



3.2 Misfire Monitoring

3.2.1 Description

1. Diagnostic Trouble Codes:
Individual DTCs for each cylinder, for either excess emissions or catalyst damage and corresponding multiple cylinder codes.

Catalyst Damage Bank A Misfire Fault	P1313
Catalyst Damage Bank B Misfire Fault	P1314
Excess Emissions Misfire Fault	P1316
Random / Multiple Misfire	P0300
Misfire Detected - Cylinder 1	P0301
Misfire Detected - Cylinder 2	P0302
Misfire Detected - Cylinder 3	P0303
Misfire Detected - Cylinder 4	P0304
Misfire Detected - Cylinder 5	P0305
Misfire Detected - Cylinder 6	P0306
Misfire Detected - Cylinder 7	P0307
Misfire Detected - Cylinder 8	P0308

2. Monitoring Procedure

Misfire detection using crankshaft period measurements has been implemented. Two algorithms compare changes in crankshaft period with respective threshold values that are speed and load dependant. If the change in crankshaft period exceeds the threshold value a misfire has occurred.
Percentage misfire is calculated over 200 or 1000 engine revolution blocks for each bank of cylinders and compared to threshold levels for excess emissions or catalyst damage. Whenever conditions are not suitable for misfire detection, engine revolution counting and misfire counting is suspended. When conditions are suitable, counting continues from the last updated values.

Catalyst Damage

The total percentage misfire indicated by the algorithm is calculated in blocks of 200 revolutions of the crankshaft. If this value exceeds the misfire rate that indicates catalyst damage (MF DIAG THRESH PCENT MF CAT), cylinder identification takes place and a misfire catalyst damage fault is present for the appropriate bank.

Excess Emissions

The percentage misfire (MF DIAG PCENT MF EMISS) is calculated in blocks of 1000 revolutions of the crankshaft using MF DIAG FIRE COUNT EMISS I as the revolution count. If the misfire rate is high enough to exceed specified emission limits, cylinder identification takes place and a misfire emission fault is present.



Cylinder Identification

Each misfire detected will be referenced to a particular cylinder. If the number of misfires occurring on a particular cylinder exceeds a given percentage of the total number of misfires from all the cylinders, then that cylinder is considered to be misfiring and a misfire cylinder number (1 to 8) fault is present. Otherwise a misfire on multiple cylinders fault is present.

3. Primary Detection Parameter
Engine speed changes processed over a series of engine firings.

4. Fault Criteria Limits
Misfire to exceed emissions limit - 2%
Misfire to cause catalyst damage - 15%

5. Monitoring Conditions
The engine must be stabilised after any rapid throttle excursion, fuel cut off condition or gear change. Monitoring is disabled during rough road conditions. The engine load must exceed a threshold, which is mapped with engine speed (to represent the positive/negative engine torque boundary).

Map of load/speed sites where misfire detection is active

Speed (RPM)	Load -Percentage															
	0	7	13	20	27	33	40	47	53	60	67	73	80	87	93	100
500																
750																
1000																
1250																
1500																
1750																
2000																
2250																
2500																
2750																
3250																
3750																
4000																
4250																
5000																
5500																

6. Monitoring Time Length / Frequency of Checks
The misfire percentage is checked at the end of every block of 200 or 1000 engine revolutions as required. The counting of engine revolutions is suspended during engine stabilisation as described above.



7. Criteria for Storing Fault Code

If catalyst damage levels of misfire are detected the fault code is stored immediately. If misfire above the emission threshold (only) is detected, then a set of conditions is stored. A DTC will be stored if misfire is detected on a subsequent driving cycle while the conditions are still stored. The conditions can be erased on intervening fault free driving cycles as allowed in OBD II regulations.

8. Criteria for Illuminating MIL

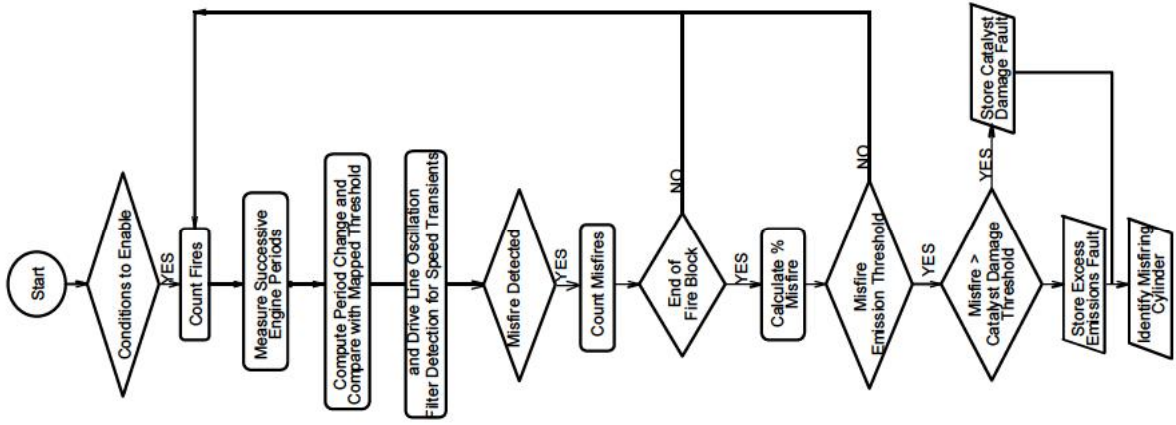
If catalyst damage levels of misfire are detected the MIL will be flashed for as long as the catalyst damage misfire level is present. If misfire above the emission threshold (only) is detected, then a set of conditions is stored. The MIL will be illuminated if misfire is detected on a subsequent driving cycle while the conditions are still stored. The conditions can be erased on intervening fault free driving cycles as allowed in OBD II regulations.

9. Criteria for Determining Out of Range Input Signals

The crankshaft position sensing system is subject to diagnostics, which detect more or less than the correct number of sensor transitions per engine revolution.



3.2.2 Monitoring Structure





Misfire Monitoring Operation

Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
MISFIRE	P0300	Crankshaft period (speed) fluctuation	Emissions threshold		Idle Speed Control step change	< 10	1000 revolutions	2 successive drive cycles
	P0301- Cylinder		Percent misfire in 1000 revolutions	> 2%	Engine Load Change Disable	< 0.1221 g/stroke Up to 1 s after fuel shut-off		
	P0308 P-1313- through	identification attributed misfire	Catalyst damage		Disable	Up to 1 s after gear change		
	P-1316		Percent misfire in 200 revolutions	> 15%	Disable	ABS Rough Road Flag	200 revolutions	Immediately

If the above table does not include details of the following enabling conditions: - intake air and engine coolant temperature, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.