

ELECTRONIC SPARK ADVANCE (ESA) CONTROL OPERATION [ZJ, Z6]

B3E014000140T30

Ignition Method

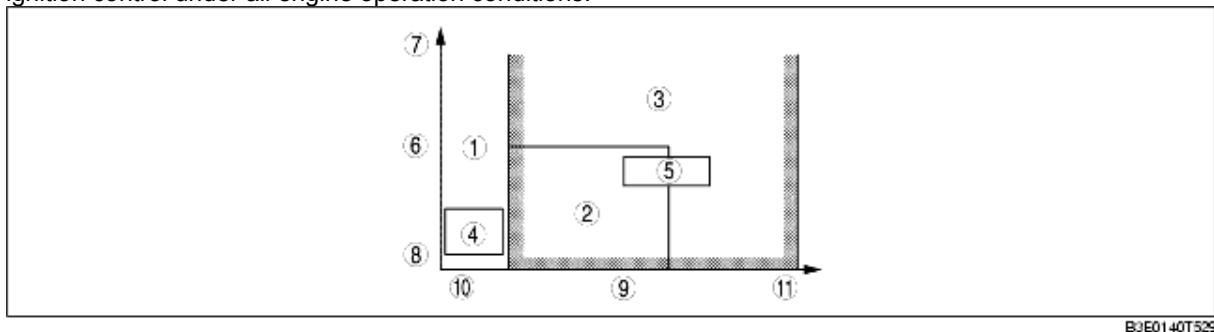
- The PCM excites the ignition coils employing either fixed ignition or cycle estimated ignition according to engine operation conditions.

Ignition method	Ignition timing	Ignition coil energization period
Fixed ignition	Fixed at BTDC 6 °	Fixed period at BTDC 6 ° 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

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.



B3E0140T529

1	Start zone
2	Idle zone
3	Cycle estimated zone
4	Fixed ignition
5	Cycle estimated ignition
6	Throttle valve position
7	Open
8	Closed
9	Engine speed
10	Low
11	High

Control zone	Control condition	Ignition method
Start zone	Engine speed is 500 rpm or less or when mass airflow sensor is damaged.	Fixed ignition
Idle zone	Fully-closed throttle valve when engine speed is	Determines ignition timing adding each

	the target idle speed + 1,500 rpm or less.	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

*: Ignition timing base, x: Correction for ignition timing

Contents		Calculation method or determination method for ignition timing, advance value and correction	Control zone		
			Start	Idle	Cycle estimated
Fixed ignition		Fixed at BTDC approx. 6 °CA	*		
Cycle estimated ignition	Idle spark advance	Set value according to target speed and charging efficiency ^{*1}		*	
	Basic spark advance	Set value according to engine speed and charging efficiency ^{*1}			*
correction	Engine coolant temperature spark advance correction	Purpose: Protects combustion stability when engine coolant temperature is low. Except during idling • High charging efficiency ^{*1} , low engine coolant temperature→large correction		x	x
	Warm-up promotion spark retard correction	Purpose: Activates the catalytic converter earlier Constant period after engine start • According to engine coolant temperature→correction		x	
	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		x	
	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 ^{*1} →correction			x
	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			x
	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		x	x

		• Low engine coolant temperature→large correction			
	Acceleration spark retard correction	Purpose: Prevents knocking and shock during sudden acceleration Acceleration when charging efficiency*1 volume increase (acceleration amount) is constant value or more. • High acceleration amount→high retard			×
	Knocking spark retard correction	Purpose: Knocking suppression When knocking is detected while driving under high load • Large amount of knocking→large correction			×

*1 : 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.