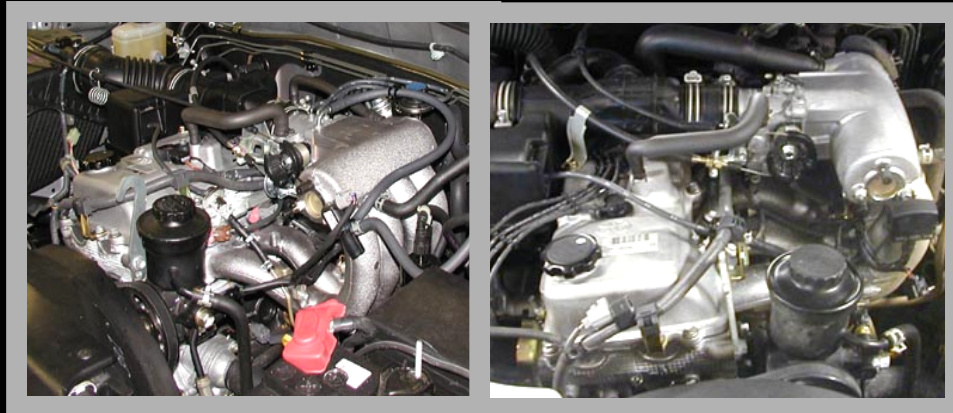


# ***Engine (Except 1GR-FE)***



***3RZ-FE [Unleaded/Leaded]***  
(-Q, -V, -\_)



***1KD-FTV***  
(-W)



***1KZ-TE***  
(-Q, -\_)



***5L-E***  
(-\_)



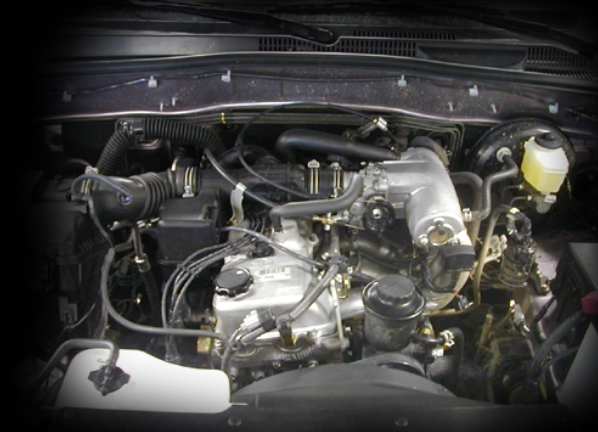
# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

- Engine Overall
- Engine Proper
- Valve Mechanism
- Intake & Exhaust System
- Fuel System
- Ignition System
- Starting System
- Charging System
- Engine Control System



**Unleaded**



**Leaded**



# 3RZ-FE Engine (Unleaded)

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

- Engine Overall
  - Engine Specification

| Item                             |                           | New                                | Previous |
|----------------------------------|---------------------------|------------------------------------|----------|
| No. of Cylinders and Arrangement |                           | 4-Cylinder, In-line                | ←        |
| Valve Mechanism                  |                           | 16-Valve DOHC,<br>Chain/Gear Drive | ←        |
| Manifolds                        |                           | Cross-Flow                         | ←        |
| Displacement                     | cm <sup>3</sup> (cu. in.) | 2694 (164.4)                       | ←        |
| Bore x stroke                    | mm (in.)                  | 95 x 95 (3.74 x 3.74)              | ←        |
| Compression Ratio                |                           | 9.5 : 1                            | ←        |
| Max. Output                      | EEC                       | 112 kW @ 4800 rpm                  | ←        |
| Max. Torque                      | EEC                       | 240 Nm @ 4000 rpm                  | ←        |



# 3RZ-FE Engine (Leaded)



- Engine Overall
  - Engine Specification

| Item                                            | New                                | Previous |
|-------------------------------------------------|------------------------------------|----------|
| No. of Cylinders and Arrangement                | 4-Cylinder, In-line                | ←        |
| Valve Mechanism                                 | 16-Valve DOHC,<br>Chain/Gear Drive | ←        |
| Manifolds                                       | Cross-Flow                         | ←        |
| Displacement          cm <sup>3</sup> (cu. in.) | 2694 (164.4)                       | ←        |
| Bore x stroke                  mm (in.)         | 95 x 95 (3.74 x 3.74)              | ←        |
| Compression Ratio                               | 9.5 : 1                            | ←        |
| Max. Output                                     | ?                                  | ?        |
| Max. Torque                                     | ?                                  | ?        |

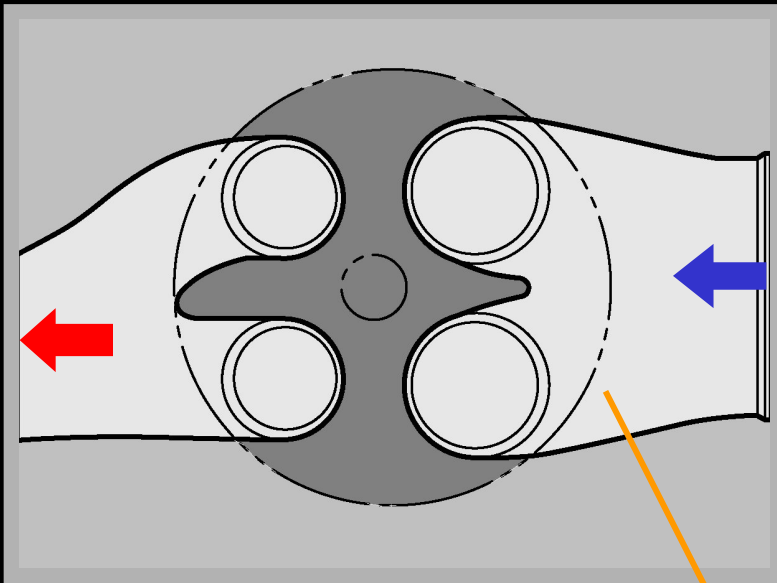


# 3RZ-FE Engine (Unleaded)

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

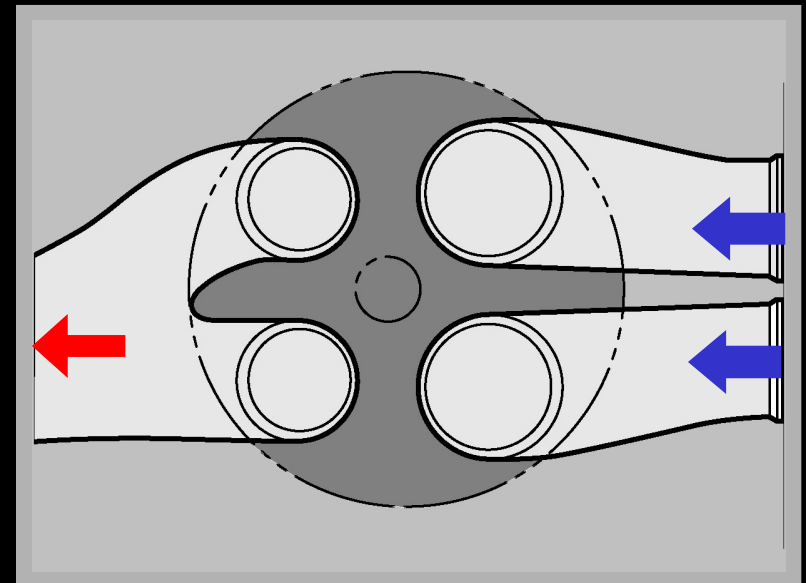
- Engine Proper
  - Cylinder Head
    - Siamese type intake port is used

New Model



Siamese Port

Previous Model



← : Intake Air  
← : Exhaust Gas



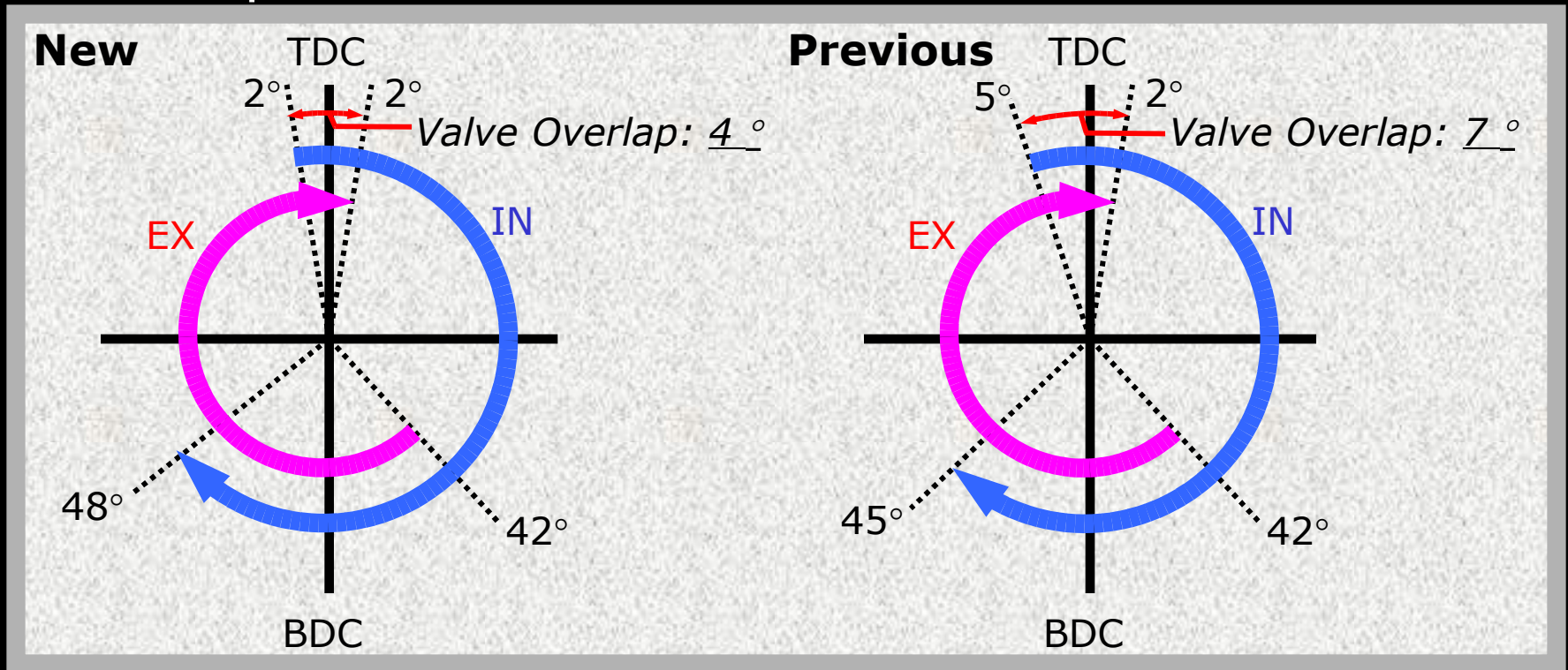
# 3RZ-FE Engine (Unleaded)

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Valve Mechanism

### • Valve Timing

- Valve overlap is changed to combustion improvement





# 3RZ-FE Engine (Unleaded)

-Q

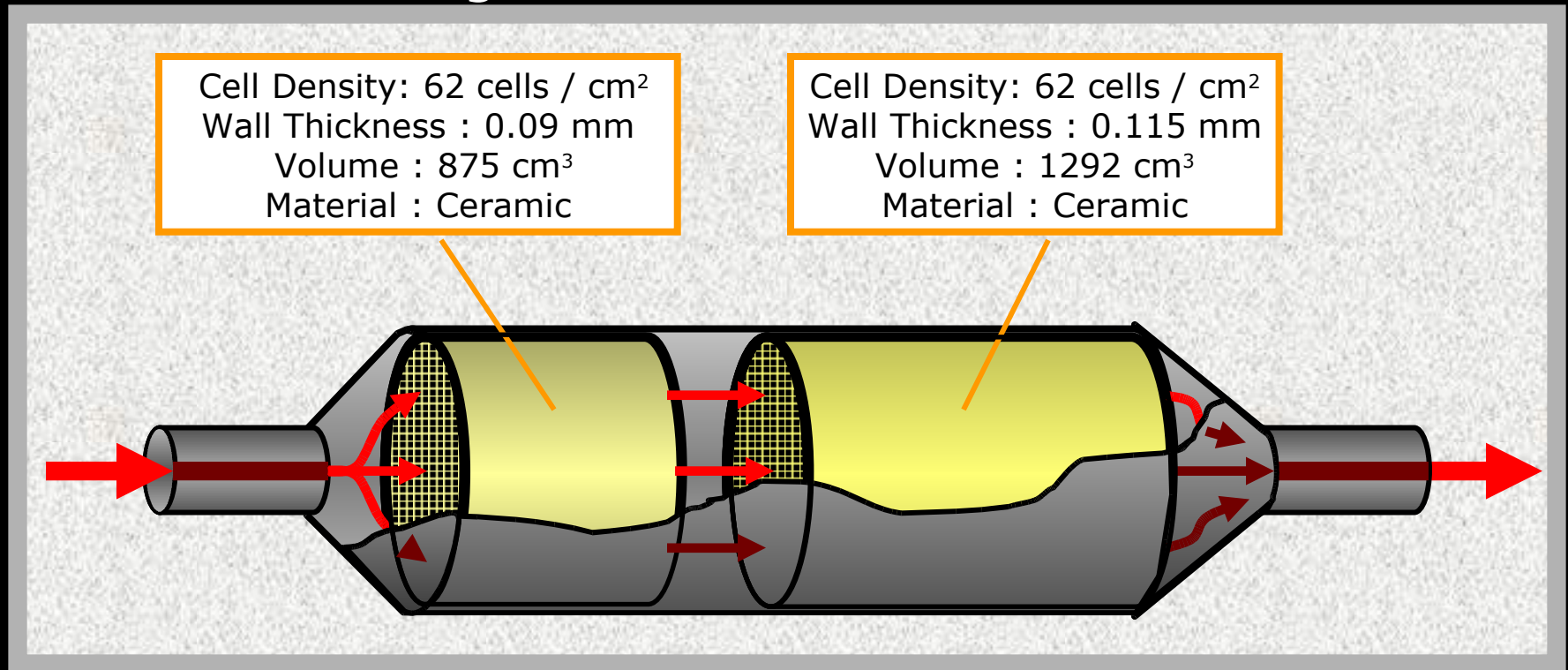
-V

-

## ■ Intake and Exhaust System

- Catalytic Converter

- Tandem type catalytic converter is used to meet STEP II regulation



# 3RZ-FE Engine (Unleaded)

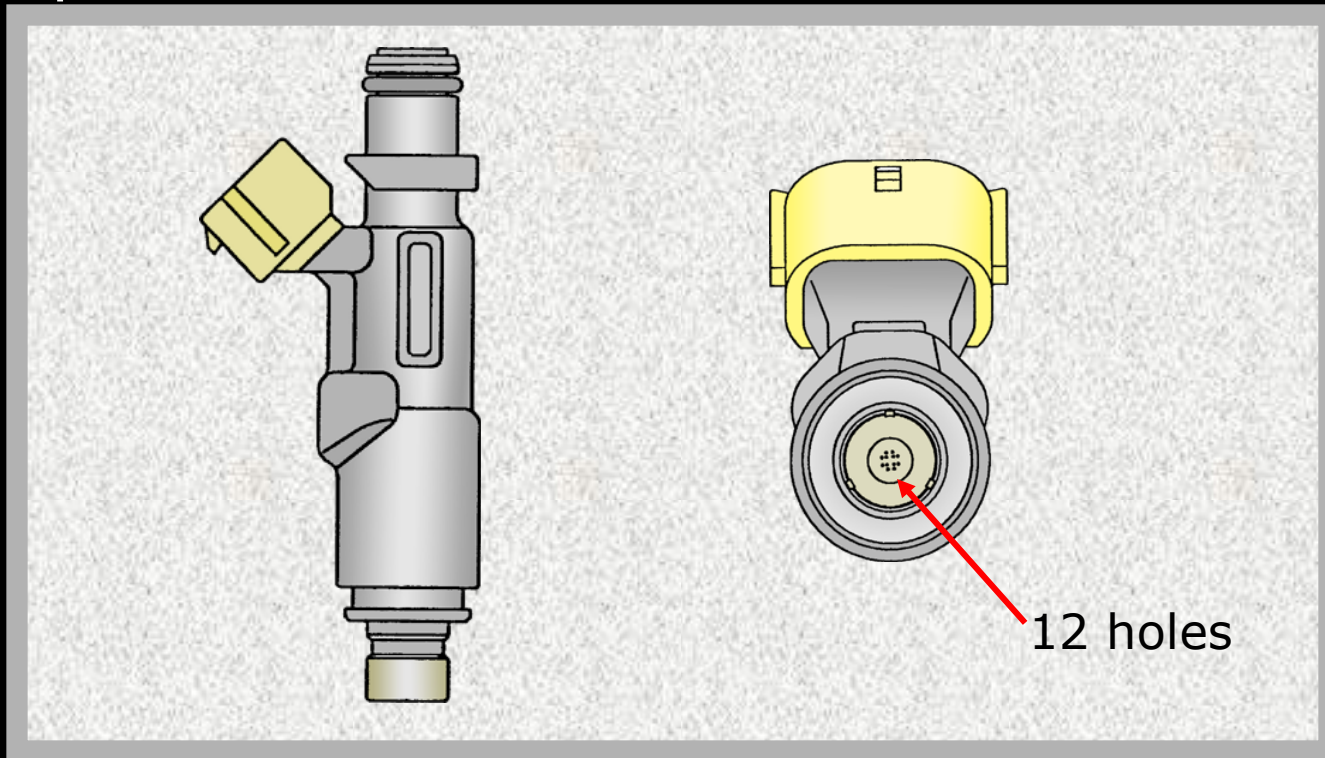
-Q

-V

-

## ■ Fuel System

- Injector (only unleaded gasoline engine)
  - Compact 12-hole type injector is used to improve the atomization of fuel





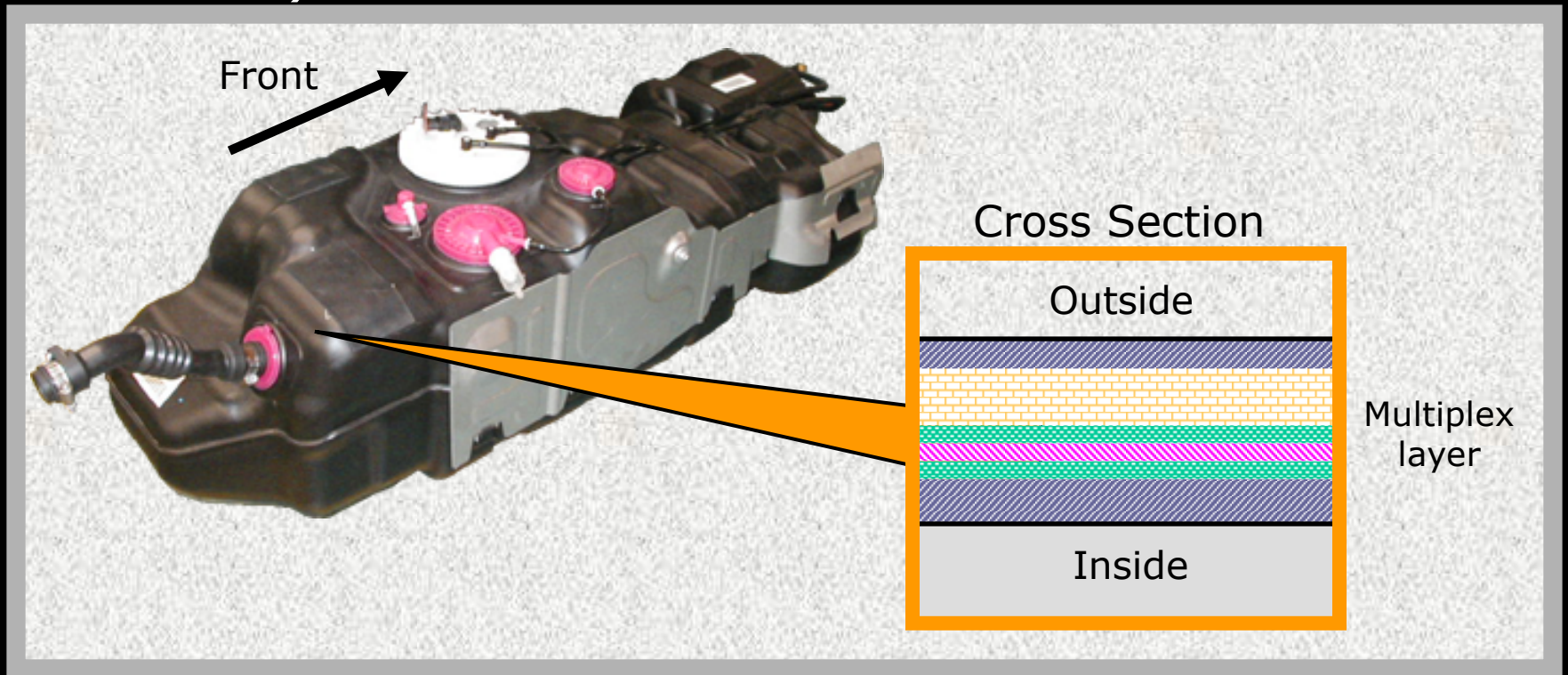
# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Fuel System

### • Fuel Tank

- Multiplex layer plastic made type fuel tank (main tank) is used for 5 door model



# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Fuel System

- Fuel Tank Cap

- Quick-type fuel tank cap has been adopted to improve usability

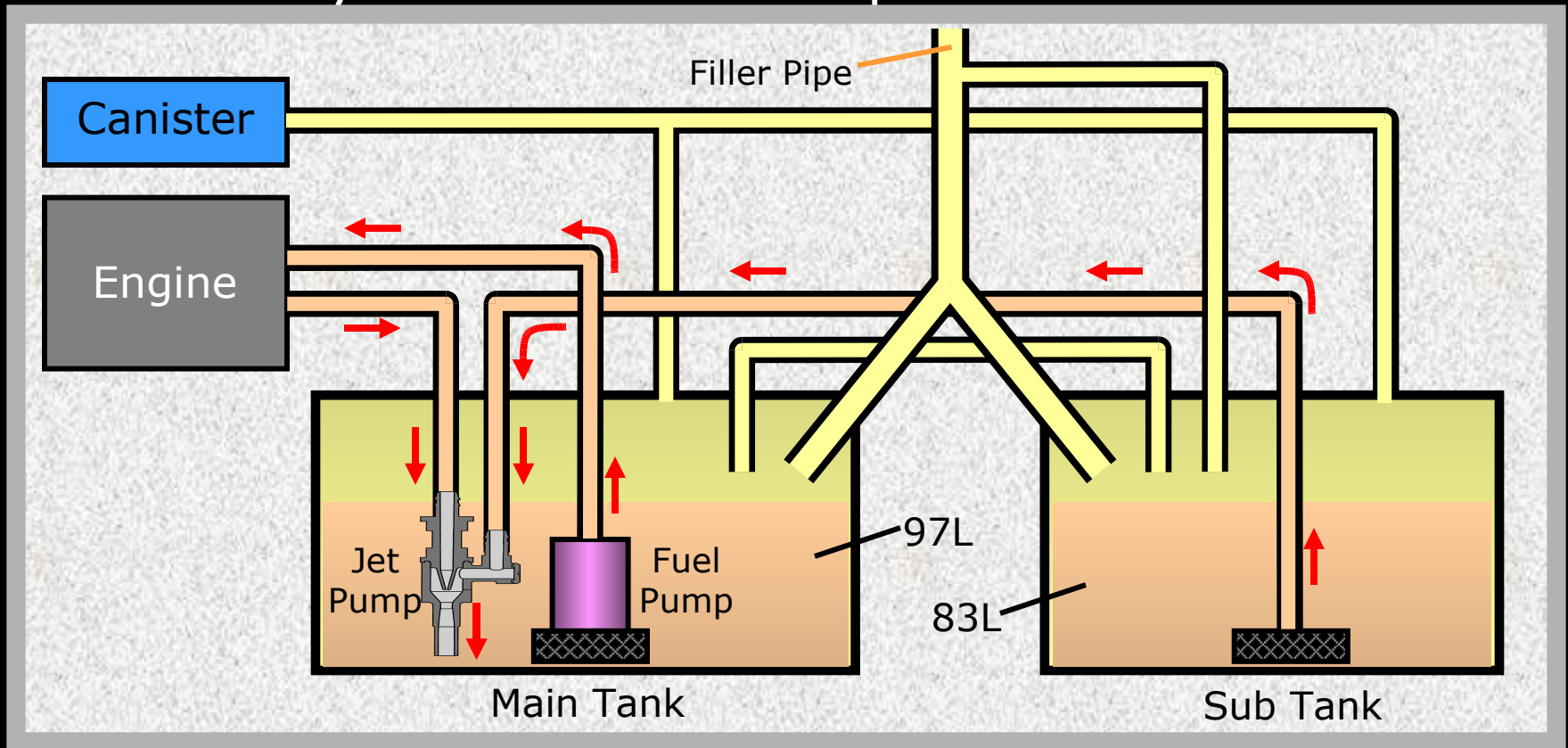


# 3RZ-FE Engine (Leaded)



## ■ Fuel System

- Dual Fuel Tank System with Jet Pump
  - This system become simple

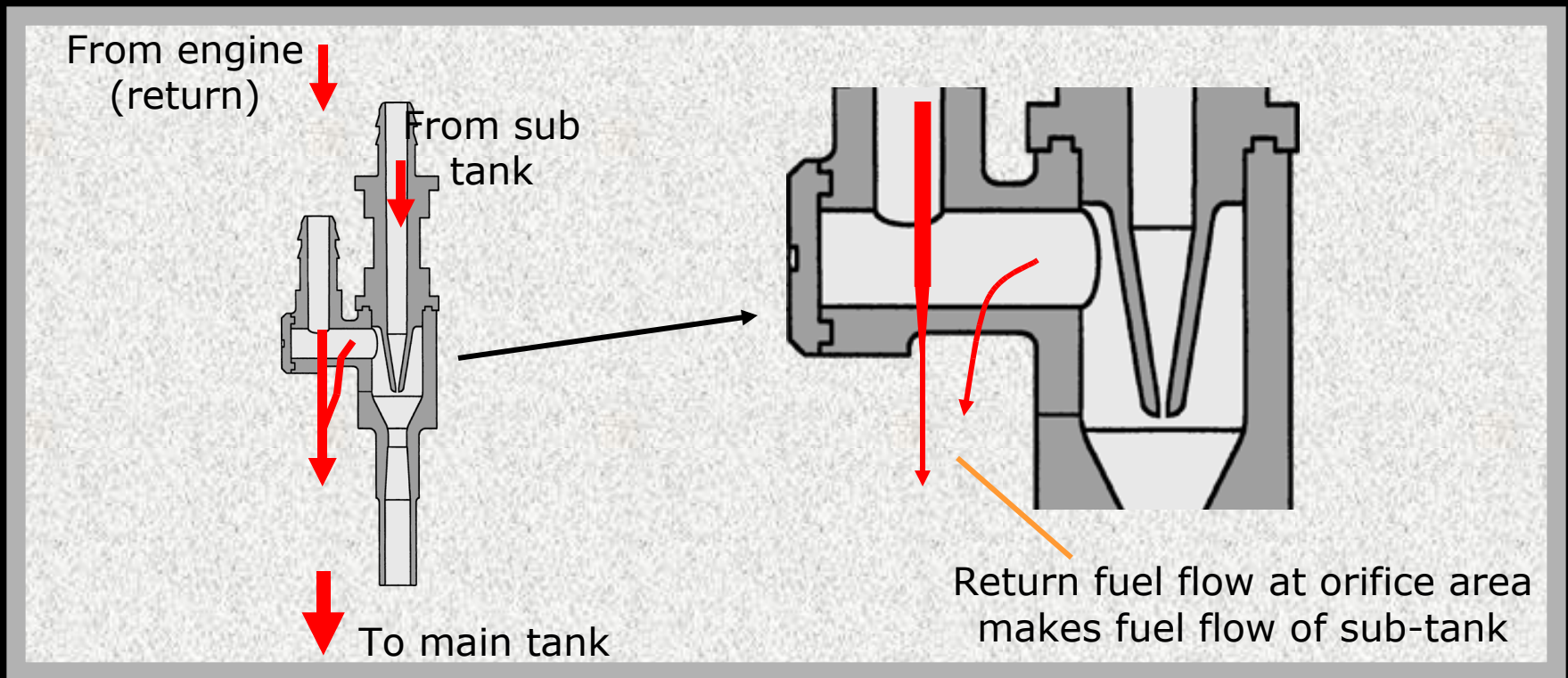


# 3RZ-FE Engine (Leaded)



## ■ Fuel System

- Dual Fuel Tank System with Jet Pump
  - A jet pump is provided to transfer the fuel from sub tank to main tank



# 3RZ-FE Engine (Unleaded)

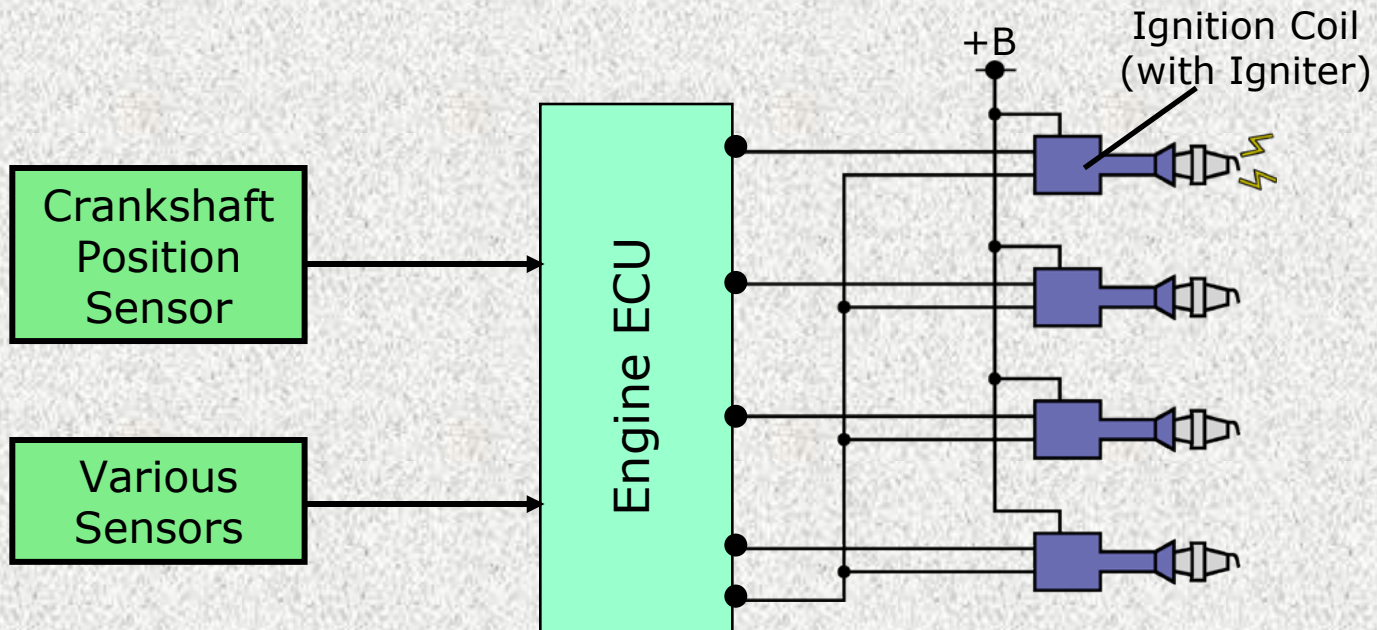
-Q

-V

-

## ■ Ignition System

- DIS (Direct Ignition System)
  - Independent ignition system



# 3RZ-FE Engine

-Q

-V

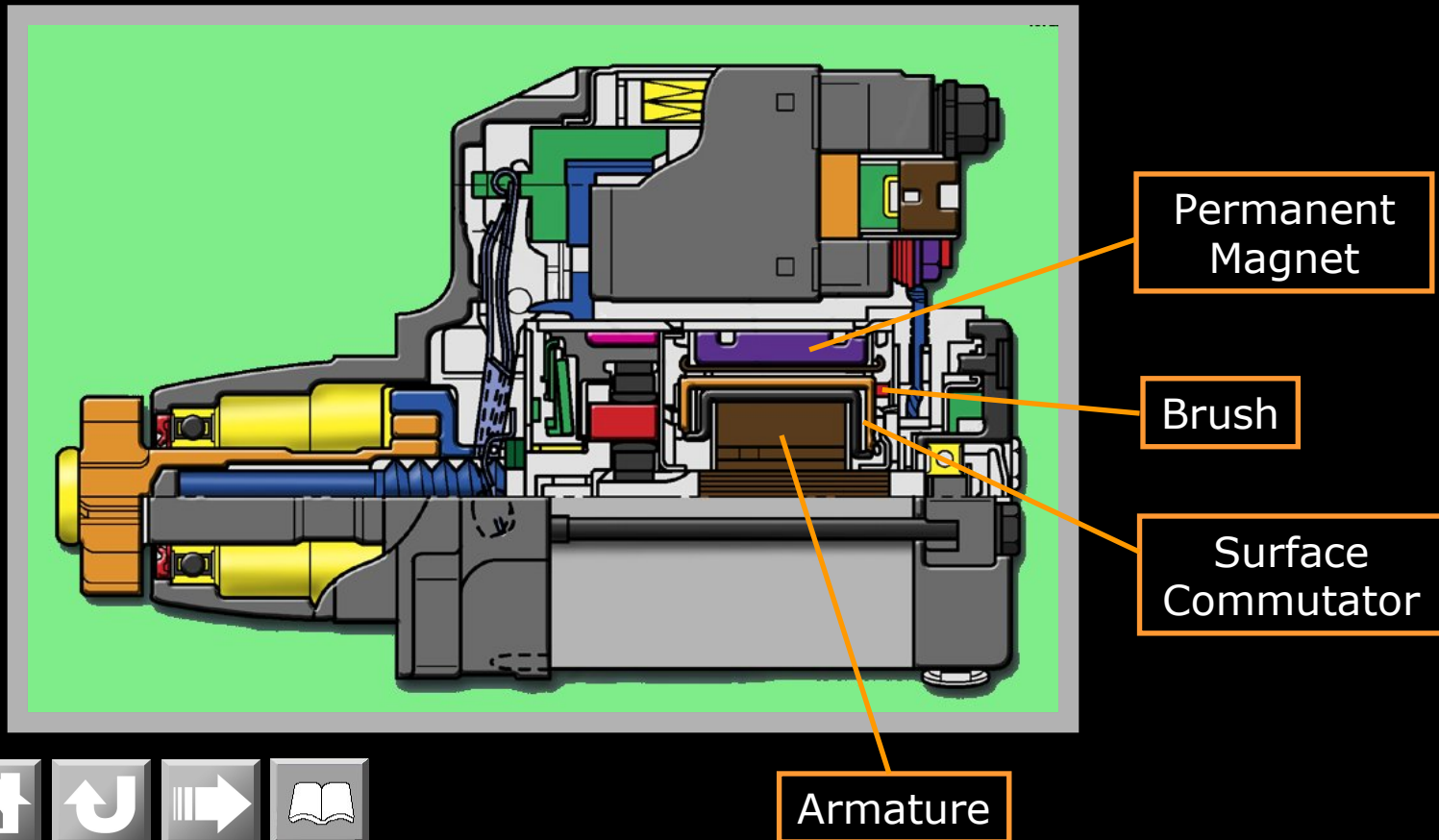
-

## ■ Starting System

### • PS Starter

(Planetary reduction-Segment conductor motor)

– Compact and lightweight PS starter





# Reference

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

- Starting System
  - PS Starter
    - Specification

| Model          | PS Starter<br>(New Model) | RA Starter<br>(Previous Model) |
|----------------|---------------------------|--------------------------------|
| Length         | <b>128 mm (5.04 in.)</b>  | 145 mm (5.71 in.)              |
| Weight         | <b>2,800 g</b>            | 3,350 / 3,600 g                |
| Rating Voltage | <b>12V</b>                | 12V                            |
| Rating Output  | <b>1.6 kW</b>             | 1.2 kW / 1.4 kW                |



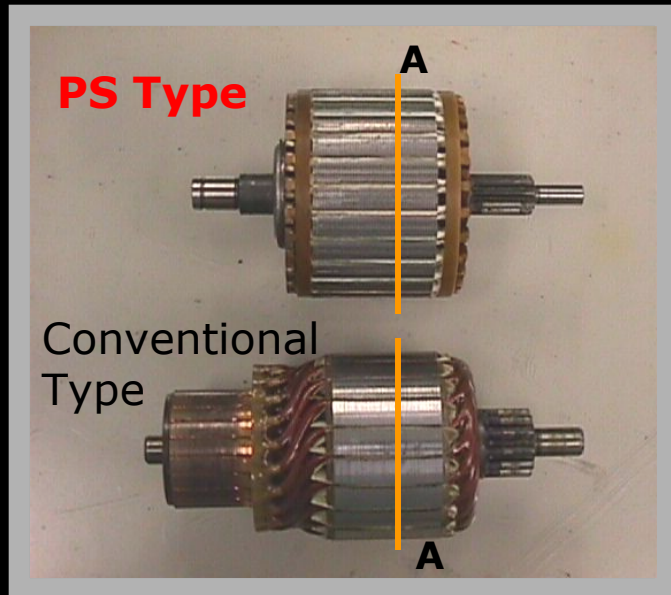
# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Starting System

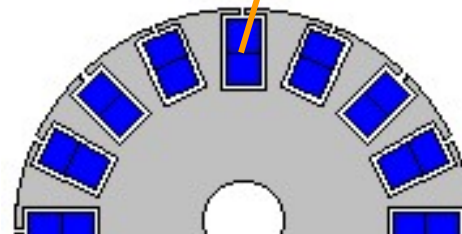
- PS Starter

- Armature uses square-shaped conductor to improve output torque

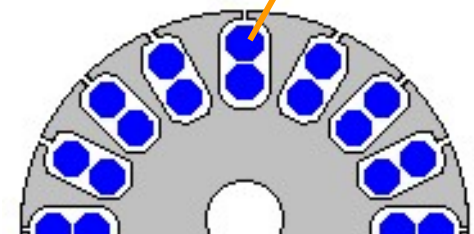


Square-shaped Conductor

Round-shaped Conductor



PS Type



Conventional Type

A – A Cross Section

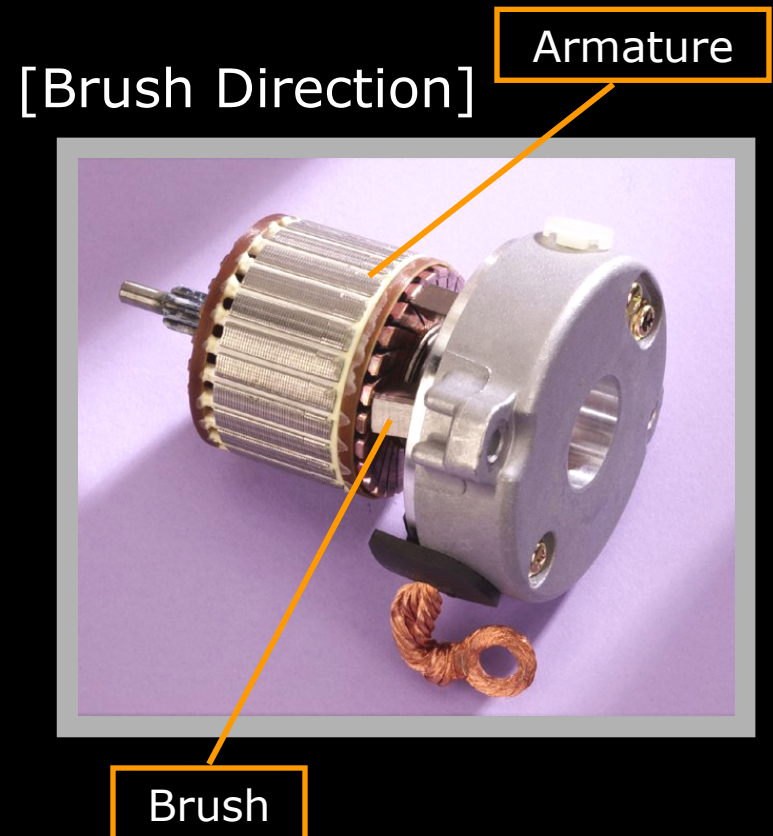
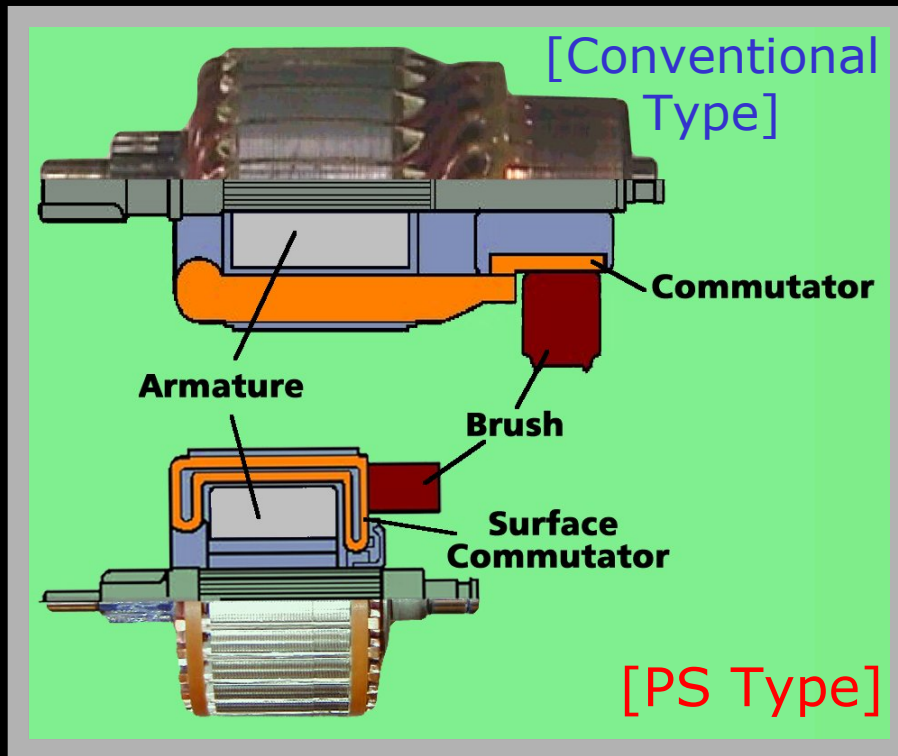


# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Starting System

- PS Starter
  - Armature commutator changed to minimize overall length



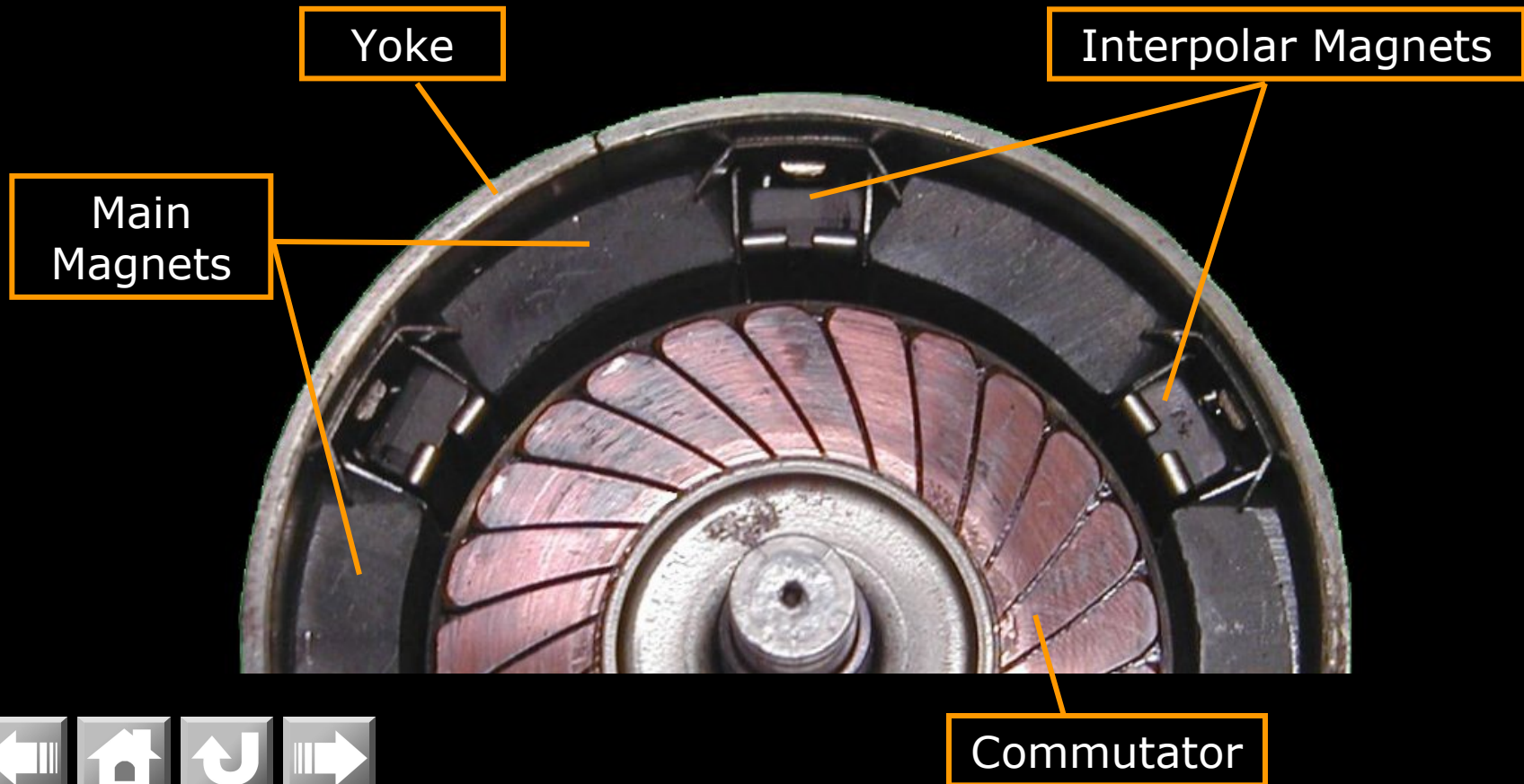
# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Starting System

### • PS Starter

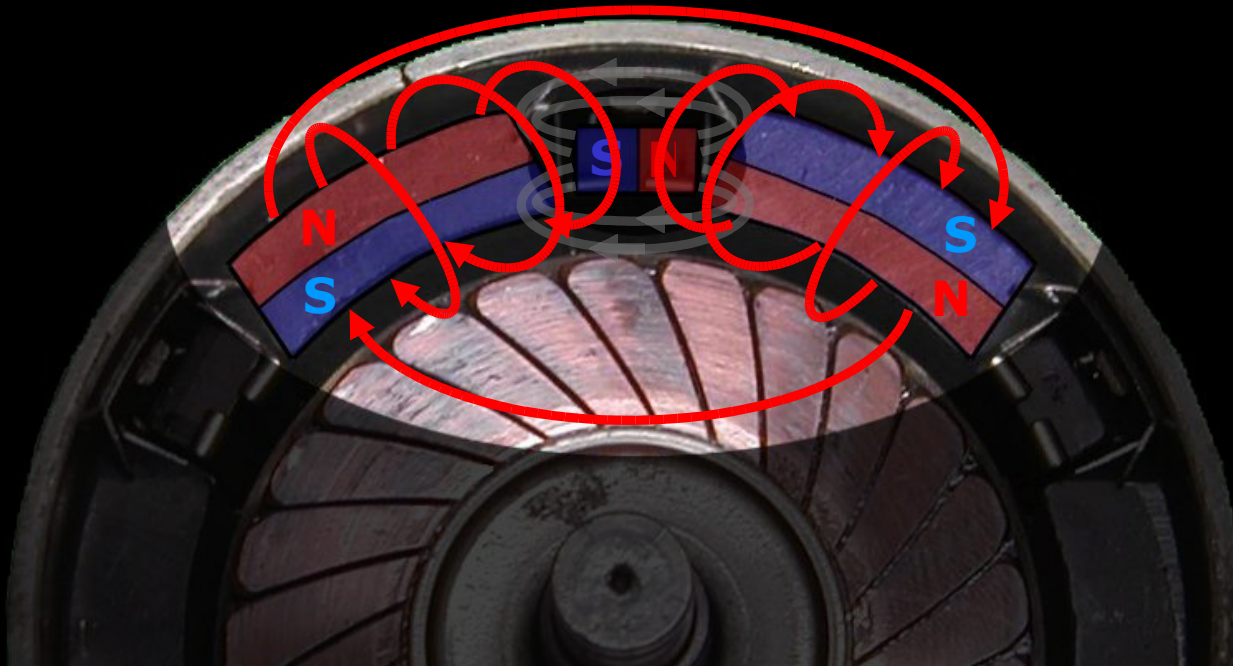
- Permanent magnets are used in place of field coil in conventional type



# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

- Starting System
  - PS Starter
    - Magnetic flux of main magnets

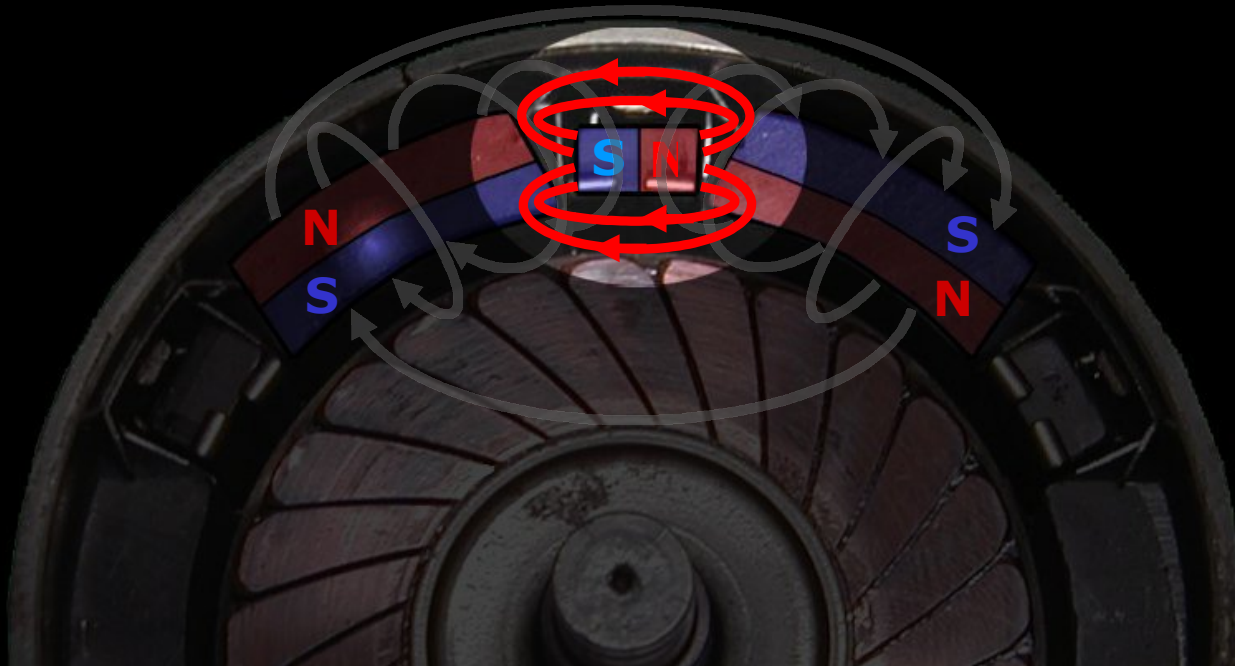




# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

- Starting System
  - PS Starter
    - Magnetic flux of interpolar magnet

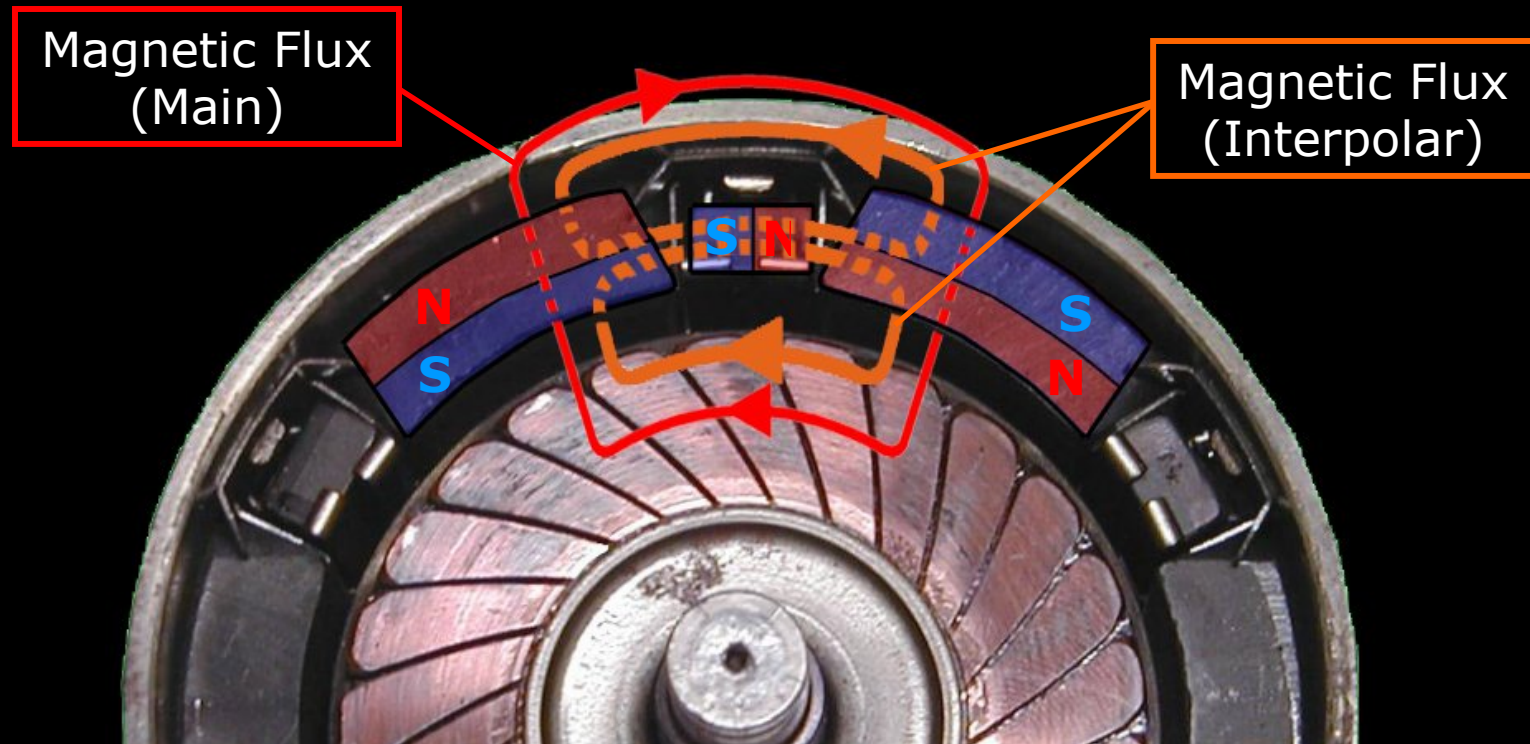




# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

- Starting System
  - PS Starter
    - Total Magnetic flux



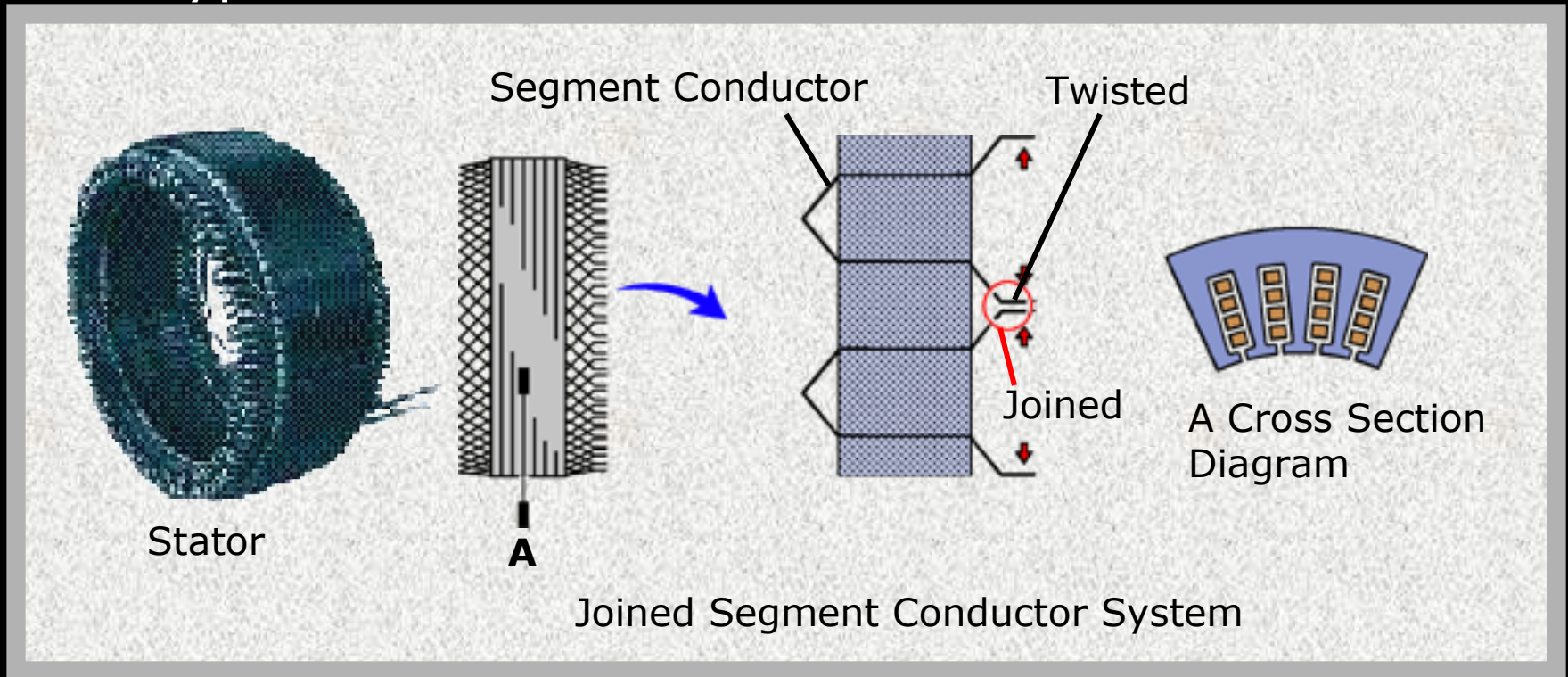
# 3RZ-FE Engine

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Charging System

### • Alternator

- Compact and lightweight Segment Conductor type alternator is used



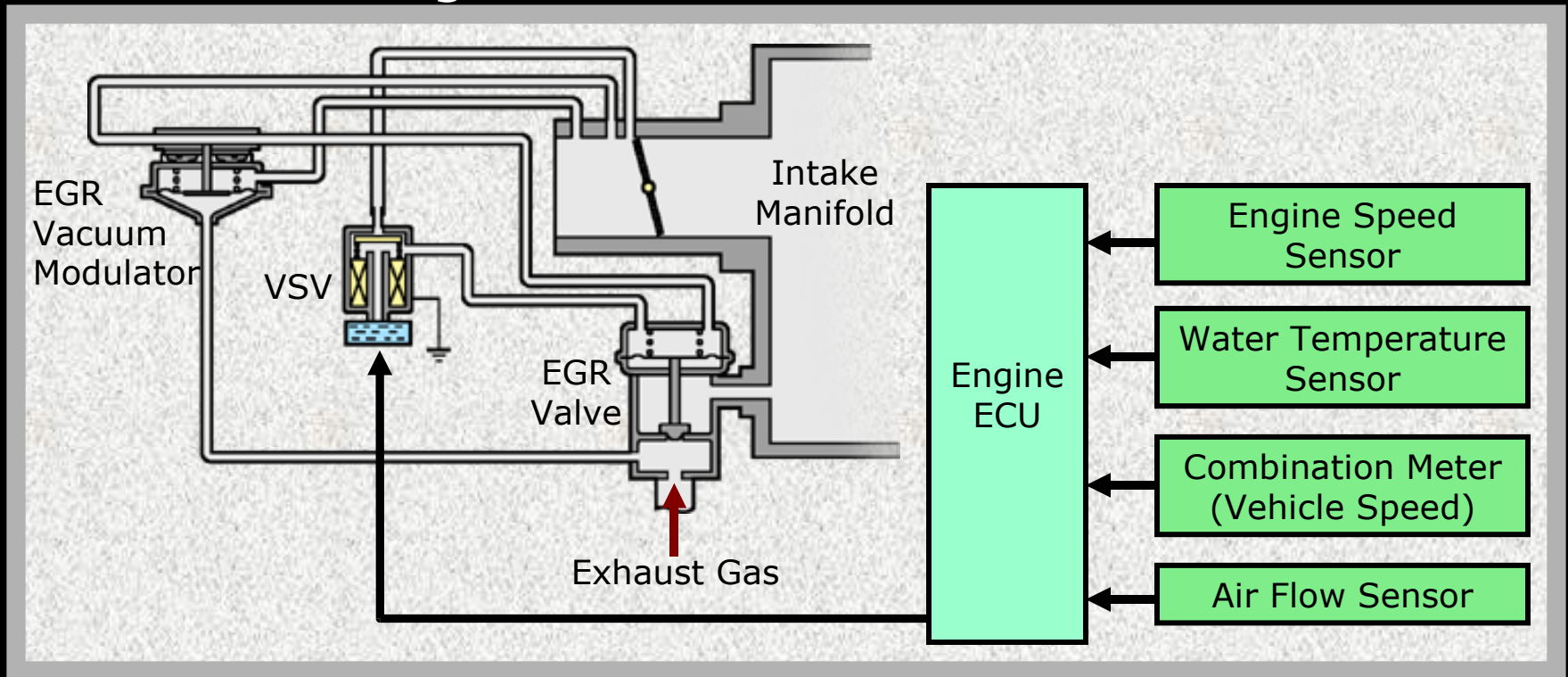
# 3RZ-FE Engine (Unleaded)

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Engine Control System

### • EGR System

- This system is used to comply the European STEPII regulations



# 3RZ-FE Engine (Leaded)



- Engine Control System
  - Evaporative Emission Control System
    - This system is discontinued in order to make a system simple

The Canister and VSV (for Evap) are discontinued



# 3RZ-FE Engine (Leaded)

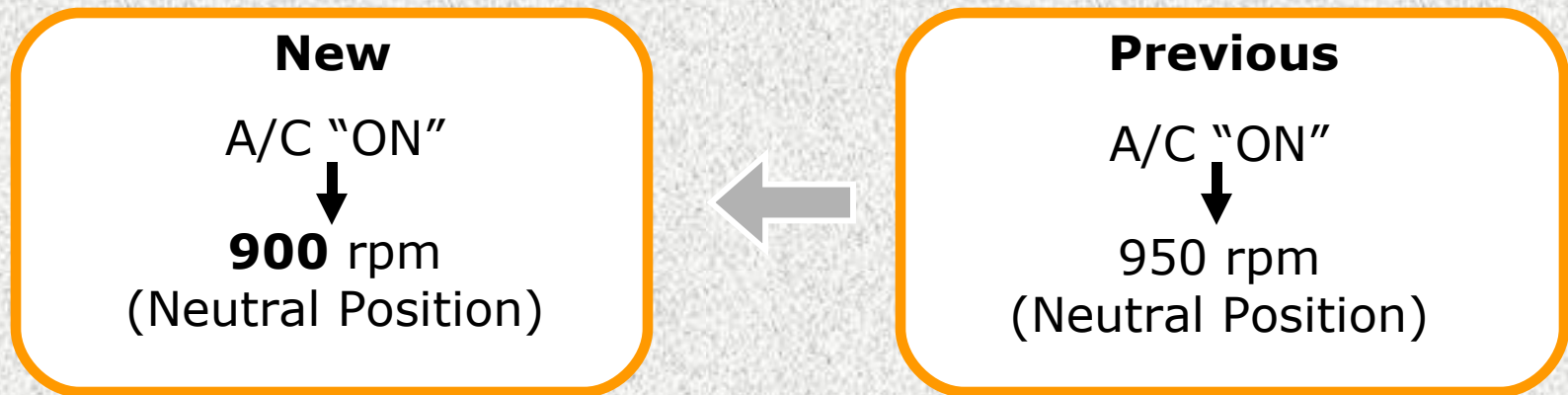


## ■ Engine Control System

- Idle Speed

- The idle speed at A/C operation is lowered for fuel economy

### Idle Speed



# 3RZ-FE Engine

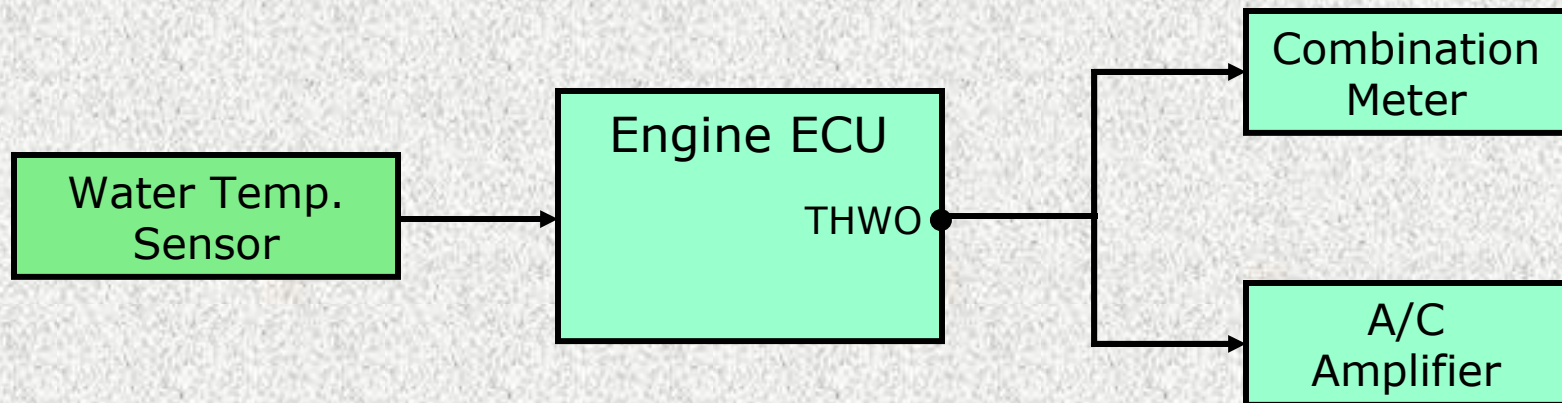
|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Engine Control System

- Signal Output

- A water temp. signal is commonly used in engine ECU, combination meter and A/C amplifier

Water temp. sender gauge for meter indication is discontinued





# 3RZ-FE Engine (Unleaded)

|  |    |    |   |
|--|----|----|---|
|  | -Q | -V | - |
|--|----|----|---|

## ■ Engine Control System

### • Diagnosis

- To comply with the OBD-II regulations, all the DTCs have been made to correspond to SAE (Society of Automotive Engineers, inc.) controlled codes. Some of DTCs have been assigned to them.

### Example

#### Old DTC

| DTC   | Detection Item                         |
|-------|----------------------------------------|
| P1215 | Injector Circuit / Open - (Cylinder 1) |



#### New DTC

| DTC   | Detection Item                         |
|-------|----------------------------------------|
| P0201 | Injector Circuit / Open - (Cylinder 1) |



# 1KD-FTV Engine

-W

- Engine Overall
- Engine Proper
- Valve Mechanism
- Lubrication System
- Intake & Exhaust System
- Fuel System
- Charging System
- Engine Cover
- Engine Control System



# 1KD-FTV Engine

-W

- Engine Overall
  - Engine Specification

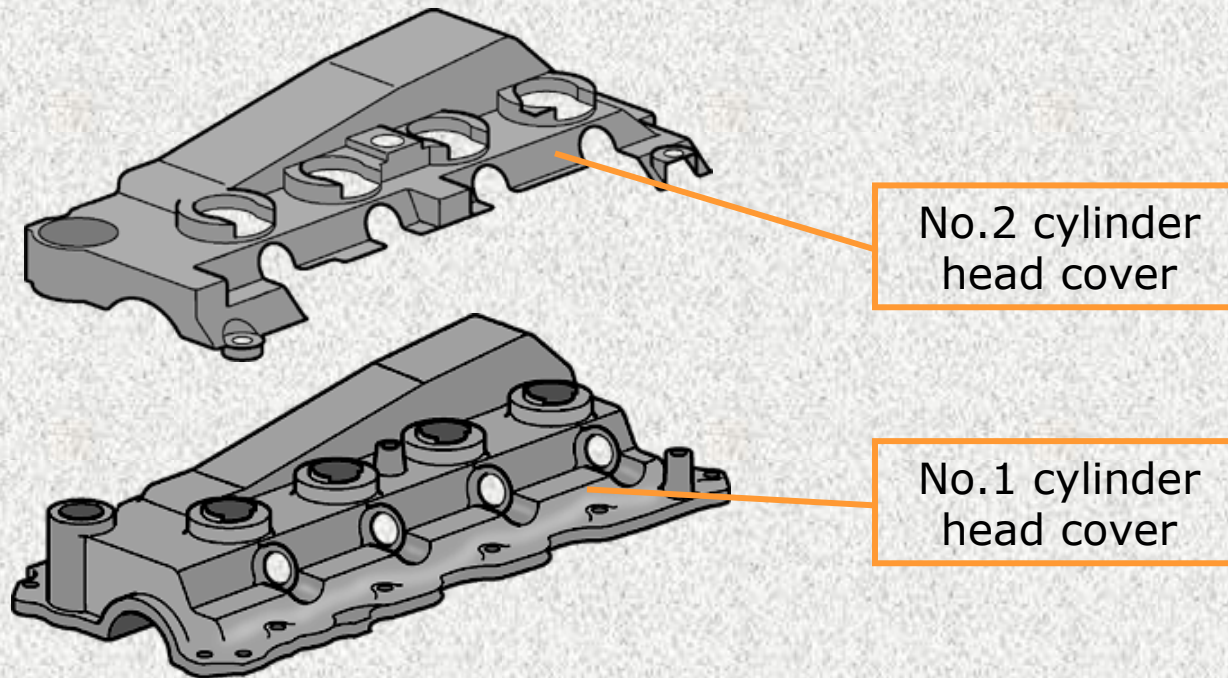
| Item                                                    | New                            | Previous |
|---------------------------------------------------------|--------------------------------|----------|
| No. of Cylinders and Arrangement                        | 4-Cylinder, In-line            | ←        |
| Valve Mechanism                                         | 16-Valve DOHC, Gear/Belt Drive | ←        |
| Combustion Chamber                                      | Direct Injection Type          | ←        |
| Manifolds                                               | Cross-Flow                     | ←        |
| Fuel System                                             | Common-rail Type               | ←        |
| Displacement                  cm <sup>3</sup> (cu. in.) | 2982 (181.9)                   | ←        |
| Bore x stroke                      mm (in.)             | 96 x 103 (3.78 x 4.06)         | ←        |
| Compression Ratio                                       | 18.4 : 1                       | ←        |
| Max. Output                      [EEC]                  | 120 kW @ 3400 rpm              | ←        |
| Max. Torque                      [EEC]                  | 343 N·m @ 1600~3200 rpm        | ←        |
| Fuel Cetan Number                                       | 48 or more                     | ←        |
| Oil Grade                                               | CF-4 10W-30                    | ←        |



# 1KD-FTV Engine

|    |  |  |  |
|----|--|--|--|
| -W |  |  |  |
|----|--|--|--|

- Engine Proper
  - Cylinder Head Cover
    - No.2 cylinder head cover is used to reduce engine noise



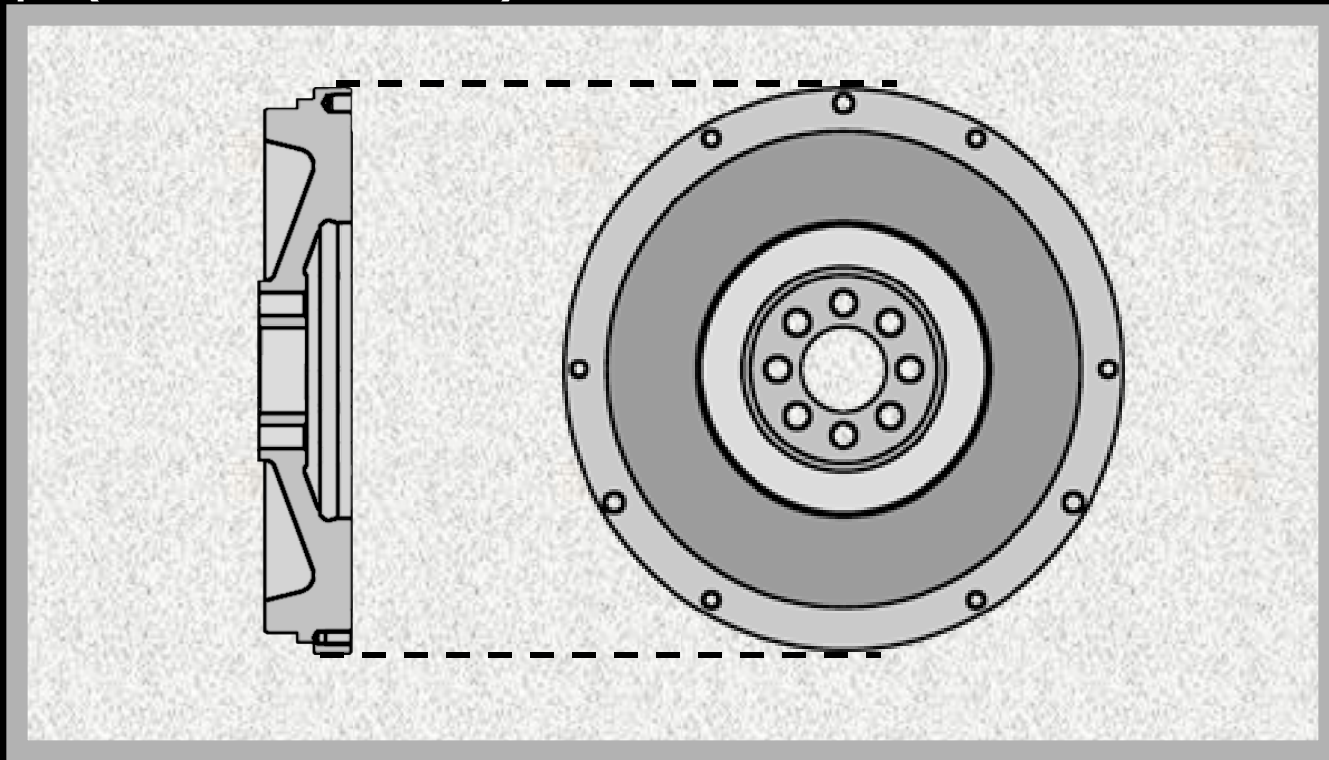
# 1KD-FTV Engine

|    |  |  |  |
|----|--|--|--|
| -W |  |  |  |
|----|--|--|--|

## ■ Engine Proper

- Flywheel

- Flywheel size is increased to meet the clutch size up (10.5" → 11")



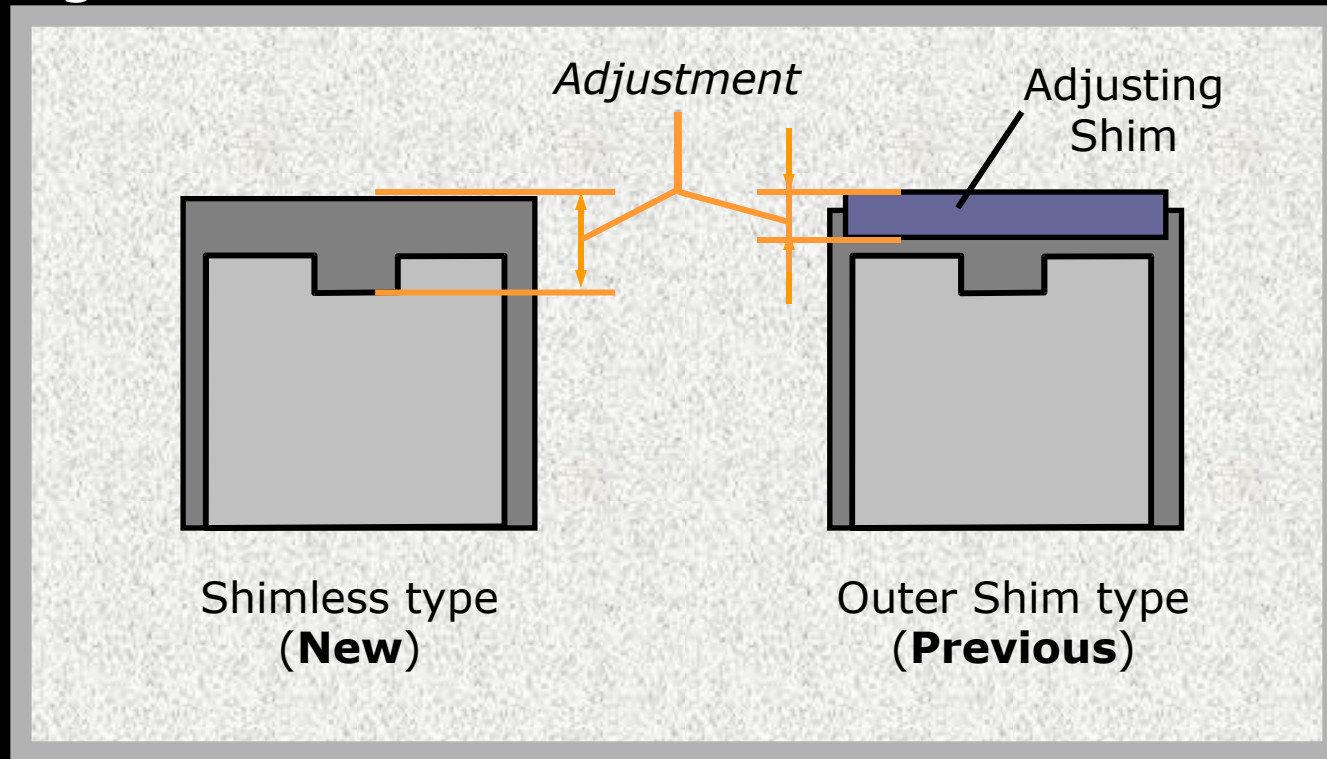
# 1KD-FTV Engine

-W

## ■ Valve Mechanism

### • Valve Lifter

- Shimless type valve lifter enables to makes larger cam contact surface





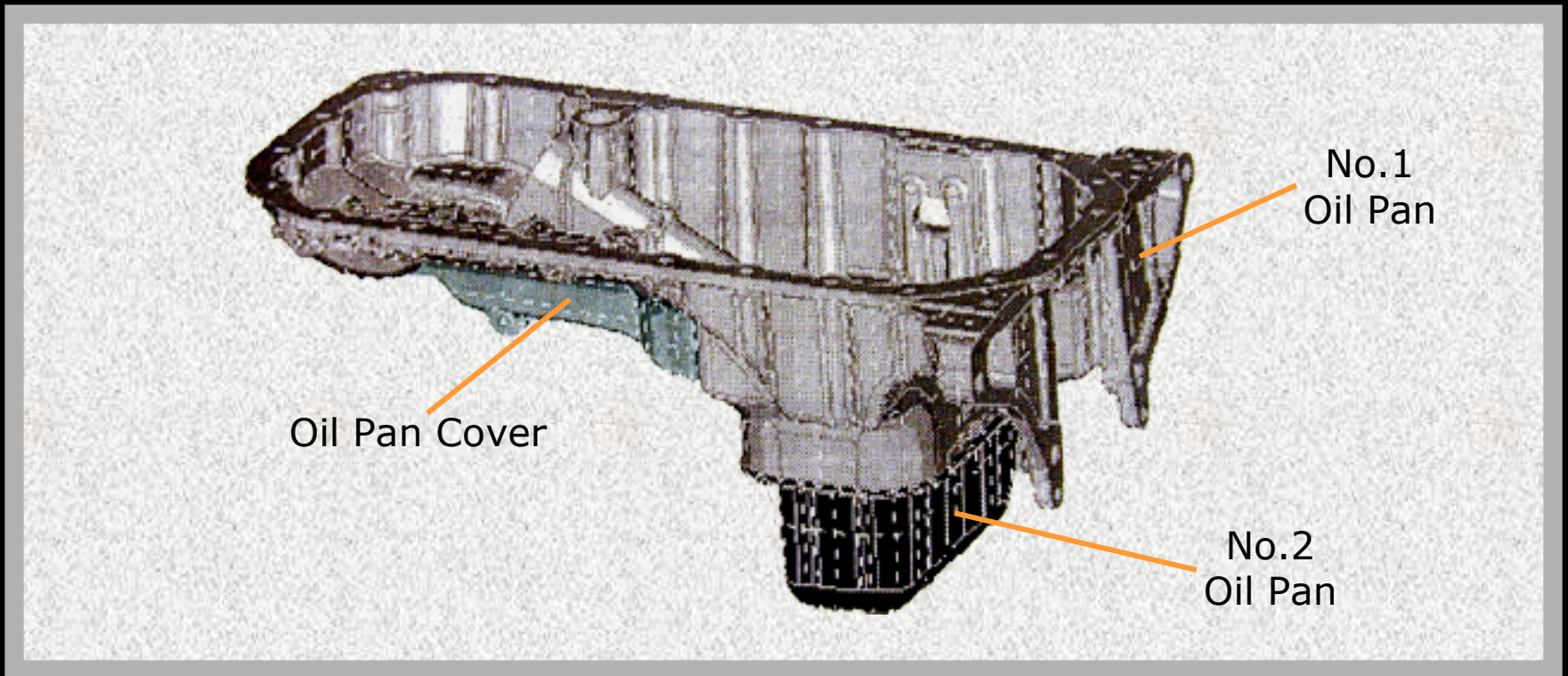
# 1KD-FTV Engine

-W

## ■ Lubrication System

- Oil Pan

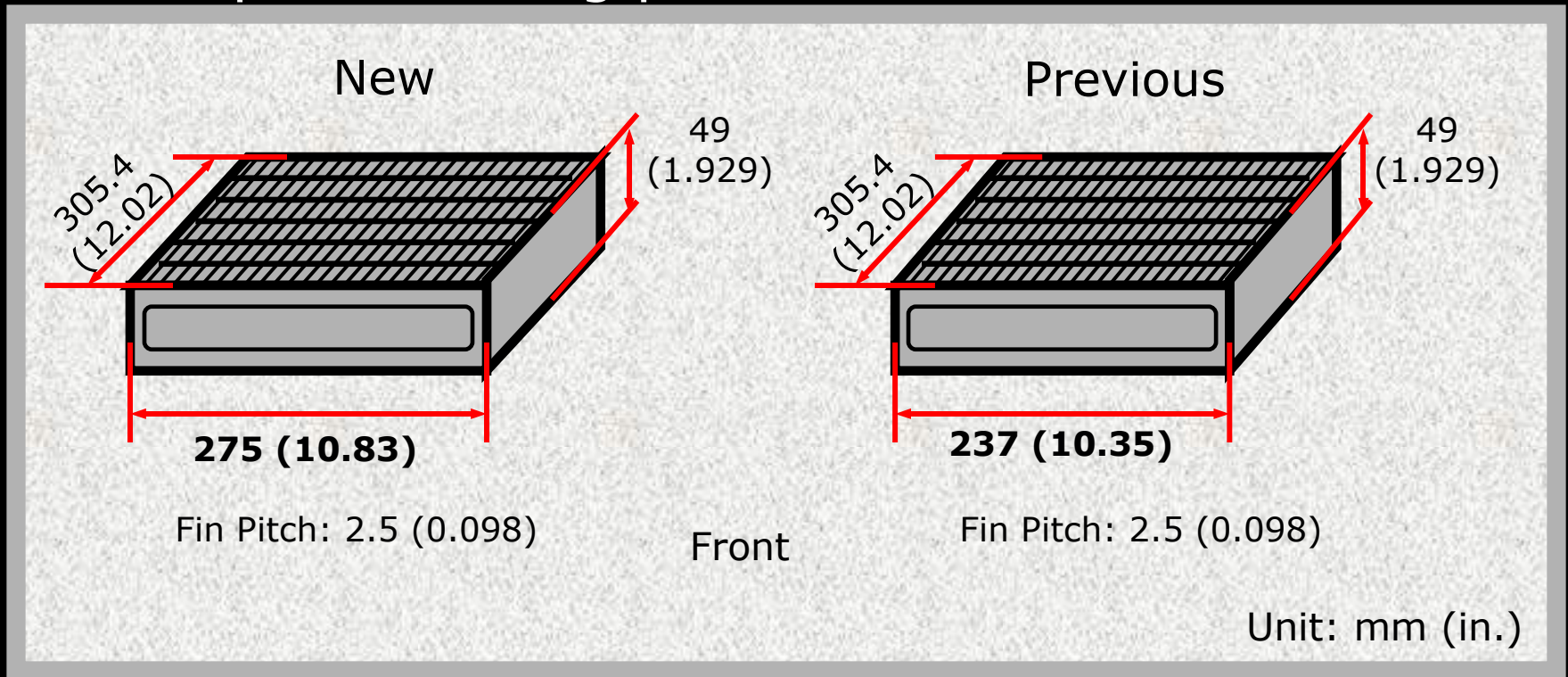
- No.1 oil pan is made of aluminum alloy



# 1KD-FTV Engine

-W

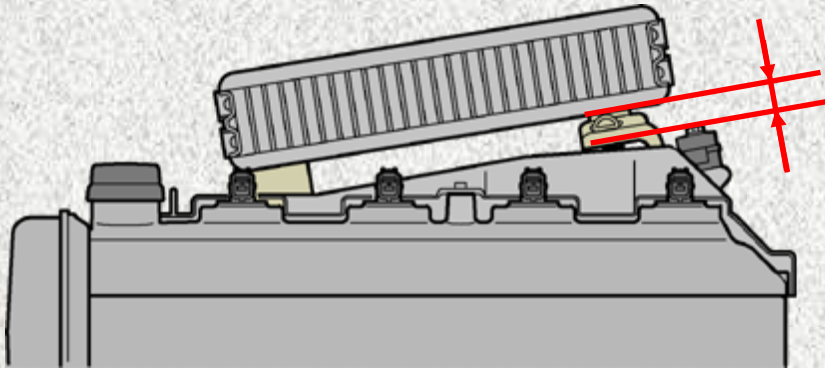
- Intake & Exhaust System
  - Intercooler
    - Intercooler core width size is increased to improve cooling performance



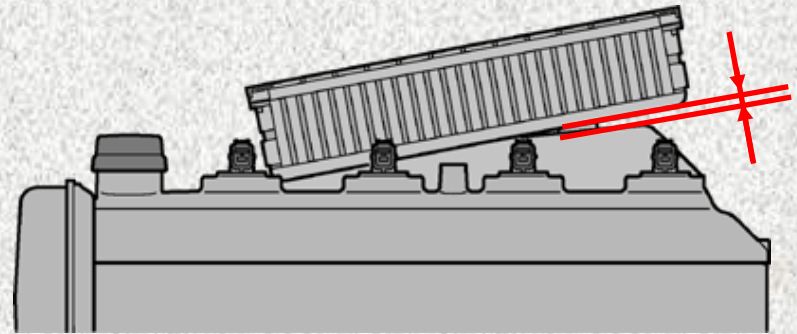
# 1KD-FTV Engine

|    |  |  |  |
|----|--|--|--|
| -W |  |  |  |
|----|--|--|--|

- Intake & Exhaust System
  - Intercooler
    - Intercooler position is changed to upper position to increase cooling performance



New Model



Previous Model

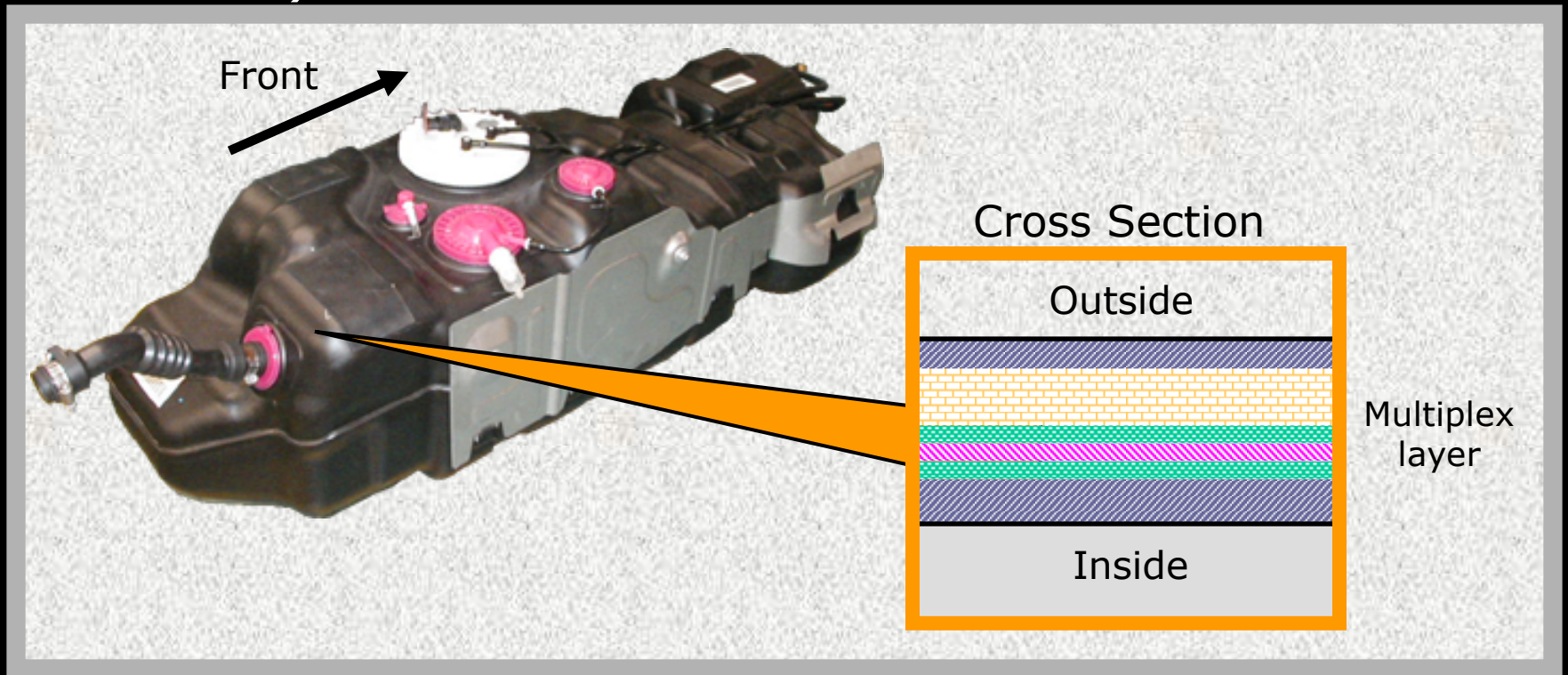
# 1KD-FTV Engine

-W

## ■ Fuel System

### • Fuel Tank

- Multiplex layer plastic made type fuel tank (main tank) is used for 5 door model



# 1KD-FTV Engine

|    |  |  |  |
|----|--|--|--|
| -W |  |  |  |
|----|--|--|--|

## ■ Fuel System

- Fuel Tank Cap

- Quick-type fuel tank cap has been adopted to improve usability





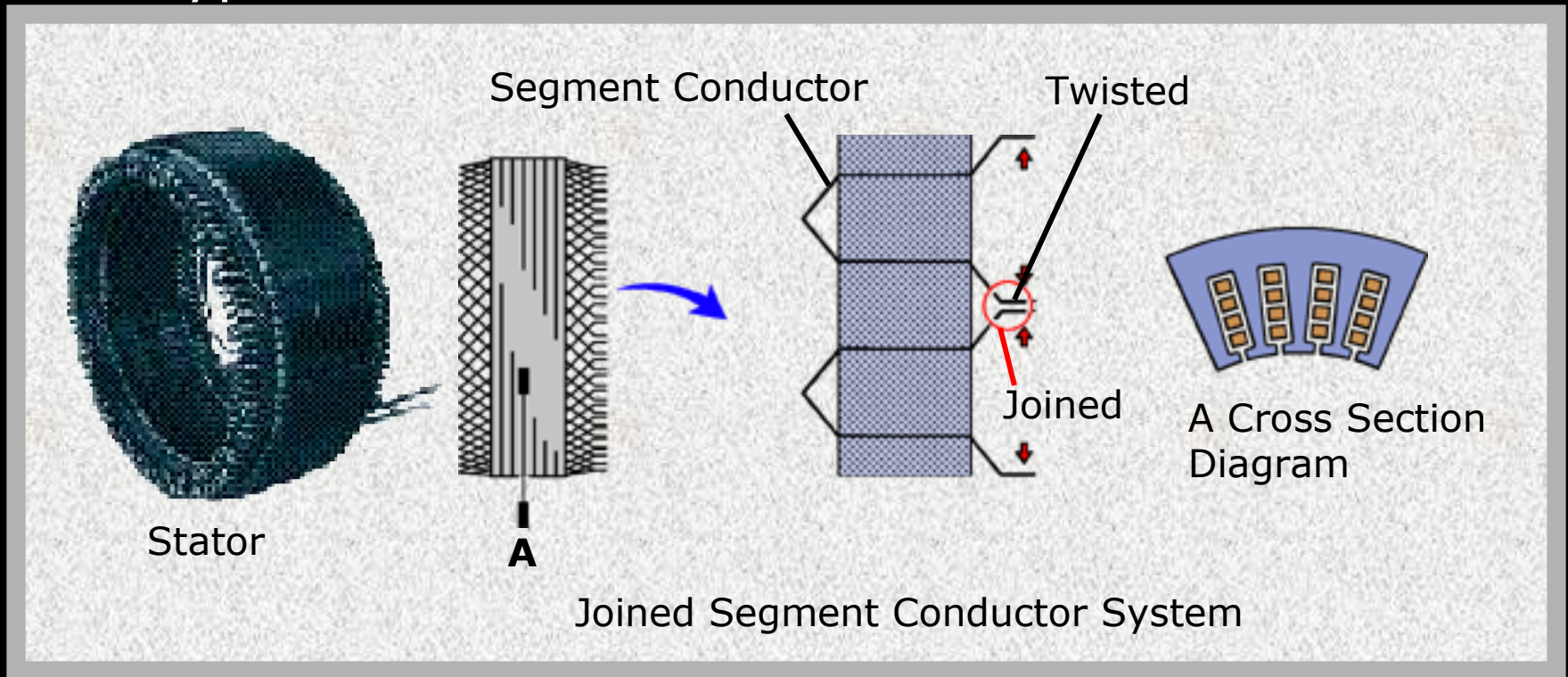
# 1KD-FTV Engine

-W

## ■ Charging System

### • Alternator

- Compact and lightweight Segment Conductor type alternator is used



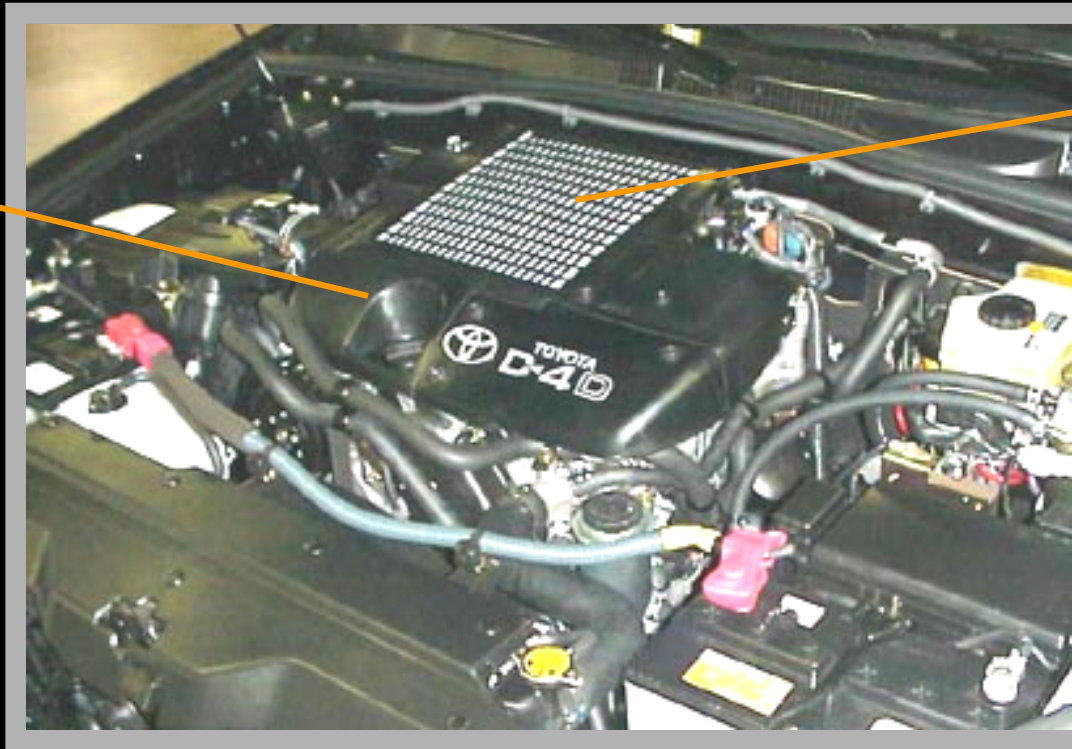


# 1KD-FTV Engine

-W

- Engine Cover
  - Engine Cover
    - Engine cover is adopted to reduce engine noise and to protect intercooler

Engine Cover



Intercooler

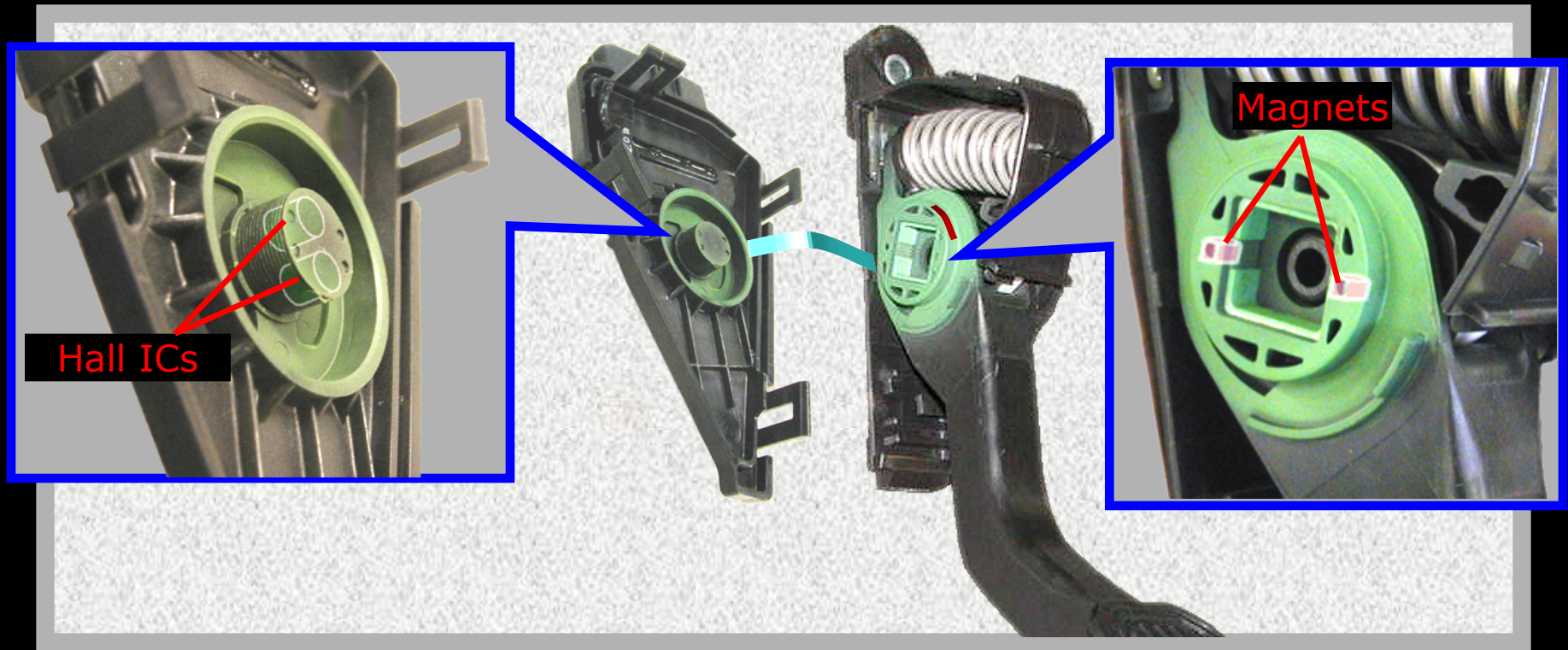
# 1KD-FTV Engine

-W

## ■ Engine Control System

- ETCS-i

- A no-contact type accelerator pedal position sensor is used



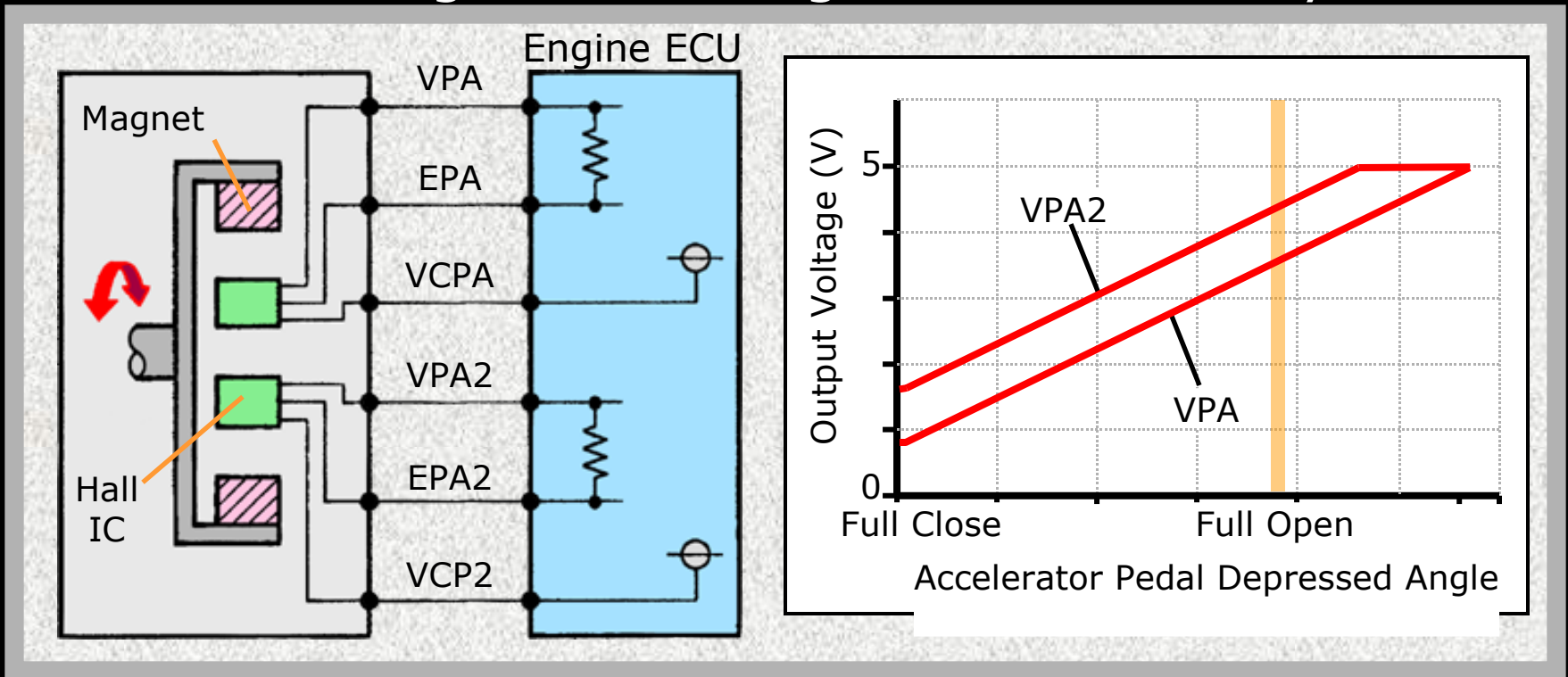
# 1KD-FTV Engine

-W

## ■ Engine Control System

- ETCS-i

- Accelerator pedal position sensor converts into electric signals the magnetic flux density



# Service Point

|    |  |  |  |
|----|--|--|--|
| -W |  |  |  |
|----|--|--|--|

## ■ Engine Control System

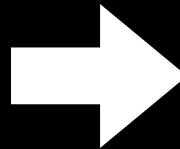
- ETCS-i

- Inspection of the accelerator pedal position sensor is discontinued from the contact type

### Contact type

#### *Inspection*

- Accelerator Pedal Position Sensor  
VC ↔ E2 : 1.64 – 3.28 kΩ  
at 20°C (68 °F)



### No-contact type

#### *Inspection*

- Accelerator Pedal Position Sensor  
None

The accelerator pedal position sensor can not be inspected



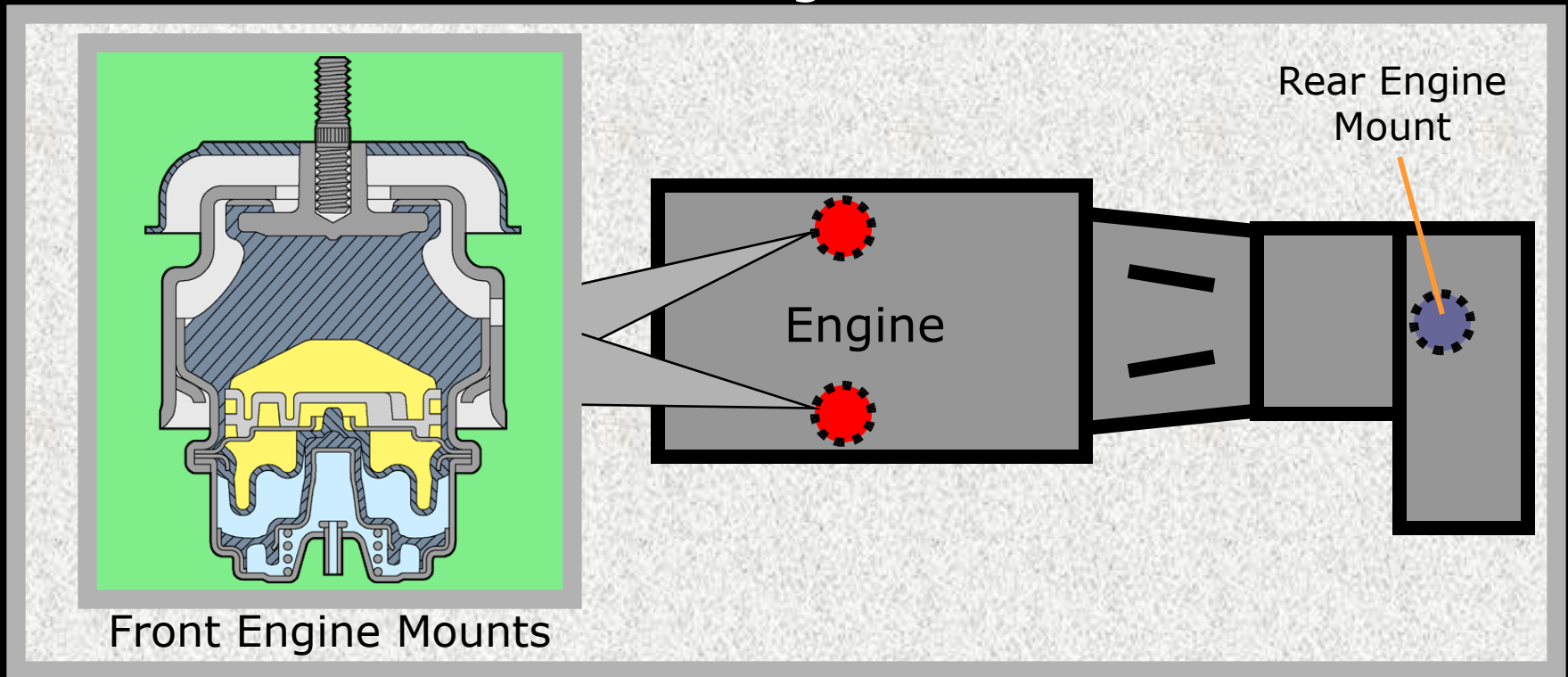
# 1KD-FTV Engine

-W

## ■ Engine Control System

- Engine Mount Control

- The electrical hydraulic type engine mounts are used to reduce the engine vibration

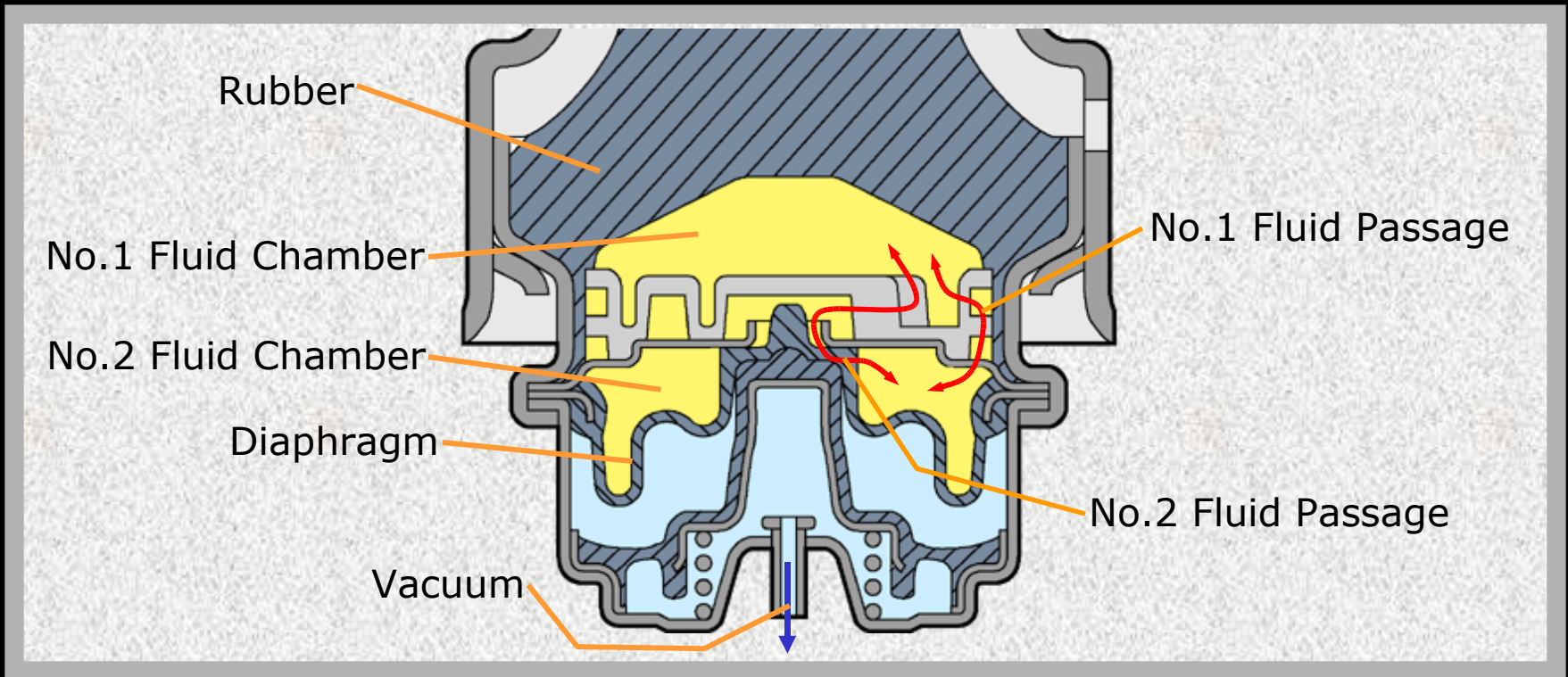




# 1KD-FTV Engine

-W

- Engine Control System
  - Engine Mount Control
    - There are two passages between No1. fluid chamber and No2. fluid chamber

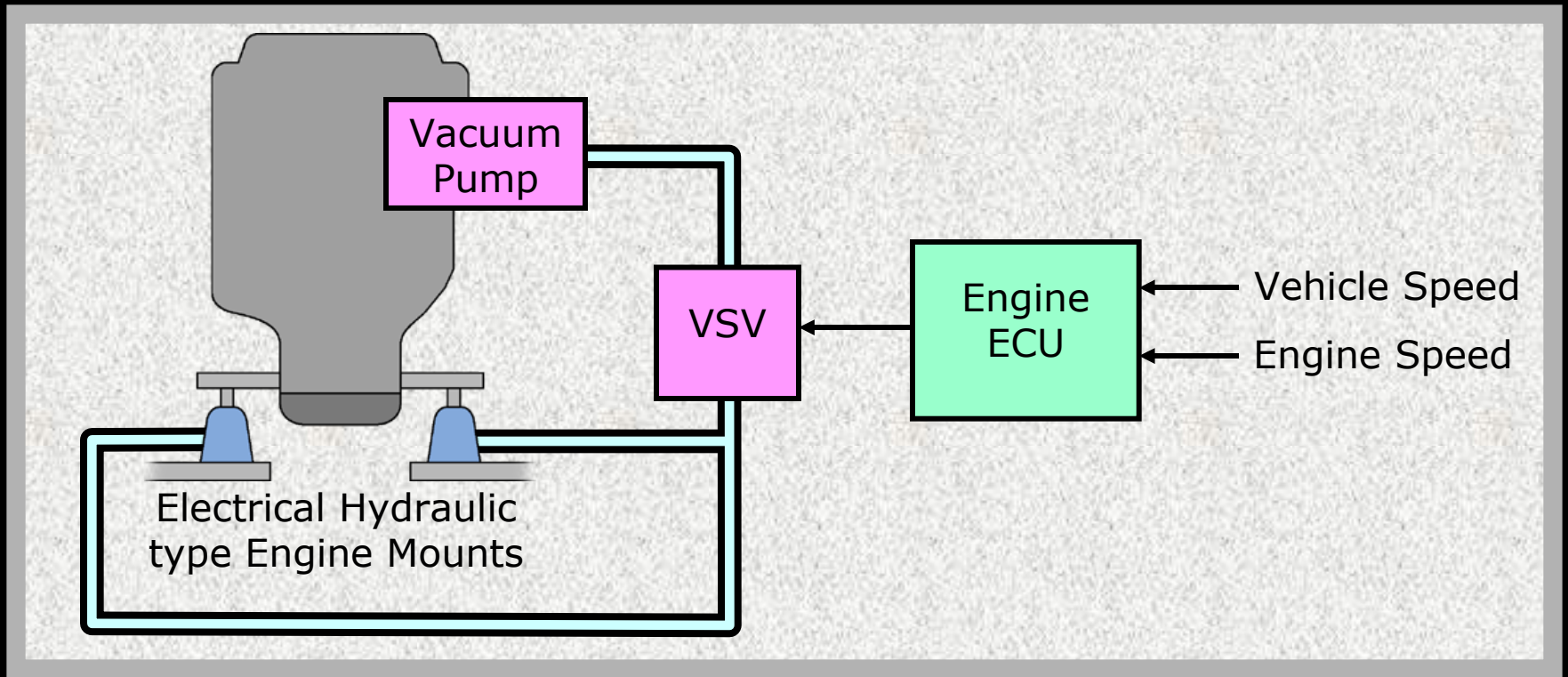




# 1KD-FTV Engine

-W

- Engine Control System
  - Engine Mount Control
    - System Diagram



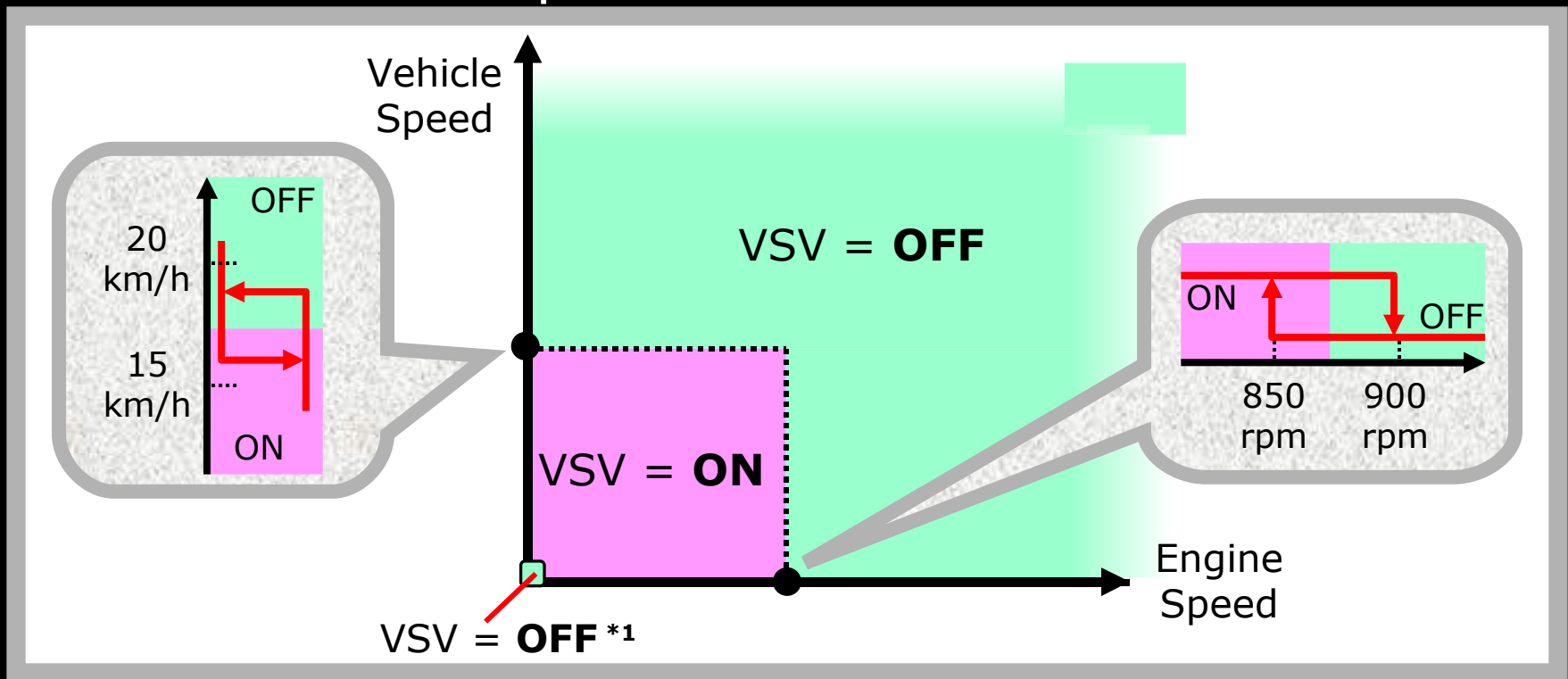
# 1KD-FTV Engine

-W

## ■ Engine Control System

### • Engine Mount Control

- The VSV is turned ON, when the engine speed and vehicle speed is low



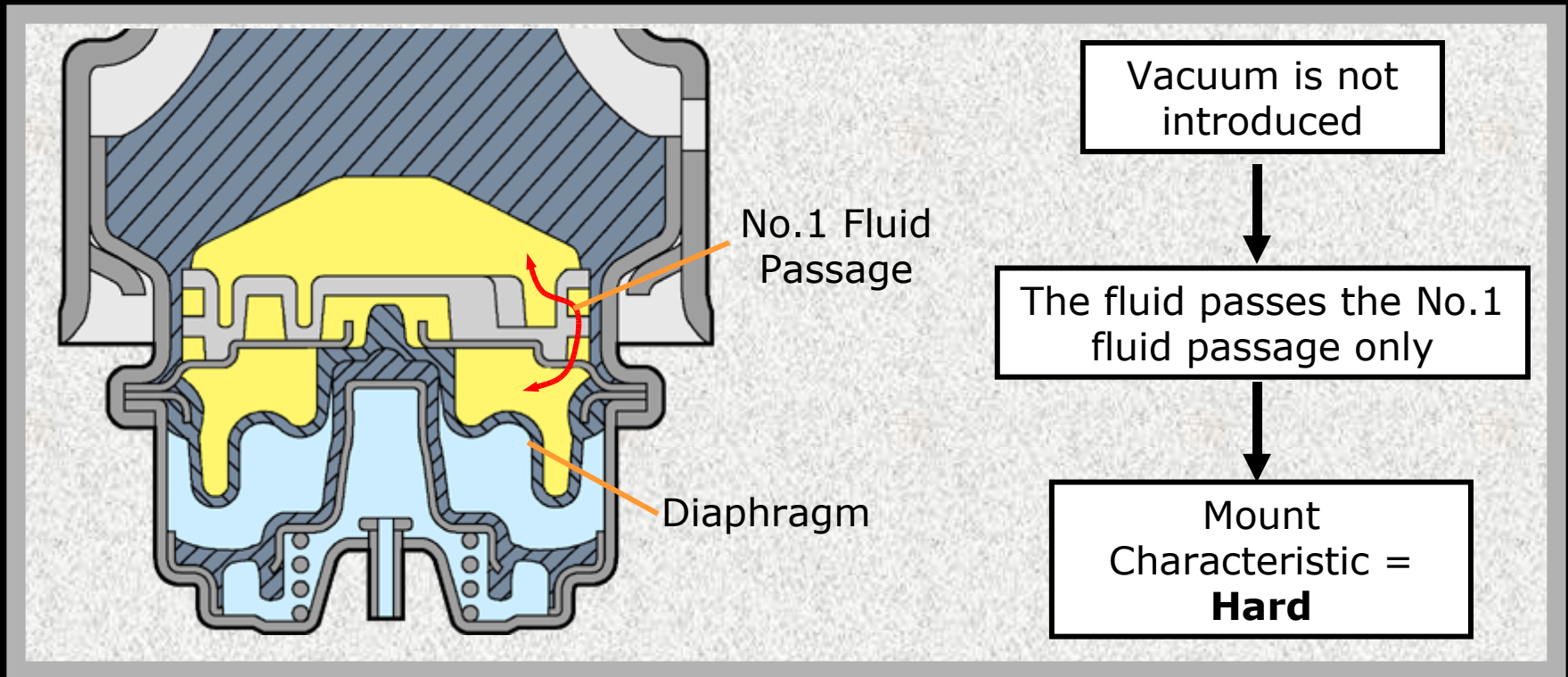
\*1: The vacuum is unstable during engine cranking



# 1KD-FTV Engine

-W

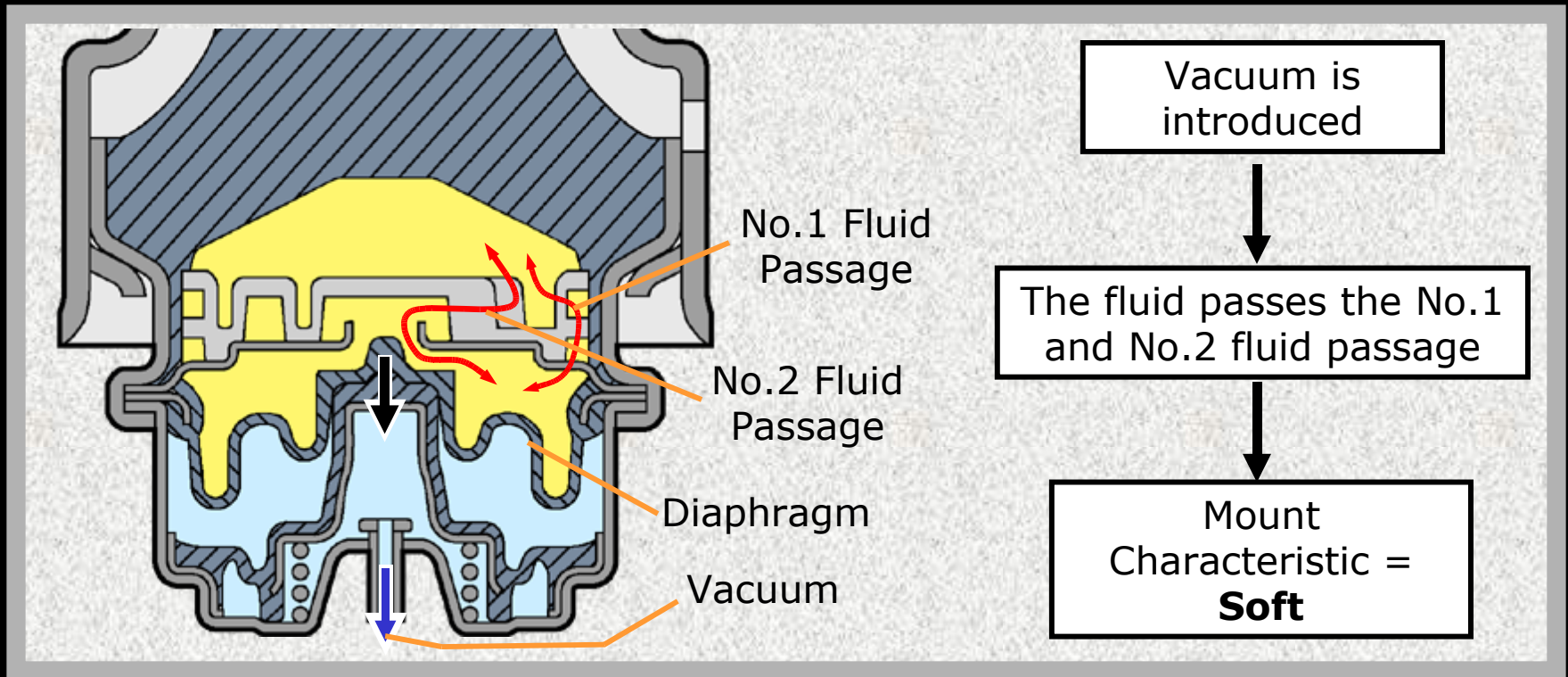
- Engine Control System
  - Engine Mount Control
    - Operation (VSV = OFF)



# 1KD-FTV Engine

-W

- Engine Control System
  - Engine Mount Control
    - Operation (VSV = ON)



# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

- Engine Overall
- Engine Proper
- Lubrication System
- Intake & Exhaust System
- Fuel System
- Engine Control System



# 1KZ-TE Engine



- Engine Overall
  - Engine Specification

| Item                             |                           | New                          | Previous          |
|----------------------------------|---------------------------|------------------------------|-------------------|
| No. of Cylinders and Arrangement |                           | 4-Cylinder, In-line          | ←                 |
| Valve Mechanism                  |                           | 8-Valve OHC, Gear/Belt Drive | ←                 |
| Combustion Chamber               |                           | Swirl Type                   | ←                 |
| Manifolds                        |                           | Cross-Flow                   | ←                 |
| Fuel System                      |                           | Distributor Type             | ←                 |
| Displacement                     | cm <sup>3</sup> (cu. in.) | 2982 (181.9)                 | ←                 |
| Bore x stroke                    | mm (in.)                  | 96 x 103 (3.78 x 4.06)       | ←                 |
| Compression Ratio                |                           | 21.2 : 1                     | ←                 |
| Max. Output                      | EEC                       | ?                            | 92 kW @ 3600 rpm  |
| Max. Torque                      | EEC                       | ?                            | 295 Nm @ 2400 rpm |
| Fuel Cetan Number                |                           | 50                           | ←                 |
| Oil Grade                        |                           | API CD or Better             | ←                 |



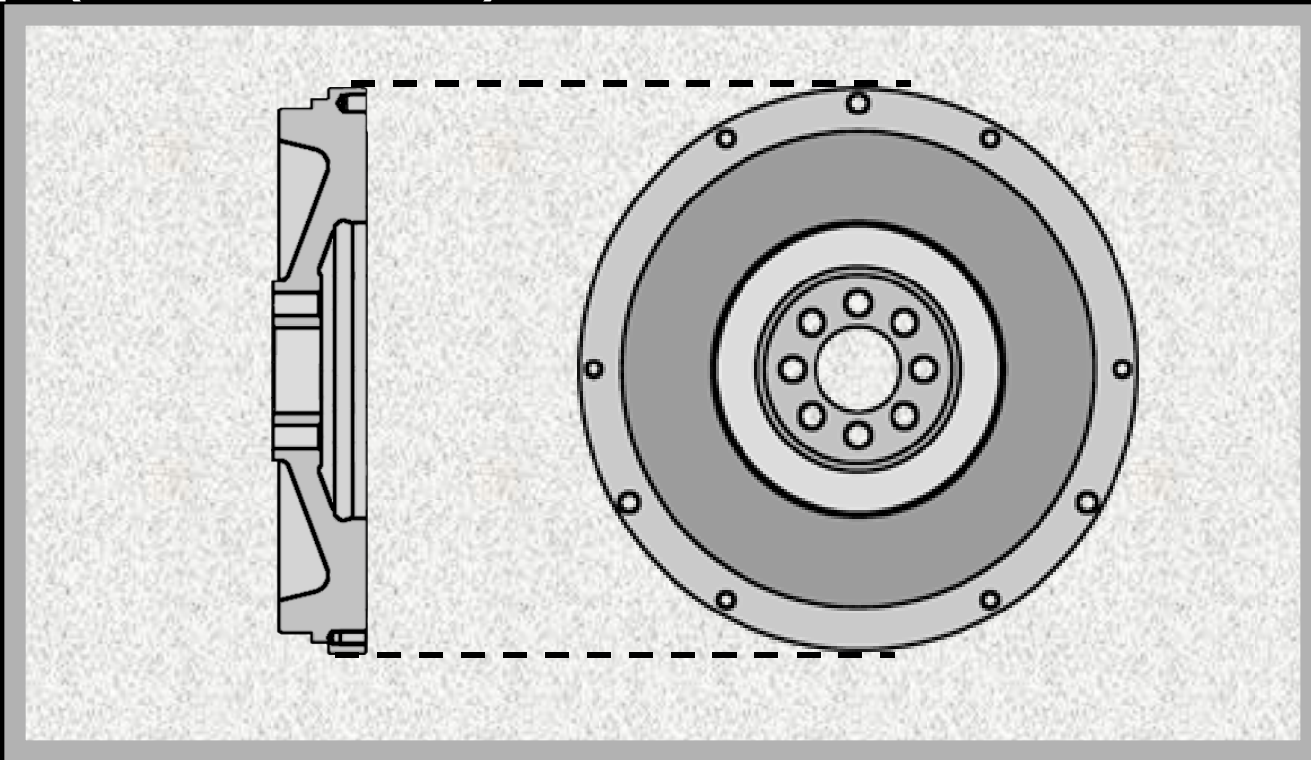


# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

## ■ Engine Proper

- Flywheel
  - Flywheel size is increased to meet the clutch size up (10.5" → 11")

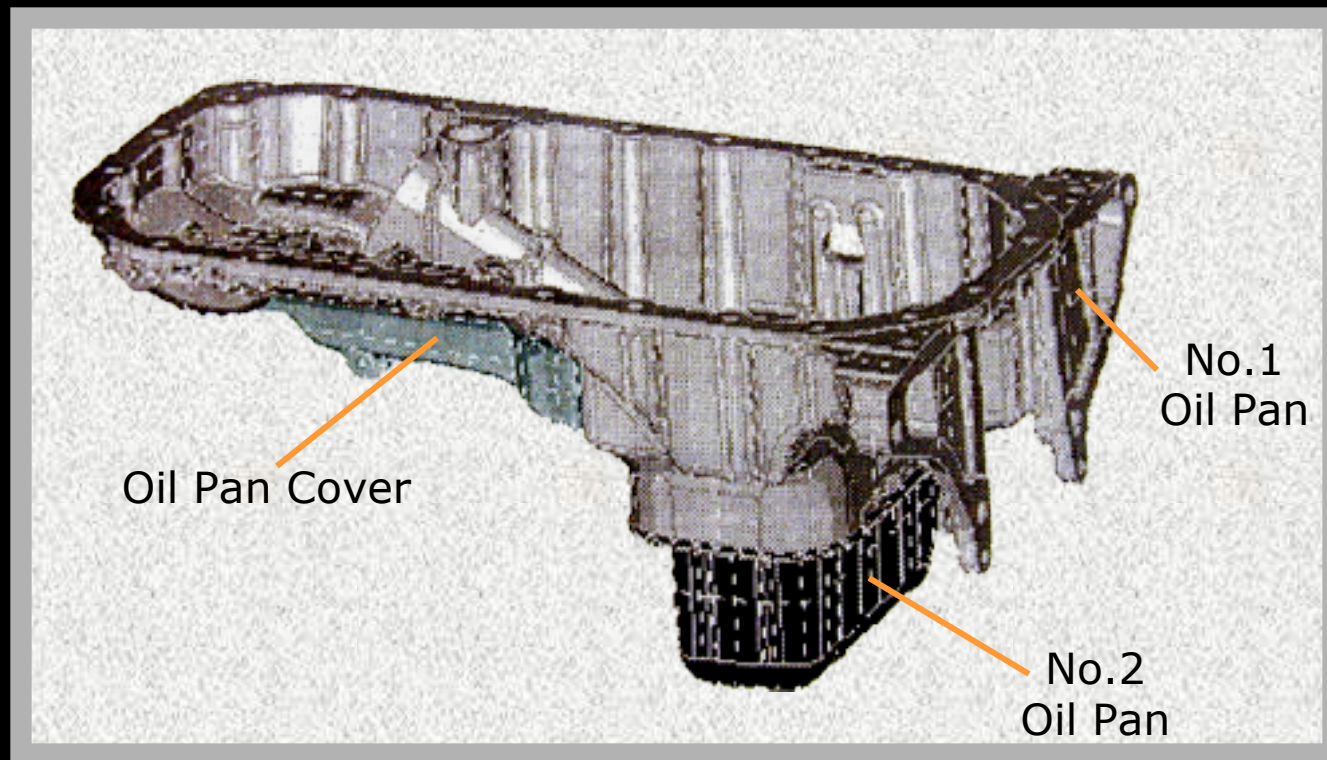


# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

## ■ Lubrication System

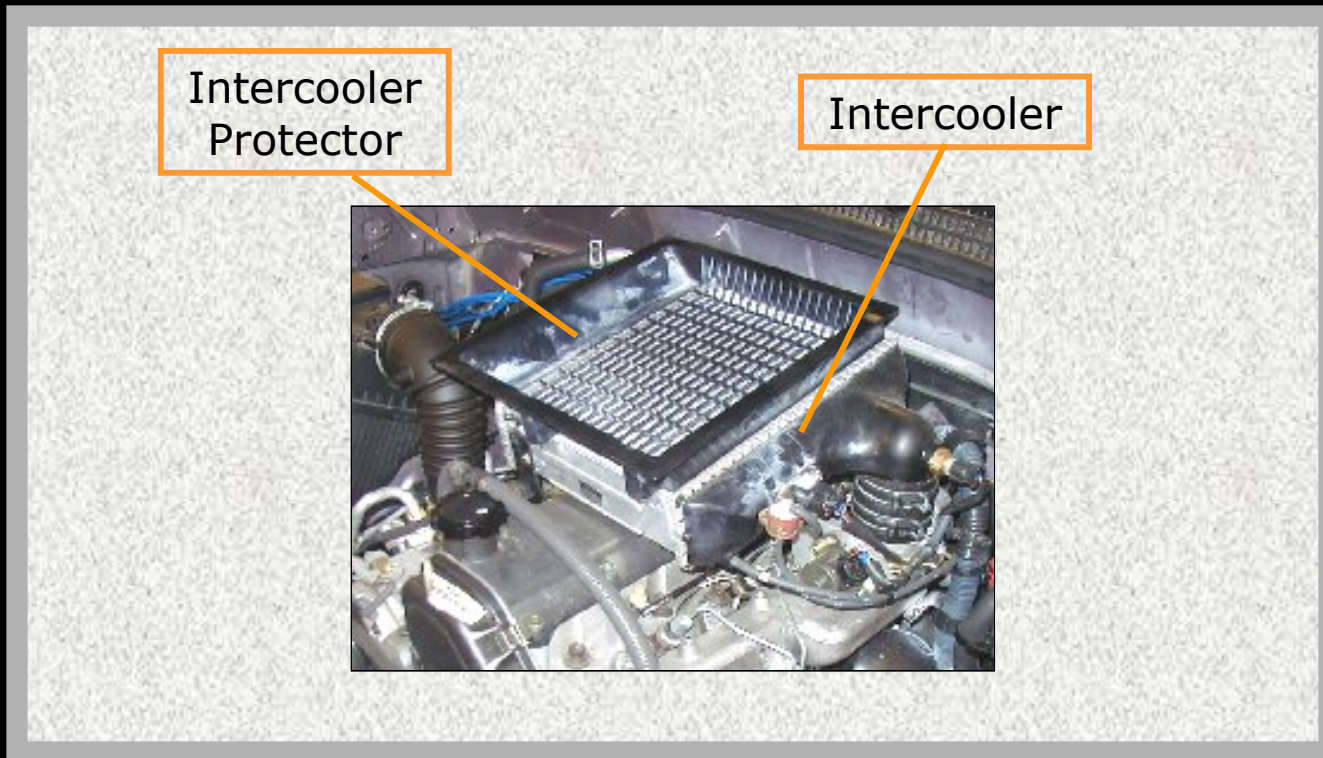
- Oil Pan
  - No.1 oil pan is made of aluminum alloy



# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

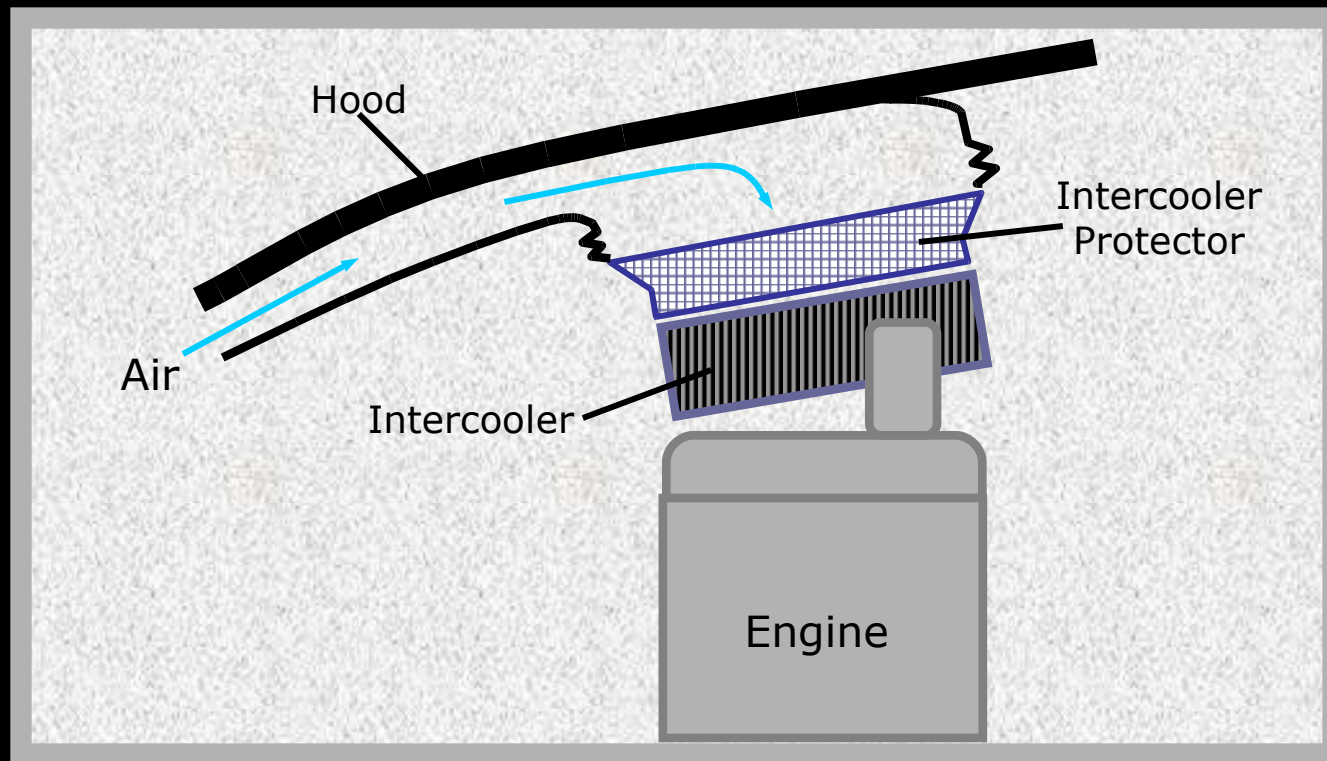
- Intake & Exhaust System
  - Intercooler
    - Intercooler is added for all models



# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

- Intake & Exhaust System
  - Intercooler Protector
    - Intercooler protector is on intercooler



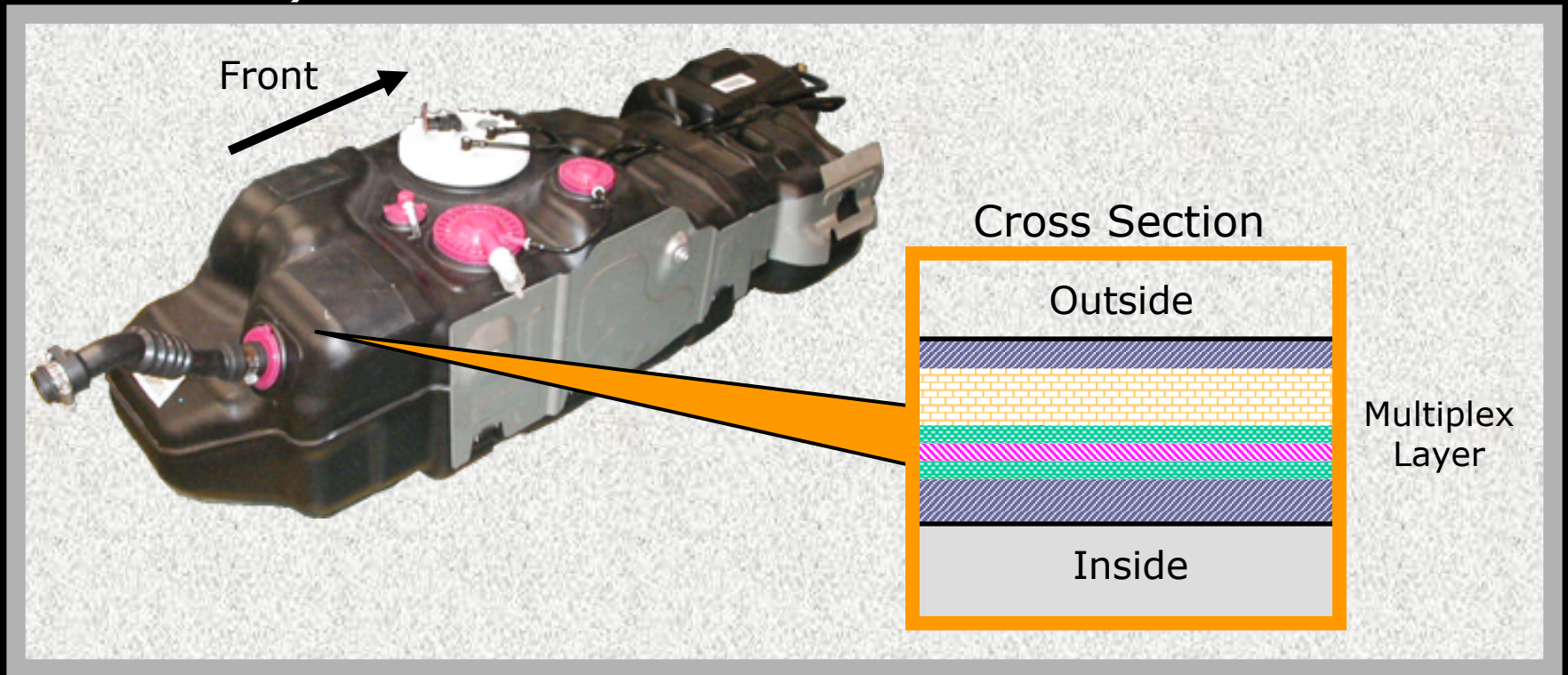
# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

## ■ Fuel System

### • Fuel Tank

- Multiplex layer plastic made type fuel tank (main tank) is used for 5 door model





# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

## ■ Fuel System

- Fuel Tank Cap

- Quick-type fuel tank cap has been adopted to improve usability





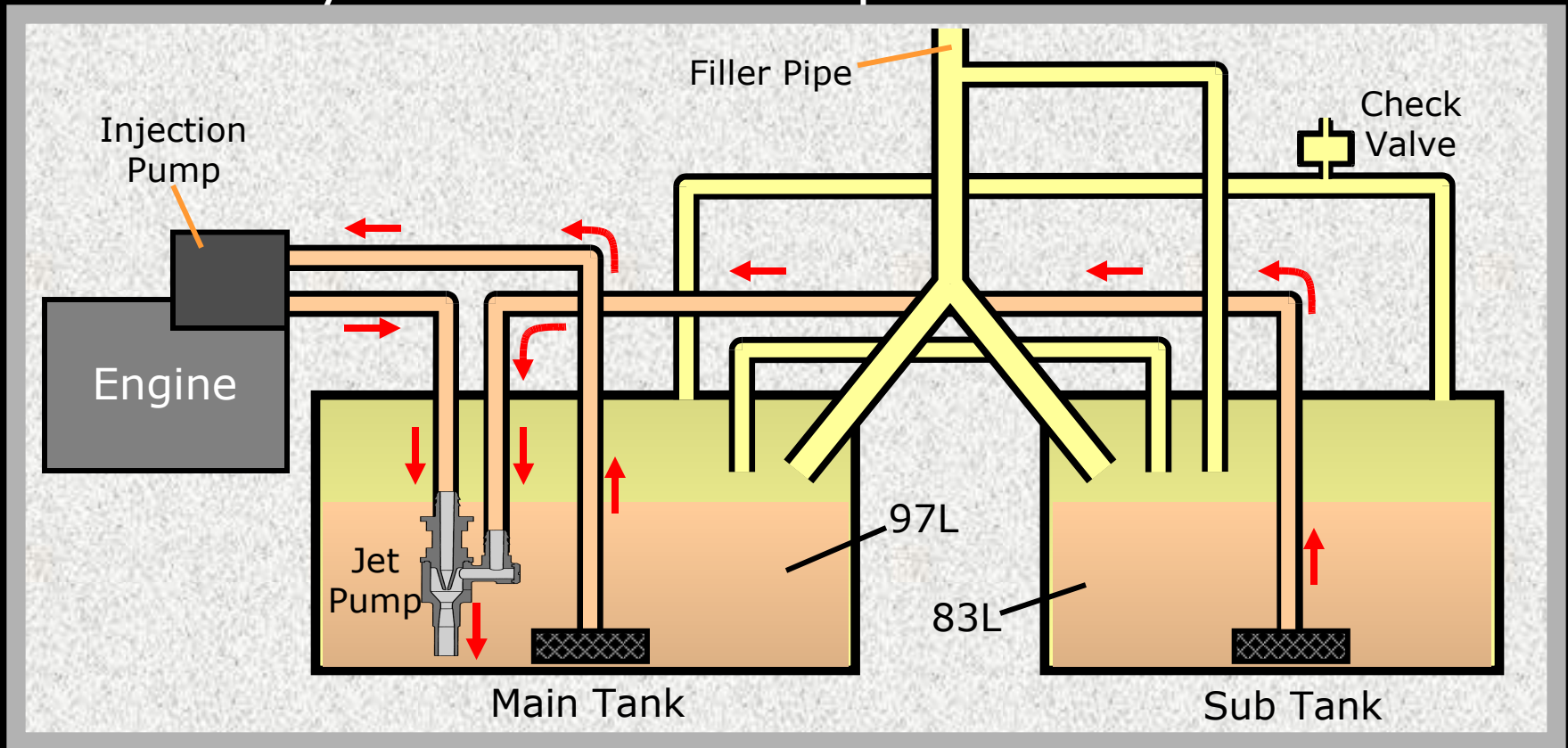
# 1KZ-TE Engine

-Q

-

## ■ Fuel System

- Dual Fuel Tank System with Jet Pump
  - The system become simple

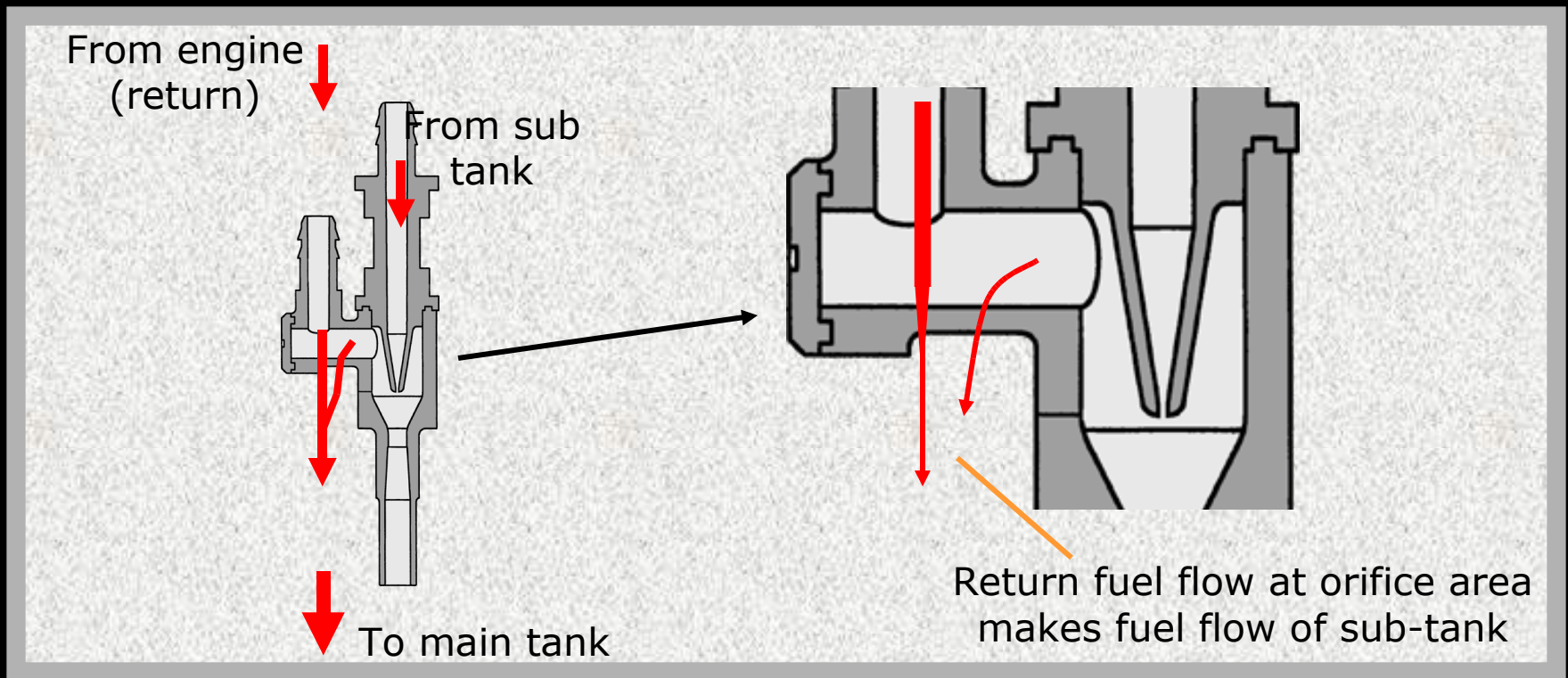


# 1KZ-TE Engine



## ■ Fuel System

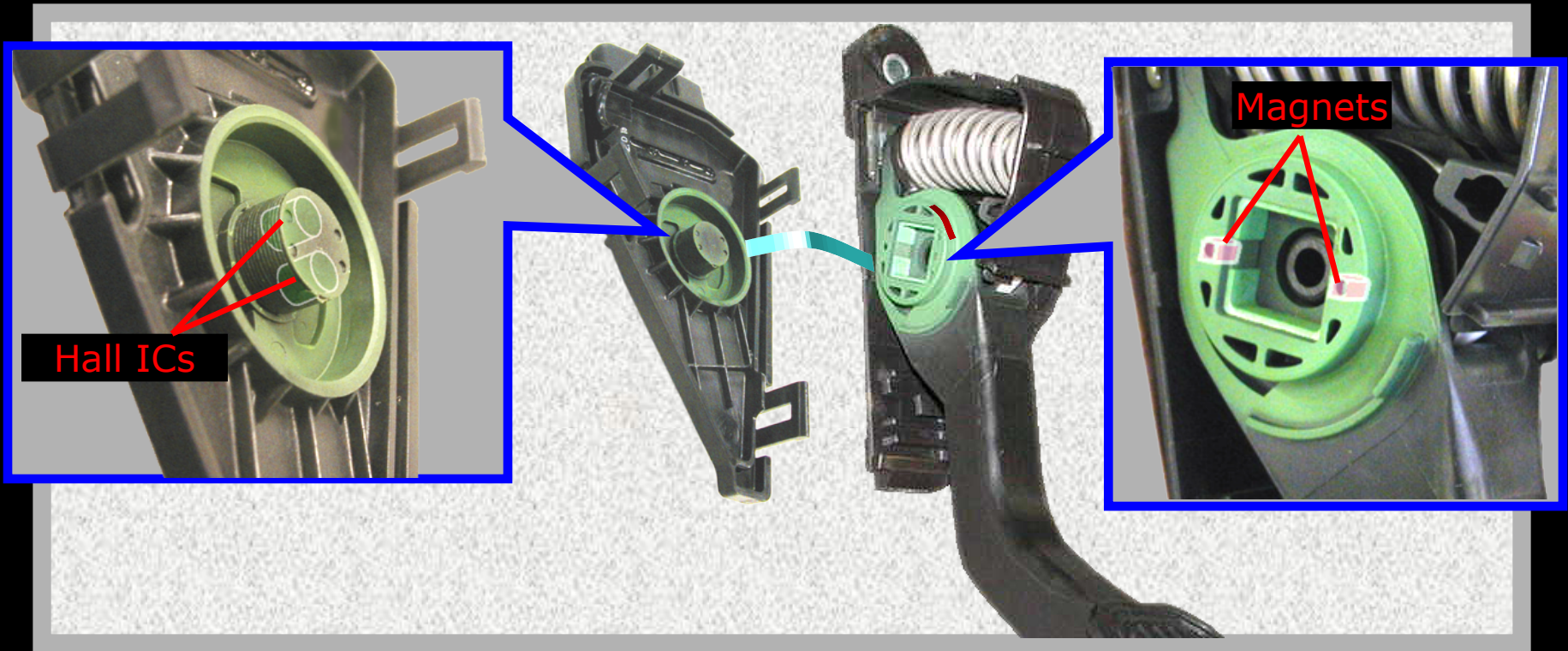
- Dual Fuel Tank System with Jet Pump
  - A jet pump is provided to transfer the fuel from sub tank to main tank



# 1KZ-TE Engine

|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

- Engine Control System
  - ETCS-i
    - A no-contact type accelerator pedal position sensor is used



# 1KZ-TE Engine

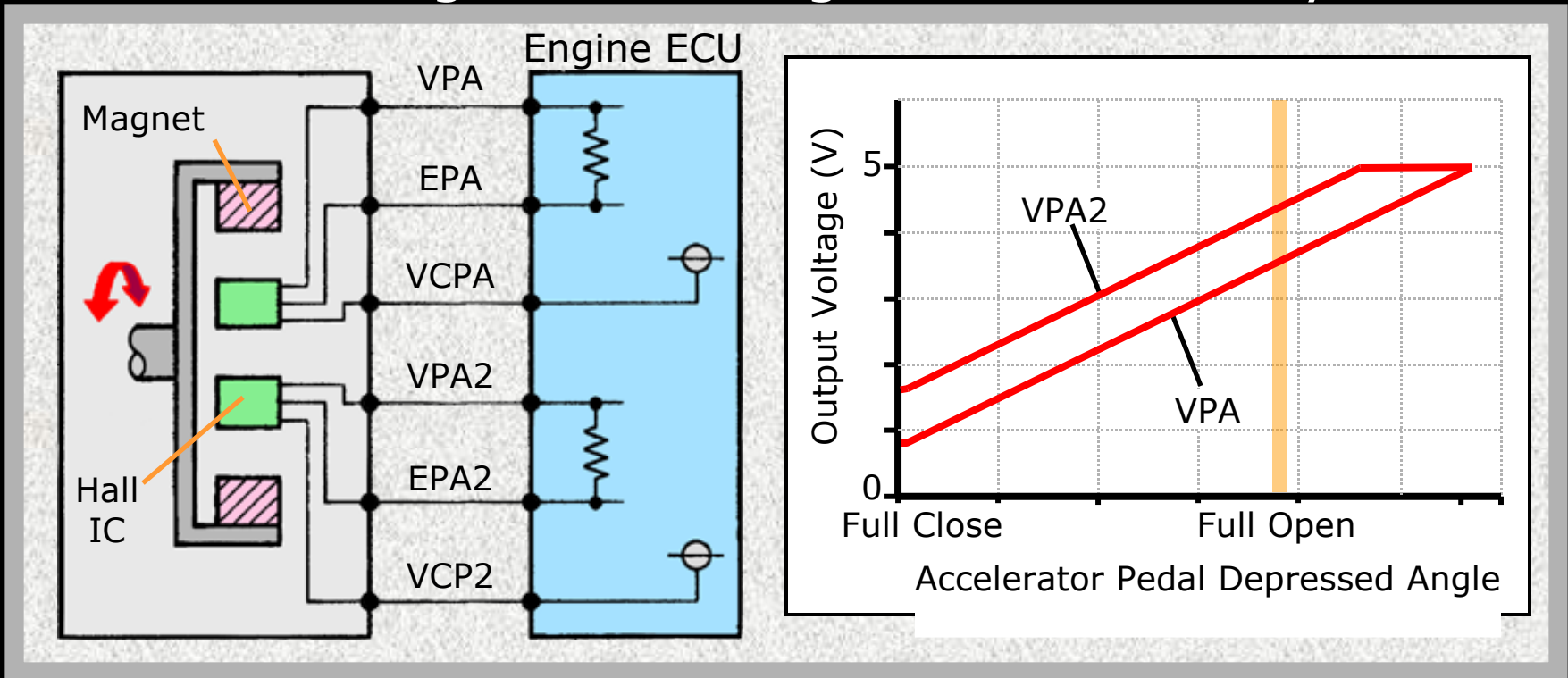
-Q

-

## ■ Engine Control System

- ETCS-i

- Accelerator pedal position sensor converts into electric signals the magnetic flux density



# Service Point

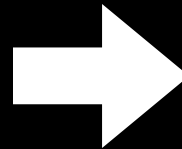
|  |    |  |   |
|--|----|--|---|
|  | -Q |  | - |
|--|----|--|---|

- Engine Control System
  - ETCS-i
    - Inspection of the accelerator pedal position sensor is discontinued from the contact type

## Contact type

### *Inspection*

- Accelerator Pedal Position Sensor  
VC ↔ E2 : 1.64 – 3.28 kΩ  
at 20°C (68 °F)



## No-contact type

### *Inspection*

- Accelerator Pedal Position Sensor  
None

The accelerator pedal position sensor can not be inspected



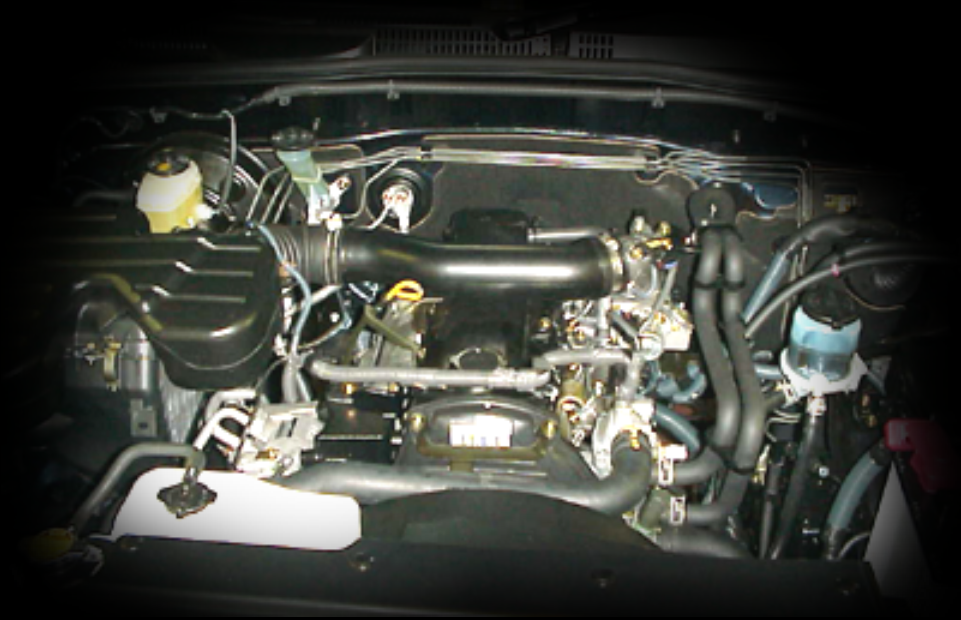
|  |      |  |            |
|--|------|--|------------|
|  | $-Q$ |  | $-$<br>$-$ |
|--|------|--|------------|



# 5L-E Engine



- Engine Overall
- Fuel System
- Engine Control System



# 5L-E Engine



- Engine Overall
  - Engine Specification

| Item                                              | Prado (5L-E)                                    | Hiace (5L-E)               |
|---------------------------------------------------|-------------------------------------------------|----------------------------|
| No. of Cylinders and Arrangement                  | 4-Cylinder, In-line                             | ←                          |
| Valve Mechanism                                   | 8-Valve OHC, Belt Drive                         | ←                          |
| Combustion Chamber                                | Swirl Type                                      | ←                          |
| Manifolds                                         | Cross-Flow                                      | ←                          |
| Fuel System                                       | Distributor Type<br>(Electronically Controlled) | ←                          |
| Displacement            cm <sup>3</sup> (cu. in.) | 2986 (182.2)                                    | ←                          |
| Bore x stroke            mm (in.)                 | 95.5 x 96.0 (3.92 x 3.78)                       | ←                          |
| Compression Ratio                                 | 22.2 : 1                                        | ←                          |
| Max. Output            [SAE-NET]                  | 75 kW @ 4000 rpm                                | 66 kW @ 4000 rpm           |
| Max. Torque            [SAE-NET]                  | 201 N·m @ 2400 rpm                              | 192 N·m @ 2400 rpm         |
| EGR System                                        | None                                            | with valve position sensor |
| Catalytic Converter for Oxidation                 | None                                            | One                        |

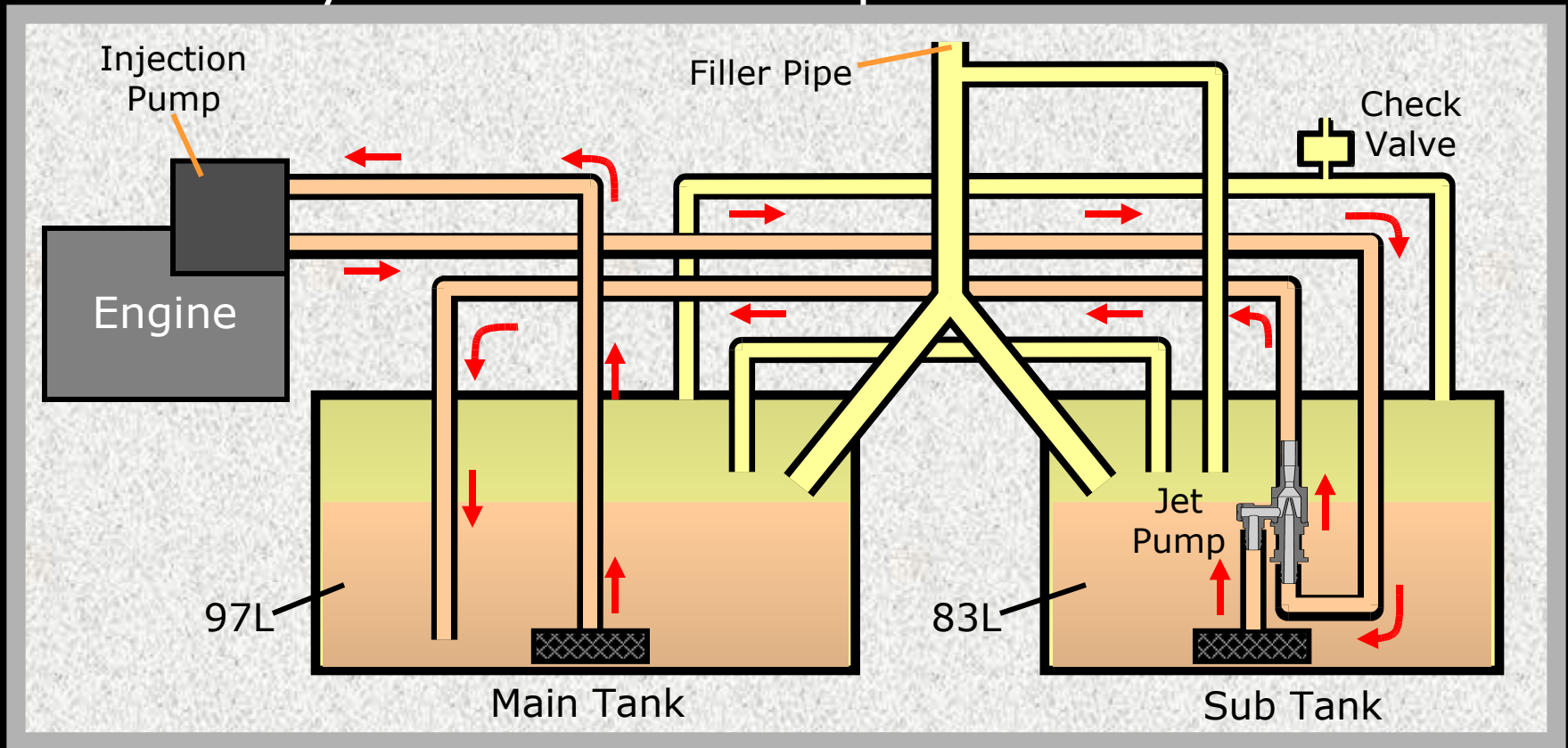


# 5L-E Engine



## ■ Fuel System

- Dual Fuel Tank System with Jet Pump
  - The system become simple

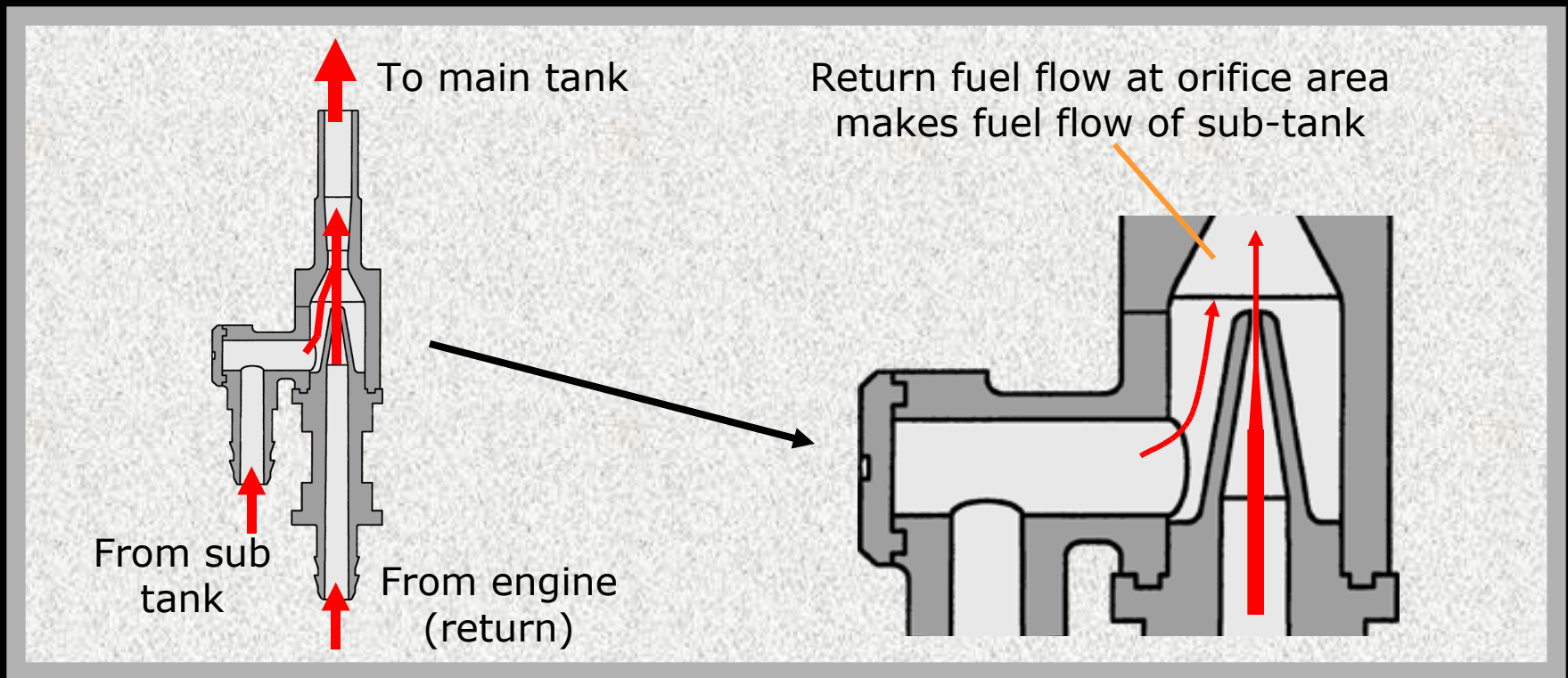


# 5L-E Engine



## ■ Fuel System

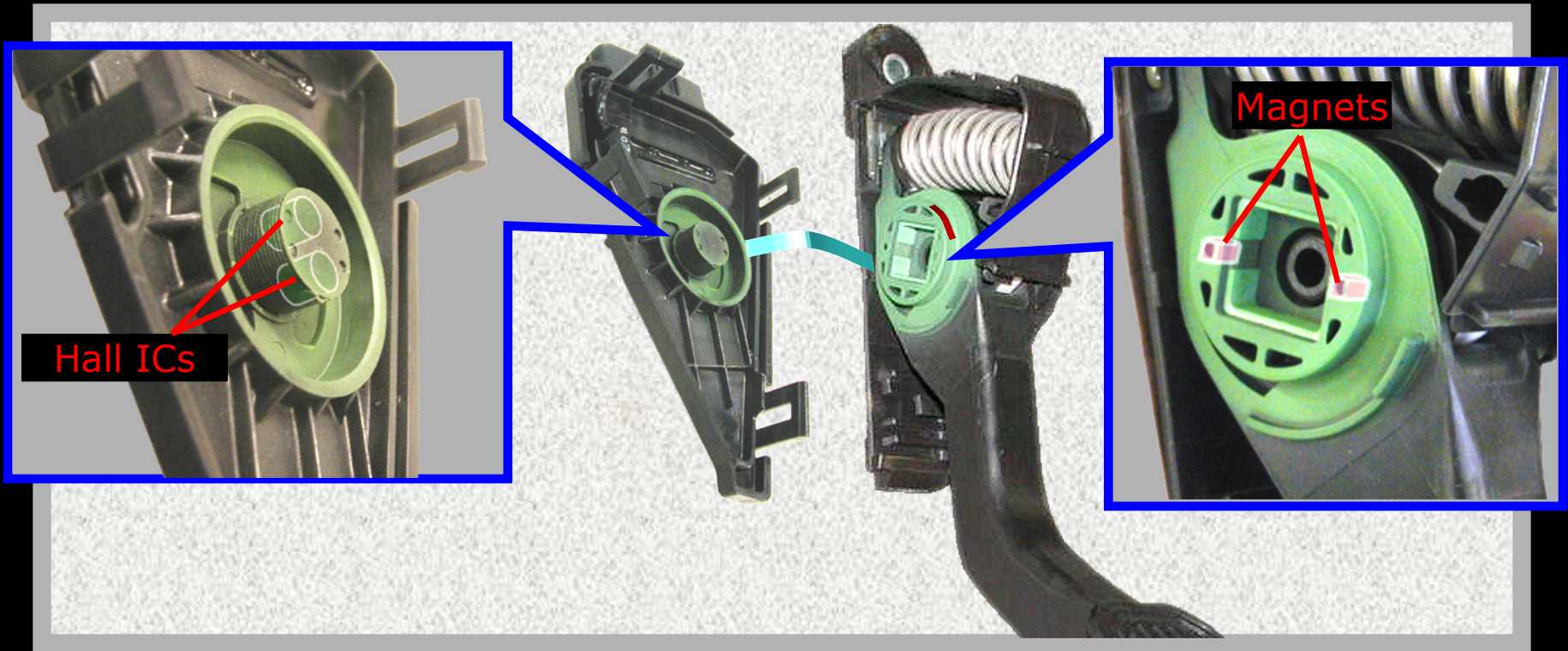
- Dual Fuel Tank System with Jet Pump
  - A jet pump is provided to transfer the fuel from sub tank to main tank



# 5L-E Engine



- Engine Control System
  - Accelerator Pedal
    - A no-contact type accelerator pedal position sensor is used



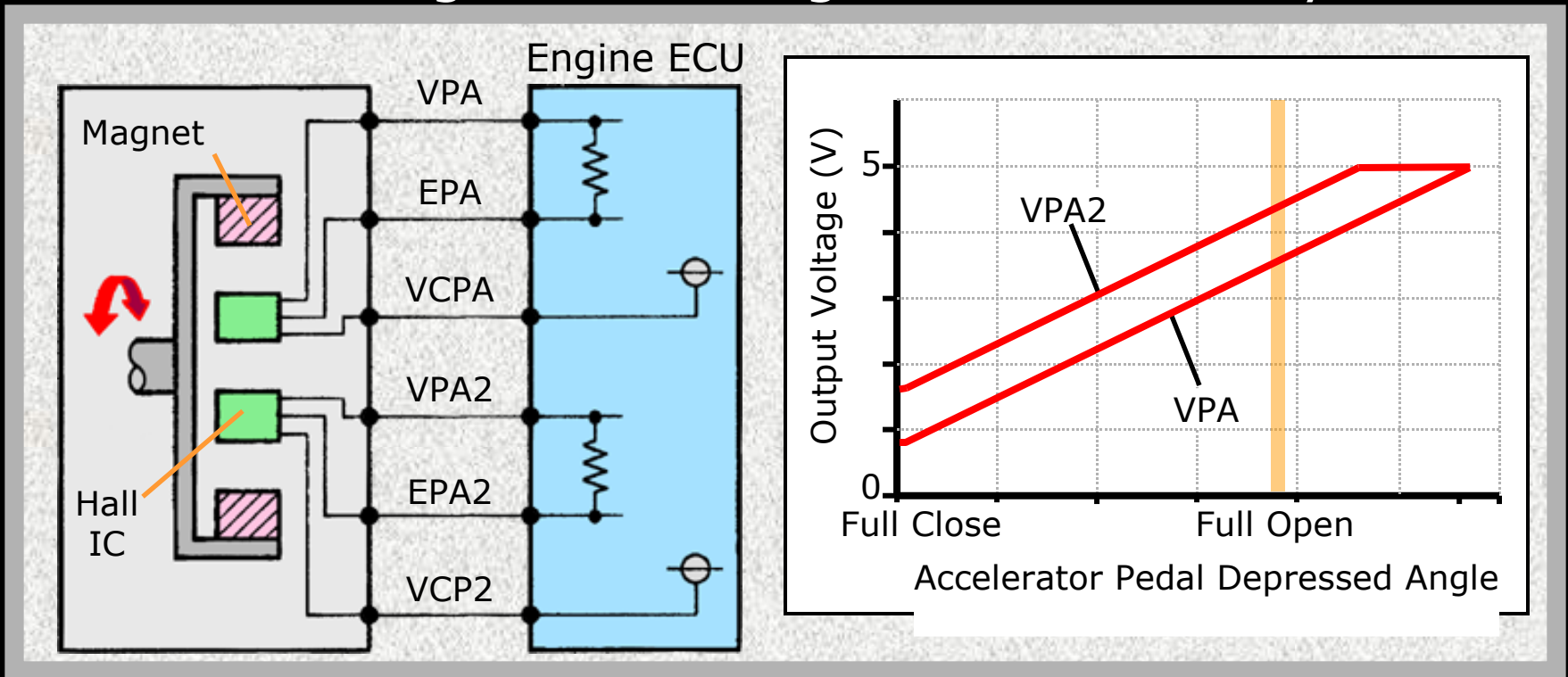
# 5L-E Engine



## ■ Engine Control System

- ETCS-i

- Accelerator pedal position sensor converts into electric signals the magnetic flux density





# Service Point



## ■ Engine Control System

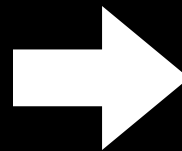
- ETCS-i

- Inspection of the accelerator pedal position sensor is discontinued from the contact type

### Contact type

#### *Inspection*

- Accelerator Pedal Position Sensor  
VC ↔ E2 : 1.64 – 3.28 kΩ  
at 20°C (68 °F)



### No-contact type

#### *Inspection*

- Accelerator Pedal Position Sensor  
None

The accelerator pedal position sensor can not be inspected

