

# EGR CONTROL OPERATION [ZJ, Z6]

B3E014000140T36

## Stepping Motor Operation Principles

- The PCM opens/closes the EGR valve by controlling the amount of stepping motor rotation (step number).
- The stepping motor operates by the combination of coils No.1-4 according to the stepping motor step number.

### Energization condition for each coil

ON: Energization, OFF: Non-energization

When current step number divided by four	Evenly divisible	One leftover	Two leftover	Three leftover
No.1 coil (PCM terminal 2Z)	ON	ON	OFF	OFF
No.2 coil (PCM terminal 2V)	OFF	OFF	ON	ON
No.3 coil (PCM terminal 2R)	OFF	ON	ON	OFF
No.4 coil (PCM terminal 2N)	ON	OFF	OFF	ON

### Example of energization condition for each coil and step number

ON: Energization, OFF: Non-energization

Step number	0	1	2	3	4	5	6	7	8	9	10	30	52
No.1 coil (PCM terminal 2Z)	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON
No.2 coil (PCM terminal 2V)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
No.3 coil (PCM terminal 2R)	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	ON	OFF
No.4 coil (PCM terminal 2N)	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	ON

- The energization condition of stepping motor coils No.1-4 can be verified by verifying the step number from "SEGRP" on the PID/data monitor function of the WDS or equivalent.

## Control outline

- The PCM constantly calculates the optimum target EGR valve position according to the engine operation conditions and controls the EGR stepping motor step number so that the current EGR valve position is close to the target.
- If the current EGR valve position is smaller than the target EGR position (deviation is a positive number), the PCM increases the stepping motor step number and opens the EGR valve. If larger (deviation is a negative number), the PCM decreases the stepping motor step number and closes the EGR valve. Step numbers are increased or decreased by one step at a time.

## Target EGR valve position

- The PCM determines the value to increase or decrease the EGR valve opening angle according to the engine operation conditions. The PCM determines the target EGR valve position through each correction based on the basic EGR valve position that is set according to the engine speed and load.

**Target EGR valve position determination table**

Contents		Method for calculating or determining the EGR valve position and correction
Basic EGR valve position		Within steps 0-52 in the stepping motor, determined as follows: • When the engine speed is 1,000-4,700 rpm and the charging efficiency <sup>*1</sup> is within 19-75 %, the engine speed and charging efficiency are determined to be at basic position • When the EGR control inhibition conditions are met, step 0.
correction <sup>*2</sup>	Engine coolant temperature correction	Purpose: Improved driveability <b>Engine coolant temperature is 55-70°C {131-158°F}</b> • The step number is restricted between 0-100% of the basic EGR valve position according to the engine coolant temperature. Low engine coolant temperature→low step number
	Intake air temperature correction	Purpose: Improved driveability <b>Intake air temperature is 60°C {140°F} or less</b> • Step number is restricted to 100% of the basic EGR valve position (Basic EGR valve position = step number). <b>Intake air temperature exceeds 60°C {140°F}</b> • Step number is restricted between 40-100% of basic EGR valve position (Low intake air temperature→large step number)
	Acceleration/deceleration correction	Purpose: Improved driveability <b>During acceleration/deceleration, when the throttle valve opening angle fluctuation rate is the set value or more</b> • During acceleration→step number is restricted to 10% of basic EGR valve position. • During deceleration→step number is restricted to 0% of basic EGR valve position.

<sup>\*1</sup> : The charging efficiency is the ratio of the actual amount of intake air to the maximum air charging amount (mass volume) of the cylinder. This value increases proportionately to the increase in engine load.

<sup>\*2</sup> : The correction is to restrict the basic EGR valve position value. Except for the above conditions and inhibition conditions, the correction value is 100%, and the target EGR valve position equals the EGR valve position value.

## Inhibition conditions

• To improve driveability and ensure exhaust emission performance, the EGR valve closes when any of the following conditions are met.

- Idling
- Engine speed is less than 1,000 rpm or more than 4,700 rpm.
- Engine coolant temperature is less than 55°C {131°F}
- Charging efficiency is less than 19% or more than 75%.
- When the fuel injection control is in the high load volume increase zone
- Decelerated
- During TCS control