

ELECTRONIC SPARK ADVANCE OPERATION [LF]

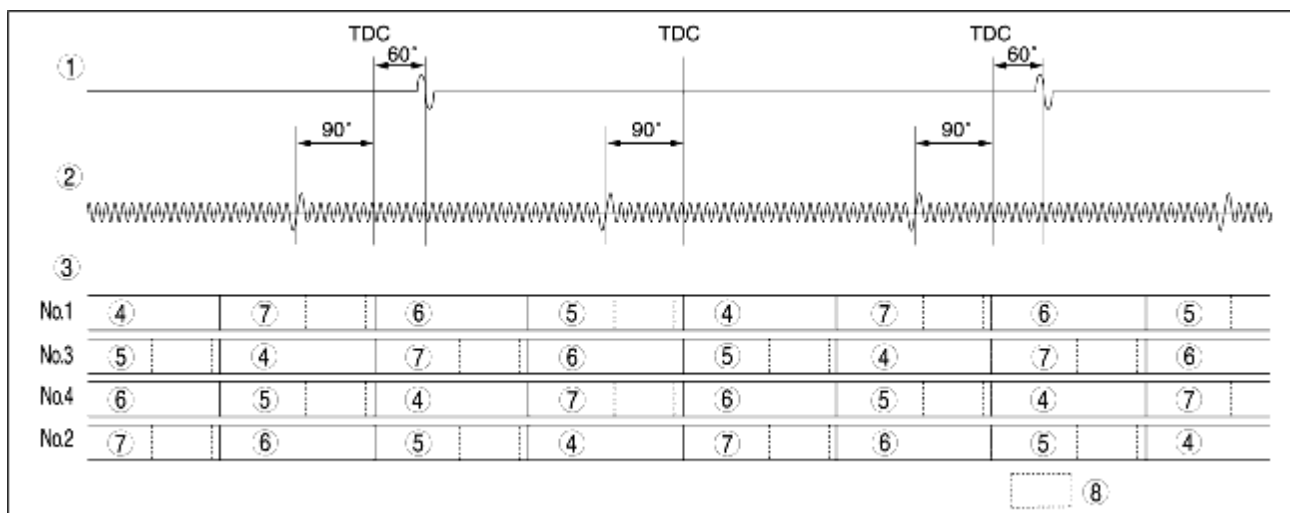
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Ignition method

- The PCM excites the ignition coils employing either fixed ignition or cycle estimated ignition according to engine operation conditions.

Ignition method	Ignition timing	Ignition coil energization period
Fixed ignition	Fixed at BTDC 10°	Fixed period at BTDC 10° to end of energization
Cycle estimated ignition	Ignition at timing appropriate to engine operation conditions based on input signals	<ul style="list-style-type: none"> Energization time (ignition coil energization time) to igniter is determined according to battery voltage Cylinder independent ignition

Timing chart



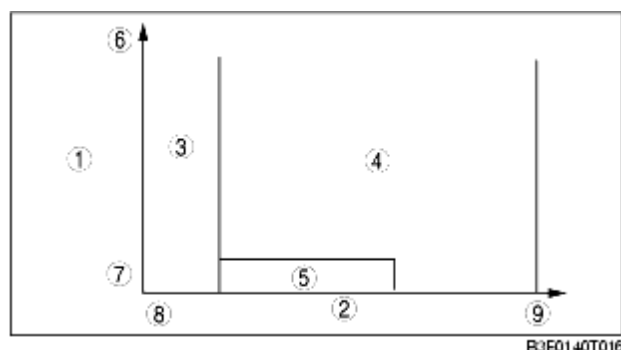
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1	CMP sensor input
2	CKP sensor input
3	Cylinder number
4	Intake air
5	Exhaust air
6	Expansion
7	Compression
8	Ignition coil energization allowance period

Determination of Ignition Timing

Division of control zones

- The PCM divides the engine control operations into each control zone according to the engine speed and throttle valve opening angle to determine the ignition timing by each of the control zones to perform optimum ignition control under all engine operation conditions.



1	Throttle valve position
2	Engine speed
3	Start zone
4	Regular zone
5	Idle zone
6	Open
7	Closed
8	Low
9	High

Control zone	Control condition	Ignition method
Start zone	Engine speed is 500 rpm or less . When mass airflow sensor is damaged.	Fixed ignition
Idle zone	Fully-closed throttle valve when engine speed is the target idle speed + 2,250 rpm or less	Determines ignition timing adding each correction to the idle spark advance
Cycle estimated zone	Engine operation except start zone and idle zone	Determines ignition timing adding each correction to the basic spark advance

Ignition timing calculation method table

A: Ignition timing base, B: Correction for ignition timing

Contents		Calculation method or determination method for ignition timing, advance value and correction	Control zone		
			Start zone	Idling zone	Cycle estimated zone
Fixed ignition		Fixed at BTDC approx. 10° CA	A		
Cycle estimated ignition	Idle spark advance	Set value according to target speed and charging efficiency*		A	
	Basic spark advance	Set value according to engine speed and charging efficiency*			A
	Engine coolant	Purpose: Ensures combustion stability when engine coolant temperature is low			

Correction	temperature advance correction	Except during idling • High charging efficiency*, low engine coolant temperature→large correction		B	B
	Warm-up promotion spark retard correction	Purpose: Activates the catalytic converter earlier Approx. 50 s after engine start • According to engine coolant temperature→correction		B	
	Feedback correction	Purpose: Ensures idling stability During idling (inhibited during test mode) • Large difference between actual engine speed and target engine speed→large correction • Small difference between actual engine speed and target engine speed→small correction		B	
	EGR correction	Purpose: Prevents deviation of required ignition timing during EGR gas feed When EGR valve position is the specified value or more except during EGR valve initialization • According to engine speed and charging efficiency*→correction			B
	Shift spark retard correction (ATX)	Purpose: Reduces shift shock during shifting Determined according to torque reduction request signal from the ATX control • Large torque down request during shifting→large correction			B
	Deceleration fuel cut recovery retard correction	Purpose: Reduces shock after recovery from deceleration fuel cut and during re-acceleration while in deceleration fuel cut Re-acceleration after recovery from deceleration fuel cut and while in deceleration fuel cut • Low engine coolant temperature→large correction		B	B
	Acceleration spark retard correction	Purpose: Prevents knocking and shock during sudden acceleration Acceleration when charging efficiency* volume increase (acceleration amount) is specified value or more • High acceleration amount→high retard			B
	Standing start spark retard correction	Purpose: Prevents shock when vehicle accelerates from a standing start When vehicle accelerates from a standing start • According to engine speed, throttle valve opening angle, engine coolant temperature and intake air temperature→correction			B
	Knocking spark retard correction	Purpose: Knocking suppression When knocking is detected while driving under high load • Large amount of knocking→large correction			B

* : Charging efficiency is ratio of actual intake air amount to maximum air charging amount (mass volume) of cylinder. This value increases proportionately to the increase in engine load.

Ignition inhibition condition

• When receiving an engine stop request signal from the immobilizer system, the PCM force-stops control of ignition coils. As a result, the engine does not start.