to be disengaged Rationality Check	Delta speed = (engine speed - turbine shaft speed) < 84 rpm	engine rpm < 3200 input shaft speed is between 224 and 2800 rpm TCC is commanded off > .25 seconds Eng torque > some value obtained from a lookup table based on turbine speed	2 failures/ign. cycle Continuous	DTC Type A
1-2 Shift Malfunction (2nd gear stuck on)	P0781	This DTC looks for gears higher than the commanded ratio Functional/Range Check	1st gear commanded and (turbine/output speed) = 2nd, 3rd or 4th ratio +/- 4% for 3 secs	No P0716, P0717, P0717, P0727, P0705, P0706, P0708 DTC's Eng. Torque > 100Nm Output speed and turbine speed are not substituted	2 failures/ign. cycle Continuous	DTC Type A
2-3 Shift Malfunction (3rd gear stuck on)	P0782	same as above	same as above	same as above	2 failures/ign. cycle Continuous	DTC Type A
3-4 Shift Malfunction (4th gear stuck on)	P0783	Same as above	Same as above	Same as above	2 failures/ign. cycle Continuous	DTC Type A
Oxygen Sensor System - Too Few O2S R/L and L/R Switches	P1133	0 V to 1.0 V This DTC determines if the 02 sensor is functioning properly by checking its switches Rationality Check	02 sensor switches < 10 counts	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP, DTC's Closed loop 02 Voltage low threshold .300 02 high threshold .600 V Airflow > 7 g/sec 1500 < rpm < 3200 453 < 02 temp model and > 549 for 5 sec	100 seconds after closed loop enable, Once per ignition	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
02 Sensor Circuit Transfer Switch Time Ratio Malfunction	P1134	0 V to 1.0 V This DTC will determine if the 02 sensor is functioning properly by checking its ratio Rationality Check	Ratio of average response time ratio < .6 or Ratio of average response time ratio > 2.8	No MAP, CRK, IAT, ECT, TP, Fuel Trim, Misfire, Cam, EGR, CCP, DTC's Closed loop 02 Voltage low threshold .300 02 high threshold .600 V Airflow > 7 g/sec 1500 < rpm < 3200 453 < 02 temp model and > 549 for 5 sec	100 seconds after closed loop enable, Once per ignition	DTC Type B
Crank Position Error not Learned	P1336	This DTC determines whether the crankshaft position sensor learned allowing it to be used in the misfire diagnostic Range Check	Position error not learned in the PCM processor	Vehicle speed > 15 mph	1 failure/ignition cycle Continuous	DTC Type A
Exhaust Gas Recirculation System - Valve B	P01404	This DTC detects a malfunction in the operation of the EGR valve Functional Check	Close Value Position> 4% if RPM < 5000 Closed Value Position> 7.8 % if RPM > 5000 for 20 seconds when desired EGR position equals 0 & valve must be cycled > 61 % four times	Battery Voltage > 11 volts	20 seconds Continuous every 100 msec	DTC Type A
5 Volt Reference Low/High	P1635	This DTC verifies the 5 volt reference line Functional Check	4.655< AD Volt < 5.255	None	Continuous	DTC Type A
Evaporative Emission Control System Malfunction (Large Leak)	P0440	This diagnostic will detect a missing gas cap or a "gross" leak in the system Functional Check	Tank Vacuum < 8" H20 for 3.2 seconds	Engine running No IAT, CT, Tank Pressure, MAP, VSS, PCM DTC's 11v <= Batt Volt <= 18 v Baro > 80.8 KPa 15% < Fuel Level < 85% 41F < IAT < 90F 41F<Coolant< 90F Coolant - IAT < = 10C ERT < or = 600 sec Purge mass accumulated > or = 6000 grams	Once/cold start 120 sec warm test 240 sec cold test	DTC Type A (Behaves as a B code)

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evaporative Emission Control System Leak Detected (small leak)	P0442	This Diagnostic will detect a small leak in the evap system Functional Check	Tank Vacuum Decay Slope is compared and subtracted from a threshold value from a lookup table based on fill level of fuel tank. The result is statistically filtered (EWMA) and compared to a decision limit (see table below)	Engine Running No IAT, CT, Tank Pressure, VSS, MAP, PCM DTC's 11 v <= Batt Volt<= 18 v Baro > 80.8 KPa 15% ≤ Fuel Lvl ≤ 43.75% (.40" lk) 43.75% < Fuel Lvl < 85% (.020" lk) 41 F < IAT < 90F 41F<Coolant< 90F Coolant - IAT < = 10C Vacuum decay < 8.0" H20	Once/ cold start 240 seconds	DTC Type A (Will Set within 8 - 10 trips based on EWMA value)
			0 Fuel Full % = 0.1297 6.25 Fuel Full % = 0.1297 12.5 Fuel Full % = 0.1297 18.75 Fuel Full % = 0.1297 25 Fuel Full % = 0.1297 31.25 Fuel Full % = 0.1297 37.5 Fuel Full % = 0.1297 43.75 Fuel Full % = 0.053406 50 Fuel Full % = 0.053406 56.25 Fuel Full % = 0.053406 62.5 Fuel Full % = 0.053406 68.75 Fuel Full % = 0.053406 75 Fuel Full % = 0.053406 81.25 Fuel Full % = 0.053406 87.5 Fuel Full % = 0.053406 93.75 Fuel Full % = 0.053406 100 Fuel Full % = 0.053406			
Evaporative Emission Control System Vent Control Malfunction	P0446	This diagnostic will detect a blockage in the evap system which would keep the system from venting Functional Check	Tank Vacuum > 12 "H20 for 1.6 seconds Purge flow accumulated > or = 350 grams	Engine Running No IAT, CT, Tank Pressure Sensor, VSS, MAP, PCM Dtc's 11v <= Batt Volt <= 18 v Baro > 80.8 KPa 15% < Fuel Level < 85% tank vacuum > 9" H20 41 deg F < IAT < 90F 41F<Coolant< 90F Coolant - IAT < = 10C ERT < or = 144 seconds	Once/ cold start 96 seconds	DTC Type A (Behaves as a B code)
Evaporative Emission Control System PressureSensor Low Input	P0452	Rationality Test	Tank Pressure < -7.5 " H20 pressure	Engine Running	Once/ignition cycle 100 msec	DTC Type A
Evaporative Emission Control System PressureSensor High Input	P0453	Rationality Test	Tank Pressure > 17.2"H20 vaccum	Engine Running	Once/ignition cycle 100 msec	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evaporative Emission Control System Continuous Open Purge Flow	P1441	This diagnostic will detect a purge valve stuck open. Functional Check	Tank Vacuum > 6" H20 for 4 seconds	Engine Running No IAT, CT, VSS, MAP, tank pressure, PCM DTC's 11 v <= Batt Volt < = 18 v Baro > 80.8 KPa 15% < Fuel Level < 85% 41deg F < IAT < 90F 41F<Coolant< 90F Coolant - IAT < = 10C Tank Vacuum < 2.5" H20 purge mass accumulated > 4000 grams	96 seconds Once/ cold start	DTC Type A (Behaves as a B code)

2002 1.9L (L24, LL0) Z-car *(Saturn S-series cars)* ENGINE *and* TRANSMISSION DIAGNOSTIC PARAMETERS

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE

P0300: Random/Multiple Cylinder Misfire Detected (Table values = time in millisecs.)

	3000 rpm =	3500 rpm =	4000 rpm =	4500 rpm =	5000 rpm =	5500 rpm =	6000 rpm =	6500 rpm =	7000 rpm =	7500 rpm =
0 OBD Load Percent =	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428
6.25 OBD Load Percent =	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428
12.5 OBD Load Percent =	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428
18.75 OBD Load Percent =	64.8	176	52428	52428	52428	52428	52428	52428	52428	52428
25 OBD Load Percent =	70.4	76	82.4	52428	52428	52428	52428	52428	52428	52428
31.25 OBD Load Percent =	112.8	80.8	64.8	47.2	52428	52428	52428	52428	52428	52428
37.5 OBD Load Percent =	128	97.6	67.2	47.2	47.2	40.8	52428	52428	52428	52428
43.75 OBD Load Percent =	143.2	97.6	76	52.8	47.2	40.8	52428	52428	52428	52428
50 OBD Load Percent =	160.8	115.2	76	60	47.2	40.8	52428	52428	52428	52428
56.25 OBD Load Percent =	188.8	124	88.8	72.8	51.2	43.2	52428	52428	52428	52428
62.5 OBD Load Percent =	210.4	146.4	104.8	73.6	55.2	43.2	52428	52428	52428	52428
68.75 OBD Load Percent =	231.2	165.6	113.6	78.4	57.6	50.4	52428	52428	52428	52428
75 OBD Load Percent =	251.2	175.2	113.6	91.2	69.6	51.2	52428	52428	52428	52428
81.25 OBD Load Percent =	281.6	178.4	130.4	100.8	72.8	58.4	52428	52428	52428	52428
87.5 OBD Load Percent =	293.6	196	128.8	102.4	75.2	60.8	52428	52428	52428	52428
93.75 OBD Load Percent =	304.8	199.2	137.6	102.4	77.6	63.2	52428	52428	52428	52428
100 OBD Load Percent =	331.2	204	157.6	108.8	84.8	70.4	52428	52428	52428	52428

	400 rpm =	600 rpm =	800 rpm =	1000 rpm =	1200 rpm =	1400 rpm =	1600 rpm =	1800 rpm =	2000 rpm =	2200 rpm =	2400 rpm =	2600 rpm =	2800 rpm =	3000 rpm =
0 OBD Load Percent =	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428
6.25 OBD Load Percent =	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428	52428
12.5 OBD Load Percent =	52428	5680.8	4120	1949.6	901.6	656	477.6	360	269.6	188	158.4	144	115.2	96
18.75 OBD Load Percent =	5680.8	5680.8	4120	1949.6	901.6	656	477.6	360	269.6	188	158.4	144	115.2	96
25 OBD Load Percent =	5680.8	7507.2	5001.6	2177.6	1336	656	477.6	360	296	214.4	158.4	144	115.2	96
31.25 OBD Load Percent =	7507.2	11351.2	5140.8	3088	1877.6	997.6	617.6	455.2	319.2	260.8	193.6	146.4	135.2	140
37.5 OBD Load Percent =	11351.2	14084.8	5279.2	3200.8	1919.2	1246.4	739.2	510.4	364	293.6	234.4	176	146.4	168.8
43.75 OBD Load Percent =	14084.8	14200.8	6240.8	3282.4	2081.6	1429.6	908.8	575.2	430.4	322.4	264	205.6	176	179.2
50 OBD Load Percent =	14200.8	14541.6	6937.6	4776.8	2934.4	1645.6	995.2	658.4	492	381.6	322.4	264	205.6	193.6
56.25 OBD Load Percent =	14541.6	14541.6	7609.6	5868.8	3052	1965.6	1160.8	841.6	577.6	572.8	439.2	371.2	264	208
62.5 OBD Load Percent =	52428	16132	10356	6345.6	3168	2050.4	1459.2	895.2	703.2	605.6	464.8	332	311.2	271.2
68.75 OBD Load Percent =	52428	18772	10418.4	6719.2	3268.8	2175.2	1470.4	1050.4	773.6	606.4	467.2	364	344.8	273.6
75 OBD Load Percent =	52428	21411.2	11245.6	6719.2	3540.8	2236.8	1482.4	1052	814.4	661.6	490.4	384	384	311.2
81.25 OBD Load Percent =	52428	28516	12210.4	7295.2	3956.8	2299.2	1643.2	1572.8	967.2	730.4	514.4	422.4	384	314.4
87.5 OBD Load Percent =	52428	52428	17278.4	7590.4	4023.2	2451.2	1877.6	1572.8	1188.8	798.4	537.6	432.8	404	318.4
93.75 OBD Load Percent =	52428	52428	22347.2	7886.4	4023.2	2451.2	1995.2	1572.8	1188.8	937.6	560.8	444	472	321.6
100 OBD Load Percent =	52428	52428	27415.2	8182.4	4023.2	2451.2	1995.2	1572.8	1188.8	937.6	583.2	452.8	479.2	324

P0401: Exhaust Gas Recirculation Flow Insufficient Detected

KQEMDRPM (offset RPM) = 1400 rpm

KQEMDRPM >	+0 rpm	+100 rpm	+200 rpm	+300 rpm	+400 rpm	+500 rpm	+600 rpm	+700 rpm	+800 rpm	+900 rpm	+1000 rpm	+1100 rpm	+1200 rpm	+1300 rpm	+1400 rpm	+1500 rpm	+1600 rpm
65 Baro KPa =	10	9	9	10	10	10	10	10	9	6	5	4	4	4	4	4	4
85 Baro KPa =	22	22	21	20	20	20	20	20	19	16	15	14	14	13	12	12	12
105 Baro KPa =	26	26	24	23	23	22	22	22	22	19	18	17	16	15	15	15	15

P0420: Catalyst System Efficiency Below Threshold

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE

	288 Deg C	384 Deg C	480 Deg C	576 Deg C	672 Deg C	768 Deg C
0.5 grams/second air flow =	0.45313	0.35938	0.29688	0.23438	0.1875	0.15625
1.0 grams/second air flow =	0.5625	0.45313	0.35938	0.29688	0.23438	0.1875
1.5 grams/second air flow =	0.70313	0.5625	0.45313	0.375	0.29688	0.23438
2.0 grams/second air flow =	0.875	0.70313	0.57813	0.45313	0.375	0.29688
2.5 grams/second air flow =	1.0938	0.89063	0.71875	0.57813	0.46875	0.375
3.0 grams/second air flow =	1.375	1.1094	0.89063	0.71875	0.57813	0.46875
3.5 grams/second air flow =	1.7188	1.3906	1.125	0.90625	0.71875	0.57813
4.0 grams/second air flow =	2	1.7344	1.4063	1.125	0.90625	0.73438
4.5 grams/second air flow =	2	2	1.75	1.4063	1.1406	0.92188
5.0 grams/second air flow =	2	2	2	1.7656	1.4219	1.1406
5.5 grams/second air flow =	2	2	2	2	1.7813	1.4375
6.0 grams/second air flow =	2	2	2	2	2	1.7969
6.5 grams/second air flow =	2	2	2	2	2	2
7.0 grams/second air flow =	2	2	2	2	2	2
7.5 grams/second air flow =	2	2	2	2	2	2
8.0 grams/second air flow =	2	2	2	2	2	2
NotUsed gms/second air flow =	0	0	0	0	0	0

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE

Misfire Diagnostic Probability of Detection
% Load vs. Engine RPM Tables

Data Generated on 1997my 1.9L (4 cylinder DOHC), automatic transmission
(data is applicable since Misfire Strategy has not changed since 1997my)
Numbers in ( ) are the max. engine load at that rpm. Numbers in [ ] are the min. required engine load.
n.a. indicates windows not required, or windows at which engine cannot operate

Table #1: Continuous One Cylinder Misfire on Cylinder #2

	500-1000	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000	5000-5500	5500-6000	6000-6500
90 - 100%	n.a.	n.a.	n.a.	n.a.	n.a.	100 (91)	100 (93)	100 (95)	100 (100)	100 (100)	100 (94)	100 (91)
75 - 90%	n.a.	n.a. (80)	100 (85)	100 (87)	100 (88)	100	100	100	100	100	98	100
60 - 75%	n.a.	100	100	100	100	100	100	100	100	100	93	99 [67]
45 - 60%	100	100	100	100	100	100	100	100	100 [46]	100 [53]	100 [60]	n.a.
30 - 45%	100	100	100	100	100	100	100 [32]	100 [39]	n.a.	n.a.	n.a.	n.a.
15 -30%	100 [24]	100 [23]	100 [23]	100 [24]	100 [25]	100 [25]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
0 - 15%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table #2: 1.96% Random Cylinder Misfire

	500-1000	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000	5000-5500	5500-6000	6000-6500
90 - 100%	n.a.	n.a.	n.a.	n.a.	95 (90)	96 (90)	70 (93)	74 (100)	79 (100)	87 (100)	90 (95)	79 (93)
75 - 90%	n.a.	n.a.	n.a.	n.a. (84)	100	100	99	81	79	87	87	77
60 - 75%	n.a.	n.a.	100	100	99	100	100	90	91	93	94	72
45 - 60%	n.a.	99	99	100	100	97	100	96	91	95	93 [45]	75 [49]
30 - 45%	100	100	100	100	100	100	100	98 [33]	96 [37]	n.a. [41]	n.a.	n.a.
15 -30%	98 [18]	100 [19]	100 [19]	100 [21]	100 [22]	100 [25]	n.a. [29]	n.a.	n.a.	n.a.	n.a.	n.a.
0 - 15%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table #3: Opposing (Paired) Cylinder Misfire on Cylinders #2 and #3

	500-1000	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000	5000-5500	5500-6000	6000-6500
90 - 100%	n.a.	n.a.	n.a.	n.a.	100 (90)	100 (90)	100 (91)	100 (93)	100 (97)	100 (100)	100 (100)	100 (94)[94]
75 - 90%	n.a.	n.a.	100 (83)	100 (87)	100	100	100	100	100	100 [75]	100 [84]	n.a.
60 - 75%	100	100 (73)	100	100	100	100	100	100	100 [65]	n.a.	n.a.	n.a.
45 - 60%	100	100	100	100	100	100	100 [46]	100 [55]	n.a.	n.a.	n.a.	n.a.

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE

30 - 45%	100 [32]	100 [31]	100 [30]	100 [32]	100 [34]	100 [36]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
15 -30%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
0 - 15%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.