EURO 4 SERVICE MANUAL

FOREWORD

This manual includes procedure for maintenance, adjustment, service operation and removal and installation of components.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of manual approval.

The right is reserved to make changes at any time without notice.

SSANGYONG

PYUNGTAEK, KOREA

SECTION INDEX

Section 1

D27DTP / D27DT ENGINE

SYSTEM

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1. MAJOR CHANGES IN D27DTP (POWERUP) ENGINE (FOR MORE INFORMATION, REFER TO ENGINE SERVICE MANUAL)

1913 VGT TURBOCHARGER

This enhances the output power and torque, reduces the fuel consumption, and decreases the exhaust gas by changing the exhaust gas flow by controlling the vane in low and high speed range.

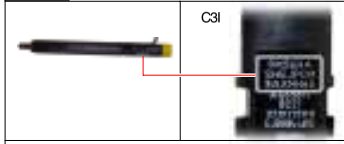
2433 VGT TURBO VACUUM MODULATOR

Only the vacuum modulator that controls VGT turbo charger actuator is adopted in accordance with the electrically controlled E-EGR.

1490 ENGINE ECU - VERSION 3.2

E-EGR valve, throttle body and AQGS are adopted to D27DTP engine, along with two connectors to control the exhaust gas.

1881 INJECTOR (C3I LABEL)



Two injection holes are added (currently 7 holes) to the injector and C3I coding is adopted to control the amount of injected fuel more precisely.

1881 COMMON RAIL & FUEL PIPE

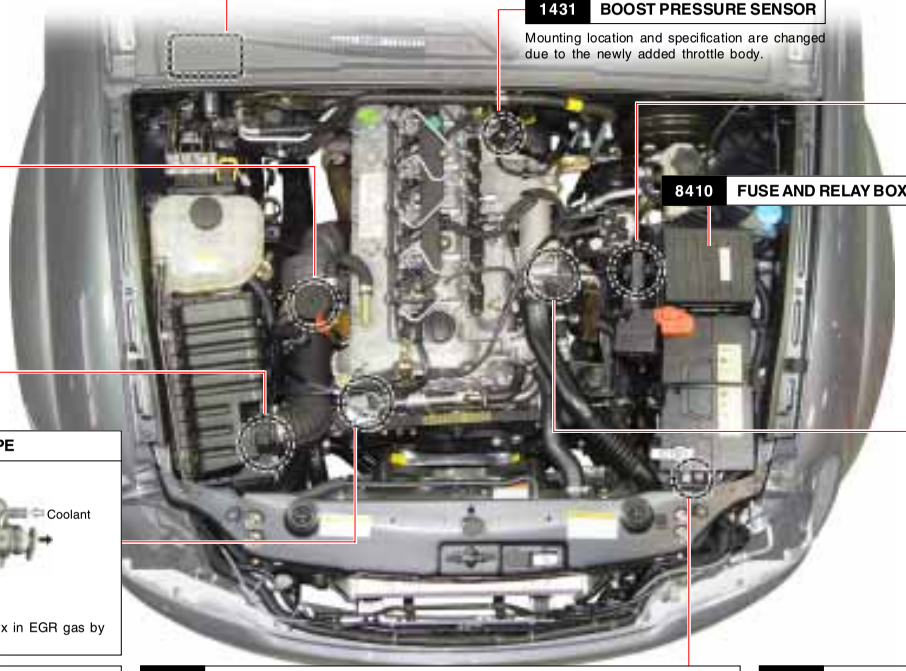
The diameter of fuel supply rail (including high pressure rail) is increased due to the increase of engine power and torque, and the orifice is installed in common rail and HP pump to prevent fuel pulsation.

1222 PCV OIL SEPARATOR

PCV oil separator with large capacity has been adopted to improve the separation efficiency for the oil and gas from crankcase.

1431 BOOST PRESSURE SENSOR

Mounting location and specification are changed due to the newly added throttle body.



8410 FUSE AND RELAY BOX

1412 GLOW PLUG

The glow plug for quick preheating is used with AQGS (Incompatible).

2820 AQGS

The glow plug for quick preheating function and CAN communication with ECU

2330 HFM SENSOR - VERSION 6.0

To control the engine more precisely, the digital signal for inlet air mass is newly adopted and the arrangement of connector pin is changed.

1792 E-EGR VALVE

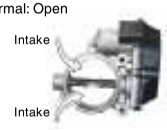
The E-EGR valve electrically controls EGR valve, and transmits the location signal of EGR valve to ECU (Vacuum modulator for control eliminated).

1792 EGR COOLER PIPE

This reduces the content of NOx in EGR gas by decreasing the temperature.

1715 ELECTRONIC THROTTLE BODY

Normal: Open



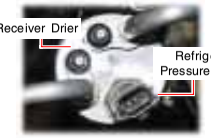
During engine stopping: Close

When the engine is not running, the flap in the throttle body is closed to block the intake air to prevent the engine turning off with abnormal noise. This is directly controlled by ECU.

1520 HIGH-CAPACITY WATER PUMP

The EGR cooler and the coolant port (inside the cylinder block) are adopted to improve the cooling performance in high power engine.

6820 REFRIGERANT PRESSURE SENSOR



With the continuous monitoring of refrigerant pressure, the engine ECU controls the air conditioner compressor precisely.

1990 SWITCHABLE ENGINE MOUNT & VACUUM SOLENOID VALVE

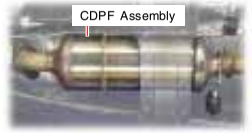
This engine mounting system can be electronically controlled in two stages (soft/hard) depending on the vehicle's condition.

Solenoid valve to draw or block the vacuum to the switchable engine mounting system by ECU control.

1533 IOP (OIL PAN)

This is integrated in the front axle so that the center of gravity of the vehicle can be lowered and NVH performance and power transfer can be improved.

2411 * CDPF SYSTEM (D27DT)



In pursuit of the exhaust gas reduction policy, this system drastically reduces polluted material. This consists of CDPF assembly and sensors.

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2. MAJOR CHANGES IN INTERIOR ELECTRIC COMPONENTS

8511 4WD SWITCH

The 4WD system with three different specifications can be used since All Wheel Drive (AWD) is adopted in D27DTP engine. The AWD system, the mechanical device without electric controls, has no TCCU and control switch (Distribution ratio of driving force to the front wheel and rear wheel = 40: 60).

8010 INSTRUMENT CLUSTER (BLACKFACE)

This uses CAN communication and also has adopted new technologies (EAS, TPMS and EPB), along with the relevant warning lights and indicators. TPMS pressure value is displayed on the ODO (Trip Odometer) display window. (Press trip switch for two seconds in ODO display mode.)

7770 OVERHEAD CONSOLE SWITCH

Sun roof can be opened in 2-step operation with this switch. In the 1st step, the sun roof is opened as much as it can minimize wind buffet phenomenon (2nd step: Fully Open).

8611 RAIN & AUTO LIGHT SENSOR (INTEGRAL TYPE)

As an integral sensor, this controls wiper by sensing the amount of rain drops and the exterior lights according to the ambient illumination intensity (in Auto position).

8511 MULTIFUNCTION SWITCH

Auto washer & wiper switch and auto hazard warning flasher switch have been added to the existing switches.

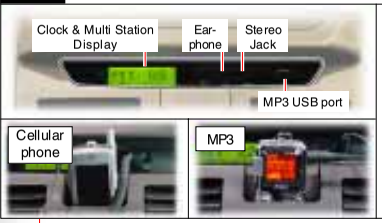
8511 REMOTE CONTROL SWITCH ON STEERING WHEEL

The tip switch, which can shift the gear when the shift lever is in “M” position, has been added to the system.

7120 DRIVER SEAT’S POWER WINDOW MOTOR

Auto-up function and anti-trap function are adopted to the driver's door glass. The system is initialized when the part is replaced or it is abnormally operated.

8611 MULTI-JACK STATION

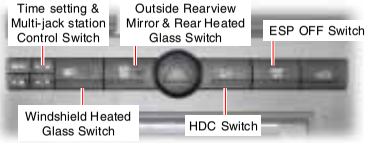


The multi-jack station has the digital clock and audio functions. It can be connected to the separate audio device with the stereo jack to listen to the music through the speakers in the vehicle. Moreover, USB memory stick can be connected to the multi-jack station for playing music (The MP3 USB memory port is optional).

6810 AIR CONDITIONER CONTROLLER (FATC)

With FATC Air Conditioner Controller System adopted, Air Quality System (AQS) automatically changes the air source by detecting the contamination degree of ambient air.

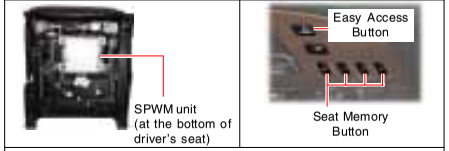
8511 CENTER FASCIA SWITCH



HDC Switch

Hill Descent Control (HDC) function is integrated into the ESP function, and the 2-corner EAS system is also adopted.

7410 SPWM UNIT

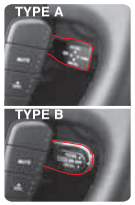


This unit has the function that memorize and adjust driver's seat and outside rearview mirror. In addition, it has the function that automatically lowers the outside rearview mirror by 3.5 degrees as well as the easy access function.

7010 IMMOBILIZER (REMOTE ENGINE STARTING FUNCTION ELIMINATED)

It has the immobilizer function and its battery can be replaced unlike.

8511 CRUISE CONTROL



The cruise control is an automatic speed control system that maintains a desired driving speed without using the accelerator pedal.

The vehicle speed must be greater than 36 km/h to engage the cruise control. This feature is especially useful for motorway driving.

8611 VARIABLE SEAT WARMER SYSTEM

This system is similar to the one of CHAIRMAN, and its control units are installed in the front and rear area of vehicle. (AUX Jack between switches is available in AV system type.)

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3. MAJOR CHANGES IN ELECTRIC COMPONENTS AND UNITS

8790 PAS UNIT

This unit controls three sensors made of piezo ceramic element in the rear bumper, and indicates the sensor's malfunction with buzzer, not with LED (LED eliminated).

8931 AV HEAD UNIT

The image quality of AV head unit has been improved by adopting 6.5 inch wide type TFT LCD panel. It can be connected to DSP amplifier and DVD changer with optic cables.

AUDIO SYSTEM

2-DIN type audio system is equipped in the vehicle as basic, and the tape slot is eliminated. The AUX button has been added to the system in accordance with introducing multi-jack station.

8931 TV ANTENNA MODULE

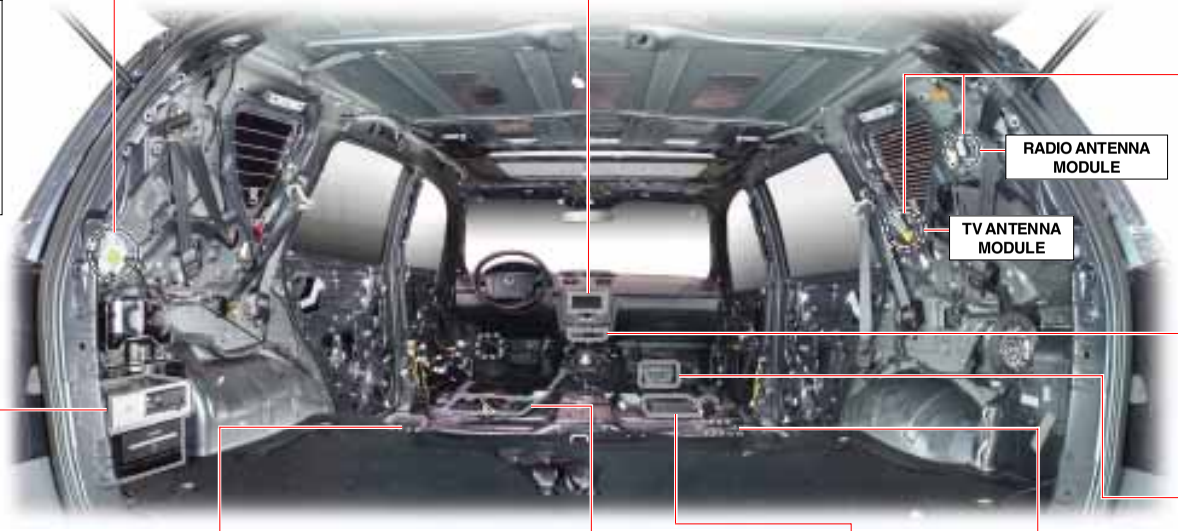
This antenna module receives TV channels and transfers them to tuner after amplifying them. Those are located on the rear quarter upper panel.

8931 RADIO ANTENNA MODULE

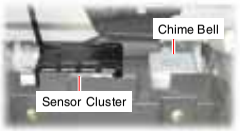
This amplifies the radio signal received from glass antenna and transfers it to tuner. It is installed on the rear right quarter upper panel.

8711 RK STICS

As the remote engine starting function is eliminated, RE STICS is eliminated too. Auto hazard warning flasher, auto washer synchronized wiper, SPWM unit and other new technologies are newly adopted.



8711 SENSOR CLUSTER & CHIME BELL



Installed at the inner bottom of audio head unit, the yaw rate sensor and acceleration sensor are installed inside. Those sensors detect the vehicle stability to control ESP.

1490 ENGINE ECU - VERSION 3.2

E-EGR valve, throttle body and AQGS are adopted to D27DTP engine, along with two connectors to control the exhaust gas.

8931 DVD CHANGER

8-DVD changer is installed inside the rear left quarter lower panel.

8611 REAR SEAT WARMER UNIT

The front seat warmer unit and rear seat warmer unit are mounted respectively. This variable seat warmer system is controlled in 5 stages.

8931 DSP AMPLIFIER

Aside from the basic speaker control function, this exterior digital AMP can separate digital audio source to give digital effects.

8611 WOOFER SPEAKER

Installed at the bottom of passenger's seat. It enforces mid-low sounds by receiving the output signal from DSP amplifier.

8931 TUNER

This device precisely tunes the input signal by filtering the signals from each antenna module.

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4. MAJOR CHANGES IN CHASSIS

4122 FRONT AXLE: INTEGRATED OIL PAN (IOP) AXLE & OTHER DEVICES

Used for the vehicle with D27DTP (POWER-UP) engine, the engine oil pan and axle is integrated in the axle system. This system can lower the height of the mounted engine. In addition, engine vibration can be greatly reduced due to the mass increase effect under the condition that the front axle and engine are integrated.

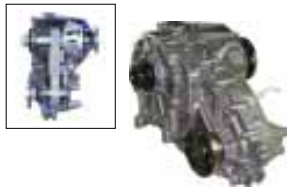
4116 IWE LOCKING HUB SYSTEM

4WD: Unlocked by vacuum pressure

2WD: Locked by vacuum pressure

This vacuum locking hub system engages or disengages the gears at the end of the drive shaft and the end of hub by using vacuum pressure. This system is used for the vehicle with 4WD system.

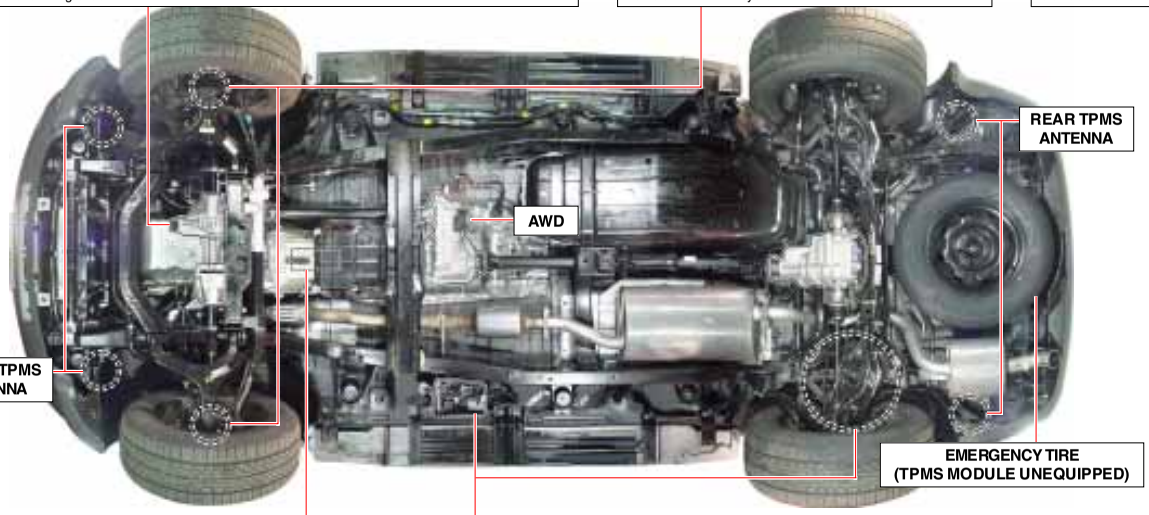
3260 ALL WHEEL DRIVE (AWD)



Adopted to the vehicle with D27DTP engine, this full-time 4-wheel drive system is the mechanical type which has no control unit, shift motor and other swift switches. Its power distribution ratio to the front and rear is 40:60.

4220 INDEPENDENT SUSPENSION REAR AXLE

Independent suspension is used for the vehicle with D27DTP. Accordingly, rear axle types are varied.

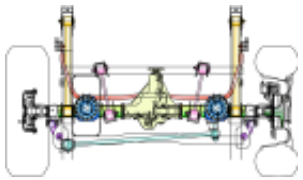


4520 REAR SUSPENSION

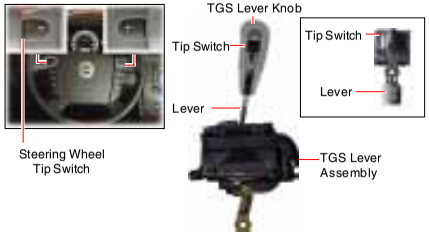
Independent Suspension (IRS) Type: D27DTP

This system independently controls the vertical vibration of the vehicle in both sides. Accordingly, this suspension guarantees the vehicle stability even on the uneven road, and enhances the driving comforts by distributing the shocks from the road surface into the number of links.

5-line (rigid) Type: D27DT



3721 TGS LEVER



The TGS lever of REXTON II communicates with Engine Control Unit (ECU), ESP Control Unit (ESP HECU) and instrument cluster. In addition, it is possible to select the gear manually in M position of shifting lever by fitting the tip switch on the lever knob and steering wheel.

4480 EAS SYSTEM

EAS Supply Unit

Air Spring

Height Sensor

Normal Level

Easy Loading Level (30 mm Down)

The EAS system in REXTON II adopts the air springs only on the rear wheels. (2-corner Open EAS system). 2-corner open EAS system enhances the driving comforts and driving stability by maintaining the height at the certain level irrespective of the road condition in the rear. The system is adopted to optimize the spring constant according to the load condition.

4920 EPB SYSTEM

EPB Unit

The existing mechanical parking brake is operated manually (by pulling up the lever). However, the vehicle with EPB system enables to automatically apply the parking brake by considering parking performance, driving speed, and the time when the main brake pedal is depressed. The parking brake system without EPB system is the same as the existing parking brake system.

4190 TPMS SYSTEM

TPMS Wheel Module

ESP HECU

TPMS ECU region

TPMS Antenna

TPMS system aims to ensure the driving stability and performance in advance, to prevent the unnecessary fuel waste, and to reduce the tire wear, when inflation pressure values of each tire are different each other. This system enables a driver to check the tire condition before or during driving by indicating the abnormality or defects on the instrument cluster.

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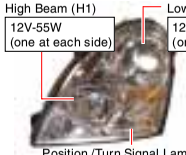
5. MAJOR CHANGES IN VEHICLE EXTERIOR

8310 HEAD LAMP

High Beam (H1)
12V-55W
(one at each side)

Low Beam (H7)
12V-55W
(one at each side)



Position /Turn Signal Lamp Bulb
12V-8W/P21W (one at each side)

8310 FRONT FOG LAMP

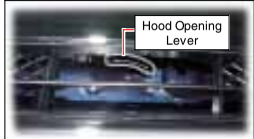
Fog Lamp Bulb
12V-H27W/2

Bulb

7410 AIMING DOWN BY 3.5° WHEN REVERSING

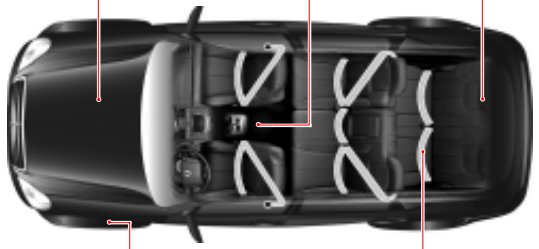
Blue mirror is adopted to improve vehicle appearance and to reduce the beaming out of the head lamp of the vehicle behind. And when reversing, the outside mirror which downs the aiming by 3.5° is adopted.

7910 RADIATOR GRILL



The shape of radiator grill is changed, and the hood opening lever is located in the top right of the grill.

6110 ENGINE HOOD / 7630 CENTER CONSOLE / 7410 SEAT



5720 FENDER PANEL

7430 SEAT BELT

8320 TAIL LAMP

Tail/Stop Lamp
12V-8W27W

Tail Lamp
12V-5W

Back-up Lamp
12V-W16W

Stop Lamp
12V-27W

Turn Signal
12V-27W

REAR GLASS ANTENNA & DEFOGGER

PAS Sensor

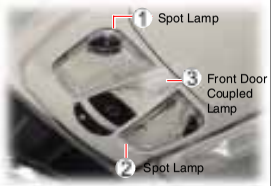
7870 FRONT BUMPER

*** Front bumper nudge bar and energy absorber eliminated.**

GLASS ANTENNA

SIDE SILL MOLDING

7770 ROOM LAMP (OVERHEAD CONSOLE LAMP)



Press each switch (1 or 2) to turn on or off the room lamp in driver side or passenger side. If pressing the door coupled lamp (3), the lamp comes on or off when opening or closing a front door.

7840 GLASS SPECIFICATION (SYMBOL)

Antenna Glass

Noise Shield Glass

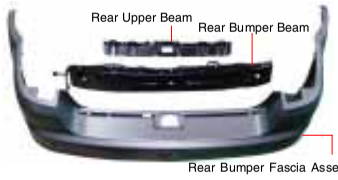
Solar Glass

Privacy Glass

4190 18-INCH WHEEL (256/60R18) AND TPMS MODULE

18-inch wheel is adopted, and the wheel shape is also changed. The wheel module can be installed on the wheel by adopting the TPMS.

7880 REAR BUMPER



*** Rear bumper energy absorber eliminated.**

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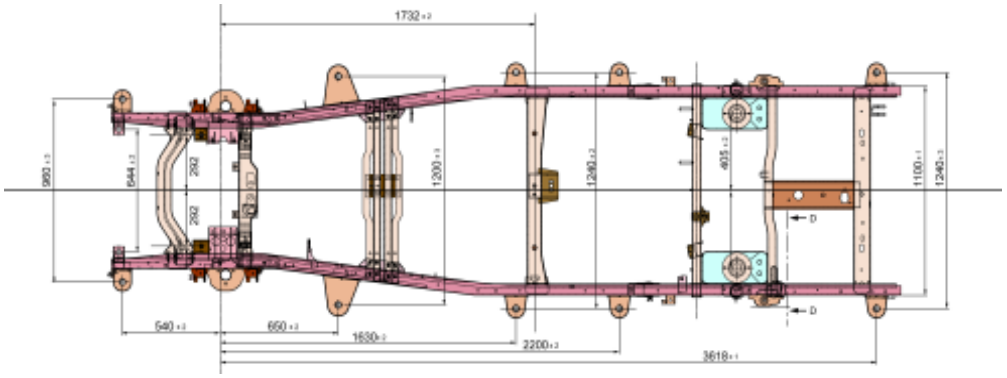
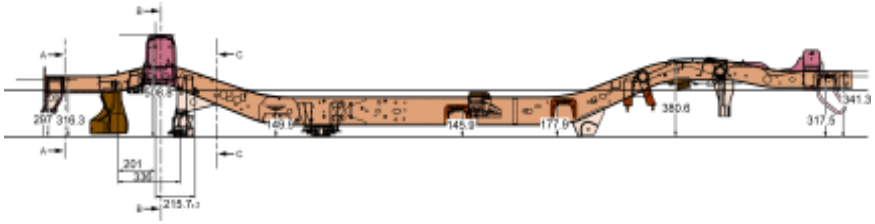
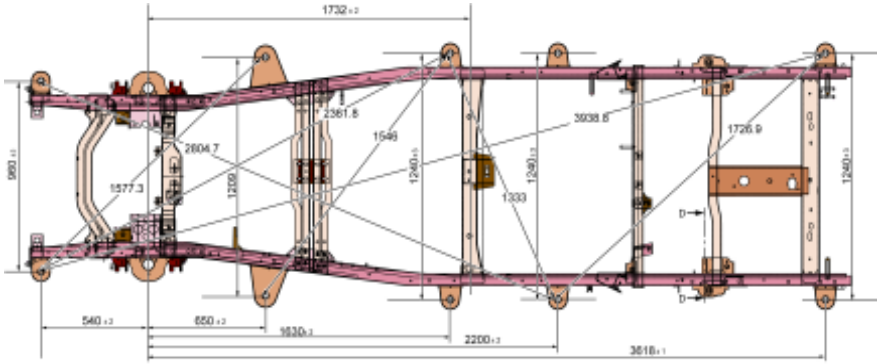
6. FRAME DIMENSION

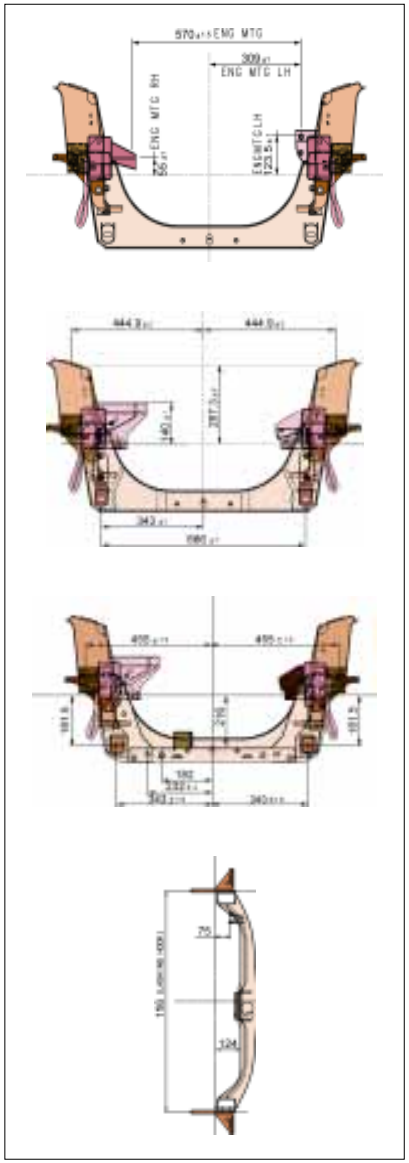
IRS TYPE





5-LINK TYPE





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GENERAL INFORMATION

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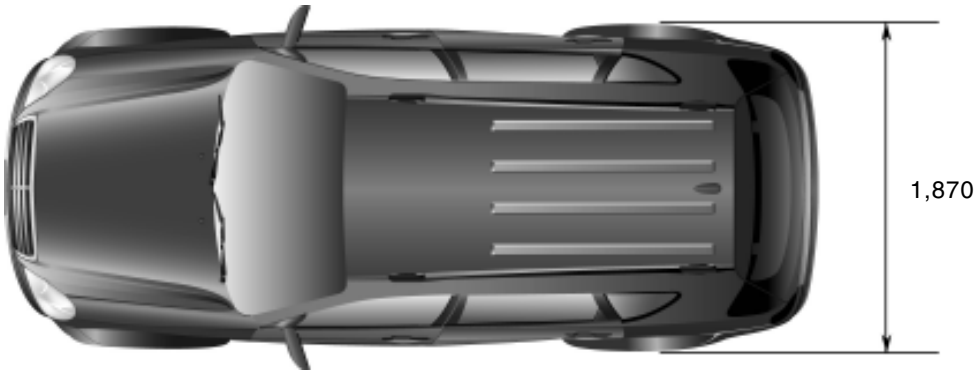
DIMENSIONS

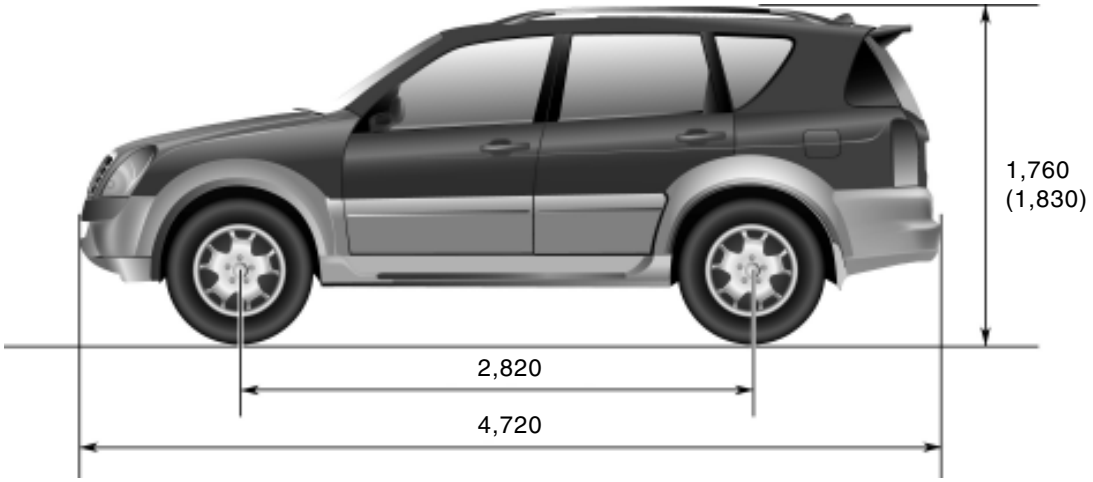
1. REXTON II

Unit: mm

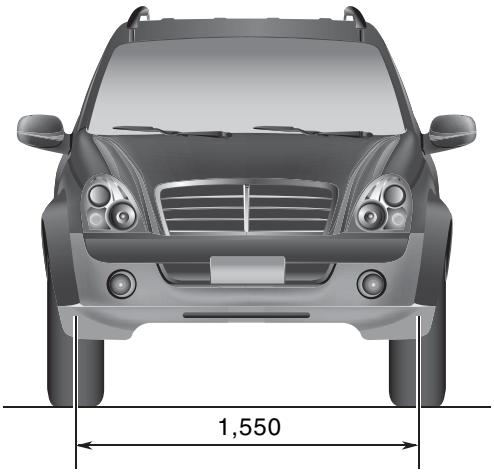
Top View



Side View



Front View



Rear View

* ( ) : Optional

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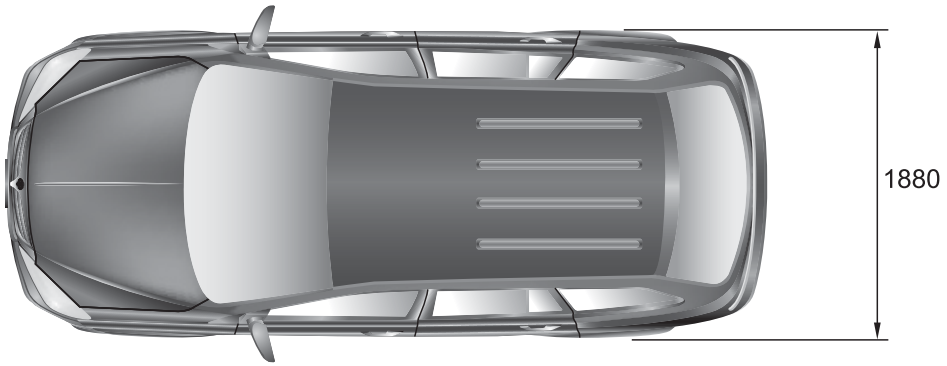
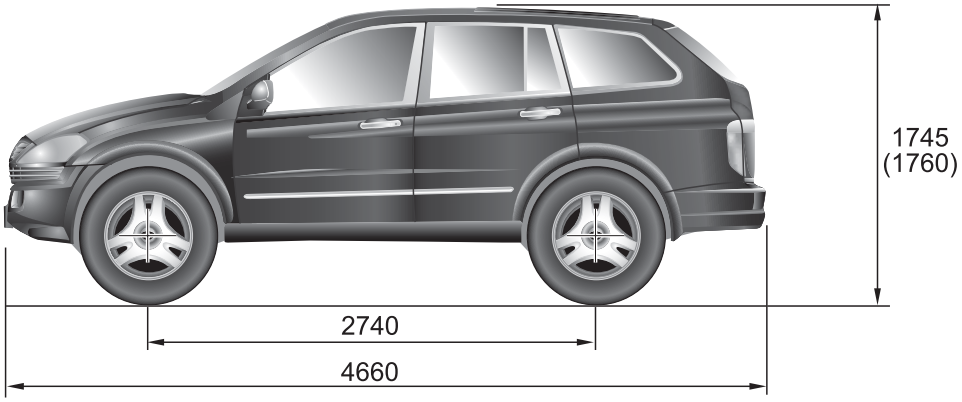
2. KYRON

Unit: mm

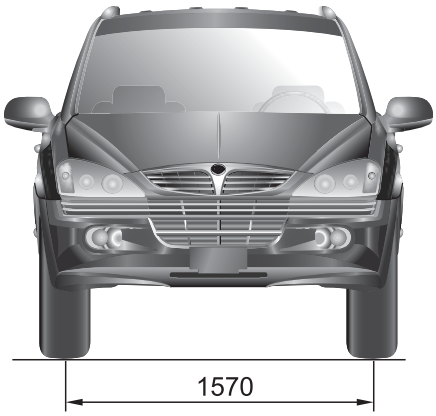
Top View



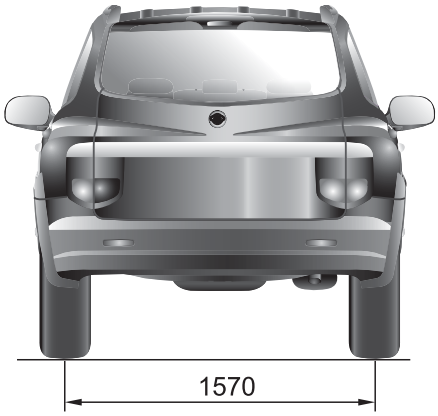
Side View



Front View



Rear View



* ( ) : Optional

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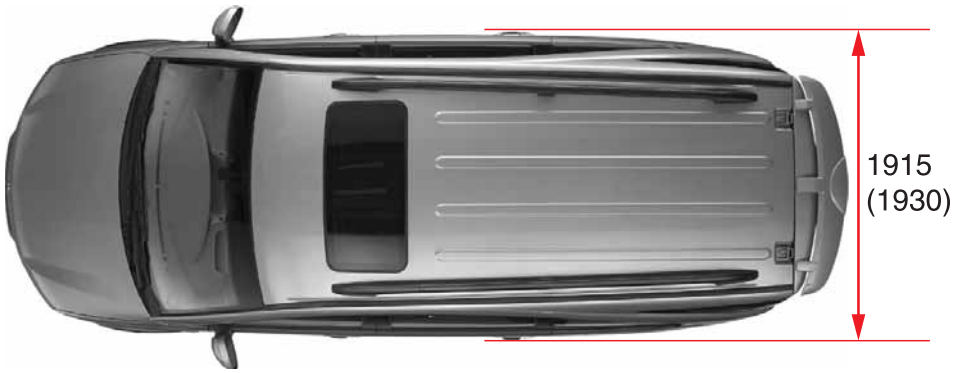
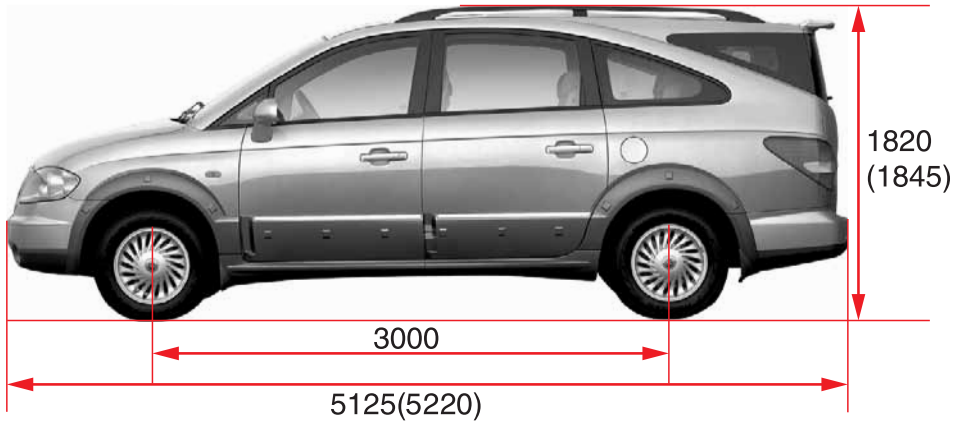
3. RODIUS / STAVIC

Unit: mm

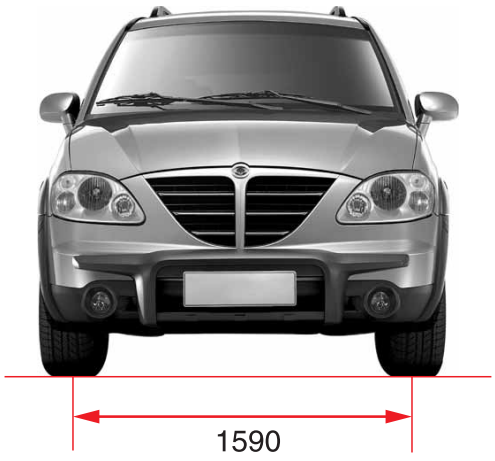
Top View



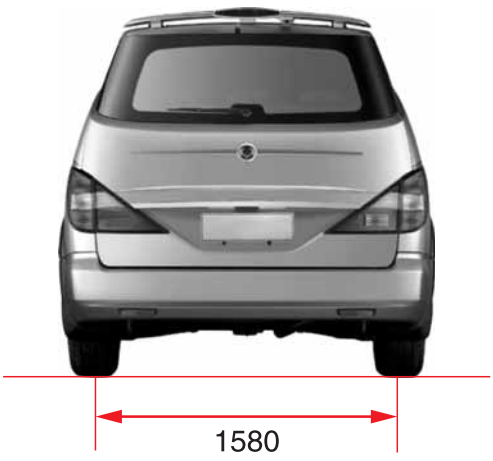
Side View



Front View



Rear View



* ( ) : Optional

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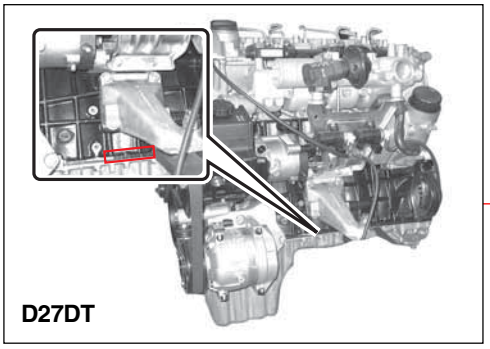
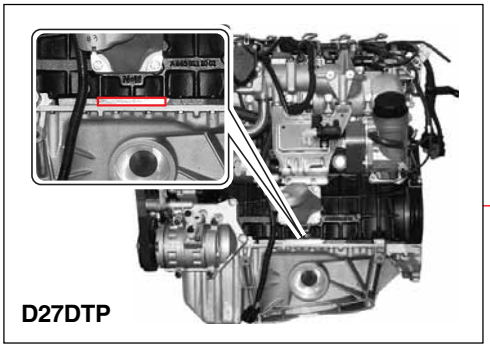
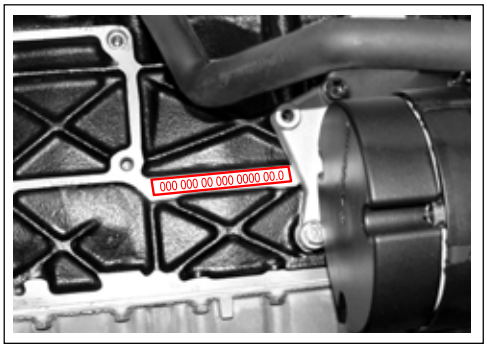
VEHICLE IDENTIFICATION





Diesel Engine (D27DTP, D27DT):
The engine number is stamped on the lower area of cylinder block behind the Intake manifold.

1. Engine Number



Gasoline Engine: The engine number is stamped on the lower area of cylinder block in exhaust manifold side.

3. Certification Label

The certification label is located on the driver's door sill.

2. Chassis Number

The chassis number is stamped on the frame behind the front right tire.

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SPECIFICATIONS

1. REXTON II

* ( ): Optional, [ ]: 2WD, D27DTP: Diesel 2.7 Power-Up, D27DT: Diesel 2.7, G32D: Gasoline

Descriptions			D27DTP	D27DT	G32D
General	Overall length		4,720 mm	←	←
	Overall width		1,870 mm	←	←
	Overall height		1,760 mm (1,830 mm)	←	←
	Gross vehicle weight		2,760 kg	←	←
	Curb vehicle weight	A/T	2,099 kg	2,101 kg	2,088 kg
		M/T	–	2,088 kg	–
	Fuel		Diesel	←	Gasoline
	Fuel tank capacity		78 ℓ	←	←
	Minimum Turning Radius		5.7 m	←	←
Engine	Numbers of cylinders / Compression ratio		5 / 17.5:1	←	6 / 10:1
	Total displacement		2,696 cc	←	3,199 cc
	Camshaft arrangement		DOHC	←	←
	Max. power	A/T	186 PS / 4,000 rpm	165 PS / 4,000 rpm	220 PS / 6,100 rpm
		M/T	–	165 PS / 4,000 rpm	–
	Max. torque	A/T	402 Nm / 1,600 ~ 3,000 rpm	340 Nm / 1,800 ~ 3,250 rpm	312 Nm / 4,600 rpm
		M/T	–	340 Nm / 1,800 ~ 3,250 rpm	–
	Idle speed		750 ± 20 rpm	←	700 ± 50 rpm
	Cooling system		Water-cooled / forced circulation	←	←
	Coolant capacity		11.0 ~ 11.5 ℓ	←	11.5 ~ 12.0 ℓ
	Lubrication type		Gear pump, forced circulation	←	←
	Max. oil capacity **(when shipping)**		9.2 ℓ	←	9.8 ℓ
	Turbocharger and cooling type		Turbocharger, air-cooled	←	–
Manual Trans-mission	Operating type		–	Semiremote control, floor change type	–
	Gear ratio	1st	–	4.315	–
		2nd	–	2.475	–
		3rd	–	1.536	–
		4th	–	1.000	–
		5th	–	0.807	–
		Reverse	–	3.919	–

Descriptions			D27DTP	D27DT	G32D
Automatic Transmission	Model		Electronic, 5-speed	←	←
	Operating type		Floor change type	←	←
	Gear ratio	1st	3.595	←	3.951
		2nd	2.186	←	2.423
		3rd	1.405	←	1.486
		4th	1.000	←	1.000
		5th	0.831	←	0.833
		Reverse 1st	3.167	←	3.147
		Reverse 2nd	1.926	←	1.930
Transfer Case	Model		AWD	Part-time (TOD)	Part-time (AWD)
	Type		Planetary gear type	←	←
	Gear ratio	High (4H)	–	1.000 : 1	←
		Low (4L)	–	2.483 : 1	← (AWD: –)
Clutch (M/T)	Operating type		–	Hydraulic type	–
	Disc type		–	Dry single diaphragm type	–
Power Steering	Type		Rack and pinion	←	←
	Steering angle	Inner	35.72°	←	←
		Outer	32.11°	←	←
Front Axle	Drive shaft type		Ball joint type	←	←
	Axle housing type		IOP type	Build-up type	Build-up type (IOP type)
Rear Axle	Drive shaft type		Semi-floating type (Ball joint type)	Semi-floating type	Semi-floating type (ball joint type)
	Axle housing type		Build-up type (IRS type)	Build-up type	Build-up type (IRS type)
Brake	Master cylinder type		Tandem type	←	←
	Booster type		Vacuum assisted booster type	←	←
	Brake typ	Front wheels	Disc type	←	←
		Rear wheels	Disc type	←	←
	Parking brake		Cable type (EPB)	←	←
Suspension	Front suspension		Wishbone + coil spring	←	←
	Rear suspension		5-link + coil spring (Multi-link + Coil spring) (EAS)	5-link + coil spring	5-link + coil spring (Multi-link + Coil spring) (EAS)

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2. KYRON

Descriptions			D20DT	D27DT	G32D
General	Overall length		4,660 mm	←	←
	Overall width		1,880 mm	←	←
	Overall height		1,740 (1,755: with roof rack) mm	←	←
	Gross vehicle weight	A/T	2,530 kg	←	←
		M/T	2,530 kg	←	–
	Curb vehicle weight	A/T	2WD: 1,920 kg / 4WD: 2,028 kg	2,071 kg (AWD: 2,053 kg)	2,046 kg
		M/T	2WD: 1,893 kg / 4WD: 2,001 kg	2030 kg	–
	Fuel		Diesel	←	Gasoline
	Fuel tank capacity		75 ℓ	←	←
Engine	Numbers of cylinders/ Compression ratio		4 / 17.5:1	5 / 17.5:1	6 / 10 : 1
	Total displacement		1,998 cc	2,696 cc	3,199 cc
	Camshaft arrangement		DOHC	←	←
	Max. power	A/T	141 PS / 4,000 rpm	165 PS / 4,000 rpm	220 PS / 6,100 rpm
		M/T	141 PS / 4,000 rpm	165 PS / 4,000 rpm	–
	Max. torque	A/T	310 Nm / 1,800 ~ 2,700 rpm	340 Nm / 1,800 ~ 3,250 rpm	312 Nm / 4,600 rpm
		M/T	310 Nm / 1,800 ~ 2,700 rpm	340 Nm / 1,800 ~ 3,250 rpm	–
	Idle speed		780 ± 50 rpm	750 ± 20 rpm	700 ± 50 rpm
	Cooling system		Water- cooled / forced circulation	←	←
	Coolant capacity		10.5 ~ 11.0 ℓ	11.0 ~ 11.5 ℓ	11.5 ~ 12.0 ℓ
	Max. oil capacity **(when shipping)**		8.2 ℓ	9.2 ℓ	9.8 ℓ
	Lubrication type		Gear pump, forced circulation	←	←
	Turbocharger and cooling type		Turbocharger, air-cooled	←	–
Manual Transmission	Operating type		Semi-Remote control, floor change type	←	–
	Gear ratio	1st	4.315	←	–
		2nd	2.475	←	–
		3rd	1.536	←	–
		4th	1.000	←	–
		5th	0.807	←	–
		Reverse	3.919	←	–
Automatic Transmission	Model		Electronic, 5-speed	←	←
	Operating type		Floor change type	←	←
	Gear ratio	1st	3.951	3.595	3.951
		2nd	2.423	2.186	2.423
		3rd	1.486	1.405	1.486
		4th	1.000	1.000	1.000
		5th	0.833	0.831	0.833
		Reverse 1st	3.147	3.167	3.147
		Reverse 2nd	1.930	1.926	1.930

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Descriptions			D20DT	D27DT	G32D
Transfer Case	Model		Part-time	Part-time (AWD)	AWD
	Type		Planetary gear type	←	←
	Gear ratio	High (4H)	1.000 : 1	←	←
		Low (4L)	2.483 : 1	← (AWD: –)	–
Clutch (M/T)	Operating type		Hydraulic type	←	–
	Disc type		Dry single diaphragm type	←	–
Power Steering	Type		Rack and pinion	←	←
	Steering angle	Inner	35.88°	←	←
		Outer	32.08°	←	←
Front Axle	Drive shaft type		Ball joint type	←	←
	Axle housing type		Build-up type	Build-up type (IOP type)	IOP type
Rear Axle	Drive shaft type		Semi-floating type	Semi-floating type (Ball joint type)	Ball joint type
	Axle housing type		Build-up type	Build-up type (IRS type)	IRS type
Brake	Master cylinder type		Tandem type	←	←
	Booster type		Vacuum assisted booster type	←	←
	Brake type	Front wheels	Disc type	←	←
		Rear wheels	Drum (disc)	←	Disc type
	Parking brake		Cable type: internal expansion	Cable type: internal expansion (EPB type)	←
Suspension	Front suspension		Wishbone + coil spring	←	←
	Rear suspension		5-link + coil spring	5-link + coil spring (Multi link + coil spring) (EAS)	Multi link + coil spring (EAS)
Air Conditioner	Refrigerant (capacity)		R-134a (650 ± 30g)	←	←
Electrical	Battery type / Capacity (V-AH)		MF / 12 - 90	←	←
	Starter capacity (V-kW)		12 - 2.2	←	12 - 1.8
	Alternator capacity (V-A)		12 - 140 (12 - 115)	←	12 - 115

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3. RODIUS / STAVIC

Descriptions			D27DT	G32D
Engine	Numbers of cylinders/ Compression ratio		5 / 18 : 1	6 / 10 : 1
	Total displacement		2,696 cc	3,199 cc
	Camshaft arrangement		DOHC	←
	Max. power		165 ps / 4,000 rpm	220 ps / 6,100 rpm
	Max. torque		34.7 kg·m / 1,800~3,250 rpm	31.8 kg·m / 4,600 rpm
	Idle speed		750 ± 20 rpm	700 ± 50 rpm
	Cooling system		Water- cooled / forced circulation	←
	Coolant capacity		11.0 ~ 11.5 ℓ	11.5 ~ 12.0 ℓ
	Lubrication system		Gear pump, forced circulation	←
	Max. oil capacity **(when shipping)**		9.2 ℓ	9.8 ℓ
	Turbocharger and cooling type		Turbocharger, air- cooled	-
	Fuel		Diesel	Gasoline
Automatic Transmission	Model		Electronic	←
	Operating type		Floor change type	←
	Gear ratio	1st	3.595	3.951
		2nd	2.186	2.423
		3rd	1.405	1.486
		4th	1.000	1.000
		5th	0.831	0.833
		Reverse 1st	3.167	3.147
		Reverse 2nd	1.926	1.930

Descriptions				11 Seaters	9 Seaters	7 Seaters
General	Overall length			5,125 (5,220) mm	←	←
	Overall width			1,915 (1,930) mm	←	←
	Overall height			1,820 (1,845) mm	←	←
	Gross vehicle weight	A/T	Diesel	3,035 [2,925] kg	2,850 [2,750] kg	←
			Gasoline	2,950 [2,850] kg	2,850 [2,750] kg	←
		M/T		3,005 [2,900] kg	2,850 [2,750] kg	←
	Curb vehicle weight	A/T	Diesel	2,320 [2,210] kg	2,308 [2,198] kg	2,244 [2,134] kg
			Gasoline	2,325 [2,215] kg	2,313 [2,203] kg	2,235 [2,125] kg
		M/T		2,290 [2,180] kg	2,281 [2,171] kg	2,217 [2,106] kg
	Fuel tank capacity			80 ℓ	←	←
Manual Transmission	Operating type			Semi- Remote control, floor change type	←	←
	Gear ratio	1st		4.315	←	←
		2nd		2.475	←	←
		3rd		1.536	←	←
		4th		1.000	←	←
		5th		0.807	←	←
		Reverse		3.919	←	←
Transfer Case	Model			D27DT: TOD / G32D: Part-time	←	←
	Type			Planetary gear type	←	←
	Gear ratio	High		1.000 : 1	←	←
		Low		2.483 : 1	←	←
Clutch (M/T)	Operating type			Hydraulic type	←	←
	Disc type			Dry single diaphragm type	←	←
Power Steering	Type			Rack and pinion	←	←
	Steering angle	Inner		37° 22′	←	←
		Outer		32° 31′	←	←
Front Axle	Drive shaft type			Ball joint type	←	←
	Axle housing type			Build-up type	←	←
Rear Axle	Drive shaft type			Ball joint type	←	←
	Axle housing type			Build-up type	←	←
Brake	Master cylinder type			Tandem type	←	←
	Booster type			Vacuum assisted booster type	←	←
	Brake type	Front wheels		Disc type	←	←
		Rear wheels		Disc type	←	←
	Parking brake			Cable type (internal expansion)	←	←
Suspension	Front suspension			Wishbone (Double) + coil spring	←	←
	Rear suspension			Multi-link + coil spring	←	←
Air Conditioner	Refrigerant (capacity)			R-134a (1050 ± 30 g)	←	←
Electrical	Battery type / Capacity (V-AH)			MF / 12 - 90	←	←
	Starter capacity (V-kW)			12 - 2.2 (1.8)	←	←
	Alternator capacity (V-A)			12 - 140 (12 - 115)	←	←

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RECOMMENDED FLUIDS AND LUBRICANTS

1. REXTON II/KYRON

Descriptions			Capacity	Specifications
Engine Oil		D27DTP	≒ 8.5 ℓ	Quality class: Ssangyong genuine engine oil (Approved by MB Sheet 229.1 or 229.3) Viscosity: MB sheet No. 224.1
		D27DT	≒ 8.5 ℓ	
		G32D	≒ 9.0 ℓ	
Engine Coolant		D27DTP	11.0 ~ 11.5 ℓ	Ssangyong genuine coolant Anti-Freeze:SYC-310 Anti-Freeze:Water = 50:50
		D27DT	11.0 ~ 11.5 ℓ	
		G32D	11.5 ~ 12.0 ℓ	
Automatic Transmission Fluid			≒ 8.0 ℓ	Ssangyong genuine oil (Shell ATF 3353 or Fuchs ATF 3353)
Manual Transmission Fluid		2WD	≒ 3.4 ℓ	Ssangyong genuine oil (ATF DEXRON II)
		4WD	≒ 3.6 ℓ	
Transfer Case Fluid		AWD	≒ 1.1 ℓ	Ssangyong genuine oil (ATF DEXRON III)
		TOD	≒ 1.4 ℓ	
		Part Time	≒ 1.4 ℓ	
Axle Oil	Front	Non IOP	≒ 1.4 ℓ , ≒1.5 ℓ	Ssangyong genuine oil (API GL-5 & SAE 80W/90)
		IOP	≒ 0.78 ℓ	Ssangyong genuine oil (Shell synthetic fuel efficient GL 75W/90)
	Rear	Rigid	≒ 2.0 ℓ	Ssangyong genuine oil (API GL-5 & SAE 80W/90)
		IRS	≒ 1.5 ℓ	Ssangyong genuine oil (Shell synthetic fuel efficient GL 75W/90)
Brake / Clutch Fluid			As required	Ssangyong genuine oil (DOT4)
Power Steering Fluid			≒ 1.0 ℓ	Ssangyong genuine oil (ATF DEXRON II or III)

D27DTP: Diesel 2.7 POWER-UP, D27DT: Diesel 2.7, G32D: Gasoline

NOTICE

- **Use only Ssangyong recommended fluids and lubricants.**
- **Do not mix any different types or brands of oils or fluids. This may cause damages.**
- **Keep the specified levels when adding or replacing the fluids.**

2. RODIUS / STAVIC

Descriptions		Capacity	Specifications
Engine Oil	Diesel Engine (D27DT)	≒ 8.0 ℓ	Quality class: Ssangyong genuine engine oil (Approved by MB Sheet 229.1 or 229.3) Viscosity: MB sheet No. 224.1
	Gasoline Engine (G32D)	≒ 8.0 ℓ	
Engine Coolant	DI Engine	11.0 ~ 11.5 ℓ	Ssangyong genuine coolant Anti-Freeze:SYC-310 Anti-Freeze:Water = 50:50
	G32D	11.5 ~ 12.0 ℓ	
Automatic Transmission Fluid		5-speed: 8.0 ℓ	SHELL or FUCHS ATF 3353
Manual Transmission Fluid	2WD	3.4 ℓ	ATF DEXRON® II, III
	4WD	3.6 ℓ	
Transfer Case Fluid		1.4 ℓ	ATF DEXRON® III
Axle Fluid	Front	1.3 ~ 1.4 ℓ	API GL-5 or SAE 80W/ 90
	Rear	1.7 ℓ	Approved by MB Sheet 235.0 Viscosity grade: 85W/90
Brake/Clutch Fluid		as required	SAE J 1703, DOT 3 or 4
Power Steering Fluid		1.0 ℓ	ATF DEXRON® II, III

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LIFTING POINTS

▶ 4-post Lift

Position the vehicle on the 4-post lift securely and chock the vehicle with chocks in front of and behind the wheels not to move during working.

IRS Type

5-link Type

NOTICE

- **During lifting, be sure to check whether vehicle is empty.**
- **Board-on lift connection device installed in front of vehicle should be positioned in front of sill locating under the front door.**
- **Install lift connecting device on the edge of front and rear of board-on lift.**

WARNING

- **Be sure to use attachment during lifting to prevent the lift from contacting with body floor.**
- **While lifting the vehicle, widen the lift floor as far as possible to stabilize between vehicle front and rear. When fixing the lift floor, be careful not to contact with brake tube and fuel lines.**

▶ Safety Jack and Safety Stand

If lift up the vehicle with safety jack and stand, should be more careful during works.

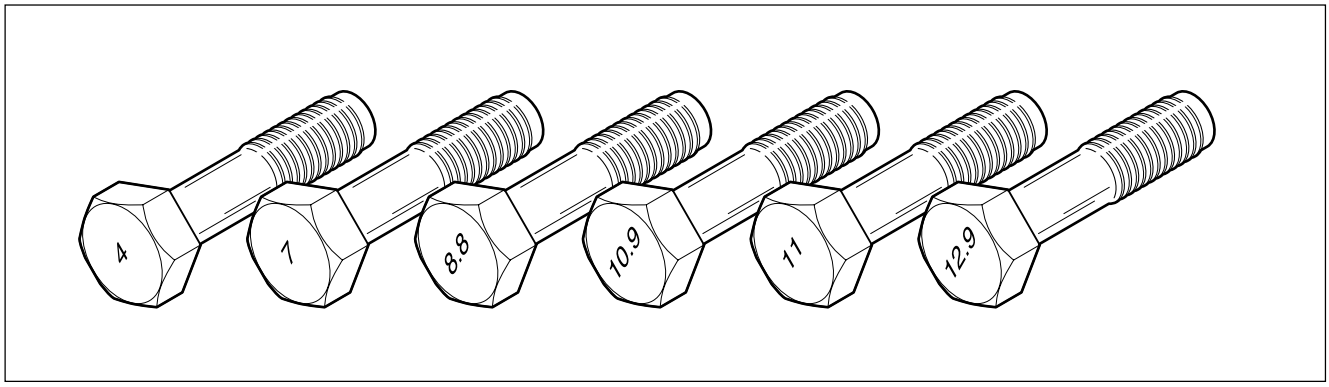
WARNING

- **Never be under the vehicle if supported with only jack. If have to be under the vehicle, be sure to use safety block.**
- **Use wheel block in front and rear of every wheel.**

TIGHTENING TORQUE OF STANDARD BOLTS

▶Tightening Torque By Bolt Specification

Bolt Diameter	Pitch	Tightening Torque (kg·cm)					
		Standard Tightening Torque			Max. Allowable Tightening Torque		
		4T	7T	9T	4T	7T	9T
M3	0.5	5	9	13	7	12	17
M4	0.7	12	20	30	16	27	40
M5	0.8	24	40	57	32	53	77
M6	1.0	41	68	99	55	91	130
M8	1.25	88	160	230	130	210	310
M10	1.25	190	330	470	260	430	620
	1.5	190	310	450	250	420	600
M12	1.25	350	580	840	460	770	1,100
	1.75	330	550	790	440	730	1,000
M14	1.5	550	910	1,300	730	1,200	1,900
M16	1.5	830	1,100	2,000	1,100	1,900	2,700
M18	1.5	1,200	2,000	2,900	1,600	2,700	3,800
M20	1.5	1,700	2,800	4,000	2,200	3,700	5,300
M22	1.5	2,300	3,800	5,400	3,000	5,000	7,200
M24	1.5	2,900	4,900	7,000	3,900	6,500	9,400
	2.0	2,800	4,700	6,800	3,800	6,300	9,100



1. Metric bolt strength is embossed on the head of each bolt. The strength of bolt can be classified as 4T, 7T, 8.8T, 10.9T, 11T and 12.9T in general.
2. Observe standard tightening torque during bolt tightening works and can adjust torque to be proper within 15 % if necessary. Try not to over max. allowable tightening torque if not required to do so.
3. Determine extra proper tightening torque if tightens with washer or packing.
4. If tightens bolts on the below materials, be sure to determine the proper torque.
   - Aluminum alloy: Tighten to 80 % of above torque table.
   - Plastics: Tighten to 20 % of above torque table.

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D27DTP ENGINE

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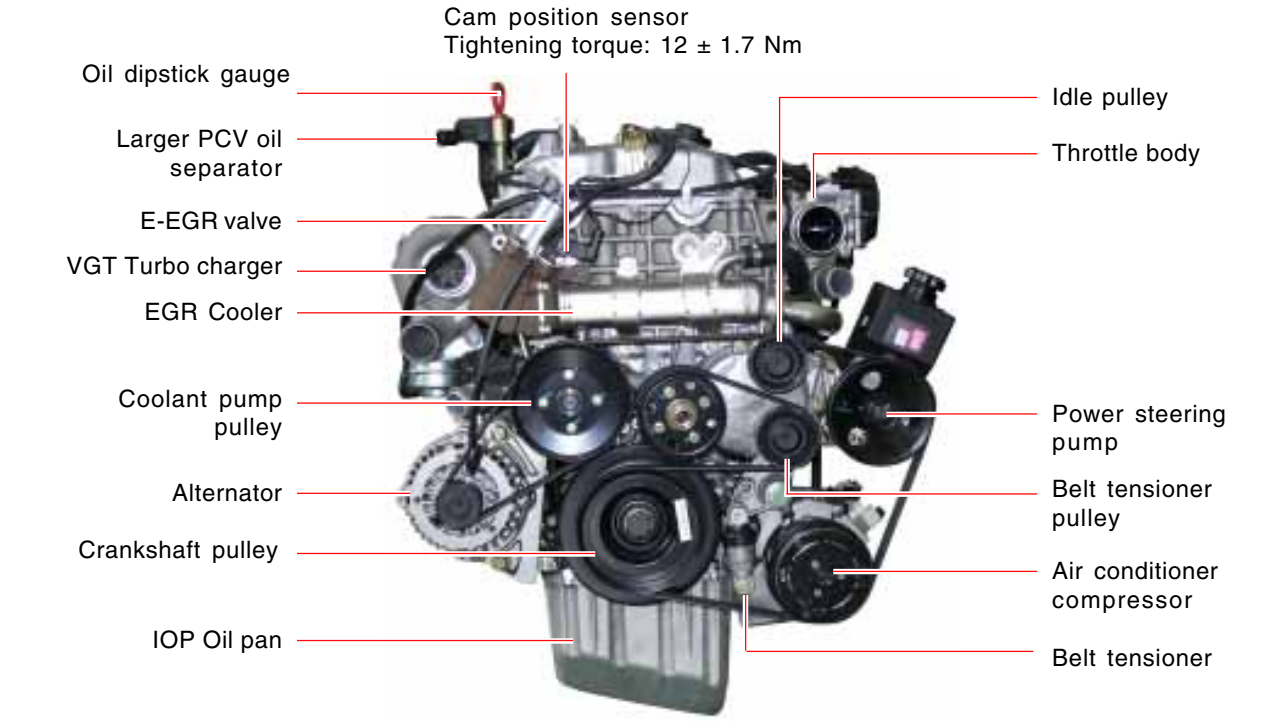
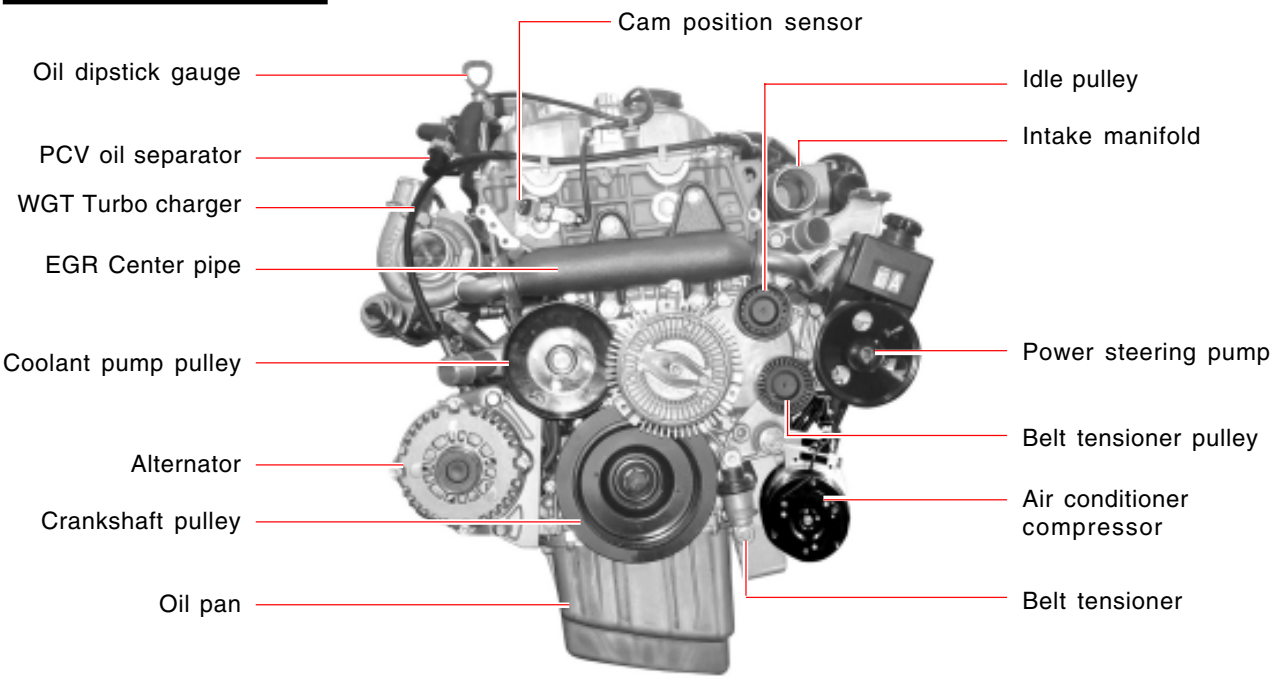
D27DTP (POWER UP) ENGINE

1. STRUCTURE AND COMPARISON

D27DTP (POWER UP) Engine - Front View



D27DT Engine - Front View



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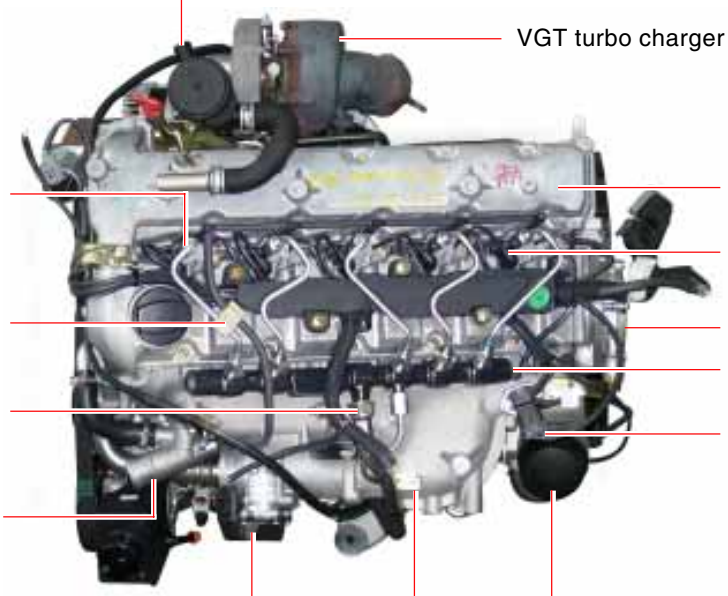
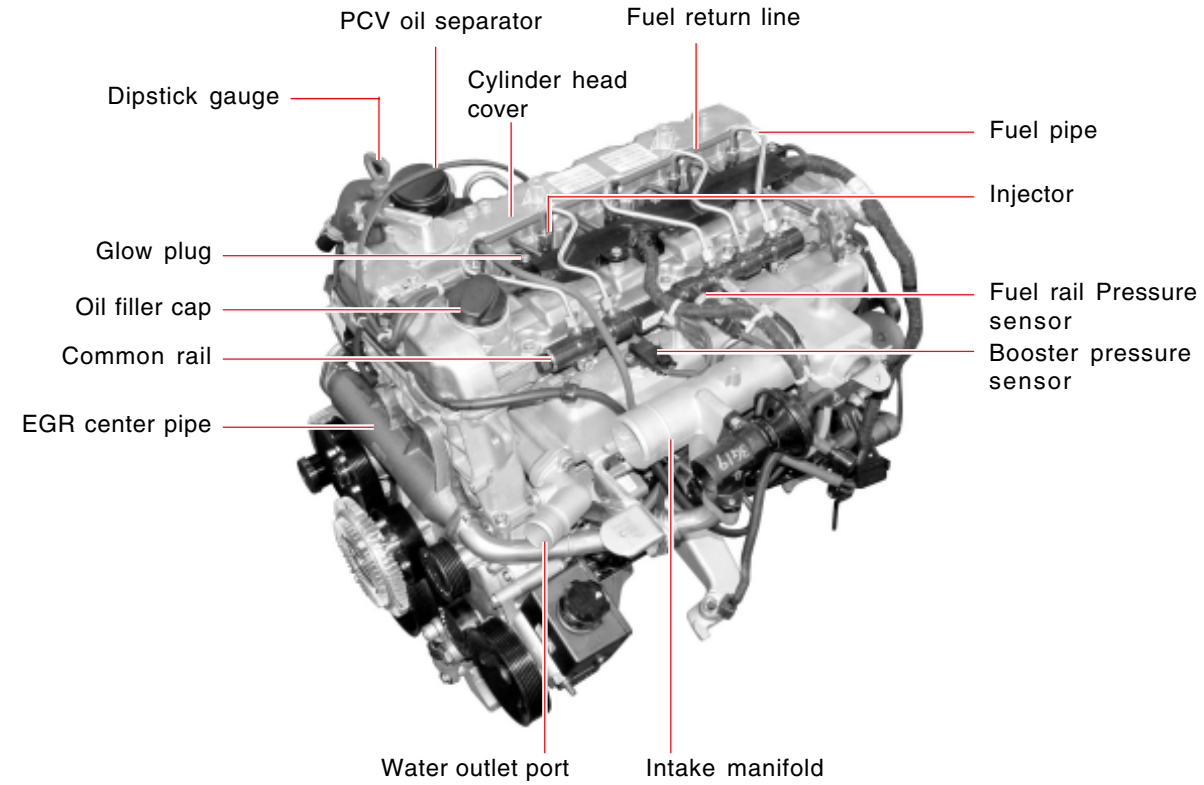
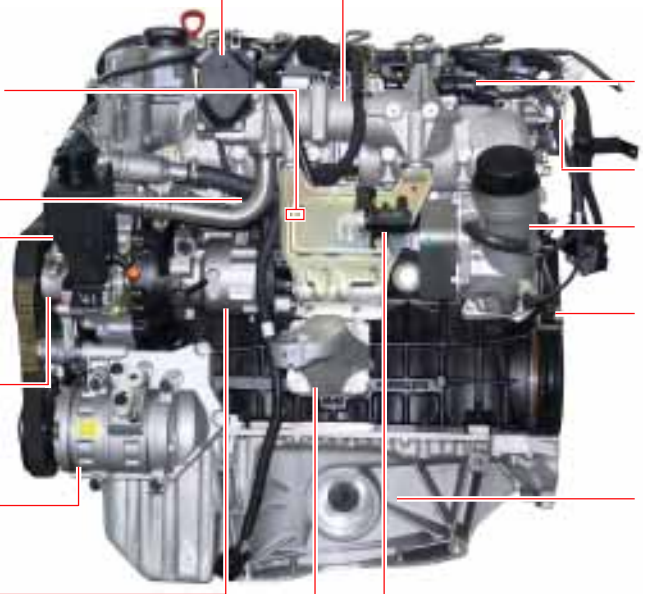
D27DTP (POWER UP) Engine -Top View



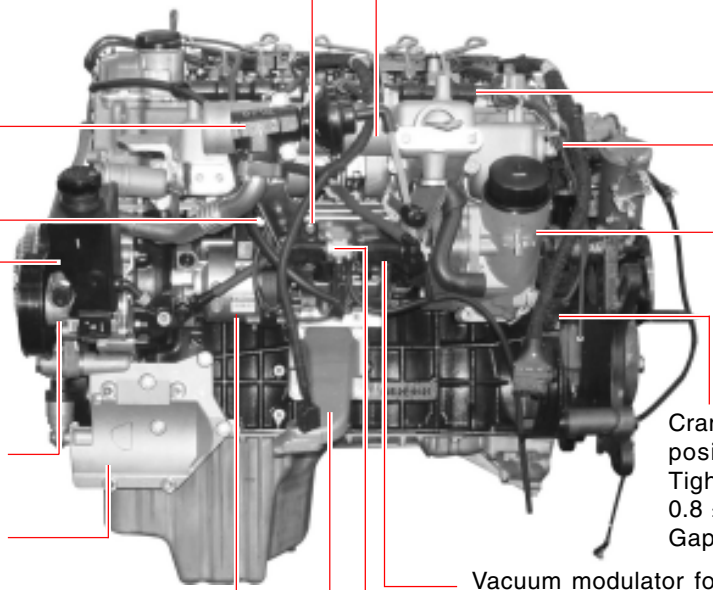
D27DT Engine - Top View



D27DTP (POWER UP) Engine - Left Side View



D27DT Engine - Side View



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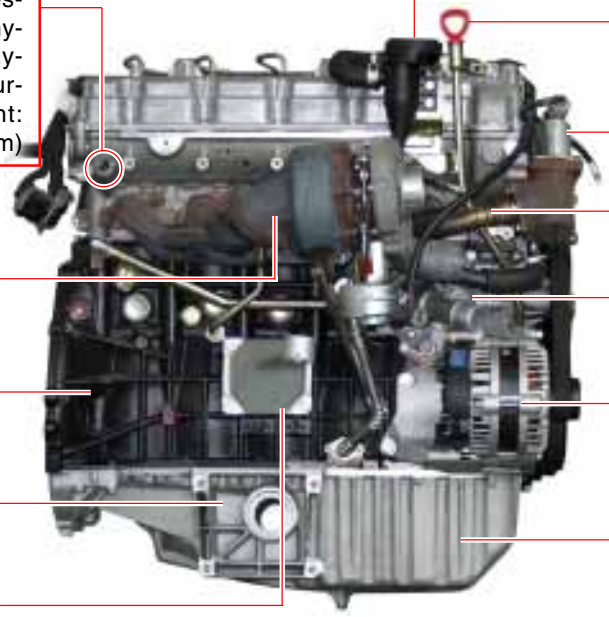
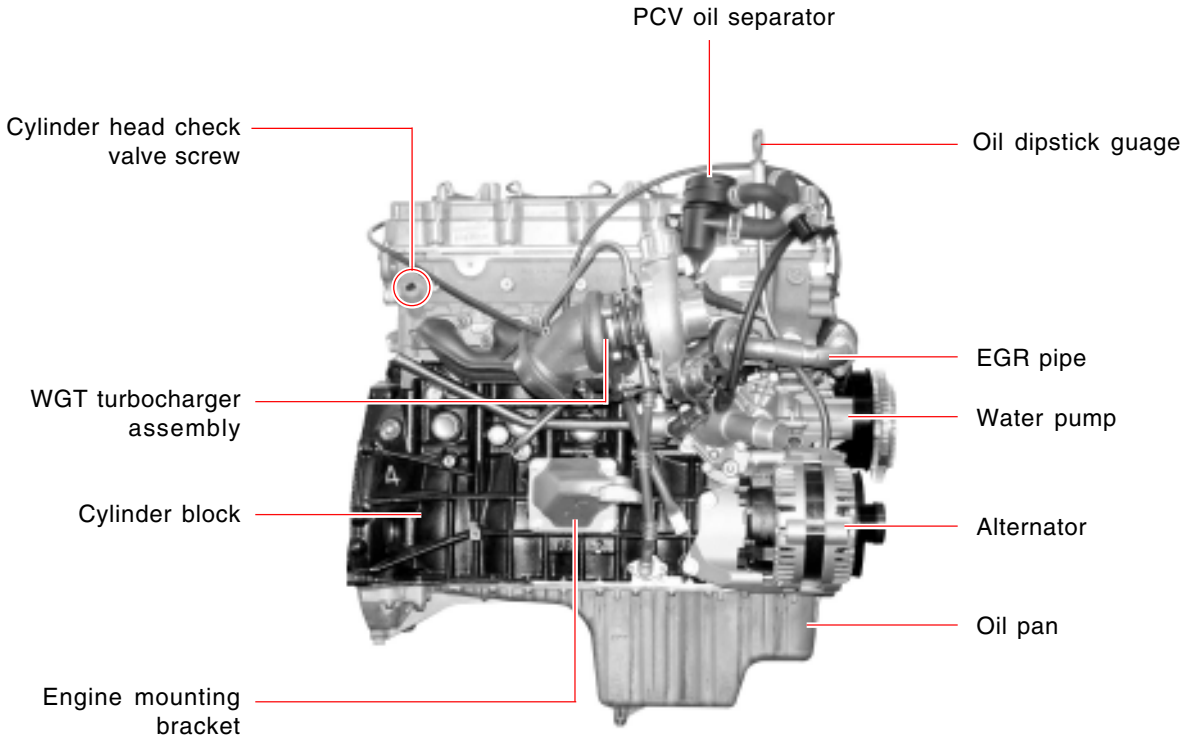
D27DTP (POWER UP) Engine - Left Side View

* Cylinder head check valve screw
: The check valve is inserted into inside of screw plug and allows to remain steady the remaining pressure of oil forcefully circulated to hydraulic tappet so as to prevent hydraulic tappet from damaging during initial engine start. (Sealant: DB2210 / tightening torque: 30 Nm)



D27DT Engine - Left Side View



2. ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

▶ Specifications

Descriptions			D27DTP (POWER UP) Engine	D27DT Engine	D27DT + CDPF Engine
Engine	Type/Number of cylinders		D27DT/5-cylinder	←	←
Cylinder	Inner diameter (mm)		86.2	←	←
	Stroke (mm)		92.4	←	←
Displacement (cc)			2696	←	←
Compression ratio			17.5:1	18.0:1	←
Maximum output (ps/rpm)		For Automatic	186 / 4,000	165 / 4,000	165 / 4,000
		Transmission	-	165 / 4,000	-
Maximum torque (kg·m/rpm)		For Manual	41 /1,600 ~ 3,000	35.7 /1,800 ~ 3,250	35.7 /1,800 ~ 3,250
		Transmission	-	34.7 /1,800 ~ 3,250	-
Idle speed	For Manual Transmission		-	760 ± 50 rpm	-
	For Automatic Transmission		750 ± 20 rpm	750 ± 20 rpm	←
Valve	Intake	Opens (btdc)	9°	←	16°
		Closes (abdc)	26°	←	33°
	Exhaust	Opens (bbdc)	38°	←	46°
		Closes (atdc)	16°	←	21°
Camshaft	Type		DOHC	←	←
Fuel system	Fuel type		Low sulfur diesel	←	←
	Fuel pump type		Vane pump in HP pump	←	←
	Fuel supply pressure	HP pump Inlet port	-0.4 ~ 0 mbar	Max. 400 mbar	←
		HP pump outlet port (with IMV fully open)	Below 1,600 bar	Above 1,050 bar	←
	Water separation in fuel filter		Every 10,000 km	←	←
	Fuel tank capacity (ℓ)		78	←	←
Lubrication system	Oil specification		SAE 10W40, 5W40 (MB Sheet 229.1, 229.3 approved oil)	←	←
	Lubrication type		Gear pump Forced circulation	←	←
	Oil filter type		Full flow type, filter element type	←	←
	Oil capacity (ℓ)		≒ 8.5	←	←
Cooling system	Cooling type		Water cooling type/ Forced circulation	←	←
	Cooling fan operation type		Belt operated type	←	←
	Thermostat (* Note: Fully opened at 100°C)	Opening temperature	85 °C	←	←
		Type	WAX Pellet Type	←	←
	Coolant capacity (ℓ)		≒ 11.0 ~ 11.5	←	←

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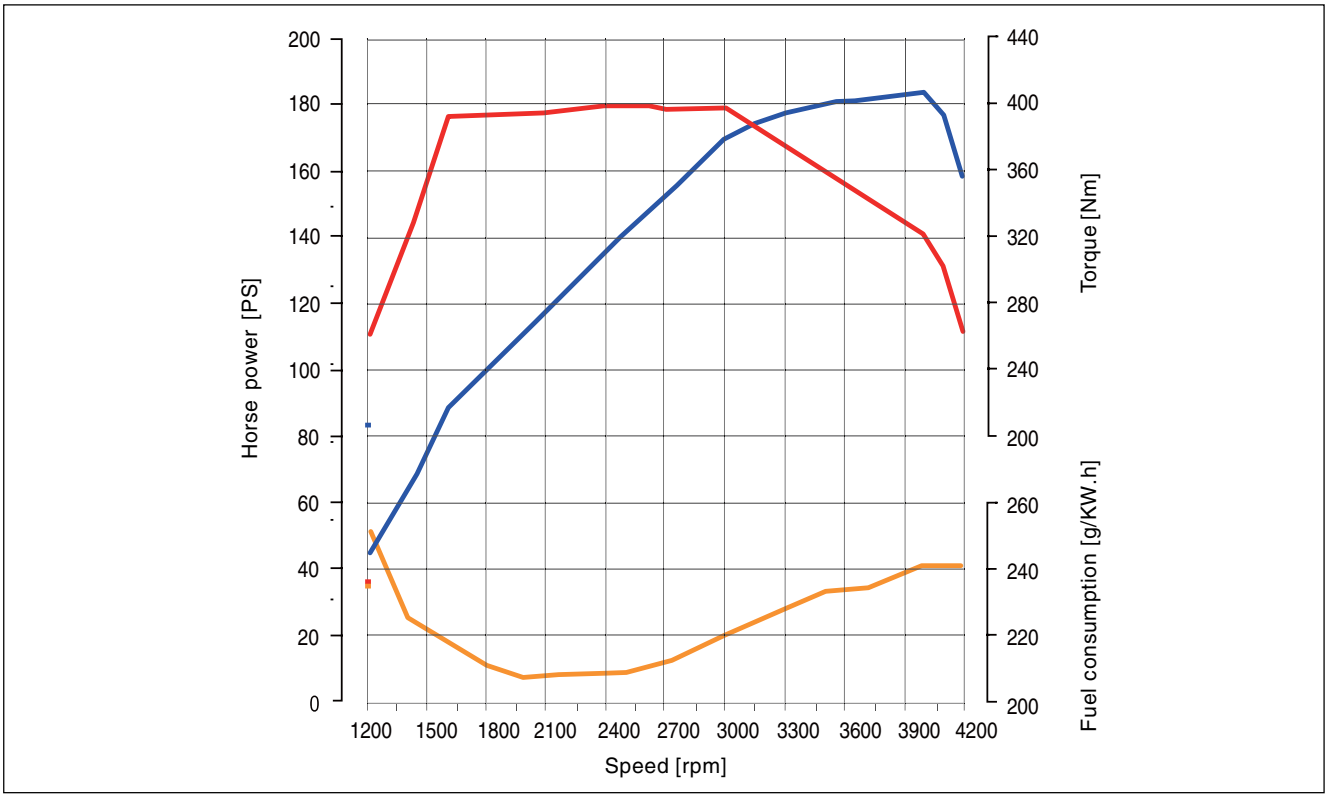
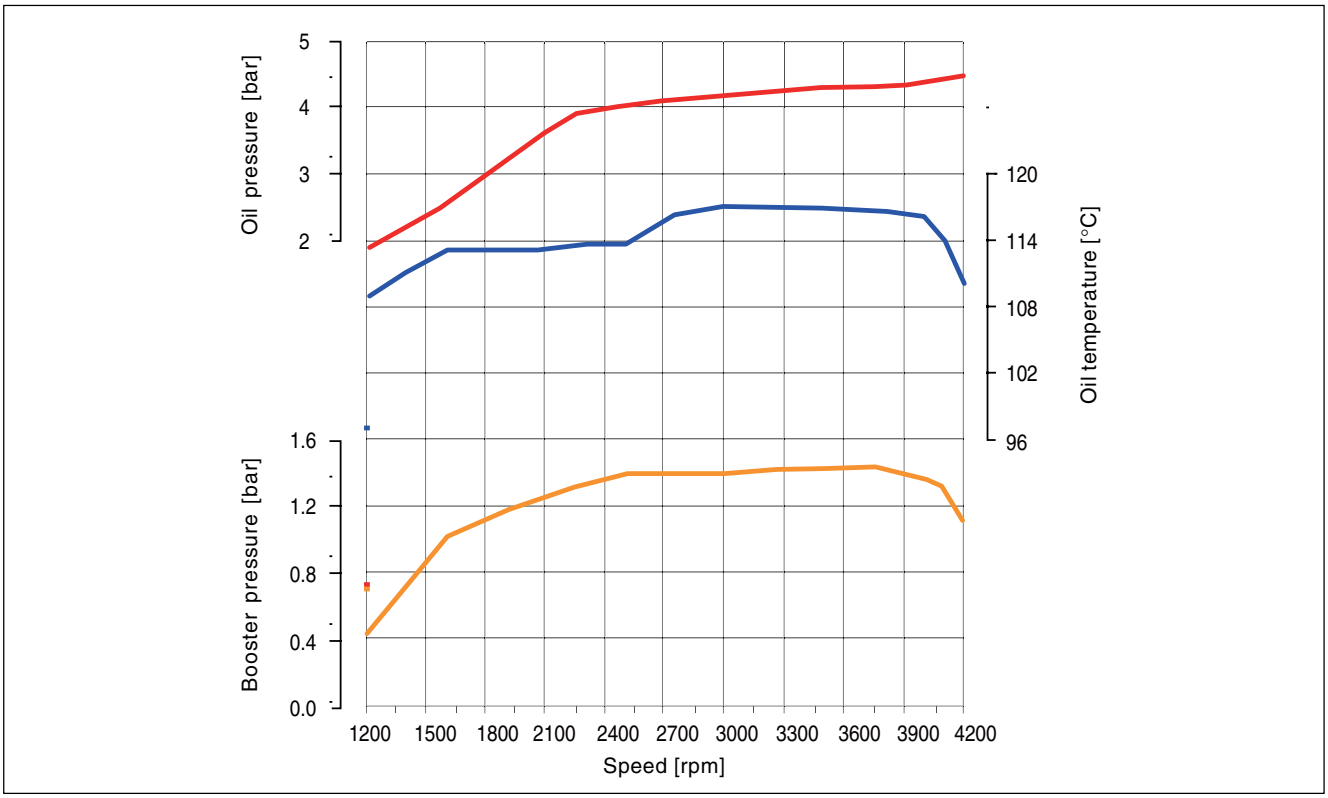
▶ D27DTP (Power Up) Engine Performance Curve

1. Output and Torque: vehicle with automatic transmission



2. Oil Temperature/Pressure and Boost Pressure: vehicle with automatic transmission



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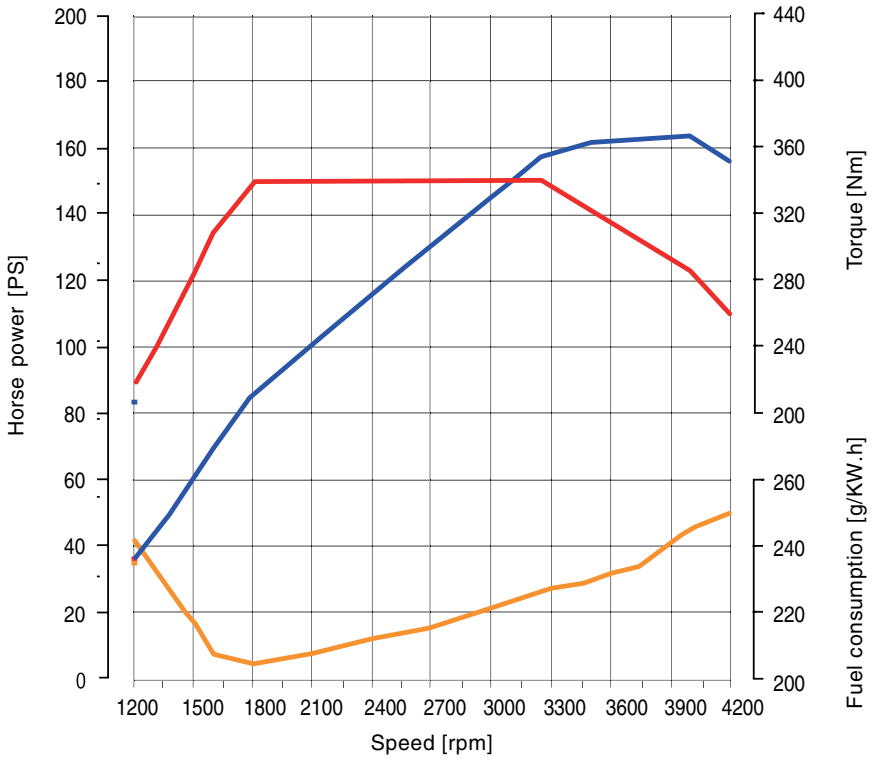
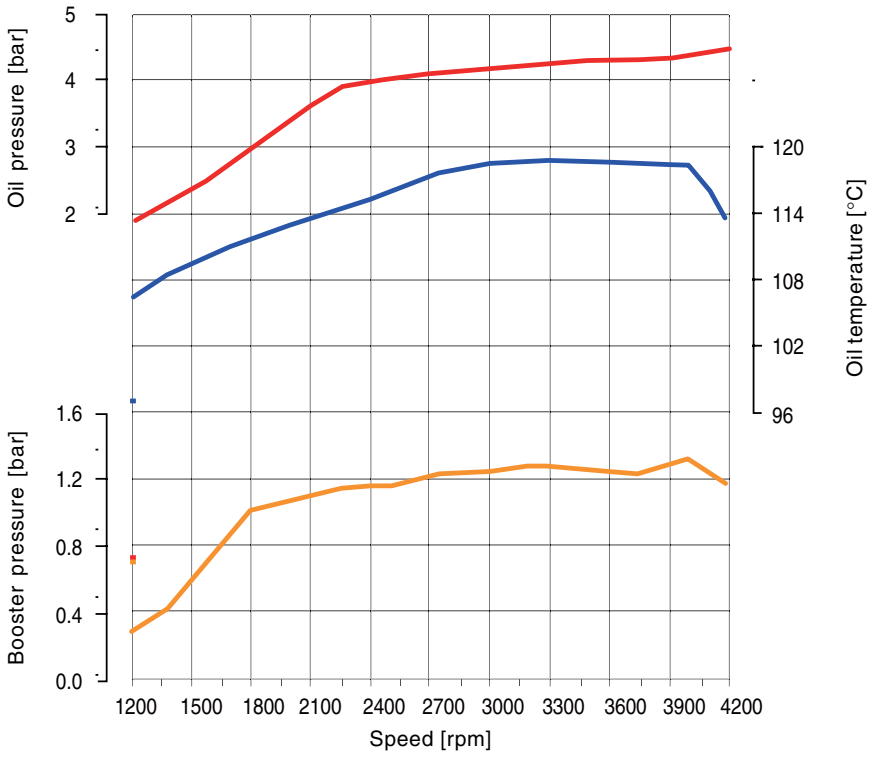
▶ D27DT Engine Performance Curve

1. Output and Torque



2. Oil Temperature/Pressure and Boost Pressure



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3. TIGHTENING TORQUE

This table shows the tightening torques for removal/mounting and disassembly/reassemly of the engine.

Name	Size	Quantity	Tightening Torque (Nm)		
			D20DT	D27DT	D27DTP
Main bearing cap	M11 x 67	10	55 ± 5 120° ± 10°	←	←
Connecting rod cap	M9 x 51	8	40 ± 5 90° ± 10°	←	←
Rear cover	M6 x 20	6	10 ± 1	←	←
Oil pump	M8 x 35SOC	3	25 ± 2.5	←	←
T.G.C.C	M6 x 40	6	10 ± 1	←	←
	M6 x 60	3	10 ± 1	←	←
	M6 x 70	2	10 ± 1	←	←
Flywheel	M10 x 22	8	45 ± 5 90° ± 10°	←	←
Crankshaft hub	M20 x 85	1	200 180° ± 10°	←	←
Oil pan	M6 x 20	24	10 ± 1	←	←
	M6 x 35	3	10 ± 1	←	←
	M6 x 85	3	10 ± 1	←	←
	M8 x 40	4	25 ± 2.5	←	←
High pressure pump mounting bolt	M8 x 55	3	25 ± 2.5	←	←
High pressure pump main nut (Intermediate shaft)	M14 x 1.5	1	65 ± 5	←	←
Cylinder head	M8 x 25	2	25 ± 2.5	←	←
	M8 x 50	2			
	M10 x 158	1	85 ± 5 270° ± 10°	←	←
	M10 x 177	9			
Camshaft sprocket (Intake)	M11 x 40	1	25 ± 2.5 90° ± 10°	←	←
Camshaft sprocket (Exhaust)					
Chain tensioner	M24	1	65 ± 5	←	←
Auto tensioner	M12 x 90(UP)	1	82 ± 6	←	←
	M8 x 45(LOW)	1	32 ± 3	←	←
Water pump	M6 x 50	7	10 ± 1	←	←
Water pump pulley	M6 x 10	4	10 ± 1	←	←
Hot water inner pipe	M6 x 12	2	10 ± 1	←	←
Alternator brackrt	M8 x 80	1	25 ± 2.5	←	←
	M8 x 34	2	25 ± 2.5	←	←
	M8 x 30	2	25 ± 2.5	←	←
Alternator	M10 x 90	1	46 ± 4.6	←	←
	M10 x 116	1	46 ± 4.6	←	←

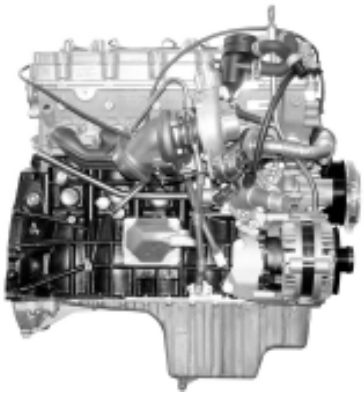
Name	Size	Quantity	Tightening Torque (Nm)		
			D20DT	D27DT	D27DTP
Air conditioner compressor bracket	M8 x 25	1	25 ± 2.5	←	←
	M8 x 60	3	25 ± 2.5	←	←
Air conditioner compressor sub bracket	M6 x 16	1	10 ± 1.0	←	←
	M8 x 20	1	25 ± 2.5	←	←
Intake manifold	M8 x 50	5	25 ± 2.5	←	←
	M8 x 133	5	25 ± 2.5	←	←
Acoustic cover bracket	M6 x 16	2	25 ± 2.5	←	←
	M8 x 105	1	25 ± 2.5	←	←
Knock sensor	M8 x 28	1	20 ± 2.6	←	←
Camshaft position sensor	M8 x 14	1	12 ± 1.7	←	←
Booster pressure sensor	M6 x 20	2	10 ± 1.0	←	←
Exhauster manifold stud bolt	M8 x 46	10	15 ± 1.5	←	←
	M8 x 35	2	15 ± 1.5	←	←
Exhaust manifold nut	M8	10	40 ± 4.0	←	←
Turbo charger assembly	M8	3	25 ± 2.5	←	←
Turbo charger hollow bolt	M10 x 1.0	1	18 ± 1.8	←	15 ± 1.0
Turbo charger oil supply pipe	M16 (BLOCK side)	1	25 ± 2.5	←	←
Turbo charger support bar (nut)	M8	1	23 ± 2.3	←	←
Turbo charger support bar (bolt)	M8 x 20	1	25 ± 2.5	←	←
Turbo charger return pipe	M6 x 16 (T/C side)	2	10 ± 1.0	←	←
	M6 x 16 (BLOCK side)	2	10 ± 1.0	←	←
EGR Valve	M6 x 16	4	10 ± 1.0	←	-
EGR pipe (RH) nut	M8	2	35 ± 3.5	←	-
EGR pipe (RH) bolt	M6 x 16	2	10 ± 1.0	←	-
EGR cooler bolt	M8 x 16	4	25 ± 1.0	←	-
EGR valve & EGR cooler	M6 x 20	3	25 ± 2.5	←	-
	M6 x 20	2	25 ± 2.5	←	-
Glow plug	M5	5	15 ± 3.0	←	←
Vacuum pump	M6 x 20	3	10 ± 1.0	←	←
Cooling pan bracket	M6 x 25	5	10 ± 1.0	←	←
	M6 x 55	1	10 ± 1.0	←	←
	M6 x 85	3	10 ± 1.0	←	←
Cylinder head cover	M6 x 35	21	10 ± 1.0	←	←
Vacuum modulator	M6 x 16	4	10 ± 1.0	←	←
Oil dipstick gage	M6 x 16	1	10 ± 1.0	←	←
Oil filter	M8 x 35	1	25 ± 2.5	←	←
	M8 x 55	2	25 ± 2.5	←	←
	M8 x 125	1	25 ± 2.5	←	←

Name	Size	Quantity	Tightening Torque (Nm)		
			D20DT	D27DT	D27DTP
Fuel rail	M8 x 35	2	25 ± 2.5	←	←
Injector	M6 x 60	4	10 ± 1.0 180° ± 20°	←	←
Fuel pipe nut (H -> C)	M14	2	40 ± 4.0	←	←
Fuel pipe nut (C -> I)	M14	8	40 ± 4.0	←	←
Crank position sensor	M6 x 14	1	0.8 ± 0.4	←	←
	Gap	-	0.7 ± 1.5 mm	←	←
Power steering pump	M8 x 100	2	25 ± 2.5	←	←
Head screw plug	-	1	25 ± 2.5	←	←
Camshaft cap bolt	M8 x 60	20	25 ± 2.5	←	←
Piston topping	-	-	0.765 mm ~ 1.055 mm		
Connecting rod end play	-	-	0.500 mm ~ 1.500 mm		
Camshaft end play	-	-	0.100 mm ~ 0.350 mm		
Crank shaft end play	-	-	0.100 mm ~ 0.254 mm		
E-EGR valve assembly	M8 x 60	1	-	-	25 ± 2.5
	M8 x 35	1	-	-	25 ± 2.5
	M6 x 20	3	-	-	10 ± 1.0
E-EGR cooler	M8 x 16	4	-	-	25 ± 2.5
EGR pipe combination bolt	M6 x 16	6	-	-	10 ± 1.0
Throttle body	M6 x 45	3	-	-	10 ± 1.0

4. MAJOR CHANGES IN D27DTP (POWER UP) ENGINE (COMPARED TO D27DT)

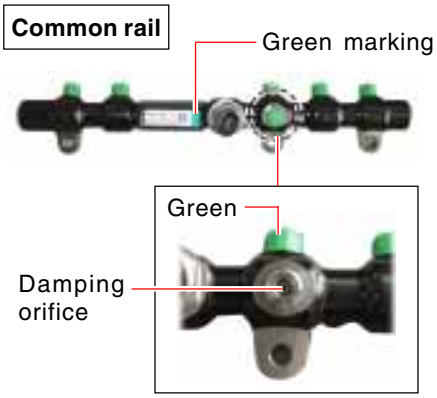
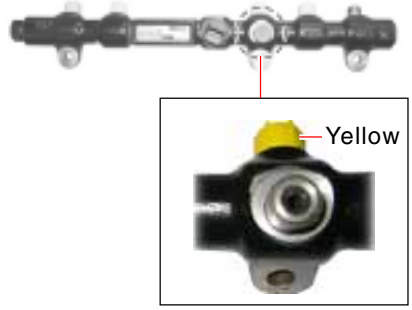
The shape and size of D27DTP (POWER UP) are slightly different from those of D27DT engine but the basic configuration of two systems is almost same.

▶ Engine Assembly

D27DTP (POWER UP) Engine	D27DT Engine
Front Side View 	
Right Side View 	
Left Side View 	

For more information about the designations of the components, refer to "1. Engine structure and comparison".

▶ Major Changes and Summary

D27DTP (POWER UP) Engine	D27DT Engine	Remarks
ECU D27DTP Engine ECU - Ver. 3.2  	D27DT Engine ECU - Ver. 3.1  	ECU version of D27DTP (POWER UP) engine: Changed to 3.2 from 3.1. Number of connectors of D27DTP (POWER UP) engine: Changed to 2 from 1. **1.E-EGR valve and related system** **2.Throttle body and related system** **3.AQGS and related system**
Injector 		* **Injection nozzle (holes)** - D27DT (5) - D27DTP (7) * **Injector label** - D27DT (16 digits: C2I value) - D27DTP (20 digits: C3I value)
Common rail 		* D27DTP: Added damping orifice. (Orifice is added to fuel inlet/ outlet ports in order to dampen the pulsation in fuel flow caused by multi-injections.)

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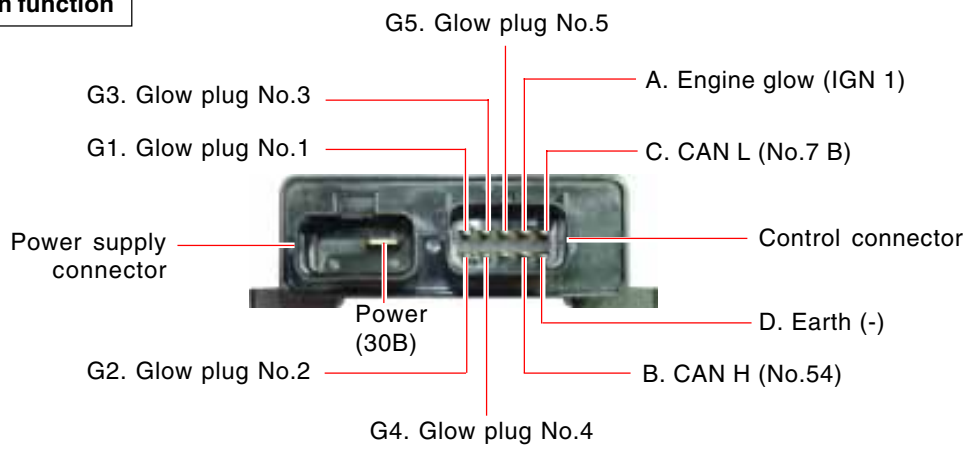
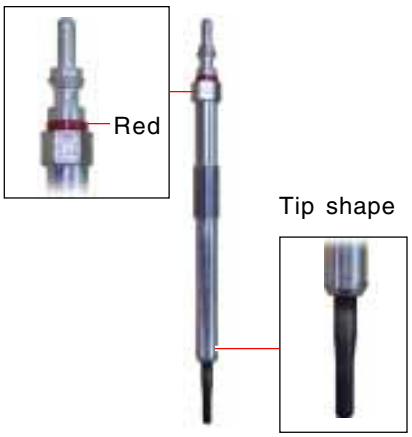
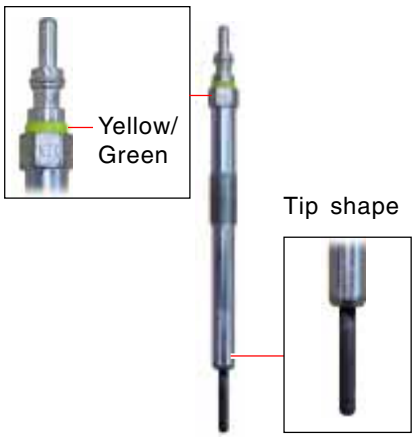
D27DTP (POWER UP) Engine	D27DT Engine	Remarks
Fuel pipe 		*** Surface coating color** - D27DT: Yellow - D27DTP: Chrome *** Diameter increased** - D27DT: ID (2.4 mm), OD (6.0 mm) - D27DTP: ID (3 mm), OD (6.35 mm)
Glow system- AQGS unit 	**Glow system - Glow control relay** 	* D27DTP (POWER UP) engine adopts AQGS (Advanced Quick Glow System), which controls the quick preheating of glow plugs and CAN communication with engine ECU.

AQGS unit pin function



Glow plug 		*** Insulator color** - D27DT: Yellow (NGK) or green (BERU) - D27DTP: Red *** Tip diameter and shape changed** - D27DT: ϕ 3.5 / 4.0 mm - D27DTP: ϕ 4.4 mm

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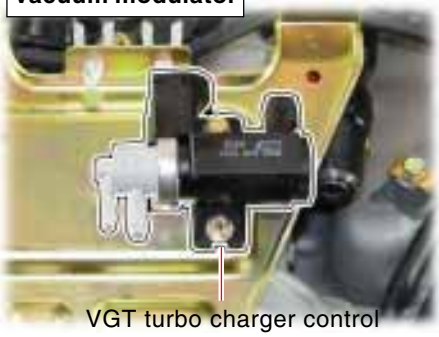
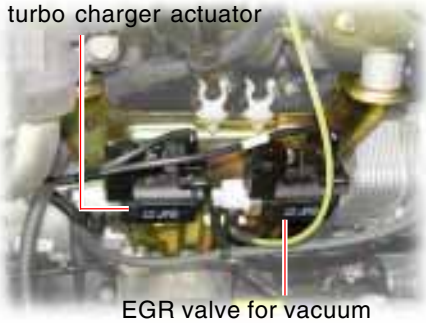
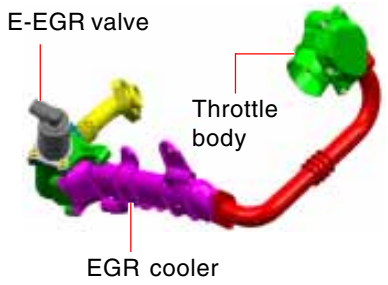
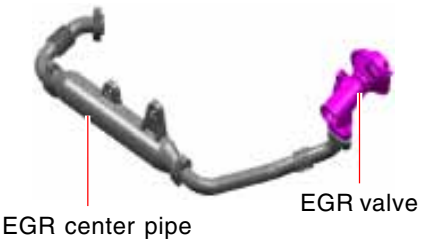
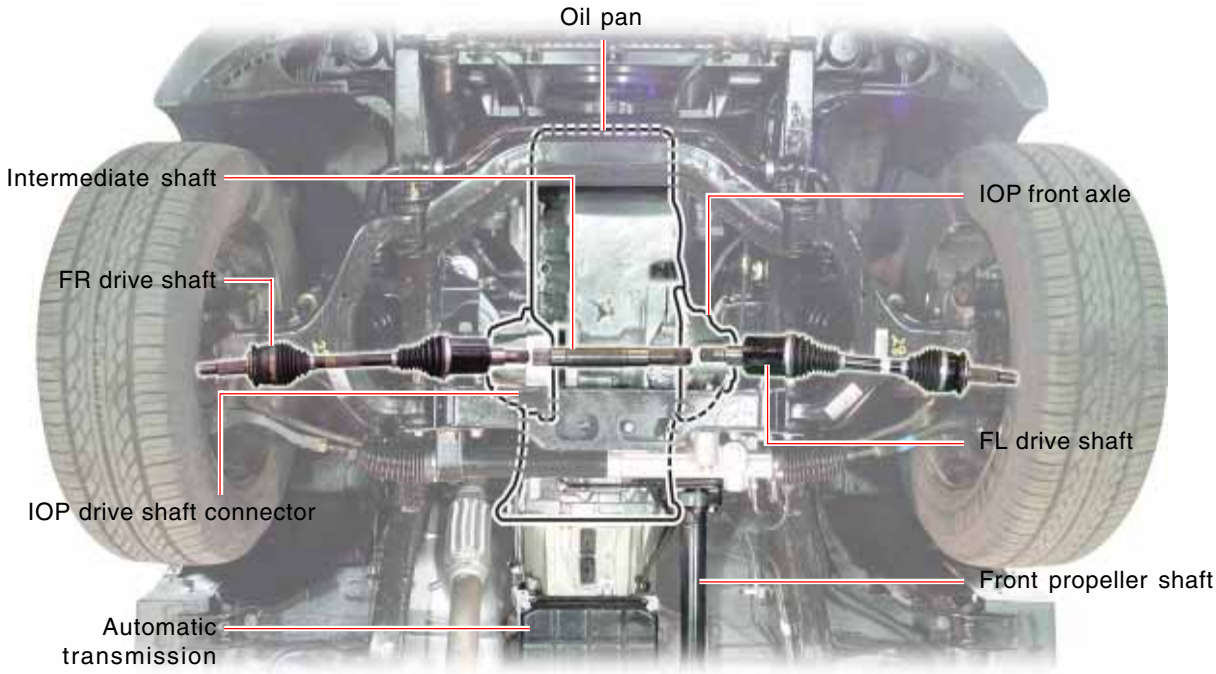
D27DTP (POWER UP) Engine	D27DT Engine	Remarks
HFM 6.0 	**HFM 5.0** 	* **Version up** - D27DT: HFM5-CI (Analog signal) - D27DTP: HFM6-ID (Digital signal added)
Electric controlled E-EGR valve 	**Vacuum modulator controlled EGR valve** 	* E-EGR valve: ECU controls the EGR valve directly without any media. It provide more precise EGR control by transmitting the electric signal of EGR valve operating position.
Vacuum modulator  VGT turbo charger control	Vacuum modulator for controlling turbo charger actuator  EGR valve for vacuum modulator	* D27DTP (POWER UP) engine uses electric ally controlled E-EGR valve. Thus, the vacuum modulator for controlling EGR valve has been deleted.
Throttle body 	**N/A**	* Throttle body is for future regulation requiring emission reductions. Currently, it is used to prevent the engine from turning off with fluttering noise at the moment the air to intake manifold is blocked by closed flap when the engine is switched off.
EGR cooler EGR Gas  Coolant	**EGR center pipe**  EGR Gas	* To enhance EGR function, coolant EGR cooler is adopted to reduce the temperature of exhaust gas into the intake manifold.

D27DTP (POWER UP) Engine	D27DT Engine	Remarks
E-EGR system layout 	**EGR system layout** 	* **Reason of changes** - To satisfy the emission regulation, E-EGR valve and EGR cooler are adopted. And the layout also has a great difference from D27DT.
IOP oil pan 	**Oil pan** 	* The vehicle with D27DTP (POWER UP) engine is equipped with IOP axle. Refer to the figure below.



VGT turbocharger 	**WGT turbocharger** 	* D27DTP (POWER UP) engine is equipped with the enhanced VGT turbocharger.

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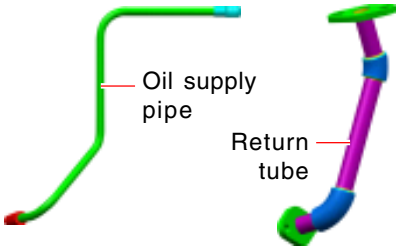
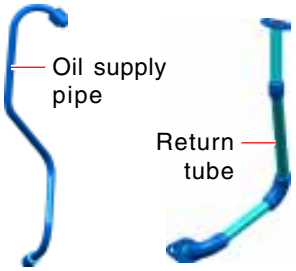
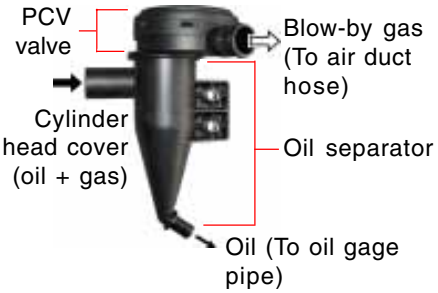
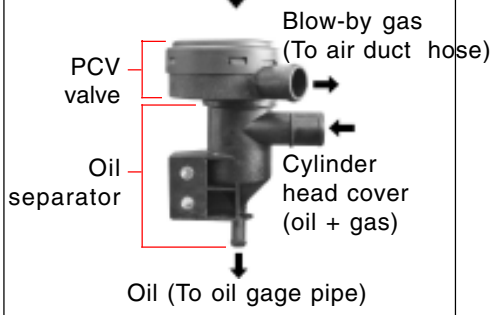
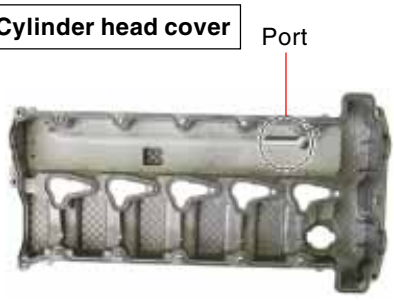
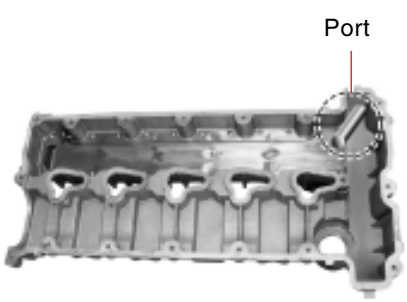
D27DTP (POWER UP) Engine	D27DT Engine	Remarks
1.Support bar of Turbocharger 		* Support bar is changed due to VGT turbocharger mounting.
2.Oil supply pipe and return tube of Turbocharger 		* The shape of oil supply pipe and return tube is changed due to VGT turbocharger mounting.
PCV oil separator  	 	* **Increase of Oil separator capacity (approx. 10%)** - D27DT: 120ℓ/min - D27DTP: 160ℓ/min
Cylinder head cover 		* The direction of blow-by outlet port is changed due to the introduction of larger oil separator.

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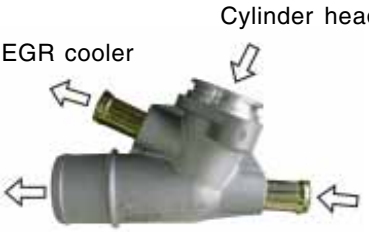
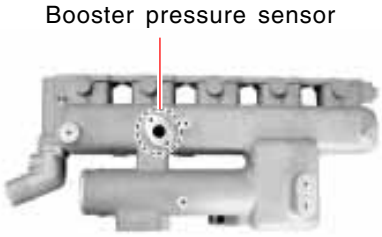
D27DTP (POWER UP) Engine	D27DT Engine	Remarks
Water pump 		* **For D27DTP engine:** Additional connecting port for EGR cooler hose
Coolant outlet port 		* For D27DTP (POWER UP) engine: Additional port for coolant of EGR cooler
Intake manifold 		* The appearance of intake manifold is changed to the round type due to the throttle body. Also, the mounting location of booster pressure sensor is changed.
Cylinder head 		* The cooling port is added to improve cooling performance for D27DTP (POWER UP) engine.

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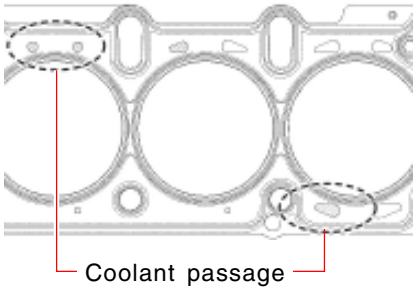
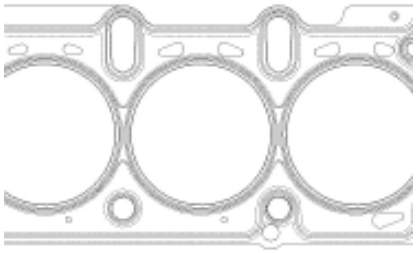
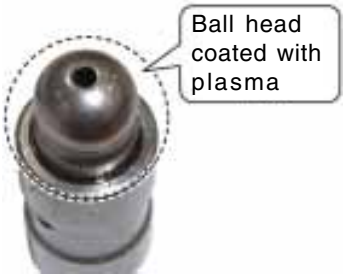
D27DTP (POWER UP) Engine	D27DT Engine	Remarks
Cylinder head gasket 		* The appearance of gasket is changed and the coolant passages are added to improve cooling performance for D27DTP (POWER UP) engine.
Piston  	 	* Changed compression ratio - D27DT (18:1) - D27DTP (17.5:1) (The appearance of bowl is changed and the color mark is added due to the new compression ratio.) * The appearance fo bowl is changed and the color mark is added due to the new compression ratio (18 → 17.5). * The piston pin bending side and the appearance of piston pin hole taper is changed for reinforcement.
Lash adjuster 		* The ball head is coated with plasma to prevent the lash adjuster from wearing.

D27DTP (POWER UP) Engine	D27DT Engine	Remarks
Switchable engine mounting 	**Engine mounting** 	* The switchable engine mounting system (SEM) controls the engine in soft mode or hard mode by dividing the speed to the low speed range and mid-high speed range according to the vehicle speed and the engine rpm. This is only available in D27DTP (POWER UP) engine.
Engine bracket LH RH 	LH RH 	* The bracket is changed due to the mounting location of D27DTP (POWER UP) engine and the switchable engine mounting.
Acoustic and Acoustic cover side front bracket 		* The appearance of front bracket at acoustic cover side (A) is changed.

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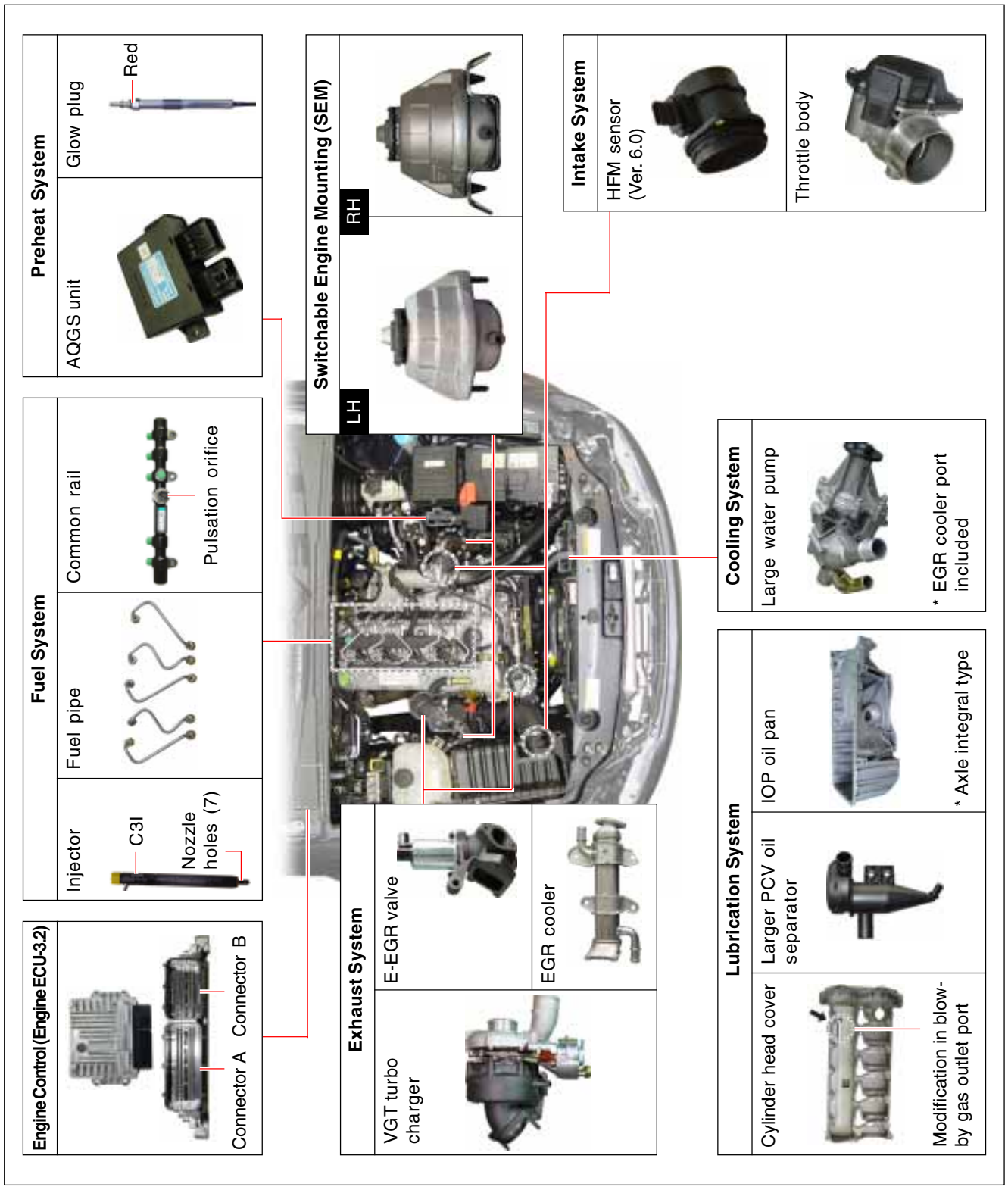
D27DTP (POWER UP) ENGINE SYSTEM

1. ENGINE COMPARTMENT OF D27DTP (POWER UP)

The major changes due to the newly adopted D27DTP (POWER UP) engine compared to D27DT engine are as follows:



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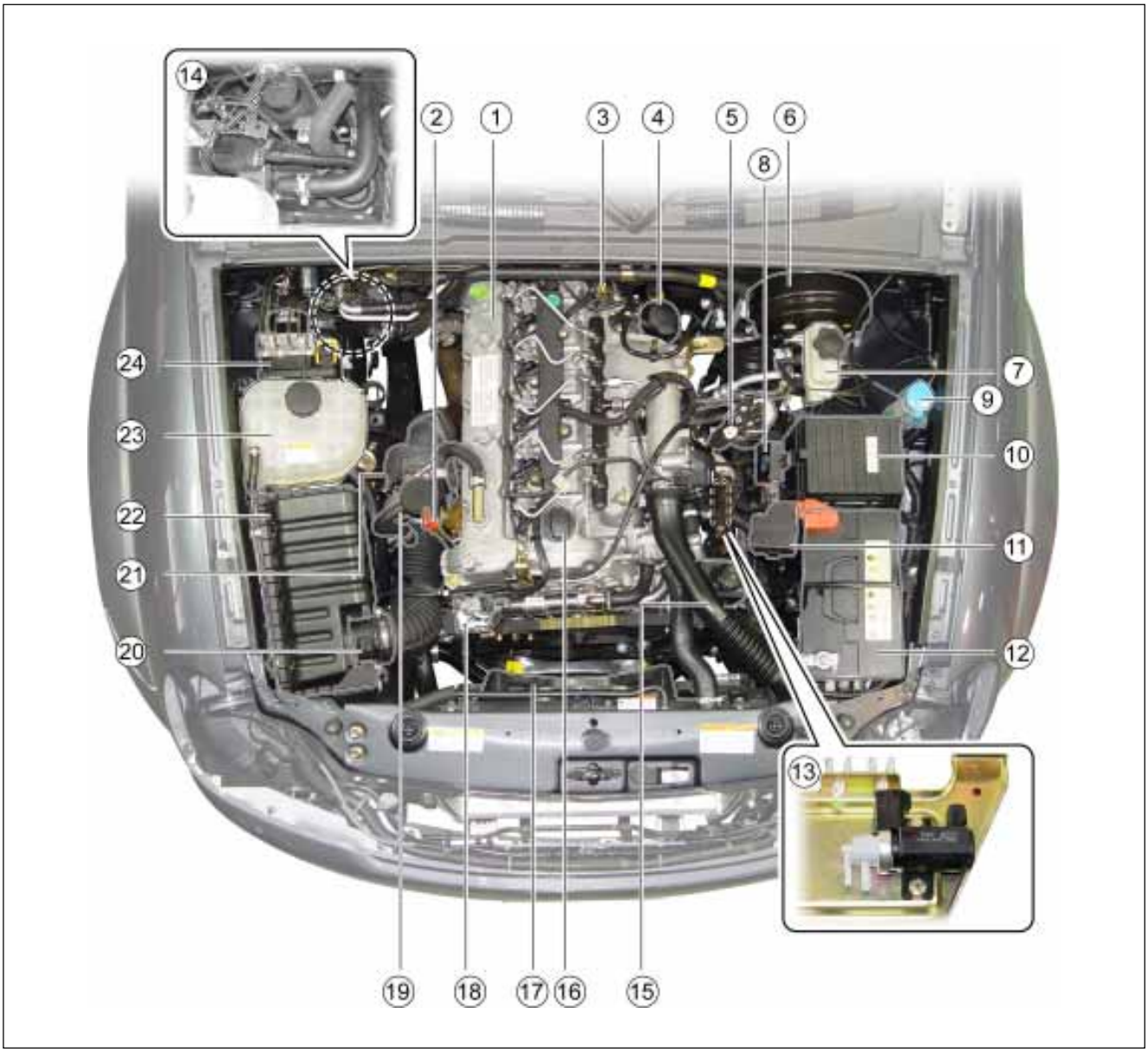
▶ Engine Compartment Layout Of D27DTP (Power Up)

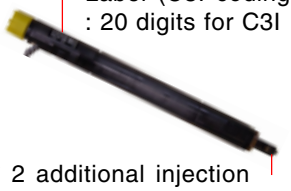


1. Engine assembly
2. Engine oil dipstick
3. Vacuum pump
4. Oil filter and cooler
5. Fuel filter and priming pump
6. Brake booster
7. Brake oil tank
8. AQGS unit
9. Washer fluid filler cap
10. Engine compartment fuse box
11. PTC relay box
12. Battery
13. Vacuum modulator (for VGT turbo charger)
14. FFH Assembly (Only for vehicle with FFH)
15. Power steering oil tank
16. Engine oil filler cap
17. Fan shroud
18. E-EGR Valve
19. High-capacity PCV oil separator
20. HFM sensor (6.0)
21. VGT turbo charger
22. Air cleaner housing
23. Coolant surge tank
24. ABS/ESP HECU (Including TPMS function: optional)

▶ Major Sensors and Components

Injector

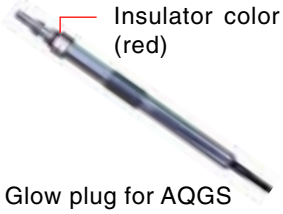
Label (C3I coding) : 20 digits for C3I



* 2 additional injection holes (currectly 7 holes)

Glow Plug

Insulator color (red)



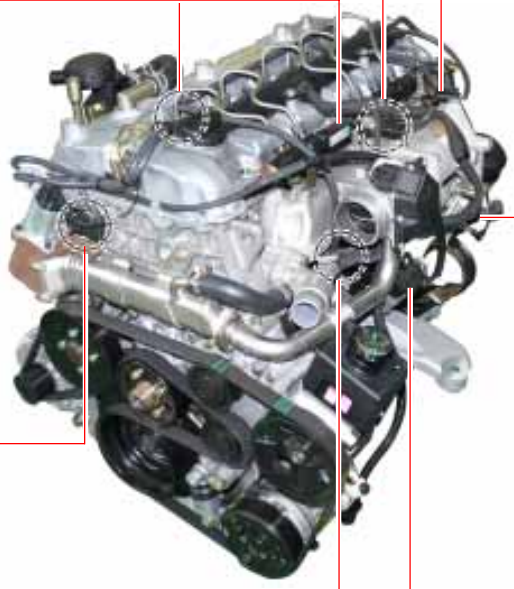
* Glow plug for AQGS (quick preheat)

Fuel Pressure Sensor (Common Rail)

Common Rail

* Orifice for preventing fuel pulsation

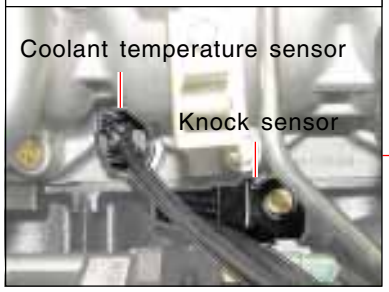
Booster Pressure Sensor



Camshaft Position Sensor

Crankshaft Position Sensor

Knock Sensor (2EA) & Coolant Temperature Sensor

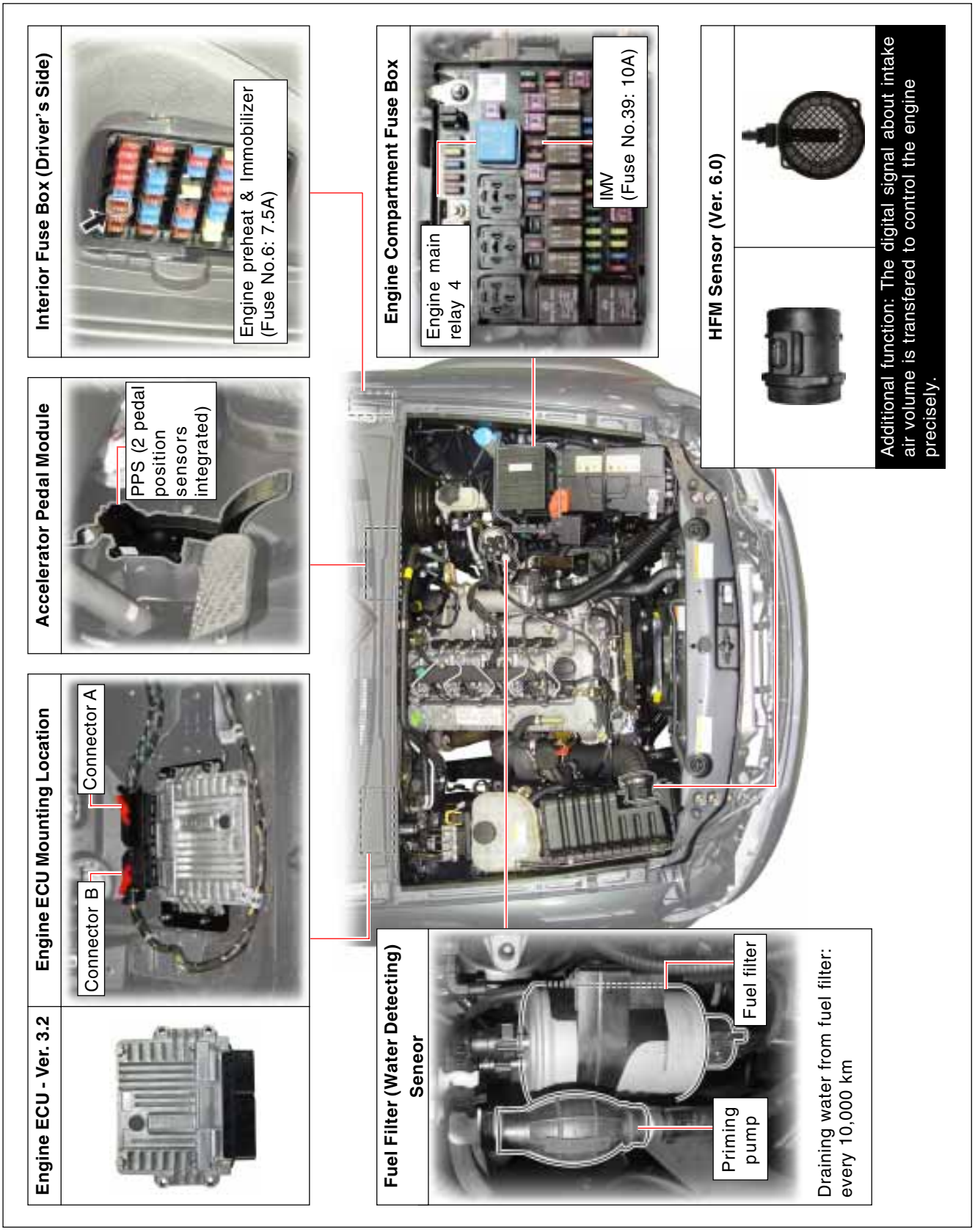


Vacuum Modulator for VGT Turbo Charger

* Vacuum modulator for EGR valve deleted

2. SYSTEMS IN ENGINE COMPARTMENT

▶ Engine Accessories Related to ECU



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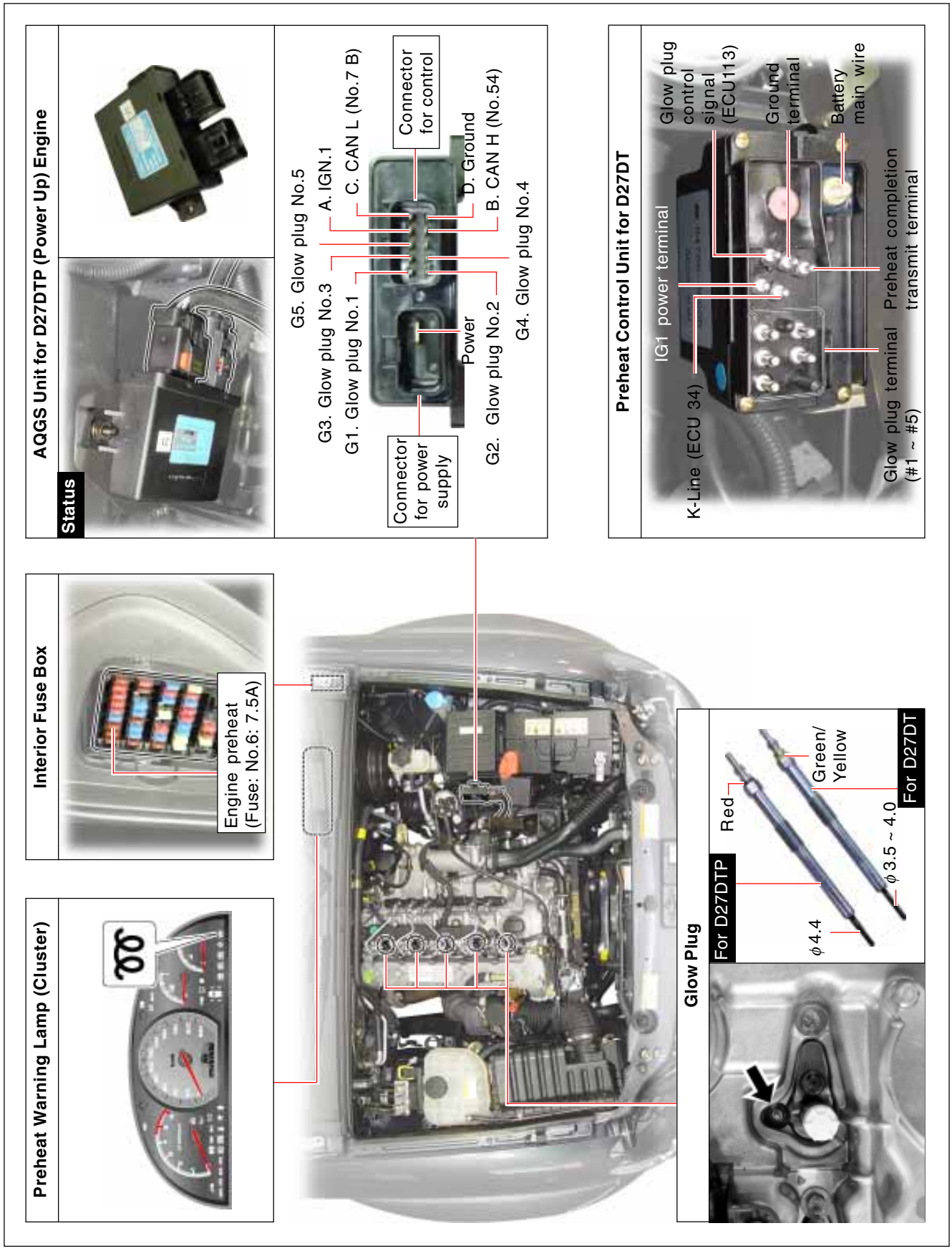
▶ Preheat System



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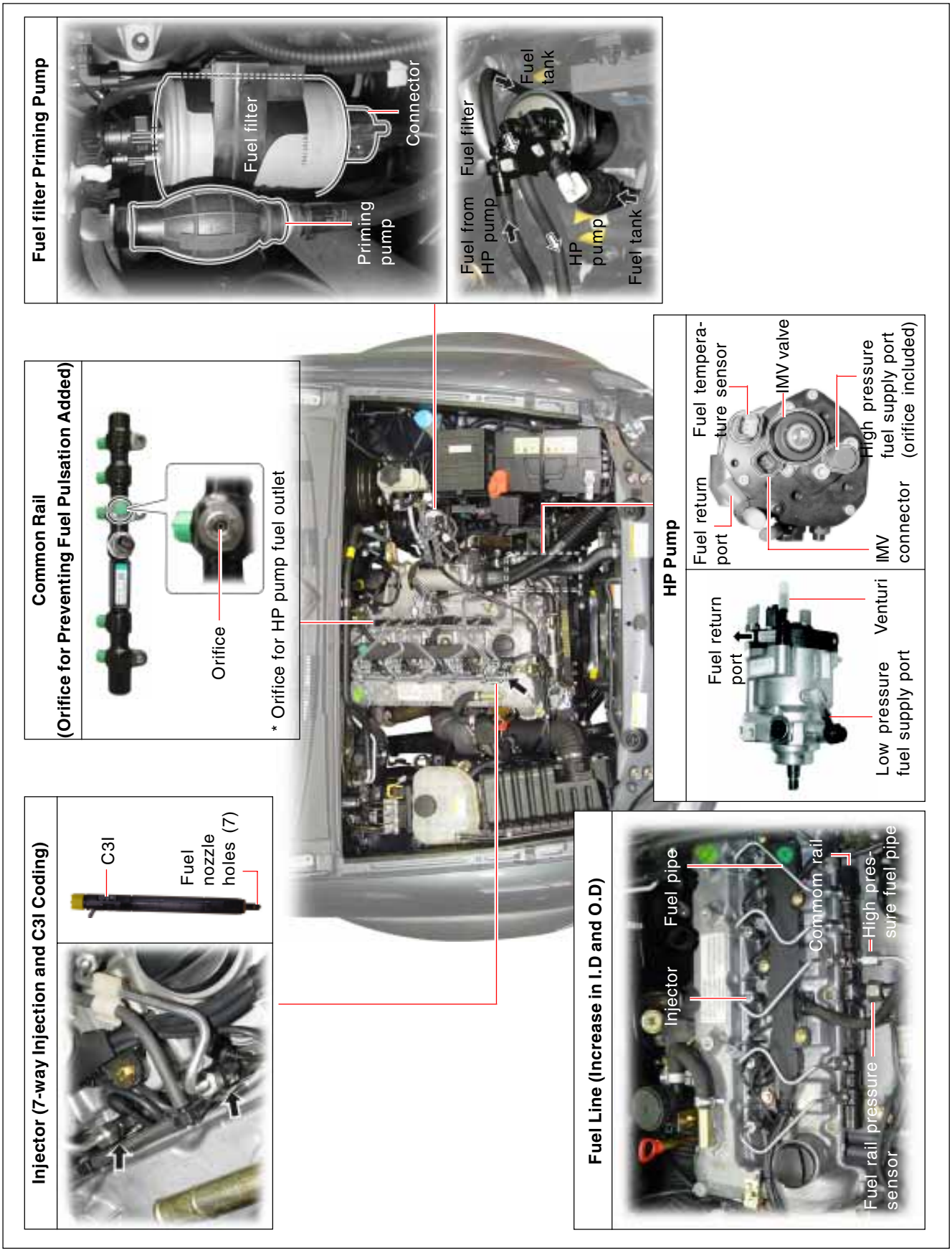
▶ Fuel System



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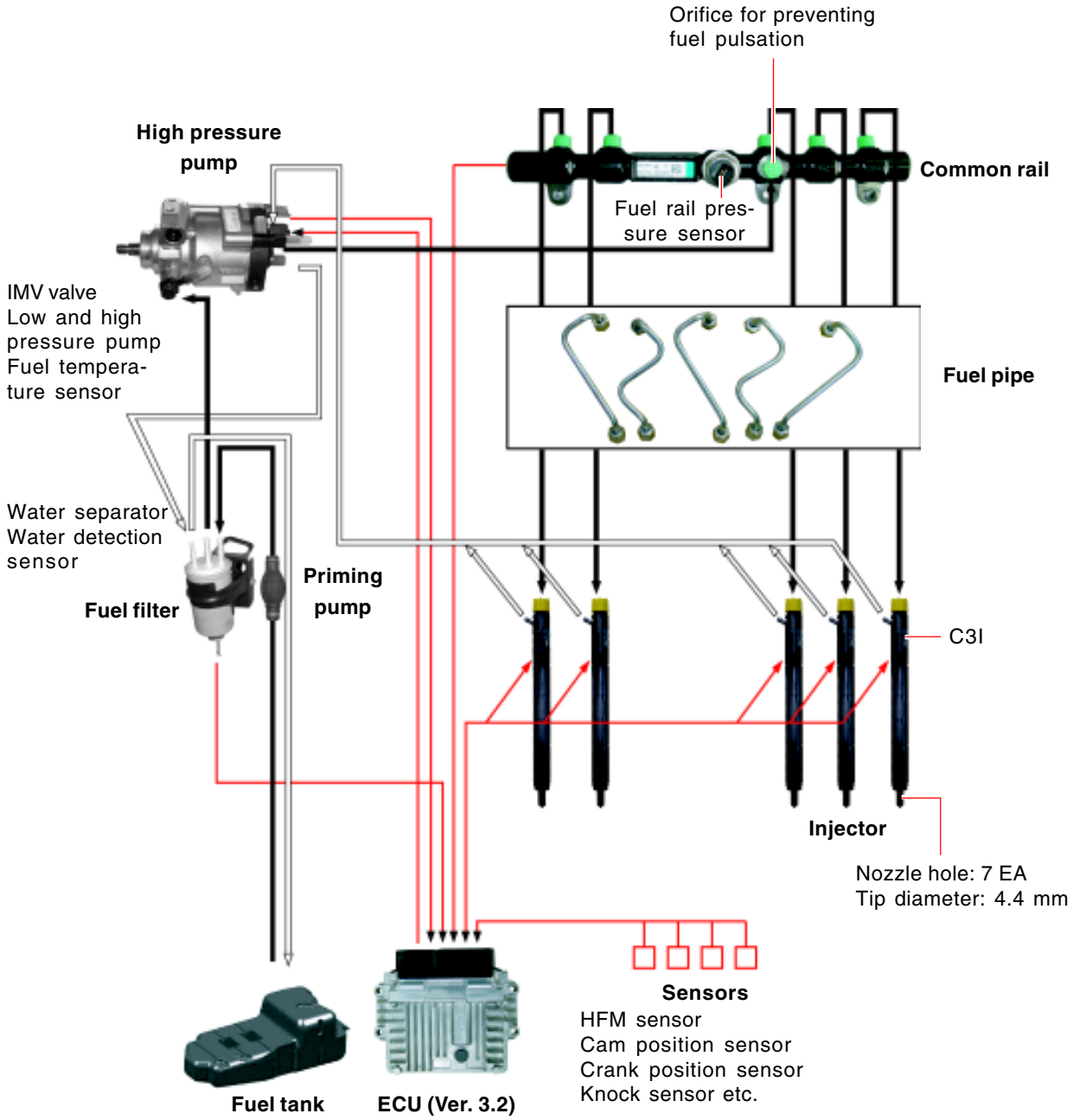
Fuel Supply System



▶ Lubrication System

Cylinder Head Cover

Blow-by gas port

Oil Filter & Oil Cooler

Oil Pan & Oil Strainer, Baffle Plate

For D27DT

For D27DTP

For D27DTP

Oil Pressure Warning Light (Cluster)

Large PCV Oil Separator

The first separation will happen when blow-by gas passes through baffle plates in cylinder head cover. Then oil and gas will be separated due to cyclone effect after entering the oil separator inlet port. Separated oil returns to oil pan via oil drain port and the gas will be burnt again after entering the combustion chamber through air duct hose via PCV valve that opens/closes due to pressure differences between the intake side and crankcase.

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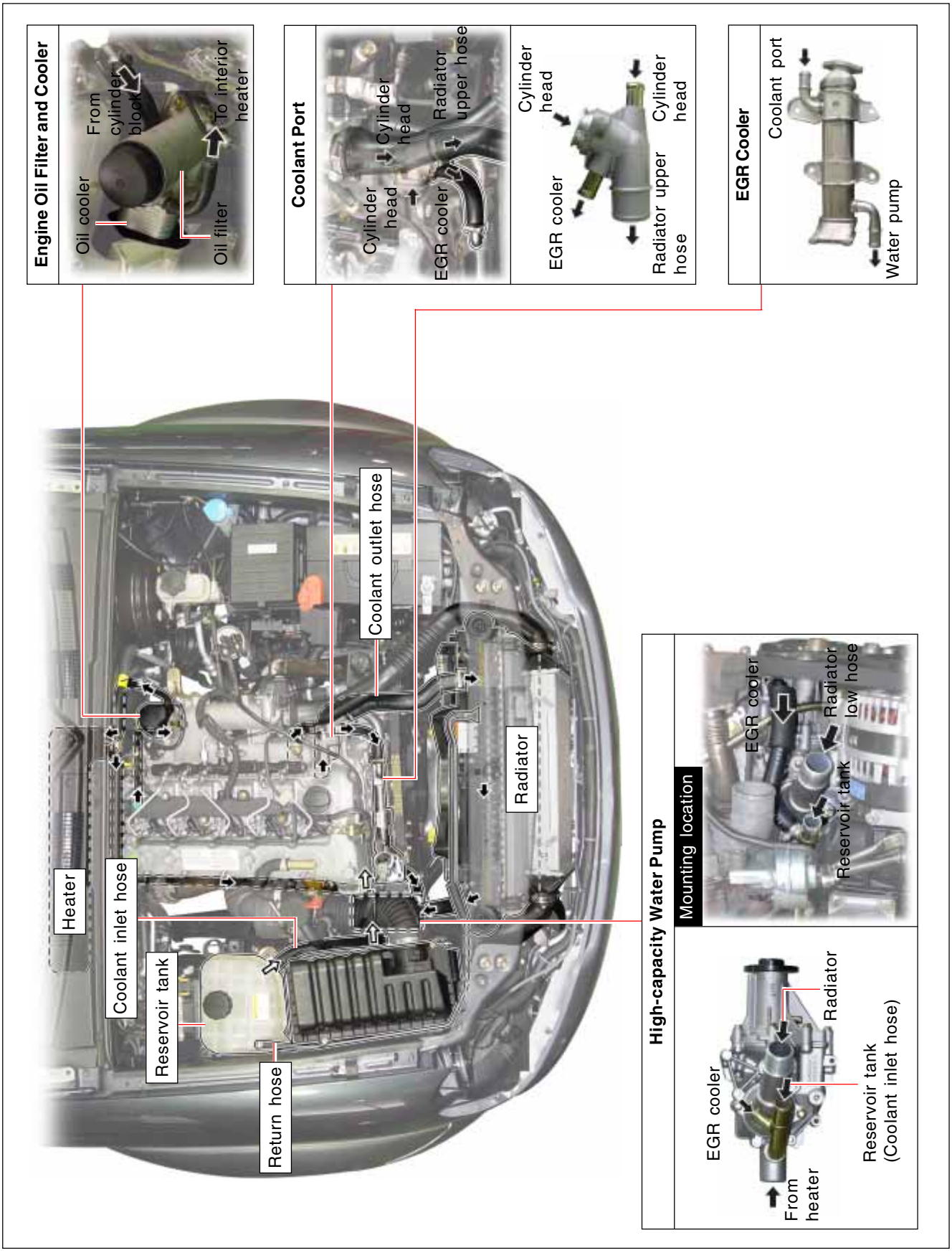
▶ Cooling System



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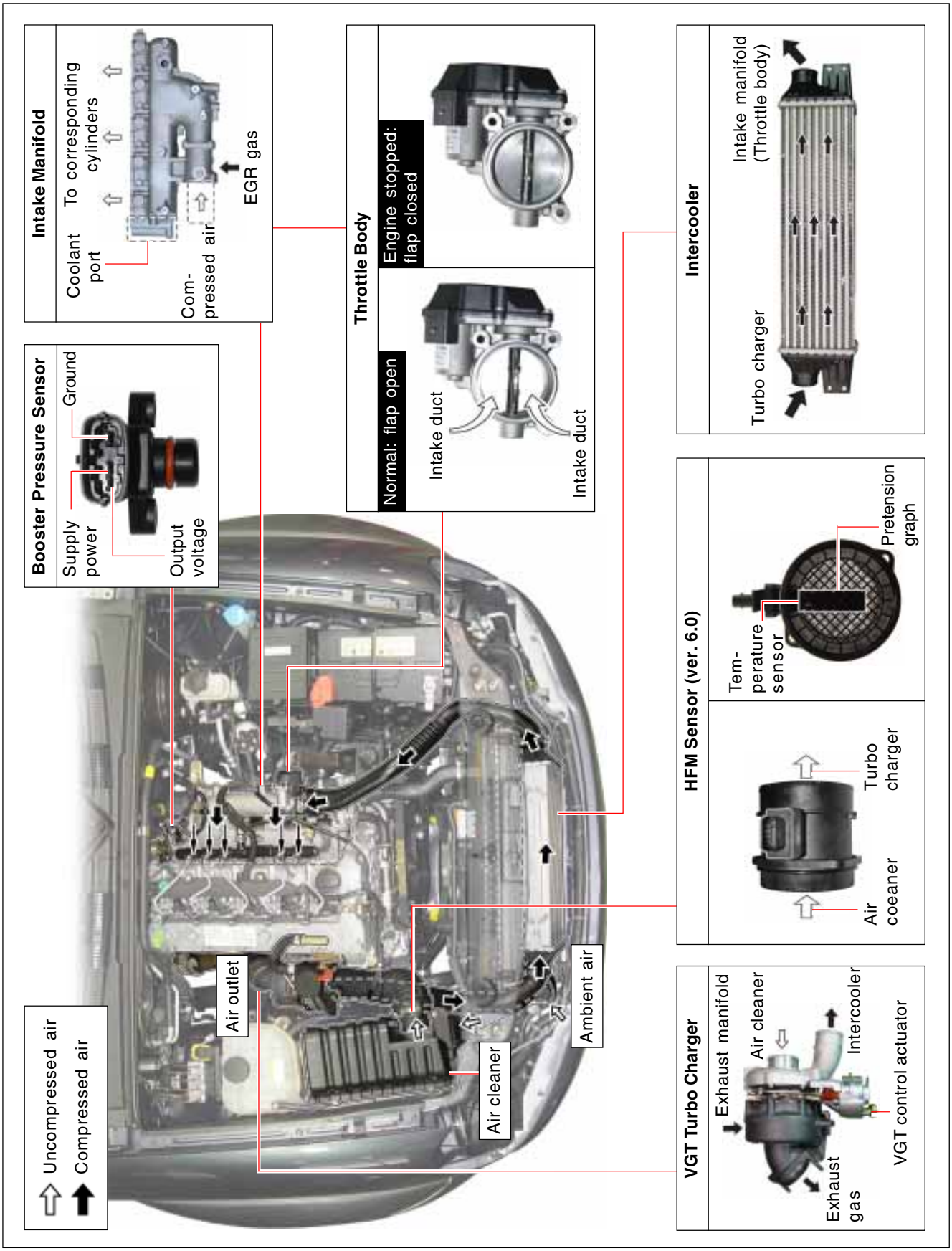
▶ Intake System



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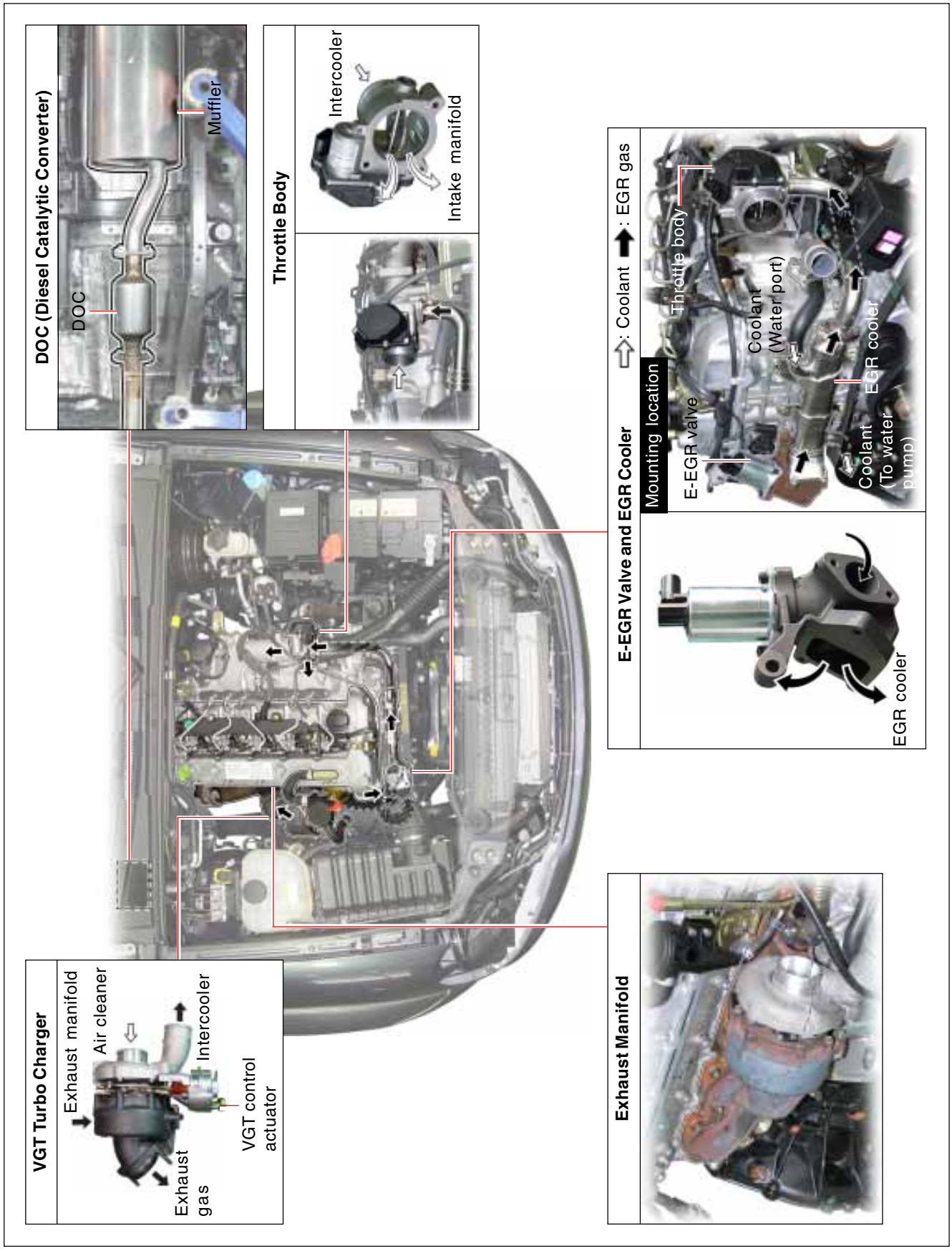
▶ Exhaust System



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MEMO

FUEL SYSTEM

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FUEL SYSTEM

1. MAJOR CHANGES IN FUEL SYSTEM OF D27DTP (POWER UP) ENGINE

There are some changes in the parts related to the fuel system due to the newly adopted D27DTP (POWER UP) engine. The major changes are as follows. Refer to the next pages for further details.

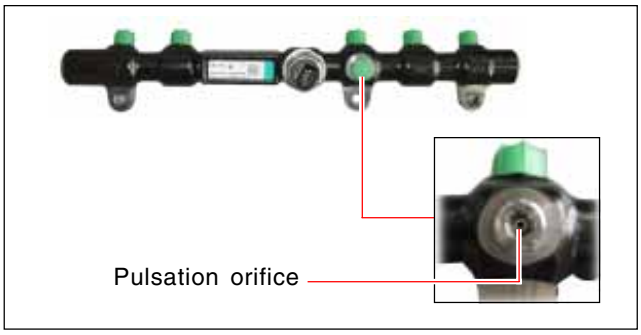
Injector

- Two nozzle holes are added (currently 7) to the tip of the injector to increase the amount of fuel injection and to improve injection efficiency according to the increased engine power.
- The existing C2I coding (16 digits) is changed to C3I coding (20 digits) to monitor fuel injection and follow the target value.
- For the D27DT engine, the injector MDP (minumum current for the solenoid in the injector to lift the nozzle) is leaned only when the engine is running. However, for the D27DTP engine, it is learned when the vehicle is in motion and the engine is at idle speed.

Common Rail

- The orifice is added to the connection to the fuel pipe of the HP pump to prevent the fuel pulsation by the fuel supply and fuel cut according to the increase of injected fuel volume.

  (It is also installed on the connection of the high pressure fuel supply line of the HP pump.)



Fuel Rail - Chrome Color

- The I.D and O.D of the fuel rail between HP pump and common rail are increased according to the increased amount of fuel injection.

  Also, the engine ECU, HFM sensor and EGR system are changed to control the fuel injection volume and engine more precisely.

* Fuel pipe (Common rail → Injector)

* Fuel high pressure pipe (HP pump → Common rail)

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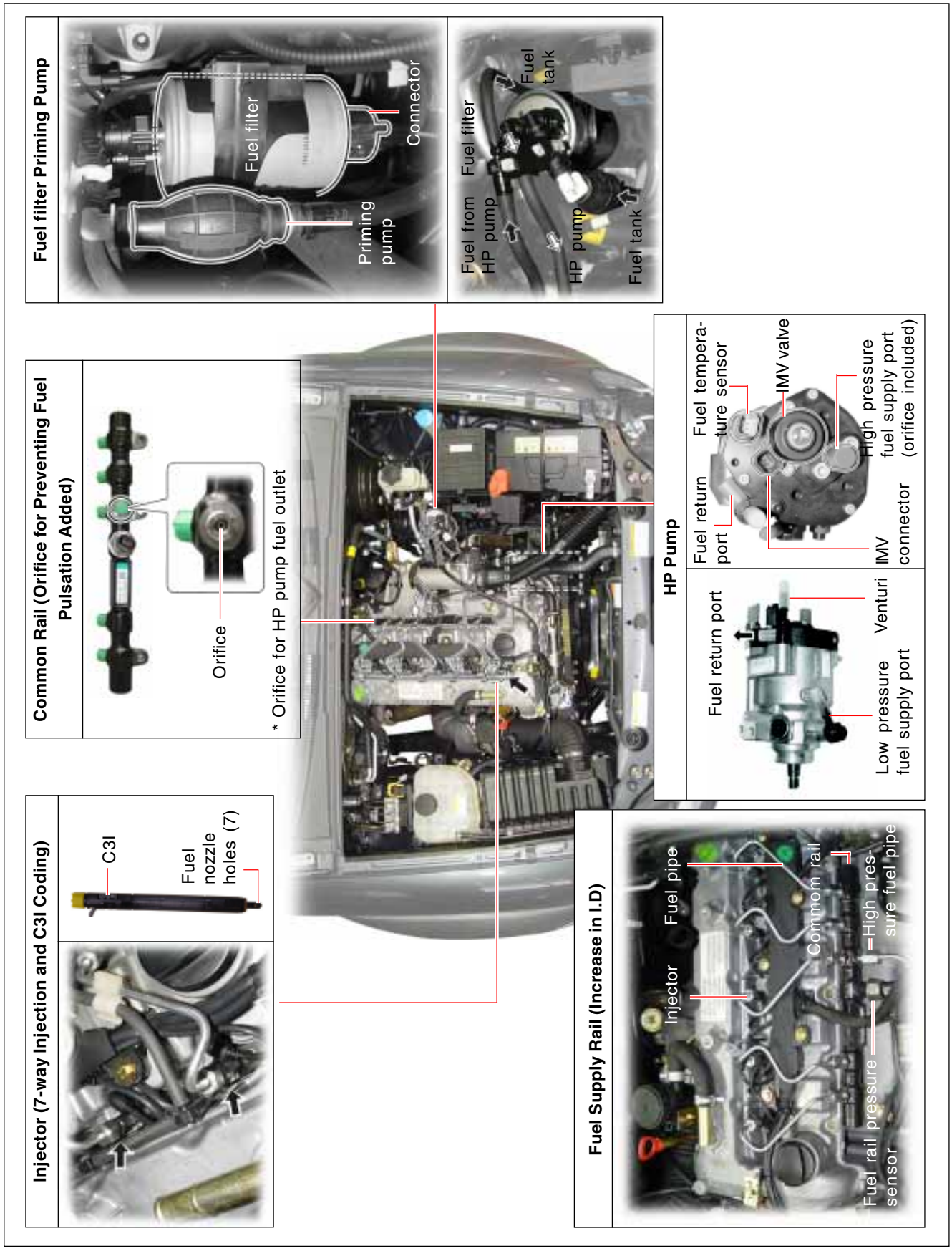
2. COMPONENTS OF FUEL SYSTEM



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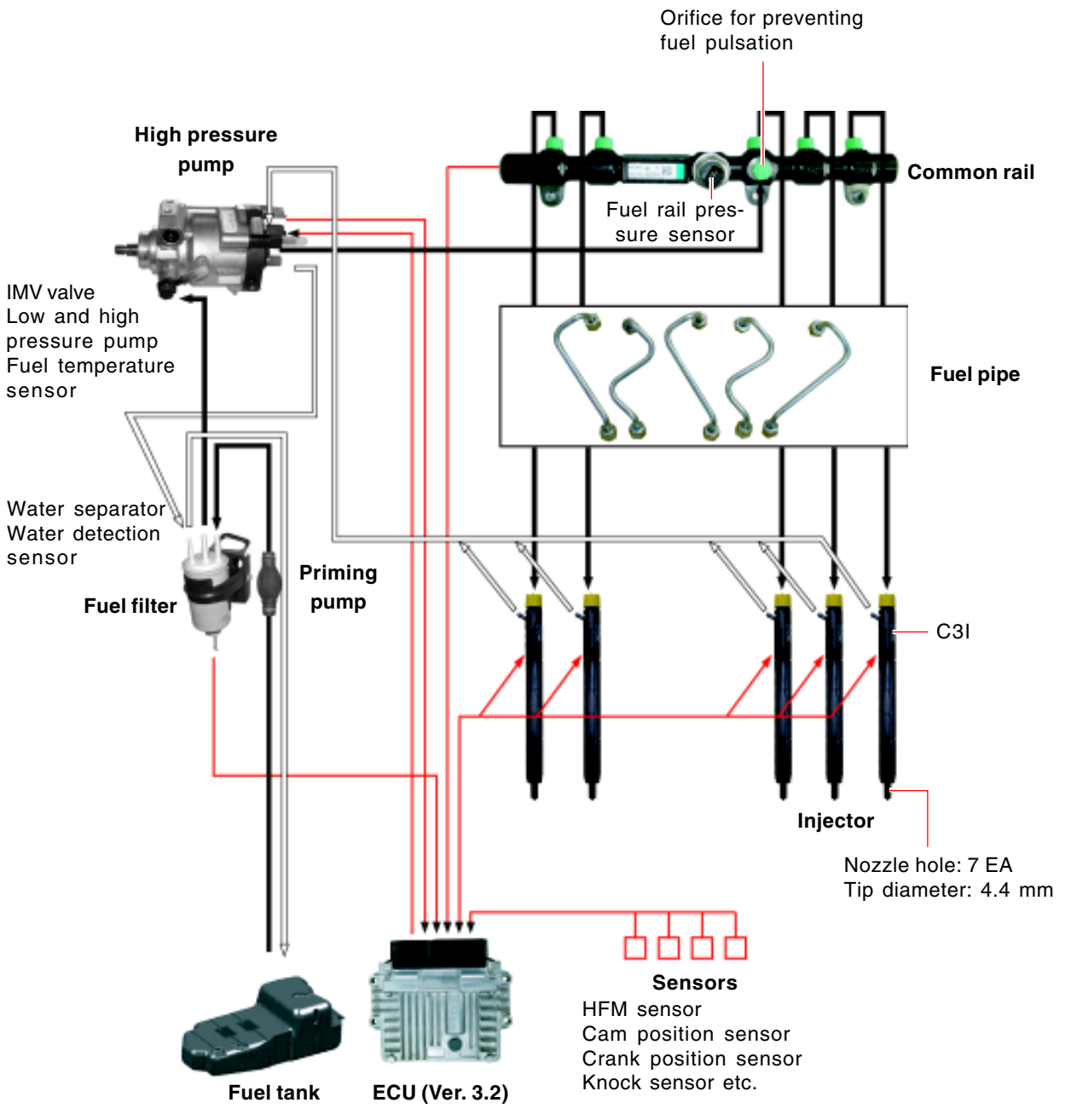
▶ Fuel Flow of D27DTP (Power Up) Engine

Fuel Supply System



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INJECTOR

1. STRUCTURE AND OVERVIEW

Injector

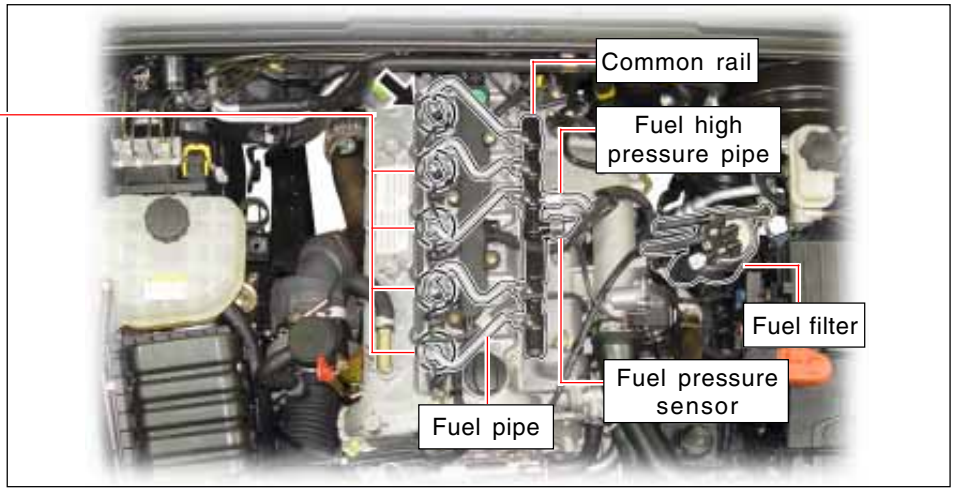
The injector for the D27DTP (POWER UP) engine is different from the injector for the D27DT engine. Also, the injectors for each engine are not compatible with each other.

The amount of fuel injection is increased according to the increased engine power and the number of nozzle holes on tip are increased (from 5 to 7).

Also, the C2I label is replaced to C3I label for the better control of the fuel injection volume.

With C3I coding, the MDP learning is performed when the vehicle is in motion and the engine is at idle speed.

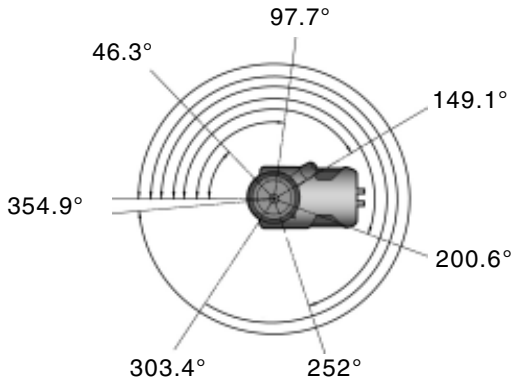
Major changes in injector are as follows:



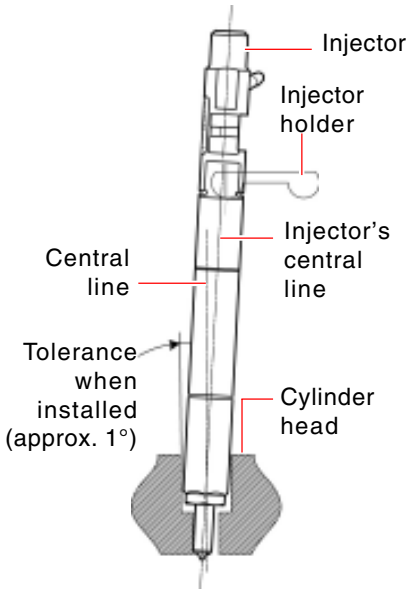
▶ Specifications (for D27DTP and D27DT)

Description	D27DTP	D27DT	Remark
Number of Nozzles (holes)	7	5	-
MDP Learning	while driving or engine idling	while driving	-

Injection Nozzle and Injection Angle of Injector for D27DTP Engine



Mounting Angle

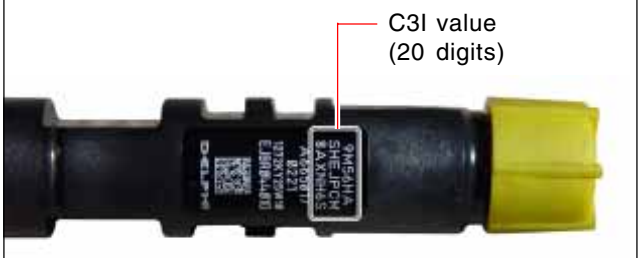


▶ Injector label (C3I)

The injector label is changed from 16 digits to 20 alphanumeric digits (C3I) as the D27DTP (POWER UP) engine has been adopted for controlling the fuel injection volume precisely and for better identification.

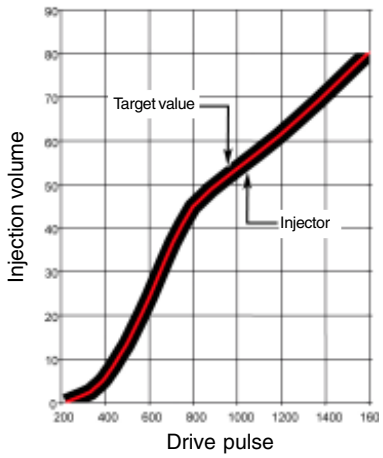
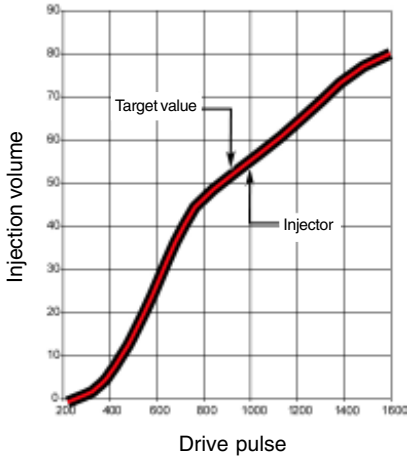
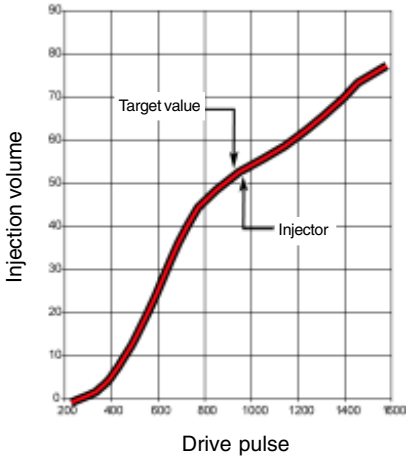
Comparison Between C3I and C2I

Injector C3I Label for D27DTP (Power Up) Engine



Injector C2I Label for D27DT Engine

Fuel Injection and Closeness to Target Value (Controllability) of C2I and C3I

When C2I is not applied	C2I	C3I
		
If the injector C2I coding is overridden, the engine ECU controls the amount of injected fuel which is not close enough to the target value.	The amount of injected fuel is close to the target value which is better than the case of C2I coding overridden.	The closeness to the target value is superb so that the volume is precisely controlled (decrease in irregular injection in each injector).

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2. NEW DTCS FOR CHANGES IN INJECTOR SPECIFICATIONS

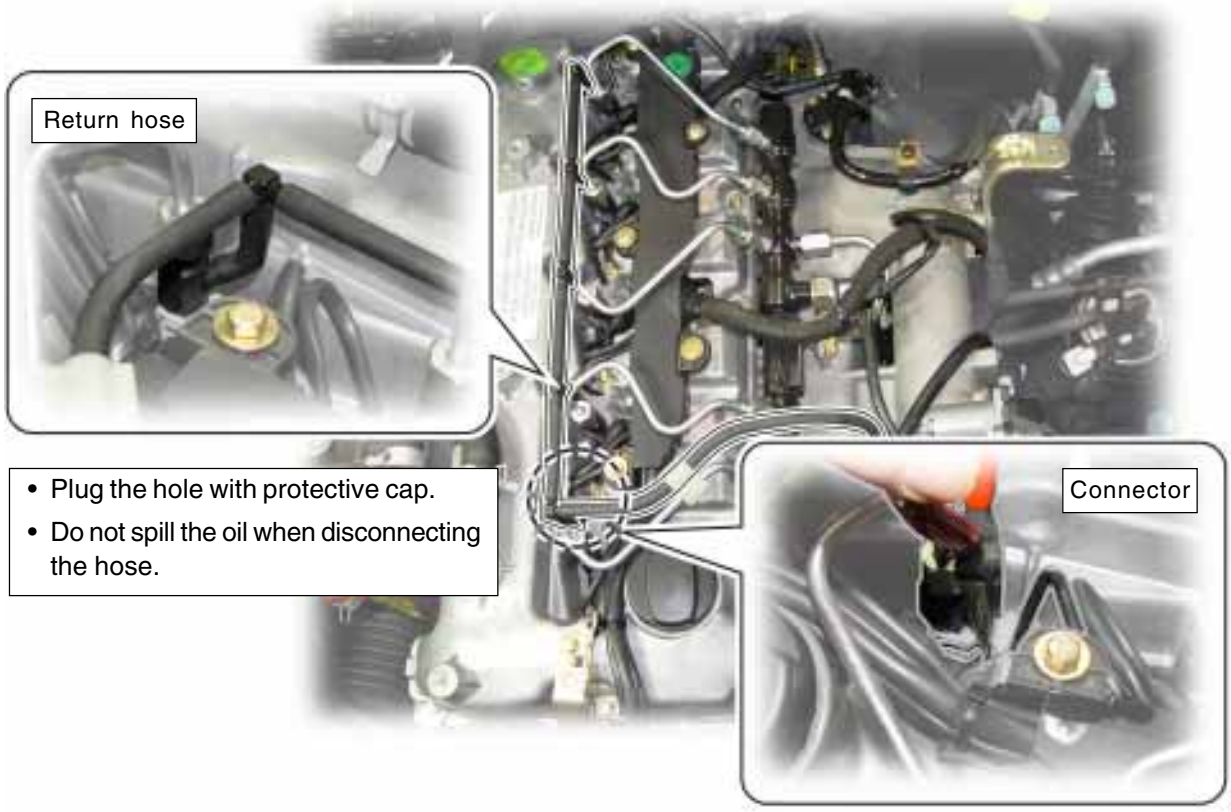
DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0171	Insufficient MDP of Injector #1	- MDP learning value is decreased due to aged injector #1.						
P0172	Insufficient MDP of Injector #2	- MDP learning value is decreased due to aged injector #2.						
P0173	Insufficient MDP of Injector #3	- MDP learning value is decreased due to aged injector #3.						
P0174	Insufficient MDP of Injector #4	- MDP learning value is decreased due to aged injector #4.						
P0175	Insufficient MDP of Injector #5	- MDP learning value is decreased due to aged injector #5.						
P0147	Impossible to learn Idle MDP	- Causes (Idle range MDP learning) • The MDP is not learned again until driving over 50,000 km after the MDP is learned. - Conditions for MDP learning (Idle) • Leaning twice for each cylinder (attempt every 5 sec.) • Initial MDP learning: coolant temperature > 60°C • Fuel temperature: 0 ~ 80°C • Vehicle speed: Idle. • The tachometer's needle vibrates while learning idle MDP. • Replace ECU after learning.						
P0148	Impossible to Learn Drive MDP	- Causes • It occurs twice for each cylilnder if MDP is not learned again until driving over 50,000 km after the MDP is learned. - Actions • Check knock sensor and wiring. • Check injector specification. • Check C3I/C2I.						
P0611	No Data for C3I	- C3I • There is no C3I data in ECU or the checksum is faulty.						**O**
P0612	Internal Error in C3I Data	- C3I • The error is occurred while sending C3I data in ECU to RAM.						

3. REMOVAL AND INSTALLATION OF INJECTOR

Removal and Installation

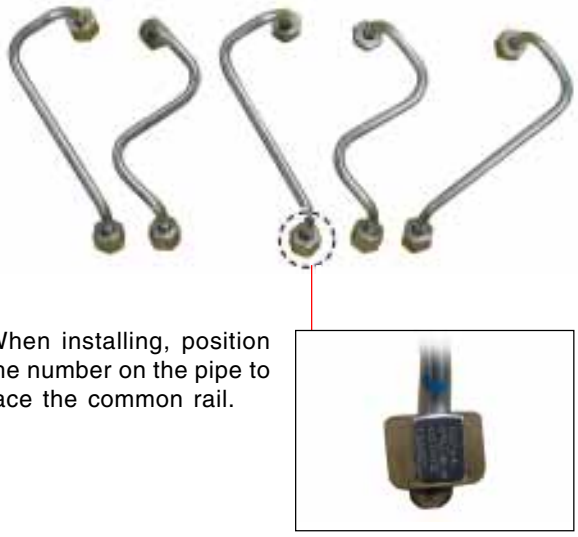
※ **Preceding Works:** Remove the engine cover and disconnect the negative battery cable.

1. Disconnect the fuel return hose and the connector from the injector.



2. Unscrew the mounting nuts (17 mm) on the high pressure line and disconnect the fuel pipes. Before disconnecting it, remove the foreign material around the injector and the fuel pipe with an air gun.

Fuel Pipe



NOTICE

- **When installing, replace the fuel pipe with new one.**
- **Plug the fuel hole to the common rail with a protective cap.**

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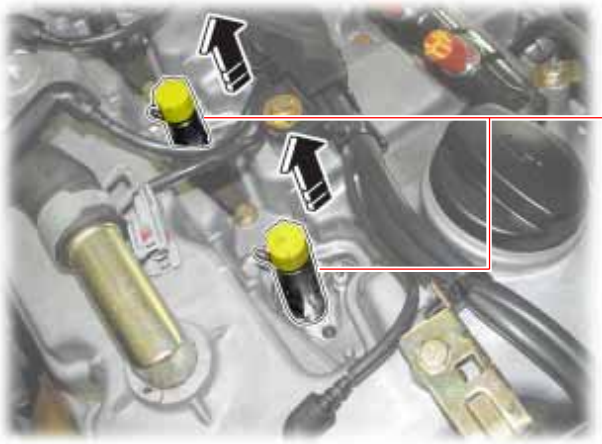
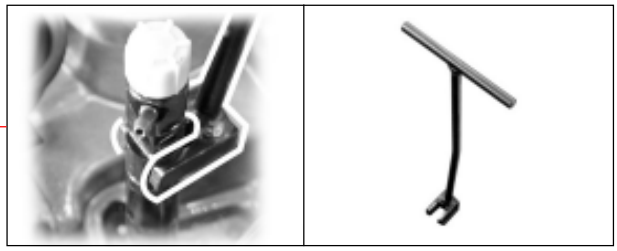
3. Before removing the injector, clean the area around it. Unscrew the bolts and remove the injector holder.

Tightening torque	10 ± 1.0 Nm
	180° ± 20°

* When installing the holder, replace the holder mounting bolts with new ones.

4. Remove the injector using a special tool.





NOTICE

- **Plug the injector with a protective cap.**

NOTICE

- **If the washer is not removed together with the injector, remove the washer from the engine using the special tool shown in the figure.**

- **When removing the injector, replace copper washer, holder mounting bolts and injector's fuel supply pipe with new ones.**

5. Install in the reverse order of removal. However, do not remove the protective cap from new injector before installing.
6. Perform the C3I coding for D27DTP engine or C2I coding for D27DT engine.

▶ Injector Coding (C2I/C3I)

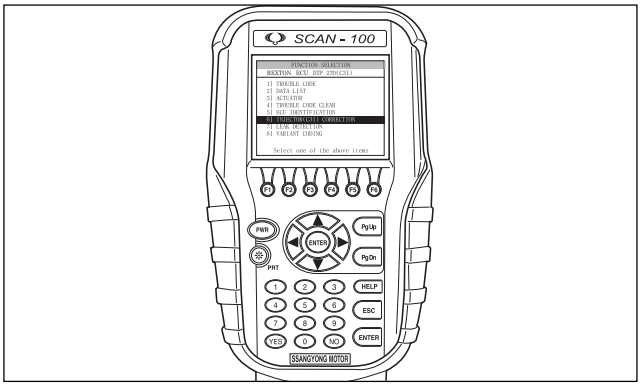
※ **Preceding Work:** Perform the "Entering Diagnosis Procedures"

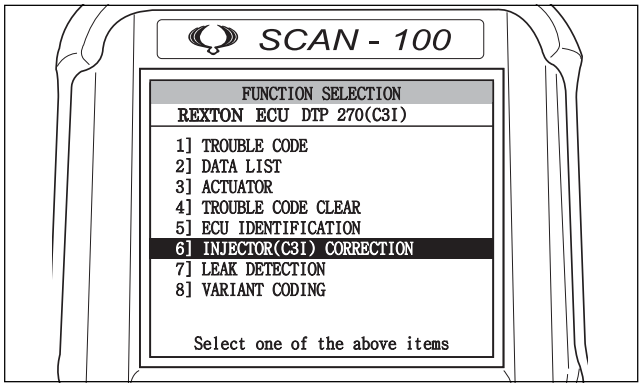
1. Select "6] INJECTOR (C2I) CODING" and press ENTER on "FUNCTION SELECTION" screen.

* Coding of D27DTP (POWER UP) Engine Injector: C3I (20 digits)
* Coding of D27DT Engine Injector: C2I (16 digits: samp with current version)

NOTICE

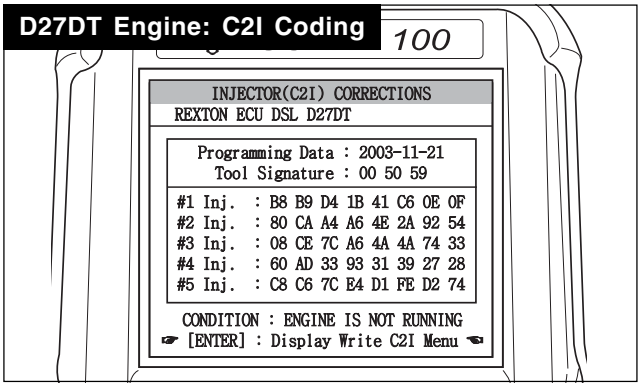
- **If the injector/ECU has been replaced or the injector system failure is suspected, go to C2I or C3I Coding item and check the injector and coded injector C2I or C3I value.**



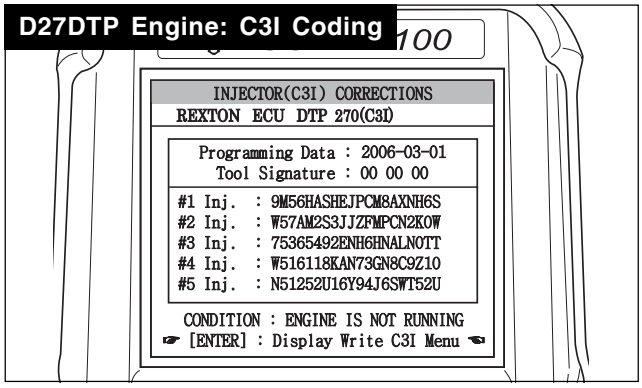


2. The "INJECTOR (C2I or C3I) CODING" screen showing the current C2I or C3I coding values of #1 to #5 injector is displayed. If necessary, press ENTER key and enter the value.

D27DT Engine: C2I Coding



D27DTP Engine: C3I Coding



3. If you have replaced the ECU, enter the C2I or C3I value for the relevant injector.

NOTE

- **The C2I value of injector is on the label.**
- **C2I coding number: 16 digits (ex, C0 2D 835....)**
- **C3I coding number: 20 digits (ex, ZD87E03R....)**

D27DTP (POWER UP) Engine	D27DT Engine
	

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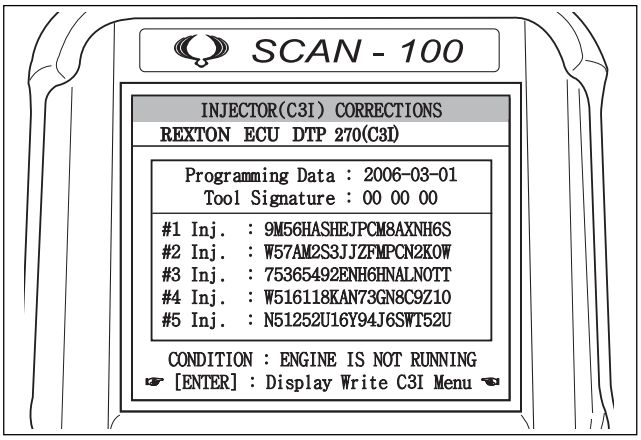
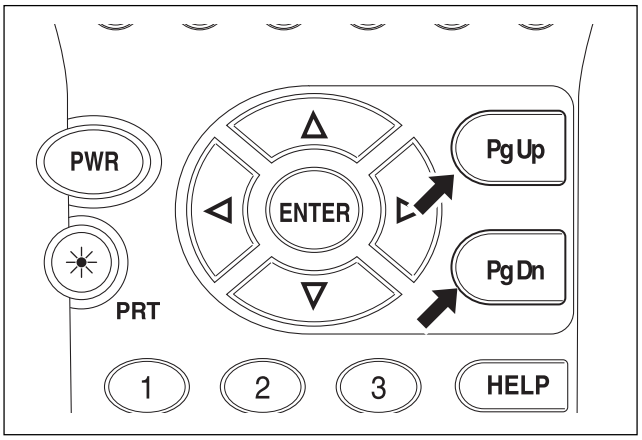
3-1. If you press [ENTER] on C3I (C2I) display, the recoding menu of C3I or C2I appears.

C3I is coded by using alphabet letters up to Z. If you want to change a number in the coding letters, press the number keypad of SCAN-100. If you press PgUp or PgDn key, you can enter alphabet letters again.

NOTE

- **The alphanumeric letters are from A ~ Z followed by 0 ~ 9.**

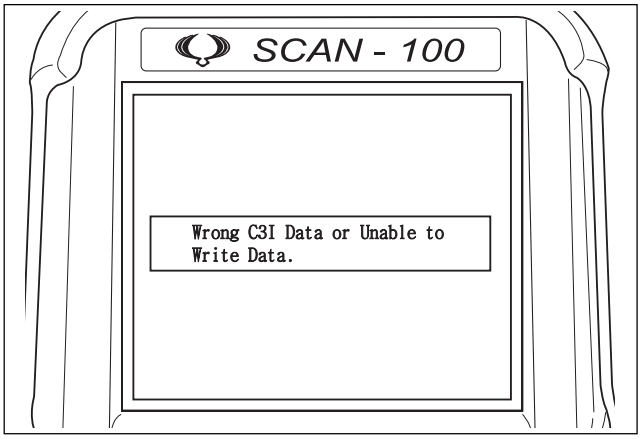




3-2. If you enter the invalid C2I or C3I value of the relevant injector, the message as shown in figure appears with alarm sound.

NOTE

- **If you want to return to previous screen, press ESC key. You can see the previous C2I or C3I value.**



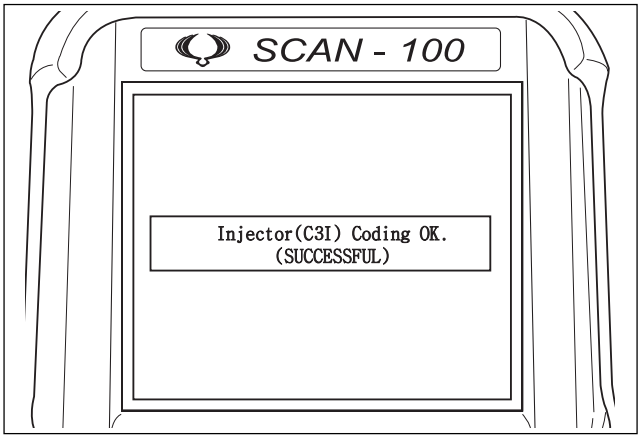
3-3. If you enter the valid C2I or C3I value of the relevant injector, the message as shown in figure appears with alarm sound.

NOTE

- **If you return to previous screen, press ESC key. Then, the new C2I or C3I values are displayed.**

NOTICE

- **When coding C2I or C3I, if you select the engine out of the models, the injector coding items pertaining to the engine appear.**



COMMON RAIL & FUEL SUPPLY PIPE

1. COMPONENTS AND OVERVIEW

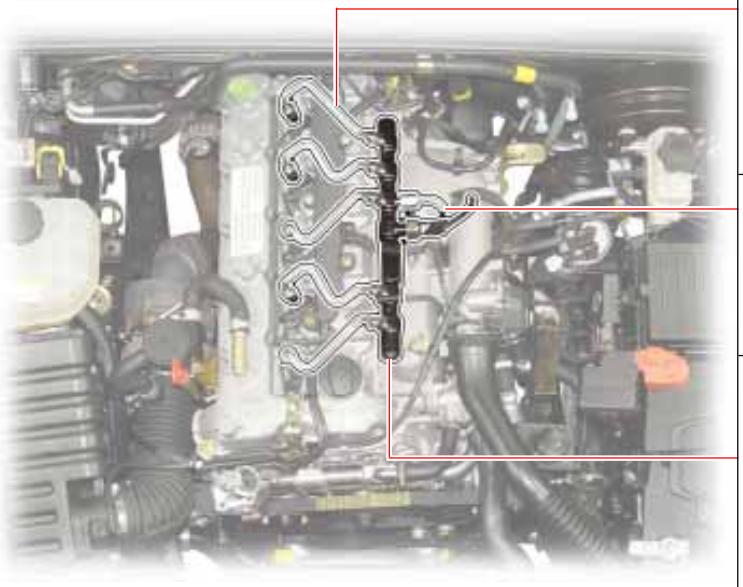
The diameter of fuel supply pipe between HP pump and the common rail and the diameter of fuel pipe between the common rail and the injector have been increased to provide the increased volume of fuel injection for the higher output of D27DTP (POWER UP) engine.

Also, the orifice has been added to prevent the fuel pulsation in the common rail and the HP pump fuel supply line.

To control the amount of injected fuel to each cylinder precisely and evenly, it is important to prevent the fuel pulsation occurred during the fuel supply and fuel cut.

The followings are the fuel pipes for the D27DT engine and D27DTP (POWER UP) engine:

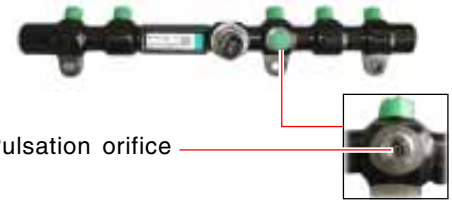
D27DTP (POWER UP) Engine



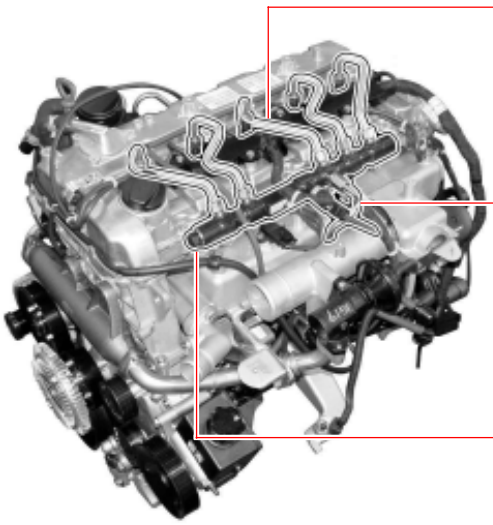
Fuel pipe (Common rail → Injector)

Fuel high pressure pipe (HP pump → Common rail)

Common rail



D27DT Engine



Fuel supply pipe (Common rail → Injector)

Fuel high pressure pipe (HP pump → Common rail)

Common rail

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2. NEW DTCS FOR IMV (HPP: HIGH PRESSURE PUMP) CONTROL

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P1260	VGT Turbo-Charger Actuator Circuit Short	- Abnormal rail pressure, IMV CURRENT TRIM TOO HIGH, DRIFT - Check the IMV wiring harnesses. - Check the ECU wiring harnesses. • Check ECU's pin A76 for open and short. - Check the Rail pressure sensor. • Supply voltage: 5 ± 0.1V • Output voltage at 1600 bar: 4.055 ± 0.125V • Output voltage at atmospheric pressure: 0.5 ± 0.04V - Check low-pressure fuel system. • Check fuel in fuel reservoir and air penetration. • Check fuel filter's specification. - Check high-pressure fuel system. • Check fuel rail and high-pressure pipe for leaks. - Check IMV's resistance (5.44 Ω). • If the resistance is out of specification, replace the high-pressure pump and IMV.						

3. REMOVAL AND INSTALLATION OF COMMON RAIL AND FUEL SUPPLY PIPE

※ **Preceding Work:** Remove the engine cover.

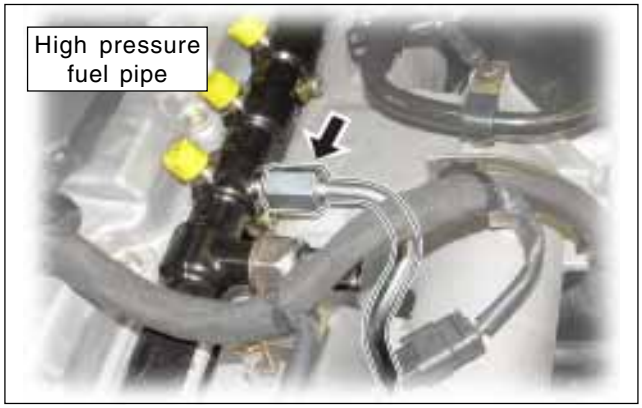
1. Unscrew the mounting nuts and disconnect the fuel supply pipes.

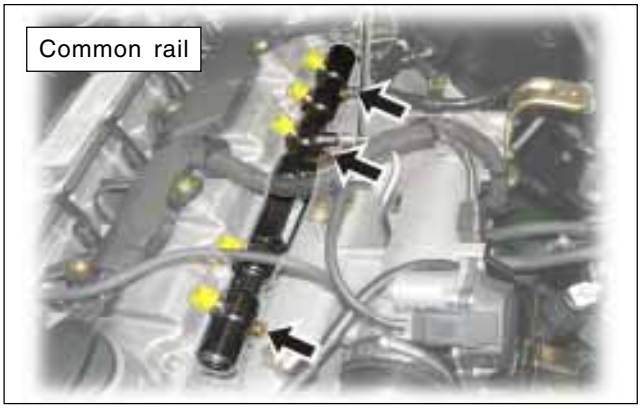
Tightening torque	40 ± 1.0 Nm

NOTICE
- **When installing, replace the fuel supply pipes with new ones.**
- **Plug the fuel hole to the common rail with a protective cap.**

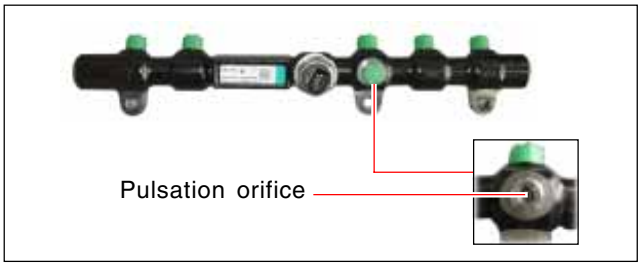
2. Disconnect the fuel pressure sensor connector and remove the clamps.

3. Remove the high pressure fuel pipe and unscrew the common rail mounting bolts (3EA - hexagon: 6 mm) and remove the common rail.





NOTICE
- **Plug the fuel hole to the common rail with a PROTECTIVEcap.**



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INTAKE SYSTEM

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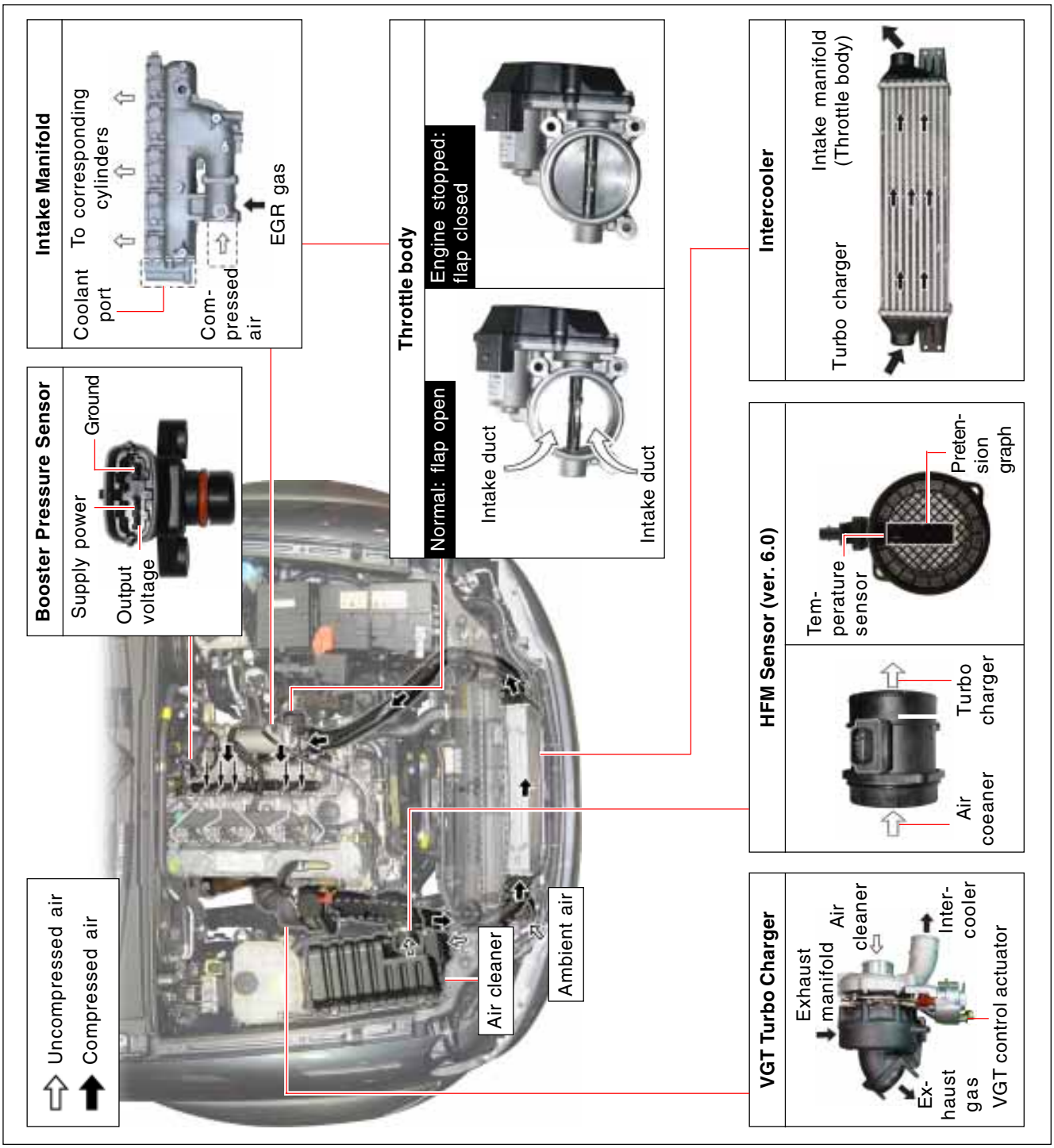
INTAKE SYSTEM

The intake system for the D27DTP (POWER UP) engine is equipped with the throttle body that has a flap to block the air coming to the engine when the engine is switched off. Therefore, the structure of the intake manifold has been changed.

Also, the improved HFM sensor (from HFM5.0 to HFM6.0) has been installed to control the intake air precisely so that the NOx in the exhaust gas can be decreased.

1. INTAKE SYSTEM LAYOUT



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HFM (Hot Film Air Mass) SENSOR (version 6.0)

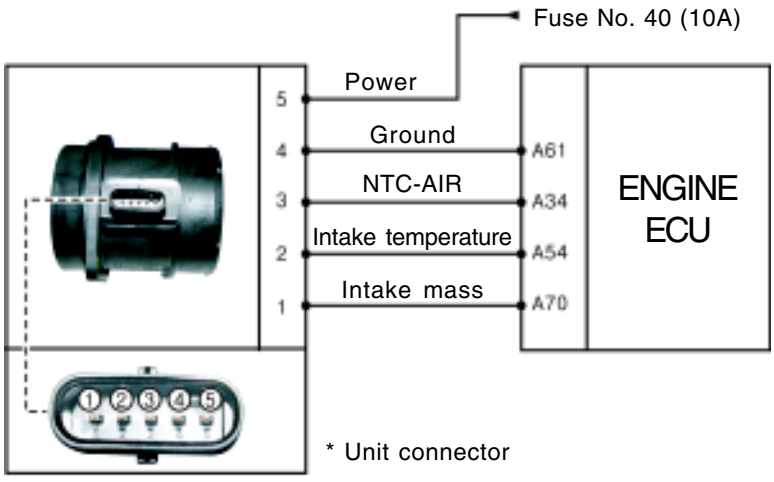
1. OVERVIEW AND LOCATION

The HFM (Hot Film Air Mass) sensor is installed on the air intake line between the air cleaner and the intake manifold and measures the air volume and air temperature coming to combustion chamber.

The engine ECU is used as a basic feedback signal for controlling the EGR. As the E-EGR valve is installed, the potentiometer in it sends the valve movement to the ECU as a feedback signal.

The HFM sensor of the D27DTP (POWER UP) engine is an upgraded version compared to the one of the D27DT engine (D27DT: HFM5.0, D27DTP: HFM6.0). Its accuracy and durability is enhanced to measure the intake air volume and air temperature more precisely. The appearance does not much differ from the previous version, but it digitalizes the transferred signal for intake air volume for the precise engine control.

For its function and inside structure, refer to the previous version of Service Manual. The followings show the HFM sensor mounted on the D27DTP (POWER UP) engine and the unit.



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2. REMOVAL AND INSTALLATION HFM SENSOR

1. Disconnect the HFM connector.

2. Release the clamp (air cleaner side) on the inlet hose (duct) and disconnect the inlet hose from the HFM.

3. Unscrew two mounting bolts and remove the HFM sensor.

4. When installing the HFM sensor, be careful not to damage the O-ring on the HFM sensor.

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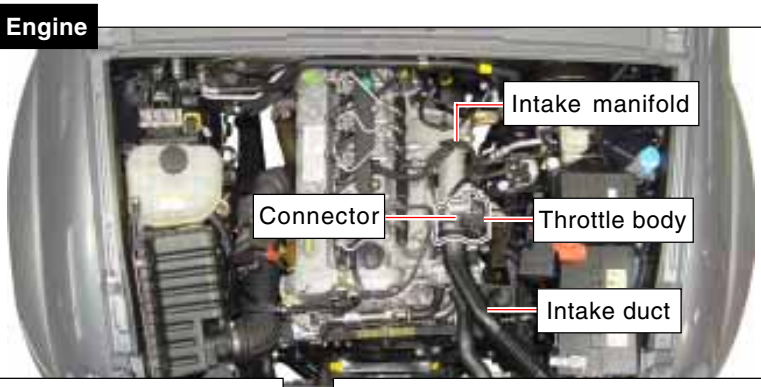
THROTTLE BODY

1. OVERVIEW AND LOCATION

The throttle body is installed for the vehicle with D27DTP (POWER UP) engine and D27DT engine with CDPF. However, its function in each engine is different as follows:

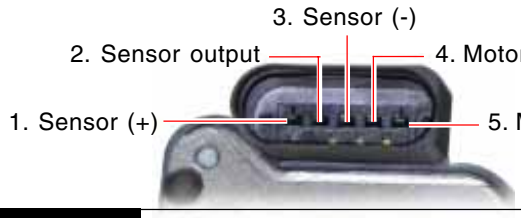
Engine	Control type	Function
D27DTP (POWER UP) engine	Electric signal of engine ECU (ON/OFF)	Preventing the engine from turning off with fluttering noise by blocking the intake air with the flap in the throttle body when the engine is switched off
D27DT + CDPF	Vacuum ON/OFF control via vacuum modulator controlled by engine ECU	Increasing the temperature of the exhaust gas by minimizing the intake air volume if the engine is in the low-load range and CDPF is being recycled

D27DTP (POWER UP) Engine

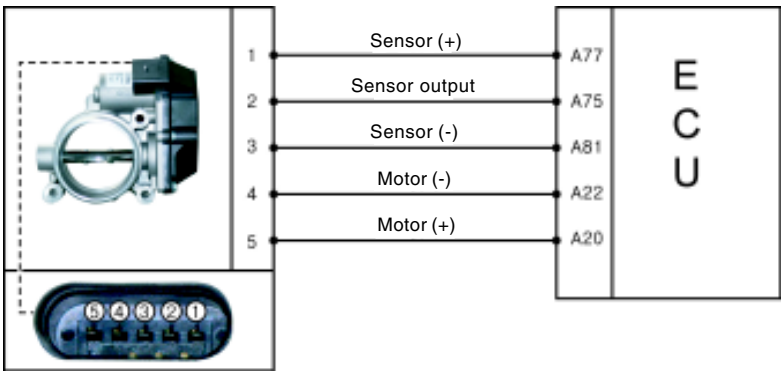


Throttle Body

Connector



Cable side



2. NEW DTCS FOR THROTTLE BODY

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0488	Faulty Maximum Throttle Opening Value	- Causes • The throttle is not fully open when learning the full open value after initial ignition on. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P0487	Faulty Maximum Throttle Closing Value	- Causes • The throttle is not fully closed when learning the full open value after stopping the engine. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2100	Throttle Drive Circuit Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2101	Throttle Drive Ground Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2102	Throttle Drive Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2103	Throttle Drive Battery Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						

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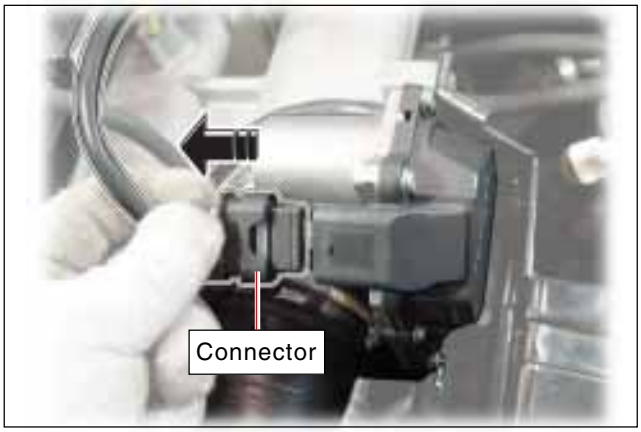
DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2104	Throttle Drive Overheat	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C.						
P213B	Abnormal Throttle Control	- Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary. - Causes • The difference between throttle position demand (MAP) and throttle position feedback signal is out of +5% or -13%. - Defective throttle control (P213B) - Defective throttle signal (P213C, P213D) - Defective throttle drive (P2103, P2101, P2102, P2104, P2100) - Check pin (refer to P213C). - Sensor specification: Refer to P213C.						
P213C	Low Throttle Signal	- Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary. - Causes • The throttle valve position sensor signal is stuck low. - Check pin for the followings: • Throttle valve #1: sensor (Power) ECU #A20 • Throttle valve #2: sensor (Signal) ECU #A22 • Throttle valve #3: sensor (GND) ECU #A81 • Throttle valve #4: valve (Positive) ECU #A75 • Throttle valve #5: valve (Positive) ECU #A77 - Sensor & Motor SPEC • Motor * Power: 12V * Max. current : 6.8A (Normal: 3.6 ~ 0.2) * Motor resistance: 4.3Ω • Sensor * Power: 5V						
P213D	High Throttle Signal	- Actions • Check the throttle valve and sensor wiring harnesses. (The signal output of throttle valve is below than 0.24 V.) • Visually check the unit and replace if necessary. - Causes • The throttle valve position sensor signal is stuck high. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						

3. REMOVAL AND INSTALLATION OF THROTTLE BODY

※ **Preceding Work:** Remove the engine acoustic cover.

Removal and Installation

1. Disconnect the connector of the throttle body.



2. Remove the intercooler outlet duct.

Tightening torque: 6 ~ 7 Nm

3. Unscrew three mounting bolts and remove the throttle body assembly (tightening torque: 10 ± 1.0 Nm).

4. When installing, clean the mating surface of the intake manifold (throttle body) and be careful not to damage the new O-ring.

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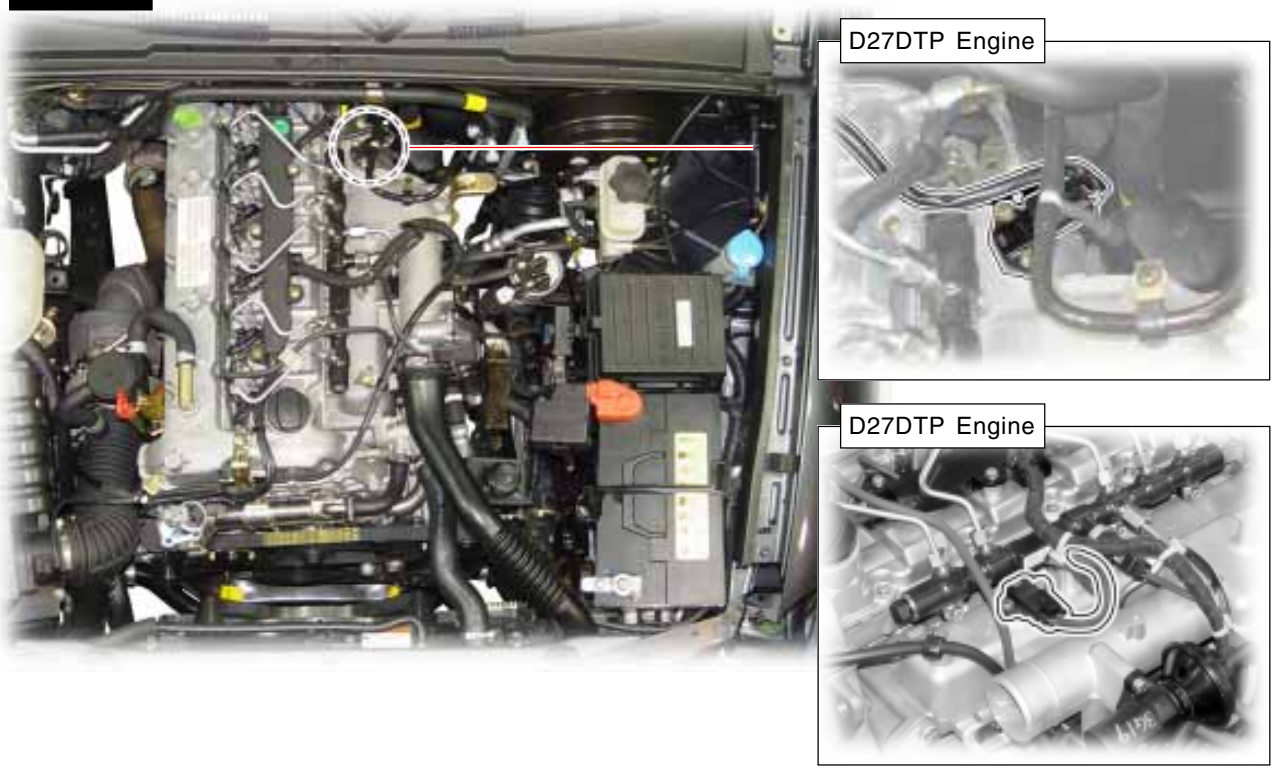
BOOST PRESSURE SENSOR

1. OVERVIEW AND LOCATION

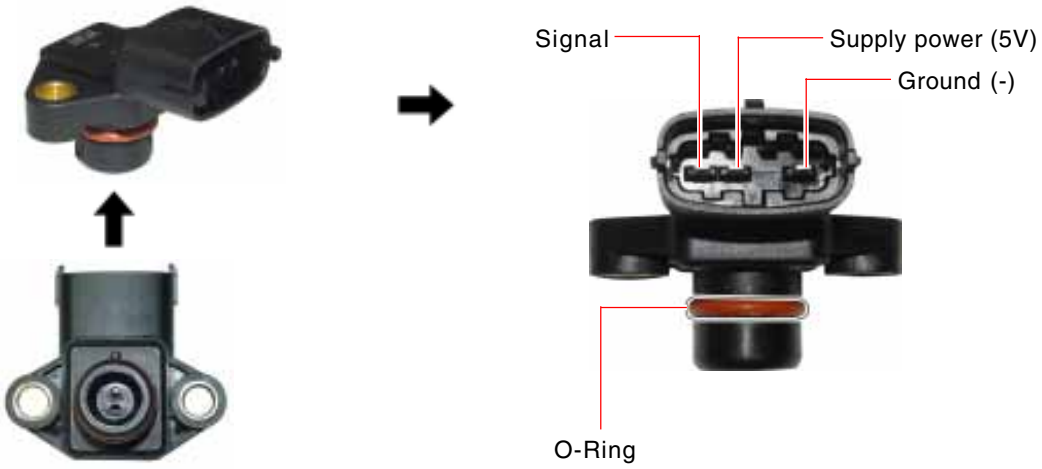
The location and the specifications of boost pressure sensor for the D27DTP (POWER UP) engine are changed due to the mounted VGT turbo charger and additional throttle body.

Location



The boost pressure sensor is piezo-electric element type and consists of three terminal. It determines the injection timing and calibrates the injection volume depending on the intake air. Also, it determines whether to stop the EGR.

Boost Pressure Sensor



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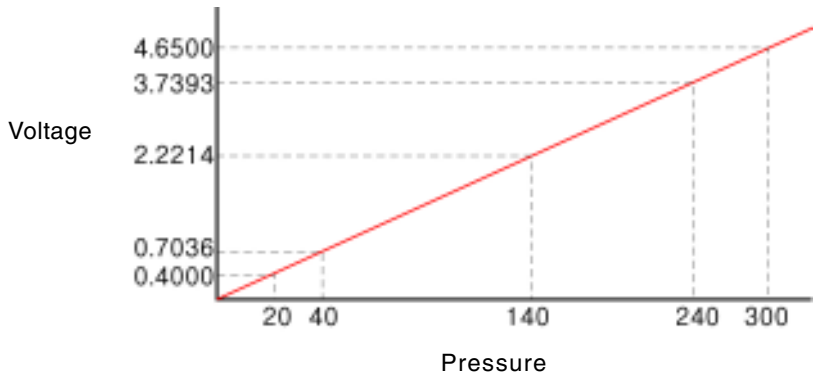
Formula for Calculating Output Voltage

Vo = Vs x (P x 0.004 - 0.04)

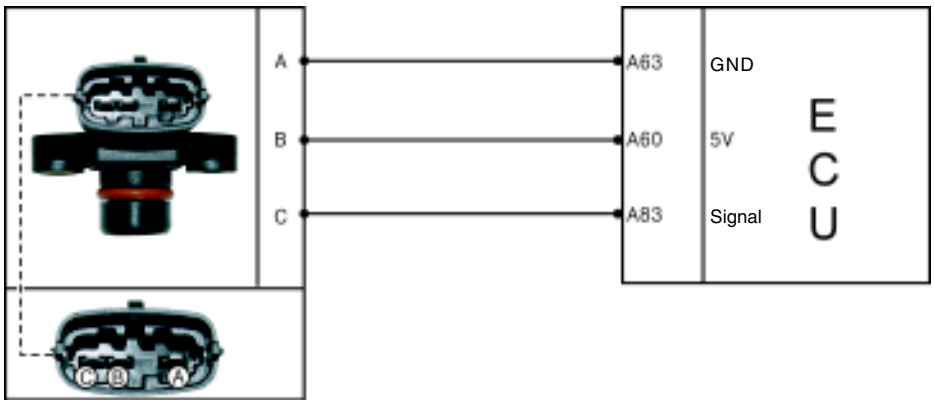
Vo: Output voltage
Vs: Supply voltage
P: Applied voltage

Booster Pressure Sensor (Based on D27DTP Engine)



Items	D27DTP (POWER UP) Engine	D27DT Engine
Pressure range	20 ~ 300 KPa	20 ~ 250 KPa
Temperature range	-40 ~ 125°C	-40 ~ 110°C
Temperature range (storage)	-40 ~ 125°C	-40 ~ 125°C
Supply voltage	4.75 ~ 5.25 V	4.85 ~ 5.35 V
Max. current	12.5 mA	10 mA
Response	$T_R \leq 7$ ms	$T_R \leq 7$ ms
Tightening torque	8 ~ 10 Nm	10 Nm

Circuit Diagram



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2. REMOVAL AND INSTALLATION OF BOOST PRESSURE SENSOR

※ **Preceding Work:** Remove the engine acoustic cover.

▶ Removal and Installation

1. Disconnect the connector of the boost pressure sensor.

2. Unscrew two mounting bolts and remove the boost pressure sensor from the intake manifold.

Tightening torque	10 ± 1.0 Nm

3. When installing, clean the mating surface of the boost pressure sensor and the intake manifold and be careful not to damage the O-ring.

MEMO

EXHAUST SYSTEM

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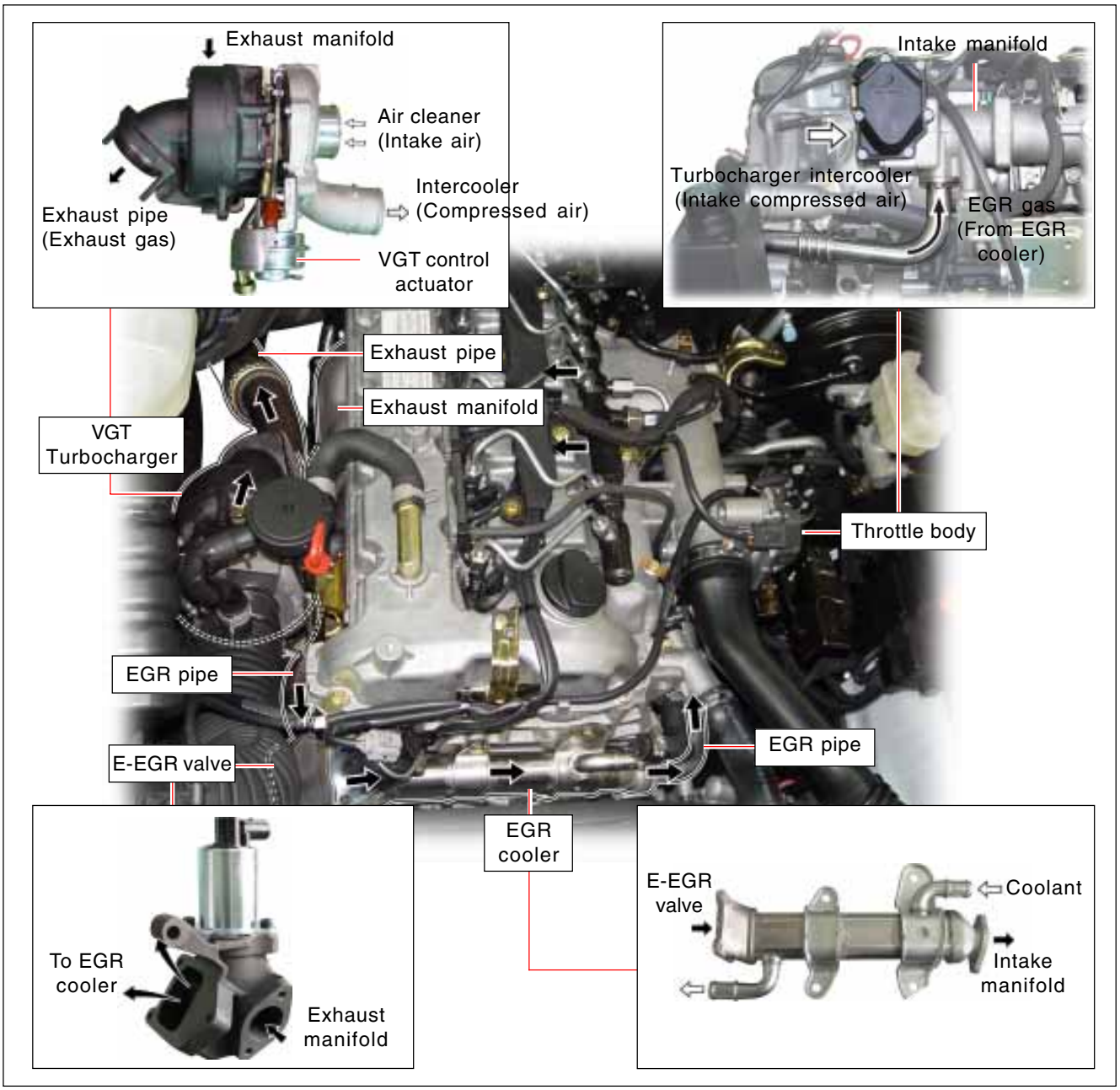
EXHAUST SYSTEM

1. COMPONENTS

The components of the exhaust system for the D27DTP (POWER UP) engine have been changed as follows:

1. **E-EGR valve**: Controlling the EGR valve electrically and sends the valve location signal to ECU (vacuum modulator control has been deleted)
2. **EGR cooler**: Decreasing EGR gas (NOx) efficiently by cooling the EGR gas and let it flow to the intake pipe
3. **VGT turbocharger**: Increase in capacity and performance compared to D20DT engine

The EGR system has been changed to control NOx more efficiently and the VGT turbo charger has been changed to increase the engine power. For more details, refer to the next description. The exhaust system for D27DTP (POWER UP) engine is as follows:



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E-EGR VALVE (Electric-Exhaust Gas Recirculation Valve)

1. OVERVIEW OF E-EGR VALVE

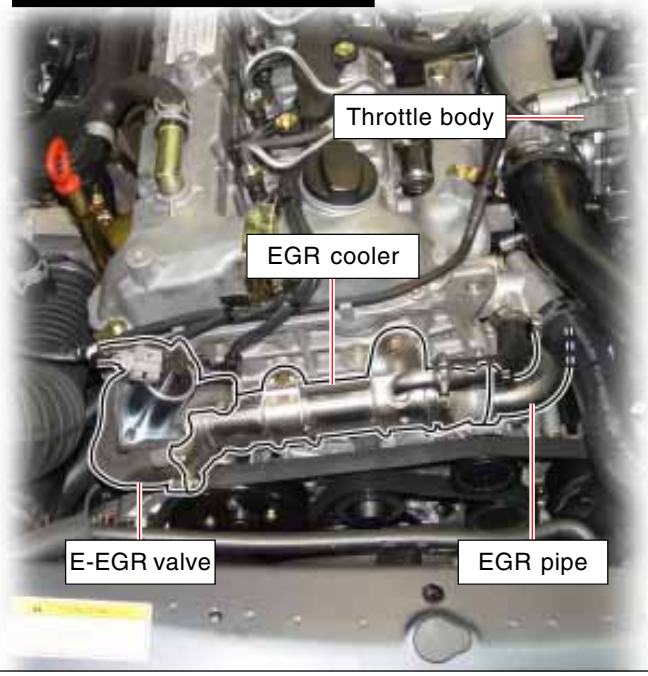
The EGR valve for the D27DTP (POWER UP) engine is the E-EGR (Electric-Exhaust Gas Recirculation) valve that is directly controlled by the ECU with electric signal, while the EGR valve for the D27DT engine is controlled by the vacuum modulator.

The E-EGR valve is directly controlled by the ECU through the duty control and the valve location signal is sent to ECU as feedback.

This signal is also used as feedback signal for ECU to control the EGR rate. Also it is used to check whether the E-EGR valve is properly controlled by ECU.

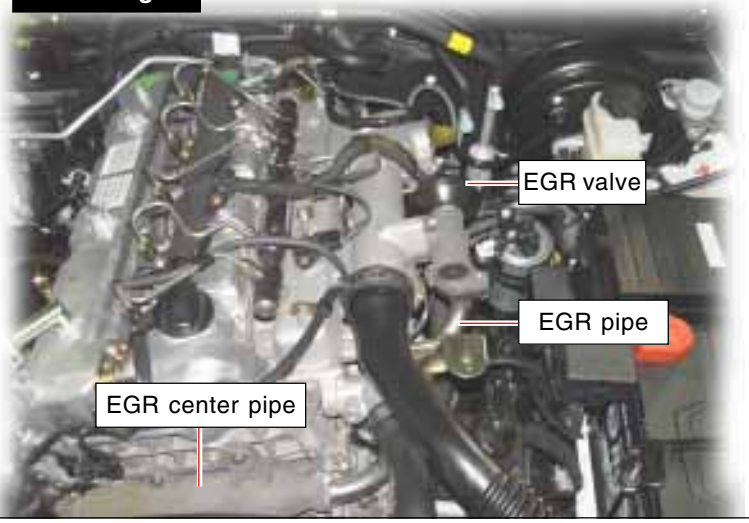
The followings are the EGR systems for D27DTP (POWER UP) engine and D27DT engine:

D27DTP (POWER UP) Engine



E-EGR Valve

D27DT Engine



EGR Valve (Vacuum Control Type)

The E-EGR valve is controlled electrically, not by vacuum, and duty controlled. Its functions and performance have been changed as follows compared to the EGR valve controlled by vacuum modulator.

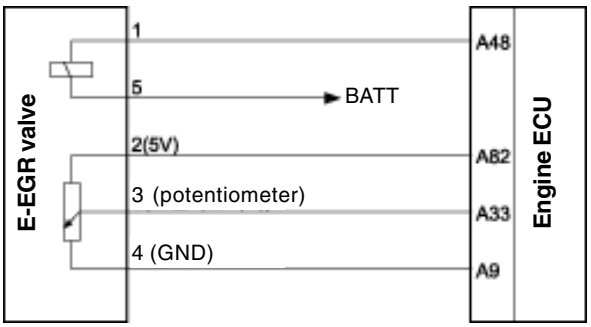
1. Improved response and accuracy by engine ECU control

For the D27DT engine, the vacuum modulator between engine ECU and EGR valve controls the opening level of EGR valve. However, for the D27DTP (POWER UP) engine, the engine ECU operates the solenoid in EGR valve only by electric signals.

The response of the EGR valve has been improved as the engine ECU controls the valve directly. Also, the valve is controlled more precisely by the electric signals.

2. Feedback function of E-EGR valve

By mean of electric signals, the engine ECU can directly control the E-EGR valve and take feedback of the valve location. In addition to, EGR control feedback signal from the HFM sensor improves the control of E-EGR valve.



The solenoid resistance of E-EGR valve is approx. 8W ± 0.5W at No. 1 and 5 terminals and the overall resistance at No. 2 and 4 terminals is approx. 4 kW ± 40%.

The resistance (at No. 3 and 2 terminals) changes as the EGR's opening level changes by the electric signals in ECU.

This signal is sent to ECU as feedback signals indicating opening level of EGR valve.

Basically, the feedback signal for the EGR valve's opening level indicates the air intake volume of the HFM sensor. (If the exhaust gas is entered into the intake pipe as the EGR valve opens, the amount of fresh air entered via the HFM sensor decreases. The engine ECU receives the amount of air passing the HFM sensor according to the opening level of the EGR valve.)

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3. Prevention of EGR valve's chattering and improved durability

Two valve seats of the EGR valve decrease the chattering phenomenon of the valve occured by the pressure of exhaust gas when the valve is being opened or closed. As to this, the durability of the valve stem has been improved.

4. Cleaning function of EGR valve

The solenoid valve is operated when the engine is being turned off and is at mid-high speed to remove the foreign materials (eg, carbon) accumulated on the valve seat and housing.

5. Learning function of EGR valve location for carbon accumulation

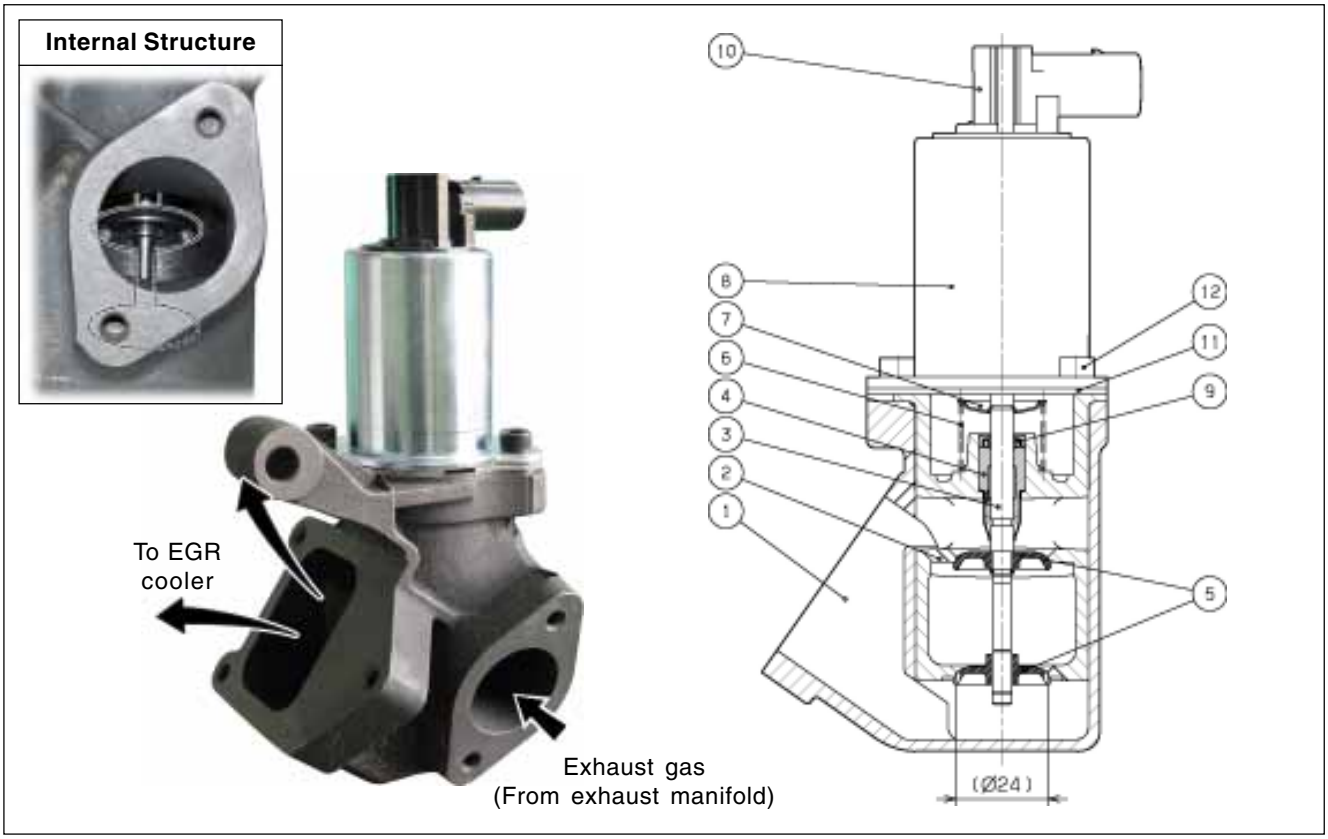
The E-EGR valve monitors the closed and open location of valve before turning off the engine. This value is analyzed to compensate the changes in valve position occured by the accumulated carbon.

2. OPERATING RANGE OF E-EGR VALVE

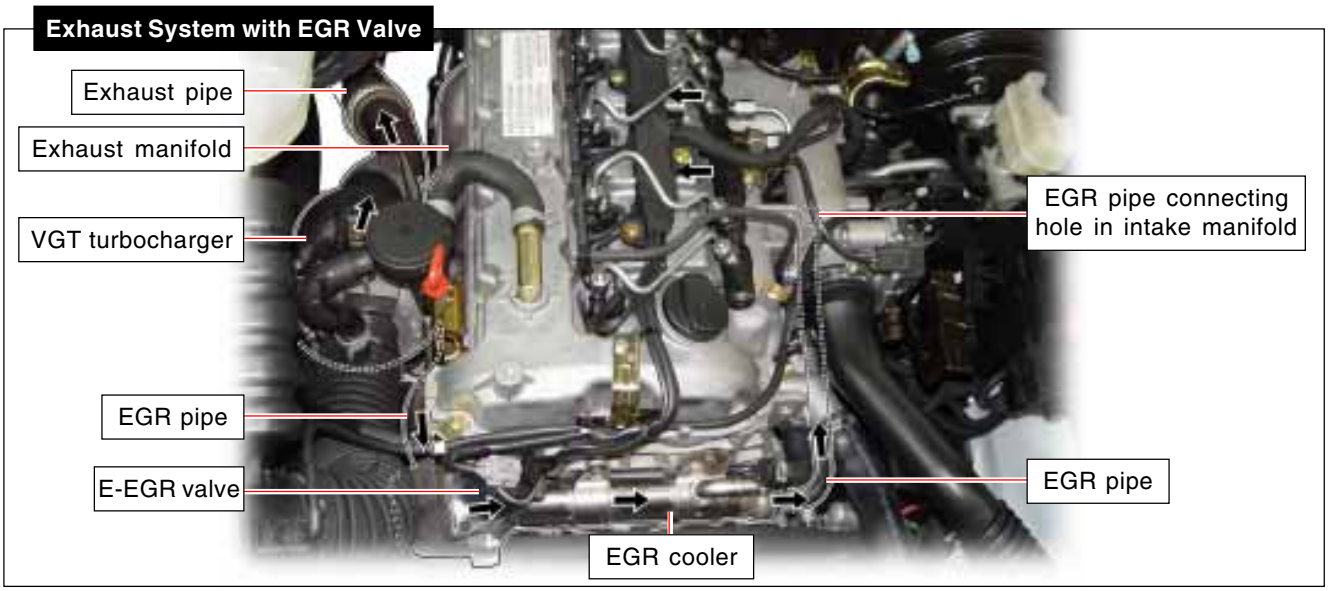
The operating range and control range of the E-EGR valve are controlled by control logic (MAP). Followings show only major operating range.

1. **Intake air temperature : approx. -10°C ~ 50°C**
2. **Atmospheric pressure: Over approx. 0.92 bar**
3. **Engine coolant temperature: 0°C ~ 100°C**
4. **EGR valve shut-off when acceleration (engine rpm > 2600)**
5. **EGR valve shut-off when engine is idling for over 1 minute**
6. **EGR valve shut-off when vehicle speed is over 100 km/h**
7. **EGR valve shut-off when engine torque is over 380 Nm**
8. **EGR valve is normal when there is no DTC related to EGR valve.**

3. STRUCTURE OF E-EGR VALVE



1. Valve body
2. Socket
3. Stem
4. Stem guide assembly
5. Valve disc (2) - Diameter ϕ 24 mm
6. Spring
7. Spring disc
8. Solenoid housing assembly
9. Sealing assembly
10. Potentiometer and connector
11. Gasket
12. Bolt



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4. NEW DTCS FOR E-EGR

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0405	High EGR Open Position deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates E-EGR is open over 15% in the close status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						
P0406	High EGR Close Position Deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates E-EGR is closed over 15% in the open status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						
P0407	Low EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) - ECU Pin #A33 • Sensor signal - ECU Pin #A82 • Sensor GND - ECU Pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						
P0408	High EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) - ECU Pin #A33 • Sensor signal - ECU Pin #A82 • Sensor GND - ECU Pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P1409	EGR Valve Circuit Short	- Check pin for the followings: • The E-EGR valve wiring is open. • E-EGR Pin #1: Power(Main Relay) • E-EGR Pin #5: ECU Pin #A48 - Actions • Check E-EGR valve wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408).						
P1407	Faulty EGR Close Position	- Causes • The EGR position is not closed when EGR is not operated within 50 seconds with the engine idling. - Check pin for the followings: • E-EGR #1: Valve power (Main relay) • E-EGR #2: Sensor (Reference voltage) ECU #A33 • E-EGR #4: Sensor (Ground) ECU #A09 • E-EGR #5: Valve drive (PWM) ECU #A48 • E-EGR #6: Sensor (Signal) ECU #A82						
P0402	EGR Valve Stuck in Open Position	- Actions • Check E-EGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408). - Causes • The E-EGR valve is stuck with it open. - Check pin (refer to the page 1407) - Actions • Check E-EGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Replace the ECU if required. • Refer to DTCs (P0407 and P0408).						

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5. REMOVAL AND INSTALLATION E-EGR VALVE ASSEMBLY

NOTICE

- **When removing the E-EGR valve, the EGR cooler pipe should be removed too.**
- **The solenoid and the valve housing can be separated. However, E-EGR valve assembly should be removed as a unit for setting the valve seat.**

▶ Removal and Installation

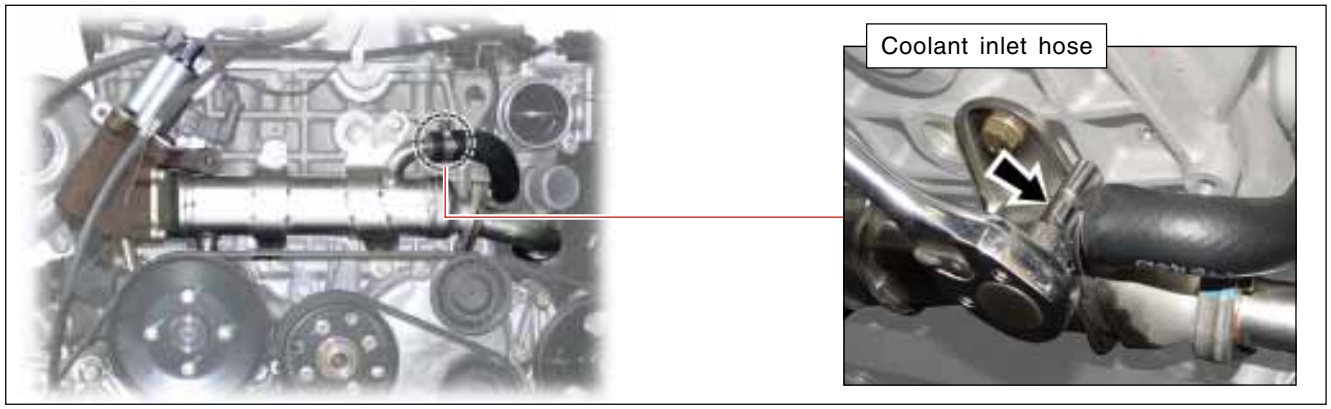
※ **Preceding Works:** 1. Remove the PCV oil separator hose ① and the intake inlet duct ②.
2. Drain the coolant.

1. Open the drain cock under the radiator and drain the coolant completely.

NOTICE

- **The coolant should be stored in the designated container. Be careful not to spill the coolant at any place.**

2. Disconnect the coolant inlet hose of EGR cooler pipe.



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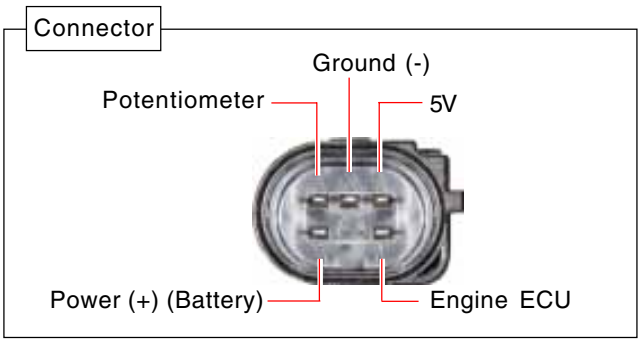
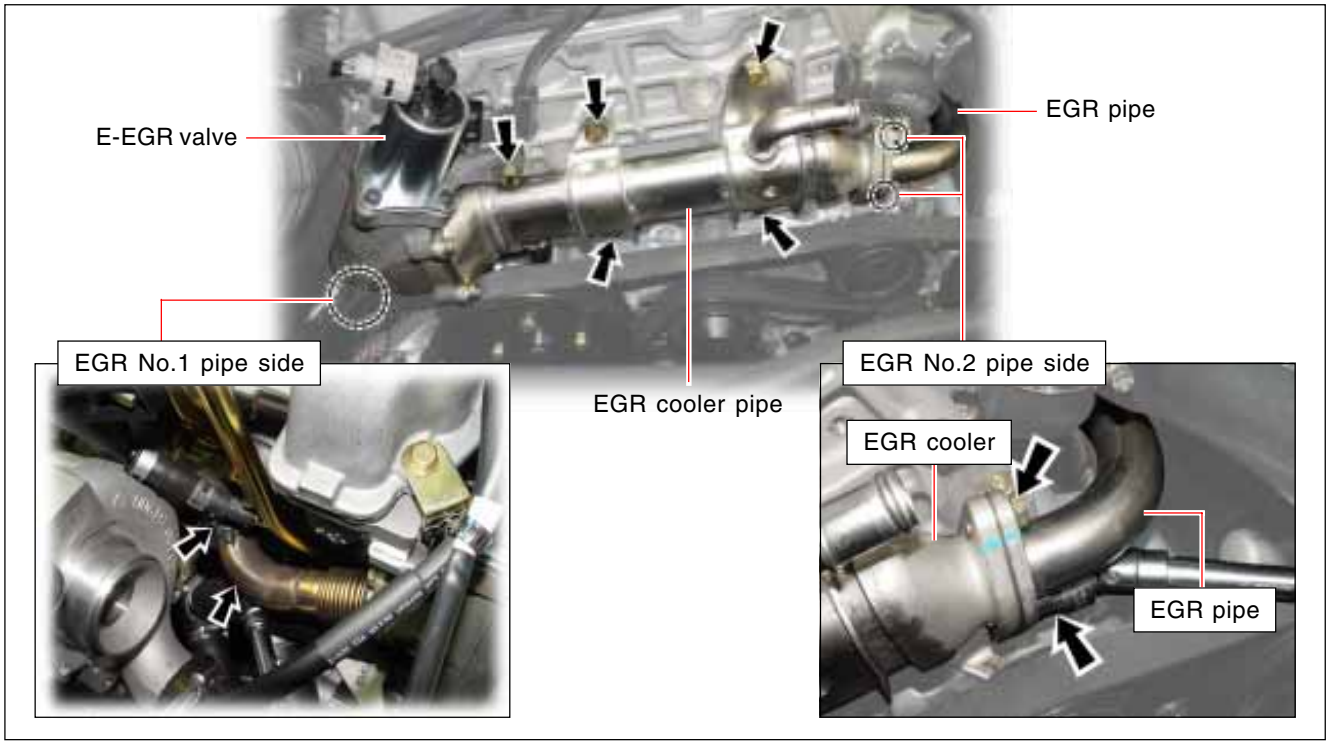
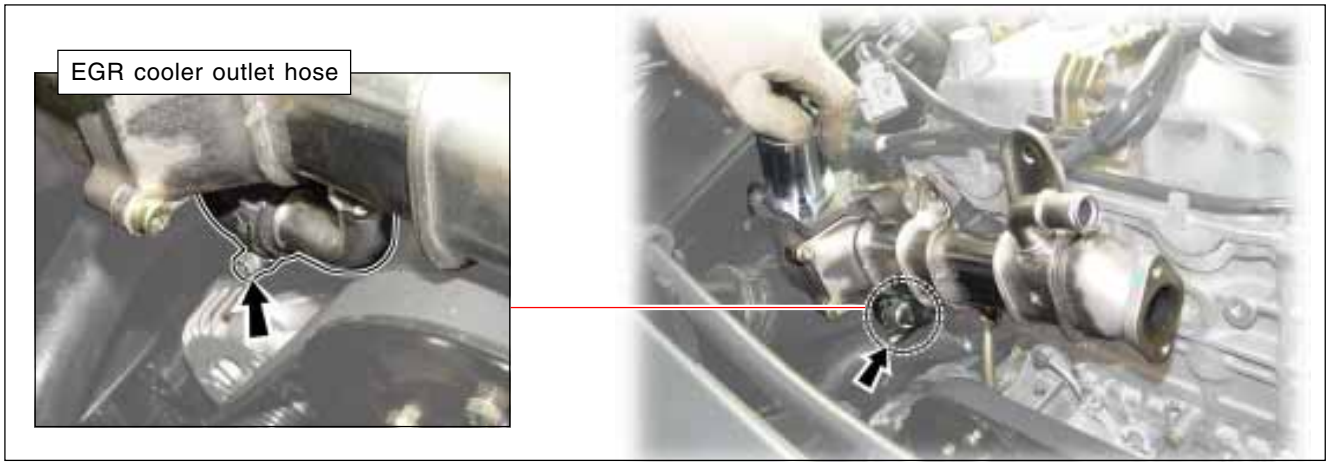
3. Disconnect the E-EGR valve connector.



4. Unscrew the mounting bolts on E-EGR valve and EGR cooler.



5. Release the hose clamp and remove the E-EGR valve and EGR cooler.



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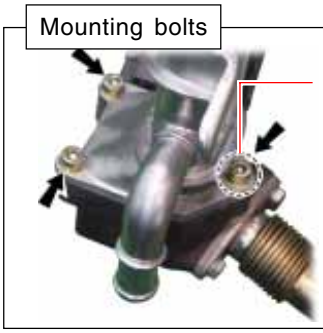
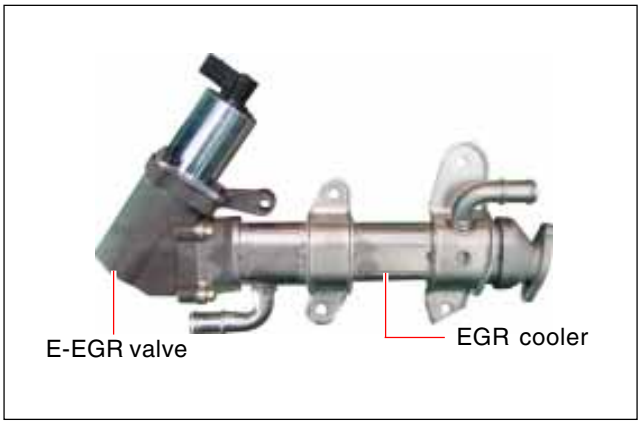
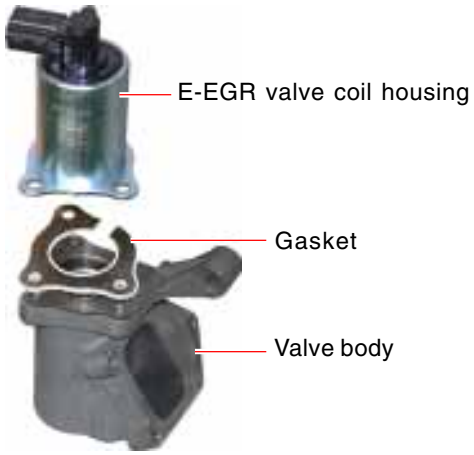
6. Remove the E-EGR valve and EGR cooler from the removed E-EGR valve assembly.





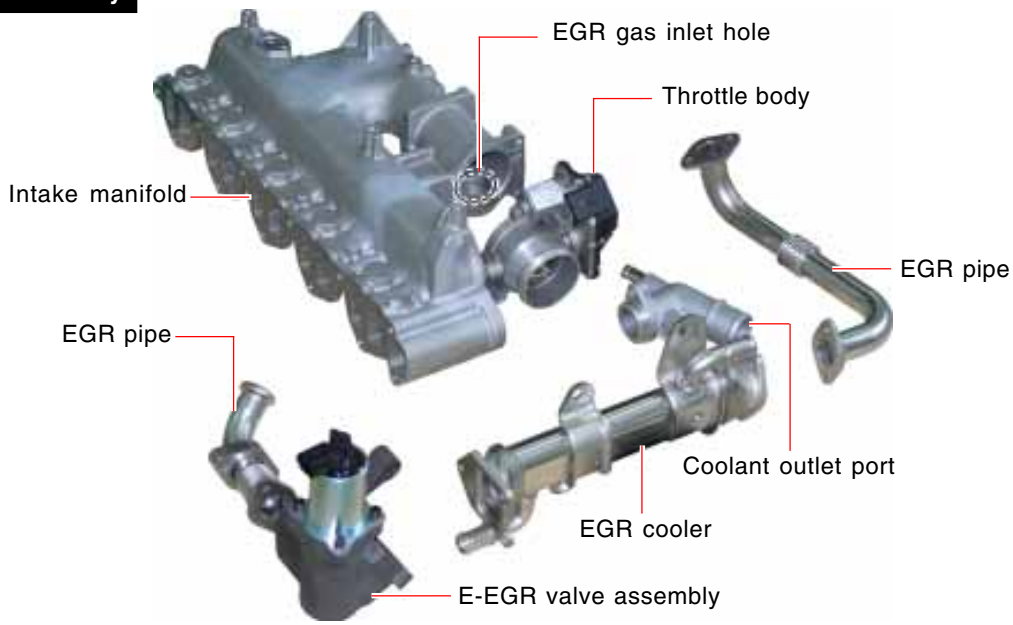
7. Separate the valve body and the E-EGR valve coil housing from the E-EGR valve assembly.

Structure of E-EGR Valve



These should be replaced as a unit.

Structure of EGR Assembly



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EGR COOLER

1. OVERVIEW OF EGR COOLER

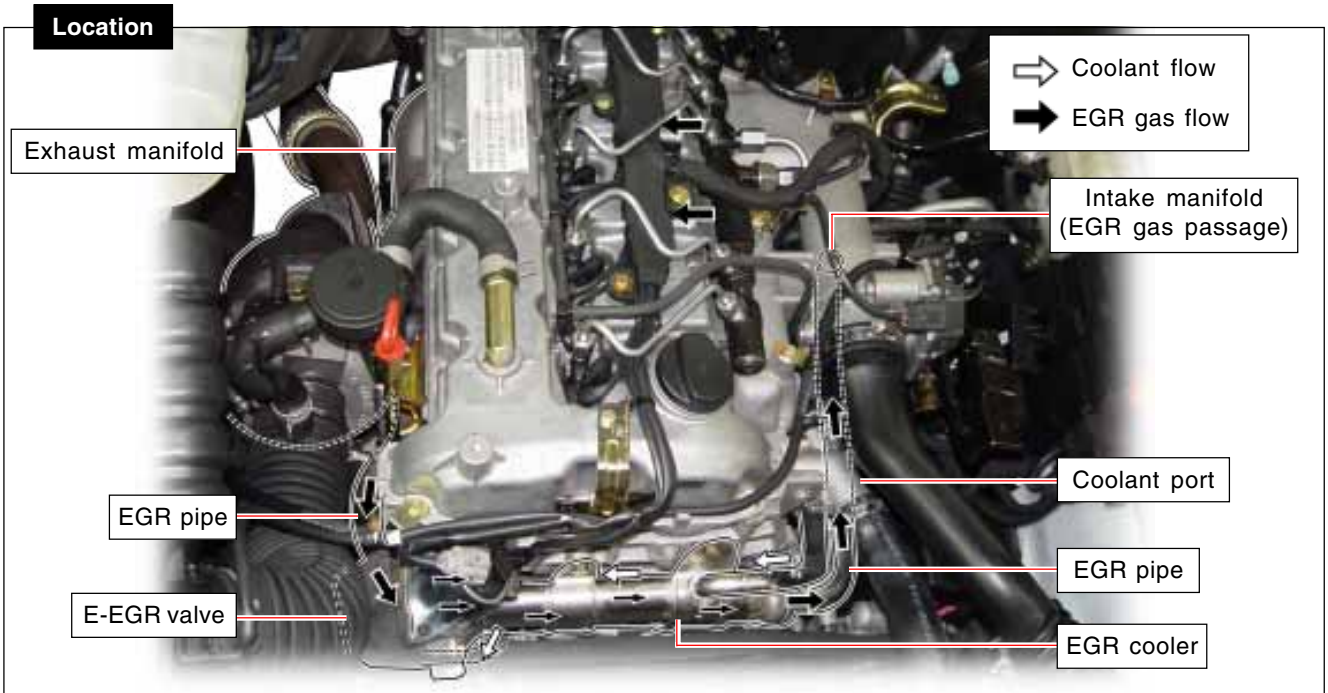
For D27DTP (POWER UP) engine, the EGR gas gets into intake manifold passing through the EGR cooler.

The EGR system is to reduce the nitrogen oxide (NOx). With the E-EGR valve, the EGR rate can be precisely controlled as the opening level of valve is precisely controlled and the feedback signal is sent to ECU.

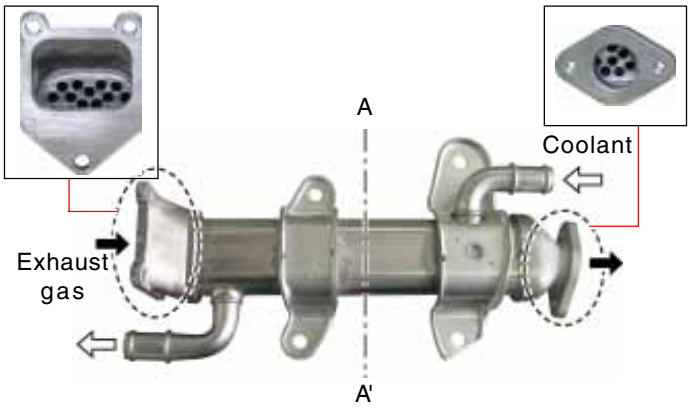
However, for more efficient EGR system (reducing NOx), the temperature of recirculated gas should be decreased. The EGR cooler decreases this temperature.

The EGR cooler is an additional cooling circuit on the center pipe. Also, the capacity of water pump has been increased for improving coolant flow.

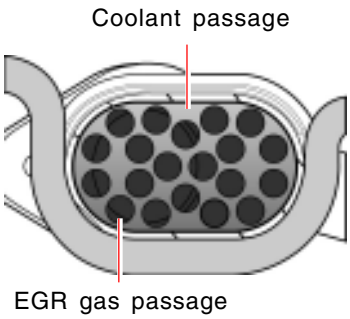
Location



EGR Cooler



Sectional View of EGR Cooler: A - A'



2. REMOVAL AND INSTALLATION OF ERG COOLER

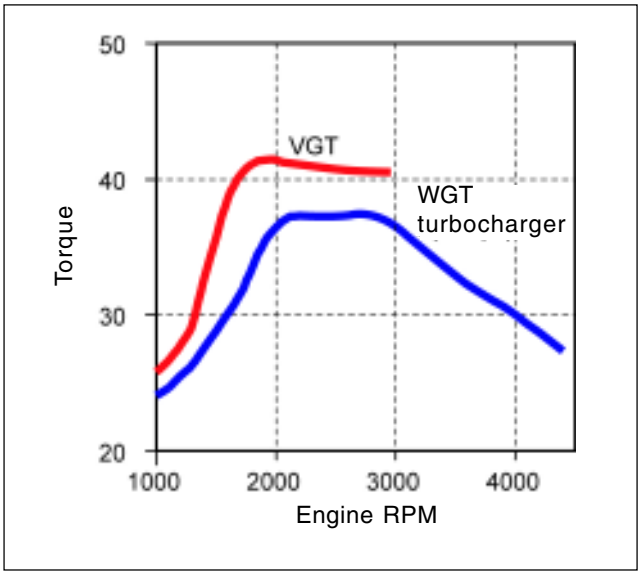
* Refer to “E-EGR valve”

VGT TURBOCHARGER

1. OVERVIEW AND FEATURES OF VGT (VARIABLE GEOMETRY TURBINE)

▶ Overview

The VGT turbocharger is a certain type of turbocharger system that controls the turning speed of turbocharger by changing the passage of the exhaust gas. At low engine speeds when exhaust flow is low, the inlet port of exhaust gas to turbocharger is partially closed. This increases the pressure of the exhaust pushing against the turbine blades, making the turbine spin faster and generating more boost. As engine speed increases, so does exhaust flow, so the inlet port is opened to reduce turbine pressure and hold boost steady or reduce it as needed.



Effect

Output and Torque : Increases the output by 10% and torque by 14% compared to conventional turbocharger. (Refer to the graph above.)

Fuel consumption : When the accelerator pedal is pressed, the proper mixture of fuel and air should be entered into the combustion chamber. However, for the conventional turbocharger, excessive fuel is supplied when accelerating as the compressor wheel (impeller) does not supply enough compressed air. The VGT reduces this phenomenon. (To supply the proper amount of fuel, the VGT turbocharger drives the turbine wheel faster in low speed range so that the amount of intake air is increased.)

Exhaust gas : The shape of turbine blade is change to increase the amount of intake air in low speed range. Therefore, the exhaust gas and smoke due to excessive fuel is reduced.

NOTE

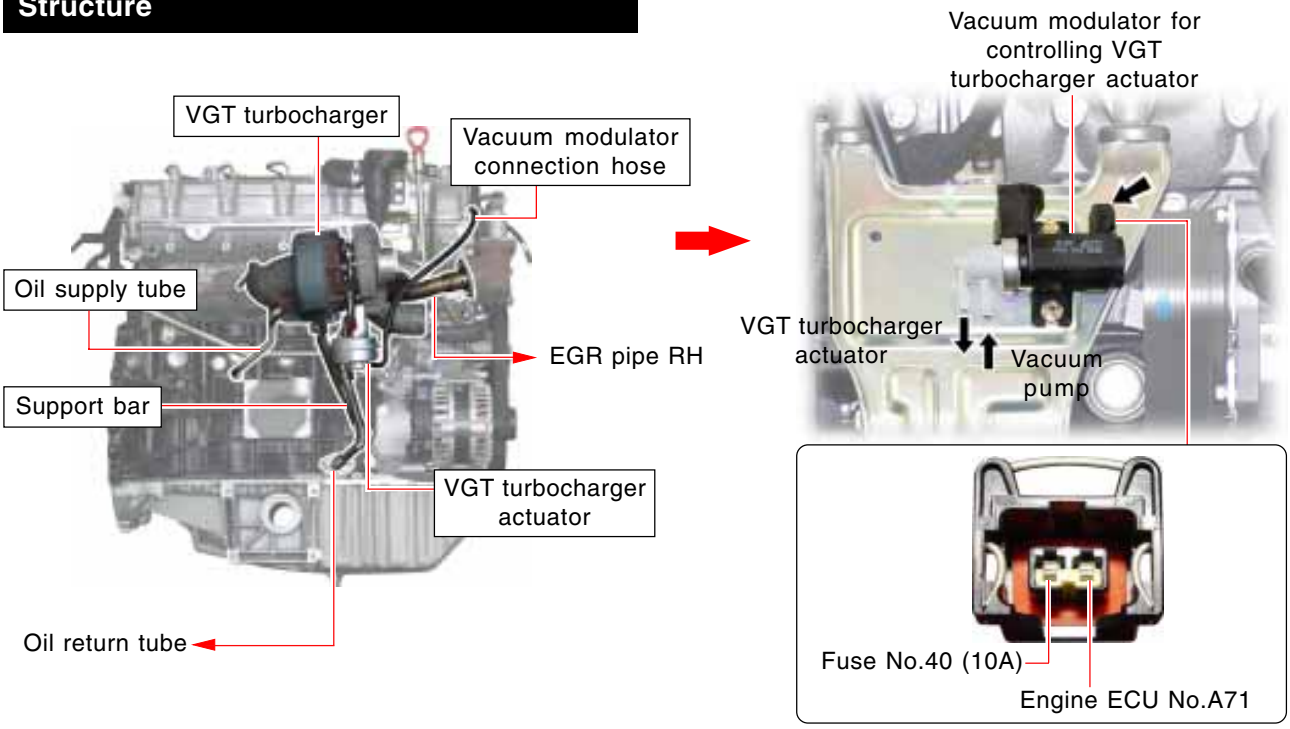
- **Turbocharger lag**

  The turbocharger is at idle speed when there is no load or it is in the normal driving condition. During this period, the amount of exhaust gass passing through the turbine is not enough to turn the compressor wheel (impeller) fast. Therefore, the intake air is not compressed as needed.

  Because of this, it takes time for turbocharger to supply the additional power after the accelerator pedal is depressed. This is called "turbocharger lag".

▶ Components and Structure of VGT Turbocharger

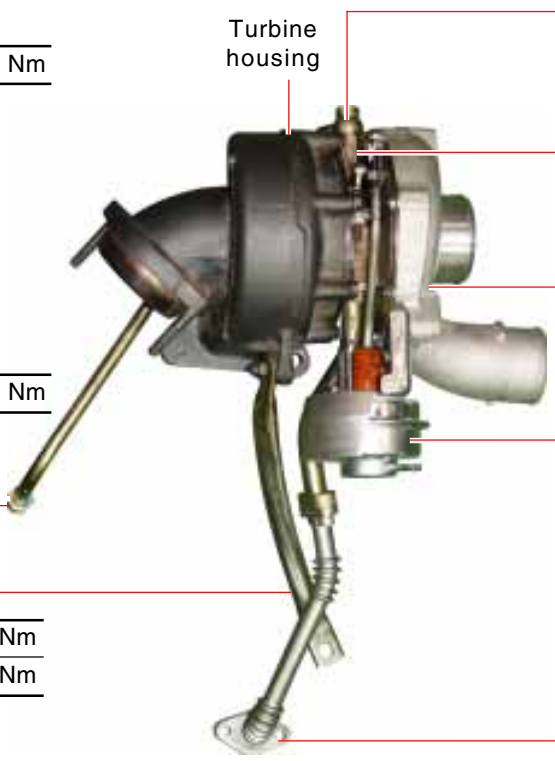
Structure



Turbocharger Tightening Torque

Turbocharger assembly

Tightening torque	25 ± 2.5 Nm



Oil supply tube (hollow bolt)

Tightening torque	15 ± 1.0 Nm

Oil supply tube (lower nut)

Tightening torque	23 ± 2.3 Nm

Support bar

Tightening torque	Nut	23 ± 2.3 Nm
	Bolt	25 ± 2.5 Nm

Oil return tube

Tightening torque	10 ± 1.0 Nm

*** For the function and operating principle of VGT turbocharger, refer to Actyon service manual.**

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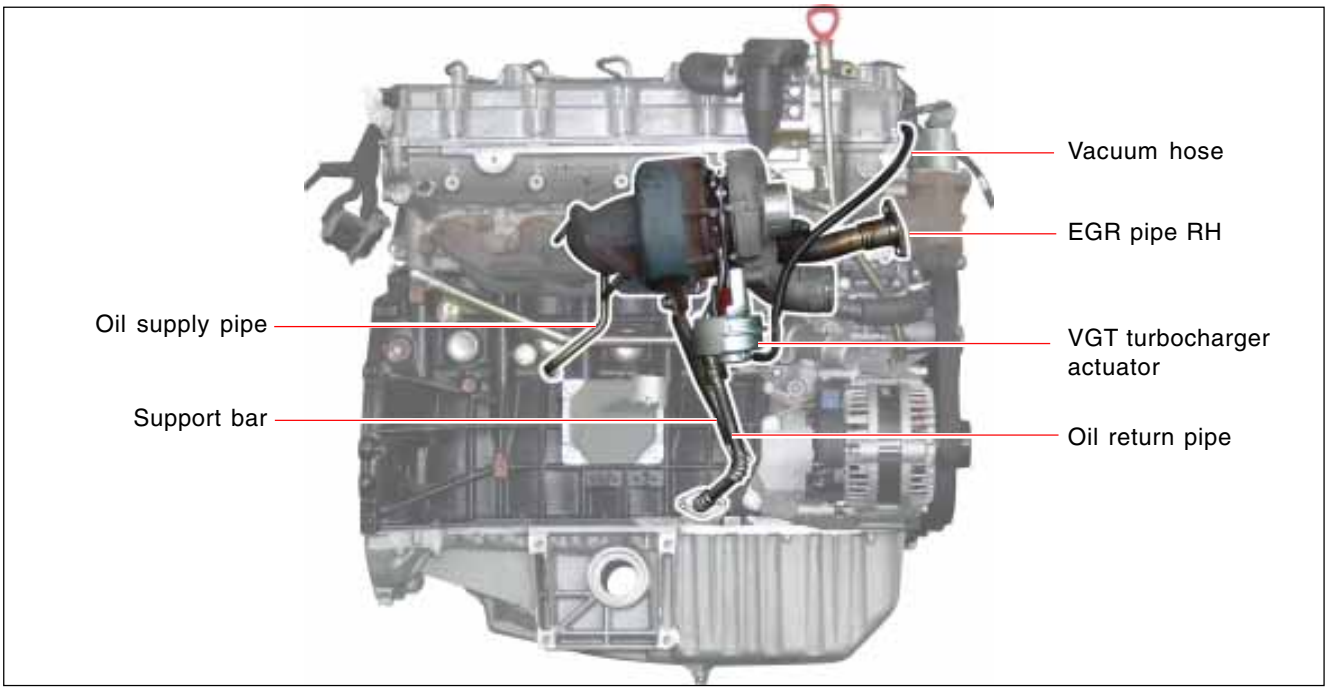
2. NEW DTCS FOR VGT TURBOCHARGER

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Malfunction Indicator light
P0243	VGT Turbo-Charger Actuator Circuit Short	- Causes • There is electric problem in the vacuum modulator drive module of turbocharger. - Check pin for the followings (Vacuum Modulator): • Power (Main Relay) • GND (ECU Pin #A71) - Actions • Check the unit's resistance (15.4 +/- 0.7Ω) and wiring. • Check the input voltage (12V). • Visually check the unit and replace if necessary.						

3. REMOVAL AND INSTALLATION OF VGT TURBOCHARGER

▶ Structure



Precautions When Removing/Installing VGT Turbocharger

When removing and installing the turbocharger, keep the followings:

1. When replacing, use only the one with same specifications.
2. When installing, replace the gasket and sealing with new ones.
3. When installing, keep the specified tightening torque.
4. Check if the actuator operates properly.

Removal and Installation of VGT Turbocharger

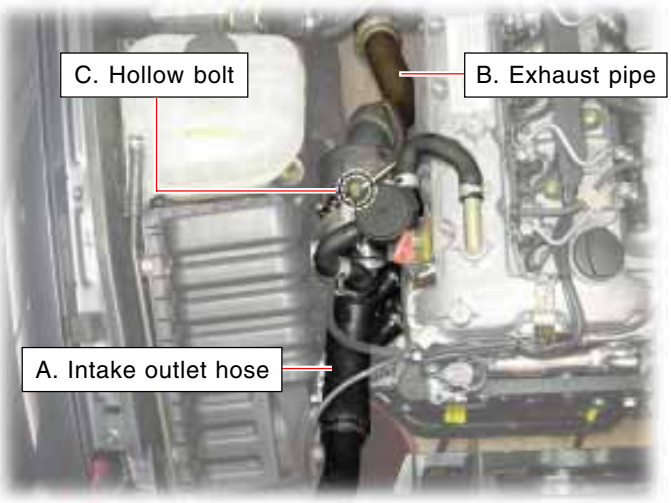
※ **Preceding Works:** 1. Disconnect the negative battery cable.
2. Drain the engine oil by removing the drain plug of oil pan (if necessary).

1. Remove the intake air duct assembly from the air cleaner.

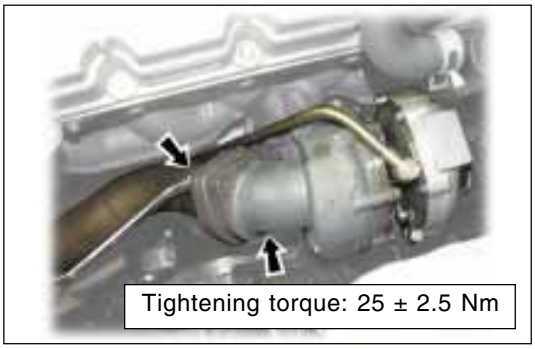
Procedures of Preceding Works

1. **Disconnect HFM sensor connector.**
2. **Disconnect the hose of oil separator to intake inlet duct.**
3. **Remove the intake inlet duct.**

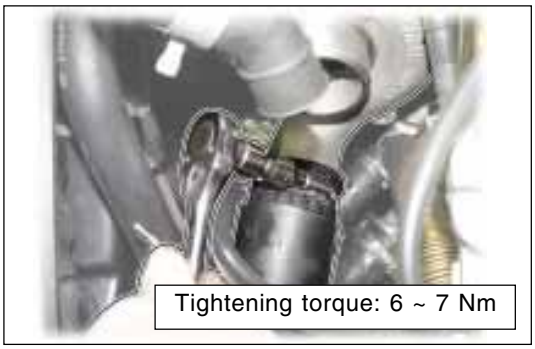
2. Remove the intake outlet hose (A), exhaust pipe (B) and hollow bolt (C) on VGT turbocharger oil supply pipe.



B. Remove two exhaust pipe mounting nuts from the turbocharger.



A. Release the clips and remove the intake outlet hose.



C. Remove the hollow bolt on the turbocharger oil supply pipe.

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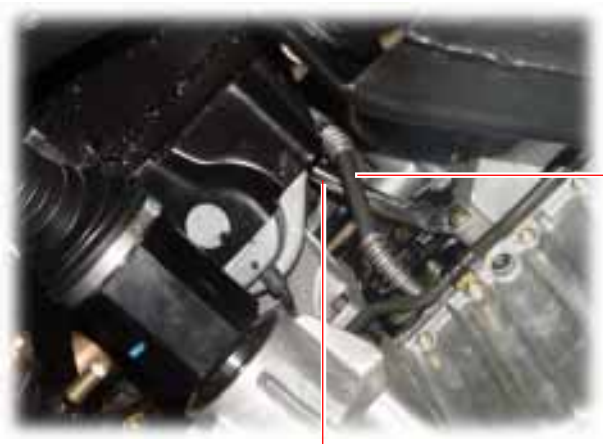
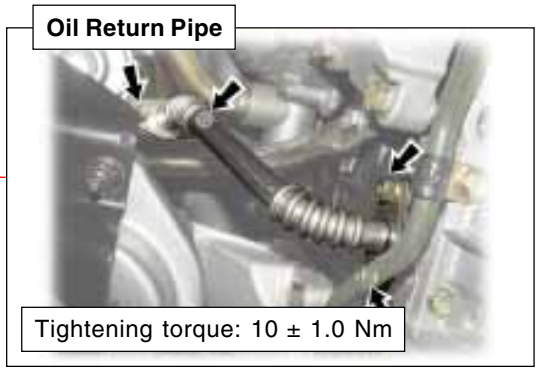
3. Lift up the vehicle and disconnect the vacuum hose from VGT turbocharger.

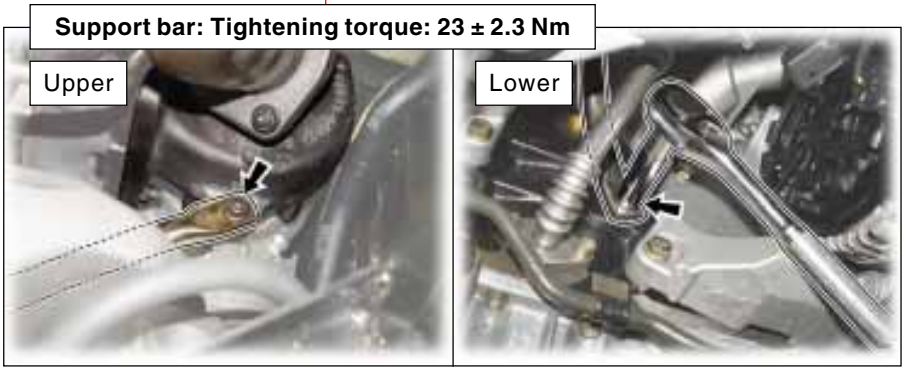
4. Unscrew the lower mounting bolt and remove the oil supply pipe.

Tightening torque	23 ± 2.3 Nm

5. Remove the support bar and the oil return pipe from VGT turbocharger.

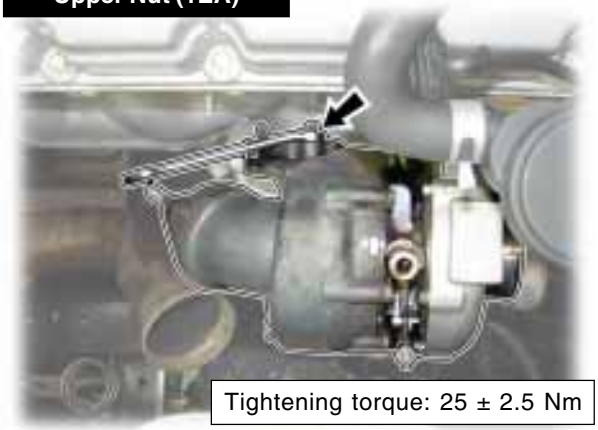






6. Remove three mounting nuts from VGT turbocharger.

Upper Nut (1EA)



Tightening torque: 25 ± 2.5 Nm

Lower Nut (2EA)

Tightening torque: 25 ± 2.5 Nm

7. Remove the VGT turbocharger assembly.

Note

Actuator for controlling vane angle

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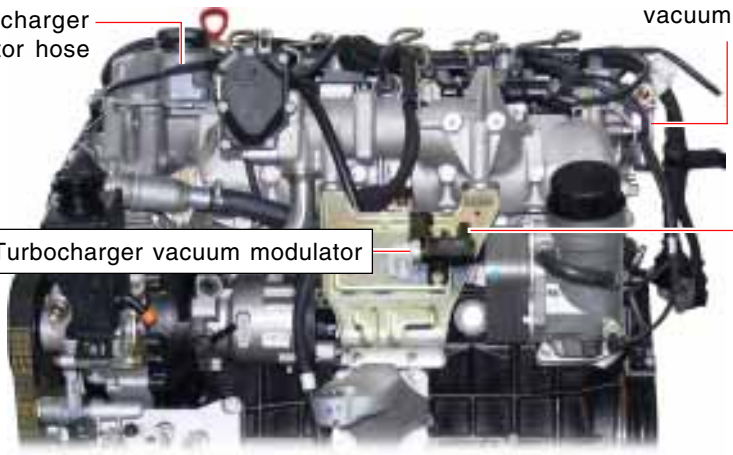
VACUUM MODULATOR FOR CONTROLLING VGT TURBOCHARGER ACTUATOR

1. OVERVIEW AND SYSTEM LAYOUT

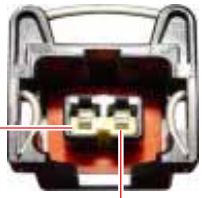
For the D27DTP (POWER UP) engine, the vacuum modulator for controlling EGR valve has been deleted and only the vacuum modulator for controlling VGT turbocharger actuator is used.

▶ System Layout

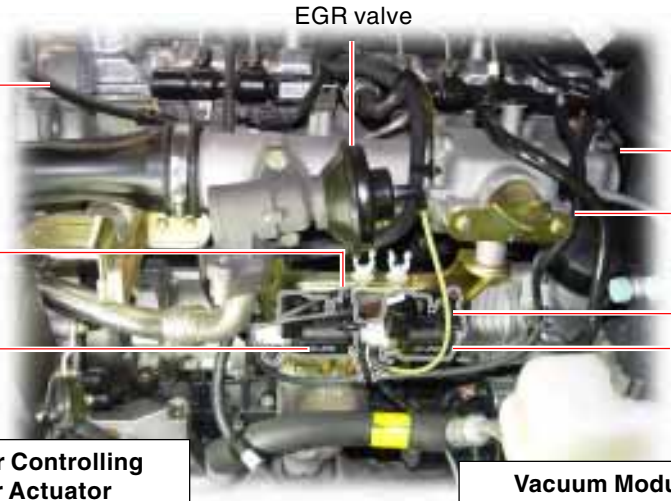
D27DTP Engine



Vacuum Modulator for Controlling VGT Turbocharger Actuator

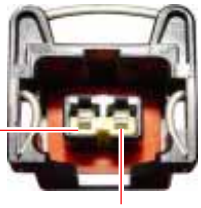


D27DT Engine



Vacuum Modulator for Controlling WGT Turbocharger Actuator

Vacuum Modulator for EGR Valve



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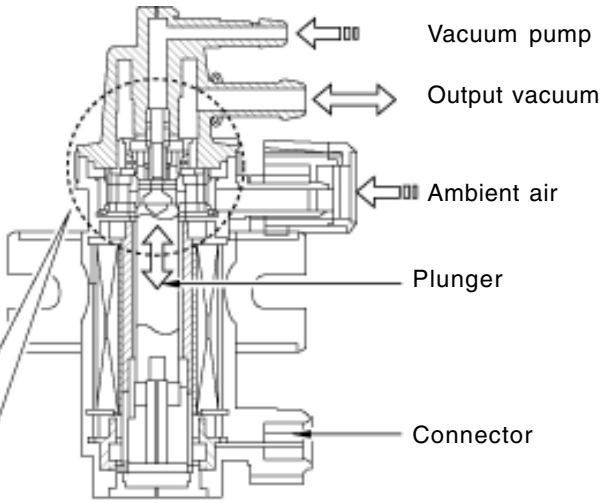
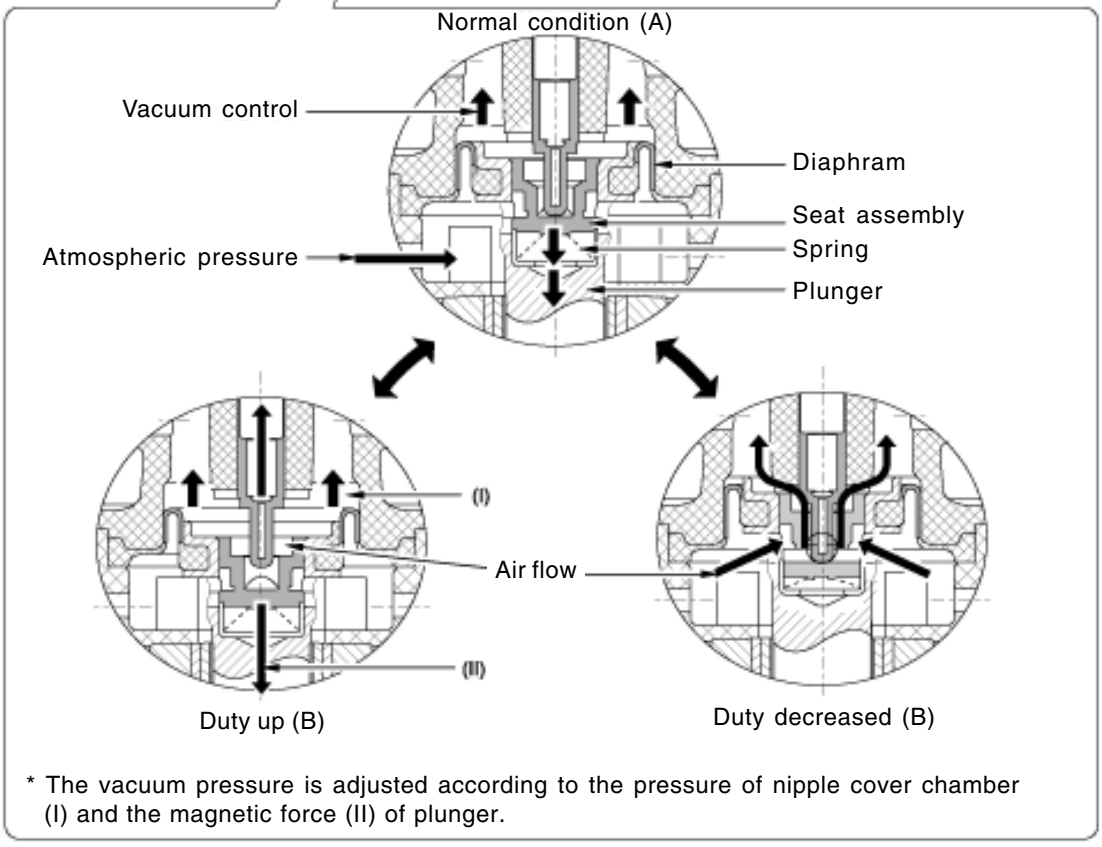
▶ Operating Principle of Vacuum Modulator

According to the signals from ECU, the solenoid valve regulates the vacuum pressure by vertical movement of plunger to operate the VGT turbocharger actuator. The plunger is moved by the vacuum pressure (-900 ± 20 mbar) from the vacuum pump (PWM control type).

> The vacuum modulator of D27DTP (Power Up) engine is very similar to that of D27DT engine. Refer to “DI Engine Service Manual for Rexton”.





* The vacuum pressure is adjusted according to the pressure of nipple cover chamber (I) and the magnetic force (II) of plunger.

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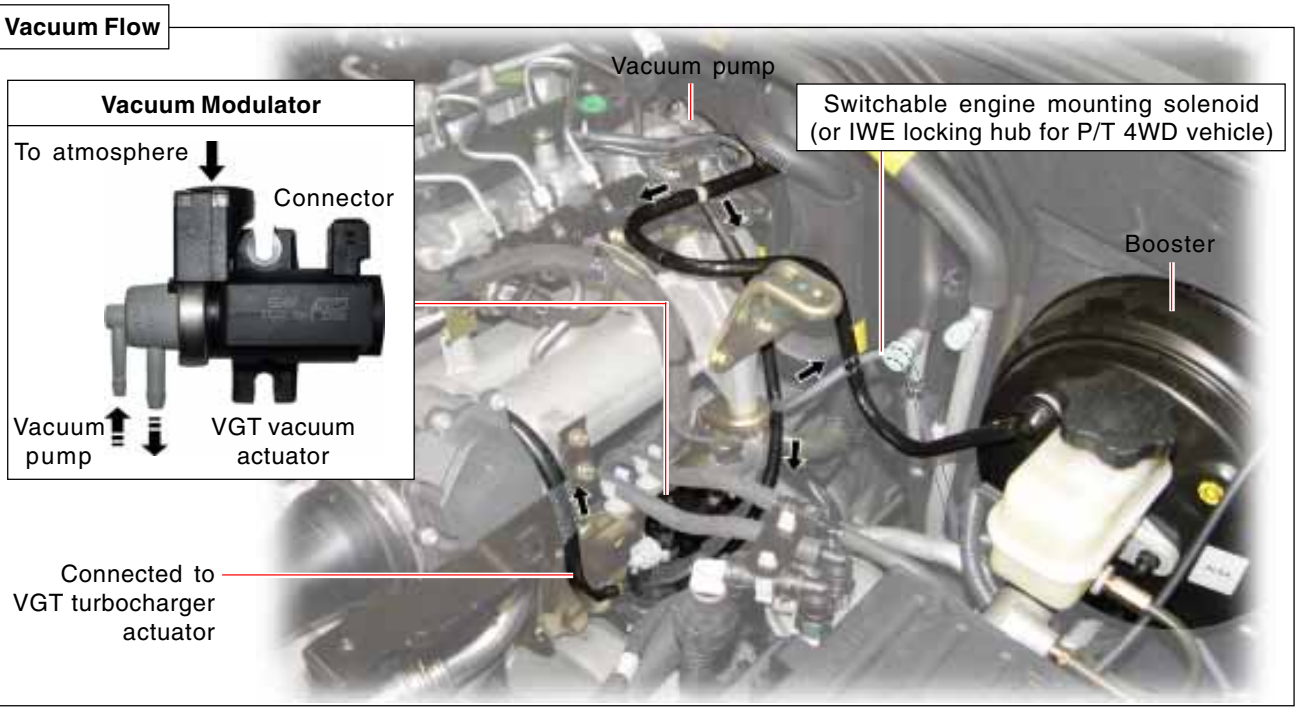
2. REMOVAL AND INSTALLATION OF VACUUM MODULATOR

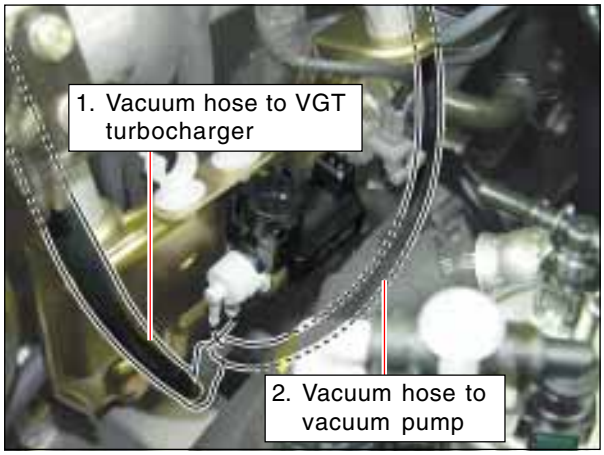
Removal and Installation

Vacuum Flow

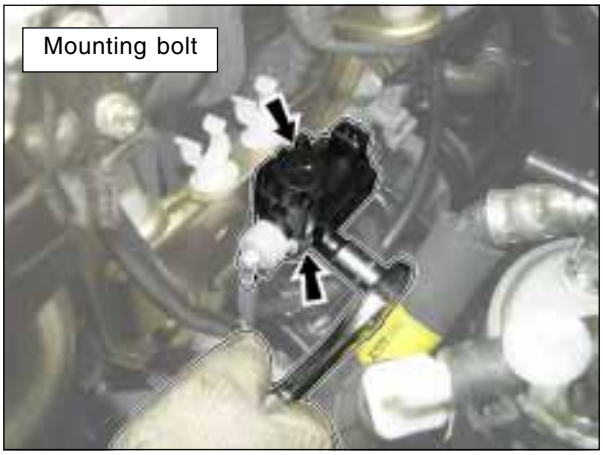


1. Disconnect the vacuum modulator connector.

2. Disconnect the vacuum hoses (1, 2) from vacuum modulator.

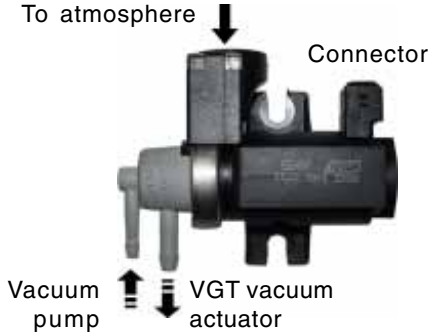


3. Unscrew the mounting bolt and remove the vacuum modulator (Tightening torque: 10 ± 1.0 Nm).



4. Install in the reverse order of removal.

Vacuum Modulator



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D27DT + CDPF (Catalytic Diesel Particulate Filter)

1. SPECIFICATIONS FOR ENGINE WITH CDPF

Descriptions			Specifications (D27DT Engine)
Engine	Type/Number		D27DT/5-cylinder
Cylinder	Inner diameter (mm)		86.2
	Stroke (mm)		92.4
Displacement (cc)			2696
Compression ratio			18:1
Max. Power (ps/rpm)			165/4,000
Tightening torque (kg.m/rpm)			35.7/2,000 ~ 3,000
Idle speed	For Automatic Transmission		760 ± 50 rpm
Valve	Intake	Opens (btdc)	16°
		Closes (abdc)	33°
	Exhaust	Opens(bbdc)	46°
		Closes (atdc)	21°
Camshaft	Type		DOHC
Fuel system	Fuel type		Low sulfur diesel
	Fuel pump type		Vane pump in HP pump
	Fuel supply pressure		HP pump inlet port: max. 400 mbar HP pump outlet port (with IMV fully open): over 1,050 bar
	Water separation in fuel filter		at every 10,000 km
	Fuel tank capacity (ℓ)		78
Catalytic converter & filter	Type		Oxidizing catalyst/DPF
	Metal type		Platinum
	Metal weight (g)		Catalyst DOC: 110g/ft^3 Catalyst DPF: 18g/ft^3
	Volume (cm^3)		Catalyst DOC: 1,200 Catalyst DPF: 3,900
	Metal ratio (Pt:PD:Rh)		Pt Only
Lubrication system	Oil specification		SAE 10W40, 5W40 (MB Sheet 229.1, 229.3 approved oil)
	Lubrication type		Gear pump, forced circulation
	Oil filter type		Full flow type, filter element type
	Oil capacity (ℓ)		6.5 ~ 8.5
Cooling system	Cooling type		Water cooling, forced circulation
	Cooling fan operation type		Belt operated type
	Thermostat (* Full open 100°C)	Opening temperature (°C)	85
		Type	WAX Pellet Type
	Coolant capacity (ℓ)		≒ 11.5

2. OVERVIEW

As the solution for environmental regulations and PM (Particla Material) of diesel engine, the low emission vehicle is getting popular. This vehicle is equipped with an extra filter to collect the soot and burn it again so that the amount of PM in the exhaust gas passed through the DOC (Diesel Oxydation Catalyst) is reduced. The CDPF (**C**atalyst & **D**iesel **P**articulate **F**ilter) is an integrated filter including DOC (Diesel Oxydation Catalyst) and DPF (Diesel Particulate Filter).

3. MAJOR CHANGES FOR CDPF SYSTEM

The CDPF system is installed for D27DT engine and the major changes are as follows.

CDPF (Catalyst & Diesel Particulate Filter) and Sensors

Differential Pressure Sensor (ΔP sensor)

As the soot is filtered in the CDPF, the pressure between the front side and the rear side of the filter is different from each other. If the amount of soot is over 28 g, the soot is burnt in the CDPF. The combustion is determined depending on the pressure difference, temperature of exhaust gas and EGR ratio. According to these, the soot filtered by post injection of injector is burnt at 600°C.

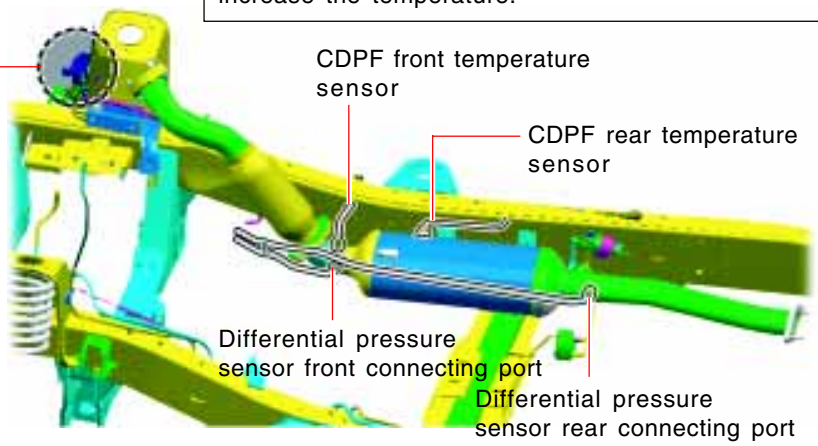
Temperature Sensor

The two temperature sensors installed in CDPF have the following functions:

Front temperature sensor:
Measuring the temperature of exhaust gas (exhaust manifold)

Rear temperature sensor:
Measuring the temperature of exhaust gas passed through DOC

The rear temperature sensor monitors the temperature of exhaust gas. If the temperature is below 600°C, the amount of post injection is increased to increase the temperature.



Engine ECU

The engine ECU has been revised since terminals have been added for front/rear temperature sensors, differential sensor and vacuum modulator for controlling throttle flap.
Its version is 3.1, but it is not compatible with ECU without CDPF.

Fuel Common Rail and Fuel Rail (Between Common Rail and Injector)

The I.D and O.D of fuel rail has changed from 2.4 mm/6.0 mm to 3.0 mm/6.35 mm. Also, the damping orifice is installed to prevent the fuel pulsation occured by fuel pressure.

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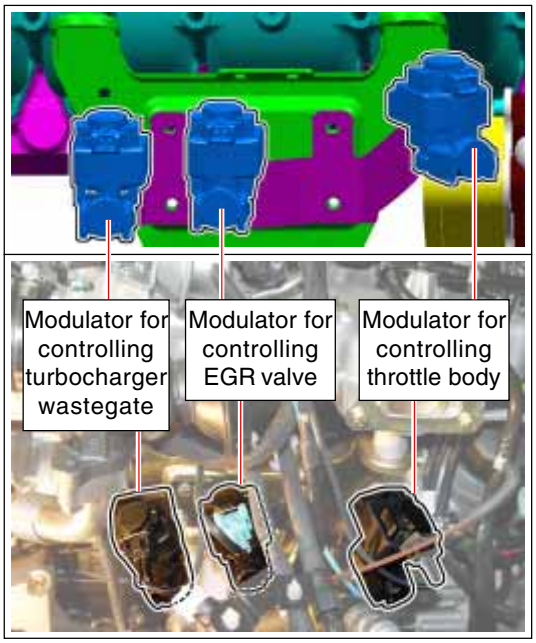
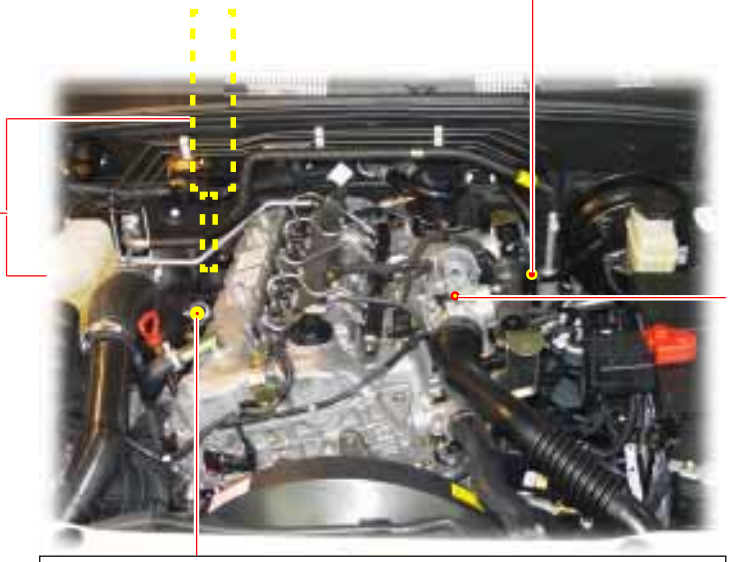
Vacuum Modulator for Controlling Throttle Body



The vacuum modulator controls the throttle flap in the throttle body.

Three vacuum modulators are installed in total, while only two vacuum modulators are installed for D27DT engine without CDPF. For the D27DTP (POWER UP) engine, only one vacuum modulator for controlling VGT turbocharger is installed since the vacuum modulator related to EGR is deleted.

The vacuum modulator for controlling throttle body reduces the amount of intake air by reducing the air passage when the soot is burnt in low load range of engine.



Turbocharger

The turbocharger bearing has been changed from normal pad type to oil pocket type since the exhaust pressure exceeds the limit (2.5 bar) when CDPF is installed.

For the turbocharger for CDPF, there is a name plate on the turbocharger indicating “CDPF”.

Conventional bearing (normal pad type)

Bearing for CDPF (oil pocket type)

Throttle Body

The ECU operates the vacuum modulator for controlling throttle body to control the amount of air using the input values from the temperature sensors and differential pressure sensor.

The throttle body is normally open. When the soot is burnt in CDPF, the engine ECU performs the post injection and the flap in the throttle body is closed to decrease the amount of intake air to the combustion chamber. Therefore, the temperature of exhaust gas is increased and the combustion temperature (approx. 600°C) is reached in CDPF.

For more details, refer to the control logic on the next page.

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4. THE CONTROLS FOR SOOT COMBUSTION OF CDPF SYSTEM

▶ Combustion Temperature and Procedures

As the soot is filtered in the CDPF, it is burnt and removed, and the CDPF is returned to the initial state to collect the soot. Therefore, the burning procedures in the CDPF can be called as recycling.

The CDPF assembly is integrated with DOC (at front side) and DPF (at rear side). After the exhaust gas is passed through the exhaust manifold, its temperature is approx. 250°C and the temperature is increased as the exhaust gas is passed through the DOC. Normally, the soot is burnt at 600°C. However, the temperature of the exhaust gas does not reach 600°C even though temperature is increased as the gas passes through the DOC.

NOTICE

- **Normally, when the vehicle is driven for 300 ~ 500 km, the enough amount of soot to be burnt is filtered and accumulated in the CDPF. The ECU increase the amount of post injection to increase the tempeature of exhaust gas up to 600°C so that the soot is burnt. The soot is burnt for 15 ~ 20 minutes.**

▶ Sytem Composition for Soot Combustion

When the engine is running in low load range, the temperature of exhaust gas is decreased as the amount of fuel supplied is decreased. To burnt the soot filtered in the CDPF, the control system should be installed to check the operating range and increase the temperature of exhaust gas by controlling the amount of fuel supplied and and intake air.

Two temperature sensors and one differential pressure sensor monitor the CDPF's operating range. According to theses sensors' information, the throttle flap decreases the intake air entered to the throttle body. Also, the fuel injection pattern is added to increase the temperature of exhaust gas for soot combustion.

There are two fuel injection patterns (pilot injection and main injection). As the CDPF is installed, the post injection pattern is added.

▶ Post Injection and Air Mass Control

When the differential pressure sensor detects the pressure difference between the front and the rear side of CDPF, the sensor sends signal indicating the soot is acumulated and the post injection is performed to raise the temperature of exhaust gas. The amount of fuel injected is determined according to the temperature of exhaust gas detected by the rear temperature sensor. If the temperature is below 600°C, the amount of fuel injected is increased to raise the temperature. If the temperature is over 600°C, the amount of fuel injected is decreased or not controlled.

When the engine is running in low load range, the amount of post injection and the amount of intake air are controlled. It is to raise the temperature by increasing the amount of fuel while decreasing the amount of intake air.

▶ Throttle Body for Different Engines

The throttle body is not installed in the D27DT engine, but is installed in the following engines:

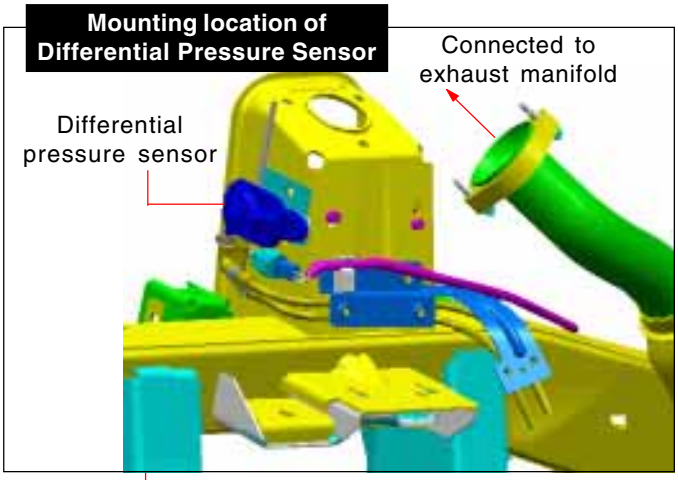
1) D27DT engine with CDPF
2) D27DTP (POWER UP) engine

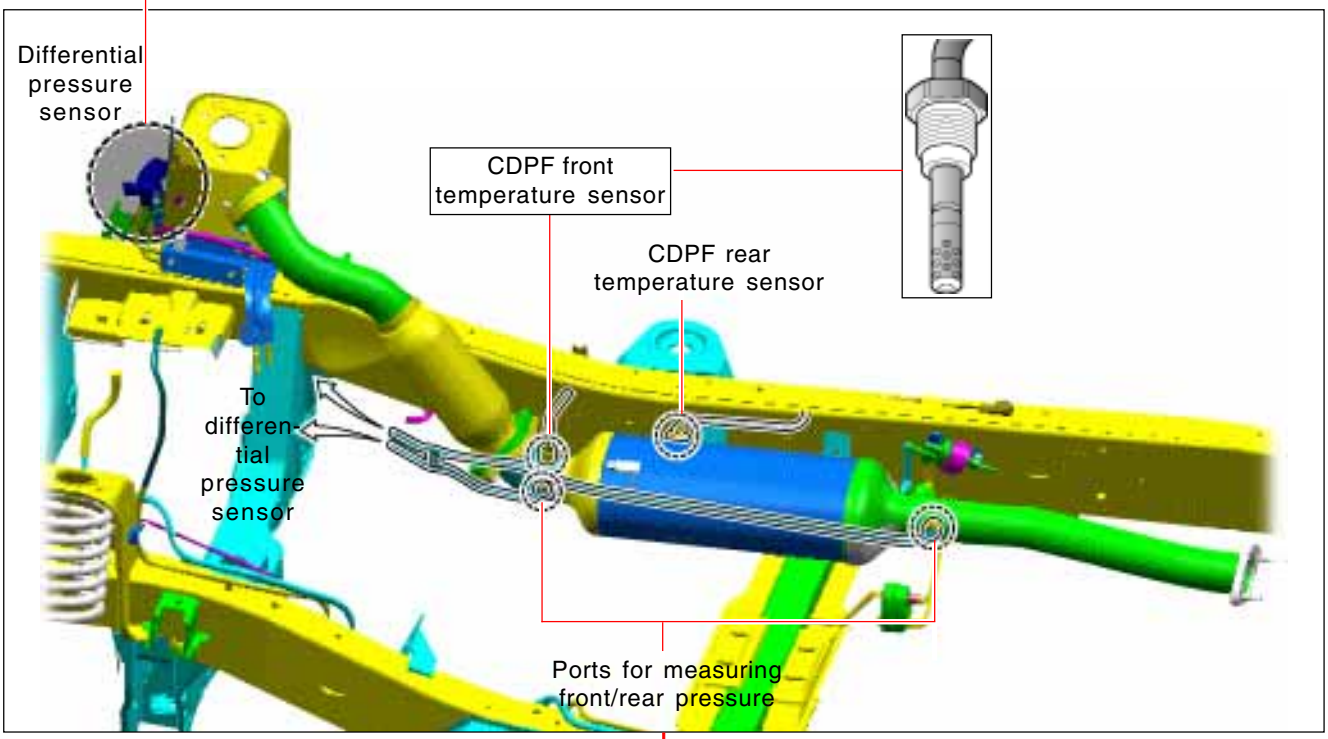
Both engines are equipeed with the throttle body, but its appearance and the related control system are differ.

For the D27DT engine with CDPF, the throttle body is used to decrease the amount of air supplied when the engine is running in low load range. For the D27DTP (POWER UP) engine, the throttle body is used to prevent the engine from turning off with fluttering noise at the moment the air to intake manifold is blocked by closed flap when the engine is switched off.

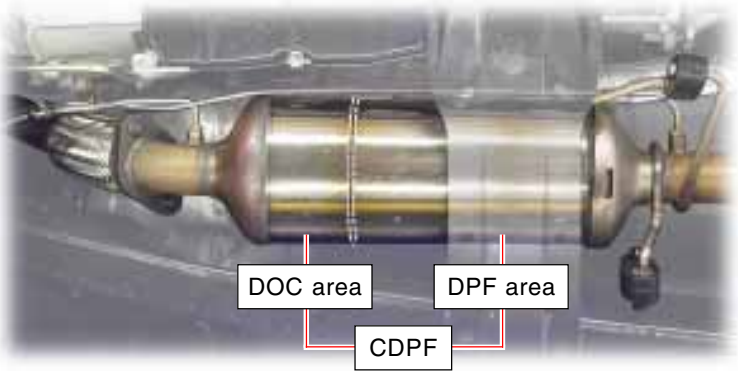
If the throttle body is installed in D27DTP (POWER UP) engine, its function can be added up to four functions by changing the ECU software.

5. CDPF (Catalyst & Diesel Particulate Filter) LAYOUT





CDPF mounted in vehicle



* DOC (Diesel Oxydation Catalyst)
DPF (Diesel Particulate Filter)

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6. SOOT FILTERING AND BURNING PROCEDURES

▶ Operating Procedures of CDPF

The most efficient and practical technology for now is adopted to the diesel particulate filter (DPF).

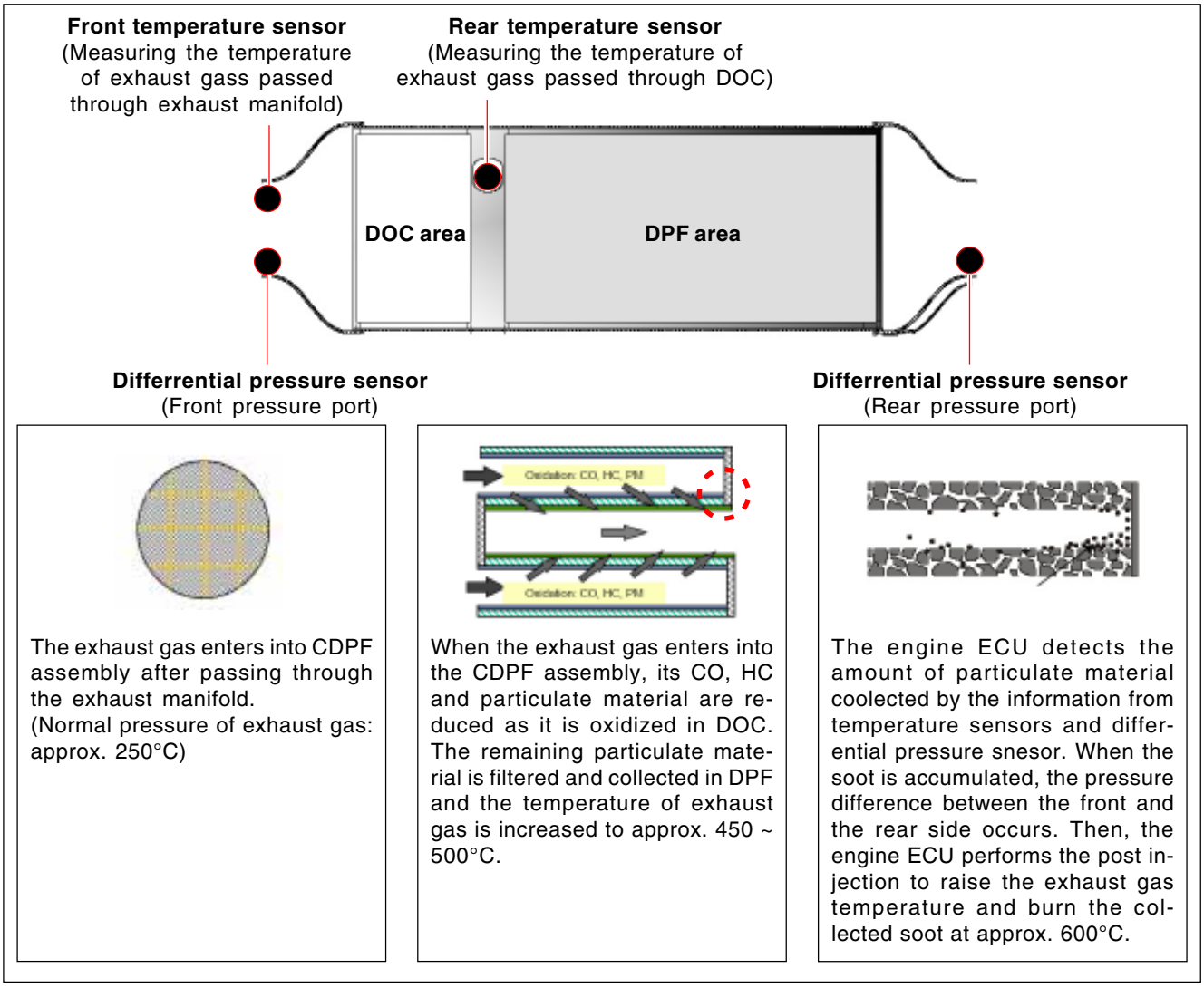
This system collects the soot from the diesel engine to the filter and burns the soot so that over than 95% of soot can be removed from the exhaust gas. However, the durability and the cost of additional system remain as problems.

Firstly, the exhaust gas is passed through the DOC and its temperature is increased as it is oxidized. The ECU detects the temperature change with two temperature sensors. The CO, HC and partial particulate material are removed from the exhaust gas (this procedures are the sames as the ones for the conventional DOC and no sensor is required).

After the exhaust gas is passed through the DOC and oxidized, most of the harmful material is removed from the exhaust gas. However, to meet the environmental regulations in the future, the soot is filtered and burnt again in DPF to decrease the particulate material further.

NOTICE

- **The filtered soot is burned whenever the vehicle is driven for 300 ~ 500 km. The driving distance can be differed depending on the vehicle's driving conditions. The soot is burnt for 15 ~ 20 minutes.**



The exhaust gas enters into CDPF assembly after passing through the exhaust manifold.
(Normal pressure of exhaust gas: approx. 250°C)

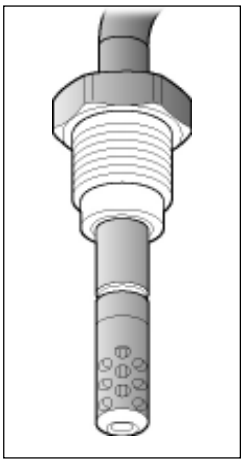
When the exhaust gas enters into the CDPF assembly, its CO, HC and particulate material are reduced as it is oxidized in DOC. The remaining particulate material is filtered and collected in DPF and the temperature of exhaust gas is increased to approx. 450 ~ 500°C.

The engine ECU detects the amount of particulate material coolected by the information from temperature sensors and differential pressure snesor. When the soot is accumulated, the pressure difference between the front and the rear side occurs. Then, the engine ECU performs the post injection to raise the exhaust gas temperature and burn the collected soot at approx. 600°C.

7. COMPONENTS OF CDPF

▶ CDPF Temperature sensor

Overview of CDPF Temperature Sensor

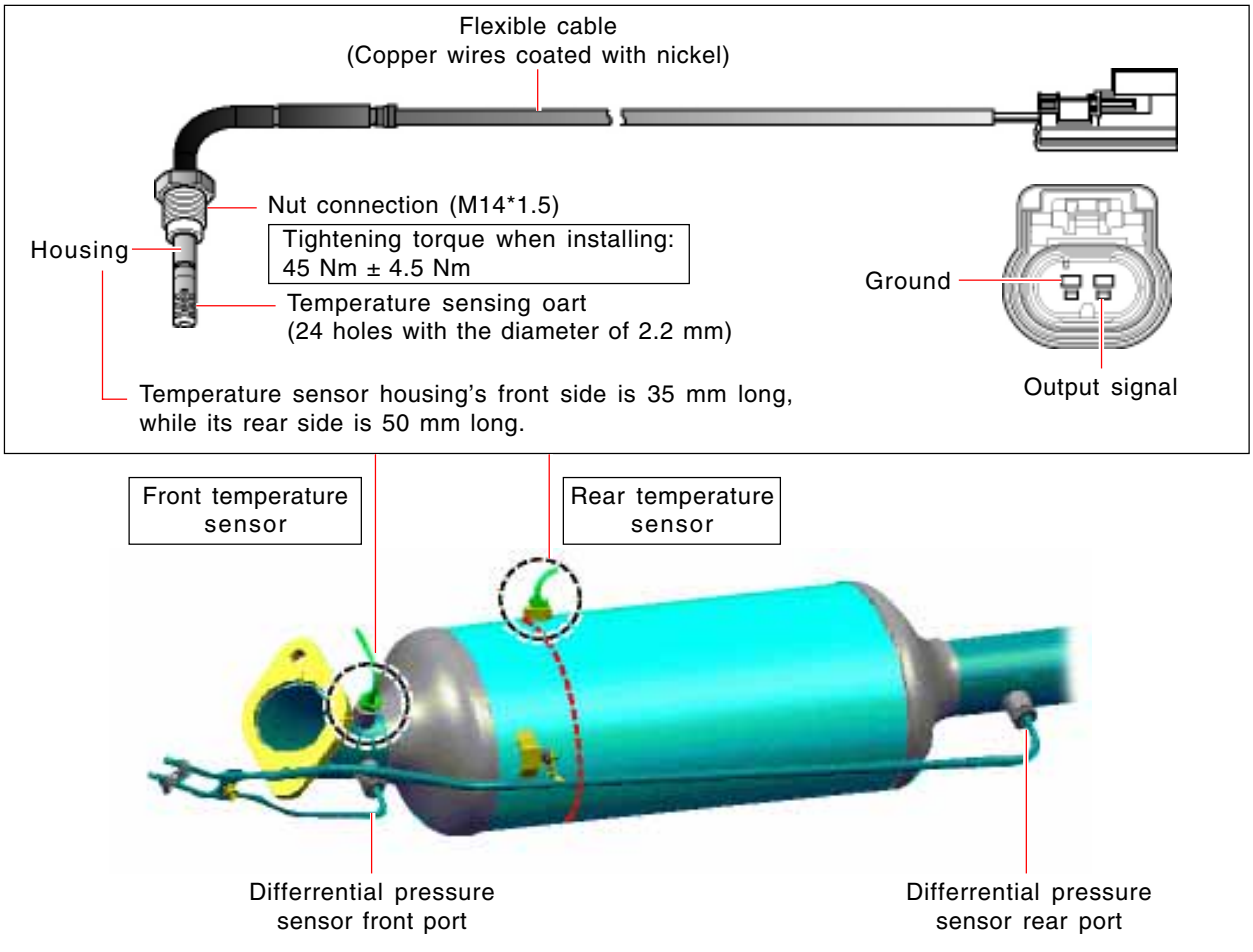


The two temperature sensors are installed in the front and the rear side of the CDPF to measure the temperature of exhaust gas passed through the exhaust manifold and the temperature of exhaust gas passed through DOC. As the exhaust gas is passed through DOC, its temperature is increased as it is oxidized.

When the CDPF is in the burning range according to the signal from the differential pressure sensor, the ECU adds up the post injection pattern to raise the exhaust gas temperature. When the engine is running in low load range, the temperature of exhaust gas is low. Therefore, the throttle flap is used to decreased the amount of intake air so that the the exhaust gas's temperature is increased. The ECU decreases or stops the post injection when the temperature detected from the rear temperature sensor is over 600°C. The ECU increases the amount of post injection when the temperature is below 600°C to control the temerature in CDPF.

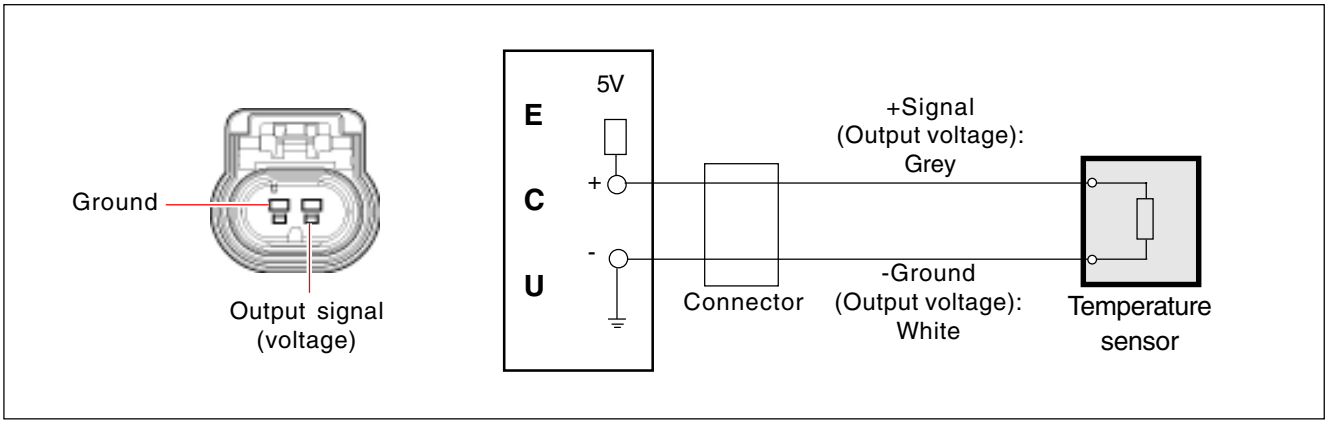
Temperature Sensor's Connecting Port and connector

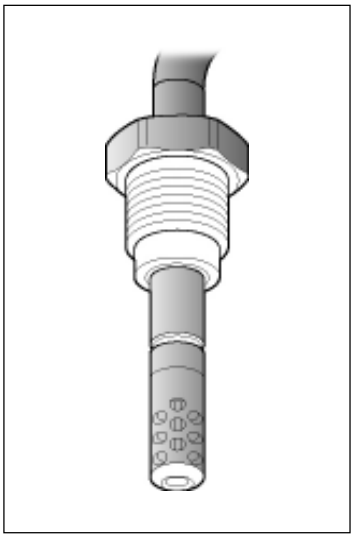
Mounting location of temperature sensor in CDPF



Resistance by Temperature Detected By Temperature Sensor

The temperature sensor is coated with thin platinum and has 24 holes with its diameter of 2.2 mm. As the temperature in CDPF increases, the resistance also increases and the temperature sensor sends the changed voltage value to ECU.





CDPF temperature (°C)	Resistance(Ω)	Output voltage(V)
-40	170.2	0.727
-20	185.6	0.783
0	201.0	0.837
25	220.1	0.902
50	239.0	0.964
100	276.4	1.083
150	313.2	1.193
200	349.5	1.295
250	385.1	1.390
300	420.2	1.479
350	454.7	1.563
400	488.6	1.641
450	521.9	1.715
500	554.6	1.784
600	618.3	1.910
700	679.7	2.023
800	738.7	2.124
900	795.4	2.215
1000	849.7	2.297

▶ Differential Pressure Sensor

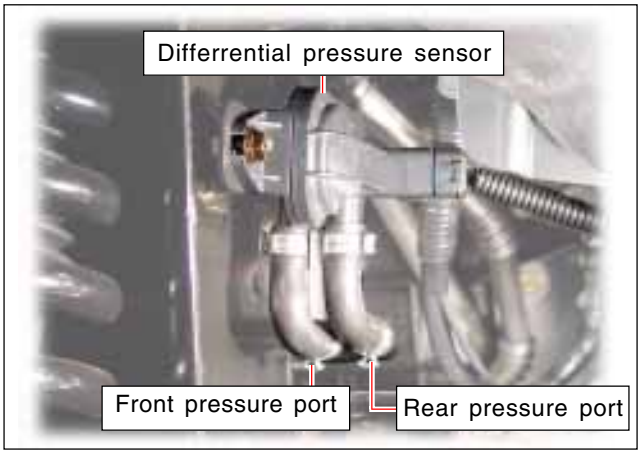
Mounting Location and Overview

The differential pressure sensor is connected to CDPF through two ports.

It can be found behind the front left tire (on the frame in front of the coil spring).

This sensor detects the pressure difference between the front and the rear side of CDPF. When the soot is collected in CDPF, the pressure difference is increased and this difference, as a signal, is sent to ECU to perform the post injection.

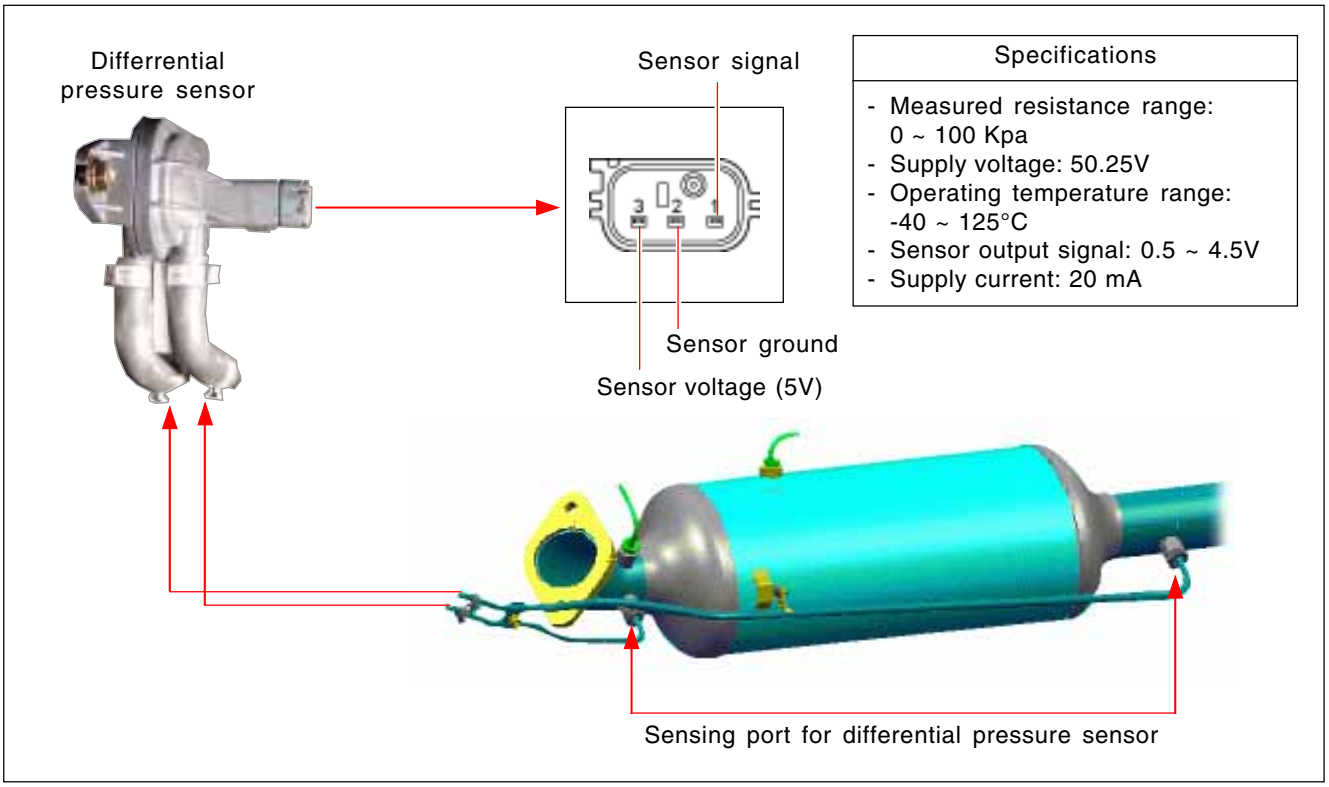
The differential pressure sensor monitors the pressure of the opening of DOC and the end of DPF. When the soot is collected as the exhaust gas is passed through CDPF, the sensor sends the combustion timing to the ECU. Then, the ECU performs the post injection to increase the temperature in CDPF up to 600°C. At this time, the temperature is monitored by rear temperature sensor. According to the temperature monitored, the amount of post injection is increased or decreased, or the post injection is ceased.



NOTICE

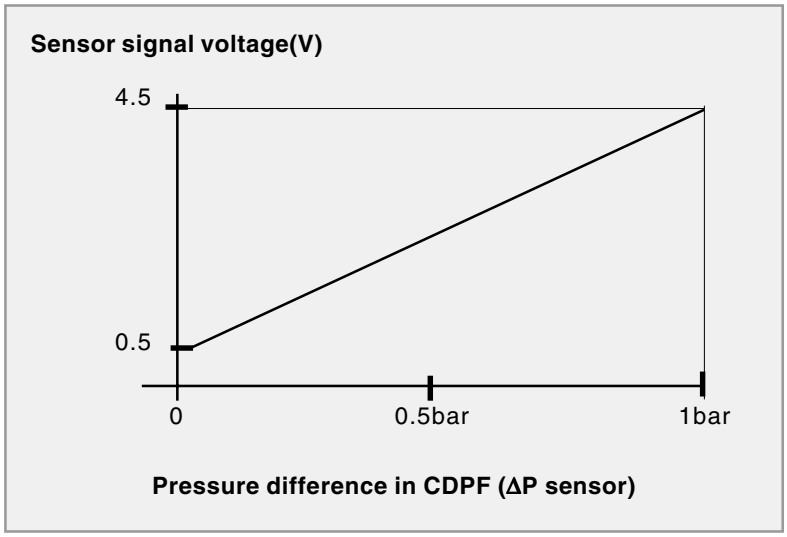
- **When the engine is running in high load/speed range, the temperature of exhaust gas passed through DOC can be over 600°C. If it happens, the collected soot is burnt without post injection.**
- **The filtered soot is burnt normally after the vehicle is driven for 300 ~ 500 km.**

Connecting Port and Connector



Specifications
- Measured resistance range: 0 ~ 100 Kpa - Supply voltage: 50.25V - Operating temperature range: -40 ~ 125°C - Sensor output signal: 0.5 ~ 4.5V - Supply current: 20 mA

Pressure Difference and Output Voltage



The differential pressure sensor sends the output voltage (0.5 ~ 4.5V) to ECU depending on the CDPF's pressure difference between front and rear sides.

The front and rear pressure ports installed on CDPF are not sensors, but the connecting ports to send the pressure to the differential pressure sensor.

The front and rear connecting ports send the pressure values of “before CDPF” and “after CDPF” to differential pressure sensor. Then, the differential pressure sensor compares these values and sends the pressure difference value to ECU.

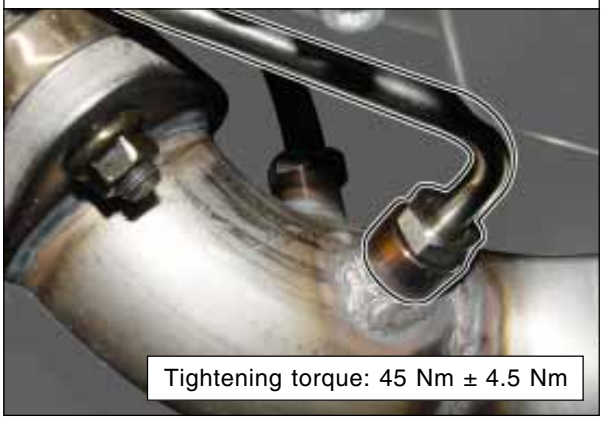
As the soot is collected, the pressure difference gets greater. When the soot mass filtered exceeds the limit (normally 28 g) and the pressure difference occurred from this is sent to ECU, ECU starts the burning process in CDPF. When the CDPF is in operating range, the post injection is performed if the engine is running at idle speed or in low-mid speed range. When the engine is running at idle speed, the flap in the throttle body is controlled to reduce the intake air.

As shown on the graph above, the smaller the pressure difference is, the greater the output voltage (signal) from the differential pressure sensor. When the pressure difference is over 1 bar, the sensor sends 4.5 V as output voltage to ECU.

Location of Pressure Measuring Ports

These pressure ports are installed in the same manner as temperature sensors. However, they are not the sensors but just for transmitting the pressure in CDPF to the differential pressure sensor.

Front Port (CDPF Front)



Rear Port (CDPF Rear)

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▶ Throttle Body and Throttle Flap Actuator

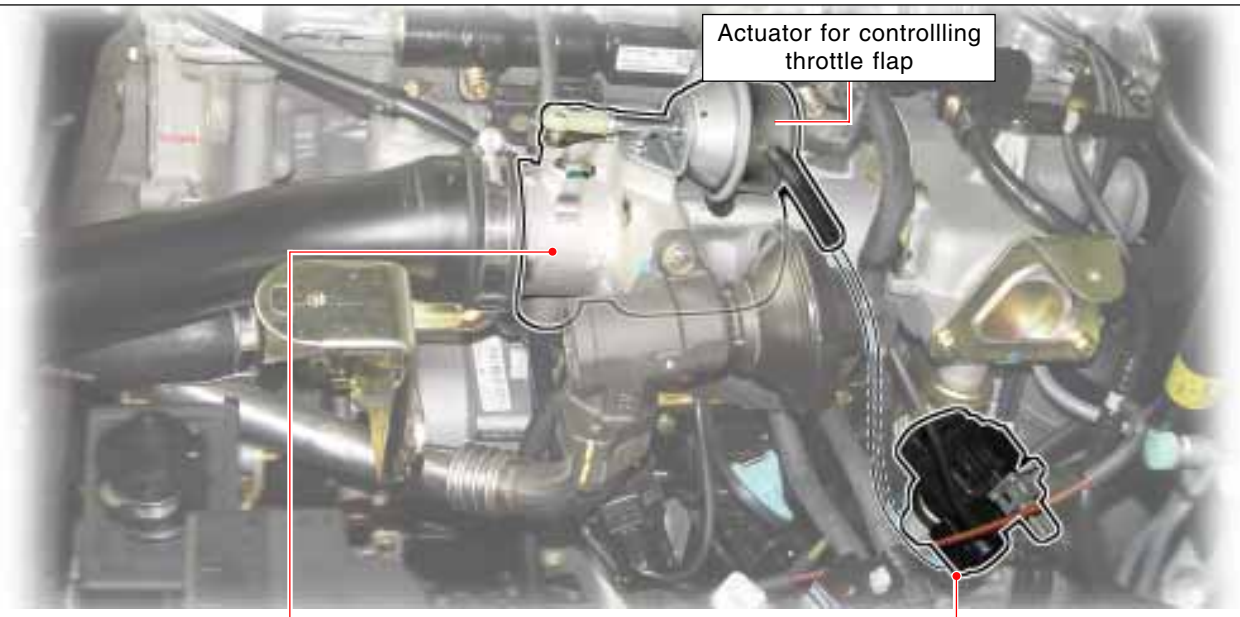
Overview

For the vehicle equipped with CDPF, the throttle body is installed in the opening of intake manifold. The flap in the throttle body is actuated by vacuum and the throttle body is operated only when the engine is idling (700 ~ 800 rpm) or running at below 2500 rpm without accelerator pedal depressed. (For detailed operating range, refer to the control map.)

With EGR ratio and pressure difference provided by the differential pressure sensor, the ECU determines the CDPF's burning range. If the ECU determines to burn the soot in CDPF, it checks whether the engine is running in low load range (engine idleing or running at below 2500 rpm without depressing the accelerator pedal). If the engine is running in low load range, the flap in the throttle body is closed by vacuum modulator. The flap is not completely closed to prevent engine from turning off.

In summary, the operating conditions for the flap in the throttle body are as follows:

1. **When the CDPF's burning conditions are met (soot mass is over the limit and EGR ratio and temperature of exhaust gas are met with operating conditions)**
2. **When the engine is running in low load range (idling (700 ~ 800 rpm) or running at below 2500 rpm without accelerator pedal depressed)**



Throttle body and throttle flap actuator

Vacuum Modulator for Controlling Throttle Flap

It controls the flap in the throttle body.

Vacuum actuated:
Throttle flap closed → Vacuum pressure at approx. 680 ~ 720 hpa (intake air volume decreased)

Vacuum released (atmospheric pressure actuated):
Throttle flap opened → Atmospheric pressure actuated (normal amount of intake air supplied)

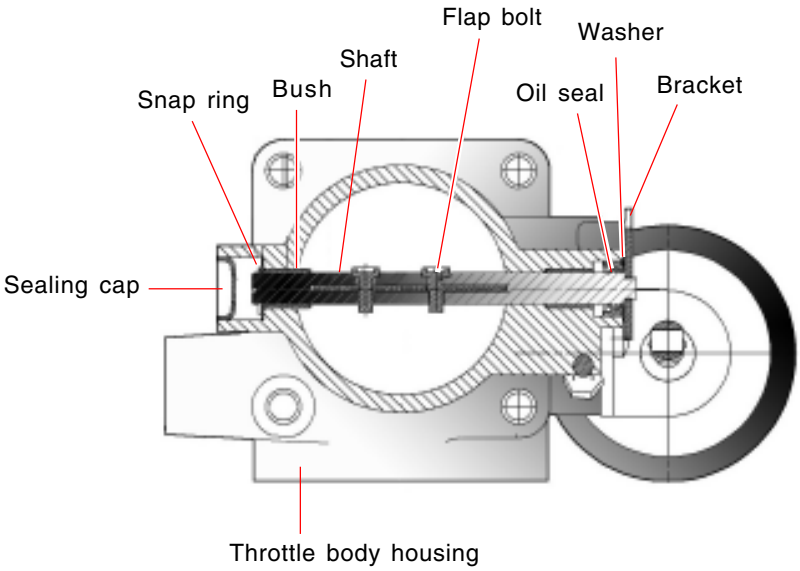
NOTICE

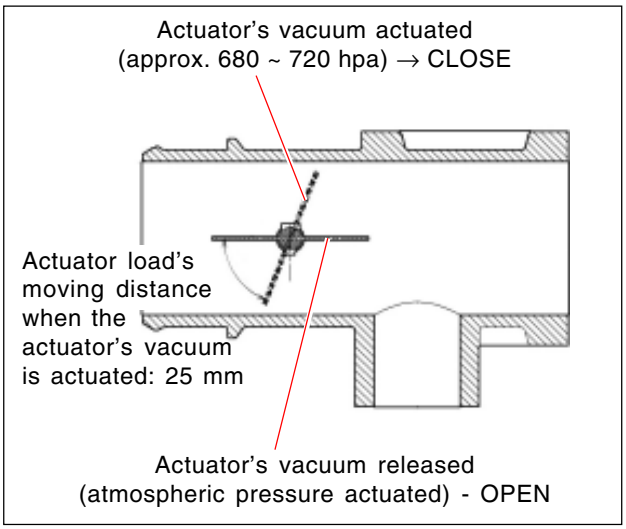
- **The flap in the throttle body is operated only when the engine is running in low load range. It is to increase the temperature of exhaust gas by decreasing the amount of intake air and increasing the amount of fuel supplied since the fuel including post injected fuel is not enough to increase the temperature up to the CDPF's burning temperature.**

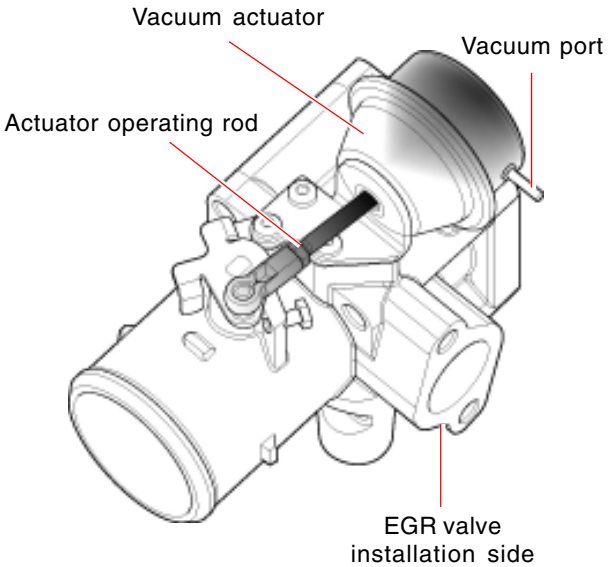
Specifications

- Housing material: AC4C (Gravity Casting)
- Response: OPEN → CLOSE: approx. 200 msec, CLOSE → OPEN: approx. 200 msec
- Operating distance of actuator by vacuum pressure
  Below approx. 0.5 mm when the vacuum pressure is at P1 (approx. -110 mbar)
  Below approx. 25 mm when the vacuum pressure is at P2 (approx. -750 mbar)
- Leak limit of actuator diaphram: Below 0.15 litre/min. (at -500 mbar)

Structure and Components







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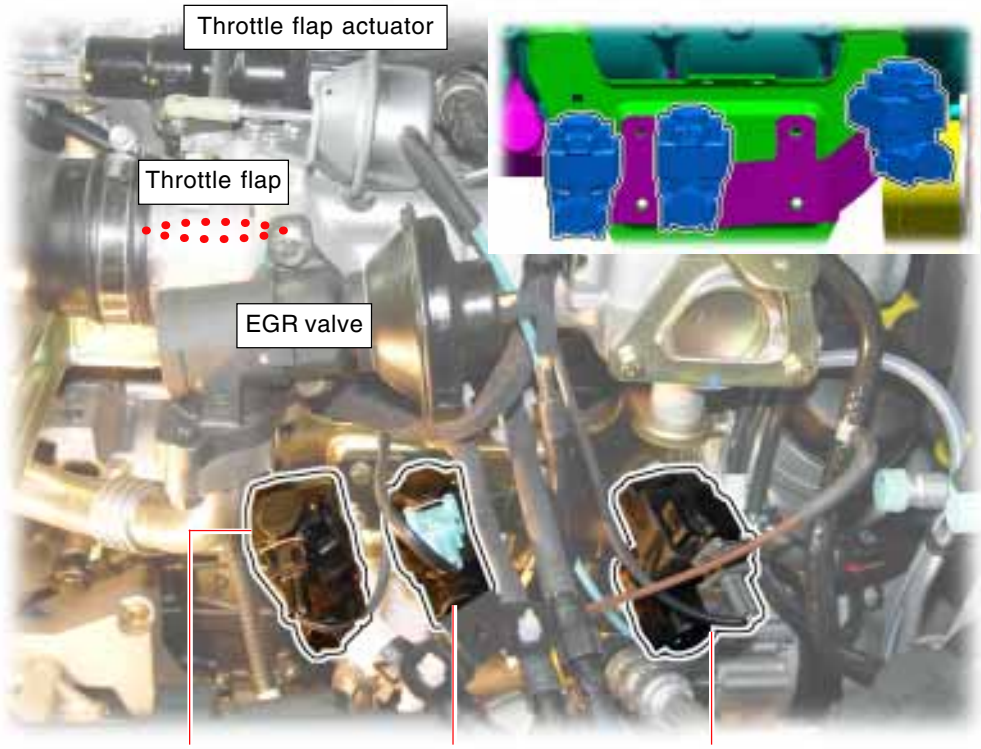
▶ Vacuum Modulator

As the vacuum modulator for controlling throttle body flap has been added, three vacuum modulators are installed in total.

As one vacuum modulator is added, the existing modulators' shape have changed.

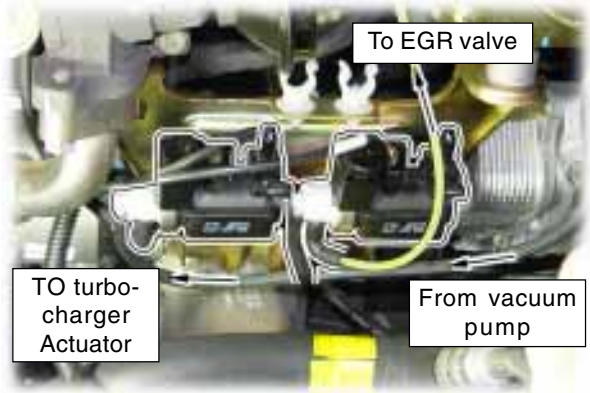
1. Vacuum modulator for controlling turbocharger wastegate (shape changed)
2. Vacuum modulator for controlling EGR valve (shape changed)
3. Vacuum modulator for controlling throttle flap (added - only for vehicle with CDPF)



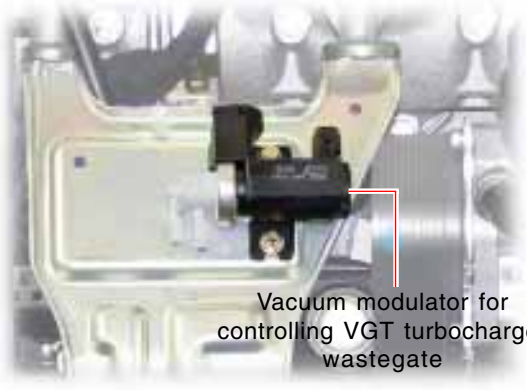
Vacuum Modulators by Engine

The vacuum modulator systems differ in D27DT engine, D27DTP (POWER UP) engine and D27DT engine with CDPF. For more details, refer to the appropriate section.

D27DT Engine Vacuum Modulator (without CDPF)



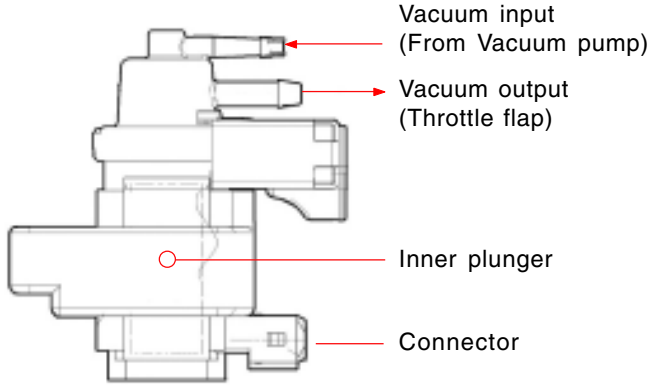
D27DTP (POWER UP) Engine Vacuum Modulator

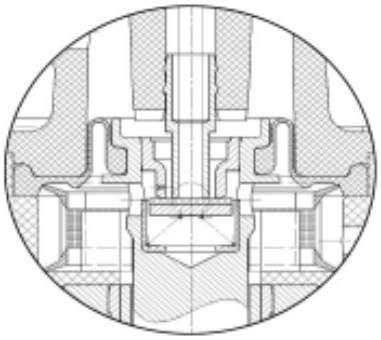


Structure and Operating Principle Vacuum Modulator

The vacuum modulator for controlling throttle body is controlled by ECU when the CDPF's burning conditions are met and the engine is running in low load range (idling or running at below 2500 rpm without accelerator pedal depressed). There is no change for other vacuum modulators.

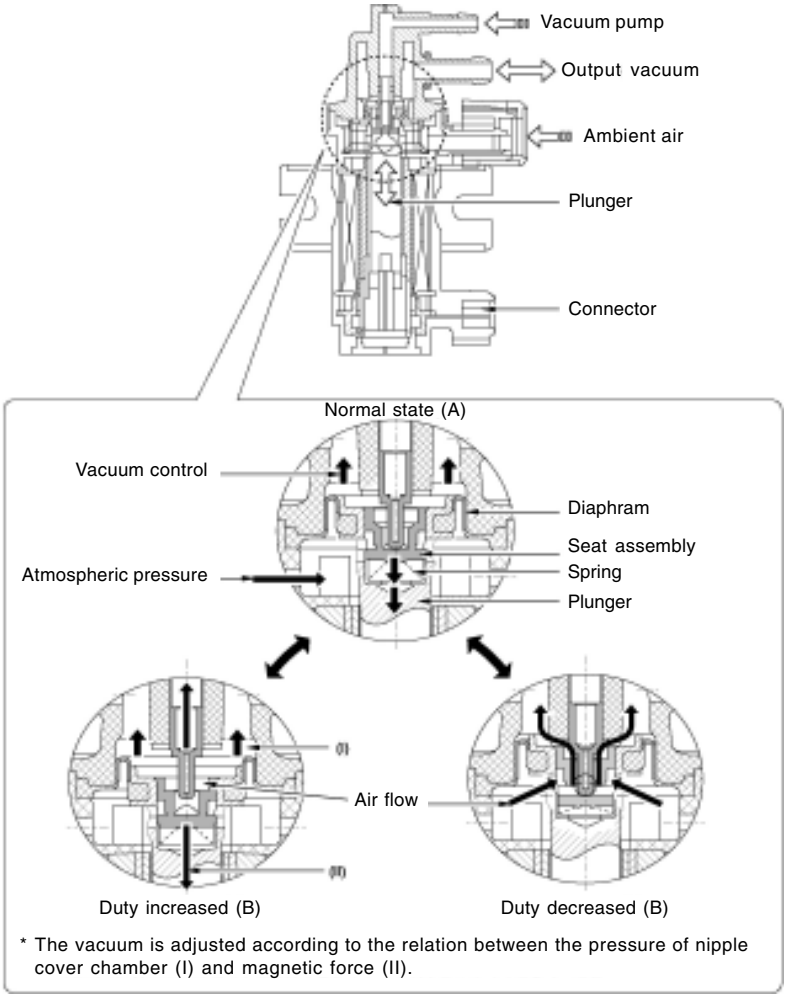
Vacuum modulator for vehicle equipped with CDPF





For internal structure, refer to the figure below.

Conventional vacuum modulator for D27DT



* The vacuum is adjusted according to the relation between the pressure of nipple cover chamber (I) and magnetic force (II).

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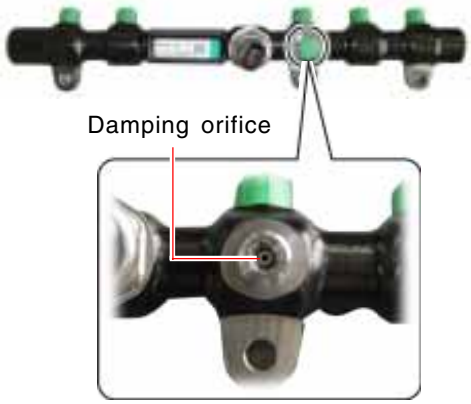
▶ Fuel Supply Rails

For the D27DT engine with CDPF, the fuel rail with larger diameter and the damping orifice is installed. The fuel rail with larger diameter is installed as the post injection for CDPF is added to injection processes (pilot injection and main injection). The diameter of the fuel rail is increased due to the increased amount of fuel injected for post injection to burn the soot in CDPF.

As the amount of fuel supplied is increased, the orifices are installed on the fuel intake side of common rail and on the fuel supply side of HP pump to prevent the fuel pulsation.

Fuel Supply Pipe (Common Rail -Injector): Increase

Common Rail (with Orifice)



Fuel Supply Pipe (HPP-Common Rail) : Increase in I.D and O.D

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MEMO

PRE - HEATING SYSTEM

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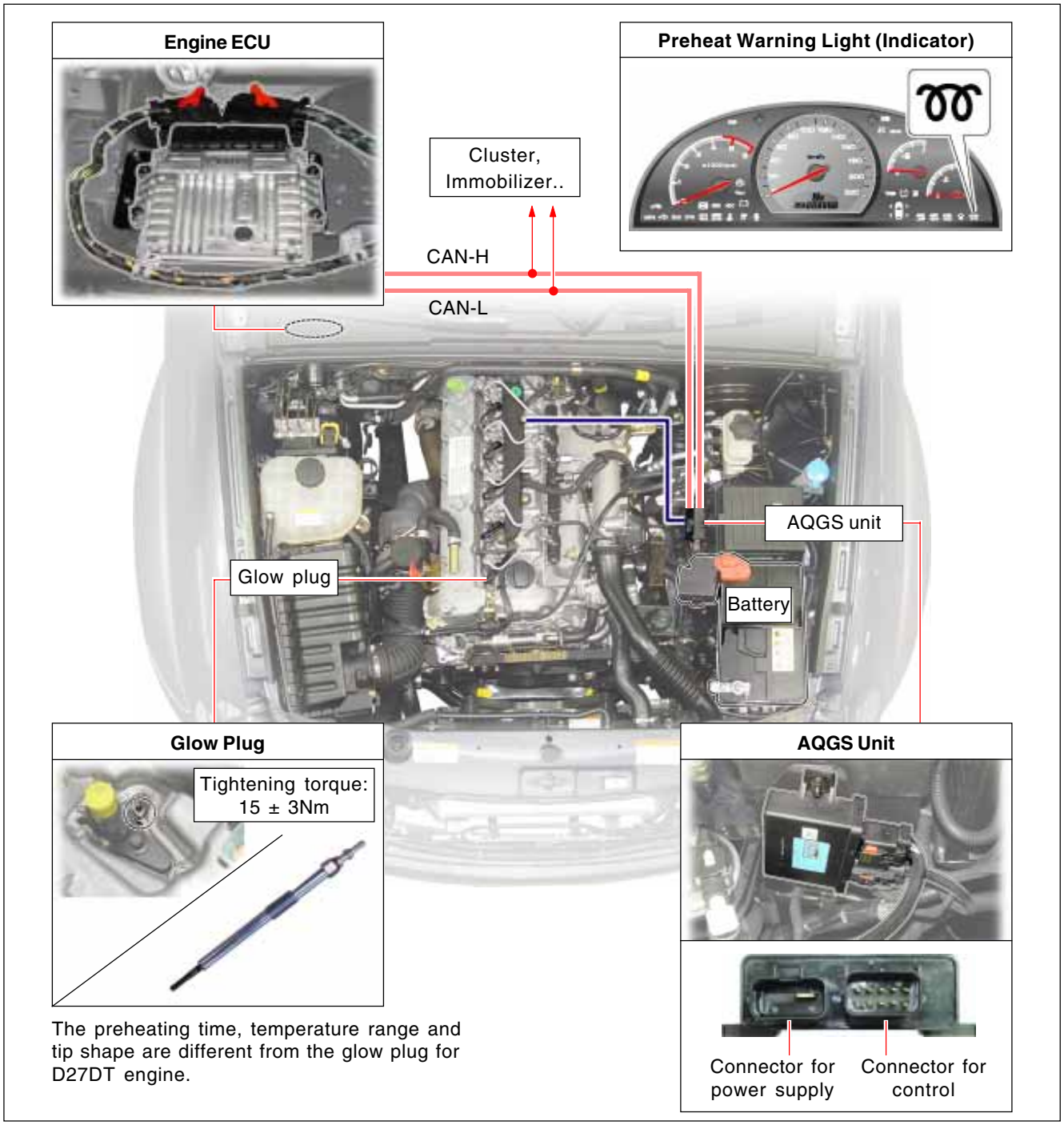
AQGS PREHEATING SYSTEM

For the D27DT engine, the conventional preheating control relay is used. For the D27DTP (POWER UP) engine, AQGS (Advanced Quick Glow System) is used. The AQGS communicates with engine ECU via CAN communication and its preheating time and performance are enhanced.

The following information is for the preheating system based on the AQGS in D27DTP (POWER UP) engine.

1. COMPONENTS AND MAJOR CHANGES IN PREHEATING SYSTEM IN D27DTP (POWER UP) ENGINE



The preheating time, temperature range and tip shape are different from the glow plug for D27DT engine.

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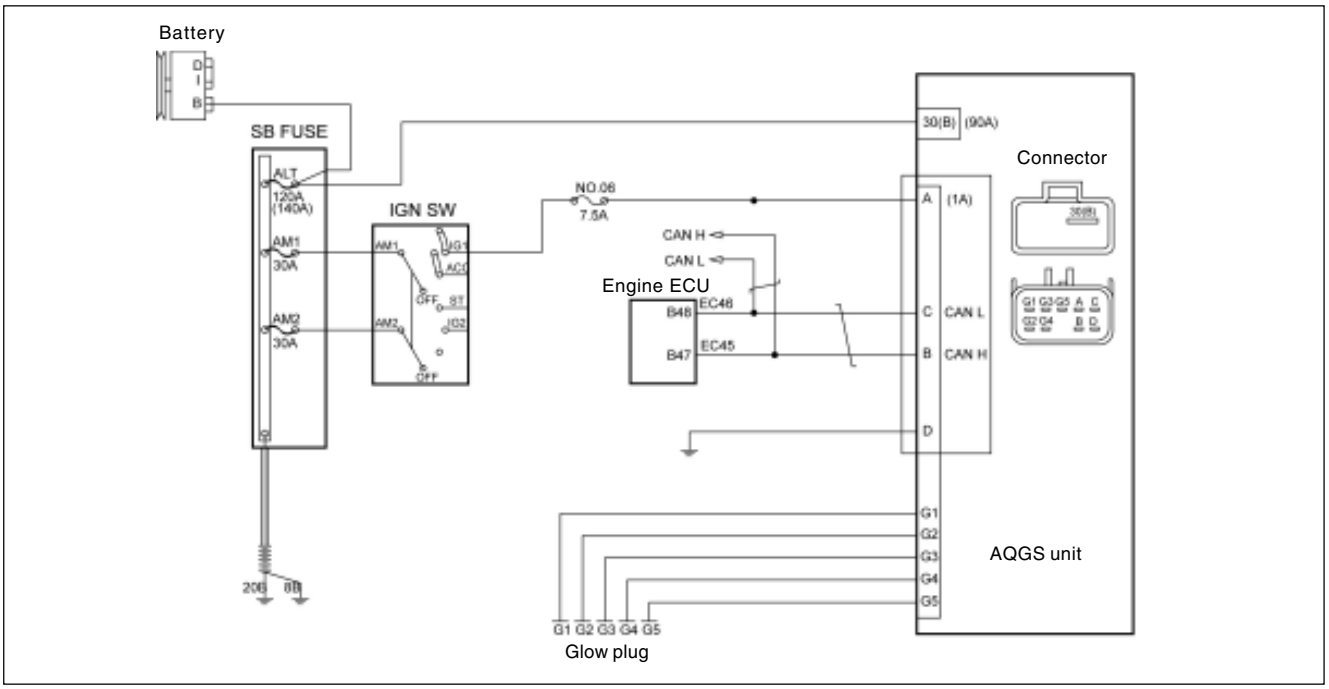
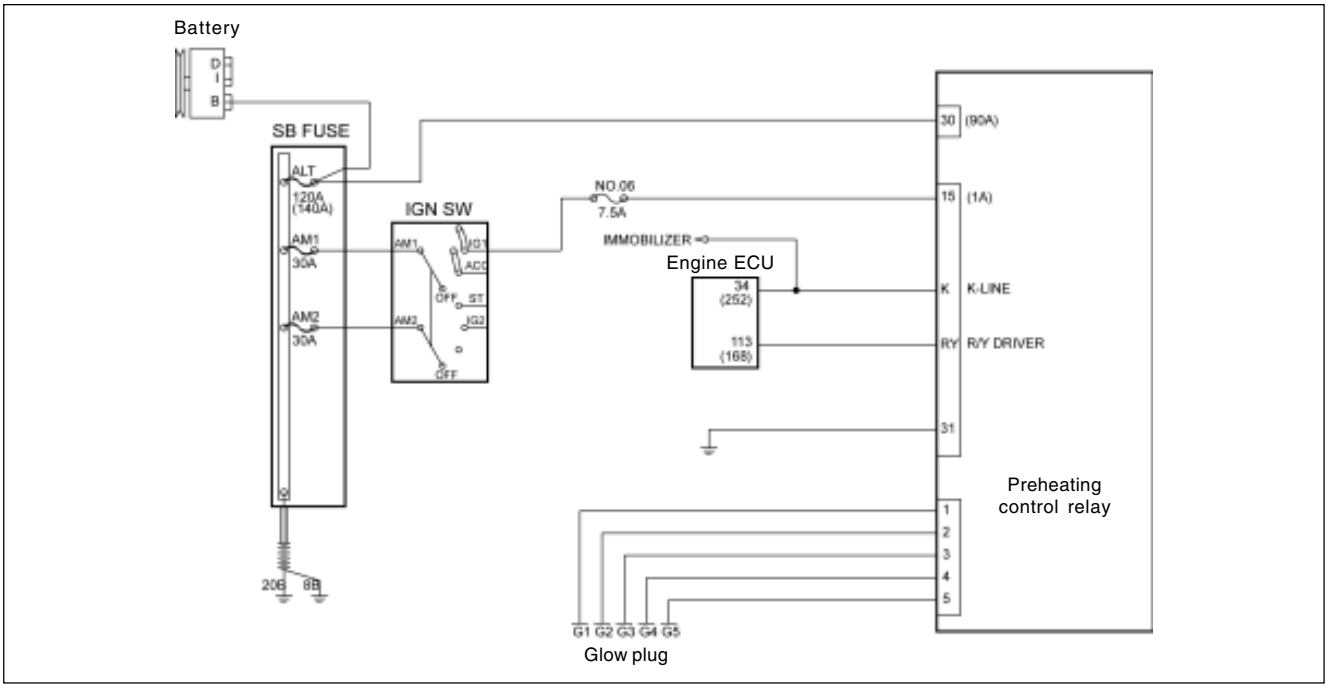
2. COMPARISON IN PREHEATING SYSTEM CIRCUIT (D27DTP (POWER UP) ENGINE AND D27DT ENGINE)

As shown in the circuit below, the AQGS unit installed in D27DTP (POWER UP) engine communicate with other units (cluster, immobilizer) via CAN.

▶ D27DTP (POWER UP) Engine



▶ D27DT Engine



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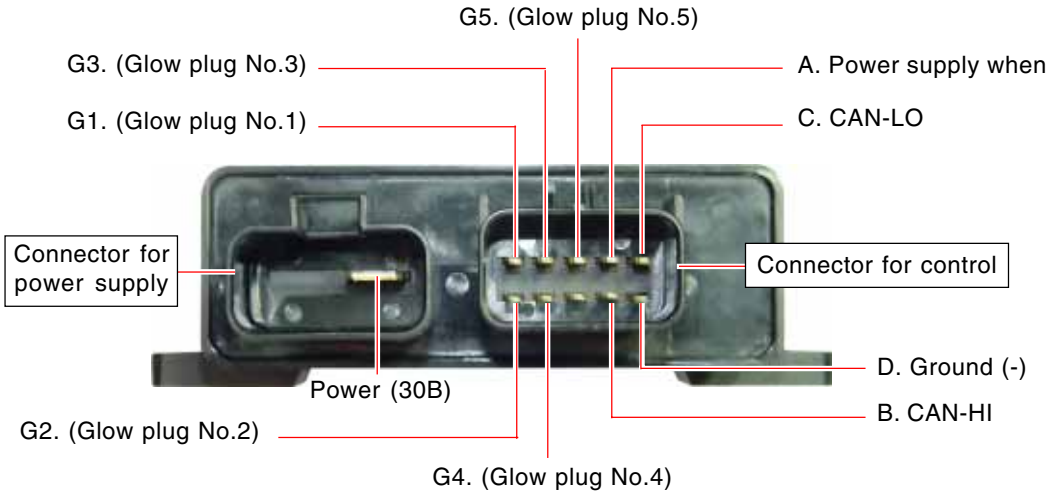
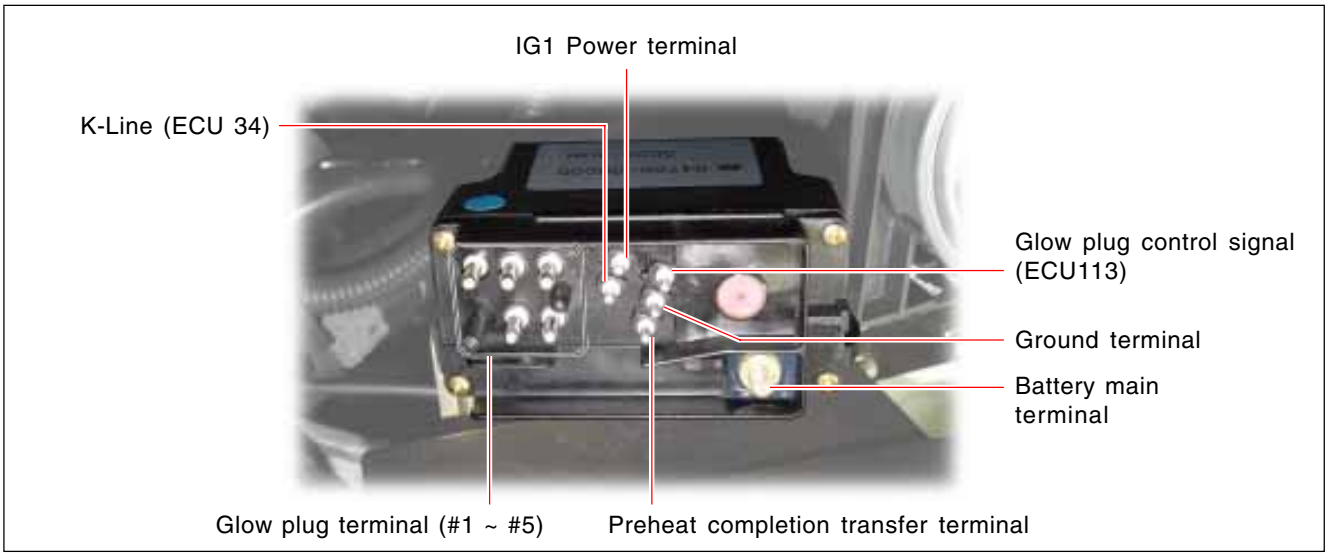
3. COMPONENTS OF PREHEATING SYSTEM

▶ AQGS Unit for D27DTP (POWER UP) Engine



▶ Preheating Control Relay for D27DT Engine



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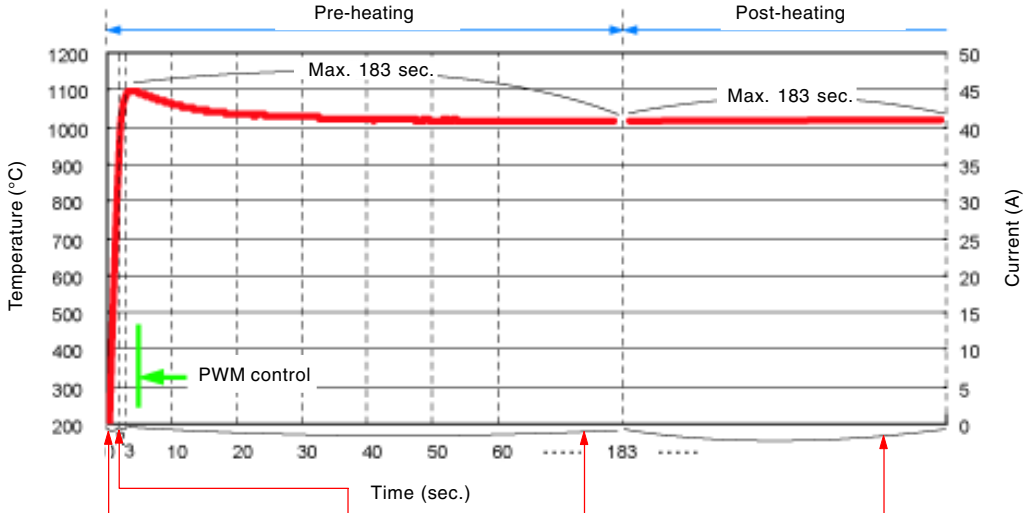
4. AQGS (ADVANCED QUICK GLOW SYSTEM) UNIT

The AQGS unit installed in D27DTP (POWER UP) engine can raise the the temperature of the glow plug up to 1,000°C in 2 seconds.

▶ AQGS Unit Control in Steps



1st step

When the ignition key is turned to ON position, the engine ECU sends the preheat signal to AQGS. Then, AQGS applies the voltage (approx. 11 V) to the glow plug for 2 seconds, and then the glow plug's temperature rises up to 1,000°C which is the target temperature.
After 1st step, the preheat warning light (indicator) goes off.

NOTICE

- **The voltage of battery should be over 11.5 V.**

2nd step

When the engine cranking signal is received, AQGS applies the voltage (approx. 6.5 V) to the glow plug for 1 second, and then the glow plug's temperature increases up to 1,100°C (target temperature).

NOTICE

- **This step is completed while the engine is cranking.**

3rd step

AQGS applies the voltage (approx. 5.1 V) to the glow plug to keep its temperature at 1,000°C. This step can be operated for up to 183 seconds depending on the conditions of engine and glow plug.

NOTICE

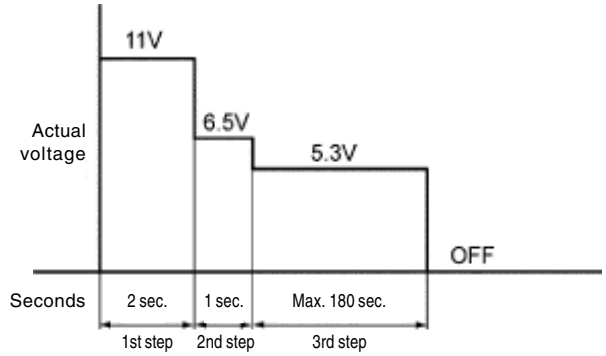
- **Temperature fixing mode of glow plug: If there is no engine cranking signal after the 1st step is completed, AQGS skips the 2nd step and performs the 3rd step for approx. 28 seconds.**

4th step

The post-heating is continued for up to 183 seconds to raise the temperature of the combustion chamber and reduce the amount the exhaust gas.
After 183 seconds, AQGS unit cuts off the power supply to the glow plug.

Voltage patterns by steps

This shows the voltage and time supplied by AQGS by steps. As shown on the graph, the supplied voltage is decreased as the steps are continued. The 3rd step is to keep the temperature, not to raise it.



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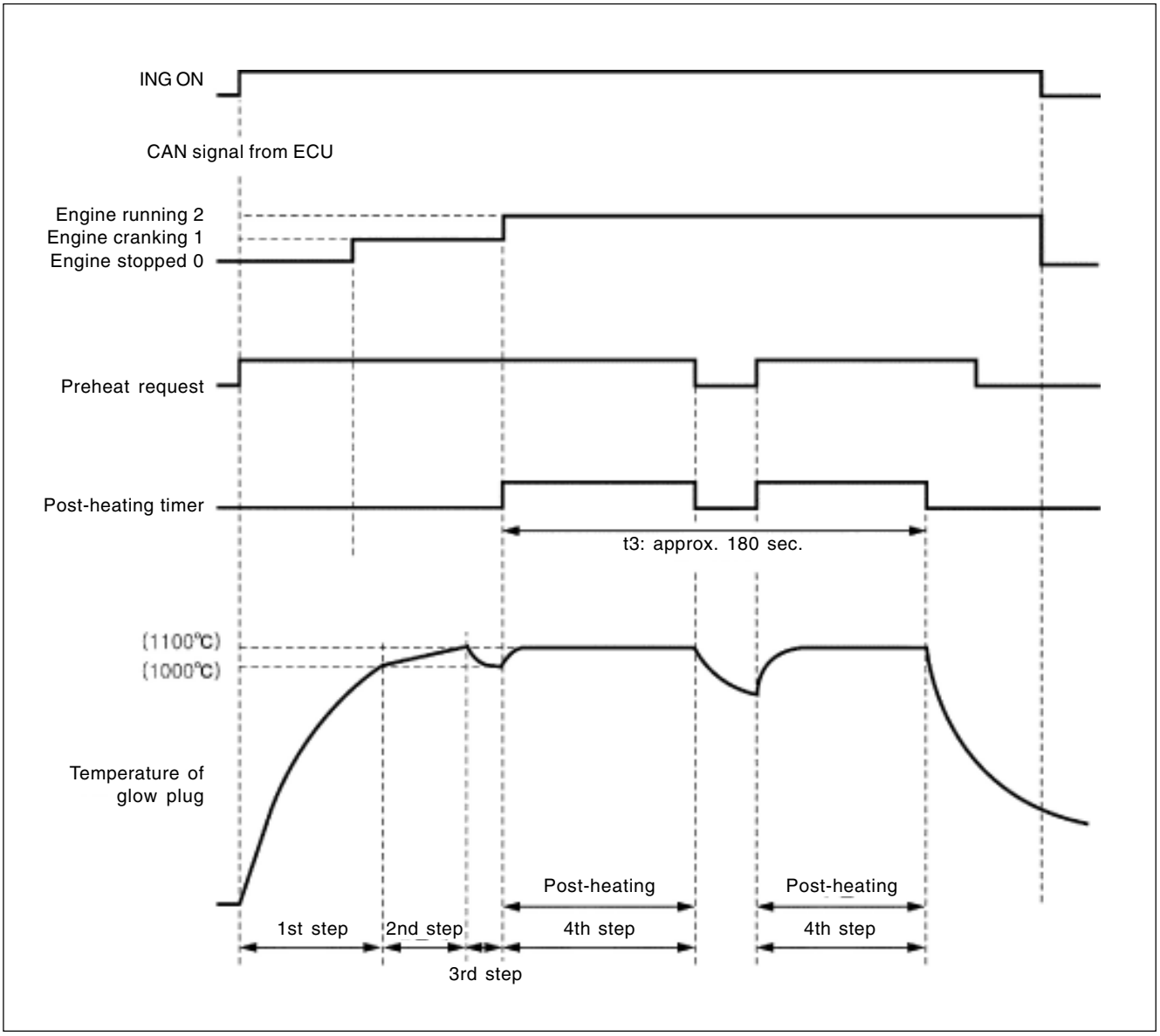
▶ Characteristic Curve of Components of Preheating System

1. Normal operating mode

This shows the components of preheating system in the pre-heating and the post-heating steps.



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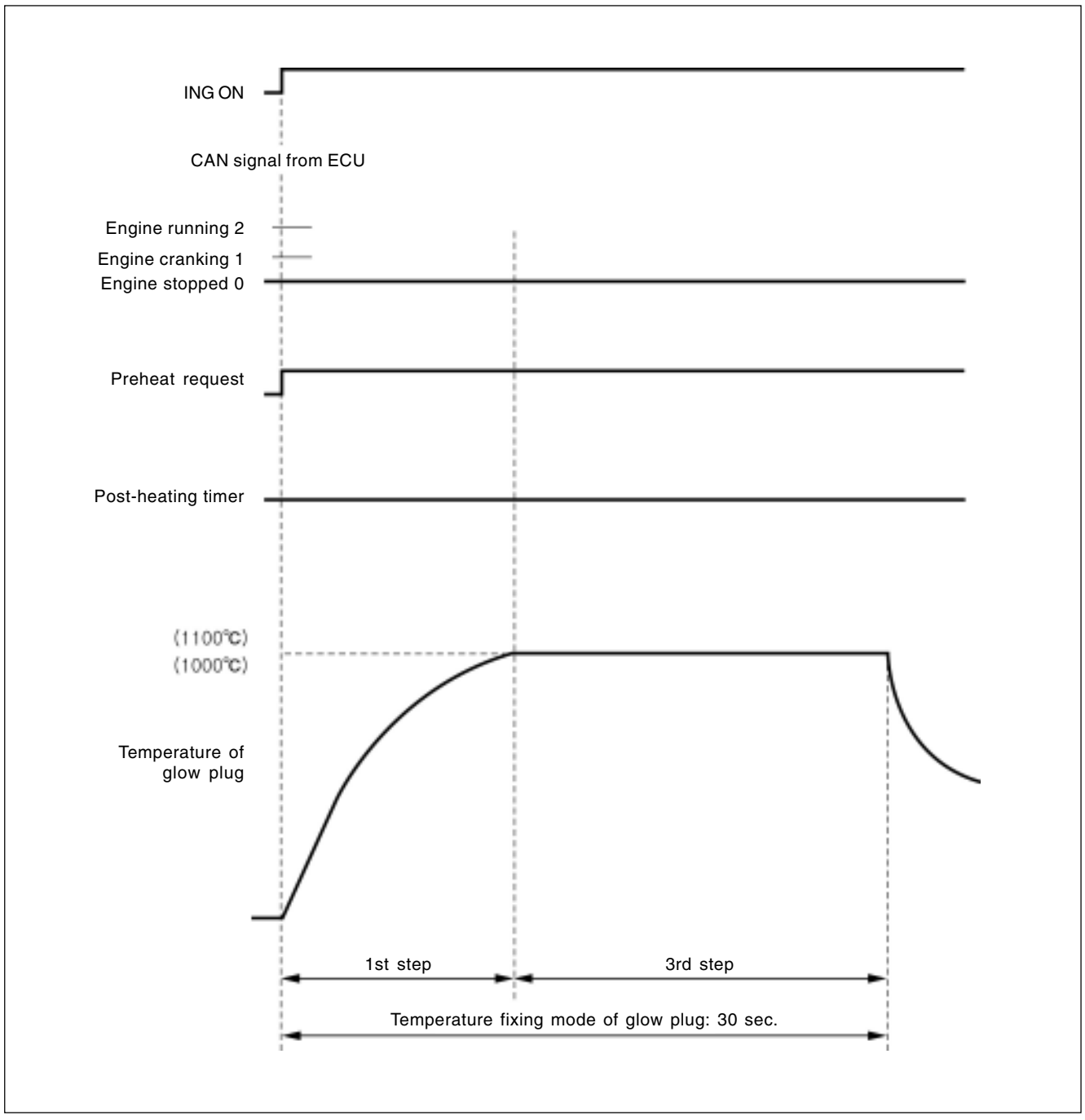
2. When there is no engine cranking signal after turning the ignition key ON



▶ Emergency Glow Mode

If there is no incoming CAN signal from engine ECU for approx. 4 seconds, AQGS initiates the emergency glow mode. In this mode, the AQGS applies the voltage (5.1 V) to the glow plug for 30 seconds.

5. NEW DTCS FOR AQGS (ADVANCED QUICK GLOW SYSTEM)

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2674	#1 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P2675	#2 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						

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DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2671	#3 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P2672	#3 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2673	#5 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (Battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P0670	Defective Power Supply of Glow Plug Controller	- Details: refer to P2673.						
P0683	Defective CAN Communiction of Glow Plug Controller	- GCU's CAN signal is intermittently defective.						
P1683	Defective CAN Communiction of Glow Plug Controller	- No GCU CAN signal - Details: refer to P2673.						
P0618	Multi Calibration not Performed	- Perform multi calibration again.						
P0619	Multi Calibration Performing error	- Perform multi calibration again.						
P062F	Multi Calibration Memory Error	- Perform multi calibration again.						
P066A	Internal Malfunction in #1 Glow Plug Controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.						
P066B	Internal Short in #1 Glow Plug Controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.						
P066C	Internal Malfunction in #2 Glow Plug Controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.						
P066D	Internal Short in #2 Glow Plug Controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.						
P066E	Internal Malfunction in #3 Glow Plug Controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.						
P066F	Internal Short in #3 Glow Plug Controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.						
P067A	Internal Malfunction in #4 Glow Plug Controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.						
P067B	Internal Short in #4 Glow Plug Controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.						
P067C	Internal Malfunction in #5 Glow Plug Controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.						
P067D	Internal Short in #5 Glow Plug Controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.						

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6. REMOVAL AND INSTALLATION OF AQGS UNIT

Removal and Installation

※ **Preceding Work:** Disconnect the negative battery cable.

1. Disconnect the AQGS unit connector.

2. Unscrew two mounting nuts and remove the AQGS unit.

AQGS Unit

3. Install in the reverse order of removal.

GLOW PLUG

1. OVERVIEW

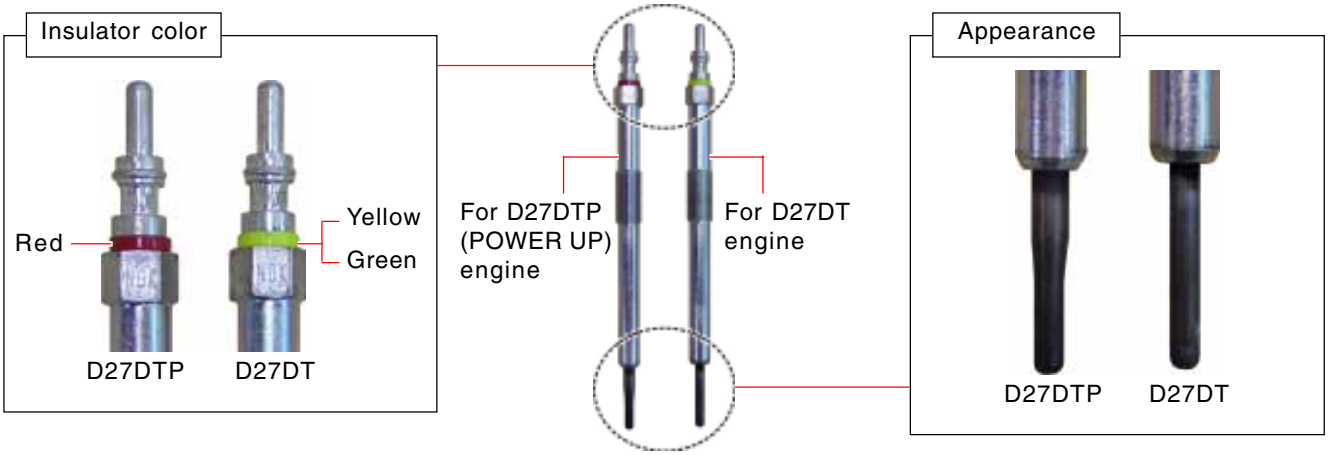
The glow plug for the D27DTP (POWER UP) engine is different from the one for the D27DT engine in terms of the temperature limit and the control steps. These two glow plugs are not compatible.

Also, there are two type of glow plugs for D27DT engine and they are not compatible either.

When replacing the glow plug, disconnect the connector, check the insulator color and install a new one with the same insulator color.

The followings are the colors of insulators according to the engine specifications.

▶ Glow Plugs by Engine Specifications



D27DTP (POWER UP) Engine

<NGK glow plug>
Insulator color: Red
Tip diameter: ϕ 4.4 mm
Glow plug resistance: 350 mΩ

D27DT Engine

<NGK Glow plug>
Insulator color: Yellow
Tip diameter: ϕ 3.5 mm
Glow plug resistance: 1.4 W ± 0.3 Ω

<BERU Glow plug>
Insulator color: Green
Tip diameter: ϕ 4 mm
Glow plug resistance: 680 mW ± 110 mΩ

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2. REMOVAL AND INSTALLATION OF GLOW PLUG

The color mark on insulator surface may be invisible due to the carbon contamination. To check the color easily, disconnect the connector and clean the glow plug mounting area with carbon cleaner.

Wait for a while and blow out the area with a compressed air.

A. Clean the glow plug mounting area with carbon cleaner and blow out the area with compressed air.

B. Check the color of the insulator.

Preparations for Replacing Glow Plug

Preparations for Replacing Glow Plug

Torque wrench, Air gun (small), Carbon cleaner (Product name: IPO CHOKE & CARBURATOR CLEANER, Model name: PRO NO 5007, Manufacturer: Sunbo), Engine oil, Glow plug wrench (special service tool), Long nose pliers

Carbon cleaner

Torque wrench (Max. 25 Nm)

Glow plug wrench - special service tool (10 mm)
Part No.: Y99220132B

Removal and Installation

※ **Preceding Work:** Disconnect the negative battery cable.

1. Disconnect the glow plug cable with long nose pliers and clean the glow mounting area with the compressed air (using air gun).

*** The preceding work is as same as other removal instruction.**

Disconnecting glow plug cable

Keep clean

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2. Spray the carbon cleaner into the gap between glow plug and cylinder head and wait for 10 minutes. Remove the dirt and foreign materials completely with the compressed air (using air gun).

NOTICE

- **At this moment, check the color mark on insulator surface and bring the same version of glow plug for replacement.**

3. To avoid damage, apply the engine oil into the gap between glow plug and cylinder head and wait for 5 minutes.

4. Install the glow plug wrench and remove the glow plug with torque wrench.

   (tightening torque: 15 ± 3 Nm)

PRECAUTIONS FOR TORQUE WRENCH

- **To prevent the preglow plug from breaking, carefully turn the wrench with the torque below 20 Nm.**
- **Never use the air impact tool or other tools.**

5. Thoroughly remove the foreign materials from the glow plug hole. If needed, use the carbon cleaner or air gun.

Glow plug wrench - special service tool (10 mm)
Part No.: Y99220132B

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LUBRICATION SYSTEM

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PCV OIL SEPARATOR

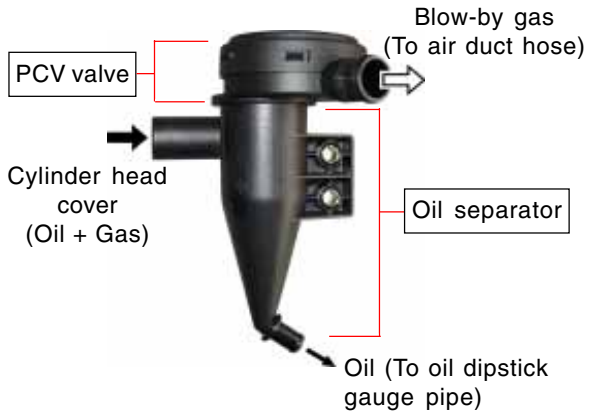
* PCV: Positive Crankcase Ventilation

1. OVERVIEW

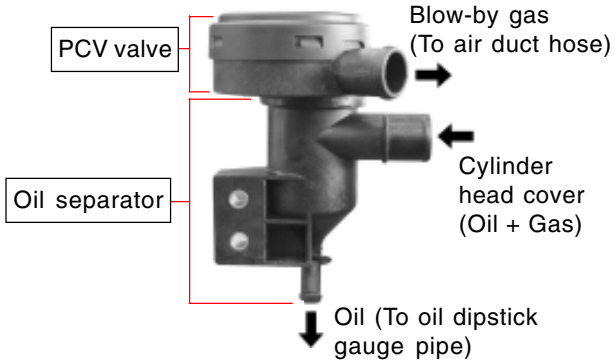
For the D27DTP (POWER UP) engine, the PCV oil separator's capacity has been increased by 10% compared to the conventional PCV oil separator for D27DT and D20DT engine to separate the oil and the gas more efficiently.

▶ Oil Separators (Compared to D27DT)

PCV Oil Separator for D27DTP (POWER UP) Engine

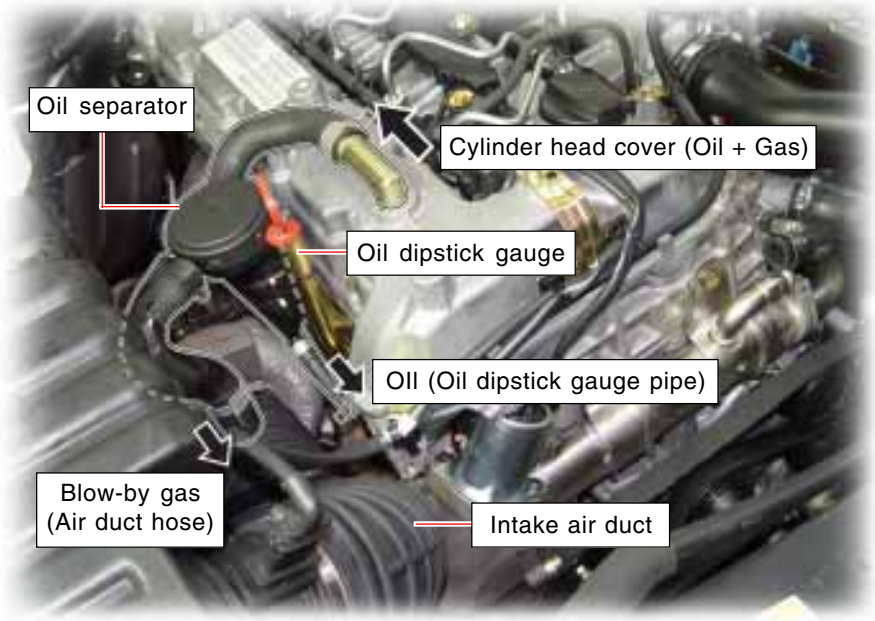


PCV Oil Separator for D27DT



▶ Components of Oil Separator for D27DTP (POWER UP) Engine

Operating Procedures



The first separation will happen when blowby gas passes through baffle plates in cylinder head cover. Then oil and gas will be separated due to cyclone effect after entering the oil separator inlet port. Separated oil returns to oil pan via oil drain port and the gas will be burnt again after entering the combustion chamber through air duct hose via PCV valve that opens/closes due to pressure differences between the intake side and crankcase.

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NOTICE

Performance of PCV Separator and Oil/Carbon Accumulation in Intake Manifold

It is not possible to separate the blowby gas (oil and unburned gas) completely from the crankcase. This problem is related to the engine control and the PCV oil separator is designed to recirculate approx. 70% of blowby gas.

When servicing the intake system, you can find that oil and carbon is accumulated in the intake pipe. It is normal for the vehicle that is normally used in city. Because of the engine control problem, the 100% of blowby gas cannot be recirculated and EGR and PCV oil separator's operating ranges are overlapped in normal driving mode. These are the cause of oil and carbon accumulated in the intake pipe.

When the EGR system is operated, the particulate material in the exhaust gas is drawn into the intake pipe and the oil not filtered in the PCV oil separator is also drawn into the intake pipe.

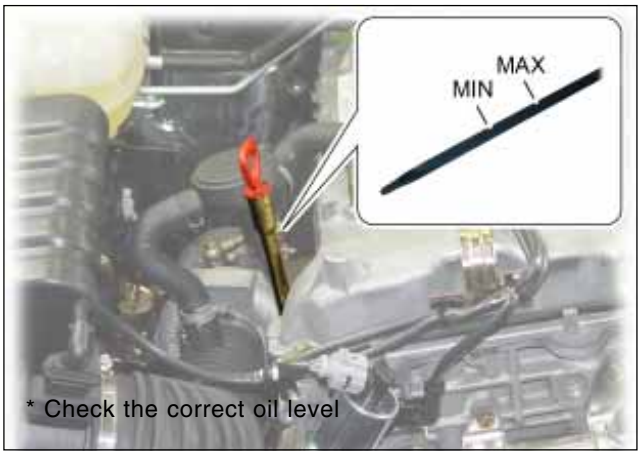
However, unless the particulate material or oil are accumulated excessively in the pipe, they do not affect the intake/exhaust valve or related components.

On the contrary, if they are removed using carbon cleaner or chemicals, the engine system may not function properly.

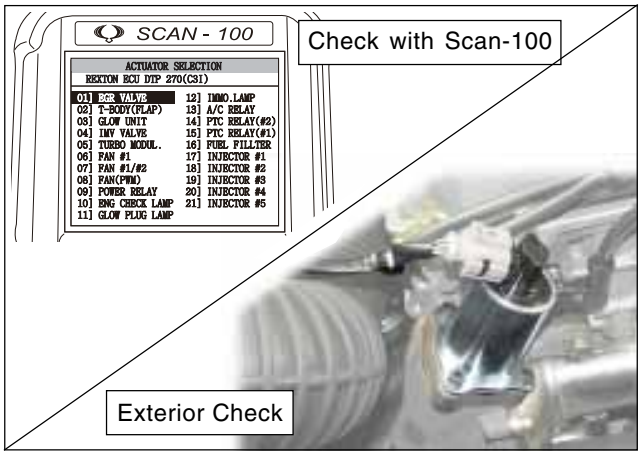
If too much oil or particulate material is accumulated, check the followings:

1. Engine oil level
2. EGR valve (exhast gas leak and operating condition)
3. Turbocharger (oil/gas leak and operating condition)
4. PCV oil separator (installation condition and leak)
5. PCV oil separator (some functions)

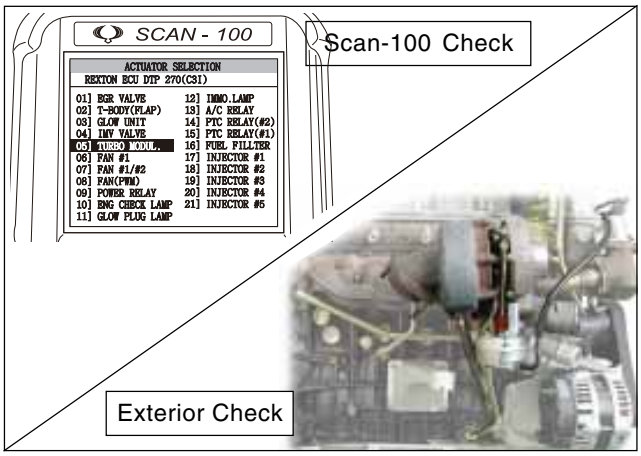
1. Engine oil level



2. EGR valve (exhast gas leak and operating condition)



3. Turbocharger (oil leak and operating condition)



4. PCV oil separator (installation and leak)

5. PCV oil separator

When the PCV oil separator is malfunctioning, remove the unit and check the following:

Block the inlet port connected to the cylinder head cover and the drain port connected to the oil drain pipe with hands and apply vacuum to the outlet port (if the unit is clean, you can suck it with your mouth to apply vacuum).

The membrane and the spring are normal if you feel the PCV oil separator is blocked with noise. (This is similar to the situation that the blowby gas coming into the outlet port is blocked by negative vacuum pressure when accelerating.)

This is only the test method. Actually, the blowby gas is passed through the outlet port by overcoming the spring tension while driving.

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2. REMOVAL AND INSTALLATION OF OIL SEPARATOR

※ **Preceding Work:** Remove the engine acoustic cover.

1. Disconnect the hoses from the PCV oil separator.

NOTICE

- **Be careful not to spill engine oil when disconnecting the hose from the oil dipstick gauge pipe.**

2. Unscrew two mounting bolts and remove the PCV oil separator.

NOTICE

- **If the clamp on the connecting port is loosened, replace it with new one.**

IOP: Integrated Oil Pan

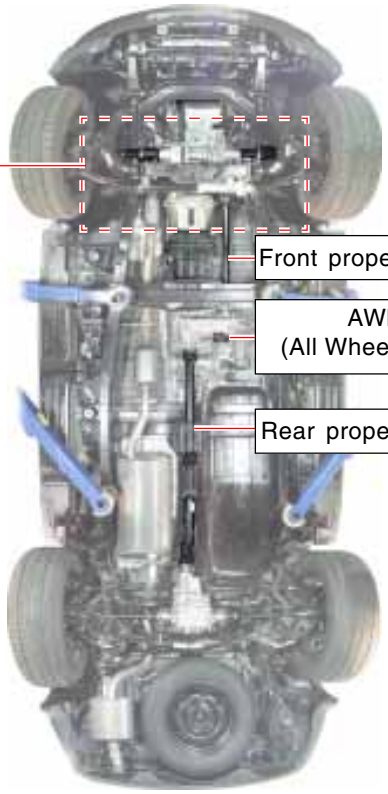
1. OVERVIEW

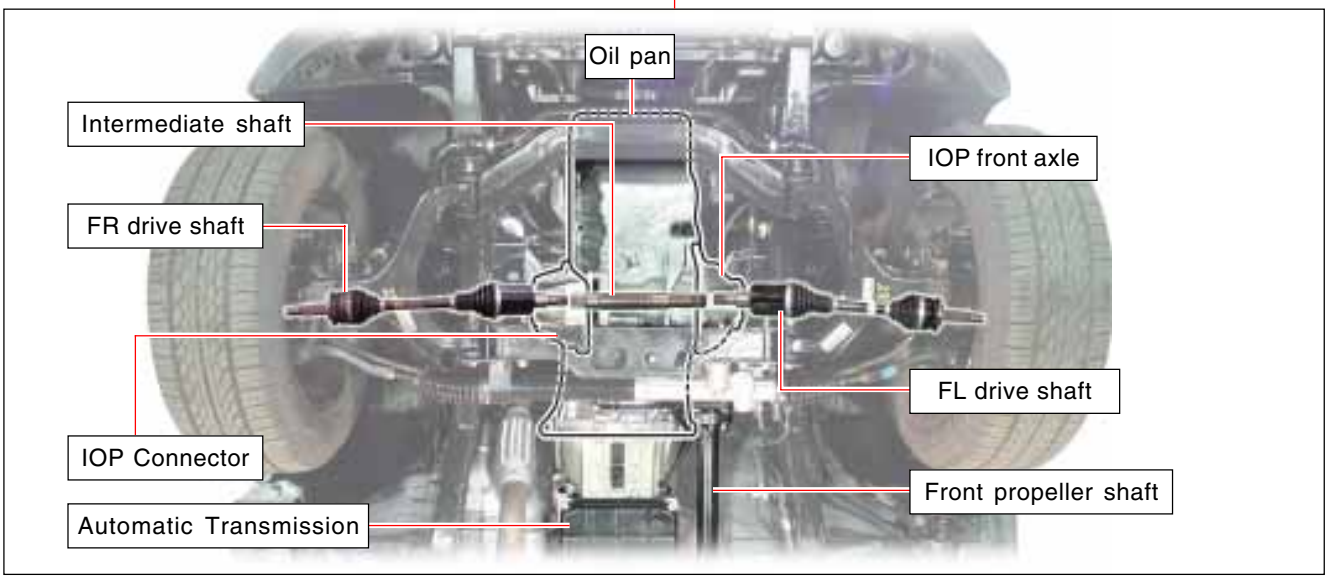
The IOP is installed for D27DTP (POWER UP) engine. In this case, the compact front axle is installed at the left side of the oil pan. The front drive shaft on the right side is passed through the oil pan.

The power train's specifications for D27DTP (POWER UP) engine is as follows:

D27DTP (POWER UP) Engine + IOP + Front Axle for IOP +AWD (All Wheel Drive)

IOP





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▶ The Advantages of IOP

1. **Lowered center of gravity**

   The IOP front axle take less space than the conventional front axle. Also, the engine can be mounted on the lower area so that the center of gravity is lowered. This also improves the driver's visibility.

   If the center of gravity is lowered, the vehicle safety is enhanced when cornering.

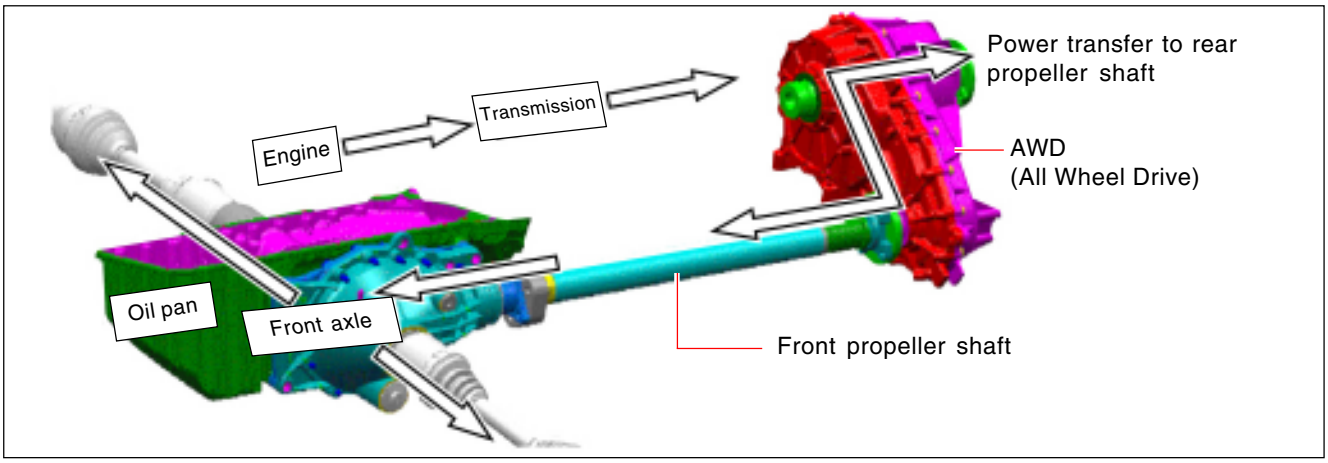
2. **Improved NVH (Noise Vibration Harshness)**

   The vibration occured from the engine is decreased since the IOP front axle integrated with IOP is heavier than the conventional front axle. Therefore, NVH is decreased.

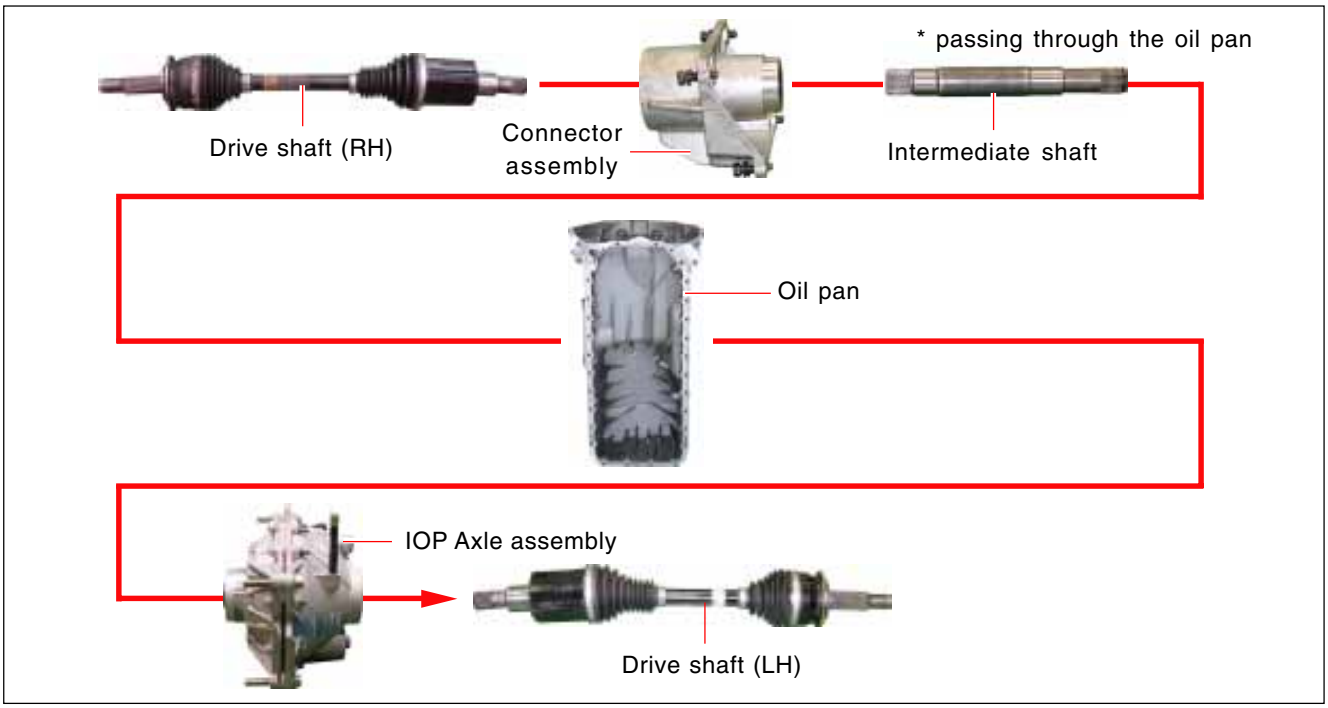
3. **Efficient power transfer**

   There is no need to install the joint device to connect the oil pan and the front propeller shaft from AWD since they are at the same height. Also, the power is transferred more effciently without any fault.

Power transfer of front axle with IOP



Layout of Components Related to IOP/AIxe



▶ Appearance of Oil Pan (IOP)

Oil Pan for D27DTP (POWER UP) Engine

Oil drain plug
(Tightening torque: 25 ± 2.5 Nm)
* Replace the washer with new one.

The IOP is 1.5 mm thicker than the conventional oil pan and the rib is added around the mounting points. Also, the flange is 8 mm thick while the conventional flange is 4 mm thick to prevent the oil leak.

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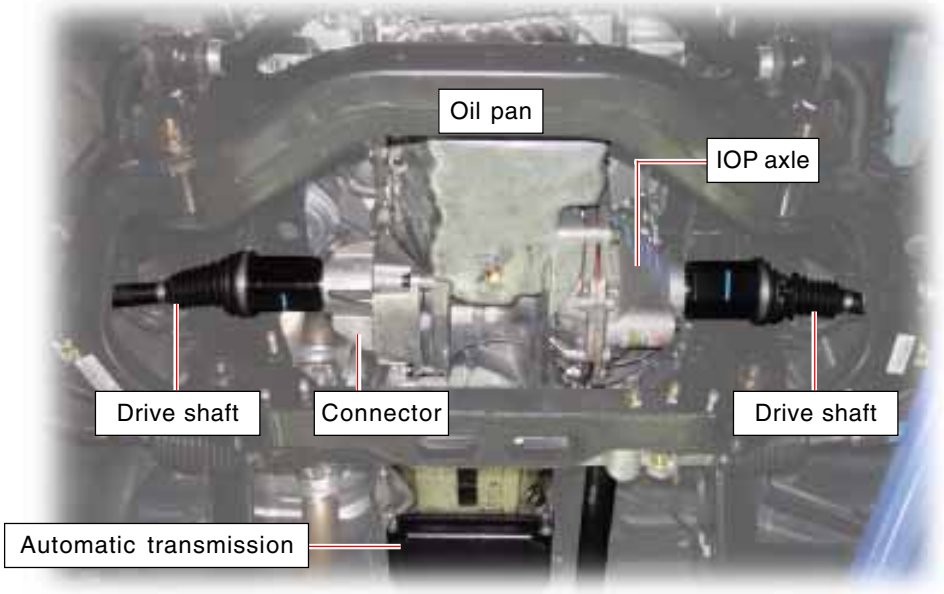
2. REMOVAL AND INSTALLATION OF IOP

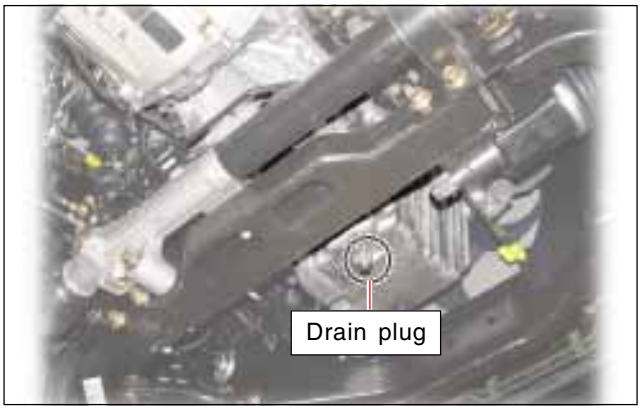
Removal and Installation

※ **Preceding Works:** 1. With SCAN-100, perform EAS ECU LOCK in EAS air release mode.
2. Remove the drive shaft, IOP axle and connector. (For details, refer to “IOP axle” section.)

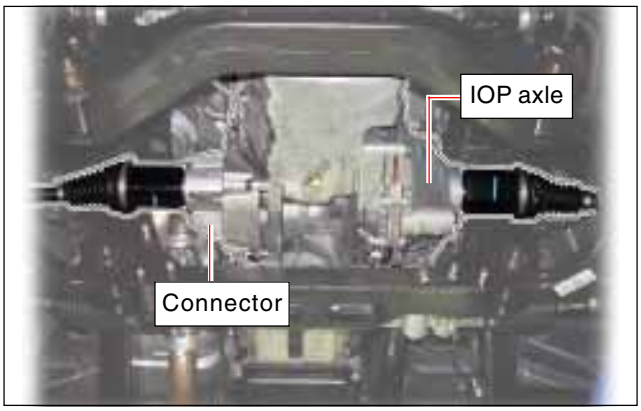


1. Remove the drain plug from the oil pan and drain the engine oil. Install the drain plug again.

NOTE
- **Store the drained engine oil in the specified container. Be careful not to spill the engine oil.**

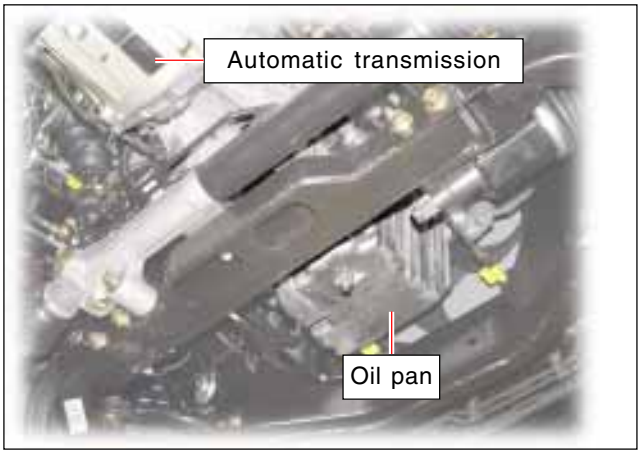


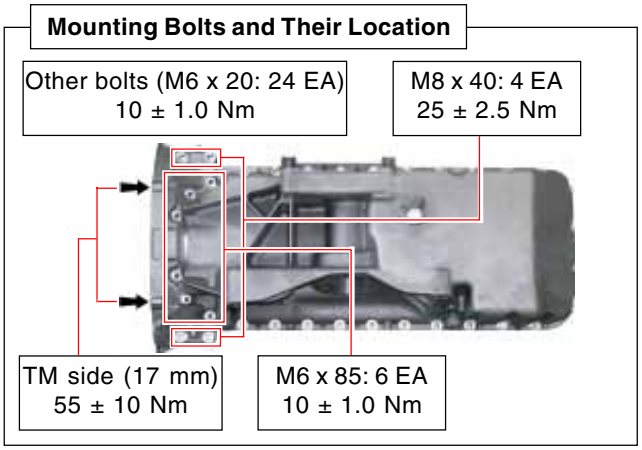
2. Drain the oil from the IOP axle and remove the IOP axle, connector and intermediate shaft. (For details, refer to the “Chassis” section.)



3. Remove the mounting bolts on the engine mounting insulator and engine bracket. Lift the engine assembly a little and secure the engine.

4. Remove the mounting bolts from the oil pan.





5. Lower the oil pan and unscrew three mounting bolts to remove the oil pump assembly.

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6. Remove the oil pan by lowering it through the front sub frames as shown in the figure.

7. When installing, apply silicon on the mating surface of oil pan and put the oil pan on the installing position. Then, install the oil pump and the oil pan in the reverse order of removal.

NOTICE

- **Remove any foreign material or oil on the cylinder block.**
- **Remove the residues from the oil pan and clean the mating surface.**
- **Do not shake the oil pan when installing it to the cylinder block.**

MEMO

COOLING SYSTEM

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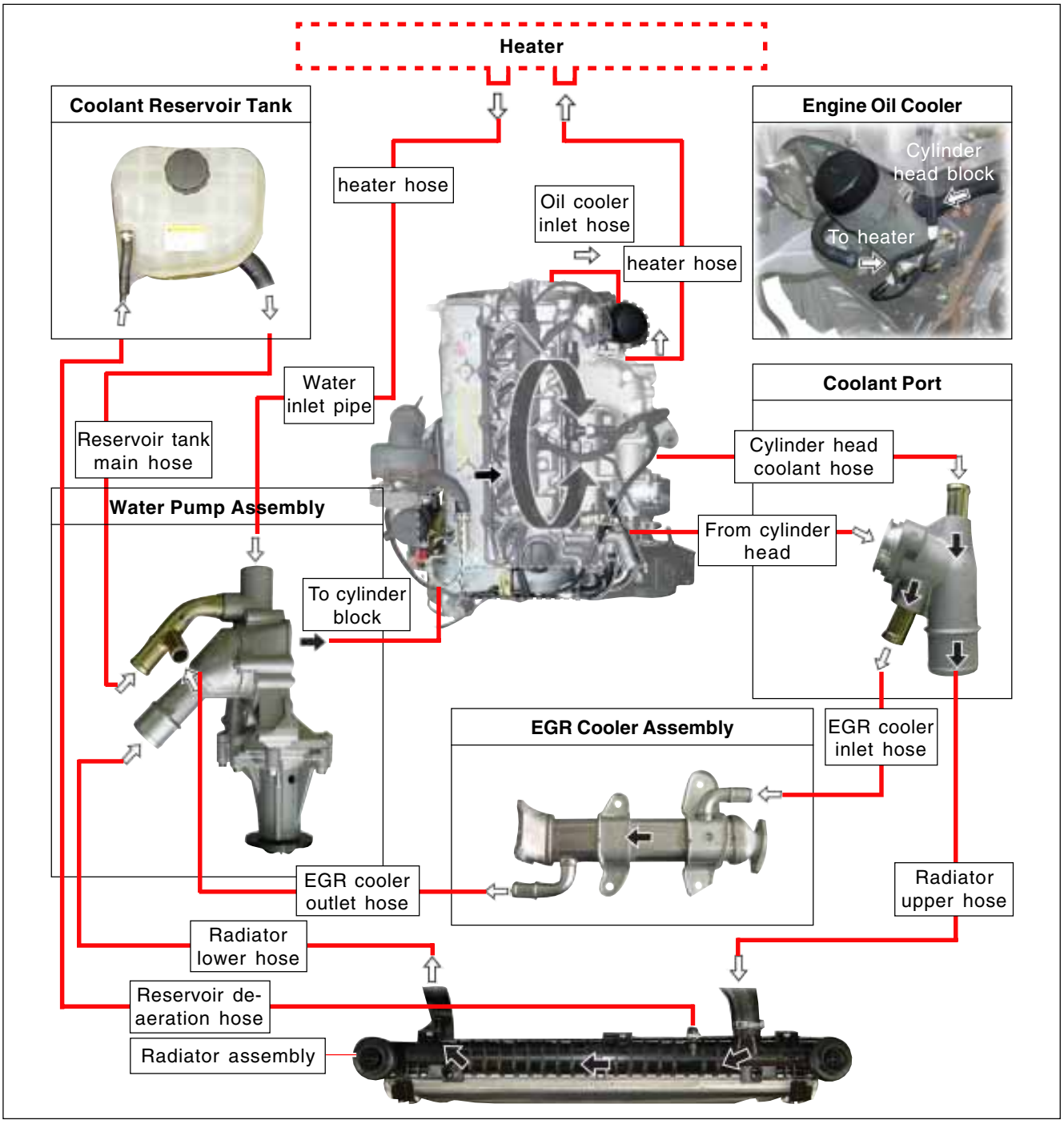
COOLING SYSTEM

1. COMPARISON IN COOLING SYSTEM FOR EACH ENGINE

For the D27DTP (POWER UP) engine, the cooling system is equipped with E-EGR cooler and the water pump which its capacity is improved according to the additional coolant line in the cylinder block. For the D27DT engine, the cooling system uses the fan clutch.

▶ Cooling System for D27DTP (POWER UP) Engine



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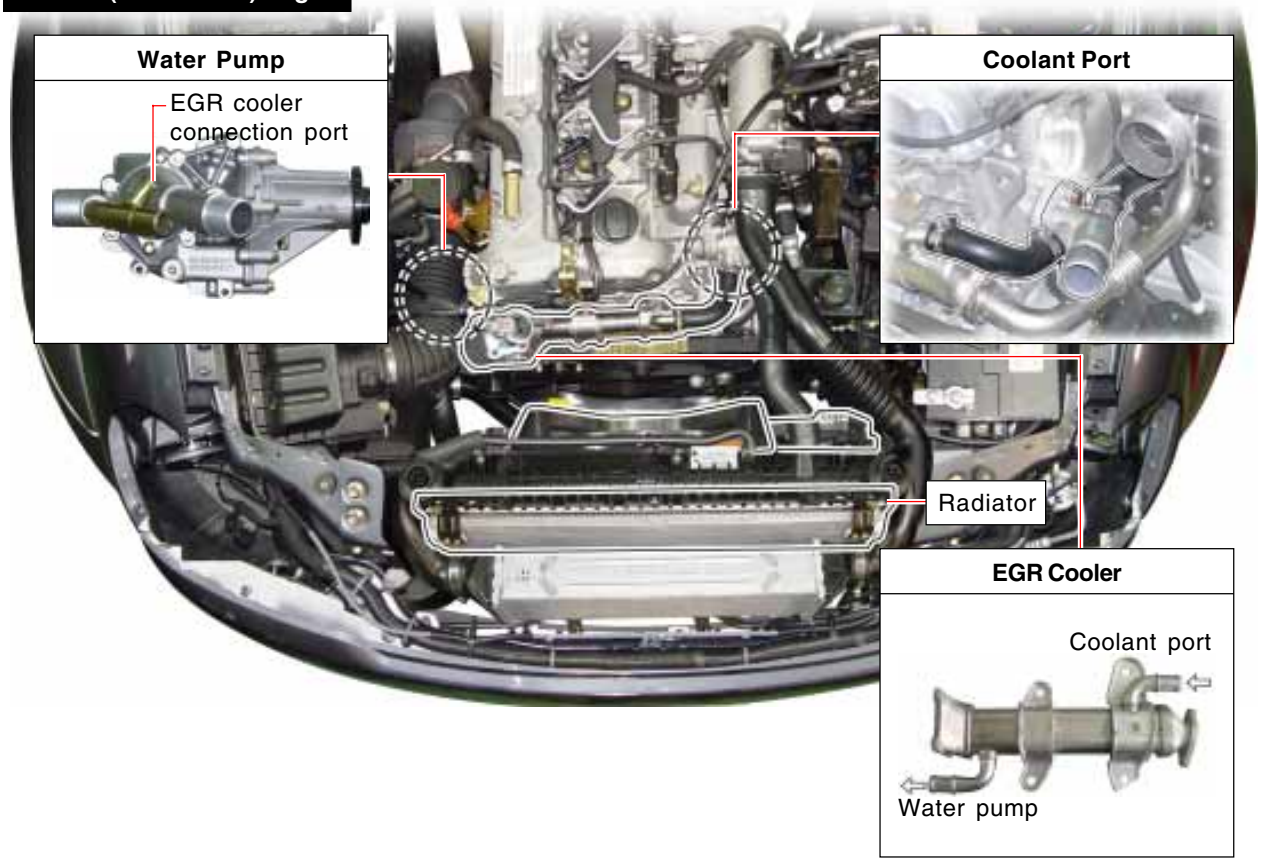
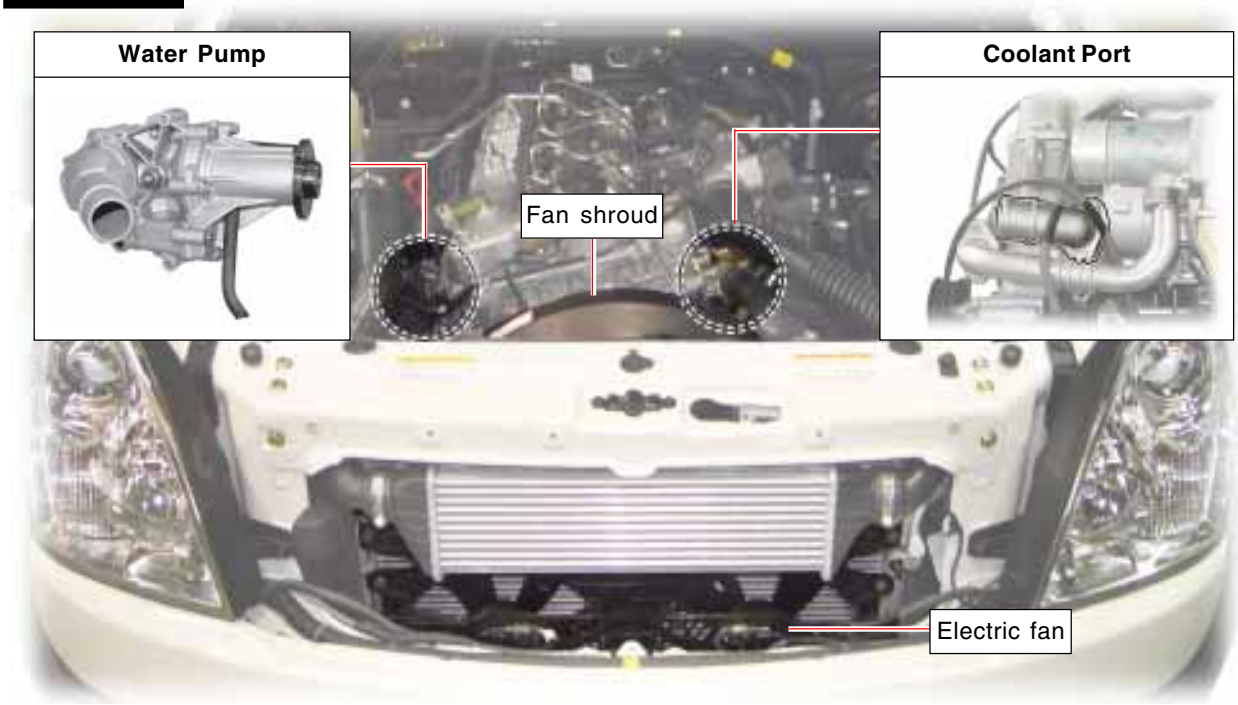
▶ Comparison

D27DTP (POWER UP) Engine



D27DT Engine



WATER PUMP

1. OVERVIEW

The belt-driven centrifugal water pump consists of an impeller, a drive shaft, and a belt pulley. The impeller is supported by a completely sealed bearing. The water pump is serviced as an assembly and, therefore, cannot be disassembled.

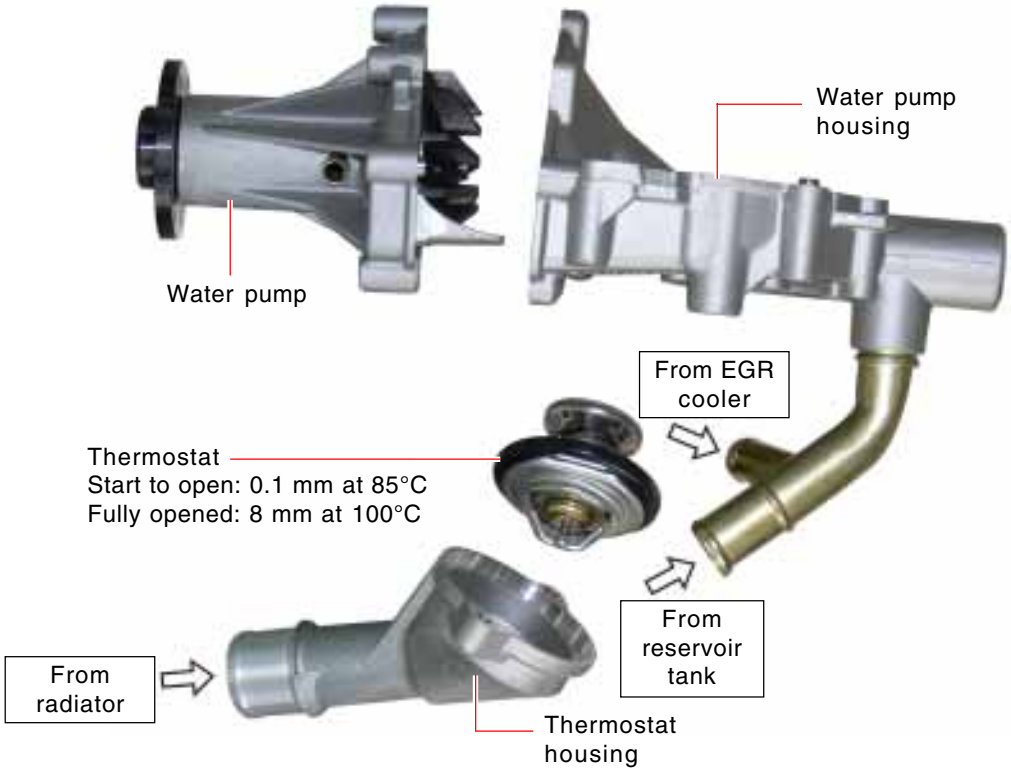
The capacity of water pump has been increased due to the EGR cooler, increased engine power and additional coolant port in the cylinder block.

For D27DTP (POWER UP) Engine

For D27DT Engine

Note

* Structure of water pump for D27DTP (POWER UP) engine



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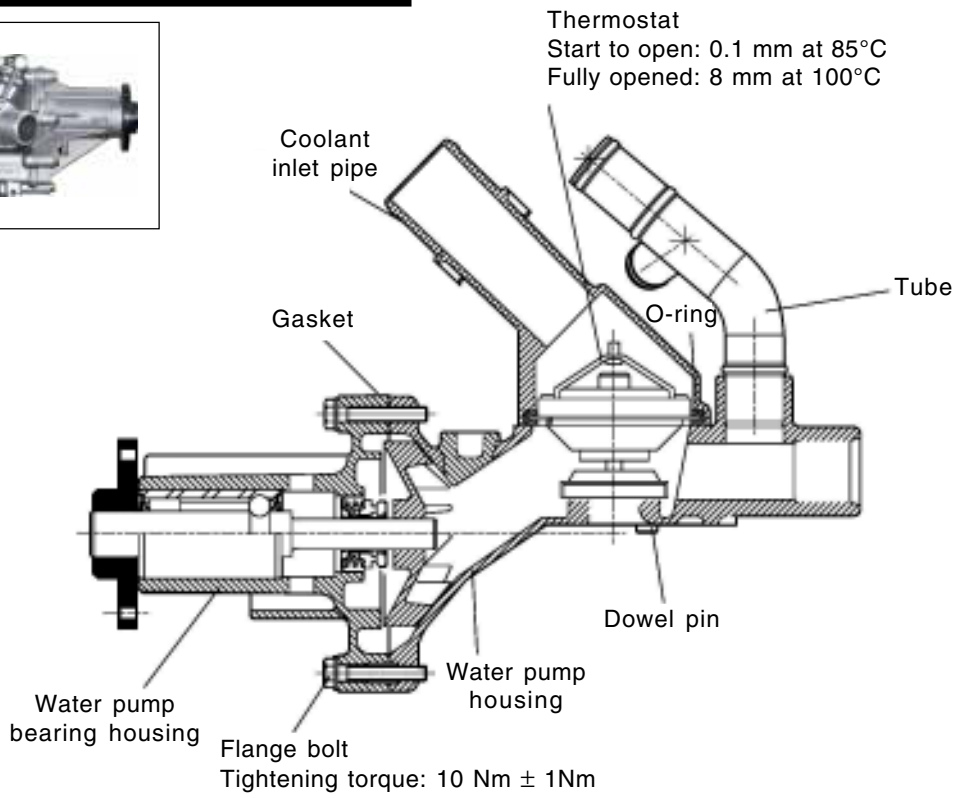
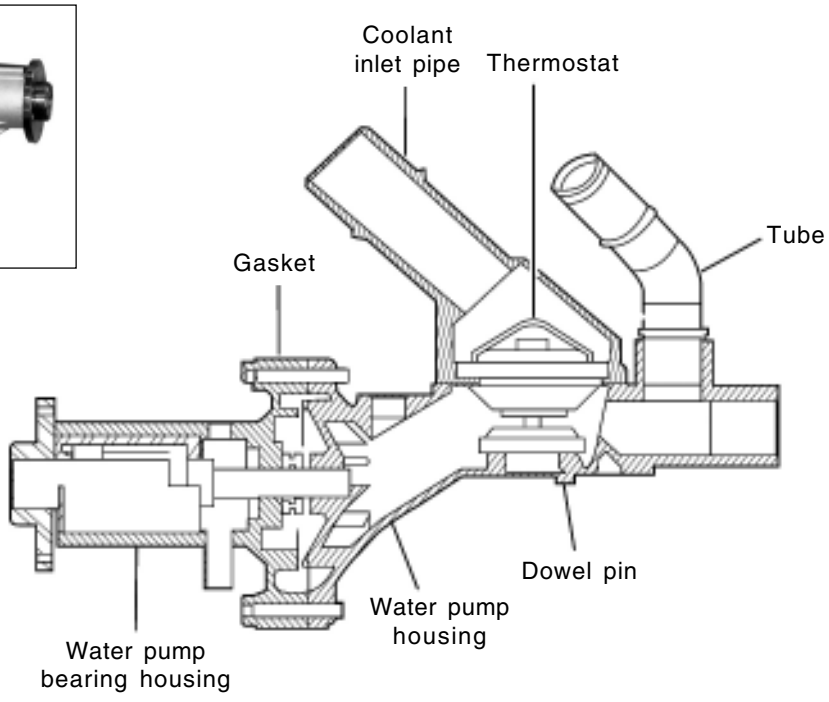
▶ Water Pumps for D27DTP (POWER UP) Engine and D27DT Engine

Water Pump for D27DTP (POWER UP) Engine



Water Pump for D27DT Engine



A/C REFRIGERANT PRESSURE SENSOR (D27DTP) AND TRIPLE PRESSURE SWITCH (D27DT)

For the vehicle equipped with D27DT engine, there is triple pressure switch on the receiver drier. For the vehicle equipped with D27DTP (POWER UP) engine, the pressure sensor is installed.

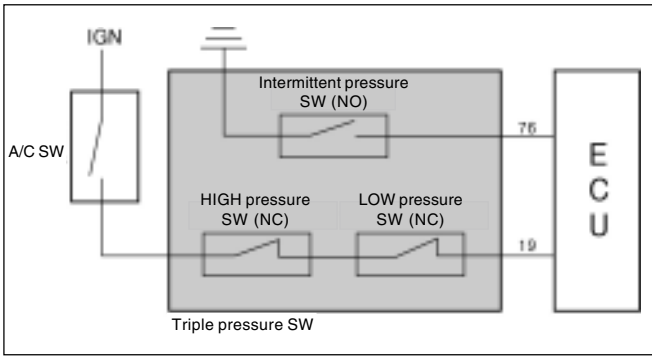
The A/C refrigerant pressure sensor monitors the refrigerant pressure of the air conditioner and sends that information to ECU for the optimum control.

1. A/C TRIPLE PRESSURE SWITCH: FOR D27DT ENGINE

- **HIGH/LOW pressure switch**

  It check the A/C line for clogging or gas penetration to stop the A/C compressor or to control the high-speed fan to protect the compressor from damage.
- **Intermittent pressure switch**

  When the pressure in the A/C line is over a certain value (14 kgf/cm^2), it sends a signal to operate the cooling fan.



Triple pressure switch

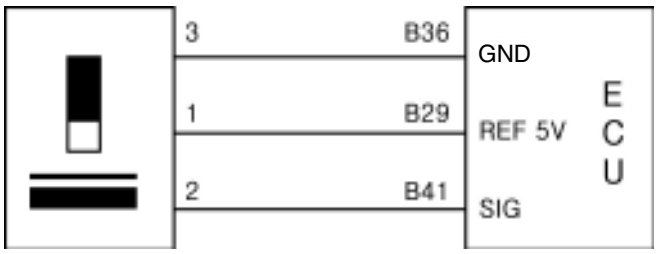
2. A/C PRESSURE SWITCH: FOR D27DTP (POWER UP) ENGINE

▶ Overview

This senses the A/C refrigerant pressure continuously and converts it to voltage value which is then sent to ECU for the optimum control.

Function: Stopping A/C compressor

For more details, refer to “Refrigerant Pressure Sensor”.



Refrigerant pressure sensor

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▶ Output Voltage

Pressure (kgf/cm²)	Output voltage (V)	Pressure (kgf/cm²)	Output voltage (V)
0	0.5	20	3.0
4	1.0	24	3.5
8	1.5	28	4.0
12	2.0	32	4.5
16	2.5		

▶ Functions of Refrigerant Pressure Sensor (D27DTP)

Conditions for Shutting Off the A/C Compressor

The refrigerant pressure sensor continuously monitors the refrigerant pressure in the A/C system to control the A/C compressor under the following conditions:

Conditions for shutting off the A/C compressor

- Coolant temperature: Below -20°C or over 115°C
- For 4 seconds after starting the engine
- If the engine rpm is below 650 rpm or above 4500 rpm
- Sudden acceleration of vehicle
- Operation A/C refrigerant pressure sensor
  - The compressor is turned off when the refrigerant pressure is below 2.0 kgf/cm² and is turned on again when the pressure is over 2.4 kgf/cm².
  - The compressure is turned off when the refrigerant pressure is over 30 kgf/cm² and is turned on again when the pressure is below 21.4 kgf/cm².

3. NEW DTCS FOR A/C REFRIGERANT SENSOR

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0530	Air Conditioner Refrigerant Sensor Supply Power Fault	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal .... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm² (0.75V) ~ 32 kgf/cm² (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm² 4.5V ..... 32.0 kgf/cm² - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						
P0532	Air Conditioner Refrigerant Pressure Signal Circuit Short	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal. ... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm² (0.75V) ~ 32 kgf/cm² (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm² 4.5V ..... 32.0 kgf/cm² - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						
P0533	Excessive Air Conditioner Refrigerant Pressure	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal .... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm² (0.75V) ~ 32 kgf/cm² (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm² 4.5V ..... 32.0 kgf/cm² - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						

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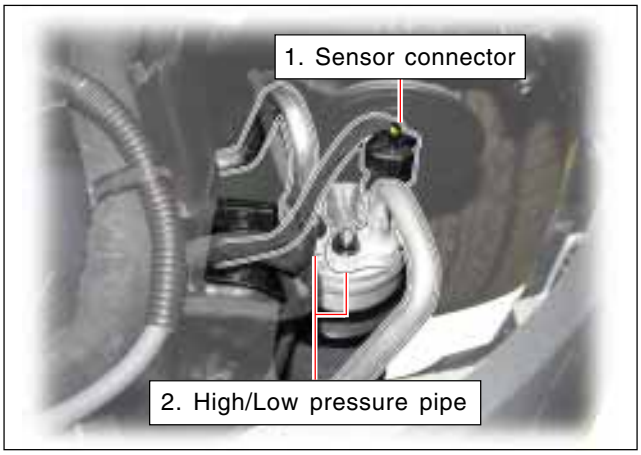
4. REMOVAL AND INSTALLATION OF A/C REFRIGERANT PRESSURE SENSOR (RECEIVER DRIER)

Receiver Drier

※ **Preceding Works:** 1. Remove the RH headlamp (refer to “LAMP” section).
2. Drain the A/C gas and refrigerant to the designated container.

1. Disconnect the receiver drier sensor connector (1) and HIGH/LOW pressure pipe (2).

Tightening torque	20 ~ 30 Nm



2. Unscrew the mounting bracket bolts and remove the receiver drier.

MEMO

SWITCHABLE ENGINE MOUNT

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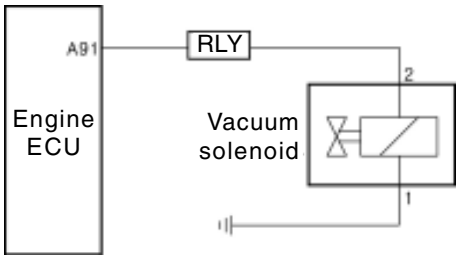
SWITCHABLE ENGINE MOUNT (ELECTRONIC CONTROL TYPE)

1. OVERVIEW AND SYSTEM LAYOUT

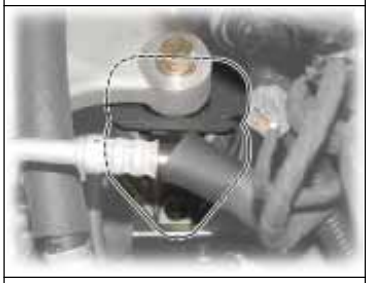
For the vehicle equipped with D27DTP (POWER UP) engine, the switchable engine mount system lets the engine ECU electronically control the shock absorber's characteristics in the engine mount.

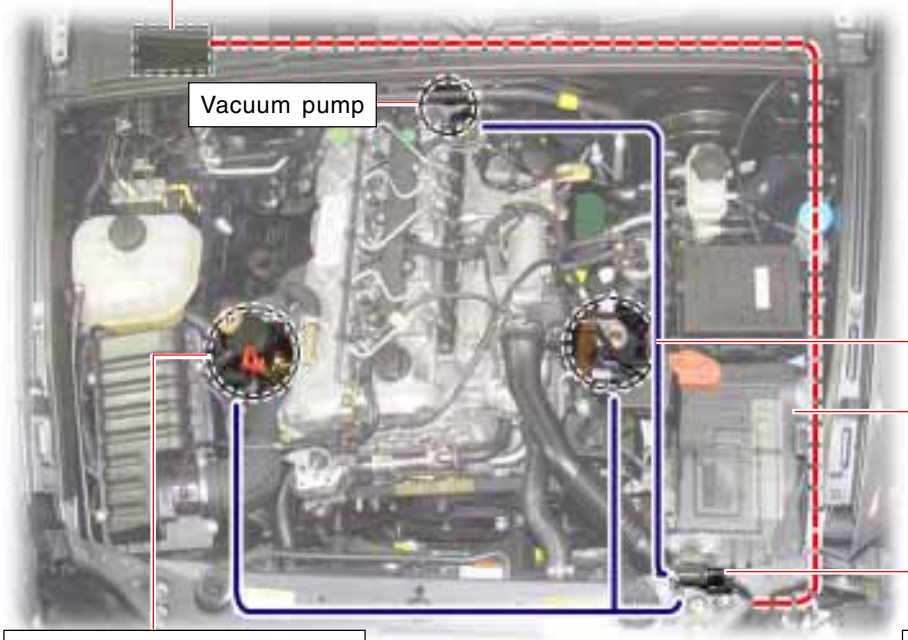
This system can control the vacuum in two modes (soft and hard) through the engine ECU to minimize the noise and vibration and improve driving comfort and stability.

Engine ECU



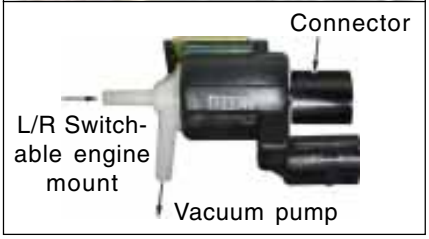
LH Switchable Engine Mount





RH Switchable Engine Mount

Vacuum Solenoid Valve



NOTE

- **The components of vacuum solenoid valves are the same in various types of engines. However, their functions are different from each other. The vacuum solenoid valve for D27DTP (POWER UP) engine controls the vacuum in the engine mount. The vacuum solenoid valve for D27DT engine controls the vacuum in IWE (Integrated Wheel End) of 4WD system.**

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2. FUNCTIONS

The switchable engine mount not only supports the engine on the vehicle body, but also has the following functions:

1. **It insulates the vibration during engine running and minimizes the noise and vibration of the engine transferred to the vehicle.**
2. **It controls the displacement during shifting, sudden acceleration, abrupt braking or cornering to keep the engine stable.**

3. CHARACTERISTICS AND PERFORMANCE

1. The engine mounting can be set to the soft mode to minimize the noise and vibration of engine transferred to the vehicle when the engine is at idle or low speed while driving.
2. The engine mounting can be set to the hard mode to keep the engine stable from the displacement occurred by poor road condition, shifting, acceleration and braking under normal driving conditions.
3. The common engine mounting cannot satisfy both of the above characteristics. Therefore, it is set to compromise both characteristics and its performance is decreased. However, the electrically controlled switchable engine mounting can switch the operating mode of the engine mounting between soft and hard mode according to the vehicle speed and engine rpm so that both characteristics are satisfied.
4. The engine mounting is switched between the soft mode and the hard mode to change the damping condition and spring characteristics.

Soft Mode: The orifice is opened to apply the atmospheric pressure so that the shoft rubber mounting's characteristic is performed for lowering the damping and spring characteristics.

Hard Mode: The orifice is closed to block the atmospheric pressure and generate the vacuum state so that the shoft rubber mounting is damped greatly. In this mode, the rattling of the engine is minimized so that the vehicle's stability is ensured during driving, cornering and braking.

4. OPERATING CONDITION

Soft Mode:
Vacuum blocked → OFF mode
Engine rpm < 1,000 rpm, vehicle speed < 5 km/h

Hard Mode:
Vacuum connected → ON mode
Engine rpm > 1,200 rpm, vehicle speed > 10 km/h

Notes: Description for Engine Mounting System

- **The engine mounting fixes the engine on the vehicle body. It minimizes the noise and vibration of the engine transferred to the vehicle and keep the engine stable during shifting, sudden acceleration, abrupt braking or cornering.**
- **When the vehicle is rolling, the engine and the vehicle body may be rattled separately and the vehicle's stability and handling get poor.**
- **The engine mounting can be designed as a hard structure to prevent this, but it may cause the noise and vibration because it cannot insulate its vibration.**
- **When the vibration with large amplitude is transferred to the vehicle body due to the road conditions (ex: driving on rough road), the vibration from the vehicle is transferred to the engine.**
- **This phenomenon is similiar to the case when you run carrying a back pack on your shoulder. If the back pack is sticked to your back, your running gets stable. However, if the back pack moves from side to side, your running gets unstable.**
- **The suspension system uses the spring and shock absorber. If the spring is soft, the vehicle is stable, but the vibration from the road surface is directly transferred to the vehicle's occupants. If there is no shock absorber, the vehicle continues to rattle once the vehicle crosses over a bump on the road. With the shock absorber, the vehicle returns to its stable condition after the impact from the road surface. These are why the spring and shock absorber are used.**
- **The hydraulic engine mounting is designed based on these principles. When the vibration with small amplitude is occurred to the engine, it insulates the vibration smoothly. When the vibration with large amplitude is occurred, it holds the engine to keep it stable.**
- **Simply, the small vibration should be insulated softly and the large vibration should be insulated hardly for the optimal performance. The rubber mounting has its own limit, but the hydraulic mounting can satisfy both conditions. To separate these distinct conditions, the modes should be switched depending on the situation.**
- **The switchable engine mounting system can be switched between two modes by the engine ECU depending on the situation to cope with both conditions.**

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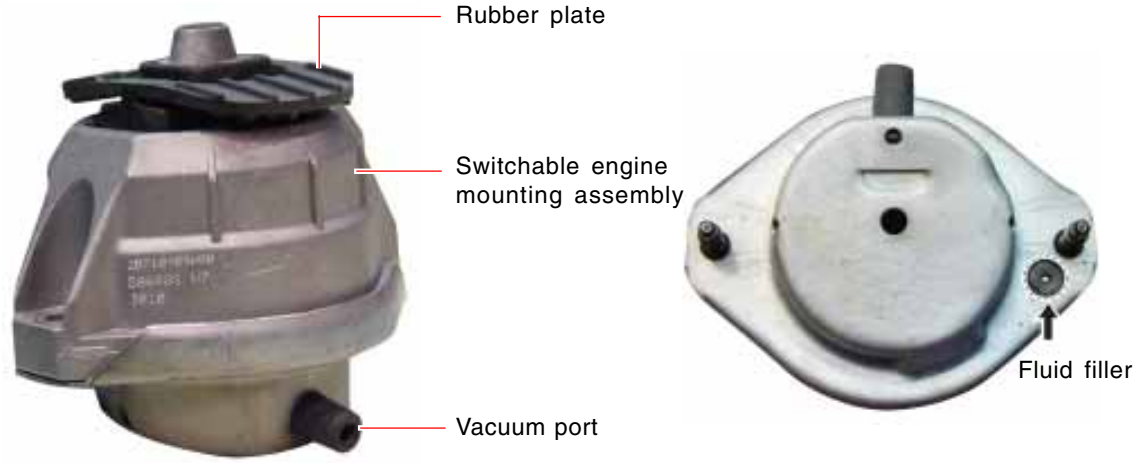
5. REMOVAL AND INSTALLATION OF SWITCHABLE ENGINE MOUNT

▶ Structure of Switchable Engine Mount



▶ Removal and Installation of Switchable Engine Mount

For the vehicle equipped with the D27DTP (POWER UP) engine, the installation/removal procedures of the switchable engine mount are different.

Location

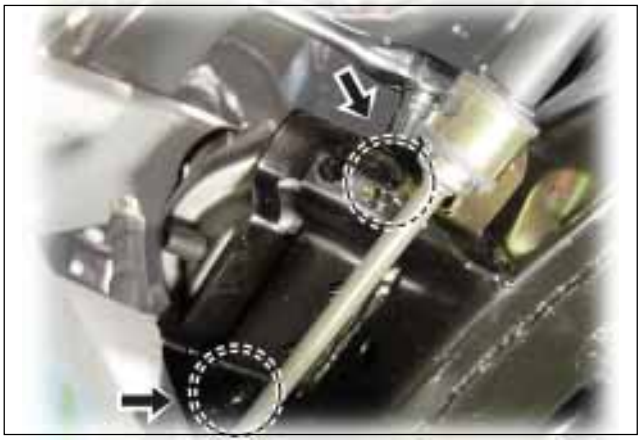
Switchable Engine Mount (LH)

※ **Preceding Work:** Perform the EAS ECU LOCK in the EAS air discharge mode using SCAN-100.

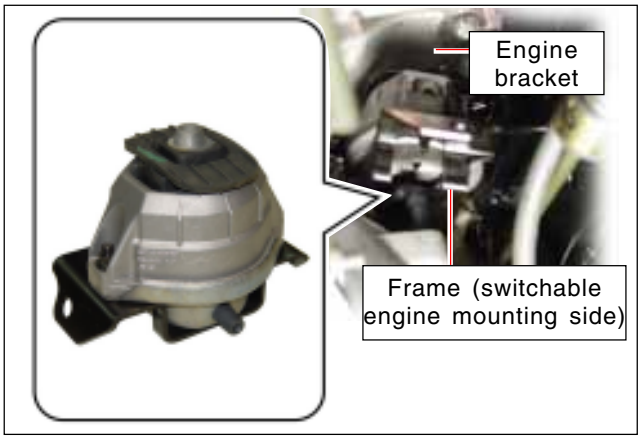
1. Unscrew the engine bracket mounting bolts.

2. Disconnect the vacuum hose of the switchable engine mount under the vehicle.

3. Lift the vehicle and unscrew two mounting bolts of the switchable engine mount bracket.



4. Lift the engine assembly a little with auxiliary lift so that the engine bracket and the switchable engine mount are separated. Remove the engine mounting adapter and the switchable engine mount at a time.



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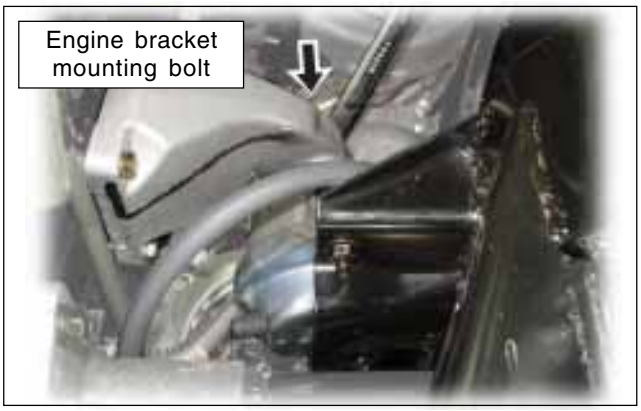
Switchable Engine Mount (RH)

1. Disconnect the vacuum hose of the switchable engine mount under the vehicle.

2. Unscrew the engine bracket mounting bolt and remove two mounting nuts on the switchable engine mount.



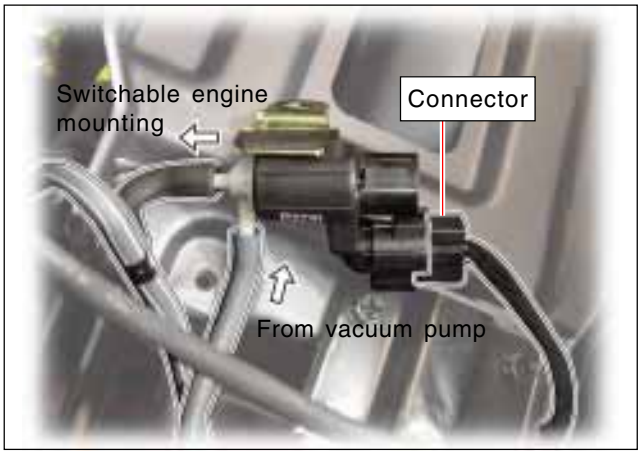
3. Lift the engine assembly a little and unscrew four engine bracket mounting bolts and remove the engine bracket.

4. Remove the RH switchable engine mount assembly.

Vacuum Solenoid Valve

1. Open the engine hood and remove the battery.

2. Unscrew the vacuum solenoid valve mounting bolt from the battery plate and disconnect the vacuum hose and connector from the vacuum solenoid to remove the vacuum solenoid.



NOTE

- **The components of vacuum solenoid valves are same in the various types of engines. However, their functions are different from each other. The vacuum solenoid valve for D27DTP (POWER UP) engine controls the vacuum in the engine mount. The vacuum solenoid valve for D27DT engine controls the vacuum in IWE (Integrated Wheel End) of 4WD system.**

ENGINE ECU

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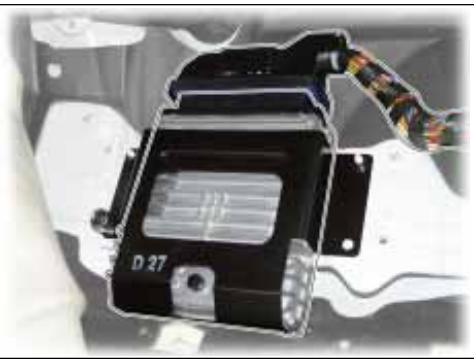
ENGINE ECU

1. OVERVIEW OF ENGINE ECU

The engine ECUs are various according to the engine model (D27DT engine, D27DT engine with CDPF and D27DTP (POWER UP) engine). For the D27DT engine with CDPF, the CDPF's function is controlled by the engine ECU with its extra pin. For the D27DTP (POWER UP) engine, one connector is added to the engine ECU (2 connectors total) to control the additional sensor, actuator and exhause gas control function.

D27DTP (POWER UP) Engine ECU - Ver. 3.2	D27DT (Including CDPF) Engine ECU - Ver. 3.1
Connector A Connector B	
	
	

For the D27DTP (POWER UP) engine, the connector pin is added and DTC is changed as the following components are added. the functions of engine ECU pin for D27DTP (POWER UP) engine and D27DTP engine are not same. For more details, refer to the respective section.

1. **E-EGR (Electric-Exhaust Gas Recirculation) Valve**
   It is electrically controlled by the ECU for precise control. Old version was controlled by the vacuum modulator.
2. **Throttle Body**
   It is electrically controlled by ECU as E-EGR valve.
3. **AQGS (Advanced Quick Glow System) Unit**
   The glow control relay (K-line communication with engine ECU) is deleted. The unit communicates via CAN communication with engine ECU. Also, the number of pins is increased as glow plug's performance has been improved (1000°C increase in approx. 2 seconds).

2. TERMINAL (PIN) ARRANGEMENT OF ECU

▶ Description of ECU Terminals for D27DTP (POWER UP) Engine

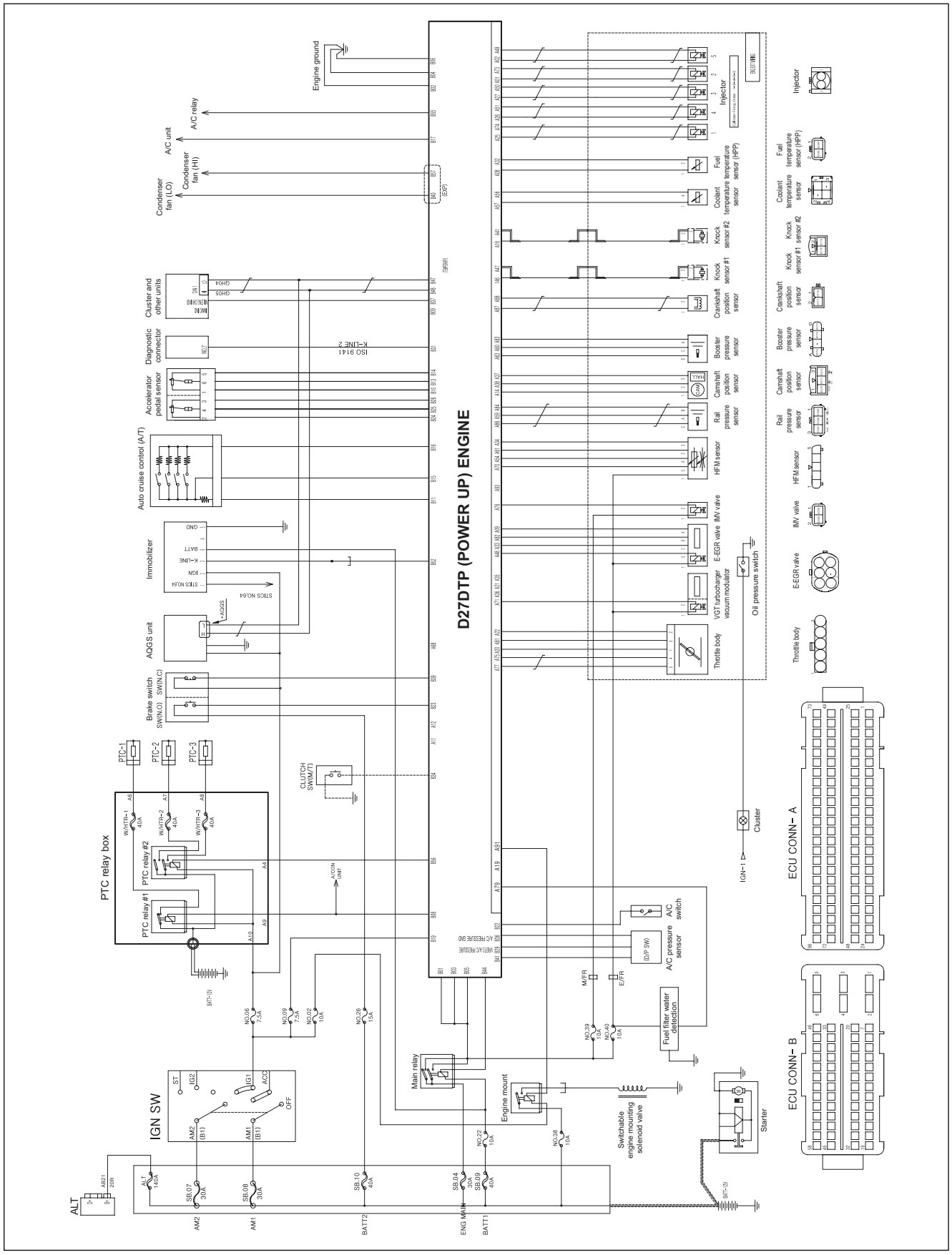
ECU Connector A (No.1 ~ 96) ECU Connector B (No.1 ~ 58)

Connector A			Connector B		
Pin No.	**Description**	**Remarks**	**Pin No.**	**Description**	**Remarks**
A1	Injector #2 (power supply)		B1	Main power (B+)	
A2	Injector #5 (power supply)		B3	Main power (B+)	
A3	Ex.Gas temp. sensor #2 ground (DPF)		B5	Main power (B+)	
A4	-		B2	Main ground	
A5	Delta pressure sensor ground (DPF)		B4	Main ground	
A6	Ex.Gas temp. sensor #2 ground (DPF)		B6	Main ground	
A7	-		B7	-	
A8	Fuel temperature sensor signal		B8	PTC #1 relay control	
A9	E-EGR valve ground		B9	-	
A10	-		B10	#2 Accelerator pedal sensor reference voltage	
A11	Vehicle speed sensor signal		B11	Auto cruise operation voltage	
A12	Vehicle speed sensor ground		B12	-	
A13	-		B13	#2 Accelerator pedal sensor signal	
A14	Camshaft position sensor ground		B14	#2 Accelerator pedal sensor ground	
A15	-		B15	Auto cruise signal input	
A16	#2 Knock sensor signal		B16	Auto cruise ground	
A17	-		B17	Blower switch signal	
A18	-		B18	PWM Electric fan control	
A19	-		B19	Ignition key signal	
A20	Throttle body reference voltage		B20	-	
A21	-		B21	-	
A22	Throttle body flap position sensor signal		B22	Air cinditioner operation signal	
A23	Ex.Gas temp. sensor #3 ground		B23	Brake switch operation signal	
A24	-		B24	#1 Accelerator pedal sensor reference voltage	
A25	Injector #1 (power supply)		B25	#1 Accelerator pedal sensor signal	
A26	Injector #4 (power supply)		B26	#1 Accelerator pedal sensor ground	
A27	Injector #3 (power supply)		B27	-	

Connector A			Connector B		
Pin No.	Description	Remarks	Pin No.	Description	Remarks
A28	-		B28	-	
A29	Ex.Gas temp. sensor #1 signal (DPF)		B29	Air conditioner refrigerant pressure sensor reference voltage	
A30	Ex.Gas temp. sensor #2 signal (DPF)		B30	-	
A31	Delta pressure sensor signal (DPF)		B31	Diagnosis connector	
A32	Fuel temperature sensor ground		B32	-	
A33	E-EGR valve reference voltage		B33	-	
A34	HFM temperature sensor signal (Analog)		B34	Clutch pedal switch input (battom)	
A35	-		B35	-	
A36	-		B36	Air conditioner pressure switch ground	
A37	Camshaft position sensor reference voltage		B37	Check engine lamp	
A38	Camshaft position sensor signal		B38	-	
A39	-		B39	Brake pedal switch	
A40	-		B40	Condenser fan (Lo) relay	
A41	#2 Knock sensor ground		B41	Air conditioner refrigerant input sensor signal	
A42	Ex.Gas temp. sensor #3 signal		B42	-	
A43	-		B43	-	
A44	-		B44	ECU main power relay	
A45	-		B45	-	
A46	#1 Knock sensor signal		B46	-	
A47	#1 Knock sensor ground		B47	CAN-LO	
A48	-		B48	CAN-HI	
A49	Injector #5 ground		B49	-	
A50	Injector #3 ground		B50	-	
A51	Injector #4 ground		B51	-	
A52	-		B52	Immobilizer (K-Line)	
A53	Delta pressure sensor voltage Ref.(DPF)		B53	-	
A54	HFM sensor temperature sensor (Digital)		B54	-	
A55	-		B55	Air conditioner compressor relay	
A56	Coolant temperature sensor ground		B56	PTC #2 relay control	
A57	Coolant temperature sensor signal		B57	Condenser fan HI relay	
A58	-		B58	-	
A59	Rail pressure sensor signal		-	-	
A60	Booster pressure sensor reference voltage		-	-	
A61	HFM sensor ground		-	-	
A62	-		-	-	

Connector A			Connector B		
Pin No.	Description	Remarks	Pin No.	Description	Remarks
A63	Booster pressure sensor signal		-	-	
A64	-		-	-	
A65	-		-	-	
A66	-		-	-	
A67	-		-	-	
A68	-		-	-	
A69	-		-	-	
A70	HFM sensor signal input		-	-	
A71	-		-	-	
A72	-		-	-	
A73	Injector #2 ground		-	-	
A74	Injector #1 ground		-	-	
A75	Throttle body drive (+)		-	-	
A76	-		-	-	
A77	Intake throttle valve (-)		-	-	
A78	-		-	-	
A79	Fuel filter water detection signal		-	-	
A80	-		-	-	
A81	Throttle body sensor ground		-	-	
A82	E-EGR valve sensor signal		-	-	
A83	Boost pressure sensor ground		-	-	
A84	Rail pressure sensor signal ground		-	-	
A85	-		-	-	
A86	Rail pressure sensor reference voltage		-	-	
A87	Crankshaft position sensor (-)		-	-	
A88	Crankshaft position sensor (+)		-	-	
A89	-		-	-	
A90	-		-	-	
A91	Switchable engine mounting control		-	-	
A92	-		-	-	
A93	-		-	-	
A94	-		-	-	
A95	-		-	-	
A96	-		-	-	

▶ D27DTP (POWER UP) ENGINE'S ECU CIRCUIT



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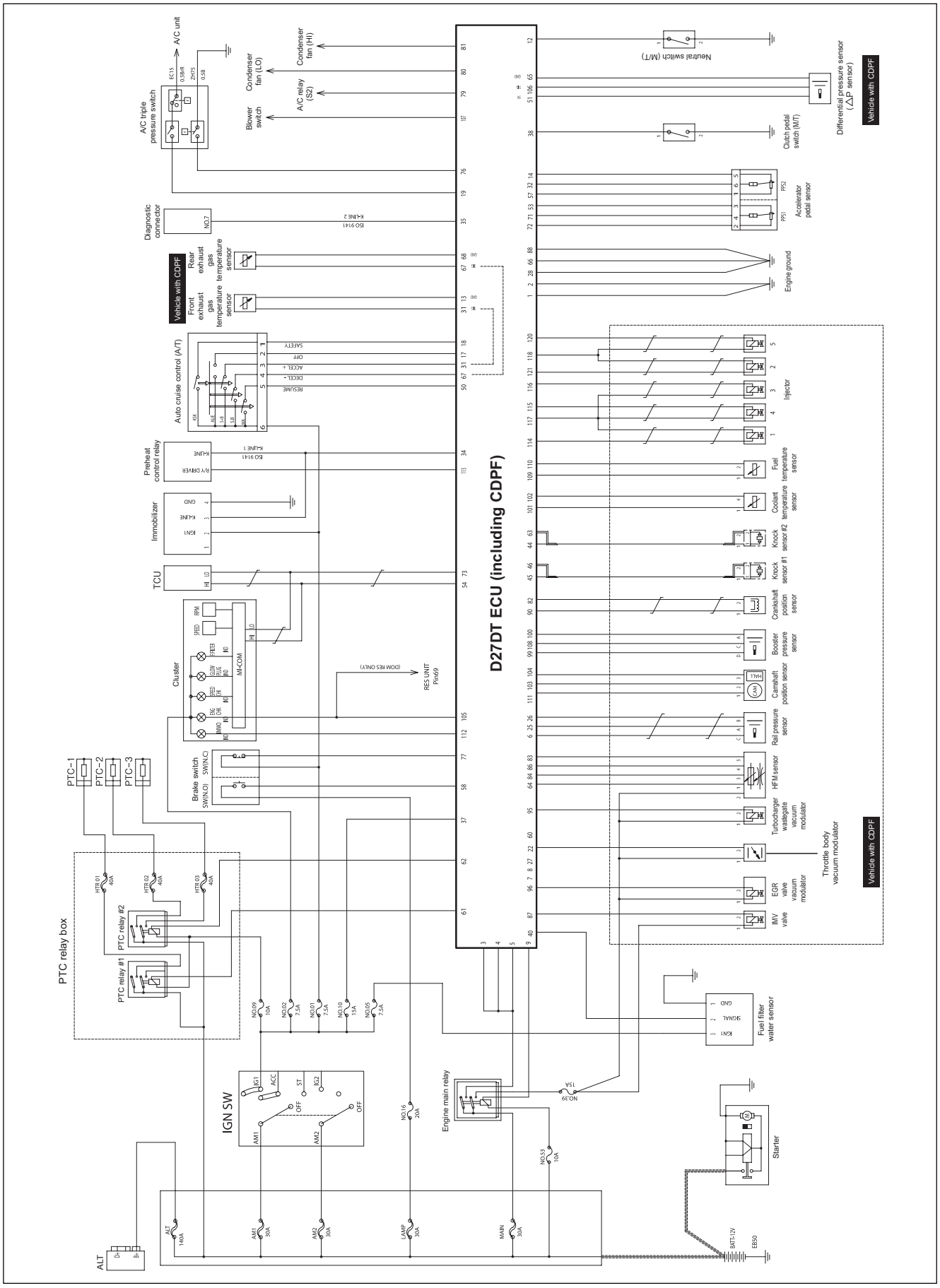

ENGINE ECU

D27DTP/D27DT (EU4) SM - 2006.08

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AFFECTED VIN	

▶ Description of ECU Terminals for D27DT Engine and D27DT Engine with CDPF

Pin No.	D27DT Engine	D27DT + CDPF Engine	Remarks
1	Engine ground	←	
2	Engine ground	←	
3	Main power (B+)	←	
4	Main power (B+)	←	
5	Main power (B+)	←	
6	Rail pressure sensor power supply	←	
7	-	-	
8	-	-	
9	ECU power hold relay	←	
10	-	-	
11	-	-	
12	Neutral switch	←	
13	-	CDPF front exhaut temperature sensor ground	
14	ACC2 sensor ground	←	
15	-	-	
16	-	-	
17	Auto cruise OFF	←	
18	Auto cruise safety switch	←	
19	A/C pressure (Hi / Low)	←	
20	-	-	
21	-	-	
22	-	Vacuum modulator for controlling throttle body flap	
23	-	-	
24	-	-	
25	Rail pressure sensor signal	←	
26	Rail pressure sensor ground	←	
27	-	-	
28	Engine ground	←	
29	-	-	
30	-	-	

Pin No.	D27DT Engine	D27DT + CDPF Engine	Remarks
31	Auto cruise acceleration signal (for export)	CDPF front exhaut temperature sensor signal	
32	ACC2 sensor signal	←	
33	-	-	
34	K-LINE # 1 (preheat/Immobilizer)	←	
35	K-LINE # 2 (Self diagnosis connector)	←	
36	Vehicle speed sensor signal input (vehicle without ABS/ESP)	←	
37	1G 1	←	
38	Clutch pedal switch (M/T)	←	
39	-	-	
40	Fuel filter water detection sensor signal	←	
41	-	←	
42	-	-	
42	-	-	
44	Knock sensor signal (# 2)	←	
45	Knock sensor signal (# 1)	←	
46	Knock sensor ground (# 1)	←	
47	-	-	
48	-	-	
49	-	-	
50	Auto cruise completion signal	-	
51	-	Vehicle pressure sensor operating reference voltage (5V)	
52	-	-	
53	ACC 1 sensor ground	←	
54	CAN - HI	←	
55	-	-	
56	-	-	
57	ACC 2 sensor ground	←	
58	Brake lamp switch(Stop lamp switch)	←	
59	-	-	
60	-	-	
61	PTC # 1 relay	←	
62	PTC # 2 relay	←	
63	Knock sensor signal (# 2)	←	
64	HFM sensor (air temperature signal)	←	
65	-	Vehicle pressure sensor ground	
66	Engine ground	←	
67	Auto cruise deceleration signal	CDPF Rear exhaust temperature sensor signal	Function is different by systems
68	-	CDPF Rear exhaust temperature sensor ground	

Pin No.	D27DT Engine	D27DT + CDPF Engine	Remarks
69	-	-	
70	-	-	
71	ACC1 sensor signal	←	
72	ACC1 sensor signal	←	
73	CAN - LO	←	
74	-	-	
75	-	-	
76	A/CON pressure switch	←	
77	Brake switch (stop lamp switch)	←	
78	-	-	
79	A/CON pressure switch	←	
80	Cooling fan LOW	←	
81	Cooling fan HIGH	←	
82	Crank position sensor ground	←	
83	HFM sensor (air mass signal)	←	
84	HFM sensor (ground)	←	
85	-	-	
86	HFM sensor (power supply)	←	
87	IMV (fuel pressure regulating valve)	←	
88	Engine ground	←	
89	-	-	
90	Crank position sensor signal	←	
91	-	-	
92	-	-	
93	-	-	
94	-	-	
95	Waste gate actuator vacuum modulator	←	
96	EGR valve Vacuum modulator	←	
97	-	-	
98	-	-	
99	Booster pressure sensor signal	←	
100	Booster pressure sensor ground	←	
101	Coolant temperature signal	←	
102	Coolant temperature sensor ground	←	
103	Cam position sensor signal	←	
104	Cam positionsensor ground	←	
105	Engine malfunction indicator light (Instrument panel)	←	
106	-	Pressure difference sensor signal	
107	A/CON blower switch	←	
108	Booster pressure sensor signal	←	
109	Fuel temperature sensor signal	←	

Pin No.	D27DT Engine	D27DT + CDPF Engine	Remarks
110	Fuel temperature sensor ground	←	
111	Cam position sensor power supply	←	
112	Immobilizer warning lamp	←	
113	Glow plug control signal (R / Y)	←	
114	Injector # 1	←	
115	Injector # 4	←	
116	Injector # 3	←	
117	Injector power supply (#1. 3. 4)	←	
118	Injector power supply (#2, 5)	←	
119	-	-	
120	Injector # 5	←	
121	Injector # 2	←	

Each pin number for D27DT engine and D27DT engine with CDPF is same. However, their engine ECUs are not same.

With the CDPF, the functions related to the following sensors are added to the ECU pins.

1. **Exhaust gas temperature sensor:** ECU pin #13, #31 (front exhaust gas temperature sensor), ECU pin #67, #68 (rear exhaust gas temperature sensor)
2. **Pressure difference sensor (DP sensor):** ECU pin #51, 65 and 106
3. **Throttle body vacuum modulator:** ECU pin #22

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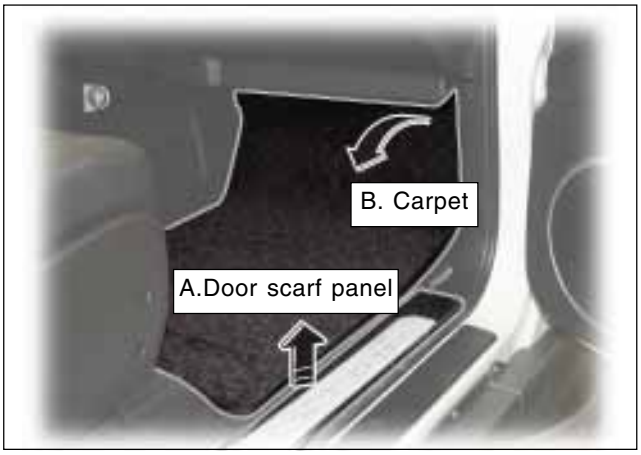
3. REMOVAL AND INSTALLATION OF ENGINE ECU (BASED ON D27DTP (POWER UP) ENGINE)

▶ Removal and Installation

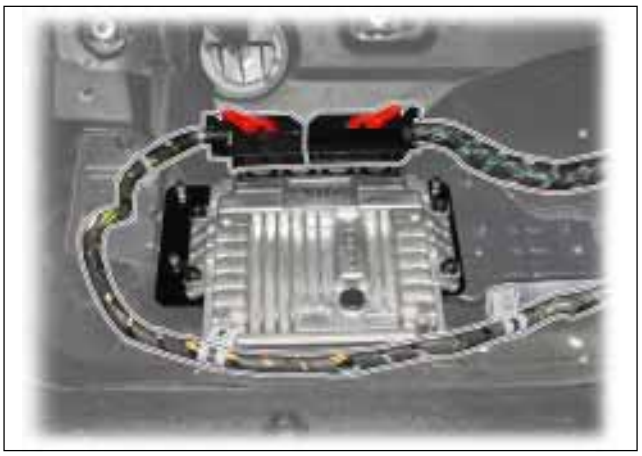
※ **Preceding Work:** Disconnect the battery negative cable.

1. Open the passenger's door and remove the carpet (B) and door scarf panel (A). lift the front side of the floor mat and cover mounting nuts on the ECU unit and remove the ECU unit cover.

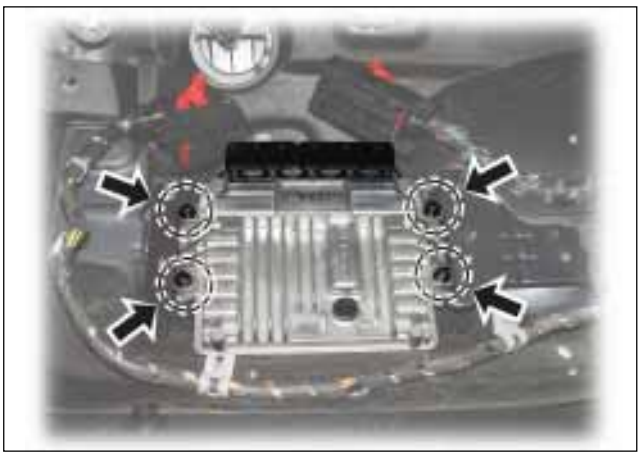


2. Remove the LH/RH connectors of the ECU unit.

NOTE
- **Push the fixing lever on the connector to the front to disconnect the connector.**



3. Unscrew four ECU unit mounting nuts and remove the ECU unit.



MEMO

DIAGNOSIS

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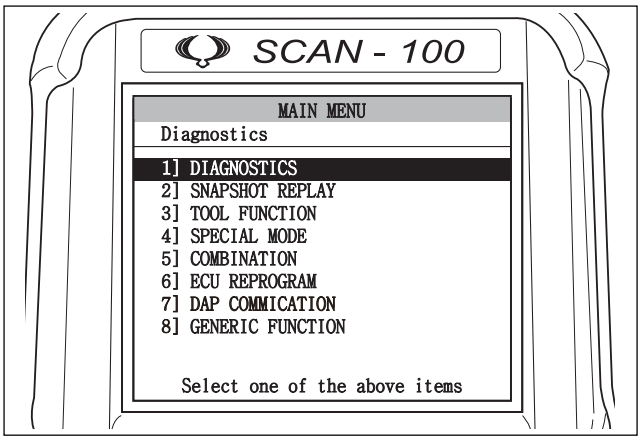
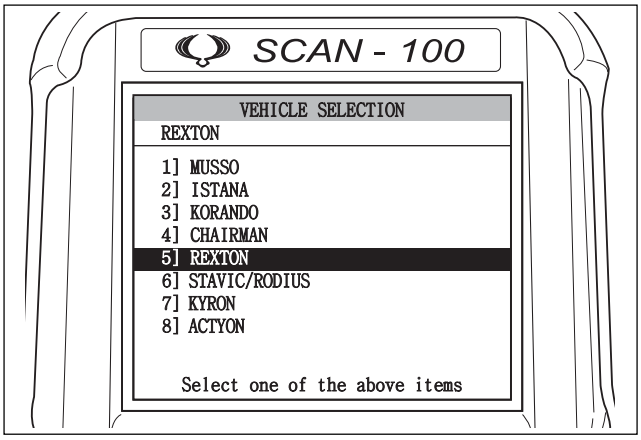
How to use SCAN-100 (D27DT/D27DTP Engine)

1. ENTERING DIAGNOSIS PROCEDURES

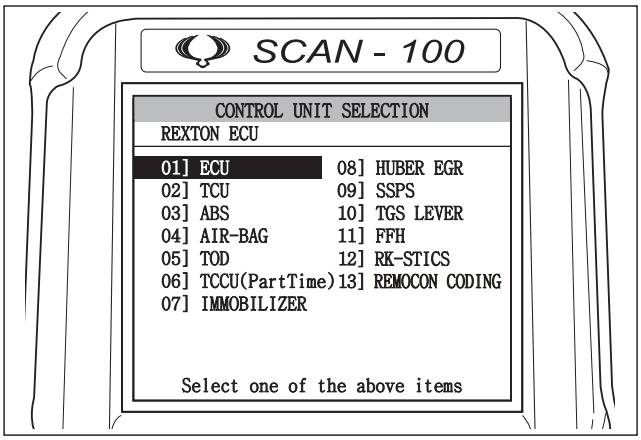
1. Select “1] DIAGNOSIS” and press (ENTER) on “MAIN MENU” screen.



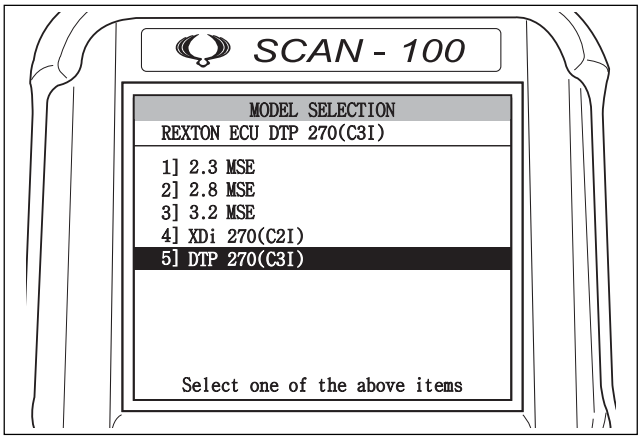
2. Select the desired model (REXTON) and press (ENTER) on “VEHICLE SELECTION” screen.



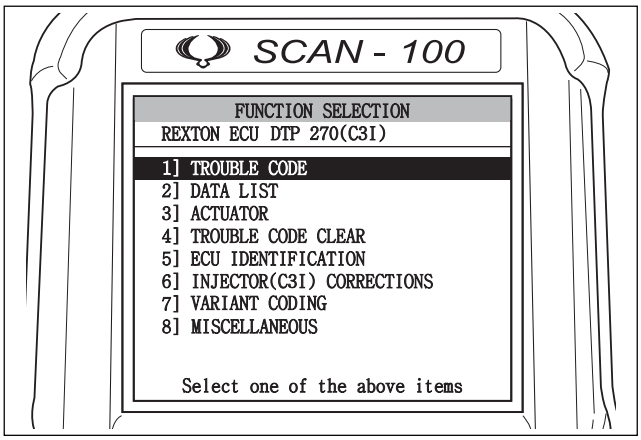
3. Select “1] ECU” and press (ENTER) on “CONTROL UNIT SELECTION” screen.



4. Select the desired engine on [MODEL SELECTION] screen and press (ENTER).



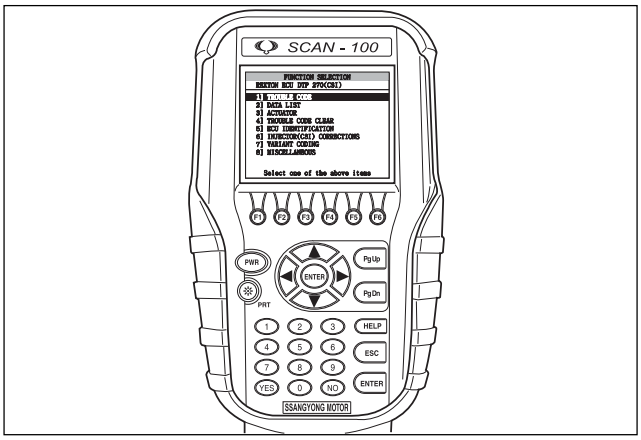
5. The [FUNCTION SELECTION] screen is displayed. Select the item to be checked.



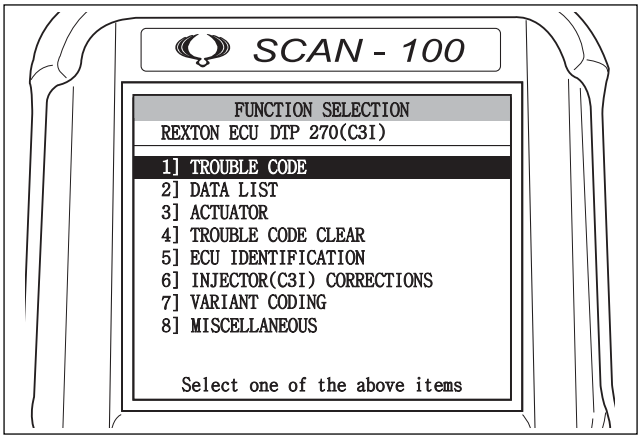
2. SELECTION OF CHECKING ITEMS FOR ENGINE D27DT/ D27DTP (POWER UP)

▶ Check the Trouble Code

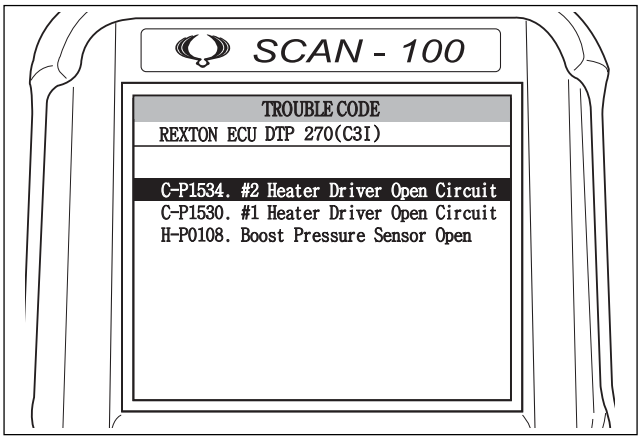
※ **Preceding Work:** Perform the "Entering Diagnosis Procedures"



1. Select "1] TROUBLE CODE" and press (ENTER) on "FUNCTION SELECTION" screen.

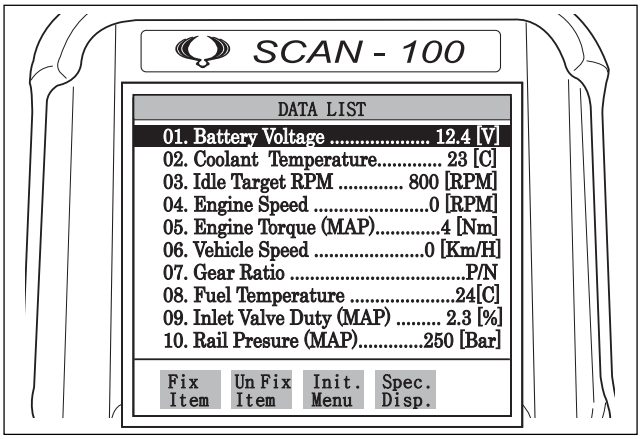


2. The [TROUBLE CODE] screen is displayed. It contains the information for the trouble.



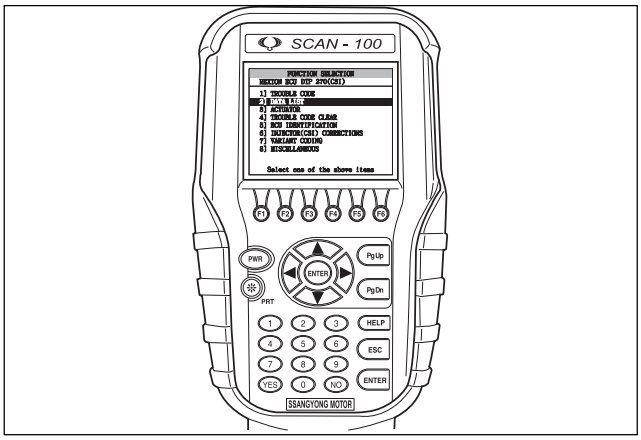
NOTE
- **If there is not any fault, "No Diagnostic Trouble Codes" message appears.**

3. When selecting a trouble code, then
   if you press (ENTER) : Displays the sensor data for the detected trouble (Freeze Frame Mode).
   if you press (HELP) : Displays the help tips for the detected trouble.

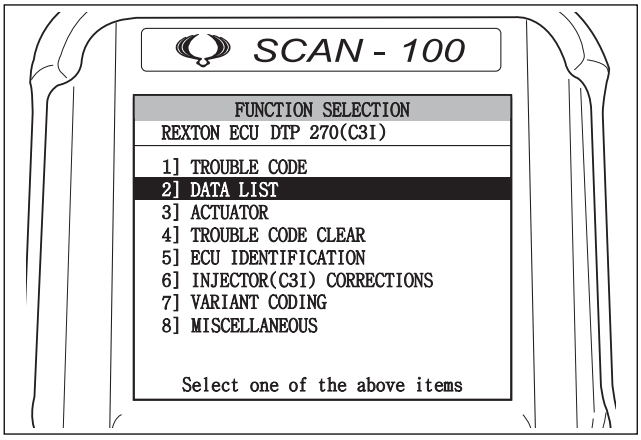


▶ Sensor Data Check

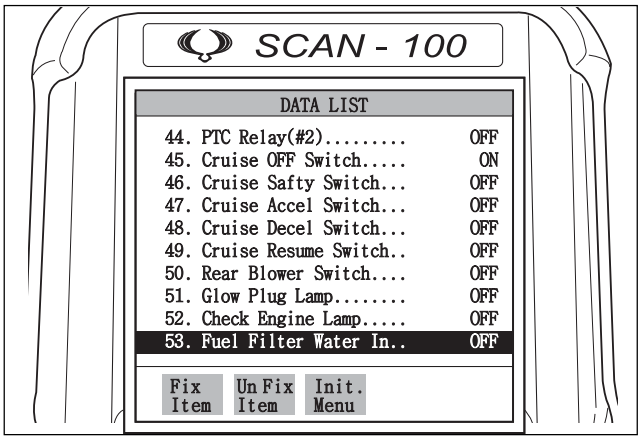
※ **Preceding Work:** Perform the “Entering Diagnosis Procedures”



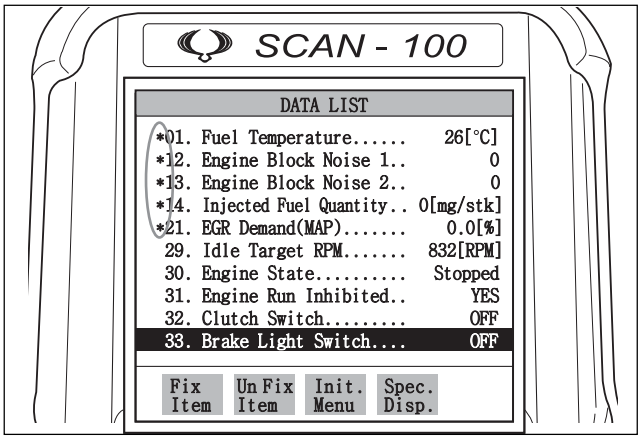
1. Select “2] DATA LIST” and press (ENTER) on “FUNCTION SELECTION” screen.



2. The screen shows all the sensor data.



3. Select the items you want to see and press (F1) key to freeze them.



NOTE

- **You can freeze up to 5 items (*: selected items).**

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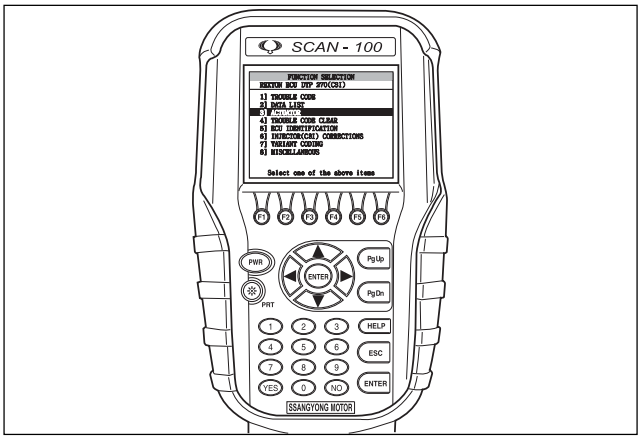
▶ Actuator Check

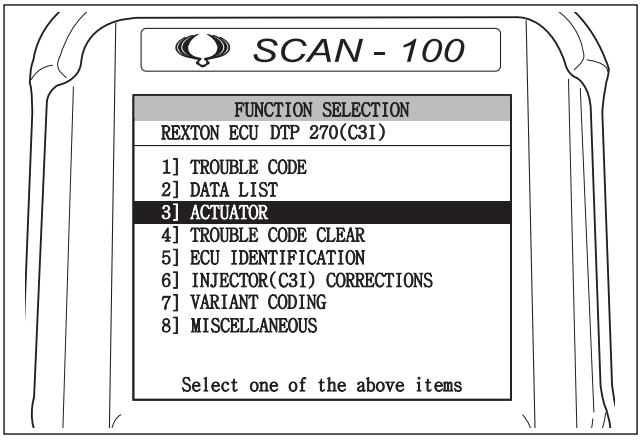
※ **Preceding Work:** Perform the “Entering Diagnosis Procedures”

NOTICE

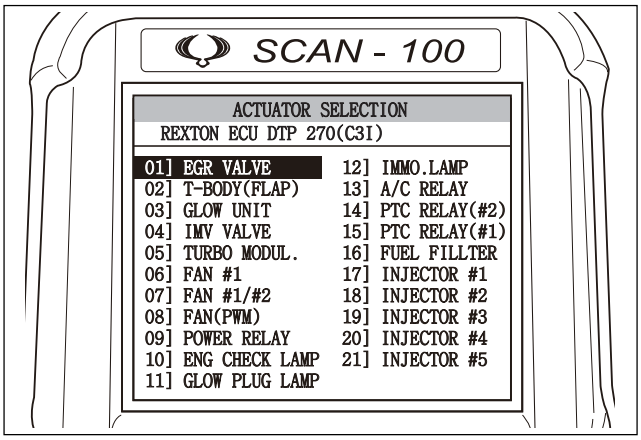
- **This section is subject to change or update from time to time so it is mainly described for the diagnostic progress. For actual display items, refer to SCAN-100 screens.**



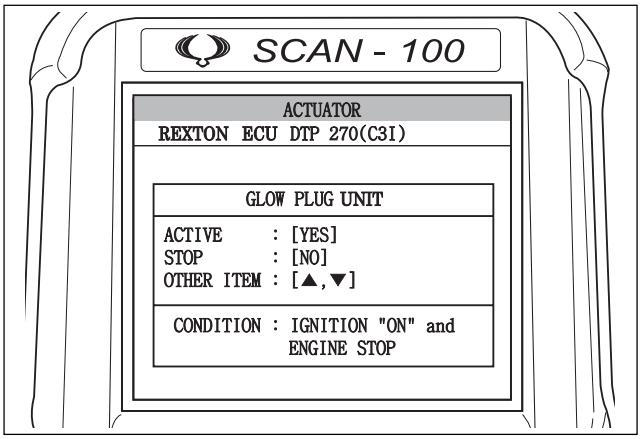
1. Select “3] ACTUATOR CHECK” and press (ENTER) on “FUNCTION SELECTION” screen.



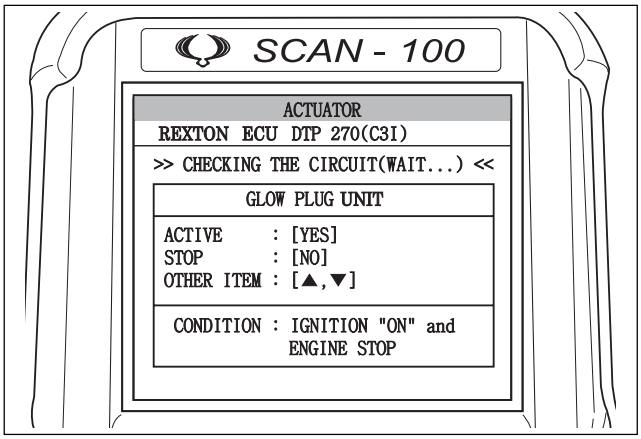
2. The screen shows 21 items. Select the item you want to see and press (ENTER).



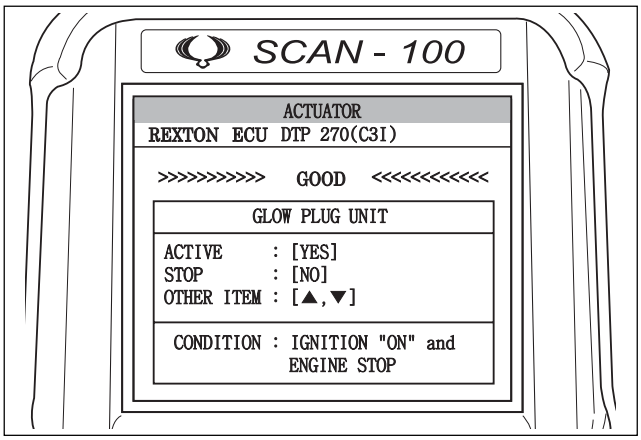
3. For example, if you select “03] GLOW UNIT” item and press (ENTER) , the screen as shown in figure is displayed.



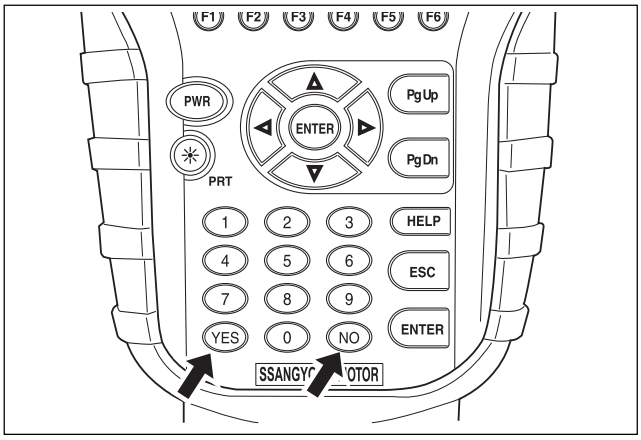
4. If you want to operate the glow plug relay, press "YES" key. The "CHECKING THE CIRCUIT (WAIT...)" message appears and the glow plug warning light in the instrument cluster comes on.



5. If the system operates properly, Scan-100 displays "GOOD".



6. If you want to stop the operation, press "NO" key.



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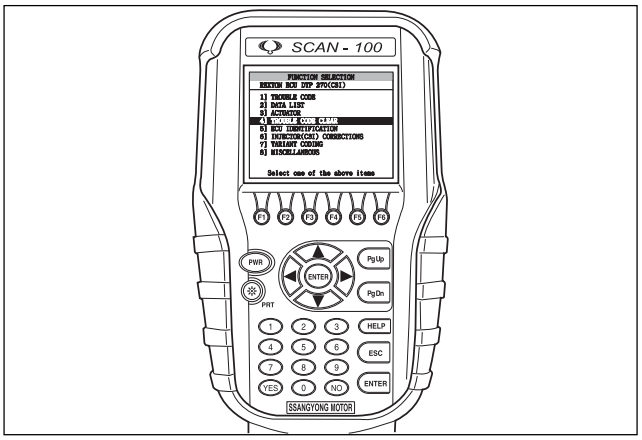
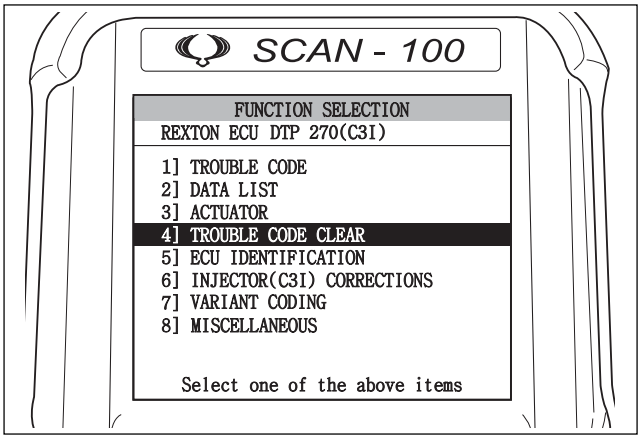
▶ Trouble Code Clearing

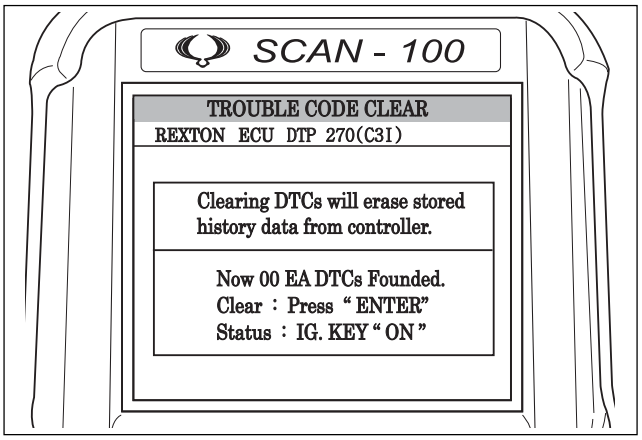
※ **Preceding Work:** Perform the "Entering Diagnosis Procedures"



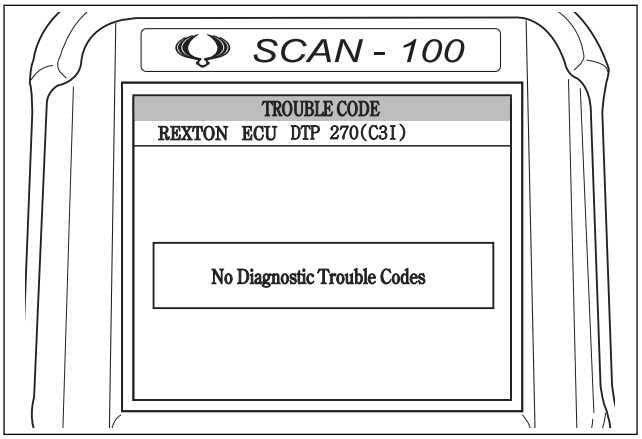
1. Select "4] TROUBLE CODE CLEAR" and press (ENTER) on "FUNCTION SELECTION" screen.



2. The "DIAGNOSTIC TROUBLE CODES" screen is displayed.
   If you press (ENTER) key, the trouble code is cleared.
   But, the active trouble code (C) cannot be cleared.

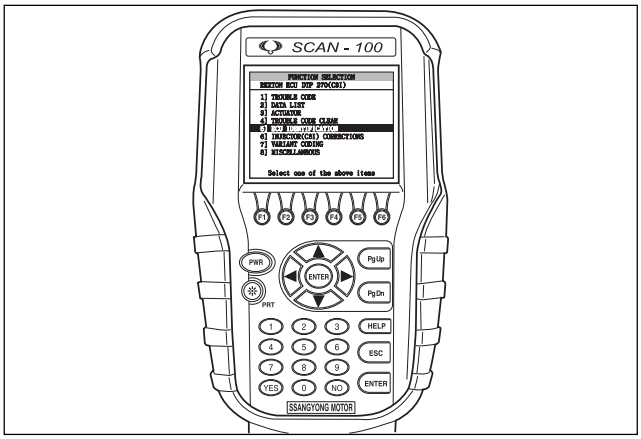


3. When the procedure is completed, return to "1] TROUBLE CODE" screen and check if the trouble codes have been completely cleared. But, the active trouble code (C) cannot be cleared.

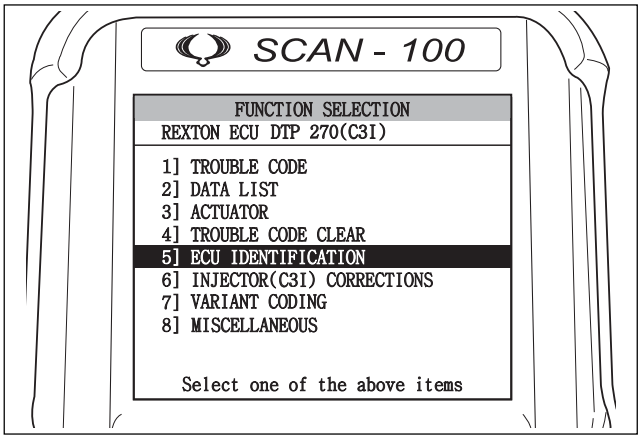


▶ ECU Identification

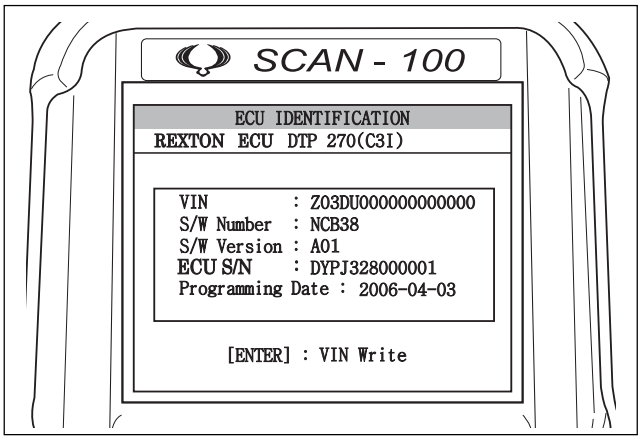
※ **Preceding Work:** Perform the “Entering Diagnosis Procedures”



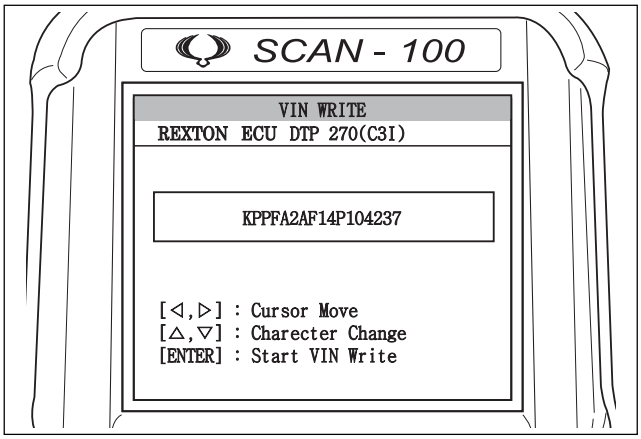
1. Select “5] ECU IDENTIFICATION” and press (ENTER) on “FUNCTION SELECTION” screen.



2. The “ECU IDENTIFICATION” screen showing the VIN, ECU software number, ECU software version and programming date is displayed.



3. If you have replaced the ECU, press (ENTER) to enter the vehicle identification number.



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▶ Injector Coding (C2I/C3I)

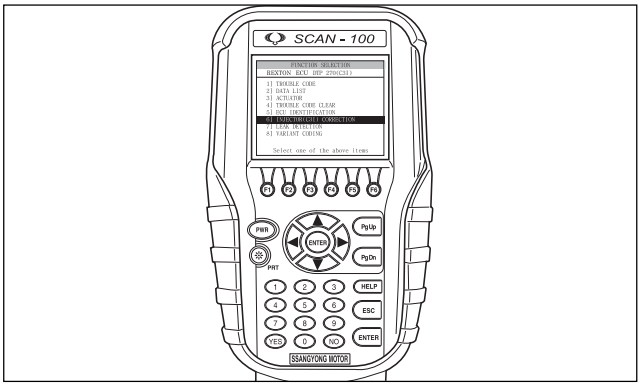
※ **Preceding Work:** Perform the "Entering Diagnosis Procedures"

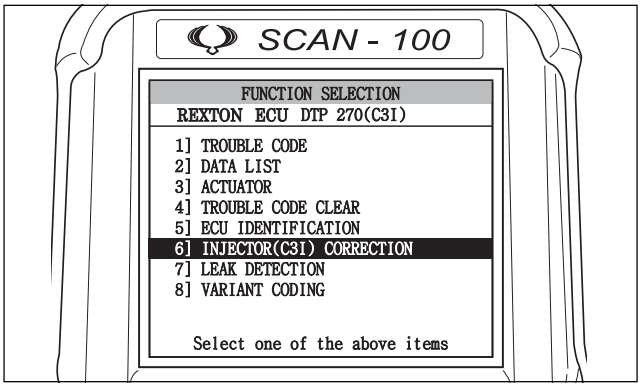
1. Select "6] INJECTOR (C2I) CODING" and press (ENTER) on "FUNCTION SELECTION" screen.

* Coding of D27DTP (POWER UP) Engine Injector: C3I (20 digits)
* Coding of D27DT Engine Injector: C2I (16 digits: samp with current version)

NOTICE

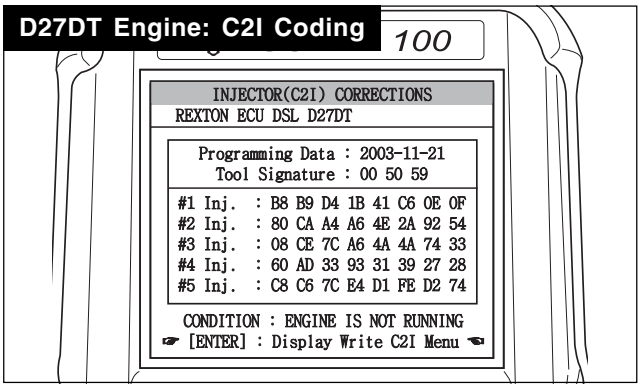
- **If the injector/ECU has been replaced or the injector system failure is suspected, go to C2I or C3I Coding item and check the injector and coded injector C2I or C3I value.**



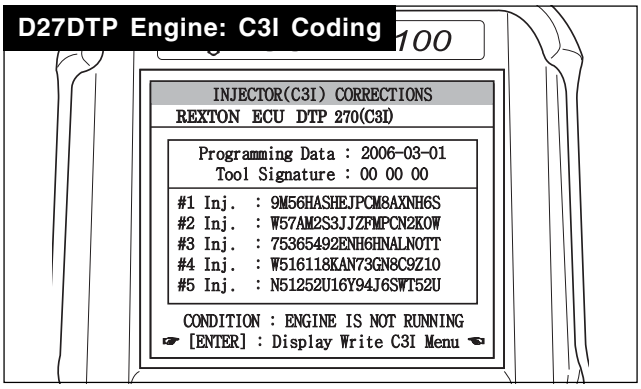


2. The "INJECTOR (C2I or C3I) CODING" screen showing the current C2I or C3I coding values of #1 to #5 injector is displayed. If necessary, press (ENTER) key and enter the value.

D27DT Engine: C2I Coding



D27DTP Engine: C3I Coding



3. If you have replaced the ECU, enter the C2I or C3I value for the relevant injector.

D27DTP (POWER UP) Engine	D27DT Engine
	

NOTE

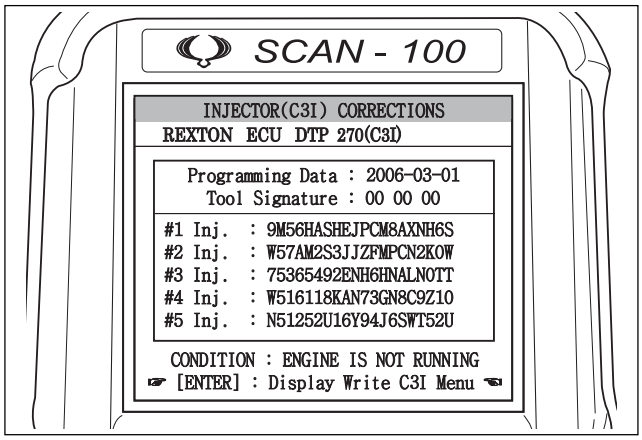
- **The C2I value of injector is on the label.**
- **C2I coding number: 16 digits (ex, C0 2D 835....)**
- **C3I coding number: 20 digits (ex, ZD87E03R....)**

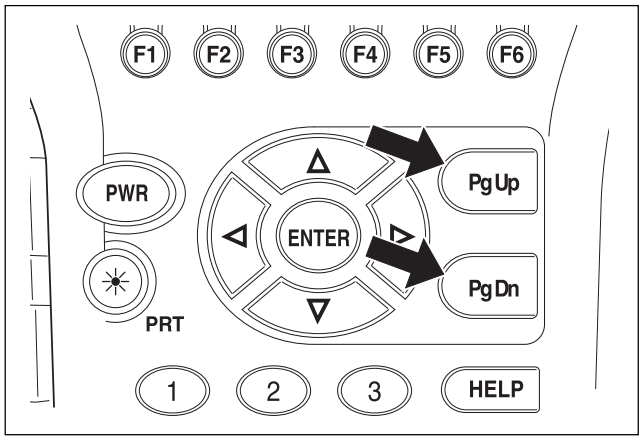
3-1. If you press [ENTER] on C3I (C2I) display, the recoding menu of C3I or C2I appears.

C3I is coded by using alphabet letters up to Z. If you want to change a number in the coding letters, press the number keypad of SCAN-100. If you press PgUp or PgDn key, you can enter alphabet letters again.

NOTE

- **The alphanumeric letters are from A ~ Z followed by 0 ~ 9.**

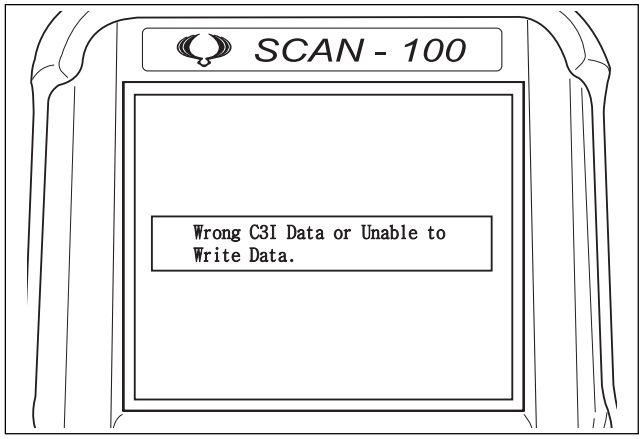




3-2. If you enter the invalid C2I or C3I value of the relevant injector, the message as shown in figure appears with alarm sound.

NOTE

- **If you want to return to previous screen, press ESC key. You can see the previous C2I or C3I value.**



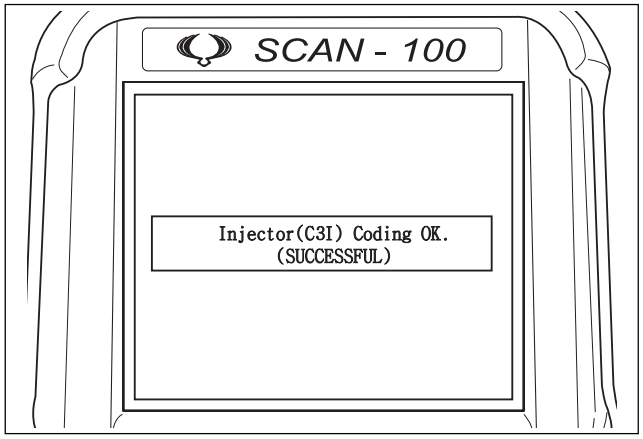
3-3. If you enter the valid C2I or C3I value of the relevant injector, the message as shown in figure appears with alarm sound.

NOTE

- **If you return to previous screen, press ESC key. Then, the new C2I or C3I values are displayed.**

NOTICE

- **When coding C2I or C3I, if you select the engine out of the models, the injector coding items pertaining to the engine appear.**



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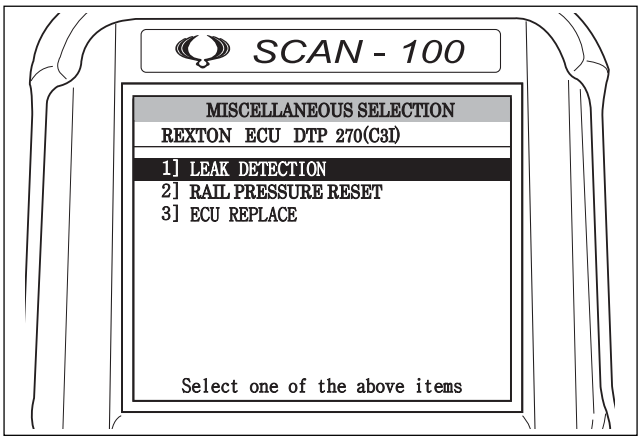
▶ Leak Detection

※ **Preceding Work:** Perform the “Entering Diagnosis Procedures”

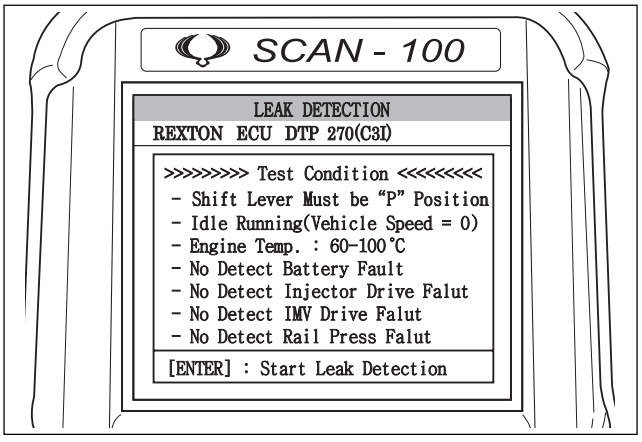
NOTE

- **This item is for checking the high fuel pressure after the IMV supply line of HP pump in DI engine fuel system. If you still suspect that the fuel pressure system is defective even after no trouble is detected, perform the fuel pressure test again by using a fuel pressure tool kit.**

1. [Select “1] LEAK DETECTION” and press (ENTER) on “MISCELLANEOUS SELECTION” screen.



2. The “LEAK DETECTION” screen showing the checking conditions as shown in figure is displayed.



3. The pressure leakage check for fuel system should be done under idling, and as the engine RPM is raising during the self test, the shift lever should be place to “P” position.

▶ Variant Coding

For REXTON II, D27DTP (POWER UP) engine is newly adopted but the coding methods are almost same as the variant coding items of the previous model. The variant coding items entering the vehicle information to the engine ECU are changed a little. As the model for exporting and current model contain the unavailable items, it is necessary to variant code to the engine ECU if the engine ECU or the ECU of other systems are replaced.

Most of all, you should check the variant coding items if the abnormal operation of any systems or errors occur.

Coding Item

1. Engine-related Coding Item

Variant Coding Item	Selection	Description
ECU coding completed	No/Yes	(YES) is automatically selected.
Supplementary heater (PTC)	No/Yes	Select (YES) only for the vehicle with PTC type supplementary heater (in DI engine).
Auto cruise	No/Yes	Only for the vehicle with auto cruise.
Immobilizer	No/Yes	Select (YES) only for the vehicle with immobilizer system.
Remote starter	No/Yes	No remote starter system is applied to this model. However, must select (NO) to confirm that this vehicle doesn't have remote starter.
Vehicle speed signal	CAN/WIRE	Select CAN.
ABS or ESP	No/Yes	Select (YES) only for the vehicle with ABS or ESP system.
TOD / Part time TCCU (4WD)	No/Yes	Select (YES) only for the vehicle with TOD/part time 4WD. * Select (NO) for the vehicle with AWD or 2WD.
A/CON	No/Yes	Select (YES) only for the vehicle with A/C.
PWM Condenser Fan	No/Yes	Select (YES).
Neutral signal input (M/T “N” signal)	No/Yes (WIRE)/CAN	Select only if the vehicle is equipped with manual transmission neutral switch. **NO** : Automatic transmission equipped vehicle or manual transmission neutral switch not equipped vehicle (adopted the manual transmission neutral switch for NEW REXTON from Sep 15, 20004) **WIRE** : Adopted neutral switch among REXTON models with manual transmission **CAN** : REXTON II, ACTYON, KYRON and RODIUS with manual transmission (REXTON II is not equipped with manual transmission) **NOTICE** • **As REXTON II D27DTP (POWER UP) engine is not equipped with manual transmission, select (NO).**
Engine mount level control (Switchable engine mounting)	No/Yes	- D27DTP (POWER UP) Engine: Select (YES). - D27DT Engine: Select (NO).
Glow plug module	Relay/AQGS (CAN)	- D27DTP (POWER UP) Engine: Select AQGS (CAN). - D27DT Engine: Select Relay.

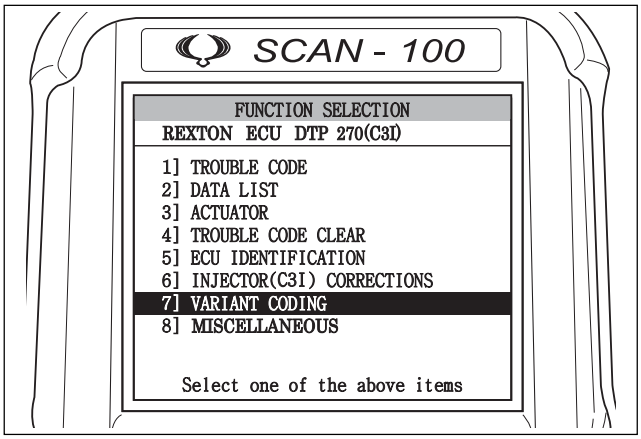
2. Chassis Related Coding Item

Variant Coding Item	Selection	Description
Engine model	D27DTP/D27DT/D20DT	Select the appropriate engine.
DOM/EXP	DOM/GENERAL/EU	Select the region.
EAS	NA/ECS/EAS (2)/EAS (4)	Select the appropriate item. EAS (2): 2 corner EAS, EAS (4): 4 corner EAS
EPB	No/Yes	For vehicle with EPB, select (YES). - Automatically selected (auto coding)
Telematics	No/Yes	For vehicle with telematics, select (YES).
Selector lever	ION (BTRA)/DC lever/ DURA lever	Select the appropriate selector lever. For REXTON II, select the DURA lever.
ABS/ESP	NA/ABS/TCS/ESP	Select the appropriate system.
SSPS	No/Yes	If equipped, select (YES).
TPMS	No/Yes	If equipped, select (YES).
Transfer case (4WD)	2WD / TOD / P/T 4WD / AWD / P/T 4WD (non-4L)	Select the appropriate system.
Transmission type	M/T / DC5AT / ION (BTRA) AT	Select the appropriate system.
Coding	CODING COMPLETED	Select the coding status.

Coding Procedures

This descripes how to progress variant coding.

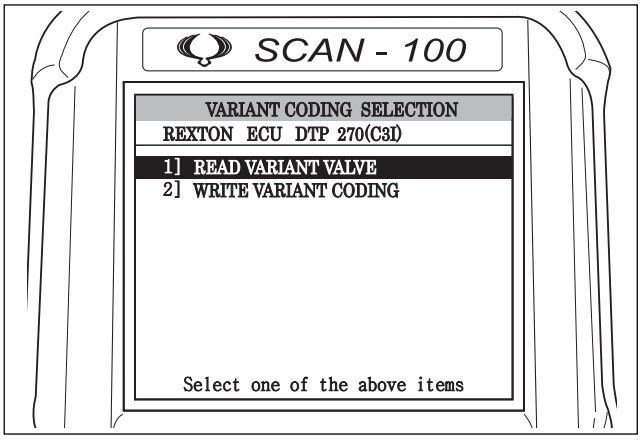
1. Select “7] VARIANT CODING” and press (ENTER) on “FUNCTION SELECTION” screen.



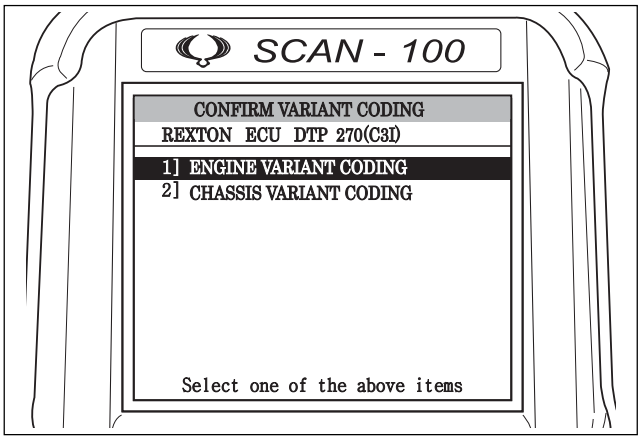
NOTICE

- **As the pictures are used to help the user to easily understand, they may be different from the actual procedures. Please follow the contents and steps on SCAN-100 screens.**

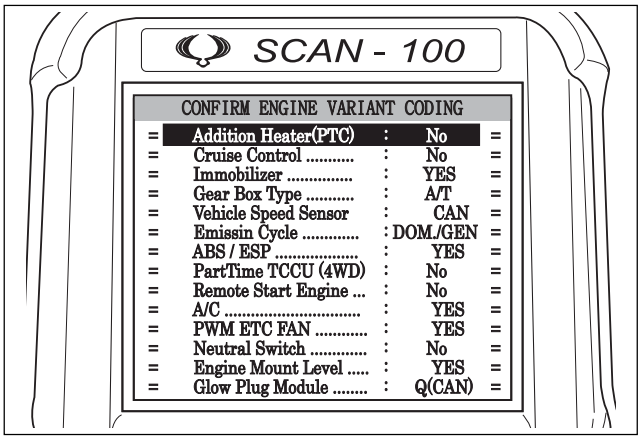
2. When the “VARIANT CODING” screen is displayed, select “1] READ VARLANT VALVE” and press (ENTER).



3. Select the variant coding item related to the engine or chassis.



4. The “VARIANT CODING” screen showing the currently equipped devices is displayed.



NOTE

- **Please refer to the remarks (mentioned at the beginning of the variant coding items) about the coding items related to engine and chassis.**

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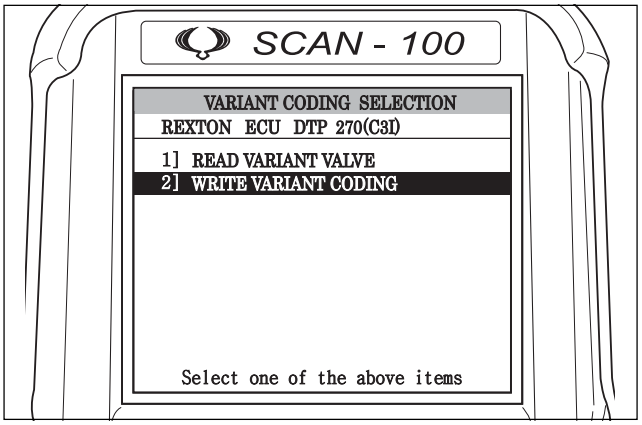
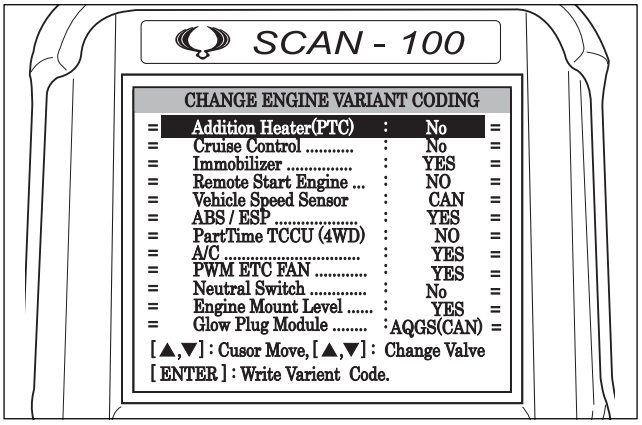
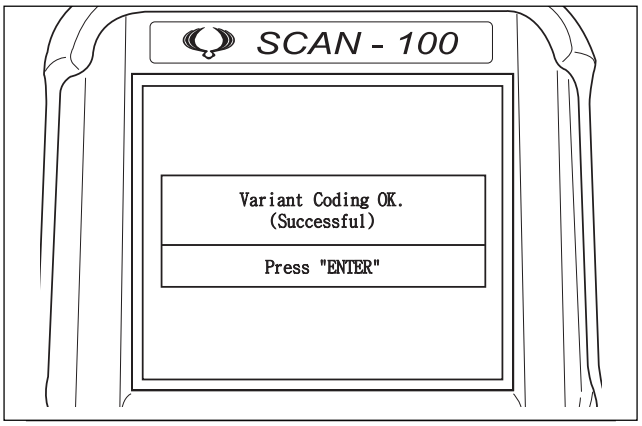
5. If you need to change the variant coding, press ESC key to return to “VARIANT CODING” screen. On the screen, select “2] WRITE VARIANT CODING” and press ENTER.



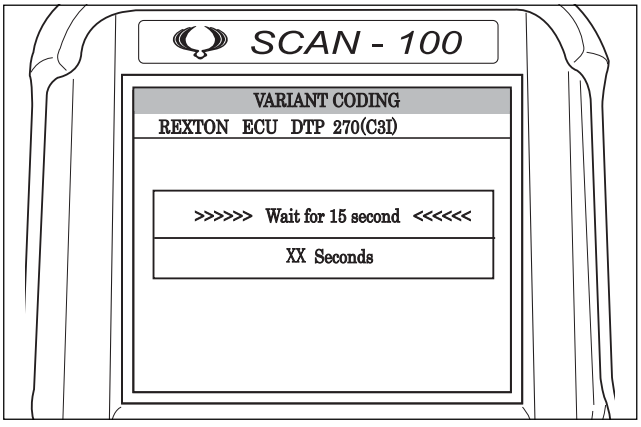
6. When the “VARIANT CODING” screen is displayed, change the item using arrow keys.



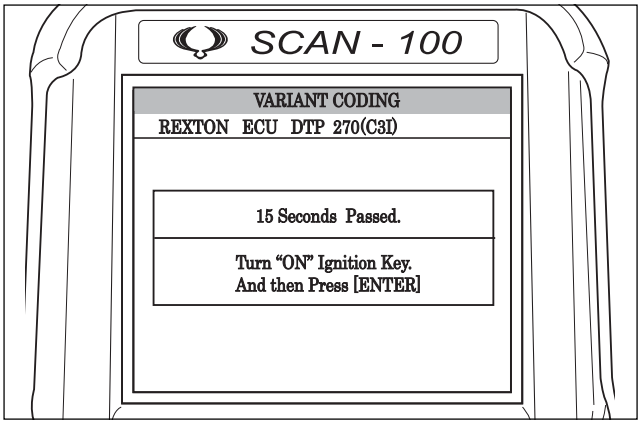
7. If you press ENTER, the message as shown in figure appears. And, then “VARIANT CODING” screen is displayed.



8. If the “ENTER” key is pressed after turning “OFF” the ignition, the standby screen will be displayed for 15 seconds.



9. After 15 seconds, if the ignition key is “ON” and the “ENTER” key is pressed, then the coding is completed.



▶ ECU Replace

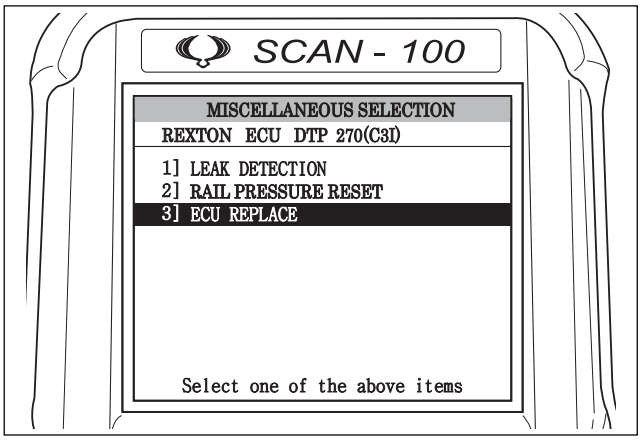
When replacing the engine ECU, there are two ways to replace the ECU according to the status of ECU. Firstly, when the ECU is able to communicate with SCAN-100, you can immediately transfer the vehicle identification number, variant coding value, and C2I/C3I coding value that the ECU is memorizing to SCAN-100 device, and then update the new ECU using this information, without manually entering the values. But when the ECU is not able to communicate with SCAN-100, you should manually enter all the values.

For more information, refer to the below.

ECU Replace (if possible to communicate with SCAN-100)

※ **Preceding Work:** Perform the "Entering Diagnosis Procedures"

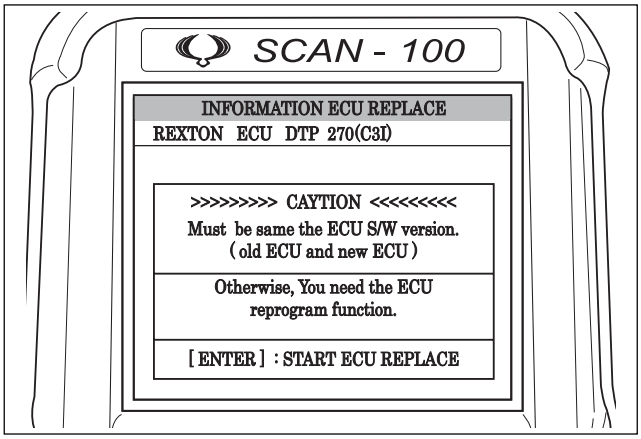
1. Select the desired model and press ENTER after selecting "3] ECU Replace" on "MISCELLANEOUS SELECTION" screen.



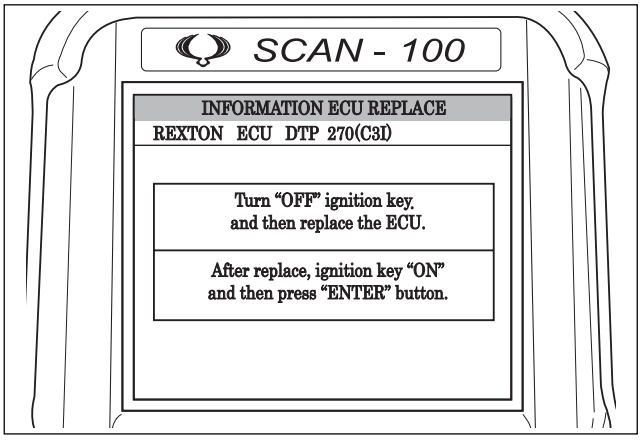
2. The version of the new ECU should be same as that of the ECU equipped in vehicle. If they differ each other, re-program after replacement. Press ENTER key to record the ECU information.

NOTICE

- **Temporarily transfer the data stored in the ECU equipped in vehicle to SCAN-100 device. At this time, be careful not to turn off the power of the device. If this happens, all the data in the device will be lost.**



3. Turn the ignition key to "OFF" and replace the ECU.



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4. ECU Replace

The version of D27DTP (POWER UP) engine ECU is upgraded from v. 3.1 to v. 3.2 due to adding or modifying of the sensors or other systems, the number of connectors is also changed from one to two.

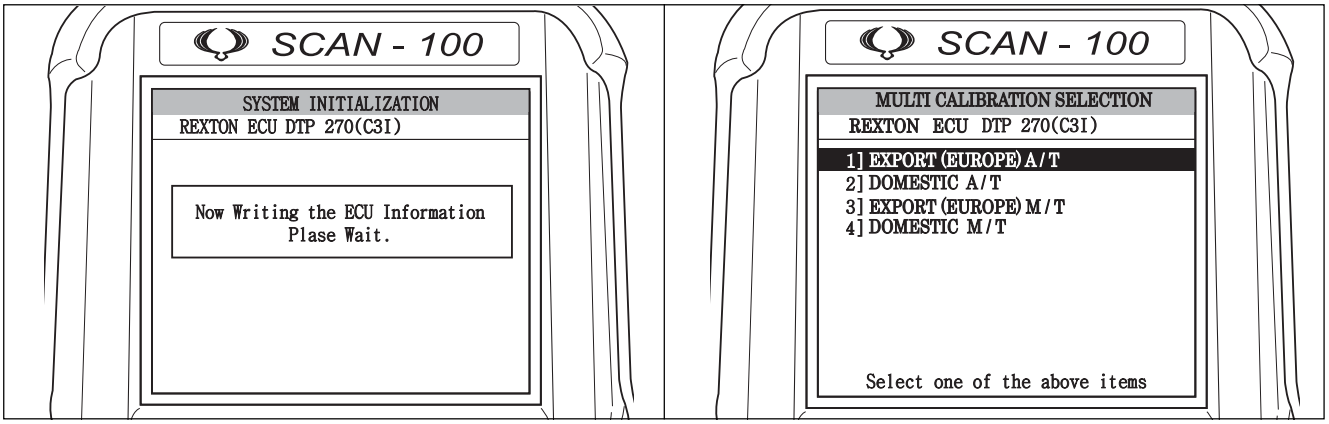
a. E-EGR valve and related systems
b. Throttle body and related systems
c. AQGS and related systems

NOTICE

- **Be careful not to turn off the power of SCAN-100 when switching the ignition key to "OFF". At this time, the data below is stored to SCAN-100 memory:**
  - **vehicle identification number**
  - **variant coding value**
  - **C2I/C3I coding value.**

D27DTP (POWER UP) Engine - Ver. 3.2 ECU	D27DT Engine - Ver. 3.1 ECU
	

5. If you turn the ignition key to "ON" and press (ENTER), the message as shown in the figure appears (the system is initializing), and then "MULTI CALIBRATION SELECTION" screen is displayed.

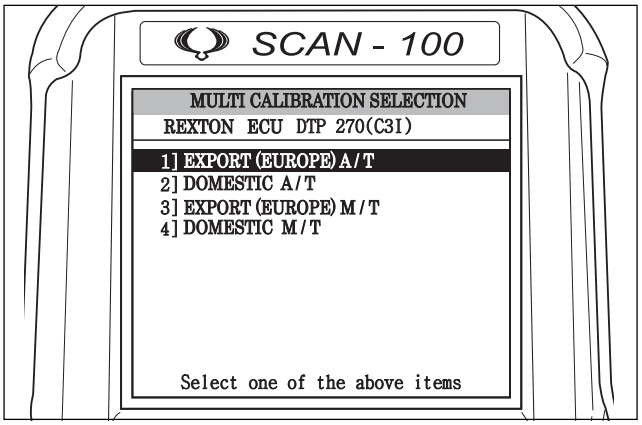


6. Select the appropriate value on the "MULTI CALIBRATION SELECTION" screen.

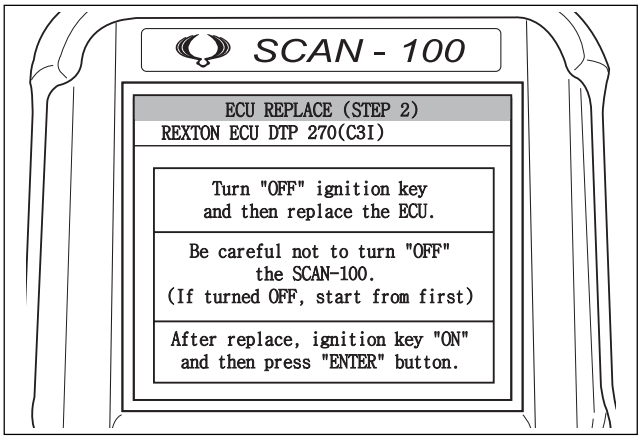
- A/T: Select "1] EXPORT (EUROPE) A/T".
- M/T: Select "3] EXPORT (EUROPE) M/T".

NOTICE

- **For REXTON D27DTP (POWER UP) engine, select the "DOM A/T".**



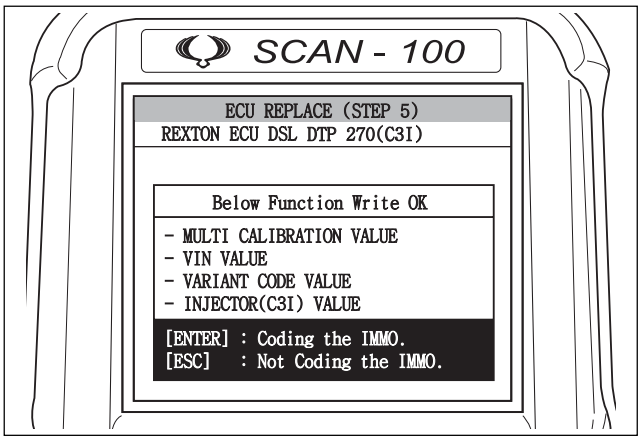
7. When you press “ENTER”, ECU information screen appears for a while, and then the message (multi-calibration completed) as shown in figure appears. Turn the ignition key to the “OFF” position and turn it to the “ON” posigion again.



8. If the multi-calibration is completed successfully, ECU REPLACE (STEP 5) screen is displayed.

   Backup data:

   - Multi-calibration value
   - VIN value
   - Variant code value
   - Injector (C2I or C3I) value

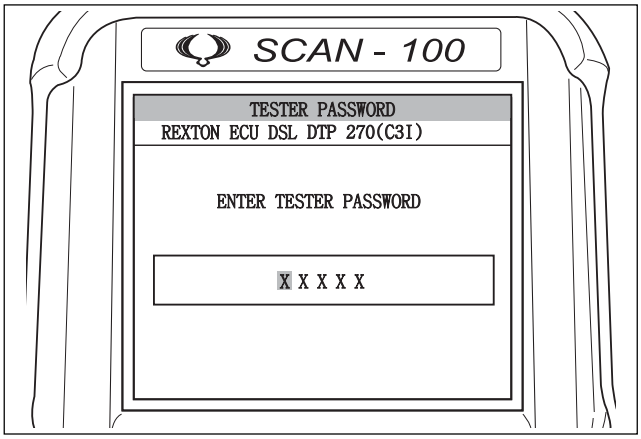


* D27DTP (POWER UP) Engine: C3I (20 digits)

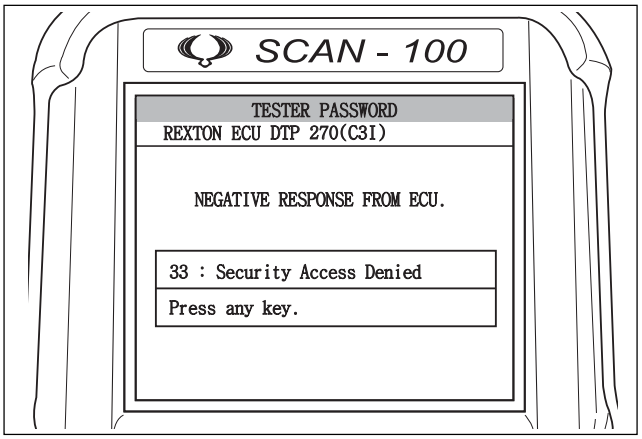
* D27DT Engine: C2I (16 digits: samp as the previous version)

9. For the vehicle eqipped with immobilizer system, the immobilizer should be coded by pressing (ENTER) after the multi calibration is completed.
   - For the vehicle without the immobilizer system, press “ESC”.

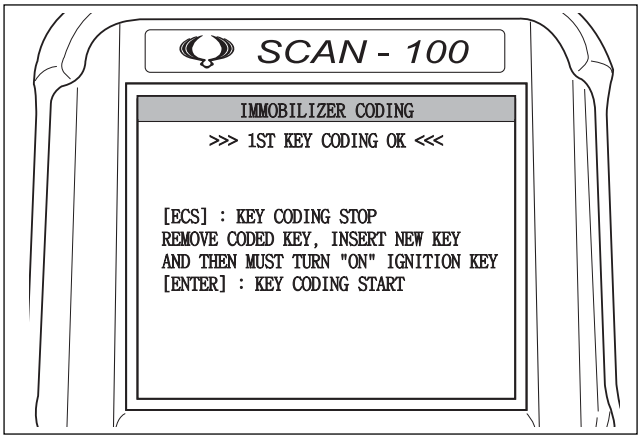
10. When you press (ENTER), the sign in screen is displayed. Enter the user password to perform the immobilizer coding.



11. When you press (ENTER), the immobilizer coding is activated. When the coding is failed, the failure screen as shown in figure appears.

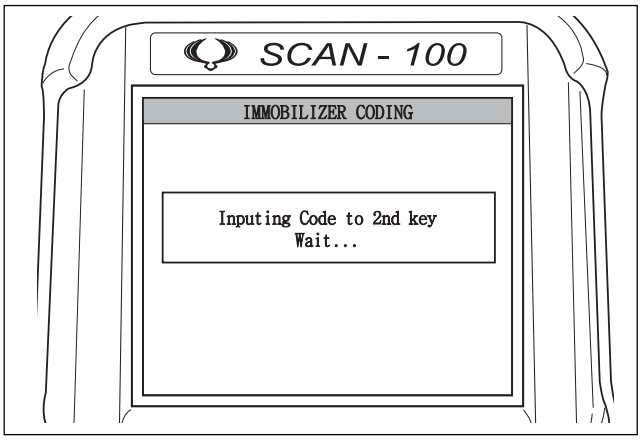


12. If the coding is completed successfully, the completion message as shown in figure appears, and then key coding completion screen is displayed.

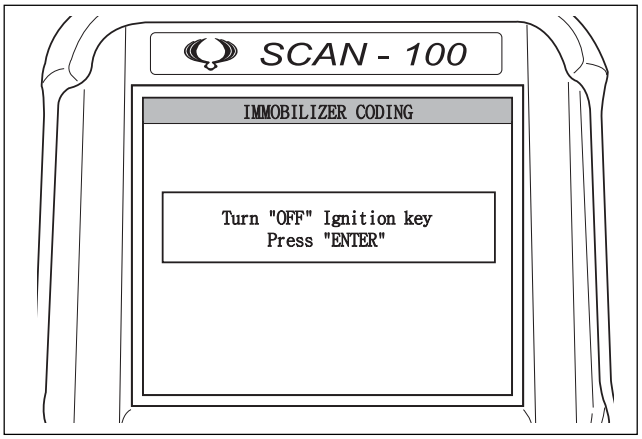


13. If you want to code for additional keys, remove the first key from key switch and insert the second key. Turn it to "ON" position and press (ENTER) to proceed.

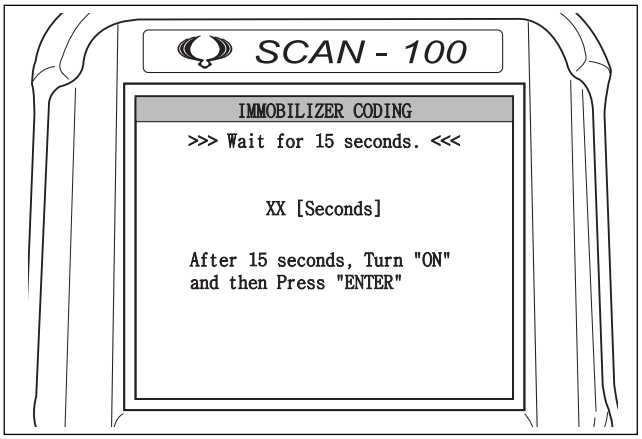
    The second key coding message appears and then key coding completion screen is displayed.



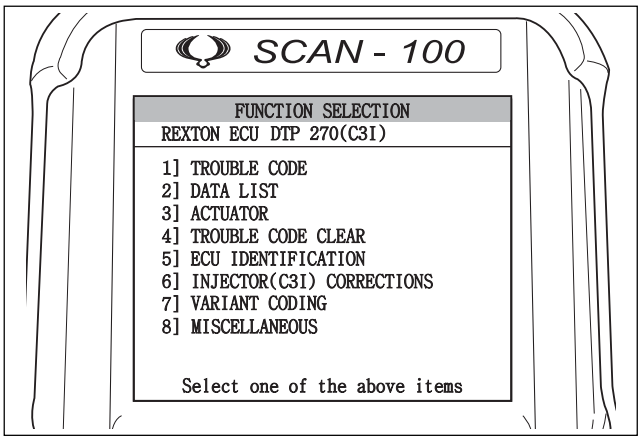
14. When the immobilizer coding is completed, press (ESC). The completion message as shown in figure appears.



15. When you turn the ignition key to “OFF” position and press (ENTER), the message screen as shown in figure appears. Wait for 15 seconds and turn the ignition key to “ON” position.



16. Press (ENTER) to return to “MAIN MENU” screen.



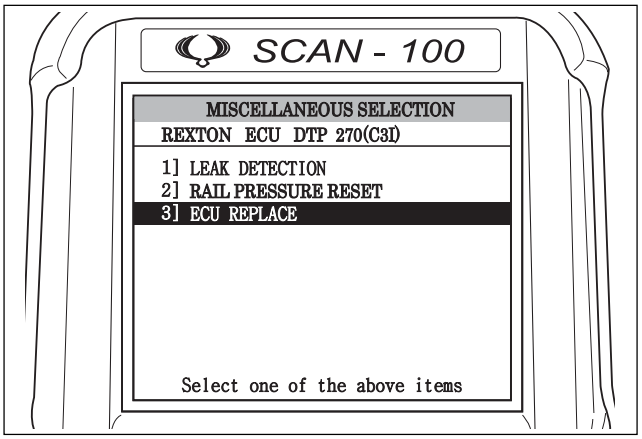
NOTE

- **Make sure that the data for the four entries (1] TROUBLE CODE, 5] ECU IDENTIFICATION, 6] INJECTOR CORRECTION and 8] VARIENT CODING) are correctly entered.**

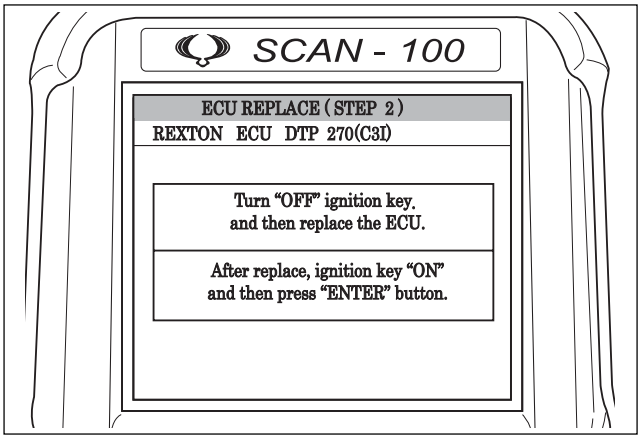
ECU Replace (Scan-100 Communication is not available)

If the Scan-100 communication is not available due to ECU failure, replace the ECU as follows.

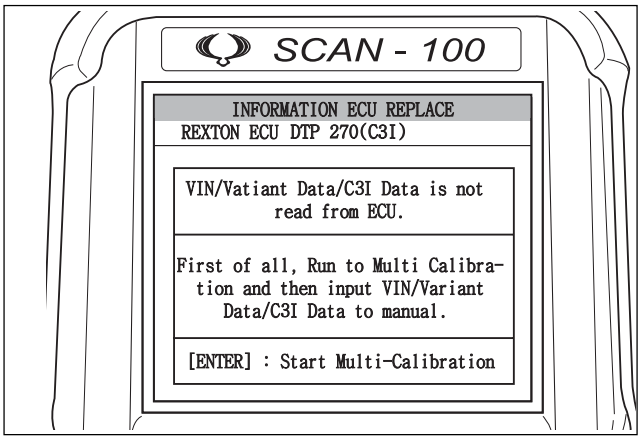
1. Replace the ECU with new one.
2. Select “3] ECU REPLACE” and press (ENTER) on “FUNCTION SELECTION” screen.



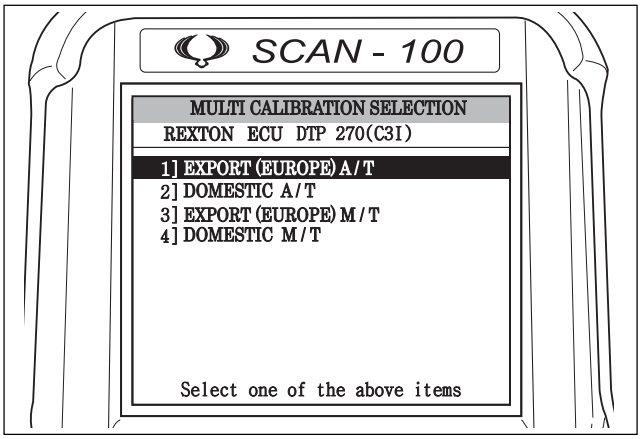
3. If the versions of ECUs are not matched, program the new ECU after replacement.



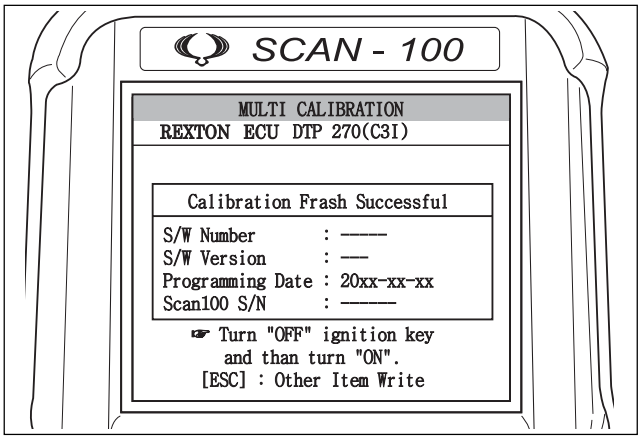
4. VIN/Variant Data/Injector Code(C2I or C3I) Data is not read from ECU. Press (ENTER) to run the multi calibration.



5. Select the appropriate model on “MULTI CALIBRATION SELECTION” screen.
   - Vehicle with A/T: 1] EXPORT (EUROPE) A/T



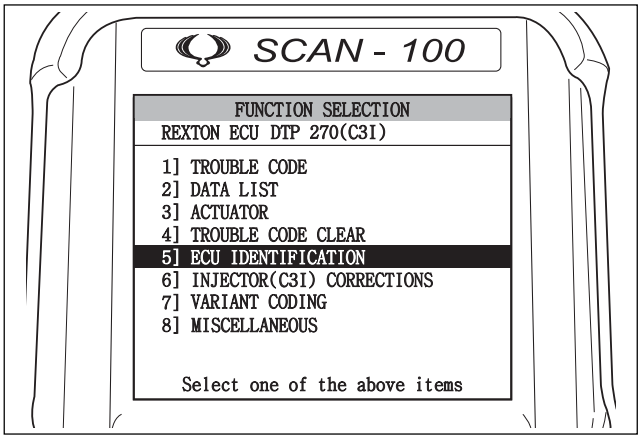
6. If the MULTI-CALIBRATION is completed successfully, the message screen shown in the figure is displayed.



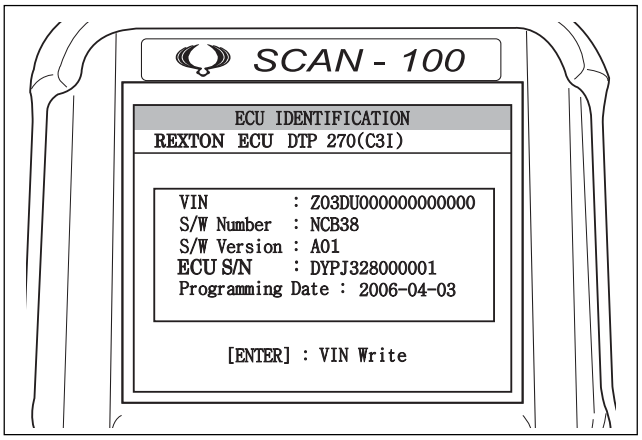
NOTICE

- **The VIN/Variant Data/Injector Code (C2I or C3I) Data should be input manually.**

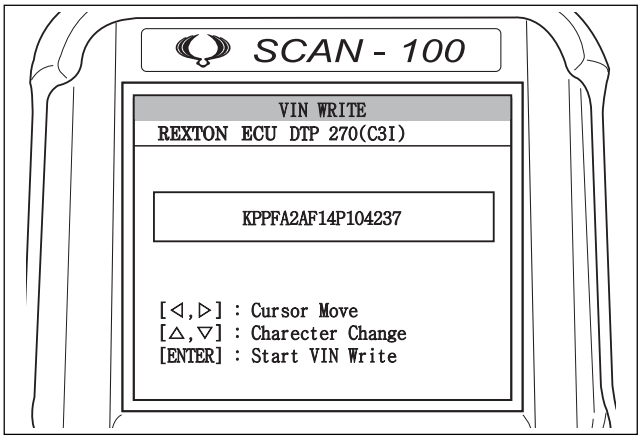
7. To enter the data manually, press “ESC” on the screen in Step 5 and return to main screen. To enter the VIN, variant data, and injector code(C2I or C3I), select “5] ECU IDENTIFICATION”, “6] INJECTOR (C2I or C3I) CORRECTIONS” and “7] VARIANT CODING”.
8. To enter the VIN, select “5] ECU IDENTIFICATION” and press “ENTER”.



9. Press “ENTER” and enter the VIN again.



10. Enter the VIN into the number plate on the screen. To change the number to the character, use the arrow keys.

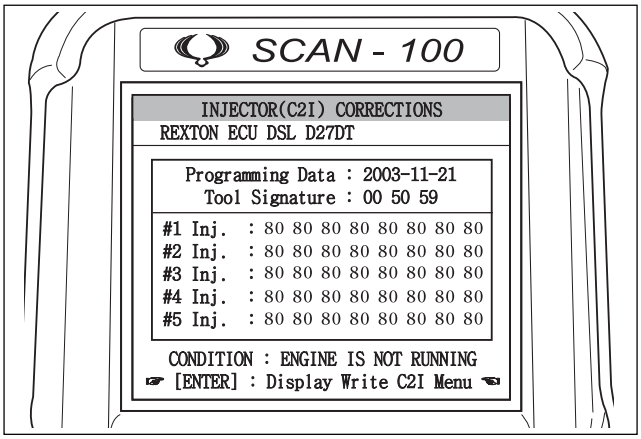


11. Select “6] INJECTOR (C2I or C3I) CORRECTIONS” and press “ENTER”. Remove the engine acoustic cover and enter the 16 or 20 character code on each injector label for all injectors.

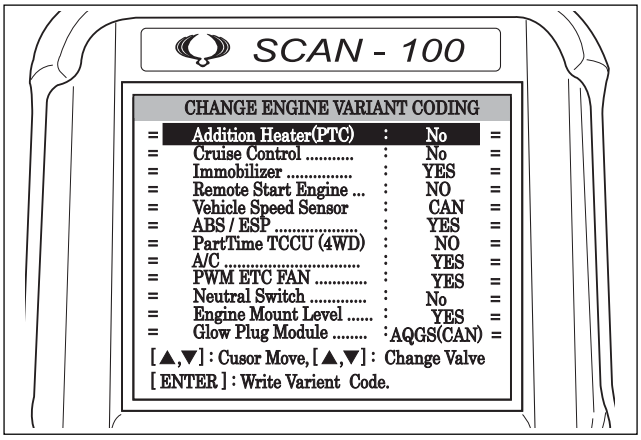
    Enter the correct injector code after pressing (ENTER) with the ignition “ON”.

    (The nearest injector from the radiator is number 1 and the number goes higher as it moves away.)

*** The figure shows that C2I is not coded.**



12. Select “7] VARIANT CODING” and press (ENTER) to change the item.



▶ Rail Pressure Initialization

Rail Pressure Reset Procedures

The engine ECU needs a specific amount of fuel according to the fuel supply lines and vehicle driving conditions.

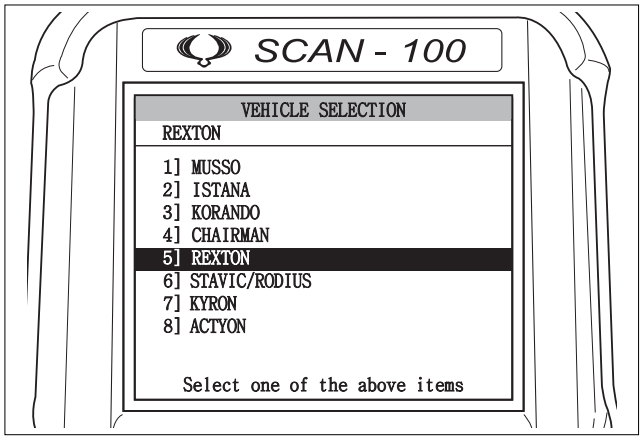
However, if the fuel supply (pressure) is not achieved due to, for instance, defective fuel system, ECU designates the offset value to the high pressure pump to compensate it.

The fuel supply pressure varies according to the offset value and the engine output could be decreased due to this variation. When the engine output decreases, check whether all rail pressure offset values is set to 0 in the Rail Pressure Reset screen in SCAN-100.

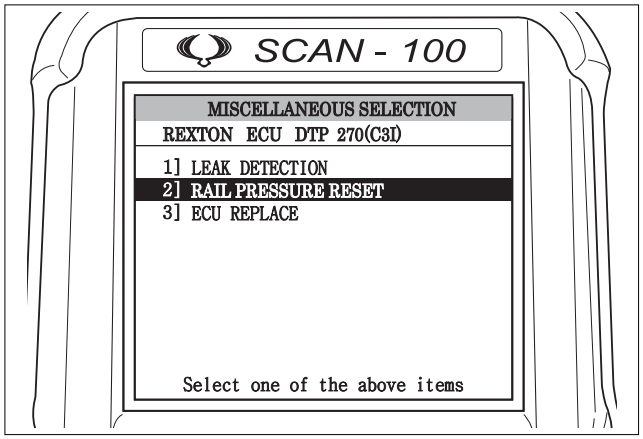
If the setting value is not 0, measure the fuel pressure with a tester. If any defective is found, repair the affected components and reset the rail pressure offset value to 0.

The rail pressure reset procedures should be done after replacing any high pressure pump and fuel system related components.

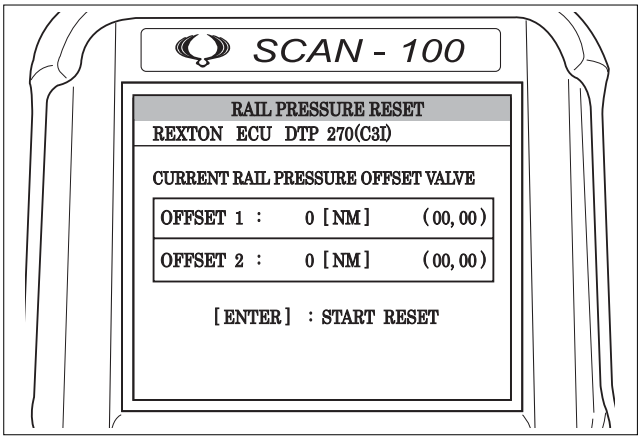
1. Select the vehicle model.



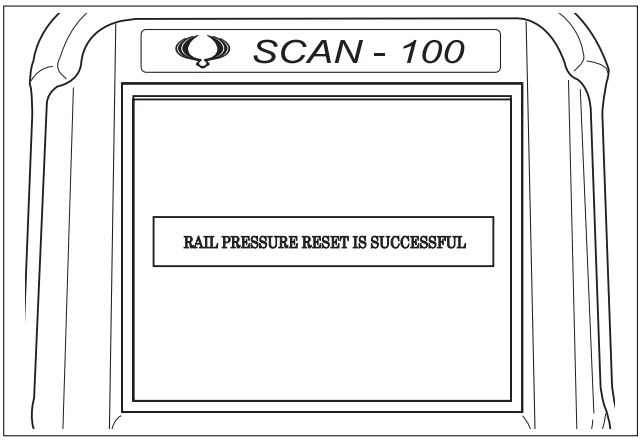
2. Select “2] RAIL PRESSURE RESET” on “MISCELLANEOUS SELECTION” screen.



3. Enter the current rail pressure value and press ENTER to reset the offset value.



4. The screen returns back to step 3 after displaying the [RAIL PRESSURE RESET IS SUCCESSFUL] message.



NOTICE

- **If the offset value is not set to 0, check the fuel pressure and other DTC generations before starting the rail pressure reset operation.**

DTC: Diagnostic Trouble Code

1. OVERVIEW FOR THE CHANGES IN DTC BY ENGINE

The DTC in this section is for the vehicle shipped after 03/06. For the vehicle shipped before 03/06, refer to the previously released DTC.

There are some changes in DTC due to the newly equipped D27DTP (power up) engine.

In this section, DTCs are for both D27DTP (power up) and D27DT engines. The contents only for D27DTP engine are shaded.

New DTCs have been added and some DTCs have changed, since E-EGR valve, throttle body, switchable engine mounting and AQGS have been applied to the D27DTP (power up) engine.

The followings are the specfications and changes in the systems according to the D27DTP (power up) engine and D27DT engine.

▶ Specifications (Based On ECU)

		D27DT Engine	D27DTP (power up) Engine	Remarks
ECU Ver.		DCM 3.1	DCM 3.2	
No.		665 540 01 32	665 540 04 32	
Connector		121pin (1 Connector)	154 pin (2 Connector)	
Flash memory	Inner	448	512	Kbyte
	Outerexport	-	2048	Kbyte
EGR		Vacuum modulator control (PWM)	ECU Electric control (PWM)	E-EGR + EGR position feedback function (DCM3.2)
VGT		Vacuum modulator control (PWM)	Vacuum modulator control (PWM)	DCM3.1 (WGT) / DCM3.2 (VGT)
Throttle body		N/A	Electric control type (DC Motor)	
HFM sensor ver.		HFM5	HFM6	
Cooling fan		Viscous electric fan (RLY On/Off)	Viscous electric fan (RLY On/Off)	
Air conditioner pressure sensor		N/A	Applied	* Triple-action pressure switch (DCM3.1)
Accelerator pedal sensor #1, #2		5V / 2.5V	5V / 5V	Changes in reference voltage
Switchable engine mounting		N/A	Applied	RLY On/Off control
AQGS		N/A	Applied	Glow control relay is available in D27DT.
Immobilizer		Applied	Applied	Option
Neutral switch (M/T)		Applied to vehicle with M/T	N/A	The D27DT engine received signals via wiring. However, now, it receives signals via CAN.

2. NEW DTCS ACCORDING TO D27DTP (POWER UP) APPLICATION

New DTCs for E-EGR

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0405	High EGR Open Position deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates E-EGR is open over 15% in the close status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						
P0406	High EGR Close Position Deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates E-EGR is closed over 15% in the open status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						
P0407	Low EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) - ECU Pin #A33 • Sensor signal - ECU Pin #A82 • Sensor GND - ECU Pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						
P0408	High EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) - ECU Pin #A33 • Sensor signal - ECU Pin #A82 • Sensor GND - ECU Pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P1409	EGR Valve Circuit Short	- Check pin for the followings: • The E-EGR valve wiring is open. • E-EGR Pin #1: Power(Main Relay) • E-EGR Pin #5: ECU Pin #A48 - Actions • Check E-EGR valve wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408).						
P1407	Faulty EGR Close Position	- Causes • The EGR position is not closed when EGR is not operated within 50 seconds with the engine idling. - Check pin for the followings: • E-EGR #1: Valve power (Main relay) • E-EGR #2: Sensor (Reference voltage) ECU #A33 • E-EGR #4: Sensor (Ground) ECU #A09 • E-EGR #5: Valve drive (PWM) ECU #A48 • E-EGR #6: Sensor (Signal) ECU #A82						
P0402	EGR Valve Stuck in Open Position	- Actions • Check E-EGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408). - Causes • The E-EGR valve is stuck with it open. - Check pin (refer to the page 1407) - Actions • Check E-EGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Replace the ECU if required. • Refer to DTCs (P0407 and P0408).						

CHANGED BY	
EFFECTIVE DATE	
AFFECTED VIN	

New DTCs for Throttle Body

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0488	Faulty Maximum Throttle Opening Value	- Causes • The throttle is not fully open when learning the full open value after initial ignition on. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P0487	Faulty Maximum Throttle Closing Value	- Causes • The throttle is not fully closed when learning the full open value after stopping the engine. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2100	Throttle Drive Circuit Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2101	Throttle Drive Ground Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2102	Throttle Drive Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P2103	Throttle Drive Battery Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						

CHANGED BY	
EFFECTIVE DATE	
AFFECTED VIN	

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2104	Throttle Drive Overheat	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C.						
P213B	Abnormal Throttle Control	- Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary. - Causes • The difference between throttle position demand (MAP) and throttle position feedback signal is out of +5% or -13%. - Defective throttle control (P213B) - Defective throttle signal (P213C, P213D) - Defective throttle drive (P2103, P2101, P2102, P2104, P2100) - Check pin (refer to P213C). - Sensor specification: Refer to P213C.						
P213C	Low Throttle Signal	- Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary. - Causes • The throttle valve position sensor signal is stuck low. - Check pin for the followings: • Throttle valve #1: sensor (Power) ECU #A20 • Throttle valve #2: sensor (Signal) ECU #A22 • Throttle valve #3: sensor (GND) ECU #A81 • Throttle valve #4: valve (Positive) ECU #A75 • Throttle valve #5: valve (Positive) ECU #A77 - Sensor & Motor SPEC • Motor * Power: 12V * Max. current : 6.8A (Normal: 3.6 ~ 0.2) * Motor resistance: 4.3Ω • Sensor * Power: 5V						
P213D	High Throttle Signal	- Actions • Check the throttle valve and sensor wiring harnesses. (The signal output of throttle valve is below than 0.24 V.) • Visually check the unit and replace if necessary. - Causes • The throttle valve position sensor signal is stuck high. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						

New DTCs for Changes in Injector Specifications

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0171	Insufficient MDP of Injector #1	- MDP learning value is decreased due to aged injector #1.						
P0172	Insufficient MDP of Injector #2	- MDP learning value is decreased due to aged injector #2.						
P0173	Insufficient MDP of Injector #3	- MDP learning value is decreased due to aged injector #3.						
P0174	Insufficient MDP of Injector #4	- MDP learning value is decreased due to aged injector #4.						
P0175	Insufficient MDP of Injector #5	- MDP learning value is decreased due to aged injector #5.						
P0147	Impossible to learn Idle MDP	- Causes (Idle range MDP learning) • The MDP is not learned again until driving over 50,000 km after the MDP is learned. - Conditions for MDP learning (Idle) • Leaning twice for each cylinder (attempt every 5 sec.) • Initial MDP learning: coolant temperature > 60°C • Fuel temperature: 0 ~ 80°C • Vehicle speed: Idle. • The tachometer's needle vibrates while learning idle MDP. • Replace ECU after learning.						
P0148	Impossible to Learn Drive MDP	- Causes • It occurs twice for each cylilnder if MDP is not learned again until driving over 50,000 km after the MDP is learned. - Actions • Check knock sensor and wiring. • Check injector specification. • Check C3I/C2I.						
P0611	No Data for C3I	- C3I • There is no C3I data in ECU or the checksum is faulty.						**O**
P0612	Internal Error in C3I Data	- C3I • The error is occurred while sending C3I data in ECU to RAM.						

New DTCs for AQGS (Advanced Quick Glow System)

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2674	#1 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P2675	#2 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2671	#3 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P2672	#3 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P2673	#5 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (Battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P0670	Defective Power Supply of Glow Plug Controller	- Details: refer to P2673.						
P0683	Defective CAN Communiction of Glow Plug Controller	- GCU's CAN signal is intermittently defective.						
P1683	Defective CAN Communiction of Glow Plug Controller	- No GCU CAN signal - Details: refer to P2673.						
P0618	Multi Calibration not Performed	- Perform multi calibration again.						
P0619	Multi Calibration Performing error	- Perform multi calibration again.						
P062F	Multi Calibration Memory Error	- Perform multi calibration again.						
P066A	Internal Malfunction in #1 Glow Plug Controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.						
P066B	Internal Short in #1 Glow Plug Controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.						
P066C	Internal Malfunction in #2 Glow Plug Controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.						
P066D	Internal Short in #2 Glow Plug Controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.						
P066E	Internal Malfunction in #3 Glow Plug Controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.						
P066F	Internal Short in #3 Glow Plug Controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.						
P067A	Internal Malfunction in #4 Glow Plug Controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.						
P067B	Internal Short in #4 Glow Plug Controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.						
P067C	Internal Malfunction in #5 Glow Plug Controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.						
P067D	Internal Short in #5 Glow Plug Controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.						

DTCs for Auto Cruise-control (for export)

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Malfunction Indicator light
P1564	Auto Cruise Switch Fault (Power)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						
P1568	Auto Cruise Switch Fault (when Accelerating)	- Auto cruise switch fault (accelerating)						
P1569	Auto Cruise Switch Fault (when Decelerating)	- Auto cruise switch fault (decelerating)						
P1578	Auto Cruise Switch Fault (Circuit Short)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						
P1573	Auto Cruise Switch Fault (Short)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						
P1570	Auto Cruise Switch Fault (Signal)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						

New DTCs for VGT Turbocharger

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0243	VGT Turbo-Charger Actuator Circuit Short	- Causes • There is electric problem in the vacuum modulator drive module of turbocharger. - Check pin for the followings (Vacuum Modulator): • Power (Main Relay) • GND (ECU Pin #A71) - Actions • Check the unit's resistance (15.4 +/- 0.7Ω) and wiring. • Check the input voltage (12V). • Visually check the unit and replace if necessary.						

New DTCs for CAN Communication

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P0614	TCCU Coding Failt	- Occurred if TCCU variant coding is faulty. - Occurred when there is CAN communication error between units.						

New DTCs for A/C Refrigerant Sensor

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Malfunction Indicator light
P0530	Air Conditioner Refrigerant Sensor Supply Power Fault	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal .... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm² (0.75V) ~ 32 kgf/cm² (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm² 4.5V ..... 32.0 kgf/cm² - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						
P0532	Air Conditioner Refrigerant Pressure Signal Circuit Short	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal. ... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm² (0.75V) ~ 32 kgf/cm² (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm² 4.5V ..... 32.0 kgf/cm² - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						
P0533	Excessive Air Conditioner Refrigerant Pressure	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal .... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm² (0.75V) ~ 32 kgf/cm² (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm² 4.5V ..... 32.0 kgf/cm² - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						

New DTCs for IMV (HPP: High Pressure Pump) Control

DTC	Trouble	Help	Torque Reduction (max. 50%)	Torque Reduction (max. 20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	**Engine Malfunction Indicator light**
P1260	VGT Turbo-Charger Actuator Circuit Short	- Abnormal rail pressure, IMV CURRENT TRIM TOO HIGH, DRIFT - Check the IMV wiring harnesses. - Check the ECU wiring harnesses. • Check ECU's pin A76 for open and short. - Check the Rail pressure sensor. • Supply voltage: 5 ± 0.1V • Output voltage at 1600 bar: 4.055 ± 0.125V • Output voltage at atmospheric pressure: 0.5 ± 0.04V - Check low-pressure fuel system. • Check fuel in fuel reservoir and air penetration. • Check fuel filter's specification. - Check high-pressure fuel system. • Check fuel rail and high-pressure pipe for leaks. - Check IMV's resistance (5.44 Ω). • If the resistance is out of specification, replace the high-pressure pump and IMV.						

Section 6

DIAGNOSIS

- ECU
- TCU
- BRAKE
- AIR-BAG
- T/C
- RK-STICS
- FFH
- RAIN SENSOR
- FATC
- TGS LEVER
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ECU

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TROUBLE DIAGNOSIS TABLE

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P0100	Air Mass Flow (HFM) Malfunction	- The external power supply is faulty. • Check the external power supply. • Check the sensor wiring harness (open, short, poor contact). - Actual air mass flow vs. Output voltages. • -20 Kg/h: 0.47 V • 0 Kg/h: 0.99 V • 10 Kg/h: 1.2226 ~ 1.2398 V • 15 Kg/h: 1.3552 ~ 1.3778 V • 30 Kg/h: 1.6783 ~ 1.7146 V • 60 Kg/h: 2.1619 ~ 2.2057 V • 120 Kg/h: 2.7215 ~ 2.7762 V • 250 Kg/h: 3.4388 ~ 3.5037 V • 370 Kg/h: 3.8796 ~ 3.9511 V • 480 Kg/h: 4.1945 ~ 4.2683 V • 640 Kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.					
P0102	Low HFM Sensor Signal (Circuit Open)	- HFM sensing values are lower than minimum sensing values. - Check the resistance in HFM sensor. - Check the ECU wiring harness (open and poor contact). • Check the ECU pin #82 and #84 for open circuit. - Actual air mass flow vs. Output voltages. • -20 Kg/h: 0.47 V • 0 Kg/h: 0.99 V • 10 Kg/h: 1.2226 ~ 1.2398 V • 15 Kg/h: 1.3552 ~ 1.3778 V • 30 Kg/h: 1.6783 ~ 1.7146 V • 60 Kg/h: 2.1619 ~ 2.2057 V • 120 Kg/h: 2.7215 ~ 2.7762 V • 250 Kg/h: 3.4388 ~ 3.5037 V • 370 Kg/h: 3.8796 ~ 3.9511 V • 480 Kg/h: 4.1945 ~ 4.2683 V • 640 Kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.					

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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0103	High HFM Sensor Signal (Circuit Short)	- HFM sensing values are higher than maximum sensing values. - Check the resistance in HFM sensor. - Check the ECU wiring harness (open and poor contact). • Check the ECU pin #82 and #84 for open circuit. - Actual air mass flow vs. Output voltages. • -20 Kg/h: 0.47 V • 0 Kg/h: 0.99 V • 10 Kg/h: 1.2226 ~ 1.2398 V • 15 Kg/h: 1.3552 ~ 1.3778 V • 30 Kg/h: 1.6783 ~ 1.7146 V • 60 Kg/h: 2.1619 ~ 2.2057 V • 120 Kg/h: 2.7215 ~ 2.7762 V • 250 Kg/h: 3.4388 ~ 3.5037 V • 370 Kg/h: 3.8796 ~ 3.9511 V • 480 Kg/h: 4.1945 ~ 4.2683 V • 640 Kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.					
P0105	Supply Voltage Fault to Booster Pressure Sensor	- Out of range of supply voltages about boost pressure sensor at Ignition key-On and Engine Stop (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness for ECU pin #100 and #108 (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0106	High Booster Pressure Sensor Signal	- Out of signal range about boost pressure sensor at Ignition key-On and Engine Stop (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages. • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness for ECU pin #99 and #100 (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction					
P0107	Booster Pressure Sensor Open/GND Short	- Out of signal range about boost pressure sensor at Engine running condition (Lower than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness for ECU pin #99 and #100 (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0108	Booster Pressure Sensor Short	- Out of signal range about boost pressure sensor at Engine running condition (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545~2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness for ECU pin #99 and #100 (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction					
P0109	Low Booster Pressure Sensor Signal	- Out of signal range about boost pressure sensor at Ignition key-On and Engine Stop (Lower than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages. • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness for ECU pin #99 and #100 (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0110	Intake Air Temperature Circuit Malfunction - Source Power Problem	- The intake air temperature sensing value is lower than minimum value or higher than maximum value, or the external power to HFM sensor is faulty. - Check the supply voltage to sensor. • Actual air temperature vs. Voltages • 20°C: 2.65 Ω • 30°C: 2.18 Ω • 50°C: 1.40 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the sensor wiring harness. • Check the source power circuit for short to ground. - Check the sensor resistance. • Actual air temperature vs. Resistance • -40°C: 39.260 Ω • -20°C: 13.850 Ω • 0°C: 5.499 Ω • 20°C: 2.420 Ω • 40°C: 1.166 Ω • 60°C: 0.609 Ω • 80°C: 0.340 Ω • 100°C: 0.202 Ω • 120°C: 0.127 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the ECU wiring harness. • Check the ECU pin #64 and #84 for open and short. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0112	Intake Air Temperature Circuit Malfunction - Open	- The intake air temperature sensing value is lower than maximum value of 150°C: Open - Check the supply voltage to sensor. • Actual air temperature vs. Voltages • 20°C: 2.65 Ω • 30°C: 2.18 Ω • 50°C: 1.40 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the sensor wiring harness. • Check the source power circuit for short to ground. - Check the sensor resistance. • Actual air temperature vs. Resistance • -40°C: 39.260 Ω • -20°C: 13.850 Ω • 0°C: 5.499 Ω • 20°C: 2.420 Ω • 40°C: 1.166 Ω • 60°C: 0.609 Ω • 80°C: 0.340 Ω • 100°C: 0.202 Ω • 120°C: 0.127 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the ECU wiring harness. • Check the ECU pin #64 and #84 for open. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0113	Intake Air Temperature Circuit Malfunction - Short	- The intake air temperature sensing value is lower than maximum value of 150°C: Open - Check the supply voltage to sensor. • Actual air temperature vs. Voltages • 20°C: 2.65 Ω • 30°C: 2.18 Ω • 50°C: 1.40 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the sensor wiring harness. • Check the source power circuit for short to ground. - Check the sensor resistance. • Actual air temperature vs. Resistance • -40°C: 39.260 Ω • -20°C: 13.850 Ω • 0°C: 5.499 Ω • 20°C: 2.420 Ω • 40°C: 1.166 Ω • 60°C: 0.609 Ω • 80°C: 0.340 Ω • 100°C: 0.202 Ω • 120°C: 0.127 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the ECU wiring harness. • Check the ECU pin #64 and #84 for open. - Replace the ECU if required.					
P0115	Supply Voltage Fault to Coolant Temperature Sensor	- Check if the supply voltage of approx. 12 V is applied.					
P0117	Coolant Temperature Sensor Malfunction - Open	- Malfunction in recognition of coolant temperature • Less than minimum values (Circuit Open) • External power supply malfunction - If Fuel temperature is invalid, the previous coolant temperature is retained. - Check the supply voltage to sensor. - Actual air temp. vs. Resistance • 20°C: 2449 Ω • 50°C: 826.3 Ω • 80°C: 321.4 Ω • 100°C: 112.9 Ω - Check the wiring harness (open and poor contact). • ECU pin #101 and #102 - Visually check the sensor and replace if required. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0118	Coolant Temperature Sensor Malfunction - Short	- Malfunction in recognition of coolant temperature • More than maximum values (Circuit Short) • External power supply malfunction - If Fuel temperature is invalid, the previous coolant temperature is retained. - Check the supply voltage to sensor. - Actual air temp. vs. Resistance • 20°C: 2449 Ω • 50°C: 826.3 Ω • 80°C: 321.4 Ω • 100°C: 112.9 Ω - Check the wiring harness (short and poor contact). • ECU pin #101 and #102 - Visually check the sensor and replace if required. - Replace the ECU if required.					
P0120	Accelerator Pedal Sensor #1 Malfunction - Supply Voltage Fault	- The supply voltage is faulty. - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. • Check the ECU pin #72, #53 for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	O				
P0122	Accelerator Pedal Sensor #1 Malfunction - Open	- Out of range about potentiometer 1 of pedal sensor: lower than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. • Check the ECU pin #71, #53 for open and poor contact. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	O				
P0123	Accelerator Pedal Sensor #1 Malfunction - Short	- Out of range about potentiometer 1 of pedal sensor: higher than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. • Check the ECU pin #71, #53 for short and poor contact. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	O				

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0147	Impossible to Learn Idle MDP	- Causes (Idle range MDP learning) • The MDP is not learned again until driving over 50,000 km after the MDP is learned. - Conditions for MDP learning (Idle) • Leaning twice for each cylinder (attempt every 5 sec.) • Initial MDP learning: coolant temperature > 60°C • Fuel temperature: 0 ~ 80°C • Vehicle speed: Idle. • The tachometer's needle vibrates while learning idle MDP. • Replace ECU after learning.					
P0148	Impossible to Learn Drive MDP	- Causes • It occurs twice for each cylilnder if MDP is not learned again until driving over 50,000 km after the MDP is learned. - Actions • Check knock sensor and wiring. • Check injector specification. • Check C3I/C2I.					
P0171	Insufficient MDP of Injector #1	- MDP learning value is decreased due to aged injector #1.					
P0172	Insufficient MDP of Injector #2	- MDP learning value is decreased due to aged injector #2.					
P0173	Insufficient MDP of Injector #3	- MDP learning value is decreased due to aged injector #3.					
P0174	Insufficient MDP of Injector #4	- MDP learning value is decreased due to aged injector #4.					
P0175	Insufficient MDP of Injector #5	- MDP learning value is decreased due to aged injector #5.					
P0180	Fuel Temperature Sensor - Malfunction	- The power source circuit is faulty for fuel temperature sensor. (Fuel temperature sensor is mounted in high pressure pump) - Actual fuel temp. vs. Resistance • -40°C: 75.780 Ω -20°C: 21.873 Ω • -10°C: 12.462 Ω 0°C: 7.355 Ω • 10°C: 4.481 Ω 20°C: 2.812 Ω • 25°C: 2.252 Ω 30°C: 1.814 Ω • 40°C: 1.199 Ω 50°C: 0.811 Ω • 70°C: 0.394 Ω 90°C: 0.206 Ω • 120°C: 0.087 Ω - Recovery values when fuel temperature sensor failure: 95°C - Check the supply voltage to sensor. - Check the wiring harness for open, short and poor contact. • ECU pin: #109, #110 - Check the ECU wiring and replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0182	Fuel Temperature Sensor - Short to Ground	- The sensing values are higher than specified values for fuel temperature sensor. (More than maximum sensing values 140°C - Circuit Short) - Actual fuel temp. vs. Resistance • -40°C: 75.780 Ω -20°C: 21.873 Ω • -10°C: 12.462 Ω 0°C: 7.355 Ω • 10°C: 4.481 Ω 20°C: 2.812 Ω • 25°C: 2.252 Ω 30°C: 1.814 Ω • 40°C: 1.199 Ω 50°C: 0.811 Ω • 70°C: 0.394 Ω 90°C: 0.206 Ω • 120°C: 0.087 Ω - Recovery values when fuel temperature sensor failure: 95°C - Check the supply voltage to sensor. - Check the wiring harness for open, short and poor contact. • ECU pin: #109, #110 - Check the ECU wiring and replace the ECU if required.					
P0183	Fuel Temperature Sensor - Short to B+	- The sensing values are lower than specified values for fuel temperature sensor. (Less than maximum sensing values - 40°C - Circuit Open) - Actual fuel temp. vs. Resistance • -40°C: 75.780 Ω -20°C: 21.873 Ω • -10°C: 12.462 Ω 0°C: 7.355 Ω • 10°C: 4.481 Ω 20°C: 2.812 Ω • 25°C: 2.252 Ω 30°C: 1.814 Ω • 40°C: 1.199 Ω 50°C: 0.811 Ω • 70°C: 0.394 Ω 90°C: 0.206 Ω • 120°C: 0.087 Ω - Recovery values when fuel temperature sensor failure: 95°C - Check the supply voltage to sensor. - Check the wiring harness for open, short and poor contact. • ECU pin: #109, #110 - Check the ECU wiring and replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0190	Supply Voltage Fault to Fuel Rail Pressure Sensor	- The supply voltage to fuel rail pressure sensor is faulty. - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055± 0.125V • Output voltage at atmospheric pressure: 0.5±0.04V - Check the sensor and ECU wiring harness. • Check the ECU pin #6, #26 for open and short. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O				
P0191	Fuel Rail Pressure Sensor Signal Fault	- The rail pressure drop is too high. - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the ECU pin #6, #26 for open and short. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O				
P0192	Fuel Rail Pressure Sensor Malfunction - Open	- The fuel rail pressure sensing values are lower than specified values. • Minimum sensing values: - 112 bar (Open) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the ECU pin #25, #26 for open and poor contact. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O				

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0193	Fuel Rail Pressure Sensor Malfunction - Short	- The fuel rail pressure sensing values are higher than specified values. • Maximum sensing values: 1,600 bar (Short) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055± 0.125V • Output voltage at atmospheric pressure: 0.5±0.04V - Check the sensor and ECU wiring harness. • Check the ECU pin #25, #26 for short and poor contact. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O				
P0201	Injector #1 Circuit Open	- Injector #1 circuit malfunction: Open. • If the injector pin is defective, perform C2I coding and check again. • If the injector pin is normal, check the ECU wiring harness (ECU pin: #117, #114). - Replace the ECU if required.					
P0202	Injector #2 Circuit Open	- Injector #2 circuit malfunction: Open. • If the injector pin is defective, perform C2I coding and check again. • If the injector pin is normal, check the ECU wiring harness (ECU pin: #118, #121). - Replace the ECU if required.					
P0203	Injector #3 Circuit Open	- Injector #3 circuit malfunction: Open. • If the injector pin is defective, perform C2I coding and check again. • If the injector pin is normal, check the ECU wiring harness (ECU pin: #117, #116). - Replace the ECU if required.					
P0204	Injector #4 Circuit Open	- Injector #4 circuit malfunction: Open. • If the injector pin is defective, perform C2I coding and check again. • If the injector pin is normal, check the ECU wiring harness (ECU pin: #117, #115). - Replace the ECU if required.					
P0205	Injector #5 Circuit Open	- Injector #5 circuit malfunction: Open. • If the injector pin is defective, perform C2I coding and check again. • If the injector pin is normal, check the ECU wiring harness (ECU pin: #118, #120). - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0215	Main Relay Fault - Stuck	- The main relay is stuck ; Shut down. - Resistance of main relay: 92 Ω ± 9 Ω (at 20°C) - Check the main relay wiring harness. - Check the ECU wiring harness. • Check the ECU pin #3, 4, 5 for open and short. - If the forced operation is not available, replace the ECU. - Check the fuse for main relay					
P0219	Too Small Clearance of Crank Angle Sensor	- Crank angle signal faults or clearance too close. - Check the sensor wiring harness for ECU pin #90 and #82 (open, short, poor contact). - Check the resistance of crank angle sensor: 1090 Ω ± 15 %. - Measure the air gap: 0.3 ~ 1.3 mm • 1.3 mm of air gap: outputs 1.0 V at 40 rpm • 0.3 mm of air gap: outputs 150 V at 7000 rpm - Check the teeth condition. • Drive plate (A/T), DMF (M/T) - Replace the ECU if required.					
P0220	Accelerator Pedal Sensor #2 Malfunction - Supply Voltage Fault	- The supply voltage is faulty. - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. • Check the ECU pin #57, #14 for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	O				
P0222	Accelerator Pedal Sensor #2 Malfunction - Open	- Out of range about potentiometer 2 of pedal sensor: lower than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. • Check the ECU pin #32, #14 for open and poor contact. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	O				
P0223	Accelerator Pedal Sensor #2 Malfunction - Short	- Out of range about potentiometer 2 of pedal sensor: higher than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. • Check the ECU pin #32, #14 for short and poor contact. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	O				

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0243	VGT Turbocharger Actuator Circuit Short	- Causes • There is electric problem in the vacuum modulator drive module of turbocharger. - Check pin for the followings (Vacuum Modulator): • Power (Main Relay) • GND (ECU Pin #A71) - Actions • Check the unit's resistance (15.4 +/ - 0.7 Ω) and wiring. • Check the input voltage (12V). • Visually check the unit and replace if necessary.					
P0245	Turbo Charger Actuator Circuit Fault - Short	- The waste gate driver circuit is short to ground or open - Check the actuator wiring harness. - Check the solenoid valve. - Check the ECU wiring harness. • Check the ECU pin #95 for open and short. - Replace the ECU if required.	O				
P0246	Turbo Charger Actuator Circuit Fault - Short to B+	- The turbo charger actuator power source circuit is short. - Check the actuator wiring harness. - Check the solenoid valve. - Check the ECU wiring harness for short and poor contact. - Replace the ECU if required.	O				
P0251	IMV Driver Circuit Malfunction - Short	- IMV driver circuit malfunction: Short - Check the IMV wiring harness. • Check the ECU pin #87 for short. - Check the ECU wiring harness. - Check the IMV resistance. • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.			O		
P0253	IMV Driver Circuit Malfunction - Short to Ground	- IMV driver circuit malfunction: Short to ground - Check the IMV wiring harness. • Check the ECU pin #87 for short to ground. - Check the ECU wiring harness. - Check the IMV resistance. • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.			O		
P0255	IMV Driver Circuit Malfunction - Open	- IMV driver circuit malfunction: Open - Check the IMV wiring harness. • Check the ECU pin #87 for open. - Check the ECU wiring harness. - Check the IMV resistance. • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.			O		

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0263	Injector #1 Balancing Fault	- Injector #1 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I coding after replacement).					
P0266	Injector #2 Balancing Fault	- Injector #2 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I coding after replacement).					
P0269	Injector #3 Balancing Fault	- Injector #3 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I coding after replacement).					
P0272	Injector #4 Balancing Fault	- Injector #4 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I coding after replacement).					
P0275	Injector #5 Balancing Fault	- Injector #5 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I coding after replacement).					
P0325	Accelerometer #1 (Knock Sensor) Malfunction	- The signal / noise ratio is too low about accelerometer # 1. - Check the accelerometer wiring harness and tightening torque. • Tightening torque: 20 ± 5 Nm - Check the ECU wiring harness for open and short. • ECU pin #45 and #46 - If the trouble still exists even after replacing the accelerometer, replace the ECU.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0325	Accelerometer #1 (Knock Sensor) Malfunction	- The signal / noise ratio is too low about accelerometer # 1. - Check the accelerometer wiring harness and tightening torque. • Tightening torque: 20 ± 5 Nm - Check the ECU wiring harness for open and short. • ECU pin #45 and #46 - If the trouble still exists even after replacing the accelerometer, replace the ECU.					
P0335	No Crank Signals	- Refer to P0372.					
P0336	Too Large Clearance of Crank Angle Sensor	- Air gap of crank angle sensor is abnormal. - Check the sensor wiring harness for ECU pin #90 and #82 (open, short, poor contact). - Check the resistance of crank angle sensor: 1090 Ω ± 15 %. - Measure the air gap: 0.3 ~ 1.3 mm • 1.3 mm of air gap: outputs 1.0 V at 40 rpm • 0.3 mm of air gap: outputs 150 V at 7000 rpm - Check the teeth condition. • Drive plate (A/T), DMF (M/T) - Replace the ECU if required.					
P0341	Cam Position Sensor Malfunction (Poor Synchronization)	- Not synchronized with Crank angle signal. - Check the source voltage of cam position sensor (specified value: 4.5 ~ 12 V). - Check the sensor wiring harness for ECU pin #103 and #104 (open, short, poor contact). - Check the cam position sensor. - Measure the air gap: 0.2 ~ 1.8 mm - Replace the ECU if required.					
P0344	Cam Position Sensor Malfunction	- No cam recognition signal (missing events). - Check the source voltage of cam position sensor (ECU pin #111) (specified value: 4.5 ~ 12 V). - Check the sensor wiring harness for ECU pin #103 and #104 (open, short, poor contact). - Check the cam position sensor. - Measure the air gap: 0.2 ~ 1.8 mm - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0372	Crank Angle Sensor Malfunction	- Even though cam position recognition is normal, no crank angle signal recognition (missing tooth). - Check the sensor wiring harness for ECU pin #90 and #82 (open, short, poor contact). - Check the resistance of crank angle sensor: 1090 Ω ± 15 %. - Measure the air gap: 0.3 ~ 1.3 mm • 1.3 mm of air gap: outputs 1.0 V at 40 rpm • 0.3 mm of air gap: outputs 150 V at 7000 rpm - Check the teeth condition. • Drive plate (A/T), DMF (M/T) - Replace the ECU if required.					
P0400	EGR Control Valve Fault	- When the EGR emission is more than specified value. • The EGR controller circuit is open or short to ground. • The EGR controller is short to battery. - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check if the EGR valve is stuck. - Check the resistance of EGR valve: 15.4 Ω. - Check the ECU wiring harness. • Check the ECU pin #96 for open and short.					
P0401	EGR Control Valve Fault (Low)	- When the EGR emission is more than specified value. • The EGR controller circuit is open or short to ground. • The EGR controller is short to battery. - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check if the EGR valve is stuck. - Check the resistance of EGR valve: 15.4 Ω. - Check the ECU wiring harness. • Check the ECU pin #96 for open and short.					
P0402	EGR Valve Stuck in Open Position	- Causes • The EEGR valve is stuck with it open. - Check pin (refer to the page 1407) - Actions • Check EEGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Replace the ECU if required. • Refer to DTCs (P0407 and P0408).					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P0405	High EGR Open Position Deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates E-EGR is open over 15% in the close status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.					
P0406	High EGR Close Position Deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates EEGR is closed over 15% in the open status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.					
P0407	Low EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) - ECU Pin #A33 • Sensor signal - ECU Pin #A82 • Sensor GND - ECU Pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0408	High EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) - ECU Pin #A33 • Sensor signal - ECU Pin #A82 • Sensor GND - ECU Pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.					
P0480	PWM Electric Fan Malfunction (Open circuit) (Only for D27DTP (POWER UP) model)	- The communication line between PWM electric fan and ECU is open. - The PWM electric fan's own malfunction cannot be identified.					
P0481	PWM Electric Fan Malfunction(Short to B+) (Only for D27DTP (POWER UP) model)	- The communication line between PWM electric fan and ECU has a short to battery. - The PWM electric fan's own malfunction cannot be identified.					
P0482	PWM Electric Fan Malfunction (Short to GND) (Only for D27DTP (POWER UP) model)	- The communication line between PWM electric fan and ECU has a short to ground. - The PWM electric fan's own malfunction cannot be identified.					
P0483	Fan PWM motor out have short to GND	- Motor out have short to GND					
P0484	Fan PWM Stall motor	- Stall motor					
P0485	Fan PWM motor have over load	- Motor have over load					
P0487	Faulty Maximum Throttle Closing Value	- Causes • The throttle is not fully closed when learning the full open value after stopping the engine. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0488	Faulty Maximum Throttle Opening Value	- Causes • The throttle is not fully open when learning the full open value after initial ignition on. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					
P0530	Air Conditioner Refrigerant Sensor Supply Power Fault	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal ..... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm^2 (0.75V) ~ 32 kgf/cm^2 (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm^2 4.5V ..... 32.0 kgf/cm^2 - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.					
P0532	Air Conditioner Refrigerant Pressure Signal Circuit Short	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal ..... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm^2 (0.75V) ~ 32 kgf/cm^2 (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm^2 4.5V ..... 32.0 kgf/cm^2 - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0533	Excessive Air Conditioner Refrigerant Pressure	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal ..... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm² (0.75V) ~ 32 kgf/cm² (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm² 4.5V ..... 32.0 kgf/cm² - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.					
P0560	Battery Voltage Malfunction	- Malfunction in recognition of system source voltage (A/D converter faults). • Less than minimum 8 Volts in 2000 rpm below • Less than 10 Volts in 2000 rpm above. - Check the battery wiring harness for ECU pin #3, #4 and #5 (open, short, poor contact). - Check the battery main relay and fuse. - Check the body ground. - Measure the resistance between body ground and ECU ground. • Repair the ECU ground if the resistance is high. - Replace the ECU if required.	O				
P0562	Low Battery Voltage	- Malfunction in recognition of system source voltage (Lower than threshold). • Less than minimum 8 Volts in 2000 rpm below • Less than 10 Volts in 2000 rpm above. - Check the battery wiring harness for ECU pin #3, #4 and #5 (open, short, poor contact). - Check the battery main relay and fuse. - Check the body ground. - Measure the resistance between body ground and ECU ground. • Repair the ECU ground if the resistance is high. - Replace the ECU if required.	O				

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P0563	High Battery Voltage	- Malfunction in recognition of system source voltage (Higher than threshold). • More than minimum 16 Volts in 2000 rpm below - Check the battery wiring harness for ECU pin #3, #4 and #5 (open, short, poor contact). - Check the alternator. - Check the body ground. - Measure the resistance between body ground and ECU ground. • Repair the ECU ground if the resistance is high. - Replace the ECU if required.	O				
P0571	Brake Pedal Switch Fault	- The brake pedal switch or light switch is faulty. • Brake pedal switch: Normal Close (NC) • Light switch: Normal Open (NO) • When operating the brake switch, one signal (NO) is sent to auto cruise and the other (NC) is sent to brake lamp. - Check the brake and light switch wiring harness. - Check the supply voltage to brake and light switch (12 V). - Check the brake and light switch for contact. - Check the ECU wiring harness for ECU pin #77 and #58 (short, poor contact). - Replace the ECU if required.					
P0602	Faulty Vehicle Speed Sensor Coding	- The vehicle signal is inputted via CAN communication without ESP or TCCU. - The CAN communication between units is malfunctioning.					
P0606	ECU Watchdog Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0608	Faulty ABS/ESP Coding	- The ABS/ESP variant coding is faulty. - The CAN communication is malfunctioning.					
P0611	No Data for C3I	- C3I • There is no C3I data in ECU or the checksum is faulty.					
P0612	Internal Error in C3I Data	- C3I • The error is occurred while sending C3I data in ECU to RAM.					
P0613	Faulty TCU Coding	- The TCU variant coding is faulty. - The CAN communication between units is malfunctioning.					
P0614	TCCU Coding Failt	- Occurred if TCCU variant coding is faulty. - Occurred when there is CAN communication error between units.					
P0618	Multi calibration not performed	- Perform multi calibration again.					
P0619	Multi calibration performing error	- Perform multi calibration again.					
P062D (former P1611)	Injector Bank #1 Malfunction - Low Voltage	- Malfunction of injector (#1, #4, #3) circuit (Low): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #1: Open and poor contact - Check if the trouble recurs with the injectors removed and the ignition key “OFF”. • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key “ON”. • If recurred, replace the injector (perform C2I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. • ECU pin #44 and #63 - Replace the ECU if required.					
P062E (former P1618)	Injector Bank #2 Malfunction - Low Voltage	- Malfunction of injector (#2, #5) circuit (Low): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #2: Open and poor contact - Check if the trouble recurs with the injectors removed and the ignition key “OFF”. • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key “ON”. • If recurred, replace the injector (perform C2I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. • ECU pin #44 and #63 - Replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P062F	Multi calibration memory error	- Perform multi calibration again.					
P0630	Variant Coding is not done	- Variant coding is not done					
P0631	Variant Coding writing error	- Variant coding writing error					
P0633	Immobilizer Fault (refer to immobilizer section)	- Key memory is not available (permissible - 5). - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.					
P0641	ECU Supply Voltage 1 Fault (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.					
P0642	ECU Supply Voltage 1 Fault - Low (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.					
P0643	ECU Supply Voltage 1 Fault - High (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.					
P0649	Diag Lamp Drive Open Circuit	Open circuit					
P0650	Diag Lamp Drive Short to BATT	Short to batt					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0651	ECU Supply Voltage 2 Fault (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.			O		O
P0652	ECU Supply Voltage 2 Fault - Low (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.			O		O
P0653	ECU Supply Voltage 2 Fault - High (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.			O		O
P066A	Internal malfunction in #1 glow plug controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.					
P066B	Internal short in #1 glow plug controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.					
P066C	Internal malfunction in #2 glow plug controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.					
P066D	Internal short in #2 glow plug controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.					
P066E	Internal malfunction in #3 glow plug controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.					
P066F	Internal short in #3 glow plug controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.					
P0670	Defective power supply of glow plug controller	- Details: refer to P2673.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0671	#3 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P0672	#4 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P0673	#5 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P0674	#1 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P0675	#2 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P067A	Internal malfunction in #4 glow plug controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.					
P067B	Internal short in #4 glow plug controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.					
P067C	Internal malfunction in #5 glow plug controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.					
P067D	Internal short in #5 glow plug controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.					
P0683	Defective CAN communiction of glow plug controller	- GCU's CAN signal is intermittently defective.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P0685	Main Relay Malfunction	- The the main relay is unexpectedly high/low state (ECU is supplied after 3 seconds). - Relay resistance: 92 ± 9 Ω (at 20°C) - Check the relay wiring harness (open, short and poor contact). • Check for open and short: ECU pin #9. - If the forced operation is not available, replace the ECU.					
P0697	ECU Supply Voltage Fault (2.5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 2.5 V - Check the supply voltage to each sensor • Supply voltage (2.55 V): accelerator pedal sensor 2 - Check the wiring harnesses. - Replace the ECU if required.					
P0698	ECU Supply Voltage Fault - Low (2.5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 2.5 V - Check the supply voltage to each sensor • Supply voltage (2.5 V): accelerator pedal sensor 2 - Check the wiring harnesses. - Replace the ECU if required.					
P0699	ECU Supply Voltage Fault - High (2.5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 2.5 V - Check the supply voltage to each sensor • Supply voltage (2.55 V): accelerator pedal sensor 2 - Check the wiring harnesses. - Replace the ECU if required.					
P0700	TCU Signal Fault	- The communication between ECU and TCU is faulty. - Check the communication line between ECU and TCU. - Check the ECU pin #54, 73 for open and short. - Replace the ECU if required.					
P0704	Clutch switch malfunction	- The clutch switch is faulty (Manual Transmission Only). - Check the switch wiring harness. • Check the ECU pin #38 for open, short and poor contact. - Check the switch supply voltage and operations. - Replace the ECU if required.					
P0805	Neutral Signal Input Malfunction (Only for D27DT M/T model)	- The neutral signal of M/T is sent to CAN cluster which is then sent to ECU via CAN communication. - The ECU cannot detect whether signal is missing due to the malfunction in neutral signal and wiring or due to the line malfunction. - Check the wiring related to neutral switch.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P1102	HFM Sensor - High Characteristic Value (Only for D27DT model)	- The characteristic value of HFM sensor is over the specified value (not wiring malfunction).					
P1103	HFM Sensor - Low Characteristic Value (Only for D27DT model)	- The characteristic value of HFM sensor is below the specified value (not wiring malfunction).					
P1105	Barometric Sensor Circuit Short	- Out of range about barometric sensor (over voltage). - Actual barometric pressure vs. Output voltages. • 15 Kpa: 0 V 35 Kpa: 1.0 V • 55 Kpa: 2.0 V 80 Kpa: 3.0 V • 100 Kpa: 4.0 V 110 Kpa: 4.5 V - Replace the ECU.					
P1106	Booster Pressure Sensor Malfunction	- Out of range of supply voltages about boost pressure sensor at Ignition key-On and Engine Stop (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages. • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness for ECU pin #99 and #100 (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction					
P1107	Barometric Sensor Circuit Short/GND Short	- Out of range about barometric sensor (short to ground). - Actual barometric pressure vs. Output voltages. • 15 Kpa: 0 V 35 Kpa: 1.0 V • 55 Kpa: 2.0 V 80 Kpa: 3.0 V • 100 Kpa: 4.0 V 110 Kpa: 4.5 V - Replace the ECU.					
P1108	Barometric Sensor Circuit Short	- Out of range about barometric sensor (short to B+). - Actual barometric pressure vs. Output voltages. • 15 Kpa: 0 V 35 Kpa: 1.0 V • 55 Kpa: 2.0 V 80 Kpa: 3.0 V • 100 Kpa: 4.0 V 110 Kpa: 4.5 V - Replace the ECU.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1109	Booster Pressure Sensor Initial Check Fault	- Implausible signal values or range about boost pressure sensor at Engine running condition (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness for ECU pin #99 and #100 (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction					
P110A	AMF OBD High Sigral	- High sigral					
P110B	AMF OBD Low Sigral	- Low sigral					
P1115	Coolant Temperature Sensor Malfunction	- Implausible values of coolant temperature (If the temperature is below the limits values after warm up). - If Fuel temperature is invalid, the previous coolant temperature is retained. - Check the supply voltage to sensor. - Actual air temp. vs. Resistance • 20°C: 2449 Ω • 50°C: 826.3 Ω • 80°C: 321.4 Ω • 100°C: 112.9 Ω - Check the wiring harness (open, short and poor contact). • ECU pin #101 and #102 - Visually check the sensor and replace if required. - Check the thermostat, water pump radiator related coolant route (thermostat stuck). - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1120	Accelerator Pedal Sensor #1 Malfunction	- The potentiometer 1 is not plausible with potentiometer 2. - Check the supply voltage to sensor. - Check the wiring harness. • Check the ECU pin #72, 53 and #32, 14 for open and short. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.	O				
P1121	Accelerator Pedal Sensor #2 Malfunction	- The potentiometer 1 is not plausible with potentiometer 2. - Check the supply voltage to sensor. - Check the wiring harness. • Check the ECU pin #72, 53 and #32, 14 for open and short. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.	O				
P1122	Accelerator Pedal Sensor Malfunction (Limp Home Mode)	- When triggering limp home mode. - Check the supply voltage to sensor. - Check the wiring harness. • Check the ECU pin #72, 71, 53 and #57, 32, 14 for open and short. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.					
P1123	Accelerator Pedal Sensor Malfunction (Torque Mode)	- When triggering reduced torque mode. - Check the supply voltage to sensor. - Check the wiring harness. • Check the ECU pin #72, 71, 53 and #57, 32, 14 for open and short. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required	O				
P1124	Accelerator Pedal Sensor Malfunction - Stuck	- The accelerator pedal sensor is stuck. - Check the brake switch wiring harness and operations. - Check the accelerator pedal operations. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.					O
P1148	Accelerometer (Knock Sensor) Learning Fault	- Check if the MDP is successful. - Check the accelerometer (knock sensor) sensor and wiring harness. - Replace the ECU if required.		O			
P1149	Too High Water Level in Fuel Filter	- Drain the water from fuel filter.					
P1170	Torque Trim Fault - High	- Refer to P0372.					
P1171	#1 Injector MDP Malfunction	- The #1 injector MDP is faulty. - Replace the injector and perform C2I coding again.					
P1172	#2 Injector MDP Malfunction	- The #2 injector MDP is faulty. - Replace the injector and perform C2I coding again.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1173	#3 Injector MDP Malfunction	- The #3 injector MDP is faulty. - Replace the injector and perform C2I coding again.					
P1174	#4 Injector MDP Malfunction	- The #4 injector MDP is faulty. - Replace the injector and perform C2I coding again.					
P1175	#5 Injector MDP Malfunction	- The #5 injector MDP is faulty. - Replace the injector and perform C2I coding again.					
P1190	Fuel Rail Pressure Sensor Initial Signal Fault	- The rail pressure sensor initial values are higher or lower than specified values with the ignition “ON”. • Maximum sensing values: 90 bar (Short) • Minimum sensing values: - 90 bar (Open) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the ECU pin #25, #26 for open and short. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O				
P1191	Pressure Build Up - Too Slow	- The pressure build up during cranking is too slow. - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4. 055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P1192	Fuel Rail Pressure Sensor Initial Signal Fault - Low	- The rail pressure sensor initial values are lower than specified values with the ignition “ON”. • Minimum sensing values: - 90 bar (Open) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the ECU pin #25, #26 for open and poor contact. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O				
P1193	Fuel Rail Pressure Sensor Initial Signal Fault - High	- The rail pressure sensor initial values are higher than specified values with the ignition “ON”. • Maximum sensing values: 90 bar (Short) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the ECU pin #25, #26 for short and poor contact. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O				
P1201	Injector #1 Circuit Short	- Injector #1 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU (ECU pin: #117, #114). - Replace the ECU if required.					
P1202	Injector #2 Circuit Short	- Injector #2 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU (ECU pin: #118, #121). - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1203	Injector #3 Circuit Short	- Injector #3 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU (ECU pin: #117, #116). - Replace the ECU if required.					
P1204	Injector #4 Circuit Short	- Injector #4 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU (ECU pin: #117, #115). - Replace the ECU if required.					
P1205	Injector #5 Circuit Short	- Injector #5 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU (ECU pin: #118, #120). - Replace the ECU if required.					
P1234	VGT Operation Fault (High)	- The boost pressure control is faulty. - Check the air intake system. - Check the supply voltage to sensor. - Check the wiring harness and the ECU wiring harness. - Replace the ECU if required.	O				
P1235	VGT Operation Fault	- The boost pressure control is faulty. - Check the air intake system. - Check the supply voltage to sensor. - Check the wiring harness and the ECU wiring harness. - Replace the ECU if required.	O				
P1252	Too High IMV Pressure	- The rail pressure is excessively high. - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4. 055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1253	Minimum Rail Pressure Control Malfunction (IMV Fault)	- Rail pressure faults: Too low - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the high pressure fuel lines, fuel rails and high pressure pipes for leaks. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					
P1254	Maximum Rail Pressure Control Malfunction (IMV Fault)	- Rail pressure faults: Too high - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the high pressure fuel lines, fuel rails and high pressure pipes for leaks. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1256	Too Small Transfer Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					
P1257	Too Large Transfer Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1258	Too Small High Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					
P1259	Too Large High Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. • Check the ECU pin #87 for open and short. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1260	Too high IMV Driving Current	- Abnormal rail pressure, IMV CURRENT TRIM TOO HIGH, DRIFT - Check the IMV wiring harnesses. - Check the ECU wiring harnesses. • Check ECU's pin A76 for open and short. - Check the Rail pressure sensor. • Supply voltage: 5 ± 0.1V • Output voltage at 1600 bar: 4.055 ± 0.125V • Output voltage at atmospheric pressure: 0.5 ± 0.04V - Check low-pressure fuel system. • Check fuel in fuel reservoir and air penetration. • Check fuel filter's specification. - Check high-pressure fuel system. • Check fuel rail and high-pressure pipe for leaks. - Check IMV's resistance (5.44 Ω). • If the resistance is out of specification, replace the high-pressure pump and IMV.					
P1286	Low Resistance for Injector #1 wiring harness	- Out of range about wiring harness resistance for Injector #1. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #1 wiring harness and electric isolation. - Check the injector #1 wiring harness for open circuit. • If the pin in injector #1 is defective, replace injector #1 and perform C2I coding, then check again. • If the pin in injector #1 is not defective, check the ECU wiring harness. - Replace the ECU if required.					
P1287	High Resistance for Injector #1 wiring harness	- Out of range about wiring harness resistance for Injector #1. • High: More than 0.573 Ω (injector circuit short) - Check the injector #1 wiring harness and electric isolation. - Check the injector #1 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #1 and perform C2I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1288	Low Resistance for Injector #2 wiring harness	- Out of range about wiring harness resistance for Injector #2. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #2 wiring harness and electric isolation. - Check the injector #2 wiring harness for open circuit. • If the pin in injector #2 is defective, replace injector #2 and perform C2I coding, then check again. • If the pin in injector #2 is not defective, check the ECU wiring harness. - Replace the ECU if required.					
P1289	High Resistance for Injector #2 wiring harness	- Out of range about wiring harness resistance for Injector #2. • High: More than 0.573 Ω (injector circuit short) - Check the injector #2 wiring harness and electric isolation. - Check the injector #2 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #2 and perform C2I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.					
P1290	Low Resistance for Injector #3 wiring harness	- Out of range about wiring harness resistance for Injector #3. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #3 wiring harness and electric isolation. - Check the injector #3 wiring harness for open circuit. • If the pin in injector #3 is defective, replace injector #3 and perform C2I coding, then check again. • If the pin in injector #3 is not defective, check the ECU wiring harness. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1291	High Resistance for Injector #3 wiring harness	- Out of range about wiring harness resistance for Injector #3. • High: More than 0.573 Ω (injector circuit short) - Check the injector #3 wiring harness and electric isolation. - Check the injector #3 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #3 and perform C2I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.					
P1292	Low Resistance for Injector #4 wiring harness	- Out of range about wiring harness resistance for Injector #4. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #4 wiring harness and electric isolation. - Check the injector #4 wiring harness for open circuit. • If the pin in injector #4 is defective, replace injector #4 and perform C2I coding, then check again. • If the pin in injector #4 is not defective, check the ECU wiring harness. - Replace the ECU if required.					
P1293	High Resistance for Injector #4 wiring harness	- Out of range about wiring harness resistance for Injector #4. • High: More than 0.573 Ω (injector circuit short) - Check the injector #4 wiring harness and electric isolation. - Check the injector #4 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #4 and perform C2I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1294	Low Resistance for Injector #5 wiring harness	- Out of range about wiring harness resistance for Injector #5. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #5 wiring harness and electric isolation. - Check the injector #5 wiring harness for open circuit. • If the pin in injector #5 is defective, replace injector #5 and perform C2I coding, then check again. • If the pin in injector #5 is not defective, check the ECU wiring harness. - Replace the ECU if required.					
P1295	High Resistance for Injector #5 wiring harness	- Out of range about wiring harness resistance for Injector #5. • High: More than 0.573 Ω (injector circuit short) - Check the injector #5 wiring harness and electric isolation. - Check the injector #5 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #5 and perform C2I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.					
P1405	EGR Solenoid Valve Malfunction - Short to ground	- Out of range about EGR gas: High. • EGR controller circuit: Open or short to ground - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check the EGR solenoid valve. - Check the EGR valve for stick. - Check the resistance of EGR actuator: 15.4 Ω. - Check the ECU wiring harness for open and short. • ECU pin #96					
P1406	EGR Solenoid Valve Malfunction - Short to +Batt	- Out of range about EGR gas: Low. • EGR controller circuit: Short to battery - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check the EGR solenoid valve. - Check the EGR valve for stick. - Check the resistance of EGR actuator: 15.4 Ω - Check the ECU wiring harness for open and short. • ECU pin #96					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1407	Faulty EGR Close Position	- Causes • The EGR position is not closed when EGR is not operated within 50 seconds with the engine idling. - Check pin for the followings: • EEGR #1: Valve power (Main relay) • EEGR #2: Sensor (Reference voltage) ..... ECU #A33 • EEGR #4: Sensor (Ground) ..... ECU #A09 • EEGR #5: Valve drive (PWM) ..... ECU #A48 • EEGR #6: Sensor (Signal) ..... ECU #A82 - Actions • Check EEGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408).					
P1409	EGR Valve Circuit Short	- Check pin for the followings: • The EEGR valve wiring is open. • EEGR Pin #1: Power(Main Relay) • EEGR Pin #5: ECU Pin #A48 - Actions • Check EEGR valve wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408).					
P1480	Condenser Fan #1 Circuit Malfunction - Open	- Condenser fan #1: Open - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. • ECU pin #80 - If the forced operation is not available after replacing the relay, replace the ECU.					
P1481	Condenser Fan #1 Circuit Malfunction - Short	- Condenser fan #1: Short - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. • ECU pin #80 - If the forced operation is not available after replacing the relay, replace the ECU.					
P1482	Condenser Fan #1 Circuit Malfunction - Short to Ground	- Condenser fan #1: Short to ground. - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. • ECU pin #80 - If the forced operation is not available after replacing the relay, replace the ECU.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P1500	Vehicle Speed Fault	- The vehicle speed signal through CAN communication is faulty. - Check the CAN communication line for open and short. - Check the ABS/ESP and TCU communication lines. - Check the ECU wiring harness. - Replace the ECU if required.					
P1501	Faulty Variant Coding (Vehicle Speed)	- If the vehicle sensor coding is set to YES (for vehicle with ABS), the vehicle speed input is faulty when the vehicle speed is below 15 km/h with the engine running at 1,600 rpm. - If the vehicle sensor coding is set to NO (for vehicle with CAN and ABS/ESP), the corresponding DTC is not shown. - Check the vehicle speed sensor coding.					
P1503	Faulty Vehicle Speed Sensor Input	- If the vehicle sensor coding is set to YES (for vehicle with ABS), the amount of pulses of the speed pulse ring for vehicle speed detection is more than the specified value. - Specified pulse: 52 pulses/rev. - Check the vehicle speed sensor coding.					
P1526	Condenser Fan #2 Circuit Malfunction - Open	- Condenser fan #2: Open - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. • ECU pin #81 - If the forced operation is not available after replacing the relay, replace the ECU.					
P1527	Condenser Fan #2 Circuit Malfunction - Short	- Condenser fan #2: Short - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. • ECU pin #81 - If the forced operation is not available after replacing the relay, replace the ECU.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1528	Condenser Fan #2 Circuit Malfunction - Short to Ground	- Condenser fan #2: Short to ground - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. • ECU pin #81 - If the forced operation is not available after replacing the relay, replace the ECU.					
P1530	#1 Heater Operating Circuit - Open	- #1 heater circuit malfunction: Open. - Check the wiring harness for open. • ECU pin #61 - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.					
P1531	#1 Heater Operating Circuit - Short	- #1 heater circuit malfunction: Short. - Check the wiring harness for short. • ECU pin #61 - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.					
P1532	#1 Heater operating circuit - Short to Ground	- #1 heater circuit malfunction: Short to ground. - Check the wiring harness for short. • ECU pin #61 - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.					
P1534	#2 Heater Operating Circuit - Open	- #2 heater circuit malfunction: Open. - Check the wiring harness for open. • ECU pin #62 - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1535	#2 Heater Operating Circuit - Short	- #2 heater circuit malfunction: Short. - Check the wiring harness for short. • ECU pin #62 - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.					
P1536	#2 Heater Operating Circuit - Short to Ground	- #2 heater circuit malfunction: Short to ground. - Check the wiring harness for short. • ECU pin #62 - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.					
P1540	Air Conditioner Operating Circuit Fault - Open	- Check the air conditioner sensors and wiring harnesses. - Check the ECU wiring harness. - Check the ECU if required.					
P1541	Air Conditioner Operating Circuit Fault - Short	- Check the air conditioner sensors and wiring harnesses. - Check the ECU wiring harness. - Check the ECU if required.					
P1542	Air Conditioner Operating Circuit Fault - Short to Ground	- Check the air conditioner sensors and wiring harnesses. - Check the ECU wiring harness. - Check the ECU if required.					
P1564	Auto Cruise Switch Fault (power)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%					
P1565	Auto Cruise Switch Malfunction (Acceleration)	- The auto cruise accelerator switch or related wiring is malfunctioning.					
P1566	Auto Cruise Switch Malfunction (OFF)	- The auto cruise OFF switch or related wiring is malfunctioning.					
P1567	Auto Cruise Switch Malfunction (Return)	- The auto cruise switch or related wiring is malfunctioning.					
P1568	Auto Cruise Switch Fault (when accelerating)	- Auto cruise switch fault (accelerating)					
P1568	Auto Cruise Switch Malfunction (Deceleration)	- The auto cruise decelerator switch or related wiring is malfunctioning.					
P1569	Auto Cruise Switch Fault (when decelerating)	- Auto cruise switch fault (decelerating)					
P1569	Auto Cruise Switch Malfunction (Safety)	- The auto cruise safety switch or related wiring is malfunctioning.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1570	Auto Cruise Switch Fault (Signal)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%					
P1571	Brake Lamp Signal Fault	- The brake pedal switch is faulty. • Brake pedal switch: Normal Close (NC) • Light switch: Normal Open (NO) • When operating the brake pedal switch, one signal (NO) is sent to auto cruise and the other (NC) is sent to brake lamp. - Check the brake pedal switch wiring harness. - Check the supply voltage to brake pedal switch (12 V). - Check the brake pedal switch for contact. - Check the ECU wiring harness for ECU pin #77 (open, short, poor contact). - Replace the ECU if required.					
P1572	Brake Lamp Signal Fault	- The brake pedal switch or light switch is faulty. • Brake pedal switch: Normal Close (NC) • Light switch: Normal Open (NO) • When operating the brake pedal switch, one signal (NO) is sent to auto cruise and the other (NC) is sent to brake lamp. - Check the brake pedal and light switch wiring harness. - Check the supply voltage to brake pedal and light switch (12 V). - Check the brake pedal and light switch for contact. - Check the ECU wiring harness for ECU pin #58 (open, short, poor contact). - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P1573	Auto Cruise Switch Fault (short)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%					
P1578	Auto Cruise Switch Fault (Circuit Short)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%					
P1600	ECU Shut Down Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					
P1601	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					
P1602	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					
P1603	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					
P1604	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1605	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					
P1606	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O
P1607	ECU Injector Cut Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					
P1608	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					
P1614	ECU C2I/MDP Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O
P1615	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O
P1616	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O
P1620	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O
P1621	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O
P1622	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P162D (former P1612)	Injector Bank #1 Malfunction - High Voltage	- Malfunction of injector (#1, #4, #3) circuit (High): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #1: Short and poor contact - Check if the trouble recurs with the injectors removed and the ignition key “OFF”. • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key “ON”. • If recurred, replace the injector (perform C2I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. • ECU pin #44 and #63 - Replace the ECU if required.					
P162E (former P1619)	Injector Bank #2 Malfunction - High Voltage	- Malfunction of injector (#2, #5) circuit (High): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #2: Short and poor contact - Check if the trouble recurs with the injectors removed and the ignition key “OFF”. • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key “ON”. • If recurred, replace the injector (perform C2I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. • ECU pin #44 and #63 - Replace the ECU if required.					
P1630	Wrong response from Immobilizer (refer to immobilizer section)	- The invalid key is inserted or no communication between transponder and immobilizer (no response from transponder). - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1631	Immobilizer Fault (refer to immobilizer section)	- The immobilizer is not operating. - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.					
P1632	Immobilizer Fault (refer to immobilizer section)	- No response from immobilizer. - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.					
P1633	Immobilizer Fault (refer to immobilizer section)	- No key coding. - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.					
P1634	Immobilizer Fault (refer to immobilizer section)	- No response from immobilizer. - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna. - Replace the ECU if required.					
P1635	No response from Immobilizer (refer to immobilizer section)	- No response from immobilizer. - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immedi-ately Engine Stop	Limp Home Mode
P1636	Immobilizer Fault (refer to immobilizer section)	- Severe trouble is not defined. - Perform the immobilizer coding again. - Check the ECU wiring harness. • Check the ECU pin #34 for open and short. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.					
P1650	AMF OBD Short to GND	- Short to GND					
P1657	Engine Mount Control Malfunction (Open)	- The wiring for engine mount level control is malfunctioning. - Standard level: - Operating condition:					
P1658	Engine Mount Control Malfunction (Short to B+)	- The wiring for engine mount level control is short to battery. - ECU pin No. 23, relay control - Engine speed : Over 1,200 rpm (30 km/h for vehicle speed)					
P1659	Engine Mount Control Malfunction (Short to GND)	- The wiring for engine mount level control is short to ground. - ECU pin No. 23, relay control - Engine speed : Over 1,200 rpm (30 km/h for vehicle speed)					
P1671	#3 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P1672	#4 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P1673	#5 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1674	#1 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P1675	#2 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.					
P1676	Glow Plug Communication Fault	- The communication between ECU and glow plug is faulty. - Check the communication line between ECU and glow plug. - Check the glow plug wiring harness. - Check the resistance of glow plug: below 1 Ω. - Check the glow plug relay. - Check the ECU wiring harness. • Check the ECU pin #113 for short to ground. - Replace the ECU if required.					
P1677	Glow Plug Controller Fault	- The communication between ECU and glow plug is faulty. - Check the communication line between ECU and glow plug. - Check the glow plug wiring harness. - Check the resistance of glow plug: below 1Ω. - Check the glow plug relay. - Check the ECU wiring harness. • Check the ECU pin #113 for short to ground. - Replace the ECU if required.					
P1678	Glow Plug Malfunction - Open	- Glow plug circuit malfunction: Open. - Check the glow plug wiring harness for open. • ECU pin #113 - Check the glow plug relay operations. - Check the glow plug power supply. - Check the ECU wiring and replace the ECU if required.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P1679	Glow Plug Malfunction - Short	- Glow plug circuit malfunction: Short. - Check the glow plug wiring harness for open. • ECU pin #113 - Check the glow plug relay operations. - Check the glow plug power supply. - Check the ECU wiring and replace the ECU if required.					
P1680	Glow Plug Malfunction - Short to Ground	- Glow plug circuit malfunction: Short to ground. - Check the glow plug wiring harness for open. • ECU pin #113 - Check the glow plug relay operations. - Check the glow plug power supply. - Check the ECU wiring and replace the ECU if required.					
P1683	Defective CAN communiction of glow plug controller	- No GCU CAN signal - Details: refer to P2673.					
P2100	Throttle Drive Circuit Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					
P2101	Throttle Drive Ground Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					
P2102	Throttle Drive Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P2103	Throttle Drive Battery Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					
P2104	Throttle Drive Overheat	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					
P213B	Abnormal Throttle Control	- Causes • The difference between throttle position demand (MAP) and throttle position feedback signal is out of +5% or -13%. - Defective throttle control (P213B) - Defective throttle signal (P213C, P213D) - Defective throttle drive (P2103, P2101, P2102, P2104, P2100) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P213C	Low Throttle Signal	- Causes • The throttle valve position sensor signal is stuck low. - Check pin for the followings: • Throttle valve #1: sensor (Power) ..... ECU #A20 • Throttle valve #2: sensor (Signal) ..... ECU #A22 • Throttle valve #3: sensor (GND) ..... ECU #A81 • Throttle valve #4: valve (Positive) ..... ECU #A75 • Throttle valve #5: valve (Positive) ..... ECU #A77 - Sensor & Motor SPEC • Motor * Power: 12V * Max. current : 6.8A (Normal: 3.6 ~ 0.2) * Motor resistance: 4.3Ω • Sensor * Power: 5V - Actions • Check the throttle valve and sensor wiring harnesses. (The signal output of throttle valve is below than 0.24 V.) • Visually check the unit and replace if necessary.					
P213D	High Throttle Signal	- Causes • The throttle valve position sensor signal is stuck high. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.					

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New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P2671	#3 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.					
P2672	#4 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.					

New DTC

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P2673	#5 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.					
P2674	#1 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.					

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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode
P2675	#2 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.					
P3040	ECU Internal Malfunction	- The internal sector of ECU is malfunctioning.					
P3041	ECU Internal Malfunction	- The internal sector of ECU is malfunctioning.					

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TROUBLE DIAGNOSIS TABLE

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Variable Valve Timing System	P0010	Cam Actuator - Short circuit to B+	• **Condition** - Variable valve timing system circuit: short circuit to battery • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	O
		Cam Actuator - Short or Open circuit to Ground	• **Condition** - Variable valve timing system circuit: short or open circuit to ground • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	O
	P0011	Cam Actuator - Fixed to Advance Position	• **Condition** - The noise occurred by valve timing (advance/retard) in each range is over than the specified value. • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	O
	P0012	Cam Actuator - Fixed to Retard Position	• **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	O
HFM Sensor	P0101	Faulty HFM Sensor Signal	• **Condition** - Improper air volume is detected. • **Specification** - 20 kg/h - 0.47 V 0 kg/h - 0.99 V 10 kg/h - 1.2226 ~ 1.2398 V 15 kg/h - 1.3552 ~ 1.3778 V 30 kg/h - 1.6783 ~ 1.7146 V 60 kg/h - 2.1619 ~ 2.2057 V 120 kg/h - 2.7215 ~ 2.7762 V 250 kg/h - 3.4388 ~ 3.5037 V 370 kg/h - 3.8796 ~ 3.9511 V 480 kg/h - 4.1945 ~ 4.2683 V 640 kg/h - 4.5667 ~ 4.6469 V • **Actions** 1. Measure the actual air volume using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 92 and 116. 3. Inspect HFM sensor. 4. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
HFM Sensor	P0102	Low HFM Sensor Signal	• **Condition** - The signal is below the minimum engine load (0.02). - Related circuit: open circuit • **Specification** - 20 kg/h - 0.47 V 0 kg/h - 0.99 V 10 kg/h - 1.2226 ~ 1.2398 V 15 kg/h - 1.3552 ~ 1.3778 V 30 kg/h - 1.6783 ~ 1.7146 V 60 kg/h - 2.1619 ~ 2.2057 V 120 kg/h - 2.7215 ~ 2.7762 V 250 kg/h - 3.4388 ~ 3.5037 V 370 kg/h - 3.8796 ~ 3.9511 V 480 kg/h - 4.1945 ~ 4.2683 V 640 kg/h - 4.5667 ~ 4.6469 V • **Actions** 1. Measure the actual air volume using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 92 and 116. 3. Inspect HFM sensor. 4. Check the ECU.	O
	P0103	High HFM Sensor Signal	• **Condition** - The signal is over the maximum engine load (0.02). - Related circuit: short circuit • **Specification** - 20 kg/h - 0.47 V 0 kg/h - 0.99 V 10 kg/h - 1.2226 ~ 1.2398 V 15 kg/h - 1.3552 ~ 1.3778 V 30 kg/h - 1.6783 ~ 1.7146 V 60 kg/h - 2.1619 ~ 2.2057 V 120 kg/h - 2.7215 ~ 2.7762 V 250 kg/h - 3.4388 ~ 3.5037 V 370 kg/h - 3.8796 ~ 3.9511 V 480 kg/h - 4.1945 ~ 4.2683 V 640 kg/h - 4.5667 ~ 4.6469 V • **Actions** 1. Measure the actual air volume using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 92 and 116. 3. Inspect HFM sensor.	O
MAP Sensor (G23 only)	P0105	Defective Intake Manifold Pressure Sensor Signal		

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Intake Air Temperature Sensor	P0111	Faulty Intake Air Temperature Sensor Signal	• **Condition** - The temperature change of over 20 °C is occurred more than 5 times. • **Specification** 20°C - 2420 Ω - 2.65 V 30°C - 1662 Ω - 2.18 V 50°C - 853 Ω - 1.40 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 80 and 116. 3. Inspect intake air temperature sensor (ATS-HFM6.0 integrated). 4. Check the ECU.	O
	P0112	Intake Air Temperature Sensor Malfunction - Open circuit	• **Condition** - The sensor value is less than minimum specified value (0.1 V). - Related circuit: open circuit • **Specification** 20°C - 2420 Ω - 2.65 V 30°C - 1662 Ω - 2.18 V 50°C - 853 Ω - 1.40 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 80 and 116. 3. Inspect intake air temperature sensor (ATS-HFM6.0 integrated). 4. Check the ECU.	O
	P0113	Intake Air Temperature Sensor Malfunction - Short circuit	• **Condition** - The sensor value is over the maximum specified value (4.9 V). - Related circuit: short circuit • **Specification** 20°C - 2420 Ω - 2.65 V 30°C - 1662 Ω - 2.18 V 50°C - 853 Ω - 1.40 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 80 and 116. 3. Inspect intake air temperature sensor (ATS-HFM6.0 integrated). 4. Check the ECU.	O
Coolant Temperature Sensor	P0116	Faulty Coolant Temperature Sensor Signal	• **Condition** - The coolant temperature is below 50 °C after engine warmed up. • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	O

New DTC

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Coolant Temperature Sensor	P0117	Coolant Temperature Sensor Malfunction - Open circuit	• **Condition** - The sensor value is less than minimum specified value (0.11 V). - Related circuit: open circuit • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	O
	P0118	Coolant Temperature Sensor Malfunction - Short circuit	• **Condition** - The sensor value is over the maximum specified value (4.96 V). - Related circuit: short circuit • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	O
Throttle Body Control	P0120	No.1 Throttle Position Sensor - Low Voltage	• **Condition** - No.1 throttle position sensor circuit: short or open circuit to ground. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O

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● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0120	No.1 Throttle Position Sensor - High Voltage	• **Condition** - No.1 throttle position sensor's main power is grounded. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		No.2 Throttle Position Sensor - Low Voltage	• **Condition** - No.2 throttle position sensor circuit: short or open circuit to ground. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		No.2 Throttle Position Sensor - High Voltage	• **Condition** - No.2 throttle position sensor's main power is grounded. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O

New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0120	Throttle Actuator - Insuffcient Supply Power	• **Condition** - Actuator circuit: short circuit • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		TPS Valve Inconsistent with HFM Sensor Value	• **Condition** - The potentiometer is defective. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		Both Throttle Position Sensors Malfunction	• **Condition** - The potentiometer is defective. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0120	Inconsistent Signals of No.1 and No.2 Throttle Position Sensors	**• Condition** - The difference in amount of 1/2 is occurred in potentiometer. **• Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A **• Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		Throttle Actuator Control Malfunction	**• Condition** - The wiring or actuator is defective. **• Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A **• Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		Intake Air Flow Sensor and Throttle Sensor Malfunction	**• Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A **• Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O

New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Accelerator Pedal Sensor	P0120	Accelerator Pedal Sensor Malfunction - Supply Voltage Fault	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	O
		Accelerator Pedal Sensor #1 Malfunction - Low Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	O
		Accelerator Pedal Sensor #1 Malfunction - High Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	O
		Accelerator Pedal Sensor #2 Malfunction - Low Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	O
		Accelerator Pedal Sensor #2 Malfunction - High Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	O
		Accelerator Pedal Sensor #1 & #2 - Defective Signal	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	O
		Accelerator Pedal Sensor #1 & #2 Malfunction	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	O

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● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0121	Throttle Position Sensor Actuator's Learning Control Malfunction	• **Condition** - The actuator is not properly adjusted and the conditions are not satisfied. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		Faulty Throttle Body Return Spring	• **Condition** - The return spring of actuator is defective. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
Coolant Temperature Sensor	P0125	Low coolant temperature while controlling air/fuel ratio	• **Condition** - The coolant temperature is below the specified temperature for controlling air/fuel ratio after engine warmed up. • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits for ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	O
Thermostat	P0128	Thermostat Fully Open	• **Condition** 1. The actual coolant temperature is lower than the coolant temperature calculated by ECU due to the slow preheat. • **Actions** 1. Check the thermostat.	O

New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0131	No.1 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds (refer to P0133) • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
	P0132	No.1 Oxygen Sensor - Overvoltage	• **Condition** - No.1 oxygen sensor is defective. Output voltage > 1.05 V The sensing voltage is not in the specified range. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0133	No.1 Oxygen Sensor - Poor Performance	• **Condition** - No.1 oxygen sensor is defective. The response to the sensor signal is delayed. Closed loop interval of air/fuel ratio control > 1500 ms • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

NOTE

- **The No.1 oxygen sensor is located before the catalytic converter (for exhaust manifold 1/2/3) and no.2 oxygen sensor is located after the catalytic converter.**
- **The No.3 oxygen sensor is located before the catalytic converter (for exhaust manifold 4/5/6) and no.4 oxygen sensor is located after the catalytic converter.**

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New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0134	No.1 Oxygen Sensor - Malfunction	**• Condition** - No.1 oxygen sensor is defective. The sensor does not operate. **• Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ **• Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
		No.1 Oxygen Sensor - Lean Indication (When Decelerating)	**• Condition** - No.1 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. **• Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ **• Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0135	No.1 Oxygen Sensor - Faulty Heating Current, Heater Circuit is Open or Short circuit or Short circuit to Ground	**• Condition** - No.1 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). **• Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds **• Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O

New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0135	No.1 Oxygen Sensor Heater - Short circuit to B+	• **Condition** - No.1 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
		No.1 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Condition** - No.1 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0137	No.2 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Condition** - No.2 oxygen sensor is defective. The sensor does not operate. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance:≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

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New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0138	No.2 Oxygen Sensor - Overvoltage	• **Condition** - No.2 oxygen sensor is defective. The output value is not within the specified range. The sensing voltage is not in the specified range. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0140	No.2 Oxygen Sensor - Lean Indication (When Decelerating)	• **Condition** - No.2 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0141	No.2 Oxygen Sensor Heater - Short circuit to B+	• **Condition** - No.2 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 7. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O

New DTC

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● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0141	No.2 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Condition** - No.2 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 7. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
		No.2 Oxygen Sensor - Poor Heating	• **Condition** - No.2 oxygen sensor is defective. The response to the sensor signal is delayed. • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 7. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0151	No.3 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

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New DTC

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● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0152	No.3 Oxygen Sensor - Overvoltage	• **Condition** - No.3 oxygen sensor is defective. The output value is not within the specified range. The sensing voltage is not in the specified range. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0153	No.3 Oxygen Sensor - Poor Performance	• **Condition** - No.3 oxygen sensor is defective. The response to the sensor signal is delayed. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0154	No.3 Oxygen Sensor - Malfunction	• **Condition** - No.3 oxygen sensor is defective. The sensor does not operate. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

New DTC

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0154	No.3 Oxygen Sensor - Lean Indication (When Decelerating)	• **Condition** - No.3 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0155	No.3 Oxygen Sensor - Faulty Heating Current	• **Condition** - No.3 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 6. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
		No.3 Oxygen Sensor Heater - Short circuit to B+	• **Condition** - No.3 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 6. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
		No.3 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Condition** - No.3 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 6. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.4 Oxygen Sensor (Installed After Catalytic Converter)	P0157	No.4 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850 °C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0158	No.4 Oxygen Sensor - Overvoltage	• **Condition** - No.4 oxygen sensor is defective. The output value is not within the specified range. The sensing voltage is not in the specified range. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip -Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
	P0160	No.4 Oxygen Sensor - Lean Indication (When Decelerating)	• **Condition** - No.4 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850 °C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.4 Oxygen Sensor (Installed After Catalytic Converter)	P0161	No.4 Oxygen Sensor - Poor Heating	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 3. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
		No.4 Oxygen Sensor Heater - Short circuit to B+	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 3. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
		No.4 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 3. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0171	Short-term Learning Control of Air/Fuel Ratio: Fuel Rich	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Correction	P0171	Air/Fuel Ratio Control Malfunction - Fuel Rich	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●
		Learning Control Malfunction - Rich at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●
		Learning Control Malfunction - Rich under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●
		Learning Control Malfunction - Rich under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●
	P0172	Air/Fuel Ratio Control Malfunction - Fuel Lean	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●
		Learning Control Malfunction - Lean at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●
		Learning Control Malfunction - Lean under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●
		Learning Control Malfunction - Lean under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	●

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0172	Short-term Learning Control of Air/Fuel Ratio: Fuel Lean	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
Fuel Correction	P0174	Air/Fuel Ratio Control Malfunction - Fuel Rich	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
		Fuel Rich at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
		Fuel Rich under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
		Fuel Rich under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0174	Short-term Learning Control of Air/Fuel Ratio: Fuel Rich	• **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850 °C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Correction	P0175	Air/Fuel Ratio Control Malfunction - Fuel Lean	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
		Fuel Lean at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
		Fuel Lean under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
		Fuel Lean under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	O
No.4 Oxygen Sensor (Installed After Catalytic Converter)	P0175	Short-term Learning Control of Air/Fuel Ratio: Fuel Lean	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance : ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	O
Throttle Body Safety Function	P0221	Deceleration Over Limit (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Acceleration Over Limit (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O

New DTC

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Safety Function	P0221	Control Lever Double Action (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Control Lever Safety Terminal Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Pedal Position Change Fault (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Throttle Position Change Fault (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Defective Constant Speed Driving Control Data (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Faulty Pedal Position Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Faulty Throttle Position Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Faulty CAN Communi-cation Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Faulty Configuration Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		Faulty A/D Converter Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		CPU #1 and #2 - Pedal Position Signal Fault	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Safety Function	P0221	CPU #1 and #2 - TP Valve Position Signal Fault	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		CPU #1 and #2 - MSR Signal Fault	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		CPU #1 and #2 - Idle Control	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		AD Converter Overflow Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		ROM Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		RAM Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
		CPU Recognition Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	O
Fuel Pump Relay	P0231	Fuel Pump Relay - Open circuit to Ground	• **Condition** - Fuel pump circuit: short or open circuit to ground • **Specification** - The voltage drop of pin No. 33 and ground: Below 1 V (current = 150 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 33. 2. Inspect the fuel pump relay. 3. Check the ECU.	O
	P0232	Fuel Pump Relay - Short circuit to B+	• **Condition** - Fuel pump: short circuit to battery • **Specification** - The voltage drop of pin No. 33 and ground: Below 1 V (current = 150 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 33. 2. Inspect the fuel pump relay. 3. Check the ECU.	O

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O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Injection System	P0261	No.1 Injector - Short or Open circuit to Ground	• **Condition** - No.1 injector is defective. No.1 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 63. 2. Inspect the injector. 3. Check the ECU.	O
	P0262	No.1 Injector - Short circuit to B+	• **Condition** - No.1 injector is defective. No.1 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.1 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	O
	P0264	No.2 Injector - Short or Open circuit to Ground	• **Condition** - No.2 injector is defective. No.2 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 61. 2. Inspect the injector. 3. Check the ECU.	O
	P0265	No.2 Injector - Short circuit to B+	• **Condition** - No.2 injector is defective. No.2 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.2 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	O

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O : Turning on when the condition is occurred twice consecutively

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Injection System	P0267	No.3 Injector - Short or Open circuit to Ground	• **Condition** - No.3 injector is defective. No.3 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 66. 2. Inspect the injector. 3. Check the ECU.	O
	P0268	No.3 Injector - Short circuit to B+	• **Condition** - No.3 injector is defective. No.3 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.3 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	O
	P0270	No.4 Injector - Short or Open circuit to Ground	• **Condition** - No.4 injector is defective. No.4 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 62. 2. Inspect the injector. 3. Check the ECU.	O
	P0271	No.4 Injector - Short circuit to B+	• **Condition** - No.4 injector is defective. No.4 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.4 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	O

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New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Injection System	P0273	No.5 Injector - Short or Open circuit to Ground	• **Condition** - No.5 injector is defective. No.5 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 65. 2. Inspect the injector. 3. Check the ECU.	O
	P0274	No.5 Injector - Short circuit to B+	• **Condition** - No.5 injector is defective. No.5 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.5 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	O
	P0276	No.6 Injector - Short or Open circuit to Ground	• **Condition** - No.6 injector is defective. No.6 injector has a short circuit to ground. • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 64. 2. Inspect the injector. 3. Check the ECU.	O
	P0277	No.6 Injector - Short circuit to B+	• **Condition** - No.6 injector is defective. No.6 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.6 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Poor Ignition (Misfire)	P0300	Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in more than one cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9.Check the ECU.	●
	P0301	No.1 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.1 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	●
	P0302	No.2 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.2 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	●

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Poor Ignition (Misfire)	P0303	No.3 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.3 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	●
	P0304	No.4 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.4 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	●
	P0305	No.5 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.5 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	●

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Poor Ignition (Misfire)	P0306	No.6 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.6 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	●
Knock Sensor	P0325	#1 Knock Sensor Malfunction (1, 2, 3 CYL)	• **Condition** - No.1 knock sensor is defective. The value is not within the specified range when the engine temperature is over 75°C, the engine speed is over 3000 rpm and other units are properly operated (for cylinder No. 1, 2 and 3). • **Specification** - Sensitivity: approx. 26 ± 8 mV/g Resistance > 10 MΩ • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 117 and 118. 2. Inspect the No.1 knock sensor. 3. Check the ECU.	O
	P0330	#2 Knock Sensor Malfunction (4, 5, 6 CYL)	• **Condition** - No.2 knock sensor is defective. The value is not within the specified range when the engine temperature is over 75°C, the engine speed is over 3000 rpm and other units are properly operated (for cylinder No. 4, 5 and 6). • **Specification** - Sensitivity: approx. 26 ± 8 mV/g Resistance > 10 MΩ • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 114 and 115. 2. Inspect the No.2 knock sensor. 3. Check the ECU.	O

New DTC

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Crank Position Sensor	P0335	Faulty Crank Position Sensor Signal - No Engine RPM	• **Condition** - The crank angle signals cannot be detected even the cam position is properly detected. • **Specification** - Sensor's internal resistance : 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	O
		Faulty Crank Position Sensor Signal - Faulty Recognition of Gap	• **Condition** - The cam and crank angle signal is improperly recognized or not recognized. • **Specification** - Sensor internal resistance: 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	O
		Crank Position Sensor Adaptation Malfunction - Poor Initialization	• **Condition** - The crank angle sensor is faulty initialized. • **Specification** - Sensor internal resistance: 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	O
	P0336	Crank Position Sensor - Excessive Engine RPM	• **Condition** - The engine rpm is over the proper amount or improper. • **Specification** - Sensor internal resistance: 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Cam Position Sensor	P0340	#1 Cylinder Synchronization Malfunction	• **Condition** - The cam position sensor is defective. The No.1 cylinder is poorly synchronized. • **Specification** - Sensor supply voltage: 4.5 V - 24 V • **Actions** 1. Measure the set voltage of cam position sensor. 2. Inspect the circuits and terminals of ECU pin No. 106 and 104. 3. Inspect the cam position sensor. 4. Check the cam sensor and sprocket for damage. 5. Check the ECU.	O
	P0341	#1 Cylinder Recognition Malfunction	• **Condition** - There is no cam recognition signal. • **Specification** - Sensor supply voltage: 4.5 V - 24 V • **Actions** 1. Measure the set voltage of cam position sensor. 2. Inspect the circuits and terminals of ECU pin No. 106 and 104. 3. Inspect the cam position sensor. 4. Check the cam sensor and sprocket for damage. 5. Check the ECU.	O
Ignition Coil	P0351	#1 Ignition Coil - Faulty Output Voltage	• **Condition** - The ignition unit is defective (for No. 2 and 5 cylinders). Ignition circuit: short circuit to primary and secondary current • **Specification** - Primary resistance: 0.36 Ω Secondary resistance: 5.9 kΩ - Secondary voltage: 38 KV - Ignition output Primary current: 7.0 A Primary voltage: 380 V • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 70, 71 and 72. 2. Inspect the power supply of ignition coil. 3. Inspect the ignition coil and high-voltage cable. 4. Inspect the spark plug for moisture, crack, wear, improper cap and excessive burnt electrode residue. 5. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Ignition Coil	P0352	#2 Ignition Coil - Faulty Output Voltage	• **Condition** - The ignition unit is defective (for No. 3 and 4 cylinders). Ignition circuit: short circuit to primary and secondary current • **Specification** - Primary resistance: 0.36 Ω Secondary resistance: 5.9 kΩ - Secondary voltage: 38 KV - Ignition output Primary current: 7.0 A Primary voltage: 380 V • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 70, 71 and 72. 2. Inspect the power supply of ignition coil. 3. Inspect the ignition coil and high-voltage cable. 4. Inspect the spark plug for moisture, crack, wear, improper cap and excessive burnt electrode residue. 5. Check the ECU.	O
	P0353	#3 Ignition Coil - Faulty Output Voltage	• **Condition** - The ignition unit is defective (for No. 1 and 6 cylinders). Ignition circuit: short circuit to primary and secondary current • **Specification** - Primary resistance: 0.36 Ω Secondary resistance: 5.9 kΩ - Secondary voltage: 38 KV - Ignition output Primary current: 7.0 A Primary voltage: 380 V • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 70, 71 and 72. 2. Inspect the power supply of ignition coil. 3. Inspect the ignition coil and high-voltage cable. 4. Inspect the spark plug for moisture, crack, wear, improper cap and excessive burnt electrode residue. 5. Check the ECU.	O
Secondary Air Supply System	P0411	Defective Secondary Air Pump - Insufficient Air Volume	• **Condition** - The secondary air injection pump relay and air pump valve/ hose are defective. • **Specification** - The voltage drop of pin No. 76 and ground: Below 1 V (current = 1000 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 76. 2. Inspect the secondary air pump relay. 3. Inspect the arrange ment of secondary air pump's valve and hose. 4. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Secondary Air Supply System	P0413	Secondary Air Pump - Open circuit to Ground	• **Condition** - Secondary air injection pump relay circuit: short or open circuit to ground • **Specification** - The voltage drop of pin No. 76 and ground: Below 1 V (current = 1000 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 76. 2. Inspect the secondary air pump relay. 3. Check the ECU.	O
	P0414	Secondary Air Pump - Short circuit to B+	• **Condition** - Secondary air injection pump relay circuit: short circuit to battery • **Specification** - The voltage drop of pin No. 76 and ground: Below 1 V (current = 1000 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 76. 2. Inspect the secondary air pump relay. 3. Check the ECU.	O
Catalytic Monitoring Device	P0420	Faulty Catalyst 1 Purification Rate (1, 2, 3 Cylinder lines)	• **Condition** - The calculated purification rate for bank 1 is below the specified range. (Bank 1 - Cylinder 1/2/3) • **Actions** 1. Inspect the exhaust gas for leaks. 2. Inspect the oxygen sensor and its signal. 3. Inspect the actual effciency of exhaust gas through the exhaust gas test. 4. Inspect the catalyst. 5. Check the ECU.	O
	P0430	Faulty Catalyst 2 Purification Rate (4, 5, 6 Cylinder lines)	• **Condition** - The calculated purification rate for bank 2 is below the specified range. (Bank 2 - Cylinder 4/5/6) • **Actions** 1. Inspect the exhaust gas for leaks. 2. Inspect the oxygen sensor and its signal. 3. Inspect the actual effciency of exhaust gas through the exhaust gas test. 4. Inspect the catalyst. 5. Check the ECU.	O
Evaporated Gas Control System	P0442	Fuel Tank: Oil Leakage	• **Condition** - Minute leak of evaporated gas is occurred (below 1 mm). • **Actions** 1. Inspect the fuel tank and connecting route for the followings: - Fuel tank cap for crack or damage - Vacuum hose for crack, puncture and clogging - Fuel tank for crack, puncture and damage - Canister for crack, puncture and damage - Fuel tank pressure sensor - Canister shut-off valve 2. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Purge Control Solenoid Valve	P0443	Purge Control Solenoid Valve Malfunction - Faulty closing	• **Condition** - The purge control circuit is defective. The purge control is not available. • **Specification** - Duty ratio: 0 ~ 100 % Below 20 % - 7.5 Hz 20 ~ 30 % - 15 Hz 30 ~ 75 % - 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 34. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	O
	P0444	Purge Control Solenoid Valve Malfunction - Short or Open circuit to Ground	• **Condition** - Power supply circuit: short or open circuit to ground • **Specification** - Duty ratio: 0 ~ 100 % below 20 % - 7.5 Hz 20 ~ 30 % - 15 Hz 30 ~ 75 % - 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 34. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	O
	P0445	Purge Control Solenoid Valve Malfunction - Short circuit to B+	• **Condition** - Power supply circuit: short circuit to battery • **Specification** - Duty ratio: 0 ~ 100 % below 20 % - 7.5 Hz 20 ~ 30 % - 15 Hz 30 ~ 75 % - 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 34. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Canister Shut-off Valve	P0447	Canister Shut-off Valve Malfunction - Short or Open circuit to Ground	• **Condition** - Fuel system shut-off valve circuit: short or open circuit to ground • **Specification** - Duty ratio: 0 ~ 100 % below 20 % → 7.5 Hz 20 ~ 30 % → 15 Hz 30 ~ 75 % → 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 36. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	O
	P0448	Canister Shut-off Valve: Short circuit to B+	• **Condition** - Fuel system shut-off valve circuit: short circuit to battery • **Specification** - Duty ratio: 0 ~ 100 % below 20 % → 7.5 Hz 20 ~ 30 % → 15 Hz 30 ~ 75 % → 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 36. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	O
Fuel tank pressure sensor	P0450	Fuel Tank Pressure Sensor Malfunction	• **Condition** - Improper fuel tank pressure is detected. • **Specification** 37.5 mbar → 4.51 V 30.0 mbar → 3.90 V 20.0 mbar → 3.10 V 10.0 mbar → 2.30 V 0 mbar → 1.50 V 10.0 mbar → 0.60 V 12.5 mbar → 0.49 V • **Actions** 1. Measure the actual fuel tank pressure using SCAN-100. 2. Inspect the circuits of ECU pin No. 18 and 41 and check pin No. 42. 3. Check the fuel tank pressure sensor. 4. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel tank pressure sensor	P0452	Low Fuel Tank Pressure Sensor Signal	• **Condition** - The fuel tank pressure signal is below the minimum fuel tank pressure (0.1V). - Related circuit: open circuit • **Specification** 37.5 mbar → 4.51 V 30.0 mbar → 3.90 V 20.0 mbar → 3.10 V 10.0 mbar → 2.30 V 0 mbar → 1.50 V 10.0 mbar → 0.60 V 12.5 mbar → 0.49 V • **Actions** 1. Measure the actual fuel tank pressure using SCAN-100. 2. Inspect the circuits of ECU pin No. 18 and 41 and check pin No. 42. 3. Check the fuel tank pressure sensor. 4. Check the ECU.	O
	P0453	High Fuel Tank Pressure Sensor Signal	• **Condition** - The fuel tank pressure signal is over the maximum fuel tank pressure (4.9 V). - Related circuit: open circuit • **Specification** 37.5 mbar → 4.51 V 30.0 mbar → 3.90 V 20.0 mbar → 3.10 V 10.0 mbar → 2.30 V 0 mbar → 1.50 V 10.0 mbar → 0.60 V 12.5 mbar → 0.49 V • **Actions** 1. Measure the actual fuel tank pressuring using SCAN-100. 2. Inspect the circuits of ECU pin No. 18 and 41 and check pin No. 42. 3. Check the fuel tank pressure sensor. 4. Check the ECU.	O
Evaporated Gas Control System	P0455	Fuel Tank: Large Oil Leakage	• **Condition** - The evaporated gas in the fuel tank is leaked. Diagnosis for large leaks • **Actions** 1. Inspect the fuel tank and connecting route for the followings: - Fuel tank cap for crack or damage - Vacuum hose for crack, puncture and clogging - Fuel tank for crack, puncture and damage - Canister for crack, puncture and damage - Fuel tank pressure sensor - Canister shut-off valve 2. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Level Detection Sensor	P0460	Faulty Fuel Pump Fuel Level Sensor Indication	• **Condition** - The fuel level or the changed amount of fuel after driving for certain distance is improper. • **Specification** 67.29 liters - 38.0 Ω 62.48 liters - 48.2 Ω 58.28 liters - 56.8 Ω 52.23 liters - 67.0 Ω 45.34 liters - 83.3 Ω 37.41 liters - 99.5 Ω 30.10 liters - 122.5 Ω 21.36 liters - 150.0 Ω 6.45 liters - 268.2 Ω • **Actions** 1. Measure the actual fuel level using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 102 and 75. 3. Check the external resistance (200 Ω). 4. Inspect the fuel sender unit. 5. Check the ECU.	O
	P0462	Faulty Fuel Pump Fuel Level Transmission	• **Condition** - The FF (hexadecimal) is inputted to ECU from cluster. • **Specification** 67.29 liters - 38.0 Ω 62.48 liters - 48.2 Ω 58.28 liters - 56.8 Ω 52.23 liters - 67.0 Ω 45.34 liters - 83.3 Ω 37.41 liters - 99.5 Ω 30.10 liters - 122.5 Ω 21.36 liters - 150.0 Ω 6.45 liters - 268.2 Ω • **Actions** 1. Measure the actual fuel level using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 102 and 75. 3. Check the external resistance (200 Ω). 4. Inspect the fuel sender unit. 5. Check the ECU.	O
Cooling fan system (PWM electric fan)	P0480	PWM electric fan - Short circuit to power supply	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Cooling fan system (PWM electric fan)	P0480	PWM electric fan - Open/Short circuit to ground	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
Condenser Fan Unit	P0481	Condenser Fan (Low) Relay - Short circuit to B+	• **Condition** - Power supply wiring: short circuit • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 35. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
		Condenser Fan (Low) Relay - Open circuit to Ground	• **Condition** - Short or open circuit to ground • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 35. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
Cooling fan system (PWM electric fan)	P0483	PWM electric fan - Motor overloaded	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
	P0484	PWM electric fan - Motor stalled	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
	P0485	PWM electric fan - Short circuit	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	

New DTC

O : Turning on when the condition is occurred twice consecutively

● : Turning on when the condition is occurred once

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Auto Cruise Control	P0500	CAN signal Fault: Auto Cruise Malfunction	• **Condition** - The auto cruise is defective.	O
		Auto Cruise Acceleration Function Fault	• **Condition** - The acceleration signal is faulty.	O
		Auto Cruise Deceleration Function Fault	• **Condition** - The deceleration signal is faulty.	O
	P0501	Defective Vehicle Speed Sensor Signal	• **Condition** - The vehicle speed signal is faulty.	O
		Defective Vehicle Speed Sensor Signal	• **Condition** - The vehicle speed signal is faulty.	O
Battery Voltage	P0562	Low Battery Voltage	• **Condition** - The voltage of ECU is faulty. * Less than minimum 8 Volts in 2000 rpm below * Less than 10 Volts in 2000 rpm above • **Specification** Over 8 V • **Actions** 1. Measure the actual battery voltage using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 12, 11, 10 and 5. 3. Check the power supply relay. 4. Check the battery and the ECU.	O
Auto Cruise Control	P0564	Defective Auto Cruise Control Lever	• **Condition** - The auto cruise lever is defective.	O
CAN Communication	P0600	CAN Communication Malfunction: ASR	• **Condition** - The CAN communication with ASR is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		CAN Communication Malfunction: ABS	• **Condition** - The CAN communication with ABS is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		Defective Immobilizer System	• **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
CAN Communication	P0600	CAN Communication Malfunction: TCU	• **Condition** - The CAN communication with TCU is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		CAN Communication Malfunction: TOD (Not used)	• **Condition** - The CAN communication with TOD is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		CAN Communication Malfunction: Shift Lever	• **Condition** - The CAN communication with TGS lever is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		CAN Communication Malfunction: ABS Speed Sensor (FR)	• **Condition** - The ABS front speed sensor's signal is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		CAN Communication Malfunction: ABS Speed Sensor (RR)	• **Condition** - The ABS rear speed sensor's signal is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
CAN Communication	P0600	CAN Communication Malfunction: Faulty Initialization	• **Condition** - The communication network data is not initialized. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		CAN Communication Malfunction: MSR Transmission Signal	• **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
		CAN Communication Malfunction: ASR Transmission Signal	• **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	O
Throttle Body Control	P0601	Throttle Position Sensor - Faulty Learning Signal	– **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS¡¯s pull-down resistance: 464 kΩ No.2 TPS¡¯s pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
ECU	P0601	Auto Cruise Shutdown Memory Malfunction	• **Condition** - The ECU's internal circuit is defective. • **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Malfunction (Call Monitor)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
ECU	P0601	Servo Motor's Voltage Output Stopped	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		Servo Motor - Short or Open circuit	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Malfunction (CPU not compatible)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Malfunction (Faulty CPU Communication)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Malfunction (Faulty CPU (2) Environment)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Malfunction (CPU (2) Malfunction)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Malfunction (Faulty CPU run-time)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		Communication Malfunction (CPU2)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
	P0602	ECU Not Coded	• **Condition** - The ECU coding is incorrect. • **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
Incorrect Coding	P0602	Incorrect Transmission Coding	• **Condition** - TCU (Variant) coding is faulty. • **Actions** 1. Check the current coding using SCAN-100. 2. Check ECU and TCU. 3. Check the CAN line.	O
Incorrect Coding	P0603	Incorrect VIN ECU Coding	• **Actions** 1. Check the current coding using SCAN-100. 2. Check ECU and TCU. 3. Check the CAN line.	O
ECU	P0604	ECU Fault (RAM)	• **Condition** - The memory function of ECU RAM is defective. • **Actions** 1.Check the ECU connector for contact. 2. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
ECU	P0605	ECU Fault (EPROM)	• **Condition** - The memory function of ECU is defective. • **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty NVRAM Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty Coding ID Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty Coding Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty Programming Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
Engine CHECK Warning Lamp	P0650	Engine CHECK Warning Lamp - Short circuit to B+	• **Condition** - Lamp circuit: short circuit to battery • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 29.	O
		Engine CHECK Warning Lamp - Open or Short circuit to Ground	• **Condition** - Lamp circuit: short or open circuit to ground • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 29.	O
Variable Air Intake System	P0661	Variable Air Intake Valve - Open or Short circuit to Ground	• **Condition** - Variable air intake valve circuit: short or open circuit to ground • **Specification** - ON/OFF flip range: approx. 3500 rpm - Operating current: 0.4 - 0.6 A - Solenoid internal resistance: 25 ± 5 Ω (20°C) • **Actions** 1. Check the actual operation condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 97. 3. Check the resonance flap's power supply. 4. Check the resonance flap solenoid and unit for damage. 5. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Variable Air Intake System	P0662	Variable Air Intake Valve - Short circuit to B+	• **Condition** - Variable air intake valve circuit: short circuit to battery • **Specification** - ON/OFF flip range: approx. 3500 rpm - Operating current: 0.4 - 0.6 A - Solenoid internal resistance: 25 ± 5 Ω (20°C) • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 97. 3. Check the resonance flap's power supply. 4. Check the resonance flap solenoid and unit for damage. 5. Check the ECU.	O
TCU	P0702	TCU Fault	• **Actions** - Check DTC codes for TCU.	O
		Transmission Malfunction: Solenoid Valve Voltage	• **Actions** - Check DTC codes for TCU.	O
Auto Cruise Control	P0703	CAN Communication Fault: Stop Lamp Switch	• **Condition** - The brake switch is defective.	O
TCU	P0705	Transmission Malfunction: Shift Lever	• **Actions** - Check DTC codes for TCU.	O
	P0715	Transmission Malfunction: Vehicle Speed Sensor	• **Actions** - Check DTC codes for TCU.	O
	P0720	Transmission Malfunction: Faulty Speed to Output	• **Actions** - Check DTC codes for TCU.	O
	P0730	Transmission Malfunction: Hydraulic System	• **Actions** - Check DTC codes for TCU.	O
		Transmission Malfunction: Faulty Gear Recognition	• **Actions** - Check DTC codes for TCU.	O
	P0734	A/T Control Malfunction	• **Actions** - Check DTC codes for TCU.	O
	P0740	Transmission Malfunction: TCC Head Control	• **Actions** - Check DTC codes for TCU.	O
	P0743	Transmission Malfunction: Lockup Converter Clutch	• **Actions** - Check DTC codes for TCU.	O
	P0748	Transmission Malfunction: Modulator Pressure	• **Actions** - Check DTC codes for TCU.	O
	P0753	Transmission Malfunction: Solenoid Valve 1-2/4-5	• **Actions** - Check DTC codes for TCU.	O
	P0758	Transmission Malfunction: Solenoid Valve 2-3	• **Actions** - Check DTC codes for TCU.	O
	P0763	Transmission Malfunction: Solenoid Valve 3-4	• **Actions** - Check DTC codes for TCU.	O
	P0778	Transmission Malfunction: Transmission Pressure	• **Actions** - Check DTC codes for TCU.	O
	P0836	Transmission Malfunction: Transfer Case	• **Actions** - Check DTC codes for TCU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Incorrect Coding	P1570	Immobilizer Not Coded	• **Actions** 1. Check the current coding using SCAN-100. 2. Check ECU and TCU. 3. Check the CAN line.	O
Throttle Body Control	P1590	Safety Fuel Shut-off Time Expired	• **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
Starter Signal	P1609	Starter Signal Recognition Malfunction	• **Condition** - The starter signal is improperly recognized. • **Specification** - Over 9.6 V (for 1 seconds) • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 2. 2. Check the ECU.	O

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TCU

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DIAGNOSTIC TROUBLE CODES FOR ION (BTRA) AUTO TRANSMISSION

DTC Code	Defective	Cause and Action
P0707	Low gear position sensor input	Cause: - Gear position sensor signal of the inhibitor switch is lower than the normal value (defective gear position sensor) - Specified value of gear position sensor signal: 0.87 V Symptom: - Cannot shift to 1st, 3rd and 4th gear. - Torque converter clucth stops from its operation. Action: - Check gear position sensor for short to ground. - Check inhibitor switch and TCU connector for proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P0708	High gear position sensor input	Cause: - Gear position sensor signal of the inhibitor switch is higher than the normal value (defective inhibitor switch) - Specified value of inhibitor switch: 4.12 V Symptom: - Cannot shift to 1st, 3rd and 4th gear position. - Torque converter clucth stops from its operation. Action: - Check gear position sensor for short to B+. - Check inhibitor switch and TCU connector for proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P0741	Torque converter clutch cannot be engaged	Cause: - Torque conver clutch cannot be engaged even when solenoid valve (S7) is operated. - The rpm of engine and output shaft is not consistent with the selected shift's gear ratio. • Allowable slip rpm of torque converter:100 rpm Symptom: - Torque converter clutch cannot be locked Action: - Check solenoid valve (S7) wiring for short to ground or open circuit. - Replace solenoicd valve (S7) if necessary. - Check T/M connector TCU connector for their proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.

DTC Code	Defective	Cause and Action
P0742	Torque converter clutch engaged	Cause: - Torque conver clutch is engaged when solenoid valve (S7) is not operated. - The rpm of engine and output shaft is not consistent with the characteristic under the condition with torque converter not engaged. • Allowable slip rpm of torque converter < 50 rpm Symptom: - Torque converter clutch is locked. Action: - Check solenoid valve (S7) wiring for short to B+. - Replace solenoicd valve (S7) if necessary. - Check T/M connector TCU connector for their proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P0710	Defective T/M oil temperature sensor	Cause: - Oil temperature of T/M exceeds the specified value. • Oil temperature sensor voltage > 4.88 V • Oil temperature sensor voltage < 0.21 V Symptom: - Oil temperature is fixed to 120°C - Shifting impression is poor. Action: - Check T/M oil temperature sensor for short or open circuit. - Check T/M connector and TCU connector for proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.
P0790	Defective W/N/P mode switch	Cause: - The W/N/P mode switch's connection is intermittently disconnected (the input of the mode switch changes rapidly). Symptom: - The switch is fixed to normal mode. Action: - Check W/N/P mode switch input circuit for short or open circuit. - Check W/N/P mode switch wiring. - Replace W/N/P mode switch if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.

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DTC Code	Defective	Cause and Action
P1703	Abnormal engine rpm (CAN)	Cause: - The engine rpm signal (CAN) is out of specified value or there is no engine rpm signal. • Engine rpm < 0 rpm • Engine rpm > 7000 rpm Symptom: - The engine rpm corresponding to the max. engine torque is applyed to the shifting condition. Action: - Check ECU and TCU connectors for poor contact. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.
P1704	Abnormal output shaft rpm (CAN)	Cause: - The output shaft signal (CAN) is out of specified value or there is no output shaft signal. • Output shaft rpm < 0 rpm • Output shaft rpm > 9000 rpm - The actual vehicle speed is 0 while other signals indicate that vehicle is moving. Symptom: - Cannot shift down by limiting the engine rpm to prevent the engine from overrunning. Action: - Check ECU and TCU connectors for poor contact. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds and the rpm is over 0.
P1708	Low TCU supply voltage	Cause: - The TCU supply voltage is low or there is no measured voltage value. Symptom: - Cannot shift to 1st gear position. - Cannot shift to other gear positions due to the low supply voltage. - No. 6 solenoid valve (S6) stops from its operation. Action: - Check TCU terminal for poor contact, bending or deformation. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P1709	High TCU supply voltage	Cause: - The TCU supply voltage is high. • TCU supply voltage > 16.5 V Symptom: - All solenoid valves stop from their operation when high battery voltage is detected. - Enters into the emergency mode. Action: - Check TCU terminal for short to B+ or short to ground. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.

DTC Code	Defective	Cause and Action
P1713	Defective accelerator pedal signal (CAN)	Cause: - The accelerator pedal signal (CAN) is out of the specified value. • Accelerator pedal signal < 0 % • Accelerator pedal signal > 100 % Symptom: - Cannot shift to 4th gear position. - Torque converter clucth stops from its operation. - The interior default value is applied for shift determination (if the accelerator pedal signal is defective, ECU selects the default value and sends it and error message to TCU via CAN line). - The accelerator pedal signal is not used for P, R, N B2. Action: - Check ECU and TCU connectors for poor contact and their terminals for bend or deformation. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P1714	Defective vehicle coding	Cause: - The vehicle coding stored in EEPROM is defective (self-test when IGN ON). Symptom: - Determines the vehicle coding value via CAN communication or selects 0 for the coding value. - Shifting impression is poor. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1715	Abnormal VPS offset	Cause: - VPS (Variable pressure solenoid valve) is used for controlling clutch and band pressure while shifting. - The VPS offset stored in EEPROM is incorrect (self-test when IGN ON). • VPS offset > 120 mA Symptom: - Shifting impression is poor. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1717	Defective RAM	Cause: - RAM operates abnormally. (self-test when IGN ON) Symptom: - No output signal. - Enters into the emergency mode. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1718	Defective ROM	Cause: - The program memory is defective (self-test when IGN ON). - The calculated checksum value is not consistent with the stored checksum value. Symptom: - No output signal. - Enters into the emergency mode. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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DTC Code	Defective	Cause and Action
P1719	Abnormal CAN communication	Cause: - Cannot use information necessary for TCU via CAN communication. Symptom: - The default value is used for all CAN signals. - Enters into the emergency mode. Action: - Check ECU and TCU connectors wiring for poor contact. - Check ECU and TCU connectors' terminals for bend or deformation. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P1720	Defective EEPROM	Cause: - EEPROM memory is defective. - The calculated checksum value is not consistent with the stored checksum value or the error occurs in EEPROM communication. (self-test when IGN ON) Symptom: - Determines the vehicle coding value via CAN communication or selects 0 for the coding value. - Shifting impression is poor. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1722	Incorrect vehicle model	Cause: - Cannot detect the vehicle coding through EEPROM or CAN communication. Symptom: - Selects 0 for the coding value. - Enters into the emergency mode. Action: - Check TCU connector and terminals for poor contact. - DTC disappears after turning ignition from OFF to ON.
P1733	No. 1 solenoid valve open	Cause: - The No. 1 solenoid valve operates with the No. 2 solenoid valve to control the oil flow for the 1-2 shift valve. - The No.1 solenoid valve internal circuit or solenoid valve wiring is open. - The solenoid valve connection is short to B+. Symptom: - The No. 1 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 1 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.1 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

DTC Code	Defective	Cause and Action
P1734	No. 2 solenoid valve open	Cause: - The No. 2 solenoid valve operates with the No. 1 solenoid valve to control the oil flow for the 2-3 shift valve. - The No. 2 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 2 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 2 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.2 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1735	No. 3 solenoid valve open	Cause: - The No. 3 solenoid valve operates with the No. 4 solenoid valve to shift smoothly and control the shifting order. - The No. 3 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 3 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 3 solenoid valve is OFF. - Shifting impression is poor. Action: - Check No. 3 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.3 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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DTC Code	Defective	Cause and Action
P1736	No. 4 solenoid valve open	Cause: - The No. 4 solenoid valve operates with the No. 3 solenoid valve to shift smoothly and control the shifting order. - The No. 4 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 4 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 4 solenoid valve is OFF or ON. - Shifting impression is poor. Action: - Check No. 4 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.4 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1737	No. 5 solenoid valve open	Cause: - The No. 5 solenoid valve is a variable solenoid valve to change the pressure for shifting. - The No. 5 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 4 solenoid valve is always OFF. - Shifting impression is poor. Action: - Check No. 5 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 3.6 ~ 5.5Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.5 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1738	No. 6 solenoid valve open	Cause: - The No. 6 solenoid valve is used to set the hydraulic line pressure to HIGH/LOW level. - The No. 6 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The hydraulic line pressure is high. (No. 6 solenoid valve stops its operation) - Cannot to shift to 1st gear position. Action: - Check No. 6 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 6 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

DTC Code	Defective	Cause and Action
P1739	No. 7 solenoid valve open	Cause: - The No. 7 solenoid valve controls the operation of the torque converter clutch. - The No. 7 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 7 solenoid valve stops its operation (OFF). - The torque converter clutch cannot be locked. Action: - Check No. 7 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 7 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1741	No. 1 solenoid valve short	Cause: - The No. 1 solenoid valve operates with the No. 2 solenoid valve to control the oil flow for the 1-2 shift valve. - The No. 1 solenoid valve circuit is short to ground. Symptom: - The No. 1 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 1 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.1 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1742	No. 2 solenoid valve short	Cause: - The No. 2 solenoid valve operates with the No. 1 solenoid valve to control the oil flow for the 2-3 shift valve. - The No. 2 solenoid valve circuit is short to ground. Symptom: - The No. 2 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 2 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 2 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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DTC Code	Defective	Cause and Action
P1743	No. 3 solenoid valve short	Cause: - The No. 3 solenoid valve operates with the No. 4 solenoid valve to shift smoothly and control the shifting order. - The No. 3 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 3 solenoid valve circuit is short to ground. Symptom: - The No. 3 solenoid valve is OFF. - Shifting impression is poor. Action: - Check No. 3 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 3 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1744	No. 4 solenoid valve short	Cause: - The No. 4 solenoid valve operates with the No. 3 solenoid valve to shift smoothly and control the shifting order. - The No. 4 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 4 solenoid valve circuit is short to ground. Symptom: - The No. 4 solenoid valve is OFF. - Shifting impression is poor. Action: - Check No. 4 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 4 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1745	No. 5 solenoid valve short	Cause: - The No. 5 solenoid valve is a variable solenoid valve to change the pressure for shifting. - The No. 5 solenoid valve circuit is short to ground. Symptom: - The No. 4 solenoid valve is always OFF. - Shifting impression is poor. Action: - Check No. 5 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 3.6 ~ 5.5Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.5 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

DTC Code	Defective	Cause and Action
P1746	No. 6 solenoid valve short	Cause: - The No. 6 solenoid valve is used to set the hydraulic line pressure to HIGH/LOW level. - The No. 6 solenoid valve circuit is short to ground. Symptom: - The hydraulic line pressure is high. (No. 6 solenoid valve stops its operation) - Cannot to shift to 1st gear position. Action: - Check No. 6 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value : 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 6 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1747	No. 7 solenoid valve short	Cause: - The No. 7 solenoid valve controls the operation of the torque converter clutch. - The No. 7 solenoid valve circuit is short to ground. Symptom: - The No. 7 solenoid valve stops its operation (OFF). - The torque converter clutch cannot be locked. Action: - Check No. 7 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 7 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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DIAGNOSIS TROUBLE CODE OF DC5AT

Trouble Code	Defectives	Action
P2000	Faulty TCU internal watchdog test	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2001	Faulty TCU internal watchdog function	• Self-diagnosis. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2002	Faulty TCU external watchdog test	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2003	Faulty TCU external watchdog function	• Self-diagnosis. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2004	Faulty TCU Clock	• Self-diagnosis. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2005	Faulty TCU RAM	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2006	Faulty TCU RAM CAN-Controller 1	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2007	Faulty TCU RAM CAN-Controller 2	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2008	Faulty TCU ROM	• Self-diagnosis with IGN ON. • When the TCU internal checksum is different from scanner checksum. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P200A	Faulty TCU EEPROM	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P200B	Faulty TCU CPU (internal)	• Self-diagnosis. • Check harness contact.
P200C	Faulty TCU program control	• Self-diagnosis. • Check harness contact.
P2010	No TCU variant coding	• Self-diagnosis with IGN ON. • When the TCU coding is not exist. • Check again after TCU coding.

Trouble Code	Defectives	Action
P2011	Faulty TCU variant coding	• Self-diagnosis with IGN ON. • When the TCU coding is faulty. • Check again after TCU coding.
P2012	Faulty TCU checksum	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2013	Faulty TCU (internally)	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2100	Defective 1-2, 4-5 shift solenoid valve	• When 1-2 or 4-5 shift solenoid valve is defective. • Measure the resistance of 1-2 or 4-5 shift solenoid valve (turn the IGN OFF, then and disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2101	1-2, 4-5 shift solenoid valve - short	• When 1-2 or 4-5 shift solenoid valve is defective. • Measure the resistance of 1-2 or 4-5 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2102	Defective 2-3 shift solenoid valve	• When 2-3 shift solenoid valve is defective. • Measure the resistance of 2-3 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2103	2-3 shift solenoid valve - short	• When 2-3 shift solenoid valve is defective. • Measure the resistance of 2-3 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered mechanical emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.

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Trouble Code	Defectives	Action
P2104	Defective 3-4 shift solenoid valve	• When 3-4 shift solenoid valve is defective. • Measure the resistance of 3-4 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B11 (15), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered mechanical emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2105	3-4 shift solenoid valve - short	• When 3-4 shift solenoid valve is defective. • Measure the resistance of 3-4 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B11 (15), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered mechanical emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2106	Defective lockup clutch solenoid valve	• Measure the resistance of lockup clutch solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B9 (17), B3 (38) - Specified value: 2.5 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2107	Defective modulator pressure solenoid valve	• Measure the resistance of modulator pressure solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B5 (36), B3 (38) - Specified value: 5.0 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2108	Defective shift pressure solenoid valve	• Measure the resistance of shift pressure solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B4 (37), B3 (38) - Specified value: 5.0 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Electrical error: Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P2200	Faulty speed sensor N2 signal	• When the speed sensor N2 detects 0 rpm of front sun gear speed. • Check the related harness for open, short and contact. - TCU connector terminal B14: rectangular wave signal B8: signal ground B13: 6V
P2203	Faulty speed sensor N3 signal	• When the speed sensor N3 detects 0 rpm of planetary gear carrier speed. • Check the related harness for open, short and contact. - TCU connector terminal B6: rectangular wave signal B8: signal ground B13: 6V
P220A	Abnormal speed sensor output signal (N2, N3)	• When the rpm difference between speed sensor N2 and N3 is over 150 rpm. • Check the related harness for open, short and contact.
P2220	T/M Oil temperature sensor - short	• Turn the IGN OFF, then disconnect TCU connector. • Selector lever position: R or D • T/M Measure the resistance of oil temperature sensor. • TCU connector terminals B7, B8 • Check the related harness for open, short and contact.
P2221	Abnormal T/M oil temperature sensor signal	• Turn the IGN OFF, then disconnect TCU connector. • Selector lever position: R or D • Measure the resistance of T/M oil temperature sensor. • TCU connector terminals: B7, B8 • Check the related harness for open, short and contact.
P2222	Abnormal T/M oil temperature sensor signal	• Turn the IGN OFF, then disconnect TCU connector. • Selector lever position : R or D • Measure the resistance of T/M oil temperature sensor. • TCU connector terminals: B7, B8 • Check the related harness for open, short and contact.
P2300	Faulty CAN communication	• Turn the IGN OFF, then disconnect TCU connector. • Check the communication line for open, short and contact. • Measure the resistance of CAN line: B1, B2 • Specified value : approx. 120 W
P2301	Faulty CAN communication	• Turn the IGN OFF, then disconnect TCU connector. • Check the communication line for open, short and contact. • Measure the resistance of CAN line: B1, B2 • Specified value : approx. 120 W
P2310	CAN: Faulty brake system communication	• Check CAN communication line H and L. • Check ABS/ESP unit. • Check the related harness for open, short and contact.

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Trouble Code	Defectives	Action
P2311	CAN: Faulty ECU communication	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2312	CAN: Faulty ECU communication	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2313	CAN: Faulty selector lever control communication	• Check CAN communication line H and L. • Check selector lever. • Check the related harness for open, short and contact.
P2315	CAN: Faulty instrument panel communication	• Check CAN communication line H and L. • Check instrument cluster. • Check the related harness for open, short and contact.
P2317	CAN: Faulty communication between TCCU/TOD and CAN (For 4WD only)	• Check CAN communication line H and L. • Check TCCU/TOD unit. • Check the related harness for open, short and contact.
P2330	CAN: Faulty brake system signal	• Check CAN communication line H and L. • Check ABS/ESP unit. • Check the related harness for open, short and contact.
P2331	CAN: Faulty ECU message	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2332	CAN: Faulty ECU message	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2333	CAN: Faulty selector lever signal	• Check CAN communication line H and L. • Check selector lever. Check selector lever. • Check the related harness for open, short and contact.
P2335	CAN: Faulty instrument cluster signal	• Check CAN communication line H and L. • Check instrument cluster. • Check the related harness for open, short and contact.
P2337	CAN: Faulty TCCU/TOD (For 4WD only)	• Check CAN communication line H and L. • Check TCCU/TOD unit. • Check the related harness for open, short and contact.
P2400	CAN: Faulty rear RH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.309 ~ 0.958 mm) - Check the numbers of tooth wheel: 48 • Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P2401	CAN: Faulty rear LH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.309 ~ 0.958 mm) - Check the numbers of tooth wheel: 48 • Check the related harness for open, short and contact.
P2402	CAN: Faulty front RH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.335 ~ 0.945 mm) - Check the numbers of tooth wheel: 48
P2403	CAN: Faulty front LH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.335 ~ 0.945 mm) - Check the numbers of tooth wheel: 48
P2404	CAN: No brake signal	• Check CAN communication line H and L. • Check ABS/ESP unit. • Check the related harness for open, short and contact.
P2405	CAN: No accelerator pedal signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2406	CAN: No engine torque signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2407	CAN: No ESP signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2408	CAN: No minimum engine torque signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2409	CAN: No maximum engine torque signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P240A	CAN: No engine rpm signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.

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Trouble Code	Defectives	Action
P240B	CAN: No engine coolant temperature signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P240C	CAN: No selector lever position signal	• Check CAN communication line H and L. • Check selector lever. • Check the related harness for open, short and contact.
P240D	CAN: No transfer case position signal (For 4WD only)	• Check CAN communication line H and L. • Check TCCU/TOD unit. • Check the related harness for open, short and contact.
P2500	Invalid transmission gear ratio	• Cycle the IGN switch from OFF to ON. Check A/T system again after a certain period of driving. • If the trouble still exists, replace A/T assembly. • To protect transmission, any shift is not available.
P2501	Excessive engine rpm	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2503	Faulty recognition of currently selected gear	• Check selector lever. • Check the related harness for open, short and contact.
P220B	Excessive N2, N3 rpm	• Check speed sensor N2 and N3.
P2510	Torque converter lockup clutch stuck	• Check the hydraulic lines for leaks (valve No.22 in valve body). • Check the resistance of lockup clutch solenoid valve (Turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals B9 (17), B3 (18) - Specified value : 2.5 ± 0.2 W • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2511	Faulty torque converter lockup heat control	• Check the hydraulic lines for leaks.
P2520	Faulty recognition of torque reduction	• Check ECU.
P2502	Poor gear mesh, transmission slip	• Check the hydraulic lines for leaks. • Check oil filter.
P2600	Too low TCU supply voltage	• Check TCU supply voltage.
P2601	Too high TCU supply voltage	• Check TCU supply voltage.
P2602	Abnormal solenoid valve supply voltage	• Check solenoid supply voltage.
P2603	Abnormal speed sensor supply voltage	• Check speed sensor supply voltage. - TCU connector terminals B13 (13) : 6V

MEMO

BRAKE

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SELF-DIAGNOSIS LIST (ABS, ABD, ASR 5.3)

Fault code	Defects	Application			Service hint
		ABS	ABD	ASR	
01	No defects	0	0	0	-
02	ECU	0	0	0	Internal fault of ECU. Replace the ECU.
03	Front/left speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
04	Front/right speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
05	Rear/left speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
06	Rear/right speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
07	Front/left speed sensor (defective wiring)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.377 - 1.229 mm. 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.
08	Front/right speed sensor (abnormal signal)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.377 - 1.229 mm. 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.
09	Rear/left speed sensor (abnormal signal)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.369 - 1.213 mm. 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.

Fault code	Defects	Application			Service hint
		ABS	ABD	ASR	
10	Rear/right speed sensor (abnormal signal)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.369 - 1.213mm 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.
11	Wheel rotor teeth	0	0	0	1. This code will appear if a wheel rotor teeth of four wheels is defective. 2. Check the teeth number of wheel rotor and condition.
13	Front/left inlet valve	0	0	0	1. If this code appear together with the items related with valve relay failure, check the items related with valve failure first and repair defective causes. 2. Check each valve using a over-riding function of tester on sole noid valve diagnosis function. 3. Replace hydraulic modulator.
14	Front/left outlet valve	0	0	0	↑
15	Front/right inlet valve	0	0	0	↑
16	Front/right outlet valve	0	0	0	↑
17	Rear/left inlet valve	-	0	0	↑
18	Rear/left outlet valve	-	0	0	↑
19	Rear/right inlet valve	-	0	0	↑
20	Rear/right outlet valve	-	0	0	↑
17	Rear axle inlet valve	0	-	-	↑
18	Rear axle outlet valve	0	-	-	↑
21	Switching valve	-	0	0	1. If this code appear together with the items related with valve relay failure, check the items related with valve failure first and repair defective causes. 2. Check each valve using a over-riding function of tester on sole noid valve diagnosis function. 3. Check contact of ECU and hydraulic modulator connectors and terminals. 4. Check terminals for open or short (When connector is removed). 5. Replace hydraulic modulator if there is no defect on above.

Reference

- Internal resistance of each solenoid valve on fault code 13-20; Inlet valve : 8.5-10W, outlet valve : 4.0-5.5W
- Internal resistance of each valve on fault code 21 and 22; ASV (prime) valve, USV (pilot) valve: 8.5-10.0W

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Fault code	Defects	Application			Service hint
		ABS	ABD	ASR	
22	Shut-off valve	-	0	0	1. If this code appear together with the items related with valve relay failure, check the items related with valve failure first and repair defective causes. 2. Check each valve using a over-riding function of tester on solenoid valve diagnosis function. 3. Check contact of ECU and hydraulic modulator connectors and terminals. 4. Check terminals for open or short (When connector is removed). 5. Replace hydraulic modulator if there is no defect on above.
24	Motor relay/ return pump	0	0	0	1. Check using a over-riding function of tester on pump motor diagnosis function 2. Check resistance between pump motor ground terminal and battery negative terminal : less than 15mW. 3. Check body ground point. 4. Check relay coil internal resistance:40-80W. 5. Replace hydraulic modulator if there is no defect on above.
27	Stop lamp switch	0	0	0	1. Check using stop lamp switch diagnosis function from sensor value output function of tester. 2. Check contact of stop lamp switch terminals on ECU connector. 3. Check other wires for open and short (more than 80% of ECU supply voltage). 4. Check stop lamp switch function and replace if defective (when switch knob (plunger) is pressed by 3mm, resistance between each switch end will be infinite and if not pressed, it will be less than 200mW). 5. Voltage on No.11 when brake pedal is depressed : 11-14V Voltage on No.4 when brake pedal is released : 11-14V
28	Battery voltage low	0	0	0	1. Check battery voltage. 2. Check resistance between relevant voltage terminal of connector and each battery terminal (positive & negative). 3. Check that normal voltage is applied on each pin on connector when ignition switch is turned 'ON' or 'OFF'. 4. Check 10A and 60A fuses for ABS. 5. Replace hydraulic modulator if there is no defect on above.
30	CAN signal (TCU)	-	-	0	1. Check related CAN line for open, short. 2. Check poor contact of related CAN connector. 3. ECU is defective, replace ECU .
31	EMS (Engine)	-	-	0	1. Check related CAN line for open, short. 2. Check poor contact of related CAN connector. 3. ECU is defective, replace ECU . 4. Check EMS using special tool of self-diagnosing.
33	CAN communication	-	-	0	1. Check related CAN line for open, short. 2. Check poor contact of related CAN connector. 3. ECU is defective, replace ECU .
34	Brake over heating	0	0	0	

ABS/ESP TROUBLE DIAGNOSIS

o: Applied x: N/A

Function	Defective Components	Trouble Code	Descriptions	System	
Sensor Monitoring	**Front LH Wheel speed sensor**	C1011 (5011) C1012 (5012)	Wheel speed sensor front left-electrical Wheel speed sensor front left-other	**ABS**	**ESP**
	1. C1011 (5011) **Cause** - Defective front LH wheel speed sensor - Short or poor contact wire to sensor **Action** - Check the wheel speed sensor connector - Check HECU connector - Check the harness connection **2. C1012 (5012)** **Cause** - Defective front LH wheel speed sensor - No signals from wheel speed sensor and tooth wheel - Too large air gap between wheel speed sensor and tooth wheel - Different number of teeth in tooth wheel **Action** - Check the wheel speed sensor connector - Check HECU connector - Check air gap and tooth wheel mounting (Specified air gap: 0.335 ~ 0.945 mm) - Check the number of teeth (48) in tooth wheel			**O**	**O**
	Front RH Wheel speed sensor	C1021 (5021) C1022 (5022)	Wheel speed sensor front right-electrical Wheel speed sensor front right-other		
	1.C1021 (5021) **Cause** - Defective front RH wheel speed sensor - Short or poor contact wire to sensor **Action** - Check the wheel speed sensor connector - Check HECU connector - Check the harness connection **2.C1022 (5022)** **Cause** - Defective front RH wheel speed sensor - No signals from wheel speed sensor and tooth wheel - Too large air gap between wheel speed sensor and tooth wheel - Different number of teeth in tooth wheel **Action** - Check the wheel speed sensor connector and HECU connector - Check air gap and tooth wheel mounting (Specified air gap: 0.335 ~ 0.945 mm) - Check the number of teeth (48) in tooth wheel			**O**	**O**

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<table>
<tr><th>Function</th><th>Defective Components</th><th>Trouble Code</th><th>Descriptions</th><th colspan="2">System</th></tr>
<tr><td rowspan="4">Sensor Monitoring</td><td>Rear RH
Wheel speed sensor</td><td>C1031 (5031)
C1032 (5032)</td><td>Wheel speed sensor rear left-electrical
Wheel speed sensor rear left-other</td><td>ABS</td><td>ESP</td></tr>
<tr><td colspan="3">1. C1031 (5031)
<u>Cause</u>
- Defective rear RH wheel speed sensor
- Short or poor contact wire to sensor
<u>Action</u>
- Check the wheel speed sensor connector
- Check the HECU connector
- Check the harness connection
2. C1032 (5032)
<u>Cause</u>
- Defective rear RH wheel speed sensor
- No signals from wheel speed sensor and tooth wheel
- Too large air gap between wheel speed sensor and tooth wheel
- Different number of teeth in tooth wheel
<u>Action</u>
- Check the wheel speed sensor connector
- Check the HECU connector
- Check air gap and tooth wheel mounting (Specified air gap: 0.309 ~ 0.958 mm)
- Check the number of teeth (48) in tooth wheel</td><td>O</td><td>O</td></tr>
<tr><td>Rear LH
Wheel speed sensor</td><td>C1041 (5041)
C1042 (5042)</td><td>Wheel speed sensor rear left-electrical
Wheel speed sensor rear left-other</td><td></td><td></td></tr>
<tr><td colspan="3">1. C1041 (5041)
<u>Cause</u>
- Defective rear LH wheel speed sensor
- Short or poor contact wire to sensor
<u>Action</u>
- Check the wheel speed sensor connector
- Check the HECU connector
- Check the harness connection
2. C1042 (5042)
<u>Cause</u>
- Defective rear LH wheel speed sensor
- No signals from wheel speed sensor and tooth wheel
- Too large air gap between wheel speed sensor and tooth wheel
- Different number of teeth in tooth wheel
<u>Action</u>
- Check the wheel speed sensor connector and HECU connector
- Check air gap and tooth wheel mounting (Specified air gap: 0.309 ~ 0.958 mm)
- Check the number of teeth (48) in tooth wheel</td><td>O</td><td>O</td></tr>
</table>

Function	Defective Components	Trouble Code	Descriptions	System	
Sensor Monitoring	**Pressure sensor**	C1051 (5051)	Defective input sensor	**ABS**	**ESP**
	Cause - Abnormal signals from pressure sensor - Defective pressure sensor or harness **Action** - Check the pressure sensor connector			**X**	**O**
	Steering wheel angle sensor	C1061 (5061)	Defective steering wheel angle sensor		
	Cause - Internally defective steering wheel angle sensor - Abnormal signals from steering wheel angle sensor - Short circuit between supplying voltage output and ground - Abnormal signal voltage from steering wheel angle sensor - Poor installation of steering wheel angle sensor and abnormal signal **Action** - Check the supplying voltage: (Specified voltage: 9 ~ 16 V) - Check the output voltage: Check voltage between ESP unit terminals with ignition ON • ST1 voltage check: between ESP unit terminal No. 5 and ground (Specified voltage: 1.3 ~ 4.1V) • ST2 voltage check: between ESP unit terminal No. 2 and ground (Specified voltage: 1.3 ~ 4.1V) • STN voltage check: between ESP unit terminal No.12 and ground (Specified voltage: 1.3 ~ 4.1V)			**X**	**O**
	Sensor cluster	C1073 (5073) C1074 (5074)	Sensor cluster -electrical Sensor cluster-internal		
	1. C1073 (5073) **Cause** - Operating voltage exceeds specified range (Hi: 18.0 ± 1.0 V / Lo: 6.5 ± 0.5 V) - Poor contact or installation of harness **Action** - Check the sensor cluster connector - Replace the sensor cluster **2. C1074 (5074)** **Cause** - Internally defective HECU - Abnormal A/D converter voltage: 5.0 ± 3 % - Abnormal supplying voltage (4.580 ~ 4.960 V) to sensor cluster → Short circuit between supplying voltage output of sensor cluster and ground - Poor ground of sensor cluster (0.0 ~ 0.5 V) → Short to ground on sensor cluster - Abnormal signals from lateral acceleration sensor - Abnormal signals from yawing sensor - Poor installation of sensor - Defective sensor cluster - Defective or short circuit of CAN communication line **Action** - Replace the sensor			**X**	**O**

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Function	Defective Components	Trouble Code	Descriptions	System	
Battery Voltage Monitoring	**Battery**	C1101 (5101) C1102 (5102)	Battery under voltage Battery over voltage	**ABS**	**ESP**
	1. C1101 (5101) **Cause** - Low voltage out of specified range (9.7 ± 0.3 V) **Action** - Check the supplying voltage **2. C1102 (5102)** **Cause** - Over voltage out of specified range (18.0 ± 1.0 V) **Action** - Check the supplying voltage			**O**	**O**
Brake Monitoring	**Brake disc**	C1111 (5111)	Disk temperature is high		
	Cause - Overheated brake disk due to braking force: over 500°C **Action** - Stop driving for a period of time after turning off the ESP			**X**	**O**
	Brake lamp switch **ESP OFF switch**	C1201 (5201) C1202 (5202)	Defective brake lamp switch Defective ESP OFF switch		
	1. C1201 (5201) **Cause** - Mechanical defective in brake switch - Defective brake switch harness **Action** - Check the harness and connector **2. C1202 (5202)** **Cause** - Mechanical defective in ESP OFF switch - Defective ESP OFF switch harness (short to ground) **Action** - Check the harness and connector for ESP OFF switch			**X**	**O**
Valve Monitoring	**Valve, valve relay**	C1301 (5301)	Defective valve, valve relay in HECU		
	Cause - Abnormal supplying voltage to valve solenoid - Internally defective HECU **Action** - Replace the HECU - Check the battery voltage - Check the HECU connector			**O**	**O**

Function	Defective Components	Trouble Code	Descriptions	System	
Pump Monitoring	**Motor pump**	C1302 (5302)	Defective motor pump	**ABS**	**ESP**
	Cause - Too low (below 6.0 V) or no supplying voltage to pump motor - Over 0.93 V from pump motor voltage - Poor contact in pump motor connector - Poor ground **Action** - Check the supplying voltage - Check the HECU connector - Replace the HECU			**O**	**O**
HECU and Sensor Monitoring	**HECU**	C1401 (5401)	HECU hardware		
	Cause - Internally defective HECU - Defective A/D converter, internal voltage regulator, and controller - Defective sensor and short to supplying voltage line - Abnormal temperature sensor signal **Action** - Replace the HECU			**O**	**O**
	Sensor initialization	C1501 (5501)	Abnormal sensor initialization		
	Cause - Abnormal signals from sensors - Abnormal sensor data **Action** - Check the sensors - Initialize the sensors			**O**	**O**
	Vehicle coding	C1170 (5170)	Variant coding error, or misinstallation HECU		
	Cause - Discrepancy between HECU coding and vehicle coding - Defective CAN communication line - Misinstallation HECU **Action** - Check the HECU coding and vehicle coding - Perform vehicle coding - Replace the exact HECU - Check engine ECU variant coding			**(O)**	**O**

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Function	Defective Components	Trouble Code	Descriptions	System	
	CAN communication	C1601 (5601)	CAN communication error	**ABS**	**ESP**
	Cause - Short or open to CAN communication line - Poor connection of CAN communication line **Action** - Check the CAN communication line - Check the HECU connector			**(O)**	**O**
	CAN communication	C1602 (5602) C1603 (5603) C1604 (5604) C1605 (5605)	Communication error between engine ECU and HECU Communication error between TCU and HECU Communication error between TCCU (4WD) and HECU Communication error between cluster (Meter) and HECU		
	1. C1602 (5602) **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the engine ECU - Check the CAN communication line - Check the engine ECU connector **2. C1603 (5603)** **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the TCU - Check the CAN communication line - Check the TCU connector **3. C1604 (5604)** **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the TCCU - Check the CAN communication line - Check the TCCU connector **4. C1605 (5605)** **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the cluster (meter) - Check the CAN communication line - Check the cluster (meter) connector			**X**	**O**

Function	Defective Components	Trouble Code	Descriptions	System	
CAN Communication Monitoring	**CAN signal error EMS**	C1612 (5612)	Signal from engine ECU is abnormal	**ABS**	**ESP**
	Cause - Engine ECU is defective - Signal from engine ECU error **Action** - Check engine ECU - Check ECU S/W version			**X**	**O**

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DIAGNOSIS (SRE-6)

Possible Cause		Action	
Ignition “ON” Check warning lamp on I/P	Does the warning lamp blink at seven times for 7 seconds and then turn off?	Yes	System OK
		No	Connect the scan tool to diagnostic connector (ALDL). Select the fault code display menu and clear code menu.
	Does the fault code display on the scan tool display?	Yes	Perform “Diagnostic System Check”.
		No	Check any fuse open. Replace fuse.
	Is there any open in fuse?	Yes	Disconnect wiring connector.
		No	Check any wiring short between fuse and wiring connector.
	Is there any short in fuse?	Yes	Repair wiring.
		No	Disconnect SDM wiring connector. Check wiring short between connector terminal and SDM connector terminal.
	Is there any short in wiring?	Yes	Replace airbag wiring.
		No	Check any open between ALDL connector No.4, No. 5 terminal and ground.
	Is there any open in wiring?	Yes	Repair wiring
		No	Ignition “ON” Measure voltage at the cigar lighter socket.
	Does the voltage indicate 11 ~ 14 V?	Yes	Check any open or short between ALDL connector terminal and wiring connector terminal.
		No	Repair the wiring of the cigar lighter socket.
	Is there any open or short in wiring?	Yes	Repair wiring
		No	Check any open or short between SDM connector terminal and wiring connector terminal.
	Is there any open or short in wiring?	Yes	Replace the airbag wiring.
		No	Replace the SDM.

DIAGNOSTIC TROUBLE CODES (SRE-6)

Code	Fault Contents	Check
01h	Driver airbag circuit, resistance too high	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
02h	Driver airbag circuit, resistance too low	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
03h	Driver airbag circuit, short to ground	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
04h	Driver airbag circuit, short to battery voltage	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
05h	Passenger airbag circuit, resistance too high	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
06h	Passenger airbag circuit, resistance too low	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
07h	Passenger airbag circuit, short to ground	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
08h	Passenger airbag circuit, short to battery voltage	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
09h	Driver pretensioner circuit, resistance too high	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.
0Ah	Driver pretensioner circuit, resistance too low	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.
0Bh	Driver pretensioner circuit, short to ground	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.
0Ch	Driver pretensioner circuit, short to battery voltage	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.

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Code	Fault Contents	Check
0Dh	Passenger pretensioner circuit, resistance too high	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
0Eh	Passenger pretensioner circuit, resistance too low	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
0Fh	Passenger pretensioner circuit, short to ground	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
10h	Passenger pretensioner circuit, short to battery voltage	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
34h	Driver side airbag circuit, resistance too high	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
35h	Driver side airbag circuit, resistance too low	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
36h	Driver side airbag circuit, short to ground	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
37h	Driver side airbag circuit, short to battery voltage	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
38h	Passenger side airbag circuit, resistance too high	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
39h	Passenger side airbag circuit, resistance too low	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
3Ah	Passenger side airbag circuit, short to ground	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
3Bh	Passenger side airbag circuit, short to battery voltage	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
50h	Driver side airbag sensor, open/short to battery voltage	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.
51h	Passenger side airbag circuit, short to ground	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.

Code	Fault Contents	Check
52h	Communication malfunction of the driver side airbag	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.
53h	Internal fault of the driver side airbag sensor	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.
54h	Passenger side airbag sensor, open/short to battery voltage	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
55h	Passenger side airbag sensor, short to ground	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
56h	Communication malfunction of the passenger side airbag	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
57h	Internal fault of the passenger side airbag sensor	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
17h	Battery voltage too high	Check generator output voltage. Check the battery voltage. Check the bending of the airbag terminal.
18h	Battery voltage too low	Check generator output voltage. Check the battery voltage. Check the bending of the airbag terminal.
1Eh	SDM internal fault (Initialization fault)	Replace the SDM.
1Fh	SDM internal fault	Replace the SDM.

Notice

- ***Use only the scan tool to check the airbag module and the sensing and diagnostic module (SDM). Never measure the resistance of an airbag module with an ohmmeter. An ohmmeter's battery can deploy the airbag and cause injury.***
- ***Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.***
- ***Do not attempt to repair the supplemental inflatable restraints (SIR) wiring harness. An SIR repair can create a high-resistance connection which can keep the airbags from deploying when needed, resulting in injury.***

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DIAGNOSIS (SRE-NCS)

Trouble Code	Defections	Action
1101	High battery voltage	• Check alternator output voltage. • Check battery condition (over 21.4 V for 16 seconds). • Check air bag unit terminals for damage.
1102	Low battery voltage	• Check alternator output voltage. • Check battery condition (below 7.2 V for 16 seconds, resumes when the voltage is normal level for 9.6 seconds) • Check air bag unit terminals for damage.
1103	Low communication voltage for curtain air bag sensor	• Check curtain air bag sensor connector. • Check curtain air bag sensor wiring. • Check air bag unit terminals for damage. • Check if curtain air bag sensor is short to battery voltage or ground. • Check if curtain air bag sensor is defective. • Check battery condition (below 10.6 V for 16 seconds, resumes when the voltage is normal level for 9.6 seconds).
1346	Driver's air bag circuit resistance is too high	• Check driver air bag connector. • Check driver air bag wiring (including clock spring). • Check air bag unit terminals for damage. • Resistance of squib: over 6.1 Ω
1347	Driver's air bag circuit resistance is too low	• Check driver air bag connector. • Check driver air bag connector (including clock spring). • Check air bag unit terminals for damage. • Resistance of squib: below 1.1 Ω
1348	Driver's air bag circuit is short to ground	• Check driver air bag connector. • Check driver air bag wiring (including clock spring). • Check air bag unit terminals for damage. • Resistance of Firing Loop: below 2 kΩ
1349	Drivers air bag circuit is short to battery voltage	• Check driver air bag connector. • Check driver air bag wiring (including clock spring). • Check the air bag unit terminals for damage. • Resistance of Firing Loop: below 2 kΩ
1352	Passengers air bag circuit resistance is too low	• Check passenger air bag connector. • Check passenger air bag wiring. • Check the air bag unit terminals for damage. • Resistance of squib: below 0.8 Ω
1353	Passengers air bag circuit resistance is too high	• Check passenger air bag connector. • Check passenger air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.0 Ω
1354	Passengers air bag circuit is short to ground	• Check passenger air bag connector. • Check passenger air bag wiring. • Check the air bag unit terminals for damage. • Resistance of Firing Loop: below 2 kΩ

Trouble Code	Defections	Action
1355	Passenger's air bag circuit is short to battery voltage	• Check passenger air bag connector. • Check passenger air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1361	Driver's pretensioner circuit resistance is too high	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.2 Ω
1362	Driver's pretensioner circuit resistance is too low	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 0.8 Ω
1363	Driver's pretensioner circuit is short to ground	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1364	Driver's pretensioner circuit is short to battery voltage	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1367	Passenger's pretensioner circuit resistance is too high	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.2 W
1368	Passenger's pretensioner circuit resistance is too low	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 0.8 Ω
1369	Passenger's pretensioner circuit is short to ground	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1370	Passenger's pretensioner circuit is short to battery voltage	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1378	Driver's curtain air bag circuit resistance is too high	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check the air bag unit terminals for damage. • Resistance of squib: over 4.3 Ω
1379	Driver's curtain air bag circuit resistance is too low	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check the air bag unit terminals for damage. • Resistance of squib: below 0.6 Ω

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Trouble Code	Defections	Action
1380	Driver's curtain air bag is short to ground	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1381	Driver's curtain air bag is short to battery voltage	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1382	Passenger's curtain air bag circuit resistance is too high	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.3 Ω
1383	Passenger's curtain air bag circuit resistance is too low	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 0.6 Ω
1384	Passenger's curtain air bag is short to ground	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1385	Passenger's curtain air bag is short to battery voltage	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1395	Air bag connector problem	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage.
1400	Driver's curtain air bag sensor problem	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage.
1401	Driver's curtain air bag sensor circuit is short to ground	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check the air bag unit terminals for damage. • Resistance: below 250 Ω
1402	Driver's curtain air bag sensor circuit is short to battery voltage	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 25 Ω
1409	Communication error in driver's curtain air bag	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • If the voltage drops below 10.6 V during normal system operation, the trouble code is generated. This trouble code is linked with B1 400, B1 401, B1 402, B1 414.

Trouble Code	Defections	Action
1414	Wrong driver's curtain air bag sensor	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage.
1403	Passenger's curtain air bag sensor	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage.
1404	Passenger's curtain air bag sensor circuit is short to ground	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 250 Ω
1405	Passenger's curtain air bag sensor circuit is short to battery voltage	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 25 Ω
1410	Communication error in passenger's curtain air bag	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check the air bag unit terminals for damage. • If the voltage drops below 10.6 V during normal system operation, the trouble code is generated. This trouble code is linked with B1 403, B1 404, B1 405, B1 415.
1415	Wrong driver's curtain air bag sensor	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage.
1620	SDM internal fault	• Replace SDM.
1650	Frontal impact record	• Replace SDM.
1651	Driver's curtain air bag impact record	• Replace SDM.
1652	Passenger's curtain air bag impact record	• Replace SDM.
1657	Belt pretensioner operation record	• Replace SDM.
2500	Warning lamp error	• Check wiring to warning lamp. • Check warning lamp bulb. • Check SDM unit terminal.

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T/C

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GENERAL DIAGNOSIS (TOD)

Symptoms	Check	Action
Electric shift problems	• Faulty or damaged TCCU, speed sensor, motor, clutch or internal wirings	• Overhaul and check, replace if necessary
	• Damaged or worn shift cam, hub, fork and rail shift	• Overhaul and check for wear and damage.
	• Binding shift fork, hub collar or gear	• Check sliding parts, replace if necessary.
Cannot drive front wheel when shifting to 4H, 4L	• Broken drive chain	• Check internal parts and replace drive chain.
Noise in 4WD operation	• Improper or low oil	• Drain and replace with specified oil.
	• Loosened bolts or mounted parts	• Retighten as specified.
	• Noisy T/C bearing	• Disassemble bearings and parts and check for wear or damage. Replace if necessary.
	• Gear abnormal noise	• Check for wear and damage including speedometer gear. Replace if necessary.
Noise in 4H or 4L	• Worn or damaged sprockets or drive chain	• Disassemble and check for wear and damage. Replace if necessary.
	• Incorrect tire pressure	• Adjust tire pressure.
Transfer case oil leakage	• Cracked transfer case	• Replace the case.
	• Leakage from other parts	• Clean case and parts and check for leakage.
	• Breather clogging	• Remove breather hose and clean. Replace if necessary.
	• Improper or too much oil	• Use specified oil and adjust oil level.
	• Loosened sealing bolts	• Retighten.
	• Improperly applied sealant	• Use specified sealant and retighten.
	• Worn or damaged oil seal	• Replace oil seal.

TCCU periodically monitors the input and output while the system is in operation. When a fault is detected, the trouble code is stored into TCCU memory.

If the ignition switch is turned to “OFF”, TCCU stops monitoring for input and output, however, when the ignition switch is turned to “OFF” before shifting completes, TCCU continues monitoring for input and output required for the shifting.

DIAGNOSTIC TROUBLE CODE (TOD)

Code	Description	Action
P1806	Detective CAN commuication	• Check communication line. • Replace TCCU if necessary.
P1805	Defective mode switch	• When the mode switch is defective • Check TCCU pin No.4 and 16. • Mode change - 2H (Pin No. 4: Ground) - 4H (No contact: Open) - 4L (Pin No.16: Ground)
P1821	Open or short to ground in magnetic clutch coil circuit	• Voltage at TCCU pin No.11: 11 ~ 15 V • EMC resistance: 2.5 Ω • Check the relevant connectors for contact. • Replace TCCU if necessary.
P1822	Open or short to ground in hub control circuit	• When the hub control circuit is open or short to ground over 0.2 second • Replace TCCU if necessary.
P1841	Open to ground in shift motor circuit	• When TCCU detects the motor failure for 1 second • Check the relevant harnesses for contact. • Replace TCCU if necessary.
P1842	Short to ground in shift motor output circuit	• When TCCU detects the motor failure for 1 second • Check the relevant harnesses for contact. • Replace TCCU if necessary.
P1843	Defective position sensor in motor	• 2H-4H: after 1.5 seconds • 4H-4L: after 3 seconds • Check the relevant harnesses for contact. • Replace TCCU if necessary.
P1844	Stuck in 4L mode	• When no shifting operation from 4L to 4H, even though the shift conditions are satisfied and no error. • Replace TCCU if necessary.

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Code	Description	Action
P1850	Defective position encoder	• When the position encoder is defective • Check the relevant harnesses. • Check the relevant connectors for contact. • Check the shift motor.
P1851	Short to ground for position encoder 1	• Short to ground for position encoder 1 in shift motor • Check the relevant harnesses for short. - TCCU pin No.18 • Check the relevant connectors for contact. • Check the shift motor.
P1852	Short to ground for position encoder 2	• Short to ground for position encoder 2 in shift motor • Check the relevant harnesses for short. - TCCU pin No.5 • Check the relevant connectors for contact. • Check the shift motor.
P1853	Short to ground for position encoder 3	• Short to ground for position encoder 2 in shift motor • Check the relevant harnesses for short. - TCCU pin No.19 • Check the relevant connectors for contact. • Check the shift motor.
P1854	Short to ground for position encoder 4	• Short to ground for position encoder 4 in shift motor • Check the relevant harnesses for short. - TCCU pin No.17 • Check the relevant connectors for contact. • Check the shift motor.
P1815	Abnormal CAN neutral signal	• No neutral signal from automatic transmission over 1 second through CAN. • Check CAN communication line. • Check TCU.

DIAGNOSIS (AWD)

Symptoms		Cause	Action
Noise	Noise in all ranges	- Low oil level	- Check major components (bearing surface) for excessive wear
			- Replenish oil
		- Improper oil	- Drain oil and replenish the specified oil
		- Worn or broken chain	- Replace chain or sprocket
	Growling	- Broken bearing	- Replace transfer case housing
		- Low oil level	- Check major components (bearing surface) for excessive wear
			- Replenish oil
	Noise when cornering	- Worn pinion gear teeth	- Replace differential carrier assembly
	Low frequency noise and vibration	- Missing shaft support snap ring	- Visually check the relevant parts for wear and replace if necessary
	Howling	- Abnormal friction in drive system	- Disassemble drive system, check rotating parts for wear and replace the worn parts.
Clunking	Clunking (when starting and stopping)	- Excessive backlash in T/C (over 3°)	- Check backlash and replace if necessary
		- Improper mounting	- Excessive backlash in drive system
			- Check drive system
		- Excessive backlash in other parts	- Excessive backlash in drive system
			- Check drive system
Undrivable	Cannot deliver forward/reverse driving force	- Worn or broken chain	- Replace chain or sprocket
		- Broken sprocket	- Replace chain or sprocket
		- Broken differential carrier	- Replace differential carrier assembly
		- Broken shaft	- Replace shaft
Binding	Dragging in front wheels or rear wheels	- Differential carrier stuck	- Replace differential carrier
Leakage	Leakage at transmission connection	- Damaged oil seal in T/C	- Replace oil seal
		- Clogged breather	- Check breather for clogging
			- Replace connecting hose
	Leakage at front and rear shafts	- Foreign material in oil seal	- Remove any foreign material, check oil seal for damage and replace oil seal
		- Broken oil seal	- Replace oil seal
		- Clogged breather	- Check breather for clogging
			- Replace connecting hose
	Leakage at case or cover body	- Cracked case or cover	- Replace transfer case
		- Air bubbles inside	
	Leakage at drain plug	- Bubbles no mounting bolt	- Replace drain plug
		- Uneven or missing plug coating	
	Leakage at filler plug	- Bubbles no mounting bolt	- Replace filler plug
		- Uneven or missing plug coating	
	Leakage at body connection	- Improperly applied sealant	- Disassembe T/C, apply sealant and reassemble it
		- Loose bolt around the leaking area	- Tighten to the specified torque

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RK-STICS

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DIAGNOSIS TROUBLE CODE AND HELP TIPS

Fault Code	Malfunction	Descriptions
01	Dr Door Lock Knob	Driver's door lock knob is not operated when locking/unlocking doors.
02	Ps Door Lock Knob	Passenger's door lock knob is not operated when locking/unlocking doors.
03	Rr Door Lock Knob	Rear door lock knob is not operated when locking/unlocking doors.
04	T/Gate Lock Knob	Tailgate lock knob is not operated when locking/unlocking doors.
05	Door Lock Output	All door lock knob are not moved to lock position even when the door lock relay is activated.
06	Door Unlock Output	All door lock knob are not moved to unlock position even when the door unlock relay is activated.
07	C/DR Lock Output	Doors are locked by central door lock switch while the engine is running.
08	DR Lock Output	Doors are locked by driver's door lock switch while the engine is running.
09	PS Lock Output	Doors are locked by passenger's door lock switch while the engine is running.
10	Auto Door Lock Output	Door lock knob is not moved to lock position when the system outputs auto door lock signal while the ignition switch is in ON position and the vehicle speed is over 50 km/h.
11	Auto Door Unlock Output	Door lock knob is not moved to unlock position after receiving the output from collision sensor.
12	Wiper Output	The WIPER P-POS signal is not detected when the wiper relay is activated.
13	SPEED SIGNAL	The vehicle speed over 3 km/h is detected at the speed signal area while the ignition switch is in ON position and the alternator signal is "D" LOW.
14	INT WIPER Volume	The circuit is open (over 4.5 V) when changing the INT volume in the speed sensitive INT wiper (saved as history error).
15	SPEED SENSOR	The vehicle speed over 200 km/h is detected (saved as history error).
16	A/BAG COLLISION SENSOR INPUT	A signal is sent to the collision sensor input area while the ignition switch is in OFF position (saved as history error unconditionally).
17	A/BAG COLLISION SENSOR OUTPUT	The RKSTICS outputs UNLOCK signal after receiving collision sensor input while the ignition switch is in ON position (saved as history error).
18	A/BAG COLLISION MONITOR	The STICS outputs the Door Unlock signal due to the collision sensor and the feedback value is in proper range (saved as history error).
19	Door Ajar Warning IND	The door warning indicator blinks when the vehicle speed is over 10 km/h (saved as history error).
20	PARKING BRAKE IND	The parking brake indicator blinks when the vehicle speed is over 10 km/h (saved as history error).
21	Auto Washer Out	The auto washer output is not sent to the front washer (saved as history error).
22	WASHER RELAY	The front washer switch receives the input signal for more than 10 seconds (saved as history error).

Fault Code	Malfunction	Descriptions
23	REMOCON VOLTAGE CHECK	The voltage from remote control key is saved as history error.
24	SBR S/BELT SW (Only EU)	When the seat belt switch circuit is OPEN (HIGH) in KEY OUT & ARMED MODE, the system recognizes it as FAIL and saves it as History error (Normal Close (GND)).
25	SBR SENSOR (Only EU)	When the sensor value is recognized in KEY OUT & ARMED MODE, the system saves it as History error.
26	SBR CONNECTION (Only EU)	When the seat belt switch circuit maintains OPEN (HIGH) in KEY OUT & ARMED MODE while the vehicle speed is over 50 km/h, the system saves it as History error.

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FFH

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DIAGNOSIS

Trouble Code	Trouble Description	Remedies
0	No faults	-
10	Shutdown for overvoltage	Measure battery voltage (must be < 15.9V). Check alternator and overvoltage.
11	Shutdown for undervoltage	Measure battery voltage (must be > 10.2V under load). Check alternator, wiring and undervoltage.
12	Overheating (abnormal reference value)	Temperature at overheating sensor > 125°C: check cooling system. Check temperature sensor and overheating sensor, replace if necessary.
14	Overheating (difference evaluation-1)	Difference in temperature values between surface sensor and control overheating sensor is too large. (Prerequisite for this trouble code display is that the heater is in operation and the water temperature at the overheating sensor has reached min. 80°C): check cooling system. Check temperature sensor and overheating sensor, replace if necessary
15	Overheating (abnormal heater operation)	Heater does not operate (The controller is locked.) Delete trouble code to release controller lock: check cooling system. Check temperature sensor and overheating sensor, replace if necessary
16	Overheating (difference evaluation-2)	If the surface sensor has a far higher temperature value than the control overheating sensor, then the system proceeds with a fault shutdown.
17	Overheating (defective hardware-2)	Temperature at control overheating sensor > 130°C: check cooling system. Check temperature sensor and overheating sensor, replace if necessary.
20	Open glow plug circuit	Check plug cable for damage, replace if necessary
21	Overload or short circuit of glow plug	Check plug cable for damage, replace if necessary
22	Short circuit of glow plug	Check plug cable for damage, replace if necessary
23	-	-
24	-	-
25	Short circuit of communication line	Check the communication line.
30	Abnormal speed of combustion fan motor	Defective fan wheel or combustion air fan motor (frozen, contaminated, stiff, damaged cable)
31	Defective combustion fan motor	Check cable harness for damage, replace if necessary.
32	Overload or short circuit of combustion fan motor	Defective fan wheel or combustion air fan motor (contaminated, stiff) Check cable harness for damage, replace if necessary.
34	Abnormal output of combustion fan motor	Check the ground and short of combustion air fan motor circuit, replace if necessary.
36	-	-
38	-	-
39	-	-
41	Abnormal water pump operation	Check connector.
42	Overload or short circuit of water pump	Check connector.

Trouble Code	Trouble Description	Remedies
43	Abnormal output of water pump	-
47	Overload or short circuit of fuel pump	Check cable harness for damage, replace if necessary.
48	Abnormal fuel pump operation	Check cable harness for damage, replace if necessary. Check plug-in connection, replace if necessary.
49	Short circuit of fuel pump (B+)	Check cable harness for open to battery voltage, replace if necessary.
50	Improper operation	The controller is locked due to excessive starting problem.
51	Delayed heating time	During start (no flame formed yet), the flame sensor reports temperature value too high for too long, check exhaust gas, combustion air and flame sensor.
52	Time exceeded for cold blowing	Check exhaust gas and combustion air. Check fuel quantity and fuel supply. Clean or replace filter in fuel pump.
53	Flame aborted from “large” stage	Fault (no more starting attempt allowed). Check exhaust gas and combustion air system. Check fuel quantity and fuel supply. Check flame sensor - see trouble code 64 and 65.
54	Flame aborted from “small” stage	Fault (no more starting attempt allowed). Check exhaust gas and combustion air system. Check fuel quantity and fuel supply. Check flame sensor - see trouble code 64 and 65.
60	Abnormal overheating sensor operation	Check cable harness for damage, check plug-in connection, replace if necessary. Check sensor resistance value, replace if necessary.
61	Short circuit or ground of overheating sensor	Check cable harness, replace if necessary. Check sensor resistance value, replace if necessary.
64	Abnormal flame sensor operation	Check cable harness for damage, check plug-in connection, replace if necessary. Check sensor resistance value, replace if necessary.
65	Short circuit of flame sensor	Check cable harness, replace if necessary. Check sensor resistance value, replace if necessary.
71	Defective surface sensor	Check cable harness for damage, check plug-in connection, replace if necessary. Check sensor resistance value, replace if necessary.
72	Short circuit of surface sensor	Check cable harness, replace if necessary. Check sensor resistance value, replace if necessary.
74	Defective overheating prevention device	-
87	-	-
88	-	-
89	-	-
90	Watchdog reset	Replace controller.
91	Abnormal reset function	If too many resets occurs, replace controller
92	ROM error	Replace controller.
93	RAM error	Replace controller.
94	Defective transistor	Replace controller.

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Trouble Code	Trouble Description	Remedies
95	Software error	Check cable harness for open to battery voltage, replace if necessary. Replace controller.
96	Abnormal process operation	Replace controller.
97	Wrong processor cycle	Replace controller.
98	Defective main relay	Replace controller.
99	EEPROM error	Replace controller.

▶ Trouble Diagnosis

Causes		Remedies
Low coolant level	• Leakage in radiator	• Change radiator.
	• Leakage in coolant auxiliary tank	• Change coolant auxiliary tank
	• Leakage in heater core	• Change heater core.
	• Leakage in joint junction of coolant hose	• Check hose or replace clamp.
	• Leakage in defective coolant hose	• Change hose.
	• Leakage in water pump gasket	• Change gasket.
	• Leakage in water pump sealing	• Change water pump.
	• Leakage in water inlet cap	• Change water inlet cap gasket.
	• Leakage in thermostat housing	• Change thermostat sealing.
	• Insufficient tightening torque of cylinder head bolt	• Tighten bolt to specified torque.
	• Damaged cylinder head gasket	• Change cylinder head gasket.
Abnormally high coolant temperature	• The coolant leakage (Check the coolant level)	• Add coolant
	• Excessive anti-freezer	• Check density of coolant (Anti-freezer).
	• Poor coolant hose condition	• Check bent of hose, replace if necessary.
	• Defective thermostat	• Change thermostat
	• Defective water pump	• Change water pump.
	• Defective radiator	• Change radiator.
	• Defective coolant auxiliary tank or tank cap	• Change coolant auxiliary tank or tank cap.
	• Crack in cylinder head or in cylinder block	• Change cylinder head or cylinder block.
	• Clogged water flow in cylinder head or block	• Clean coolant flow line.
	• Clogged water flow in radiator core	• Clean radiator core.
	• Defective cooling fan	• Change or check cooling fan.
	• Defective temp. sensor, wiring, and lamp cluster	• Change sensor or check relevant wiring.
Abnormally low coolant temperature	• Defective thermostat	• Change thermostat.
	• Defective cooling fan	• Change or check cooling fan.
	• Defective temp. sensor, wiring, and lamp cluster	• Change sensor or check relevant wiring.

MEMO

RAIN SENSOR

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TROUBLE SHOOTING

Symptom 1. The wiper does not operate one cycle when turning the multifunction wiper switch to the "AUTO" from the "OFF" position or starting the engine while the wiper switch is in the "AUTO" position.

1. When starting the engine with the multifunction wiper switch in the "AUTO" position, the wiper operates one cycle to remind a driver that the wiper switch is in the "AUTO" position.
2. When the wiper switch is turned to "AUTO" from "OFF", the wiper operates one cycle. It always operates one cycle for the initial operation, however, the wiper does not operate afterwards to prevent the wiper blade wear if not raining when turning the wiper switch to "AUTO" from "OFF". However, the wiper operates **up to 5 minutes** after rain stops. If this function does not occur, check No. 8 pin. If the pin is normal, check the wiper relay related terminals in the ICM box.

Symptom 2. It rains but the system does not work in the "AUTO" position.

1. Check whether the multifunction wiper switch is in the "AUTO" position.
2. Check the power to the sensor. Check the conditions of the pin 3 (Ground) and the pin 4 (IGN).
3. Check the wiper relay for defective.

Symptom 3. The wiper operates 3 or 4 times at high speed abruptly.

Check whether the variable resistance knob on the multifunction wiper switch is set in "FAST". The "FAST" is the highest stage of the sensitivity and very sensitive to small amount of rain drops. Therefore, change the knob to the low sensitivity.

Symptom 4. The wiper operates continuously even on the dry glass.

1. Check the wiper blade for wear. If the wiper blade cannot wipe the glass uniformly and clearly, this problem could be occurred. In this case, replace the wiper blade with a new one.
2. Check whether the variable resistance knob on the multifunction wiper switch is set in "FAST". The "FAST" is the highest stage of the ensitivity and very sensitive to small amount of rain drops. Therefore, change the knob to the low sensitivity.

Symptom 5. The wiper does not operate at high speed even in heavy rain.

Check if the wiper operates at high speed when grounding pin 1 and pin 2.

Symptom 6. The wiper responses are too fast or slow.

Check whether the variable resistance knob on the wiper switch is set in "FAST" or "SLOW".

Notify that the customer can select the sensitivity by selecting the variable resistance value. And, select a proper stage.

MEMO

FATC

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SELF DIAGNOSIS (ONLY FOR FATC AIR CONDITIONER)

▶ Self Diagnosis

1. Starting Self Diagnosis

Turn the ignition switch to ON position and press OFF switch for more than 5 seconds within 10 seconds.

2) Check LED segments on the vacuum fluorescent display (VFD).

1) Press OFF switch more than 5 seconds.

2. Set in Trouble Diagnosis Step 2

In this step, check the air mix door and sensors for defect.

Once the system starts diagnosis step 2, the digit “2” is displayed, implying step 2, on the display window and the trouble diagnosis for sensors is executed. If no failure exists, “20” is displayed. If any failure exists, the appropriate trouble code is displayed as below.

1) Slightly turn the TEMP dial to the right to set in the trouble diagnosis step 2

2) Indication of Step 2. Starting self diagnosis

10 ~ 20 seconds

3) Sensor failure code blinking

When two sensors are defective

NOTICE

- **The symbol "-" in front of step number "2" means a short circuit of the blinking sensor.**

Short-circuit in the ambient air temperature sensor

First sensor failure code blinks twice

Second sensor failure code blinks twice

Trouble Code

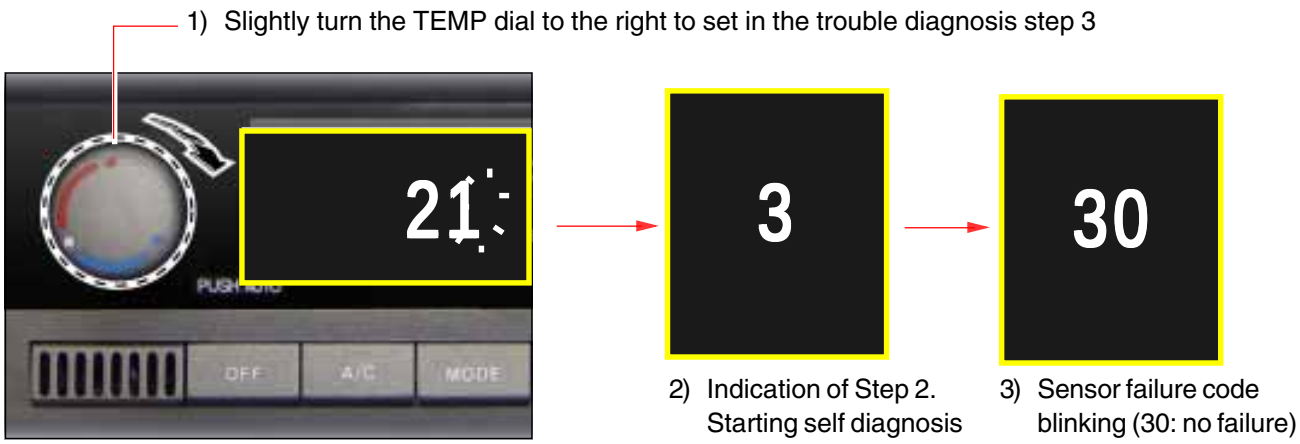
Code	Malfunction	Remark	Code	Malfunction	Remark
0	VDF segments are OK		5	Defective sun sensor	
1	Defective ambient temperature sensor		6	Check Air mix door	
2	Defective interior temperature sensor		7	Defective humidity sensor	
3	Defective duct temperature sensor		8	-	
4	Defective intake sensor		9	-	

3. Set in Trouble Diagnosis Step 3

In this step, check the position and conditions of recirculation air door and mode door.

Slightly turn the TEMP switch until “3” is displayed on the display window.

If no failure exists, "30" is displayed. If any failure exists, the appropriate trouble code is displayed.



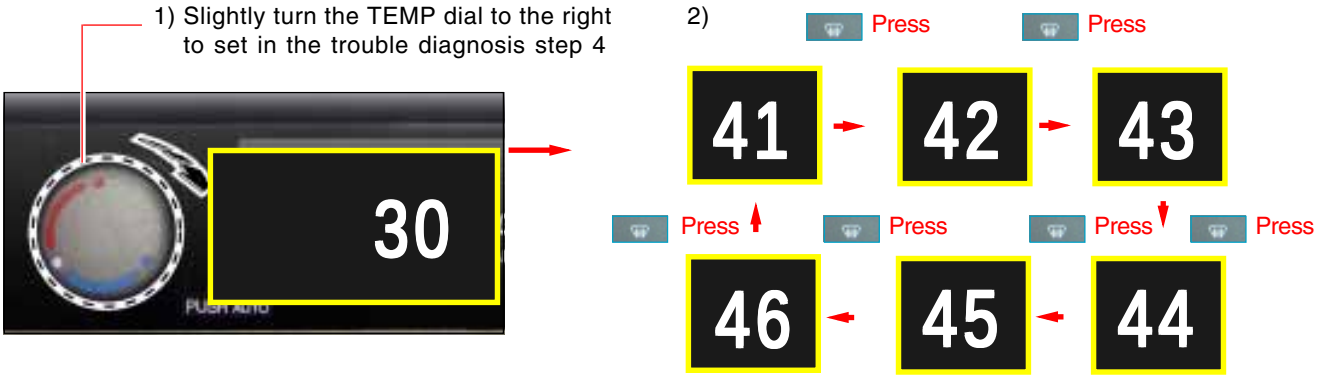
Trouble Code

Code	Malfunction	Remark	Code	Malfunction	Remark
1	Defective VENT		6	DEF	
2	Defective B/L		7	FRE	
3	-		8	20% FRE	
4	FOOT		9	REC	
5	D/F		0	All door OK	

4. Set in Trouble Diagnosis Step 4

In this step, check the position of actuator door, check the fan speed, and check the compressor operation.

Slightly turn the TEMP switch in step 3 until “41” is displayed on the display window. When pressing DEF switch ,mode changes as shown below in turns to check each function.



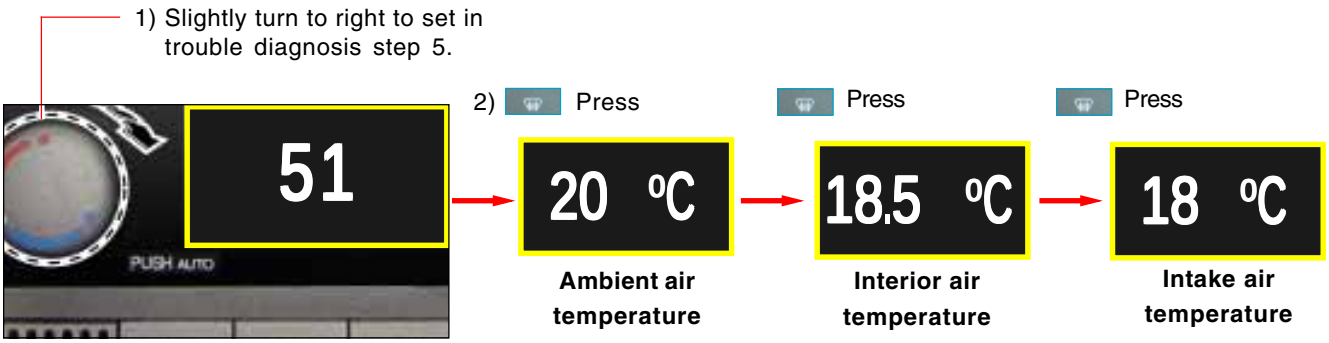
Function Check

Displayed Number	41	42	43	44	45	46
Mode door	VENT	B/L	B/L	FOOT	D/F	DEF
Interior/Ambient door	REC	REC	20%FRE	FRE	FRE	FRE
Air mix door	F/COOL	F/COOL	F/HOT	F/HOT	F/HOT	F/HOT
Blower	4.5 V	10.5 V	8.5 V	8.5 V	8.5 V	MAX
Compressor	ON	ON	OFF	OFF	ON	ON

5. Set in Trouble Diagnosis Step 5

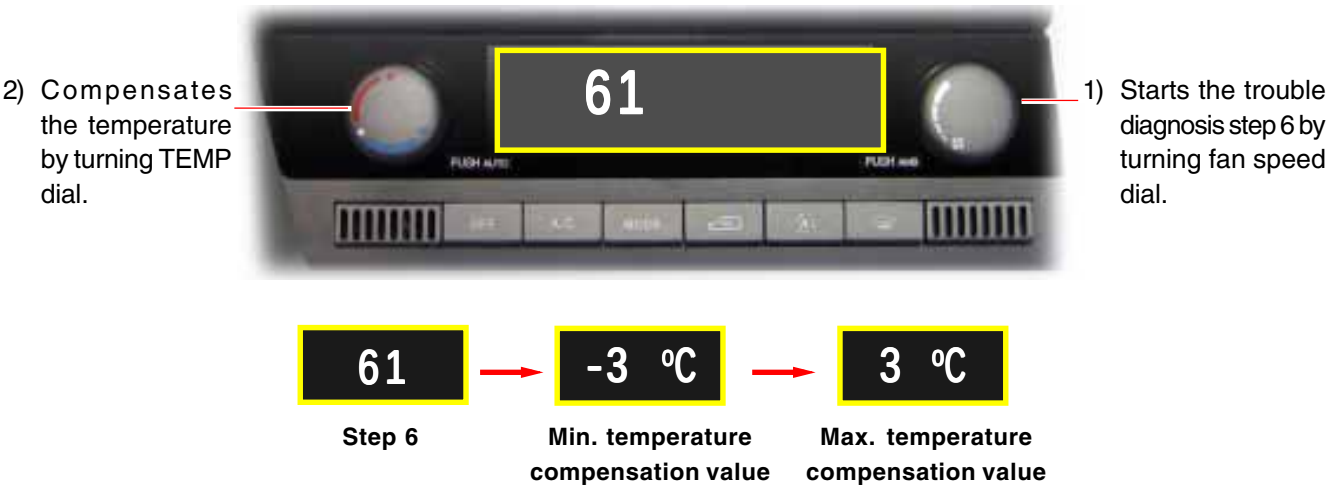
In this step, check the conditions of temperature related sensors.

Slightly turn the TEMP switch in step 4 until “51” is displayed on the display window. When pressing DEF switch , displayed temperature changes as shown below in turns.



6. Set in Trouble Diagnosis Step 6

In this step, the temperature can be compensated within the range of -3°C to 3°C in the control process according to the temperature to air conditioner controller. The step 6 initiates when slightly rotating the fan speed switch (other than TEMP switch) in step 5.



7. Canceling the Trouble Diagnosis

Turn the AUTO switch ON or turn the ignition key OFF.

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TGS LEVER

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DTC AND DIAGNOSIS

▶ DTC for Selector Lever

DTC	Malfunction	Help tips	
P1000-1	Defective program memory	Cause:	The calculated checksum value is not consistent with the stored checksum value.
		Symptom:	- Solenoid valve is inoperative. - Backup lamp is OFF. - CAN bus is OFF. - All shift lever position indicators are OFF.
		Action:	Reset the unit by cyling the ignition switch (OFF → ON) several times.
P1000-2	Defective data memory	Cause:	The malfunction is occurred during the RAM memory test with the ignition ON.
		Symptom:	- Solenoid valve is inoperative. - Backup lamp: OFF - CAN bus: OFF - All shift lever position indicators: OFF
		Action:	If the malfunction stays after turning the ignition switch from OFF to ON, replace the TGS lever.
P1000-3	Faulty MCU reset	Cause:	The malfunction is occurred during the microprocessor test with the ignition ON.
P1000-4	Faulty MCU data process	Symptom:	- Solenoid valve is inoperative. - Backup lamp is OFF. - CAN bus is OFF. - All shift lever position indicators are OFF.
P1000-5	Faulty MCU watchdog function	Action:	Reset the unit by cyling the ignition switch (OFF → ON) several times.
P1000-6	Too long MCU data throughput time		
P1750-2	Low battery voltage	Cause:	The battery voltage is low. (Specified value: less than 8.0 ± 0.3 V for 50 ms)
		Symptom:	All shift lever position indicators are OFF.
		Action:	- The operation is automatically resumed if the battery voltage is over 8.7 ± 0.3 V for 50 ms. - Check the shift lever connector and power line for contact.
P1817-1	Faulty backup lamp operating current	Cause:	The operating current is over 14 ~ 36 A for 50 ms when the backup lamp is in ON condition.
		Symptom:	- Backup lamp is OFF. - Current shift lever indicator is flashing. - Indicator “R” is flashing in “R” position.
		Action:	Check the input and output wirings of backup lamp for open and short.
P1832-1	Faulty solenoid operating current	Cause:	The solenoid valve operating current is over 3 ~ 5 A when the solenoid is operating.
		Symptom:	- Solenoid valve is OFF. - Current shift lever indicator is flashing.
		Action:	The operation is automatically resumed since the interior temperature is normally within the solenoid operating temperature range. If the problem stays, check the power to the shift lever.

DTC	Malfunction	Help tips
P1833-2	Open solenoid valve circuit	Cause: The solenoid valve circuit is open or short to battery for 50 ms when the solenoid valve is OFF. Symptom: - Solenoid valve is OFF. - Current shift lever indicator is flashing. Action: Check the power terminal to the shift lever.
P1856-1	Short shift lever position signal (to B+)	Cause: The shift lever position sensor or the power supply is malfunctioning. Symptom: - All shift lever position indicators are flashing.. - The incorrect lever position signal is transmitted through the CAN line. Action: - The operation is automatically resumed if the fault is not detected for 100 ms. - Check the power supply terminal to the shift lever.
P1856-2	Open or short shift lever position signal (to GND)	Cause: The shift lever position sensor is open or short to ground. Symptom: - All shift lever position indicators: flashing. - The incorrect lever position signal is transmitted through the CAN line. Action: - The operation is automatically resumed if the fault is not detected for 100 ms. - Check the power supply terminal to the shift lever.
P1856-3	Abnormal shift lever position signal	Cause: The shift lever position sensor signal is incorrect. Symptom: - All shift lever position indicators are flashing. - The incorrect lever position signal is transmitted through the CAN line. Action: - The operation is automatically resumed if the fault is not detected for 100 ms. - Check the power supply terminal to the shift lever.
P1856-4	Incorrect shift lever position sensor coding	Cause: The calibration value of shift lever position sensor is not stored or not consistent with the stored value. Symptom: - All shift lever position indicators are flashing. - The incorrect lever position signal is transmitted through the CAN line. Action: - Reset the unit by cyling the ignition switch (OFF → ON) several times. - Check the shift lever and replace it if necessary.
P1860-2	Faulty vehicle speed signal	Cause: The vehicle speed is detected as 300 km/h. Symptom: - The gear is shifted as for the vehicle speed is 0 km/h. - Current shift lever position indicator is flashing. Action: - The operation is automatically resumed if the fault is not detected. * For the shift lever, the vehicle speed data is needed to the solenoid valve operation for R/P lock and N lock function.
P1875-3	Faulty CAN bus OFF signal	Cause: The CAN bus OFF condition of the CAN controller is detected for 3 times in the unit. Symptom: - Cannot send the CAN message. - Current shift lever position indicator is flashing. Action: - Check the CAN communication line for open or short. - Check the shift lever and replace it if necessary. * CAN Bus OFF: The status that the CAN communication is totally interrupted if there is an error in the sent/received data through the CAN communication in the unit.

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DTC	Malfunction	Help tips
P1876-1	Abnormal CAN communication (vehicle speed)	Cause: There is no vehicle speed signal via CAN communication for 500 ms. Symptom: - The gear is shifted as for the vehicle speed is 0 km/h. - Current shift lever position indicator is flashing. Action: Check the CAN communication line.
P1910-1	High battery voltage	Cause: The battery voltage is too high. (Specified value: Over 16.3 ± 0.3 V for 50 ms) Symptom: All shift lever position indicators: OFF Action: - The operation is automatically resumed if the battery voltage is over 16.3 ± 0.3 V for 50 ms. - Check the shift lever power supply line.
P1912-1	Open/Short shift lever tip switch signal (to B+)	Cause: The shift lever tip switch signal is open or short to B+. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the shift lever tip switch.
P1912-2	Short shift lever tip switch signal s(to GND)	Cause: The shift lever tip switch signal is open or short to ground. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M”, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the shift lever tip switch.
P1912-3	Abnormal shift lever tip switch signal	Cause: The shift lever tip switch signal is faulty. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the shift lever tip switch.
P1912-4	Open/Short steering wheel tip switch signal (to B+)	Cause: The steering wheel tip switch signal is open or short to B+. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the steering wheel's tip switch.
P1912-5	Open/Short steering wheel tip switch signal (to GND)	Cause: The steering wheel tip switch signal is open or short to ground. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the steering wheel tip switch.

DTC	Malfunction	Help tips
P1912-6	Abnormal steering wheel tip switch signal	Cause: The steering wheel tip switch signal is faulty. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the steering wheel tip switch.
P1912-7	Defective tip switch	Cause: The manual mode switch operates for 50 ms when the shift lever is P, R or N positions. Symptom: - Indicator “M” flashes if the shift lever is in D. - The mode is recognized as the manual mode even if the shift lever is in “D” position. Action: The operation is automatically resumed if the fault is not detected for 50 ms and the shift lever is in P, R or N positions.
P1927-8	Faulty TCU shift	Check the TCU if there is errors related to the A/T shift.
P1928-4	Defective TCU CAN communication	Cause: - The up/down shift command in not delivered to the TCU (faulty tip switch). - There is no CAN signal for 500 ms. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: Check the CAN communication line.

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P/TRUNK

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DTC

Function	System component	DTC	Description
Power Trunk Monitoring	**Power striker**	**0**	**Faulty power striker**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The micro switch is malfunctioning. - The power striker'motor is malfunctioning. **Actions** - Check the related wiring and connector for proper connection. - Replace the power striker.		
	Power latch	**1**	**Faulty power latch**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The micro switch is malfunctioning. - The power latch motor is malfunctioning. **Actions** - Check the related wiring and connector for proper connection. - Replace the power latch.		
	DC-Gear motor	**2**	**Faulty DC-gear motor**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The hall sensor is malfunctioning. - The DC-gear motor is malfunctioning. **Actions** - Check the related wiring and connector for proper connection. - Replace the DC-gear motor.		
	Power trunk lid	**3**	**Faulty power trunk lid**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The PTL ECU is malfunctioning. **Actions** - Check the related wiring for proper connection. - Replace the PTL ECU.		

Function	System component	DTC	Description
Power Trunk Monitoring	**Battery**	**4**	**Low battery voltage**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The battery is defective. **Actions** - Check the related wiring for proper connection. - Check the battery and replace it if necessary.		
	CAN communication	**5**	**Faulty CAN communication**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The CAN communication is malfunctioning. - The PTL ECU is malfunctioning. **Actions** - Check the related wiring for proper connection. - Replace the PTL ECU.		
	Power trunk	**6**	**Faulty usage**
	Cause - If the DC-gear motor is operated 7 times within 2 minutes, it is considered as misusage and overheated DC-gear motor. **Action** - The system resumes its operation in 90 seconds.		
	PTL ECU	**7**	**Faulty temperature detection of unit**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The internal temperature sensor in the PTL ECU is malfunctioning. - The PTL ECU is malfunctioning. **Actions** - Check the related wiring for proper connection. - Replace the PTL ECU.		
	PTL ECU	**8**	**Faulty temperature detection of unit**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The power trunk lamp is malfunctioning. - The PTL ECU is malfunctioning. **Actions** - Check the related wiring for proper connection. - Replace the power trunk lamp. - Replace the PTL ECU.		

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CCCS

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CCCS DIAGNOSIS

Code	Malfunction	Help
0 X 01	Driver door lock knob does not lock	- Check the driver side door actuator - Check the sensor values • Driver side door open switch (STICS sensor value: No. 5) • Door lock switch (STICS sensor value: No. 21) • Driver door lock switch (STICS sensor value: No. 37) • Door lock switches other than the driver side door (STICS sensor value: No. 38) • Door lock (DICS-Main: No. 30) • Key lock (DICS-Main: No. 32) - Check the driver side door wires and connectors
0 X 02	Passenger door lock knob does not lock	- Check the passenger side door actuator - Check the sensor values • Passenger side door open switch (STICS sensor value: No. 6) • Door lock switch (STICS sensor value: No. 21) • Door lock switches other than the driver side door (STICS sensor value: No. 38) • Door lock (DICS-Sub: No. 3) • Key lock (DICS-Sub: No. 5) - Check the passenger side door wires and connectors
0 X 03	Rear door lock knob does not lock	- When one of the two rear seat door knobs is defective - Check the rear seat door actuator - Check the sensor values • Rear door knob switch (STICS sensor value: No. 7) • Rear right door open switch (STICS sensor value: No. 8) • Door lock switch (STICS sensor value: No. 21) • Rear door open switch (STICS sensor value: No. 23) • Door lock switches other than the driver side door (STICS sensor value: No. 38) • Door lock switch (DICS-Main sensor value: No. 32) • Key lock (DICS-Main sensor value: No. 32) • Door lock (DICS-Sub sensor value: No. 3) • Key lock (DICS-Sub sensor value: No. 5) - Check the rear door wires and connectors
0 X 04	Defective tail lamp auto off function (Battery save function)	- Check the tail lamp relay connector - Check the sensor values • Tail lamp switch (STICS sensor value: No. 3) • Tail lamp signal input status (STICS sensor value: No. 20) • Tail lamp relay (STICS sensor value: No. 47) - Check the tail lamp wires and connectors - The defective code of signals coming from ABS/ESP which senses the vehicle speed incorrectly due to the exterior noises - Current vehicle speed (STICS sensor value: No. 58)
0 X 05	Incorrect indication of the vehicle speed (Detects as over 300 km/h)	- Check the speed sensor connector - Check the other units (ABS) that use speed signal - Does not receive the vehicle speed signal from STICS when the ignition switch is turned off

Code	Malfunction	Help
0 X 06	Vehicle speed indicates over 0 km/h when the ignition switch is turned off	- Current vehicle speed (STICS sensor value: No. 58) - Check the speed sensor connector - Check the other units (ABS) that use speed signal
0 X 07	Tail lamp turns OFF without any signals when the tail lamp switch is turned on	- Check the tail lamp relay connector - Check the sensor values • Tail lamp switch (STICS sensor value: No. 3) • Tail lamp signal input status (STICS sensor value: No. 20) • Tail lamp relay (STICS sensor value: No. 47)
0 X 08	IGN 2 SW is detected as OFF when IGN 1 SW is ON	- Check the tail lamp wires and connectors - Check the sensor values • Key reminder switch (STICS sensor value: No. 13) • Ignition 1 switch (STICS sensor value: No. 17) • Ignition 2 switch (STICS sensor value: No. 18) • Ignition 1 switch (DICS-Main sensor value: No. 60) • Ignition 2 switch (DICS-Main sensor value: No. 59) • Key reminder (DICS-Main sensor value: No. 62)
0 X 09	Driver side door lock knob does not unlock	- Check the driver side door actuator - Check the sensor values • Door open switch (STICS sensor value: No. 5) • Door unlock switch (STICS sensor value: No. 22) • All door unlock switches (STICS sensor value: No. 39) • Key unlock (Main-DICS: No. 31) - Check the driver side door wires and connectors
0 X 0A	Passenger side door lock knob does not unlock	- Check the passenger side door actuator - Check the sensor values • Passenger side door open switch (STICS sensor value: No. 6) • Door unlock switch (STICS sensor value: No.22) • All door unlock switches (STICS sensor value: No. 39) • Key unlock (DICS-Main: No. 31) • Key unlock (Main-DICS: No. 04) - Check the driver side door wires and connectors
0 X 0B	Rear door lock knob does not unlock	- When one of the two rear seat door knobs is defective - Check the rear seat door actuator - Check the sensor values • Rear door knob switch (STICS sensor value: No. 7) • Rear right door open switch (STICS sensor value: No. 8) • Door unlock switch (STICS sensor value: No. 22) • Rear door open switch (STICS sensor value: No. 23) • All door unlock switches (STICS sensor value: No. 39) • Key unlock (DICS-Main sensor value: No. 31) • Key unlock (DICS-Sub sensor value: No. 4) - Check the rear seat door wires and connectors

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▶ STICS Input/Output Monitoring Data

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Reverse lever detection	Not detected	GND	Detected	12 V	1. Sensor signal detects when the reverse gear signal in A/T equipped vehicle 2. Ground level when not operating 3. Battery level when operating 4. This signal is used when outside rearview mirror in DICS Main/Sub is linked with 5°C. It is linked only when the outside rearview mirror selection switch in DICS Main is not in center position.
2	Input	Driver side seatbelt switch	Unfasten	GND	Fastened	12 V	1. Switch signal checks the driver side seatbelt has been fastened 2. Ground level when unfastened 3. Battery level when fastened
3	Input	Tail lamp switch	OFF	12 V	ON	GND	1. Switch that turns ON or OFF tail lamp switch 2. Battery level when tail lamp switch is OFF 3. Ground level when tail lamp switch is ON
4	Input	Trunk lid open switch	Close	GND	Open	12 V	1. When equipped with PTL, no input data is transmitted from trunk lid open switch to STICS 2. Battery level when open 3. Ground level when close
5	Input	Front left door open switch	Close	12 V	Open	GND	1. Ground level when door is open 2. Battery level when door is close
6	Input	Front right door open switch	Close	12 V	Open	GND	1. Ground level when door is open 2. Battery level when door is close
7	Input	Rear door knob switch	Open	GND	Close	12 V	1. Operating conditions • When the central door lock and unlock function is in operation • When the doors are locked by the driver's door lock knob • When receiving signal from DICS via CAN communication in auto door lock/unlock operation at vehicle speed of 50 km/h. 2. Ground level when rear door knob is open 3. Battery level when rear door knob is close
8	Input	Rear right door open switch	Close	12 V	Open	GND	1. Ground level when door is open 2. Battery level when door is close
9	Input	Parking brake switch	Not operating	12 V	Operating	GND	1. Switch detects the parking brake engagement 2. Ground level when parking brake is engaged 3. Battery level when not operating
10	Input	Auto windshield wiper switch	OFF	12 V	ON	GND	1. Auto windshields wiper switch. No inputs to STICS when the vehicle is equipped with the rain sensor 2. Ground level when ON 3. Battery level when OFF
11	Input	Hood open switch	Close	12 V	Open	GND	1. Hood open detection switch 2. Ground level when open 3. Battery level when close

No.	Input/ Output	Sensor value item	Information				Help
12	Input	Trunk unlock switch	Not operating	GND	Operating	12 V	1. Switch detects the trunk lid unlock from the glove compartment • With the power trunk: Communication between PTL and CAN • Without the power trunk: Controlled by STICS 2. OFF: GND 3. ON: 12 V
13	Input	Key reminder switch	Not detected	GND	Detected	12 V	1. Key reminder detection switch 2. Battery level when operating 3. Ground level when not operating
14	Input	KEY ACC switch	Not detected	GND	Detected	12 V	1. Key accessory detection switch 2. Battery level when operating 3. Ground level when not operating
15	Input	Alternator switch	Not detected	GND	Detected	12 V	1. Alternator charging detection switch 2. Battery level when operating 3. Ground level when not operating
16	Input	P/N switch	Not detected	GND	Detected	12 V	1. Parking (P) or neutral (N) position of A/T detection switch 2. Battery level when operating 3. Ground level when not operating
17	Input	IGN1 switch	Not detected	GND	Detected	12 V	1. Ignition 1 detection switch 2. Battery level when operating 3. Ground level when not operating
18	Input	IGN2 switch	Not detected	GND	Detected	12 V	1. Ignition 2 detection switch 2. Battery level when operating 3. Ground level when not operating
19	Input	Windshield Wiper position switch	Not detected	12 V	Detected	GND	1. Windshield wiper position switch detects the wiper position when the operation stops. With the rain sensor equipped vehicle, no inputs are transmitted to STICS 2. Ground level when in the original position (operating) 3. Battery level when not operating 4. Cannot detect when equipped with the rain sensor
20	Input	Tail lamp operation signal	No input	12 V	Input	GND	1. Tail lamp operation signal (monitoring) is the function that detects the auto light operation of the tail lamp 2. With signal input 3. Without signal input
21	Input	Central door lock switch	Not detected	12 V	Detected	GND	1. Locking door knob switch (Can be detected when the lock switch is in operation) 2. Battery level during door unlock 3. Ground level during door lock
22	Input	Central door unlock switch	Not detected	12 V	Detected	GND	1. Unlocking door knob switch (Can be detected when the unlock switch is in operation) 2. Battery level during door lock 3. Ground level during door unlock

No.	Input/ Output	Sensor value item	Information				Help
23	Input	Rear left door open switch	Close	12 V	Open	GND	1. Rear left door open switch 2. Ground level when door is open 3. Battery level when door is close
24	Input	Heating grid switch	Not detected	12 V	Detected	GND	1. Heating grid operation switch (Blink once when the switch is operated) 2. Battery level when not operating (OFF) 3. Ground level when operating (ON)
25	-	-	-	-	-	-	-
26	Input	Washer switch	OFF	GND	ON	12 V	1. Windshield washer operating switch When equipped with the rain sensor,no inputs are transmitted to STICS 2. Battery level when operating (ON) 3. Ground level when not operating (OFF)
27	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-
32		Armed mode operation	Operating	GND	Not operating	12 V	1. Informs on armed mode 2. Electrical signals cannot be found 3. Battery level when operating 4. Ground level when not operating
33	Output	Rear left P/WDW UP relay	Not operating	12 V	Operating	GND	1. Relay for raising the rear left power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
34	Output	Rear left P/WDW DN relay	Not operating	12 V	Operating	GND	1. Relay for lowering the rear left power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
35	Output	Rear right P/WDW UP relay	Not operating	12 V	Operating	GND	1. Relay for raising the rear right power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
36	Output	Rear right P/WDW DN relay	Not operating	12 V	Operating	GND	1. Relay for lowering the rear right power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
37	Output	Driver side door lock relay	Not operating	12 V	Operating	GND	1. Driver side door knob lock relay (Locks all doors) The value appears only when the relay is connected 2. Ground level when operating 3. Battery level when not operating

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No.	Input/ Output	Sensor value item	Information				Help
38	Output	All door lock other than driver side	Not operating	12 V	Operating	GND	1. All door knob lock relays other than the driver side The value appears only when the relay is connected 2. Ground level when operating 3. Battery level during normal
39	Output	Driver side door unlock relay	Not operating	12 V	Operating	GND	1. All door knob unlock relays (Cannot operate with driver side lock knob) The value appears only when the relay is connected 2. Ground level when operating 3. Battery level when not operating
40	Output	Windshield wiper relay	Not operating	GND	Operating	12 V	1. Windshield wiper operation switch When equipped with the rain sensor, no inputs are transmitted to STICS 2. Battery level when operating 3. Ground level when not operating
41	Output	Siren operation	Not operating	12 V	Operating	GND	1. Siren operation signal 2. Ground level when operating 3. Battery level when not operating
42	Output	Parking brake headlamp	Not operating	12 V	Operating	GND	1. Parking brake headlamp 2. Ground level when operating 3. Battery level when not operating
43	Output	Buzzer operation	Not operating	12 V	Operating	GND	1. Buzzer operation 2. Ground level when operating 3. Battery level when not operating
44	Output	Door open headlamp	Not operating	12 V	Operating	GND	1. Door open and driving warning 2. Ground level when operating 3. Battery level when not operating
45	Output	Heating grid relay	Not operating	12 V	Operating	GND	1. Heating grid operation relay drive output 2. Ground level when operating 3. Battery level when not operating
46	Output	Hazard warning relay	Operating	GND	Not operating	12 V	1. Heating grid operation relay drive output (Operates when in armed mode) 2. Ground level when operating 3. Battery level when not operating
47	Output	Tail lamp relay	Not operating	12 V	Operating	GND	1. Tail lamp relay drive output (Blink once when operating the tail lamp switch) 2. Ground level when operating 3. Battery level when not operating
48	-	-	-	-	-	-	-
49	Output	Front left foot lamp	Not operating		Operating		1.Driver side foot lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications

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No.	Input/ Output	Sensor value item	Information				Help
50	Output	Front right foot lamp	Not operating		Operating		1. Passenger side foot lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications
51	Output	Rear foot lamp	Not operating		Operating		1. Rear door foot lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications
52	Output	Room lamp	Not operating		Operating		1. Room lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications
53	Output	Rheostat lamp	Not operating		Operating		1. Brightness changes according to the rheostat volume when the tail lamp is turned on 2. Pulse signal between the battery and ground when operating. Pulse width may change by 20% ~ 100% (based on GND). → Refer to operation signal STICS specifications
54	Output	Fixed rate dimming control	Not operating		Operating		1. Fixed rate dimming light (Operating value changes periodically) 2. Pulse signal between the battery and ground when operating. Pulse width maintains 50% of the duty rate. → Refer to operation signal STICS specifications
55	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-
58	Output	Current vehicle speed	A km/h				
59	Output	Dimming control	A %				Controls the dimming by 20 ~ 100%
60	Output	Windshield wiper operating resistance stages	A kohn				1. Windshield wiper volume value: 0 ~ 10 kΩ → Value between 0 ~ Vcc For the rain sensor equipped vehicle, no inputs are transmitted to STICS
61	Output	Intermittent time	A · 10 ms				1. The unit time of the windshield wiper intermittent intervals For the rain sensor equipped vehicle, no inputs are transmitted to STICS

DIAGNOSIS OF MAIN DICS

Code	Malfunction	Help
0 X 21	Power window limiter switch open	- The inputs have more than 30 edge hall pulses under the limiter switch off recognized as the upper position condition during the power window up or down outputs - Check the limiter switch - Check the sensor values • Power window anti-trap (DICS-Main: No. 50) • Power window limiter switch (DICS-Main: No. 56)
0 X 22	Defective power window motor hall sensor	- When the power window motor is under load, the auto-stop orders the power window to disengage auto-up function regardless ON or OFF inputs (no pulse signals) - No inputs of hall pulse exceeding 700 milliseconds during the power window motor down outputs under the limiter switch OFF (the upper position of the window) conditions or no inputs of pulse exceeding 100 milliseconds during the up outputs under the limit switch ON (the lowest position of the window) conditions. - Replace the power window motor
0 X 23	Inactive key door lock actuator	- Check the driver side door actuator - Check the sensor value • Key lock (DICS-Main: No. 32)
0 X 24	Inactive key door unlock actuator	- Check the driver side door actuator • Check the method of the actuator operation - Check the sensor value • Key unlock (DICS-Main: No. 31)
0 X 25	Memory switch input during no mirror UP or DN input	- When the outside rearview mirror has no UP or DOWN sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror UP or DOWN sensor wires - Measure sensor values and check the accordance position • Internal DOWN switch of the outside rearview mirror (DICS-Main: No. 21) • Internal UP switch of the outside rearview mirror (DICSMain:No. 22) • Internal DOWN motor of the outside rearview mirror (DICS-Main: No. 37) • Internal UP motor of the outside rearview mirror (DICSMain:No. 38) • Internal sensor of the outside rearview mirror (DICS-Main: No. 49) • Internal operation of the outside rearview mirror (DICSMain:No. 53)
0 X 26	Memory switch input during no mirror LT or RT input	- When the outside rearview mirror has no LEFT or RIGHT sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror LEFT or RIGHT sensor wires. - Measure the sensor values and check the relevant position • Internal RIGHT switch of the outside rearview mirror (DICS-Main: No. 19) • Internal LEFT switch of the outside rearview mirror (DICSMain: No. 20) • Internal RIGHT motor of the outside rearview mirror (DICSMain: No. 35) • nternal LEFT motor of the outside rearview mirror (DICSMain: No. 36) • Internal sensor of the outside rearview mirror (DICS-Main: No. 49) • Internal operation of the outside rearview mirror (DICSMain: No. 53)
0 X 27	Defective auto-stop	- The window does not lower to the certain range when autostop is detected during the driver side window auto-up operation. - Check the power window motor wires - Measure the sensor values and check the relevant position • Power window anti-trap (DICS-Main: No. 50) • Replace the power window motor

▶ Main DICS Input/Output Monitoring Data

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Rear left P/WDW UP S/W	Not operating		Operating		1. Switch the input signal to raise the rear left window 2. Internal input 3. Input signal transmits to STICS through CAN
2	Input	Front right P/WDW DN S/W	Not operating		Operating		1. Switch the input signal to lower the passenger's window 2. Internal input 3. Input signal transmits to DICS-Sub through CAN
3	Input	Front right P/WDW AUTO DN S/W	Not detected		Detected		1. Switch the input signal to lower the passenger's window automatically 2. Internal input 3. Input signal transmits to DICS-Sub through CAN
4	Input	Front right P/WDW UP S/W	Not operating		Operating		1. Switch the input signal to raise the passenger's window 2. Internal input 3. Input signal transmits to DICS-Sub through CAN
5	Input	Front left P/WDW DN S/W	Not operating		Operating		1. Switch the input signal to lower the driver side window 2. Internal input 3. DICS-Main has direct drive circuit
6	Input	Front left P/WDW AUTO DN S/W	Not detected		Detected		1. Switch the input signal to lower the driver side window automatically 2. Internal input 3. MICOM drives based on the signal
7	Input	Front left P/WDW UP S/W	Not operating		Operating		1. Switch input signal to raise the driver side window 2. Internal input 3. DICS-Main has direct drive circuit
8	Input	Front left P/WDW AUTO UP S/W	Not operating		Operating		1. Switch input signal to raise the driver side window automatically (operates only when the engine is running) 2. Internal input 3. MICOM drives based on the signal 4. When the obstruction is found (detects as hall pulse signal), the auto-stop engages the window to be lowered by 150 mm from its position
9	Input	Detecting driver's P/WDW detention	Not detected		Detected		1. Input signal of the motor protection is engaged by cutting the motor output when detects the increasing in currency when the motor is stopped at the lowest position of the driver side's window 2. Internal input
10	Input	Detecting 3 km/h of vehicle speed	Not detected		Detected		1. Input signal coming from STICS 2. Outside rearview mirrors will not fold when the signal comes on while outside rearview mirror is folding.

No.	Input/ Output	Sensor value item	Information				Help
11	Input	The driver side window status (limit switch)	Closed		Open		1. A signal that informs when the driver side window is opened. 2. When the window is at upper position, it is OFF (close) and when it's not in upper position by lowering, it is ON (open). 3. VCC 5 V level when window is opened: Operating 4. Ground level when window is closed: Not operating
12	Input	Easy access switch	Not operating		Operating		1. The steering column and electrical seat moves automatically during riding ON or OFF when this signal is ON. 2. Internal input 3. Input signal transmits to ESIMS and MSDOS through CAN
13	Input	P/WDW lock switch	Not operating		Operating		1. Only the driver side window is operational when this signal is ON. 2. Internal input 3. Input signal transmits to STICS and DICS Sub through CAN
14	Input	Rear right P/WDW DN S/W	Not operating		Operating		1. Switch input signal to lower the rear right window 2. Internal input 3. Input signal transmits to STICS through CAN
15	Input	Rear right P/WDW UP S/W	Not operating		Operating		1. Switch input signal to raise the rear right window 2. Internal input 3. Input signal transmits to STICS through CAN
16	Input	Rear left P/WDW DN S/W	Not operating		Operating		1. Switch input signal to lower the rear left window 2. Internal input 3. Input signal transmits to STICS through CAN
17	Input	Passenger side outside rearview mirror selection switch	Not detected		Detected		1. Signal that operates the driver side mirror, passenger side mirror and inside rearview mirror has selected the passenger side outside rearview mirror 2. Internal input 3. The signal transmits to DICS SUB and ESIMS through CAN
18	Input	Driver side outside rearview mirror selection switch	Not detected		Detected		1. Signal that operates the driver side mirror, passenger side mirror and inside rearview mirror has selected the passenger side outside rearview mirror 2. Internal input 3. When both left and right mirror selection signals are OFF, the signal selects inside rearview mirror and then ESIMS controls the inside rearview mirror 4. The signal transmits to DICS SUB and ESIMS through CAN

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No.	Input/ Output	Sensor value item	Information				Help
19	Input	Driver side outside rearview mirror right-turn switch	Not operating		Operating		1. Switch input to raise the mirror toward right 2. Internal input 3. This signal transmits to DICS SUB and ESIMS through CAN
20	Input	Driver side outside rearview mirror left-turn switch	Not operating		Operating		1. Switch input to move the mirror toward left 2. Internal input 3. This signal transmits to DICS SUB and ESIMS through CAN
21	Input	Driver side outside rearview mirror down switch	Not operating		Operating		1. Switch input to lower the mirror 2. Internal input 3. This signal transmits to DICS SUB through CAN
22	Input	Driver side outside rearview mirror up switch	Not operating		Operating		1. Switch input to raise the mirror upward 2. Internal input 3. This signal transmits to DICS SUB through CAN
23	Input	Driver side outside rearview mirror unfolding switch	Not operating		Operating		1. Switch input to unfold the mirror 2. Internal input 3. This signal transmits to DICS SUB through CAN
24	Input	Driver side outside rearview mirror folding switch	Not operating		Operating		1. Switch input to fold the mirror 2. Internal input 3. This signal transmits to DICS SUB through CAN
25	Input	Memory switch 3	Not detected		Detected		1. Signal that selects No. 3 memory position 2. When the memory switch is pressed for more than 2 seconds under P/N signal ON condition, MSDOS receives memorized position of the mirror through CAN and then moves the mirror to memorized position. 3. When the memory position switch is pressed after memory set switch input under the P/N signal ON condition, the current position value of the mirror (sensor value) transmits to MSDOS 4. Analog input when operating (about 3.8V) 5. VCC 5V when not operating
26	Input	Memory switch 2	Not detected		Detected		1. Signal that selects number 2 memory position 2. Analog input when operating (about 2.4V) 3. VCC 5V level when not operating
27	Input	Memory switch 1	Not detected		Detected		1. Signal that selects number 1 memory position 2. Analog input when operating (about 1.3V) 3. VCC 5 V level when not operating
28	Input	Memory stop switch	Not detected		Detected		1. Switch signal to stop the memory return 2. Ground level when operating 3. VCC 5 V level when not operating
29	Input	Memory SET switch	Not detected		Detected		1. Switch input to store the positions of the memory related mechanisms. When one of the memory switch among 3 is pressed after this signal, position value of the outside rearview mirrors will be transmitted to MSDOS through CAN 2. Analog input when operating (about 0V) 3. VCC 5 V level when not operating

No.	Input/ Output	Sensor value item	Information				Help
31	Input	Driver side door key unlock	Not operating		Operating		1. ON when the driver side door key fob is unlocked 2. Ground level when operating 3. VCC 5 V level when not operating
32	Input	Driver side door key lock	Not operating		Operating		1. ON when the driver side door key fob is locked 2. Ground level when operating 3. VCC 5 V level when not operating
33	Output	Driver side outside rearview mirror unfolding motor	Not operating		Operating		1. Unfolding operation of the driver side outside rearview mirror mottor 2. Battery level when operating 3. Ground level when not operating
34	Output	Driver side outside rearview mirror folding motor	Not operating		Operating		1. Folding operation of the driver side outside rearview mirror motor 2. Battery level when operating 3. Ground level when not operating
35	Output	Driver side outside rearview mirror right-turn motor	Not operating		Operating		Operates the driver side outside rearview mirror motor toward right
36	Output	Driver side outside rearview mirror left-turn motor	Not operating		Operating		Operates the driver side outside rearview mirror motor toward left
37	Output	Driver side outside rearview mirror down motor	Not operating		Operating		Operates the driver side outside rearview mirror motor down
38	Output	Driver side outside rearview mirror up motor	Not operating		Operating		Operates the driver side outside rearview mirror motor up
39	Output	Driver side P/WDW DN MTR	Not operating		Operating		1. Driver side power window motor down 2. Battery level when operating 3. Ground level when not operating
40	Output	Driver side P/WDW UP MTR	Not operating		Operating		1. Driver side power window motor up 2. Battery level when operating 3. Ground level when not operating
41	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-
43	Output	Memory LED	Not operating		Operating		1. Indicates when the LED lamp blinks during the memory set or when the return operation is ON 2. 2 V level when operating 3. Ground level when not operating
44	Output	Output power (5V)	Not operating		Operating		1. 5 V of power supplies each of the power window switch, outside rearview mirror sensor and power window motor hall sensor 2. 5 V level when operating 3. Ground level when not operating
45	Output	Driver side outside rearview mirror operating power	Not operating		Operating		1. Supplying power for the mirror LED lamp 2. 5 V level when operating 3. Ground level when not operating
46	Output	Easy access LED	Not operating		Operating		1. LED lamp turns on when easy access switch is pressed and turns off when pressed again.

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No.	Input/ Output	Sensor value item	Information	Help
47	Output	Driver side P/WDW S/W LED		1. LED lamp for power window switch illumination
48	Output	Driver side P/WDW LOCK S/W LED		1. LED lamp turns on when the window lock button is pressed and turns off when pressed again.
49	Status	Yes or No of the driver side outside rearview mirror sensor		1. ON when the driver side outside rearview mirror has no sensor detected or sensor is open-circuited
50	Status	Anti-trap operation status		1. Anti-trap activates when the obstruction is found during auto-up operation of the driver side power window with ignition ON.
51	Status	Side rearview mirror time lag		1. Indicates the outside rearview mirror can be controlled for a certain period of time after ignition key has been removed.
52	Status	Power window time lag		1. Indicates the power window can be controlled for a certain period of time after ignition key has been removed.
53	Status	Possibility of the side rearview mirror operation		1. Indicates the mirror can be controlled when ignition key is in ACC or IGN 1 or when mirror is in time lag
54	Status	Possibility of the power window operation		1. Indicates the power windows can be controlled when ignition key is in IGN 1 or when power windows is in time lag
55	Status	Hall sensor malfunction		1. When the signal coming from a hall sensor in the power window is abnormal
56	Status	Limit switch malfunction		1. When the signal coming from a limit switch in the power window regulator is abnormal
57	Input (CAN)	Armed mode operation state		1. Receives the signal from STICS when the vehicle enters the armed mode by REKES by locking the door. REKES linked power window and outside rearview mirror operation is possible only under the armed status.
58	Input (CAN)	Key ACC power		1. Ignition key ACC status receives from STICS
59	Input (CAN))	IGN 2 power		1. Ignition key IGN 2 status receives from STICS
60	Input	IGN 1 power		1. Ignition key IGN 1 status receives from STICS or DICS receives directly
61	Input (CAN)	Alternator operation status		1. Status of the engine under starting receives from STICS
62	Input (CAN)	Key reminder switch		1. Receives from STICS and indicates when the ignition key is inserted
63	Input (CAN)	Input status of the P/N signals		1. Receives from STICS and indicates the P/N status of transmission
64	Input (CAN)	Input status of the reverse signal		1. Receives from STICS and indicates the reverse status of transmission
65	Input	Lateral sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)	1. Vertical sensor upper value of the outside rearview mirror 2. Sensor value when turned right: Increase 3. Sensor value when turned left: Decrease

No.	Input/ Output	Sensor value item	Information	Help
66	Input	Lateral sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]	1. Vertical sensor upper value of the outside rearview mirror 2. Sensor value when turned right: Increase 3. Sensor value when turned left: Decrease * HI value increases or decreases by 1 if exceeded 8 bit (1~255)
67	Input	Vertical sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)	1. Lateral sensor upper value of the outside rearview mirror 2. Sensor value when moved up: Increase 3. Sensor value when moved down: Decrease
68	Input	Vertical sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]	1. Lateral sensor upper value of the outside rearview mirror 2. Sensor value when moved up: Increase 3. Sensor value when moved down: Decrease * HI value increases or decreases by 1 when exceeds 8 bit (1~255)
69	Input	Software version		Indicates current software version

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DIAGNOSIS OF SUB DICS

Code	Malfunction	Help
0 X 07	Operates when power window is locked	- When the power window is locked, the window can be operated from the passenger side. (Passenger switch input during the control by DICS-Main while power window is locking) - Defective CAN communication
0 X 08	Door lock key actuator does not operate	- Check the passenger side door actuator • Check the method of actuator operation status - Check the sensor value • Key lock (DICS-Sub: No. 5)
0 X 09	Door unlock key actuator does not operate	- Check the passenger side door actuator • Checking the method of actuator operation status - Check the sensor value • Key unlock (DICS-Sub: No. 4)
0 X 0A	No mirror UP or DN inputs correspondence to the memory switch inputs	- When the outside rearview mirror has no UP or DOWN sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror UP or DOWN sensor wires - Measure the sensor values and check the relevant position • Internal DOWN motor of the outside rearview mirror (DICS-Sub: No. 13) • Internal UP motor of the outside rearview mirror (DICSSub: No. 14) • Internal sensor of the outside rearview mirror (DICS-Sub: No. 44)
0 X 0B	No mirror LEFT or RIGHT inputs correspondence to the memory switch inputs	- When the outside rearview mirror has no LEFT or RIGHT sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror LEFT or RIGHT sensor wires - Measure the sensor values and check the relevant position • Internal RIGHT motor of the outside rearview mirror (DICSSub: No. 11) • Internal LEFT motor of the outside rearview mirror (DICSSub: No. 12) • Internal sensor of the outside rearview mirror (DICS-Sub: No. 17)

▶ Sub DICS Input / Output Data

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Detecting passenger side P/WDW detention	Not operating		Operating		1. Input signal for the motor protection is transmitted. The motor output detects increasing current when the motor is stopped at the lowest position of the passenger side window. 2. Internal input
2	-	-	-	-	-	-	-
3	Input	Passenger side door lock knob	Not operating		Operating		1. Status of the door lock actuator monitors ring switch on(passenger side) door trim 2. Ground level when the lock is detected 3. VCC 5V level when the unlock is detected
4	Input	Passenger side door key unlock	Not operating		Operating		1. ON when the passenger side door key fob is unlocked 2. Ground level when operating (unlock) 3. VCC 5V level when not operating (lock)
5	Input	Passenger side door key lock	Not operating		Operating		1. ON when the passenger side door key fob is locked 2. Ground level when operating 3. VCC 5V level when not operating
6	Input	Front left P/WDW DN S/W	Not detected		Detected		1. Switch input signal to lower the passenger side window 2. DICS SUB drives directly with the circuit
7	Input	Front right P/WDW auto DN S/W	Not detected		Detected		1. Switch input signal to lower the passenger side window automatically 2. MICOM drives directly according to the above signal
8	Input	Front right P/WDW UP S/W	Not detected		Detected		1. Switch input signal to raise the passenger side window 2. DICS SUB drives directly with the circuit
9	Output	Passenger side outside rearview mirror unfolding MTR	Not detected		Detected		1. Motor operates the passenger side's outside rearview mirror to unfold
10	Output	Passenger side outside rearview mirror folding MTR	Close		Open		1. Motor operates the passenger side's outside rearview mirror to fold
11	Output	Passenger side outside rearview mirror left-turn MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror towards right
12	Output	Passenger side outside rearview mirror right-turn MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror towards left
13	Output	Passenger side outside rearview mirror down MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror down
14	Output	Passenger side outside rearview mirror up MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror up
15	Output	Passenger side P/WDW down MTR	Not operating		Operating		1. Passenger side's power window motor down 2. Battery level when operating 3. Ground level when not operating

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No.	Input/ Output	Sensor value item	Information				Help
16	Output	Passenger side P/ WDW up MTR	Not operating		Operating		1. Passenger side's power window motor up 2. Battery level when operating 3. Ground level when not operating
17	State	Yes or No of the passenger side outside rearview mirror sensor	Yes		No		1. ON when the passenger side's outside rearview mirror has no sensor or sensor is open-circuited
18	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-
20	Output	Output power (5V) VDD	Not operating		Operating		1. 5 V is supplied to the power window switch and outside rearview mirror sensor 2. 5 V of level when operating 3. Ground level when not operating
21	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-
23	Output	Passenger side P/ WDW SW LED Lamp	Not operating		Operating		1. LED lamp for the power window switch illumination (Value changes when the window is locked)
24	-	-	-	-	-	-	-
25	Input	Lateral sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)				1. Lateral sensor upper value of the outside rearview mirror Sensor value when moves up: Increase Sensor value when moves down: Decrease
26	Input	Lateral sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]				1. Lateral sensor lowers value of the outside rearview mirror Sensor value when moves up: Increase Sensor value when moves down: Decrease
27	Input	Vertical sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)				1. Vertical sensor raises value of the outside rearview mirror Sensor value when turns right: Increase Sensor value when turns left: Decrease
28	Input	Vertical sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]				1. Vertical sensor raises value of the outside rearview mirror Sensor value when turns right: Increase Sensor value when turns left: Decrease
29	Input	Software version					Indicates the current software version

DIAGNOSIS OF MS-DOS

Code	Malfunction	Help
0 X 61	Defective driver side seat sliding	• MSDOS continuously monitors the sensor values when the driver operates the seat sliding switch or when the memory return is in action. When the seat sliding operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. **NOTE** **• When it's operated continuously at the seat stall position, it can be recognized as an error and the motor may not respond. You should erase the stored errors then test the seat at the mid position.** • Measure the sensor values and check the relevant position Driver side seat slides-backward (MSDOS sensor value: No. 7) Driver side seat slides-forward (MSDOS sensor value: No. 8) Driver side seat backward slide motor (MSDOS sensor value: No. 15) Driver side seat forward slide motor (MSDOS sensor value: No. 16)
0 X 62	Defective driver side seat tilting	• MSDOS continuously monitors the sensor values when the driver operates the seat tilting or the memory return is in motion. When the seat tilting operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. **NOTE** **• When it's operated continuously at the seat stall position, it can be recognized as an error and the motor may not respond. You should erase the stored errors then test the seat at the mid position.** • Measure the sensor values and check the relevant position Driver side seat tilt-down (MSDOS sensor value: No. 5) Driver side seat tilt-up (MSDOS sensor value: No. 6) Driver side seat tilt-down motor (MSDOS sensor value: No. 13) Driver side seat tilt-up motor (MSDOS sensor value: No. 14)
0 X 63	Defective driver side seat height adjustment	• MSDOS continuously monitors the sensor values when the driver operates the seat height adjustment or the memory return is in motion. When the seat height adjustment operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. **NOTE** **• When it's operated continuously at the seat stall position, it can be recognized as an error and the motor may not respond. You should erase the stored errors then test the seat at the mid position.** • Measure the sensor values and check the relevant position Driver side seat height-lowers (MSDOS sensor value: No. 3) Driver side seat height-raises (MSDOS sensor value: No. 4) Driver side seat height-lowering motor (MSDOS sensor value: No. 11) Driver side seat height-raising motor (MSDOS sensor value: No. 12)

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Code	Malfunction	Help
0 X 64	Defective driver side seatback angle adjustment	• MSDOS continuously monitors the sensor values when the driver operates the seat reclining or the memory return is in motion. When the seat recline operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. **NOTE** **• When it's operated continuously at the seat stall position, it can be recognized as an error and the motor may not respond. You should erase the stored errors then test the seat at the mid position.** • Measure the sensor values and check the relevant position Driver side seatback angle-declination (MSDOS sensor value: No. 1) Driver side seatback angle-inclination (MSDOS sensor value: No. 2) Driver side seatback angle-declination motor (MSDOS sensor value: No. 10) Driver side seatback angle-inclination motor (MSDOS sensor value: No. 11)
0 X 65	No position data input from DICSMain	• When MSDOS sends memory setting order, all DICS_MAIN, DICS-SUB and ESIMS send the position data to MSDOS. If no position data has received from DICS_MAIN, then it will be recognized as an error. • Input data from a respective unit when resetting the memory switch • Check CAN communication between DICS_MAIN and MSDOS
0 X 66	No position data input from DICSSub	• When MSDOS sends memory setting order, all DICS_MAIN, DICS-SUB and ESIMS send the position data to MSDOS. If no position data has received from DICS_MAIN, then it will be recognized as an error. • Input data from a respective unit when resetting the memory switch • Check CAN communication between DICS_SUB and MSDOS
0 X 67	No position data input from ESIMS	• When MSDOS sends memory setting order, all DICS_MAIN, DICS-SUB and ESIMS send the position data to MSDOS. If no position data has received from DICS_MAIN, then it will be recognized as an error. • Input data from a respective unit when resetting the memory switch • Check CAN communication between ESIMS and MSDOS
0 X 68	No return data input from DICS-Main	• During the memory return, DICS_MAIN, DICS-SUB and ESIMS send the memory return operation signals continuously through CAN communication. MSDOS recognizes malfunction and then determines as an error when no data has been received from DICS_MAIN during the memory return. • Input data from a respective unit when operating the memory switch • Check CAN communication between DICS_MAIN and MSDOS • During the memory return, DICS_MAIN, DICS-SUB and ESIMS send the memory return operation signals continuously through CAN communication. MSDOS recognizes malfunction and then determines as an error when no data has been received from DICS_MAIN during the memory return.
0 X 69	No return data input from DICS-Sub	• Input data from a respective unit when operating the memory switch • Check CAN communication between DICS_SUB and MSDOS • During the memory return, DICS_MAIN, DICS-SUB and ESIMS send the memory return operation signals continuously through CAN communication. MSDOS recognizes malfunction and then determines as an error when no data has been received from ESIMS during the memory return.
0 X 70	No return data input from ESIMS	• Input data from a respective unit when operating the memory switch • Check CAN communication between ESIMS and MSDOS

▶ MSDOS Input / Output Data

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Driver side seatback reverse switch	Not operating	Vcc	Operating	GND	• A driver operates the seat recliner (seatback angle adjustment) switch backward • Ground level when operating • Vcc level when not operating
2	Input	Driver side seatback forward switch	Not operating	Vcc	Operating	GND	• A driver operates the seat recliner (seatback angle adjustment) switch forward • Ground level when operating • Vcc level when not operating
3	Input	Driver side seat height down switch	Not operating	Vcc	Operating	GND	• A driver operates the seat height (rear part of the seat bottom) adjustment switch downward • Ground level when operating • Vcc level when not operating
4	Input	Driver side seat height up switch	Not operating	Vcc	Operating	GND	• A driver operates the seat height (rear part of the seat bottom) adjustment switch upward • Ground level when operating • Vcc level when not operating
5	Input	Driver side seat tilt-down switch	Not operating	Vcc	Operating	GND	• A driver operates the seat tilting (front part of the seat bottom) switch downward • Ground level when operating • Vcc level when not operating
6	Input	Driver side seat tilt-up switch	Not operating	Vcc	Operating	GND	• A driver operates the seat tilting (front part of the seat bottom) switch upward • Ground level when operating • Vcc level when not operating
7	Input	Driver side seat slide-backward switch	Not operating	Vcc	Operating	GND	• A driver operates the seat slide switch backward • Ground level when operating • Vcc level when not operating
8	Input	Driver side seat slide-forward switch	Not operating	Vcc	Operating	GND	• A driver operates the seat slide switch forward • Ground level when operating • Vcc level when not operating
9	Input	Driver side seatback declining MTR	Not operating	GND	Operating	12 V	• When the recliner (seatback) is moving backward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.

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No.	Input/ Output	Sensor value item	Information				Help
10	Output	Driver side seatback inclining MTR	Not operating	GND	Operating	12 V	• When the recliner (seatback) is moving forward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
11	Output	Driver side seat height down MTR	Not operating	GND	Operating	12 V	• When the seat height adjustment (rear part of the seat bottom) is moving downward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
12	Output	Driver side seat height up MTR	Not operating	GND	Operating	12 V	• When the seat height adjustment (rear part of the seat bottom) is moving upward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
13	Output	Driver side seat tilt-down MTR	Not operating	GND	Operating	12 V	• When the seat tilts (front part of the seat bottom) downward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.

No.	Input/ Output	Sensor value item	Information				Help
14	Output	Driver side seat tilt-up MTR	Not operating	GND	Operating	12 V	• When the seat tilts (front part of the seat bottom)upward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
15	Output	Driver side seat slide-backward MTR	Not operating	GND	Operating	12 V	• When the seat (forward/backward movement of seat) slides backward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
16	Output	Driver side seat slide-forward MTR	Not operating	GND	Operating	12 V	• When the seat (forward/backward movement of seat) slides forward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
17	Output	Driver side seat slide sensor value	Sensor value				• Sensor value when seat slides (forward or backward movement of the seat) is moving • Sensor value when moving forward: Increase • Sensor value when moving backward: Decrease
18	Input	Driver side seat tilting sensor value	Sensor value				• Sensor value when seat tilting (front part of the seat bottom) is moving • Sensor value when moving upward: Increase • Sensor value when moving downward: Decrease
19	Input	Driver side seat height sensor value	Sensor value				• Sensor value when seat height (rear part of the seat bottom) is moving • Sensor value when moving upward: Increase • Sensor value when moving downward: Decrease
20	Input	Driver side seatback sensor value	Sensor value				• Sensor value when seat recliner (seatback) is moving • Sensor value when moving forward: Increase • Sensor value when moving backward: Decrease

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DIAGNOSIS OF ESIMS

Code	Malfunction	Help
0 X 81	Defective steering column tilt	- ESIMS continuously monitors the sensor values when the driver operates the steering column or the steering column is in motion. When the teering wheel column operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. - Measure the sensor values and check the relevant position • Steering column tilt-up (ESIMS sensor value: No. 1) • Steering column tilt-down (ESIMS sensor value: No. 2) • Steering column tilt-up motor (ESIMS sensor value: No. 13) • Steering column tilt-down motor (ESIMS sensor value: No. 14)
0 X 82	Defective steering column telescope	- ESIMS continuously monitors the sensor values when the driver operates the steering column or the steering column is in motion. When the steering wheel column operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. - Measure the sensor values and check the relevant position • Steering column tilt-up (ESIMS sensor value: No. 3) • Steering column tilt-down (ESIMS sensor value: No. 4) • Steering column tilt-up motor (ESIMS sensor value: No. 15) • Steering column tilt-down motor (ESIMS sensor value: No. 16)
0 X 83	Defective inside rearview mirror left or right movement	- ESIMS continuously monitors the sensor values when the driver adjusts the inside rearview mirror horizontally or the inside rearview mirror is in motion. When the inside rearview mirror horizontal operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. **NOTE** **• When it's operated continuously at the stall position, it can be recognized as an error and the motor may not respond. You should erase the stored errors then test the inside rearview mirror from the mid position.** - Measure the sensor values and check the relevant position • Inside rearview mirror moves right (ESIMS sensor value: No. 5) • Inside rearview mirror moves left (ESIMS sensor value: No. 6) • Inside rearview mirror left movement motor (ESIMS sensor value: No. 11) • Inside rearview mirror right movement motor (ESIMS sensor value: No. 12)
0 X 84	Defective inside rearview mirror up or down functions	- ESIMS continuously monitors the sensor values when the driver adjusts the inside rearview mirror vertically or the inside rearview mirror is in motion. When the inside rearview mirror vertical operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. **NOTE** **• When it's operated continuously at the stall position, it can be recognized as an error and the motor may not respond. You should erase the stored errors then test the inside rearview mirror from the mid position.** - Measure the sensor values and check the relevant position • Inside rearview mirror moves down (ESIMS sensor value: No. 7) • Inside rearview mirror moves up (ESIMS sensor value: No. 8) • Inside rearview mirror down movement motor (ESIMS sensor value: No. 10) • Inside rearview mirror up movement motor (ESIMS sensor value: No. 9)

▶ ESIMS Input / Output Data

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Steering wheel tilt-up switch	Not operating	Vcc	Operating	GND	1. A driver operates the tilt switch at the steering column upward 2. Ground level when operating 3. Vcc level when not operating
2	Input	Steering wheel tilt-down switch	Not operating	Vcc	Operating	GND	1. A driver operates the tilt switch at the steering column downward 2. Ground level when operating 3. Vcc level when not operating
3	Input	Steering wheel telescope up switch	Not operating	Vcc	Detected	GND	1. A driver operates the telescopic switch on the steering column toward extract 2. Ground level when operating 3. Vcc level when not operating
4	Input	Steering wheel telescope down switch	Not operating	Vcc	Operating	GND	1. A driver operates the telescopic switch on the steering column toward retract 2. Ground level when operating 3. Vcc level when not operating
5	Input	Inside rearview mirror right moving switch	Not operating	Vcc	Operating	GND	1. A driver presses the right side of the mirror operation switch when the mirror selector switch is in the neutral position (center) (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror moves right (*Note: The mirror operates when the ignition switch is in ACC or other position) 5. Receives CAN data from DICS-Main
6	Input	Inside rearview mirror left moving switch	Not operating	Vcc	Detected	GND	1. A driver presses the left part of the mirror operation switch when the mirror selector switch is in center position (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror moves left (*Note: The mirror operates when the ignition switch is in ACC or other position) 5. Receives CAN data from DICS-Main
7	Input	Inside rearview mirror down moving switch	Not operating	Vcc	Operating	GND	1. A driver presses the lower part of the mirror operation switch when the mirror selector switch is in center position (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror tilts down (*Note: The mirror operates if ignition switch is in ACC or more) 5. Receives CAN data from DICS-Main
8	Input	Inside rearview mirror up moving switch	Not operating	Vcc	Operating	GND	1. A driver presses the upper part of the mirror operation switch when the mirror selector switch is in center position (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror tilts up (*Note: The mirror operates if ignition switch is in ACC or more) 5. Receives CAN data from DICS-Main

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No.	Input/ Output	Sensor value item	Information				Help
9	Output	Inside rearview mirror up motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for vertical movement) is moving upward 2. Battery level when operating 3. Ground level when not operating
10	Output	Inside rearview mirror down motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for vertical movement) is moving downward 2. Battery level when operating 3. Ground level when not operating
11	Output	Inside rearview mirror left moving motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for vertical movement) is moving downward 2. Battery level when operating 3. Ground level when not operating
12	Output	Inside rearview mirror right moving motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for horizontal movement) is moving right side 2. Battery level when operating 3. Ground level when not operating
13	Output	Steering wheel tilt-up motor	Not operating	GND	Operating	12 V	1. When the tilt motor on the steering column is moving upward 2. Battery level when operating 3. Ground level when not operating
14	Output	Steering wheel tilt-down motor	Not operating	GND	Operating	12 V	1. When the tilt motor on the steering column is moving downward 2. Battery level when operating 3. Ground level when not operating
15	Output	Steering wheel telescope up MTR	Not operating	GND	Operating	12 V	1. When the telescopic motor on the steering column is moving towards the driver 2. Battery level when operating 3. Ground level when not operating
16	Output	Steering wheel telescope down MTR	Not operating	GND	Operating	12 V	1. When the telescopic motor on the steering column is moving away from the driver 2. Battery level when operating 3. Ground level when not operating
17	Input	Steering wheel column tilting sensor	Sensor value				1. Sensor value when the tilt motor on the steering column is moving up/down 2. Sensor value when moving up: Decrease 3. Sensor value when moving down: Increase
18	Input	Steering wheel column telescope sensor	Sensor value				1. Sensor value when the telescopic motor on the steering column is moving up/down 2. Sensor value when moving long extraction : Decrease 3. Sensor value when moving short retraction : Increase
19	Input	Inside rearview mirror left and right movement sensor	Sensor value				1. Sensor value when the longitudinal motor in the mirror moves left or right 2. Sensor value when moving toward right: Increase 3. Sensor value when moving toward left: Decrease
20	Input	Inside rearview mirror up and down movement sensor	Sensor value				1. Sensor value when the vertical motor in the mirror moves up or down 2. Sensor value when moving upward: Increase 3. Sensor value when moving downward: Decrease

MEMO

EURO 4
SERVICE MANUAL

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