

TOYOTA CAMRY / AURION REPAIR MANUAL

# **NEW CAR FEATURES**

**AURION GSV40 RHD**

**NEW MODEL OUTLINE**

**ENGINE**

**CHASSIS**

**BODY**

**BODY ELECTRICAL**

**APPENDIX**

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# Foreword

To assist you in your sales and service activities, this manual explains the main characteristics of the Aurion, in particular providing a technical explanation of the construction and operation of new mechanisms and new technology used.

Some drawings and pictures used in this publication are for illustration purposes. They may not be the same as that on the actual vehicle.

Applicable model: GSV40L

This manual is divided into 3 sections.

- 1. New Model Outline** - Explanation of the product to give a general understanding of its features.
- 2. Technical Description** - Technical explanation of the construction and operation of each new system and components.
- 3. Appendix** - Major technical specifications of the vehicle.

**CAUTION, NOTICE, REFERENCE** and **NOTE** are used in the following ways:

CAUTION	A potentially hazardous situation which could result in injury to people may occur if the instructions on “what to do” or “not do” are ignored.
NOTICE	Damage to the vehicle or components may occur if the instructions on “what to do” or “not do” are ignored.
REFERENCE	Explains the theory behind mechanisms and techniques.
NOTE	Notes or comments not included under the above 3 titles.

For detail service specifications and repair procedures, refer to the Repair Manual CD: Pub. SC02N1EQ

## WARNING

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**TOYOTA MOTOR CORPORATION AUSTRALIA LIMITED**

# NEW MODEL OUTLINE

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## ***EXTERIOR APPEARANCE***

### **Front View**



02KMO01TE

### **Rear View**



02KMO02TE

**MODEL CODE**

# GSV40L – JETGKV

1

2

3

4

5

6

7

8

1	BASIC MODEL CODE
	GSV40: With 2GR-FE Engine

5	GEAR SHIFT TYPE
	T: 6-Speed Automatic, Floor

2	STEERING WHEEL POSITION
	L: Left-Hand Drive R: Right-Hand Drive

6	GRADE
	D: Touring G: Grande

3	MODEL NAME
	J: Aurion

7	ENGINE SPECIFICATION
	K: DOHC and EFI

4	BODY TYPE
	E: 4-Door Sedan

8	DESTINATION
	Q: Australia, New Zealand, SPI V: GCC Countries, Iran, SPI (LHD)

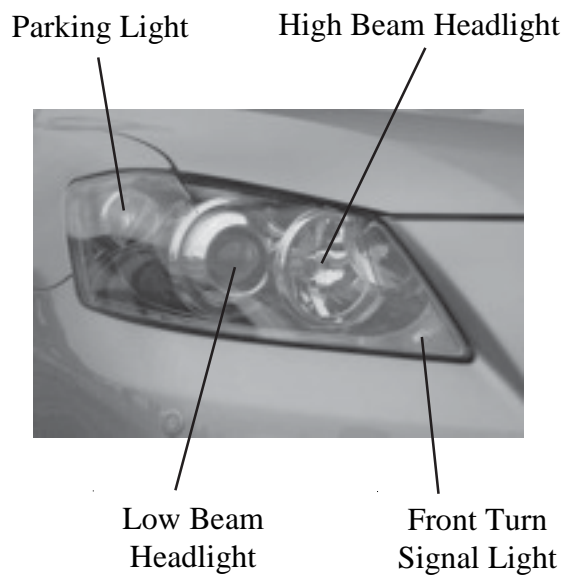
**MODEL LINE-UP**

Destination	Engine	Grade	Transaxle
			U660E
GCC	2GR-FE	Touring	GSV40L-JETDKV
		Grande	GSV40L-JETGKV
Iran	2GR-FE	Grande	GSV40L-JETGKV
South Pacific Islands	2GR-FE	Touring	GSV40L-JETDKV

## ***EXTERIOR***

### ***Front View***

- The vehicle front design is characterised by the unique U-shaped lines. The contrast created by the combination of concave and convex shapes gives the surface a sense of solidity and sharpness.
- Through the combination of clear outer lenses and the extensions, the headlights have given visual impact. Either halogen bulbs or discharge bulbs are used depending on the vehicle grade.



A99T8895



02KM003TE

### ***Radiator Grille***

Chrome Plating around  
the outer perimeter and  
across the horizontal  
bars

Material Colour

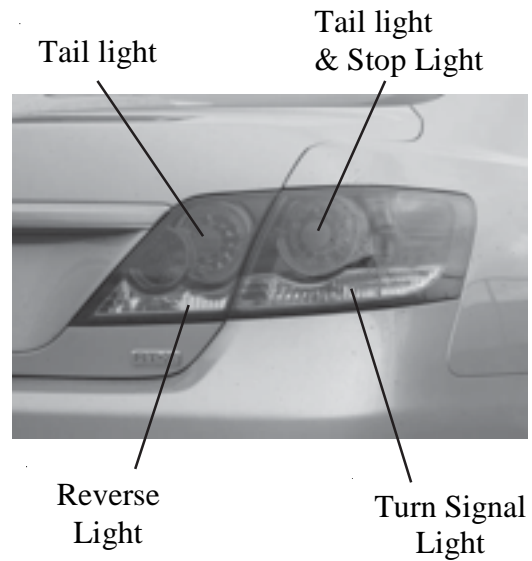


Presara grille

**All Grades**

## **Rear View**

- The luggage door and rear bumper design is characterised by the unique U-shaped lines.
- With its impressive cylindrical designs, the rear combination light creates a sophisticated look. The taillight & stop light have been designed using LEDs (Light Emitting Diodes) to reduce power consumption.



02KMO05TE

\_N1Y0242

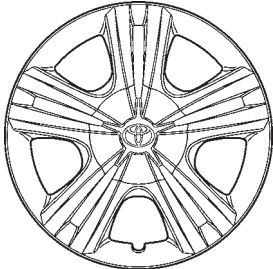

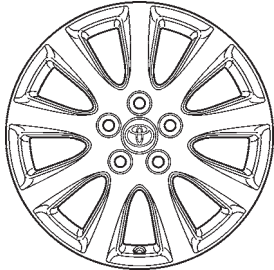
## **Side View**

The curved front corner of the engine hood is designed to emphasise the dignity of the vehicle, and the side protection mouldings give an accent to the side design.



02KMO07TE

**Tyre & Disc Wheel**

Tyre	Size	P215/60R16 V95	P215/60R16
Disc Wheel	Size	16 x 6.5 JJ	16 x 6.5 J
	Material	Steel with Full Cap	Aluminium with Centre Ornament*
Full cap / Wheel Design		 02KMO09Y	 VIC-DP-030
Tyre	Size	P215/55R17 93V	
Disc Wheel	Size	17 x 7 J	
	Material	Aluminium with Centre Ornament	
Wheel Design		 02KMO08Y	

\*: Option for Touring grade



**Exterior Colour List**

Colour No.	Colour Name	Colour No.	Colour Name
061	White (Diamond White)	580	Yellow Mica Metallic (Aurora Gold)
1D4	Silver Metallic (Silver Ash)	6U7	Green Mica Metallic (Cyber Green)
209	Black Mica (Ink)	8M7	Light Blue Metallic (Ice Blue)
4N3	Beige Mica Metallic (Titan Silver)	8T0	Blue Mica Metallic (Caribbean Blue)
3R3	Red Mica Metallic (Red Earth)	—	—

## **INTERIOR**

### **Instrument Panel**

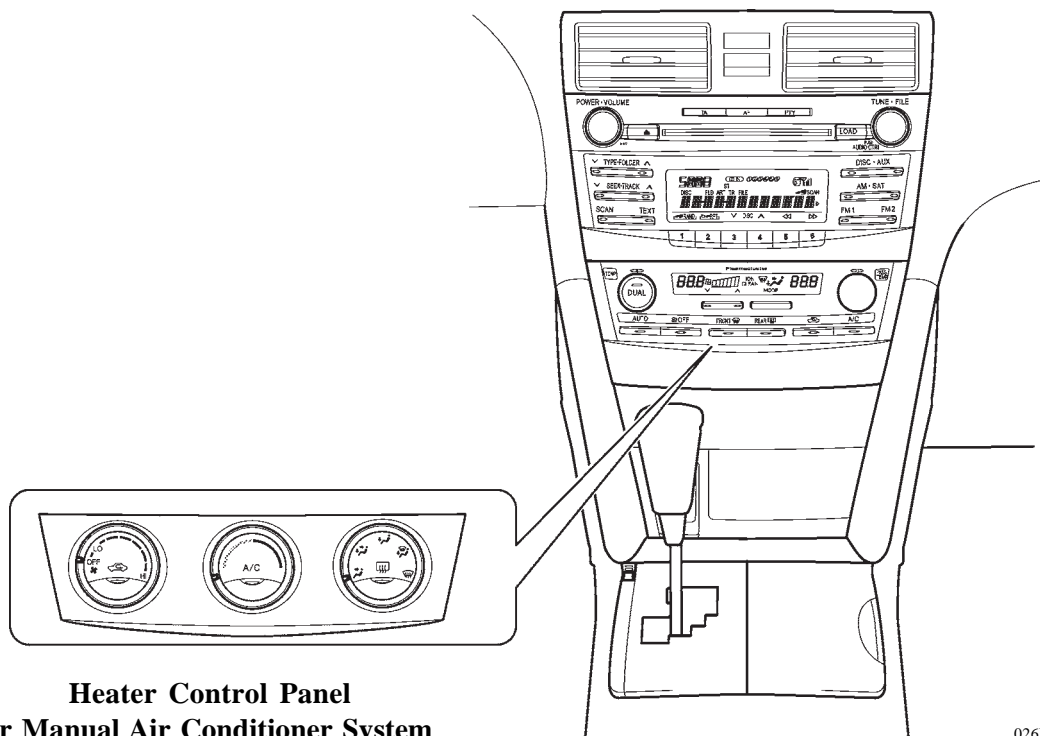
The interior design features a smooth and continuous line flowing from the centre cluster, through the instrument panel upper, to the door trims. By designing the combination meter and seats to the details, a high-class appearance has been achieved.



026MO10TE

### **Centre Cluster**

- The centre cluster has been designed to be fresh and clear. By making the LCD display larger and putting the display and the switches closer together, both ease of use and freshness have been achieved.
- Light is emitted by the entire panel at night, creating a fresh atmosphere.



**Heater Control Panel  
for Manual Air Conditioner System**

026MO11TE

## **Combination Meter**

- 2 different large 4-meter optitron display type combination meters are used. One with a multi-information display and one without a multi-information display. Both have an outside temperature display.
- The Multi-information display shows outside temperature, driving range, average fuel consumption since refueling, time driven since engine start and average speed since engine start.



ATX Dash

### **Optitron Display Type Combination Meter for Touring**



02KMO36Y

### **Optitron Display Type Combination Meter for Grande**

## **Welcome Function**

When the driver starts the engine, the graduated illumination sequence of the combination meter, audio and heater control panel gives the impression of the driver being welcomed aboard. This function is available only for models with the optitron display type combination meter with multi-information display.

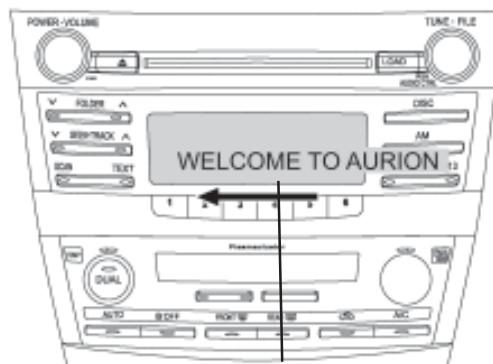
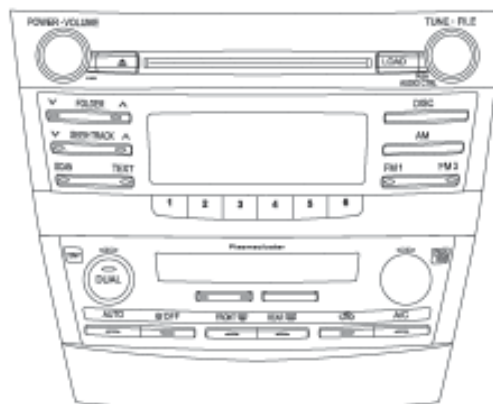
(1) 0.7 seconds after engine start



(2) Approximately 2 seconds after engine start



(3) Approximately 3 seconds after engine start



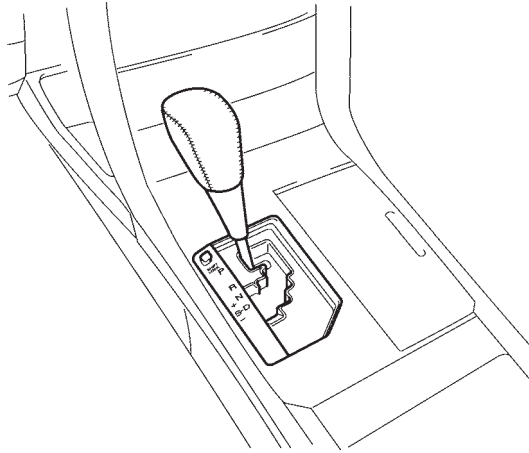
Horizontal Scrolling Display



02KMO33TE

**Shift Lever**

The Aurion has a gate type 6 speed multi-mode Transmission.



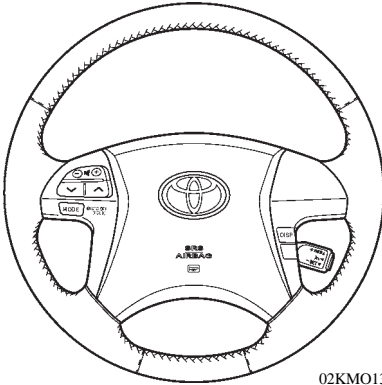


P7120028

**Multi-mode 6 speed Automatic Transaxle Lever**

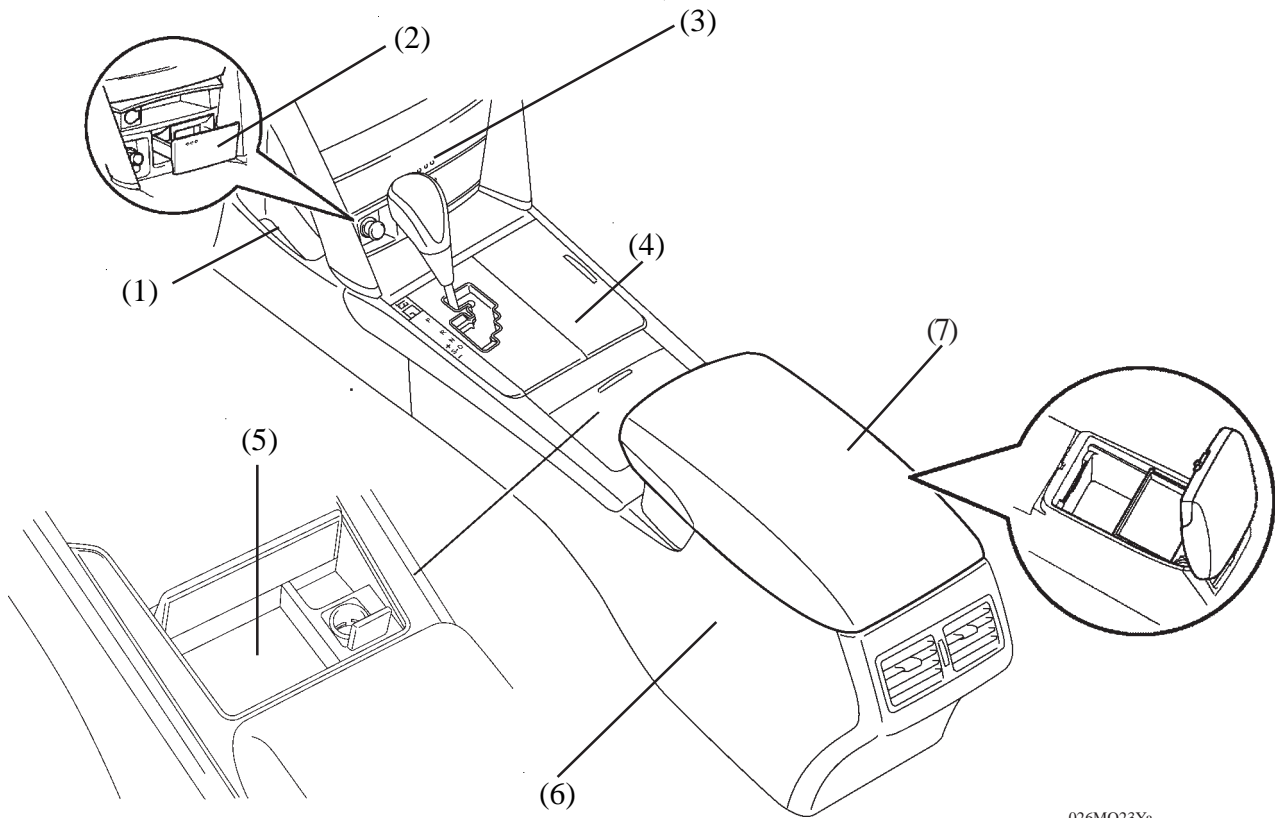
**Steering Wheel**

- There are three types of steering wheels available; 4-spoke urethane type both with and without Audio controls and 4-spoke leather-wrapped.
- A newly designed steering switch pad is used to give a more integrated and attractive appearance.
  - Audio controls are also available.
  - A display switch is mounted on the right side of the steering wheel and is used to operate the Multi-function Display.
- The cruise control switch is incorporated in the steering wheel for ease of operation.

Design	4-Spoke Urethane	4-Spoke Urethane with Audio*
	 02KMO17Y	 02KMO12Y
	4-Spoke Leather-wrapped	*: with optional Audio
	 02KMO13Y	

## **Console Box**

- A storage pocket for items such as mobile phones and wallets has been provided beside the front console (1).
- An ashtray has been built into the front box (2).
- A storage box for small articles with an internal 12V power supply terminal has been provided above the ashtray (3).
- Two drink cup holders, which can hold large sized drink cups and have a lid, have been provided on the centre console, beside the shift lever (4). In addition, a storage box with a lid has been provided behind the shift lever (5).
- The rear console box has a large capacity and a storage tray has been provided for keeping small articles (6). The console box lid can be used as an armrest (7).

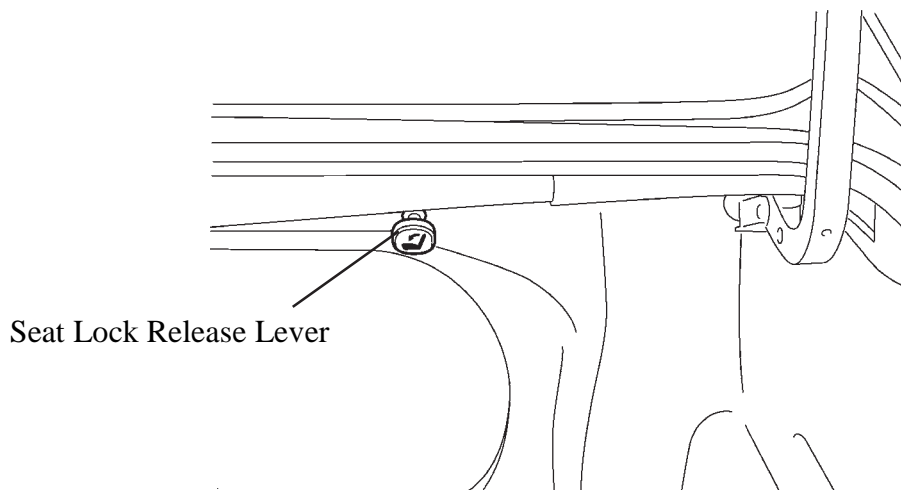
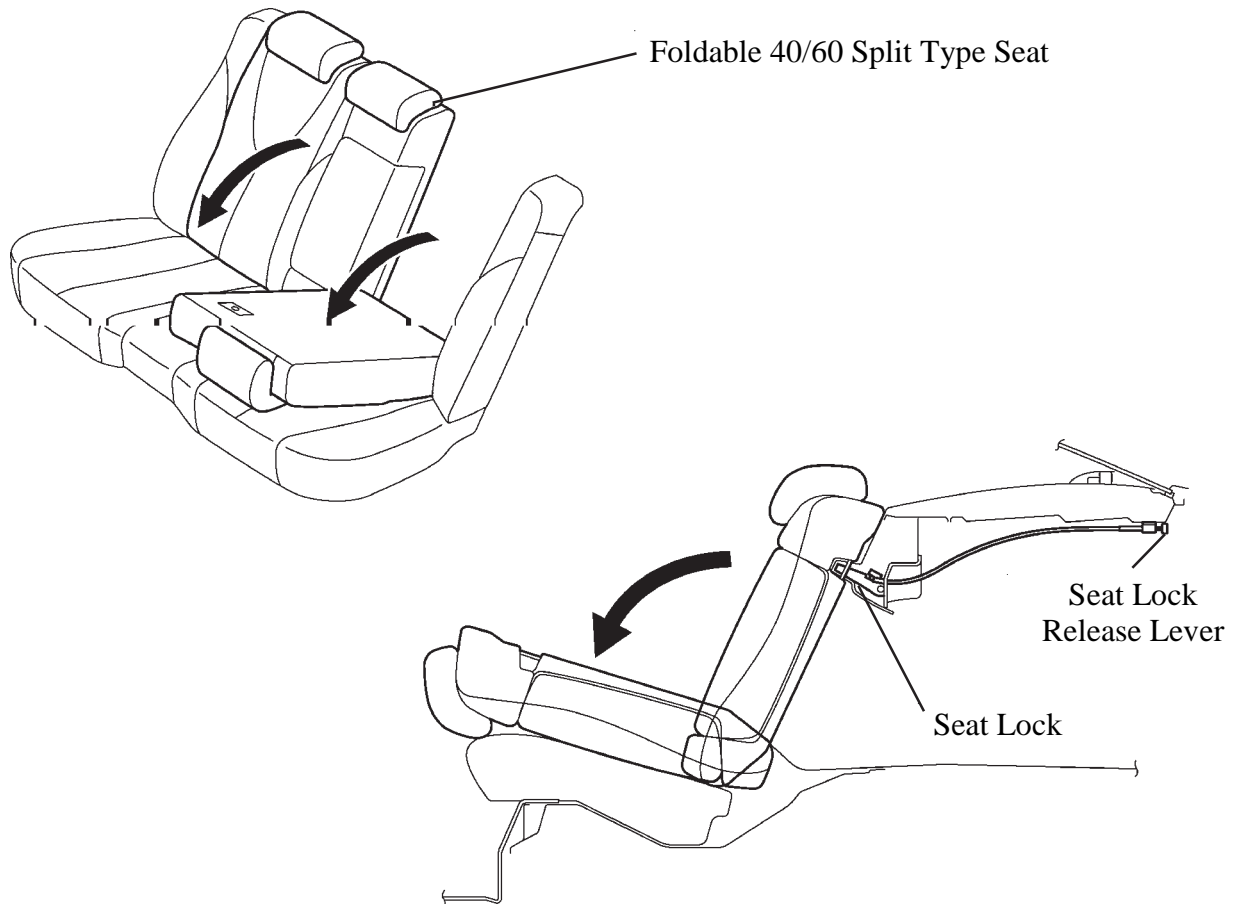


026MO23Ya

**Console Box**

## **Rear Seat**

- A fold-down function has been provided for all models.
- The rear seat lock is now released from the trunk compartment, this has increased boot security when the boot is dead locked.
- An adjustable centre rear headrest is fitted to all grades.



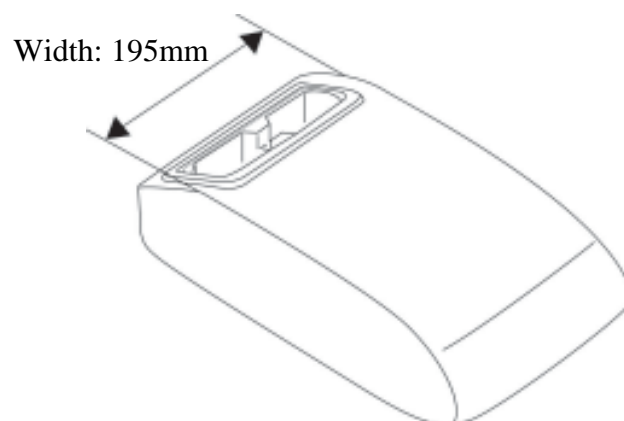
**Foldable Seat and Seat Lock Release Lever**

DOMCAM-025MO26Y



**Rear Seat Armrest**

- A large rear seat centre arm rest is fitted to all grades.
- The armrest features a cup holder that can accommodate two large-sized cups.



DOMCAM-V1CC-IN-035

**Armrest for all grades  
(both Touring & Grande)**

## EQUIPMENT

### **Audio System**

- The large and varied original LCD panels and large switched have been provided for each CD audio head unit system, improving visibility and ease of use.
- By implementing new DSP (Digital Signal Processor) technology with psychoacoustic theory, less distorted, clear, powerful sound quality has been achieved.
- The CD audio system supports MP3 and WMA (Windows Media Audio) playback.
- The text display during MP3 and WMA playback features ID3 tag version 1.0/1.1 including folder name, file name or MP3 file album name, track number, and artist name.
- A new DSP (Digital Signal Processor) is adopted, which features psychoacoustics. Optimal tuning is used to create clear and powerful audio without distortion.
- The radio tuner features digital processing that further reduces AM/FM noise (multipass and adjacent interference).
- The audio system features an ASL (Automatic Sound Leveliser) that automatically controls volume and frequency characteristics in relation to vehicle speed for greater audio quality.
- A large LCD monitor is adopted for the audio system, and a 6.5-inch display is adopted for the navigation system.
- A “Welcome Display” function is adopted for the audio system. (Except for integrated navigation system)..
  - > When the key is switched to ACC or IG, the peripheral accessories including the meters slowly illuminate, and the message “WELCOME TO AURION” scrolls across the monitor. (Except for navigation and cassette system)
  - > The surface lights illuminate to give the cabin a luxurious feel.

## —REFERENCE—

*Psychoacoustic Theory:*

*Psychoacoustic theory is technology that exploits human perceptions (sensory illusions). Through the implementation of this technology, without changing the speaker sizes or locations, listeners can sense deeper bass sound (1) and feel as if the speakers were located at eye level, despite them being located in low positions like door speakers (2).*

- (1) *Bass Sound Reproduction Principle: Since olden times, when pipe organs are built in churches, due to the difficulty of housing long resonating pipes for very low tones, a technique has been used which reproduces low tones through the utilization of two short pipes.*

*When two pipes, of which the frequencies are 100Hz and 150Hz, are sounded simultaneously to reproduce a note at 50Hz, human brains discern four different notes at 100Hz, 150Hz, 250Hz (100Hz + 150Hz) and 50Hz (150Hz - 100Hz). Among these, human brains perceive the frequency difference of 50Hz most strongly.*

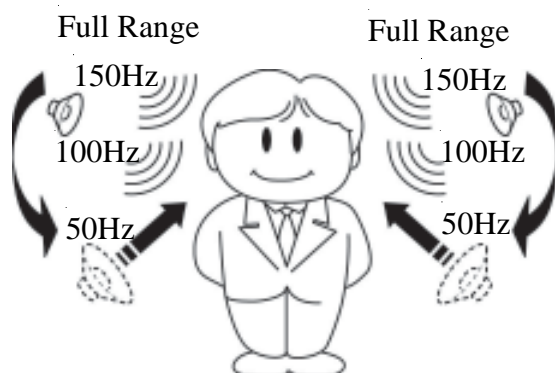
*By electrically generating differential components from fundamental notes for very low tones and emitting them through speakers, the human brains sense the deep bass sound despite it being not emanated from the speakers.*

- (2) *Virtual Sound Source Layout: When the theory of HRTFs (Head Related Transfer Functions) is employed in the vertical direction, human brains perceive the source of sounds emitted from the speakers in the lower positions as if it was at windshield level.*

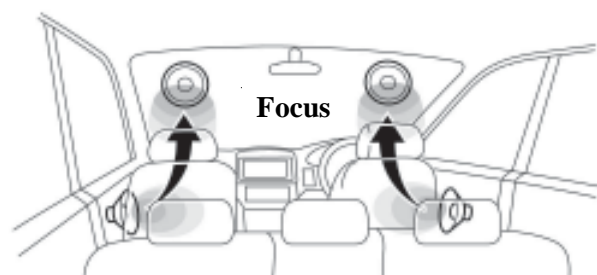
*HRTFs are acoustic transfer functions from the sound source to the ears.*

*It is said that humans detect the location of sound sources through time differences and physical reflective interference; the horizontal direction is recognized through the time difference between the sound reception of the left and right ears, and the vertical direction is discerned through the reflective interference caused by the head and earlobes.*

*Sound sources can be virtually reproduced by incorporating the HRTFs into amplifiers and emitting the sound through speakers.*

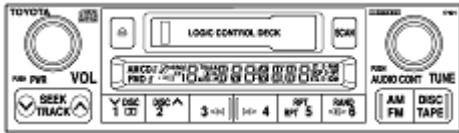
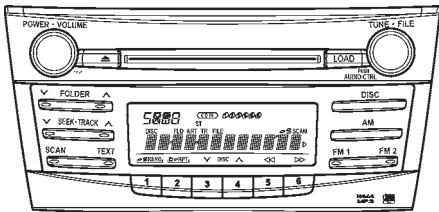
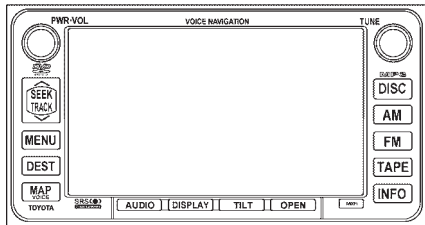



**Heavy bass playback function image**



**Upper position control function image**

**Audio Head Unit**

Grade	Design	Specifications
<b>Touring</b>	 <p>271MO61</p>	<ul style="list-style-type: none"> <li>• AM/FM Tuner</li> <li>• Cassette Player</li> <li>• 4-Speaker System</li> <li>• Maker: Fujitsu Ten</li> </ul>
<b>Grande Option for Touring</b>	 <p>026MO13Y</p>	<ul style="list-style-type: none"> <li>• AM/FM Tuner</li> <li>• In-Dash 6-CD Changer (MP3, WMA Compatible*<sup>1</sup>)</li> <li>• DSP*<sup>2</sup>/ASL*<sup>3</sup></li> <li>• 6-Speaker System</li> <li>• Maker: Fujitsu Ten</li> </ul>
<b>Option for Touring &amp; Grande</b>	 <p>02KMO46Y</p> <p><b>SRS</b>  is the trademark of SRS Labs, Inc. DR019MO34</p>	<ul style="list-style-type: none"> <li>• 6.5-inch Display</li> <li>• AM/FM Tuner</li> <li>• CD</li> <li>• Cassette Player</li> <li>• 6-Speaker System</li> <li>• Maker: Fujitsu Ten</li> </ul>

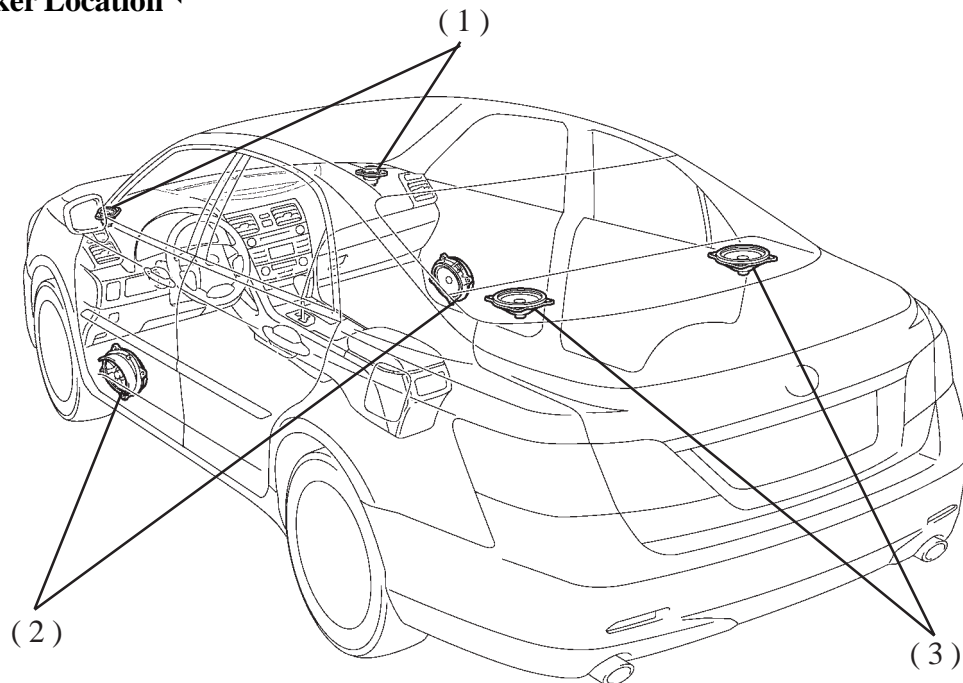
\*1: Compatible with the compressed sound and music files complying with MP3 (MPEG Audio Layer-3) standard and WMA (Windows Media Audio)

\*2: Digital Sound Processor

\*3: Automatic Sound Leveliser

## Speaker

### ▶ Speaker Location ◀



02KMO39Y

### ▶ Speaker Specifications ◀

Location	Speaker Type	Caliber	Impedance	Input Rated (Max)
(1)	Front Tweeter × 2*	65 mm	4 Ω	17.5 W
(2)	Front Midrange × 2	150×225mm	4 Ω	20 W
(3)	Rear Full Range × 2	150×225mm	4 Ω	20 W

\*: Except systems with 4 speakers

## **Smart Entry and Start System**

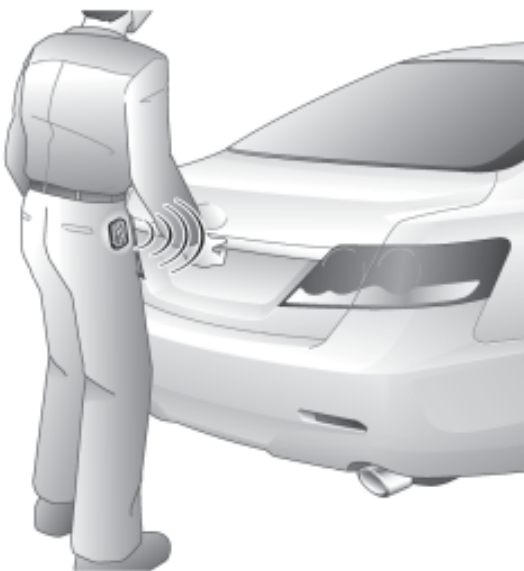
The smart entry and start system provides a key with a bi-directional communication function. Accordingly, by enabling the certification ECU to recognise the presence of the key within the detection area, this system can lock or unlock the doors, or start the engine without the use of the key, as long as the user has the key in his/her possession.



02KMO47Y

**Door Unlock**

02KMO48Y

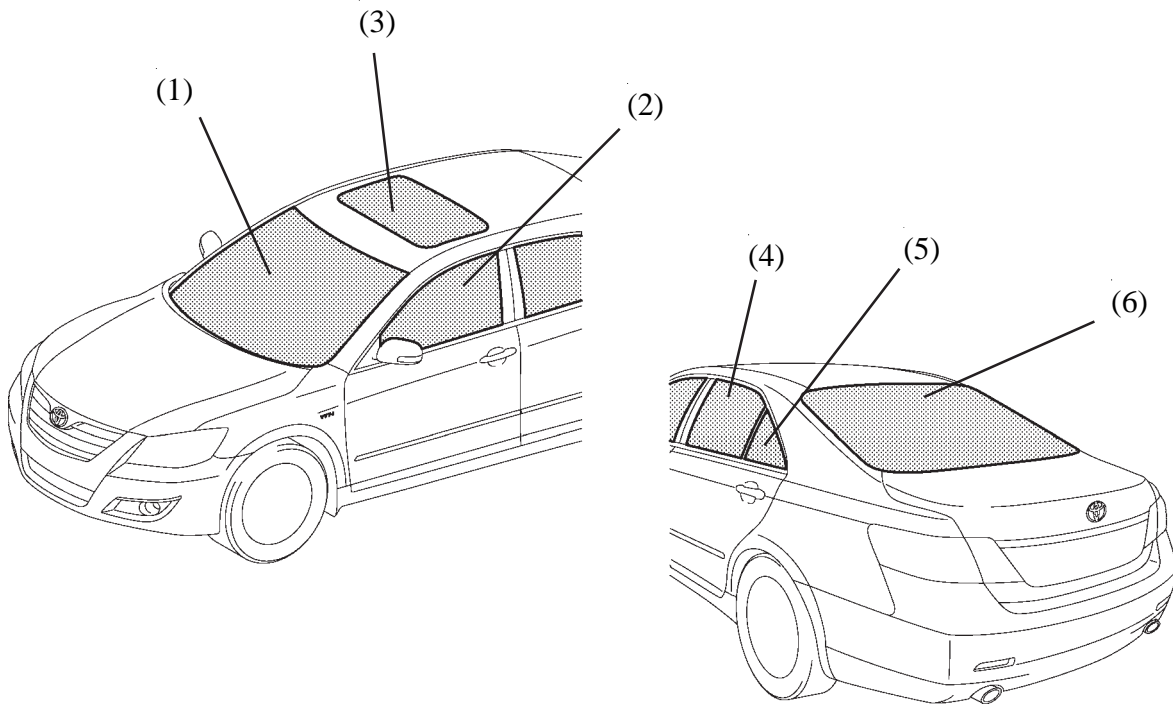
**Door Lock**

02KMO49Y

**Trunk Open**

02KMO50Y

**Engine Start**

**Glass**

02KMO43TE

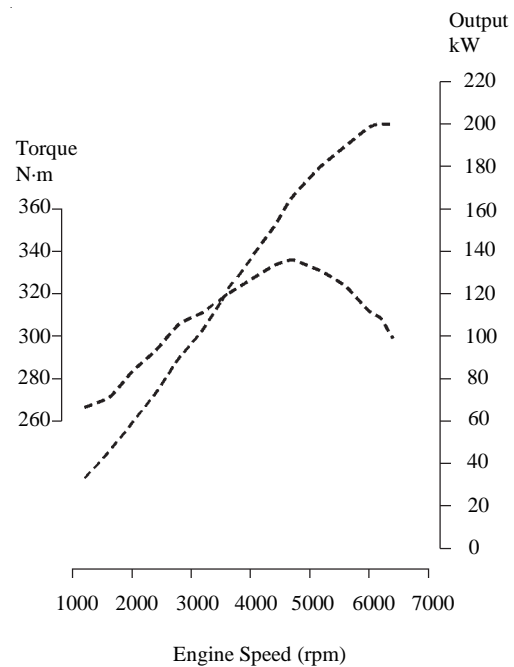
Glass Portion		Colour	Glass Type	Visible Light Penetration Rate
(1)	Windshield	Green with Dark Shade	Laminate	75% or more
(2)	Front Door	Green	Tempered	70% or more
(3)	Moon Roof Panel	Grey	Tempered	20 %
(4)	Rear Door	Green	Tempered	70% or more
(5)	Rear Door Quarter	Green	Tempered	70% or more
(6)	Back Window	Green	Tempered	70% or more

# PERFORMANCE

## Power Train

### Engine

Type	2GR-FE	
No. of Cylinders & Arrangement	6-Cylinder, V Type	
Valve Mechanism	24-Valve DOHC, Chain Drive (with Dual VVT-i)	
Displacement	3456 cm <sup>3</sup>	
Max. Output	SAE-NET	200kW @ 6200rpm
Max. Torque	SAE-NET	336N·m @ 4700rpm



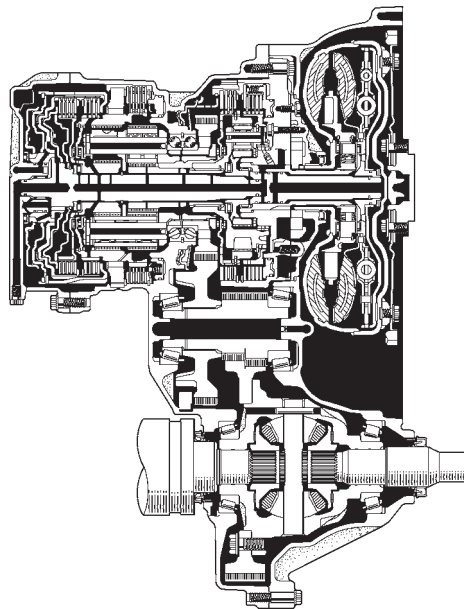
02KRG07Y\_1



**Transaxle**

Type		6-Speed Automatic
		U660E
Gear Ratio	1st	3.300
	2nd	1.900
	3rd	1.420
	4th	1.000
	5th	0.713
	6th	0.608
	Reverse	4.148
Differential Gear Ratio		3.685*

\*: Counter gear ratio included



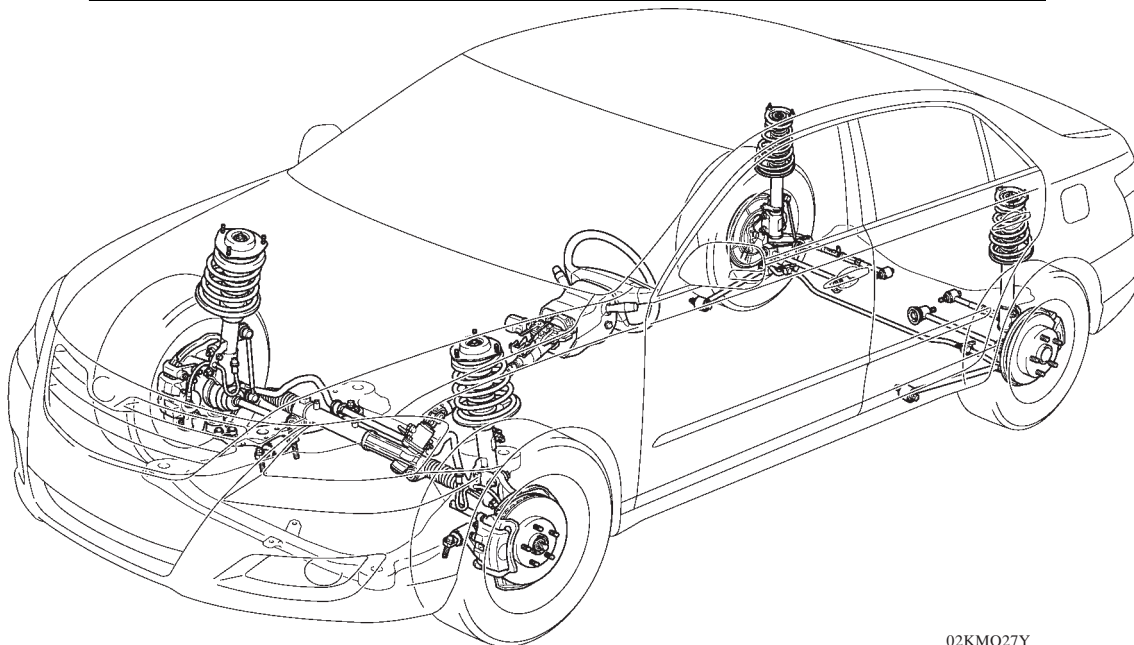
01YCH01Y

**U660E Automatic Transaxle**

## **Chassis**

### **Suspension**

Front Suspension	Rear Suspension
MacPherson Strut Type Independent Suspension	Dual Link MacPherson Strut Type Independent Suspension



02KMO27Y

### **Steering**

Steering Type	Engine Speed Sensing Hydraulic Type Power Steering
Gear Type	Rack & Pinion

### **Brake**

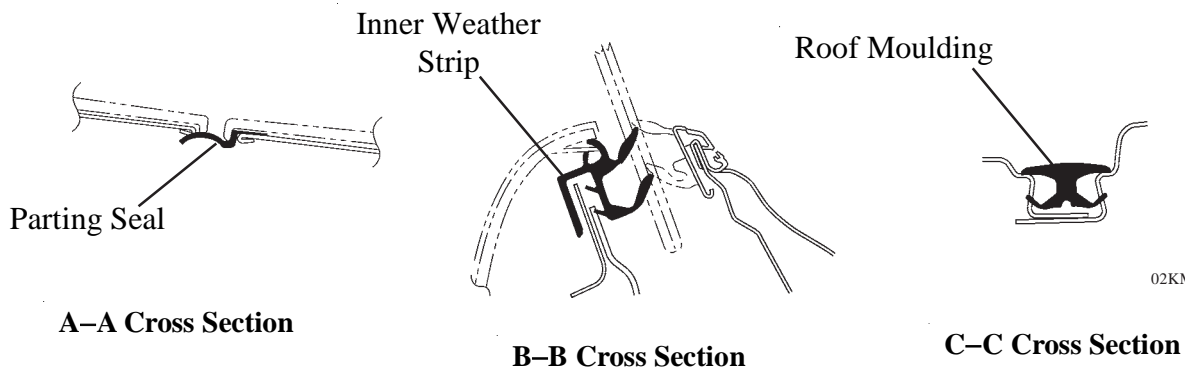
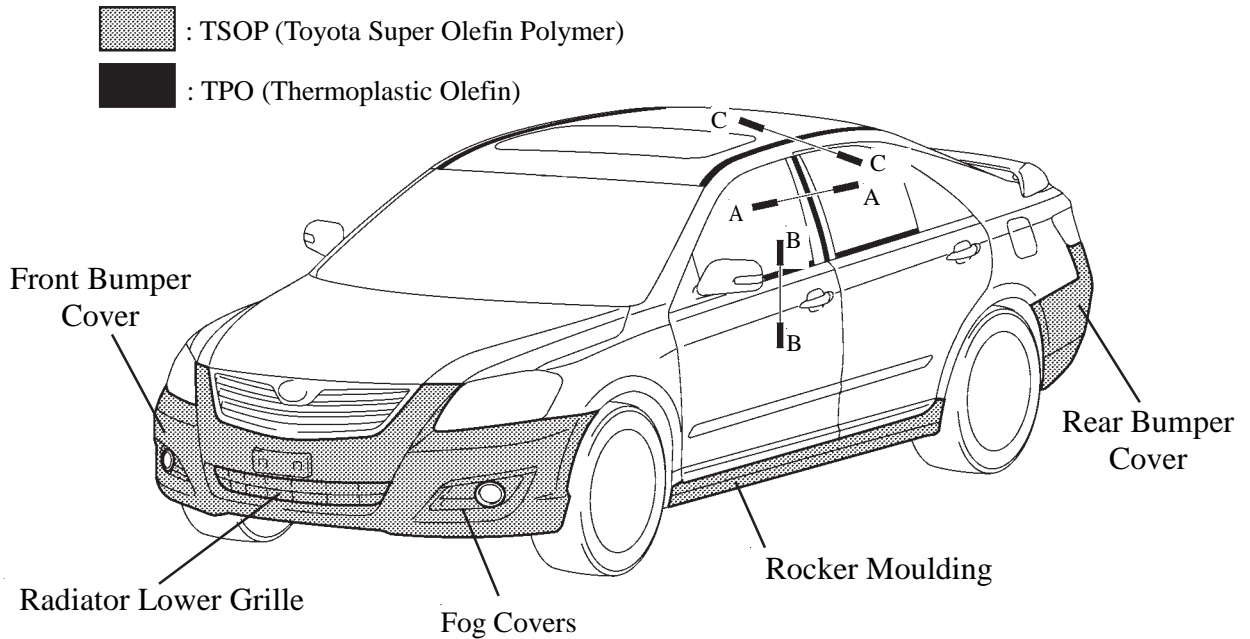
Front Brake Type	Ventilated Disc
Front Rotor Size (D x T) mm	296 x 28
Rear Brake Type	Solid Disc
Rear Rotor Size (D x T) mm	281 x 10
Parking Brake	Foot Pedal Type with foot release
Brake Control System	<ul style="list-style-type: none"> <li>• ABS with EBD, Brake Assist*<sup>1</sup></li> <li>• ABS with EBD, Brake Assist, TRC and VSC*<sup>2</sup></li> </ul>

\*<sup>1</sup>: Touring\*<sup>2</sup>: Grande

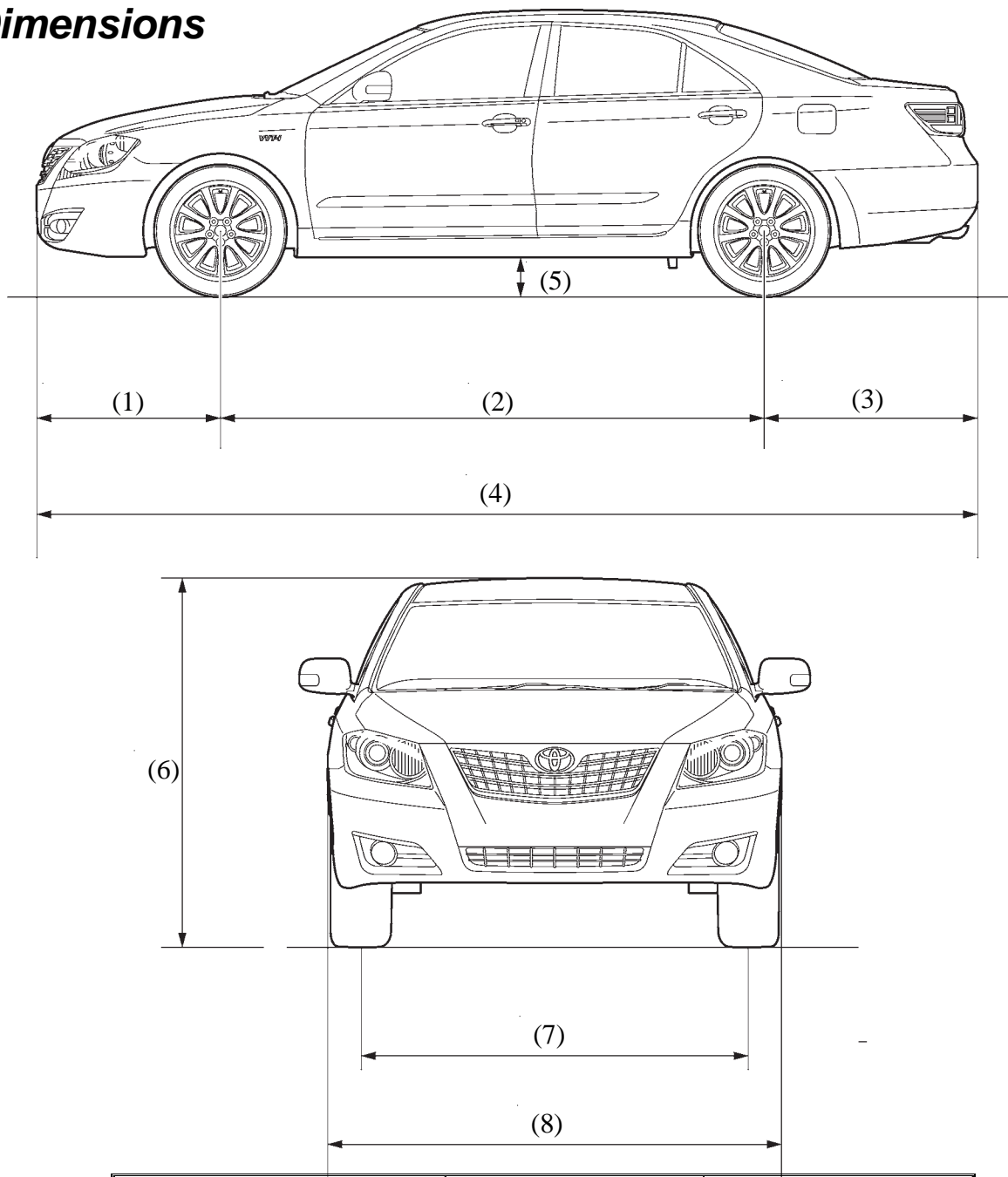
# ENVIRONMENT and RECYCLING

## Adoption of TSOP & TPO

TSOP (Toyota Super Olefin Polymer), TPO (Thermoplastic Olefin), which have superior recyclability, are actively utilised while the use of chlorine has been reduced as much as possible.



## Dimensions



02KMO42TE

Height		Normal	Normal + Height up*
(1)	Front Overhang	965mm	
(2)	Wheel Base	2775mm	
(3)	Rear Overhang	1085mm	
(4)	Overall Length	4825mm	
(5)	Minimum Running Ground Clearance	150mm	165mm
(6)	Overall Height	1470mm	1485mm
(7)	Tread	Front	1575mm
		Rear	1560mm
(8)	Overall Width	1820mm	

\*: Option SPI  
© TMCAL

LHD

## EQUIPMENT LIST

The equipment list hereafter is a guide and some slight variations may occur to model grades always confirm first with your sales department.

•: Standard O: Option -: Not available

Aurion / Grade			Touring	Grande
Exterior	Boot Spoiler Wing type		O	O
	Chrome outside door handles		•	•
	Mud Guard Colour		•	•
	Side Protection Moulding Colour with Chrome Plating		•	•
Chassis	ABS with EBD, BA (Electrical), VSC & TRC		-	•
	ABS with EBD, BA (Mechanical)		•	-
	16 x 6.5JJ Steel Wheels		•	-
	215/60R16 tyres (95V)		•	-
	215/55R17 tyres (93V)		-	•
	16 x 6.5J Alloy Wheels		O	-
	17 x 7J Alloy Wheels		-	•
	Spare Wheel Steel		•	-
	Spare Wheel Alloy		O	•
	Gate type auto shift lever with shift lock		•	•
	PKB Pedal Type		•	•
	Steering Wheel	4 Spoke Urethane	•	-
		4 Spoke Urethane (with Audio controls)	O	-
		4 Spoke Leather (with Audio & Multi-Information display controls)	-	•
	Steering System	Engine Speed Sensing Hydraulic Type	•	•
		Manual Tilt & Telescopic Mechanism	•	•
Body / Interior	Overhead Sunglasses holder		•	•
	Lockable glove box		•	•
	Seat Cover Material	Leather	-	O
		Fabric	•	•
	Rear Seat, foldable 40/60 Split Type with Arm Rest incl. Cup Holders		•	•

•: Standard O: Option -: Not available

Aurion / Grade			Touring	Grande
Body/ Interior	Front Seat Belt, 3-point ELR with Force Limiting Pre-tensioners		•	•
	Front seat belt height adjustment		•	•
	Rear Seat Belt, 3-point ELR + ALR x 3		•	•
	Front Console Box	Metallic	•	-
		Woody	-	•
	Rear Console Box with Leather Arm Rest		•	•
	Card holder in the centre console		•	•
	Front & Rear cup holders		•	•
Body Electrical	Audio	AM/FM Tuner, Cassette Player 4 Speaker	•	-
		6 CD AM/FM 6 Speaker (MP3)	O	•
		Navigation System 6 Speaker AM/FM, Cassette Player & CD	O	O
	Audio controls on steering wheel		O	•
	Cruise Control		•	•
	Auto OFF Headlights		•	•
	Power Remote Central Locking and boot release with panic function		•	•
	Smart Entry & Start System		-	•
	Engine Immobiliser		•	•
	Variable intermittent wipers		•	-
	Clock incorporating a Speed alert (3 setting)		•	•
	Front Driver & Passenger side and curtain Airbag		-	O
	Power Windows, Front & Rear with One Touch Auto Up & Down for Driver		•	•

●: Standard O: Option -: Not available

Aurion / Grade			Touring	Grande	
Body Electrical	Power mirrors		●	●	
	Power mirrors with reverse-linked Function & Memory		-	●	
	Day night Interior Rear view mirror		●	-	
	Front Map lights		●	●	
	Illumination Entry System		●	●	
	LED High Mount Stop Light		●	●	
	Multi-Information Display with control switch on steering wheel		-	●	
	Outside Temperature displayed		●	●	
	Sliding Roof		O	O	
	Vanity mirrors illuminated		O	O	
	Front Fog lights		O	●	
	Rear map Lamps		O	O	
	All Power Drivers seat		●	●	
	All Power Passenger Front Seat		-	●	
	Manual Passenger Front Seat		●	-	
	Power Rear Sunshade		O	●	
	Headlight	Standard (projector low, halogen high) with Manual level control		●	-
		HID with Automatic level control & Headlight Cleaner		-	●
	Toyota Park Assist System		4 corners (front & rear)	-	●
			2 Centre rear	-	●
	Air Conditioning system		Manual	●	-
			Automatic with Dual Zone (Left & Right)	-	●
	Clean Air Filter			●	●

# ENGINE

## **2GR-FE Engine**

<i>Description.....</i>	<i>EG-2</i>
<i>Features of 2GR-FE Engine.....</i>	<i>EG-4</i>
<i>Engine Proper.....</i>	<i>EG-6</i>
<i>Valve Mechanism.....</i>	<i>EG-13</i>
<i>Lubrication System.....</i>	<i>EG-16</i>
<i>Cooling System.....</i>	<i>EG-19</i>
<i>Intake and Exhaust System.....</i>	<i>EG-21</i>
<i>Fuel System.....</i>	<i>EG-26</i>
<i>Ignition System.....</i>	<i>EG-28</i>
<i>Charging System.....</i>	<i>EG-30</i>
<i>Starting System.....</i>	<i>EG-32</i>
<i>Engine Mount.....</i>	<i>EG-34</i>
<i>Serpentine Belt Drive System.....</i>	<i>EG-36</i>
<i>Engine Control System.....</i>	<i>EG-37</i>

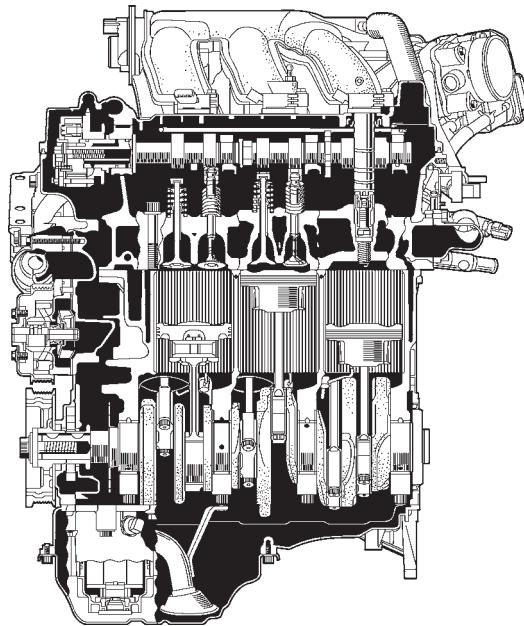


# ENGINE

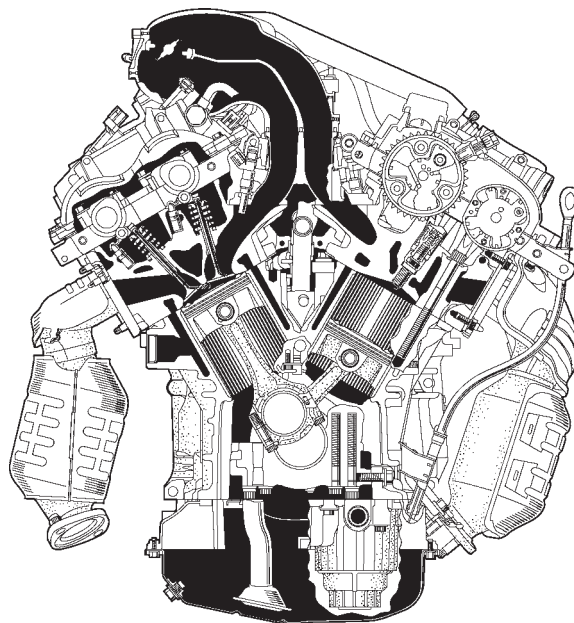
## 2GR-FE ENGINE

### ● DESCRIPTION

The 2GR-FE engine on the Aurion is a newly developed, V6 3.5-litre, 24-valve DOHC engine. This engine uses the Dual VVT-i (Dual Variable Valve Timing-intelligent) system, DIS (Direct Ignition System), ACIS (Acoustic Control Induction System), and ETCS-i (Electronic Throttle Control System-intelligent). These control functions achieve improved engine performance, fuel economy, and reduced exhaust emissions.



285EG01



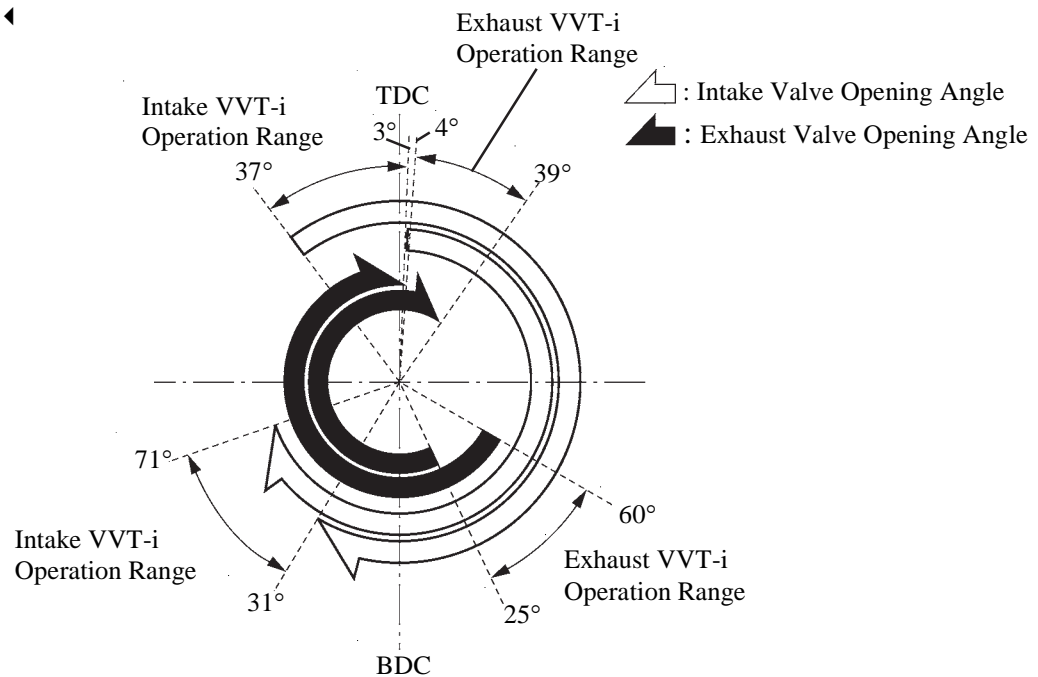
285EG02

### Engine Specifications

No. of Cyls. & Arrangement			6-Cylinder, V Type
Valve Mechanism			24-Valve DOHC, Chain Drive (with Dual VVT-i)
Combustion Chamber			Pentroof Type
Manifolds			Parallel-Flow
Fuel System			EFI
Ignition System			DIS
Displacement		cm <sup>3</sup>	3456
Bore X Stroke		mm	94.0 X 83.0
Compression Ratio			10.8 : 1
Max. Output		SAE-NET	200 kW @ 6200 rpm
Max. Torque		SAE-NET	336 N·m @ 4700 rpm
Valve Timing	Intake	Open	37° BTDC to 3° ATDC
		Close	31° to 71° ABDC
	Exhaust	Open	60° to 25° BBDC
		Close	4° to 39° ATDC
Firing Order			1 – 2 – 3 – 4 – 5 – 6
Oil Grade			API grade SL "Energy-Conserving", SM "Energy-Conserving" or ILSAC
Research Octane Number			91 or higher
Emission Regulation			EURO IV
Engine Service Mass* <sup>1</sup> (Reference)		kg	163

\*<sup>1</sup>: Weight shows the figure with the oil and engine coolant fully filled.

### Valve Timing



## FEATURES OF 2GR-FE ENGINE

The 2GR-FE engine has achieved the following performance through the use of the items listed below.

- (1) High performance and reliability
- (2) Low noise and vibration
- (3) Lightweight and compact design
- (4) Good serviceability
- (5) Clean emission and fuel economy

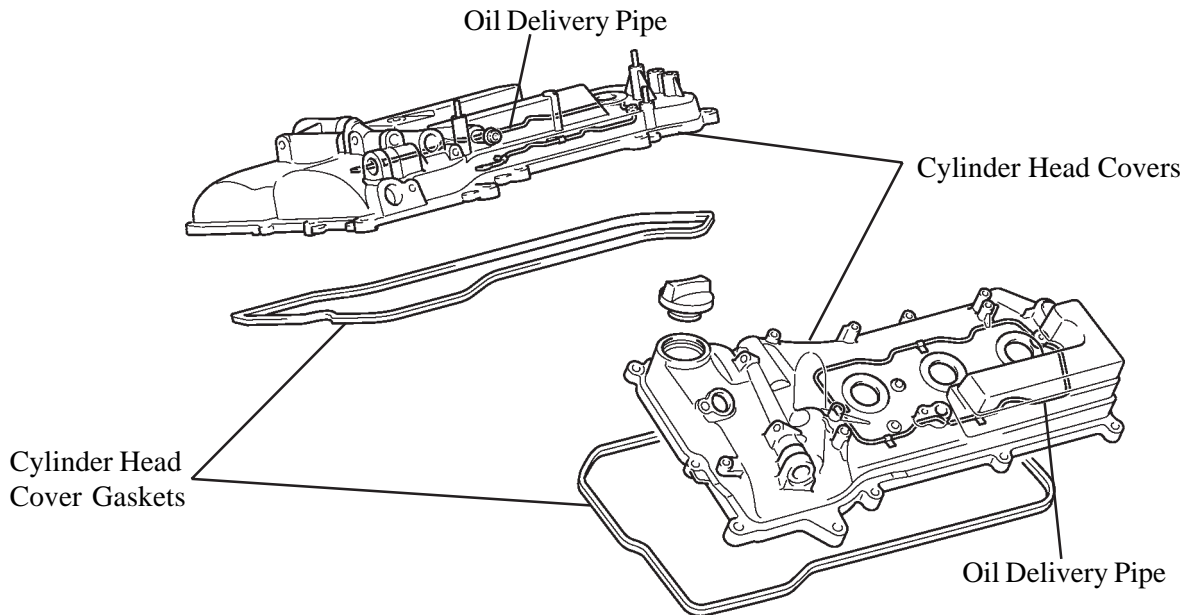
Item		(1)	(2)	(3)	(4)	(5)
Engine Proper	A steel laminate type cylinder head gasket is used.	○				
	An upright intake port is used.	○		○		
	A taper squish shape is used for combustion chamber.	○				○
	A cylinder block made of aluminium alloy is used.			○		
	The skirt portion of the piston is applied with resin plating to reduce friction.	○	○			○
	An oil pan No.1 made of aluminium alloy is used.		○	○		
Valve Mechanism	The Dual VVT-i system is used.	○				○
	A hydraulic lash adjuster is used.	○	○		○	
	A timing chain and chain tensioner are used.		○	○	○	
	Roller rocker arms are used.	○				○
Lubrication System	An oil filter with a replaceable element is used.				○	
Cooling System	The engine coolant is used the TOYOTA Genuine SLLC (Super Long Life Coolant).				○	
Intake and Exhaust System	The link-less type throttle body is used.			○	○	
	The intake air chamber made of plastic is used.			○		
	A stainless steel exhaust manifold is used.			○		○
	A ceramic type TWC (Three-Way Catalytic Converter) is used.					○
Fuel System	The fuel delivery pipe made of plastic is used.			○		
	A compact 12-hole type injector is used.	○				○
	Quick connectors are used to connect the fuel hose with the fuel pipe.				○	
Ignition System	The DIS makes ignition timing adjustment unnecessary.	○			○	○
	The long-reach type spark plugs are used.	○				
Charging System	A segment conductor type alternator is used.	○		○		
	An alternator pulley with a clutch is used.					○
Starting System	The PS (Planetary reduction-Segment conductor motor) type starter is used.			○		

Item		(1)	(2)	(3)	(4)	(5)
Engine Mount	An active control engine mount is used.		○			
Serpentine Belt Drive System	A serpentine belt drive system is used.			○	○	
Engine Control System	The MRE (Magnetic Resistance Element) type VVT sensors are used.	○				
	The ETCS-i is used.	○				○
	The ACIS is used.	○				○
	The cranking holding function is used. (Only for models with smart entry and start system)	○				
	The air intake control system is used.	○	○			
	Evaporative emission control system is used.					○

## ✱ ENGINE PROPER

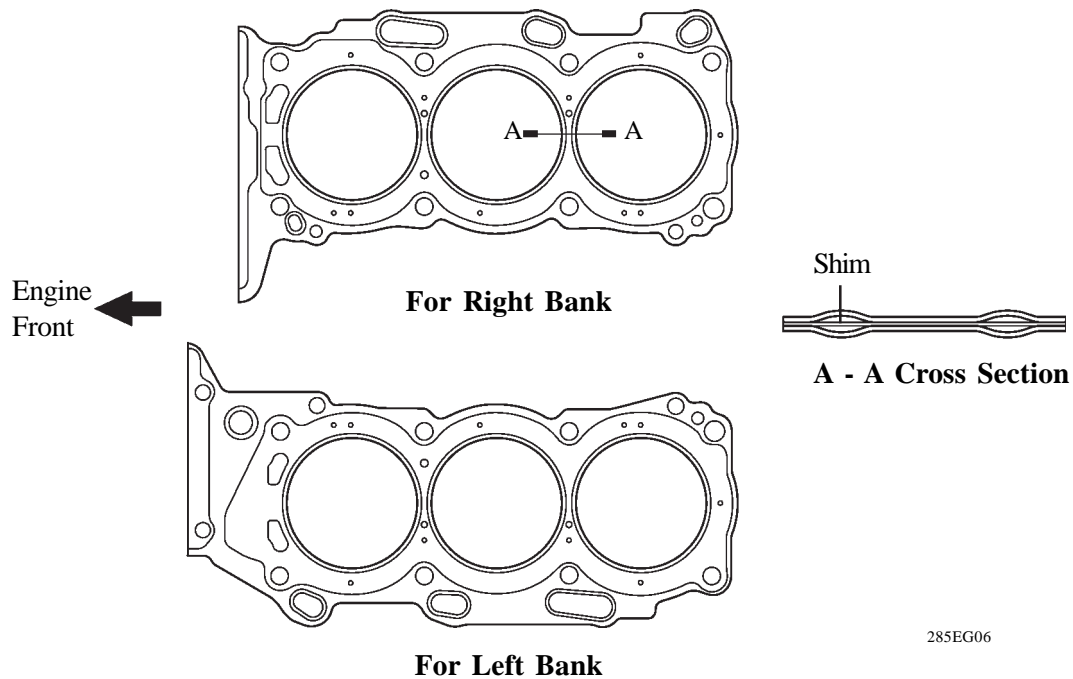
### 1. Cylinder Head Cover

- Lightweight yet high-strength aluminium cylinder head covers are used.
- An oil delivery pipe is installed inside the cylinder head cover. This ensures lubrication to the sliding parts of the roller rocker arm, improving reliability.



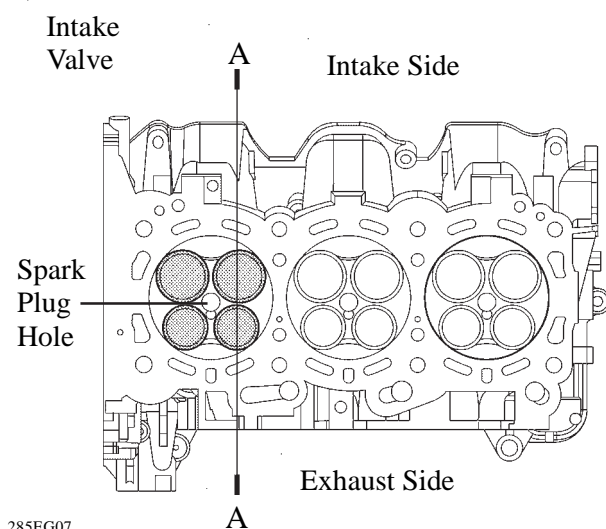
### 2. Cylinder Head Gasket

A steel-laminate type cylinder head gasket is used. A shim is used around the cylinder bore of the gasket to help enhance sealing performance and durability.

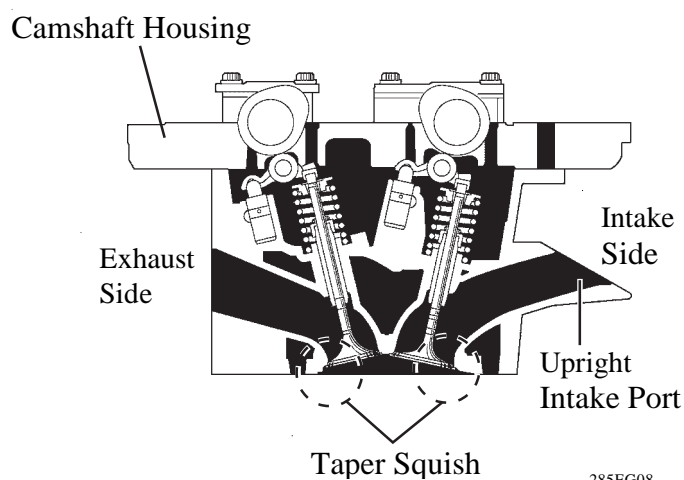


### 3. Cylinder Head

- The cylinder head structure has been simplified by separating the cam journal portion (camshaft housing) from the cylinder head.
- The cylinder head, which is made of aluminium, contains a pentroof-type combustion chamber. The spark plug is located in the centre of the combustion chamber in order to improve the engine's anti-knocking performance.
- The intake ports are on the inside and the exhaust ports on the outside of the left and right banks respectively.
- Upright intake ports are used to improve the intake efficiency.
- A taper squish combustion chamber is used to improve anti-knocking performance and intake efficiency. In addition, engine performance and fuel economy have been improved.
- The siamese type intake port is used to reduce the overall surface area of the intake port walls. This prevents the fuel from adhering onto the intake port walls, thus reducing HC exhaust emissions.



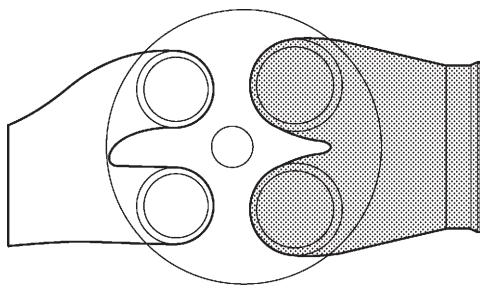
View from Back Side



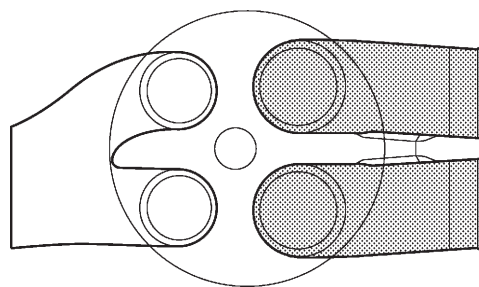
A - A Cross Section

#### — REFERENCE —

Siamese Type

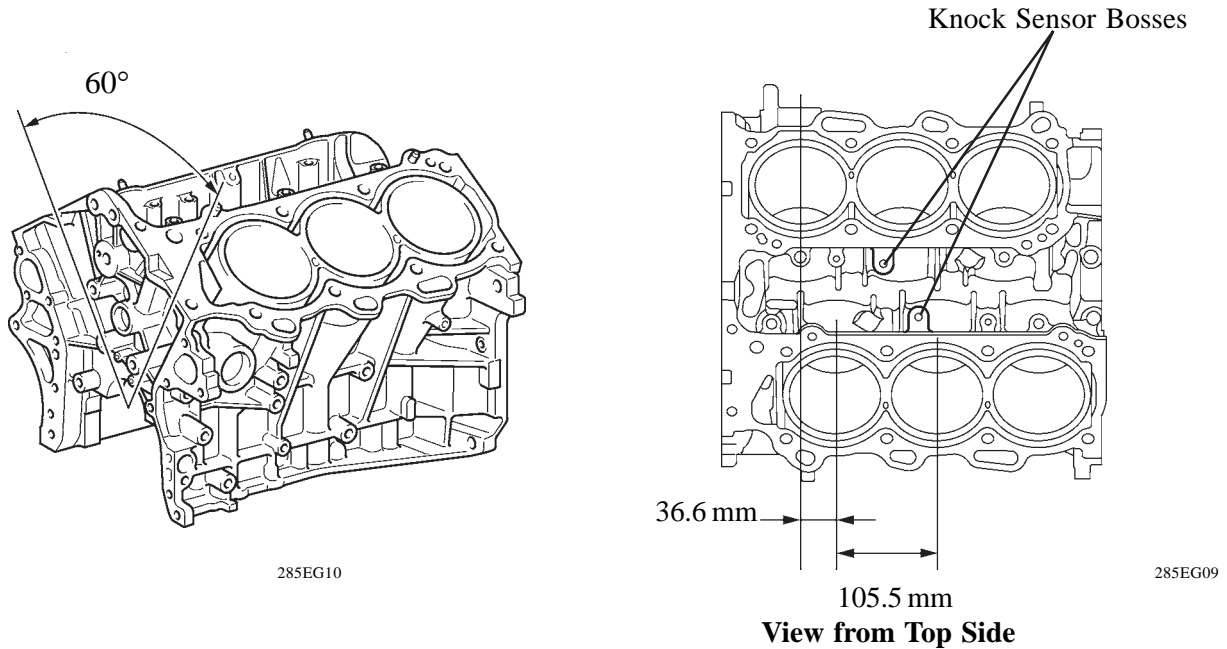


Independent Type

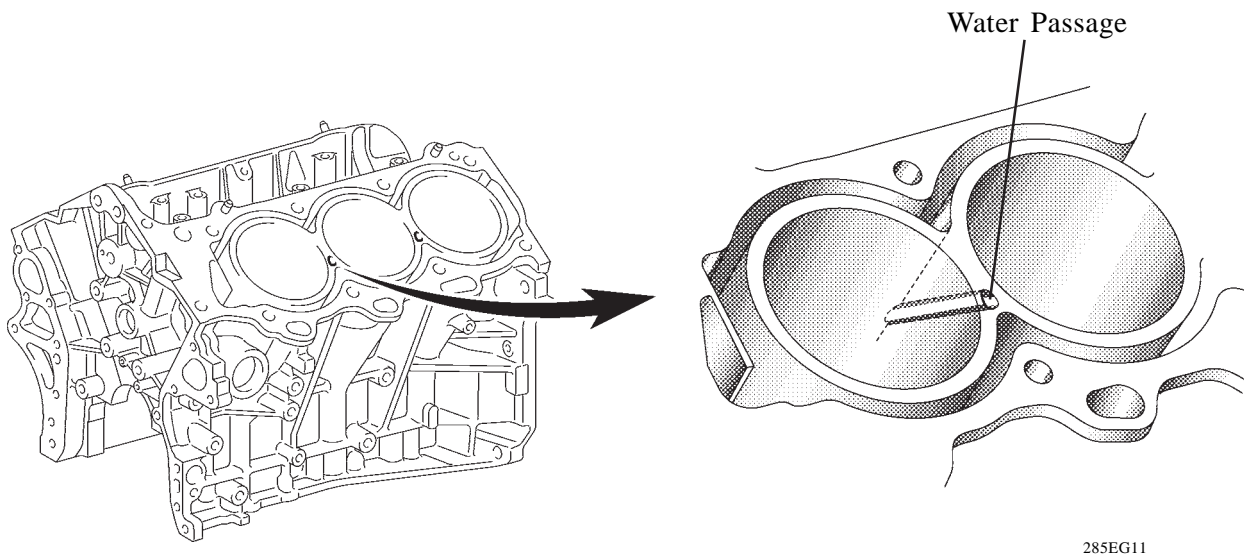


## 4. Cylinder Block

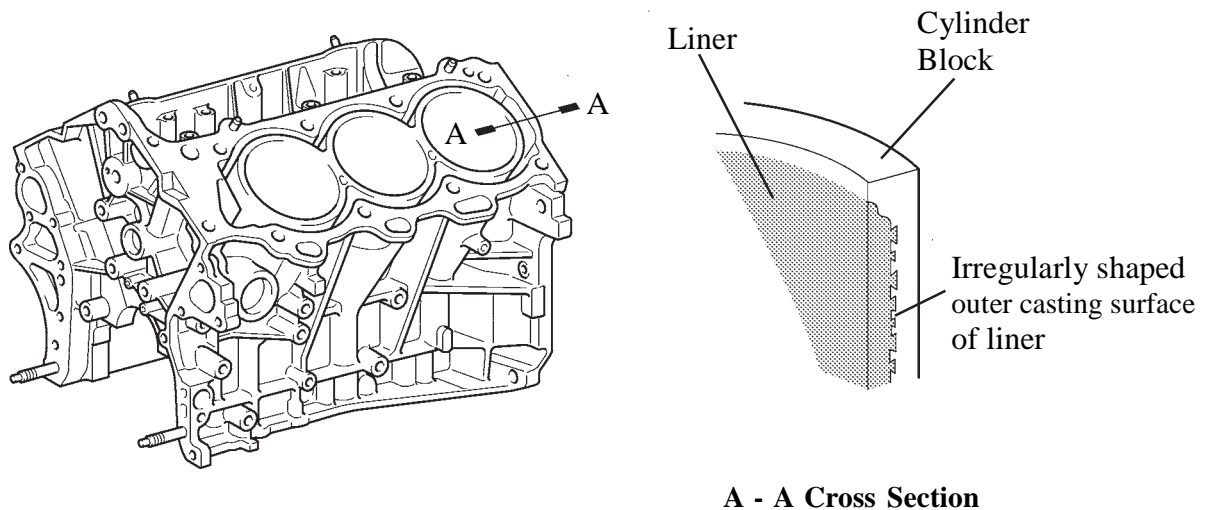
- The cylinder block is made of aluminium alloy, so it is lightweight.
- The cylinder block has a bank angle of  $60^\circ$ , a bank offset of 36.6 mm and a bore pitch of 105.5 mm, resulting in a compact block in its length and width even for its displacement.
- Installation bosses of the two knock sensors are located on the inner side of left and right banks.



- A water passage has been provided between the cylinder bores. By allowing the engine coolant to flow between the cylinder bores, this construction enables the temperature of the cylinder walls to be kept uniform.

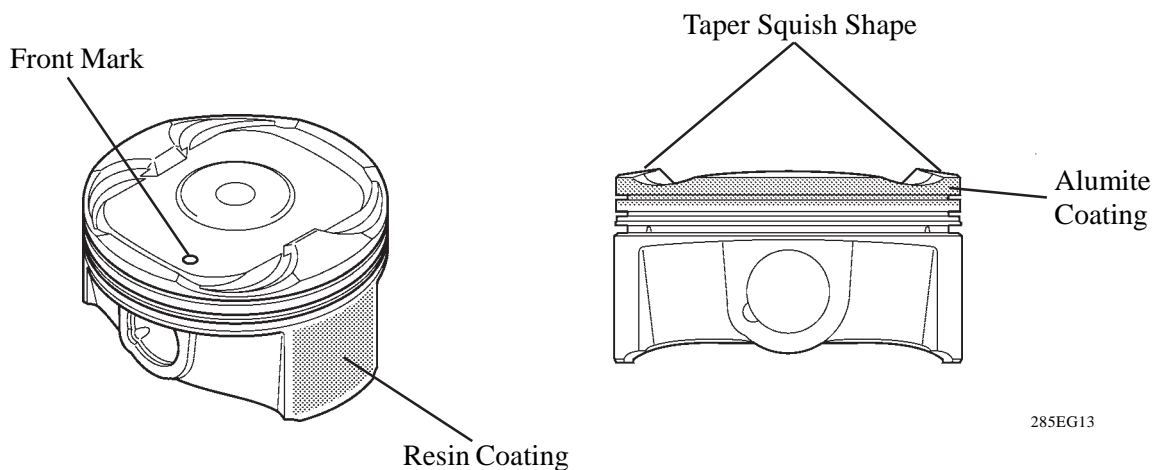


- A compact block has been achieved by producing the thin cast-iron liners and cylinder block as a unit. It is not possible to bore the block with this liner.
- The liners are the spiny-type, which have been manufactured so that their casting exterior forms a large irregular surface in order to enhance the adhesion between the liners and the aluminium cylinder block. The enhanced adhesion helps improve heat dissipation, resulting in a lower overall temperature and heat deformation of the cylinder bores.



## 5. Piston

- The piston is made of aluminium alloy.
- The piston head portion uses a taper squish shape to accomplish fuel combustion efficiency.
- The piston skirt is coated with resin to reduce the friction loss.
- The groove of the top ring is coated with alumite to ensure abrasion resistance.
- By increasing the machining precision of the cylinder bore diameter, the outer diameter of the piston is made into one size.

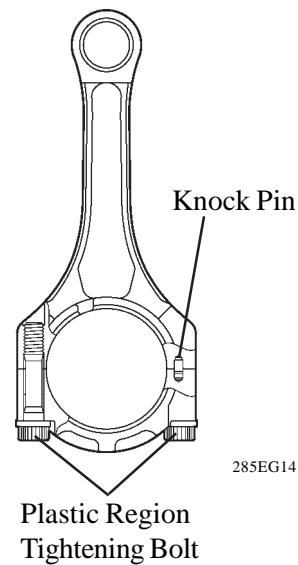


285EG13



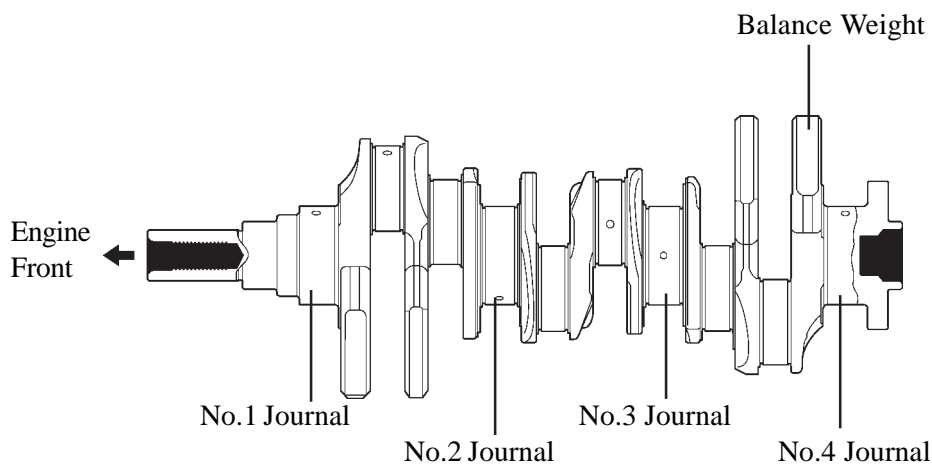
## 6. Connecting Rod and Connecting Rod Bearing

- Connecting rods that have been forged for high strength are used for weight reduction.
- Knock pins are used at the mating surfaces of the bearing caps of the connecting rod to minimise the shifting of the bearing caps during assembly.
- The connecting rods and caps are made of high-strength steel for weight reduction.
- Nutless-type plastic region tightening bolts are used on the connecting rods for a lighter design.
- An aluminium bearing is used for the connecting rod bearings.
- The connecting rod bearings are reduced in width to reduce friction.



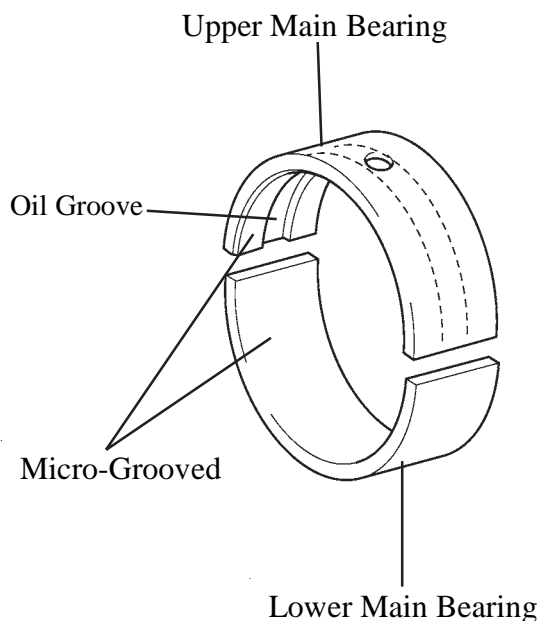
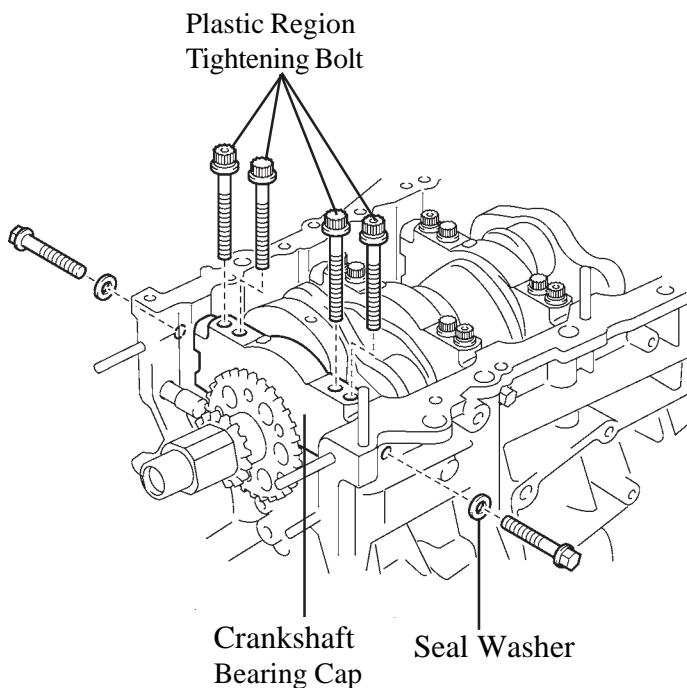
## 7. Crankshaft

- A crankshaft made of forged steel, which excels in rigidity and wear resistance, is used.
- The crankshaft has 4 journals and 5 balance weights.



## 8. Crankshaft Bearing and Crankshaft Bearing Cap

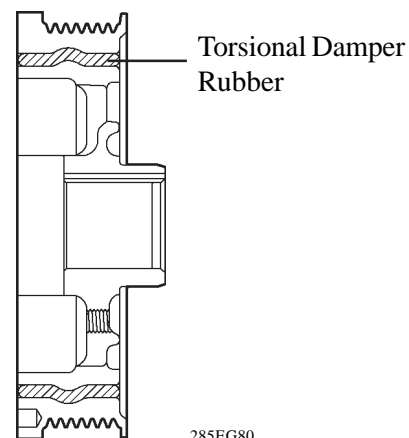
- The crankshaft bearing is made of aluminium alloy.
- Similar to the connecting rod bearings, the lining surface of the crankshaft bearings is micro-grooved to realise an optimal amount of oil clearance. As a result, cold-engine cranking performance is improved and engine vibration is reduced.
- The upper main bearing has an oil groove around its inside circumference.
- The crankshaft bearing caps are tightened using 4 plastic-region tightening bolts for each journal. In addition, each cap is tightened laterally to improve its reliability.



285EG81

## 9. Crankshaft Pulley

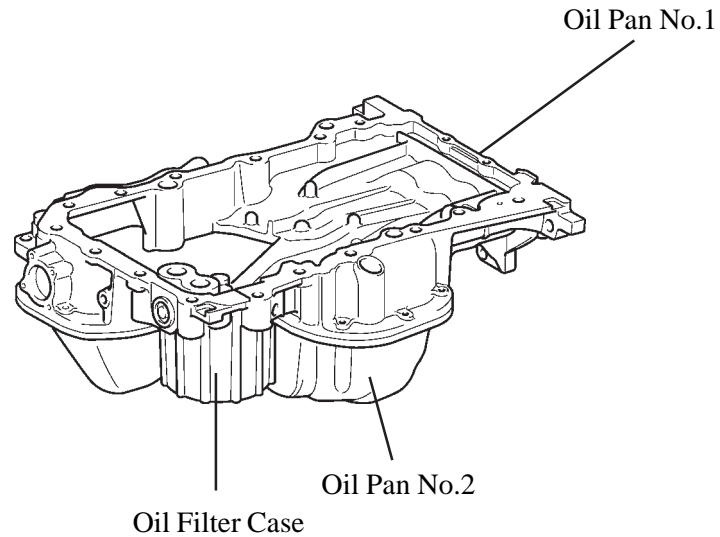
The rigidity of the crankshaft pulley with its built-in torsional damper rubber reduces noise.



285EG80

## 10. Oil Pan

- The oil pan No.1 material is made of aluminium alloy.
- The oil pan No.2 material is made of steel.
- The oil pan No.1 is secured to the cylinder block and the transmission housing and is increasing rigidity.
- The oil filter case is integrated with the oil pan No.1.



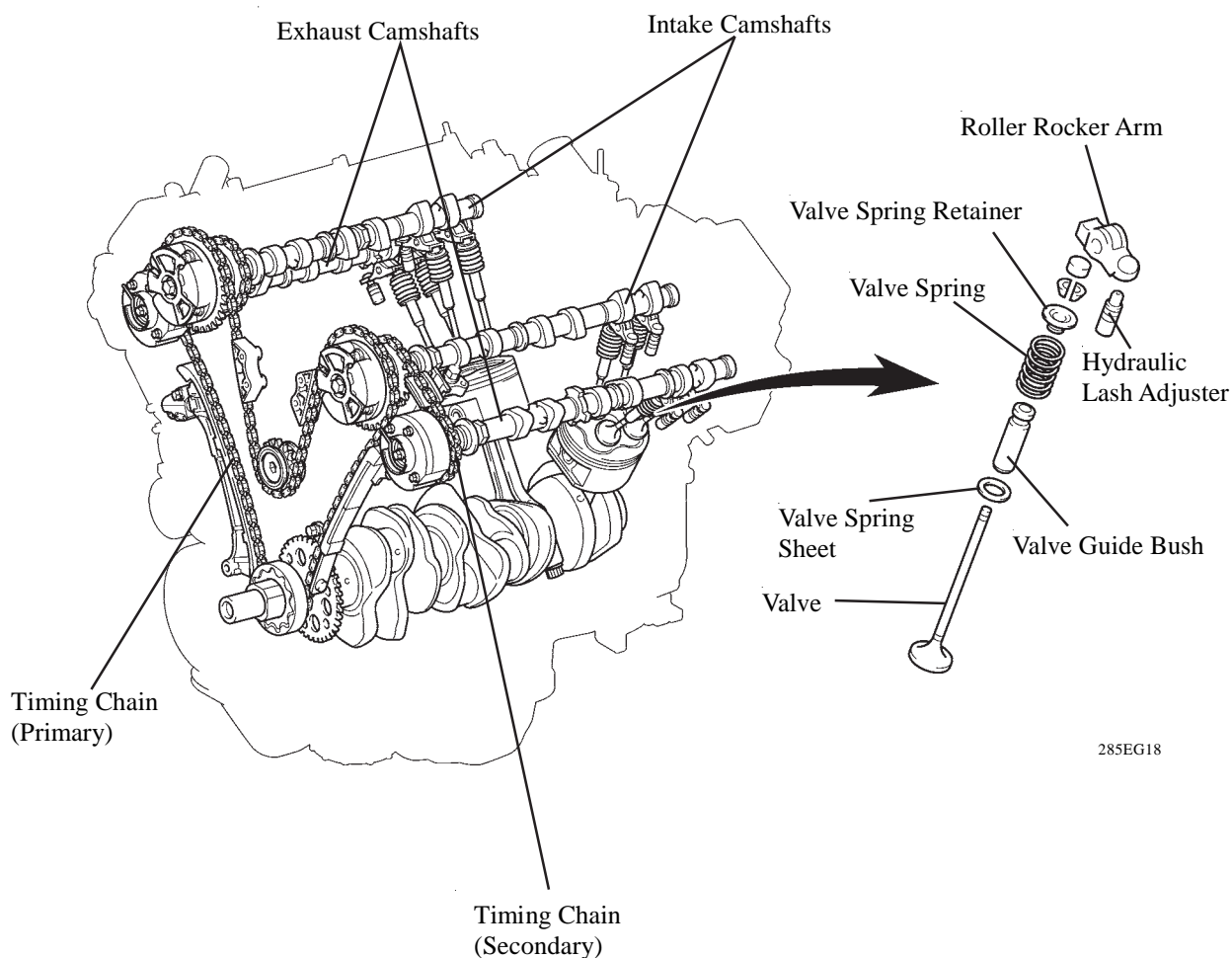
285EG16

**Models without Oil Cooler**

## ● VALVE MECHANISM

### 1. General

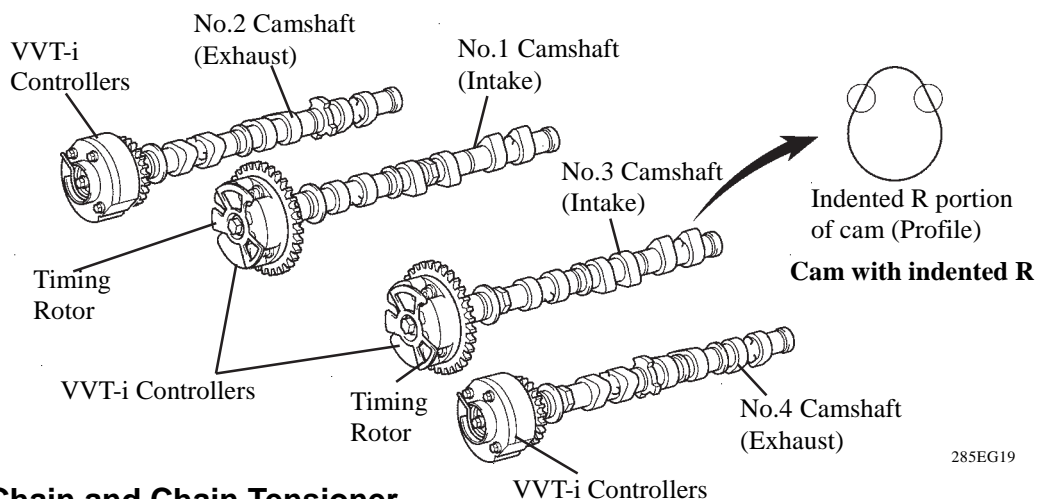
- Each cylinder of this engine has 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency is increased due to the larger total port areas.
- This engine uses roller rocker arms with built-in needle bearings. This reduces the friction that occurs between the cams and the areas (roller rocker arms) that push the valves down, thus improving fuel economy.
- A hydraulic lash adjuster, which maintains a constant zero valve clearance through the use of oil pressure and spring force, is used.
- The intake camshafts are driven by the crankshaft via the primary timing chain. The exhaust camshafts are driven by the intake camshaft of the respective bank via the secondary timing chain.
- This engine uses a dual VVT-i (Variable Valve Timing-intelligent) system, which controls the intake and exhaust camshafts to provide optimal valve timing according to driving conditions. With this adoption, lower fuel consumption, higher engine performance, and fewer exhaust emissions have been achieved. For details of dual VVT-i control, refer to page EG-57.



285EG18

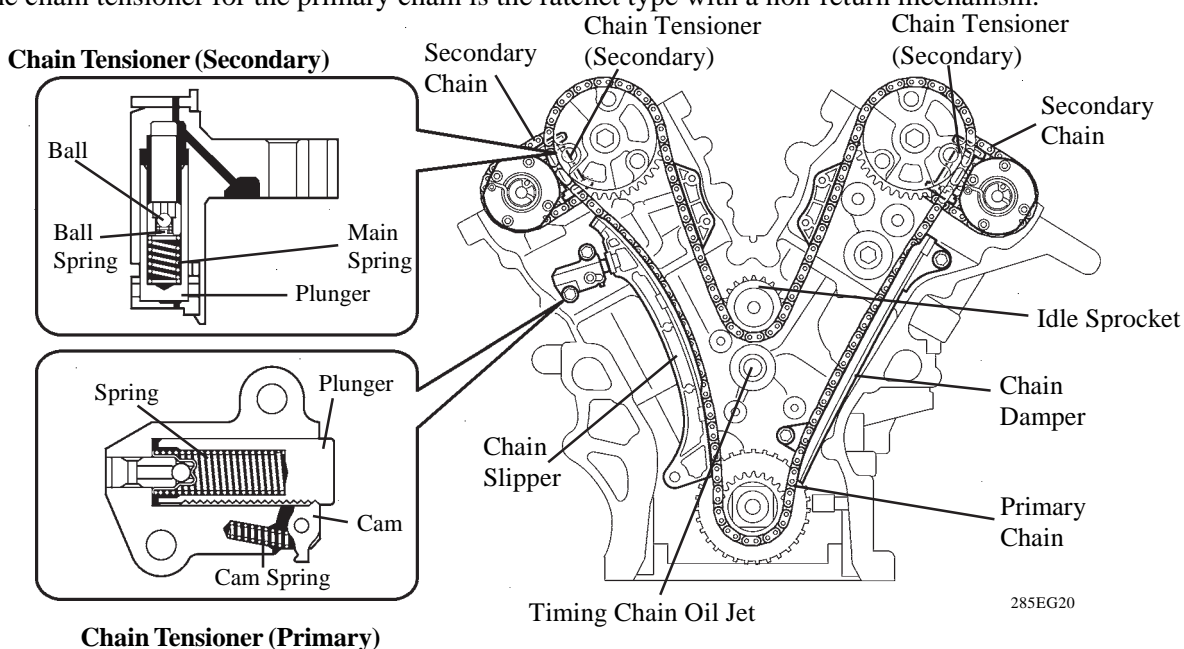
## 2. Camshaft

- The camshafts are made of cast iron alloy.
- An oil passage is provided on the intake and exhaust camshaft in order to supply engine oil to the VVT-i system.
- A VVT-i controller has been installed on the front of the intake and exhaust camshaft to vary the timing of the intake and exhaust valves.
- Together with the use of the roller rocker arm, the cam profile has been designed with an indented R (radius). This results in increased valve lift when the valve begins to open and finishes closing, helping to achieve enhanced output performance.



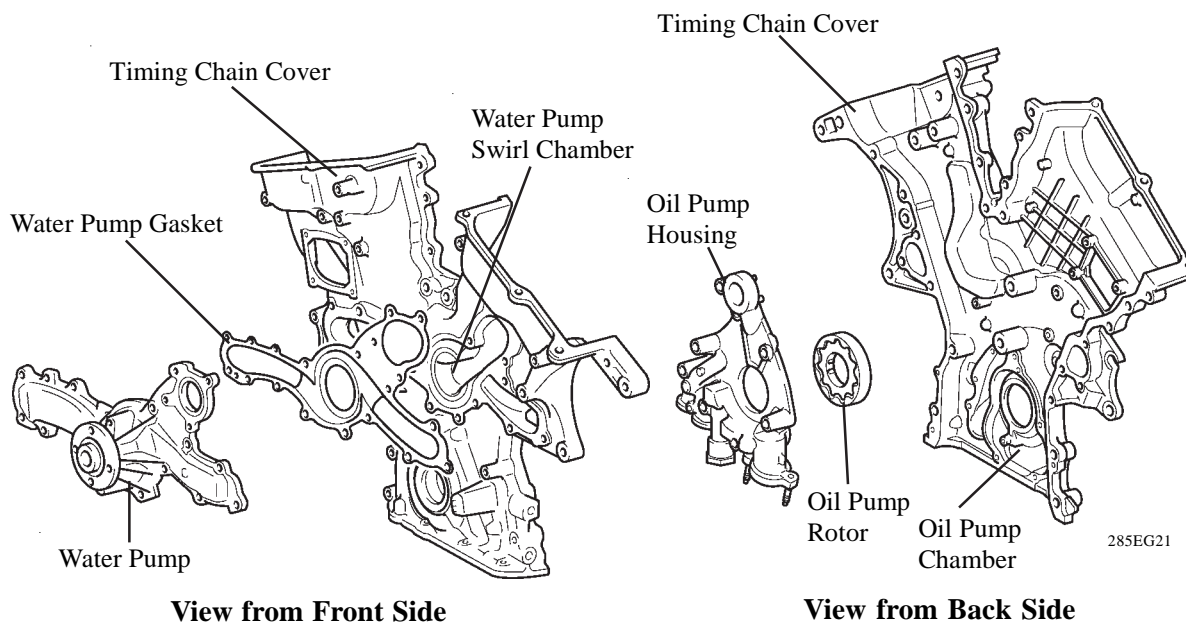
## 3. Timing Chain and Chain Tensioner

- Both the primary and secondary timing chains use roller chains with a pitch of 9.525mm.
- The timing chain is lubricated by an oil jet.
- The primary chain uses one timing chain tensioner and each of the secondary chains for the right and left banks uses one timing chain tensioner.
- Both the primary and secondary chain tensioners use a spring and oil pressure to maintain proper chain tension at all times. They suppress noise generated by the timing chains.
- The chain tensioner for the primary chain is the ratchet type with a non-return mechanism.



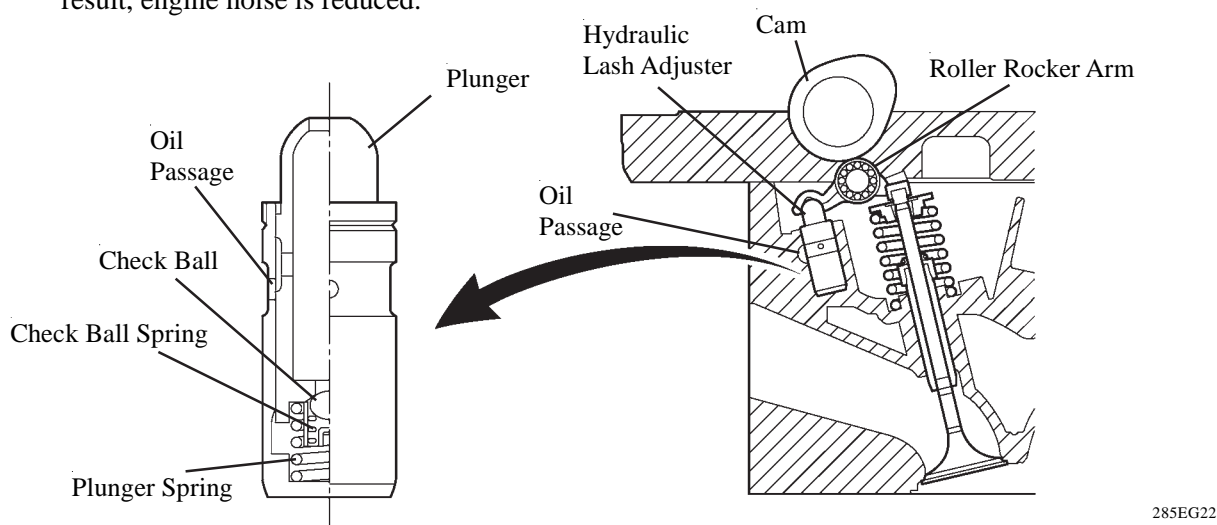
#### 4. Timing Chain Cover

The timing chain cover has an integrated construction consisting of the cooling system (water pump and water passage) and the lubrication system (oil pump and oil passage). Thus, the number of parts has been reduced to reduce weight.



#### 5. Hydraulic Lash Adjuster

- The hydraulic lash adjuster, which is located at the fulcrum of the roller rocker arm, consists primarily of a plunger, plunger spring, check ball, and check ball spring.
- The engine oil that is supplied by the cylinder head and the built-in spring actuate the hydraulic lash adjuster. The oil pressure and the spring force that act on the plunger push the roller rocker arm against the cam, in order to adjust the valve clearance that is created during the opening and closing of the valve. As a result, engine noise is reduced.



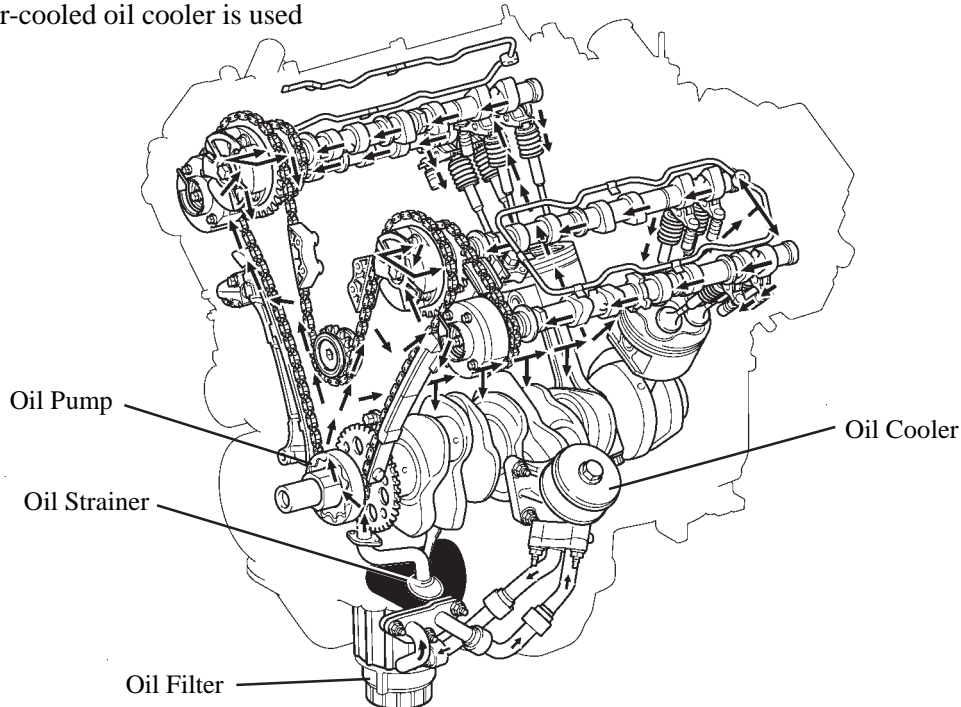
#### Service Tip

Valve clearance adjustment is not necessary because a hydraulic lash adjuster is used in this model.

## LUBRICATION SYSTEM

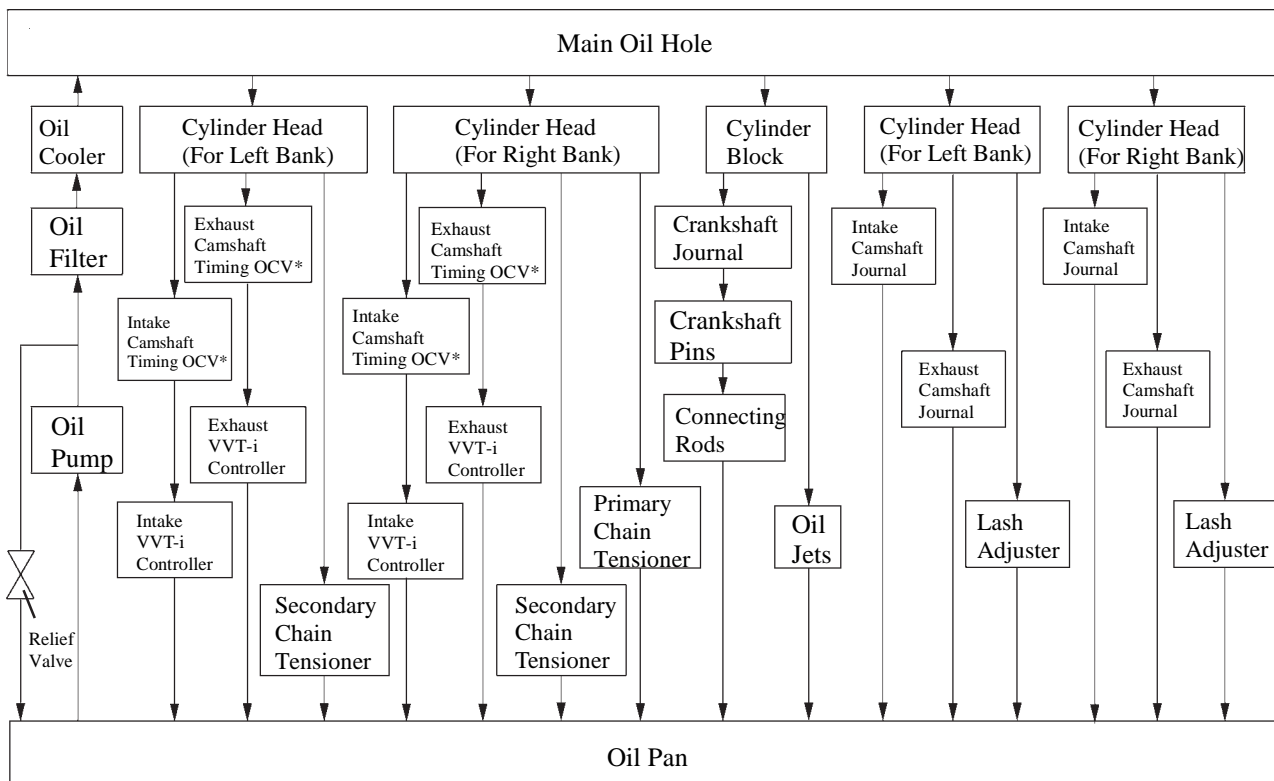
### 1. General

- The lubrication circuit is fully pressurised and all oil passes through an oil filter.
- A cycloid rotor type oil pump is used.
- A water-cooled oil cooler is used



02KEG41TE

### ► Oil Circuit ◀



\*: Oil Control Valve

0270EG28C

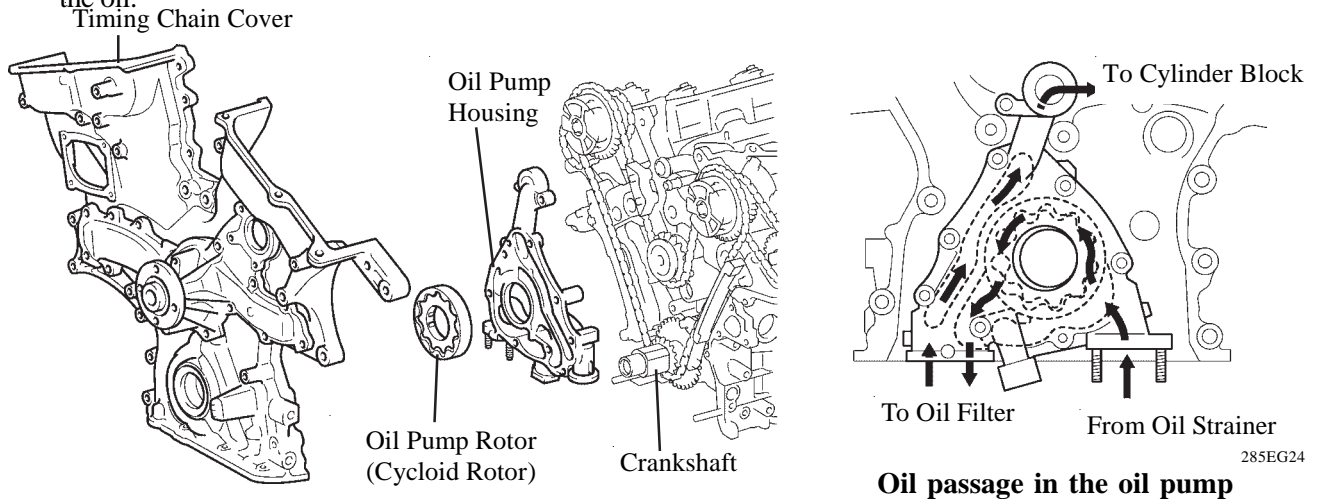


### ▸ Oil Capacity ◀

	2GR-FE with Oil Cooler
Dry	6.8 Litres
with Oil Filter	6.1 Litres
without Oil Filter	5.7 Litres

## 2. Oil Pump

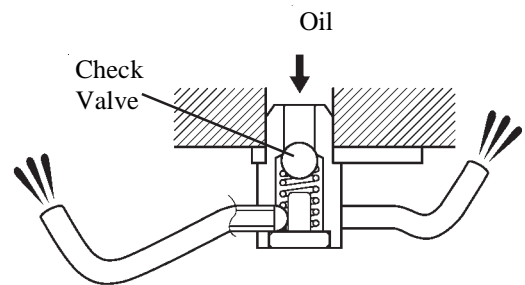
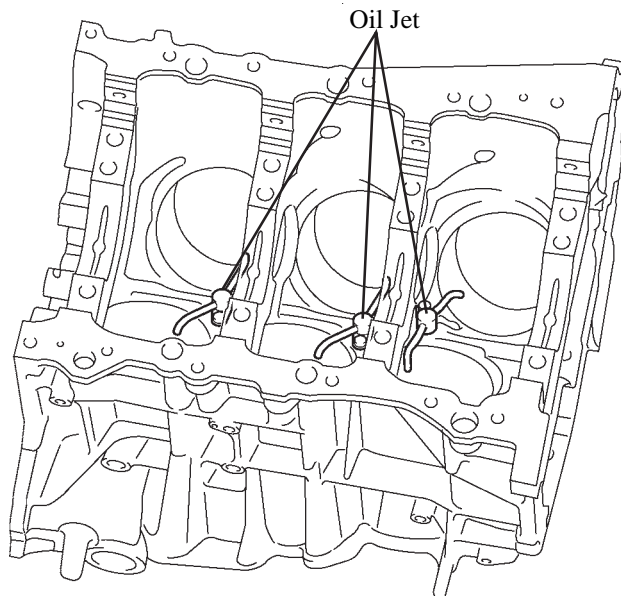
- A compact cycloid rotor type oil pump directly driven by the crankshaft is used.
- This oil pump uses an internal relief method which circulates relief oil to the suction passage in the oil pump. This aims to minimise oil level change in the oil pan, reduce friction, and reduce air mixing rate in the oil.



**Oil passage in the oil pump**

## 3. Oil Jet

- Oil jets for cooling and lubricating the pistons have been provided in the cylinder block, in the centre of the right and left banks.
- These oil jets contain a check valve to prevent oil from being fed when the oil pressure is low. This prevents the overall oil pressure in the engine from dropping.



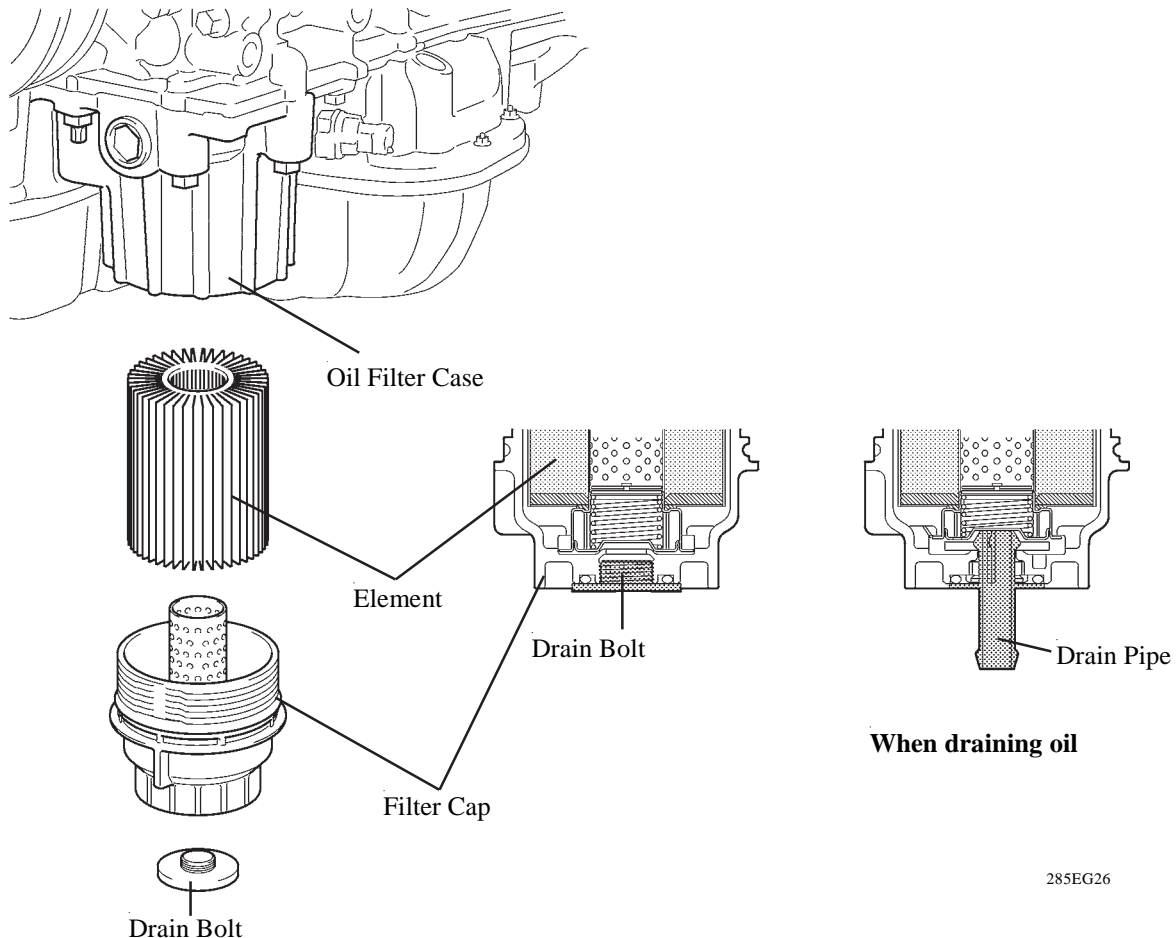
**Oil Jet Cross Section**

02KEG43Y



#### 4. Oil Filter

- A newly developed oil filter with a replaceable element is used. The element uses a high-performance filter paper to improve filtration performance. It is also combustible for environmental protection.
- An aluminium alloy filter cap is used to extend its life.
- This oil filter has a structure which can drain the oil remaining in the oil filter. This prevents oil from spattering when replacing the element and allows the technician to work without touching hot oil.



285EG26

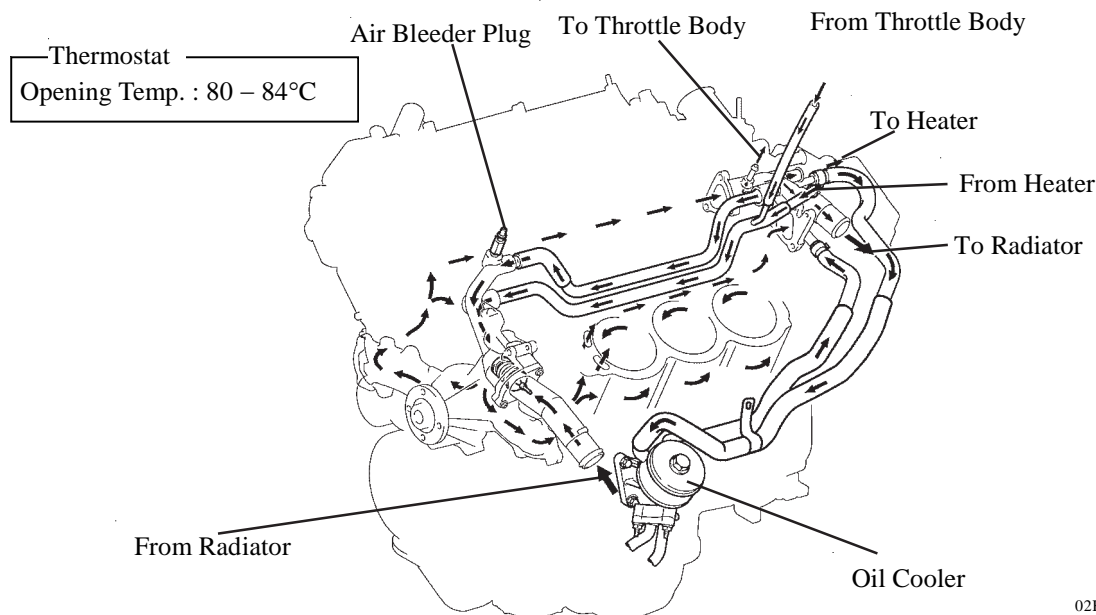
#### Service Tip

- The oil in the oil filter can be drained by removing the drain bolt and inserting the drain pipe supplied with the element into the oil filter. For details, refer to the Aurion Repair Manual.
- The engine oil maintenance interval for a model that has an oil filter with a replaceable element is the same as that for the conventional model.

## ● COOLING SYSTEM

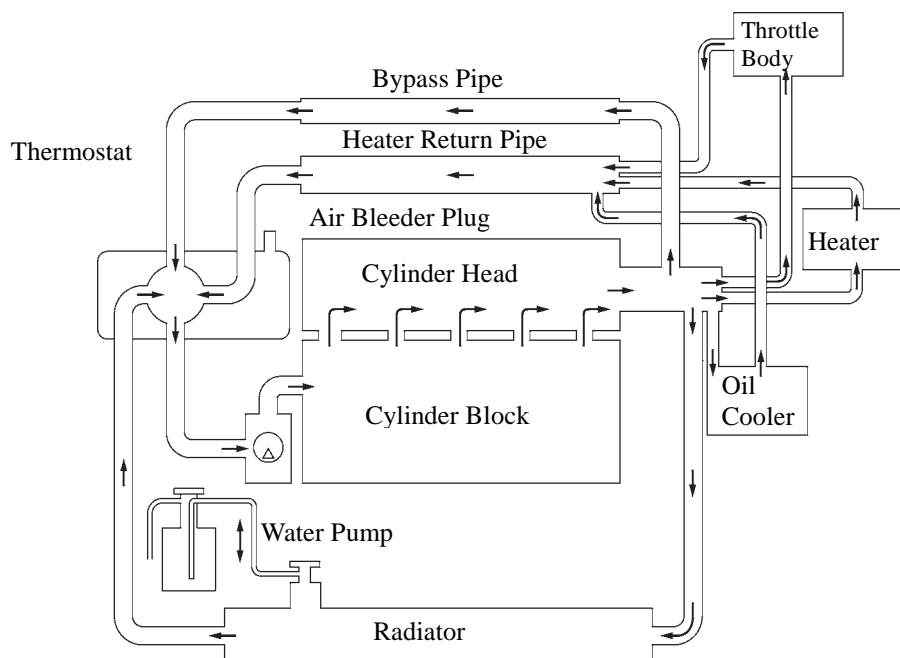
### 1. General

- The cooling system is a pressurised forced circulation system with open air type reserve tank.
- A thermostat with a bypass valve is located on the water inlet housing to maintain suitable temperature distribution in the cooling system.
- A cooling fan control system in which the engine ECU optimally controls cooling fan speed is used. For details, see page EG-67.
- An air bleeder plug is provided on the water inlet assembly to improve the efficiency of changing the engine coolant. For details, refer to the Aurion Repair Manual.
- The engine coolant uses TOYOTA genuine SLLC (Super Long Life Coolant).



02KEG42TE

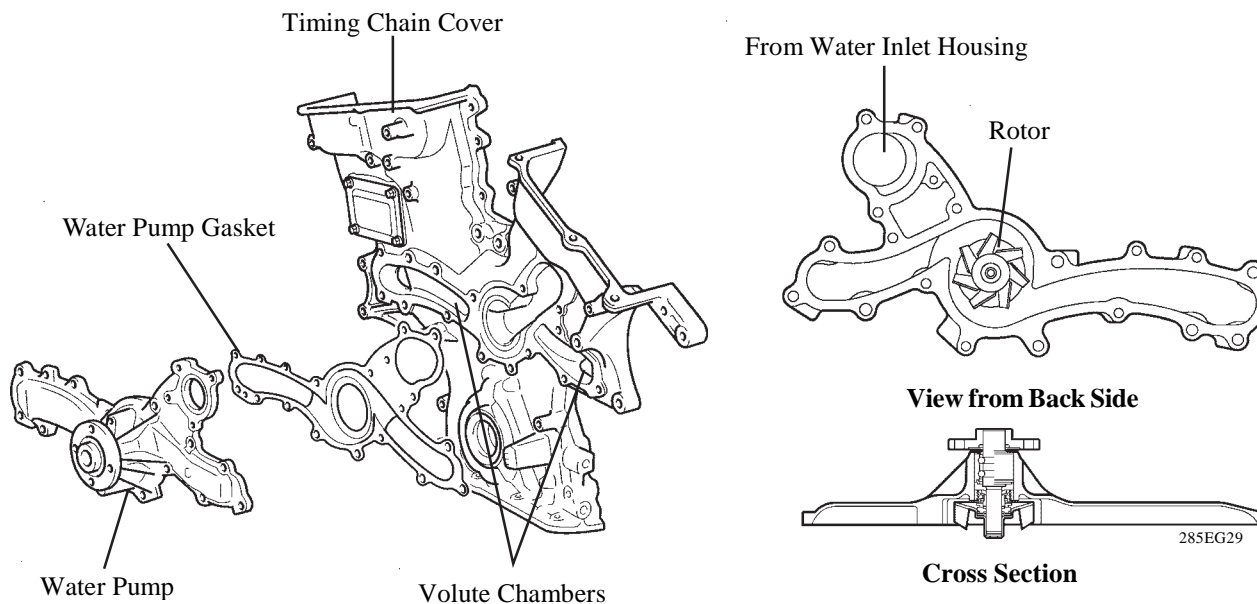
### ▶ Water Circuit ◀



02KEG40Y

## 2. Water Pump

- The water pump has two volute chambers, and circulates coolant uniformly to the left and right banks of the cylinder block.
- A rust-resistant water pump rotor made of stainless steel is used.



## 3. Engine Coolant

- TOYOTA genuine SLLC (Super Long Life Coolant) is used. Maintenance interval is as shown in the table below:

Type		TOYOTA Genuine SLLC or the Following*
Maintenance Intervals	First Time	160,000
	Subsequent	Every 80,000 km
Colour		Pink

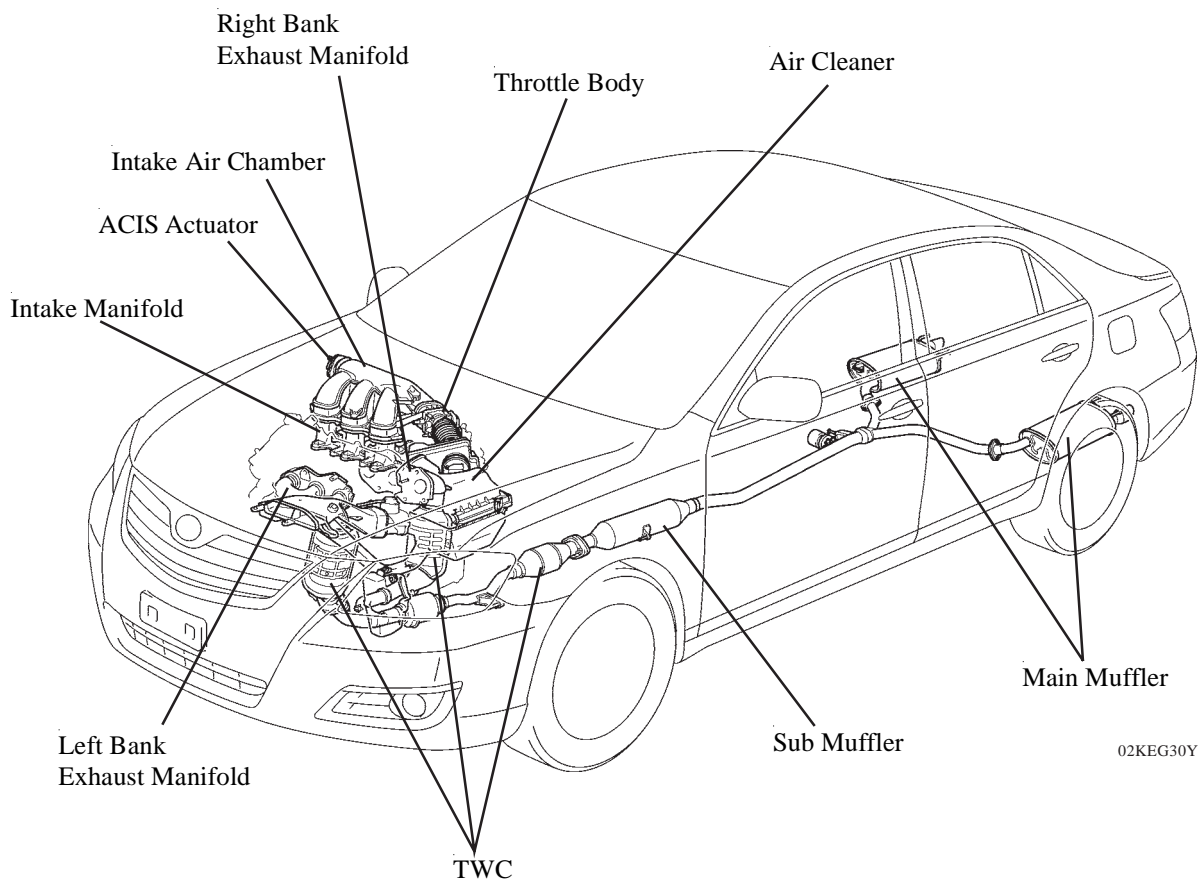
\*: Similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, and non-borate coolant with long-life hybrid organic acid technology. (Coolant with hybrid organic acid technology consists of the combination of low phosphates and organic acids.)

- SLLC is pre-mixed (50 % coolant and 50 % deionized water), so no dilution is needed when adding or replacing SLLC in the vehicle.

## ● INTAKE AND EXHAUST SYSTEM

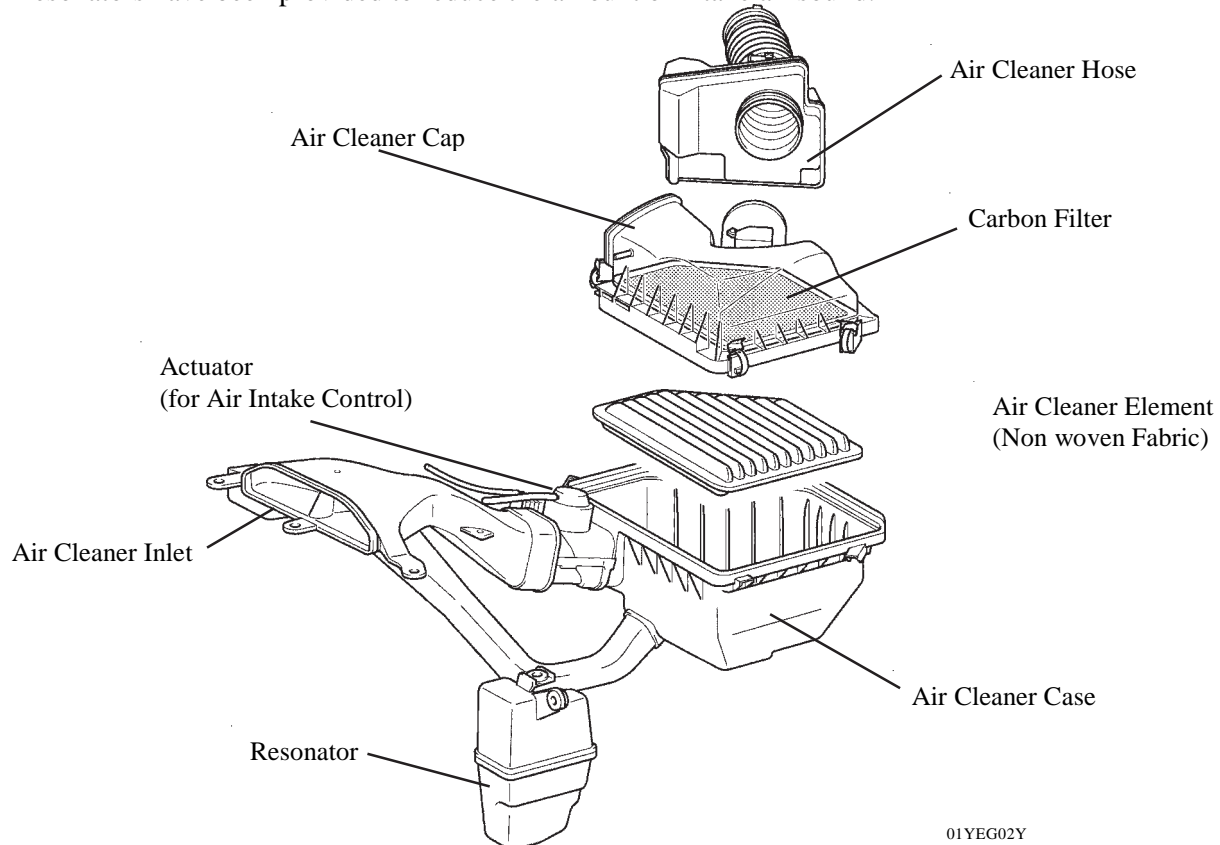
### 1. General

- The link-less type throttle body is used and it realises excellent throttle control.
- The adoption of the ETCS-i has realised excellent throttle control. For details, refer to page EG-55.
- The intake air chamber made of plastic is used.
- A stainless steel exhaust manifold and exhaust pipe are used.
- ACIS has improved the engine performance. For details, see page EG-63.
- The air intake control system is used to reduce engine noise. For details, see page EG-65.



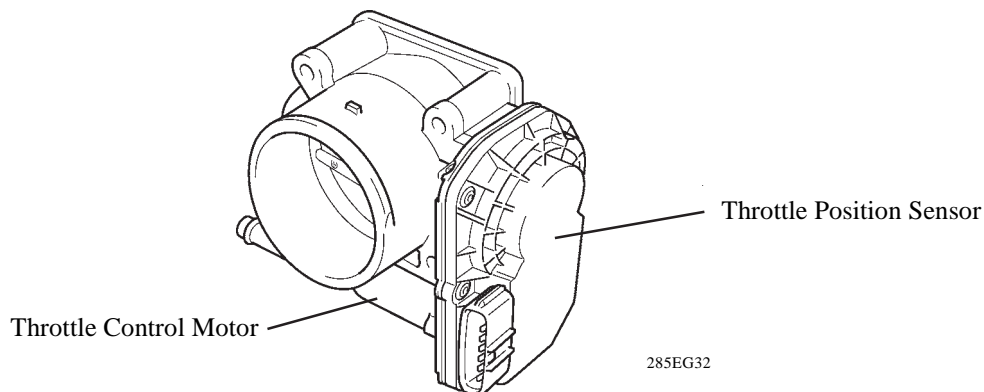
## 2. Air Cleaner

- A non-woven, full-fabric type air cleaner element is used.
- A carbon filter, which adsorbs the HC that accumulates in the intake system when the engine is stopped, is used in the air cleaner case in order to reduce evaporative emissions. This filter is maintenance-free.
- Along with the use of the air intake control system, an air intake control valve is provided on the air cleaner case.
- Resonators have been provided to reduce the amount of intake air sound.



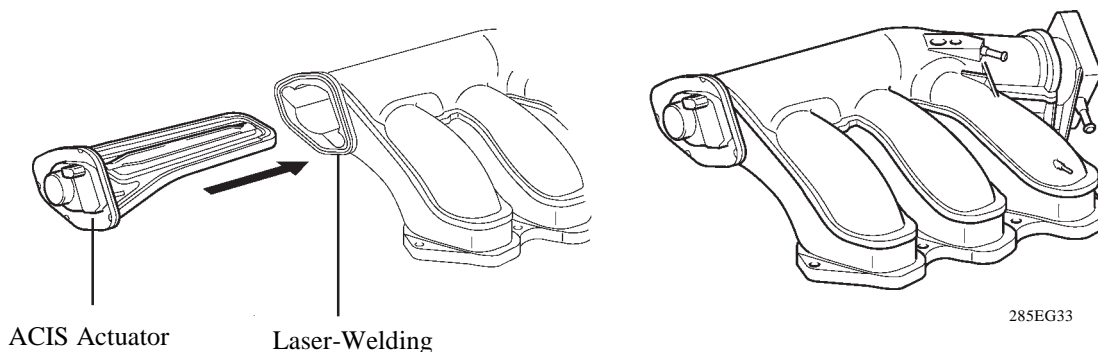
## 3. Throttle Body

- A link-less type throttle body in which the throttle position sensor and the throttle control motor are integrated is used. It realises excellent throttle valve control.
- In the throttle control motor, a DC motor with excellent response and minimal power consumption is used. The engine ECU performs the duty ratio control of the direction and the amperage of the current that flows to the throttle control motor in order to regulate the throttle valve angle.



#### 4. Intake Air Chamber

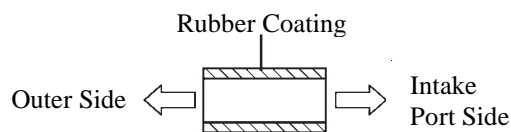
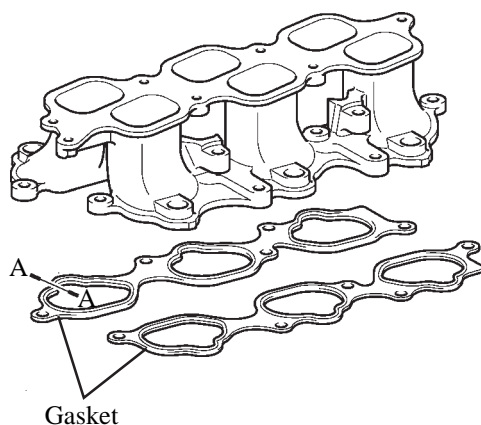
- The intake air chamber is made of plastic to realise lightweight.
- The air intake chamber consists of upper and lower section and contains an intake air control valve. This valve is activated by ACIS and is used to alter the intake pipe length to improve the engine performance in all speed range. For details, see page EG-63.
- The ACIS actuator has used an electric actuator and is laser-welded onto the intake air chamber. Many of the components are made of plastic for weight reduction.



#### — REFERENCE —

##### *Laser-Welding:*

*In laser-welding, a laser-absorbing material (for the intake air chamber) is joined to a laser-transmitting material (for the ACIS actuator). Laser beams are then irradiated from the laser-transmitting side. The beams penetrate the laser-transmitting material to heat and melt the surface of the laser-absorbing material. Then, the heat of the laser-absorbing material melts the laser-transmitting material and causes both materials to become welded.*

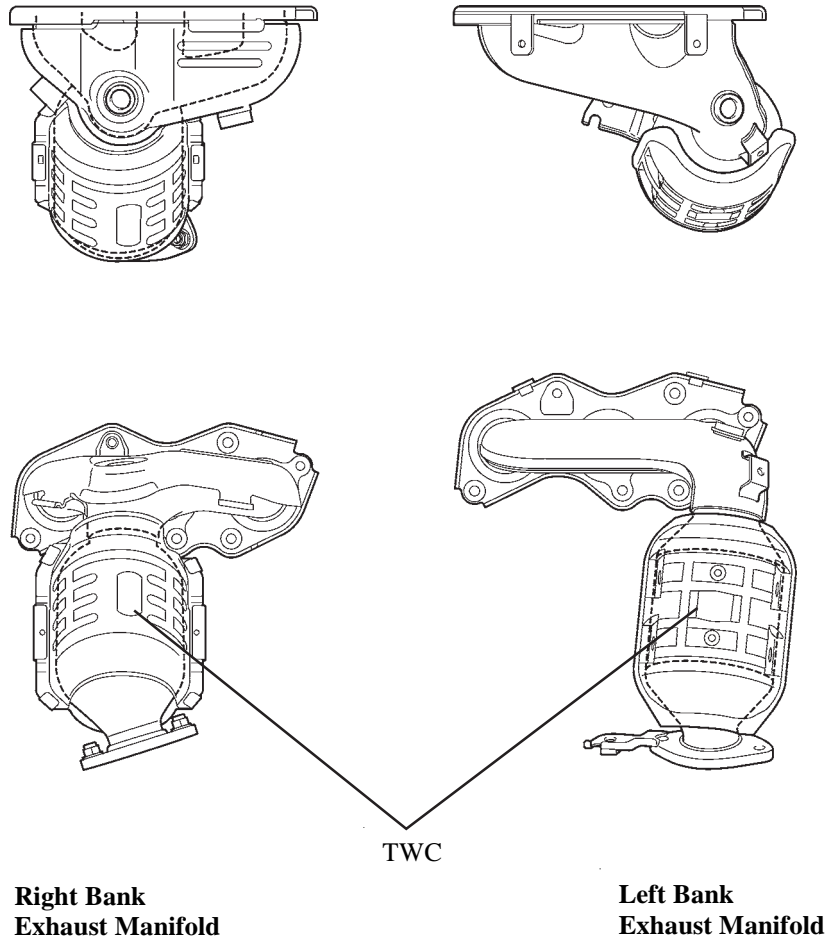


**A A Cross Section**

285EG34

## 6. Exhaust Manifold

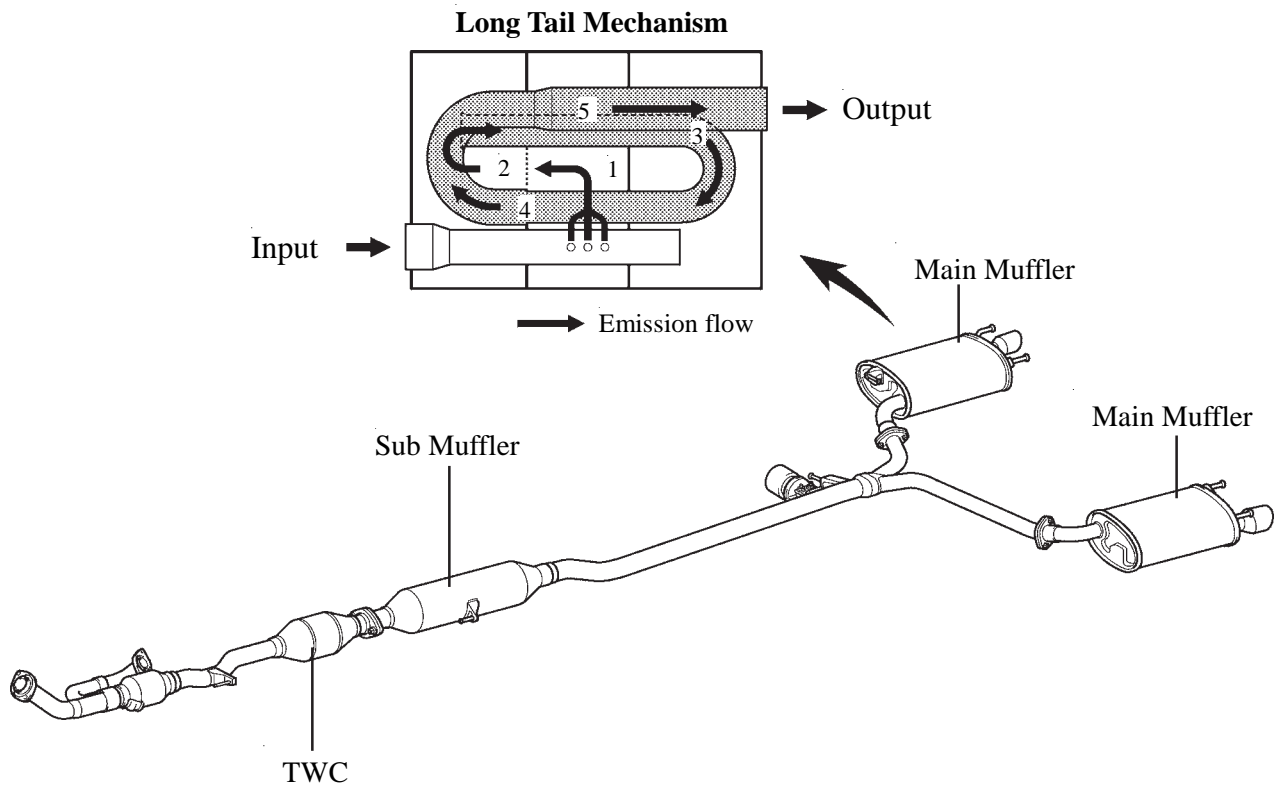
- A stainless steel exhaust manifold with an integrated TWC is used for warm-up of the TWC and for weight reduction.
- A ceramic type TWC is used. This TWC is incorporated on each of the right and left banks.
- This TWC enables to improve exhaust emissions by optimising the cells density and the wall thickness.



01YEG18TE

## 7. Exhaust Pipe

- The exhaust pipe is made of stainless steel for improved rust resistance.
- A ceramic type TWC is used.
- A dual main muffler is used to ensure engine performance and reduce exhaust noise.
- A long tail mechanism is used in the main muffler to aim at reducing exhaust noise while the engine is running in the low speed range.



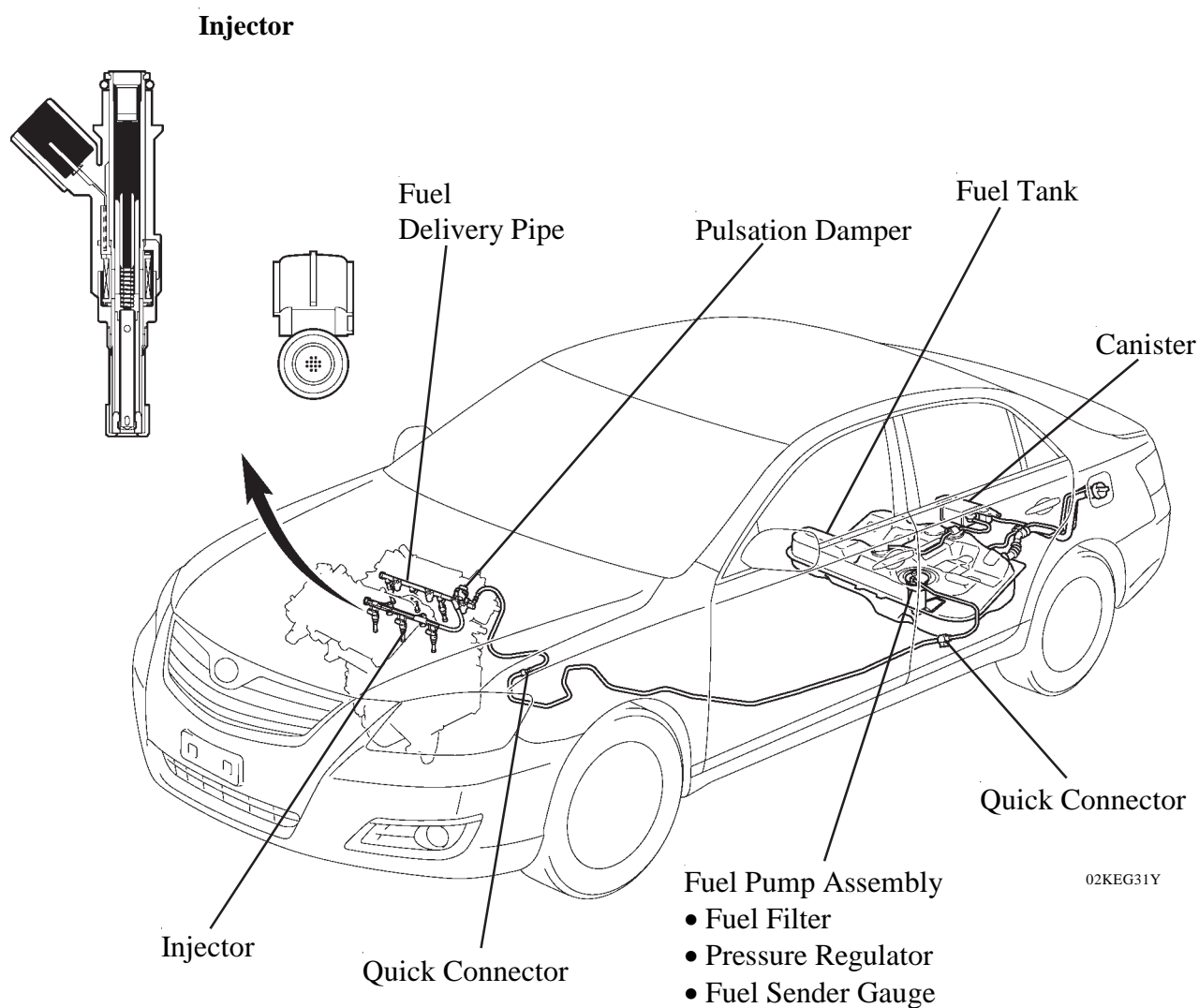
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## ● FUEL SYSTEM

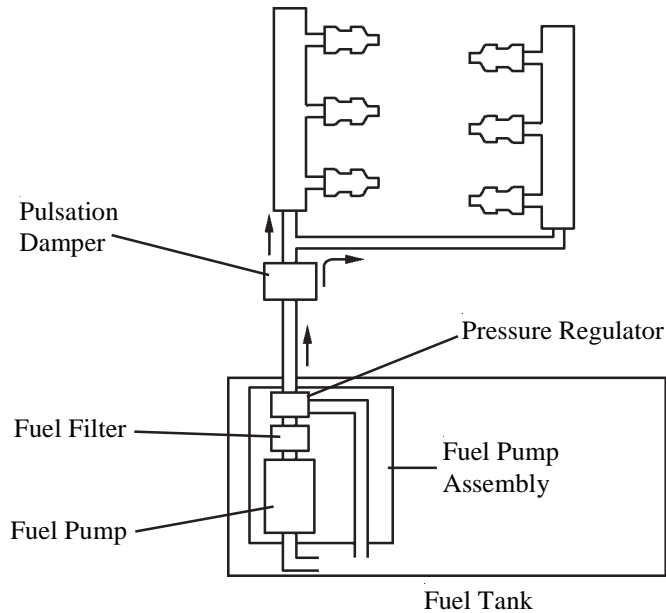
### 1. General

- The fuel return less system is used to reduce evaporative emissions.
- A fuel cut control is used to stop the fuel pump when the SRS airbag is deployed in a frontal or side collision. For details, see page EG-66.
- The fuel delivery pipe made of plastic is used.
- A quick connector is used to connect the fuel pipe with the fuel hose for excellent serviceability.
- A compact 12-hole type injector is used to increase atomization of the fuel.
- A compact fuel pump in which a fuel filter, pressure regulator, and fuel sender gauge is integrated in the fuel pump assembly is used.



## 2. Fuel Return less System

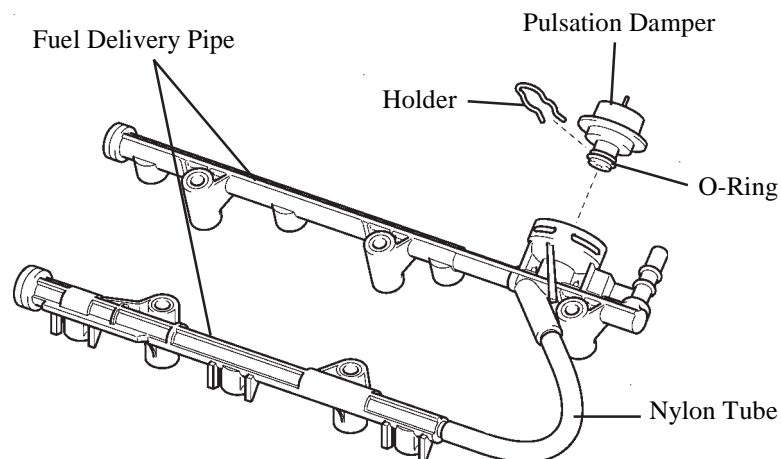
This system is used to reduce the evaporative emission. As shown below, integrating the fuel filter, pressure regulator, and fuel sender gauge with fuel pump assembly, it is possible to discontinue the return of fuel from the engine area and prevent temperature rise inside the fuel tank.



208EG117

## 3. Fuel Delivery Pipe

- The fuel delivery pipe made of plastic is used to realise lightweight.
- The right and left fuel delivery pipes are connected by a nylon tube.
- The pulsation damper is sealed with an O-ring and secured with a holder.



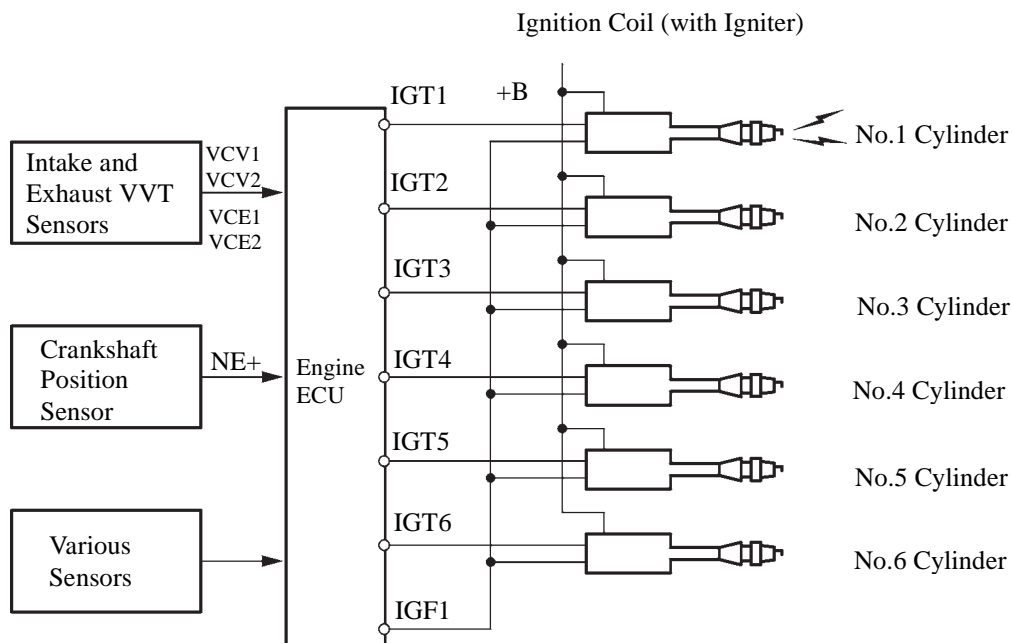
285EG38

## ● IGNITION SYSTEM

### 1. General

A DIS (Direct Ignition System) is used. The DIS improves the ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor.

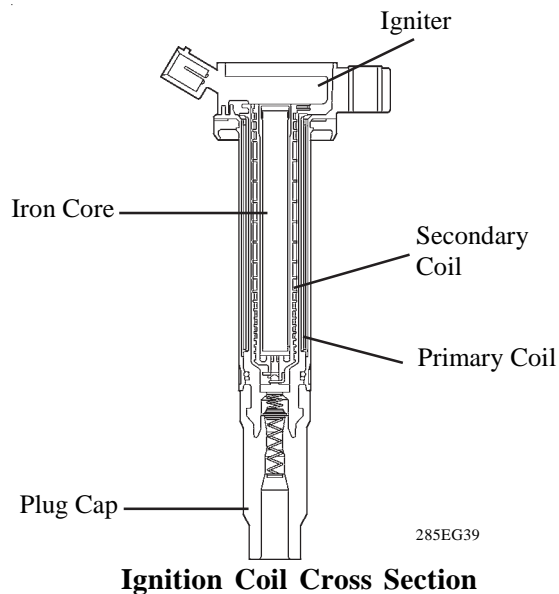
The DIS is an independent ignition system which has one ignition coil (with igniter) for each cylinder.



238EG68

### 2. Ignition Coil

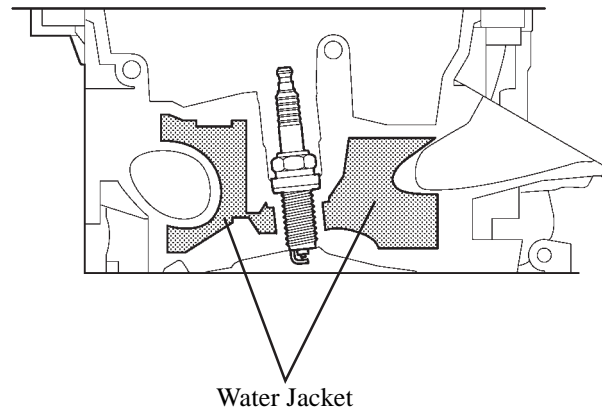
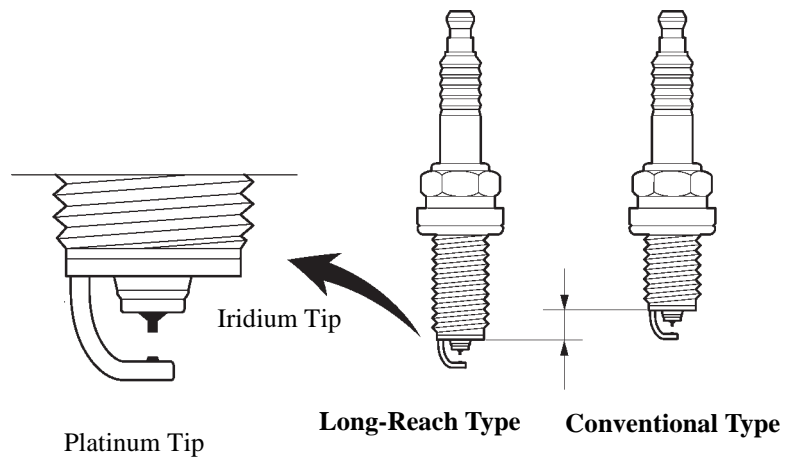
The DIS provides 6 ignition coils, one for each cylinder. The spark plug caps, which provide contact to spark plugs, are integrated with an ignition coil. Also, an igniter is enclosed to simplify the system.



285EG39

### 3. Spark Plug

- Long-reach type spark plugs are used. This type of spark plugs allows the area of the cylinder head to receive the spark plugs to be made thick. Thus, the water jacket can be extended near the combustion chamber, which contributes to cooling performance.
- Iridium-tipped spark plugs are used to achieve a 100,000 km maintenance interval. By making the centre electrode of iridium, the superior ignition performance as platinum-tipped spark plugs is achieved and durability has been increased.



285EG40

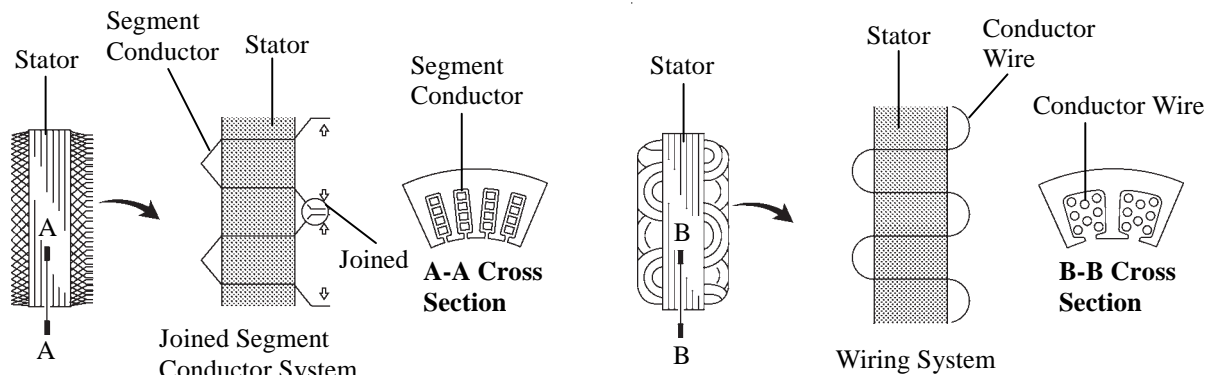
#### ► Specifications ◀

Maker	DENSO
Type	FK20HR11
Plug Gap	1.0 - 1.1 mm

## ● CHARGING SYSTEM

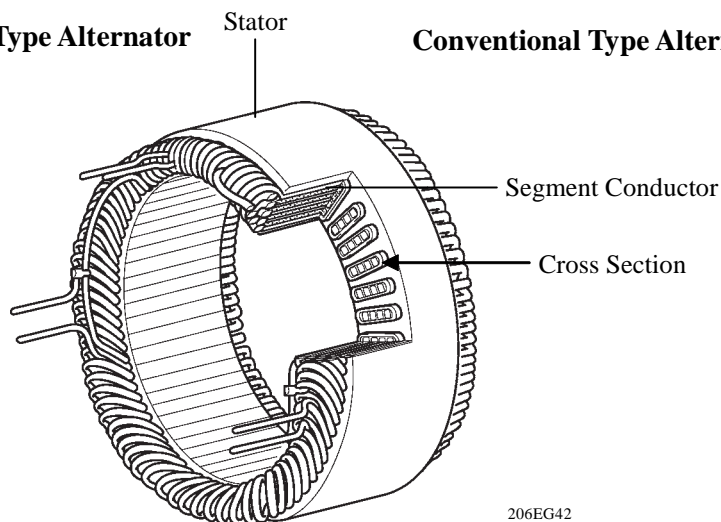
### 1. General

- Instead of the conventional type alternator, a compact and lightweight segment conductor type alternator (SE0 type) that generates a high amperage output (100 A) in a highly efficient manner is used.
- This alternator uses a joined segment conductor system, in which multiple segment conductors are welded together to the stator. Compared to the conventional winding system, the electrical resistance is reduced due to the shape of the segment conductors, and their arrangement helps to make the alternator more compact.



Segment Conductor Type Alternator

Conventional Type Alternator

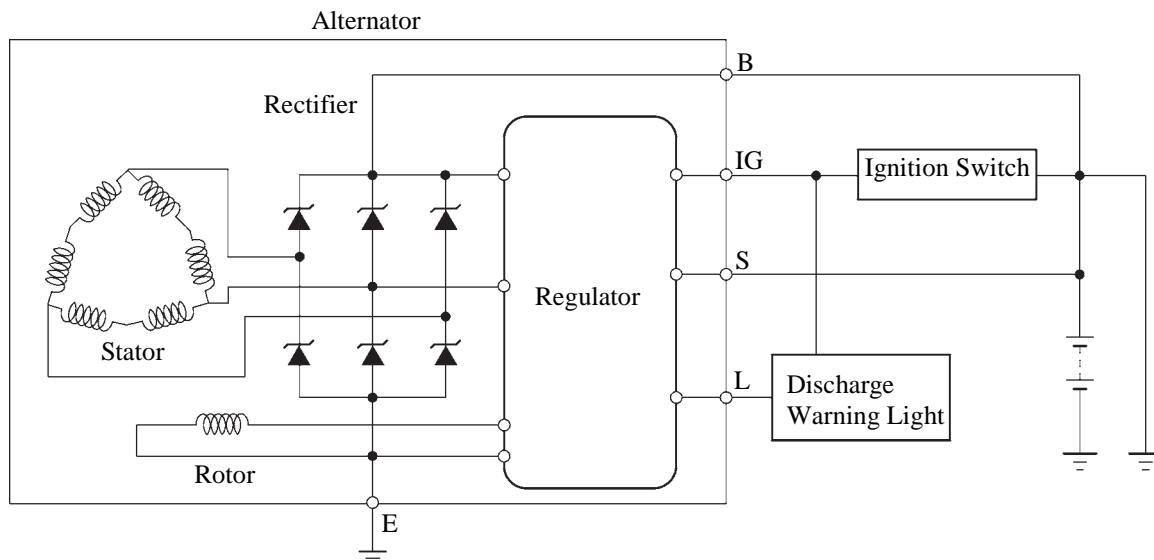


Stator of Segment Conductor Type Alternator

Type	SE0
Rated Voltage	12V
Output Rated	100 A

## ▸ Wiring Diagram ◀

- An alternator pulley with a clutch is used.

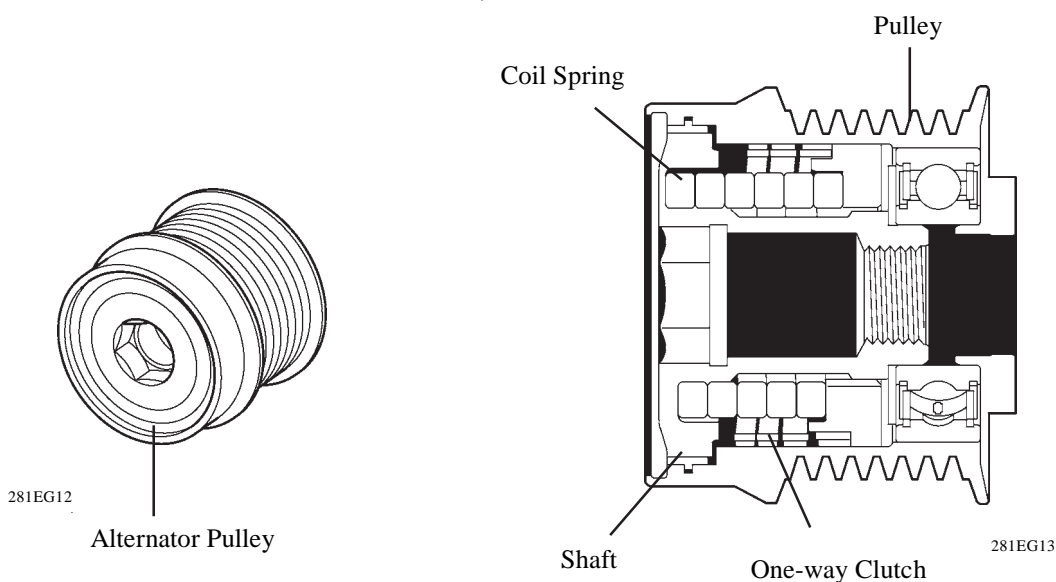


### Service Tip

Although the charging circuit of a conventional alternator is checked through the F terminal, this check cannot be performed on the Segment Conductor type alternator through the use of the F terminal because the F terminal has been eliminated. For details, refer to the Aurion Repair Manual.

## 2. Alternator Pulley

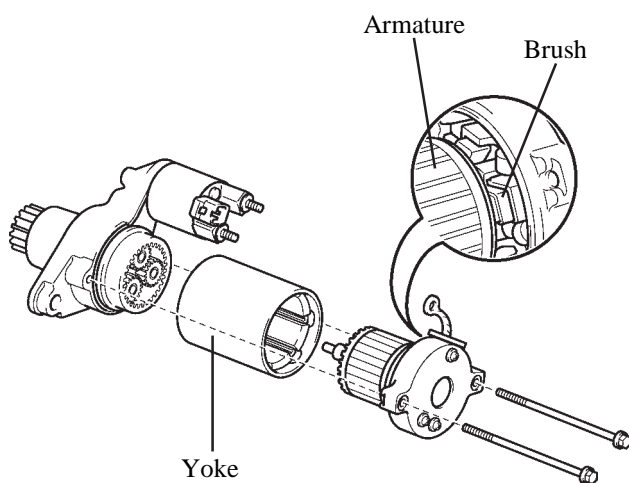
A one-way clutch is set to the alternator pulley. Operation of the one-way clutch cancels alternator pulley inertia and helps to prevent slipping of the V-ribbed belt. This realises a low tension V-ribbed belt that achieves reduced friction.



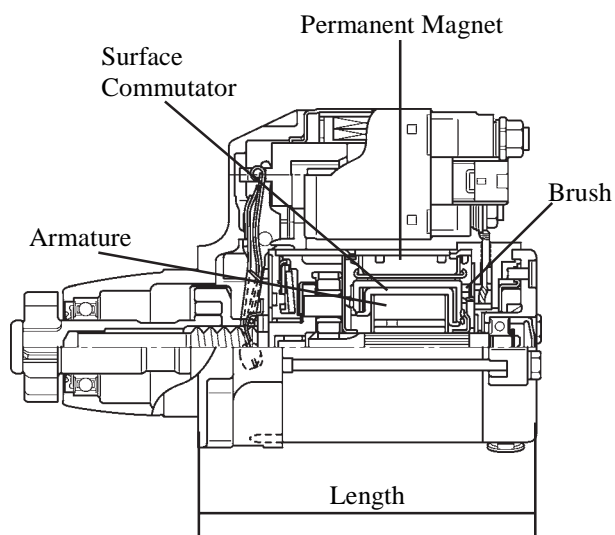
## ✿ STARTING SYSTEM

### 1. General

- A compact and lightweight PS (Planetary reduction - Segment conductor motor) type starter (PS1.7 type) is used as standard equipment on all models.
- The PS starter contains an armature that uses square-shaped conductors and its surface functions as a commutator, resulting in improved output torque and overall length reduction.
- In place of the field coil used in the conventional starter, the PS starter uses two types of permanent magnets: main magnets and interpolar magnets. The main magnets and interpolar magnets have been efficiently arranged to increase the magnetic flux and to shorten the length of the yoke.



206EG18



206EG19

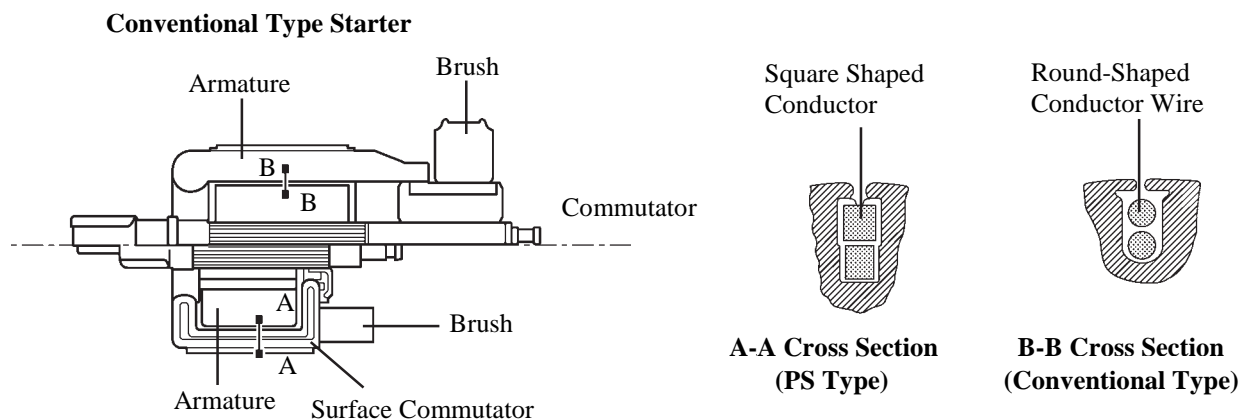
### ► Specifications ◀

Type	PS1.7
Length	128 mm
Weight	2950 g
Rating Voltage	12V
Rating Output	1.7 kW
Rotating Direction	Counter clockwise*

\*: Viewed from Pinion Side

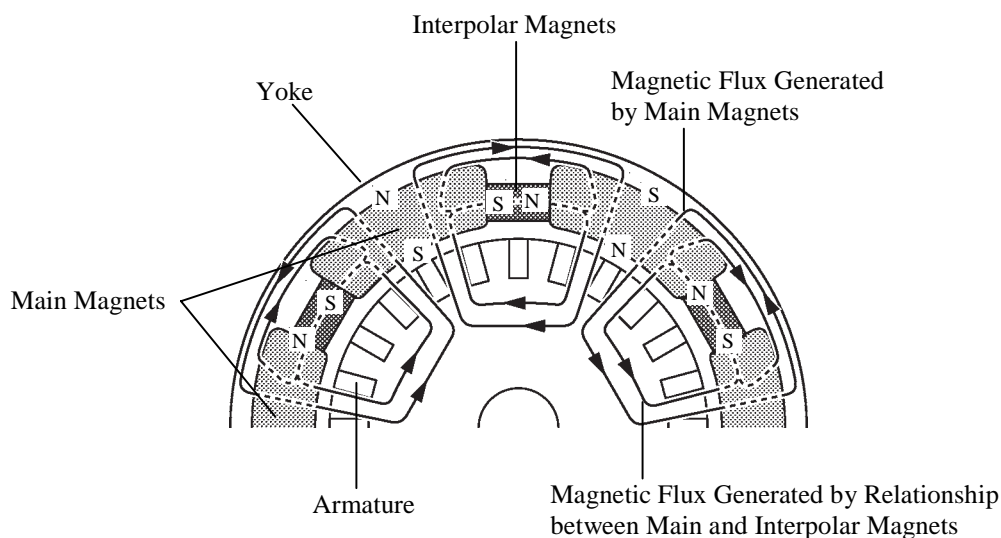
## 2. Construction

- Instead of the round-shaped conductor wires used in the conventional starter, the PS type starter uses square-shaped conductors. In this type of construction, square-shaped conductors can achieve the same conditions as those achieved by winding numerous round-shaped conductor wires, but without increasing the mass. As a result, the output torque is increased, and the armature coil is more compact.
- Because the surface of the square-shaped conductors that are used in the armature coil functions as a commutator, the overall length of the PS type starter has been shortened.



206EG20

- Instead of the field coils used in the conventional starter, the PS type starter uses two types of permanent magnets: the main magnets and the interpolar magnets. The main and interpolar magnets are arranged alternately inside the yoke. This allows the magnetic flux generated between the main and interpolar magnets to be added to the magnetic flux generated by the main magnets. In addition to increasing the amount of magnetic flux, this construction shortens the overall length of the yoke.



**Cross Section of Yoke Portion**

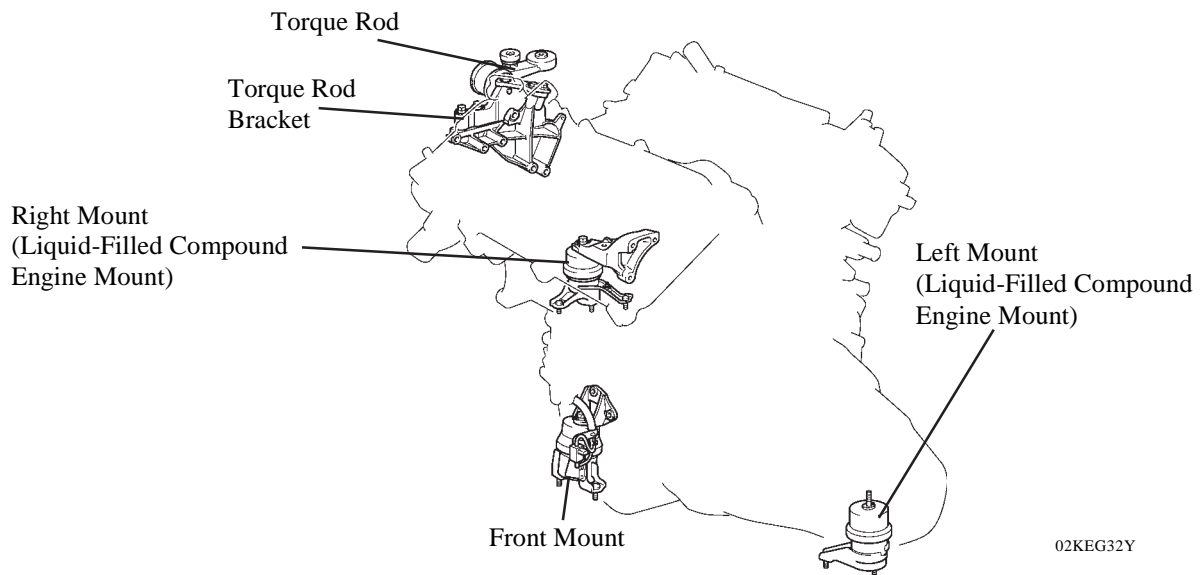
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## ✿ ENGINE MOUNT

### 1. General

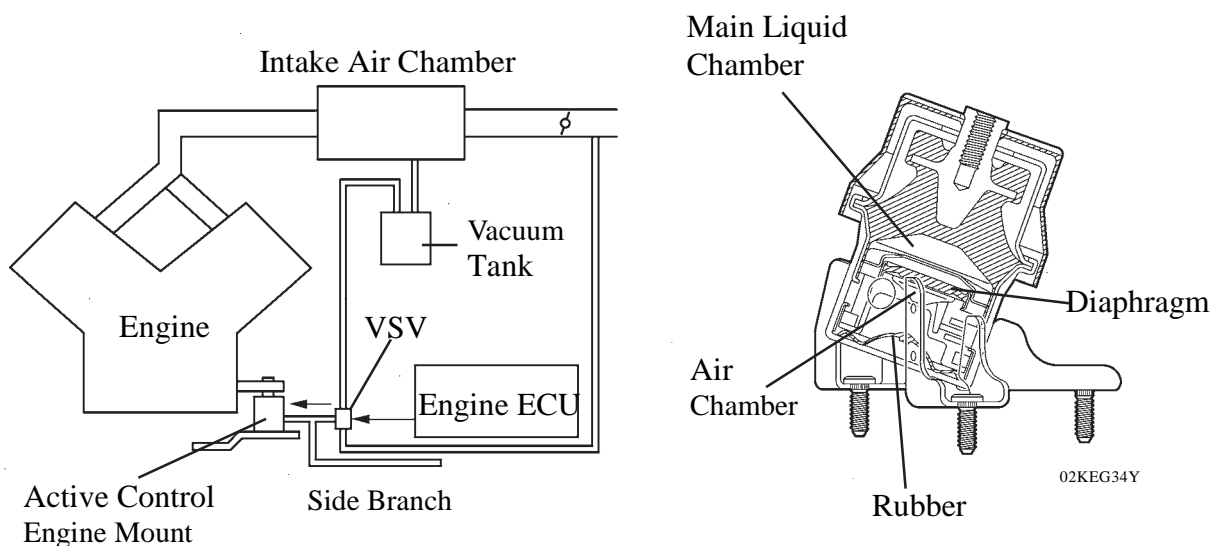
- A 3-point support on the front sub-frame is used.
- An active control engine mount is used on the front engine mount and a liquid-filled compound engine mount is used on the right and left engine mounts to realise low noise and vibration and to achieve high levels of both riding comfort and drivability.
- The Aurion uses a vacuum type active control engine mounts.



**Vacuum Type Active Control Engine Mount**

## 2. Vacuum Type Active Control Engine Mount

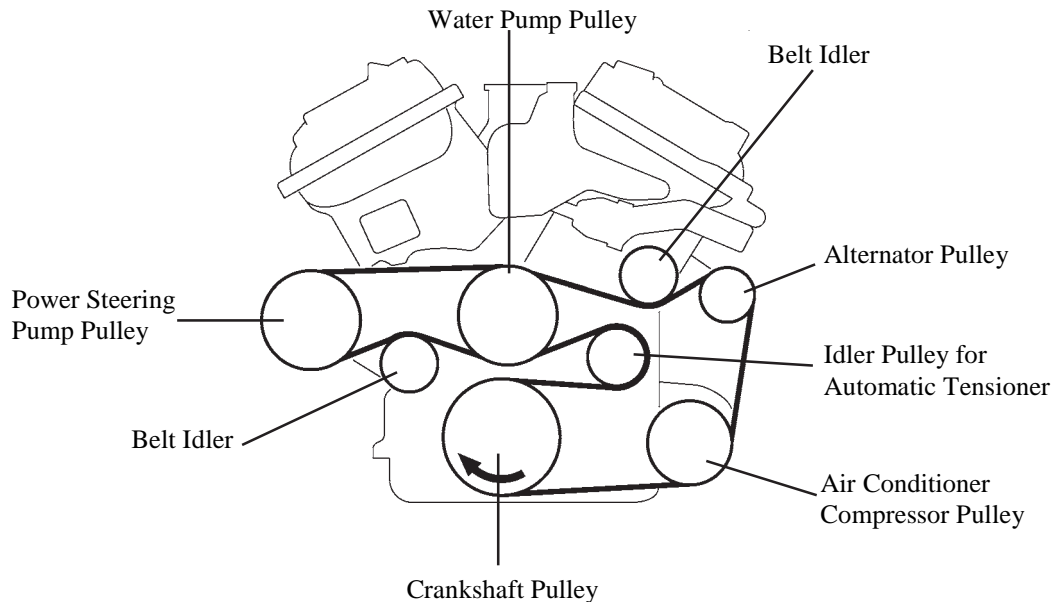
- The vacuum type active control engine mount is used to reduce engine vibration and noise during idling.
- Signals that are synchronized to the engine speed are sent by the engine ECU to the VSV and the engine vacuum is utilised to vary the pressure of the intake air chamber in the active control engine mount. As a result, the diaphragm vibrates, and using the liquid as a medium, the rubber mount vibrates. This vibration of the engine mount acts to cancel out the engine vibration during idle, thus reducing the vibration and noise at idle. The engine mount's damping force to generate vibrations is adjusted through the effects of the orifice and the side branch.



## SERPENTINE BELT DRIVE SYSTEM

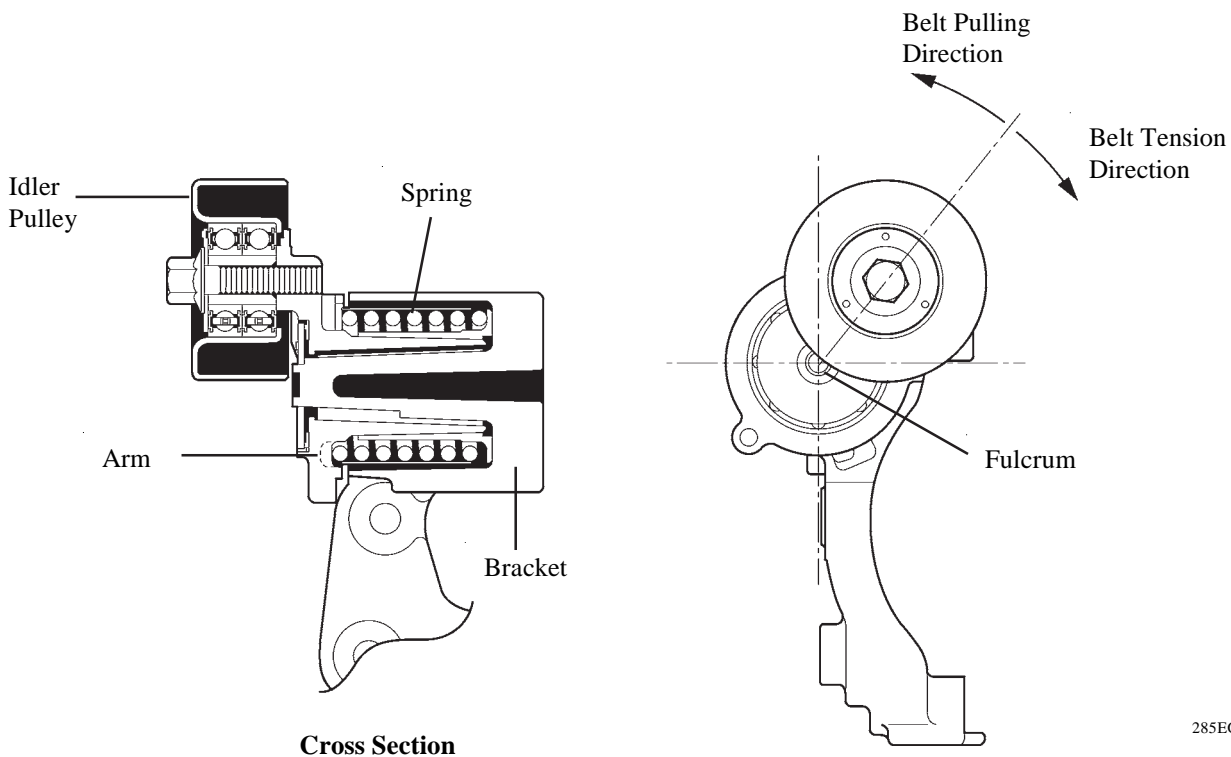
### 1. General

- Accessory components are driven by a serpentine belt consisting of a single V-ribbed belt. It reduces the overall engine length, weight and number of engine parts.
- An automatic tensioner eliminates the need for tension adjustment.



### 2. Automatic Tensioner

The tension of the V-ribbed belt is properly maintained by the tension spring that is enclosed in the automatic tensioner.



## ENGINE CONTROL SYSTEM

### 1. General

The engine control system of the 2GR-FE engine has the following features.

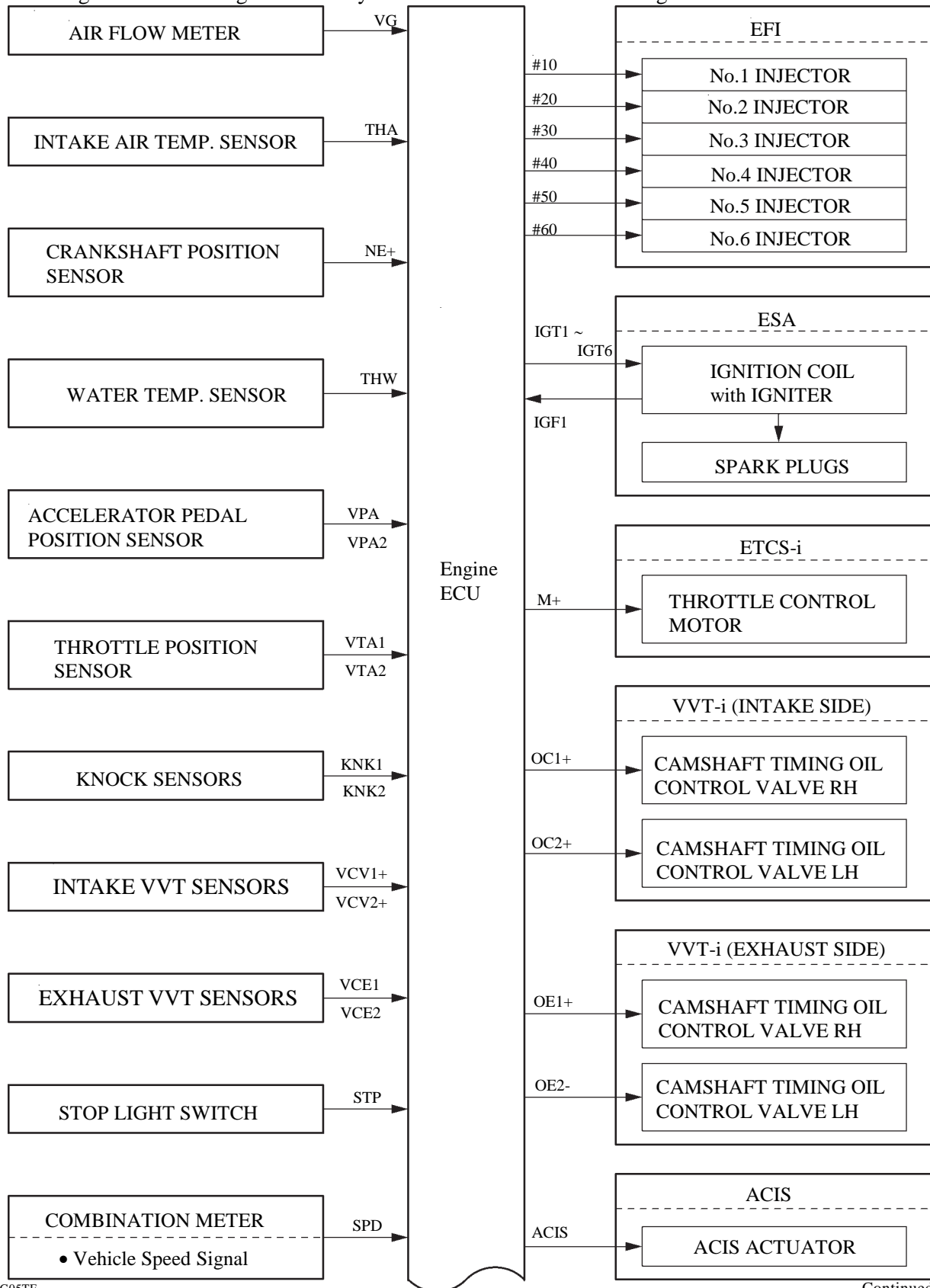
System	Outline
EFI (Electronic Fuel Injection)	<ul style="list-style-type: none"> <li>• An L-type EFI system directly detects the intake air mass with a hot wire type air flow meter.</li> <li>• The fuel injection system is a sequential multi-port fuel injection system.</li> <li>• Fuel injection takes two forms: Synchronous injection, which always takes place with the same timing in accordance with the basic injection duration and an additional correction based on the signals provided by the sensors. Non-synchronous injection, which takes place at the time an injection request based on the signals provided by the sensors, is detected, regardless of the crankshaft position.</li> <li>• Synchronous injection is further divided into group injection during a cold start, and independent injection after the engine is started.</li> </ul>
ESA (Electronic Spark Advance)	<ul style="list-style-type: none"> <li>• Ignition timing is determined by the engine ECU based on signals from various sensors. The engine ECU corrects ignition timing in response to engine knocking.</li> <li>• This system selects the optimal ignition timing in accordance with the signals received from the sensors and sends the (IGT) ignition signal to the igniter.</li> </ul>
ETCS-i (Electronic Throttle Control System-intelligent) [See page EG-55]	Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle.
Dual VVT-i (Dual Variable Valve Timing-intelligent) [See page EG-57]	Controls the intake and exhaust camshafts to optimal valve timing in accordance with the engine condition.
ACIS (Acoustic Control Induction System) [See page EG-63]	The intake air passages are switched according to the engine speed and throttle valve opening angle to provided high performance in all speed ranges.
Air Intake Control System [See page EG-65]	The intake air duct is divided into two areas, and the engine ECU controls the air intake control valve and the actuator that are provided in one of the areas to reduce the amount of engine noise.
Fuel Pump Control [See page EG-66]	<ul style="list-style-type: none"> <li>• Fuel pump operation is controlled by signals from the engine ECU.</li> <li>• The fuel pump is stopped, when the SRS airbag is deployed in a frontal, side, and rear of side collision.</li> </ul>

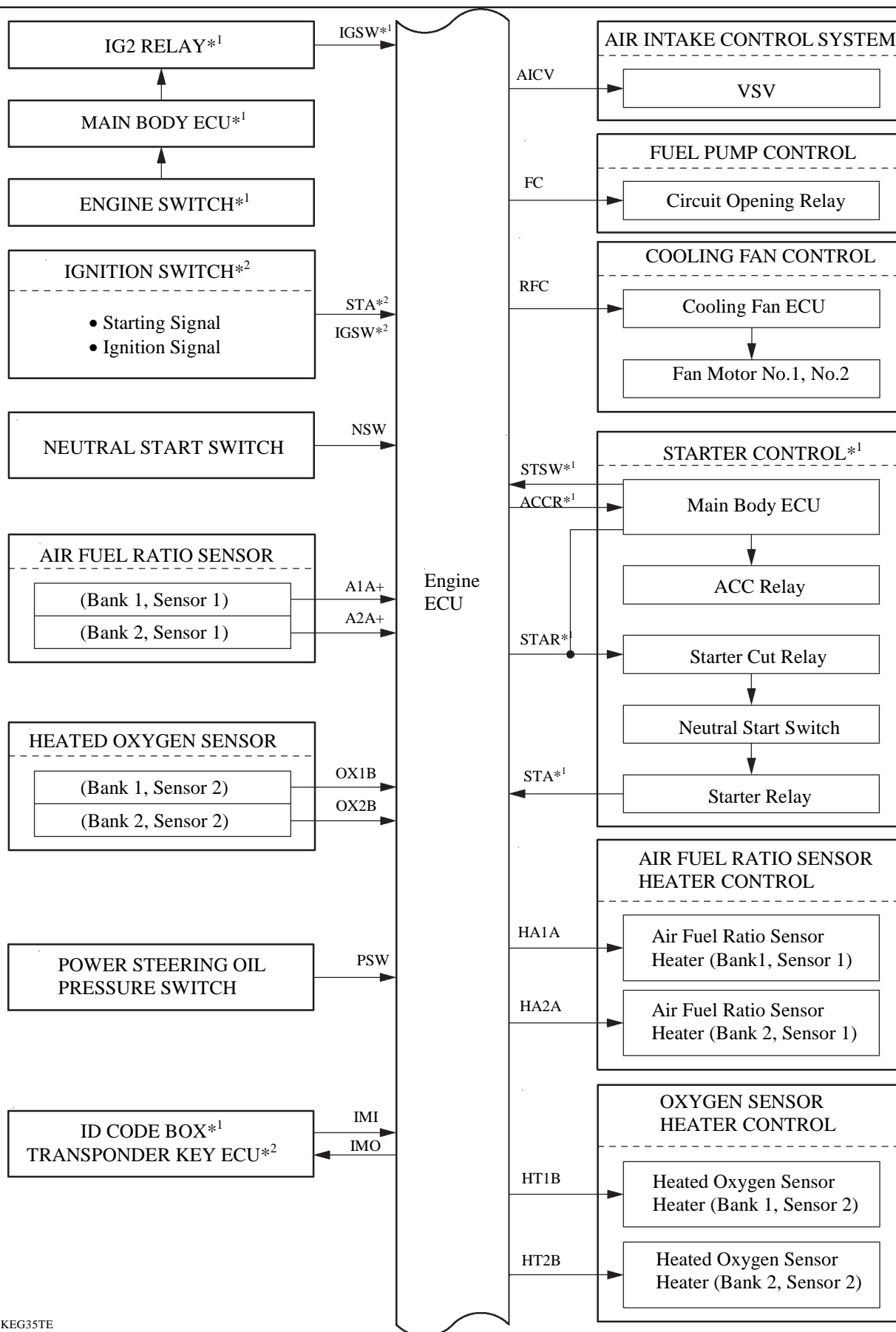
System	Outline
Air Conditioner Cut-off Control	By turning the air conditioner compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Cooling Fan Control [See page EG-67]	The Cooling Fan ECU linearly controls the speed of the fans in accordance with the engine coolant temperature, vehicle speed, engine speed, and air conditioner operating conditions. As a result, the cooling performance is improved.
Starter Control* (Cranking Hold Function) [See page EG-69]	<ul style="list-style-type: none"> <li>Once the engine switch is pushed, while the brake pedal is depressed, this control continues to operate the starter until the engine started.</li> </ul>
Air Fuel Ratio Sensor and Oxygen Sensor Heater Control	Maintains the temperature of the air fuel ratio sensor or oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emission (HC) in the canister in accordance with engine conditions.
Active Control Engine Mount [See page EG-34]	The damping characteristic of the front engine mount is controlled variably to reduce idling vibration.
Engine Immobiliser	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid key.
Diagnosis [See page EG-71]	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorises the failed section.
Fail-Safe [See page EG-71]	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.

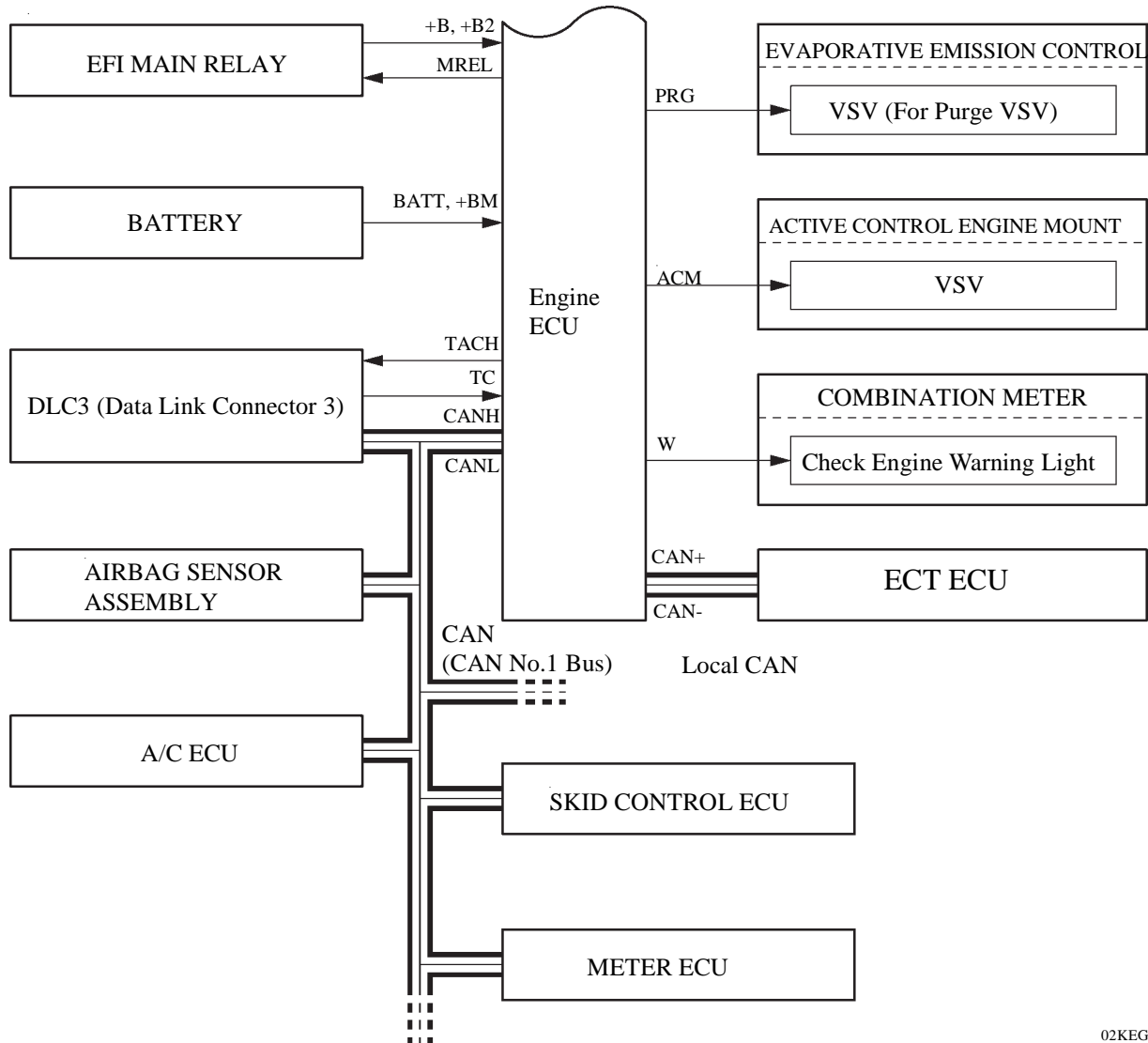
\*: Only for models with smart entry and start system

## 2. Construction

The configuration of the engine control system is as shown in the following chart.







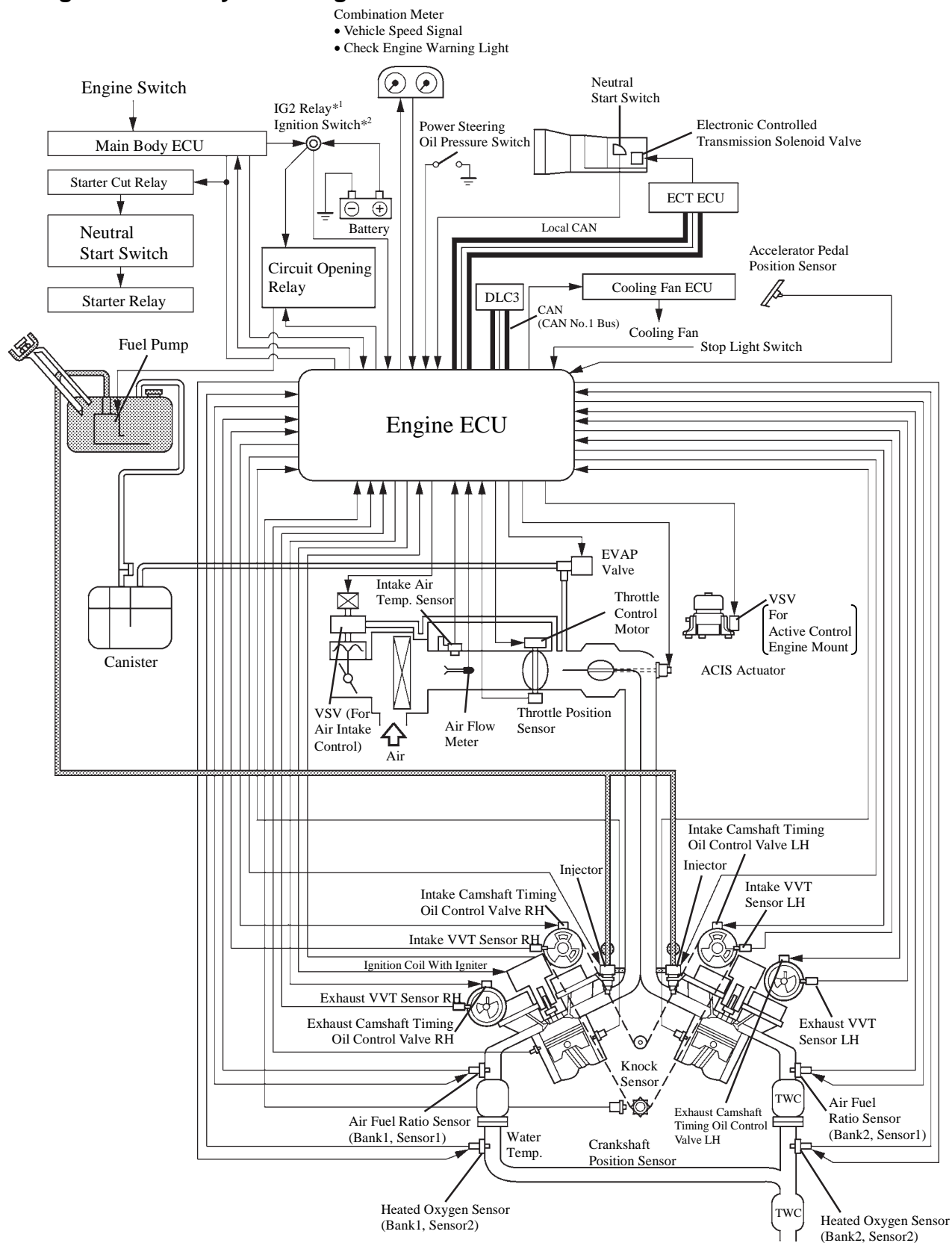
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\*1: Only for models with smart entry and start system

\*2: Only for models without smart entry and start system



### 3. Engine Control System Diagram



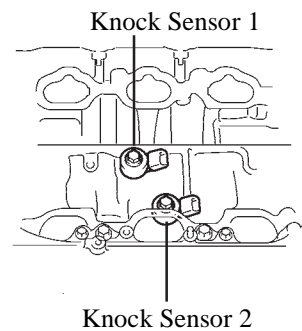
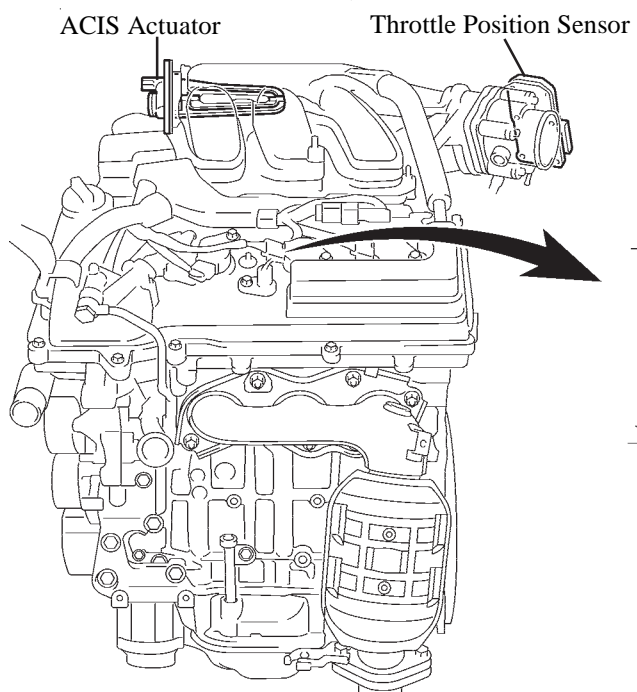
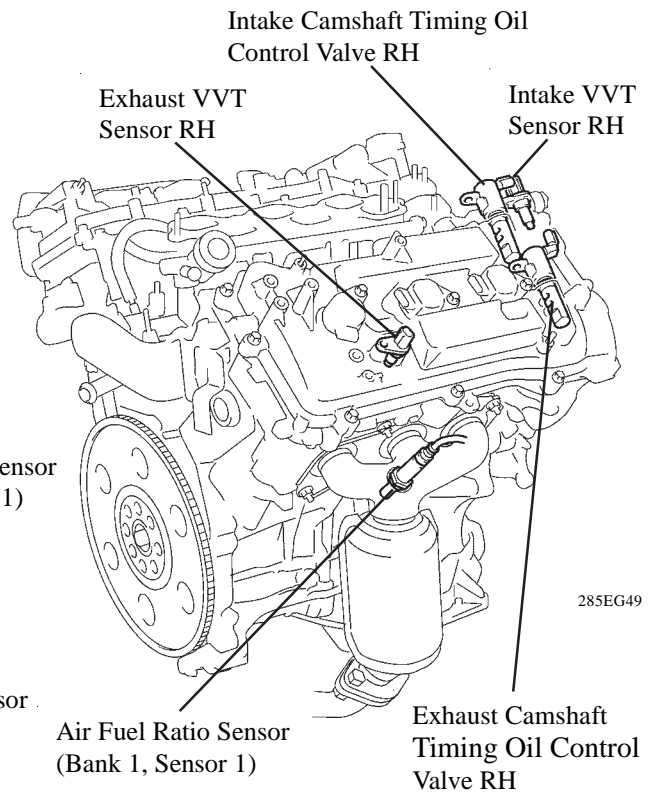
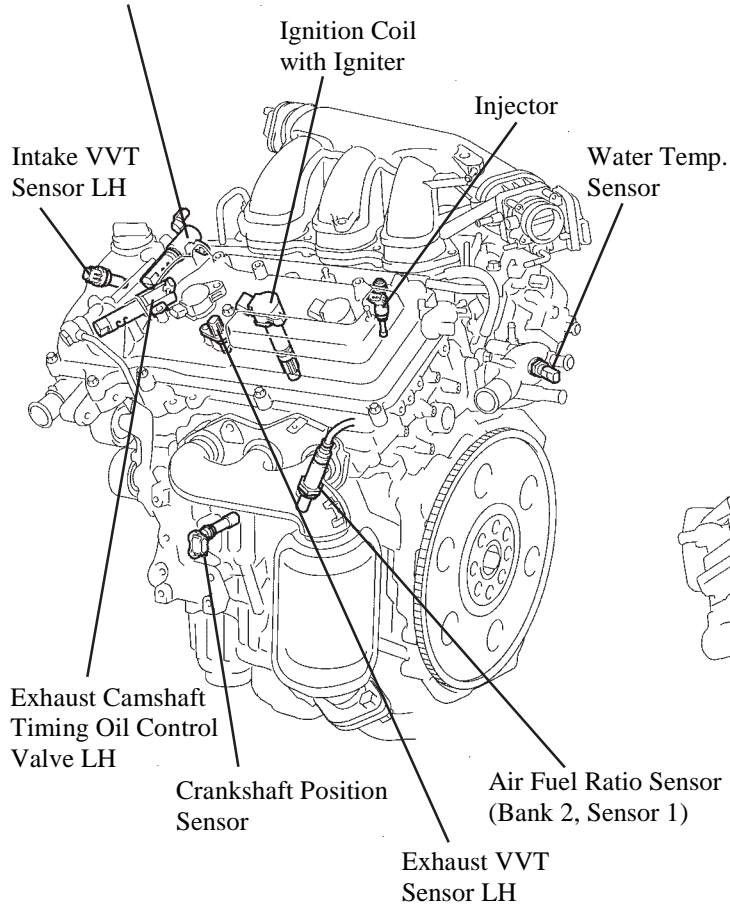
\*<sup>1</sup>: Only for models with smart entry and start system

\*<sup>2</sup>: Only for models without smart entry and start system

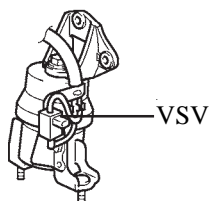
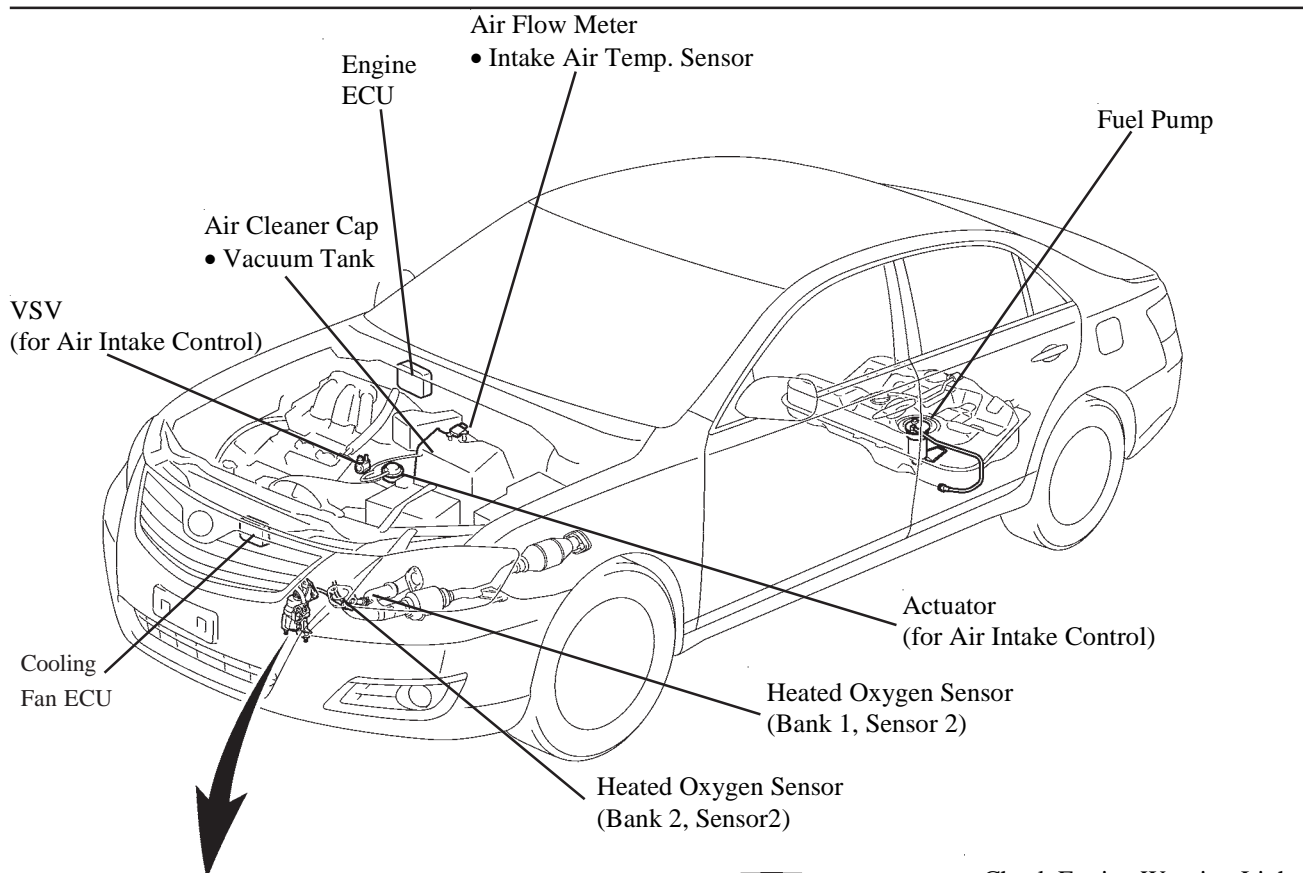
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## 4. Layout of Main Components

Intake Camshaft Timing Oil  
Control Valve LH

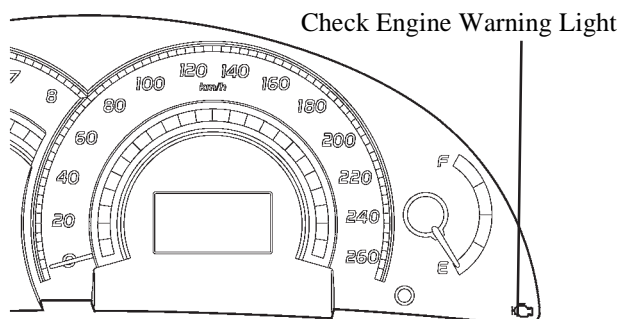


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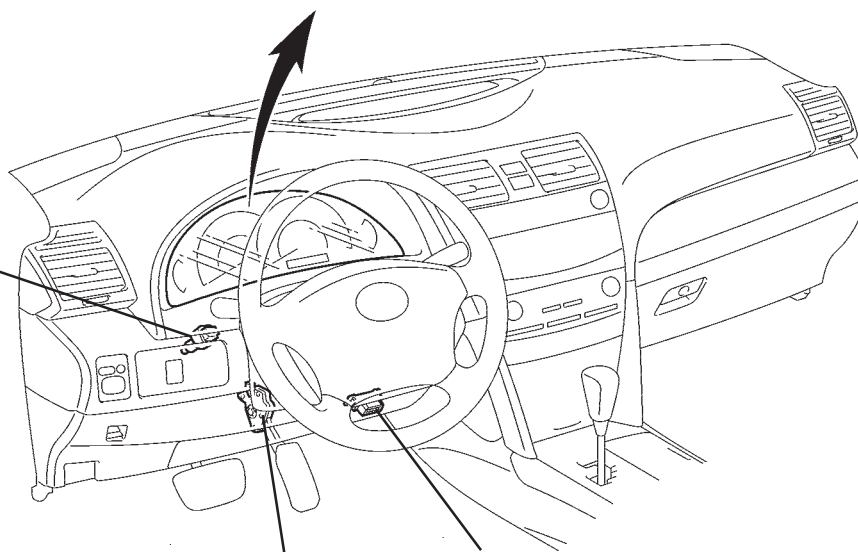


Vacuum Type

**Active Control Engine Mount**



Stop Light Switch



Accelerator Pedal  
Position Sensor

DLC3

## 5. Main Component of Engine Control System

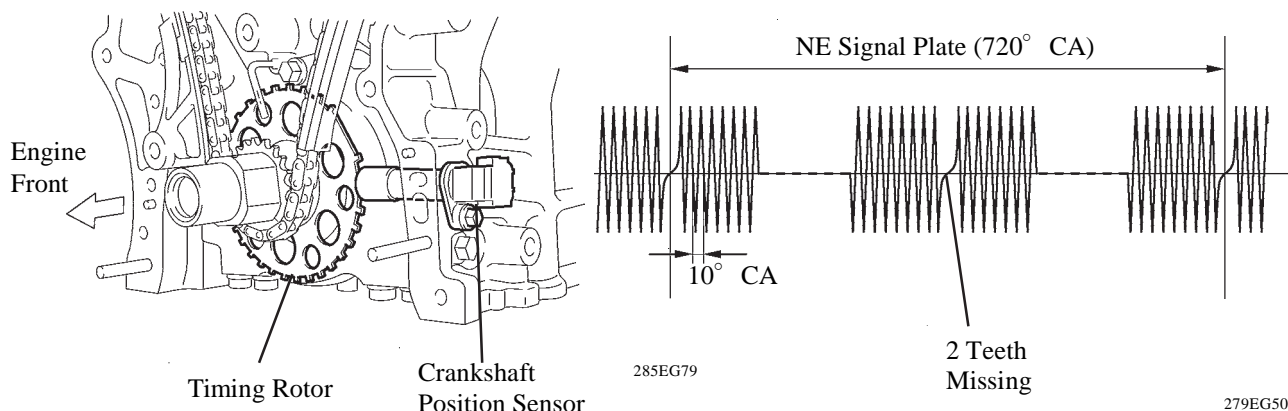
### General

The main components of the 2GR-FE engine control system are as follows:

Components	Outline	Qty	Function
Engine ECU	32-bit CPU	1	The engine ECU optimally controls the EFI ESA and ISC to suit the operating conditions of the engine in accordance with the signals provided by the sensors.
Oxygen Sensor (Bank 1, Sensor 2) (Bank 2, Sensor 2)	Cup Type with Heater	2	<ul style="list-style-type: none"> <li>This sensor detects the oxygen concentration in the exhaust emission by measuring the electromotive force which is generated in the sensor itself.</li> </ul>
Air Fuel Ratio Sensor (Bank 1, Sensor 1) (Bank 2, Sensor 1)	Planar Type with Heater	2	<ul style="list-style-type: none"> <li>As with the oxygen sensor, this sensor detects the oxygen concentration in the exhaust emission. However, it detects the oxygen concentration in the exhaust emission linearly.</li> </ul>
Air Flow Meter	Hot-wire Type	1	<ul style="list-style-type: none"> <li>This sensor has a built-in hot-wire to directly detect the intake air mass.</li> </ul>
Crankshaft Position Sensor (Rotor Teeth)	Pick-up Coil Type (36-2)	1	This sensor detects the engine speed and performs the cylinder identification.
Intake VVT Sensor LH, RH (Rotor Teeth)	MRE Type (3)	2	This sensor performs the cylinder identification.
Exhaust VVT Sensor LH, RH (Rotor Teeth)	MRE Type (3)	2	This sensor performs the cylinder identification.
Water Temperature Sensor	Thermistor Type	1	This sensor detects the engine coolant temperature by means of an internal thermistor.
Intake Air Temperature Sensor	Thermistor Type	1	This sensor detects the intake air temperature by means of an internal thermistor.
Knock Sensor 1,2	Built-in Piezoelectric Type (Flat Type)	2	This sensor detects an occurrence of the engine knocking indirectly from the vibration of the cylinder block caused by the occurrence of engine knocking.
Throttle Position Sensor	No-contact Type	1	<ul style="list-style-type: none"> <li>This sensor detects the throttle valve opening angle.</li> </ul>
Accelerator Pedal Position Sensor	No-contact Type	1	<ul style="list-style-type: none"> <li>This sensor detects the amount of pedal effort applied to the accelerator pedal.</li> </ul>
Injector	12-Hole Type	6	The injector is an electromagnetically-operated nozzle which injects fuel in accordance with signals from the engine ECU.

## Crankshaft Position Sensor

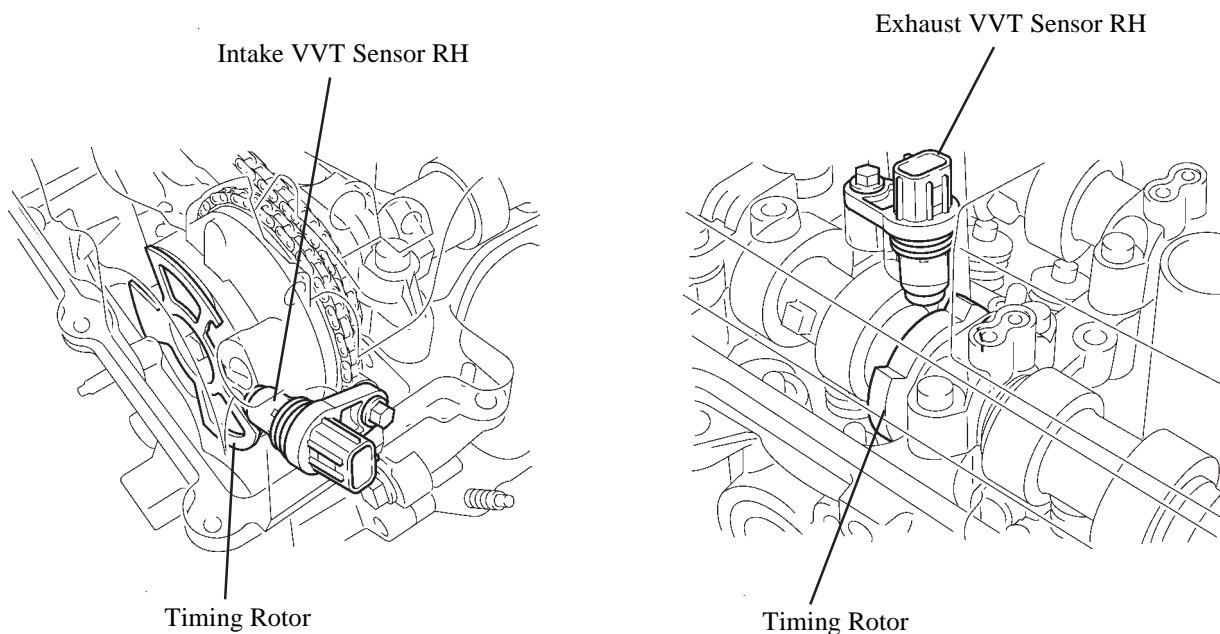
The timing rotor of the crankshaft consists of 34 teeth, with 2 teeth missing. The crankshaft position sensor outputs the crankshaft rotation signals every  $10^\circ$ , and the missing teeth are used to determine the top-dead-centre.



## Intake and Exhaust VVT Sensors

### 1) General

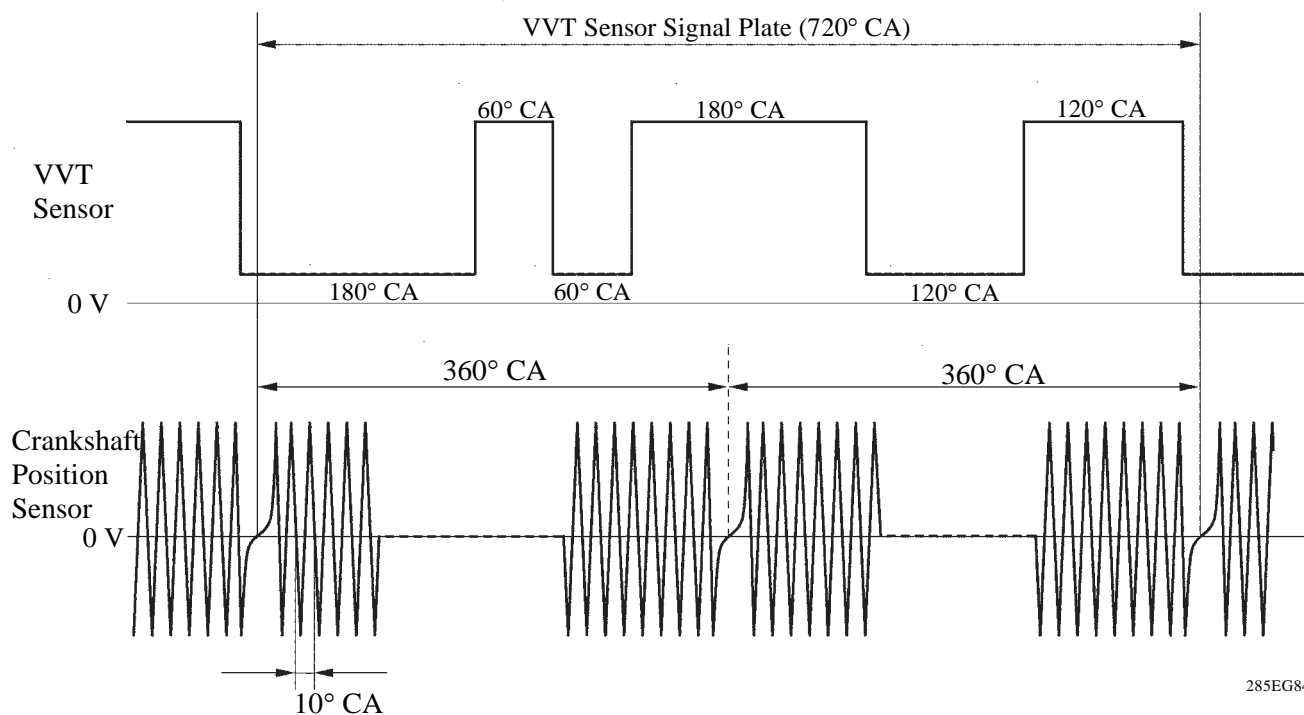
The MRE (Magnetic Resistance Element) type intake and exhaust VVT sensors are used. To detect the camshaft position, a timing rotor that is secured to the camshaft in front of the VVT controller is used to generate 6 (3 Hi Output, 3 Lo Output) pulses for every 2 revolutions of the crankshaft.



**Intake VVT Sensor (Right Bank)**

**Exhaust VVT Sensor (Right Bank)**

## ► Sensor Output Waveforms ◀

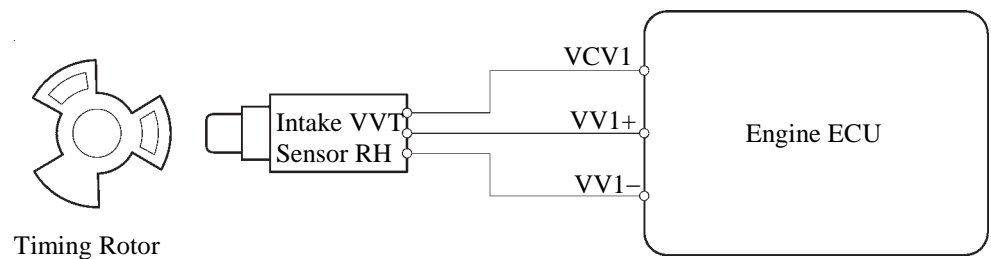


### 2) MRE Type VVT Sensor

- The MRE type VVT sensor consists of an MRE, a magnet and a sensor. The direction of the magnetic field changes due to the different shapes (protruded and non-protruded portions) of the timing rotor, which passes by the sensor. As a result, the resistance of the MRE changes, and the output voltage to the engine ECU changes to Hi or Lo. The engine ECU detects the camshaft position based on this output voltage.
- The differences between the MRE type VVT sensor and the pickup coil type VVT sensor used on the conventional model are as follows.

Item	Sensor Type	
	MRE	Pick-up Coil
Signal Output	Constant digital output starts from low engine speeds.	Analog output changes with the engine speed.
Camshaft Position Detection	Detection is made by comparing the NE signals with the Hi/Lo output switch timing due to the protruded/non-protruded portions of the timing rotor, or made based on the number of the input NE signals during Hi/Lo outputs.	Detection is made by comparing the NE signals with the change of waveform that is output when the protruded portion of the timing rotor passes.

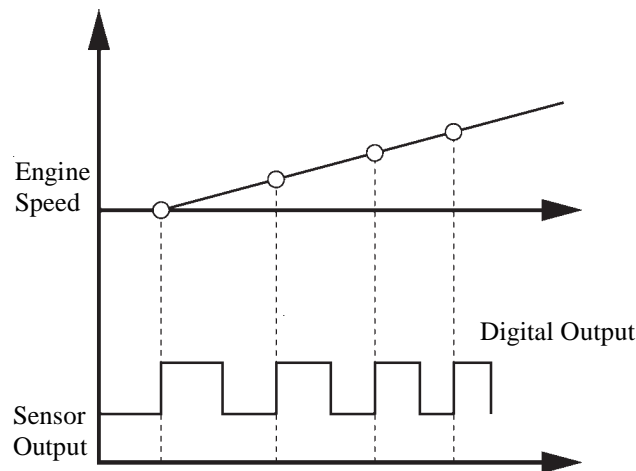
▸ **Wiring Diagram** ◀



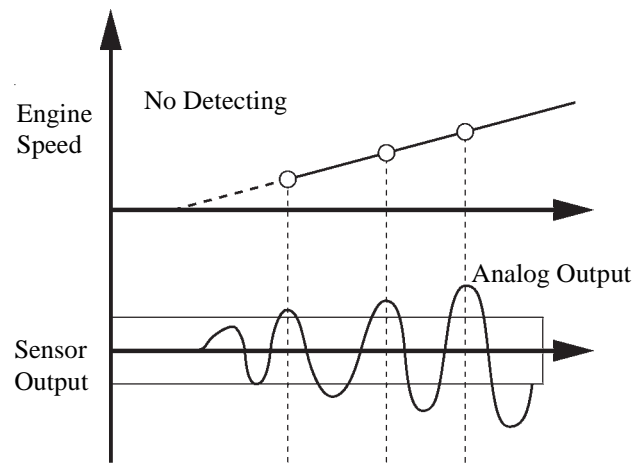
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**Intake VVT Sensor RH**

▸ **MRE Type and Pick-up Coil Type Output Waveform Image Comparison** ◀



**MRE Type**



**Pick-up Coil Type**

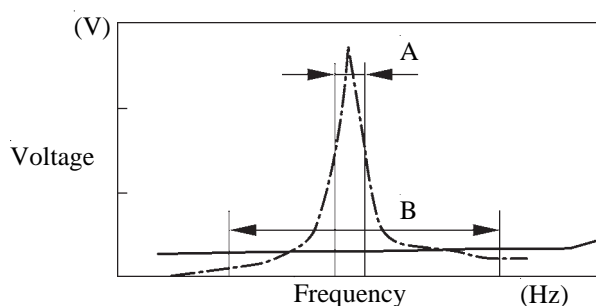
## Knock Sensor (Flat Type)

### 1) General

In the conventional type knock sensor (resonant type), a vibration plate, which has the same resonance point as the knocking frequency of the engine, is built in and can detect the vibration in this frequency band. On the other hand, a flat type knock sensor (non-resonant type) has the ability to detect vibration in a wider frequency band from about 6 kHz to 15 kHz, and has the following features:

- The engine knocking frequency will change a bit depending on the engine speed. The flat type knock sensor can detect vibration even when the engine knocking frequency is changed. Thus the vibration detection ability is increased compared to the conventional type knock sensor, and a more precise ignition timing control is possible.

— · — : Conventional Type  
 — : Flat Type



A: Detection Band of Conventional Type

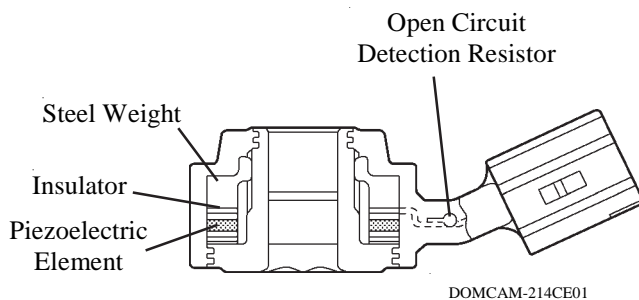
B: Detection Band of Flat Type

Characteristic of Knock Sensor

DOMCAM-214CE04

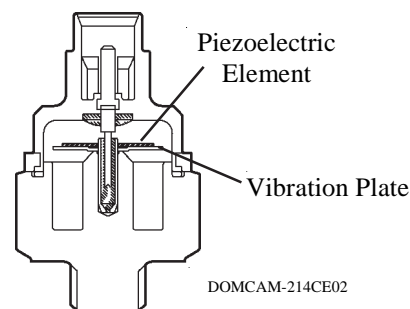
### 2) Construction

- The flat type knock sensor is installed on the engine through the stud bolt installed on the cylinder block. For this reason, a hole for the stud bolt is running through in the centre of the sensor.
- Inside of the sensor, a steel weight is located on the upper portion and a piezoelectric element is located under the weight through the insulator.
- The open/short circuit detection resistor is integrated.



DOMCAM-214CE01

Flat Type Knock Sensor  
(Non-Resonant Type)



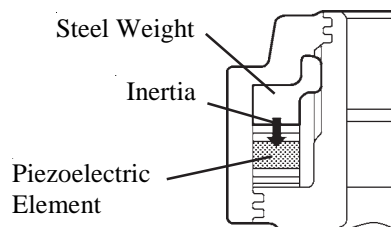
DOMCAM-214CE02

Conventional Type Knock Sensor  
(Resonant Type)



### 3) Operation

The knocking vibration is transmitted to the steel weight and its inertia applies pressure to the piezoelectric element. The action generates electromotive force.

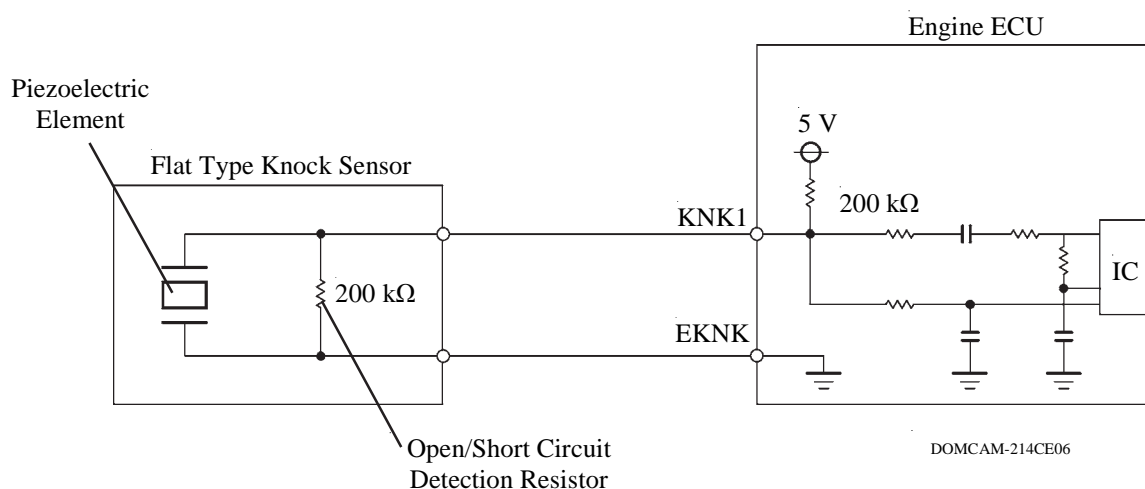


DOMCAM-214CE08

### 4) Open/Short Circuit Detection Resistor

During the ignition is ON, the open/short circuit detection resistor in the knock sensor and the resistor in the engine ECU keep the voltage at the terminal KNK1 of engine constant.

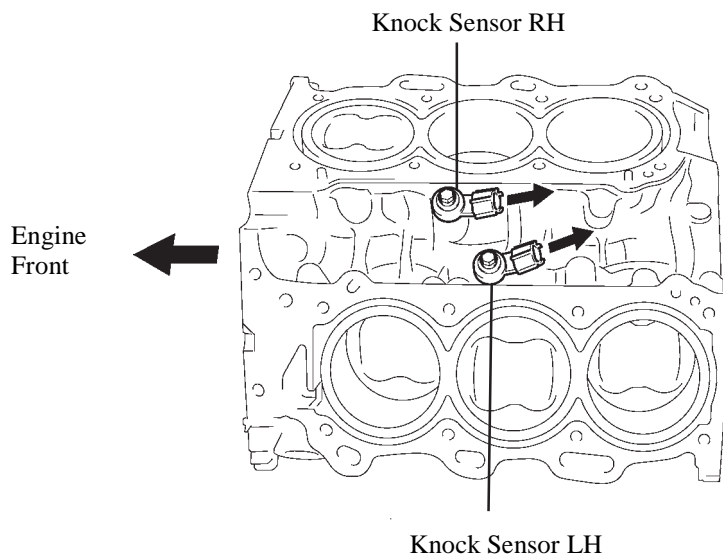
An IC (Integrated Circuit) in the engine ECU is always monitoring the voltage of the terminal KNK1. If the open/short circuit occurs between the knock sensor and the engine ECU, the voltage of the terminal KNK1 will change and the engine ECU detects the open/short circuit and stores DTC (Diagnostic Trouble Code).



DOMCAM-214CE06

### Service Tip

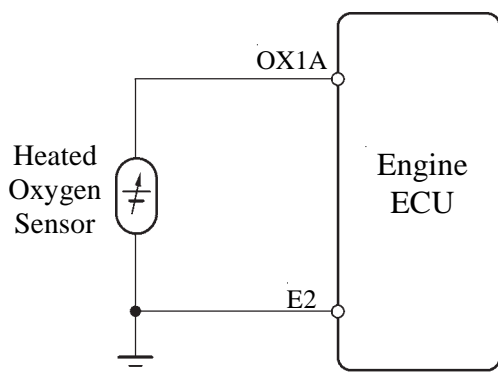
These knock sensors are mounted in the specific directions and angles as illustrated. To prevent the right and left bank connectors from being interchanged, make sure to install each sensor in its prescribed direction.



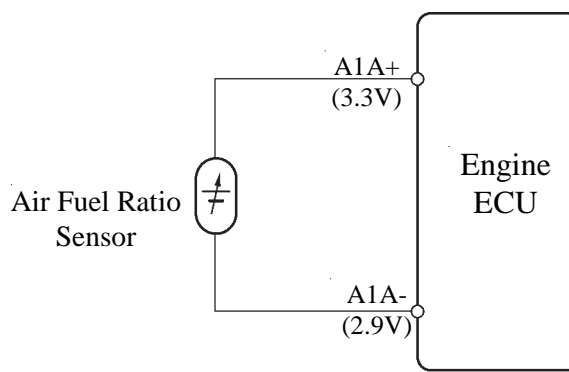
## Heated Oxygen Sensor and Air Fuel Ratio Sensor

### 1) General

- The heated oxygen sensor and the air fuel ratio sensor differ in output characteristics.
- The output voltage of the heated oxygen sensor changes in accordance with the oxygen concentration in the exhaust gas. The engine ECU uses this output voltage to determine whether the present air-fuel ratio is richer or leaner than the stoichiometric air-fuel ratio.
- Approximately 0.4V is constantly applied to the air-fuel ratio sensor, which outputs an amperage that varies in accordance with the oxygen concentration in the exhaust gas. The engine ECU converts the changes in the output amperage into voltage in order to linearly detect the present air-fuel ratio.

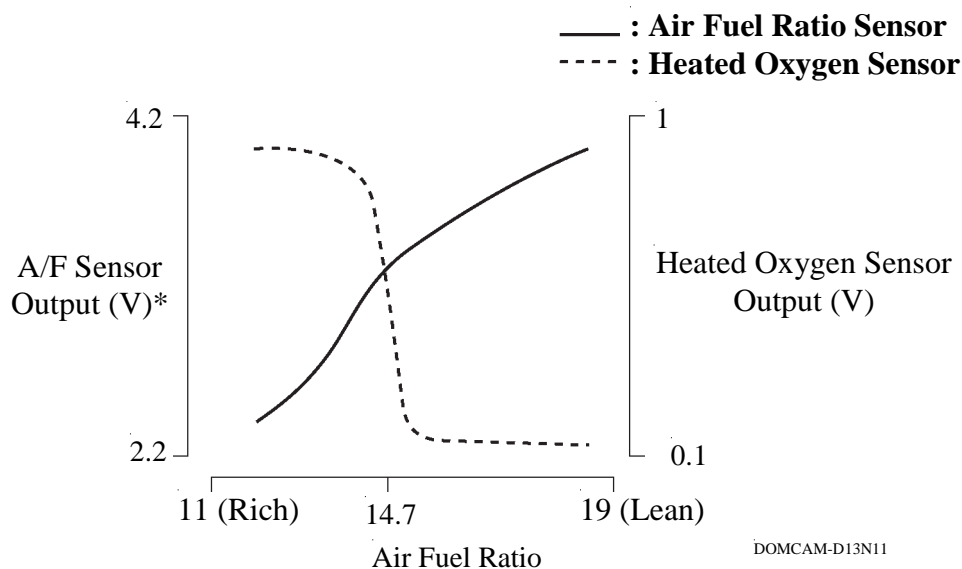


**Heated Oxygen Sensor Circuit**



**Air Fuel Ratio Sensor Circuit**

DOMCAM-271EG44

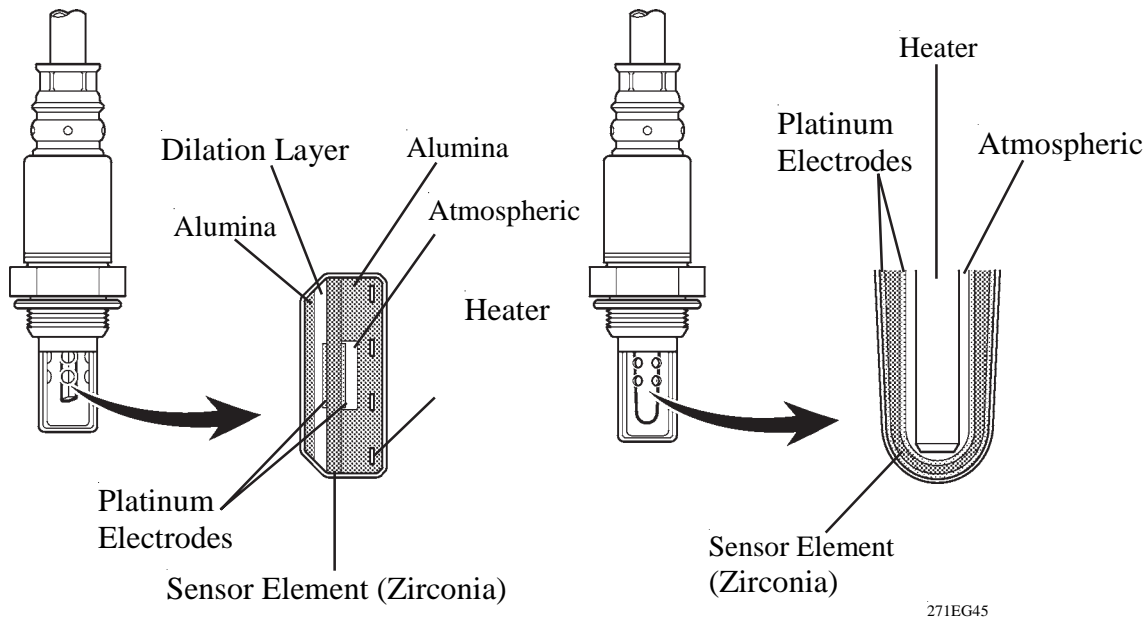


DOMCAM-D13N11

\*: This calculation value is used internally in the engine ECU, and is not an engine ECU terminal voltage.

## 2) Construction

- The basic construction of the heated oxygen sensor and the air-fuel ratio sensor is the same. However, they are divided into the cup type and the planar type, according to the different types of heater construction that are used.
- The cup type sensor contains a sensor element that surrounds a heater.
- The planar type sensor uses alumina, which excels in heat conductivity and insulation, to integrate a sensor element with a heater, thus improving the warm-up performance of the sensor.

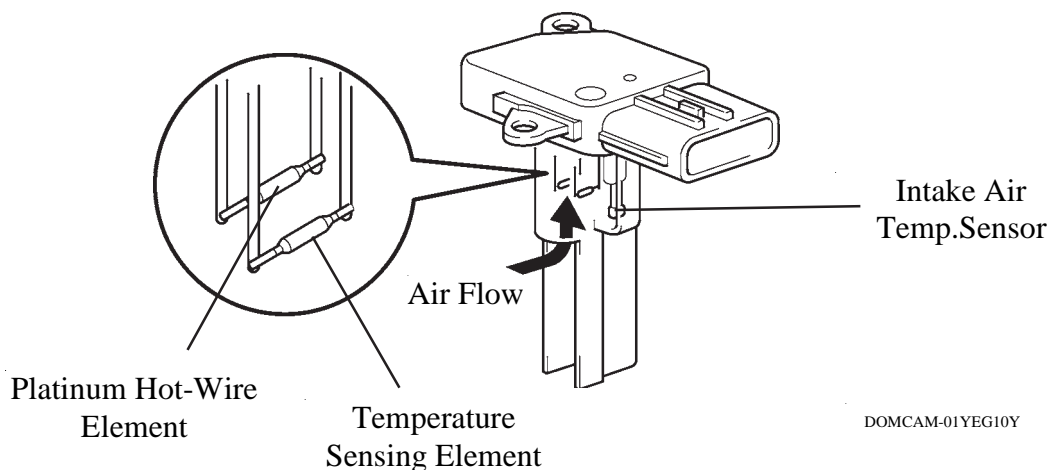


**Planar Type Air Fuel Ratio Sensor**

**Cup Type Heated Oxygen Sensor**

## Air Flow Meter

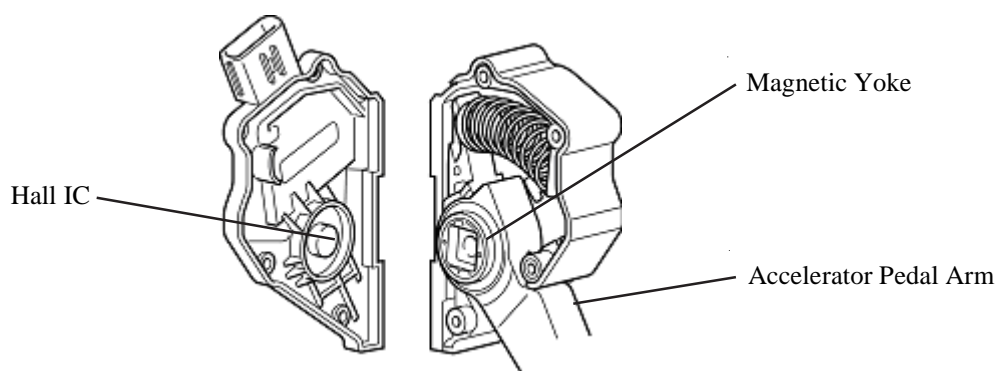
- This air flow meter, which is a plug-in type, allows a portion of the intake air to flow through the detection area. By directly measuring the mass and the flow rate of the intake air, the detection precision is improved and the intake air resistance is reduced.
- This air flow meter has a built-in intake air temperature sensor.



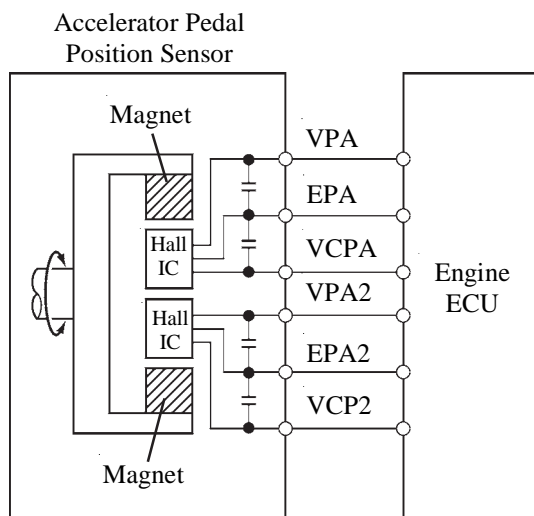
## Accelerator Pedal Position Sensor

This no-contact type accelerator pedal position sensor uses a Hall IC, which is mounted on the accelerator pedal arm.

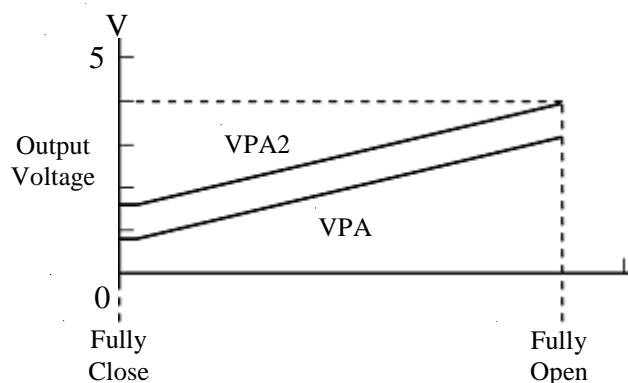
- The magnetic yoke is mounted at the base of the accelerator pedal arm. This yoke rotates around the Hall IC in accordance with the amount of effort that is applied to the accelerator pedal. The Hall IC converts the changes in the magnetic flux that occur into electrical signals, and outputs them in the form of accelerator pedal position signals to the engine ECU.
- The Hall IC contains two circuits, one for the main signal, and one for the sub signal. It converts the accelerator pedal position (angle) into electric signals that have differing characteristics and outputs them to the engine ECU.



DOMCAM-0140EG125C



DOMCAM-228TU24



Accelerator Pedal Position (Angle)

DOMCAM-0140EG126C

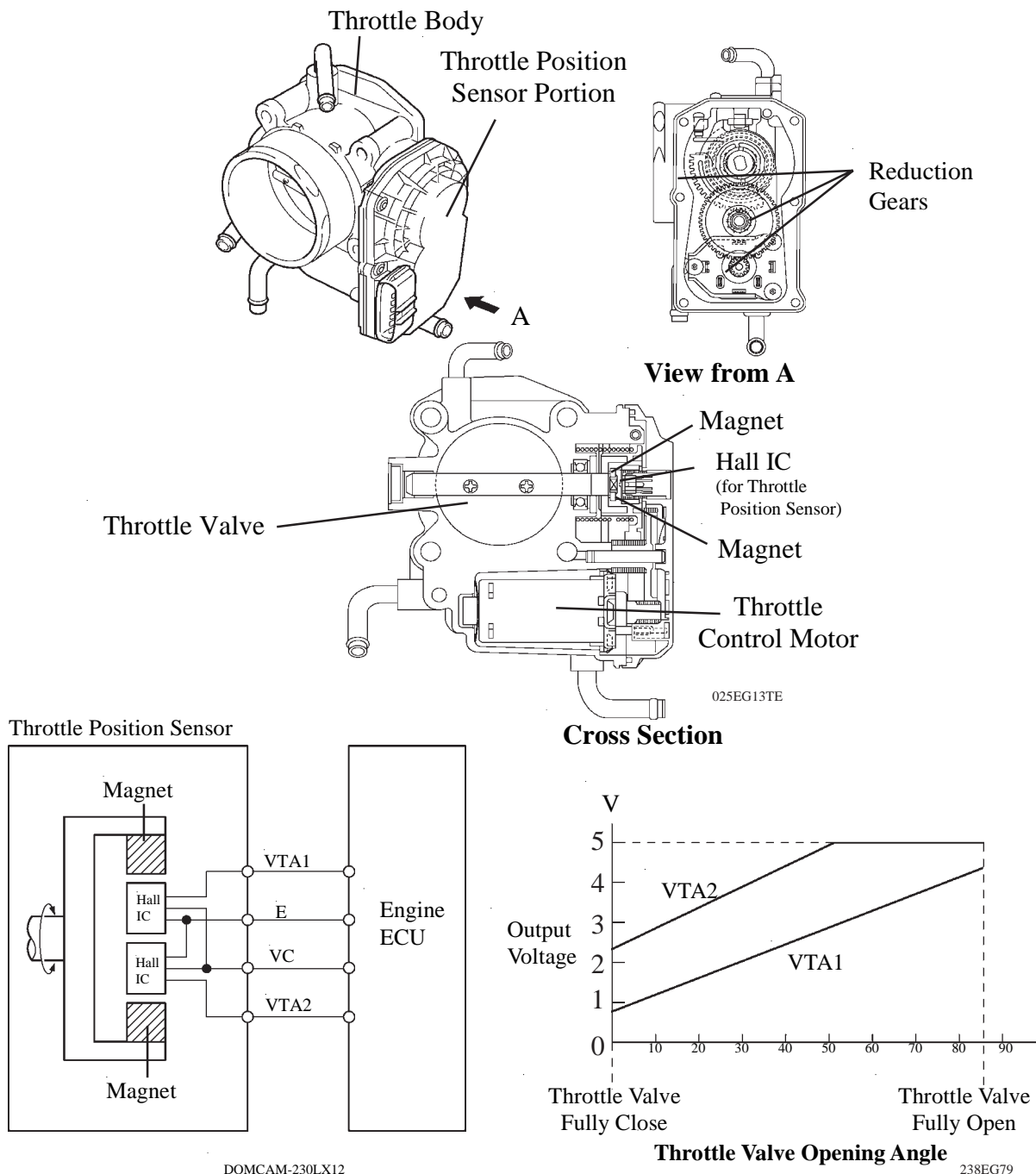
### Service Tip

The inspection method differs from a conventional accelerator pedal position sensor because this sensor uses a Hall IC. For details, refer to the Aurion Repair Manual.

## Throttle Position Sensor

The no-contact type throttle position sensor uses a Hall IC, which is mounted on the throttle body.

- The Hall IC is surrounded by a magnetic yoke. The Hall IC converts the changes that occur in the magnetic flux at that time into electrical signals and outputs them in the form of a throttle valve intention to the engine ECU.
- The Hall IC contains circuits for the main and sub signals. It converts the throttle valve opening angles into electric signals with two differing characteristics and outputs them to the engine ECU.



DOMCAM-230LX12

### Service Tip

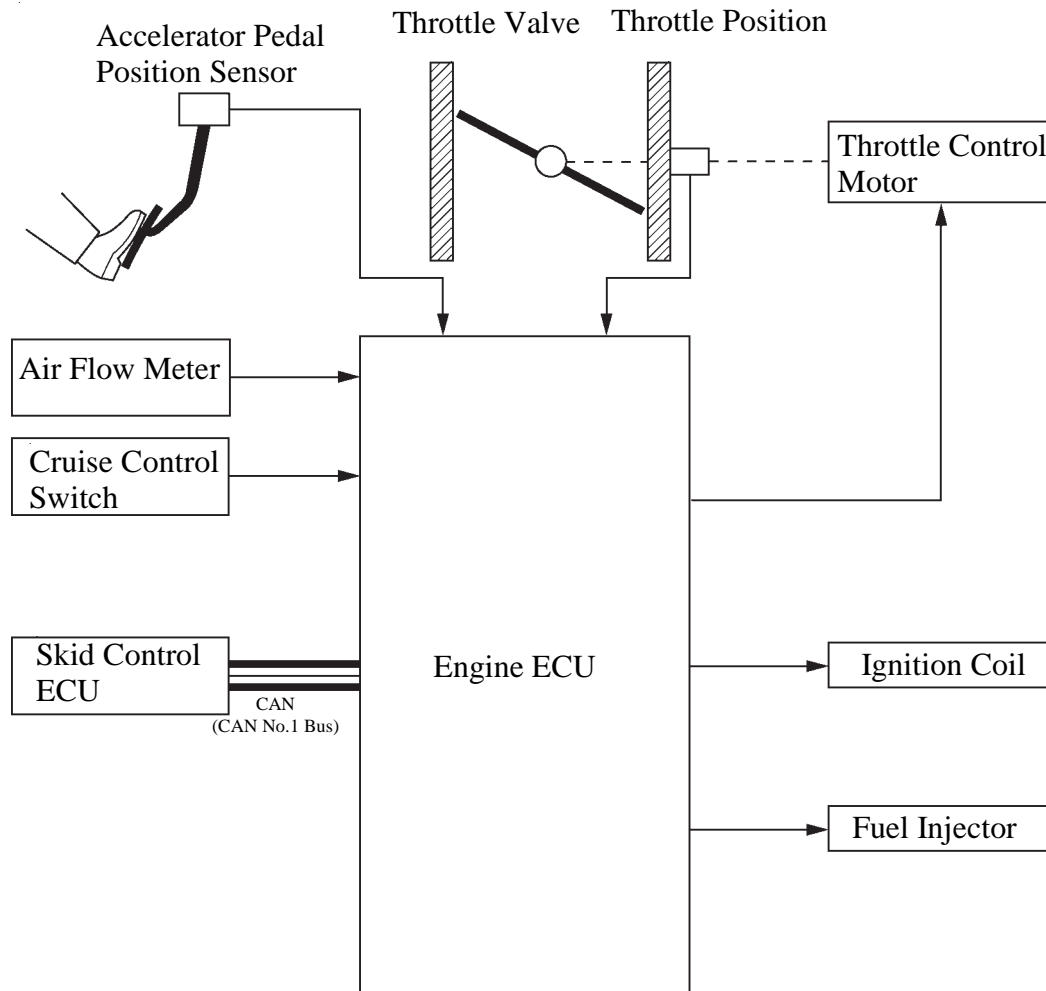
The inspection method differs from a conventional accelerator pedal position sensor because this sensor uses a Hall IC. For details, refer to the Aurion Repair Manual.

## 6. ETCS-i (Electronic Throttle Control System-intelligent)

### General

- In the conventional throttle body, the throttle valve angle is determined invariably by the amount of the accelerator pedal effort. In contrast, ETCS-i uses the engine ECU to calculate the optimal throttle valve angle that is appropriate for the respective driving condition and uses a throttle control motor to control the angle.
- In case of an abnormal condition, this system transfers to the limp mode. For details, see page EG-72.

### ▶ System Diagram ◀



01YEG11Y

### Control

#### 1) General

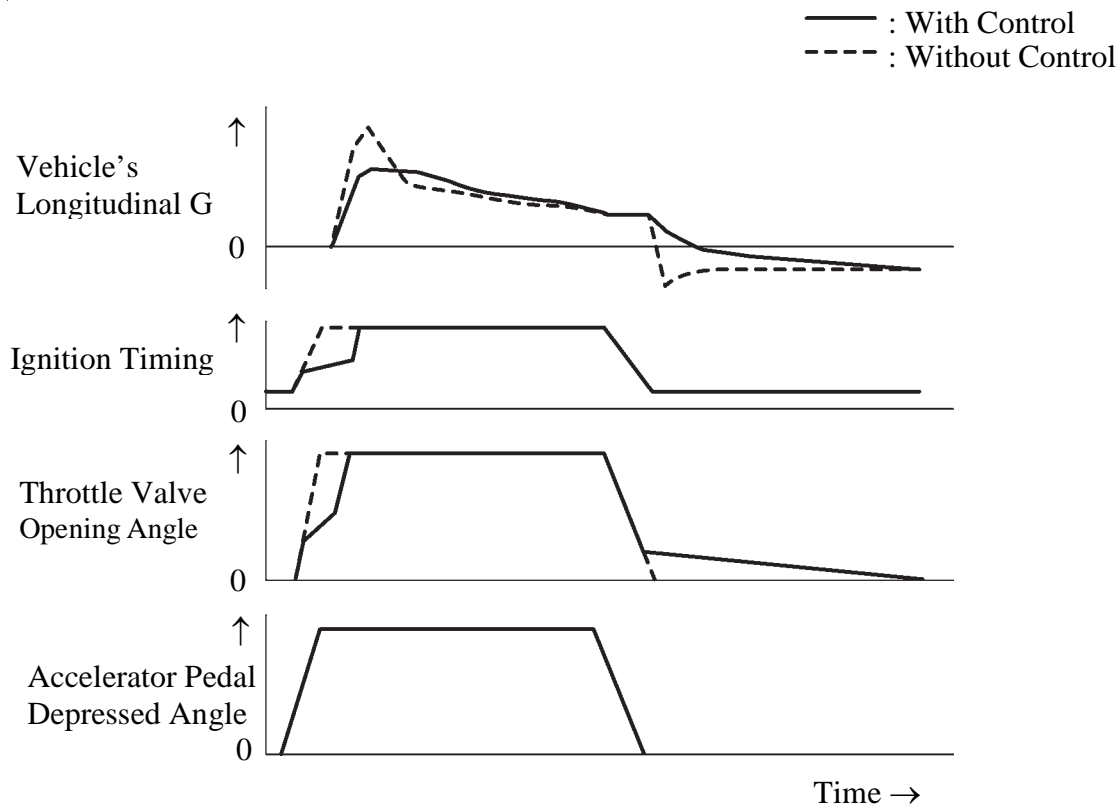
The ETCS-i consists of the following six functions:

- Normal Throttle Control (Non-linear Control)
- ISC (Idle Speed Control)
- TRC (Traction Control)
- VSC (Vehicle Stability Control)
- Cruise Control

## 2) Normal Throttle Control (non-linear control)

Controls the throttle to an optimal throttle valve angle that is appropriate for the driving condition such as the amount of the accelerator pedal effort and the engine speed in order to realise excellent throttle control and comfort in all operating ranges.

### ► Conceptual Diagrams of Engine Control During Acceleration and Deceleration ◀



## 3) Idle Speed Control

The engine ECU controls the throttle valve in order to constantly maintain an ideal idle speed.

## 4) TRC Throttle Control

As part of the TRC system, the throttle valve is closed by a demand signal from the skid control ECU if an excessive amount of slippage is created at a driving wheel, thus facilitating the vehicle in ensuring excellent vehicle stability and driving force.

## 5) VSC Coordination Control

In order to bring the effectiveness of the VSC system control into full play, the throttle valve angle is controlled by effecting a coordination control with the skid control ECU.

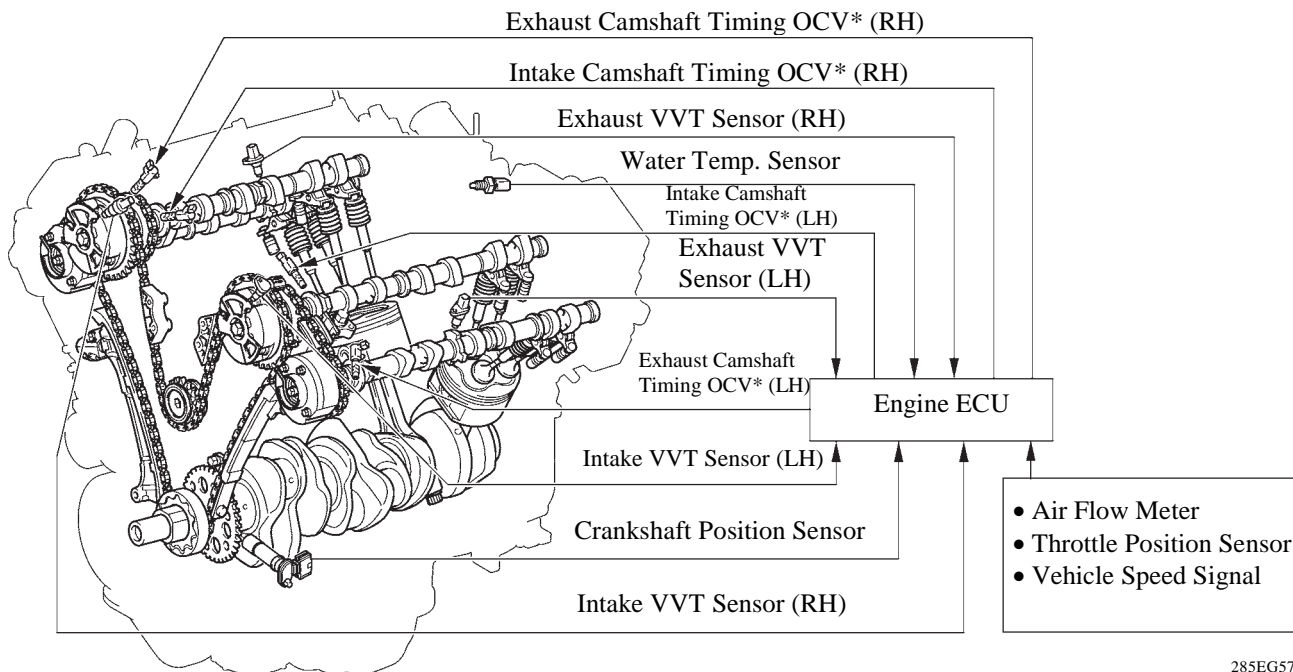
## 6) Cruise Control

An engine ECU with an integrated cruise control ECU directly actuates the throttle valve for operation of the cruise control.

## 7. Dual VVT-i (Variable Valve Timing-intelligent) System

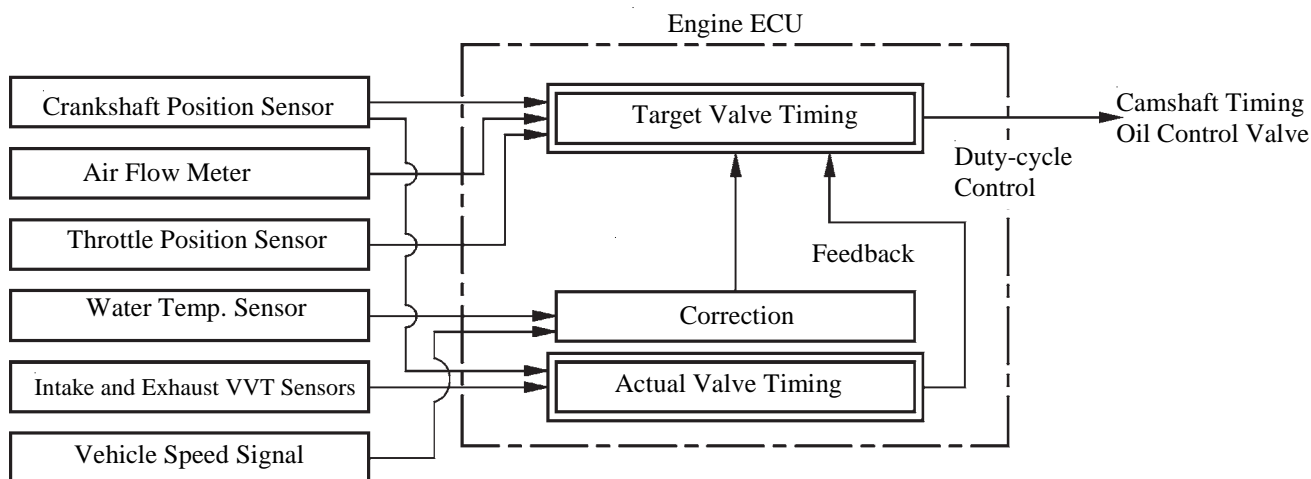
### General

- The dual VVT-i system is designed to control the intake and exhaust camshafts within a range of 40° and 35° respectively (of Crankshaft Angle) to provide valve timing that is optimally suited to the engine condition. This improves torque in all the speed ranges as well as increasing fuel economy, and reducing exhaust emissions.



\*: Oil Control Valve

- By using the engine speed, intake air volume, throttle position and engine coolant temperature, the engine ECU calculates optimal valve timing for each driving condition and controls the camshaft timing oil control valve. In addition, the engine ECU uses signals from the camshaft position sensor and the crankshaft position sensor to detect the actual valve timing, thus providing feedback control to achieve the target valve timing.





### Effectiveness of the VVT-i System

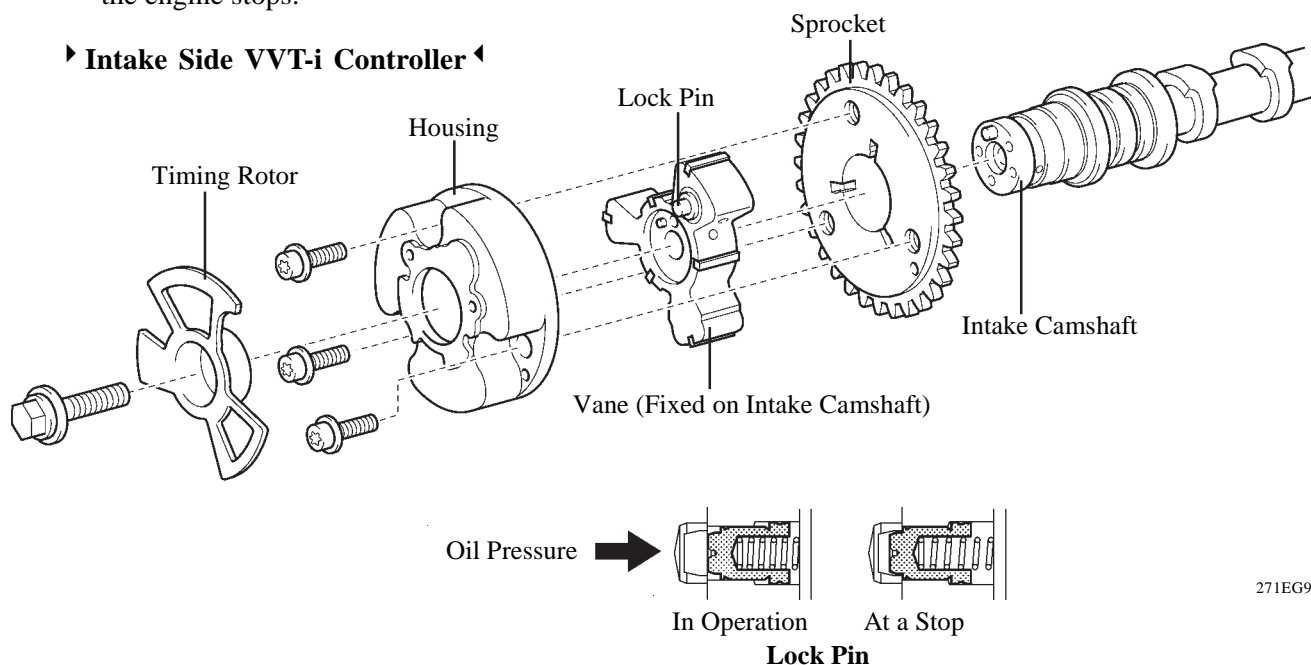
Operation State	Objective	Effect
During Idling	<p>Eliminating overlap to reduce blow back to the intake side.</p> <p>285EG59</p>	<ul style="list-style-type: none"> <li>• Stabilised idling rpm</li> <li>• Better fuel economy</li> </ul>
At Light Load	<p>Eliminating overlap to reduce blow back to the intake side.</p> <p>285EG60</p>	Ensured engine stability
At Medium Load	<p>Increasing overlap increases internal EGR, reducing pumping loss.</p> <p>285EG61</p>	<ul style="list-style-type: none"> <li>• Better fuel economy</li> <li>• Improved emission control</li> </ul>
In Low to Medium Speed Range with Heavy Load	<p>Advancing the intake valve close timing for volumetric efficiency improvement.</p> <p>285EG62</p>	Improved torque in low to medium speed range
In High Speed Range with Heavy Load	<p>Retarding the intake valve close timing for volumetric efficiency improvement.</p> <p>285EG63</p>	Improved output
At Low Temperatures	<p>Eliminating overlap to reduce blow back to the intake side.</p> <p>285EG59</p>	<ul style="list-style-type: none"> <li>• Stabilised fast idle rpm</li> <li>• Better fuel economy</li> </ul>
<ul style="list-style-type: none"> <li>• Upon Starting</li> <li>• Stopping the Engine</li> </ul>	<p>Eliminating overlap to minimise blow back to the intake side.</p> <p>285EG59</p>	Improved start ability

## Construction

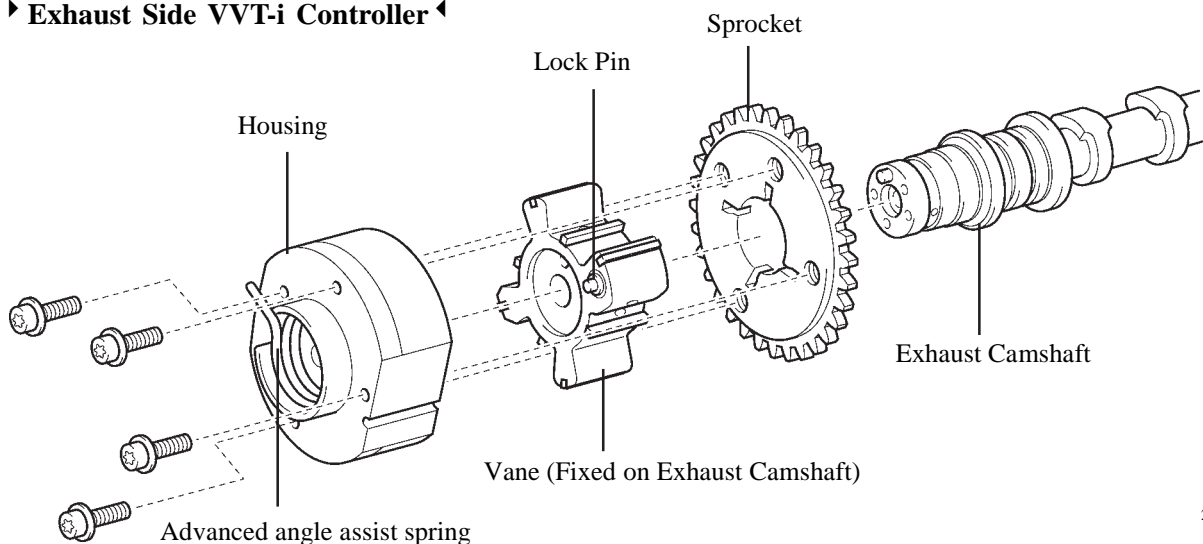
### 1) VVT-i Controller

- This controller consists of the housing driven from the timing chain and the vane coupled with the intake and exhaust camshafts.
- The intake side has used a VVT-i controller with 3 vanes, and the exhaust side has used one with 4 vanes.
- When the engine stops, the intake side VVT-i controller is locked on the most retarded angle side by the lock pin, and the exhaust side controller is locked on the most advanced angle side. This ensures excellent engine start ability.
- The oil pressure sent from the advance or retard side path at the intake and exhaust camshaft causes rotation in the VVT-i controller vane circumferential direction to vary the intake valve timing continuously.
- An advanced angle assist spring is provided on the exhaust side VVT-i controller. This helps to apply torque in the advanced angle direction so that the vane lock pin securely engages with the housing when the engine stops.

#### ► Intake Side VVT-i Controller ◀



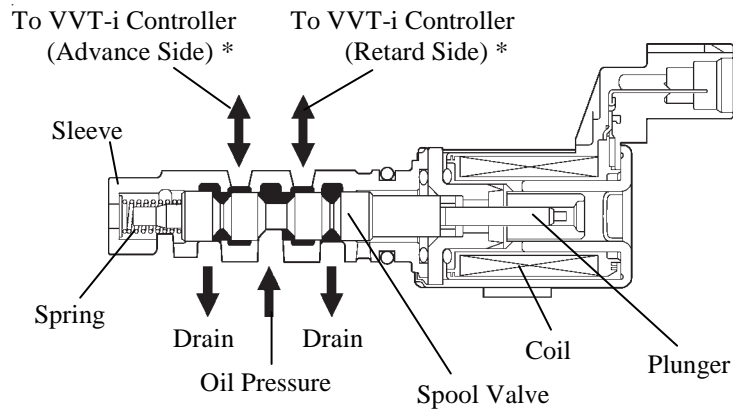
#### ► Exhaust Side VVT-i Controller ◀



## 2) Camshaft Timing Oil Control Valve

This camshaft timing oil control valve controls the spool valve using duty-cycle control from the engine ECU. This allows hydraulic pressure to be applied to the VVT-i controller advance or retard side. When the engine is stopped, the camshaft timing oil control valve is in the most retard position.

### ► Intake Camshaft Timing Oil Control Valve ◄



238EG62

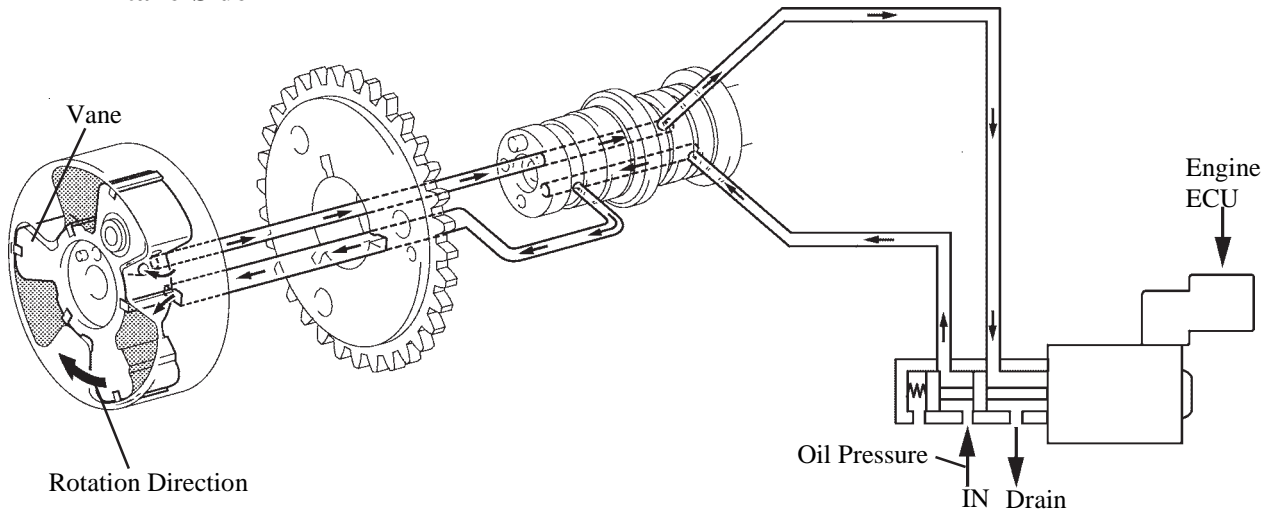
\*: The advance and retard sides of the exhaust side oil control valve are reverse of the intake side.

## Operation

### 1) Advance

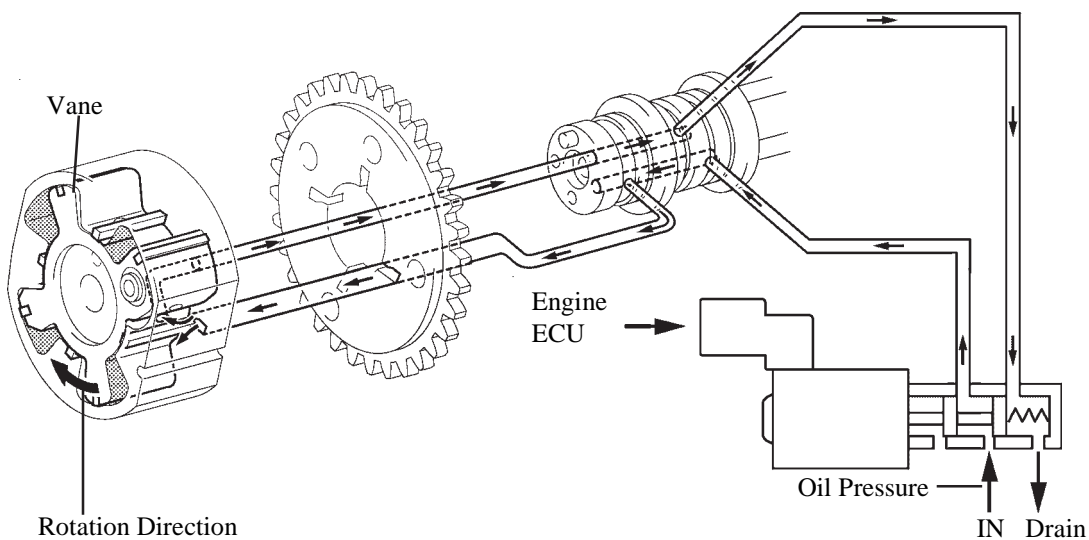
When the camshaft timing oil control valve is positioned as illustrated below by the advance signals from the engine ECU, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.

#### ► Intake Side ◀



238EG63

#### ► Exhaust Side ◀

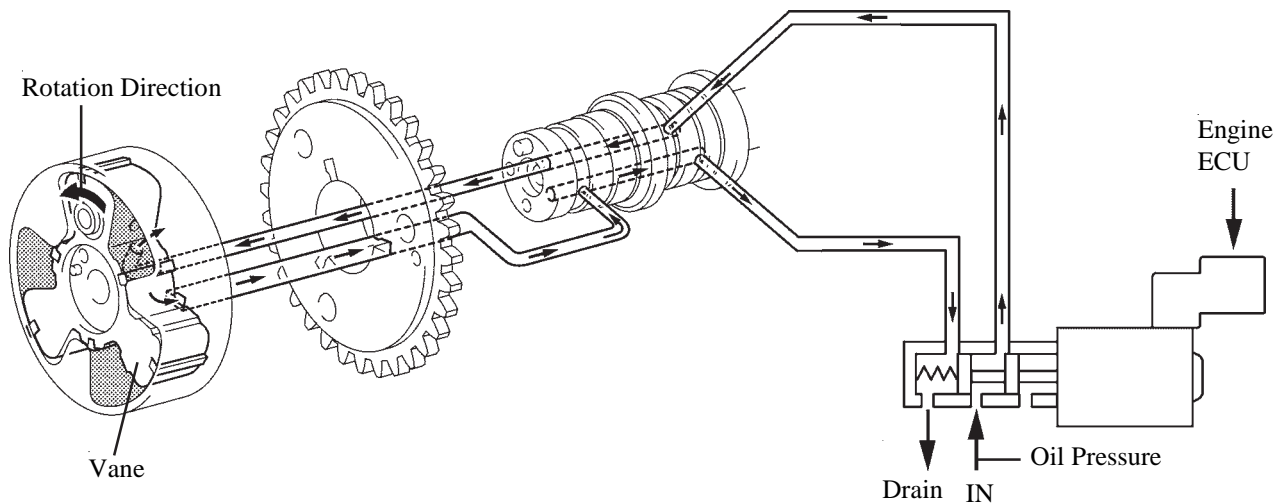


281EG48

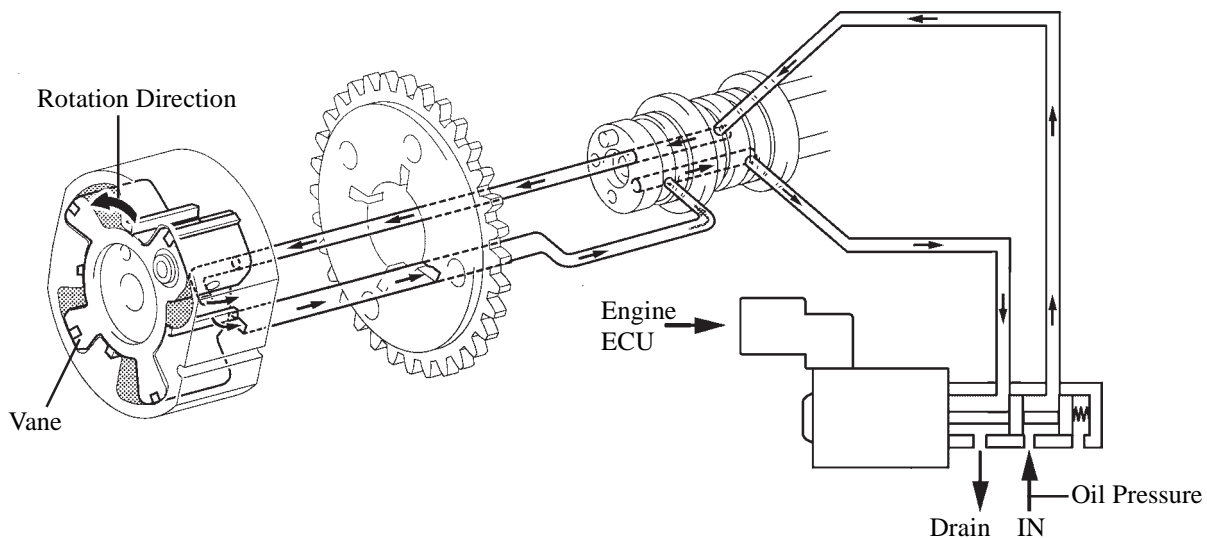
## 2) Retard

When the camshaft timing oil control valve is positioned as illustrated below by the retard signals from the engine ECU, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.

### ► Intake Side ◀



### ► Exhaust Side ◀



## 3) Hold

After reaching the target timing, the valve timing is held by keeping the camshaft timing oil control valve in the neutral position unless the travelling state changes.

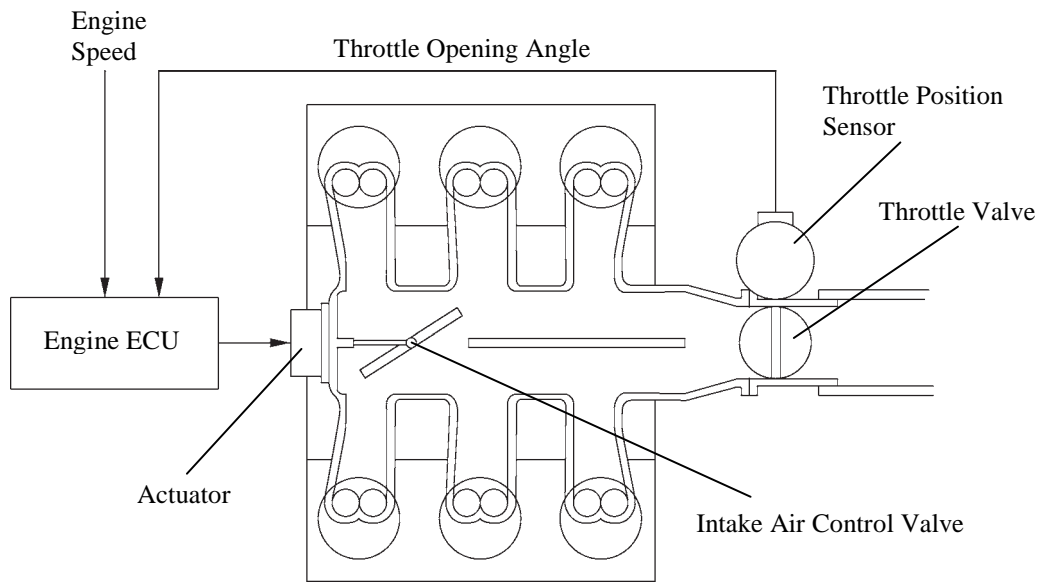
This adjusts the valve timing at the desired target position and prevents the engine oil from running out when it is unnecessary.

## 8. ACIS (Acoustic Control Induction System)

### General

The ACIS is realised by using a bulkhead to divide the intake manifold into 2 stages, with an intake air control valve in the bulkhead being opened and closed to vary the effective length of the intake manifold in accordance with the engine speed and throttle valve opening angle. This increases the power output in all ranges from low to high speed.

### ▸ System Diagram ◀



285EG58

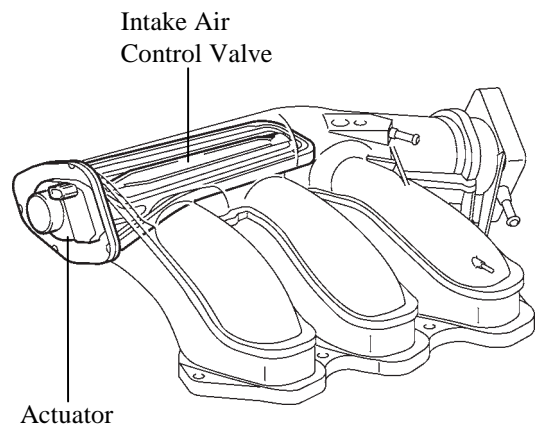
### Construction

#### 1) Intake Air Control Valve

The intake air control valve, which is provided in the intake air chamber, open and close to change the effective length of the intake manifold in 2 stages.

#### 2) Actuator (Motor)

The actuator activates the intake air control valve based on signals from the engine ECU.



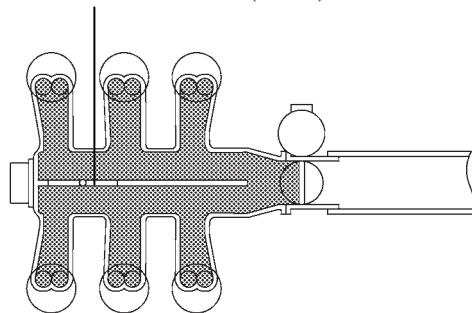
285EG64

## Operation

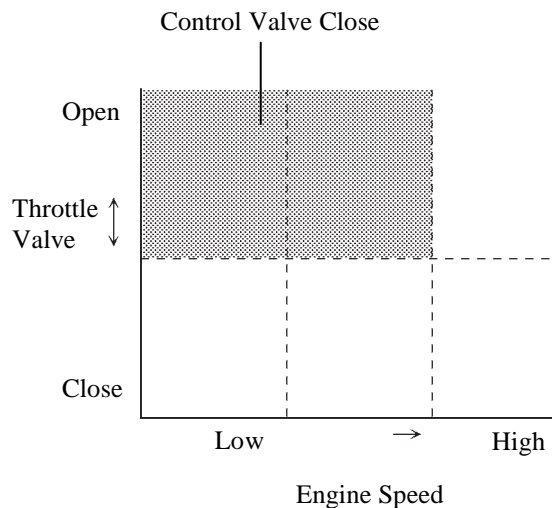
### 1) When the Intake Air Control Valve Closes

While the engine is running at middle speed under high load, the engine ECU controls the actuator to close the control valve. As a result, the effective length of the intake manifold is lengthened and the intake air efficiency, in the medium speed range, is improved due to the dynamic effect of the intake air, thereby increasing power output.

Intake Air Control Valve (Close)



 : Effective Intake Manifold Length

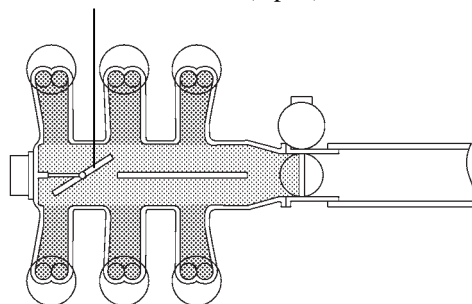


285EG65


### 2) When the Intake Air Control Valve Open

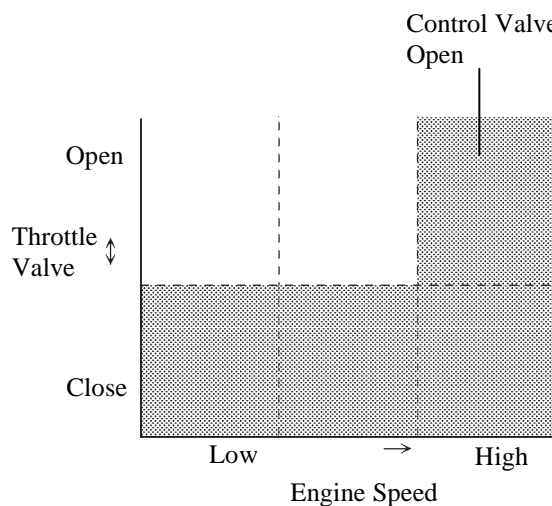
Under any condition except when the engine is running at middle speed under high load, the engine ECU controls the actuator to open the control valve. When the control valve is open, the effective length of the intake air chamber is shortened and peak intake efficiency is shifted to the low-to-high engine speed range, thus providing greater output at low-to-high engine speeds.

Intake Air Control Valve (Open)



 : Effective Intake Manifold Length

 : Effective Intake Air Chamber Length



285EG66

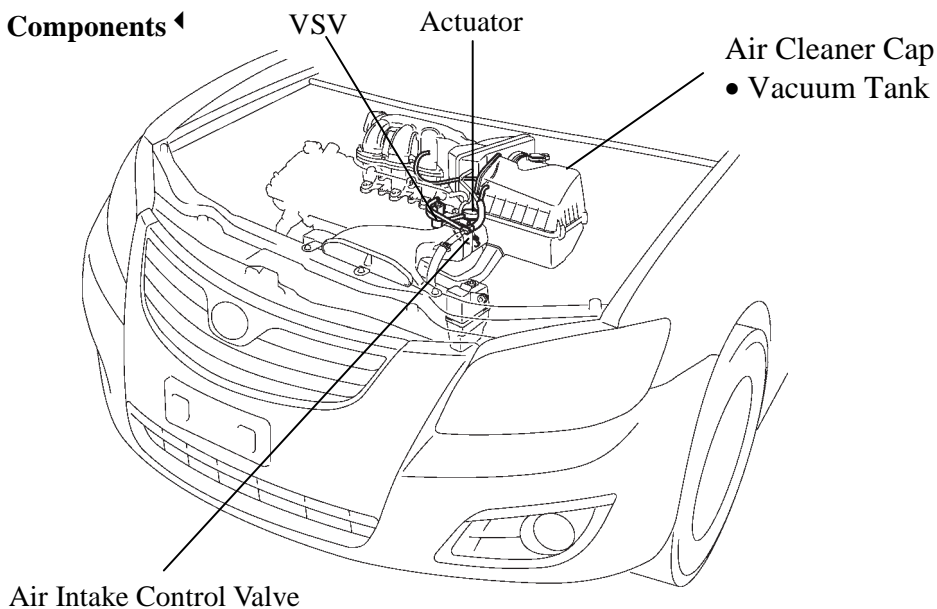
## 9. Air Intake Control System

### General

The system has a dual path design for air intake. An air intake control valve and actuator control the air flow path.

As a result, a reduction in intake noise in the low-speed range and an increase in the power output in the high-speed range is realised.

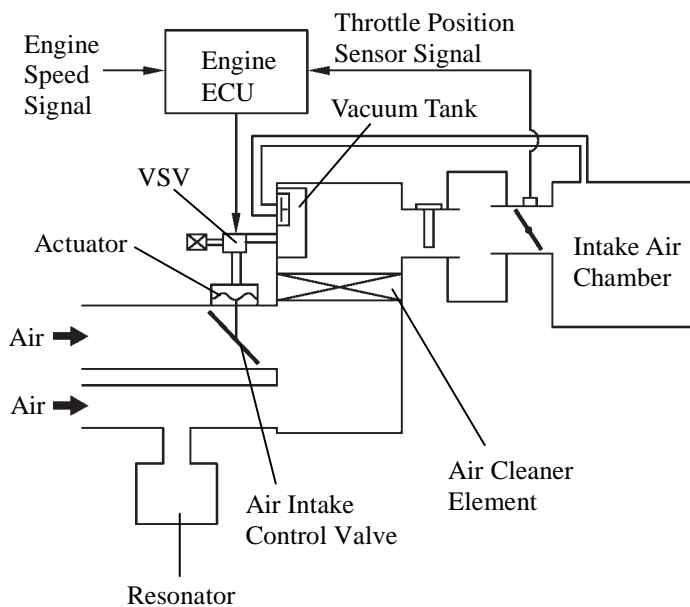
#### ▸ Layout of Components ◀



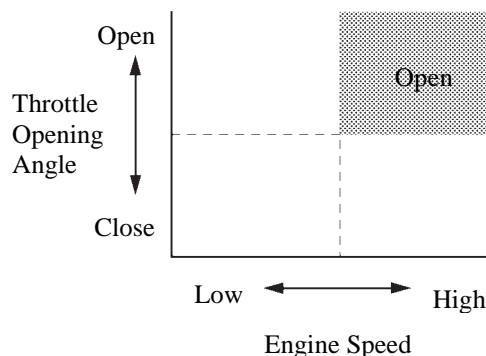
02KEG39Y

### Operation

- When the engine is operating in the low- to mid-speed range, this control operates the air intake control valve to close one side of the air cleaner inlet. As a result, the intake area has been minimised and the intake noise is reduced.
- When the engine is operating in the high-speed range, this control operates the air intake control valve to open both sides of the air cleaner inlet. As a result, the intake area has been maximised and the intake efficiency is improved.



LHD



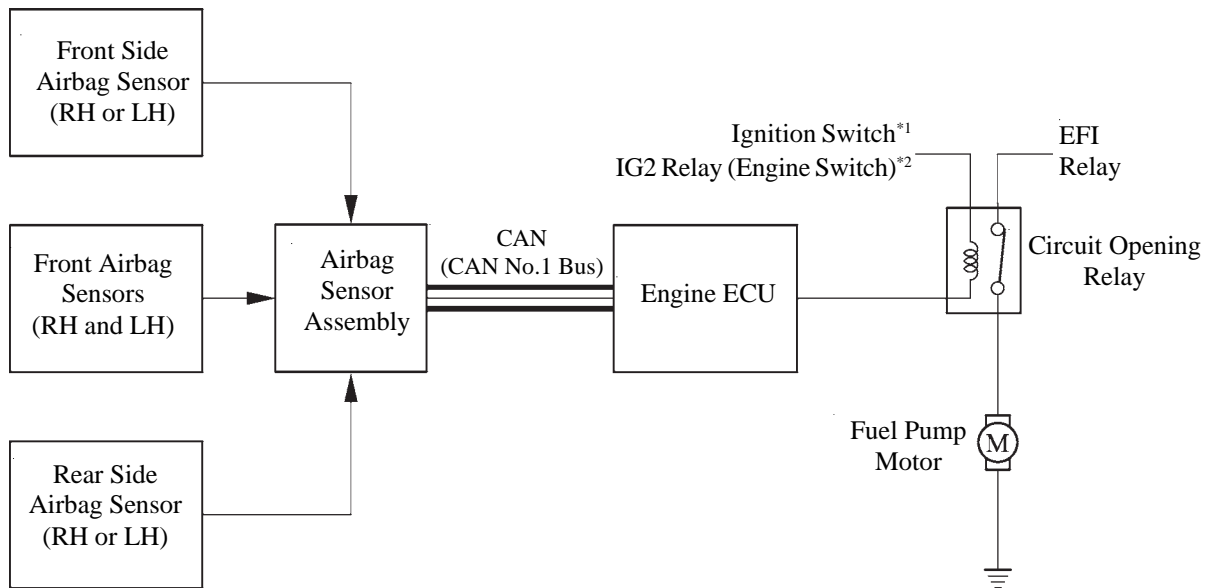
**Air Intake Control Valve Condition**

285EG68



## 10. Fuel Pump Control

A fuel cut control is used to stop the fuel pump once when any of the SRS airbags is deployed. In this system, the airbag deployment signal from the airbag sensor assembly is detected by the engine ECU, and it turns OFF the circuit opening relay. After the fuel cut control has been activated, turning the ignition switch<sup>\*1</sup> (engine switch<sup>\*2</sup>) from OFF to ON cancels the fuel cut control, and the engine can be restarted.



02HEG20TE

\*1: Only for models without smart entry and start system

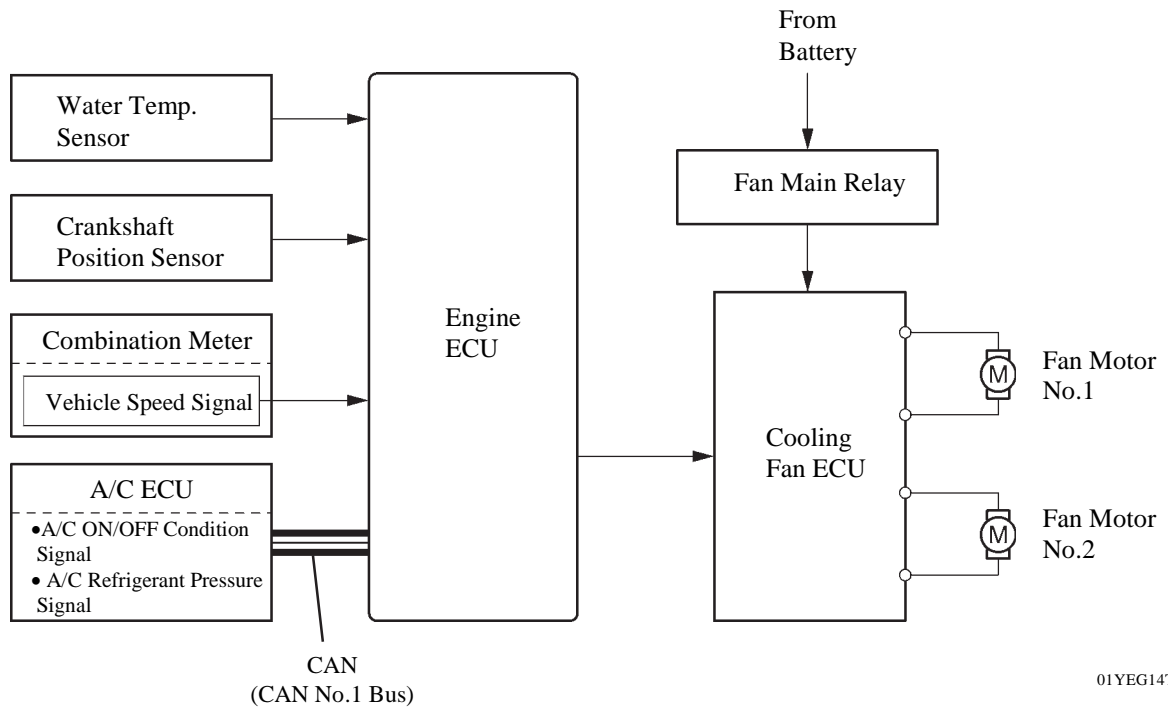
\*2: Only for models with smart entry and start system

## 11. Cooling Fan Control System

### General

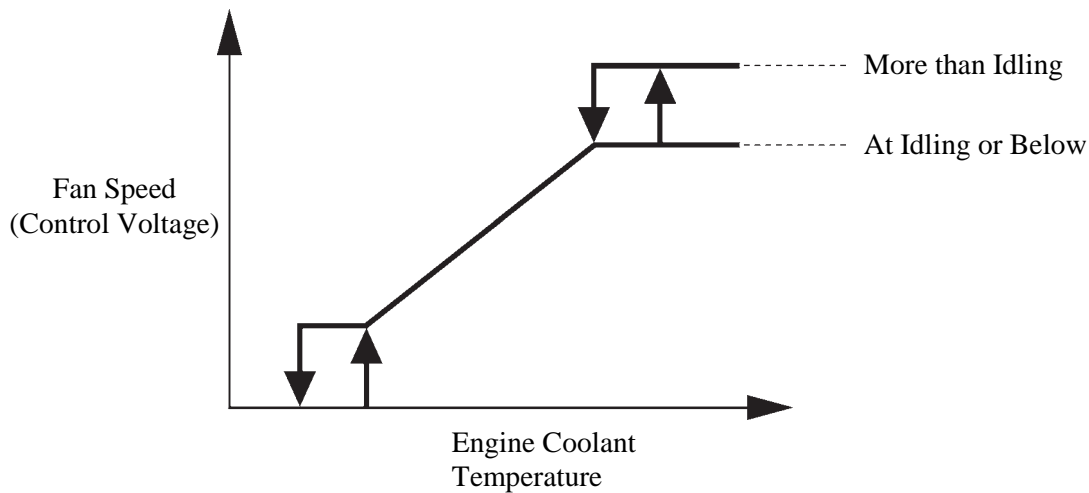
A cooling fan control system is used. To achieve an optimal fan speed in accordance with the engine coolant temperature, vehicle speed, engine speed, and air conditioner operating conditions, the engine ECU calculates the proper fan speed and sends the signals to the cooling fan ECU. Upon receiving the signals from the engine ECU, the cooling fan ECU actuates the fan motors.

### ▸ Wiring Diagram ◀



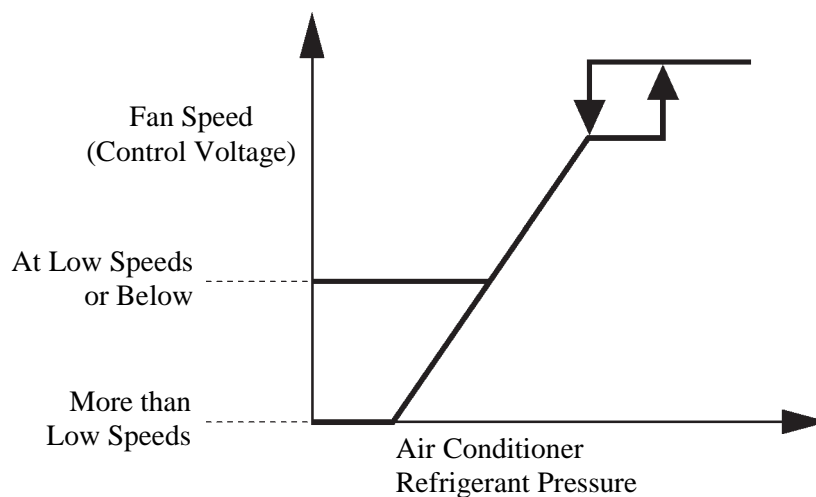
## Operation

- The engine ECU controls the cooling fan speed in accordance with the value of the engine coolant temperature, as shown in the graph below. When the engine coolant temperature is higher than a specific value, the control differs depending on whether the engine speed is at idling and below or more.



025EG14TE

- The engine ECU controls the cooling fan speed in accordance with the value of the air conditioner refrigerant pressure, as shown in the graph below. When the air conditioner refrigerant pressure is higher than a specific value, the control differs depending on whether the engine speed is at low speeds and below or more.



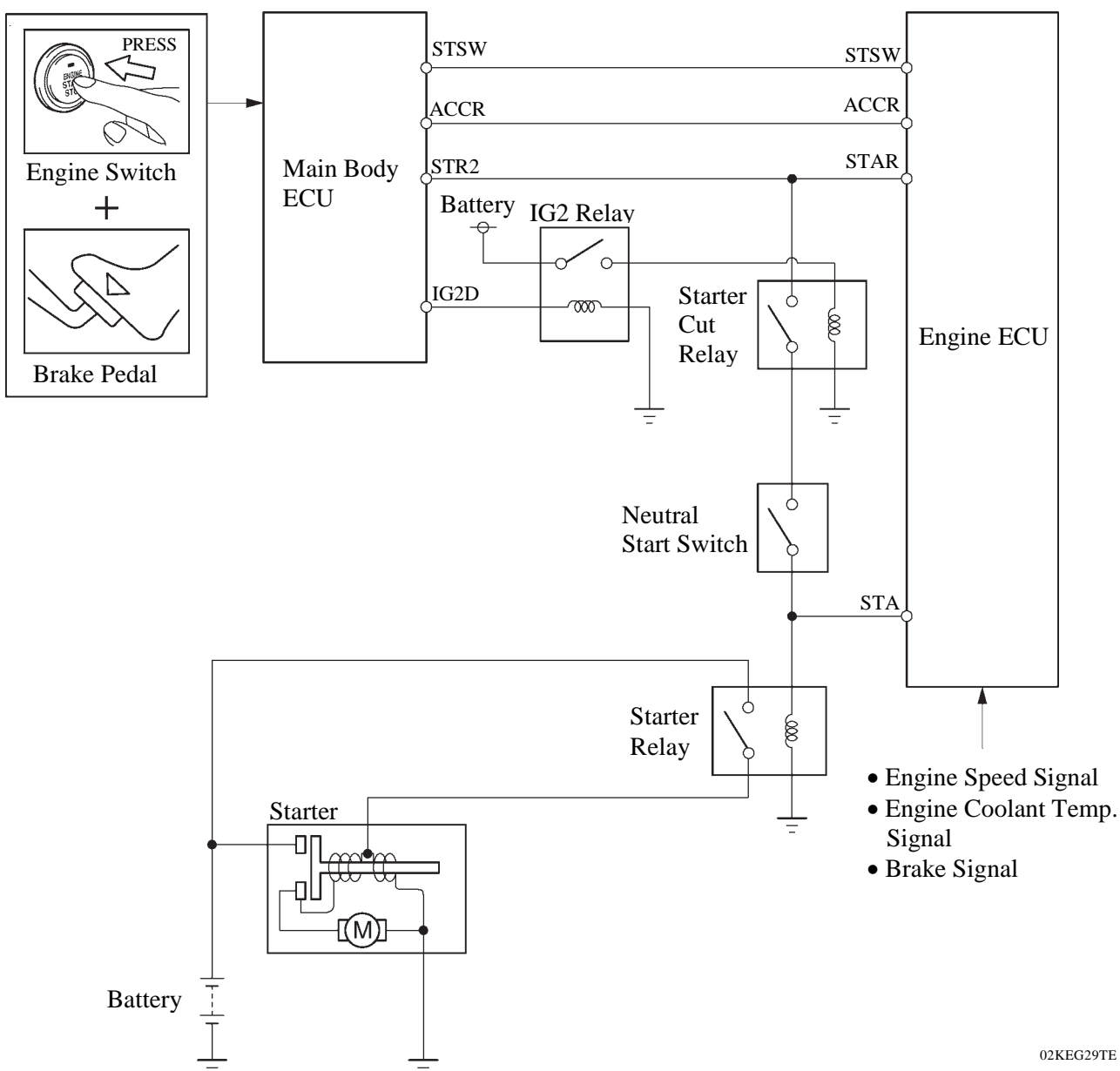
025EG15TE

## 12. Cranking Hold Function

### General

- Once the engine switch is pressed, this function continues to operate the starter until the engine has started, provided that the brake pedal is depressed. This prevents starting failure and the engine from being cranked after it has started.
- When the engine ECU detects a start signal from the main body ECU, this system monitors the engine speed (NE) signal and continues to operate the starter until it has determined that the engine has started. Furthermore, even if the engine ECU detects a start signal from the main body ECU, this system will not operate the starter if the engine ECU has determined that the engine has already started.

### System Diagram



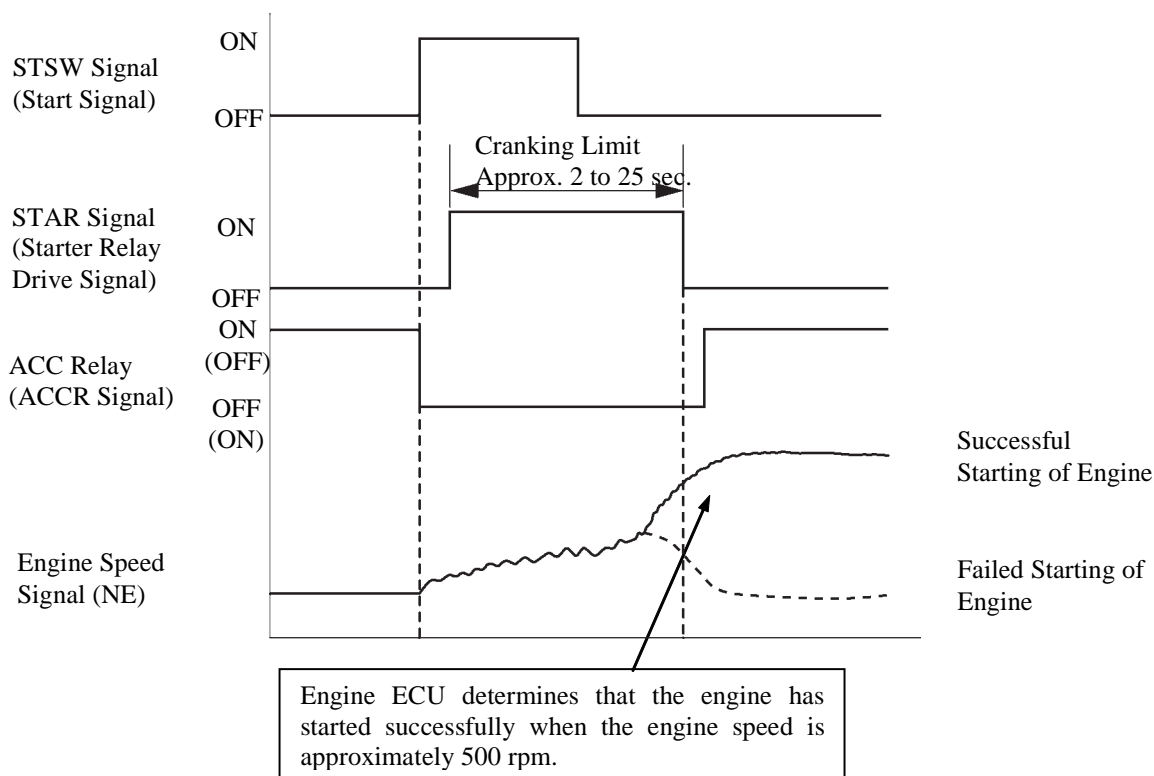
02KEG29TE

## Operation

- As indicated in the below timing chart, when the engine ECU detects a STSW signal (start signal) from the main body ECU, the engine ECU outputs STAR signal (starter relay drive signal) through the starter cut relay to the starter relay and actuates the starter. The engine ECU also outputs ACCR signal (ACC-cut request signal) to the main body ECU. Thus, the main body ECU will not energize the ACC relay. If the engine is already running, the engine ECU stops the output of the STAR signal to the starter relay and the output of the ACCR signal to the main body ECU. Thus, the starter operation stops and the main body ECU energises the ACC relay.
- After the starter operates and the engine speed becomes higher than approximately 500 rpm, the engine ECU determines that the engine has started and stops the output of the STAR signal to the starter relay and the output of ACCR signal to the main body ECU. Thus, the starter operation stops and the main body ECU energises the ACC relay.
- If the engine has any failure and does not start, the starter operates as long as its maximum continuous operation time and stops automatically. The maximum continuous operation time is approximately 2 seconds through 25 seconds depending on the water temperature condition. When the engine water temperature is extremely low, it is approximately 25 seconds and when the engine is warmed up sufficiently, it is approximately 2 seconds.
- This system cuts off the current that powers the accessories while the engine is cranking to prevent the accessory illumination from operating intermittently due to the unstable voltage that is associated with the cranking of the engine.
- This system has following protections.
  - While the engine is running normally, the starter does not operate.
  - Even if the driver keeps pressing the engine switch, the engine ECU stops the output of the STAR and ACCR signals when the engine speed becomes higher than 1200 rpm. Thus, the starter operation stops and the main body ECU energises the ACC relay.
  - In case the driver keeps pressing the engine switch and the engine does not start, the engine ECU stops the output of the STAR and ACCR signals after 30 seconds have elapsed. Thus, the starter operation stops and the main body ECU energises the ACC relay.
  - Thus, the main body ECU will stop the operation of the starter.
  - In case the engine ECU cannot detect an engine speed signal while the starter is operating, the engine ECU will immediately stop the output of the STAR and ACCR signals. Thus, the starter operation stops and the main body ECU energises the ACC relay.

Timing chart next page /...

### ▶ Timing Chart ◀



## 13. Diagnosis

- When the engine ECU detects a malfunction, the engine ECU makes a diagnosis and memorises the failed section. Furthermore, the check engine warning light in the combination meter illuminates or blinks to inform the driver.
- The engine ECU will also store the DTC (Diagnostic Trouble Code) of the malfunctions. The DTC can be accessed by using the intelligent tester II.
- For details, see the Aurion Repair Manual.

### Service Tip

- The engine ECU of the Aurion uses the CAN protocol for diagnostic communication. Therefore, an intelligent tester II is required for accessing diagnostic data. For details, see the Aurion Repair Manual.
- To clear the DTC that is stored in the engine ECU, use an intelligent tester II, disconnect the battery terminal or remove the EFI No.1 fuse and ETCS fuse for 1 minute or longer.

## 14. Fail-Safe

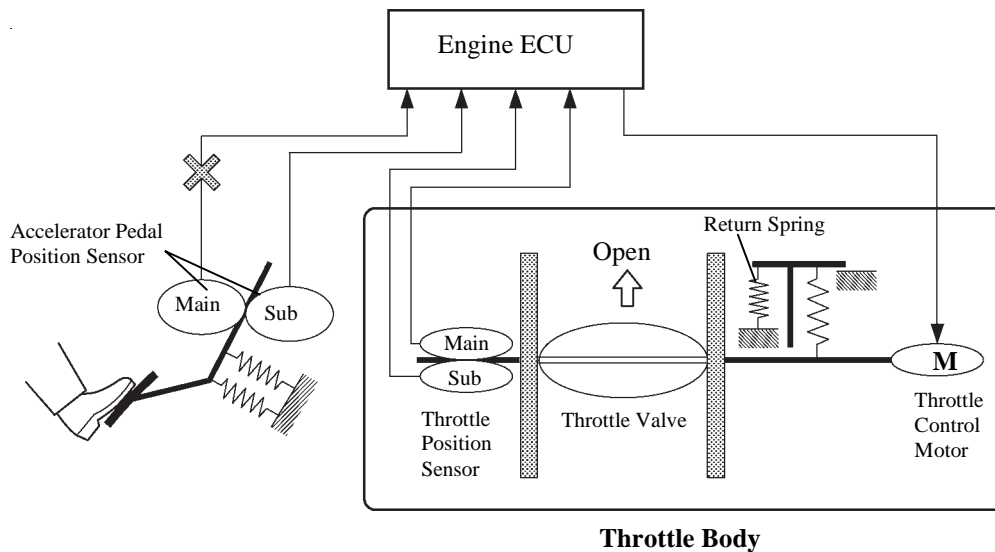
### General

When a malfunction is detected at any of the sensors, there is a possibility of an engine or other malfunction occurring if the engine ECU were to continue to control the engine control system in the normal way. To prevent such a problem, the fail-safe function of the engine ECU either relies on the data stored in memory to allow the engine control system to continue operating, or stops the engine if a hazard is anticipated. For details, refer to the Aurion Repair Manual.

## Fail-safe of Accelerator Pedal Position Sensor

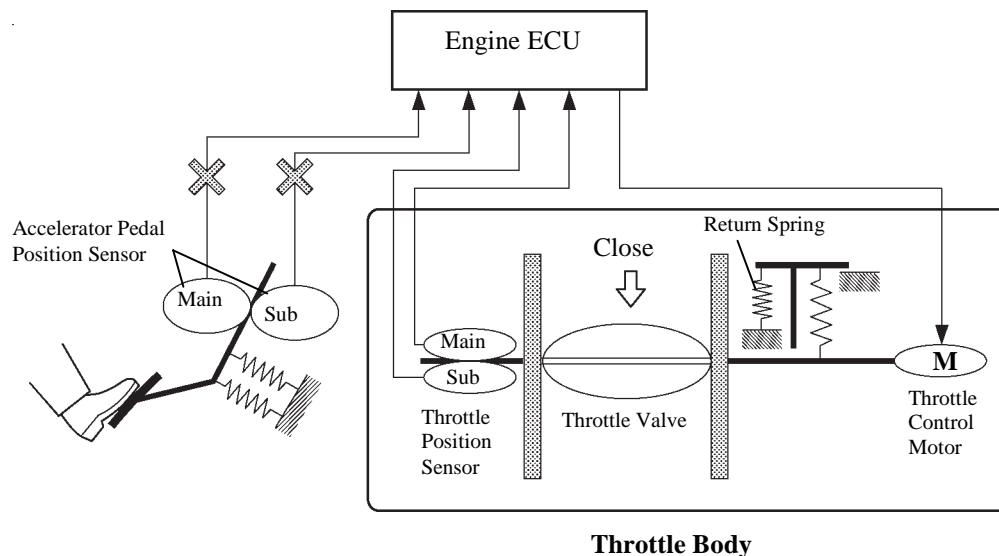
The accelerator pedal position sensor comprises two (Main, Sub) sensor circuits.

- If a malfunction occurs in either of the sensor circuits, the engine ECU detects the abnormal signal voltage difference between these two sensor circuits and switches into the limp mode. In the limp mode, the remaining circuit is used to calculate the accelerator pedal opening, in order to operate the vehicle under limp mode control.



D13N08

- If both circuits malfunction, the engine ECU detects the abnormal signal voltage from these two sensor circuits and discontinues the throttle control. At this time, the vehicle can be driven within its idling range.

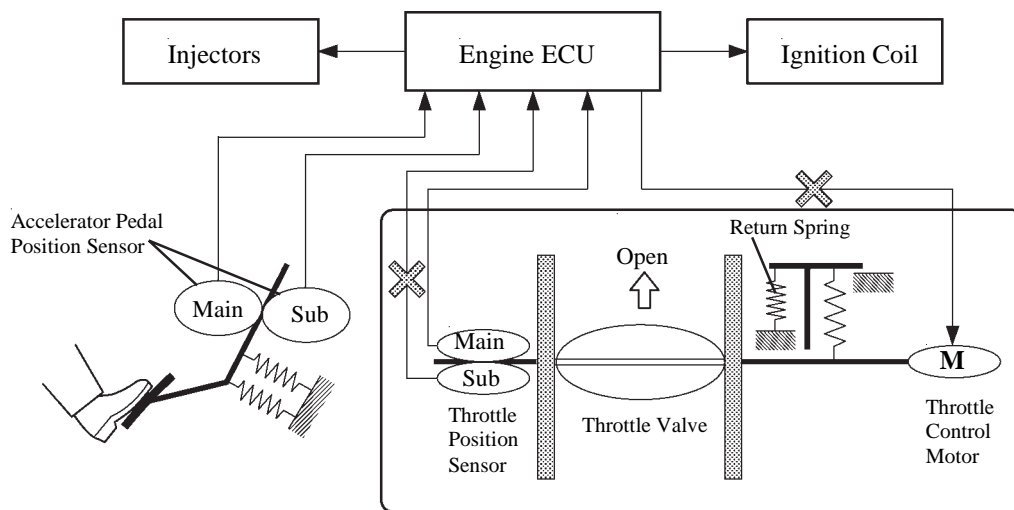


D13N09

## Fail-safe of Throttle Position Sensor

The throttle position sensor comprises two (Main, Sub) sensor circuits.

- If a malfunction occurs in either of the sensor circuits, the engine ECU detects the abnormal signal voltage difference between these two sensor circuits, cuts off the current to the throttle control motor, and switches to the limp mode.
- Then, the force of the return spring causes the throttle valve to return and stay at the prescribed opening. At this time, the vehicle can be driven in limp mode while the engine output is regulated through the control of the fuel injection and ignition timing in accordance with the accelerator opening.
- The same control as above is effected if the engine ECU detects a malfunction in the throttle control motor system.



**Throttle Body**

D13N10



# CHASSIS

## **U660E AUTOMATIC TRANSAXLE**

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## **STEERING**

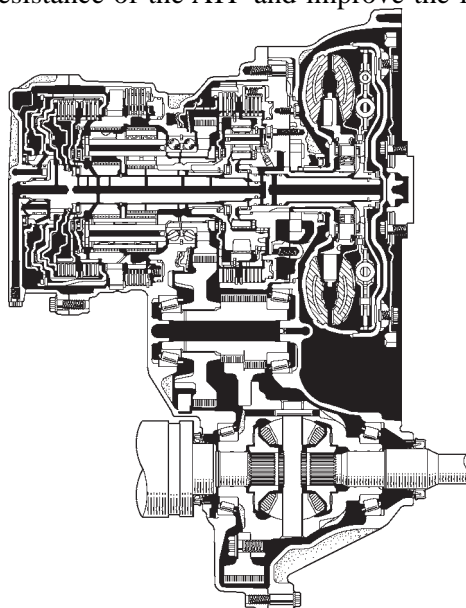
Description.....	CH-91
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# CHASSIS

## U660E AUTOMATIC TRANSAXLE

### DESCRIPTION

- A newly developed U660E automatic transaxle is used on the 2GR-FE engine models. This automatic transaxle is a compact, lightweight and high-capacity 6-speed Super ECT (Electronically Controlled Transaxle).
- ATF WS is used to reduce the resistance of the ATF and improve the fuel economy. For detail, refer to page CH-5.



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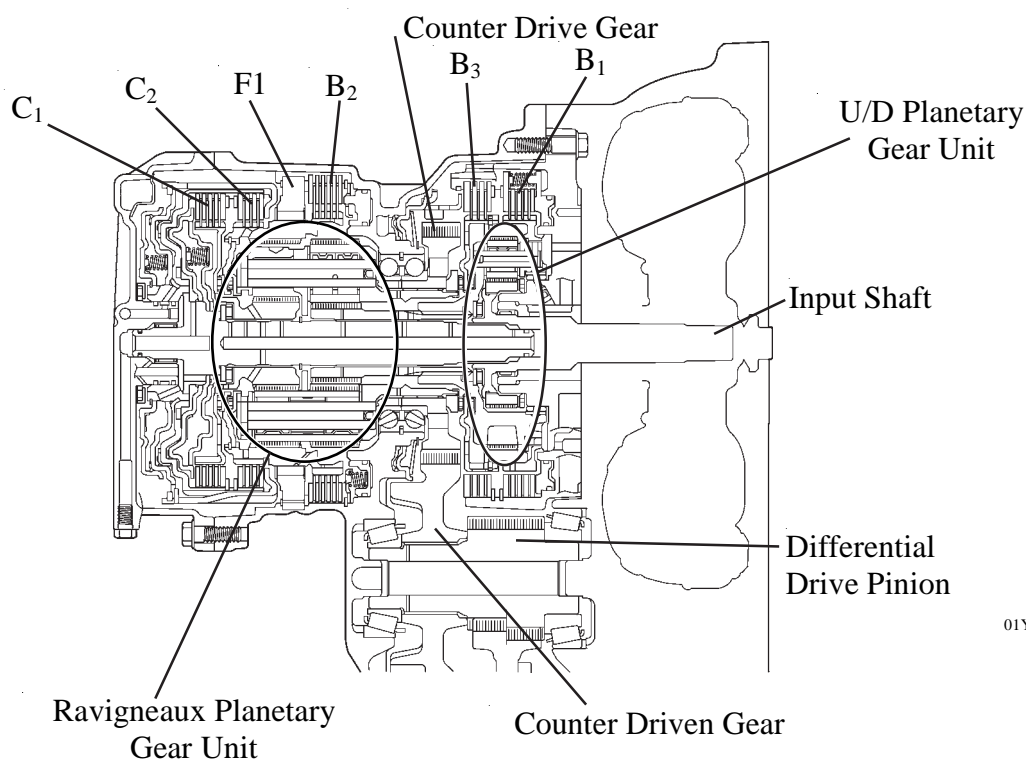
### Specifications

Gear Ratio	1st	3.300
	2nd	1.900
	3rd	1.420
	4th	1.000
	5th	0.713
	6th	0.608
	Reverse	4.148
Differential Gear Ratio		3.685* <sup>1</sup>
Fluid Capacity* <sup>2</sup> Litres		6.57
Fluid Type		Toyota Genuine ATF WS
Weight (Reference)* <sup>3</sup> kg		94.4

\*1: Counter gear ratio included

\*2: Differential included

\*3: Weight shows the figure with the fluid filled to the maximum level.



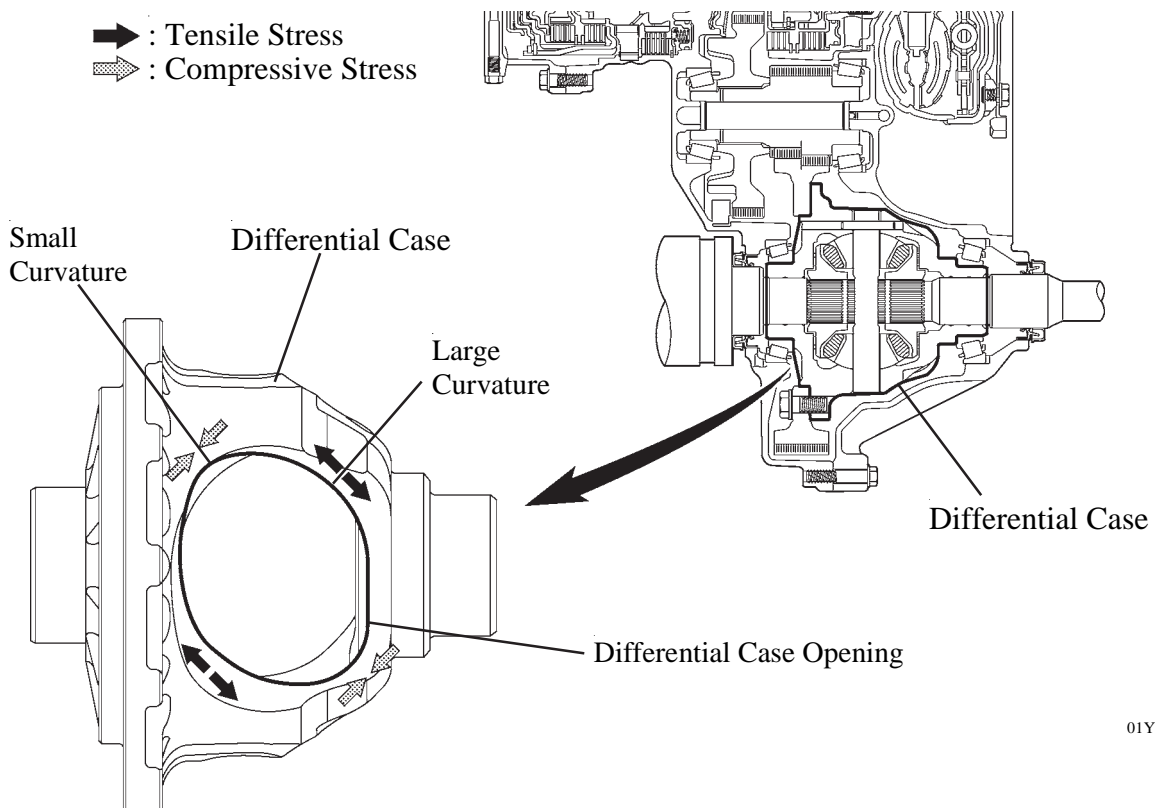
01YCH02Y

### ▸ Specifications ◀

C <sub>1</sub>	No.1 Clutch	The No. of Discs	4
C <sub>2</sub>	No.2 Clutch		3
B <sub>1</sub>	No.1 Brake		4
B <sub>2</sub>	No.2 Brake		5
B <sub>3</sub>	No.3 Brake		3
F <sub>1</sub>	No.1 One- Way Clutch	The No. of Sprags	20
Ravigneaux Planetary Gear Unit		The No. of Front Sun Gear Teeth	30
		The No. of Rear Sun Gear Teeth	27
		The No. of Long Pinion Gear Teeth	20
		The No. of Short Pinion Gear Teeth	22
		The No. of Ring Gear Teeth	69
U/D Planetary Gear Unit		The No. of Sun Gear Teeth	66
		The No. of Pinion Gear Teeth	21
		The No. of Ring Gear Teeth	110
Counter Gear		The No. of Drive Gear Teeth	44
		The No. of Driven Gear Teeth	47

## ✱ DIFFERENTIAL CASE

The curvature of the differential case opening, where tensile stress is concentrated during driving, is enlarged, in order to moderate the stress concentration and enhance the differential gear tolerant torque. As a result, use of the lightweight 2-pinion differential gears is possible.

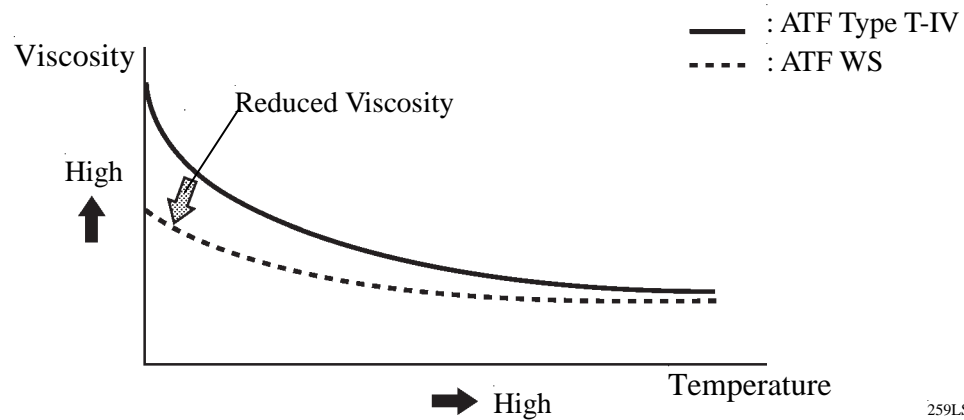


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**Stresses Applied to Differential Case Opening during Driving**

## ☀ ATF (AUTOMATIC TRANSMISSION FLUID) WS

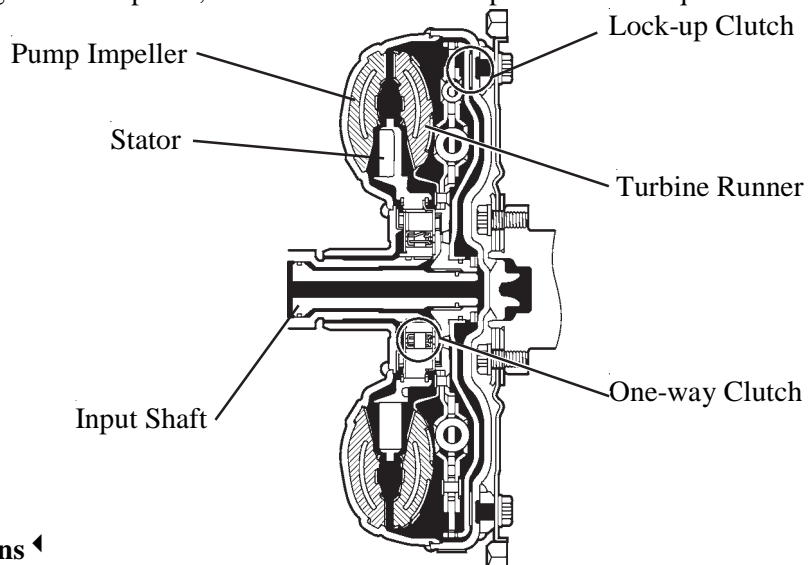
- ATF WS is used to reduce the resistance of the ATF and improve the fuel economy by reducing its viscosity in the practical operating temperature range. At higher fluid temperatures, the viscosity is the same as that of ATF Type T-IV, which ensures the durability of the automatic transaxle.
- ATF WS and other types of ATF (ATF Type T-IV, D-II) are not interchangeable.



259LSK03

## ✿ TORQUE CONVERTER

- A compact, lightweight and high-capacity torque converter is used.
- In order to make the torque converter more compact and shorten its total length, the pump impeller and turbine runner have been flattened, and the structure of the one-way clutch has been simplified.
- This torque converter has optimally designed fluid passages and impeller configuration resulting in substantially enhanced transmission efficiency to ensure better starting, acceleration and fuel economy.
- Furthermore, a hydraulically operated lock-up mechanism, which enables the lock-up (flex lock-up) operation at low to high vehicle speeds, is used to reduce the slip loss of the torque converter.

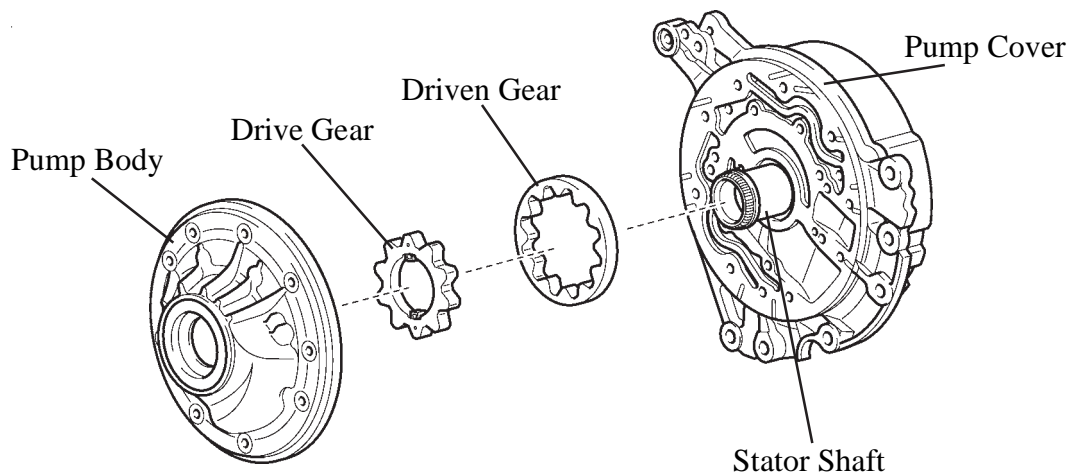


### ► Specifications ◀

Torque Converter Type	3-Element, 1-Step, 2-Phase
Stall Torque Ratio	1.8

## ✿ OIL PUMP

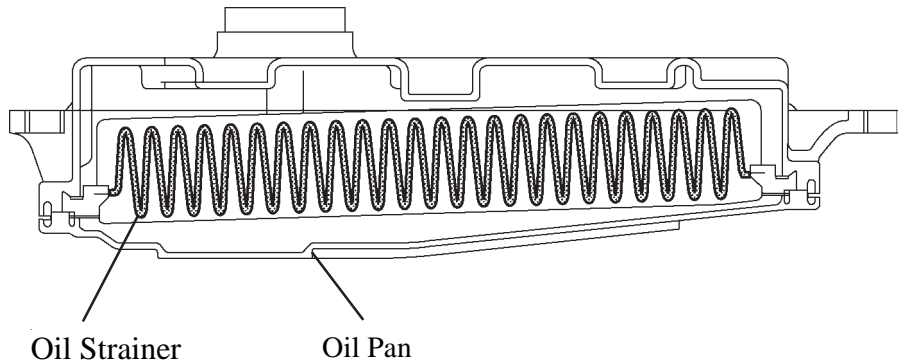
- The oil pump is operated by the torque converter. It lubricates the planetary gear units and supplies operating fluid pressure for hydraulic control.
- The pump cover is made of aluminium to reduce weight.



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## ✱ **OIL STRAINER**

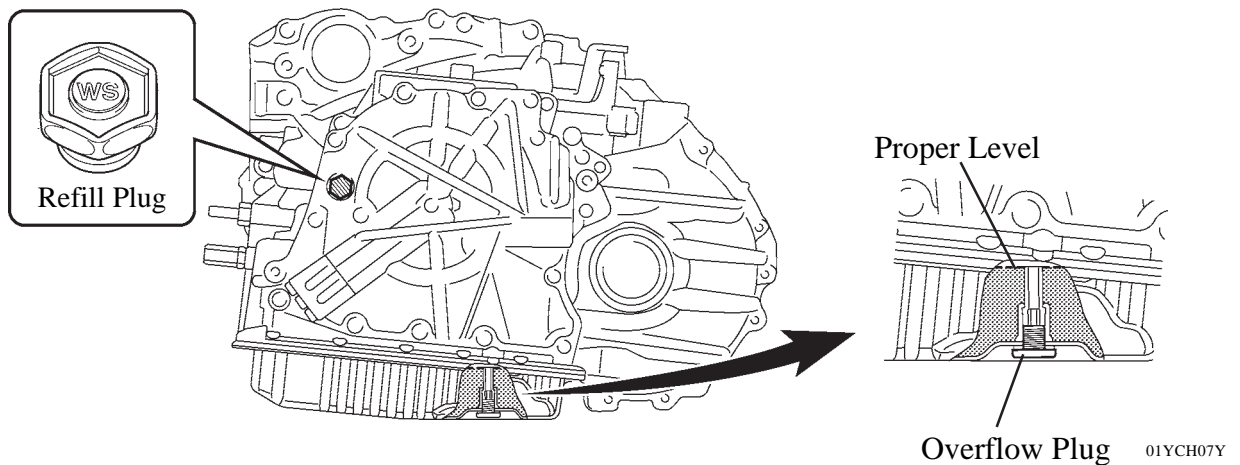
A felt type oil strainer is used because it is; lightweight, provides excellent filtering ability, more reliable and free from maintenance.



01YCH06Y

## ✱ **ATF FILLING PROCEDURES**

- The ATF filling procedure is changed in order to improve the accuracy of the ATF level when the transaxle is being repaired or replaced. As a result, the oil filler tube and the oil level gauge used for a conventional automatic transaxle are discontinued, eliminating the need to inspect the fluid level as a part of routine maintenance.
- This filling procedure employs a refill plug, overflow plug, ATF temperature sensor, and shift indicator light "D". After the transaxle is refilled with ATF, remove the overflow plug and drain the extra ATF at the proper ATF temperature. Thus, the appropriate ATF level can be obtained. For details about the ATF filling procedure, refer to the Service Tip on the next page.



01YCH07Y

**Service Tip****ATF Filling procedure using SST (09843-18040)**

When a large amount of ATF needs to be filled (i.e. after removal and installation of oil pan or torque converter), perform the procedure from step 1.

When a small amount of ATF is required (i.e. removal and installation of oil cooler tube, repair of a minor oil leak), perform the procedure from step 7.

- 1) Raise the vehicle while keeping it level.
- 2) Remove the refill plug and overflow plug.
- 3) Fill the transaxle with WS type ATF through the refill plug hole until it overflows from the overflow plug hole.
  - ATF WS must be used to fill the transaxle.
- 4) Reinstall the overflow plug.
- 5) Add the specified amount of ATF (specified amount is determined by the procedure that was performed) and reinstall the refill plug.

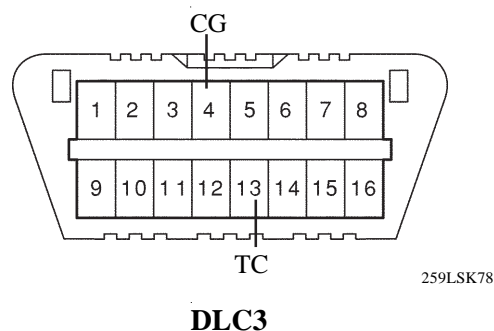
**Example:**

Procedure	Litres
Removal and installation of transaxle oil pan (including oil drainage)	2.9
Removal and installation of transaxle valve body	3.3
Replacement of torque converter	4.9

- 6) Lower the vehicle
- 7) Use the SST (09843-18040) to make shorts between the TC and CG terminals of the DLC3 connector:
- 8) Start the engine and allow it to idle.
  - A/C switch must be turned off.
- 9) Move the shift lever from the P position to the S mode position and slowly selects each gear S1 – S6. Then move the shift lever back to the P position.
- 10) Move the shift lever to the D position, and then quickly move it back and forth between N and D (at least once every 1.5 seconds) for at least 6 seconds. This will activate oil temperature detection mode.

**Standard: The shift position indicator light “D” remains illuminated for 2 seconds and then goes off.**

- 11) Return the shift lever to the P position and disconnect the TC terminal.
- 12) Idle the engine to raise the ATF temperature.



Continued \...



- 13) Immediately after the shift position indicator “D” light turns on, lift the vehicle up.
- The shift position indicator light “D” will indicate the ATF temperature according to the following table.

ATF Temp.	Lower than Optimal Temp.	Optimal Temp.	Higher than Optimal Temp.
Shift Position Indicator Light “D”	OFF	ON	Blinking

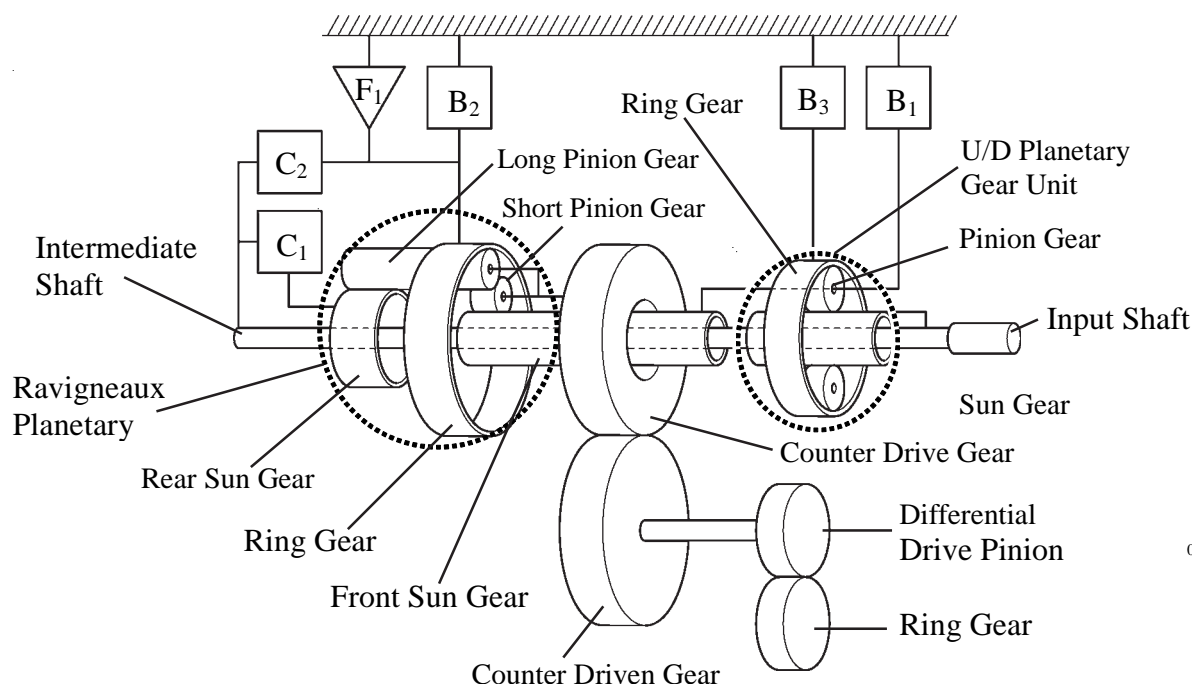
- 14) Remove the overflow plug and adjust the oil quantity.
- If the ATF overflows, go to step 17, and if the ATF does not overflow, go to step 15.
- 15) Remove the refill plug.
- 16) Add ATF through the refill plug hole until it flows out from the overflow plug hole.
- 17) When the ATF flow slows to a trickle, install the overflow plug and a new gasket.
- 18) Reinstall the refill plug (if the refill plug was removed).
- 19) Lower the vehicle.
- 20) Turn the ignition switch (engine switch) OFF to stop the engine.

For details about the ATF Filling procedures, see the Aurion Repair Manual.

## ✱ PLANETARY GEAR UNIT

### 1. Construction

- The 6-speed configuration has been achieved by using 2 planetary gear units, creating a 6-speed automatic transaxle.
- A Ravigneaux type planetary gear unit is used as the rear gear unit. The gear unit consists of pairs of sun gears (front and rear) and planetary pinion gears (long and short) with different diameters within a single planetary gear.
- The centrifugal fluid pressure cancelling mechanism is used.
- The shapes of the grooves in the clutches and brake linings have been optimised in order to reduce drag during clutch and brake operation.



01YCH03Y

### 2. Function of Components

Component		Function
C <sub>1</sub>	No.1 Clutch	Connects intermediate shaft and Ravigneaux planetary rear sun gear.
C <sub>2</sub>	No.2 Clutch	Connects intermediate shaft and Ravigneaux planetary ring gear.
B <sub>1</sub>	No.1 Brake	Prevents Ravigneaux planetary front sun gear and U/D planetary carrier from turning either clockwise or counter clockwise.
B <sub>2</sub>	No.2 Brake	Prevents Ravigneaux planetary ring gear from turning either clockwise or counter clockwise.
B <sub>3</sub>	No.3 Brake	Prevents U/D planetary ring gear from turning either clockwise or counter clockwise.
F <sub>1</sub>	No.1 One-Way Clutch	Prevents Ravigneaux planetary ring gear from turning counter clockwise.
Planetary Gears		These gears change the route through which driving force is transmitted, in accordance with the operation of each clutch and brake, in order to increase or reduce the input and output speeds.

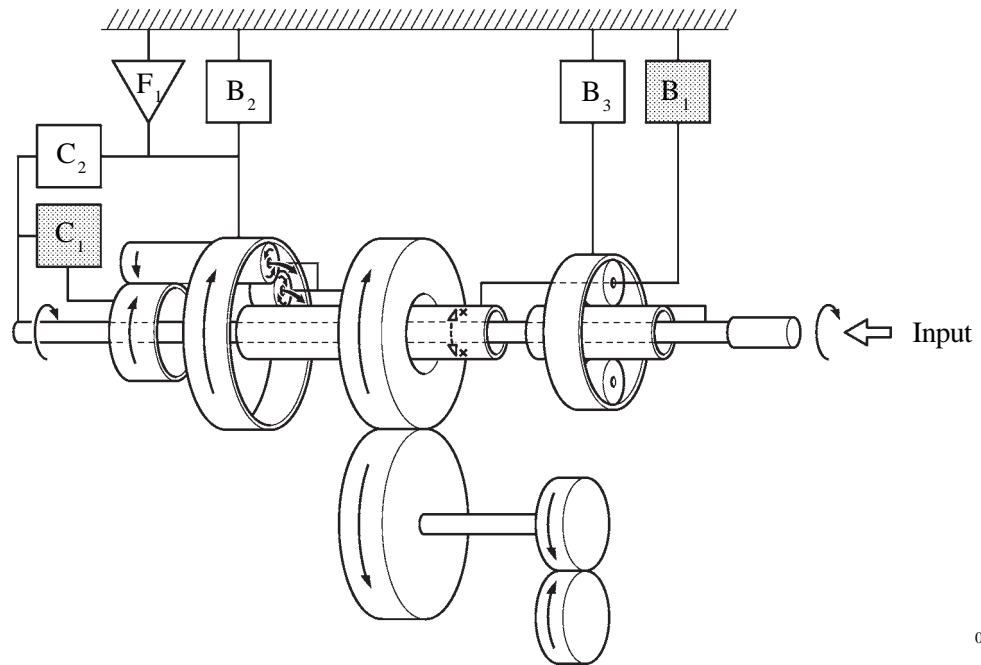
**3. Transaxle Power Flow**

Shift Lever Position	Gear	Solenoid Valve						Clutch		Brake			One-way Clutch
		SL	SL1	SL2	SL3	SL4	SLU	C <sub>1</sub>	C <sub>2</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	F <sub>1</sub>
P	Park		○										
R	Reverse	●				○					○	○	
N	Neutral		○										
D, S6	1st		○					○					○
	2nd	○	○		○		Δ	○		○			
	3rd	○	○			○	Δ	○				○	
	4th	○	○	○			Δ	○	○				
	5th	○		○		○	Δ		○			○	
	6th	○		○	○		Δ		○	○			
S5	1st		○					○					○
	2nd	○	○		○		Δ	○		○			
	3rd	○	○			○	Δ	○				○	
	4th	○	○	○			Δ	○	○				
	5th	○		○		○	Δ		○			○	
S4	1st		○					○					○
	2nd	○	○		○		Δ	○		○			
	3rd	○	○			○	Δ	○				○	
	4th	○	○	○			Δ	○	○				
S3	1st		○					○					○
	2nd		○		○			○		○			
	3rd		○			○		○				○	
S2	1st		○					○					○
	2nd		○		○			○		○			
S1	1st		○				○	○			○		○

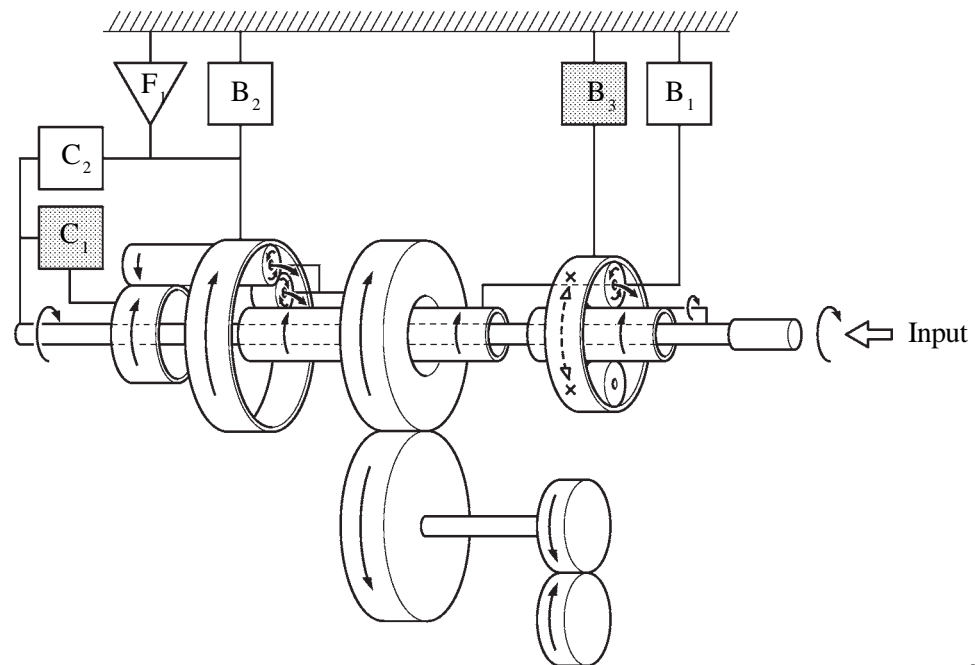
○: ON    Δ: In accordance with flex lock-up    ●: ON while engaging, OFF after engaged

The diagram illustrates a mechanical system with a feedback loop. The system consists of a shaft with three rotors. The first rotor is connected to a feedback loop with blocks  $C_1$  and  $C_2$ . The second rotor is connected to a feedback loop with blocks  $B_2$  and  $B_3$ . The third rotor is connected to a feedback loop with blocks  $B_1$  and  $B_2$ . The input is applied to the third rotor. The output is the angular displacement of the first rotor.

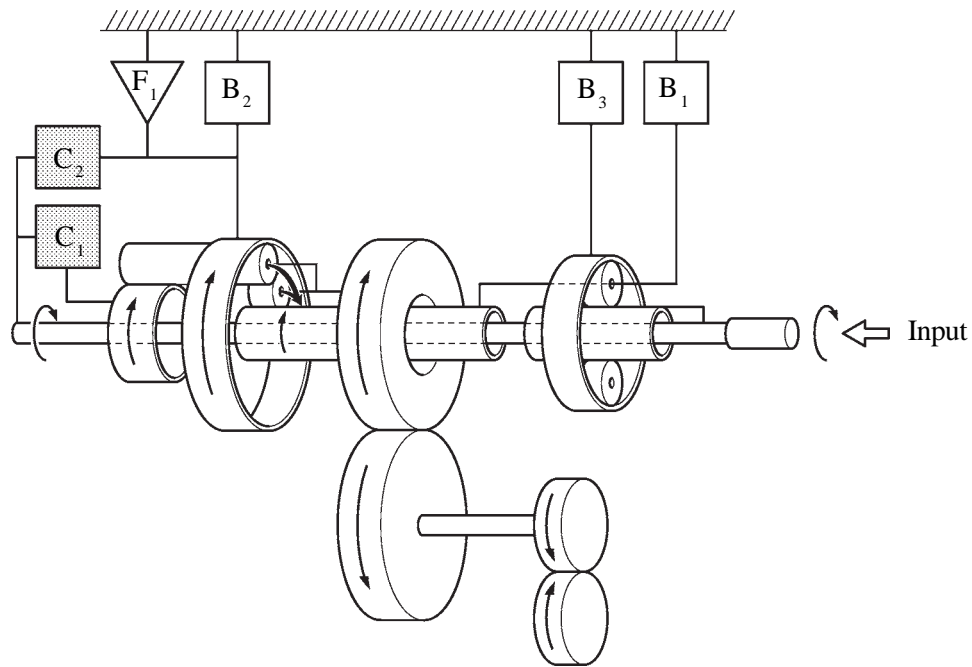
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**2nd Gear (D Position or S Mode)**

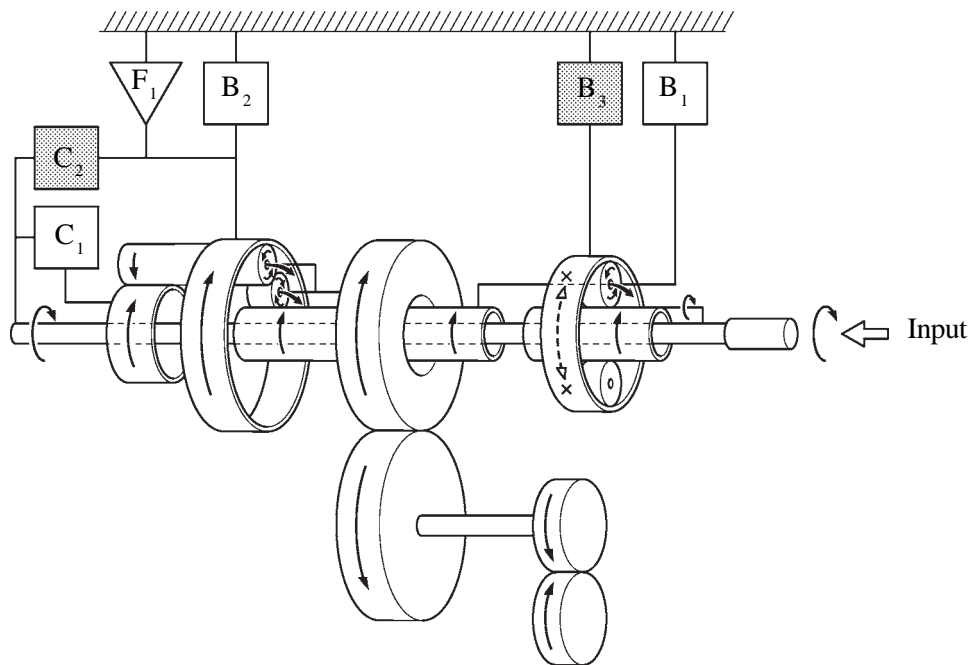
01YCH10Y

**3rd Gear (D Position or S Mode)**

01YCH11Y

**4th Gear (D Position or S Mode)**

01YCH12Y

**5th Gear (D Position or S Mode)**

01YCH13Y

### 6th Gear (D Position or S Mode)



### Reverse Gear (R Position)



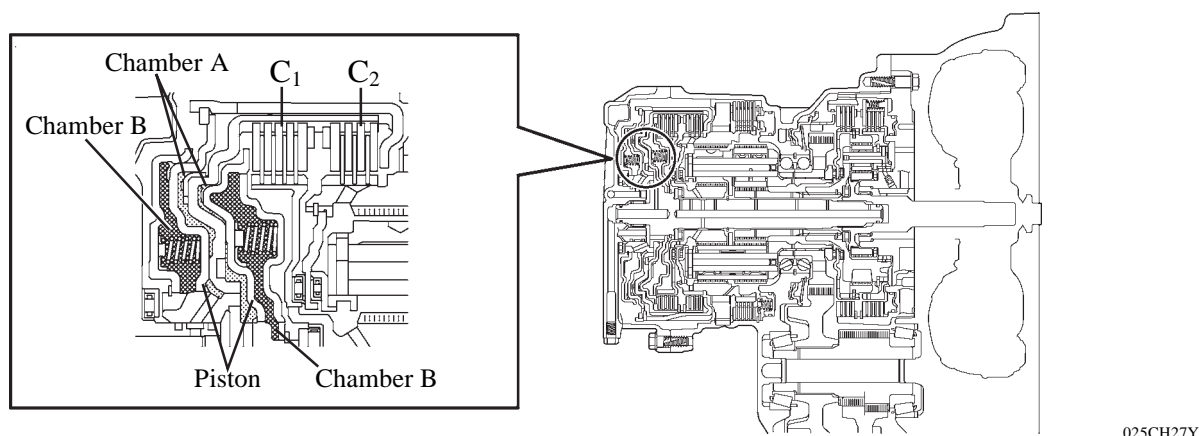
#### 4. Centrifugal Fluid Pressure Cancelling Mechanism

This mechanism is applied to  $C_1$  and  $C_2$  clutches when shifting between the 1st to 6th gears. The basic construction and operation of the mechanism are the same as those used on U241E.

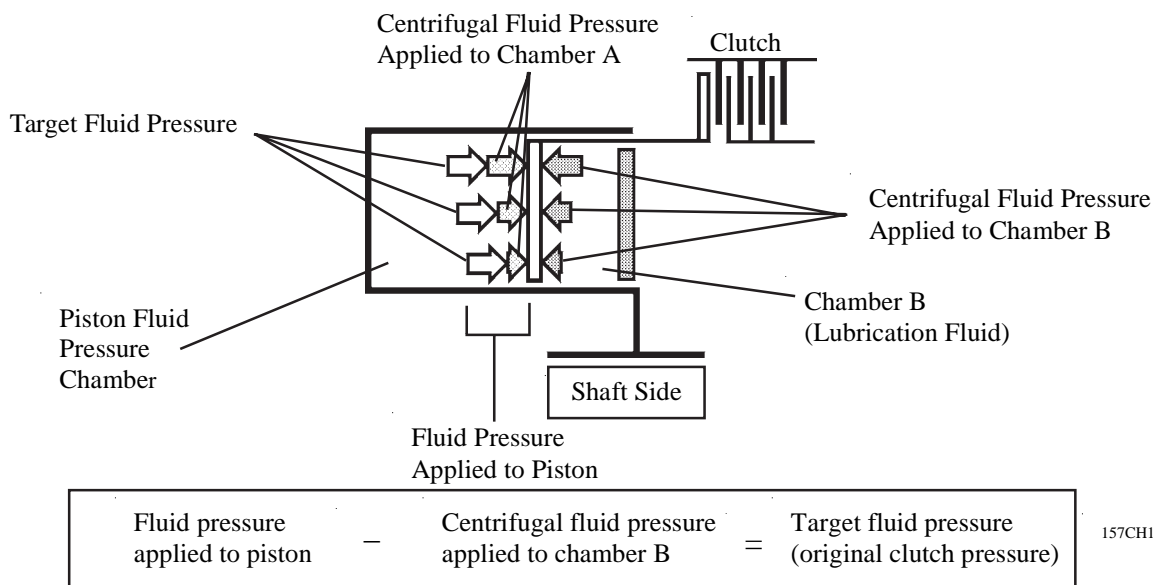
There are two reasons for improving the conventional clutch mechanism:

- To prevent the generation of pressure by the centrifugal force that is applied to the fluid in piston fluid pressure chamber (hereafter referred to as “chamber A”) when the clutch is released, a check ball is provided to discharge the fluid. Therefore, before the clutch could be subsequently applied, it took time for the fluid to fill the chamber A.
- During shifting, in addition to the original clutch pressure that is controlled by the valve body, the pressure that acts on the fluid in chamber A also exerts influence, which is dependent upon revolution fluctuations.

To address these two needs for improvement, a cancelling fluid pressure chamber (hereafter referred to as “chamber B”) has been provided opposite chamber A.



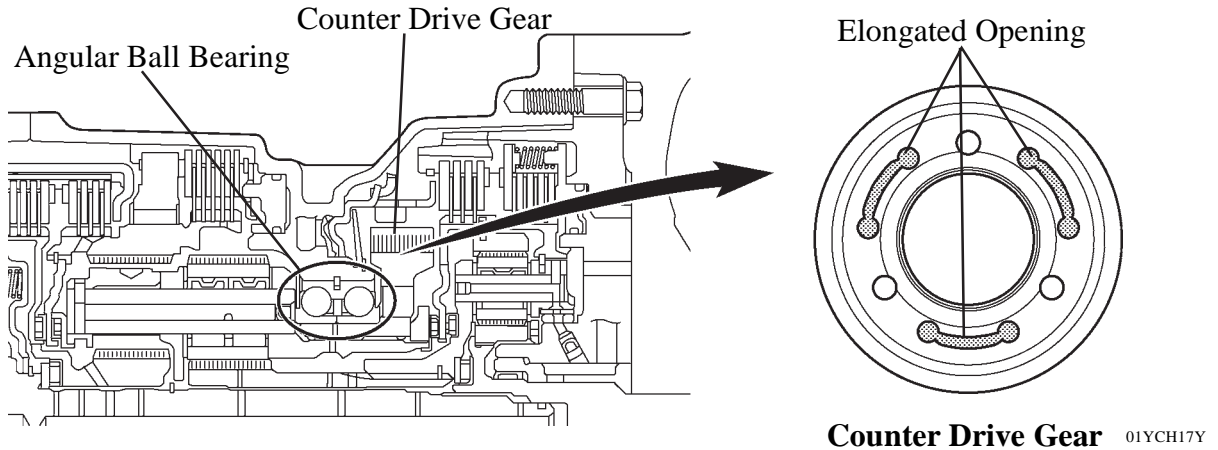
By utilising lubrication fluid such as that of the shaft, an equal centrifugal force is applied, thus cancelling the centrifugal force that is applied to the piston itself. Accordingly, it is not necessary to discharge the fluid through the use of a check ball, and a highly responsive and smooth shifting characteristic has been achieved.





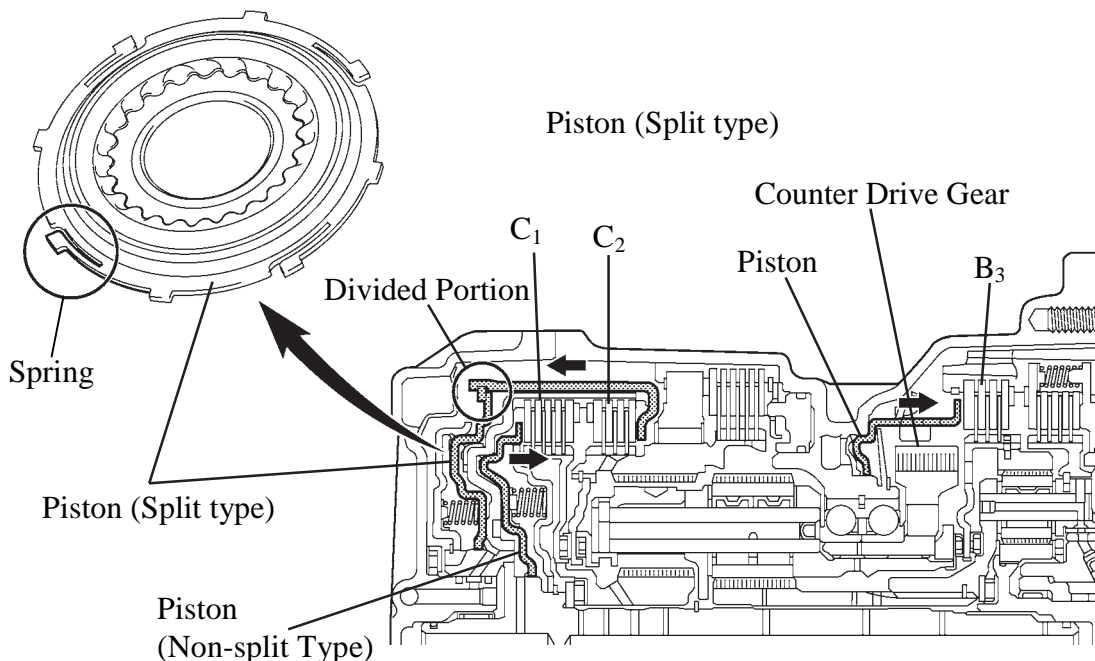
## 5. Counter Drive Gear

- Angular ball bearings are used to support the counter drive gear and the Ravigneaux planetary gear unit, reducing the rolling resistance and noise.
- By providing three elongated openings in the counter drive gear, the vibration conduction characteristic of the gear has been optimised. As a result, both gear noise and weight reductions have been achieved.



## 6. Clutch and Brake Pistons

- Two types of pistons are used; a non-split piston that acts in the push direction for the No.1 clutch ( $C_1$ ) operation, and a split piston that acts in the pull direction for the No.2 clutch ( $C_2$ ) operation. These two types of pistons contribute to making the entire clutch structure compact.
- When the split piston operates, clutch drag occurs due to rattling cause by the divided portion of the piston. However, by fitting springs on the piston circumference, such rattling is restrained and the occurrence of clutch drag is minimised.
- By setting the piston for the No.3 brake ( $B_3$ ) operation around the counter drive gear, the brake structure has been made more compact.

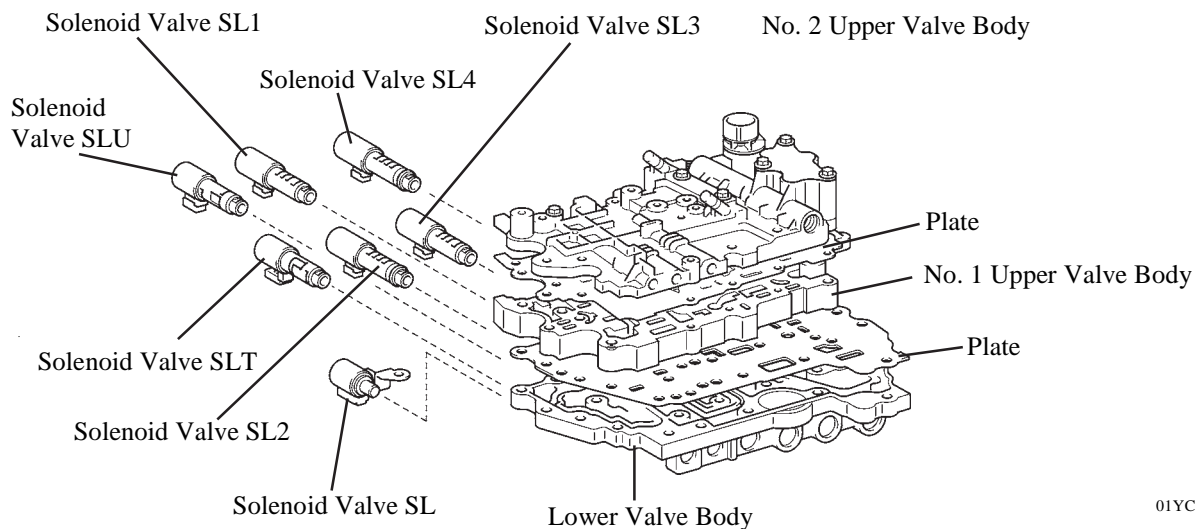


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## ★ VALVE BODY UNIT

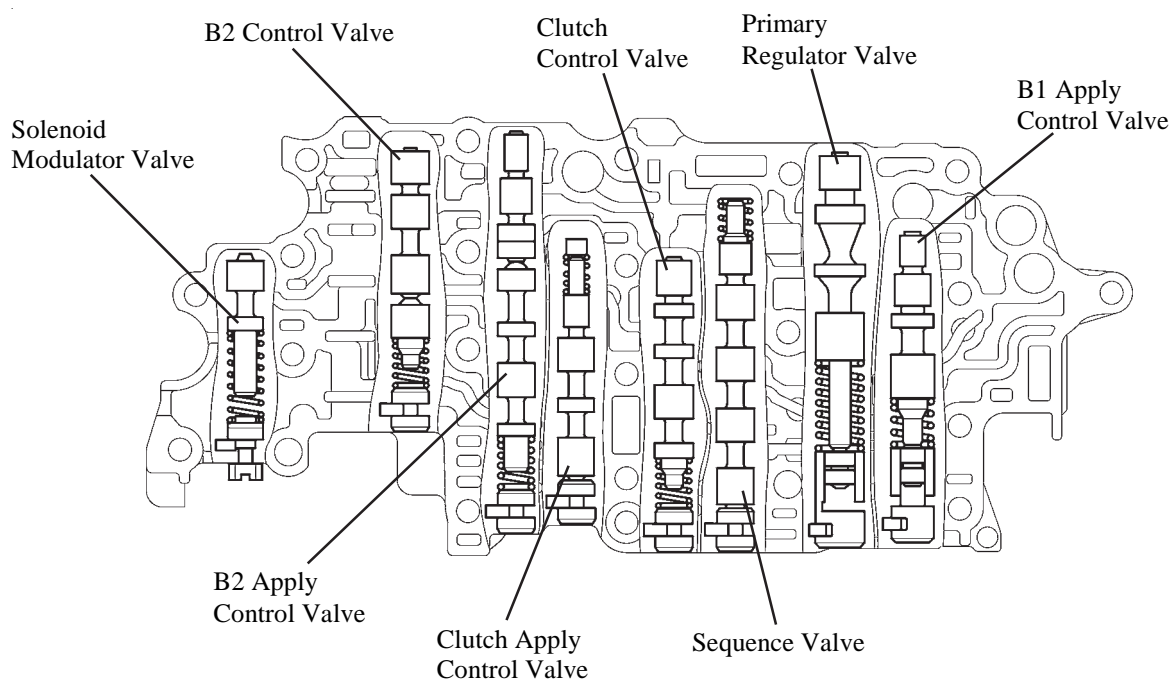
### 1. General

The valve body unit consists of the No.1 upper, No.2 upper and lower valve bodies and 7 solenoid valves (SL1, SL2, SL3, SL4, SLU, SLT, SL).



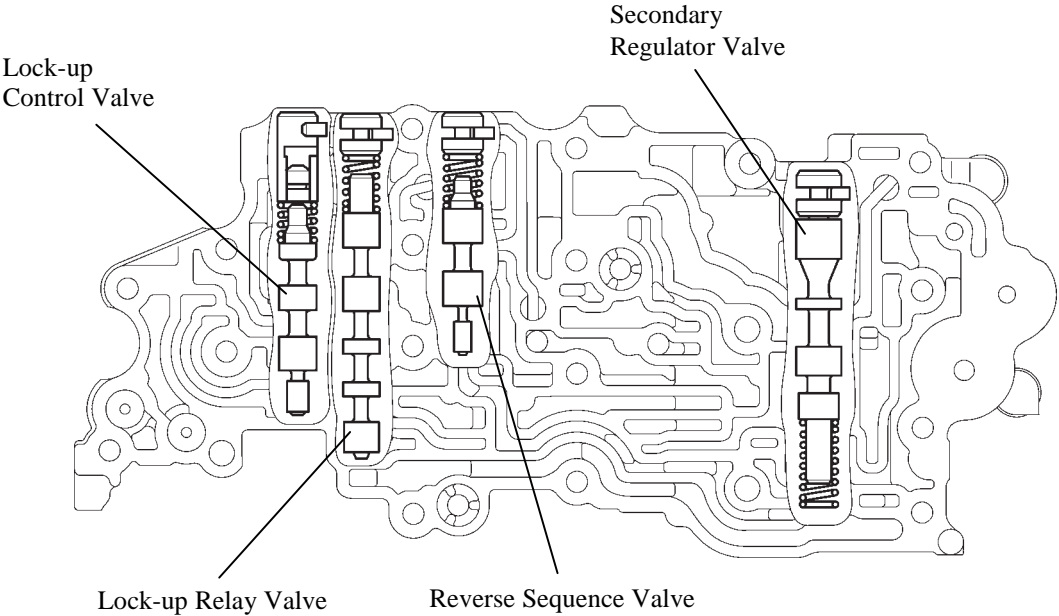
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### ► No.1 Upper Valve Body ◀



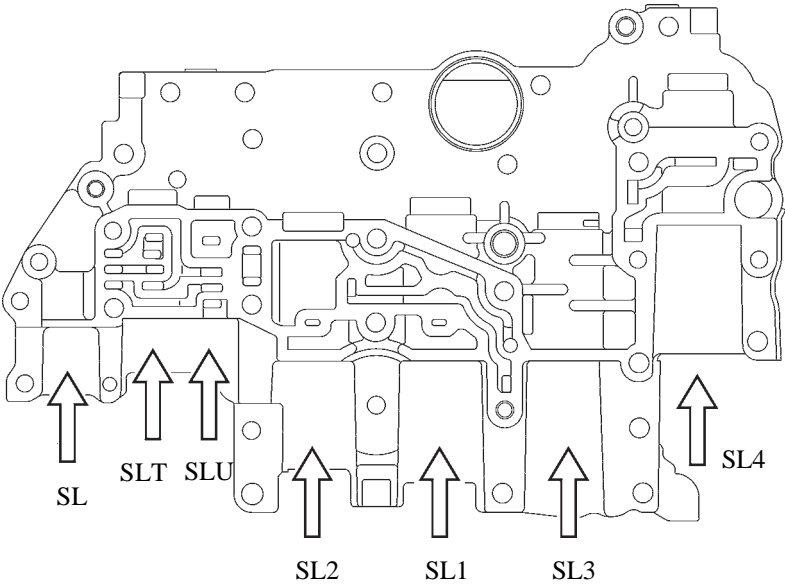
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► No.2 Upper Valve Body ◀



01YCH39TE

► Lower Valve Body ◀

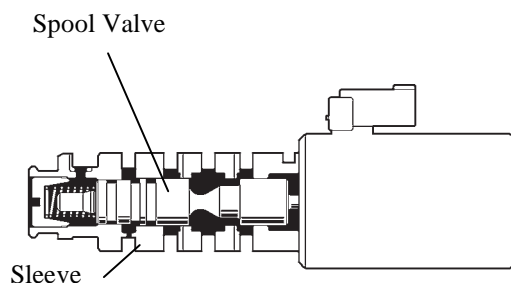
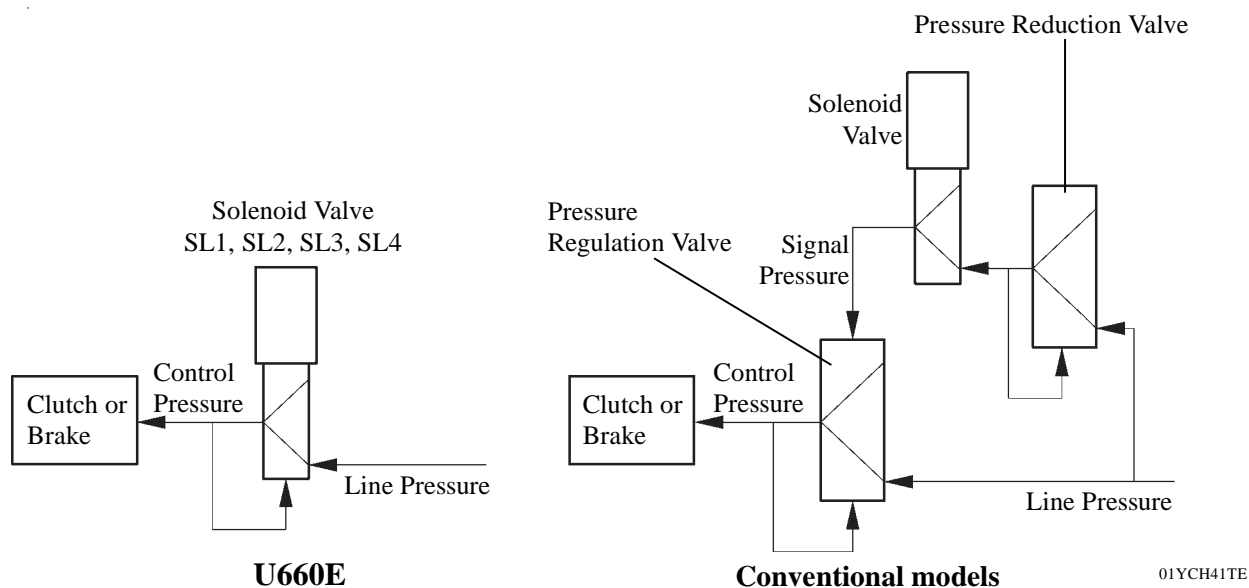


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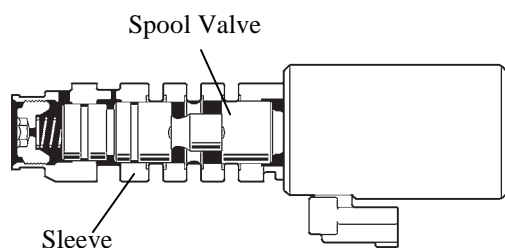
## 2. Solenoid Valves

### Solenoid Valves SL1, SL2, SL3, SL4, SLU and SLT

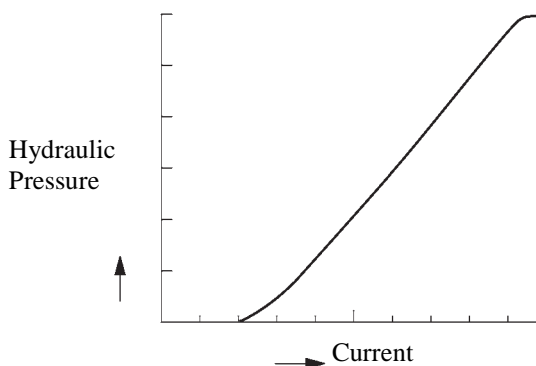
- In order to provide a hydraulic pressure that is proportional to the current that flows to the solenoid coil, solenoid valves SL1, SL2, SL3, SL4, SLU and SLT linearly control the line pressure and clutch and brake engagement pressure based on the signals from the ECT ECU.
- Solenoid valves SL1, SL2, SL3 and SL4 are large flow linear solenoid valves that can supply more pressure than conventional ones. These solenoid valves control engagement elements by directly regulating the line pressure without using the pressure regulation valve or the pressure reduction valve. Thus, the number of valves and the length of the valve body fluid passage have been reduced, the shifting response has been increased and the shift shock has been minimised.



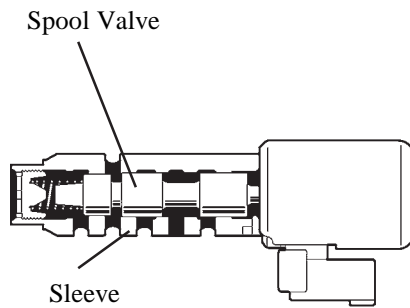
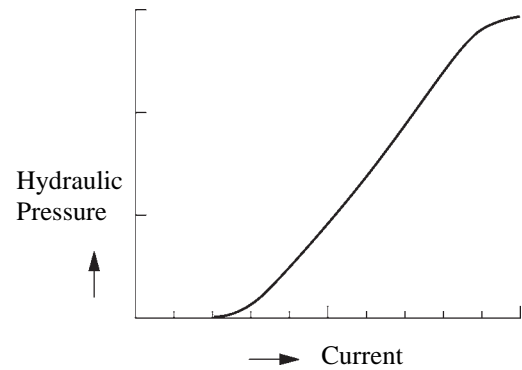
**Solenoid Valve SL2 and SL4**



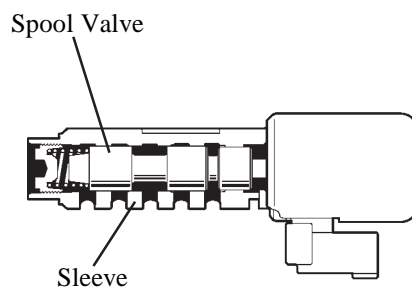
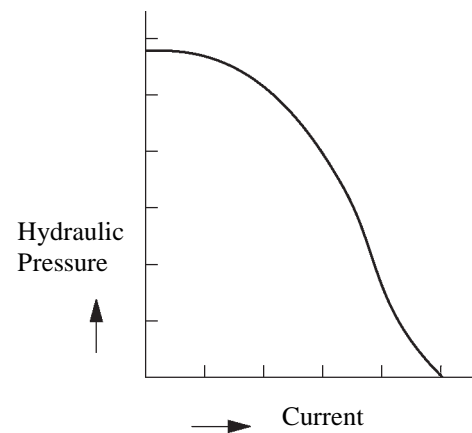
**Solenoid Valve SL1 and SL3**



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**Solenoid Valve SLU**

01YCH20Y

**Solenoid Valve SLT**

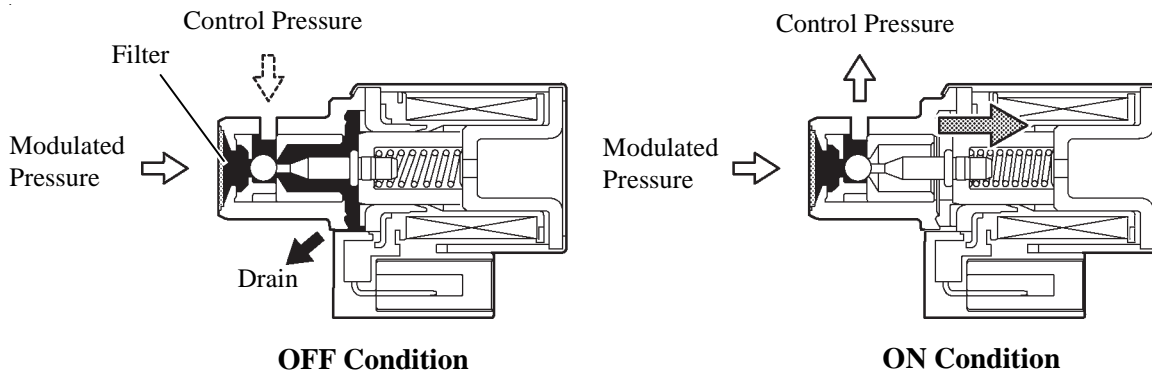
01YCH21Y

### ► Function of Solenoid Valves ◀

Solenoid Valve	Function
SL1	C <sub>1</sub> clutch pressure control
SL2	C <sub>2</sub> clutch pressure control
SL3	B <sub>1</sub> brake pressure control
SL4	B <sub>3</sub> brake pressure control
SLU	<ul style="list-style-type: none"> <li>• Lock-up clutch pressure control</li> <li>• B<sub>2</sub> brake pressure control</li> </ul>
SLT	Line pressure control

### Solenoid Valve SL

- Solenoid valve SL uses a three-way solenoid valve.
- A filter is provided at the tip of the solenoid valve to further improve operational reliability.



01YCH22Y

#### ► Function of Solenoid Valve ◀

Solenoid Valve	Type	Function
SL	3-way	<ul style="list-style-type: none"> <li>• Switches the lock-up relay valve.</li> <li>• Switches the B<sub>2</sub> apply control valve and the reverse sequence valve.</li> </ul>

## ✱ ELECTRONIC CONTROL SYSTEM

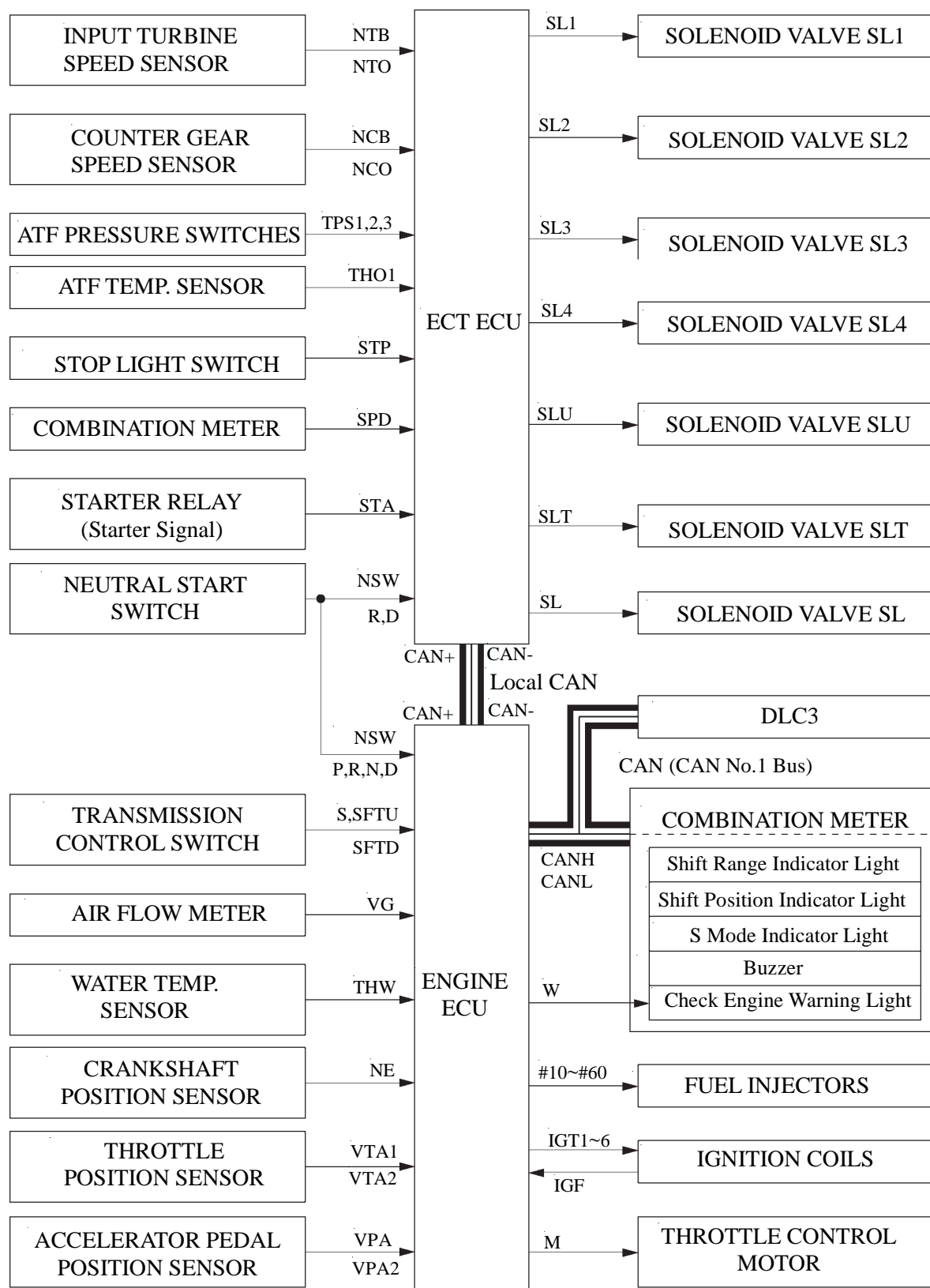
### 1. General

The electronic control system of the U660E automatic transaxle consists of the control listed below.

System	Outline
Shift Timing Control	The ECT ECU supplies current to 6 solenoid valves (SL1, SL2, SL3, SL4, SL and/or SLU) based on signals from each sensor to shift the gear.
Clutch to Clutch Pressure Control (See page CH-30)	Controls the pressure that is applied directly to the C <sub>1</sub> , C <sub>2</sub> clutches and B <sub>1</sub> , B <sub>3</sub> brakes by actuating the shift solenoid valves (SL1, SL2, SL3 and SL4) in accordance with ECT ECU signals.
Line Pressure Optimal Control (See page CH-31)	Actuates solenoid valve SLT to control the line pressure in accordance with information from the ECT ECU and the operating conditions of the transaxle.
Power train Cooperative Control (See page CH-32)	Controls both the shift control and engine output control in an integrated way, achieving excellent shift characteristics and drivability.
Lock-up Timing Control (See page CH-33)	The ECT ECU supplies current to shift solenoid valves SL and SLU based on signals from each sensor and engages or disengages the lock-up clutch.
Flex Lock-up Clutch Control (See page CH-34)	Controls solenoid valves SLU and SL, provides an intermediate mode between the ON/OFF operation of the lock-up clutch, and increases the operating range of the lock-up clutch to improve fuel economy.
Coast Downshift Control (See page CH-35)	The ECT ECU performs downshift control so that fuel cut control can continue for as long as possible during deceleration.
AI (Artificial Intelligence) -SHIFT (See page CH-36)	Based on the signals from various sensors, the ECT ECU determines the road condition and the intention of the driver. Thus, the shift pattern is automatically regulated to an optimal level, improving drivability.
Multi-mode Automatic Transmission (See page CH-38)	The ECT ECU appropriately controls the automatic transaxle in accordance with the range position selected while the shift lever is in the S mode position.
Diagnosis (See page CH-40)	When the ECT ECU detects a malfunction, the ECT ECU makes a diagnosis and memorizes the malfunctioning part.
Fail-safe (See page CH-40)	Even if a malfunction is detected in the sensors or solenoids, the ECT ECU activates fail-safe control to prevent the vehicle's drivability from being significantly affected.

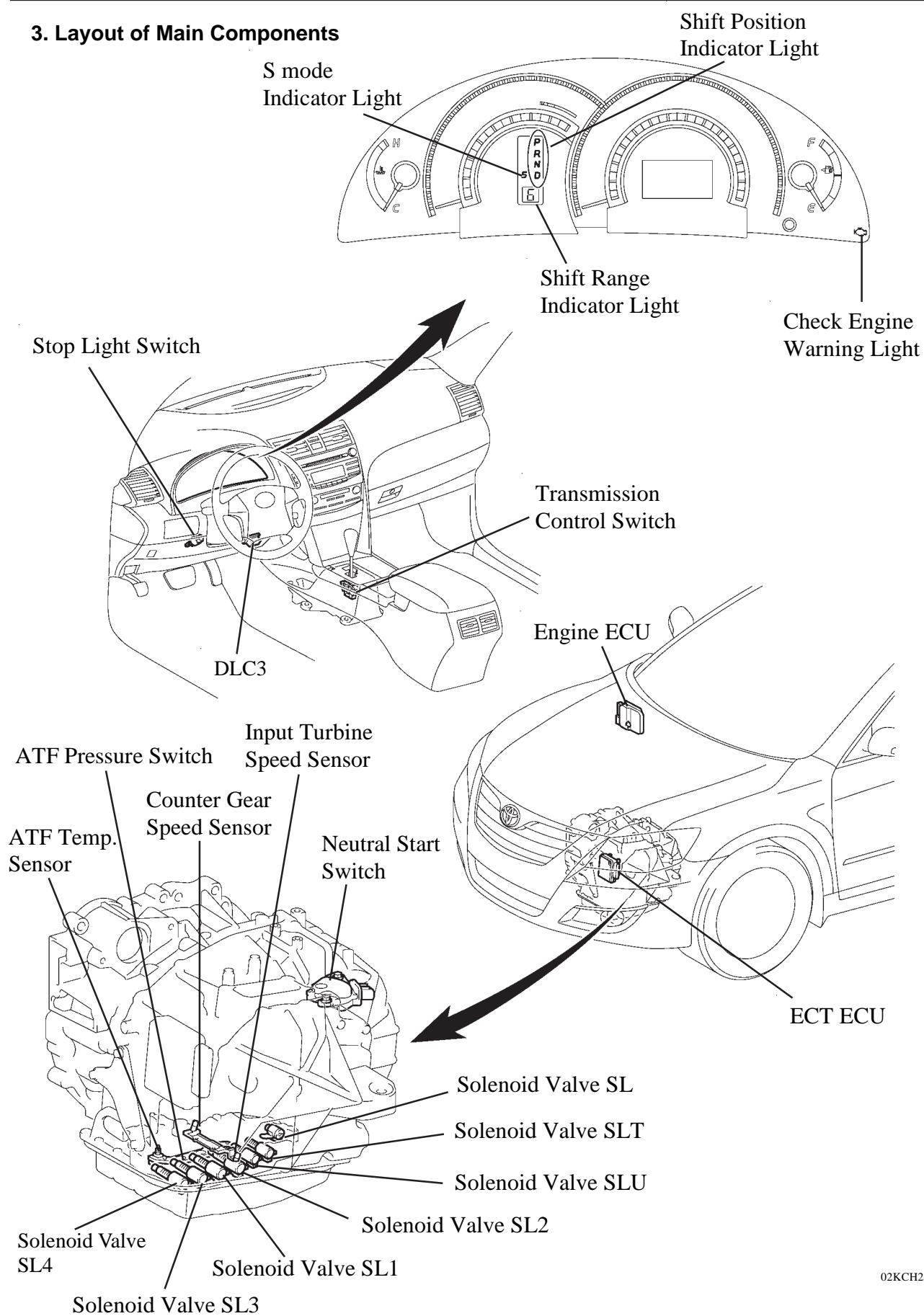
## 2. Construction

The configuration of the electronic control system in the U660E automatic transaxle is as shown in the following chart.





### 3. Layout of Main Components

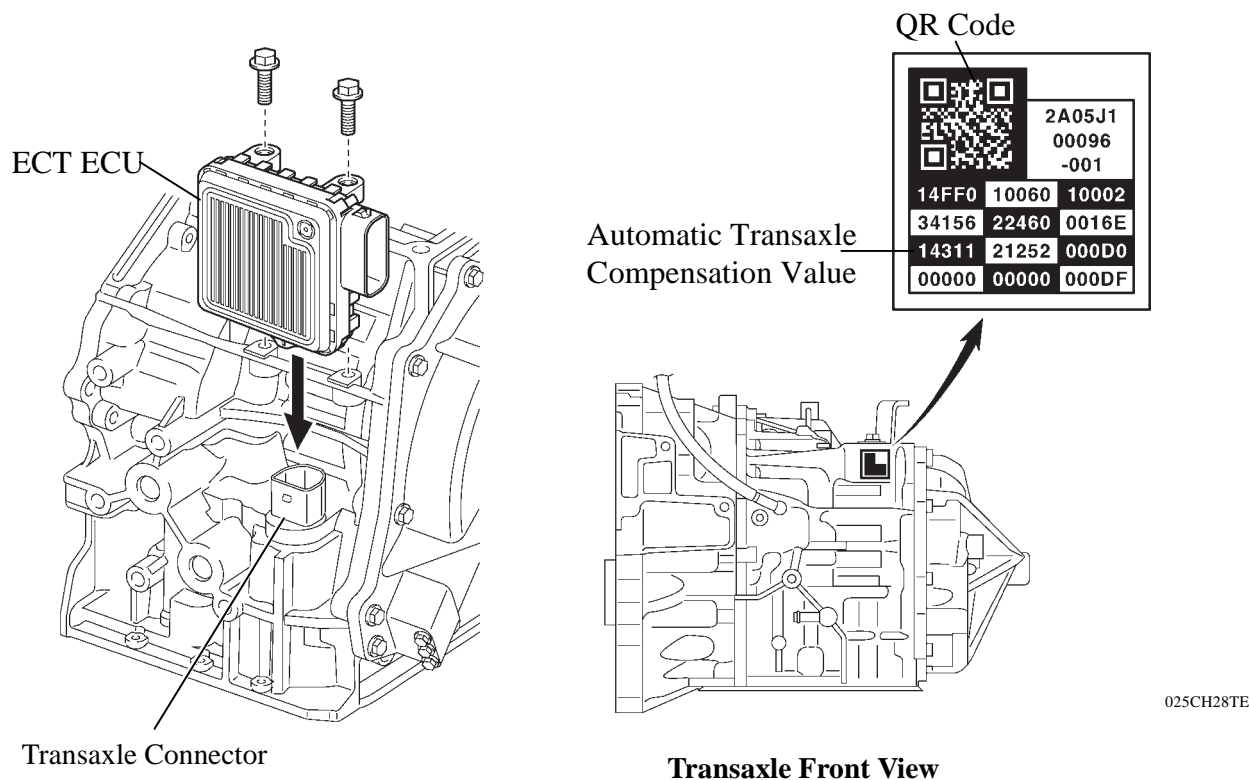


02KCH24TE

## 4. Construction and Operation of Main Components

### ECT ECU

- The ECT ECU has been isolated from the engine ECU and directly fitted to the transaxle. Thus, the wiring harness has been shortened allowing the weight to be reduced. All the solenoid valves and sensors used for automatic transaxle control are directly connected to the ECT ECU through the connector located in front of the automatic transaxle.
- The ECT ECU maintains communication with the engine ECU through the CAN (Controller Area Network). Thus, engine control is effected in coordination with ECT control.
- A label, on which the automatic transaxle compensation values and QR (Quick Response) code are printed, is attached on the top of the automatic transaxle. The label contains encoded automatic transaxle property information. When the automatic transaxle is replaced, allow the ECT ECU to learn the automatic transaxle property information by inputting the automatic transaxle compensation values into the ECT ECU using an intelligent tester II. In this way, the shift control performance immediately after replacement of the automatic transaxle is improved. For details, see the Aurion Repair Manual.
- The QR code, which requires a special scan tool, is used at the vehicle assembly plant.



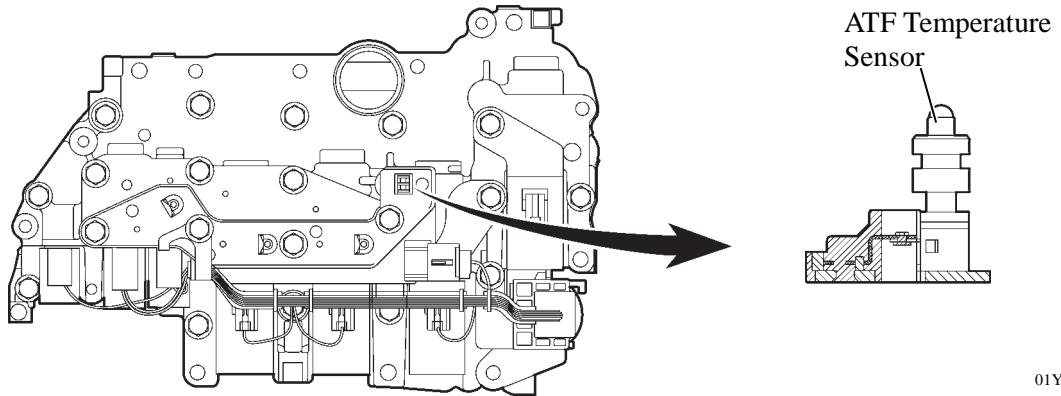
### - REFERENCE -

What are QR (Quick Response) Codes?

- QR code, a matrix symbology consisting of an array of nominally square cells, allows omni-directional, high-speed reading of large amounts of data.
- QR codes encode many types of data such as numeric, alphanumeric, kanji, kana and binary codes. A maximum of 7,089 characters (numeric) can be encoded.
- QR codes (2D code) contain information in the vertical and horizontal directions, whereas bar codes only contain data in one direction. QR codes (2D code) hold considerably greater volumes of information than bar codes.

### ATF Temperature Sensor

- The ATF temperature sensor is installed in the valve body for direct detection of the fluid temperature.
- The ATF temperature sensor is used for the revision of clutch and brake pressures to maintain a smooth shift quality every time.

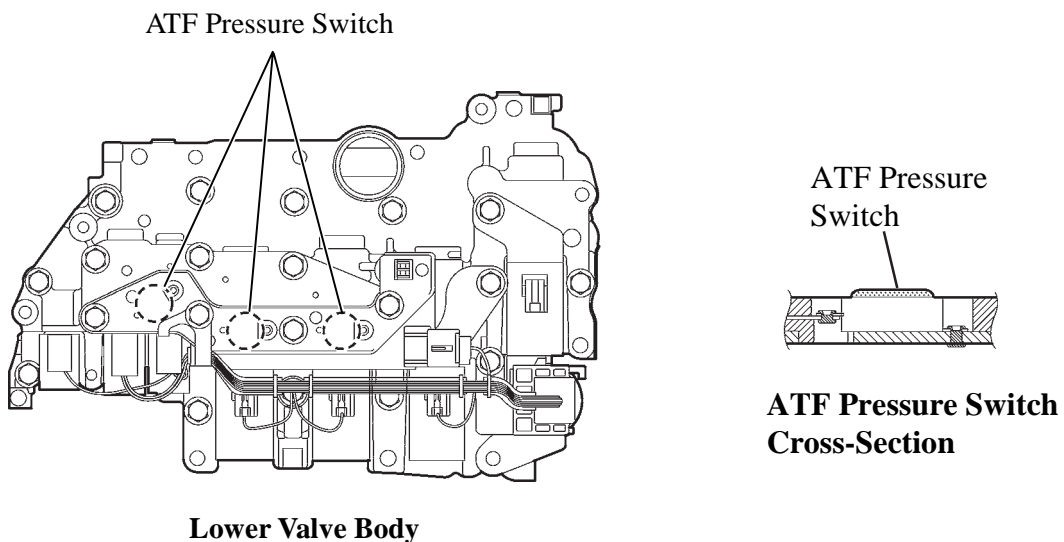


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**Lower Valve Body**

### ATF Pressure Switch

- The ATF pressure switches are located in the output fluid passages of SL1, SL2 and SLU, and turn ON/OFF in accordance with the solenoid valve output fluid pressure.
- The ECT ECU detects malfunctions in solenoid valves SLU and SL used in lock-up control in accordance with the ON/OFF signals from ATF pressure switch 3 located in the SLU output fluid passage.
- When any of SL1 to SL4 malfunctions, the ECT ECU determines the appropriate fail-safe operation to be actuated in accordance with the ON/OFF signals from ATF pressure switches 1 and 2 located in the SL1 and SL2 output fluid passages.



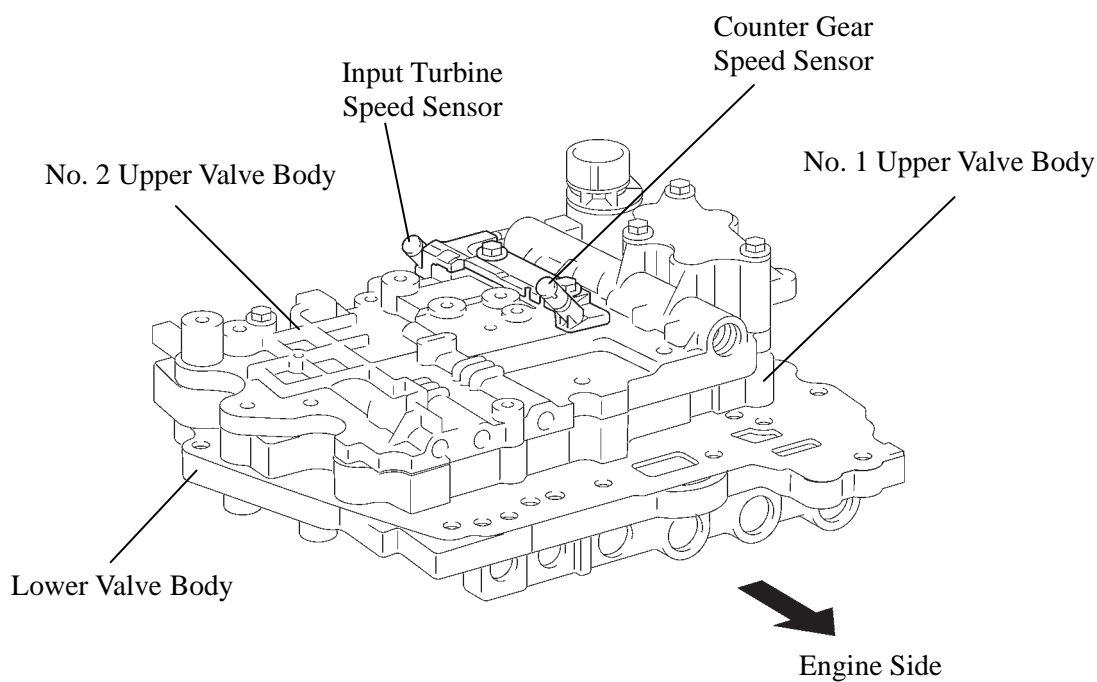
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**Lower Valve Body**

**ATF Pressure Switch  
Cross-Section**

## Speed Sensors

- The U660E automatic transaxle uses an input turbine speed sensor (for the NT signal) and a counter gear speed sensor (for the NC signal). Thus, the ECT ECU can detect the timing of the shifting of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions. These speed sensors are the Hall type.
- The input turbine speed sensor detects the input speed of the transaxle. The No.2 clutch piston is used as the timing rotor for this sensor.
- The counter gear speed sensor detects the speed of the counter gear. The counter drive gear is used as the timing rotor for this sensor.
- The Hall type speed sensor consists of a magnet and Hall IC. The Hall IC converts the changes in the magnetic flux density that occur through the rotation of the timing rotor into electric signal, and outputs the signal to the ECT ECU.



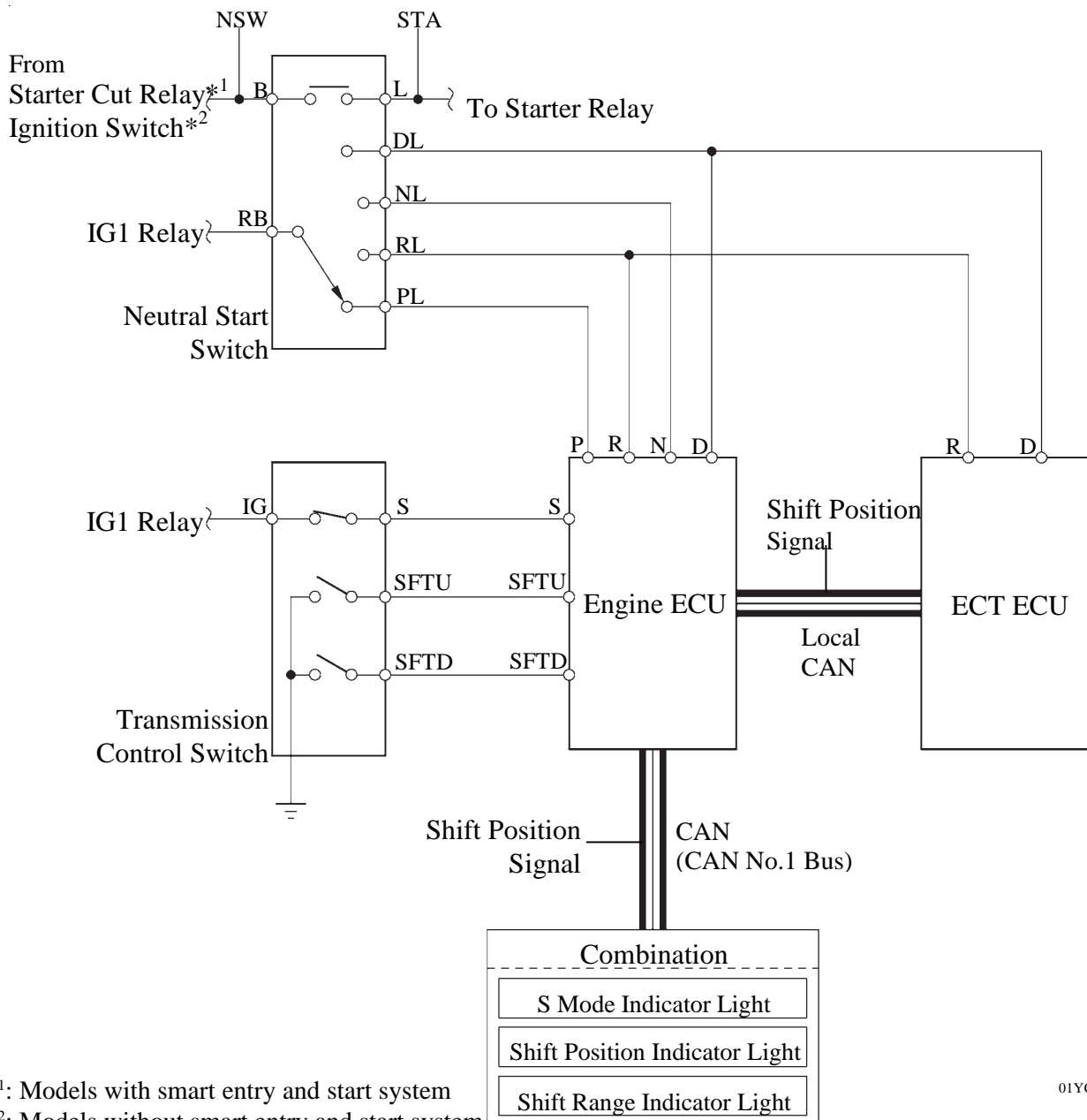
01YCH24TE

## Transmission Control Switch and Neutral Start Switch

The ECT ECU and engine ECU use these switches to detect the shift lever position.

- The neutral start switch sends the P, R, N and D position signals to both the engine ECU and ECT ECU. The engine ECU transmits signals to the combination meter for the shift position indicator light (P, R, N and D) in response to the signal it receives from the switch.
- The transmission control switch is installed inside the shift lever assembly. Switch terminal S is used to detect whether the shift lever is in the D position or S mode position, and terminals SFTU and SFTD are used to detect the operating conditions of the shift lever (front [+ position] or rear [- position]) if S mode is selected. By transmitting signals to the engine ECU, the transmission control switch turns on both the shift range indicator light and S mode indicator light when the shift lever is moved to the S mode position, and indicates the selected range position through shift range indicator light.

### ▶ Wiring Diagram ◀



\*1: Models with smart entry and start system

\*2: Models without smart entry and start system

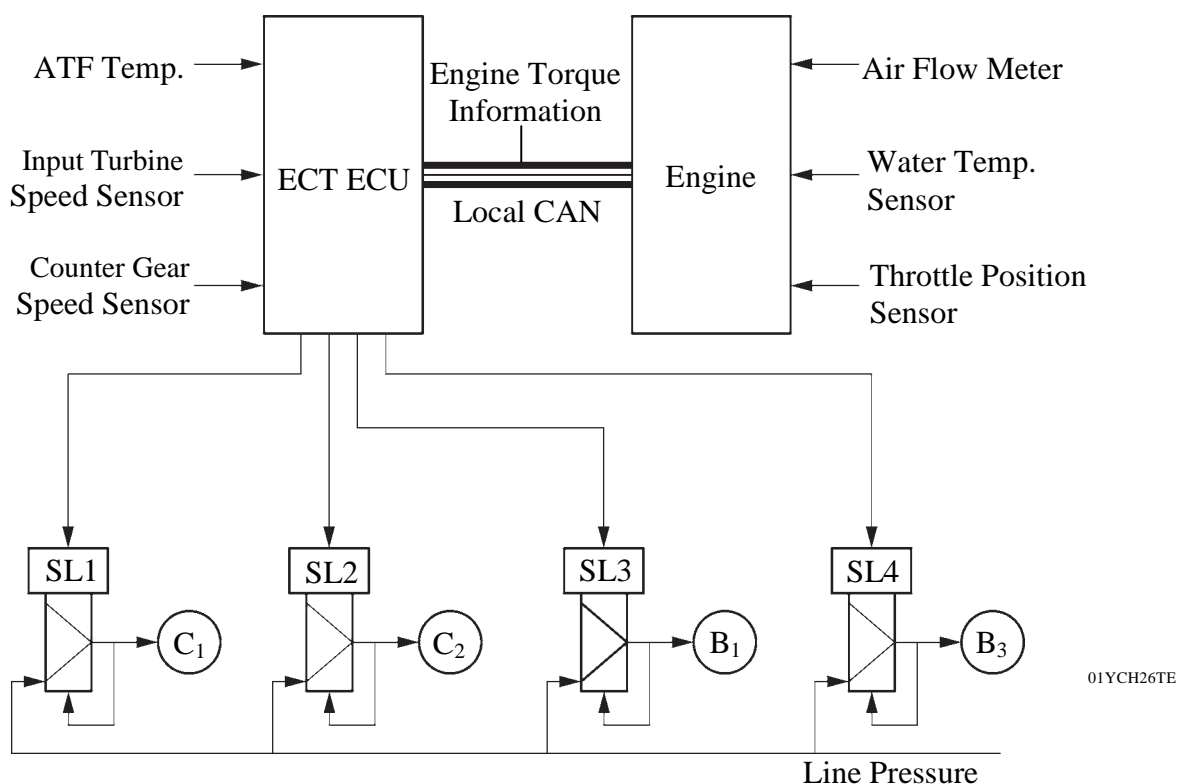
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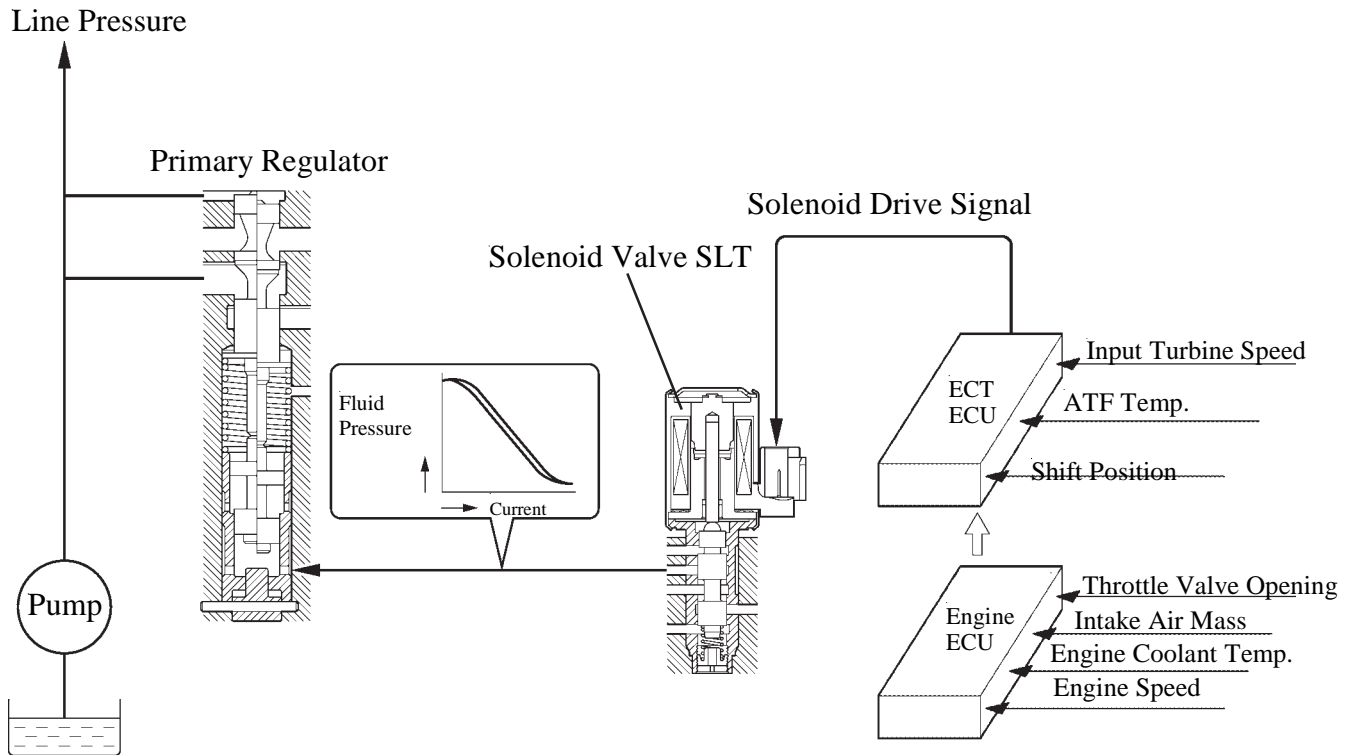
## 5. Clutch to Clutch Pressure Control

- Clutch to clutch pressure control is used for shift control. As a result, shift control in the 2nd gear or above is possible without using the one-way clutch, and the automatic transaxle has been made lightweight and compact.
- Using the fluid pressure circuit, which enables the clutches and brakes ( $C_1$ ,  $C_2$ ,  $B_1$  and  $B_3$ ) to be controlled independently, and the high flow SL1, SL2, SL3 and SL4 linear solenoid valves, which directly control the line pressure, the ECT ECU controls each clutch and brake accordingly with the optimum fluid pressures and timings in accordance with the information transmitted by the sensors, and then shifts the gears. As a result, highly responsive and excellent shift characteristics have been realised.



## 6. Line Pressure Optimal Control

The line pressure is controlled by using solenoid valve SLT. Through the use of solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle. Accordingly, the line pressure can be accurately controlled in accordance with the engine output, traveling condition, and the ATF temperature, thus realising smooth shift characteristics and optimising the workload of the oil pump.



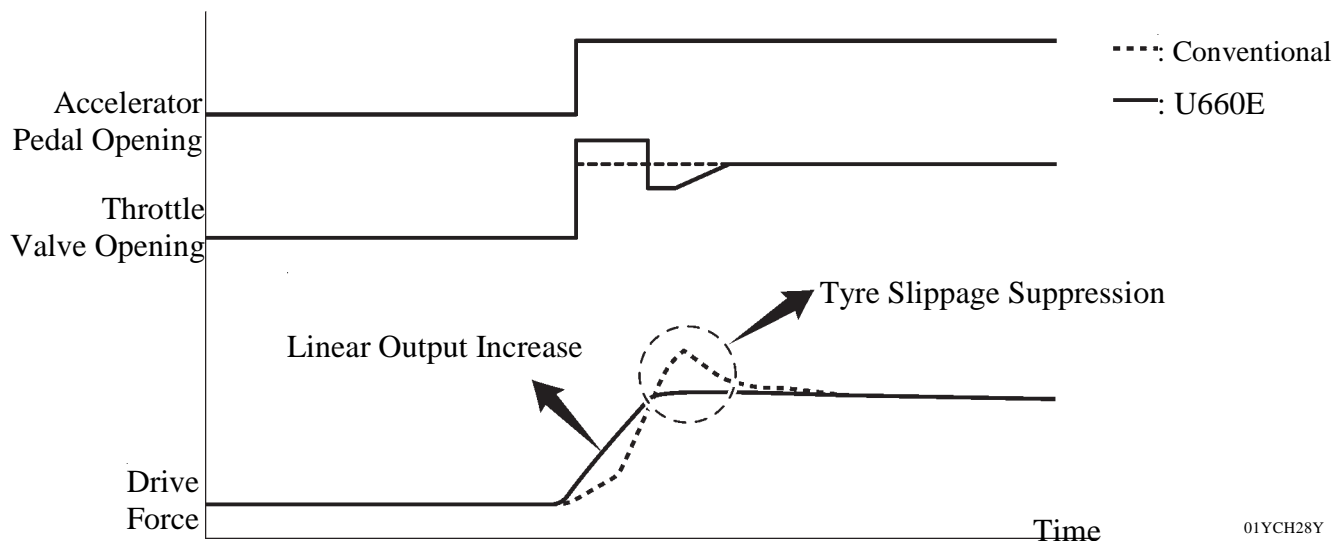
01YCH27Y

\*: This diagram illustrates the fundamentals of line pressure control. The valve shapes differ from the actual ones.

## 7. Power Train Cooperative Control

### Throttle Control at Launch

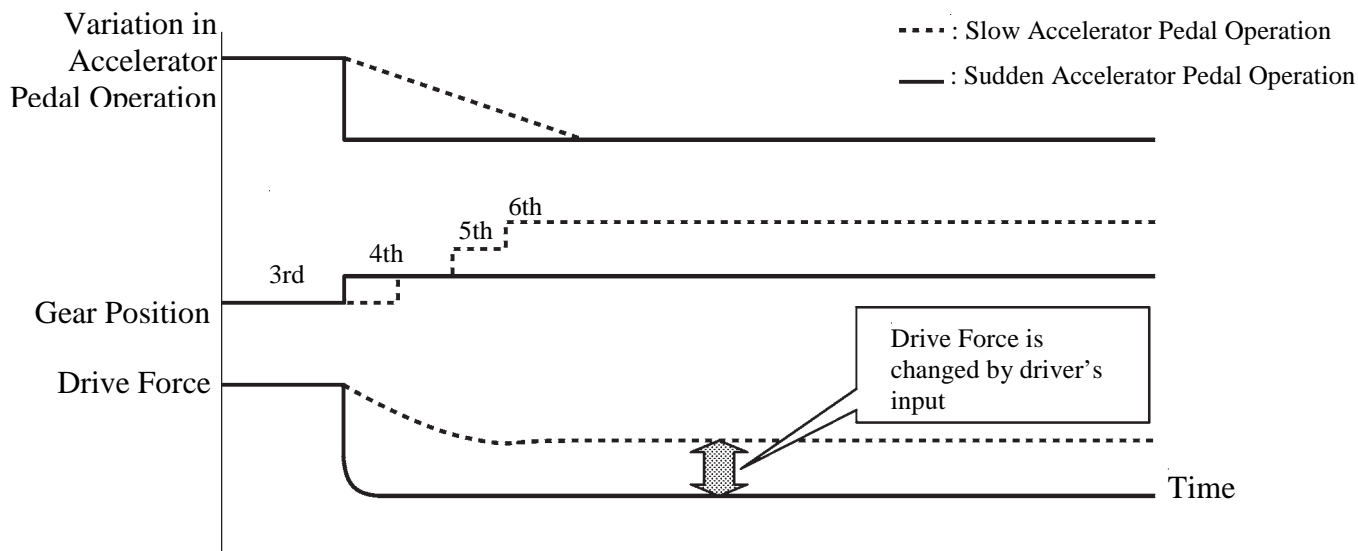
By controlling the engine output in cooperative control with ETCS-i (Electronic Throttle Control System-intelligent) when the vehicle is launched, excellent launch performance (improved response and suppression of tyre slippage) is ensured.



01YCH28Y

### Deceleration Force Control

The ECT ECU determines the gear position when the accelerator pedal is OFF (released completely) in accordance with the operation of the accelerator pedal (released suddenly or slowly) during deceleration. In this way, preventing unnecessary up shifts and downshifts when the accelerator pedal is OFF and ensuring smooth acceleration when the vehicle needs to accelerate again.

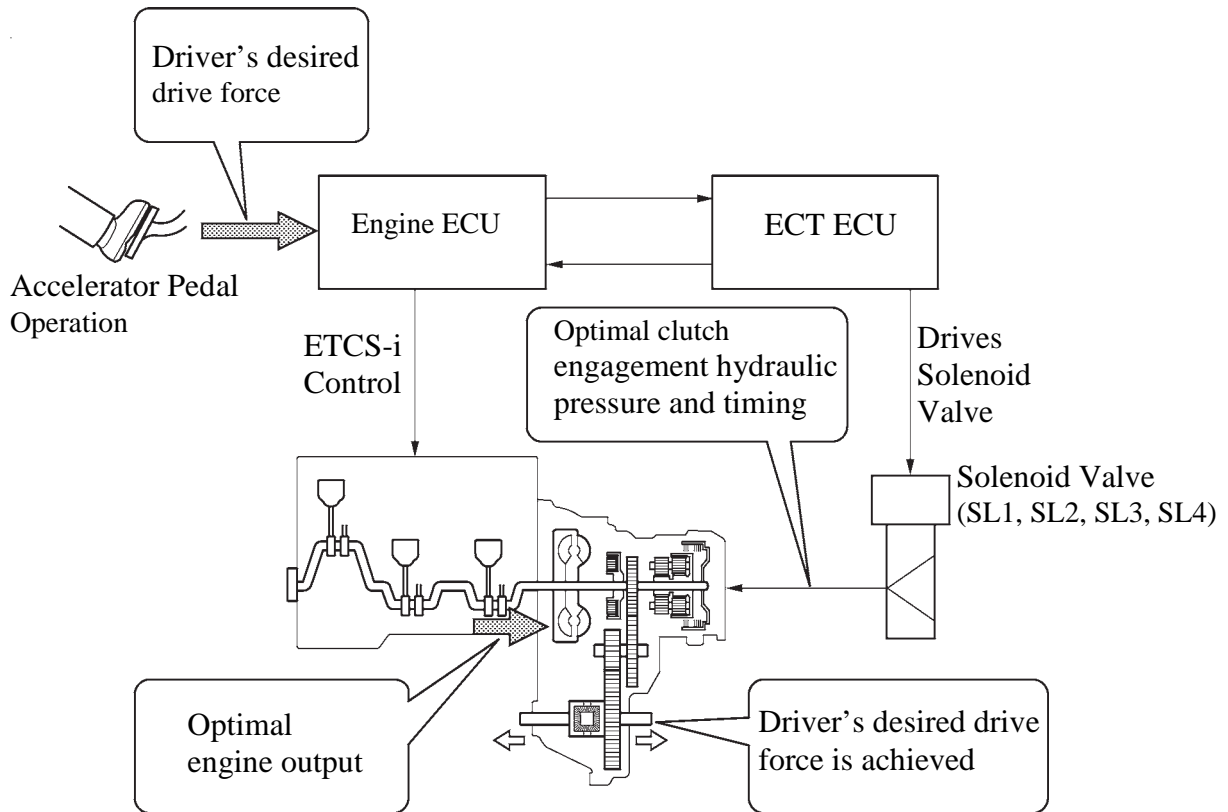


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### Transient Shifting Control

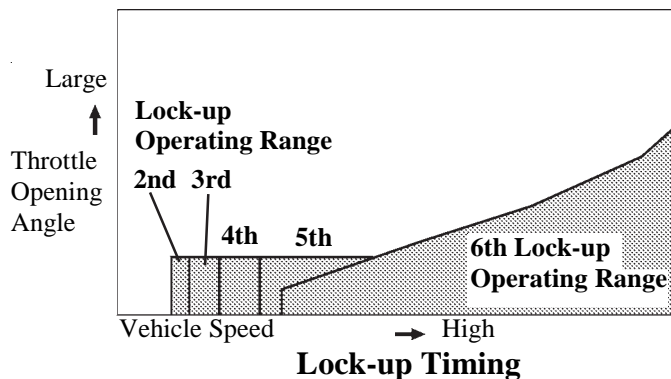
Through cooperative control with ETCS-i (Electronic Throttle Control System-intelligent) and ESA (Electronic Spark Advance), and electronic control of the engagement and release speed of the clutch and brake hydraulic pressures, excellent response and shift shock reduction have been achieved.



01YCH30Y

### 8. Lock-up Timing Control

The ECT ECU operates the lock-up timing control in order to improve the fuel consumption while in the 2nd gear or above with the shift lever in the D, S6, S5, and S4 range.



#### Lock-up Operation

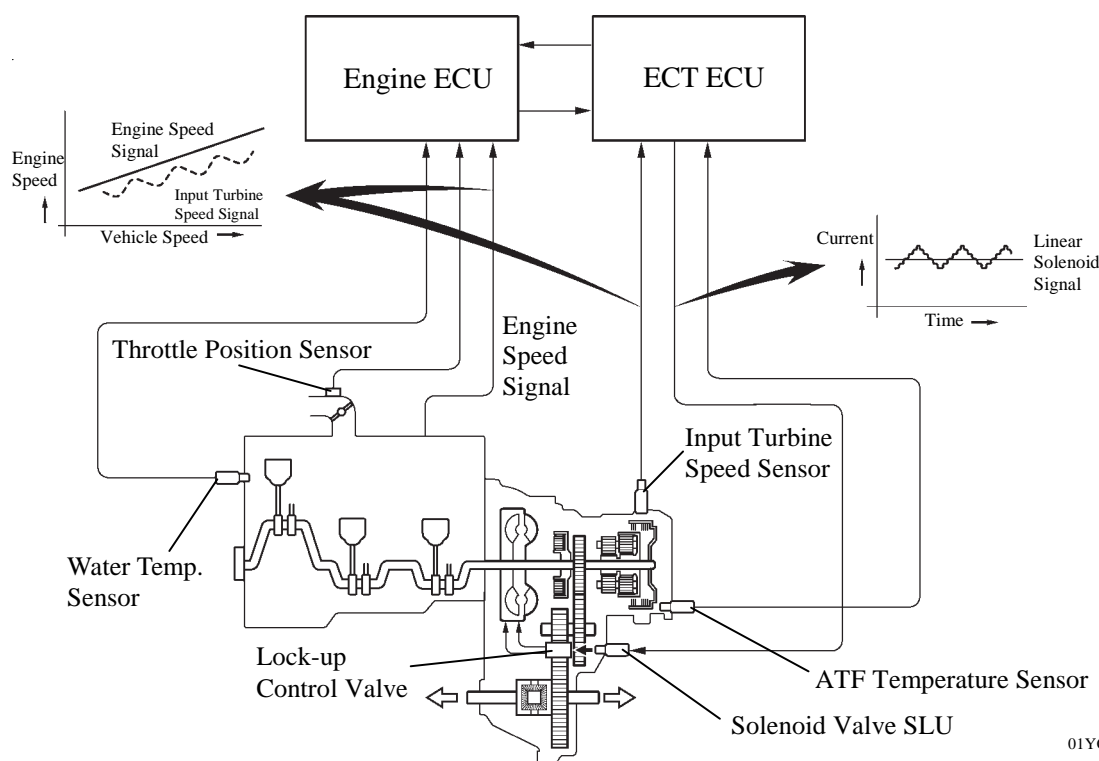
Gear	Position or Range		
	D or S6	S5	S4
1st	×	×	×
2nd	○	○	○
3rd	○	○	○
4th	○	○	○
5th	○	○	—
6th	○	—	—

○: Operates ×: Does not operate —: Not applicable

01YCH31Y

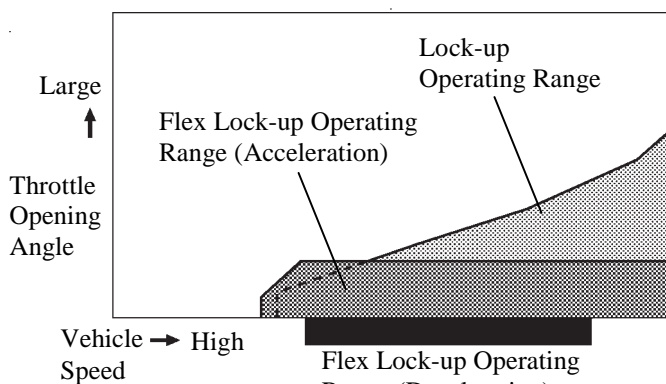
## 9. Flex Lock-up Clutch Control

- In addition to the conventional lock-up timing control, flex lock-up clutch control is used.
- This flex lock-up clutch control regulates solenoid valve SLU as an intermediate mode between the ON and OFF operations of the lock-up clutch.
- During acceleration, flex lock-up clutch control operates when the gear position is the 2nd or higher and the shift lever is in the D, S6, S5 or S4 range position. During deceleration, it operates when the gear position is the 4th or higher and the shift lever is in the D, S6, S5 or S4 range position.
- During acceleration, the partition control of the power transmission between the lock-up clutch and torque converter greatly boosts the transmission efficiency in accordance with the driving conditions, improving the fuel economy.
- During deceleration, the lock-up clutch is made to operate. Therefore the fuel-cut area is expanded and fuel economy is improved.
- By allowing flex lock-up clutch control to continue operating during gearshift, the smooth torque transmission has been obtained. As a result, the fuel economy and drivability have been improved.



01YCH32Y

### Flex Lock-up Operation



Flex Lock-Up Timing in 6th Gear

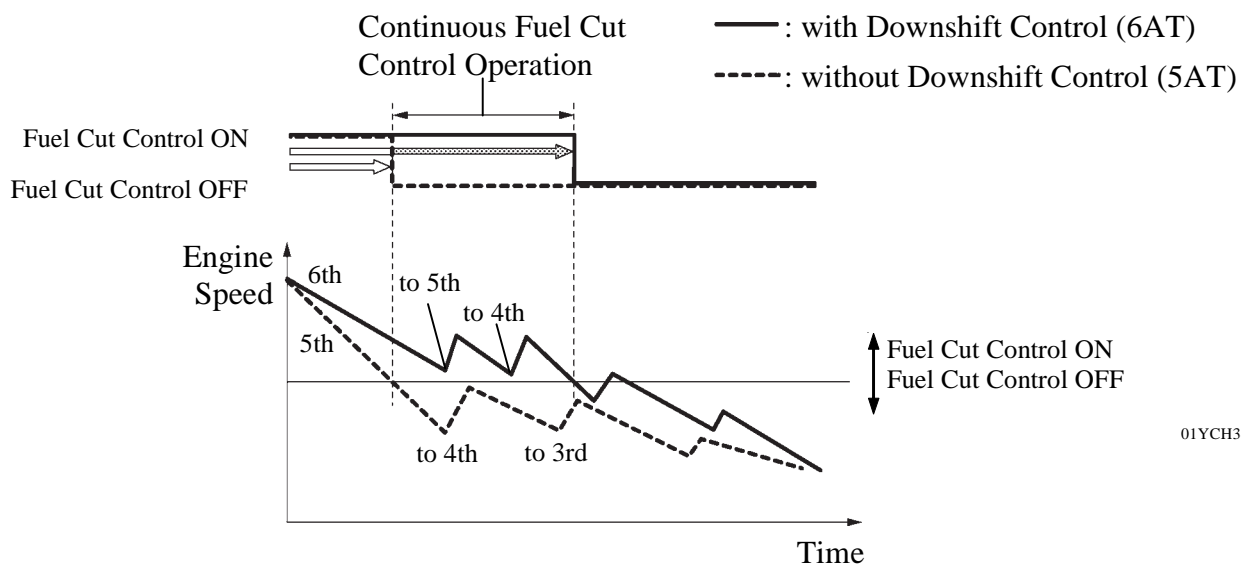
Position or Range				
Gear		Position or Range		
		D, S6	S5	S4
1st		×	×	×
2nd		○	○	○
3rd		○	○	○
4th		○*	○*	○*
5th		○*	○*	—
6th		○*	—	—

○: Operates ×: Does not operate —: Not applicable

\*: Flex Lock-up Clutch Control also operates when the vehicle is decelerated.

## 10. Coast Downshift Control

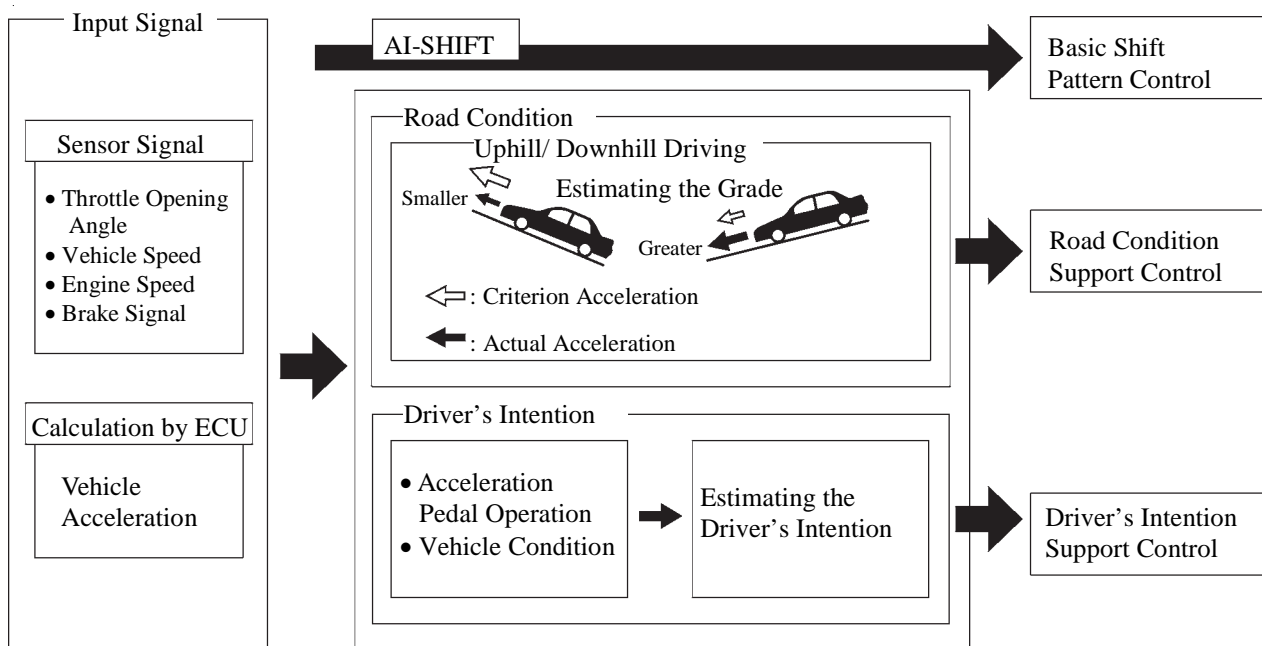
- The ECT ECU performs downshift control to restrain the engine speed from decreasing, and keeps fuel cut control operating for as long as possible. In this way, the fuel economy is improved.
- In this control, the transaxle downshifts from 6th to 5th and then 5th to 4th before fuel cut control ends when the vehicle is decelerated in the 6th gear, so that fuel cut control continues operating.



## 11. AI (Artificial Intelligence)- Shift Control

### General

AI- SHIFT control enables the ECT ECU to estimate the road conditions and the driver's intention in order to automatically control the shift pattern in the optimal manner. As a result, a comfortable ride has been achieved.

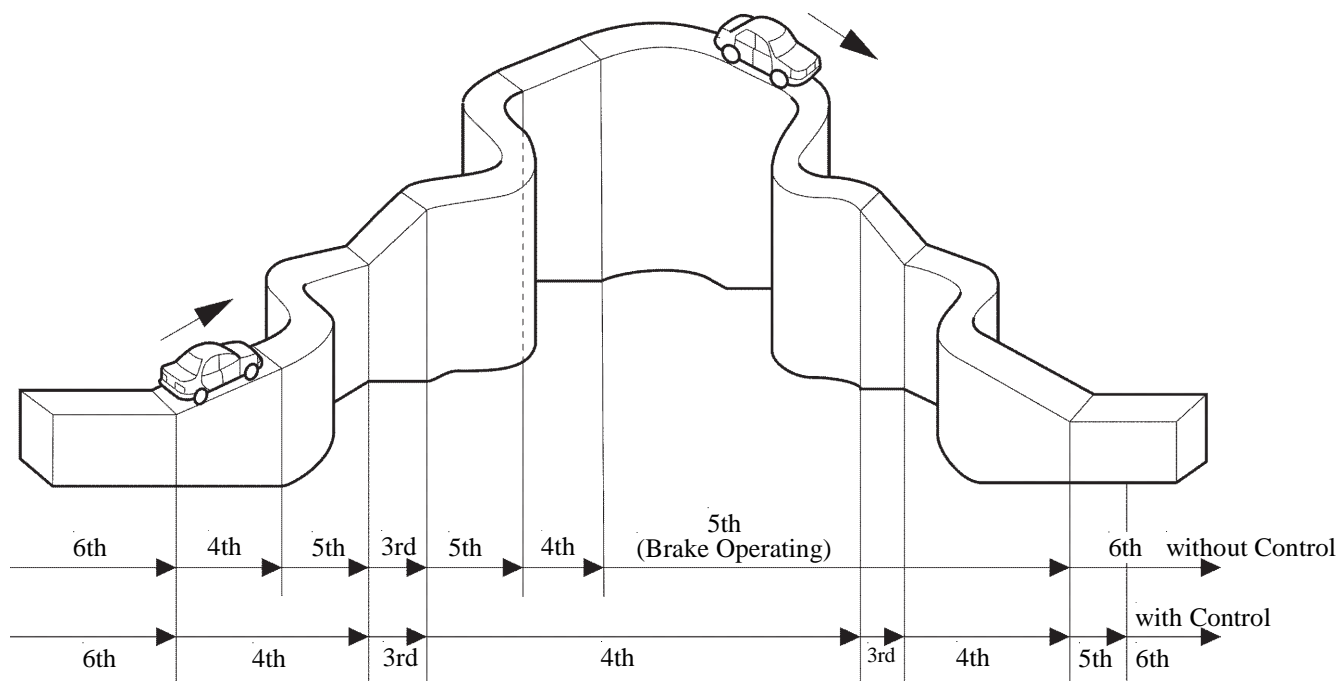


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## Road Condition Support Control

Under road condition support control, ECT ECU determines the throttle valve opening angle and the vehicle speed whether the vehicle is being driven uphill or downhill.

To achieve the optimal drive force while driving uphill, this control prevents the transaxle from up shifting to the 5th or 6th gear. To achieve the optimal engine brake effect while driving downhill, this control automatically downshifts the transaxle to the 5th or 4th or 3rd gear.



040SC13C

## Driver's Intention Support Control

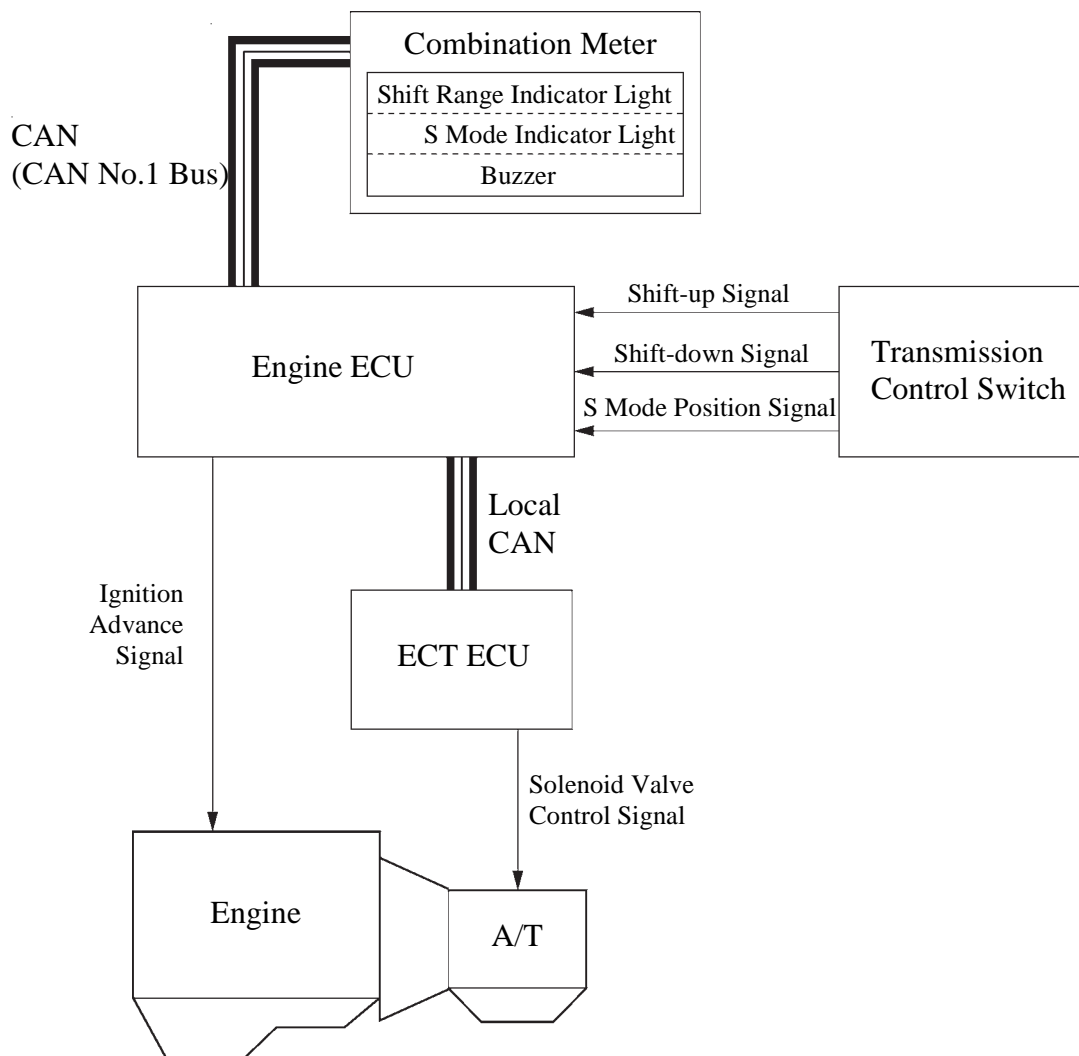
Estimates the driver's intention based on the accelerator operation and vehicle condition to switch to a shift pattern that is well-suited to each driver, without the need to operate the shift pattern select switch used in the conventional models.

## 12. Multi-mode Automatic Transmission

### General

By moving the shift lever to the front (“+” position) or to the rear (“-” position), the driver can select the desired shift range position. Thus, the driver is able to shift gears with a manual-like feel.

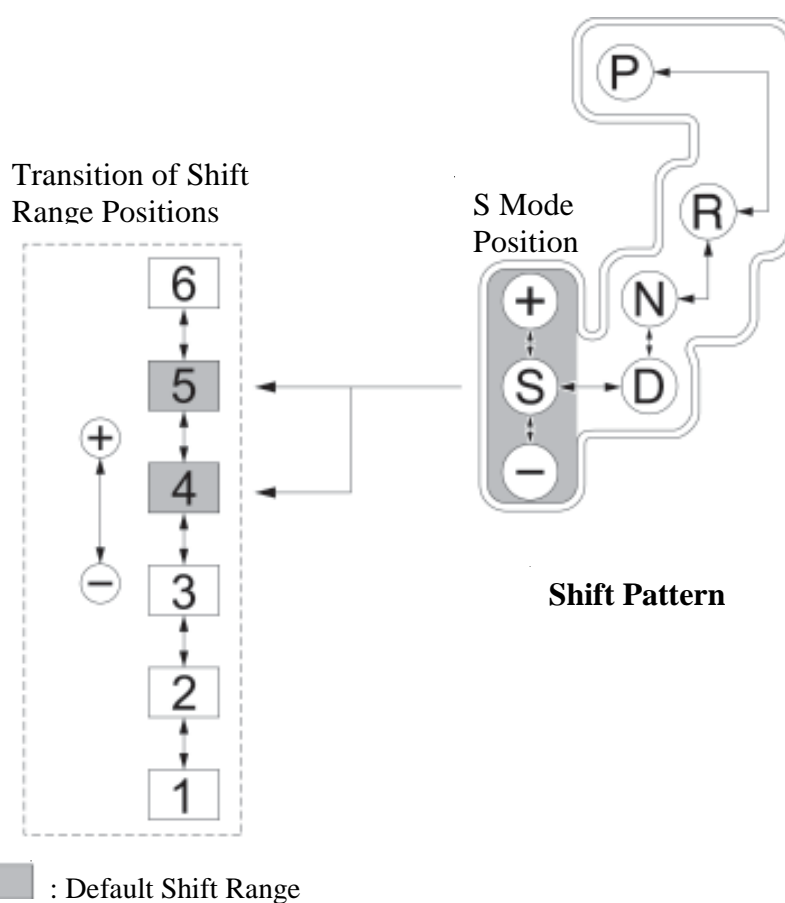
- This multi-mode automatic transmission is designed to allow the driver to switch the gear ranges; not for manually selecting single gears.
- An S mode indicator light, which illuminates when the S mode position is selected and a shift range indicator light, which indicates the range position, have been provided in the combination meter.
- When the vehicle is being driven at a prescribed speed or higher, any attempt to shift down the range by through the operation of the shift lever will not be executed, in order to protect the mechanism of the automatic transaxle. In this case, the engine ECU sounds the buzzer in the combination meter twice to alert the driver.



01YCH35Y

## Operation

- The driver selects the S mode position by engaging the shift lever. At this time, the shift range position selects the 4th or 5th range according to the vehicle speed. (During AI-Shift control, the shift range that has the currently controlled gear position as the maximum usable gear position is displayed.) Then, the shift range positions change one at a time, as the driver moves the shift lever to the front (“+” position) or to the rear (“-” position).
- Under this control, the ECT ECU effects optimal shift control within the usable gear range that the driver has selected. As with an ordinary automatic transmission, it shifts to the 1st gear when the vehicle is stopped.
- When the shift lever is in the S mode position, the S mode indicator light in the combination meter illuminates. The shift range indicator light indicates the state of the shift range position that the driver has selected.



030SC29C

Shift Range Indicator Light Indication	Shift Range	Usable Gear
6	6	6th ↔ 5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st
5	5	5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st
4	4	4th ↔ 3rd ↔ 2nd ↔ 1st
3	3	3rd ↔ 2nd ↔ 1st
2	2	2nd ↔ 1st
1	1	1st

### 13. Diagnosis

- When the ECT ECU detects a malfunction, the ECT ECU makes a diagnosis and memorises the information related to the fault. Furthermore, the check engine warning light in the combination meter illuminates or blinks to inform the driver of the malfunction.
- At the same time, the DTC (Diagnosis Trouble Code) are stored in the memory. The DTC stored in the ECT ECU are output to an intelligent tester II connected to the DLC3 via the engine ECU.
- For details, see the Aurion Repair Manual.

### 14. Fail-safe

This function minimises the loss of operation when any abnormality occurs in a sensor or solenoid.

#### ► Fail-safe Control List ◀

Malfunction Part	Function
Input Turbine Speed Sensor	Shifting to only either the 1st or 3rd gears is allowed.
Counter Gear Speed Sensor	<ul style="list-style-type: none"> <li>• The counter gear speed is detected through the signals from the skid control ECU (speed sensor signals).</li> <li>• Shifting between the 1st to 4th gears is allowed.</li> </ul>
ATF Temp. Sensor	Shifting between the 1st to 4th gears is allowed.
ECT ECU Power Supply (Voltage is Low)	When the vehicle is being driven in 6th gear, the transaxle is fixed in 6th gear. When being driven in any of the 1st to 5th gears, the transaxle is fixed in 5th gear.
CAN Communication	Shifting to only either the 1st or 3rd gears is allowed.
Knock Sensor	Shifting between the 1st to 4th gears is allowed.
Solenoid Valve SL1, SL2, SL3 and SL4	The current to the failed solenoid valve is cut off and operating the other solenoid valves with normal operation performs shift control. (Shift controls in fail-safe mode are described in the table on the next page. For details, refer to Fail-Safe Control List)



### ▸ Solenoid Valve Operation when Normal ◀

○: ON    ✕: OFF

Gear Position		1st	2nd	3rd	4th	5th	6th
Solenoid Valve	SL1	○	○	○	○	✕	✕
	SL2	✕	✕	✕	○	○	○
	SL3	✕	○	✕	✕	✕	○
	SL4	✕	✕	○	✕	○	✕

### ▸ Fail-safe Control List ◀

Gear Position in Normal Operation		1st	2nd	3rd	4th	5th	6th
SL1	OFF Malfunction (without Fail-safe Control)	1st→N	2nd→N	3rd→N	4th→N	5th	6th
	ON Malfunction (without Fail-safe Control)* <sup>1</sup>	1st	2nd	3rd	4th	5th→4th	6th→4th
	Fail-safe Control during OFF Malfunction	Fixed in 3rd or 5th* <sup>2</sup>					
	Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 or 2 Malfunctions)	Fixed in 3rd or 5th* <sup>2</sup>					
SL2	OFF Malfunction (without Fail-safe Control)	1st	2nd	3rd	4th→1st	5th→N	6th→N
	ON Malfunction (without Fail-safe Control)* <sup>1</sup>	1st→4th	2nd→4th	3rd→4th	4th	5th	6th
	Fail-safe Control during OFF Malfunction	1st	2nd	3rd	3rd* <sup>3</sup>	3rd* <sup>3</sup>	3rd* <sup>3</sup>
	Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 or 2 Malfunctions)	Fixed in 2nd or 3rd* <sup>3</sup>					
SL3	OFF Malfunction (without Fail-safe Control)	1st	2nd→1st	3rd	4th	5th	6th→N
	ON Malfunction (without Fail-safe Control)* <sup>1</sup>	1st→2nd	2nd	3rd	4th	5th	6th
	Fail-safe Control during OFF Malfunction	1st	3rd	3rd	4th	5th	5th* <sup>3</sup>
	Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 or 2 Malfunctions)	Fixed in 3rd* <sup>3</sup>					
SL4	OFF Malfunction (without Fail-safe Control)	1st	2nd	3rd→1st	4th	5th→N	6th
	ON Malfunction (without Fail-safe Control)* <sup>1</sup>	3rd	3rd	3rd	4th	5th	5th
	Fail-safe Control during OFF Malfunction	1st* <sup>4</sup>	2nd* <sup>4</sup>	4th* <sup>4</sup>	4th* <sup>4</sup>	6th	6th
	Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 or 2 Malfunctions)	Fixed in 2nd* <sup>3</sup>					

\*<sup>1</sup>: Fail-safe control is not actuated when the ON malfunction occurs.

\*<sup>2</sup>: If malfunctions already exist in any of the P, R or N range positions and a malfunction is detected when the gear is shifted to the 1st gear, the gear position is fixed in the 5th gear. After that, if any of the P, R or N range positions is selected, the gear is fixed in the 3rd gear position.

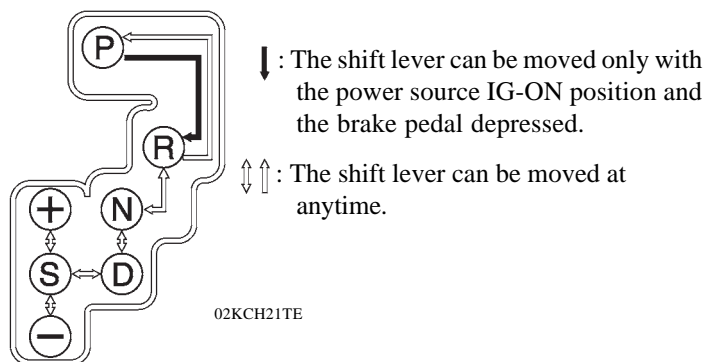
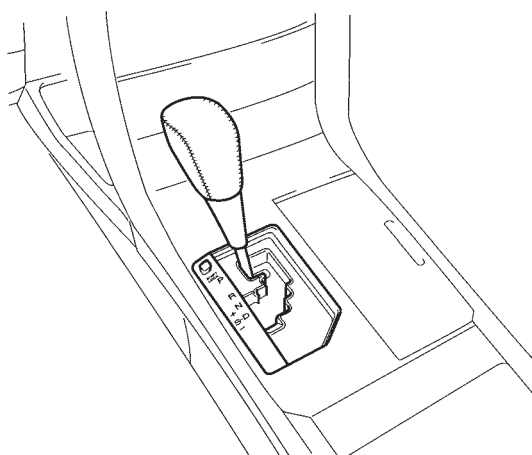
\*<sup>3</sup>: The gear is fixed in the neutral position until the vehicle speed reaches a certain speed that enables the transaxle to be shifted.

\*<sup>4</sup>: Shifting to the 5th and 6th gears is prohibited.

## \* SHIFT CONTROL MECHANISM

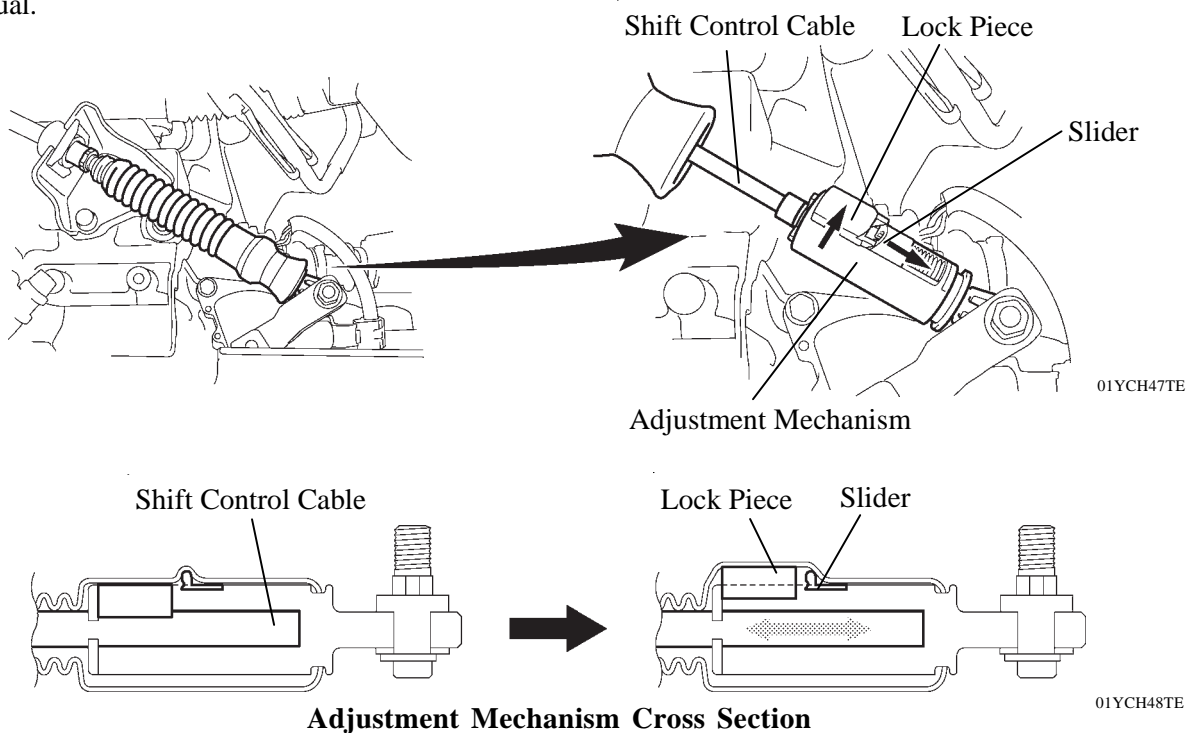
### 1. General

- A gate type shift lever is used in conjunction with the 6-speed automatic transaxle. With the gate type lever, the shift lever button and the overdrive switch of the straight type shift lever are discontinued. Similar functions are achieved through a single-shift operation (fore-aft and side-to-side).
- The shift control cable with a length adjustment mechanism is used.
- Shift pattern is provided with the S mode position on the side of the D position.
- A shift lock system is used.



### Service Tip

The shift control cable is fixed by the lock piece of the adjustment mechanism. Adjustment of the shift control cable is possible by releasing the lock piece from the cable. For details, see the Aurion Repair Manual.



## 2. Shift Lock System

### General

The shift lock system function setting is as follows:

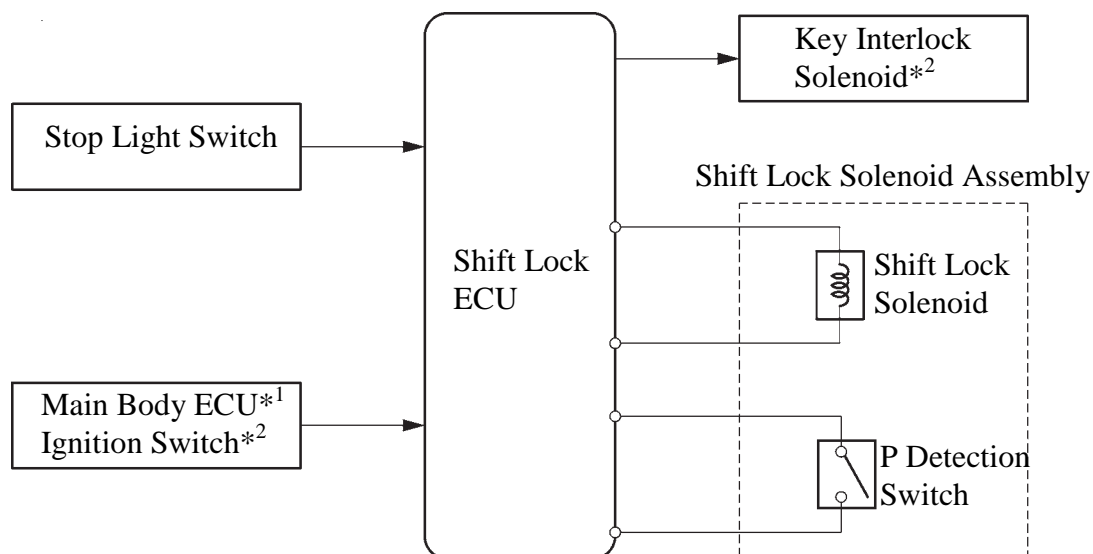
Function	Without Smart Entry and Start System	With Smart Entry and Start System
Key Interlock	○	—
Shift Lock	○	○

- The key interlock device prevents the key from being pulled out after the ignition switch is turned OFF, unless the shift lever is moved to the P position. Thus, the driver is urged to park the vehicle in the P position.
- The shift lock mechanism prevents the shift lever from being shifted to any position other than the P position, unless the ignition switch is ON (unless the IG-ON mode is selected)\*<sup>1</sup>, and the brake pedal is depressed. This mechanism helps to prevent unintentional acceleration.
- The shift lock system mainly consists of the shift lock ECU, shift lock solenoid, key interlock solenoid\*<sup>2</sup> and shift lock override button.
- The shift lock solenoid has a built-in P detection switch.

\*<sup>1</sup>: Models with smart entry and start system

\*<sup>2</sup>: Models without smart entry and start system

### ▶ System Diagram ◀

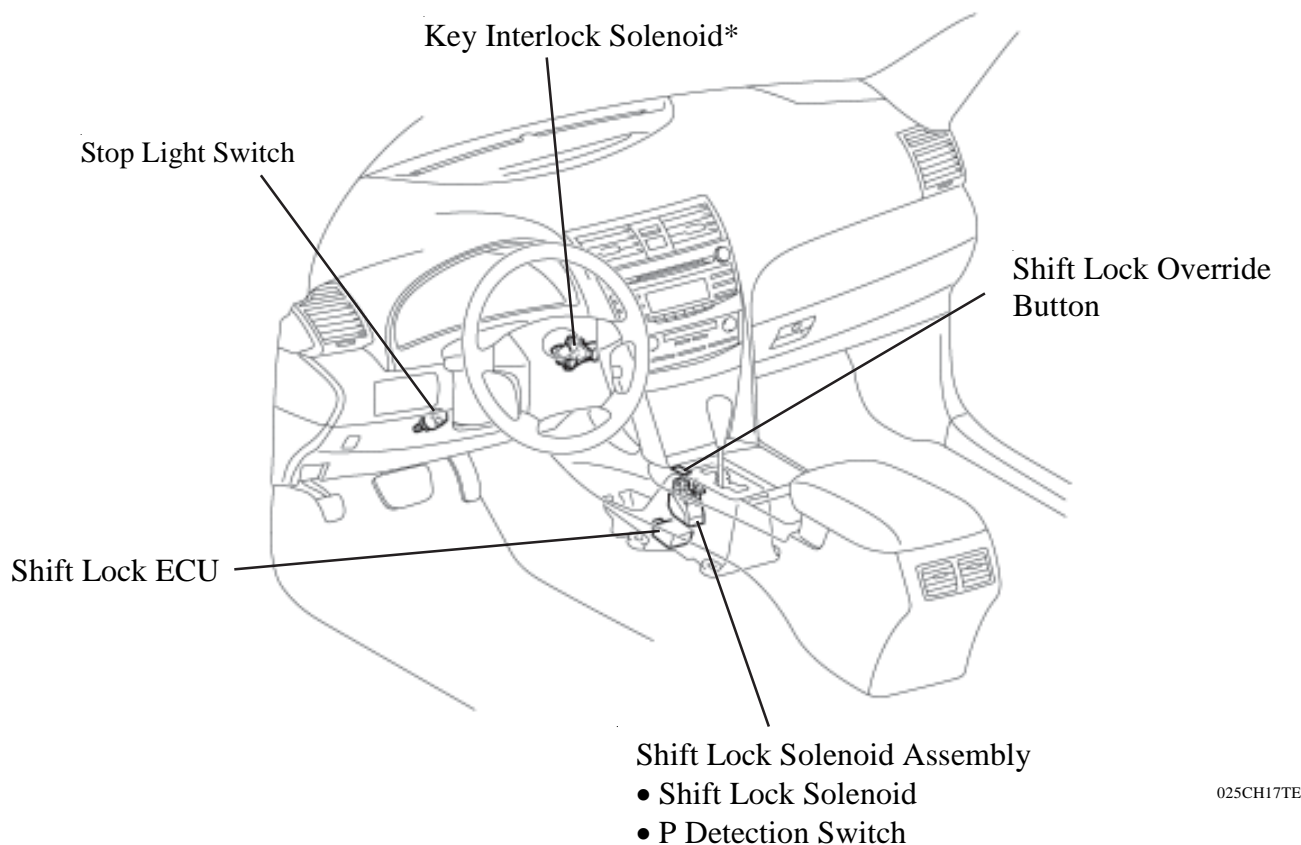


025CH20TE

\*<sup>1</sup>: Models with smart entry and start system

\*<sup>2</sup>: Models without smart entry and start system

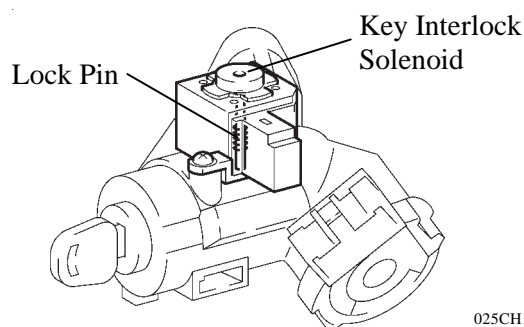
## Layout of Main Components



\*: Models without smart entry and smart system

## Key Interlock Solenoid

The activation of the key interlock solenoid that is mounted on the upper column bracket moves the lock pin to restrict the movement of the key cylinder. Therefore, if the shift lever is shifted to any position other than “P”, the ignition key cannot be moved from “ACC” to the “LOCK” position.



## System Operation

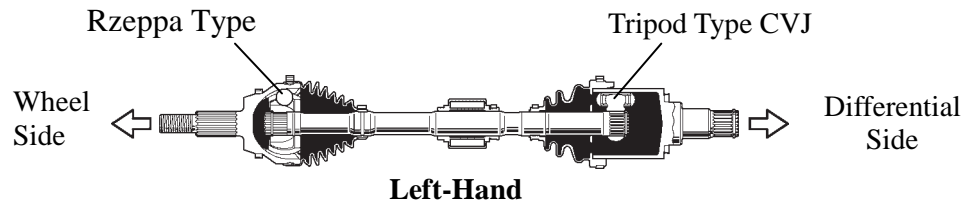
- Models with smart entry and start system: The shift lock ECU uses the P detection switch to detect the shift lever position, and receives inputs from the stop light switch and the main body ECU. Upon receiving these signals, the shift lock ECU turns ON the shift lock solenoid in order to release the shift lock.
- Models without smart entry and start system: The shift lock ECU uses the P detection switch to detect the shift lever position, and receives inputs from the stop light switch and the ignition switch. Upon receiving these signals, the shift lock ECU turns ON the key interlock solenoid and the shift lock solenoid in order to release the key interlock and shift lock.
- A shift lock override button, which manually overrides the shift lock mechanism, is used.

## DRIVE SHAFT

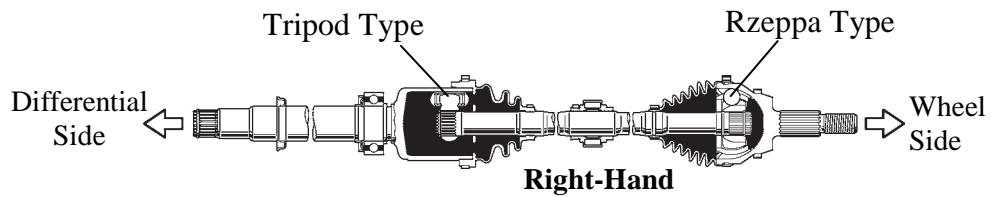


### DESCRIPTION

The drive shaft uses a tripod type CVJ (Constant Velocity Joint) on the differential side, and Rzeppa type CVJ on the wheel side.



01YCH51Y



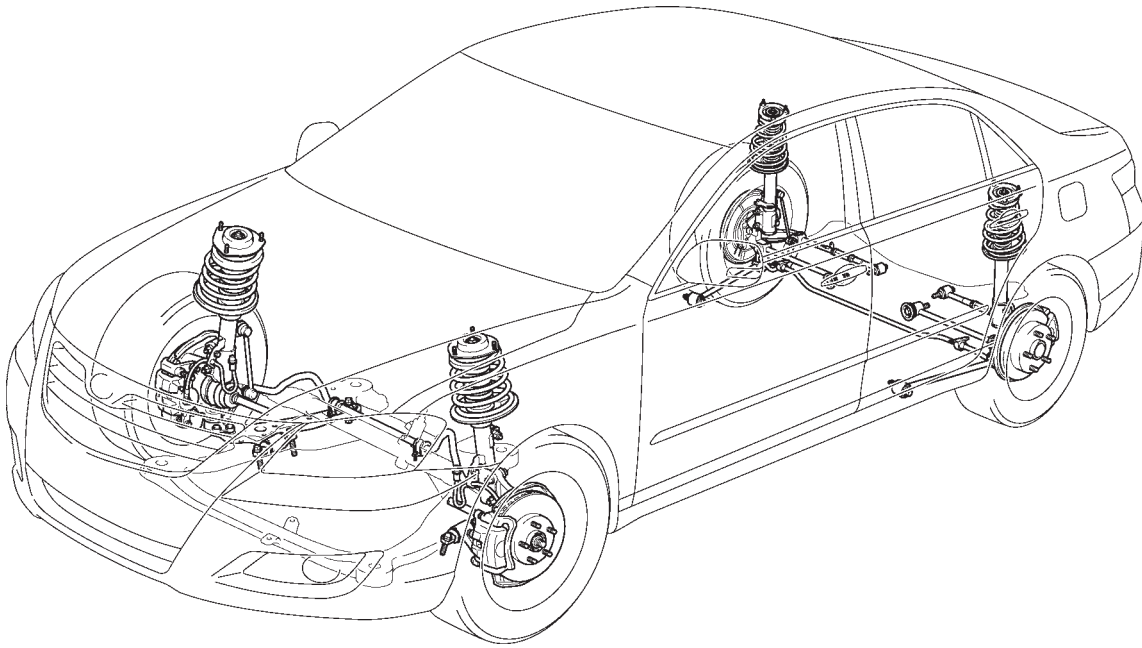
01YCH52Y

## SUSPENSION AND AXLE

### ✱ SUSPENSION

#### 1. General

- MacPherson strut type independent suspension is used for the front.
- Dual link MacPherson strut type independent suspension is used for the rear.



#### ► Specifications ◀

Front Wheel Alignment	Type	MacPherson Strut
	Tread* <sup>1</sup>	mm 1,575
	Caster* <sup>1</sup>	degrees 2°50'
	Camber* <sup>1</sup>	degrees -0°40'
	Toe-in* <sup>1</sup>	mm 0
	King Pin Inclination* <sup>1</sup>	degrees 12°20'
Rear Wheel Alignment	Type	Dual Link MacPherson Strut
	Tread* <sup>1</sup>	mm 1,565
	Camber* <sup>1</sup>	degrees 1°05' * <sup>2</sup> 1°22'
	Toe-in* <sup>1</sup>	mm 3±2

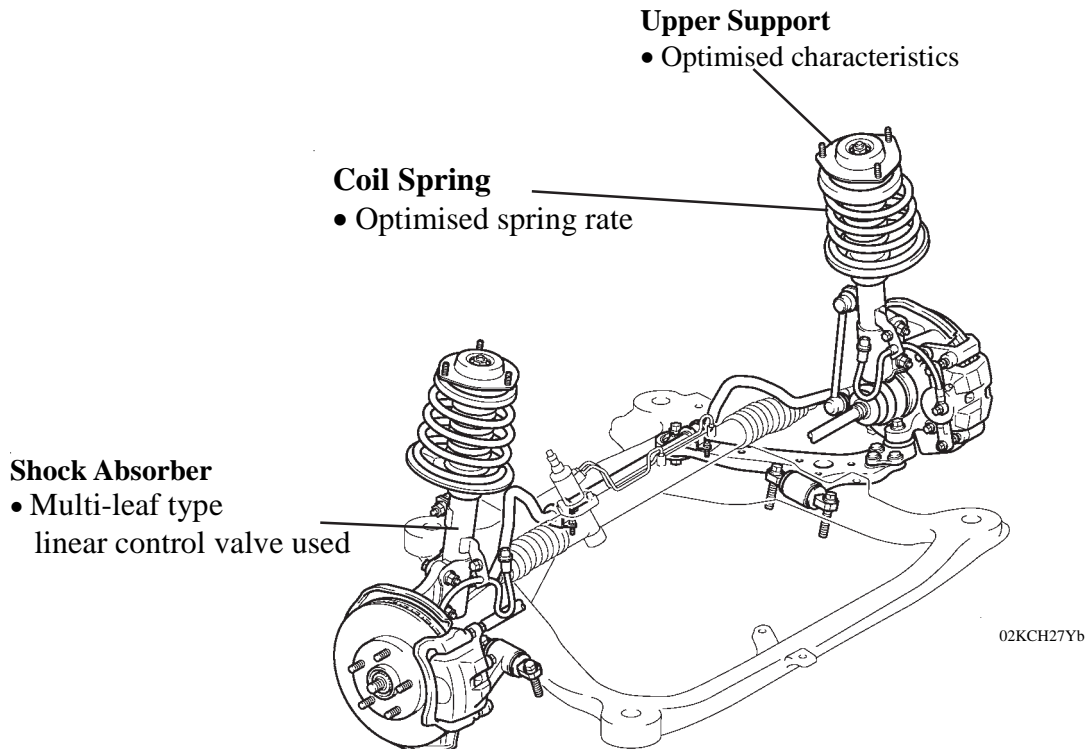
\*<sup>1</sup> : Unloaded Vehicle Condition

\*<sup>2</sup> : Rough Road Package

## 2. Front Suspension

### General

Through the optimal location of components, and the use of Nachlauf geometry, the front suspension provides excellent riding comfort and controllability.

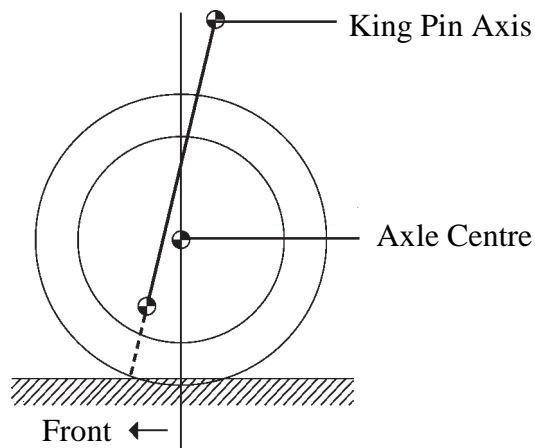


### Service Tip

To prevent hazardous conditions, make sure to empty the gas from the shock absorber before discarding a low-pressure ( $N_2$ ) gas sealed shock absorber. For details, see the Aurion Repair Manual.

### Nachlauf Geometry

The front suspension uses the Nachlauf geometry in which the king pin axis is located ahead of the axle centre. As a result, excellent straight-line stability and steering feel has been improved.



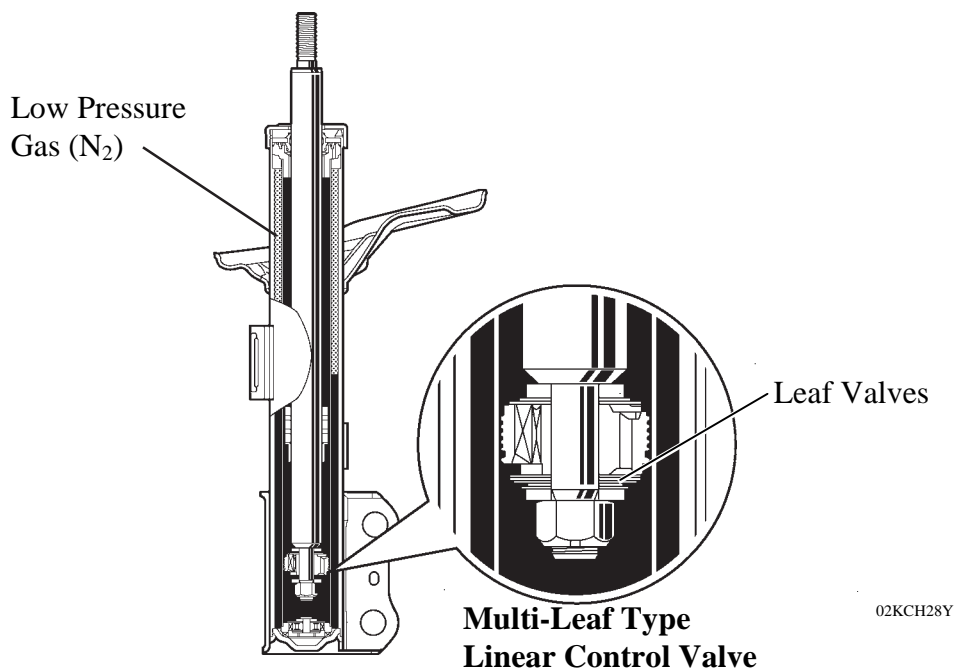
181CH22

## Front Shock Absorber

### 1) General

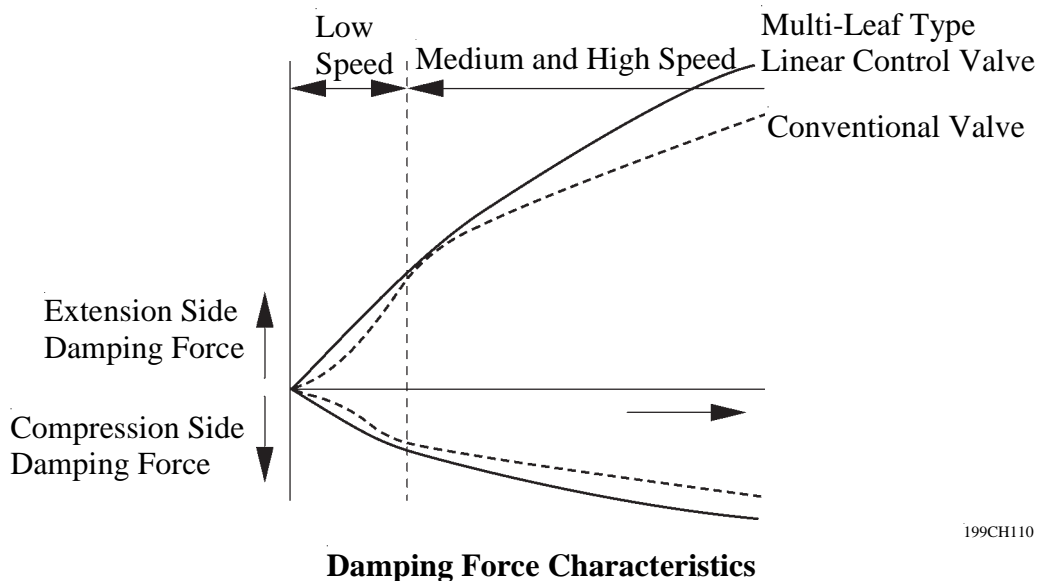
The two functions listed below are used for the shock absorber to realise both driving stability and riding comfort.

- A low-pressure ( $N_2$ ) gas sealed type construction is used to suppress cavitation.
- A multi-leaf type linear control valve is used to attain linear damping force characteristics.



### 2) Construction of Multi-Leaf type Linear Control Valve

The multi-leaf type linear control valve has a structure consisting of several layered leaf valves with different diameters. Through use of the multi-leaf type linear control valve, changes in the damping force are made constant at low piston speeds, thus realising excellent riding comfort and controllability.

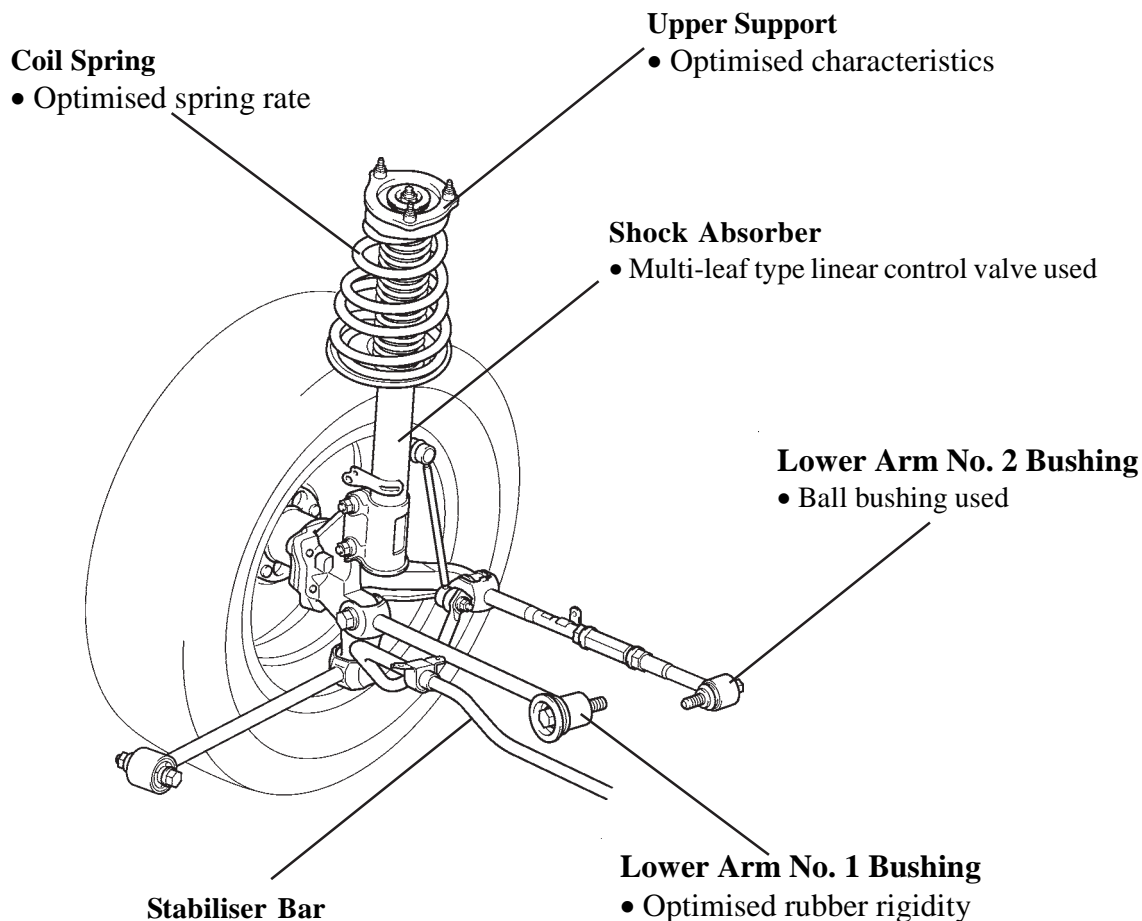




### 3. Rear Suspension

#### General

Excellent stability and controllability have been realised by optimising the suspension geometry and allocation of components.



02KCH29Y

#### Service Tip

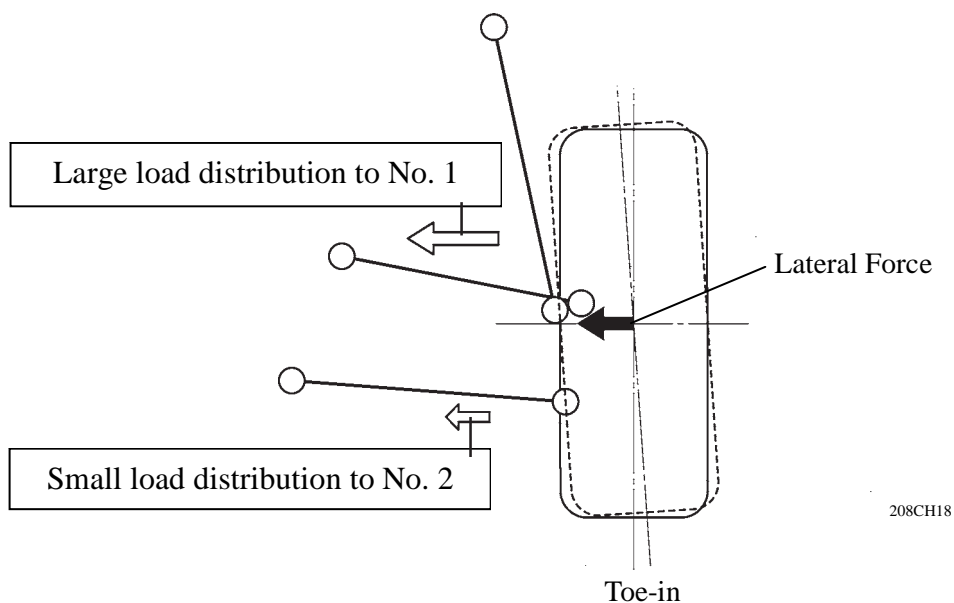
To prevent hazardous conditions, make sure to empty the gas from the shock absorber before discarding a low-pressure ( $N_2$ ) gas sealed shock absorber. For details, see the Aurion Repair Manual.

#### Rear Shock Absorber

The rear shock absorber construction and operation is similar to the front shock absorber. For details refer to page CH-48.

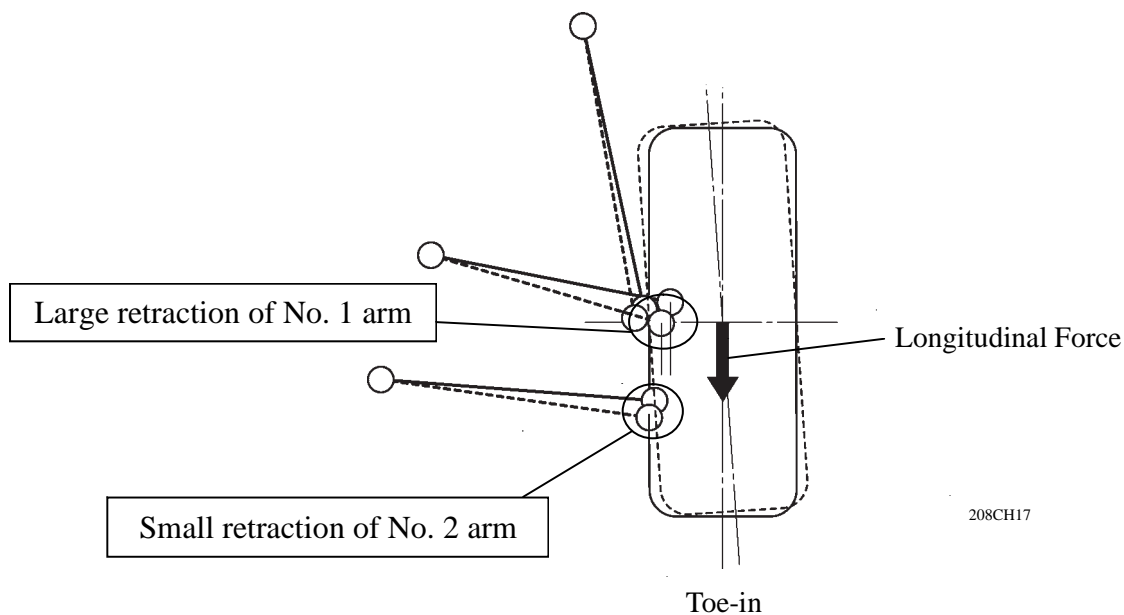
## Cornering Geometry

When a lateral force is generated, the load becomes distributed to the No. 1 and No. 2 suspension arms. The illustration shown below indicates the lateral force distribution on suspension arms of the right side rear wheel during left cornering. This causes the wheels to toe-in, in order to ensure the proper stability of the rear suspension.



## Braking Geometry

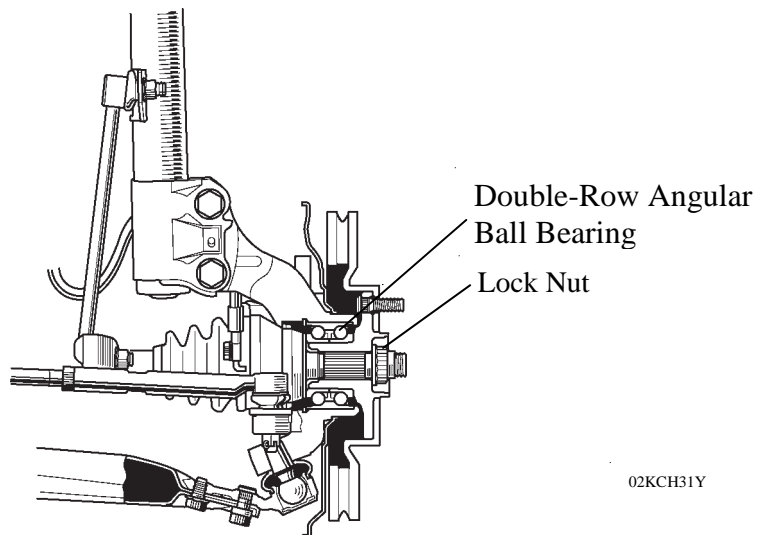
When the longitudinal force is generated, the displacement locus of the No. 1 and No. 2 suspension arms will toe-in as shown below, in order to ensure the stability of the vehicle.



## ✱ AXLE

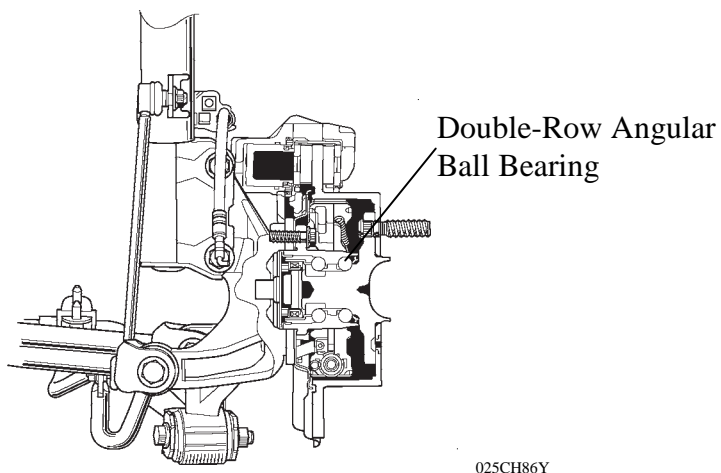
### 1. Front Axle

- The front axle uses compact and highly rigid double-row angular ball bearings. The bearings and the axle hub have been integrated to ensure high rigidity, thus realising excellent driving and braking stability.
- A lock nut (12-point) is used and staked in order to ensure that the axle hub is properly secured. Once removed, this nut cannot be reused.



### 2. Rear Axle

A compact and highly rigid double-row angular ball bearing is used on the front axle. The double-row angular ball bearing and the axle hub have been integrated to ensure high rigidity, thus realising excellent driving stability and braking stability.



## BRAKE

### ✱ DESCRIPTION

#### 1. General

- Models with the brake control system consisting of ABS with EBD and Brake Assist use a mechanical type brake assist, which is integrated into the brake booster.
- Models with the brake control system consisting of ABS with EBD, Brake Assist, TRC and VSC use an electrical type brake assist, which effects brake assist control through the brake actuator.
- The Aurion has a brake system with the following specifications:

Front Brake Type	Ventilated Disc
Rear Brake Type	Solid Disc
Brake Control System	ABS with EBD, Brake Assist (Mechanical)* <sup>1</sup>
	ABS with EBD, Brake Assist (Electrical), TRC and VSC* <sup>2</sup>
Parking Brake Type	Pedal

\*<sup>1</sup>: Touring

\*<sup>2</sup>: Grande

#### ► Specifications ▼

Master Cylinder	Type	Tandem (Plunger type)
	Diameter mm	22.22
Brake Booster	Type	Single, Tie Rod Type
	Size in.	10
Front Disc Brake	Caliper Type	PE63
	Wheel Cylinder Dia. mm	63.5
	Rotor Size (D×T)* mm	296 × 28
	Pad Material	PN562H
Rear Disc Brake	Caliper Type	PEAL38
	Wheel Cylinder Dia. mm	38.1
	Rotor Size (D×T)* mm	281 × 10
	Pad Material	D6234
Parking Brake	Type	Duo Servo
	Drum Inner Dia. mm	170.0
Brake Actuator Supplier	For ABS with EBD	Bosch
	For ABS with EBD, Brake Assist, TRC and VSC	

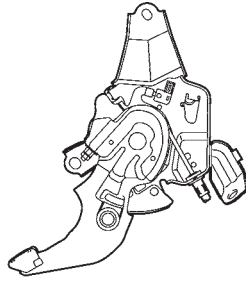
\*: D: Outer Diameter, T: Thickness

#### Service Tip

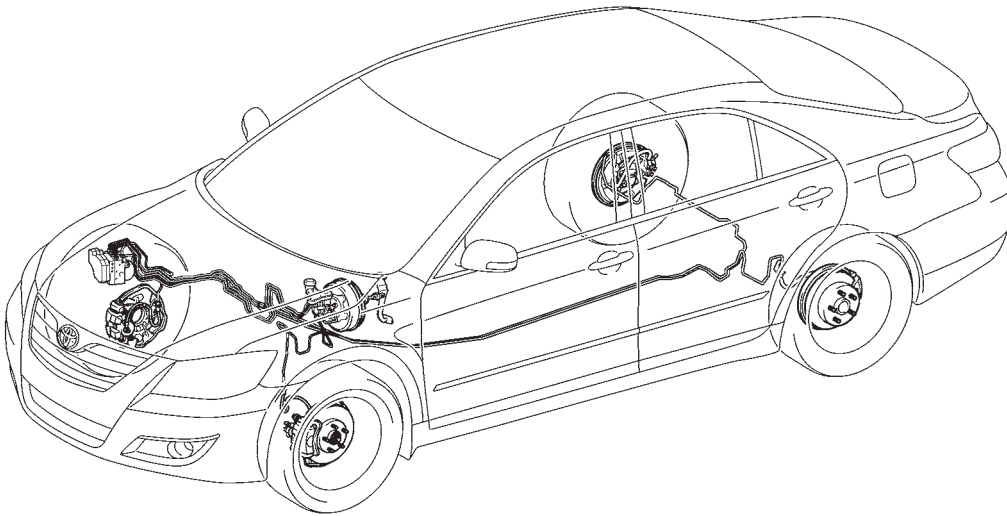
- To ensure the performance and reliability of the plunger type master cylinder, it must not be disassembled. If it malfunctions, replace the entire assembly.
- Before removing the plunger type master cylinder from the brake booster, discharge the vacuum from the brake booster. Otherwise, the piston of the master cylinder may be left inside the brake booster. For details, see the Aurion Repair Manual.

## 2. Component of Brake System

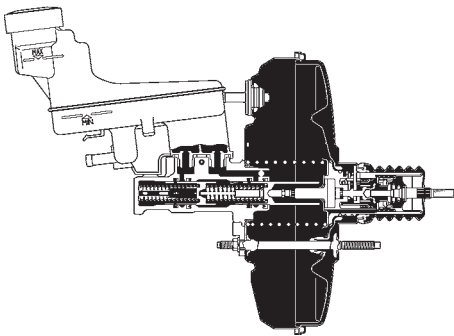
### ► Parking Brake ◀



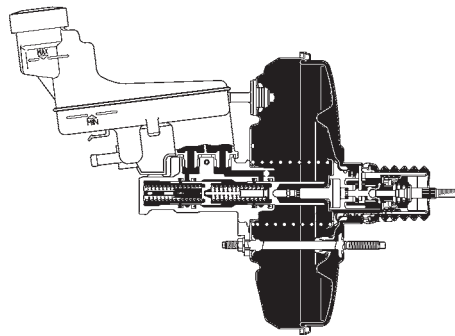
Lever Type



### ► Master Cylinder and Brake Booster ◀



Models with  
mechanical type Brake assist

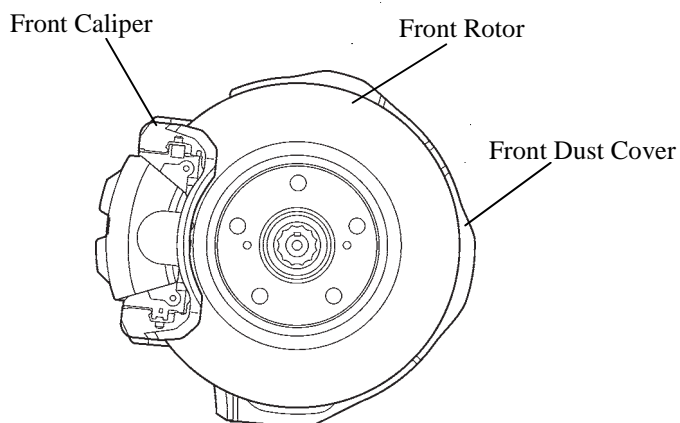


Except models with  
mechanical type Brake assist

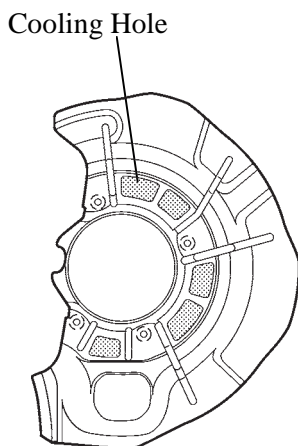
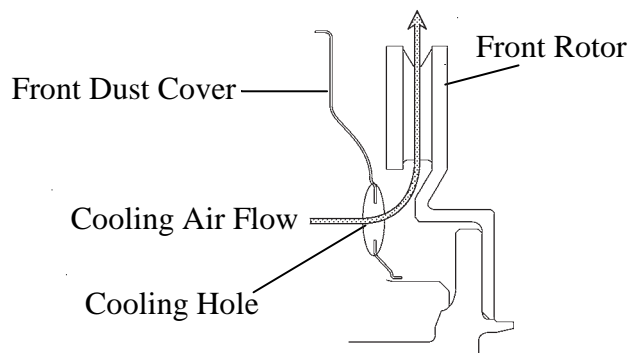
02KCH33TEc

## ✿ FRONT BRAKE

- The diameter of the front rotor is 296mm. The front rotor is the ventilated type that excels in heat dissipation to ensure reliability.
- The shape of the front dust cover has been optimized to efficiently direct cool air to the ventilated disc, thus ensuring excellent cooling performance.



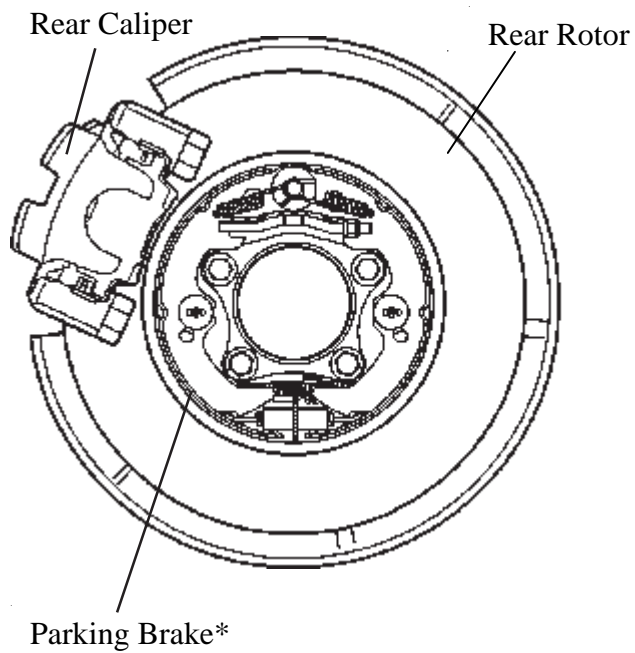
02KCH59TE

**Front Dust Cover****Cross Section**

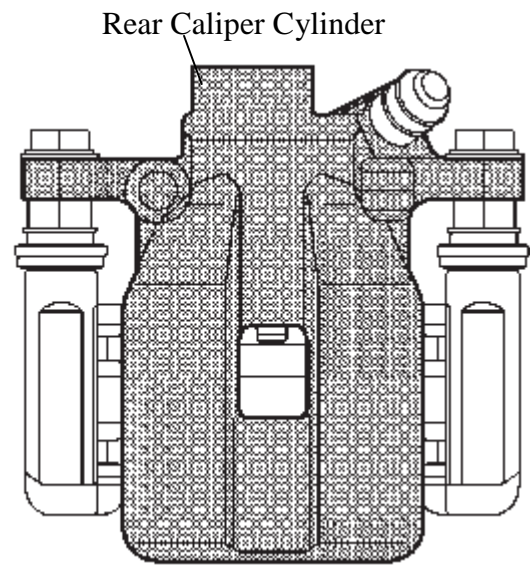
02KCH60TE

## REAR BRAKE

- The diameter of the rear rotor is 281 mm. It has a drum in disc type parking brake.
- For weight reduction, a rear caliper cylinder made of aluminium is used.



\*: Inside view of the parking brake drum



**Rear Caliper**



**Rear Brake Caliper & Disc**

## BRAKE CONTROL SYSTEM (ABS with EBD)

## 1. General

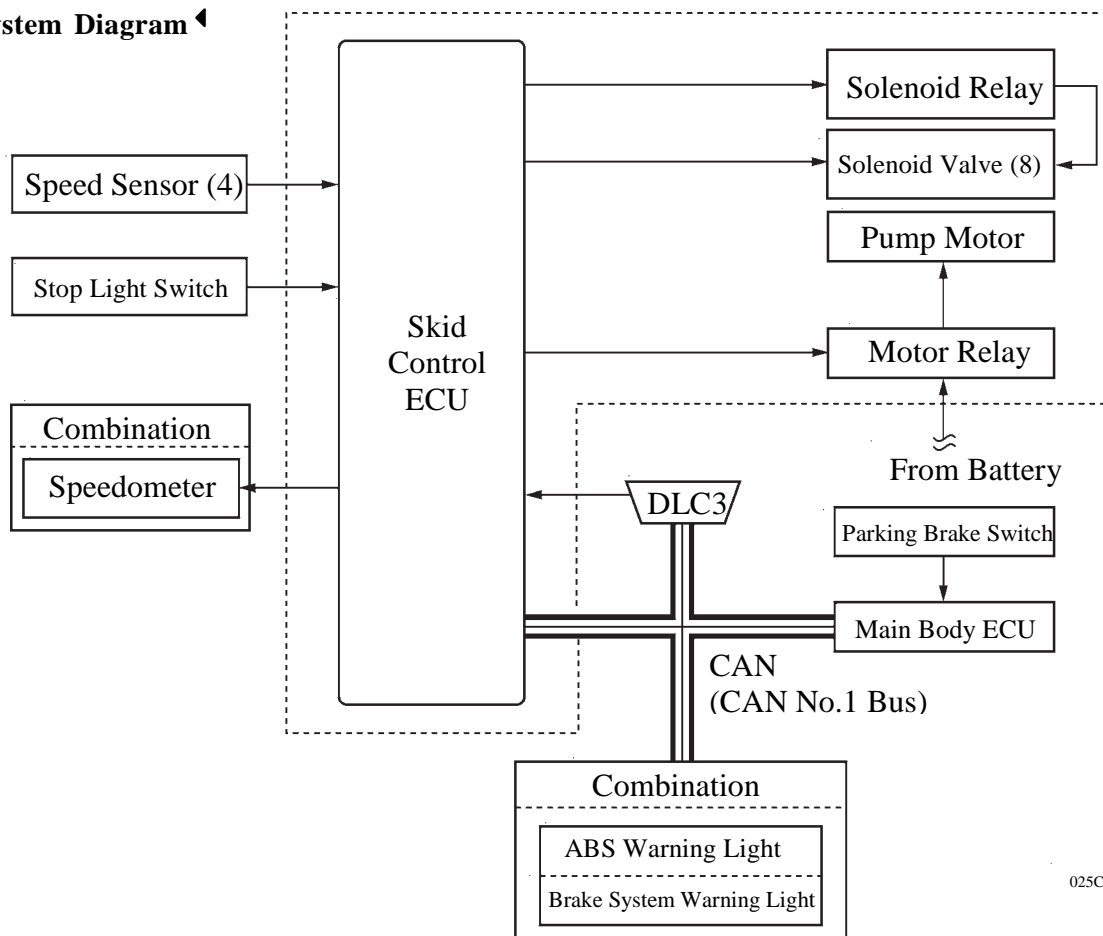
The brake control system (ABS with EBD) of Aurion has the following functions:

Function	Outline
ABS (Anti-lock Brake System)	The ABS helps prevent the wheels from locking when the brakes are applied firmly or when braking on a slippery surface.
EBD (Electronic Brake force Distribution)	The EBD control utilises ABS, realising the proper brake force distribution between front and rear wheels in accordance with the driving conditions. In addition, during cornering braking, it also controls the brake forces of right and left wheels, helping to maintain the vehicle behaviour.
Brake Assist (Mechanical Type)	The primary purpose of the Brake Assist is to provide an auxiliary brake force to assist the driver who cannot generate a large brake force during emergency braking, thus helping to realise the vehicle's brake performance.

### Service Tip

When the brake control system is activated, the brake pedal could shudder, which is a normal occurrence of the system in operation, and should not be considered to be a malfunction.

### ► System Diagram ◀



025CH37P



## 2. Outline of EBD Control

### General

The distribution of the brake force, which was performed mechanically in the past, is now performed under electrical control of the skid control ECU, which precisely controls the braking force in accordance with the vehicle's driving conditions.

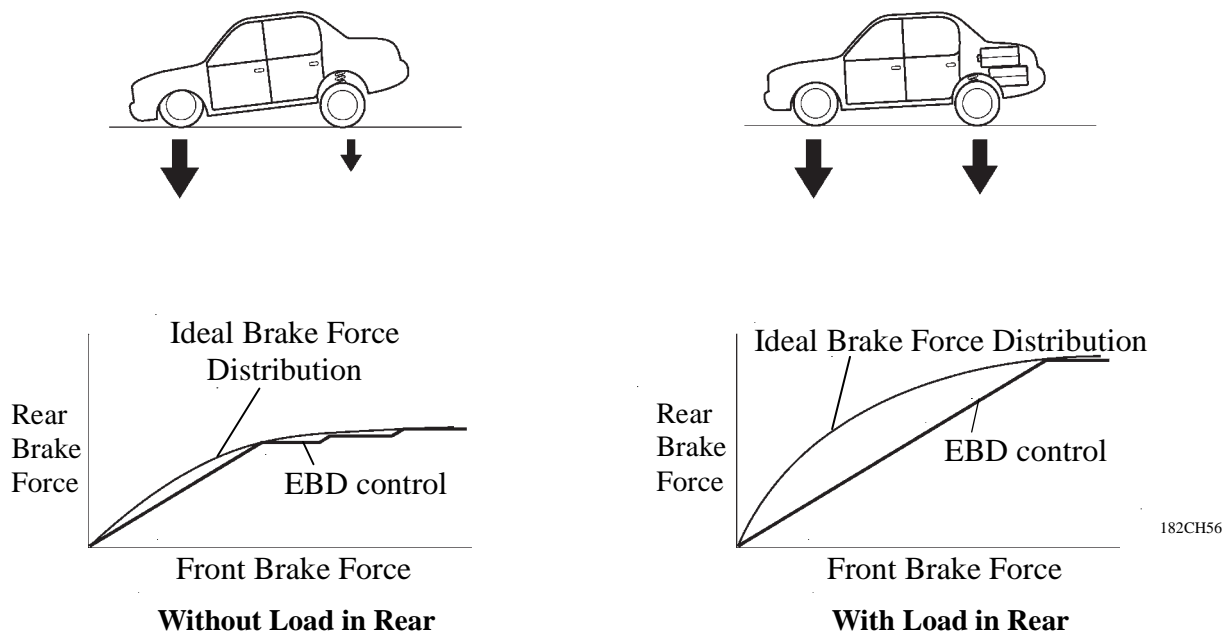
### Front/ Rear Wheels Brake Force Distribution

If the brakes are applied while the vehicle is moving straight forward, the transfer of the road reduces the load that is applied to the rear wheels. The skid control ECU determines this condition by way of the signals from the wheel speed sensors, and the brake actuator regulates the distribution of the brake force of the rear wheels to optimally control.

For example, the amount of the brake force that is applied to the rear wheels during braking varies whether or not the vehicle is carrying a load. The amount of the brake force that is applied to the rear wheels also varies in accordance with the extent of the deceleration.

Thus, the distribution of the brake force to the rear is optimally controlled in order to effectively utilise the braking force of the rear wheels under these conditions.

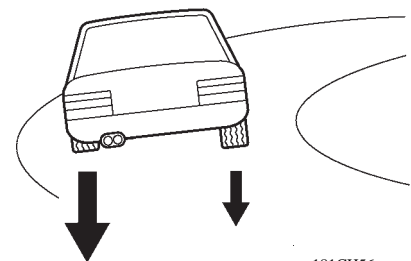
#### ▸ EBD Control Concept ◀



### Right/Left Wheels Brake Force Distribution (During Cornering Braking)

When the brakes are applied while the vehicle is cornering, the load that applied to the inner wheel decreases and the outer wheel increases.

The skid control ECU determines this condition by way of the signals from the wheel speed sensors, and the brake actuator regulates the brake force in order to optimally control the distribution of the brake force to the inner wheel and outer wheel.

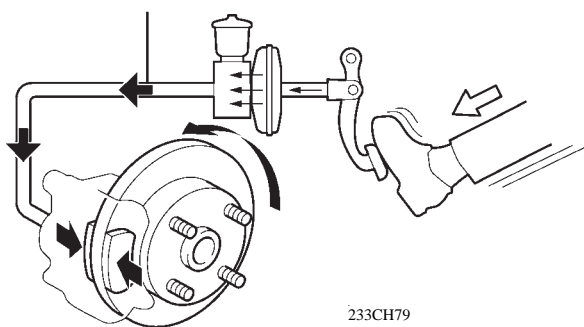


### 3. Outline of Brake Assist (Mechanical Type)

- The brake assist in combination with ABS helps improve the vehicle's brake performance.
- The brake assist interprets a quick push of the brake pedal as emergency braking and supplements the brake power applied if the driver has not stepped hard enough on the brake pedal. In emergencies, the driver, especially inexperienced ones, often panic and do not apply sufficient pressure on the brake pedal.
- A key feature of brake assist system is that the timing and the degree of braking assistance are designed to ensure that the driver does not discern anything unusual about the braking operation. When the driver intentionally eases up on the brake pedal, the system reduces the amount of assistance it provides.
- The mechanical type brake assist uses the brake assist mechanism in the brake booster to mechanically activate the brake booster function in order to increase the brake force. For details, see page CH-61.

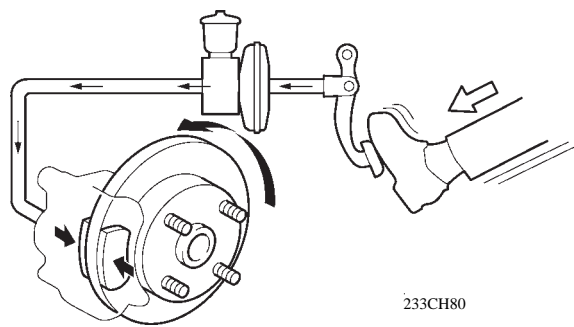
► In case that the driver's depressing force is small when applying emergency braking ◀

The fluid pressure is increased  
by the brake booster



233CH79

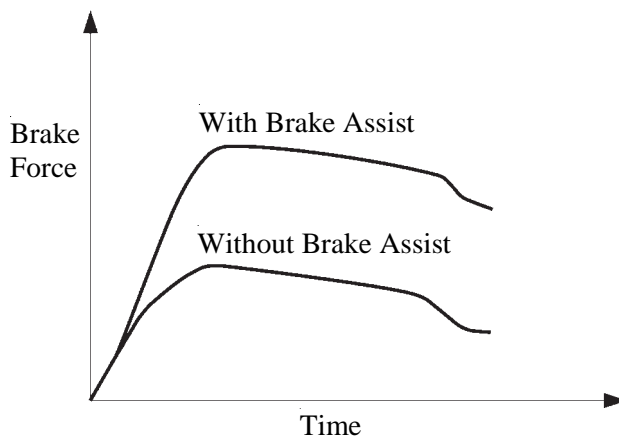
**With Brake Assist**



233CH80

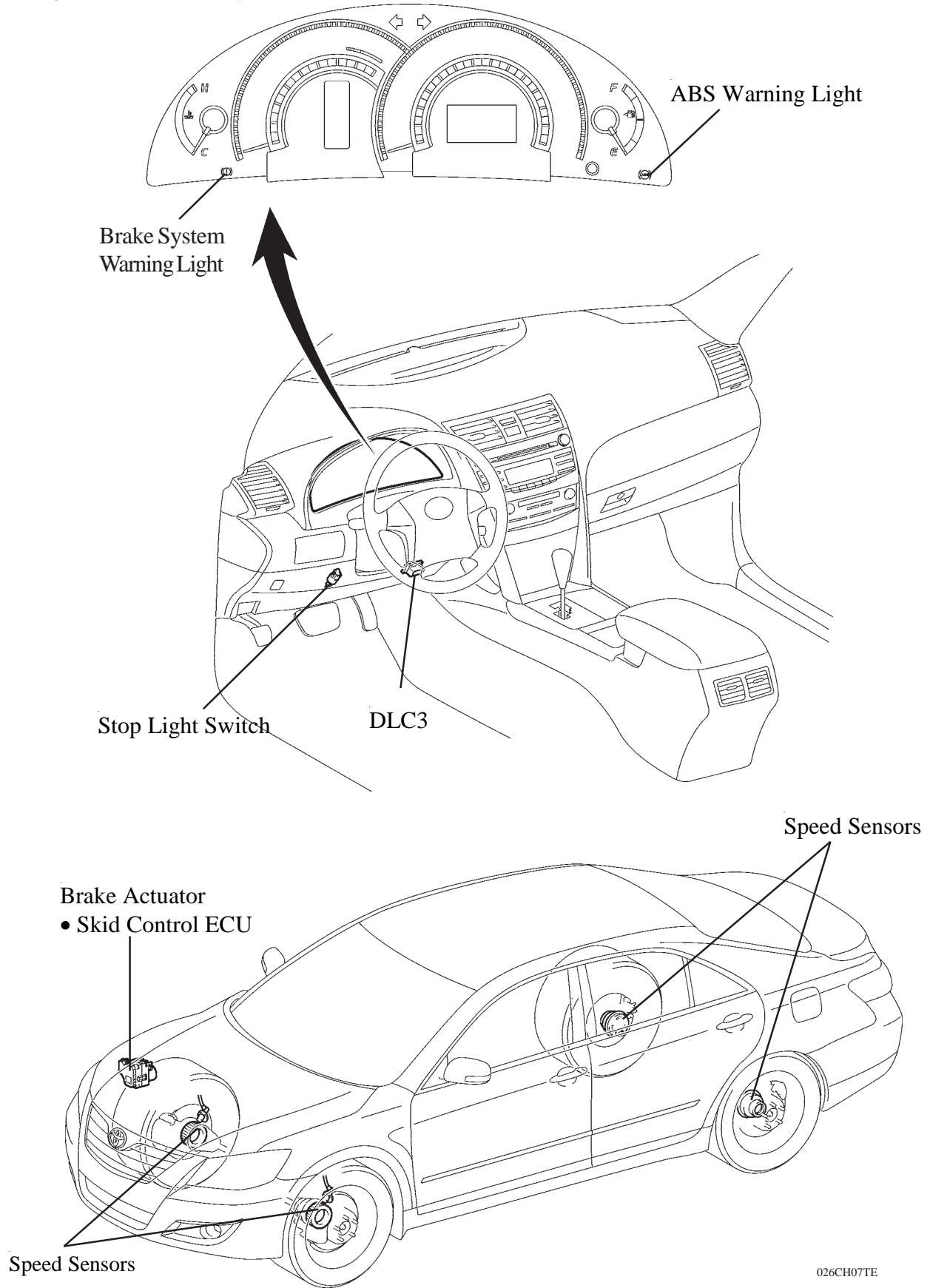
**Without Brake Assist\***

\*: The basic performance of the brake is the same as of the models with the brake assist system



170CH18

#### 4. Layout of Main Components



026CH07TE

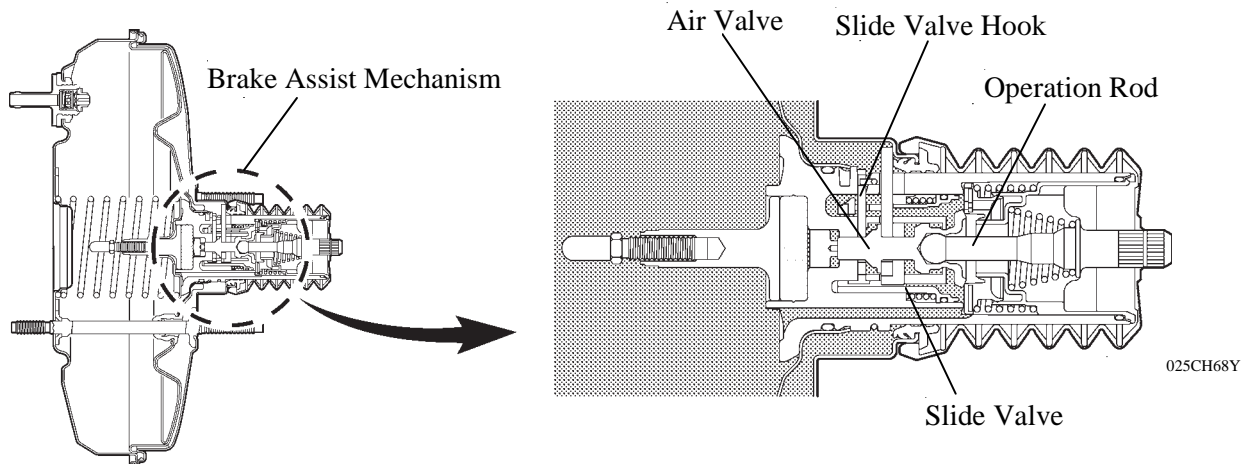
## 5. Function of Main Components

Component		Function
Combination Meter	Brake System Warning Light	<ul style="list-style-type: none"> <li>• Lights up to alert the driver when a malfunction occurs in the EBD or skid control ECU.</li> <li>• Lights up to alert the driver when the brake fluid level is low.</li> <li>• Lights up to alert the driver when the parking brake is actuated.</li> </ul>
	ABS Warning Light	Lights up to alert the driver when the skid control ECU detects a malfunction in the ABS or EBD System.
Brake Fluid Level Warning Switch		Detects the brake fluid level.
Speed Sensors		Detects the wheel speed of each of 4 wheels.
Stop Light Switch		Detects the brake pedal depressing signals.
Parking Brake Switch		Detects the parking brake actuation signals.
Brake Actuator	Actuator Portion	In charge of fluid path based on the signals from the skid control ECU during the operation of the ABS with EBD, in order to control the fluid pressure that is applied to the wheel cylinders.
	Skid Control ECU	Judges the vehicle driving condition based on the signals from each sensor, and sends brake control signals to the brake actuator.
	ABS solenoid relay	Supplies or cuts off power to solenoid valves in the brake actuator.
	ABS motor relay	Supplies or cuts off power to motor in the brake actuator.

## 6. Brake Booster (with Brake Assist Mechanism)

### General

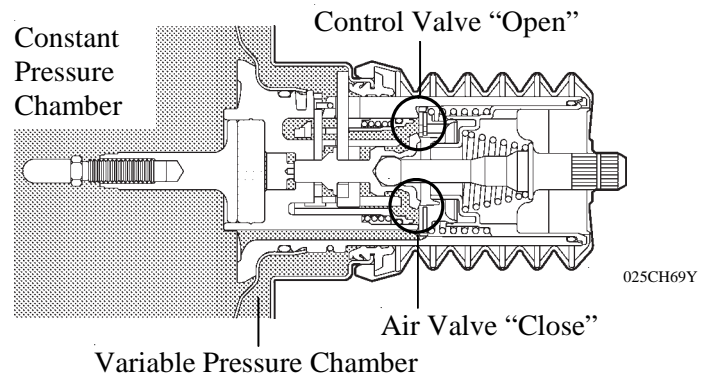
This brake booster consists of the conventional type brake booster to which a brake assist has been added. During a normal brake operation, the function of the brake booster is the same as that of the conventional type. The major difference in construction between this booster and the conventional type one is that the slide valve and the slide valve hook are added in the air valve in this booster.



### Operation

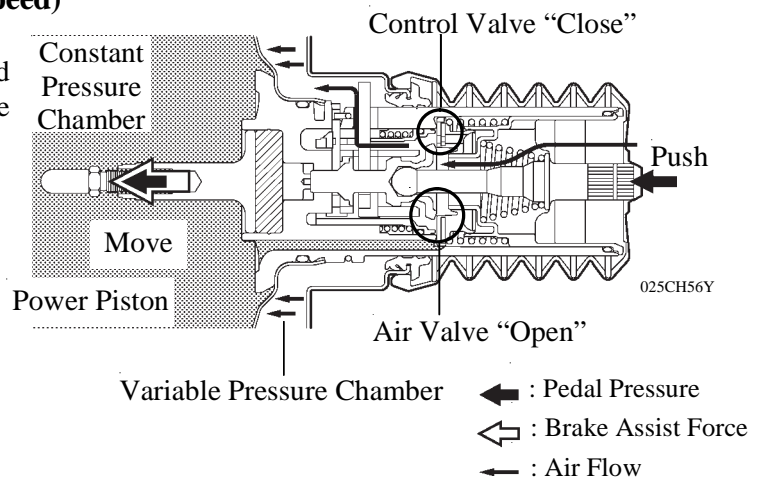
#### 1) No Braking Condition

When the air valve closes and the control valve opens, the pressure in the constant pressure chamber and that in the variable pressure chamber become the same.



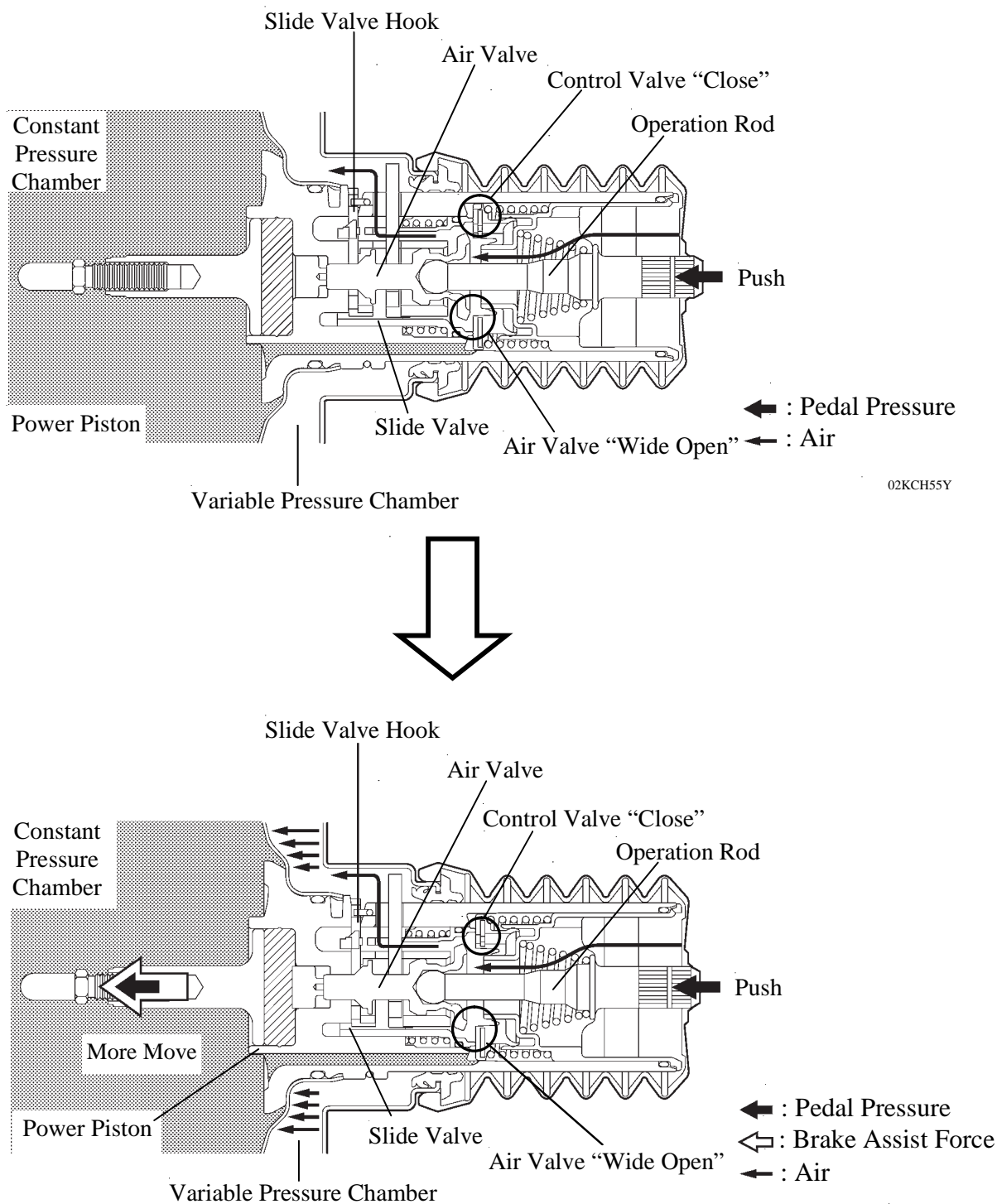
#### 2) Normal Braking Condition (Operation Rod Speed = Power Piston Speed)

During normal braking, the air valve opens and the control valve closes to activate the brake booster function.



### 3) Brake Assist Condition (Operation Rod Speed > Power Piston Speed)

When the operation rod speed is faster than the power piston speed, the air valve pushes the slide valve hook. Consequently, the slide valve separates from the slide valve hook, the spring pushes the control valve, and the control valve closes. Thus, the opening of the air valve becomes enlarged and the air volume that is introduced increases. This results in a brake assist force to powerfully push the power piston.



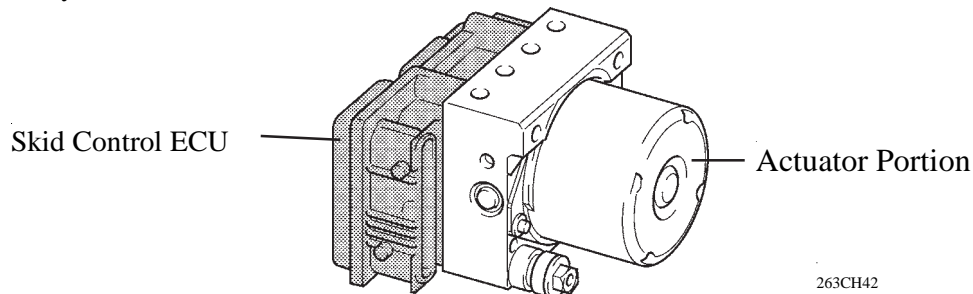
02KCH55Y

02KCH56Y

## 7. Brake Actuator

### General

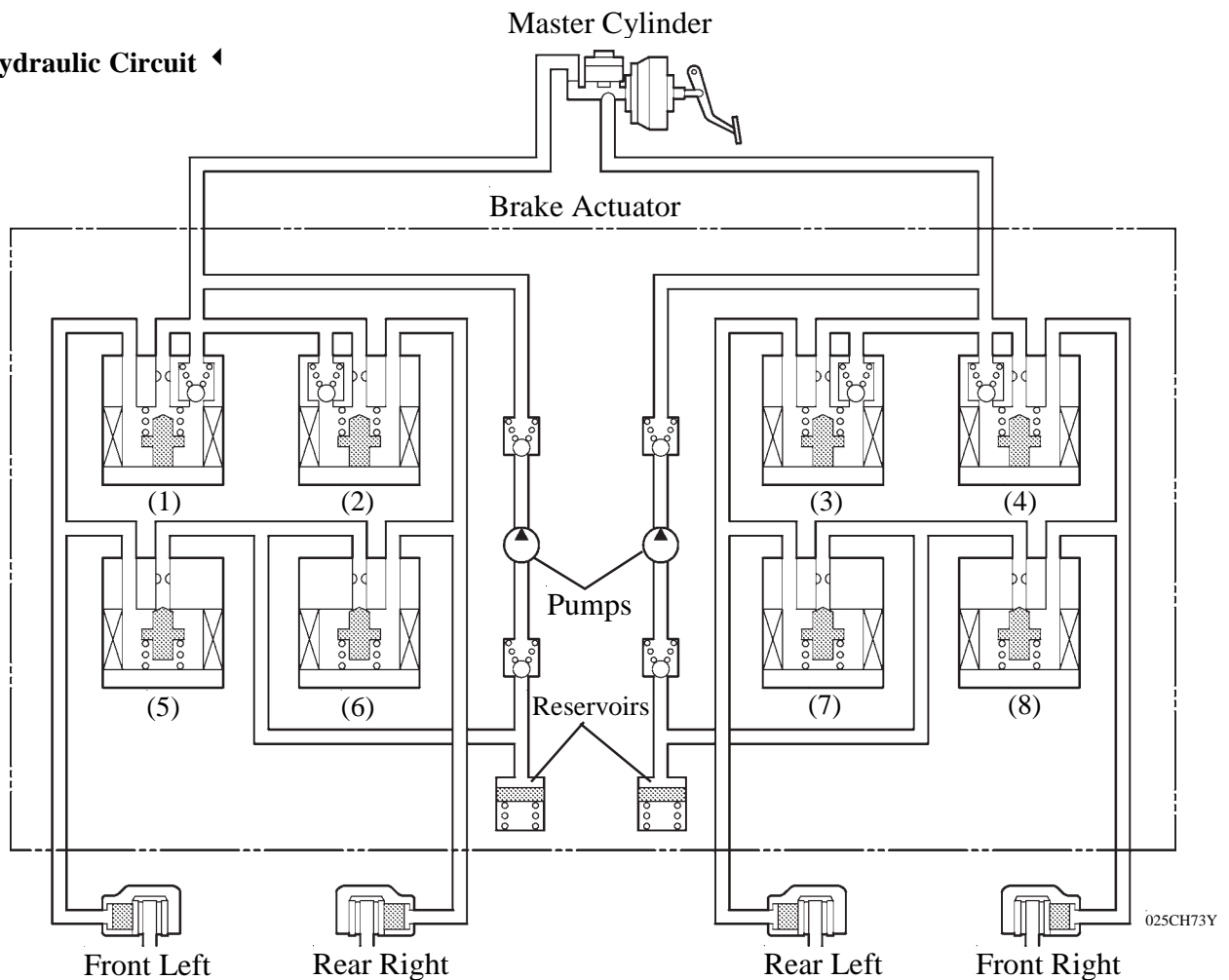
- The brake actuator consists of actuator portion, skid control ECU, ABS solenoid relay, and ABS motor relay.
- The 2 relays are built in the brake actuator.



### Actuator Portion

The actuator portion consists of 8 two-position solenoid valves 1 motor, 2 pumps and 2 reservoirs. The 8 two-solenoid valves consist of 4 pressure holding valves [(1), (2), (3), (4)] and 4 pressure reduction valves [(5), (6), (7), (8)].

#### ► Hydraulic Circuit ◀

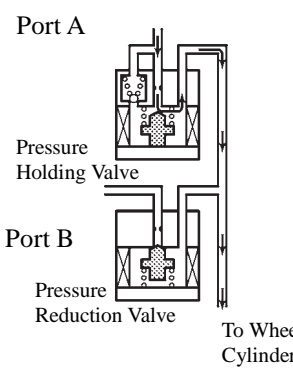
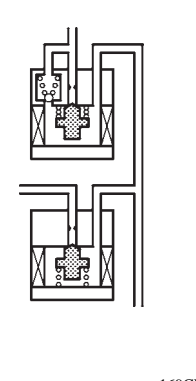
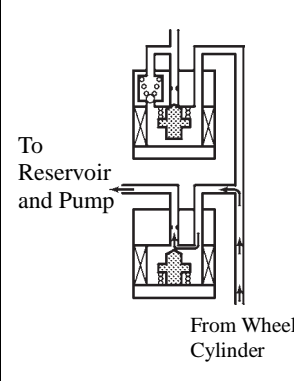




## 8. System Operation

### ABS with EBD Operation

Based on the signals received from the 4 wheel speed sensors, the skid control ECU calculates each wheel speed and deceleration, and checks wheel slipping conditions. And according to the slipping condition, the skid control ECU controls the pressure holding valve and pressure reduction valve in order to adjust the fluid pressure of the each wheel cylinder in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes.

Not Activated	Normal Braking	—	—
Activated	Increase Mode	Holding Mode	Reduction Mode
Hydraulic Circuit	 <p>169CH54</p>	 <p>169CH55</p>	 <p>169CH56</p>
Pressure Holding Valve (Port A)	OFF (Open)	ON (Close)	←
Pressure Reduction Valve (Port B)	OFF (Close)	←	ON (Open)
Wheel Cylinder Pressure	Increase	Hold	Reduction

### Initial Check

After the ignition is turned ON, and the vehicle attains an approximate speed of 15 km/h or more only at first time, the skid control ECU performs the initial check.

The functions of each solenoid valve and pump motor in the brake actuator are checked in order.



## 9. Diagnosis

### General

If the skid control ECU detects a malfunction in the brake control system (ABS with EBD), the ABS and brake system warning lights that correspond to the function in which the malfunction have been detected indicate or light up to alert the driver of the malfunction as indicated in the table below.

○: Light ON —: Light OFF

Item	ABS	EBD	Skid Control ECU
ABS Warning Light	○	○	○
Brake System Warning Light	—	○	○

- At the same time, the DTC (Diagnostic Trouble Code) are stored in the memory. The DTC can be read by connecting the SST (09843-18040) between the Tc and CG terminals of DLC3 and observing the blinks of the ABS warning light, or by connecting an intelligent tester II.
- This system has a sensor signal check (test mode) function. This function is activated by connecting the SST (09843-18040) between the Ts and CG terminal of the DLC3 or by connecting an intelligent tester II.
- If the skid control ECU detects a malfunction during a sensor signal check (test mode), it stores the DTC in its memory. These DTC can be read during a sensor check operation by connecting the SST (09843-18040) to the Tc and CG terminals of the DLC3 and observing the blinking of the ABS warning light or a connecting an intelligent tester II.

### Diagnosis of CAN

- If a malfunction occurs on a CAN communication line, the skid control ECU is connected to the CAN communication lines and it will store the DTC (Diagnostic Trouble Code) in its memory.
- There are 2-digit DTC and 5-digit DTC for CAN communications related to the brake control system (ABS with EBD and brake assist).
  - 2-digit DTC can be read by connecting the SST (09843-18040) to Tc and CG terminals of the DLC3, and reading the code from the blinking warning light in the combination meter.
  - 5-digit DTC can be read by connecting an intelligent tester II to the DLC3.

### Fail-Safe

- In the event of a malfunction in the ABS, the skid control ECU prohibits the ABS operation.
- In the event of a malfunction in EBD control, the skid control ECU prohibits EBD control. Thus, the brake will be operated in the same condition as the system without the ABS with EBD.

## ✱ BRAKE CONTROL SYSTEM (ABS with EBD, Brake Assist, TRC and VSC)

### 1. General

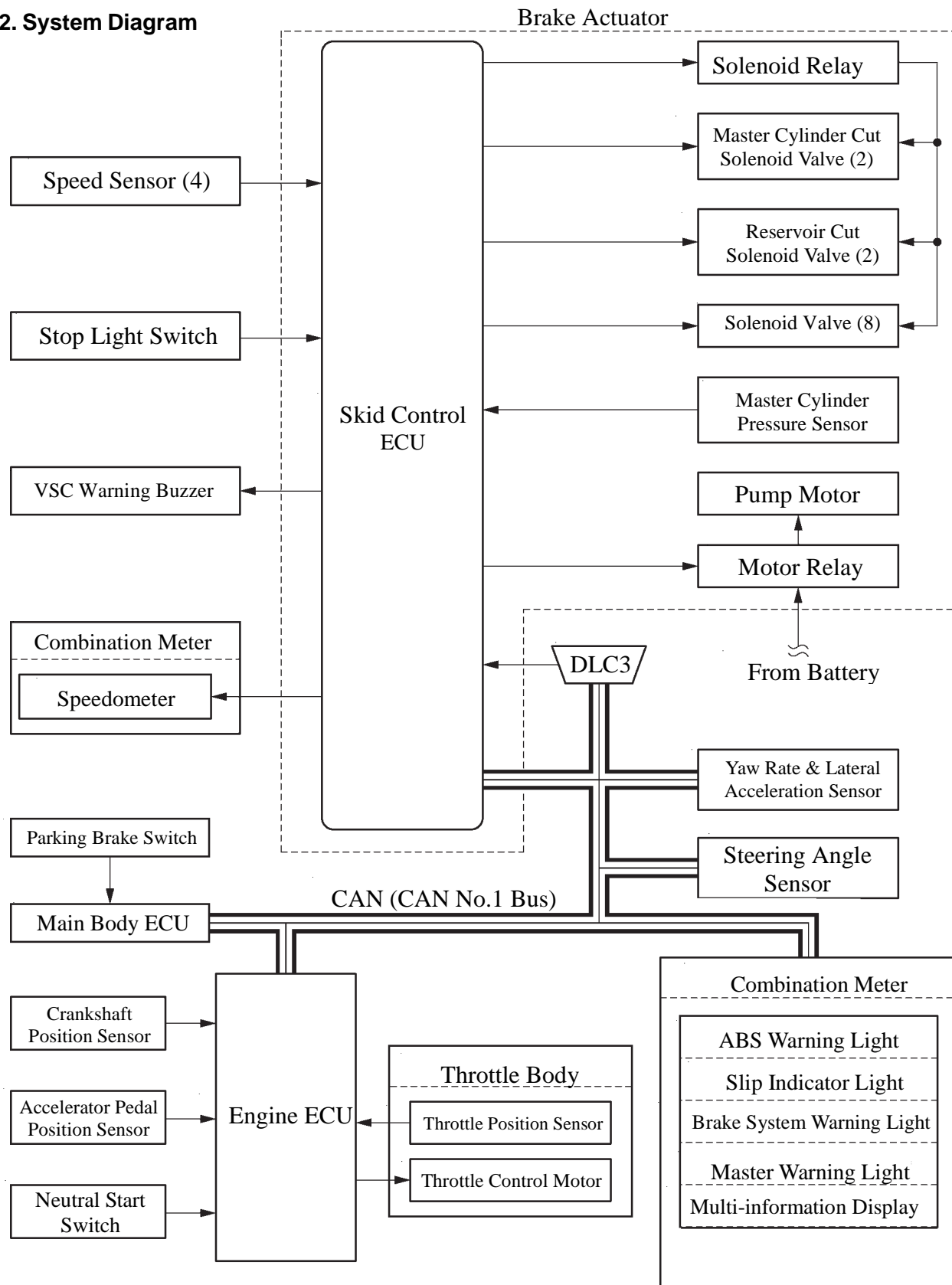
The brake control system (ABS with EBD, brake assist, TRC and VSC) of Aurion has the following functions:

Function	Outline
ABS (Anti-lock Brake System)	The ABS helps prevent the wheels from locking when the brakes are applied firmly or when braking on a slippery surface.
EBD (Electronic Brake force Distribution)	The EBD control utilises ABS, realising the proper brake force distribution between front and rear wheels in accordance with the driving conditions. In addition, during cornering braking, it also controls the brake forces of right and left wheels, helping to maintain the vehicle behaviour.
Brake Assist (Electrical Type)	The primary purpose of the brake assist is to provide an auxiliary brake force to assist the driver who cannot generate a large brake force during emergency braking, thus helping draw the vehicle's brake performance.
TRC (Traction Control)	The TRC system helps prevent the drive wheels from slipping if the driver presses the accelerator pedal excessively when starting off or accelerating on a slippery surface.
VSC (Vehicle Stability Control)	The VSC system helps prevent the vehicle from slipping sideways as a result of strong front wheel skid or strong rear wheel skid during cornering.

#### Service Tip

When brake control system is activated, the brake pedal could shudder, which is a normal occurrence of the system in operation and should not be considered a malfunction.

## 2. System Diagram



\*1: Grande only

\*2: Touring Only

### 3. Outline of EBD Control

#### General

The distribution of the brake force, which was performed mechanically in the past, is now performed under electrical control of the skid control ECU, which precisely controls the braking force in accordance with the vehicle's driving conditions.

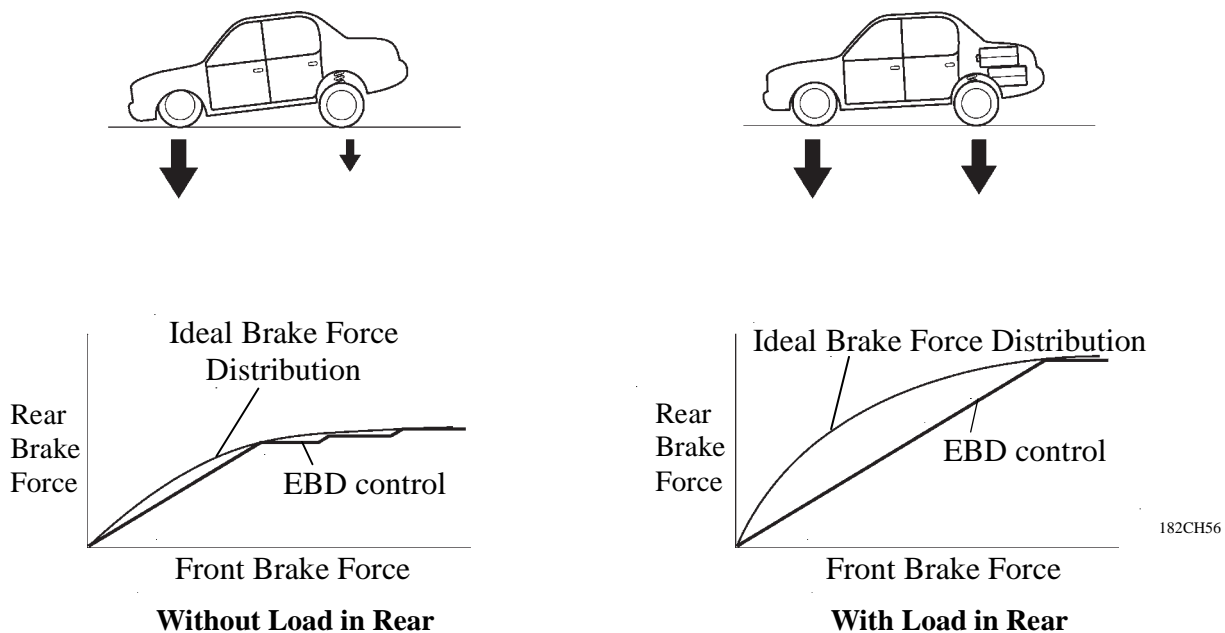
#### Front/ Rear Wheels Brake Force Distribution

If the brakes are applied while the vehicle is moving straight forward, the transfer of the road reduces the load that is applied to the rear wheels. The skid control ECU determines this condition by way of the signals from the wheel speed sensors, and the brake actuator regulates the distribution of the brake force of the rear wheels to optimally control.

For example, the amount of the brake force that is applied to the rear wheels during braking varies whether or not the vehicle is carrying a load. The amount of the brake force that is applied to the rear wheels also varies in accordance with the extent of the deceleration.

Thus, the distribution of the brake force to the rear is optimally controlled in order to effectively utilise the braking force of the rear wheels under these conditions.

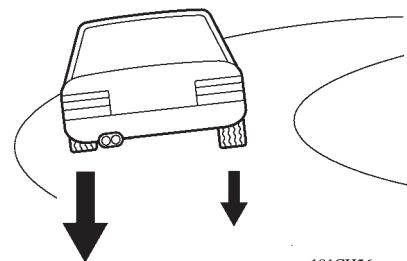
#### ► EBD Control Concept ◀



#### Right/Left Wheels Brake Force Distribution (During Cornering Braking)

When the brakes are applied while the vehicle is cornering, the load that applied to the inner wheel decreases and the outer wheel increases.

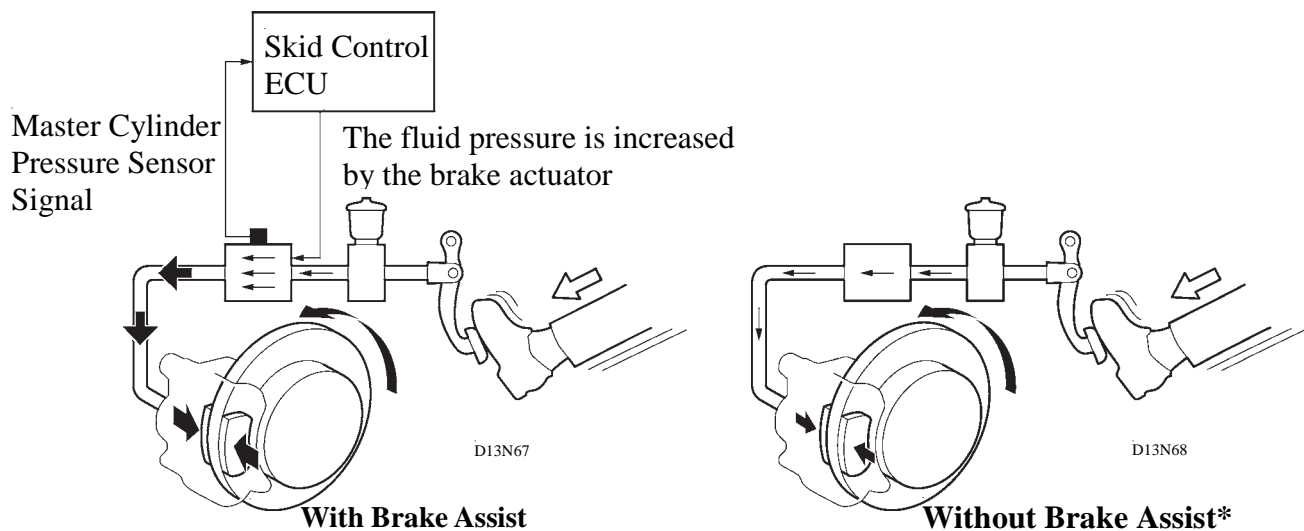
The skid control ECU determines this condition by way of the signals from the wheel speed sensors, and the brake actuator regulates the brake force in order to optimally control the distribution of the brake force to the inner wheel and outer wheel.



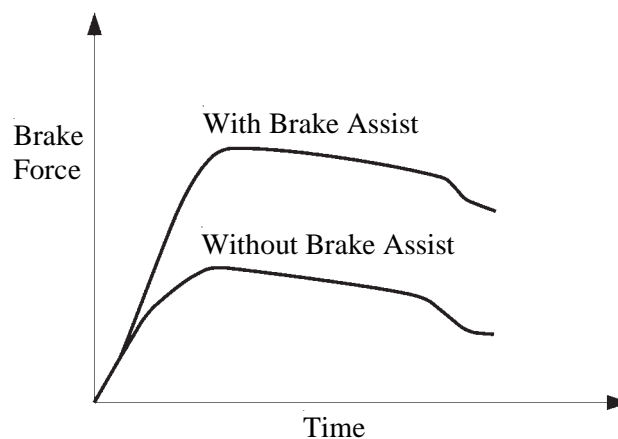
#### 4. Outline of Brake Assist

- The brake assist in combination with ABS help to improve the vehicle's brake performance.
- The brake assist interprets a quick push of the brake pedal as emergency braking and supplements the brake power applied if the driver has not stepped hard enough on the brake pedal. In emergencies, some drivers, especially inexperienced ones, often panic and do not apply sufficient pressure on the brake pedal.
- A key feature of brake assist system is that the timing and the degree of braking assistance are designed to help ensure that the driver does not discern anything unusual about the braking operation. When the driver intentionally eases up on the brake pedal, the system reduces the amount of assistance it provides.
- Based on the signals from the master cylinder pressure sensor, the skid control ECU calculates the speed and the amount of the brake pedal application and then determines the intention of the driver to make an emergency braking. If the skid control ECU determines that the driver intends the emergency braking, the system activates the brake actuator to increase the brake fluid pressure, which increases the braking force.

► In case that the driver's depressing force is small when applying emergency braking ◀



\*: The basic performance of the brake is the same as of the models with the brake assist system

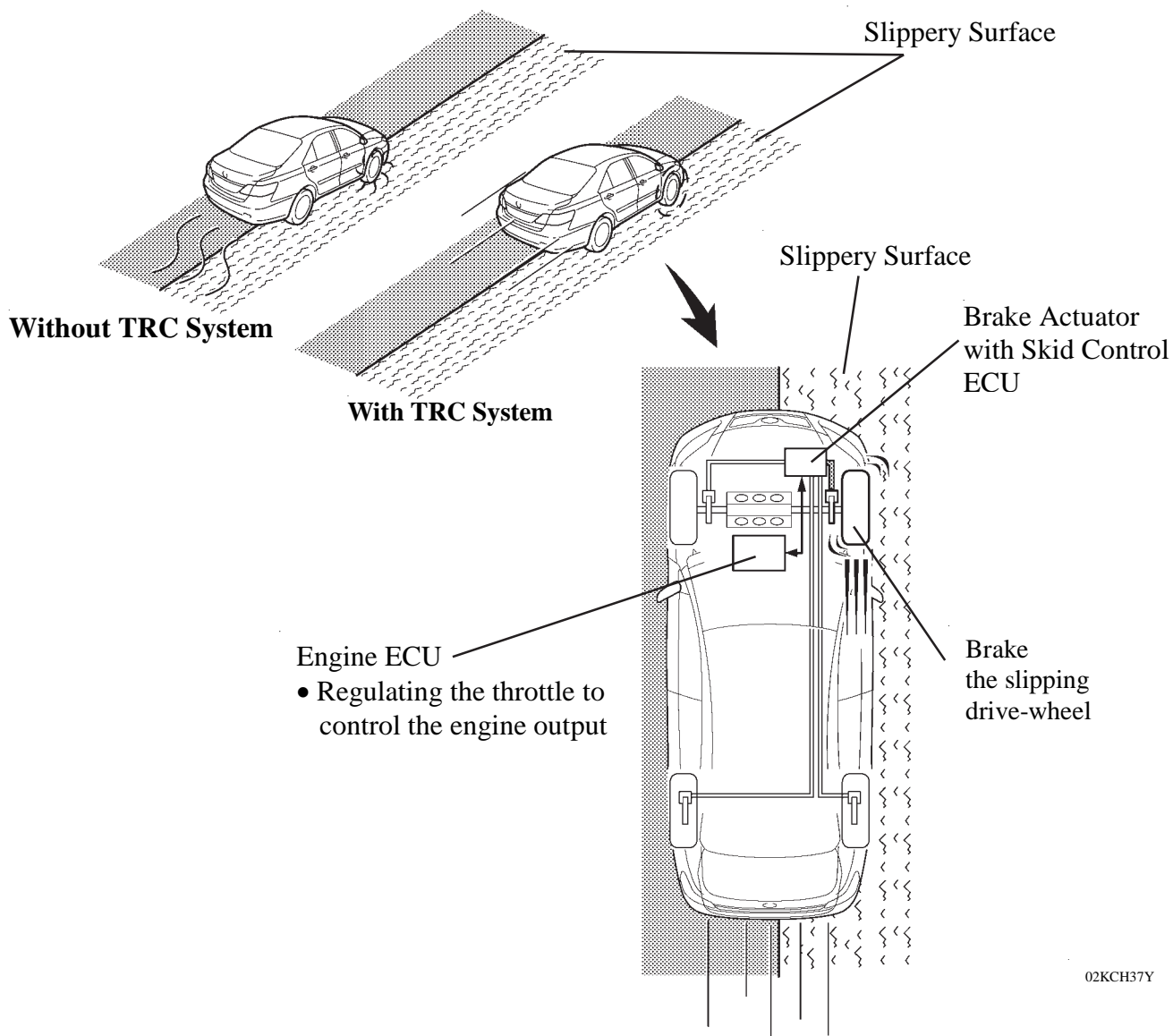


## 5. Outline of TRC Function

- If the driver presses the accelerator pedal aggressively when initially acceleration or when accelerating on a slippery surface, the drive wheels could slip due to the excessive amount of torque that is generated. By applying hydraulic brake control to the drive wheels and regulating the throttle to control the engine output, the TRC helps minimise the slippage of the drive wheels, thus generating the drive force that is appropriate for the road surface conditions.
- For example, a comparison may be made between two vehicles, one with the TRC function and the other without. If the driver of each vehicle operates the accelerator pedal in a rough manner while driving over a surface with different surface friction characteristics, the drive wheel on the slippery surface could slip as illustrated. As a result, the vehicle could become unstable.

However, when the vehicle is equipped with the TRC function, the skid control ECU instantly determines the state of the vehicle and operates the brake actuator in order to apply the brake of the slipping drive wheel. Furthermore, the engine ECU receives the signals from the skid control ECU and regulates the throttle in order to control the engine output. Thus, this function can constantly maintain a stable vehicle posture.

### ▸ Driving condition on road with different surface friction characteristics ▹



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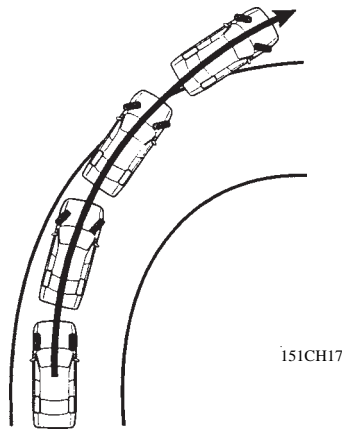
## 6. Outline of VSC Function

### General

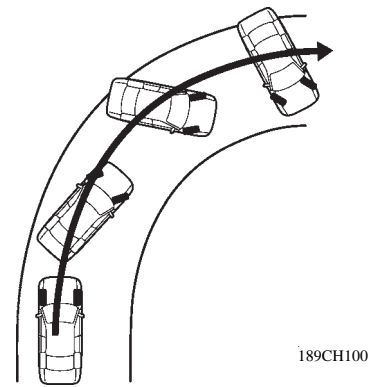
The followings are two examples that can be considered as circumstances in which the tires exceed their lateral grip limit.

The VSC function is designed to help control the vehicle behaviour by controlling the motive force and the brakes at each wheel when the vehicle is under one of the conditions indicated below.

- When the front wheels lose grip in relation to the rear wheels (front wheel skid tendency).
- When the rear wheels lose grip in relation to the front wheels (rear wheel skid tendency).



**Front Wheel Skid Tendency**



**Rear Wheel Skid Tendency**

### Method for Determining the Vehicle Condition

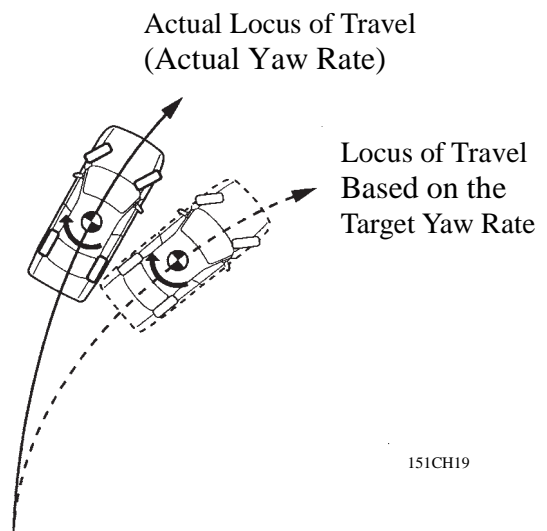
To determine the condition of the vehicle, sensors detect the steering angle, vehicle speed, vehicle's yaw rate, and the vehicle's lateral acceleration, which are then calculated by the skid control ECU.

#### 1) Determining Front Wheel Skid

Whether or not the vehicle is in the state of front wheel skid is determined by the difference between the target yaw rate and the vehicle's actual yaw rate.

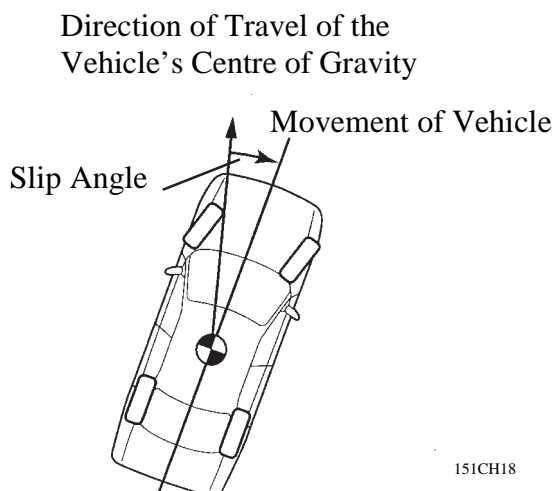
When the vehicle's actual yaw rate is smaller than the yaw rate (a target yaw rate that is determined by the vehicle speed and steering angle) that should be rightfully generated when the driver operates the steering wheel, it means the vehicle is making a turn at a greater angle than the locus of travel.

Thus, the skid control ECU determines that there is a large tendency to front wheel skid.



## 2) Determining Rear Wheel Skid

Whether or not the vehicle is in the state of rear wheel skid is determined by the values of the vehicle's slip angle and the vehicle's slip angular velocity (time-dependent changes in the vehicle's slip angle). When the vehicle's slip angle is large, and the slip angular velocity is also large, the skid control ECU determines that the vehicle has a large rear wheel skid tendency.



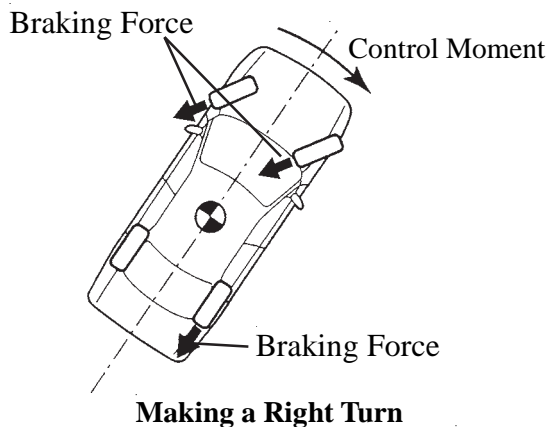
## Method for VSC Operation

When the Skid Control ECU determines that the vehicle exhibits a tendency to front wheel skid or rear wheel skid, it decreases the engine output and applies the brake of a front or rear wheel to control the vehicle's yaw moment.

The basic operation of the VSC is described below. However, the control method differs depending on the vehicle's characteristics and driving conditions.

### 1) Dampening a Strong Front Wheel Skid

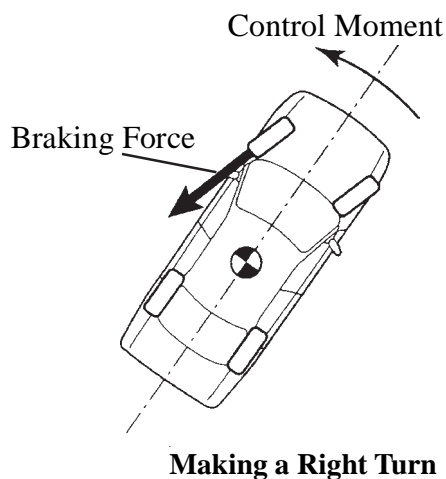
When the skid control ECU determines that there is a large front wheel skid tendency, it counteracts in accordance with the extent of that tendency. The skid control ECU controls the engine output and applies the brakes of the front wheels and rear wheel of the inner circle of the turn in order to help restrain the front wheel skid tendency.



### 2) Dampening a Strong Rear Wheel Skid

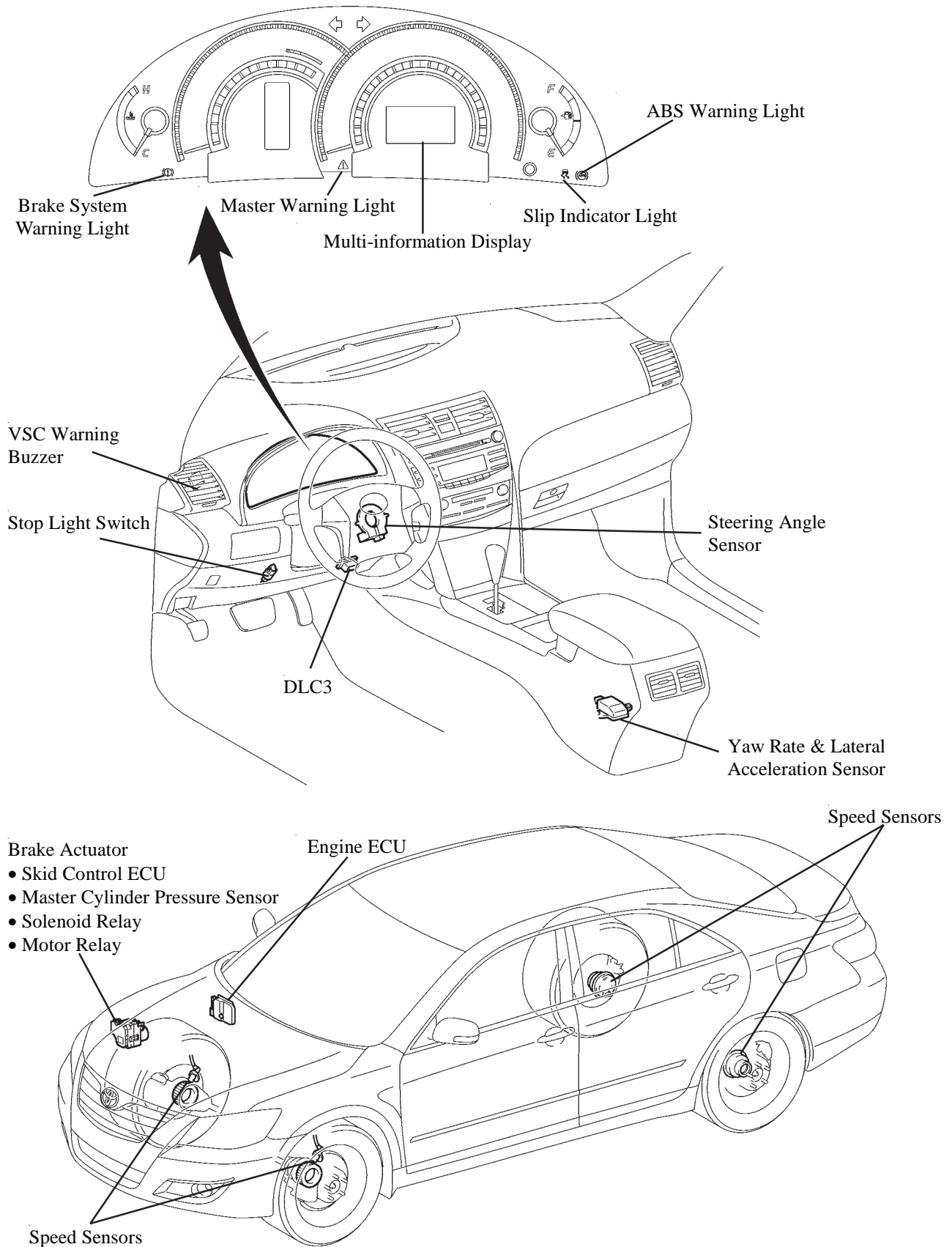
When the skid control ECU determines that there is a large rear wheel skid tendency, it counteracts in accordance with the extent of that tendency. It applies the brakes of the front wheel of the outer circle of the turn, and generates an outward moment of inertia in the vehicle, in order to restrain the rear wheel skid tendency. Along with the reduction in the vehicle speed caused by the braking force, the excellent vehicle's stability is ensured.

In some cases, the skid control ECU applies the brake of the rear wheels, as necessary.





## 7. Layout of Main Components



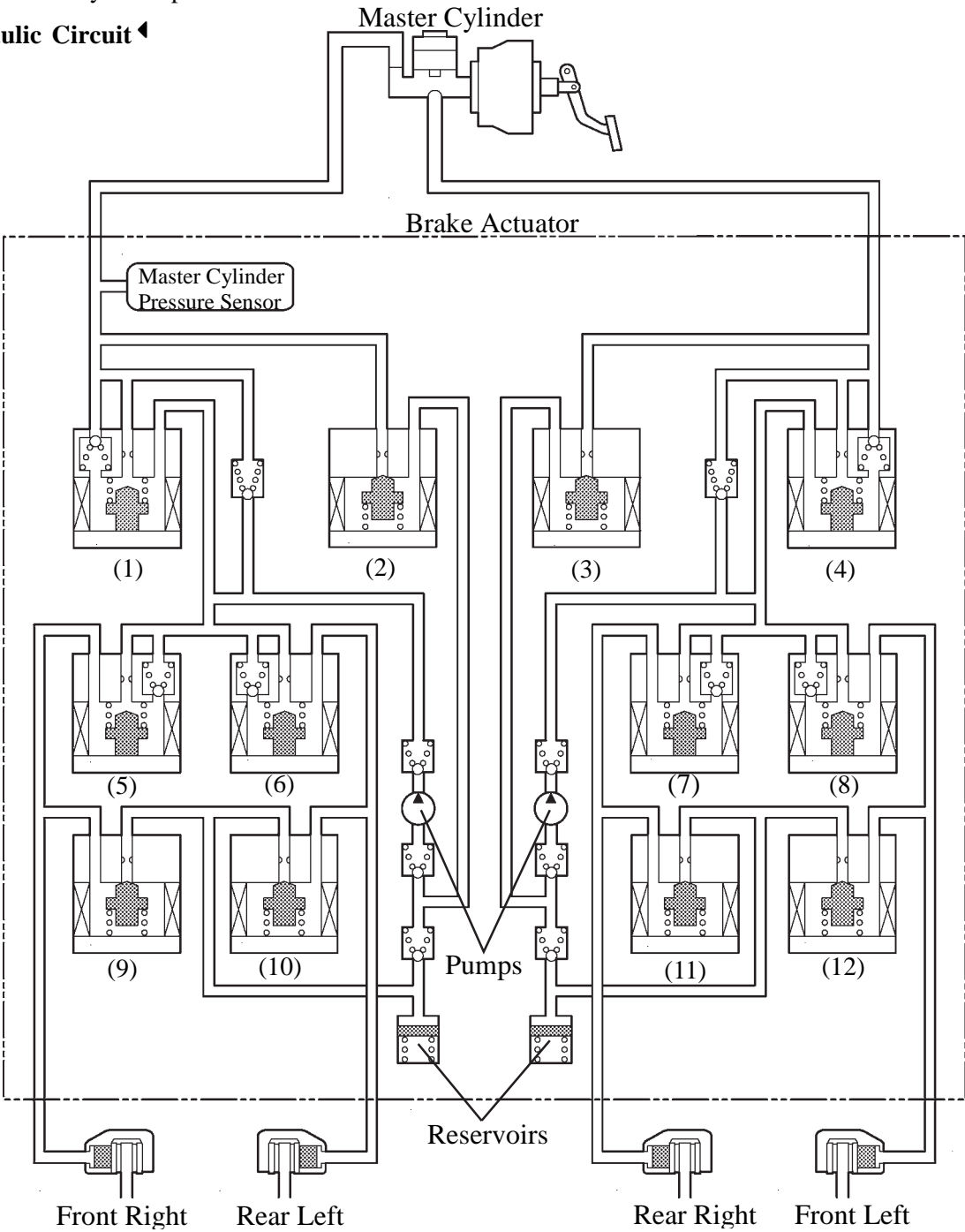
## 8. Function of Main Components

Component		Function
Combination Meter	ABS Warning Light	Lights up to alert the driver when the skid control ECU detects the malfunction in the ABS, EBD or Brake Assist system.
	Slip Indicator Light	<ul style="list-style-type: none"> <li>• Blinks to inform the driver when the TRC system or the VSC system is operated.</li> </ul>
	Brake System Warning Light	<ul style="list-style-type: none"> <li>• Lights up together with ABS warning light to alert the driver when the skid control ECU detects the malfunction in the EBD control.</li> <li>• Lights up to inform the driver when the parking brake is ON or the brake fluid level is low.</li> </ul>
	Master Warning Light	Lights up to alert the driver when the skid control ECU detects the malfunction in the TRC or VSC system.
	Multi-information Display	Displays a warning message to alert the driver when the skid control ECU detects a malfunction in the TRC or VSC system.
Engine ECU		<ul style="list-style-type: none"> <li>• Sends the throttle valve angle signal, accelerator pedal position signal, engine speed signal, and shift lever position signal to the skid control ECU.</li> <li>• Receives the signal of throttle control request from the skid control ECU.</li> </ul>
Parking Brake Switch		Detects when the parking brake lever is pulled up.
Speed Sensors		Detects the wheel speed of each 4 wheels.
Stop Light Switch		Detects the brake pedal depressing signal.
Brake Actuator		Changes the fluid path based on the signals from the skid control ECU during the operation of the ABS with EBD & brake assist & TRC & VSC system, in order to control the fluid pressure that is applied to the wheel cylinders.
	Master Cylinder Pressure Sensor	Assembled in the brake actuator and detects the master cylinder pressure.
	Skid Control ECU	Judges the vehicle driving condition based on signals from each sensor, and sends brake control signal to the brake actuator.
	Solenoid Relay	Supply power to the solenoid valves.
	Motor Relay	Supply power to the pump motor in the brake actuator.
VSC Warning Buzzer		Emits an intermittent sound to inform the driver that the skid control ECU detects the strong front skid tendency or strong rear skid tendency.
Yaw Rate & Lateral Acceleration Sensor		<ul style="list-style-type: none"> <li>• Detects the vehicle's yaw rate.</li> <li>• Detects the vehicle's lateral acceleration.</li> </ul>
Steering Angle Sensor		Detects the steering direction and angle of the steering wheel.

9. Brake Actuator

- The brake actuator consists of the actuator portion, skid control ECU, relays.
- The Bosch brake actuator consists of 12 solenoid valves, 1 pump motor, 2 pumps, 2 reservoirs and 1 master cylinder pressure sensor.

► Hydraulic Circuit ◄



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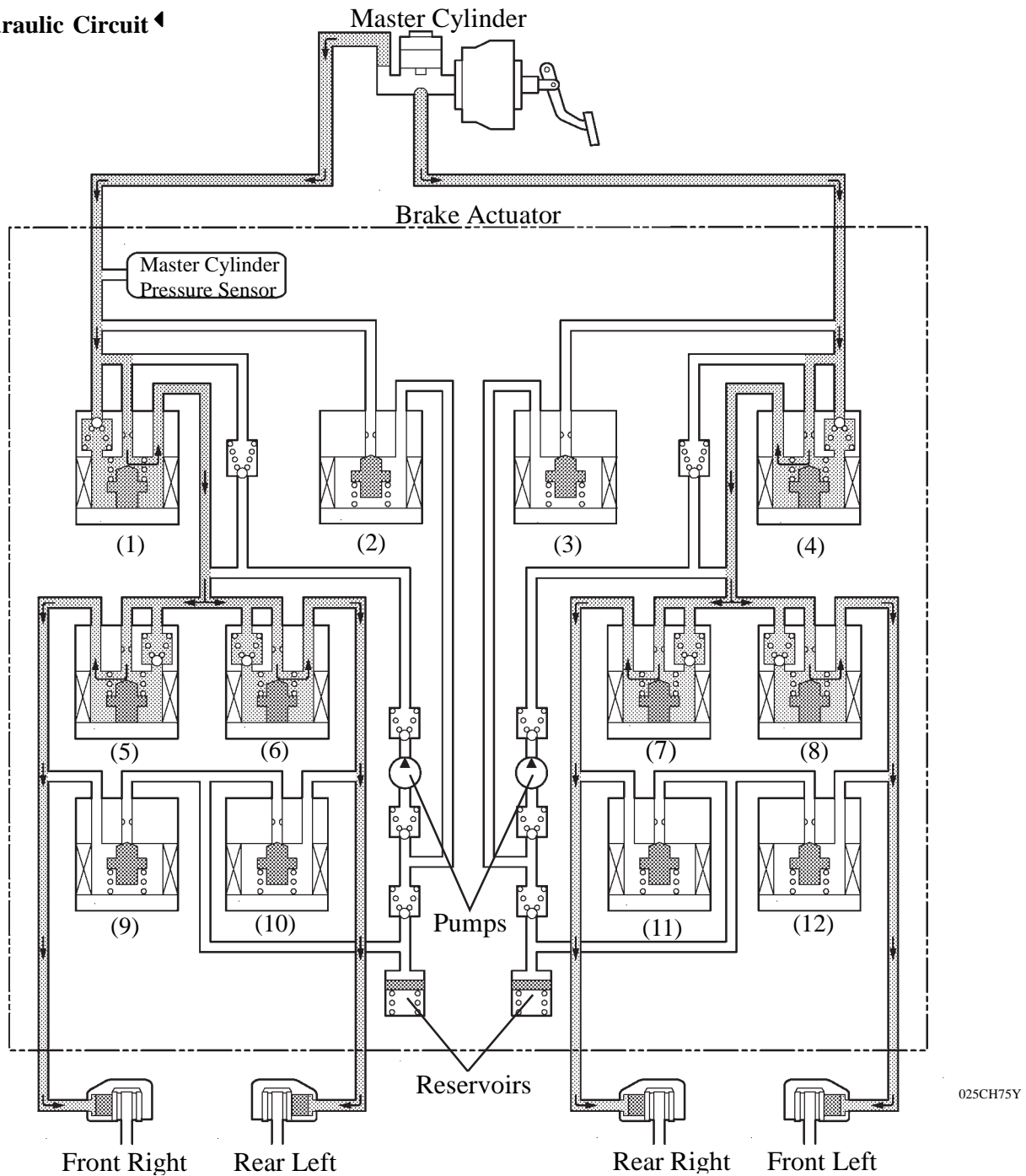
Component	
(1), (4)	Master Cylinder Cut Solenoid Valve
(2), (3)	Reservoir Cut Solenoid Valve
(5), (6), (7), (8)	Pressure Holding Valve
(9), (10), (11), (12)	Pressure Reduction Valve

## 10. System Operation

### Normal Braking Operation

During normal braking, all solenoid valves are remained OFF.

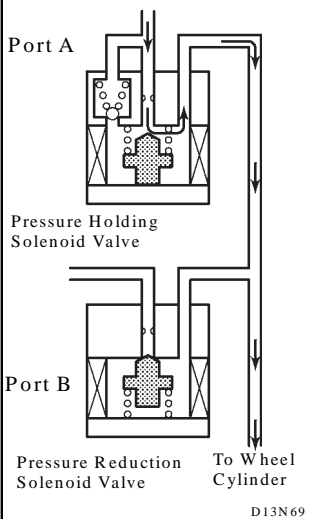
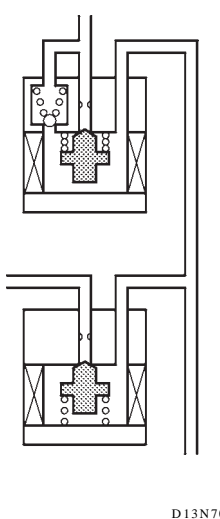
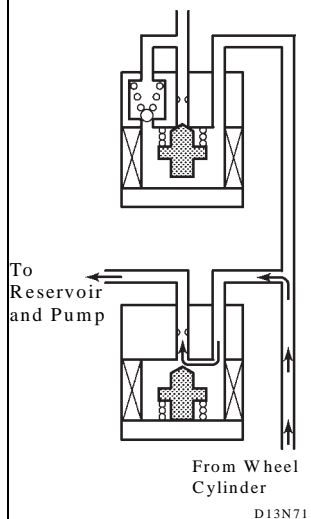
#### ► Hydraulic Circuit ◀



025CH75Y

**ABS with EBD Operation**

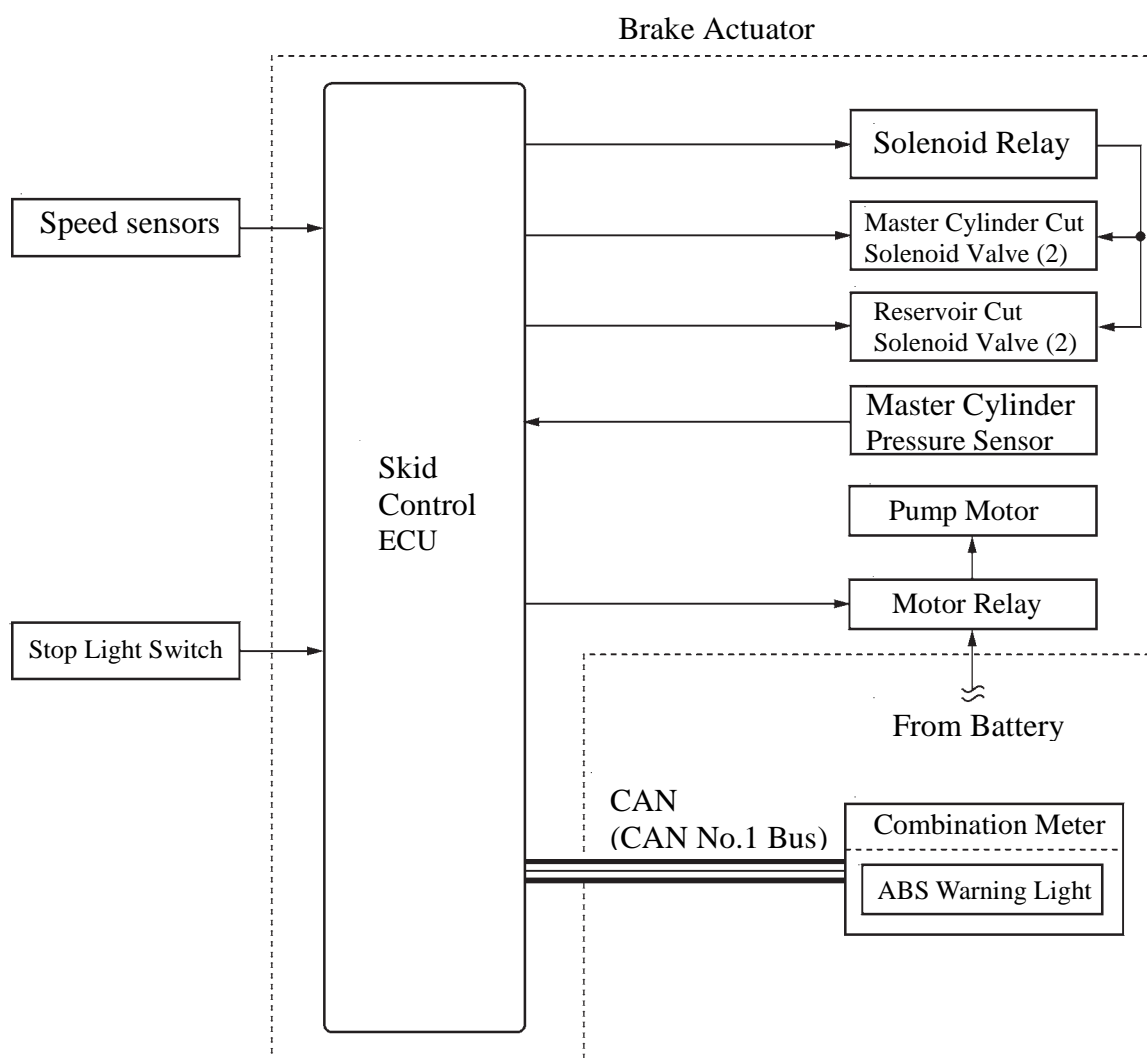
Based on the signals received from the 4 wheel speed sensors and yaw rate & lateral acceleration sensor, the skid control ECU calculates each wheel speed and deceleration, and checks wheel slipping condition. According to the slipping condition, the ECU controls the pressure holding solenoid valve and pressure reduction solenoid valve in order to adjust the fluid pressure of each wheel cylinder in the following three modes: pressure reduction, pressure holding, and pressure increase modes.

Not Activated	Normal Braking	—	—
Activated	Increase Mode	Holding Mode	Reduction Mode
Hydraulic Circuit	 <p>Port A</p> <p>Pressure Holding Solenoid Valve</p> <p>Port B</p> <p>Pressure Reduction Solenoid Valve</p> <p>To Wheel Cylinder</p> <p>D13N69</p>	 <p>D13N70</p>	 <p>To Reservoir and Pump</p> <p>From Wheel Cylinder</p> <p>D13N71</p>
Pressure Holding Valve (Port A)	OFF (Open)	ON (Close)	←
Pressure Reduction Valve (Port B)	OFF (Close)	←	ON (Open)
Wheel Cylinder Pressure	Increase	Hold	Reduction

## Brake Assist Operation

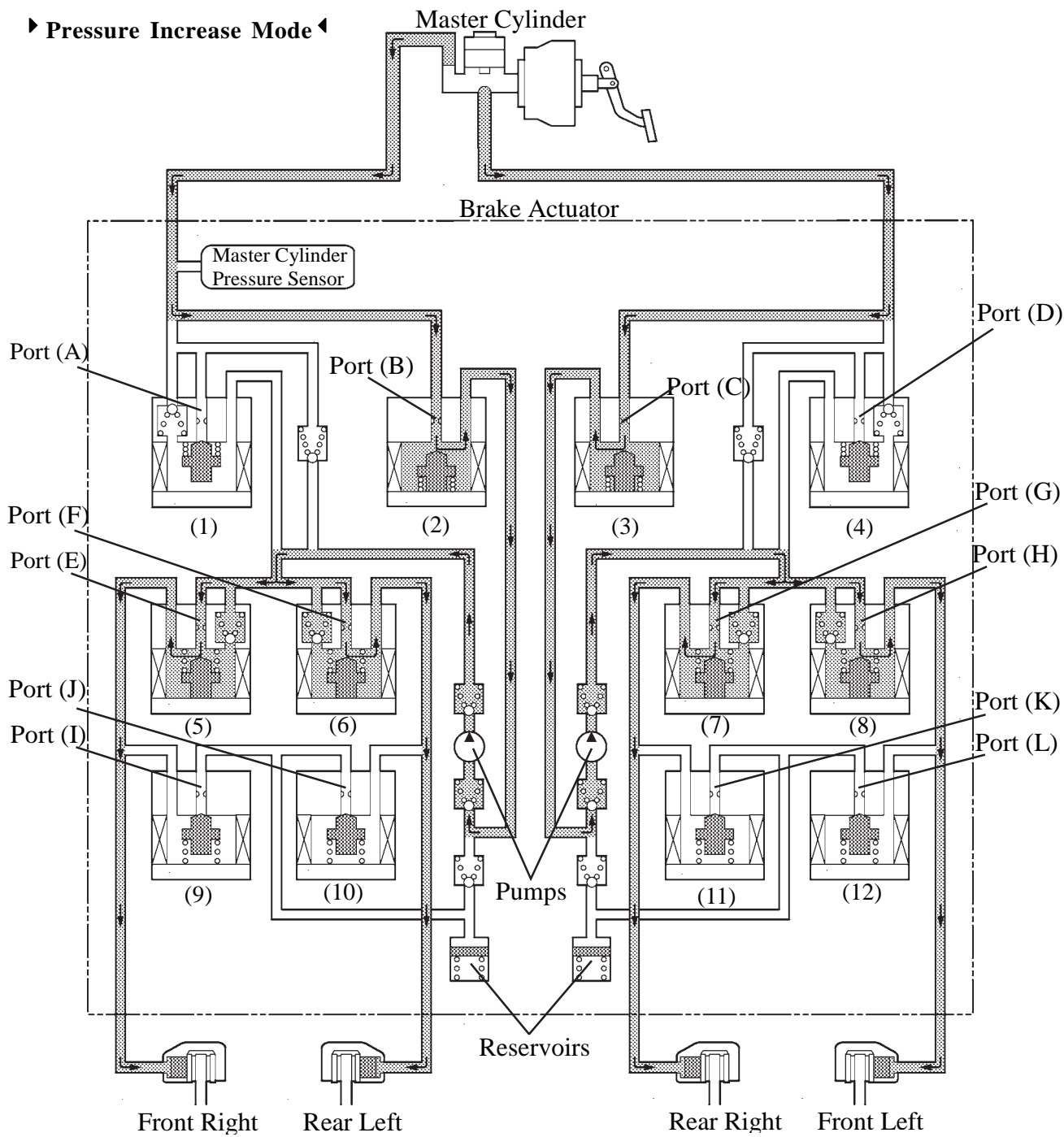
- In the event of emergency braking, the skid control ECU detects the driver's intention based on the speed of the pressure increase in the master cylinder determined by the pressure sensor signal. If the ECU judges the need for the additional brake assist, the fluid pressure is generated by the pump in the actuator and directed to the wheel cylinder to apply a greater fluid pressure than the master cylinder.
- Also in the following cases, the skid control ECU provides brake assist.
- The brake assist system is activated; each solenoid operates as shown in the table on the next page.

### ▸ System Diagram ◀



02SCH44P

▶ Pressure Increase Mode ◀



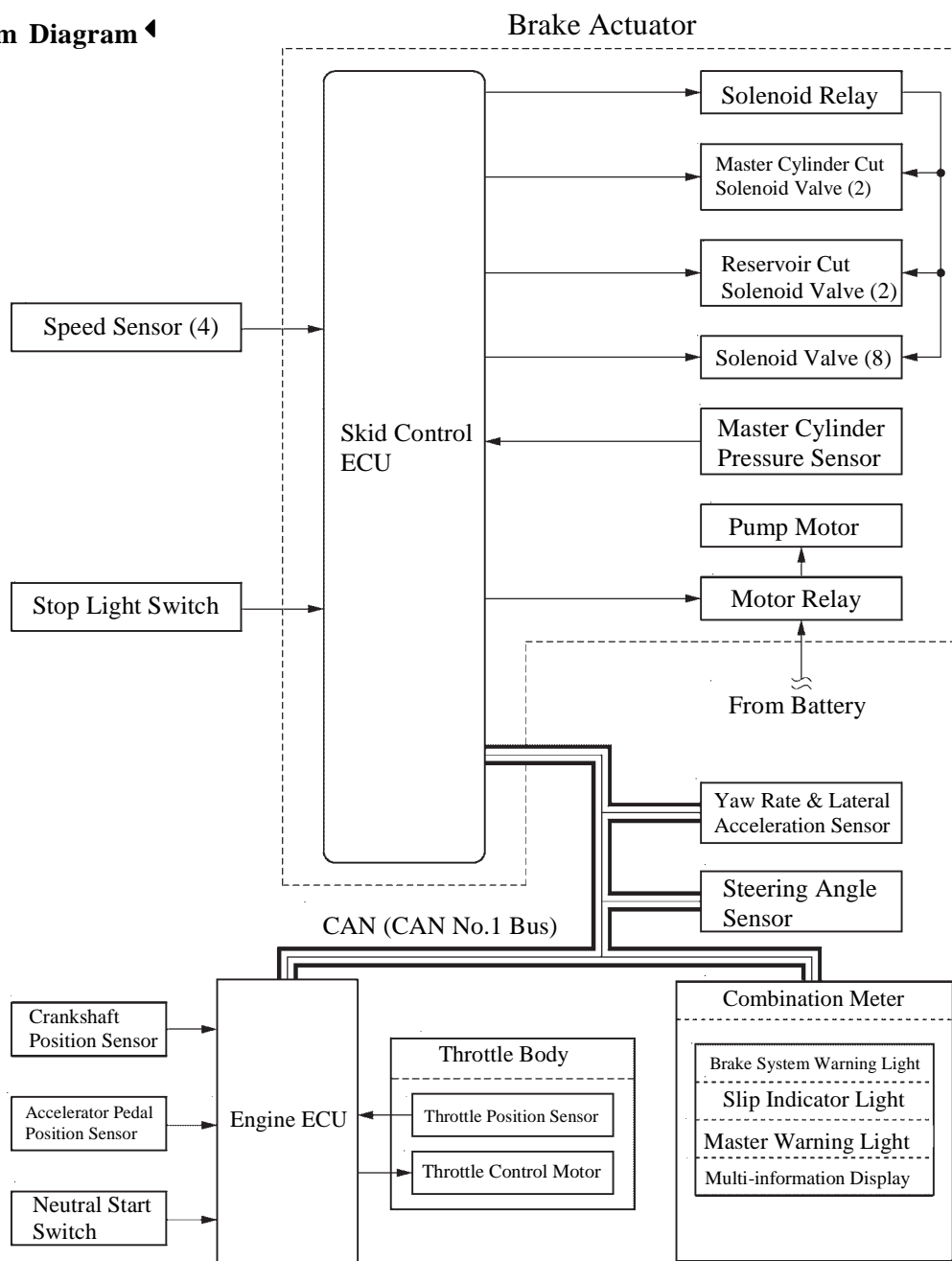
Brake Assist Activated

Item		Brake Assist Not Activated	Brake Assist Activated
(1), (4)	Master Cylinder Cut Solenoid Valve	OFF (Open)	ON (Close)
	Port: (A), (D)		
(2), (3)	Reservoir Cut Solenoid Valve	OFF (Close)	ON (Open)
	Port: (B), (C)		
(5), (6), (7), (8)	Pressure Holding Valve	OFF (Open)	←
	Port: (E), (F), (G), (H)		
(9), (10), (11), (12)	Pressure Reduction Valve	OFF (Close)	←
	Port: (I), (J), (K), (L)		

## TRC Operation

- The fluid pressure generated by the pump is regulated by the master cylinder cut solenoid valve to the required pressure. Thus, the wheel cylinders of the drive wheels are controlled in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes, to control the slippage of the drive wheels.
- The diagram below shows the hydraulic circuit in the pressure increase mode when the TRC is activated.
- The pressure holding solenoid valve and the pressure reduction solenoid valve are turned ON/OFF according to the ABS operation pattern described earlier on page CH-77.
- The TRC is activated; each solenoid operates as shown in the table on the next page.

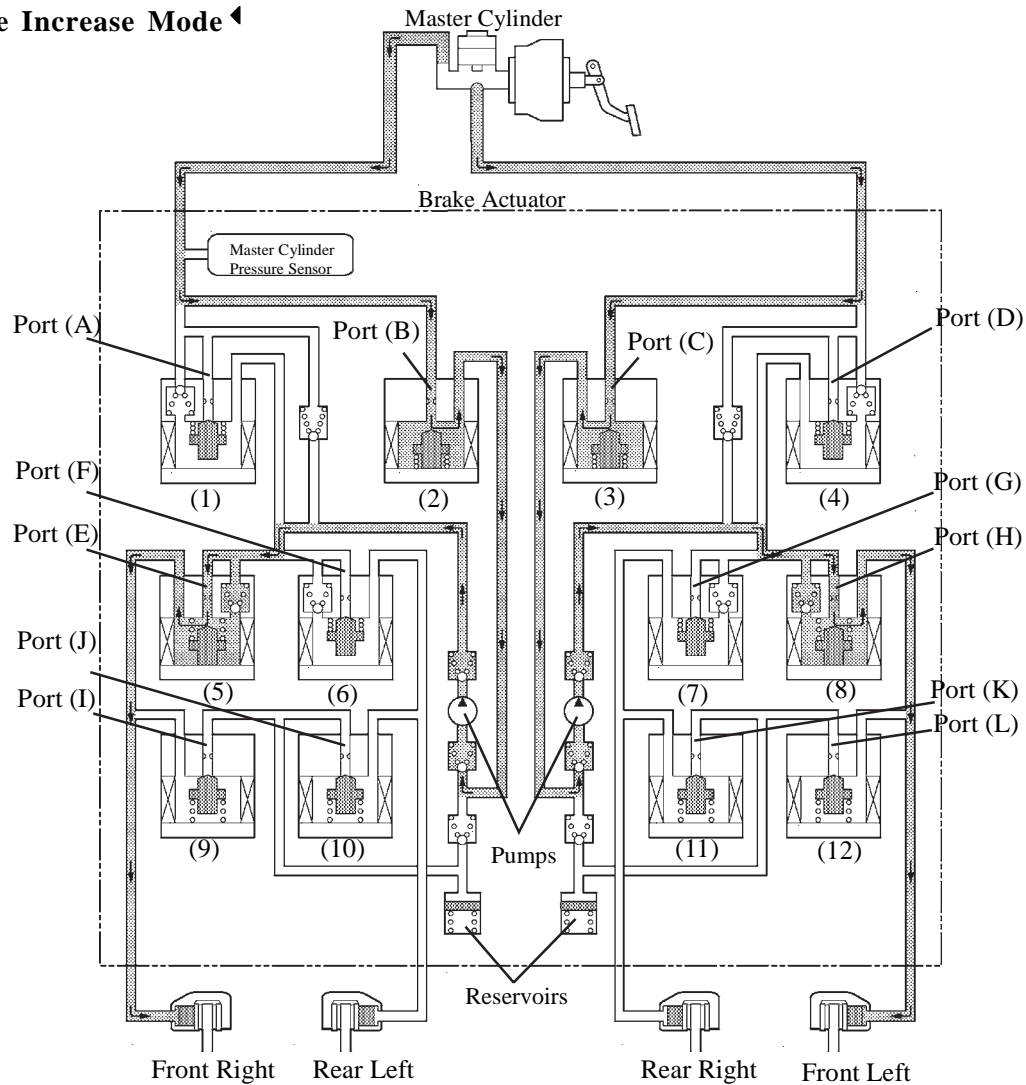
### System Diagram



02KCH39TE



### ► Pressure Increase Mode ◀



025CH77Yb

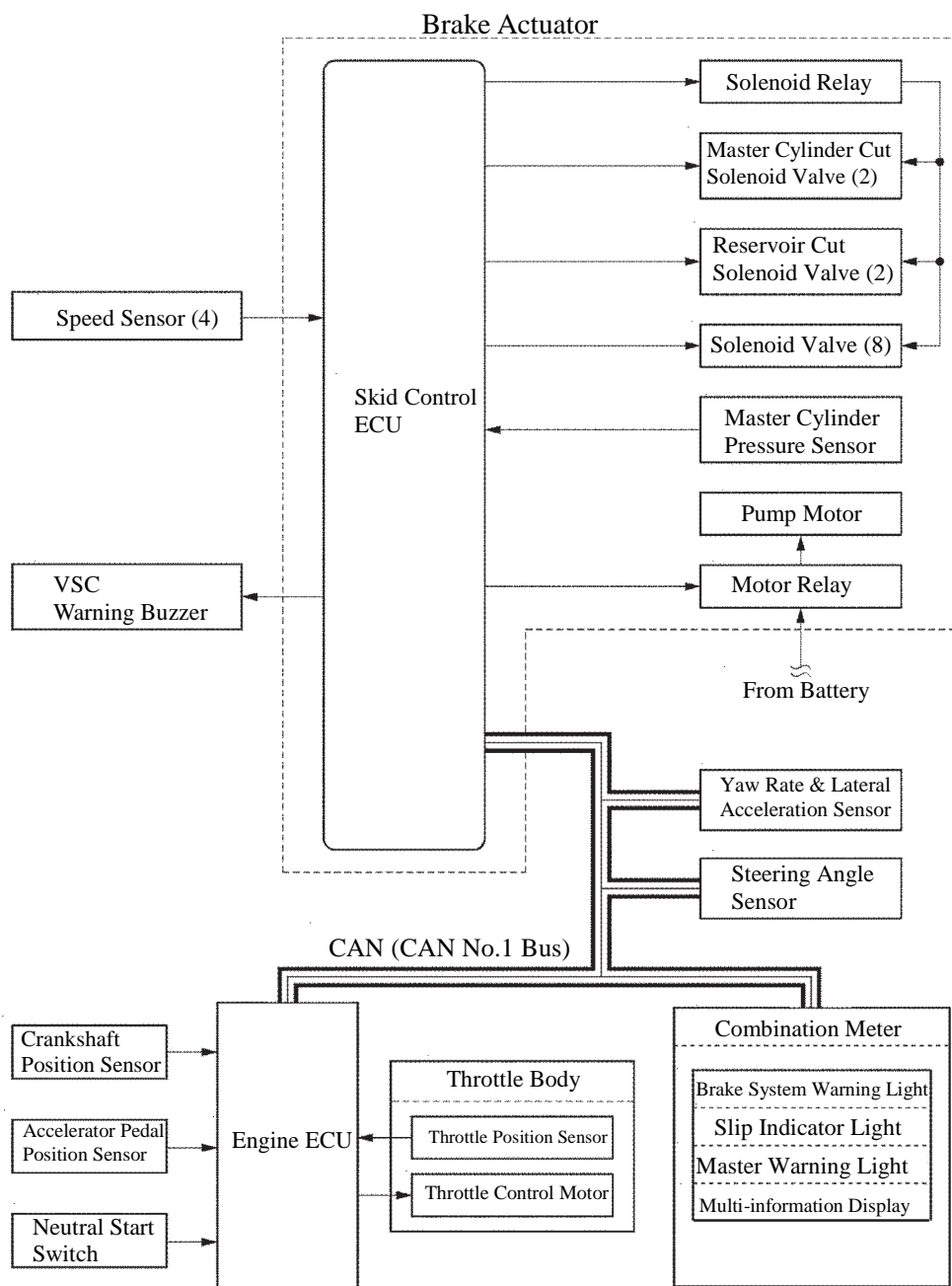
Item			TRC not Activated	TRC Activated		
				Increase Mode	Hold Mode	Reduction Mode
(1), (4)	Master Cylinder Cut Solenoid Valve		OFF/ Open	ON/ Close	←	←
	Port: (A), (D)					
(2), (3)	Reservoir Cut Solenoid Valve		OFF/ Close	ON/ Open	←	←
	Port: (B), (C)					
Front Brake	(5), (8)	Pressure Holding Valve	OFF/ Open	←	ON/ Close	←
		Port: (E), (H)				
	(9), (12)	Pressure Reduction Valve	OFF/ Close	←	←	ON/ Open
		Port: (I), (L)				
	Wheel Cylinder Pressure		—	Increase	Hold	Reduction
Rear Brake	(6), (7)	Pressure Holding Valve	OFF/ Open	ON/ Close	←	←
		Port: (F), (G)				
	(10), (11)	Pressure Reduction Valve	OFF/ Close	←	←	←
		Port: (J), (K)				
	Wheel Cylinder Pressure		—	—	—	—

## VSC Operation

### 1) General

The VSC operation, by way of solenoid valves, controls the fluid pressure that is generated by the pump and applies it to the brake wheel cylinder of each wheel in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes. As a result, the tendency to front wheel skid or rear wheel skid is controlled.

### ► System Diagram ◀

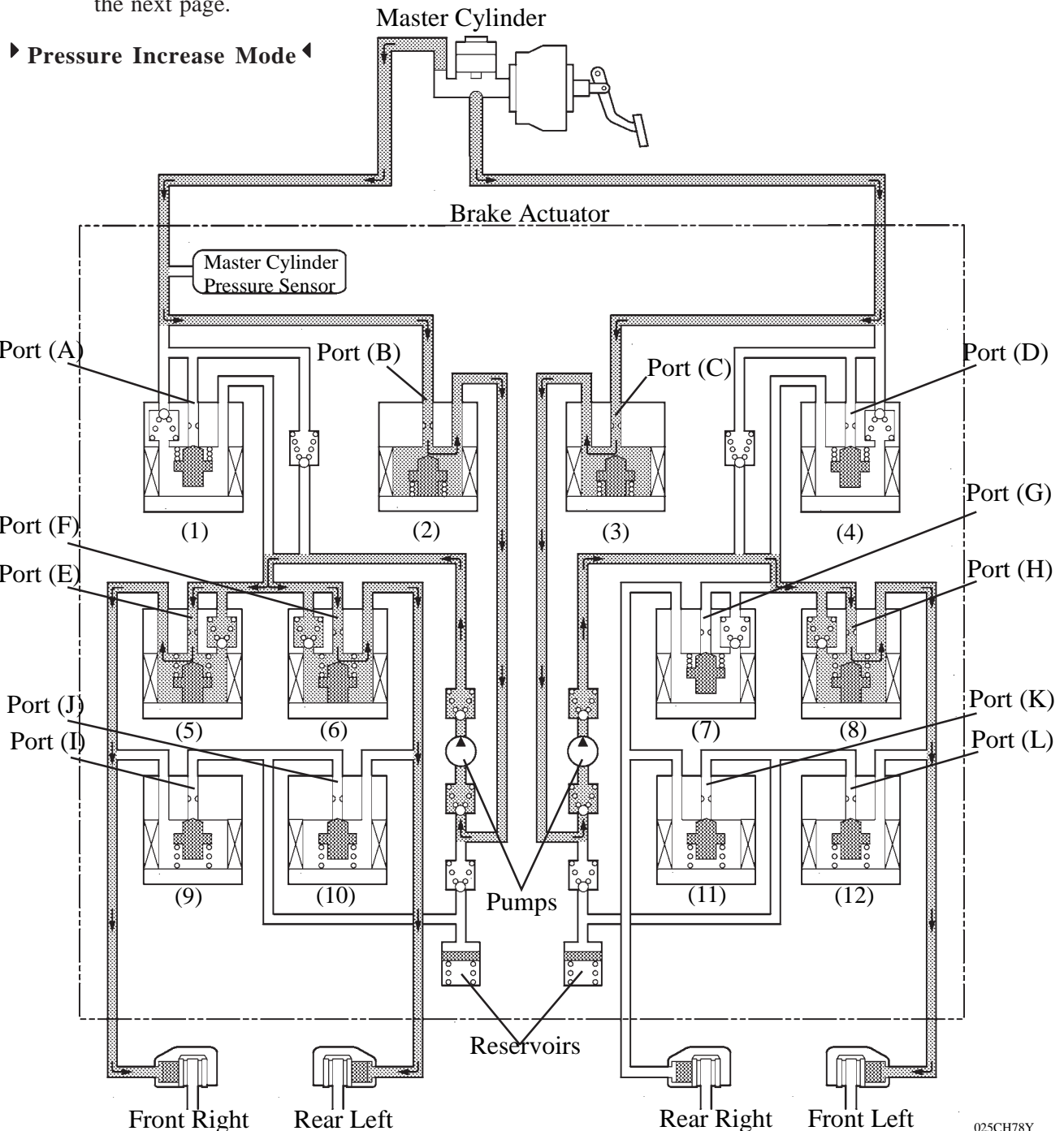


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## 2) Front Wheel Skid Restraining Control (Turn to the Right)

In the front wheel skid restraining control, the brakes of the front wheels and the rear wheel of the inner circle of the turn are applied. Also, depending on whether the brake is ON or OFF and the condition of the vehicle, there are circumstances in which the brake might not be applied to the wheels even if those wheels are targeted for braking.

- The diagram below shows the hydraulic circuit in the pressure increase mode, as it controls the front wheel skid condition while the vehicle makes a right turn.
- In other operating modes, the pressure holding valve and the pressure reduction valve are turned ON/OFF according to the ABS with EBD operation pattern.
- The front wheel skid restraining control is activated; each solenoid operates as shown in the table on the next page.



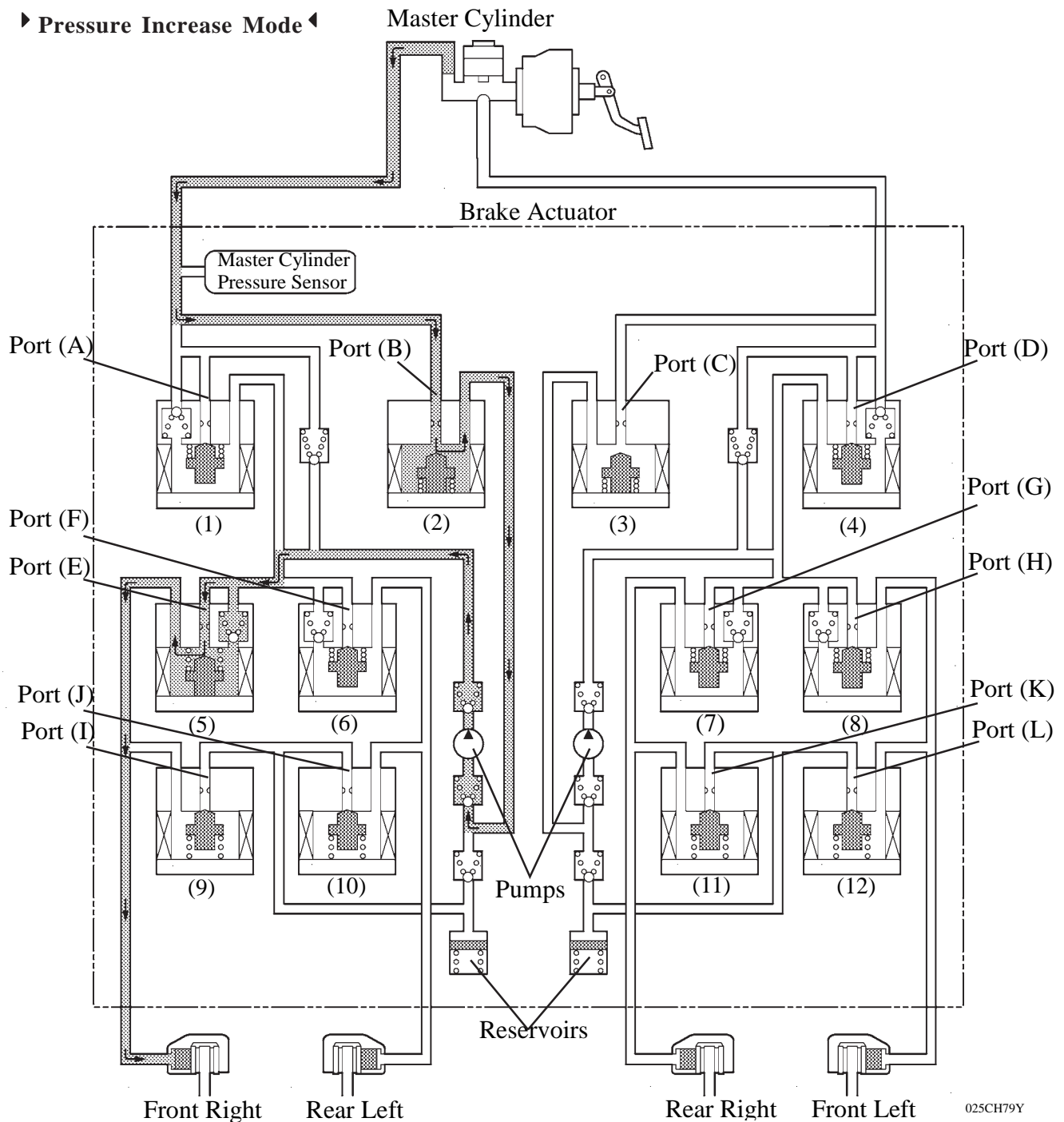
Item			VSC not Activated	VSC Activated			
				Increase Mode	Hold Mode	Reduction Mode	
(1), (4)	Master Cylinder Cut Solenoid Valve		OFF/ Open	ON/ Close	←	←	
	Port: (A), (D)						
(2), (3)	Reservoir Cut Solenoid Valve		OFF/ Close	ON/ Open	←	←	
	Port: (B), (C)						
Front Brake	(5), (8)	Pressure Holding Valve	OFF/ Open	←	ON/ Close	←	
		Port: (E), (H)					
	(9), (12)	Pressure Reduction Valve	OFF/ Close	←	←	ON/ Open	
		Port: (I), (L)					
	Wheel Cylinder Pressure		—	Increase	Hold	Reduction	
Rear Brake	(6)	Pressure Holding Valve (Rear Right)	OFF/ Open	←	ON/ Close	←	
		Port: (F)					
	(7)	Pressure Holding Valve (Rear Left)	OFF/ Open	ON/ Close	←	←	
		Port: (G)					
	(10)	Pressure Reduction Valve (Rear Right)	OFF/ Close	←	←	ON/ Open	
		Port: (J)					
	(11)	Pressure Reduction Valve (Rear Left)	OFF/ Close	←	←	←	
		Port: (K)					
	Wheel Cylinder Pressure		Right	—	Increase	Hold	Reduction
			Left	—	—	—	—

### 3) Rear Wheel Skid Restraining Control (Turn to the Right)

In rear wheel skid restraining control, the brake of the front wheel of the outer circle of the turn is applied. Also, depending on whether the brake is ON or OFF and the condition of the vehicle, there are circumstances in which the brake might not be applied to the wheels even if those wheels are targeted for braking.

- The diagram below shows the hydraulic circuit in the pressure increase mode, as it controls the rear wheel skid condition while the vehicle make a right turn.
- In other operating modes, the pressure holding valve and the pressure reduction valve are turned ON/OFF according to the ABS with EBD operating pattern.
- The rear wheel skid restraining control system is activated; each solenoid operates as shown in the table on the next page.

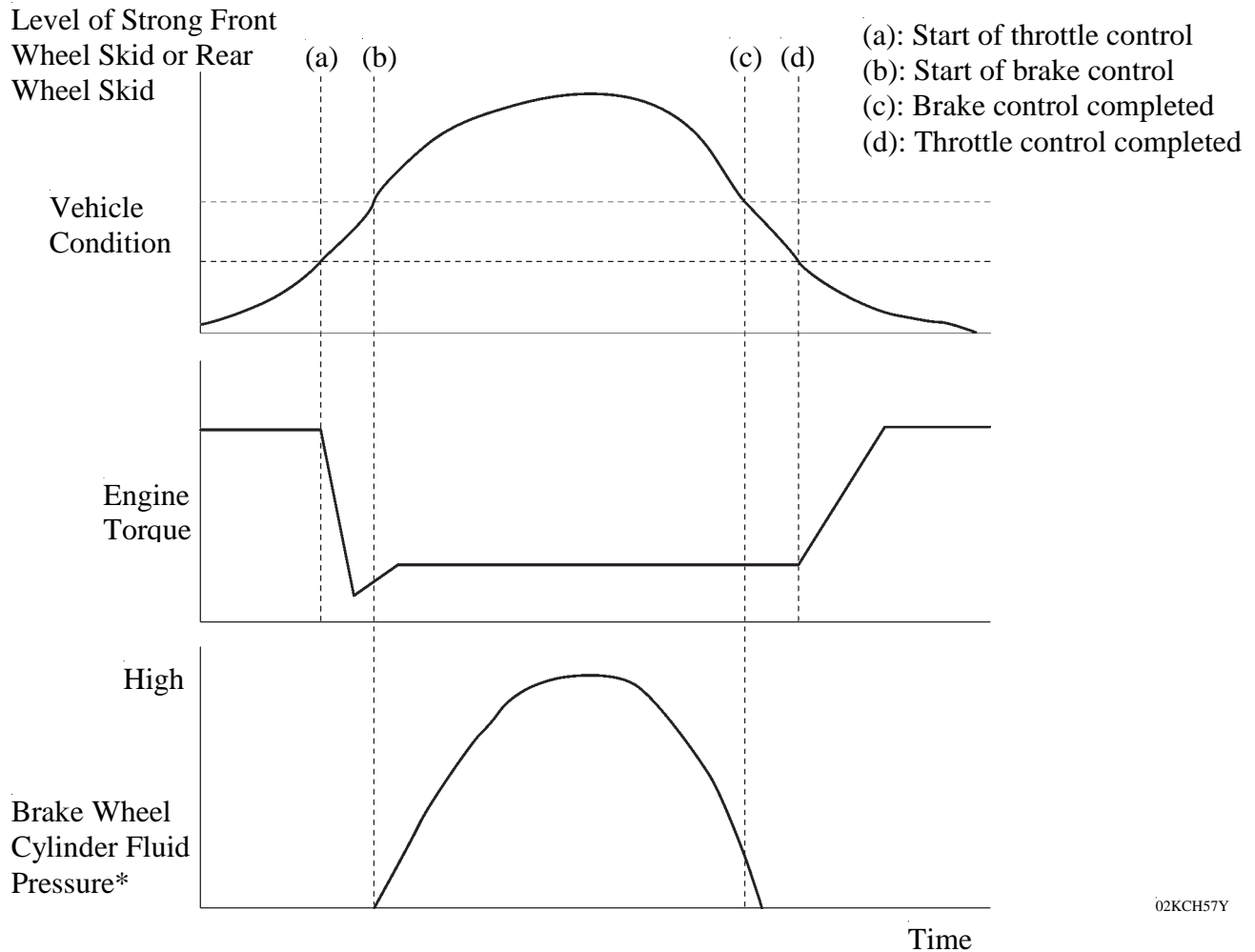
#### ► Pressure Increase Mode ◀



Item				VSC not Activated	VSC Activated		
					Increase Mode	Hold Mode	Reduction Mode
(1), (4)	Master Cylinder Cut Solenoid Valve			OFF/ Open	ON/ Close	←	←
	Port: (A), (D)						
(2), (3)	Reservoir Cut Solenoid Valve			OFF/ Close	ON/ Open	←	←
	Port: (B), (C)						
Front Brake	(8)	Pressure Holding Valve (Front Right)		OFF/ Open	ON/ Close	←	←
		Port: (H)					
	(5)	Pressure Holding Valve (Front Left)		OFF/ Open	←	ON/ Close	←
		Port: (E)					
	(12)	Pressure Reduction Valve (Front Right)		OFF/ Close	←	←	←
		Port: (L)					
	(9)	Pressure Reduction Valve (Front Left)		OFF/ Close	←	←	ON/ Open
		Port: (I)					
	Wheel Cylinder Pressure		Right	—	—	—	—
			Left	—	Increase	Hold	Reduction
Rear Brake	(6)	Pressure Holding Valve (Rear Right)		OFF/ Open	ON/ Close	←	←
		Port: (F)					
	(7)	Pressure Holding Valve (Rear Left)		OFF/ Open	ON/ Close	←	←
		Port: (G)					
	(10)	Pressure Reduction Valve (Rear Right)		OFF/ Close	←	←	←
		Port: (J)					
	(11)	Pressure Reduction Valve (Rear Left)		OFF/ Close	←	←	←
		Port: (K)					
	Wheel Cylinder Pressure		Right	—	—	—	—
			Left	—	Increase	Hold	Reduction

## Engine Output Control

During a VSC operation, the skid control ECU outputs a VSC operation signal to the engine ECU. Upon receiving this signal, the engine ECU effects throttle control to regulate the engine output.



02KCH57Y

\*: The wheel cylinder that activates varies depending on the condition of the vehicle.

## Initial Check

Each time the power source is IG-ON\*, and the vehicle reaches a speed of approximately 6 km/h or more, the skid control ECU performs an initial check. The functions of each solenoid valve and pump motor in the brake actuator are checked in sequence.

\*: The power source condition can be changed by operating the engine switch on models with the smart entry and start system, and the ignition switch on models without the smart entry and start system.

## 11. Service Mode

- A new service mode has been created for Aurion. In this mode, VSC & TRC functions are forcibly turned OFF, either through the operation of an intelligent tester II or by operating the parking brake and the brake pedal together. Please refer to the following service tip for information regarding changing the service mode.

### Service Tip

#### Transition to the service mode (VSC & TRC OFF mode).

The VSC & TRC systems can be turned off by following the procedures below:

- *When using the parking brake and brake pedal:*
  - 1) Check that the ignition is OFF\* and the shift lever is in position P.
  - 2) Start the engine .
  - 3) Operate the following steps 4 to 8 within 30 seconds of starting the engine.
  - 4) Turn the parking brake switch on.
  - 5) Depress and release the brake pedal twice.
  - 6) Turn the parking brake switch on and off twice while depressing the brake pedal.
  - 7) Depress and release the brake pedal twice while the parking brake switch is on.  
**Notice:** Steps 6 and 7 should each be performed within 15 seconds.
  - 8) Check that the slip indicator light is on. If not, repeat the procedure from the step 1.
  - 9) The brake control system can be returned to the normal mode by turning the Ignition ON\* from OFF\*.
- *When using the intelligent tester II:*
  - 1) Check that the ignition switch is OFF\* and the shift lever is in position P.
  - 2) Connect the intelligent tester II to the DLC3 and switch on.
  - 3) Start the engine .
  - 4) Operate the intelligent tester II to send signals of memory change function.
  - 5) The brake control system can be returned to the normal mode by turning the Ignition ON\* from OFF\*.

For details of the transition to service mode, see the Aurion Repair Manual.


\*: The power source condition can be changed by operating the engine switch on models with the smart entry and start system, and the ignition switch on models without the smart entry and start system.



## 12. Diagnosis

### General

If the skid control ECU detects a malfunction in the brake control system (ABS with EBD, brake assist, TRC and VSC), the ABS or brake or VSC system warning light that corresponds to the function for which the malfunction has been detected illuminates, as indicated in the table below, to alert the driver of the malfunction.

Item	○: Illuminate      Δ: Indicate				
	ABS	EBD	Brake Assist	TRC	VSC
ABS Warning Light	○	○	○	—	—
Brake System Warning Light	—	○	—	—	—
VSC Warning Light* <sup>1</sup>	○* <sup>3</sup>	○* <sup>3</sup>	○* <sup>3</sup>	○	○
Master Warning Light* <sup>2</sup>	○* <sup>3</sup>	○* <sup>3</sup>	○* <sup>3</sup>	○	○
Multi-information Display* <sup>2</sup> 	○* <sup>3</sup>	○* <sup>3</sup>	○* <sup>3</sup>	Δ	Δ

\*<sup>1</sup>: Models without multi-information display

\*<sup>2</sup>: Models with multi-information display

\*<sup>3</sup>: Failure in the ABS, EBD, and brake assist systems prohibits operation of the TRC, VSC systems. Accordingly, the VSC or master warning lights will be illuminated and the warning message will appear on the multi-information display.

- At the same time, the DTC (Diagnostic Trouble Code) are stored in the memory. The DTC can be read by connecting SST (09843-18040) between the Tc and CG terminals of the DLC3, and observing the blinking of the ABS warning light or the observing the diagnostic code indicated on the multi-information display, connecting an intelligent tester II.
- This system has a sensor signal check (test mode) function. This function is activated by connecting the SST (09843-18040) between the Ts and CG terminal of the DLC3 or by connecting an intelligent tester II. The ABS warning light and VSC warning light blinks at a 0.25-second interval. This check function performs deceleration sensor check, yaw rate sensor check, master cylinder pressure sensor check, and speed sensor check.

#### ▸ Display example of the multi-information display ◀



02KCH51TE

Normal system code is displayed



02KCH52TE

DTC is displayed

- If the skid control ECU detects a malfunction during a sensor signal check (test mode), it stores the DTC in its memory. These DTC can be read during a sensor check operation by connecting the SST (09843-18040) to the Tc and CG terminals of the DLC3 and observing the blinking of the ABS warning light or observing the diagnostic code indicated on the multi-information display, or connecting an intelligent tester II.

For details of the DTC that are stored in skid control ECU memory and the DTC that are output through the sensor signal check (test mode) functions, see the Aurion Repair Manual.

### Diagnosis of CAN

- If a malfunction occurs on a CAN communication line, the skid control ECU is connected to the CAN communication lines and it will store the DTC (Diagnostic Trouble Code) in its memory.
- There are 2-digit DTC and 5-digit DTC for CAN communications related to the brake control system (ABS with EBD, brake assist, TRC and VSC).
  - 2-digit DTC can be read by connecting the SST (09843-18040) to Tc and CG terminals of the DLC3, and observing the diagnostic code indicated on the VSC warning light (models without multi-information display) or multi-information display (models with multi-information display) in the combination meter.
  - 5-digit DTC can be read by connecting an intelligent tester II to the DLC3.

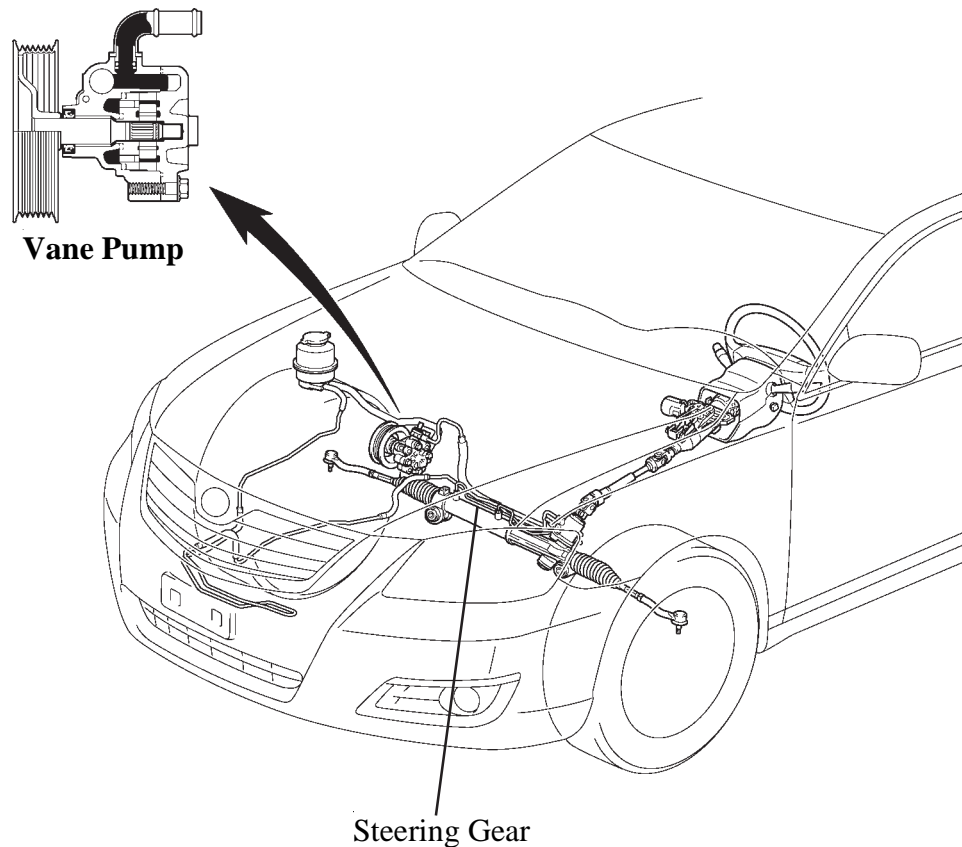
### Fail-Safe

- In the event of a malfunction in the ABS and/or brake assist controls, the skid control ECU prohibits the ABS, brake assist, TRC and VSC operations.
- In the event of a malfunction in the EBD control, the skid control ECU prohibits the EBD operation. Even in this case, usual braking performance excluding the brake control system (ABS with EBD, brake assist, TRC and VSC) is secured.
- In the event of a malfunction in the TRC and/or VSC, the skid control ECU prohibits TRC and VSC operations.
- If a communication malfunction occurs between the skid control ECU, the steering angle sensor, the yaw rate & lateral acceleration sensor, or engine ECU, the skid control ECU stops the TRC and VSC.
- When the engine ECU detects the DTC, it will disable the TRC and VSC.

## STEERING

### DESCRIPTION

- A rack and pinion type steering gear with an engine speed sensing type power steering is used on all models.
- The pressure return type vane pump is used which makes the discharge pressure flow volume return at middle and high speed, thus ensuring a fine steering feeling.
- The steering column uses an energy absorbing mechanism.



02KCH42Y

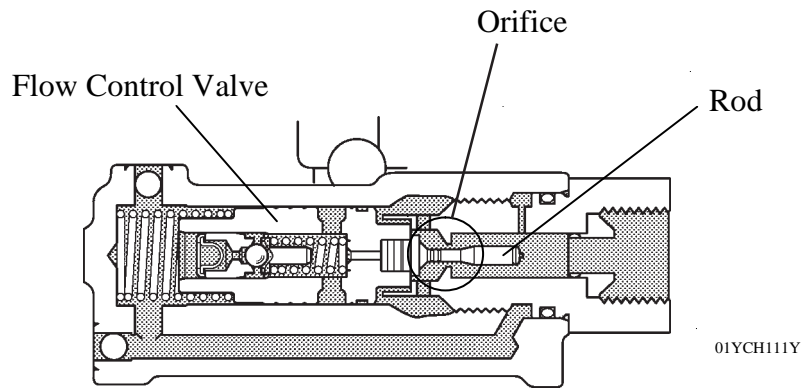
### Specifications

Gear Ratio (Overall)		15.9
No. of Turns Lock to Lock		3.20
Rack Stroke	mm	156.0
Fluid Type		ATF Type DEXRON® II or III

## ❁ POWER STEERING VANE PUMP

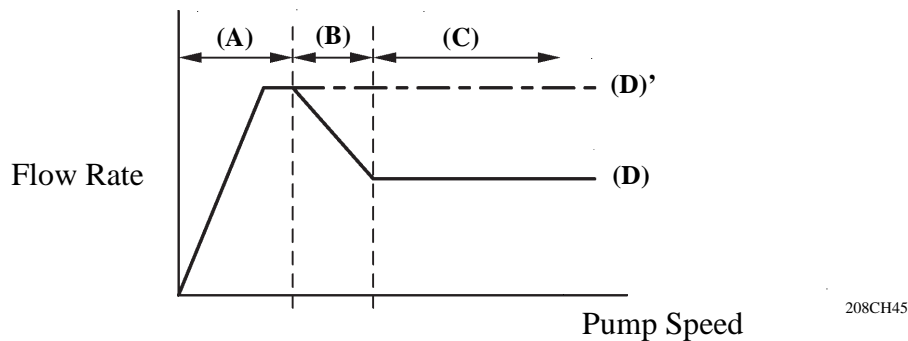
### 1. Construction

The rod type flow control valve, which adjusts flow rate according to the pump speed and load by moving the inside rod to change the opening area of the orifice, is used in this pump.



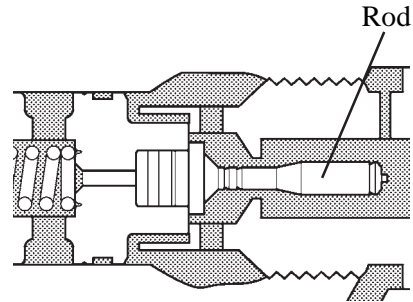
### 2. Operation

#### ► Flow Rate Characteristics ◀



**At Low Pump Speed Range (A)**

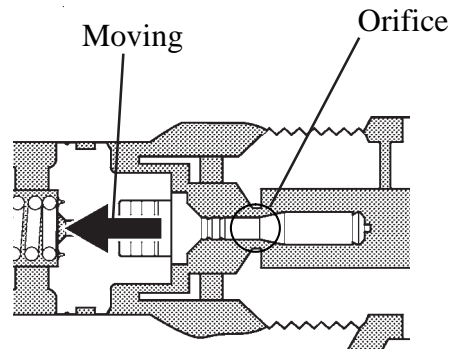
The flow rate increases proportionally to the pump speed.



01YCH112Y

**At Middle Pump Speed Range without Steering (B)**

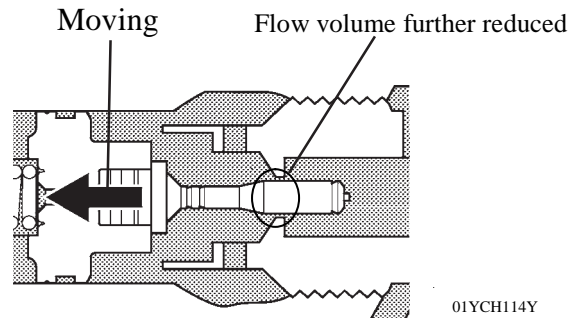
The flow control valve moves to the left, the flow rate is decreased due to the reduction in the orifice area, which is related to the rod shaft diameter at each position.



01YCH113Y

**At High Pump Speed Range without Steering (C)**

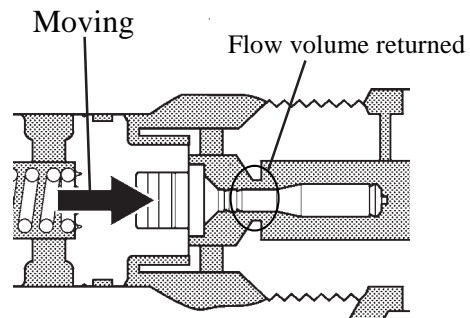
As the flow control valve moves further to the left, the flow rate is further reduced at the maximum rod shaft diameter.



01YCH114Y

**During Pressure Loading (D → D')**

When operating the steering in the middle or high pump speed range, the pressure inside the vane pump is increased causing the flow control to move back to the right, which results in an increase in the flow rate.

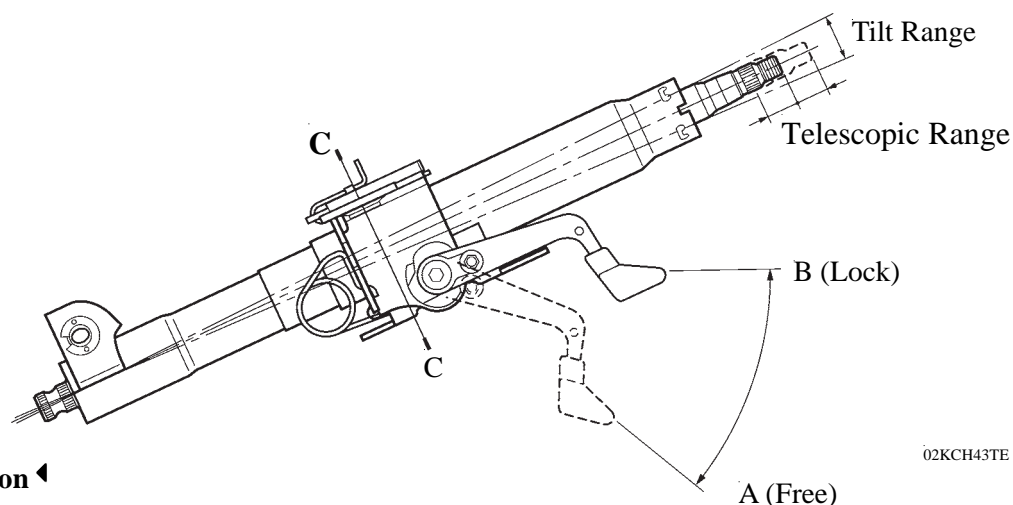


01YCH115Y

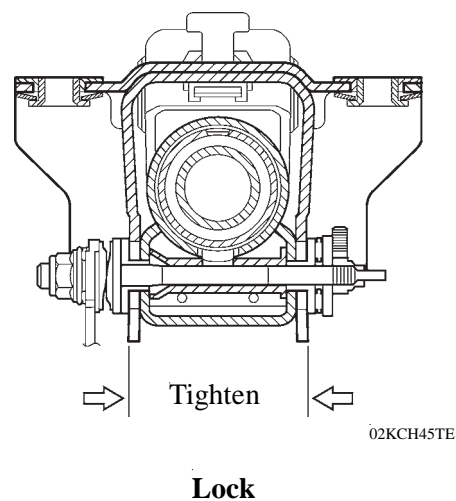
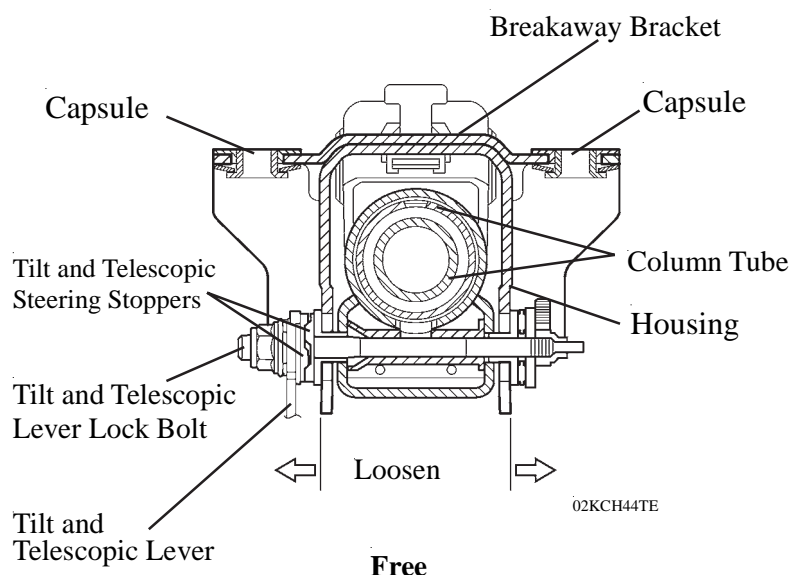
## ✱ STEERING COLUMN

### 1. Manual tilt and Telescopic Steering Column

- The manual tilt and telescopic mechanism consists mainly of a tilt lever, steering column tube, breakaway bracket, tilt lever lock bolt, and tilt steering stoppers.
- The tilt lever controls the tilt and the telescope motion.
- With the tilt adjustment range of  $3.2^\circ$  (step less) and the telescopic adjustment range of 40 mm, the steering column can be adjusted to a position selected by the driver.
- When the tilt and telescopic mechanism is in its locked state, the tilt lever at position B causes the cam of the tilt and telescopic steering stoppers to tighten the steering column tube.
- When the tilt and telescopic mechanism is in its free state, the tilt lever at position A causes the cam of the tilt and telescopic steering stoppers to loosen the steering column tube.



#### ► C – C Cross Section ◀



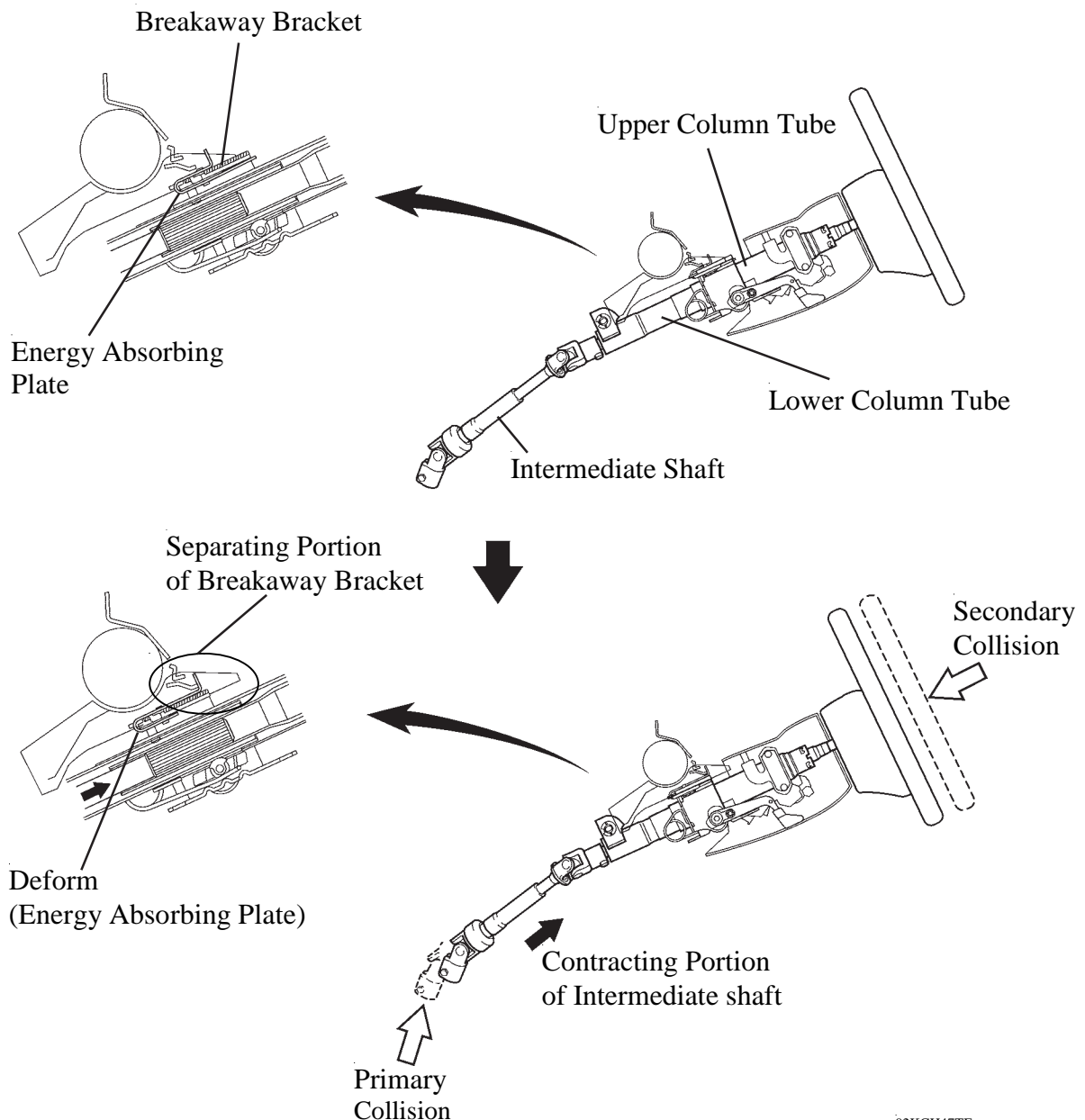
**Drawings for Illustration Purposes Only**

### 3. Energy Absorbing Mechanism

#### Manual Tilt and Telescopic Steering Column

- The energy absorbing mechanism consists mainly of a breakaway bracket, breakaway capsule, energy absorbing plate, upper column tube and lower column tube.
- When an impact is transmitted to the steering wheel during a collision (secondary collision), the steering wheel and the steering wheel pad help absorb the impact. In addition, the breakaway bracket and the reinforcement separate, and the upper and lower column tubes contract.
- At this time, the energy absorbing plate becomes deformed to help absorb the impact of the secondary collision.

#### ► Energy Absorbing Mechanism ◀



Drawings for Illustration Purposes Only

02KCH47TE

# BODY

**BODY STRUCTURE**

<i>Lightweight and Highly Rigid Body.....</i>	<i>BO-2</i>
<i>Safety Features.....</i>	<i>BO-4</i>
<i>Rust-resistant Body.....</i>	<i>BO-9</i>
<i>Low Vibration and Low Noise Body.....</i>	<i>BO-11</i>
<i>Aerodynamics.....</i>	<i>BO-15</i>

**ENHANCEMENT OF PRODUCT APPEAL**

<i>Parts with Low Repair Cost.....</i>	<i>BO-17</i>
<i>Washer Nozzle.....</i>	<i>BO-17</i>
<i>Wiper Arm &amp; Blade.....</i>	<i>BO-18</i>
<i>Child Restraint System.....</i>	<i>BO-18</i>
<i>Seat Belt.....</i>	<i>BO-19</i>



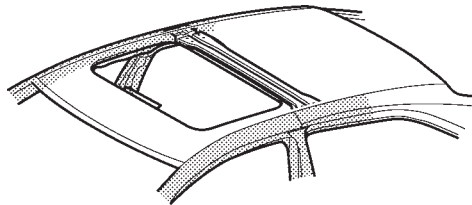
# BODY


## BODY STRUCTURE

### ✱ LIGHTWEIGHT AND HIGHLY RIGID BODY

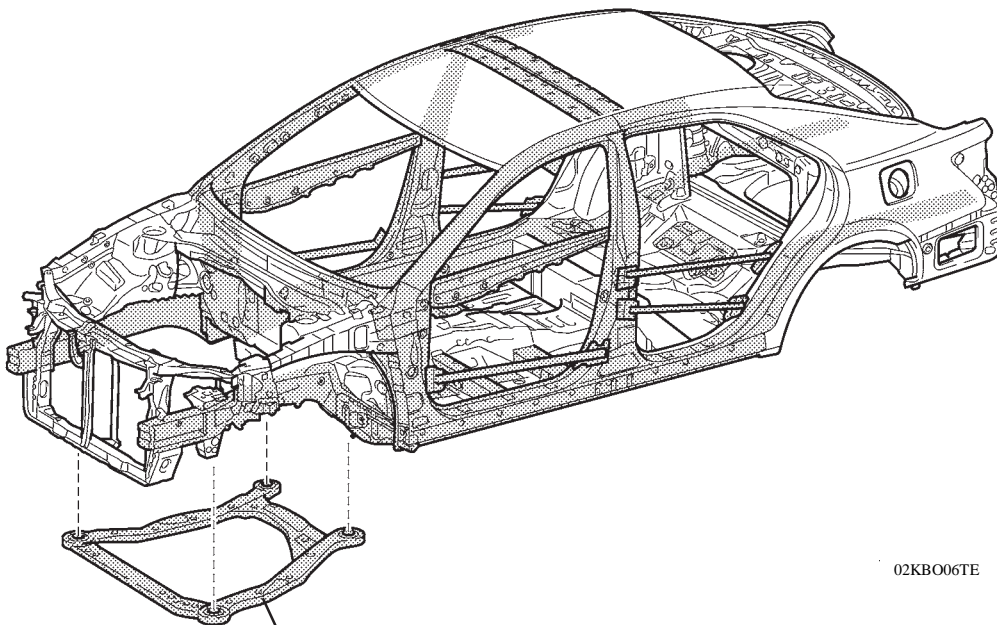
#### 1. High Strength Sheet Steel

High strength sheet steel is used in order to ensure body rigidity and realise a lightweight body.



 : High Strength Sheet Steel

#### Models with Sliding Roof

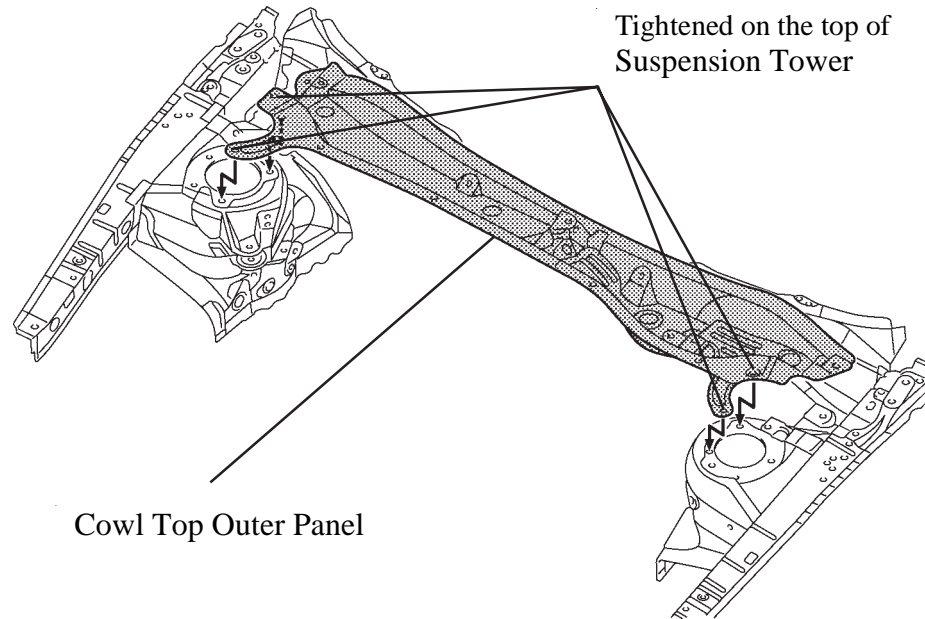


Front Sub Frame

02KBO06TE

## 2. Brace

- Excellent manoeuvrability and stability has been achieved by providing a cowl top outer panel for the front suspension tower.



025BO02Y

## SAFETY FEATURES

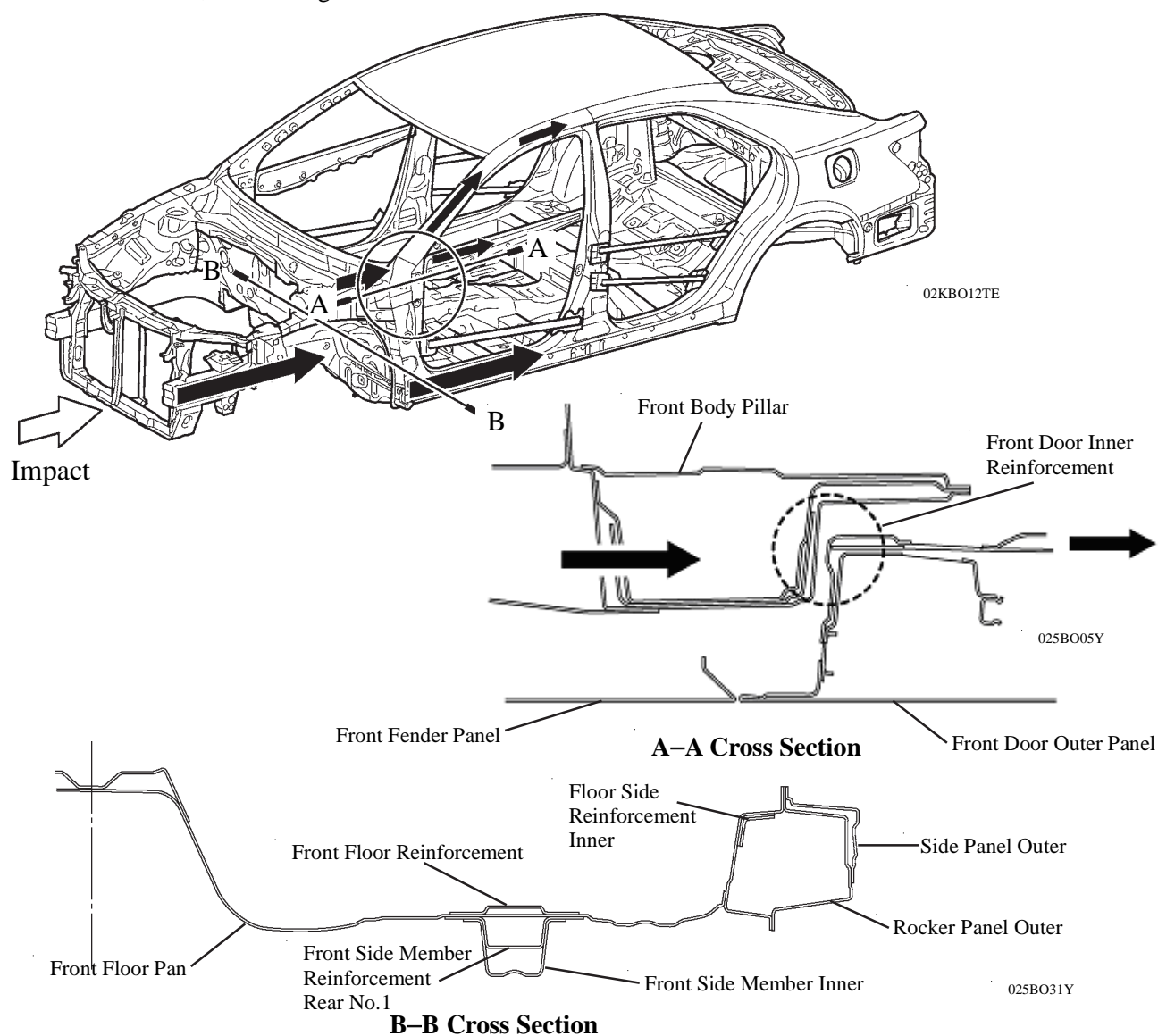
## 1. General

The impact absorbing structure of the Aurion minimises cabin deformation by effectively helping to absorb the impact energy in the event of a front, side or rear collision. This provides high-performance occupant protection.

## 2. Impact Absorbing Structure for Front Collision

An optimal arrangement of the basic frame and reinforcements helps to minimise cabin deformation in the event of a collision.

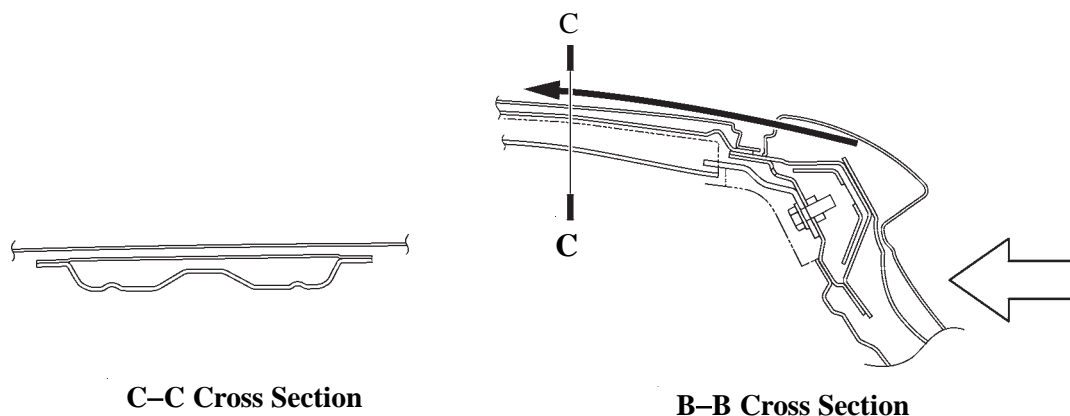
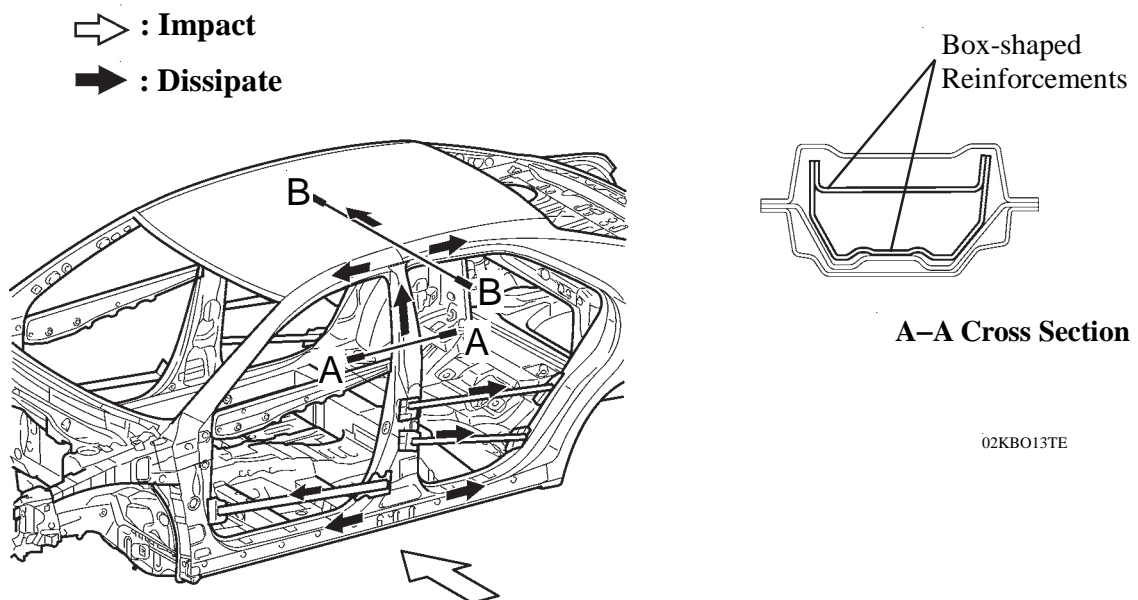
- The body disperses the impact force in the event of an offset frontal collision.
- The body strengthens inner door reinforcements and reduces the gap between the door inner panel and the pillar. This communicates impact load to the door belt line reinforcement, reducing the load on the pillar in the event of an offset frontal collision.
- The floor side of the front side member and the inside of the floor side member reinforcements have been used, minimising the cabin deformation.



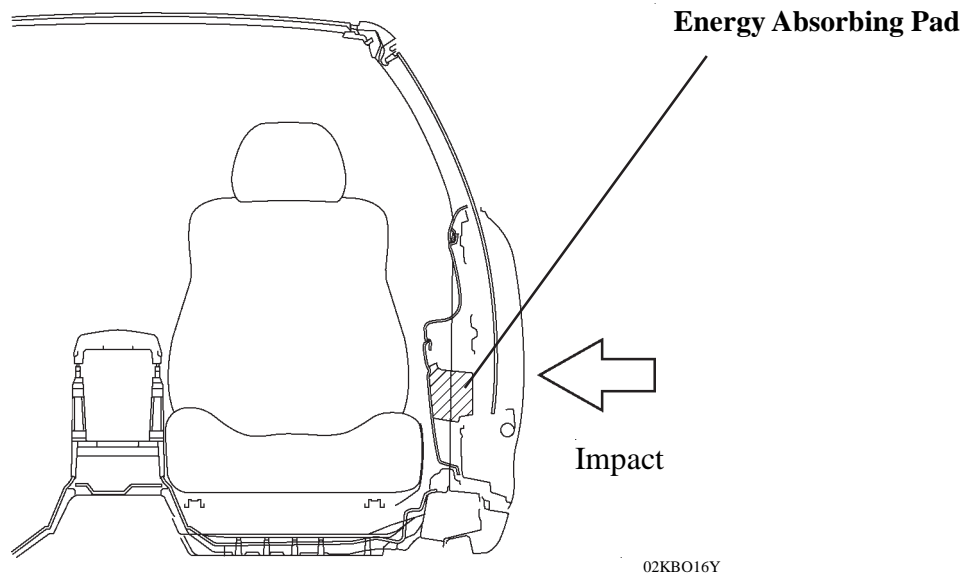
### 3. Impact Absorbing Structure for Side Collision

The impact energy of a side collision directed to the cabin area is dispersed throughout the body via the pillar reinforcements, side impact protection beams, and roof reinforcement, thus helping minimise the impact energy finally directed to the cabin.

- In order to obtain optimal bearing force, high strength sheet steel is employed in the centre pillar reinforcement as described on page BO-2, furthermore, box-shaped reinforcement is used inside the centre pillar (A-A cross section).
- High strength sheet steel is used in the roof reinforcement. In addition, the structure has been made to bear impact loads with both side rails (B-B cross section). This reduces the intrusion of the roof rail into the cabin in the event of a side collision.

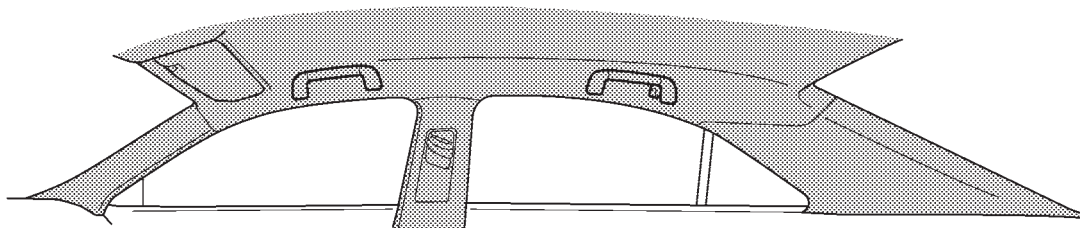


- Energy absorbing pads have been included in the door trims in order to reduce the impact on the chests and pelvises of occupant at the time of a side collision.



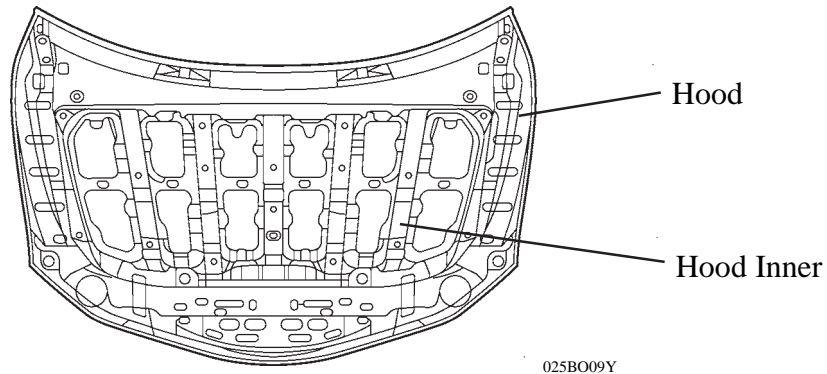
- A head impact protection structure is used. With this type of construction, if the occupant's head hits against the roof side rail or pillar due to a collision, the inner panels of the roof side rail, roof area and pillar collapse to help reduce the impact.

 : Head Impact Protection Structure

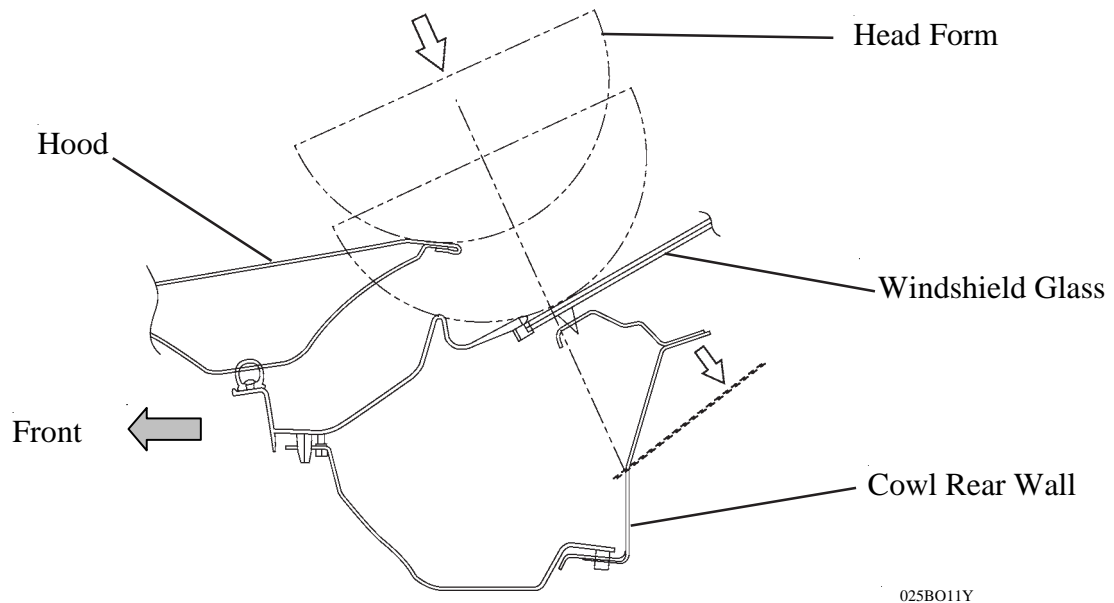


#### 4. Reducing Pedestrian Head Injury

- A longitudinal frame is used as the principle structure of the hood inner, giving uniform rigidity to the hood surface.

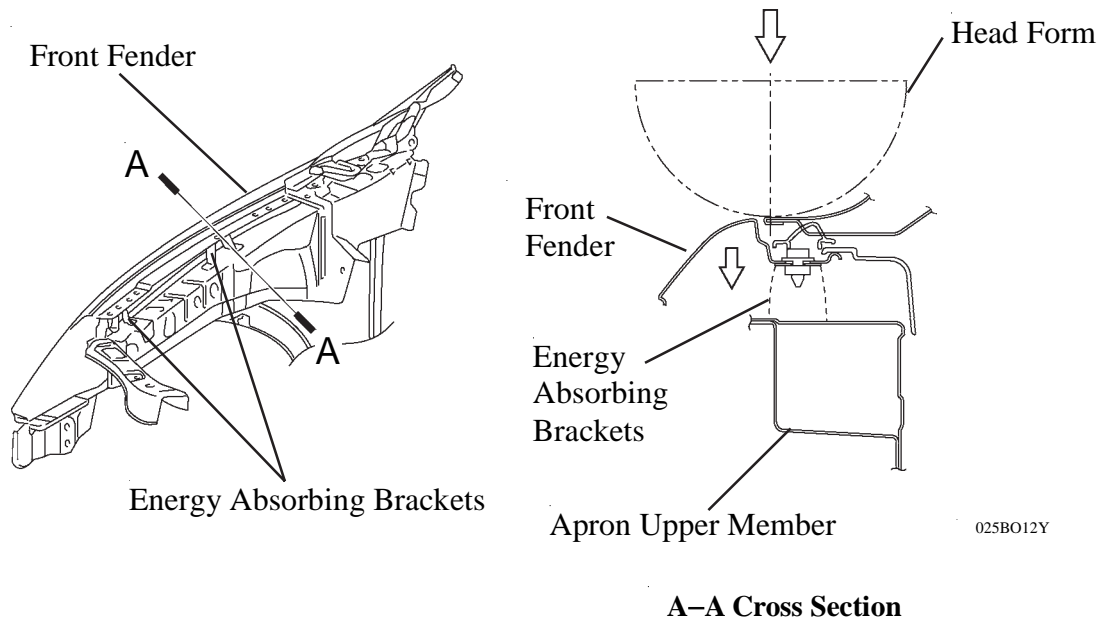


- The rear wall of the cowl has been opened, so that it can easily collapse in the direction of an impact. Thus, a completely collapsible structure has been achieved.



**Cross Section at Lower Portion of Windshield Glass**

- Energy absorbing brackets are used in the joint portion of the front fender. Thus, a certain deformation stroke in the event of a head form collision has been ensured, reducing the impact.



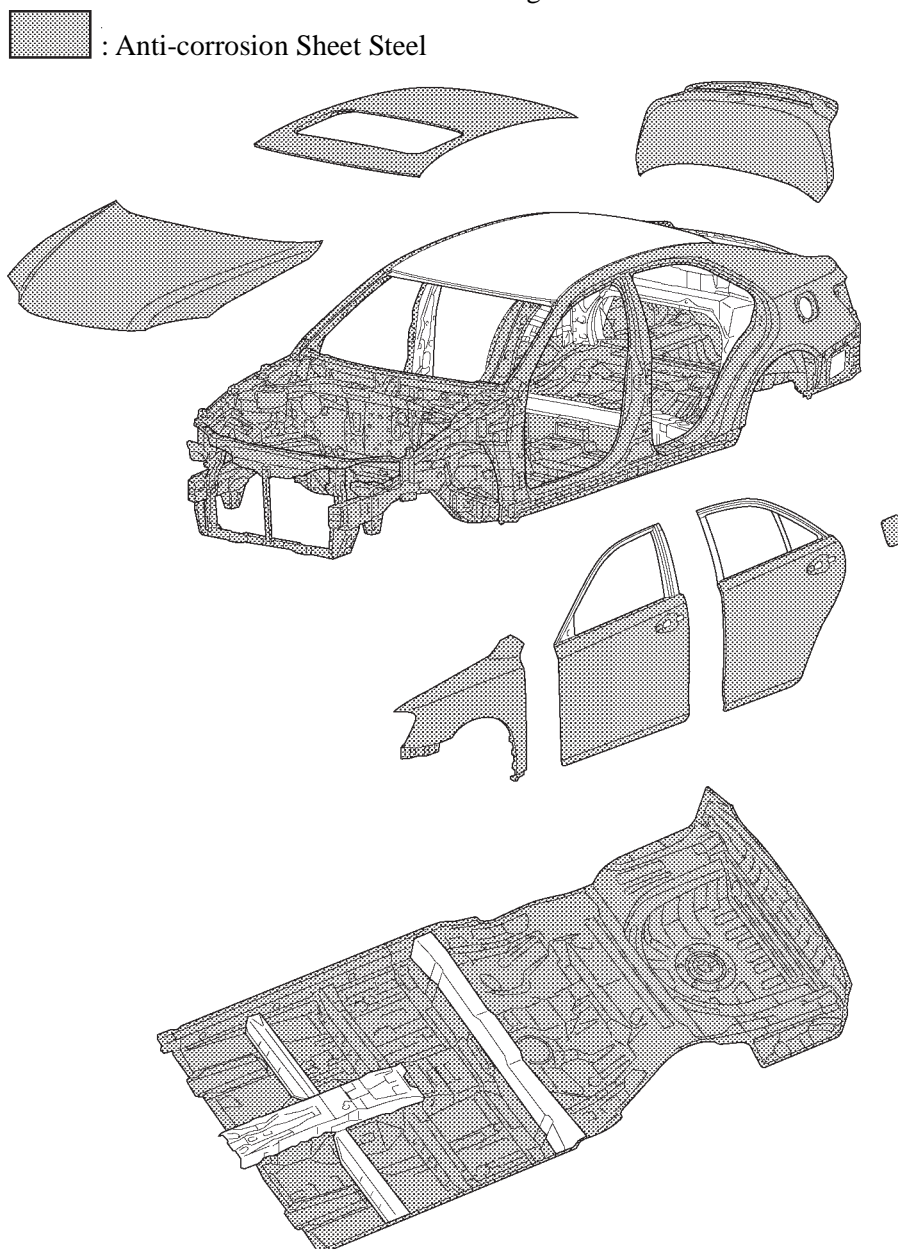
## ✱ RUST-RESISTANT BODY

### 1. General

Rust-resistant performance is enhanced extensively through the use of anti-corrosion sheet steel, as well as by an anti-corrosion treatment that includes the application of anti-rust wax, sealer and anti-chipping paint to easily corroded parts such as the hood and doors.

### 2. Anti-corrosion Sheet Steel

Anti-corrosion sheet steel is used as shown in the following illustration.



02KBO19Y

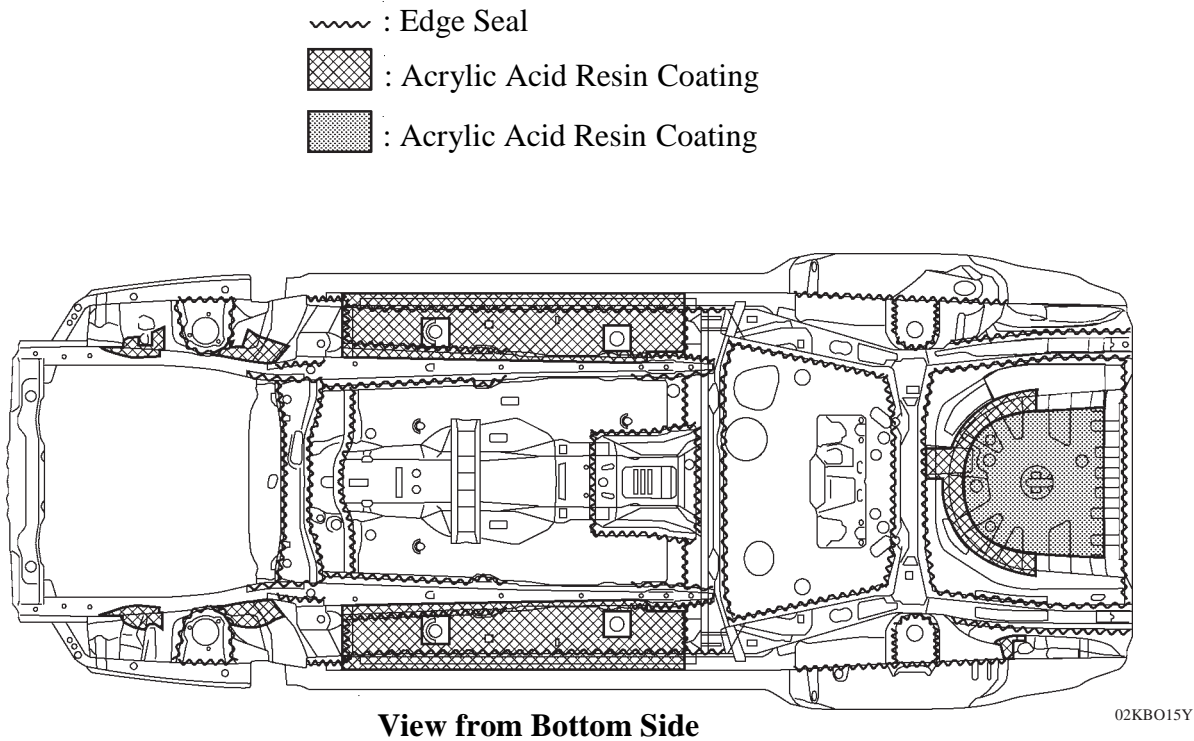
### 3. Wax and Sealer

Wax is applied to edge of the hood, door lower portion, door hinge and fuel filler lid hinge to improve rust-resistant performance. Sealer is applied to hemmed portions of the hood, door panels and luggage door.



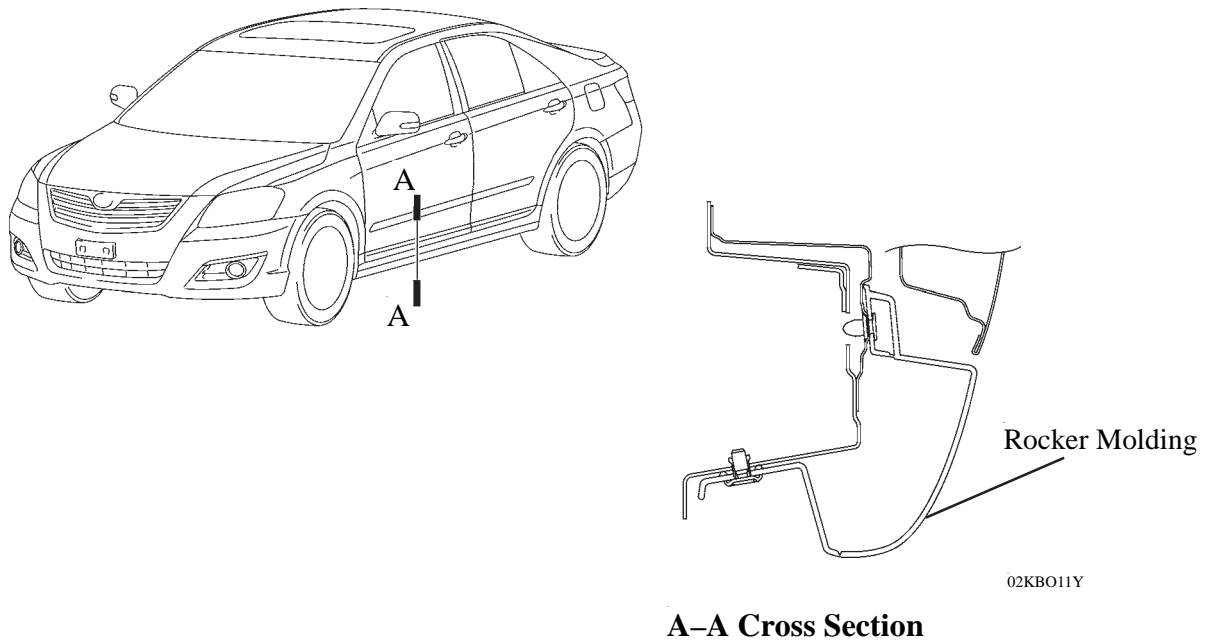
#### 4. Under Coat

Acrylic acid resin is applied to the under side of the body, inside the rear wheel housing and other parts that are susceptible to stone chipping damage, thus improving the rust-resistant performance of these areas.



#### 5. Anti-chipping Application

Large rocker mouldings are fitted to the lower side of the vehicle, which is liable to suffer from stone-chipping in order to ensure chip resistance.



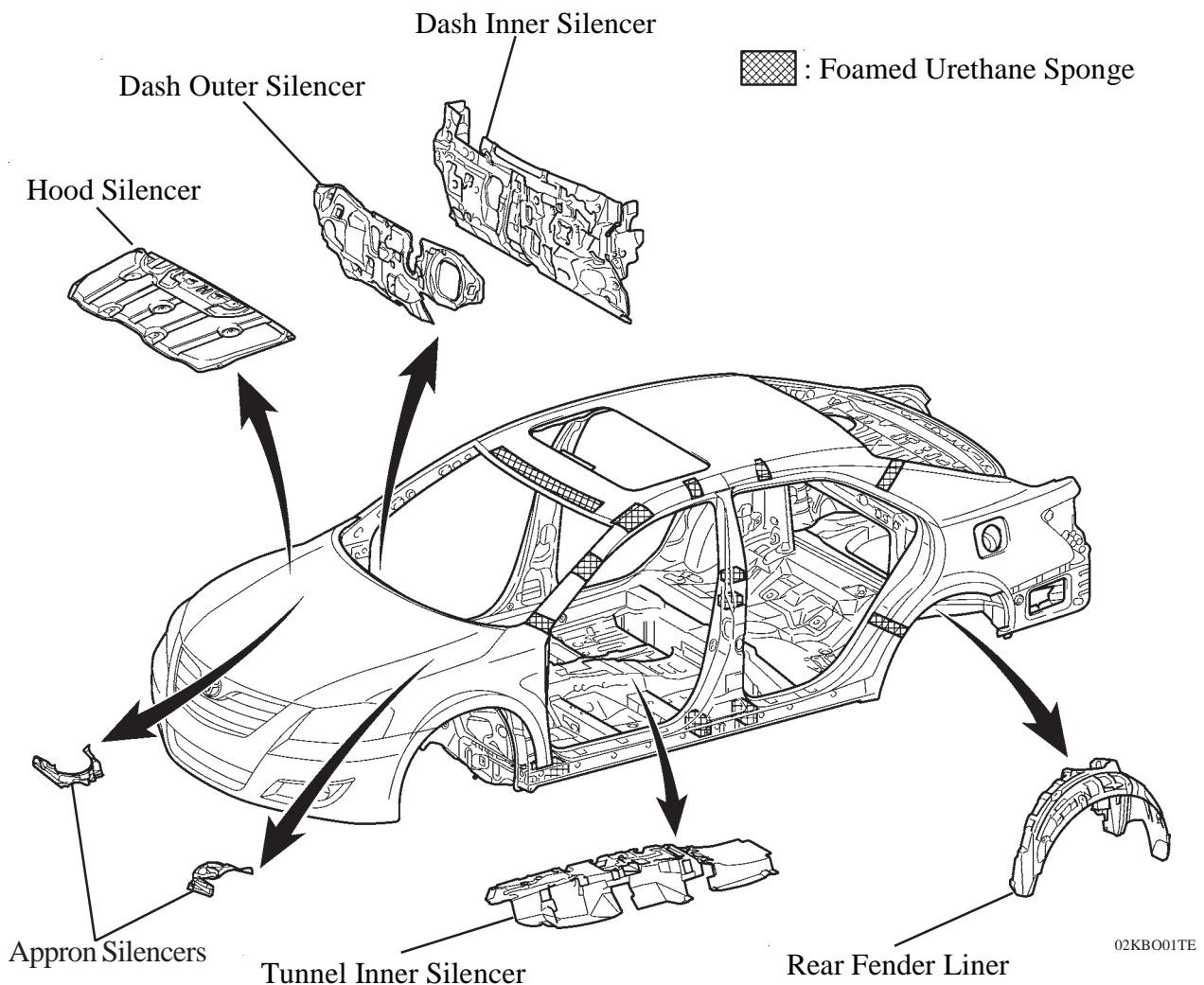
## ★ LOW VIBRATION AND LOW NOISE BODY

### 1. General

Effective application of vibration damping and noise suppressant materials reduces engine and road noise.

### 2. Sound Absorbing and Vibration Damping Materials

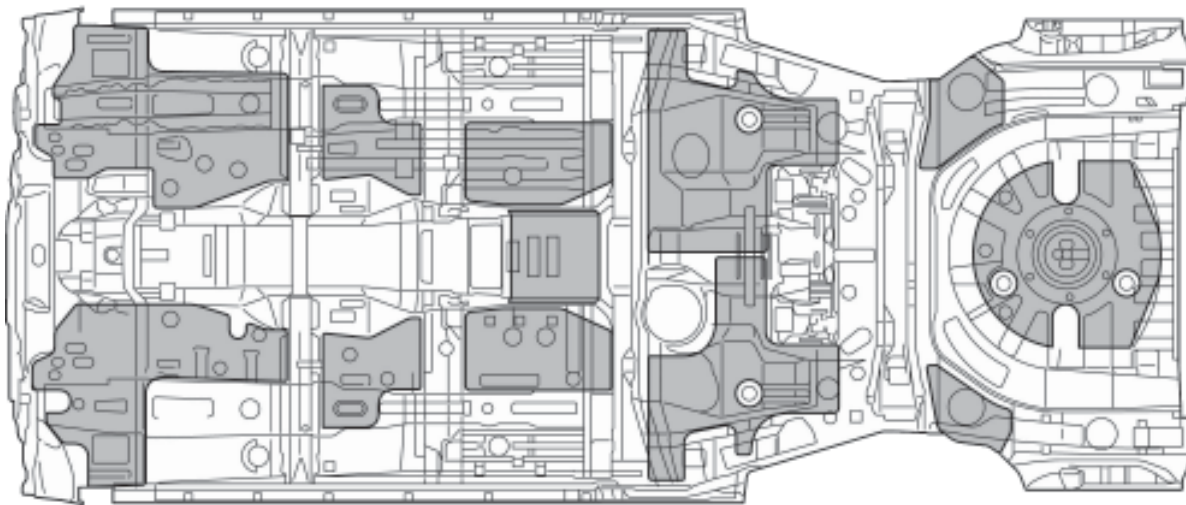
- Foamed urethane sponge and foamed sealing material are applied onto the roof panel and pillars to reduce wind and road noise.
- A large-size dash inner silencer, dash outer silencer, hood silencer, apron silencers and tunnel inner silencer are used to reduce engine and road noise and improve quietness inside the passenger compartment.
- The rear fender liner, which is made of non woven felt, is fitted inside the rear wheelhouse in order to minimise grit, water and road noises.



- The positions in which the asphalt sheets adhere to the floor have been optimised in order to reduce muffled sound and road noise, and therefore achieve a quiet ride.



: Used on all models

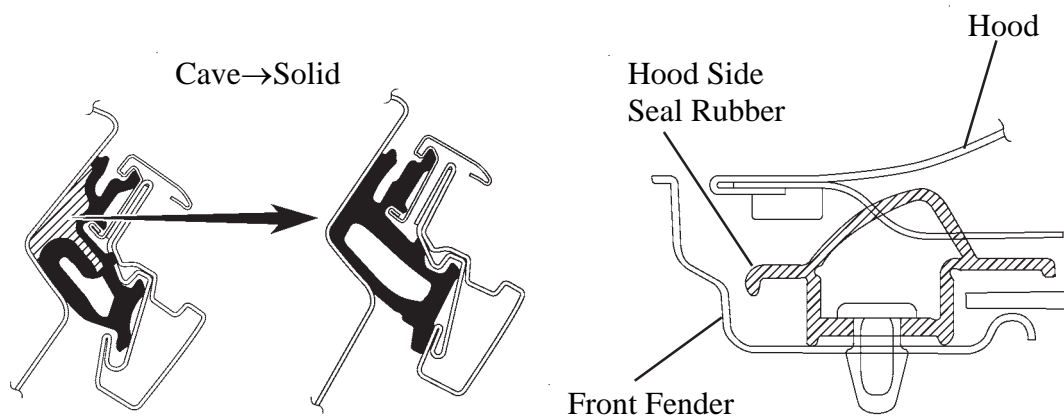
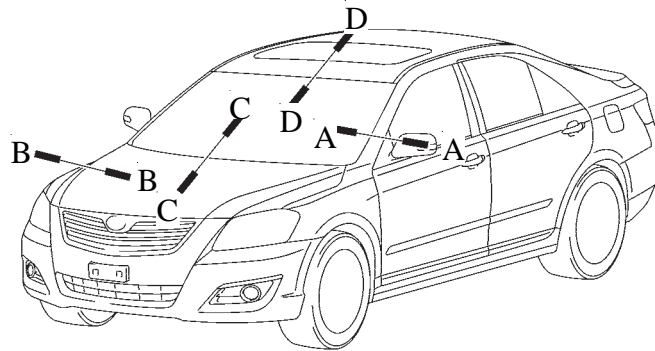


02KBO04Yb

**View from Top Side**

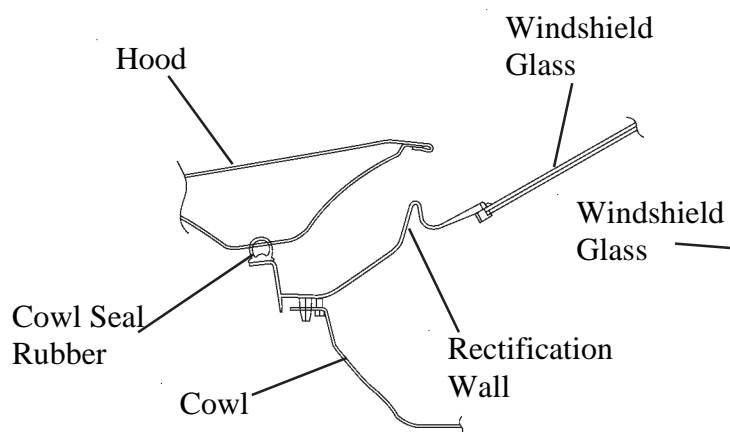
### 3. Reducing Wind Noise

- A structure that blocks the airflow is used in a portion of the door weather strip (at the front corner) in order to reduce wind noise (A-A cross section).
- The air turbulence has been eliminated through the use of the hood side seal rubber (B-B cross section).
- By streamlining the joins between the hood and windshield glass (C-C cross section) and between windshield glass and the roof (D-D cross section), air turbulence has been minimised.

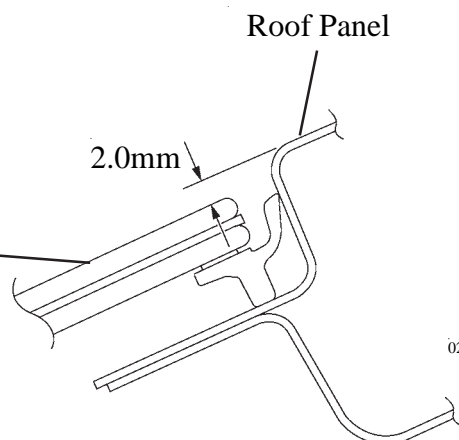


A-A Cross Section

B-B Cross Section

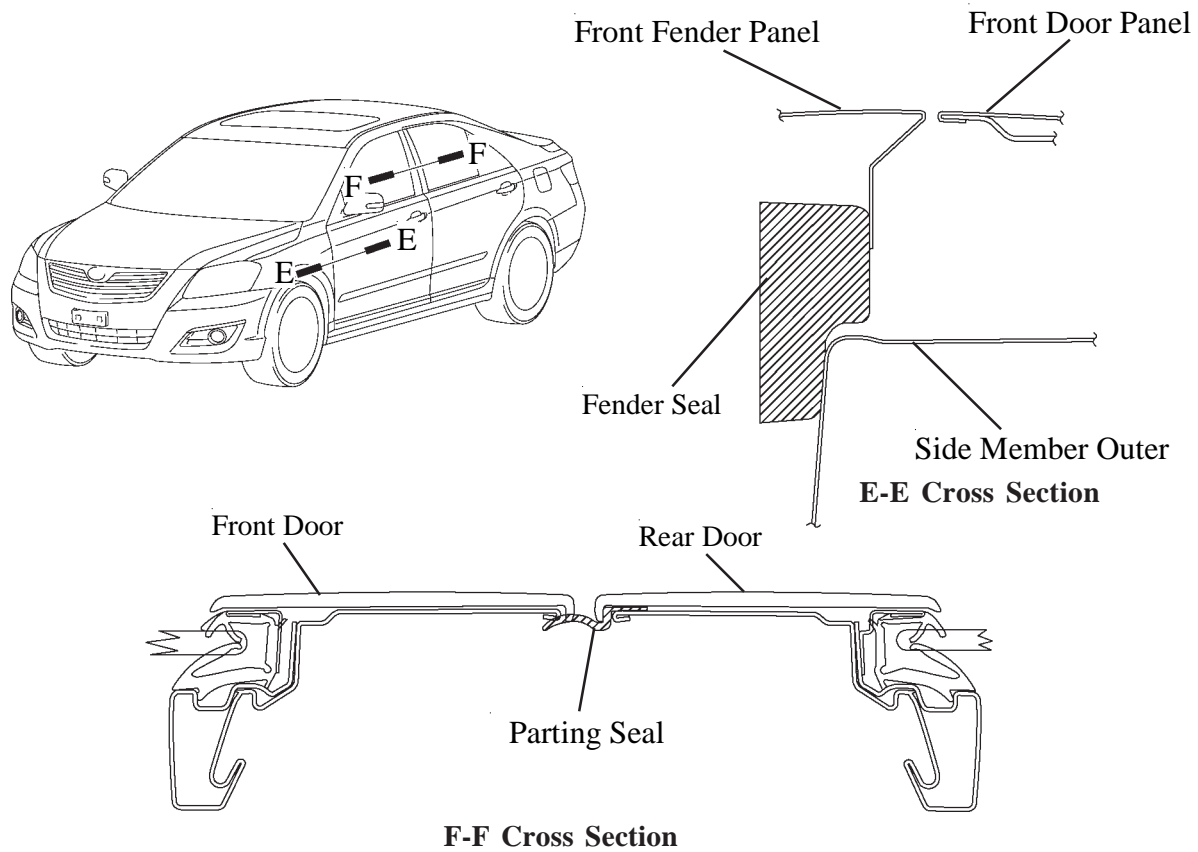


C-C Cross Section



D-D Cross Section

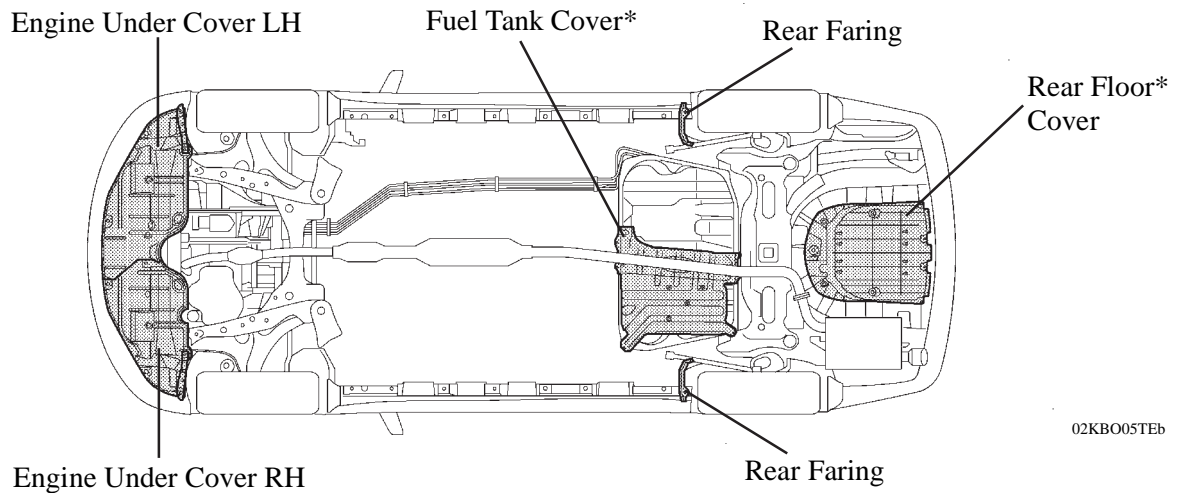
- Fender seals made of foamed resin are used between the front fender and the side member outer to prevent air from blowing through. (E-E cross section)
- Parting seals made of flexible resin are employed between the front and rear doors to eliminate air turbulence (F-F cross sections).



02KBO08Y

## ✱ AERODYNAMICS

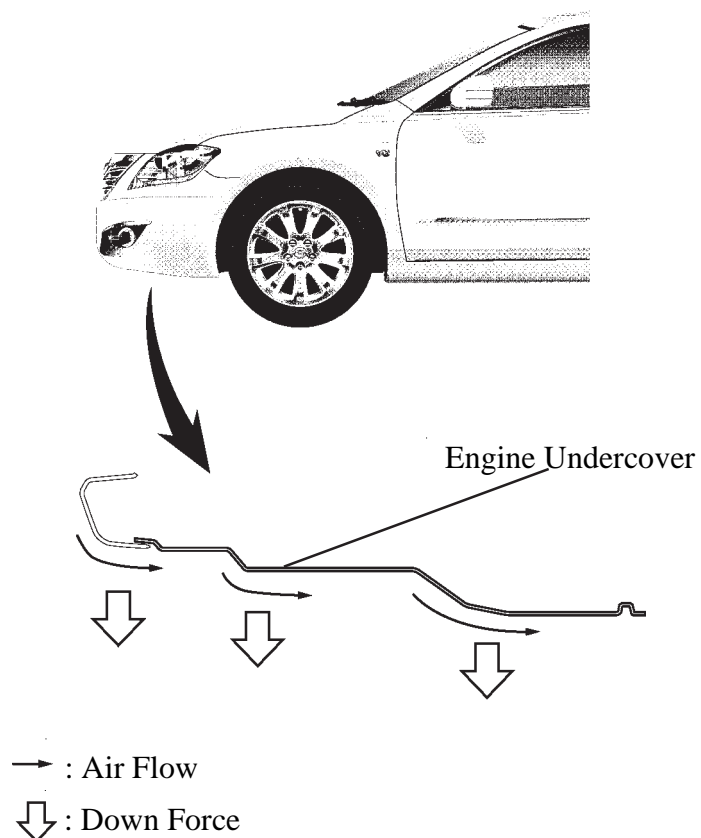
In order to achieve excellent steering stability and fuel economy, various rectifying parts have been used to regulate the airflow under the floor and the aerodynamic performance has been improved by flattening the underside of the vehicle.



\*: Sportivo grades

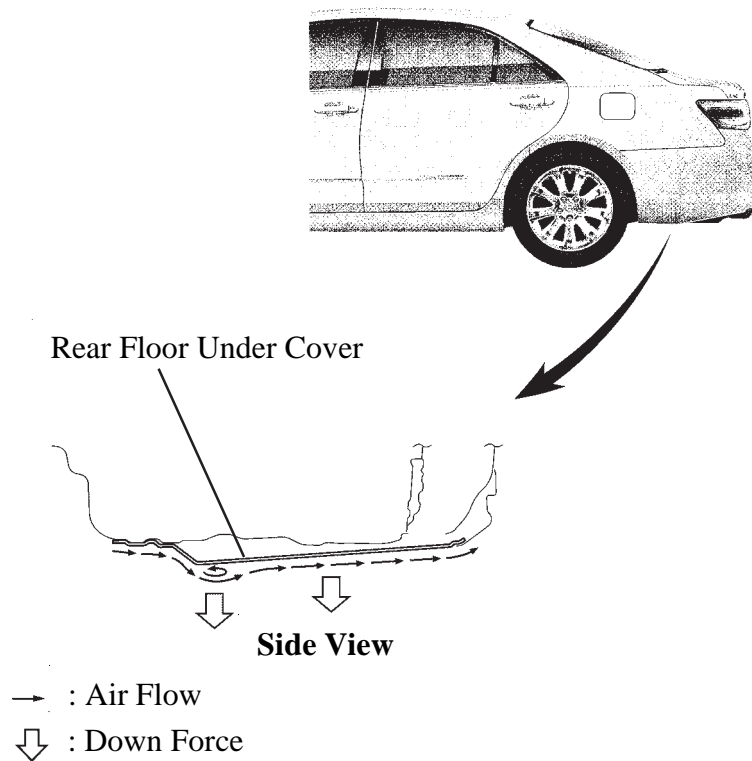
### View from Bottom Side

- The engine undercover has been formed into a step shape to increase the velocity of the air flowing underneath the vehicle. This creates a vacuum and suppresses the lift force, thus excellent manoeuvrability and stability is achieved.



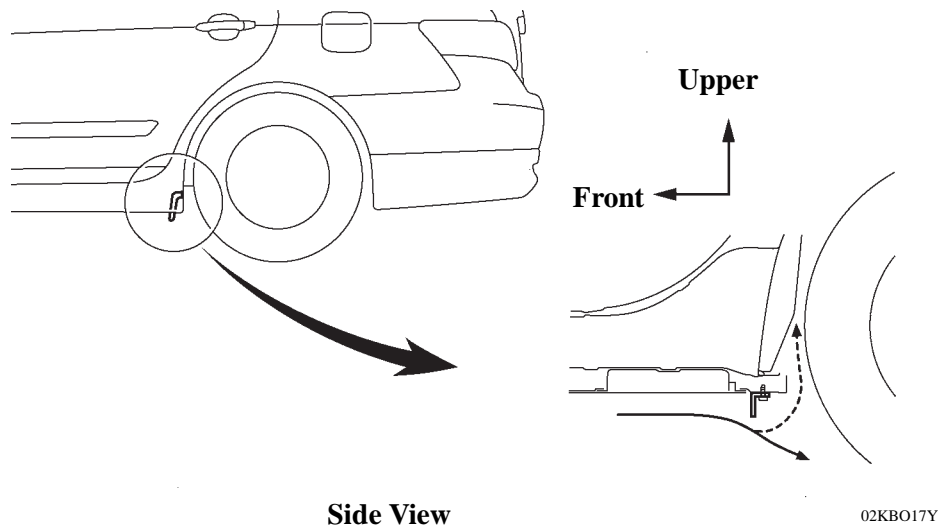
02KBO09Y

- Excellent manoeuvrability and stability have been achieved by providing a rear floor under cover that is shaped to generate rectification and swirl effects on the rear floor



02KBO10Y

- The airflow disturbance has been reduced by using a rear faring to direct the airflow outside the tyre house, thus minimising the air resistance and improving the fuel economy.

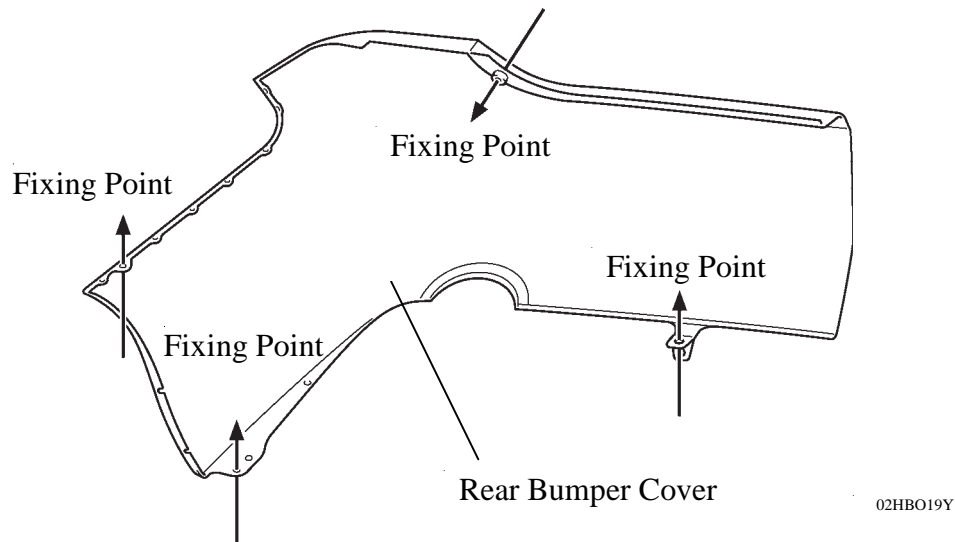


02KBO17Y

## ENHANCEMENT OF PRODUCT APPEAL

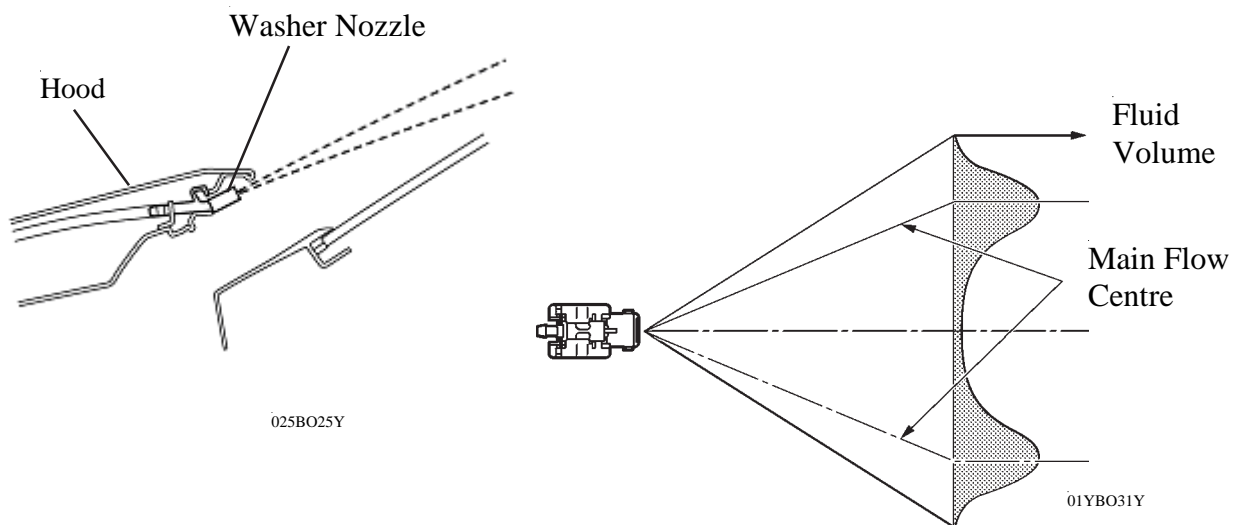
### ✱ PARTS WITH LOW REPAIR COST

- By reducing the number of fixing points, from 18 to 8, used for installing the rear bumper cover onto the vehicle body, repair time has been shortened.



### ✱ WASHER NOZZLE

Spray type washer nozzles are located under the engine hood to ensure good appearance. These nozzles can spray windshield washer fluid over a wide area by spraying it in a fan shape. The washer fluid volume has been reduced so as not to hinder the driver's view when washer system is operated.



#### Service Tip

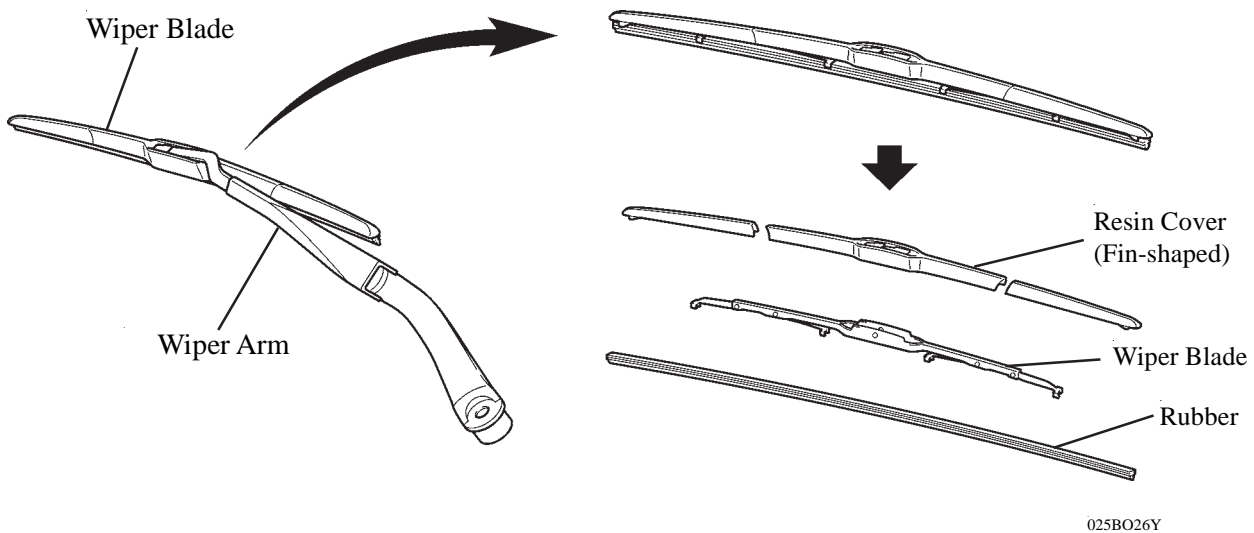
Spray type washer nozzles cannot be adjusted because of their structure. Do not attempt to adjust the nozzles as it could damage them.

If adjustment is necessary, adjust the nozzles after replacing them with those selected from five part numbers with different spray angles. For details, see the Aurion Repair Manual .



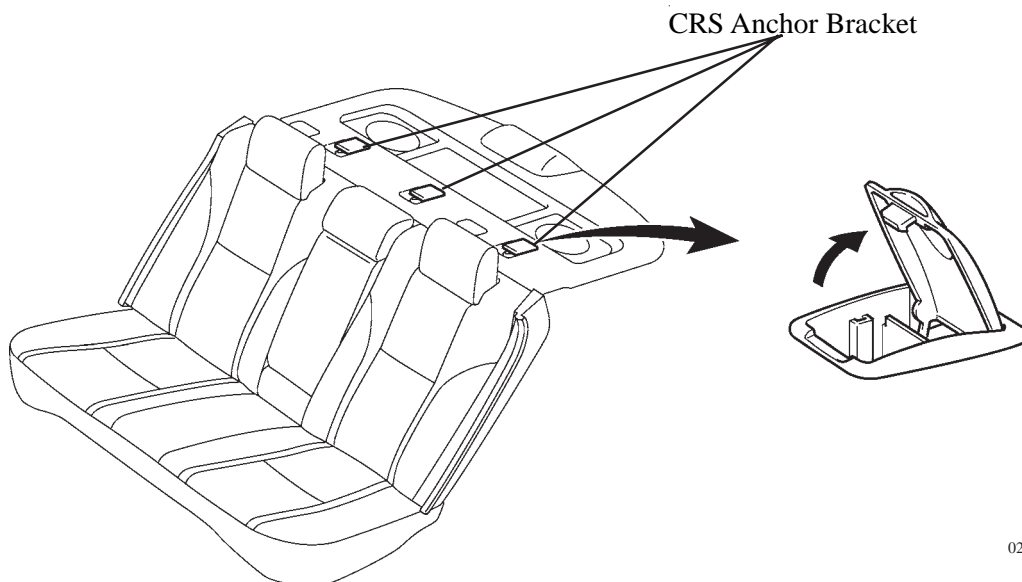
## ❁ WIPER ARM & BLADE

The unified construction of the wiper blade and arm is used. A fin-shaped resin cover is used for the entire wiper blade. This ensures the effectiveness of the wipers even when travelling at high speeds.



## ❁ CHILD RESTRAINT SYSTEM

Three CRS anchor brackets for securing a child seat are provided above the package tray trim.



## ✱ SEAT BELT

### 1. General

The following types of seat belts are provided.

Seat Position	Seat Belt Type	Remarks
Driver	3-point ELR	Electrical Sensing Type Pre-tensioner, Force Limiter and Tension Reducer
Front Passenger	3-point ELR	Electrical Sensing Type Pre-tensioner & Force Limiter
Rear Passengers (Right, Left & Centre )	3-point ELR & ALR	—

ELR - Emergency Locking Retractor

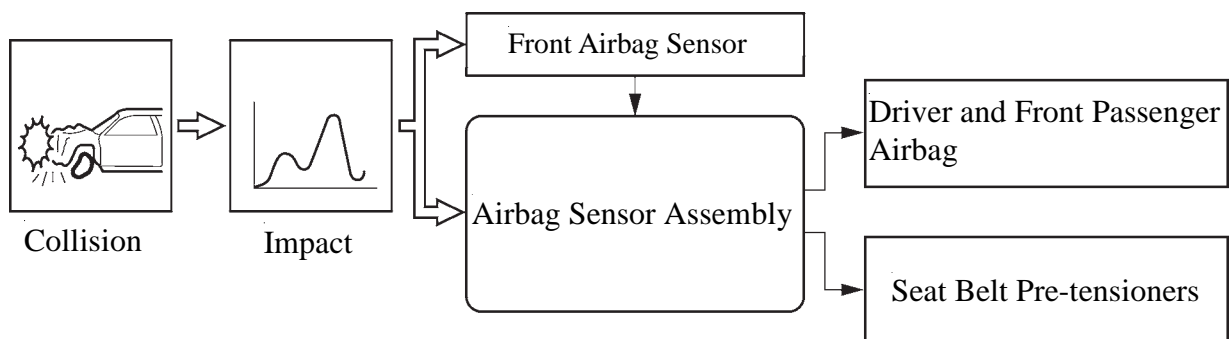
ALR - Automatic Locking Retractor

### 2. Pre-tensioner and Force Limiter

In accordance with the ignition signal from the airbag sensor assembly, the seat belt pre-tensioner activates simultaneously with the deployment of SRS airbag for the driver and front passenger.

In the beginning of the collision if the tension of the seat belt applied to the occupant reaches a predetermined level, the force limiter activates to control the force.

#### ► Front Airbag Operation ◀



02KBO14TE

# BODY ELECTRICAL

## **MULTIPLEX COMMUNICATION**

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## **POWER WINDOW SYSTEM**

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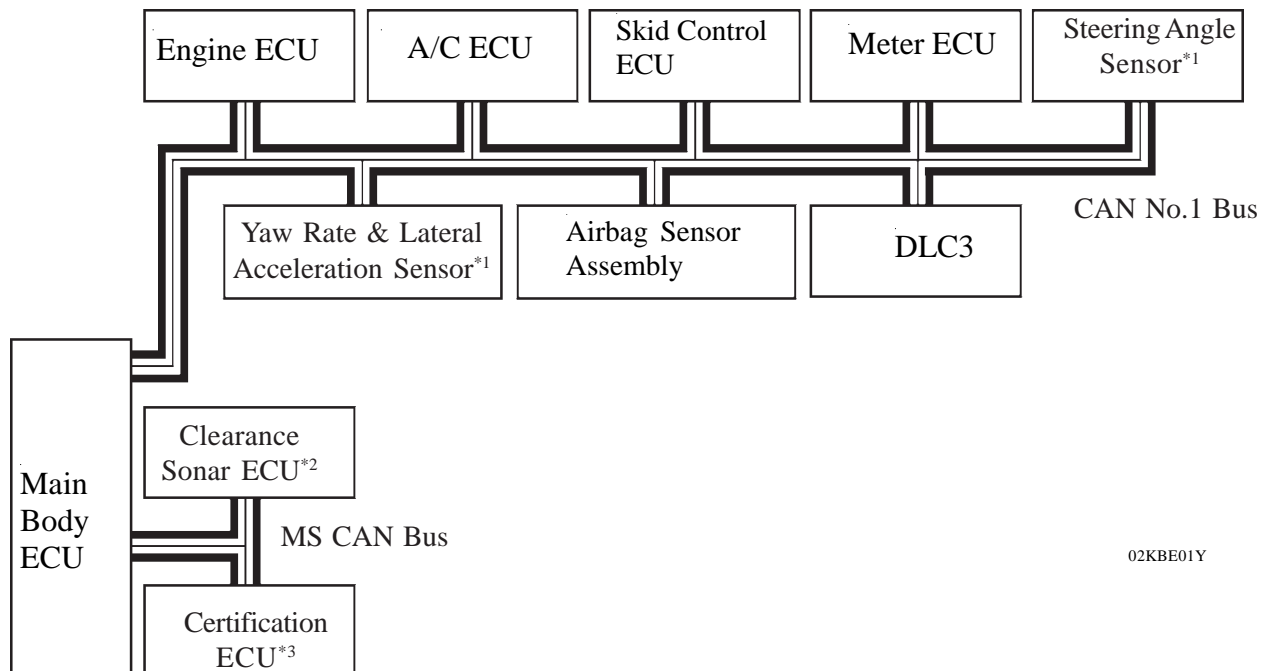
# BODY ELECTRICAL

## MULTIPLEX COMMUNICATION

### DESCRIPTION

- The multiplex communication system of the Aurion uses the CAN (Controller Area Network) to achieve a streamlined wiring harness configuration.
- The CAN (Controller Area Network) is classified into two types according to communication speed. The HS (High Speed)-CAN is used for the power train, chassis and body electrical systems, and the MS (Medium Speed)-CAN is used for the body electrical system.
- The HS-CAN (CAN bus) and the MS-CAN (MS bus). The main body ECU is used to transmit data between the buses.
- Due to the introduction of the CAN system for the power train, chassis and body electrical systems, the BEAN (Body Electronics Area Network) is no longer used on this model.
- A customised body electronics system is used, enabling the control functions of the ECU's to be set using an intelligent tester II. For details, see page BE-11

### System Diagram



02KBE01Y

\*1: With VSC

\*2: With Clearance Sonar

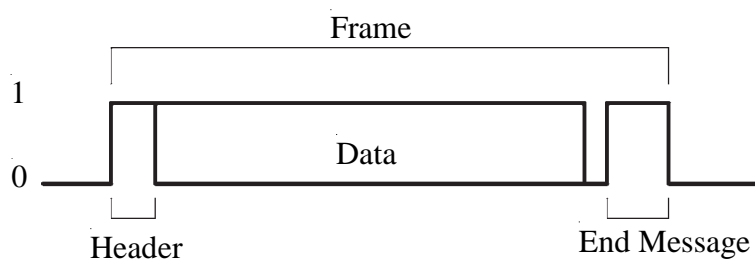
\*3: With Smart Entry and Start System

## — REFERENCE —

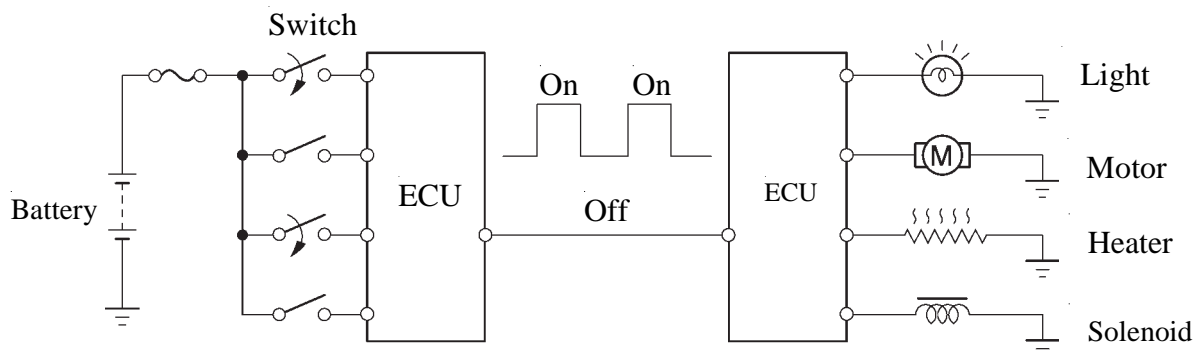
MPX communication uses serial communication data that consists of bits and frames in order to exchange information among the various ECU's. This allows a reduction of the amount of wiring on the vehicle.

- A bit is the basic unit of communication that is used to represent information. A bit is represented by binary values of “0” or “1”.
- A frame is a body of data that is transmitted together. A frame contains a header that indicates the beginning, and an end message that indicates the end.

## ► Conceptual Drawing ◀



240BE03



240BE03

## ❁ DIFFERENCES BETWEEN CAN, AVC-LAN AND BEAN

### 1. General

- The protocols, which are the rules for establishing data communication, differ between the CAN, AVC-LAN\*<sup>1</sup> and BEAN\*<sup>2</sup>. If the ECU's in the networks use different frameworks for their data, such as communication speed, communication wire, and signals, they will be unable to understand each other. Therefore, protocols (rules) must be established among them.
- Compared to the AVC-LAN\*<sup>1</sup> and BEAN\*<sup>2</sup>, the CAN features high-speed data transmission. Therefore, the CAN is able to transmit larger amounts of data faster than the other protocols. This feature makes it possible to transmit data accurately in the power train and chassis control system, which requires large amounts of data to be transmitted in short periods of time.

\*<sup>1</sup>: AVC-LAN is used in the audio-visual system of some other TOYOTA models, but is not on the new Aurion.

\*<sup>2</sup>: The BEAN is used in the body electrical system of some other TOYOTA models, but is not used on the new Aurion.

Protocol	CAN (ISO Standard)	AVC-LAN (TOYOTA Original)	BEAN (TOYOTA Original)
Communication Speed	500 kbps*/ HS-CAN 250 kbps*/ MS-CAN (Max. 1 M bps)	Max. 17.8 kbps*	Max. 10 kbps*
Communication Wire	Twisted-pair Wire	Twisted-pair Wire	AV Single Wire
Drive Type	Differential Voltage Drive	Differential Voltage Drive	Single Wire Voltage Drive
Data Length	1-8 Byte (Variable)	0-32 Byte (Variable)	1-11 Byte (Variable)




\*: bps: abbreviation for “Bits per Second”, indicating the number of bits that can be transmitted per second.

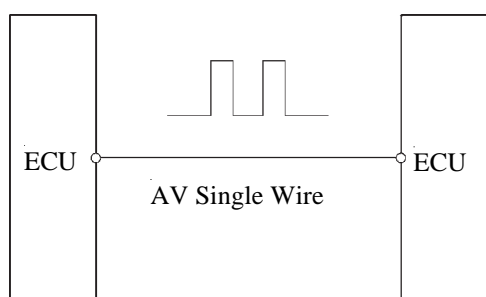
## 2. Communication Wire

A twisted-pair wire is used for CAN and AVC-LAN\*<sup>1</sup> communication. A single, AV (Automobile Vinyl) wire is used for BEAN\*<sup>2</sup> communication.

\*1: AVC-LAN is used in the audio-visual system on some other TOYOTA models, but is not used on the new Aurion.

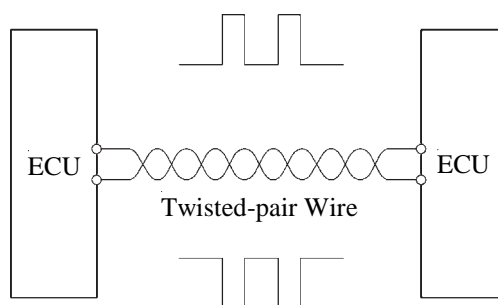
\*2: The BEAN is used in the body electrical system of the some other TOYOTA models, but is not used on the new Aurion.

Communication Wire	Outline
Twisted-pair Wire for CAN  241BE168	This communication wire is a pair of twisted lines. Communication is driven by applying voltage of 1.5 to 2.5 V and 2.5 to 3.5 V to the two lines in order to send a single signal. This system, which is called a “Differential Voltage Drive”, reduces noise.
Twisted-pair Wire for AVC-LAN  241BE168	This communication wire is a pair of twisted lines. Communication is driven by applying positive (+) and negative (-) voltages to the two lines in order to send a single signal. This system, which is called a “Differential Voltage Drive”, reduces noise.
AV Single Wire  240BE09	This is a lightweight single communication wire that consists of a single core line surrounded by insulation. Voltage is applied to this line in order to drive communication, and this system is called a “Single Wire Voltage Drive”.



240BE11

**Single Wire Voltage Drive**



240BE12

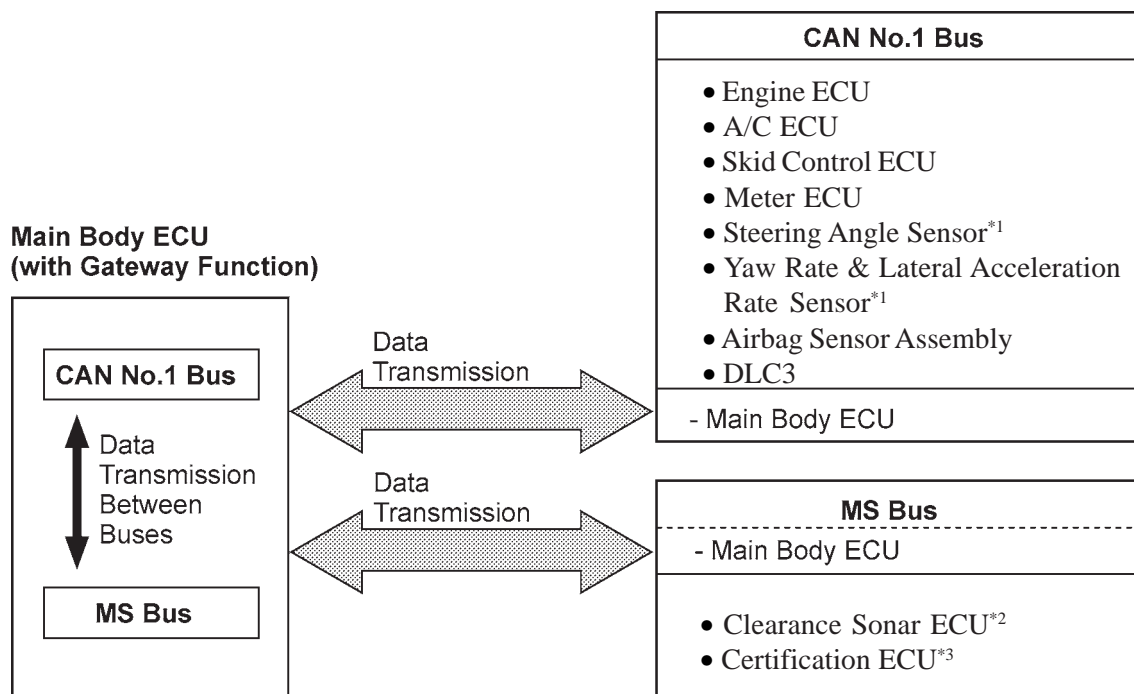
**Differential Voltage Drive**

## CAN

### 1. General

- The Aurion uses two types of CAN that have different communication speeds: HS-CAN (500kbps) and MS-CAN (250kbps).
- The HS-CAN consists of the CAN No.1 bus. The terminating resistors of the CAN No.1 bus are built into the engine ECU and meter ECU.
- The MS-CAN consists of the MS bus. The terminating resistors of the MS bus are built into the main body ECU and certification ECU. For models without the smart entry and state system, the terminating resistors are built into the junction connector RH II.
- ECUs with the gateway functions are used to transmit data between buses. The main body ECU is used between the CAN No.1 bus and the MS bus.

#### ▶ Image of Data Transmission between Buses ◀



<sup>\*1</sup>: With VSC

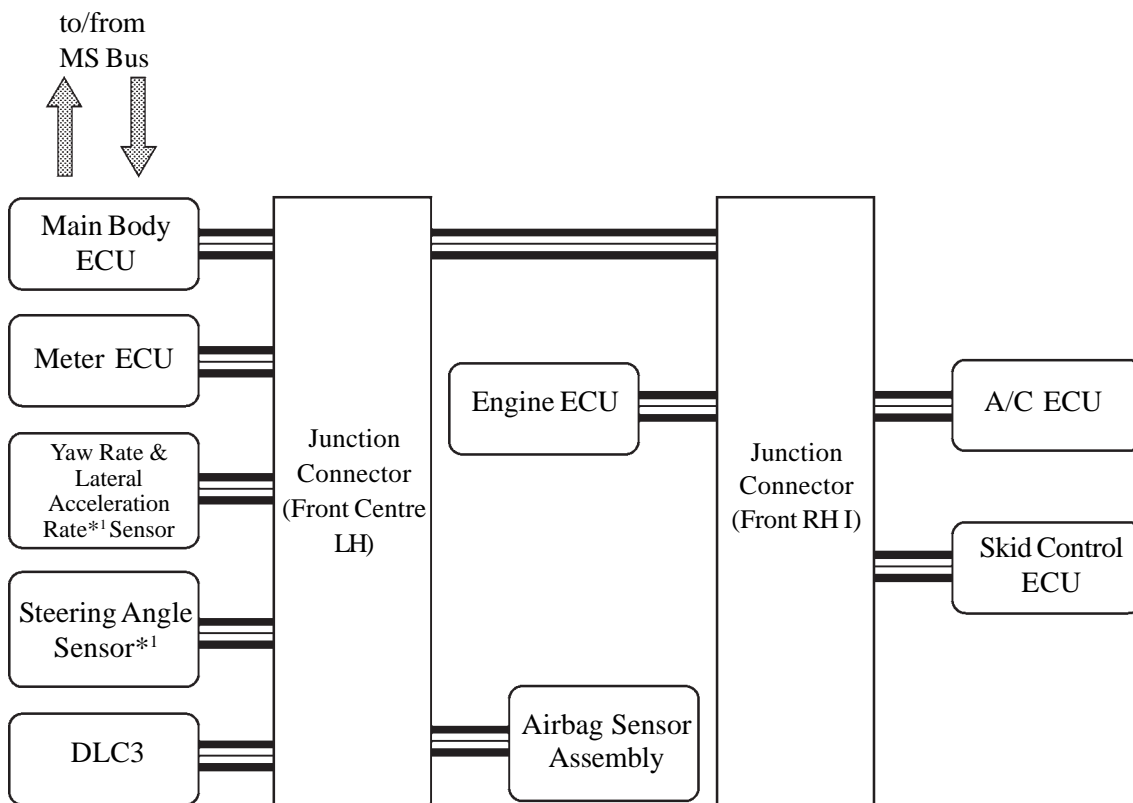
<sup>\*2</sup>: With Clearance Sonar

<sup>\*3</sup>: With Smart Entry and Start System

01YBE04P



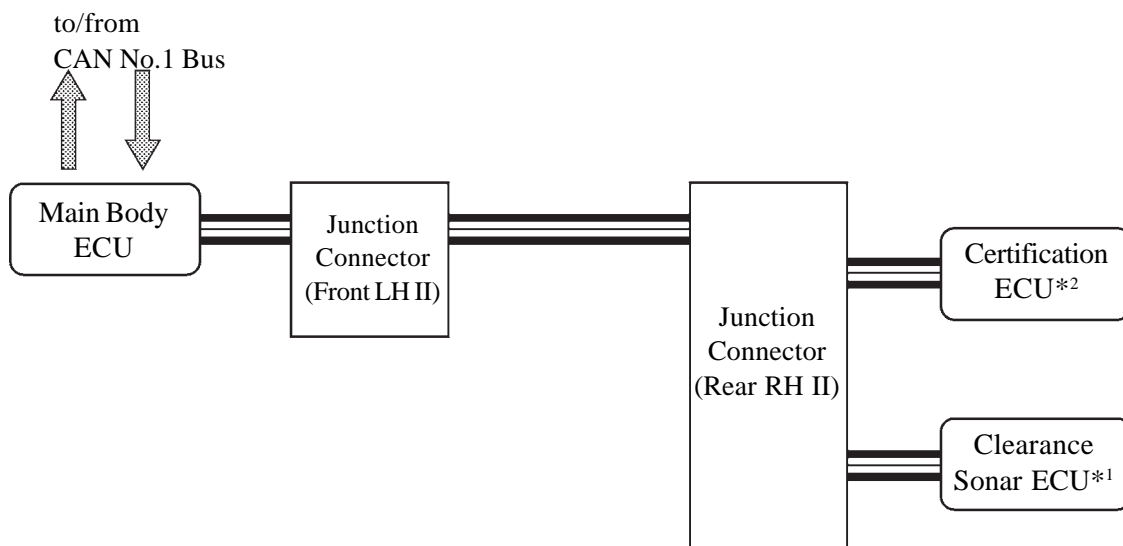
### ▸ CAN No.1 Bus ◀



02KBE02Y

\*<sup>1</sup>: With VSC

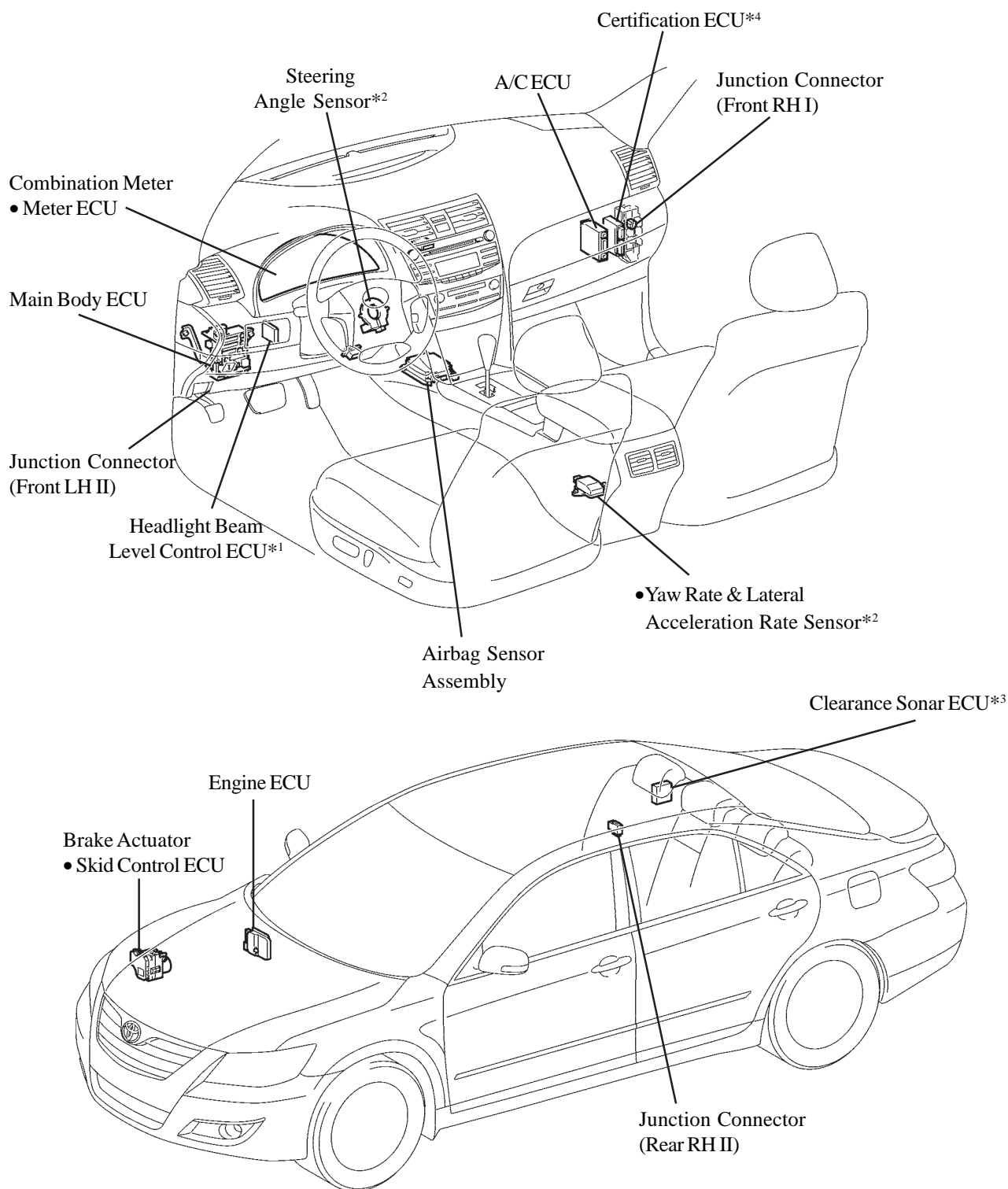
### ▸ MS Bus ◀



02KBE122Y

\*<sup>1</sup>: With Clearance Sonar\*<sup>2</sup>: With Smart Entry and Start System

## 2. Layout of Main Components



\*1: with Auto Headlight Level Control

\*2: with VSC

\*3: With Clearance Sonar

\*4: With Smart Entry and Start System

LHD

### 3. Diagnosis

- If a malfunction occurs on the CAN communication line, the ECU that is connected to the CAN communication line stores the DTC (Diagnostic Trouble Code) in its memory.
- The 5-digit DTC can be read by connecting an intelligent tester II to the DLC3.
- The DLC3 is equipped with CAN-H and CAN-L terminals for CAN diagnosis. It is possible to determine if there is an open or short in the main wire of the CAN No.1 bus by measuring the resistance value between these terminals. For details, see the Aurion Repair Manual.

## CUSTOMISED BODY ELECTRONICS SYSTEM

An intelligent tester II can be used to customise the system settings.

System	Intelligent Tester II Display Content	Contents	Default Setting	Available Setting
Wireless Door Lock	Trunk Lid Operation	To change the operation method of opening the trunk by the transmitter.	0.8s PR	1 TIME/ 2 TIMES / 0.8s PR / OFF
	Wireless Control	Function to turn ON/OFF of the wireless door lock.	ON	ON/OFF
	Hazard Answer Back	Function to turn ON/OFF of the hazard answer back of the wireless door lock.	ON	ON/OFF
	Wireless Buzzer Resp	Function to turn ON/OFF of the wireless buzzer response function.	ON	ON/OFF
	Open Door Warn	Function to make the buzzer sound for 10 seconds if the door is open when locking with the wireless door lock.	ON	ON/OFF
	Auto lock time	Function to change the time until re-locking after unlocking with the wireless door lock.	30 sec	30 sec /60 sec
	Unlock 2 Operation	Function to unlock the driver's door by pressing the unlock button of the transmitter once and to unlock all the doors by pressing it twice. In the OFF setting, pressing one time makes all the doors unlocked.	OFF	ON /OFF
Door Lock	Panic function	Function to operate the theft deterrent system by keeping pressing the lock button of the transmitter for 1.5 seconds. If there is the panic button, press the panic button instead of the lock button.	ON	ON/OFF
	Unlock Key Twice	Function to unlock only the driver's door by doing the key operation once and to unlock all the doors by doing it twice. In the OFF setting, operating the key "UNLOCK" once makes all the doors unlocked.	OFF	ON /OFF

System	Intelligent Tester II Display Content	Contents	Default Setting	Available Setting
Illuminated Entry	Lighting Time	Function to change the lighting time after closing the door. (It will quickly fade out in the event the power source/ignition switch is turned ON.)	15 sec	7.5 sec/ 15 sec/ 30 sec
	I/L when ACC OFF	Function to light up the interior lights when power source/ignition switch is turned from "ACC" to "OFF".	ON	ON/OFF
	I/L ON W/Door Unlock	Function to light up the interior lights when unlocking.	ON	ON/OFF
Warning	Seat Belt Warning	Function to change the seat-belt warning buzzer.	D/P ON	N/A
	Key Low Battery Warning <sup>*1</sup>	Setting a warning function for the first time when a key battery becomes weak	ON	ON/OFF
Smart Entry Start <sup>*1</sup> &	Select IG ON Available Area	Function to choose the available area for the key to start E/G and cancel the Steering Lock.	ALL	FRONT/ALL
	Park Wait Time	Setting a wait time to permit opening a door after it being locked.	3.0 sec	1.0 sec/ 2.0 sec/ 3.0 sec/ 5.5 sec
	Trunk Open Mode	Function to permit opening a trunk with the key.	ON	ON/OFF
A/C	Set Temperature Shift	To control with the shifted temperature against the display temperature.	NORMAL	+2 °C/ +1 °C/ NORMAL / -1 °C/ -2 °C
	Air Inlet Mode	In case of turning the A/C ON when you desire to make the compartment cool down quickly, this is the function to change the mode automatically to RECIRCULATED mode.	AUTO	MANUAL/ AUTO
	Compressor Mode	Function to turn the A/C ON automatically by pressing the AUTO button when the blower is ON and the A/C is OFF.	AUTO	MANUAL / AUTO
	Compressor/Air Inlet DEF operation	Function to turn the A/C ON automatically linking with the FRONT DEF button when A/C OFF.	LINK	NORMAL / LINK
	Evaporator Control	Function to set the evaporator control to the AUTOMATIC position (AUTO) to save power or to the coldest position (MANUAL) to dehumidify the air and to prevent the windows fogging up.	AUTO	MANUAL / AUTO
	Foot/DEF Auto Mode	Function to turn the air flow from FOOT/DEF ON automatically when AUTO MODE is ON.	ON	OFF/ON
	Ambient Temperature Shift	To control with the shifted ambient temperature against the display ambient temperature.	NORMAL	+2 °C/ +1 °C/ NORMAL / -1 °C/ -2 °C
	Foot/DEF Automatic Blow Up Function	Function to switch the blower level automatically when the defroster is ON.	ON	OFF/ON

<sup>\*1</sup>: With Smart Entry and Start System

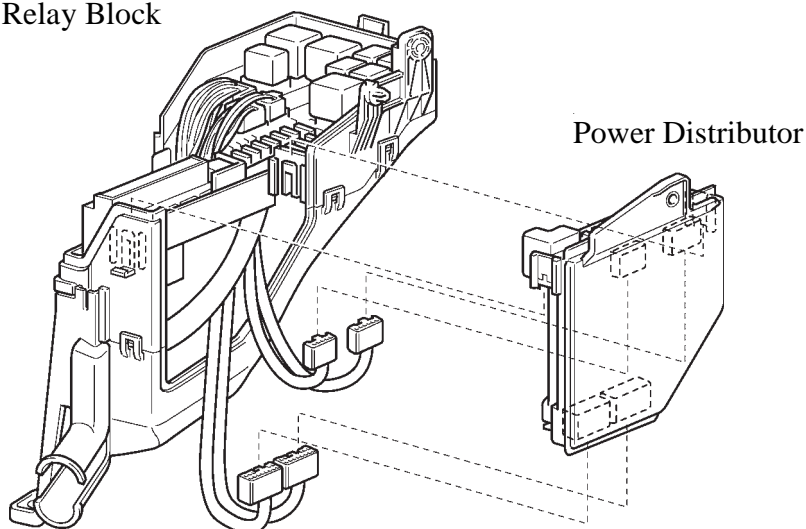
System	Intelligent Tester II Display Content	Contents	Default Setting	Available Setting
A/C	Set Temperature Shift	To control with the shifted temperature against the display temperature.	NORMAL	+2 °C/ +1 °C/ NORMAL / -1 °C/ -2 °C
	Air Inlet Mode	In case of turning the A/C ON when you desire to make the compartment cool down quickly, this is the function to change the mode automatically to RECIRCULATED mode.	AUTO	MANUAL/ AUTO
	Compressor Mode	Function to turn the A/C ON automatically by pressing the AUTO button when the blower is ON and the A/C is OFF.	AUTO	MANUAL / AUTO
	Compressor/Air Inlet DEF operation	Function to turn the A/C ON automatically linking with the FRONT DEF button when A/C OFF.	LINK	NORMAL / LINK
	Evaporator Control	Function to set the evaporator control to the AUTOMATIC position (AUTO) to save power or to the coldest position (MANUAL) to dehumidify the air and to prevent the windows fogging up.	AUTO	MANUAL / AUTO
	Foot/DEF Auto Mode	Function to turn the air flow from FOOT/DEF ON automatically when AUTO MODE is ON.	ON	OFF/ON
	Ambient Temperature Shift	To control with the shifted ambient temperature against the display ambient temperature.	NORMAL	+2 °C/ +1 °C/ NORMAL / -1 °C/ -2 °C
	Foot/DEF Automatic Blow Up Function	Function to switch the blower level automatically when the defroster is ON.	ON	OFF/ON

## POWER DISTRIBUTOR

### ● DESCRIPTION

The power distributor is built into the engine room relay block, and uses a small mechanical relay and semiconductor relay for a compact and lightweight design.

Engine Room Relay Block



01YBE09Y

- The components of the power distributor are shown below.

Component	Relay
Mechanical Relay	<ul style="list-style-type: none"> <li>• Horn Relay</li> <li>• A/F (Fan) Relay</li> <li>• EFI Relay</li> <li>• Circuit Opening Relay</li> <li>• Headlight Relay (RH)*<sup>1</sup></li> <li>• Headlight Relay (LH)*<sup>1</sup></li> </ul>
Semiconductor Relay	<ul style="list-style-type: none"> <li>• Headlight HI Beam Relay</li> <li>• Headlight Relay (RH)*<sup>2</sup></li> <li>• Headlight Relay (LH)*<sup>2</sup></li> </ul>

\*<sup>1</sup>: Models with Halogen type headlights

\*<sup>2</sup>: Models with HID type headlights

## LIGHTING

### ● DESCRIPTION

#### 1. General

The lighting system includes the following equipment:

Item		Grade	
		Touring	Grande
Front Fog Light		○	●
Headlight	Halogen	●	-
	HID	-	●
Headlight Beam Level Control	Automatic	-	●
	Manual	●	-
Illuminated Entry		●	●
Light Turn-OFF System		●	●
Headlight Cleaner		-	●

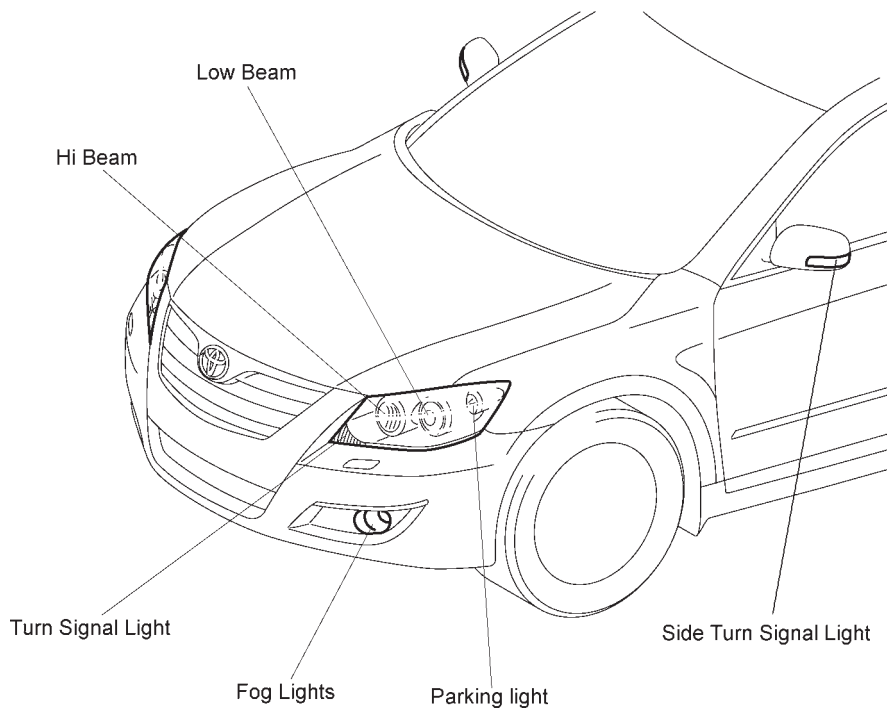
●: Standard feature

○: Option available

-: Not available



## 2. Front Exterior Light



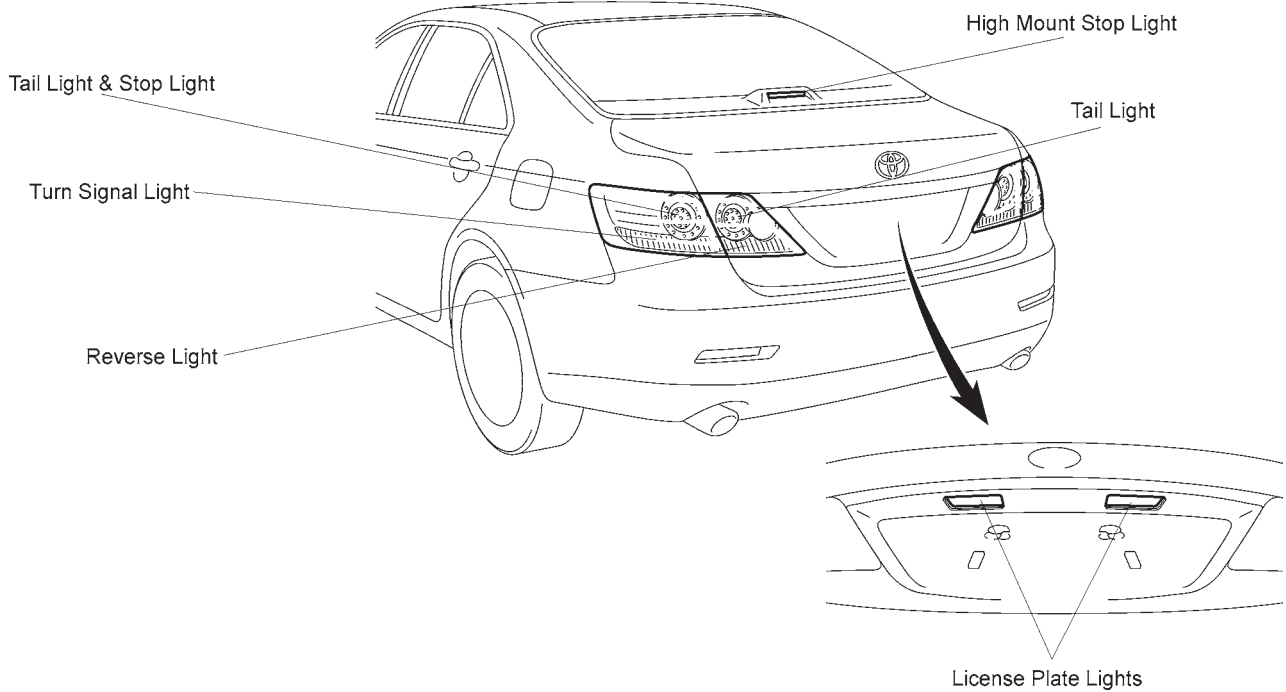
02KBE06TE

### ► Specifications ◀

Light		Type	Specification
Headlight Unit	Hi Beam	Halogen Bulb	65 W
	Lo Beam (Projector Type)	Halogen Bulb	55 W
		Discharge Bulb*	35 W
	Turn Signal Light	Wedge Base Bulb (Amber)	21 W
	Parking Lights	Wedge Base Bulb (Clear)	5 W
Side Turn Signal Light	Outer Rear View Mirrors	Assembly Unit (Amber)	5 W
Fog Lights		Halogen Bulb	55 W

\*: Vehicles with HID Headlights. For details, see the equipment list in Model Outline (see page MO-27).

### 3. Rear Exterior Light



02KBE07TE

#### ► Specifications ◀

Light		Type	Spec
Combination Light	Tail Light & Stop Light	LED x 2	0.1 / 3.8W
	Tail Light	LED x 2	0.1W
	Turn Signal Light	Wedge Base Bulb (Amber)	21W
	Reverse Light	Wedge Base Bulb (Clear)	16W
License Plate Lights		Wedge Base Bulb (Clear)	5W
High Mount Stop Light		LED x 4	1.0W

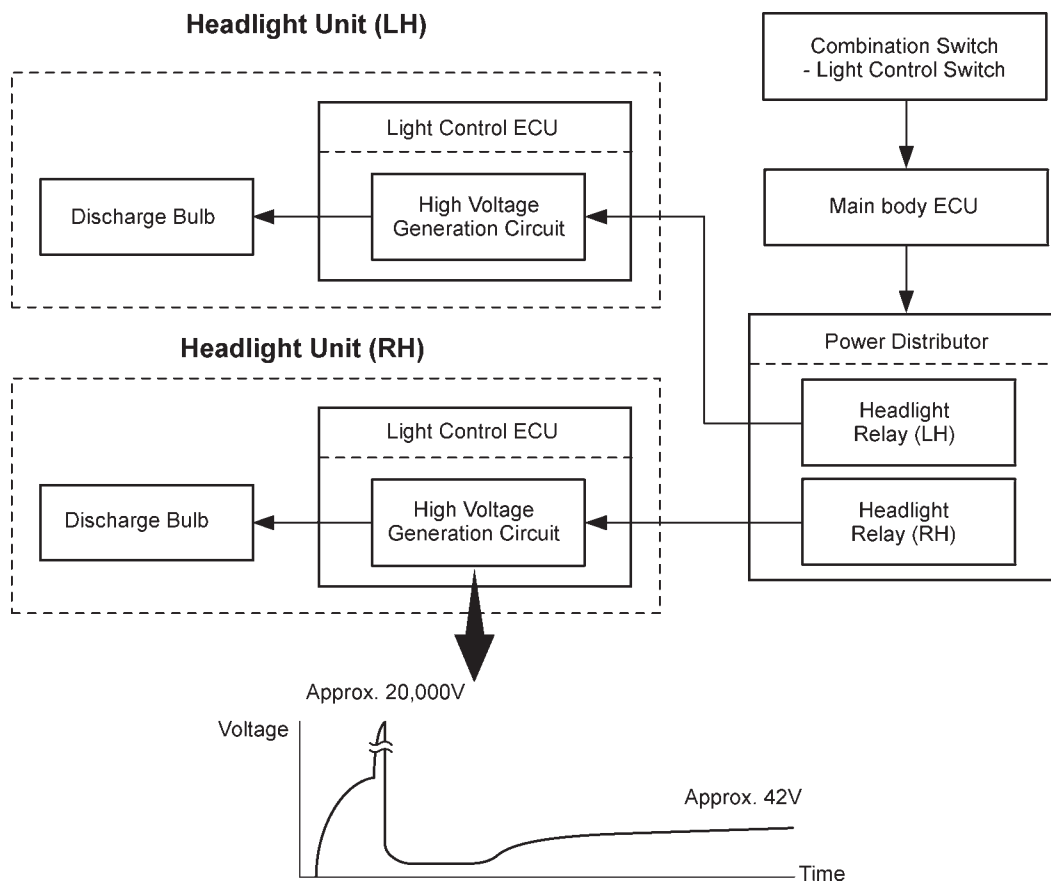
## ✱ HID HEADLIGHT SYSTEM

### 1. General

The HID (High Intensity Discharge) headlight system uses discharge bulbs as its light source for the Lo beam. Discharge bulbs are superior to halogen bulbs.

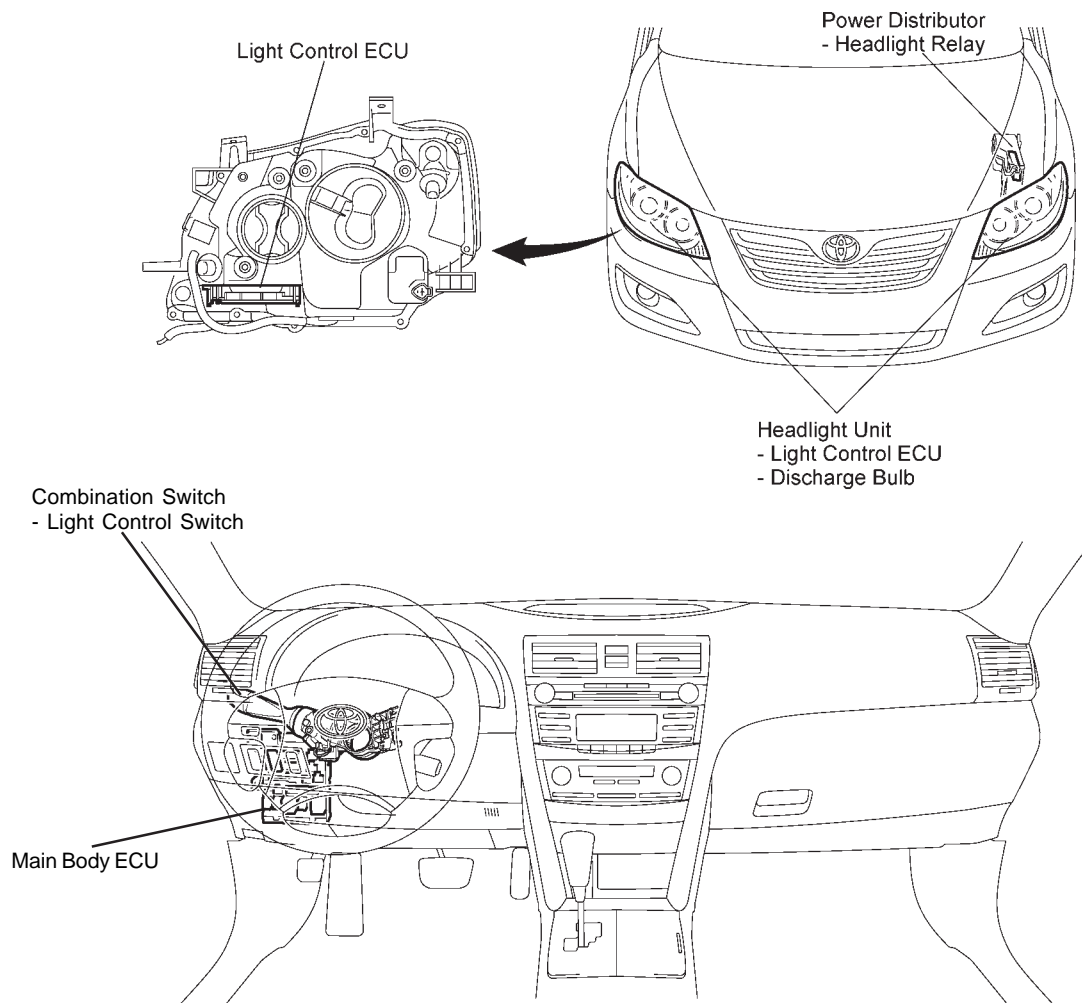
- Discharge bulbs have the following features.
  - The light emitted by the bulb is close in color to sunlight. The light shines ahead over a broader area and further forward, increasing the area visible to the driver.
  - Less power is consumed.
- This system consists of discharge bulbs and light control ECUs.
- The Light control ECU transforms the voltage that is input from the battery to a high voltage of up to 20,000V and applies it to the discharge bulbs in order to illuminate them.
- A fail-safe function is provided as a countermeasure against the high voltage that is generated in case a problem occurs in the headlight system.

#### ► System Diagram ◀



01YBE12P

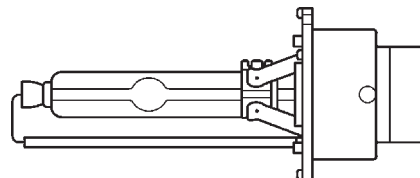
## 2. Layout of Main Components



026BE07TE

## 3. Discharge Bulb

Instead of the filament contained in an incandescent bulb, a discharge bulb contains an arc tube, which is filled with xenon gas, and metal halide.



240BE29

#### 4. Fail-Safe Function

The light control ECU executes the fail-safe actions listed below in accordance with the problem that has been detected.

Problem	Outline
Detection of Abnormal Input Voltage	If the voltage that is input to the light control ECU deviates from the normal operating voltage (9 – 16 volts), the light control ECU stops illuminating the headlights. It resumes illuminating the headlights once the voltage reverts to the operating voltage range. However, if the input voltage decreases after the headlights have illuminated, the headlights will remain illuminated until the input voltage is insufficient to light the bulbs.
Detection of Abnormal Output (Open Circuit or Short Circuit) or Flashing Bulb	If an abnormal condition (open or short) occurs in the voltage that is output by the light control ECU, or if the bulb flashes, the light control ECU stops illuminating the headlights and maintains this state until the power is reinstated. Power is reinstated by turning the headlight control switch from OFF to ON.
Detection of Bulb Open	If a bulb is not inserted in its socket, the light control ECU stops generating a high voltage until a bulb is inserted correctly and the power is reinstated. The power is reinstated by turning the headlight control switch from OFF to ON or turning the ignition switch from OFF to ON.

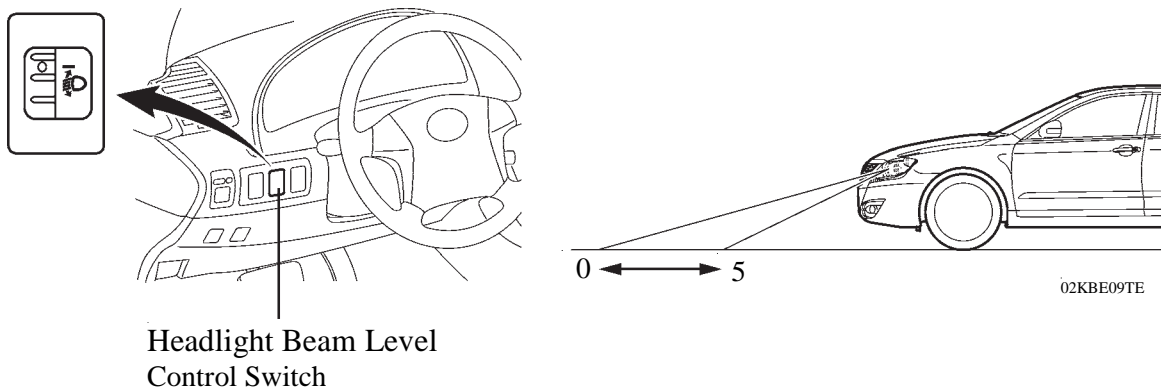
#### 5. Precautions for HID Headlight System

- When the HID headlights illuminate, a high voltage (approximately 20,000V) is applied momentarily to the bulb sockets, which could lead to a serious accident. Never connect the tester to the high voltage socket of the HID headlights for measurement, as this may lead to a serious accident because of the high voltage.
- Whenever inspecting the HID headlight system, make sure that no water or rain is present in order to prevent electric shocks, the light control switch is OFF, the battery terminal is removed, and the connector of the light control ECU is disconnected.
- Whenever operating the HID headlights, make sure it is only after assembly has been completed and never operate them without bulbs installed.
- Do not operate the HID headlights using any power source other than the vehicle's.
- When there is a defect in a HID headlight or any shock has been applied to it, replace the bulb with a new one.
- A discharge bulb reaches a high temperature when it is illuminated. For this reason, the life of the bulb could be shortened if any oil comes in contact with the glass portion of the bulb. Do not touch the glass portion of a bulb with bare hands.

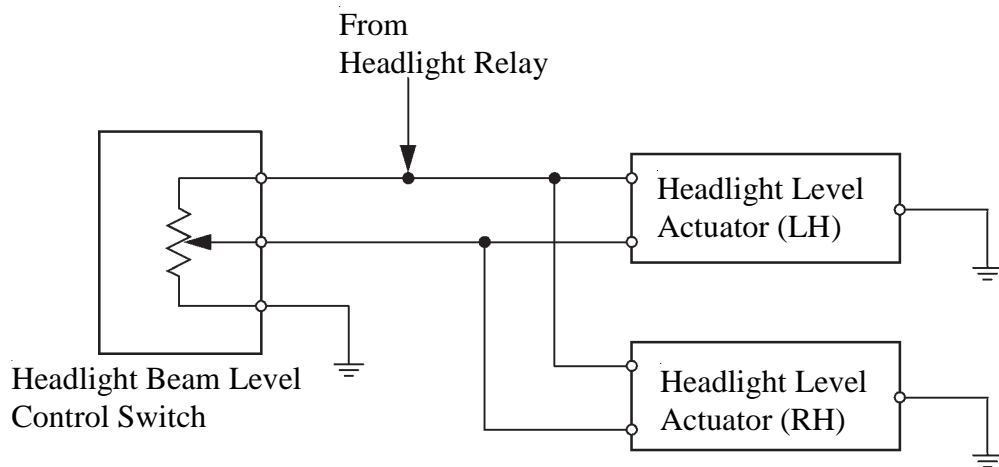
## ☀ HEADLIGHT BEAM LEVEL CONTROL SYSTEM

### 1. Manual Headlight Beam Level Control

When the vehicle posture changes due to the number (weight) of passengers and volume of luggage, this system enables the driver to manually adjust the headlight beam level (in 5-steps) to the appropriate level by using the headlight beam level control switch. The beam level of the headlights can be adjusted with the actuators that are integrated into the headlight units.



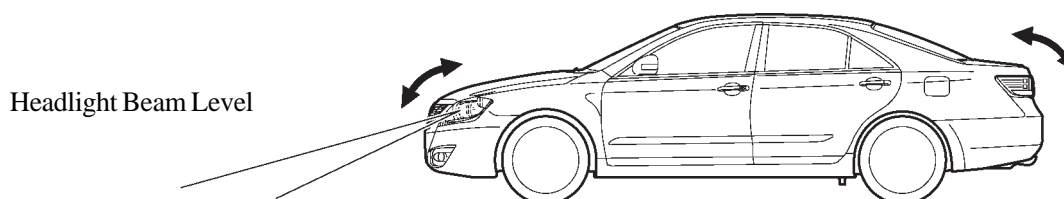
### ▸ Wiring Diagram ◀



## 2. Automatic Headlight Beam Level Control

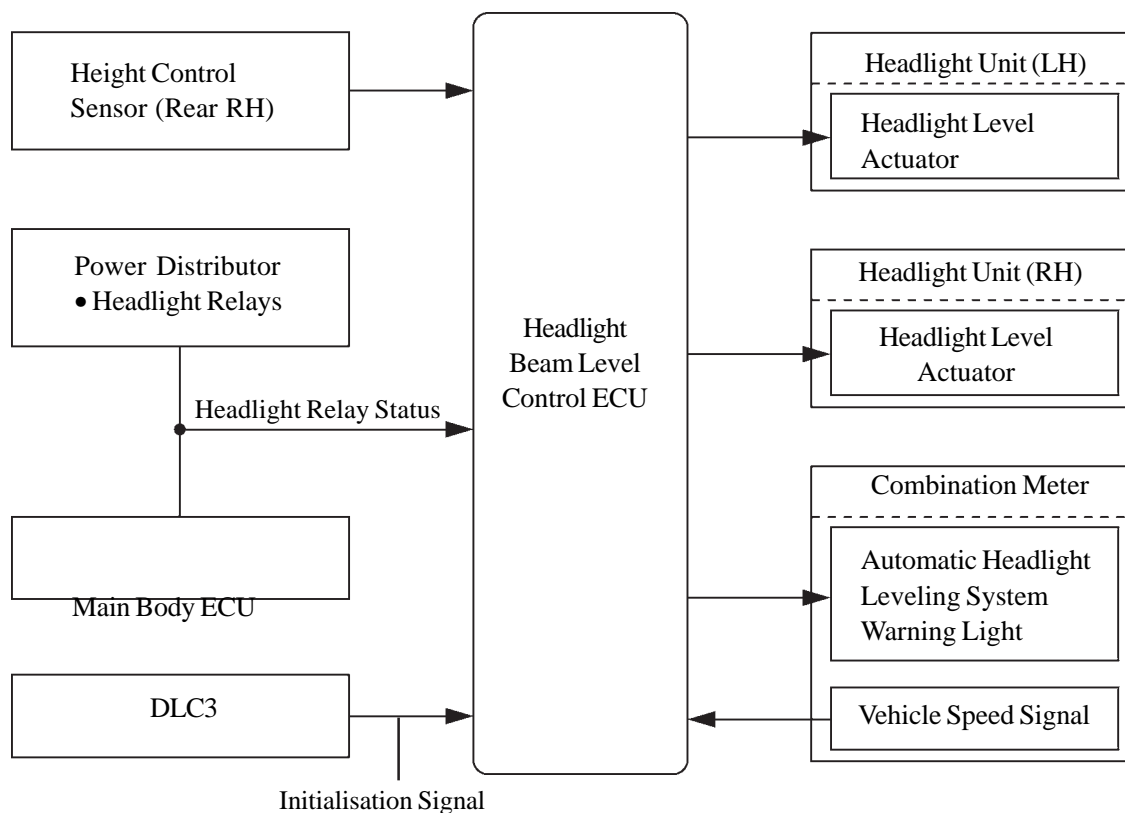
### General

- The automatic headlight beam level control system, which is controlled by the Headlight Beam Level Control ECU.
- When the vehicle is stationary and the headlights are on, the automatic headlight beam level control system operates the headlight level actuator in accordance with the amount of variation in the vehicle posture.
- The automatic headlight beam level control system mainly consists of the Headlight Beam Level Control ECU, rear height control sensor, and two headlight level actuators.
- The Headlight Beam Level Control ECU calculates changes in the vehicle posture based on signals from the height control sensor (rear RH) and each ECU.
- The ECU then controls the headlight level actuator based on this information, in order to change the headlight reflector angle.



02KBE10TE

### System Diagram

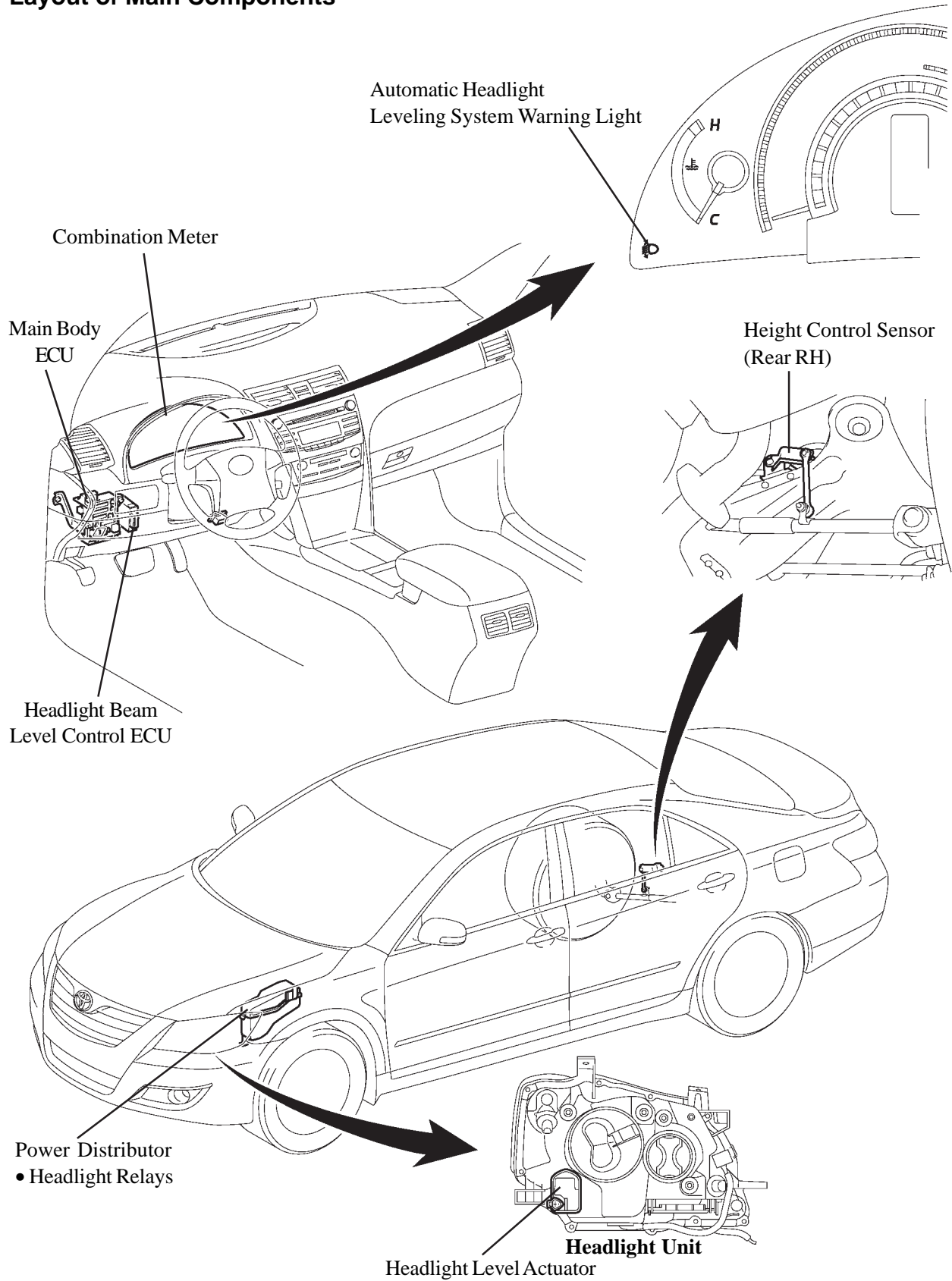


026BE10P

### Service Tip

If the headlight beam level control ECU is replaced, or the rear height control sensor is removed, the headlight beam level control ECU must be initialised.  
For details, see the Aurion Repair Manual.

## Layout of Main Components



02KBE11TE



## Function of Main Components

Components		Function and Construction
Headlight Beam Level Control ECU		<ul style="list-style-type: none"> <li>Based on the signals that are transmitted by the height control sensor, this ECU detects the amount of variation in the vehicle posture.</li> <li>Based on the detected value, this ECU outputs a control signal to the headlight level actuator.</li> <li>When the ECU detects a malfunction, it outputs a warning display request signal to the combination meter (meter ECU).</li> <li>This ECU provides a fail-safe function.</li> </ul>
Headlight Unit	Headlight Level Actuator	<ul style="list-style-type: none"> <li>Based on the signals received from the headlight beam level control ECU, the headlight level actuators move the reflectors in the headlights to vary their beams.</li> <li>These actuators use DC motors and precisely regulate the angles of the reflectors.</li> </ul>
Height Control Sensor (Rear RH)		The height control sensor detects the amount of variation in the vehicle height, and outputs this information in the form of a signal to the headlight beam level control ECU.
Combination Meter		<ul style="list-style-type: none"> <li>Outputs the vehicle speed signal to the headlight beam level control ECU.</li> <li>If the system malfunctions, the combination meter (meter ECU) illuminates the automatic headlight levelling system warning light to alert the driver.</li> </ul>

## Fail-Safe

When any of the malfunctions below are detected, the headlight beam level control ECU stops transmitting output signals to the headlight level actuator, suspends headlight level control, and transmits a warning display request signal to the combination meter. On receiving this signal, the combination meter illuminates the automatic headlight levelling system warning light to alert the driver.

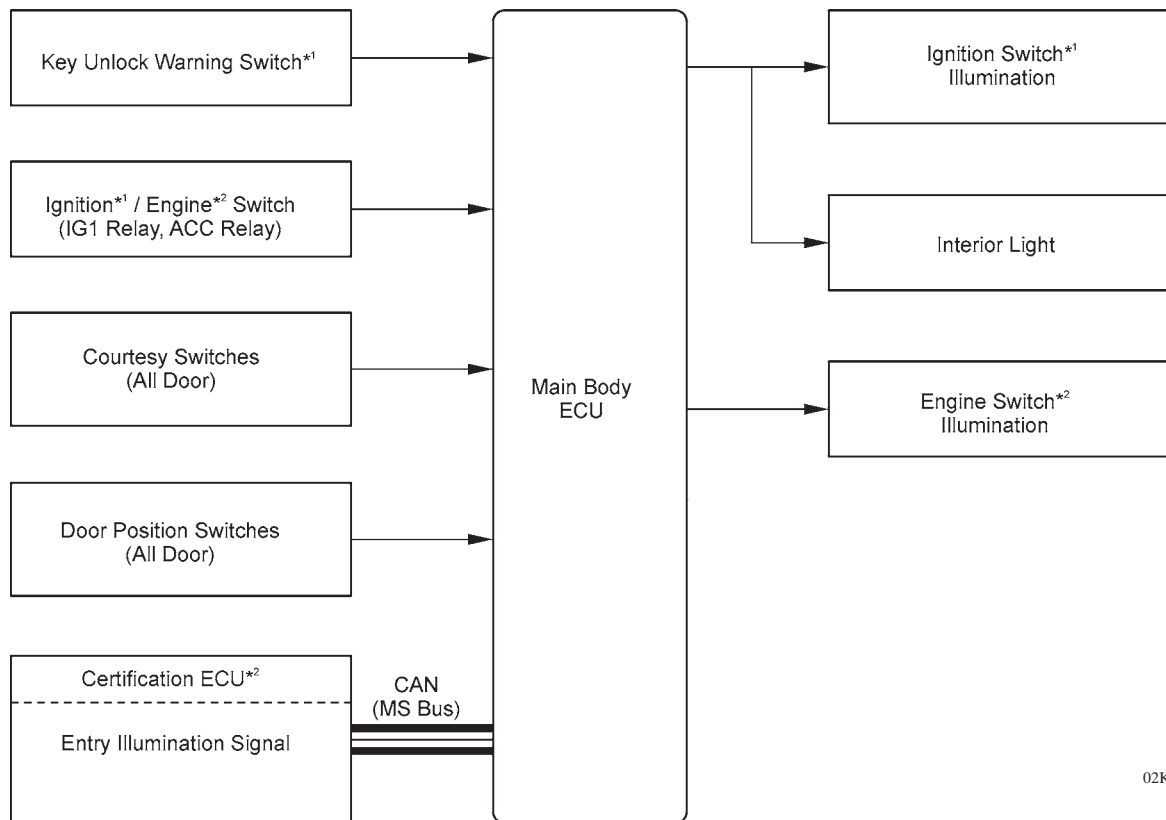
Item	Abnormality Detection Condition	Automatic Headlight Levelling System Warning Light
Height Control Sensor	<ul style="list-style-type: none"> <li>Abnormal height control sensor power source voltage (4.6 V or less)</li> <li>Abnormal height control sensor signal voltage (0.25 V or less, or 4.75 V or more)</li> </ul>	ON
Power Source Voltage	Abnormal headlight beam level control ECU power source voltage (18.5 V or more, or 9 V or less)	OFF
Vehicle Speed	Excessive vehicle speed detected	OFF
ECU Reset During Driving	Headlight beam level control ECU reset while vehicle running (For example, headlight beam level control ECU power source circuit open momentarily)	OFF

## ✱ ILLUMINATED ENTRY SYSTEM

### 1. General

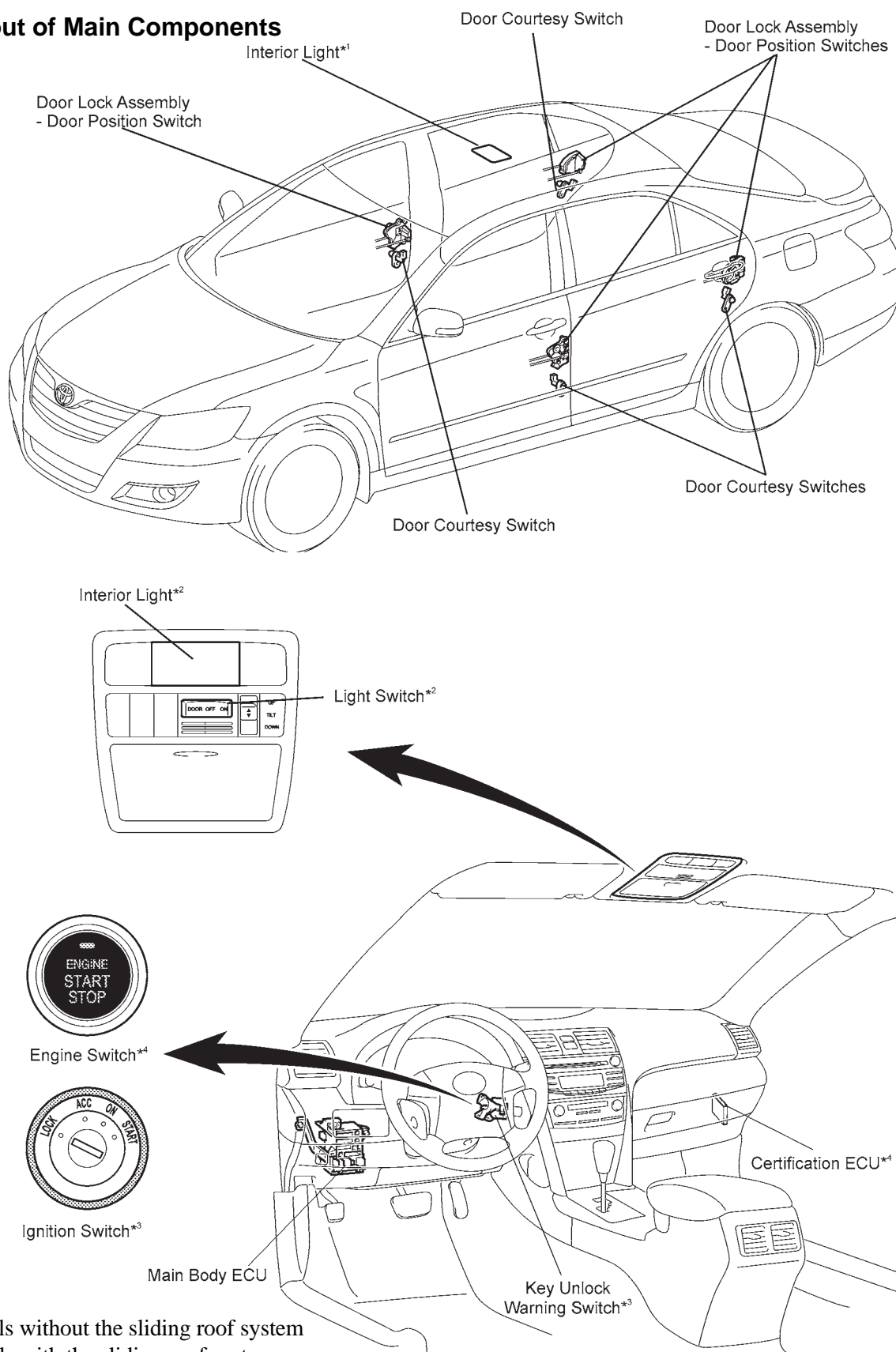
- The illuminated entry system of the Aurion controls 2 kinds of light: interior light and ignition switch.
- The interior light is operated when the light switch is in the DOOR position.

#### ► System Diagram ◀



02KBE18Y

## 2. Layout of Main Components



\*1: Models without the sliding roof system

\*2: Models with the sliding roof system

\*3: Models without smart entry and start system

\*4: Models with smart entry and start system

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02KBE19TE

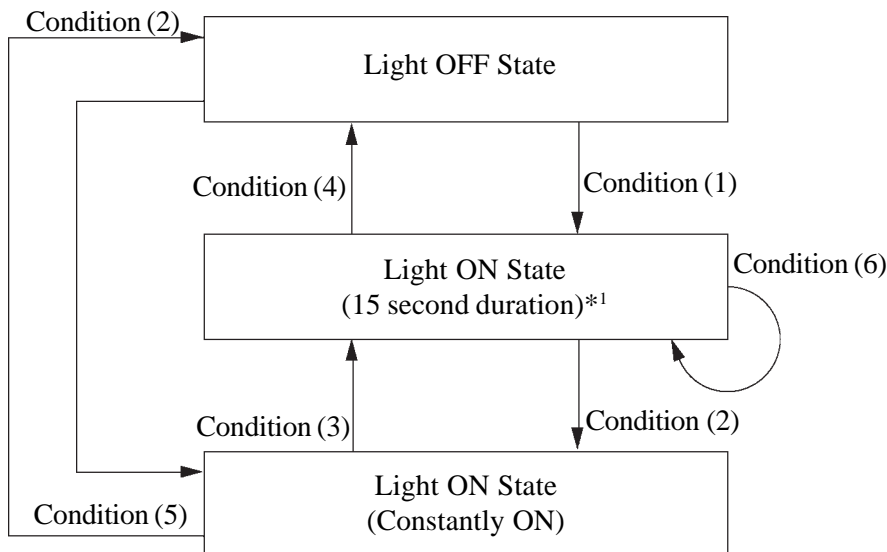
LHD

### 3. Interior Light Control

- The interior light control (interior light and ignition switch illumination<sup>\*1</sup>/engine switch illumination<sup>\*2</sup>) consists primarily of the fade-in/fade-out function and timer illumination function.
- The interior light control activates as described in the diagram below when one of items is in the respective state.
- This control is controlled by the main body ECU.

<sup>\*1</sup>: Models without the smart entry and start system

<sup>\*2</sup>: Models with the smart entry and start system



02KBE128Y

Condition	Item
Condition (1)	<ul style="list-style-type: none"> <li>• With power source<sup>*2</sup> OFF and all doors closed, any door is unlocked.</li> <li>• With all doors closed, power source<sup>*2</sup> is changed from ACC to OFF.</li> <li>• With power source OFF and all doors closed, key enters any actuation area around the doors. (Only for models with smart entry and start system)</li> </ul>
Condition (2)	<ul style="list-style-type: none"> <li>• Any door is open.</li> </ul>
Condition (3)	<ul style="list-style-type: none"> <li>• With power source<sup>*2</sup> OFF and all doors are closed, any door is unlocked.</li> </ul>
Condition (4)	<ul style="list-style-type: none"> <li>• Power source<sup>*2</sup> is ACC or ON.</li> <li>• More than 15 seconds have elapsed since the Light ON State (15 second duration)<sup>*1</sup>.</li> <li>• With power source<sup>*2</sup> OFF and all doors closed, all doors are locked.</li> </ul>
Condition (5)	<ul style="list-style-type: none"> <li>• With power source<sup>*2</sup> ACC or ON, all doors are closed or locked.</li> </ul>
Condition (6)	<ul style="list-style-type: none"> <li>• With power source OFF and all doors closed, key enters any actuation area around the doors. (Only for models with smart entry and start system)</li> <li>• With power source<sup>*2</sup> OFF and all doors locked, any door is unlocked.</li> </ul>

<sup>\*1</sup>: The function setting can be changed using the customised body electronics system. For details, refer to Customised Body Electronics System section on page BE-11.

<sup>\*2</sup>: The power source condition can be changed by operating the engine switch on models with the smart entry and start system, and the ignition switch on models without the smart entry and start system.

#### **4. Battery Saving Control**

When the following two conditions have been met, battery saving control turns off the lights illuminated by the illuminated entry controls. Battery saving control is controlled by the main body ECU.

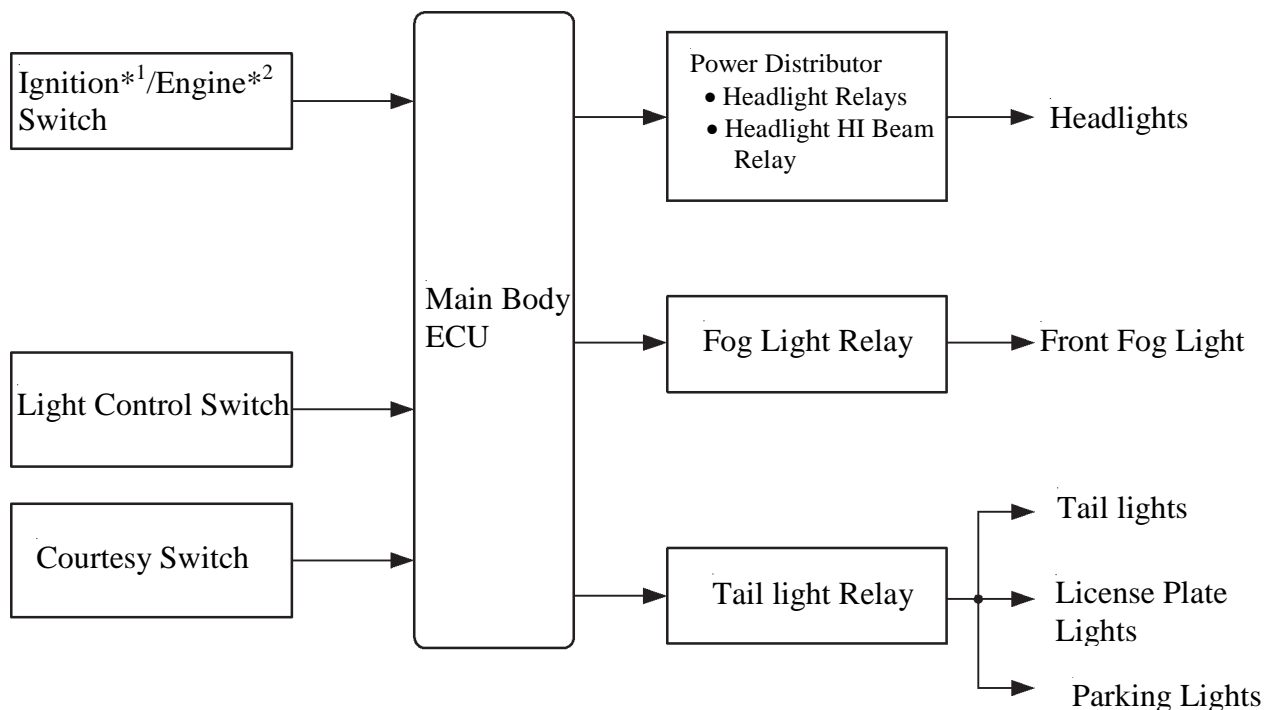
- The power source is OFF (models with smart entry and start system), or the ignition key is not in the ignition key cylinder (models without smart entry and start system).
- There is no change in the condition of the doors for 20 minutes.

## LIGHT TURN-OFF SYSTEM

- The light turn-off system is used to prevent the driver from leaving the vehicle with the headlights, fog lights, parking lights, taillights, or license plate lights on.
- When all of the following conditions are met, the exterior lights turn off.
  - Power source\* changes from IG-ON to OFF or ACC.
  - The light control switch is in any position except OFF.
  - The fog light switch is ON(Only for models with fog lights).
  - The driver's door is opened after the being closed.

\*: The power source condition can be changed by operating the engine switch on models with the smart entry and start system, and the ignition switch on models without the smart entry and start system.

### System Diagram



\*1: Models without the smart entry and start system

\*2: Models with the smart entry and start system

01ZBE13Pb

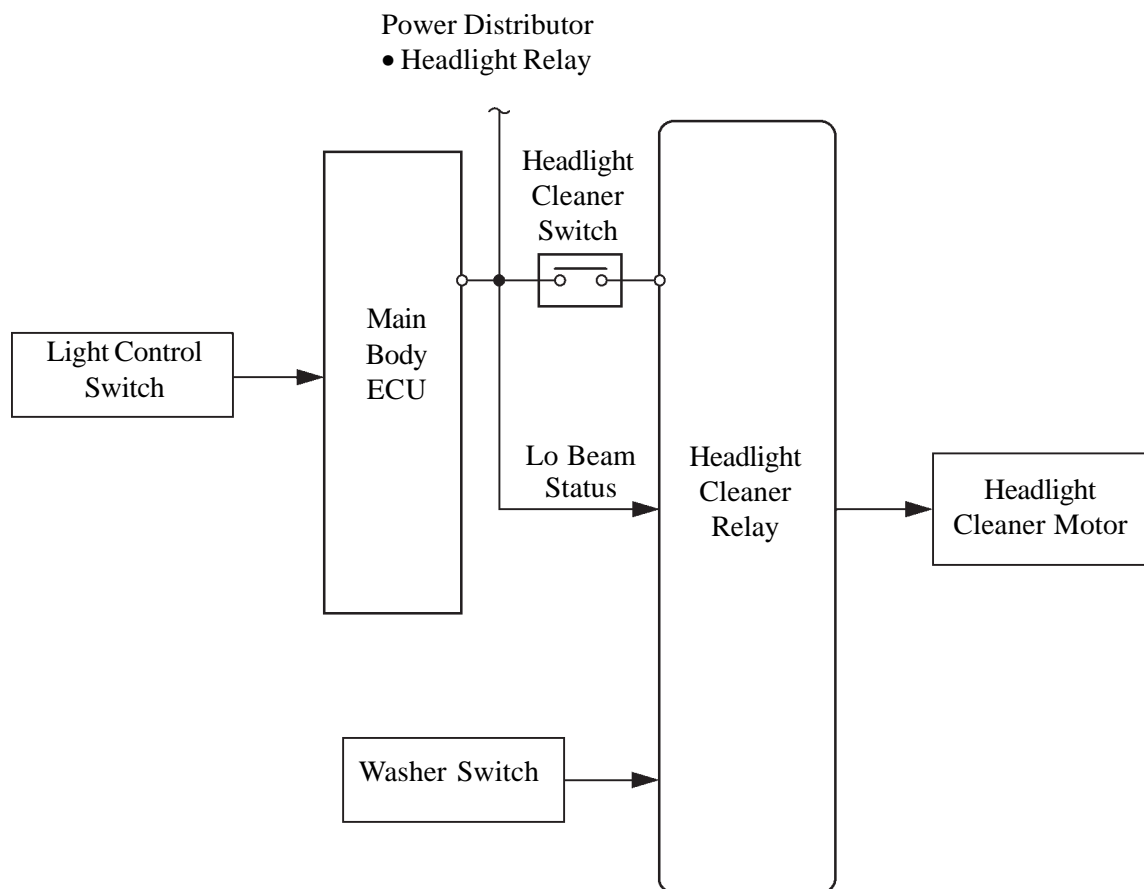
## ✿ HEADLIGHT CLEANER SYSTEM

### 1. General

- The headlight cleaner system sprays washer fluid onto the headlight lenses to clean them.
- The headlight cleaner relay controls this system.
- The headlight cleaner system operates as follows:

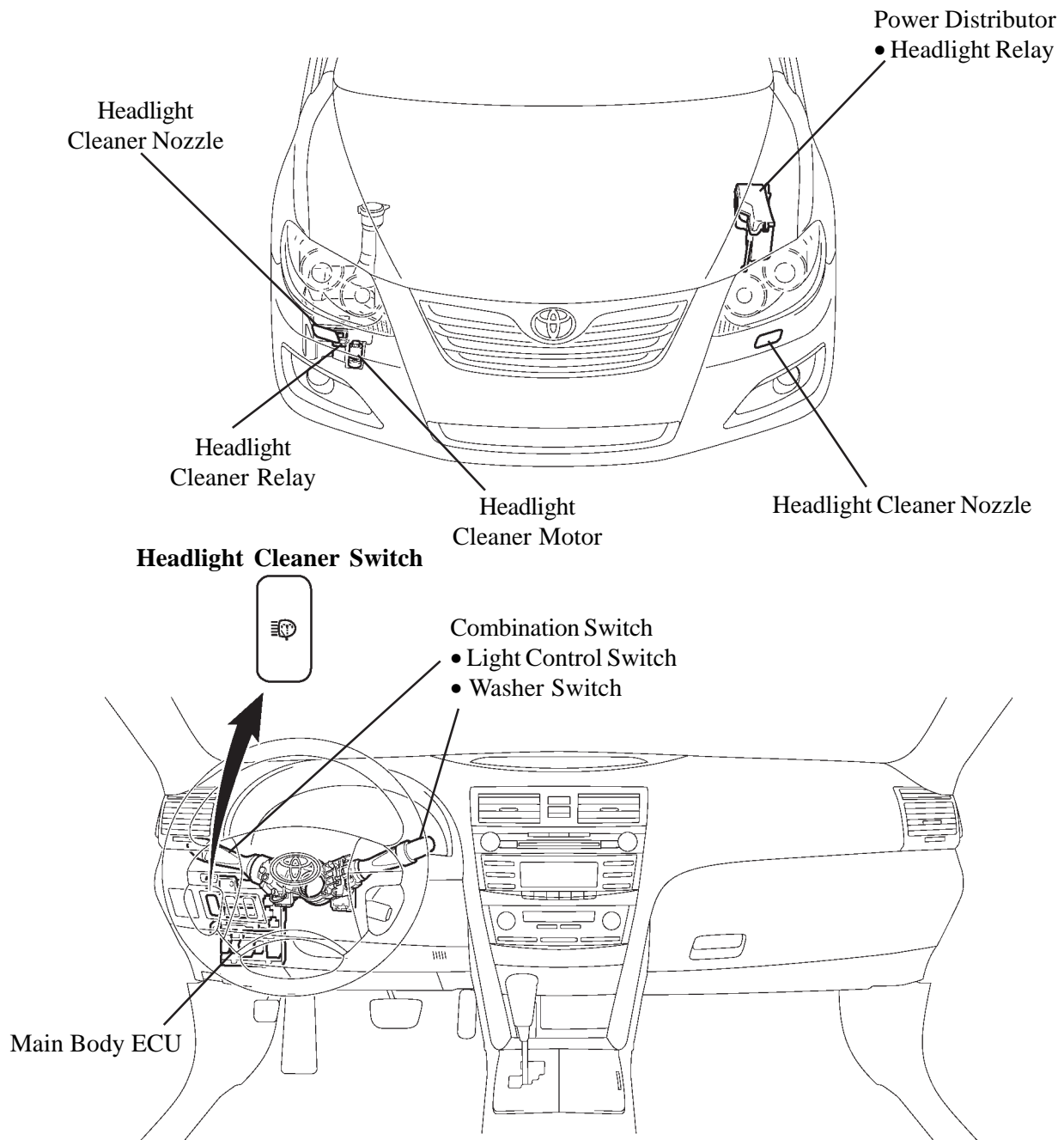
Headlight Lo Beam	Headlight Cleaner Switch	Washer Switch	
	ON	ON (First Time)	ON (Second Time or more)
Turn ON	Activated	Activated	Not Activated
Turn OFF	Activated	Not Activated	Not Activated

### ► System Diagram ◀



026BE14P

## 2. Layout of Main Components



02KBE20TE



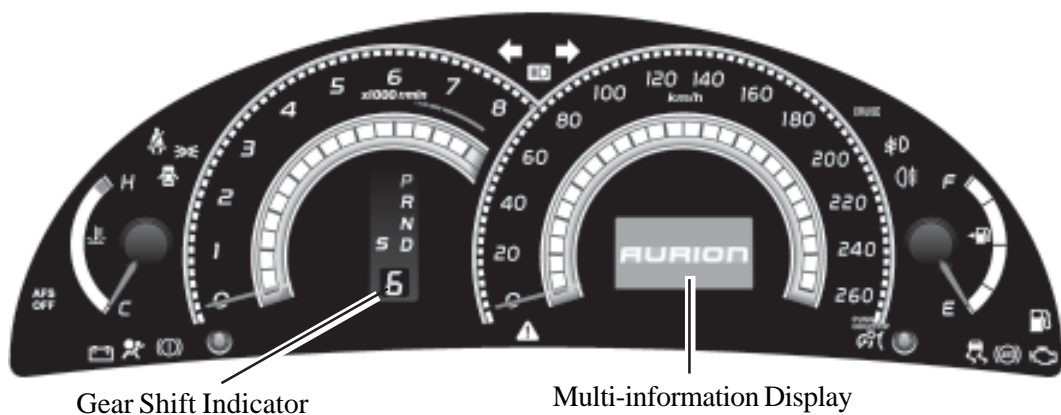
## METER

### ☼ COMBINATION METER

#### 1. General

- An optitron display type combination meter is used as standard on Grande.
- An analog type combination meter is used on Touring grade.
- A meter ECU and buzzer are enclosed in the combination meter. This ECU maintains communication with other ECUs through the CAN (Controller Area Network).
- Illumination control, which turns on the combination meter illumination at different time intervals when the power source\* is switched to IG-ON, has been provided.
- A step-motor type movement is used to actuate the indicators of the speedometer, the fuel gauge, the engine coolant temperature gauge and the tachometer.

\*: The power source condition can be changed by operating the engine switch on models with the smart key system, and the ignition switch on models without the smart key system.



02KBE21Y

Gear Shift Indicator

Multi-information Display

for Grande



AT-X Dasha

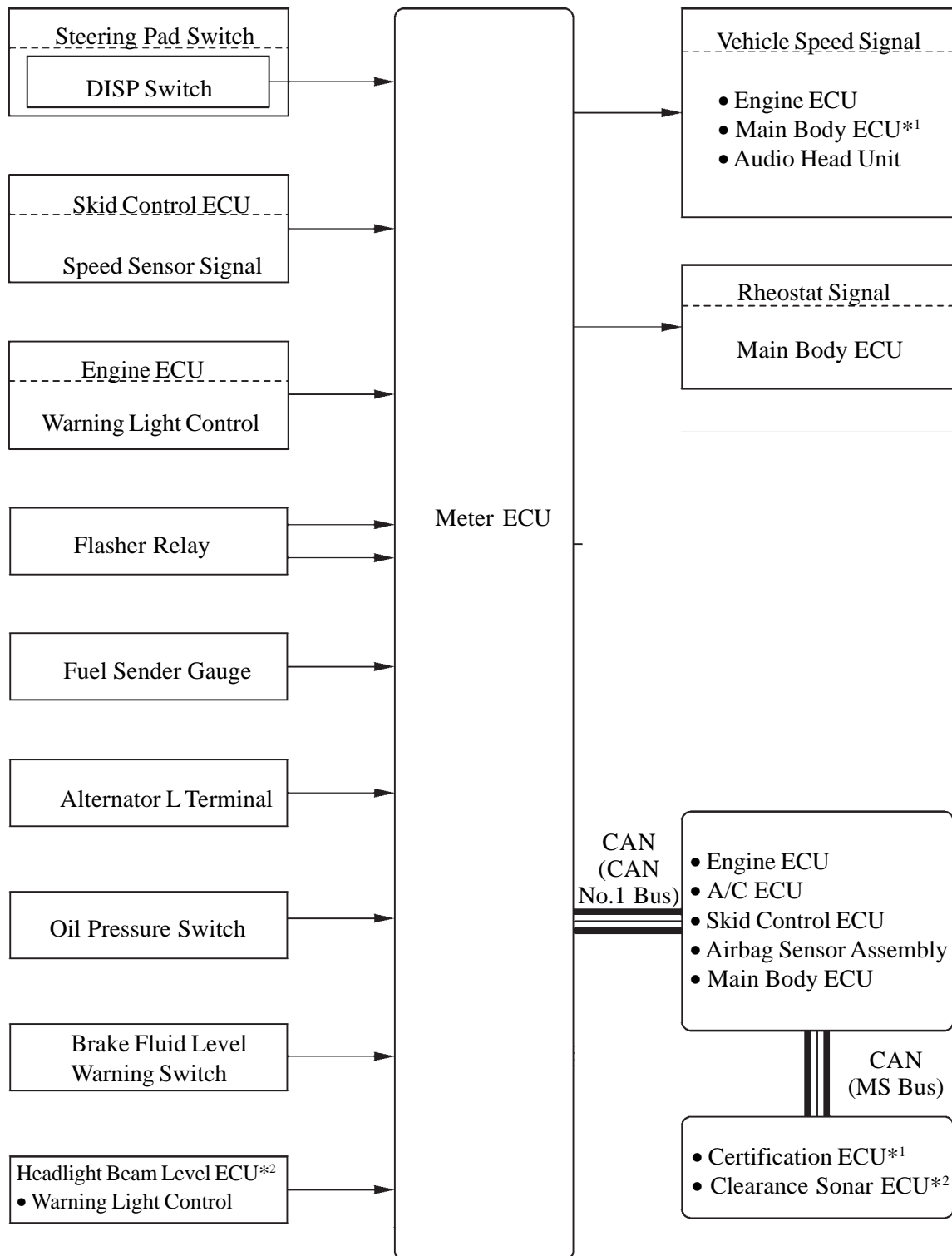
Gear Shift Indicator

for Touring

#### Service Tip

If the LEDs malfunction, the entire combination meter assembly must be replaced. Refer to the Aurion Repair Manual.

## 2. System Diagram



02KBE23Y

\*<sup>1</sup>: Only for models with the smart entry and start system.

\*<sup>2</sup>: for Grande

► Input and output communication signals of the meter ECU ◀

Protocol	ECU	Input Signal to meter ECU	Output Signal from meter ECU
CAN (CAN No.1 Bus)	Engine ECU	<ul style="list-style-type: none"> <li>• Engine speed</li> <li>• Engine coolant temperature</li> <li>• Fuel injection volume</li> <li>• Starter condition</li> <li>• Shift position</li> <li>• S mode indicator</li> <li>• Current range position</li> <li>• Buzzer sounding request</li> <li>• Indicator light control</li> <li>• Diagnosis (Cruise)</li> <li>• Engine type information</li> </ul>	-
	A/C ECU	Outside temperature	Vehicle speed
	Airbag Sensor Assembly	<ul style="list-style-type: none"> <li>• Warning light control</li> <li>• Seat belt remainder control (D)</li> <li>• Diagnosis</li> </ul>	Vehicle speed
	Skid Control ECU	<ul style="list-style-type: none"> <li>• Warning light control</li> <li>• Indicator light control</li> <li>• Vehicle Speed</li> <li>• Diagnosis</li> </ul>	-
	Main Body ECU	<ul style="list-style-type: none"> <li>• Lighting status</li> <li>• Parking brake switch</li> <li>• Courtesy switch</li> <li>• Buzzer sounding request</li> <li>• Auto dimmer signal</li> <li>• Unlock Warning Switch</li> <li>• Warning display control</li> <li>• Diagnosis</li> </ul>	Vehicle Speed
CAN (MS Bus)	Certification ECU* <sup>1</sup>	<ul style="list-style-type: none"> <li>• Warning display control</li> <li>• Buzzer sounding request</li> </ul>	-
	Clearance Sonar ECU* <sup>2</sup>	<ul style="list-style-type: none"> <li>• Warning display control</li> </ul>	Vehicle speed

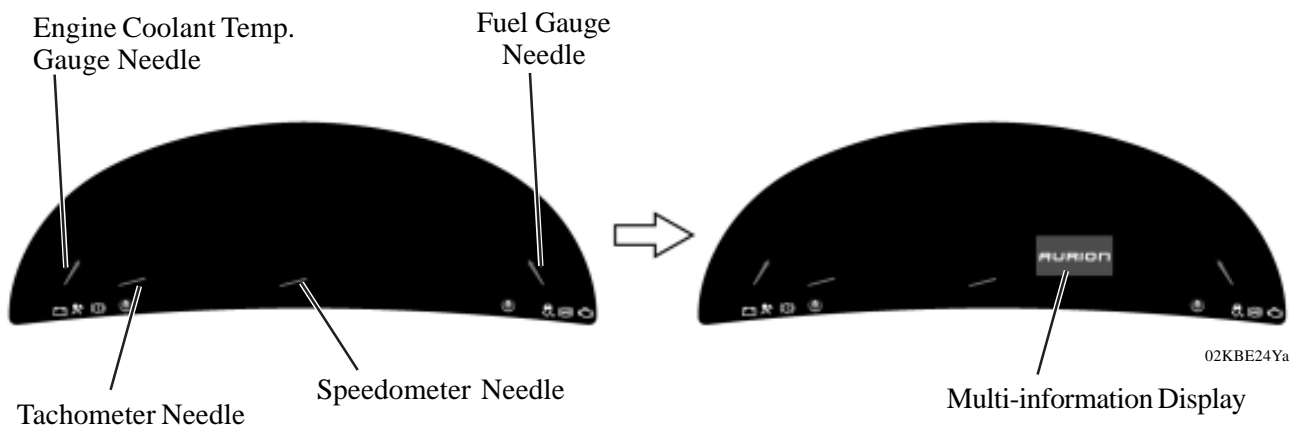
\*1: With Smart Entry and Start System.

\*2: for Grande

### 3. Illumination Control

- When the power source is switched to IG-ON, the illumination control operates as follows (1, 2). However, all illuminations turn off while the engine is cranked.
- When the power source is switched to OFF, the illumination control is as follows (3).

1) The needles of the speedometer, tachometer, fuel gauge and engine coolant temperature gauge are illuminated and “Aurion” appears on the multi-information display.



2) After the multi-information display illuminates, the meter illumination gradually fades in.



3) All illuminations other than the multi-information display go off, and “Aurion” appears on the multi-information display. Then the “Aurion” disappears and the multi-information display turns off.



#### 4. Multi-information Display (Excluding Touring)

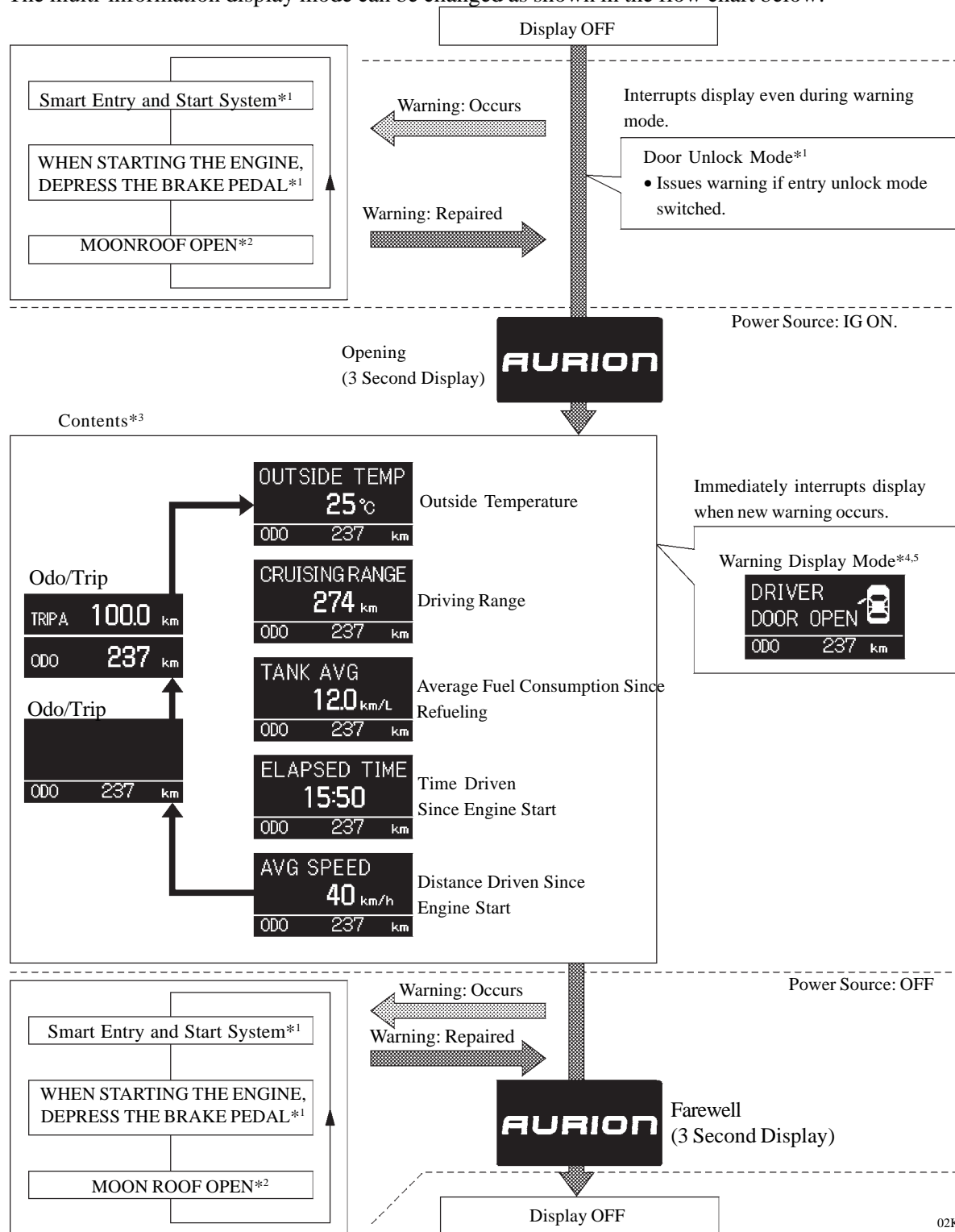
##### General

- The multi-information display has three modes:

Mode	Outline
Cruise Information (See page BE-38)	<ul style="list-style-type: none"><li>• Five types of information can be displayed.</li><li>• The display can be switched by using the DISP switch.</li><li>• Optitron display type combination meter: outside temperature, driving range, average fuel consumption since refueling, time driven since engine start, and average speed since engine start.</li></ul>
Warning (See page BE-39)	Interrupts the multi-information display immediately when a warning occurs.
Diagnosis (See page CH-89)	DTC (Diagnostic Trouble Code) for the brake control system (TRC and VSC) can be displayed.

## Flow of The Multi-information Display Indication

The multi-information display mode can be changed as shown in the flow chart below:



02KBE27TE

\*1: Only for models with the smart entry and start system

\*2: Only for models with the sliding roof system

\*3: The first screen to be displayed is the same as that displayed when the power source was last turned OFF.

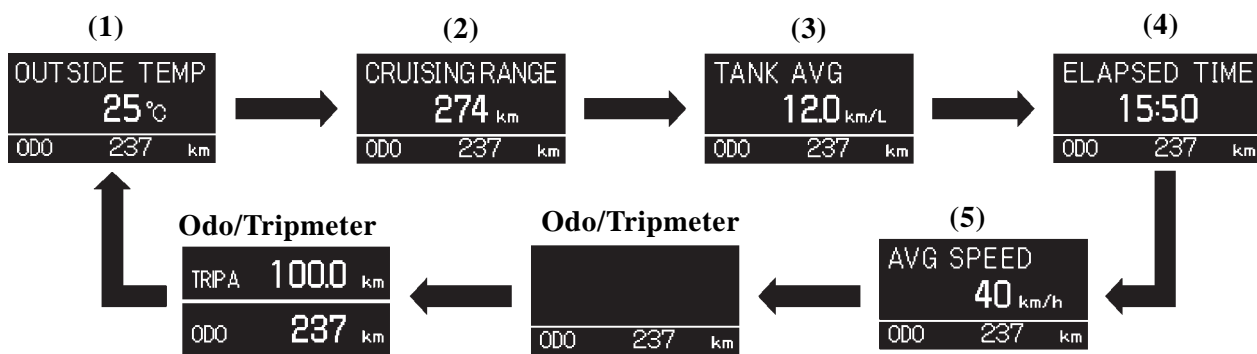
\*4: If multiple new warnings occur, they are automatically displayed at 2 second intervals.

\*5: If the display is changed from warning display mode to another mode, it automatically returns to warning display mode after 6 seconds.

## Cruise Information Mode

The cruise information is displayed in the following order, changing each time the DISP switch is pressed. However, pressing the DISP switch for approximately 1 second or more changes the display to the outside temperature indication.

### ► Models with the Multi-information Display Type Combination Meter ◀


























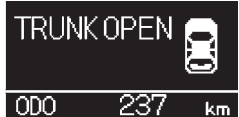


02KBE28TE

Information	Outline
(1)	Displays the outside temperature in accordance with the outside temperature sensor signal from the A/C ECU.
(2)	<ul style="list-style-type: none"> <li>Displays the range, calculated by the combination meter which continuously monitors and stores fuel consumption data and the residual fuel volume when IG-ON has been selected.</li> <li>Updated every 1 seconds.</li> </ul>
(3)	<ul style="list-style-type: none"> <li>Displays the value calculated by the combination meter based on the distance driven since refuelling and the fuel consumption volume, which is calculated from the fuel injection signals from the No.1 injector.</li> <li>The combination meter determines the vehicle has been refuelled through the signal from the fuel sender gauge.</li> <li>Updated every 10 seconds.</li> </ul>
(4)	<ul style="list-style-type: none"> <li>Displays the length of time has elapsed since engine start.</li> <li>Updated every 60 seconds.</li> </ul>
(5)	<ul style="list-style-type: none"> <li>Displays the average speed calculated by the combination meter based on the length of time and the distance driven since engine start.</li> <li>Updated every 10 seconds.</li> </ul>






## Warning Mode

### General

- When a warning is necessary, the warning display interrupts the multi-information display.
- The master warning light may illuminate or flash and the buzzer may sound depending on the item in the multi-information display.

Warning	Detail	Warning	Detail
  : Flash Buzzer: Sound 025BE19P	The key is not inside the vehicle. (On models with smart entry and start system)	  : Flash Buzzer: Sound 025BE20P	The driver door is opened with the shift lever in any position other than P. (On models with smart entry and start system)
  : Flash 025BE21P	Steering lock has not been released. (On models with smart entry and start system)	  : Flash 025BE22P	Steering lock is malfunctioning. (On models with smart entry and start system)
 Buzzer: Sound 025BE23P	The power source is switched from OFF to ACC twice with the brake pedal released. (On models with smart entry and start system)	  : Illuminate Buzzer: Sound 025BE24P	TRC and VSC are malfunctioning.
  : Flash Buzzer: Sound 025BE25P	Key battery is low. (On models with smart entry and start system)	  : Flash Buzzer: Sound 025BE26P	Parking brake is still engaged with the vehicle having reached a speed of 5 km/h.
     : Flash*  : Illuminate Buzzer: Sound* 025BE27P	Any door is open. *: The vehicle having reached a speed of 5 km/h.	  : Flash* Buzzer: Sound* 02KBE112TE	Engine hood is open. *: The vehicle having reached a speed of 5 km/h.
		  : Flash*  : Illuminate Buzzer: Sound* 02HBE84TE	Luggage compartment door is open. *: The vehicle having reached a speed of 5 km/h.



Warning	Detail	Warning	Detail
 <p>! : Flash Buzzer: Sound 025BE30P</p>	Engine oil pressure is low.	 <p>! : Flash Buzzer: Sound 025BE31P</p>	Engine coolant temperature is high.
 <p>Displayed for 8 sec. ! : Flash Buzzer: Sound 025BE33P</p>	The sliding roof is open and the driver door is open. (On models with sliding roof system)	 <p>! : Illuminate Buzzer: Sound 02KBE117TE</p>	Toyota parking assist is dirty or covered with ice.
 <p>! : Illuminate Buzzer: Sound 02KBE116TE</p>	Toyota parking assist is malfunctioning.		

## 4. Buzzer

### General

The table below shows the warning and reminder functions of the buzzer.

Function	Item
Warning	<ul style="list-style-type: none"><li>• Multi-information Display Warning Mode Indication (See page BE-39)</li><li>• Shift Down Warning (See page CH-38)</li></ul>
Reminder	<ul style="list-style-type: none"><li>• Key Reminder (See page BE-115)</li><li>• Seat Belt Reminder (See page BE-142)</li></ul>

## AIR CONDITIONER

### ✱ DESCRIPTION

- A manual air conditioner or automatic air conditioner using left/right independent temperature control and neural network is available as standard on the Aurion. The type of air conditioner available varies depending on the destination and model. For details, see the equipment list in Model Outline (page MO-27).
- The air conditioner has the following features:

Features	Outline	Automatic A/C	Manual A/C
High Performance	Neural network control is used so passengers can control the air conditioner accurately for maximum comfort.	○	—
	FACE mode for the rear seat is installed to blow warm air and ensure excellent heating performance.	○	○
	An Air Conditioner Filter is used.	○	○
	The blower control has seven levels for precise control.	○	○
Lightweight	A BUS connector with a built-in IC is used in a lightweight wire harness design with a reduced number of wires. The use of this connector means that pulse pattern type servo motors are used.	○	○
Compact	A blower motor with a built-in blower motor controller is used in a compact construction.	○	○
Others	The following parts are used to ensure high cooling performance while realising a compact and lightweight construction. <ul style="list-style-type: none"> <li>• Semi-centre Location A/C Unit</li> <li>• RS (Revolutionary super-slim Structure) Evaporator</li> <li>• SFA (Straight Flow Aluminium)-II Heater Core</li> <li>• MF (Multi-Flow)-IV Sub-cool Condenser</li> <li>• Continuously Variable Capacity Type Compressor with magnetic clutch.</li> </ul>	○	○

## PERFORMANCE AND SPECIFICATION

### 1. Performance

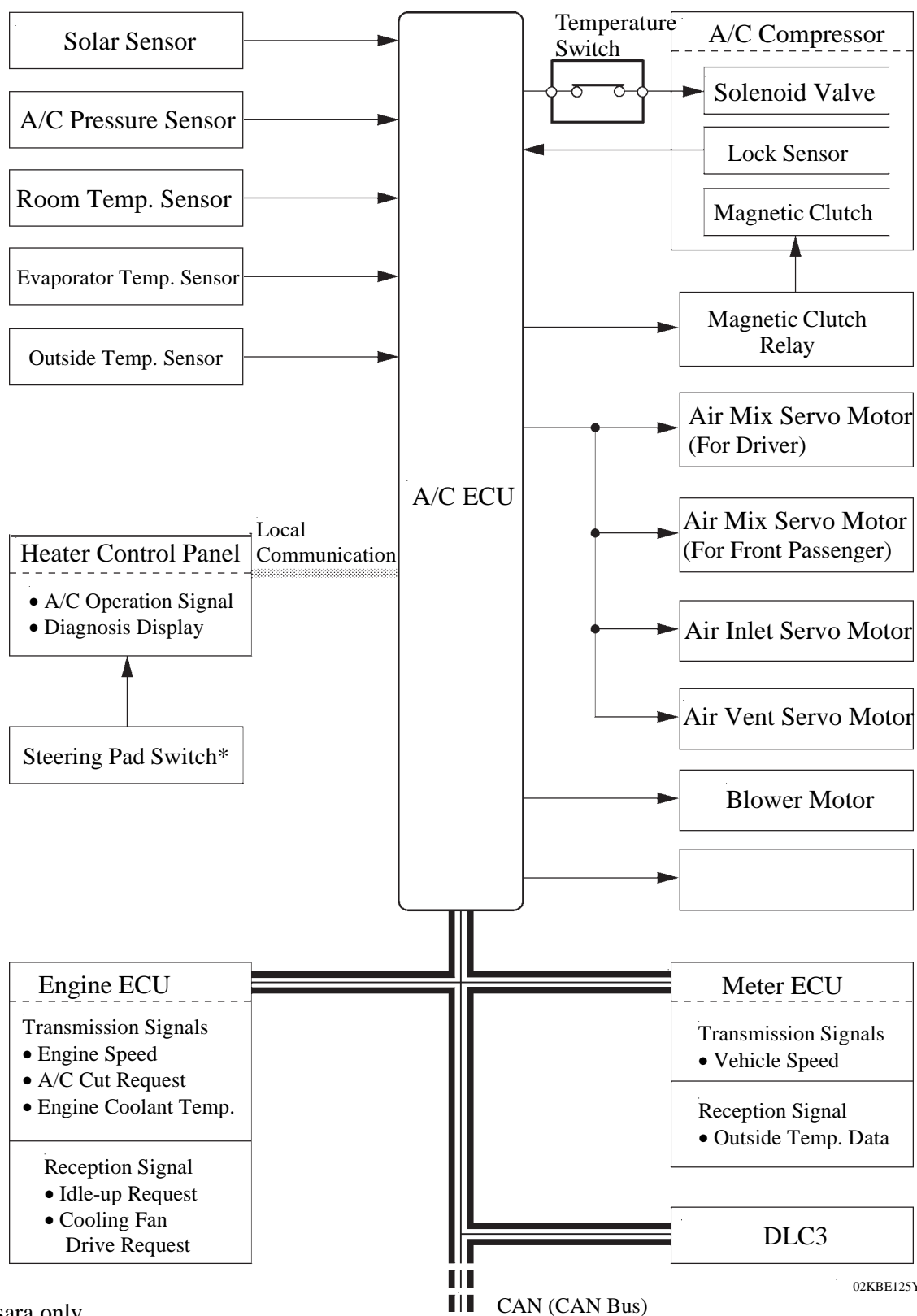
			Aurion (GSV40)
Heater	Heat Output	W	6000
	Air Flow Volume	m <sup>3</sup> /h	360
	Power Consumption	W	Maximum 210
Air Conditioner	Cooling Capacity	W	6100
	Air Flow Volume	m <sup>3</sup> /h	←
	Power Consumption	W	←

### 2. Specifications

			Aurion (GSV40)
Ventilation and Heater Core	Heater Core	Type	SFA (Straight Flow Aluminium) -II
		Size W×H×L mm	201.5 × 150 × 27
		Fin Pitch mm	1.5
	Blower	Motor Type	K70 BMM
		Fan Type	Semi Sirocco
		Fan Size Dia.×H mm	165 × 70
Air Conditioner	Condenser	Type	MF (Multi-Flow) -IV
		Size W×H×L mm	720 × 370.2 × 16
		Fin Pitch mm	3.15
	Evaporator	Type	RS (Revolutionary super-slim Structure)
		Size W×H×L mm	266.3 × 251 × 38
		Fin Pitch mm	2.6
	Compressor	Type	6SBU16
		Pulley	Magnetic Clutch
	Refrigerant	Type	←
		Charge Volume g	500 ±50

## \* SYSTEM DIAGRAM

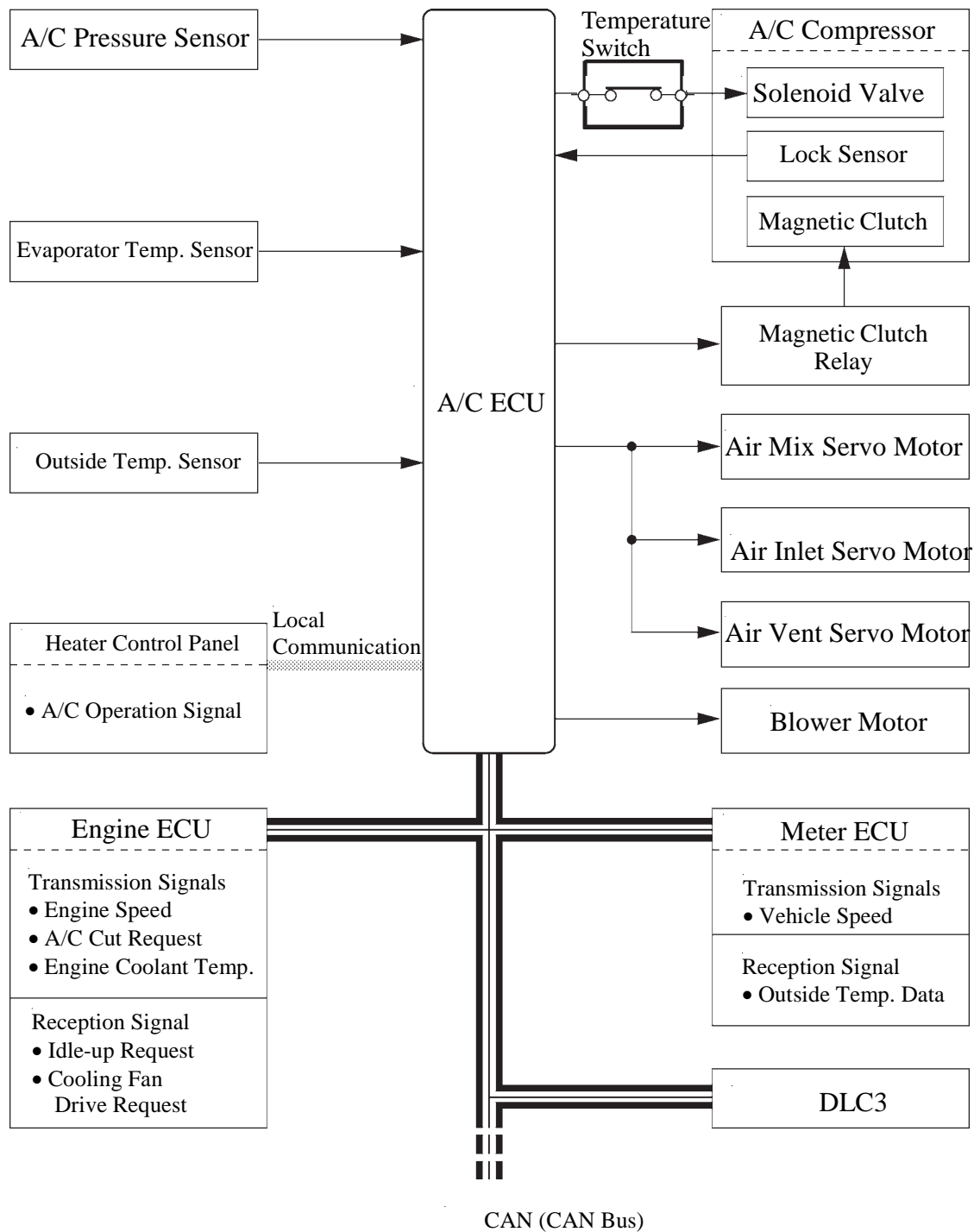
### ▶ Automatic Air Conditioner ◀



\*: Presara only  
© TMCAL

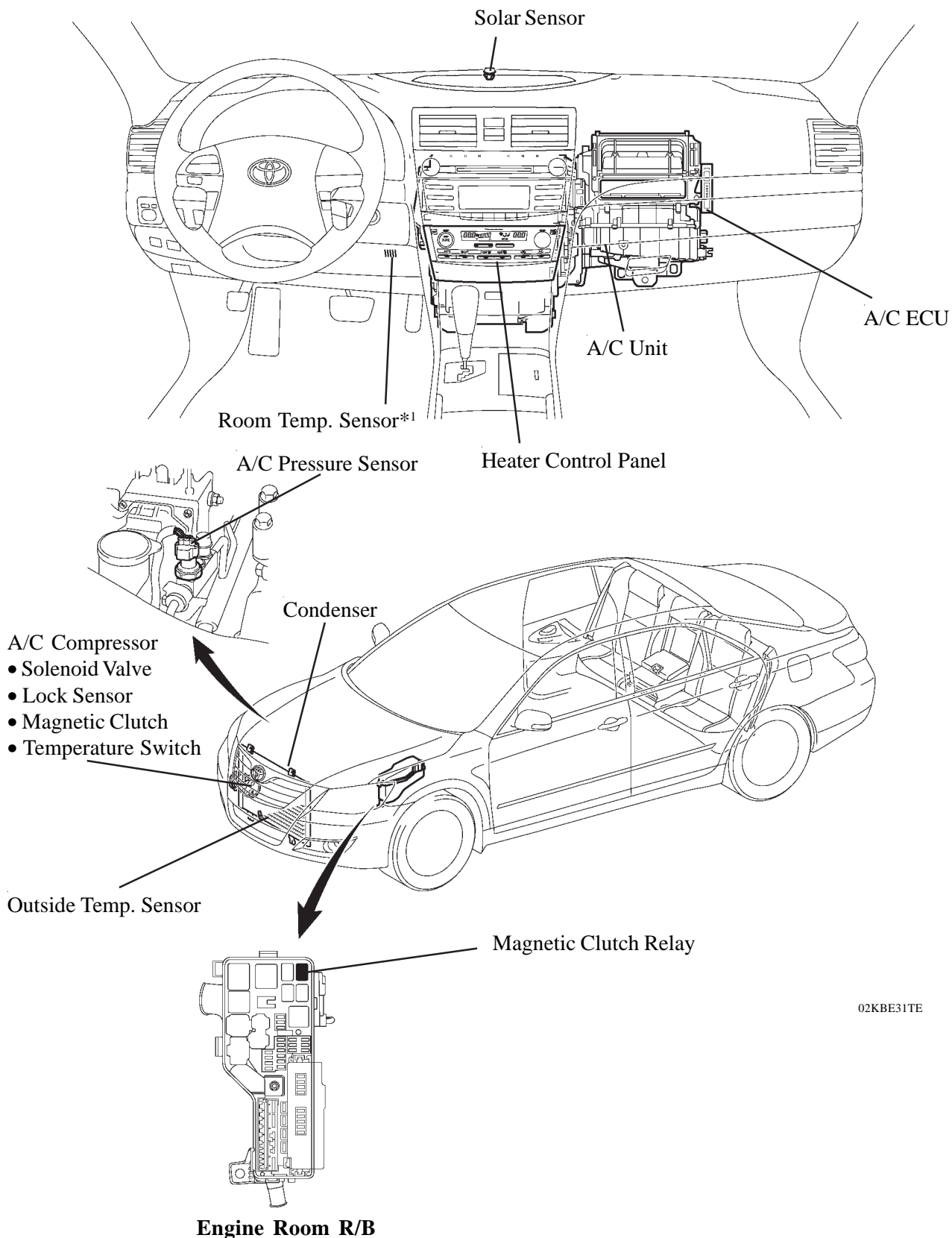
LHD

▶ Manual Air Conditioner ◀



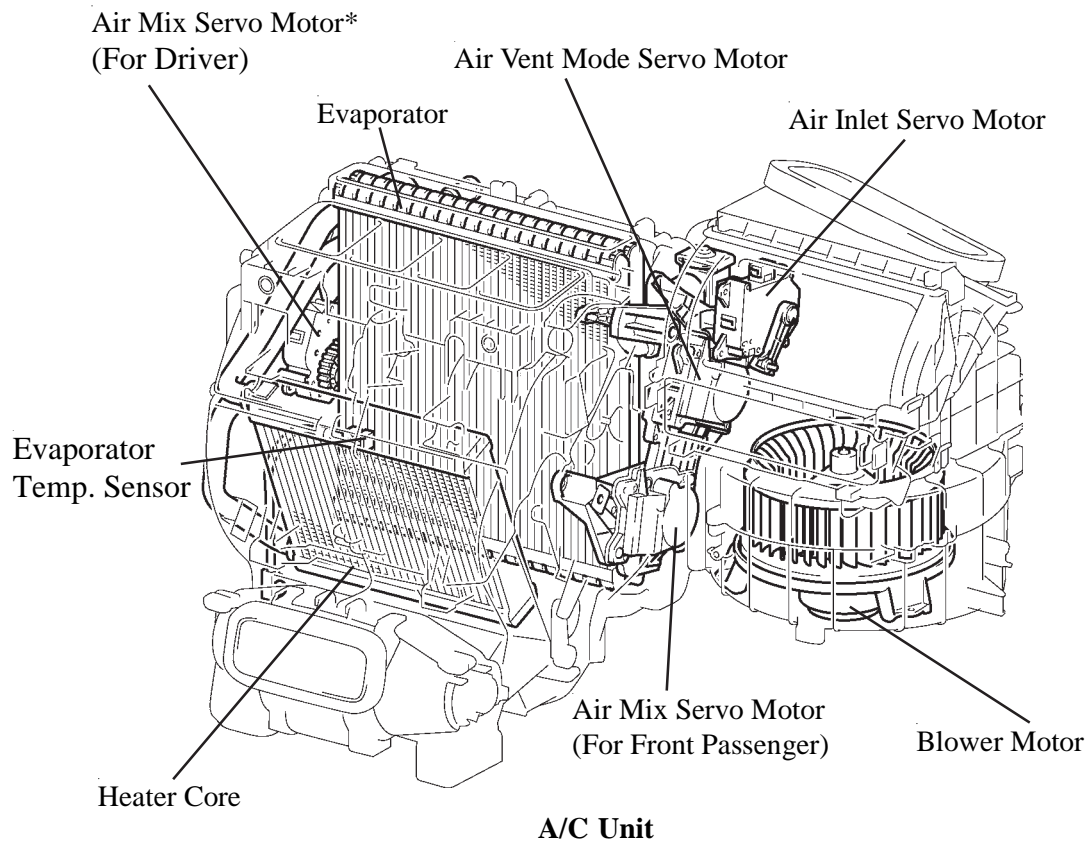
02KBE126Yb

## ● LAYOUT OF MAIN COMPONENTS



02KBE31TE

\*1: Only for models with automatic air conditioner



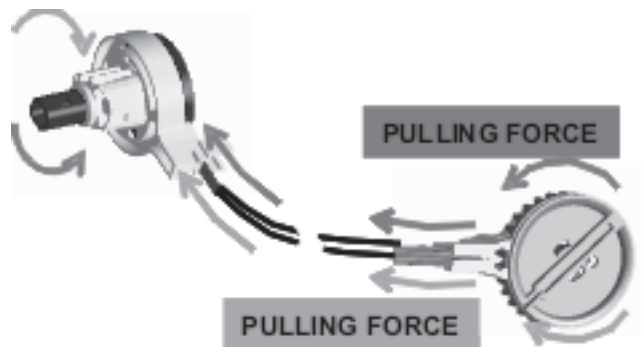
\*: Only for models with the automatic air conditioner

01YBE48TE



### Servo Module

Servo Module contains both Servo motors and Linkage for the Air Mix and the Air Distribution controls.



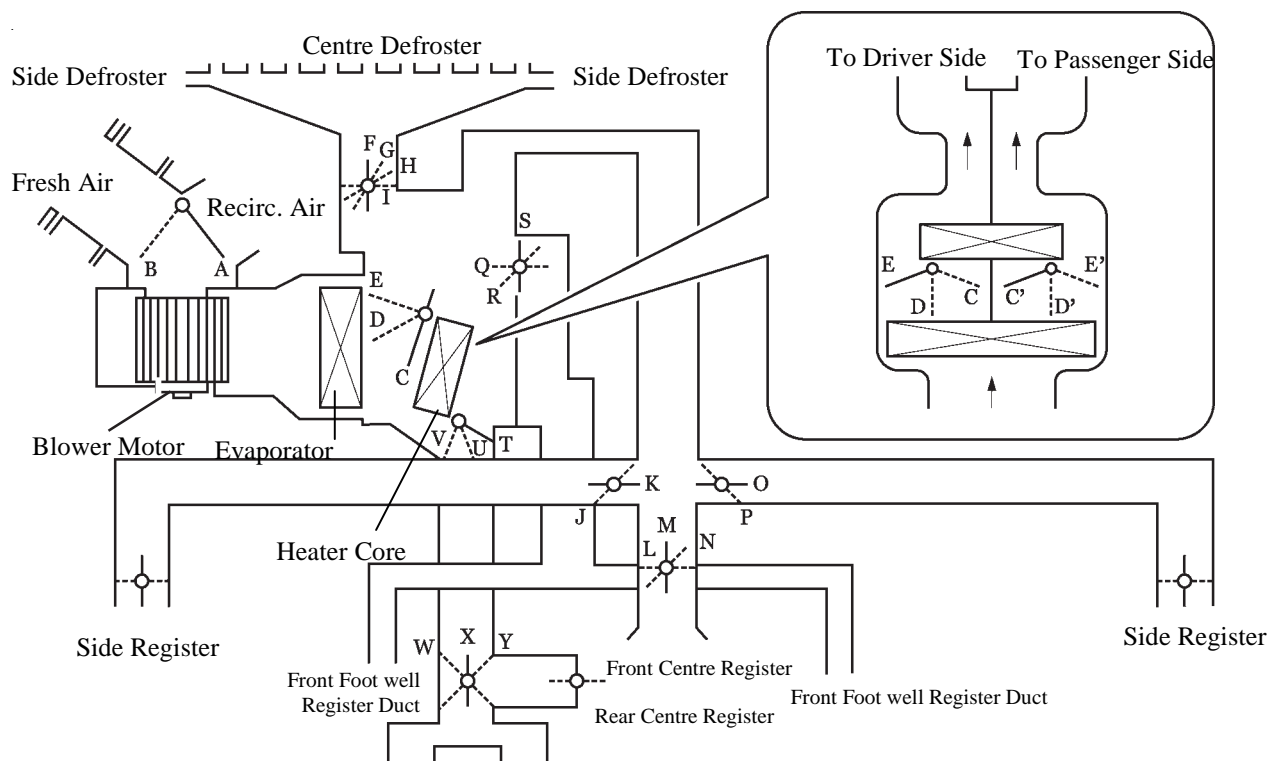
### Pull Pull Control Cable

Pull Pull Cable is used to connect the linkage on the Servo Module to the Rear Duct Control.



## MODE POSITION AND DAMPER OPERATION

### 1. Automatic Air Conditioner



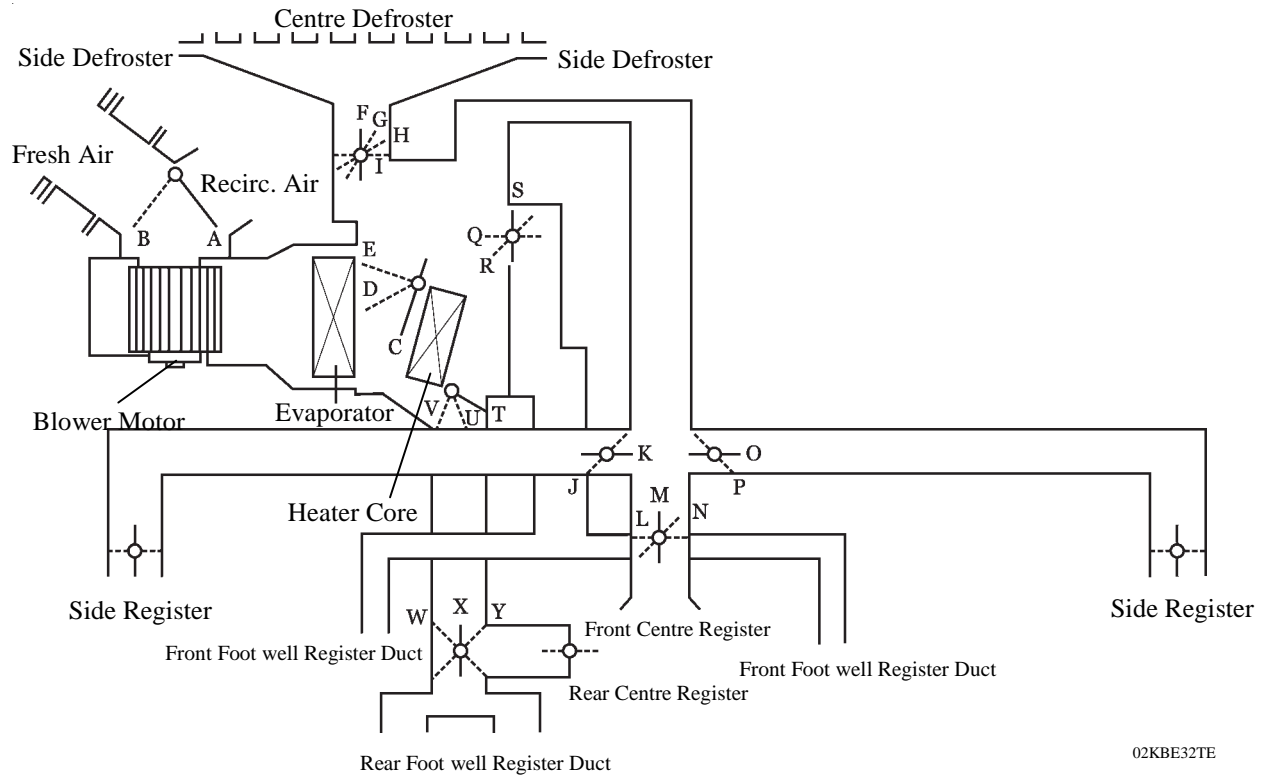
#### Function of Main Damper

Rear Foot well Register Duct

02HBE35TE

Control Damper	Operation Position	Damper Position	Operation
Air Inlet Control Damper	FRESH	A	Brings in fresh air.
	RECIRC	B	Recirculates internal air.
Air Mix Control Damper	MAX COLD to MAX HOT Temp. Setting	C – D – E (C' – D' – E') T – U – V	Varies the mixture ratio of the fresh air and the recirculated air in order to regulate the temperature continuously from HOT to COLD.
Mode Control Damper	DEF 187BE28	F, J, L, P, S, Y	Defrosts the windshield through the centre defroster, side defroster, and side register.
	FOOT / DEF 187BE27	G, J, L, P, Q, X	Defrosts the windshield through the centre defroster, side defroster, and rear centre register, while air is also blown out from the front and rear foot well register ducts.
	FOOT 187BE26	H, J, L, P, Q, X	Air blows out of the foot well register duct, and side register. In addition, air blows out slightly from the centre defroster and side defroster.
	BI-LEVEL 187BE25	I, K, N, O, R, X	Air blows out of the front and rear centre registers, side register and front and rear foot well register ducts.
	FACE 187BE24	I, K, M, O, S, W	Air blows out of the front and rear centre registers, and side register.

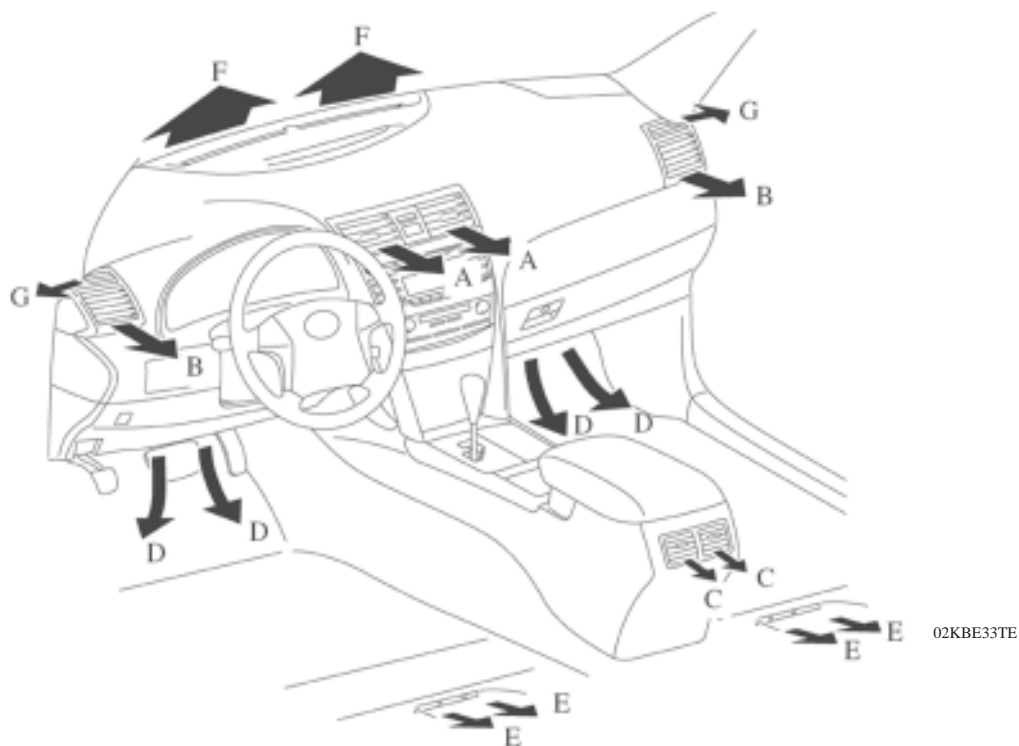
## 2. Manual Air Conditioner



### ► Function of Main Damper ◀

Control Damper	Operation Position	Damper Position	Operation
Air Inlet Control Damper	FRESH	A	Brings in fresh air.
	RECIRC	B	Recirculates internal air.
Air Mix Control Damper	MAX COLD to MAX HOT Temp. Setting	C – D – E T – U – V	Varies the mixture ratio of the fresh air and the recirculated air in order to regulate the temperature continuously from HOT to COLD.
Mode Control Damper	DEF 187BE28	F, J, L, P, S, Y	Defrosts the windshield through the centre defroster, side defroster, and side register.
	FOOT / DEF 187BE27	G, J, L, P, Q, X	Defrosts the windshield through the centre defroster, side defroster, and side register, while air is also blown out from the front and rear foot well register ducts.
	FOOT 187BE26	H, J, L, P, Q, X	Air blows out of the foot well register duct, and side register. In addition, air blows out slightly from the centre defroster and side defroster.
	BI-LEVEL 187BE25	I, K, N, O, R, X	Air blows out of the front centre register, side register and front and rear foot well register ducts.
	FACE 187BE24	I, K, M, O, S, W	Air blows out of the front centre register and side register.

## ✿ AIR OUTLETS AND AIRFLOW VOLUME



INDICATION	MODE	SELECTION		FACE			FOOT		DEF	
				CTR	SIDE	RR	FR	RR	CTR	SIDE
		AUTO	MANUAL	A	B	C	D	E	F	G
	FACE	○	○	⊙	⊙	⊙	—	—	—	—
	B/L-U* <sup>1</sup>	○	○	⊙	⊙	⊙	○	○	—	—
	B/K-L* <sup>2</sup>	○	—	○	○	○	⊙	⊙	—	—
	FOOT-F* <sup>3</sup>	○	—	—	○	○	⊙	○	○	○
	FOOT-R* <sup>4</sup>	○	○	—	○	○	⊙	⊙	○	○
	FOOT-D* <sup>5</sup>	○	—	—	○	○	○	○	○	○
	F/D	○	○	—	○	○	⊙	⊙	○	○
	DEF	○	○	—	○	—	—	—	⊙	⊙

The size of the circle ○ indicates the proportion of airflow volume.

\*<sup>1</sup>: Greater airflow volume at the upper area.

\*<sup>2</sup>: Greater airflow volume at the lower area.

\*<sup>3</sup>: Greater airflow volume at the front.

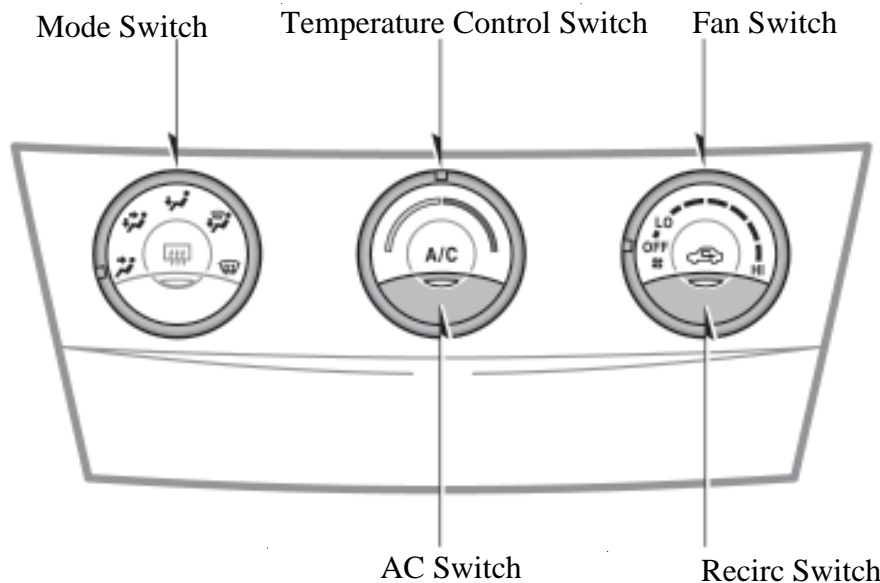
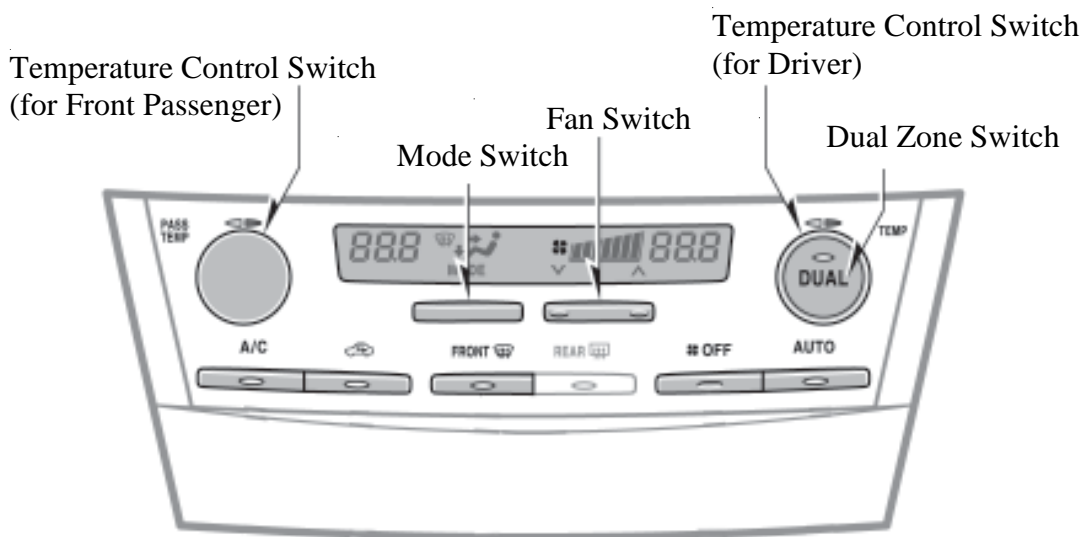
\*<sup>4</sup>: Greater airflow volume at the rear.

\*<sup>5</sup>: Greater airflow volume at the defroster.

## ✱ CONSTRUCTION AND OPERATION

### 1. Heater Control Panel

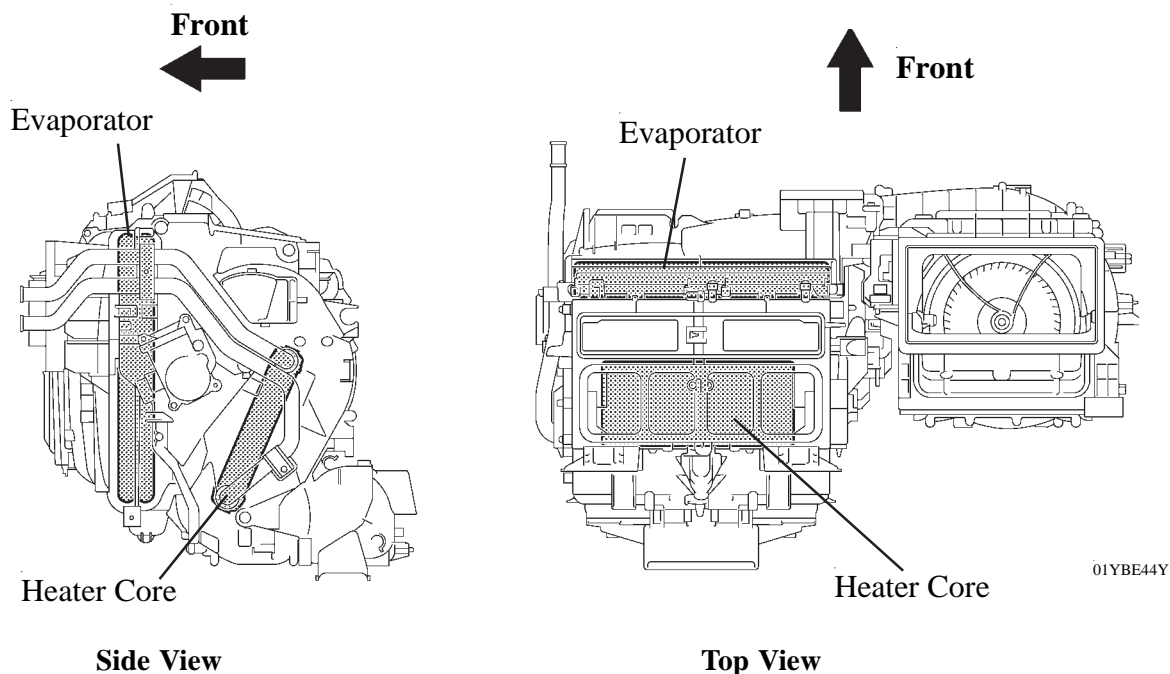
- 2 types of heater control panel are used on Aurion, differing between models with the automatic air conditioner and those with the manual air conditioner.
- On models with the automatic air conditioner, the air conditioner status is displayed on an LCD (Liquid Crystal Display) panel.
- On models with the automatic air conditioner, as part of the right/left independent temperature control, the temperature control switches for the driver and the front passenger have been located closer to the respective seats for enhanced ease of use.



## 2. Air Conditioner Unit

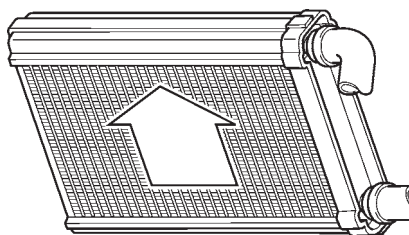
### General

A semi-centre location air conditioner unit, in which the evaporator and heater core are placed in the vehicle's longitudinal direction, is used. As a result, the air conditioner unit has been made compact and lightweight.



### Heater Core

A compact, lightweight, and highly efficient SFA (Straight Flow Aluminium)-II type heater core is used.

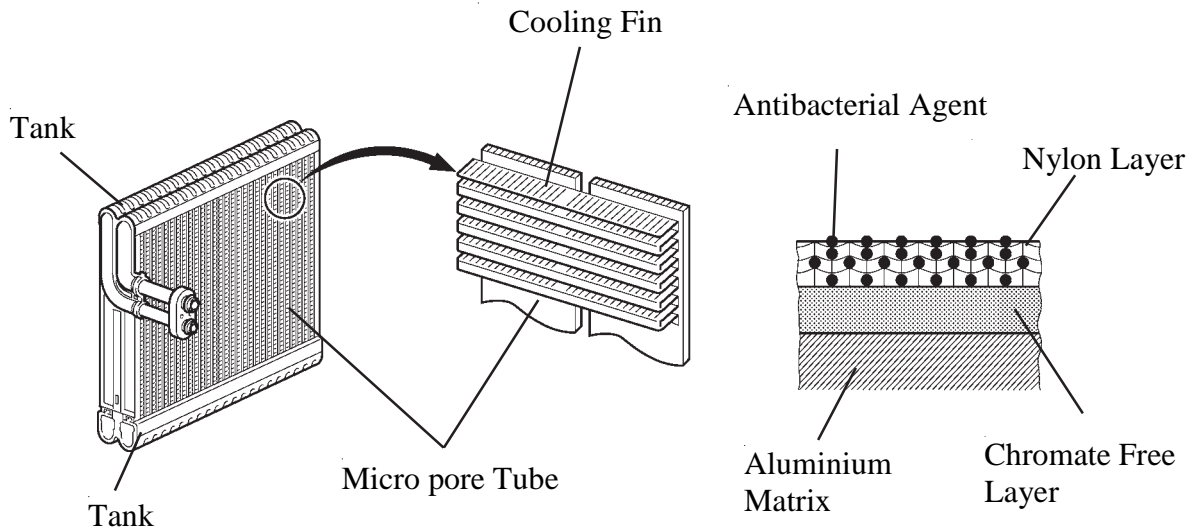


### Evaporator

A semi-centre location air conditioner unit, in which the evaporator and heater core are placed in the vehicle's longitudinal direction, is used. As a result, the air conditioner unit has been made compact and lightweight.

- A revolutionary super-slim structure evaporator is used.
- By placing the tanks at the top and the bottom of the evaporator unit and adopting a micro pore tube construction, the following effects have been realised:
  - a) The heat exchanging efficiency has been improved.
  - b) The temperature distribution has been made more uniform.
  - c) The evaporator has been made thinner: 58 mm → 38 mm

- The evaporator body has been coated with a type of resin that contains an antibacterial agent in order to minimise the source of foul odor and the propagation of bacteria. The substrate below this coating consists of a chromate-free layer to help protect the environment.



### Evaporator Temp. Sensor

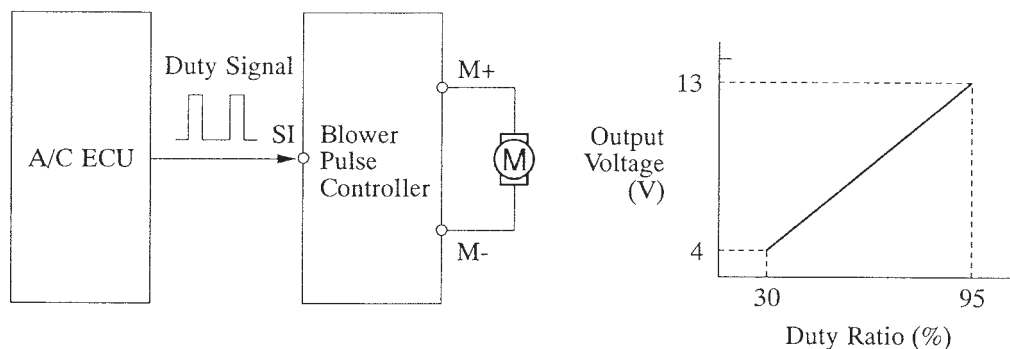
The evaporator temp. sensor detects the temperature of the cool air immediately past the evaporator by measuring resistance changes, and outputs it to the A/C ECU.

### Blower Motor

The blower motor has an in-built blower controller, and is controlled with the duty control from the A/C ECU.

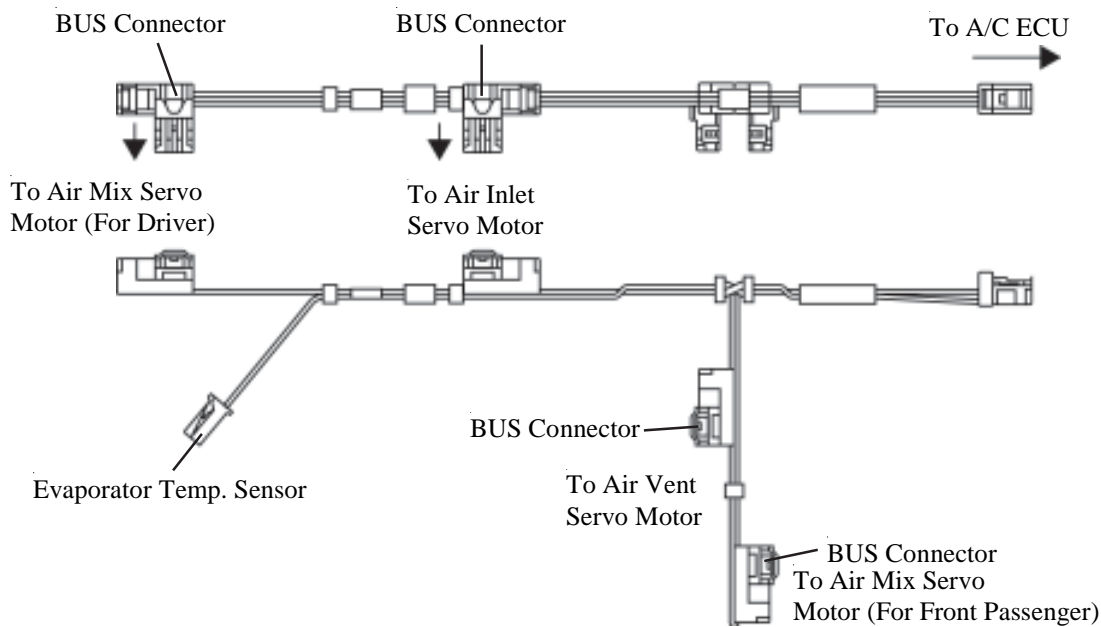
### Blower Pulse Controller

The blower pulse controller control the voltage that is output to the blower motor in accordance with the duty cycle signals that are input by the A/C ECU.



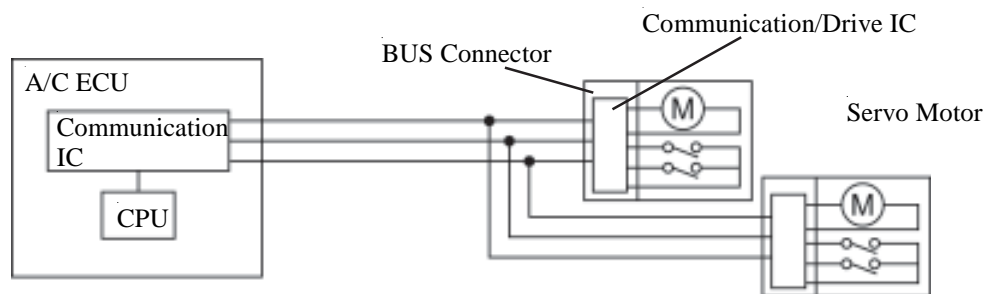
## BUS Connector

- A BUS connector is used in the wire harness connection that connects the servo motor to the A/C ECU.



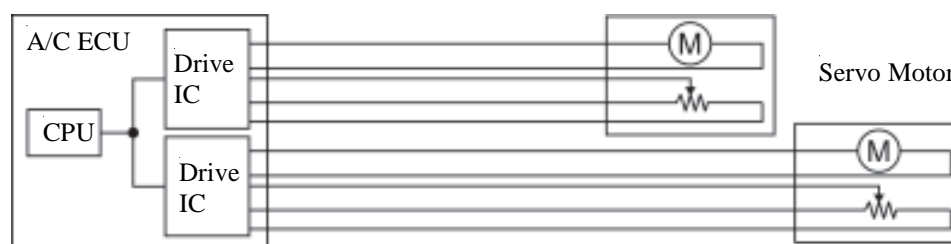
285BE43

- The BUS connector has a built-in communication/drive IC which communicates with each servo motor connector, actuates the servo motor, and has a position detection function. This enables bus communication for the servo motor wire harness, for a more lightweight construction and a reduced number of wires.



**With BUS Connector**

285BE44

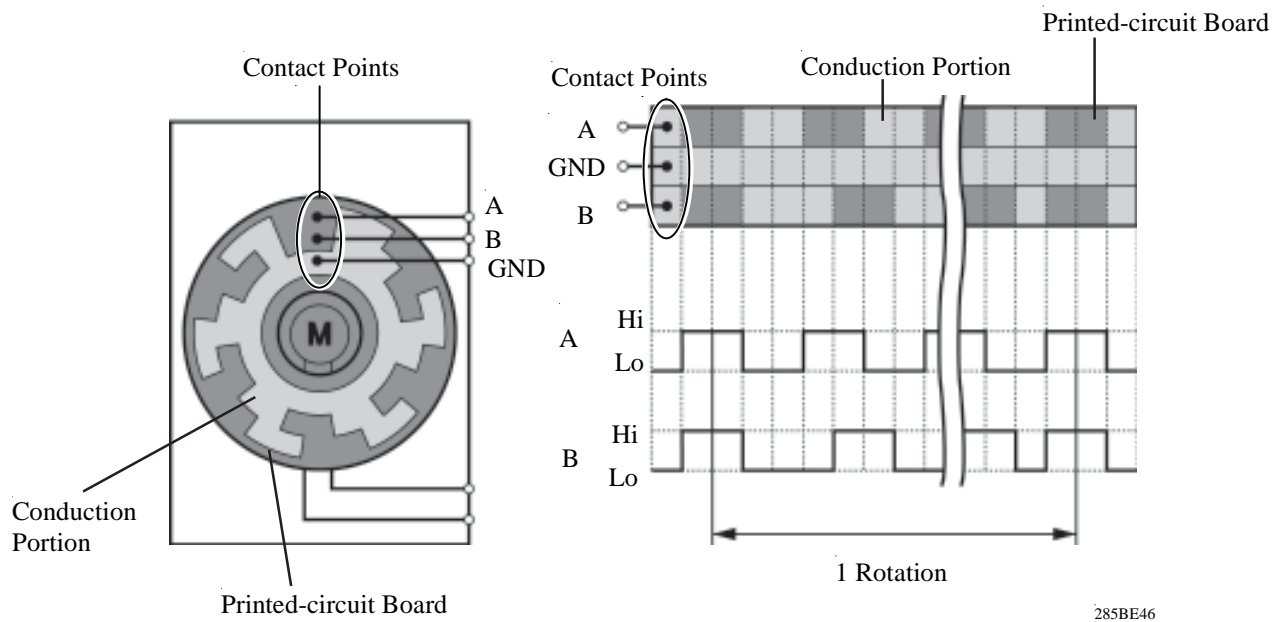


**Without BUS Connector**

285BE45

## Servo Motor

The pulse pattern type servo motor consists of a printed circuit board and servo motor. The printed circuit board has three contact points, and transmits to the A/C ECU two ON-OFF signals for each change in the pulse phase. The smart connector detects the damper position and movement direction with this signal.



**NOTE:** When one of the following operations is conducted, the A/C ECU automatically performs the initialisation to detect the original positions of the servo motors. Although either the front DEF indicator<sup>\*1</sup> or the rear DEF indicator<sup>\*2</sup> on the heater control panel blinks during the initialisation, this does not indicate a malfunction.

- After the battery terminal has been disconnected, the power source<sup>\*3</sup> is switched to IG-ON or the engine is started<sup>\*4</sup>.
- The engine starts and stops repeatedly in a short period of time.
- The engine starts when the battery voltage is low.

<sup>\*1</sup>: Models with the automatic air conditioner

<sup>\*2</sup>: Models with the manual air conditioner

<sup>\*3</sup>: The power source condition can be changed by operating the engine switch on models with the smart entry and start system, and the ignition switch on models without the smart entry and start system.

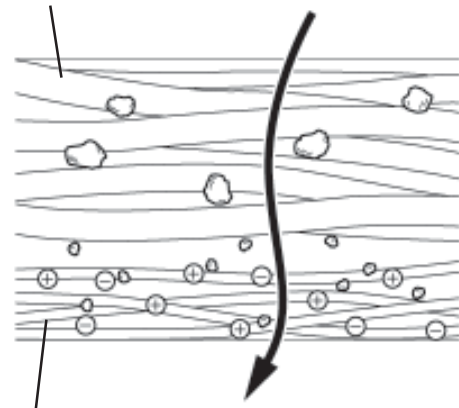
<sup>\*4</sup>: Only for models without the smart entry and start system



## Air Conditioner Air Filter

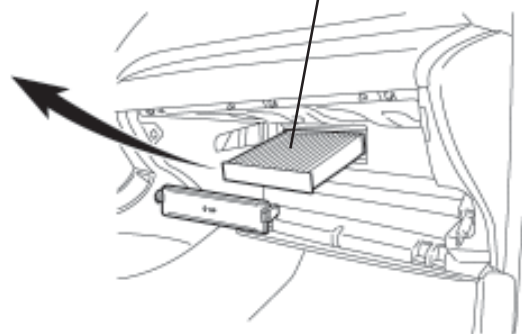
- A Pollen-removal type Air Conditioner air filter is used.
- The filter is made of polyester. Thus, it can be disposed of easily as a non hazardous combustible material, a feature that is provided in consideration of the environment.

Large Foreign Object  
Filter Layer



Electret Layer  
(Microscopic foreign object filtration)

Air Filter



025BE47Y

### Service Tip

The replacement interval of the filter varies:

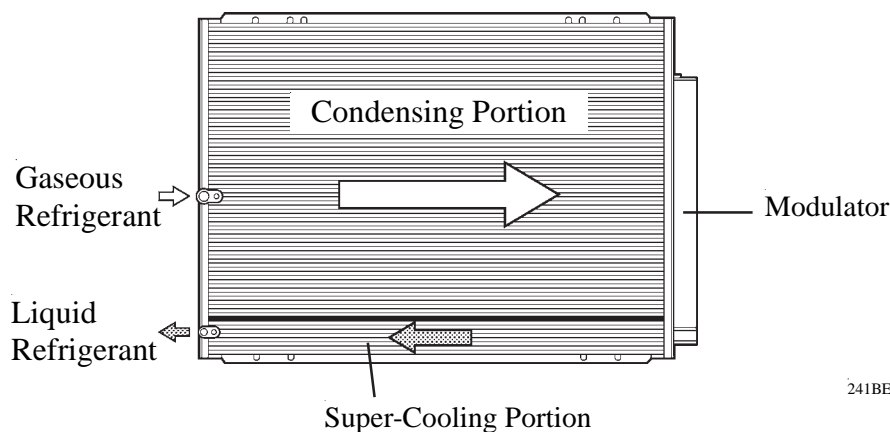
Cleaning Interval [km]		Replacement Interval [km]	
Normal Condition	Dusty Condition	Normal Condition	Dusty Condition
10,000	5,000	30,000	15,000

However, observation of these guidance lines should depend on the usage conditions (or environment).

### 3. Condenser

- An MF (Multi-Flow) type condenser is used. The condenser consists of two cooling portions; a condensing portion and a super-cooling portion, which are integrated together with a gas-liquid separator (modulator). This condenser uses a sub-cool cycle that offers excellent heat-exchange performance.
- In the sub-cool cycle, after the refrigerant passes through the condensing portion of the condenser, both the liquid refrigerant and the gaseous refrigerant that could not be liquefied are cooled again in the super-cooling portion. Thus, the refrigerant is sent to the evaporator in an almost completely liquefied state.

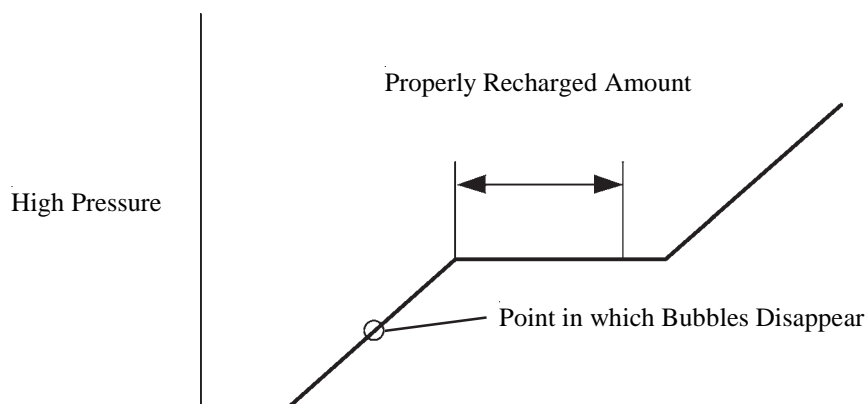
Note: For condenser fan control refer to EG-67.



#### Service Tip

The point at which the air bubbles disappear in the refrigerant of the sub-cool cycle is lower than the proper amount of refrigerant with which the system must be filled. Therefore, if the system is recharged with refrigerant based on the point at which the air bubbles disappear, the amount of refrigerant would be insufficient. As a result, the cooling performance of the system will be affected. If the system is overcharged with refrigerant, this will also lead to a reduced performance.

For the proper method of verifying the amount of the refrigerant and for instructions on how to recharge the system with refrigerant, see the Aurion Repair Manual.

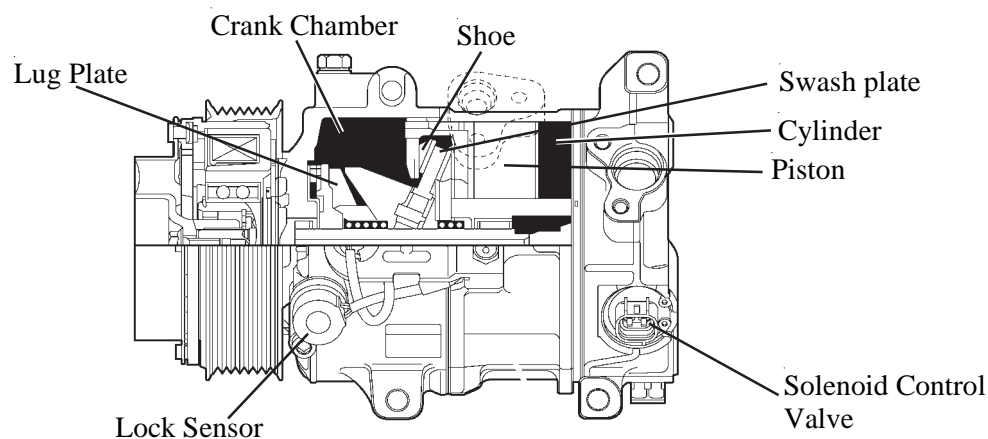


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## 4. A/C Compressor

### General

- The A/C compressor is a continuously variable capacity type, of which the capacity can be varied in accordance with the cooling load of the air conditioner.
- The A/C compressor is a continuously variable capacity type, of which the capacity can be varied in accordance with the cooling load of the air conditioner.
- This compressor consists of the A/C pulley, shaft, lug plate, swash plate, piston, shoe, crank chamber, cylinder, and solenoid valve.
- The A/C pulley with built-in magnetic clutch and the lock sensor that detects whether the magnetic clutch is locked are installed.
- A solenoid valve that adjusts the suction pressure so that the compressor capacity can be controlled as desired is provided.
- The internal valve is installed to improve the A/C compressor durability at high speeds and under heavy thermal load conditions. The internal valve is integrated into the solenoid valve.



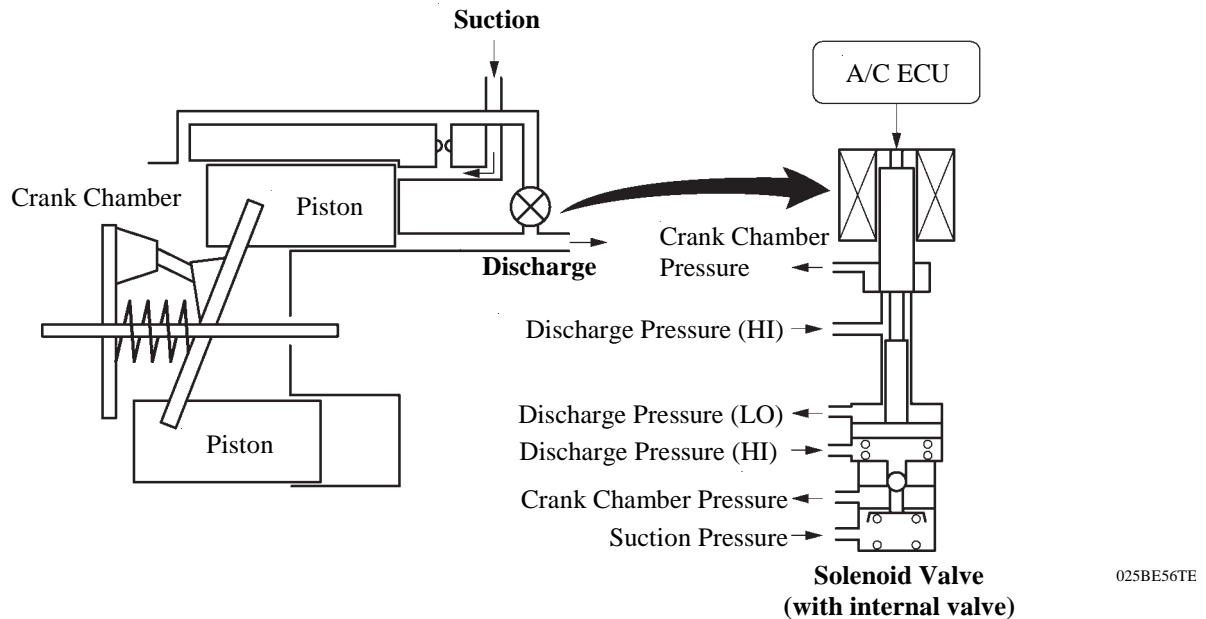
025BE48TE

### Lock Sensor

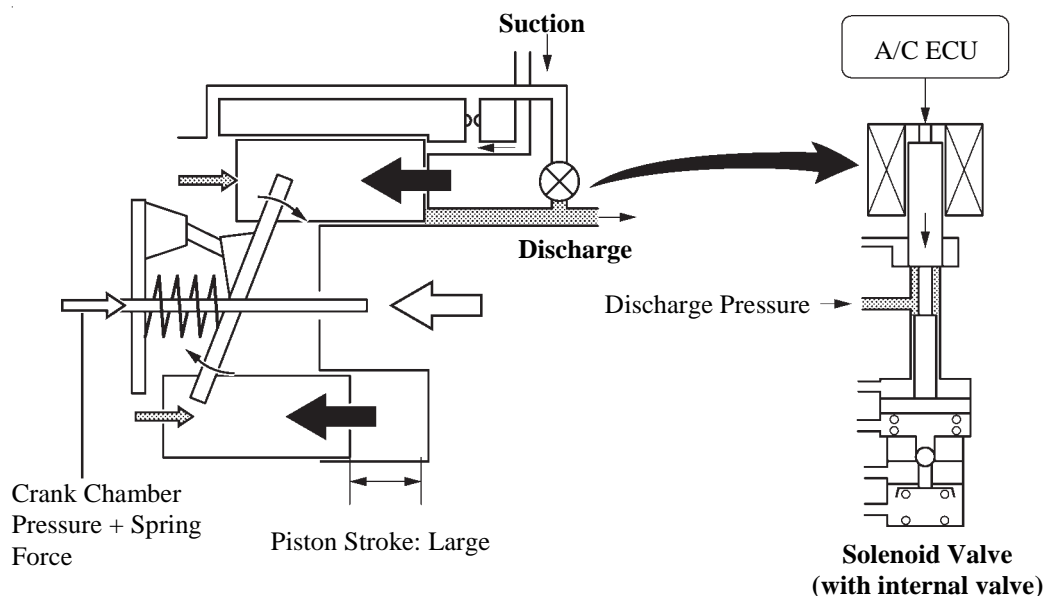
The lock sensor sends A/C pulley speed signals to the A/C ECU. The A/C ECU determines whether the magnetic clutch is locked or not by using those signals and engine speed signals.

## Solenoid Valve Operation

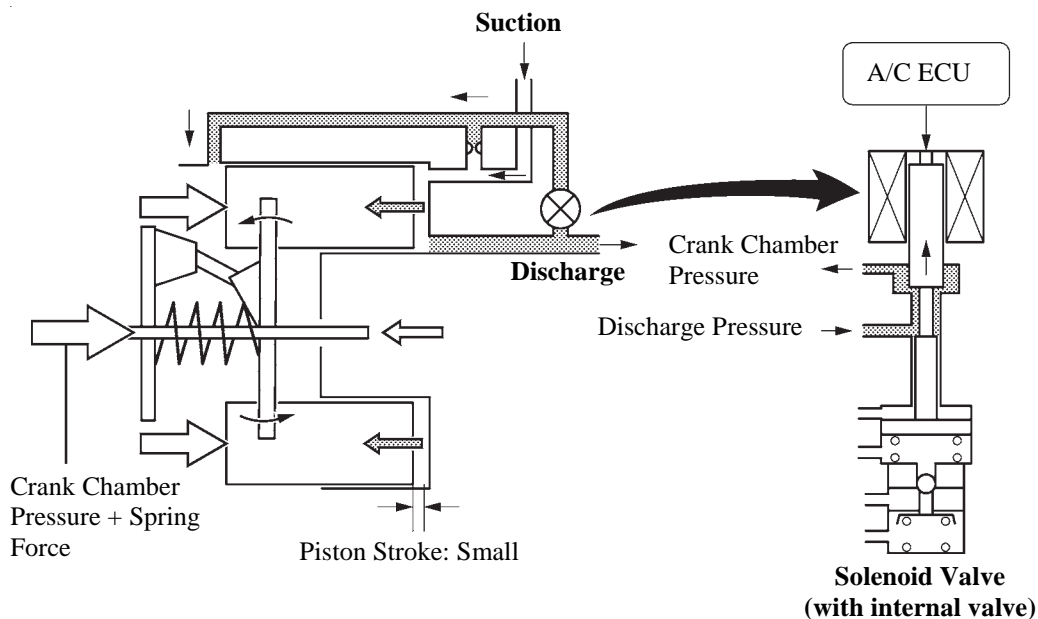
- The crank chamber is connected to the discharge passage. A solenoid valve is provided between the discharge passage (LO pressure) and the discharge passage (HI pressure).
- The solenoid valve operates under duty cycle control in accordance with the signals from A/C ECU.



- When the solenoid valve closes (the solenoid coil is energised), a difference in pressure is created and the pressure in the crank chamber decreases. Then, the pressure that is applied to the right side of the piston becomes greater than the pressure that is applied to the left side of the piston. This compresses the spring and tilts the swash plate. As a result, the piston stroke length increases and the discharge capacity increases.



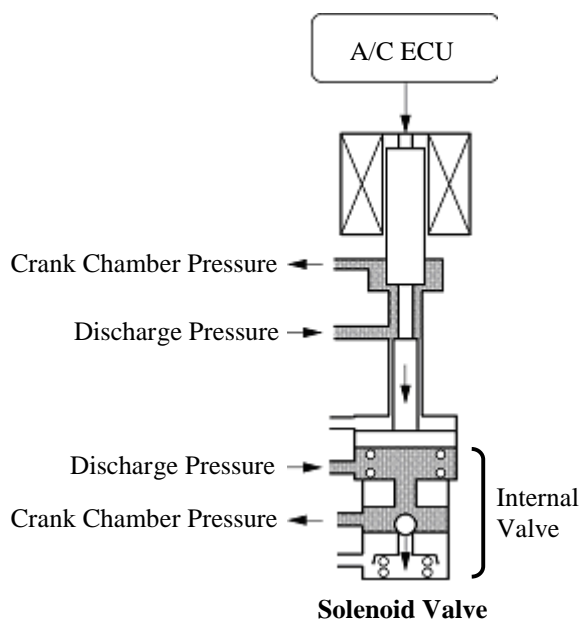
- When the solenoid valve opens (the solenoid coil is not energised), the difference in pressure disappears. Then, the pressure that is applied to the left side of the piston becomes the same as the pressure that is applied to the right side of the piston. Thus, the spring elongates and eliminates the tilt of the swash plate. As a result, there is no piston stroke and the discharge capacity is reduced.



025BE58TE

### Internal Valve Operation

The internal valve operates when the A/C compressor speed has increased rapidly, the A/C compressor speed is high, or when the thermal load has suddenly changed. As a result, the A/C compressor capacity is reduced, increasing the durability of the A/C compressor.



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## 5. A/C Pressure Sensor

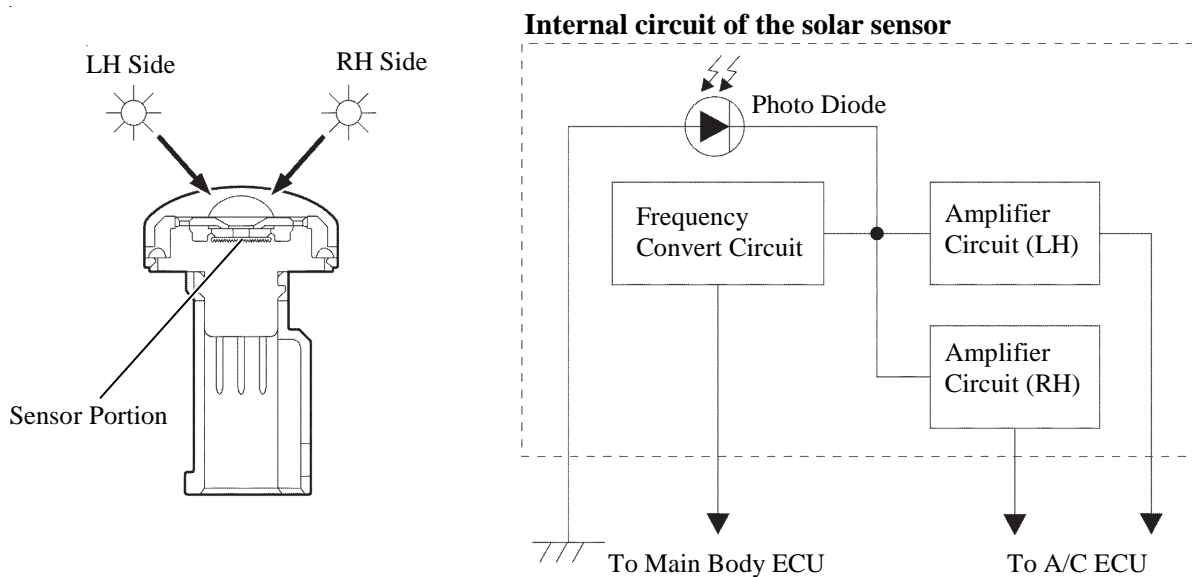
The A/C pressure sensor detects the refrigerant pressure and outputs it to the A/C ECU in the form of voltage changes.

## 6. Room Temp. Sensor and Outside Temp. Sensor

- The room temperature sensor detects the room temperature based on changes in the resistance of its built-in thermistor and sends a signal to the A/C ECU. This sensor is used on models with automatic air conditioner.
- The outside temperature sensor detects the outside temperature based on changes in the resistance of its built-in thermistor and sends a signal to the A/C ECU.

## 7. Solar Sensor

- The solar sensor consists of a photo diode, two amplifier circuits for the solar sensor, and a frequency converter circuit for the light control sensor. This sensor is used on models with automatic air conditioner.
- A solar sensor detects (in the form of changes in the current that flows through the built-in photo diode) the changes in the amount of sunlight from the LH and RH sides (2 directions) and outputs these sunlight strength signals to the A/C ECU.



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## SYSTEM CONTROL

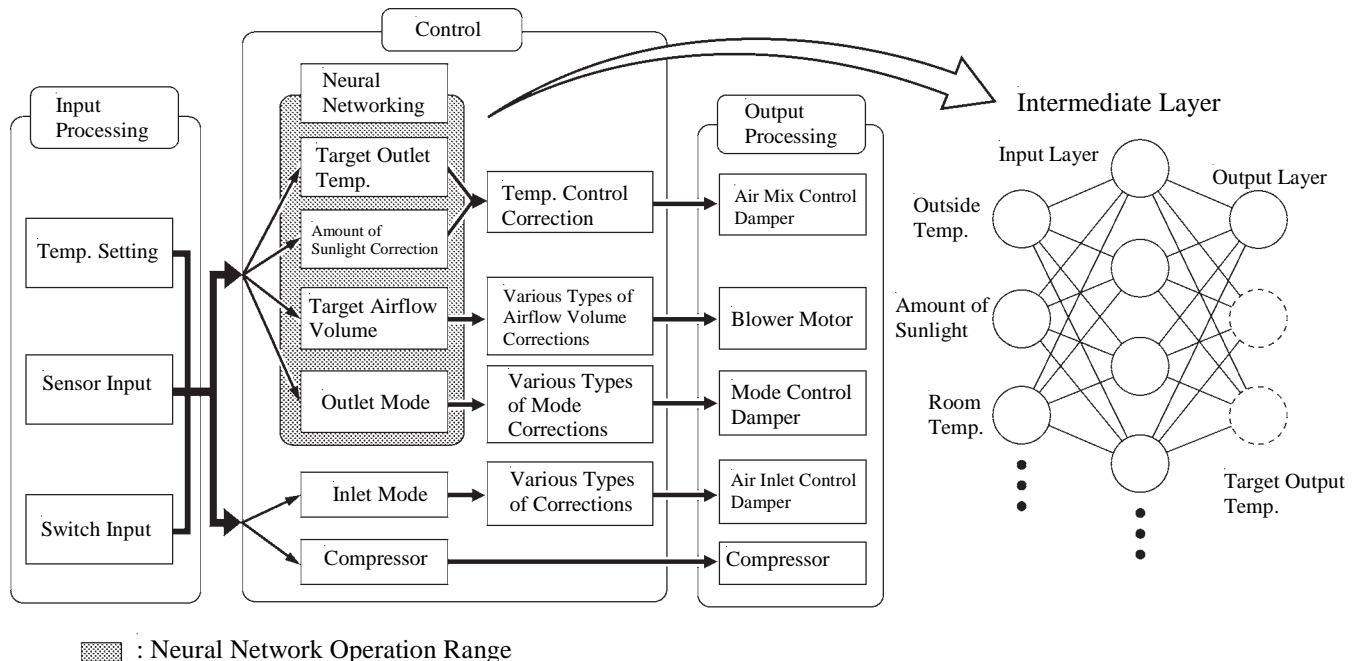
### 1. General

The air conditioner system has the following controls.

Control	Outline	Automatic A/C	Manual A/C
Neural Network Control [See page BE-63]	This control is capable of effecting complex control by artificially simulating the information processing method of the nervous system of living organisms in order to establish a complex input/output relationship that is similar to a human brain.	○	—
Manual Control	The A/C ECU controls the damper positions (air inlet control damper, air mix control damper and mode control damper) and blower speed in accordance with the positions of the switches (temperature control switch, blower switch, mode select switch and air inlet control switch).	—	○
Outlet Air Temp. Control	Based on the temperature set at the temperature control switch, the neural network control calculates the outlet air temperature based on the input signals from various sensors.	○	—
	The temperature settings for the driver and front passenger are controlled independently in order to provide separate vehicle interior temperatures for the right and left sides of the cabin. Thus, an air conditioner that accommodates the occupants' preferences has been realised.	○	—
Blower Control	Controls the blower motor in accordance with the airflow volume that has been calculated by the neural network control based on the input signals from various sensors.	○	—
Air Outlet Control	Automatically switches the air outlets in accordance with the outlet mode that has been calculated by the neural network control based on the input signals from various sensors.	○	—
	In accordance with the engine coolant temperature, outside air temperature, amount of sunlight, required blower, outlet temperature, and vehicle speed conditions, this control automatically switches the blower outlet to FOOT / DEF mode to prevent the windows from becoming fogged when the outside air temperature is low.	○	—
Air Inlet Control	Automatically controls the air inlet control damper to achieve the calculated required outlet air temperature.	○	—
Compressor Control	Through the calculation of the target evaporator temperature based on various sensor signals, the A/C ECU optimally controls the discharge capacity by regulating the opening extent of the A/C compressor solenoid valve.	○	○
	The A/C ECU compares the A/C pulley speed signals, which are transmitted by the lock sensor located on the A/C compressor, with the engine speed signals, which are transmitted by the ECM (crankshaft position sensor). When the A/C ECU determines that the A/C pulley is locked, it turns off the magnetic clutch.	○	○
Rear Window Defogger Control [See page BE-152]	Switches the rear defogger and outside rear view mirror heaters on for 15 minutes to 60 minutes when the rear defogger button is pressed. Switches them off if the button is pressed again while they are operating.	○	○
Outside Temperature Indication Control	Calculates the outside temperature using signals transmitted by the outside temperature sensor. Calculated values are corrected by the A/C ECU and then indicated on the multi-information display.	○	○
Self-Diagnosis [See page BE-63]	A DTC (Diagnostic Trouble Code) is stored in the memory when the A/C ECU detects a problem with the air conditioner system.	○	○

## 2. Neural Network Control

- In previous automatic air conditioner systems, the A/C ECU determined the required outlet air temperature and blower air volume in accordance with the calculation formula that has been obtained based on information received from the sensors. However, because the senses of a person are rather complex, a given temperature is sensed differently, depending on the environment in which the person is situated. For example, a given amount of solar radiation can feel comfortably warm in a cold climate, or extremely uncomfortable in a hot climate. Therefore, as a technique for effecting a higher level of control, a neural network is used in the automatic air conditioner system. With this technique, the data that has been collected under varying environmental conditions is stored in the A/C ECU. The A/C ECU can then effect control to provide enhanced air conditioner comfort.
- The neural network control consists of neurons in an input layer, intermediate layer, and output layer. The input layer neurons process the input data of the outside temperature, the amount of sunlight, and the room temperature based on the outputs of the switches and sensors, and output them to the intermediate layer neurons. Based on this data, the intermediate layer neurons adjust the strength of the links among the neurons. The sum of these is then calculated by the output layer neurons in the form of the required outlet temperature, solar correction, target airflow volume, and outlet mode control volume. Accordingly, the A/C ECU controls the servo motors and blower motor in accordance with the control volumes that have been calculated by the neural network control.



## 3. Self-Diagnosis

- The A/C ECU has a self-diagnosis function. It stores any operation failures in the air conditioner system memory in the form of DTC (Diagnostic Trouble Code).
- There are two methods for reading DTC. One is to use an intelligent tester II, and the other is to read DTC indicated on the heater control panel display (Only for models with automatic air conditioner).
- For details, see the Aurion Repair Manual.



## TOYOTA PARKING ASSIST SYSTEM

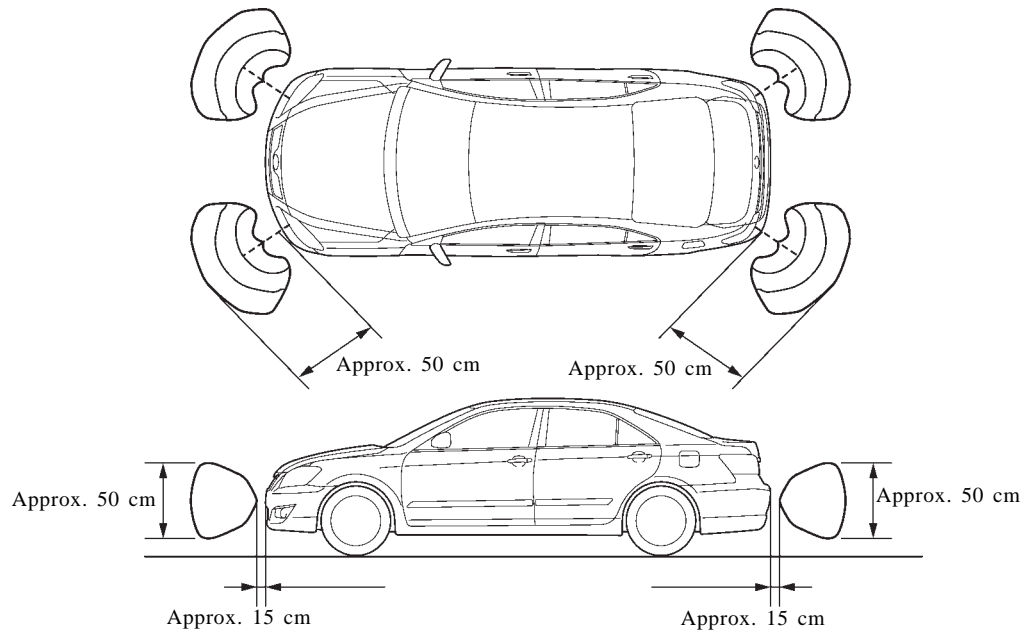
### ✱ DESCRIPTION

- The Toyota park assist system used on Aurion is a 6 sensor type (front corners, rear corners and rear centre).
- The Toyota parking assist system uses ultrasonic sensors to detect any obstacles at the corners, the front, or the rear of the vehicle.
- The Toyota parking assist system then informs the driver of the approximate distance between the sensors and the obstacles as well as their positions by displaying them on the multi-information display in the combination meter and by sounding a buzzer.
- The Aurion uses local communication lines among the ultrasonic sensors and the clearance sonar ECU, reducing the number of wire harnesses.
- The operating condition of each Toyota parking assist system differs according to its installation position as shown in the table below:

Installation Position	Operating Conditions
Front Corner	<ul style="list-style-type: none"> <li>• Power source* is IG-ON.</li> <li>• Toyota parking assist system switch is ON.</li> <li>• Shift position is except P.</li> <li>• Sensor stops operating when vehicle speed is 10 km/h or more.</li> </ul>
Rear Corner	<ul style="list-style-type: none"> <li>• Power source* is IG-ON.</li> <li>• Toyota parking assist system switch is ON.</li> <li>• Shift position is R.</li> </ul>
Rear Centre	<ul style="list-style-type: none"> <li>• Power source* is IG-ON.</li> <li>• Toyota parking assist system switch is ON.</li> <li>• Shift position is R.</li> </ul>

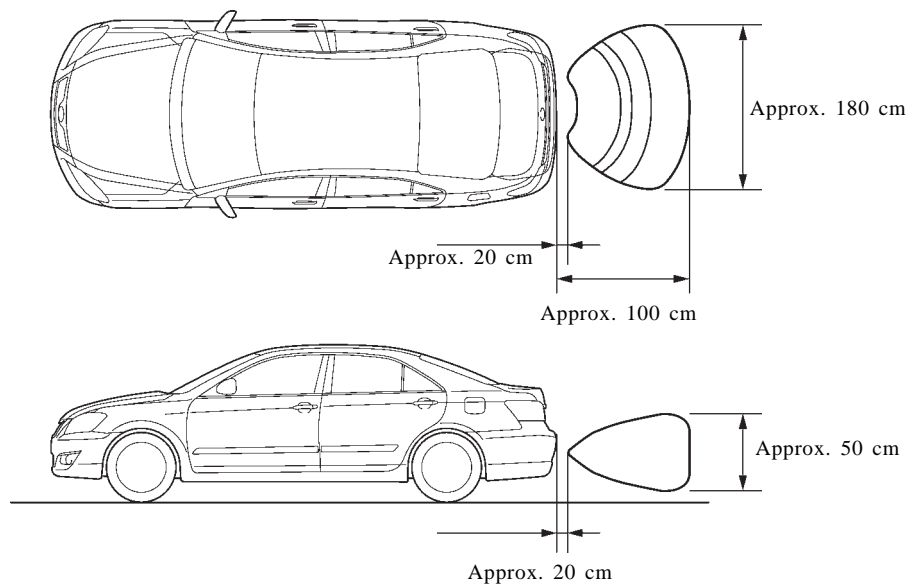
\*: The power source condition can be changed by operating the engine switch on models with the smart entry and start system, and the ignition switch on models without the smart entry and start system.

☀ **DETECTION AREA**



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**Corner Area**

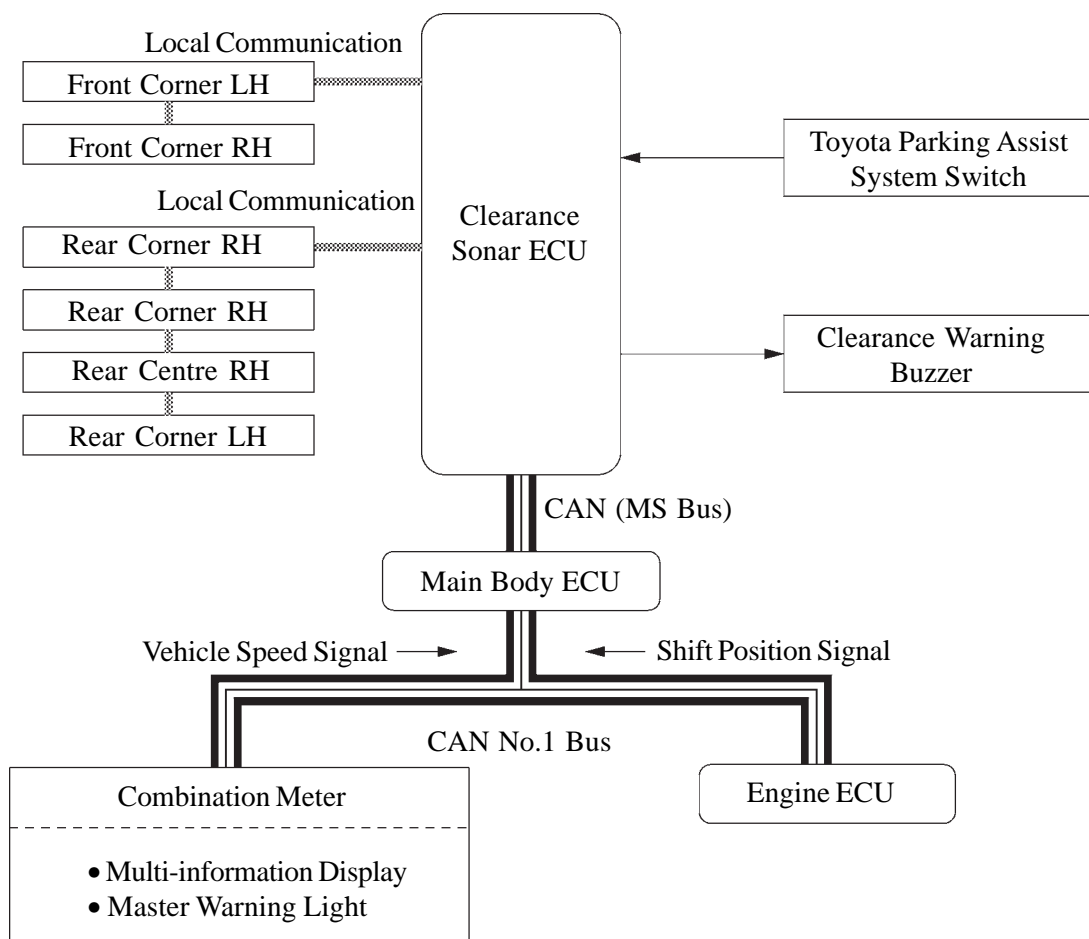


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**Rear Centre Area**

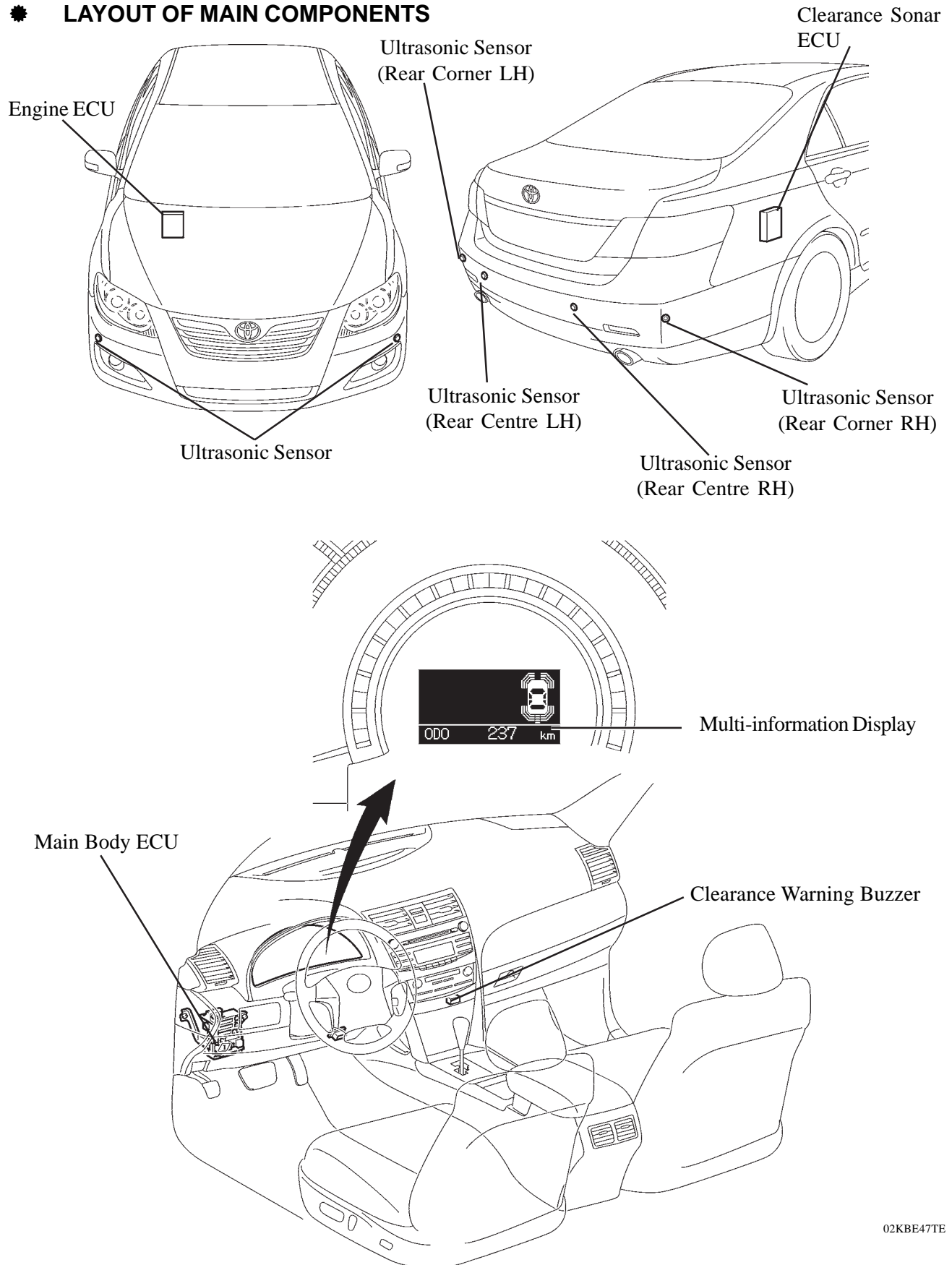
## \* SYSTEM DIAGRAM

### ▶ 6 Sensor Type ◀



02KBE121Y

# ● LAYOUT OF MAIN COMPONENTS



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Models with 6 Sensor Type

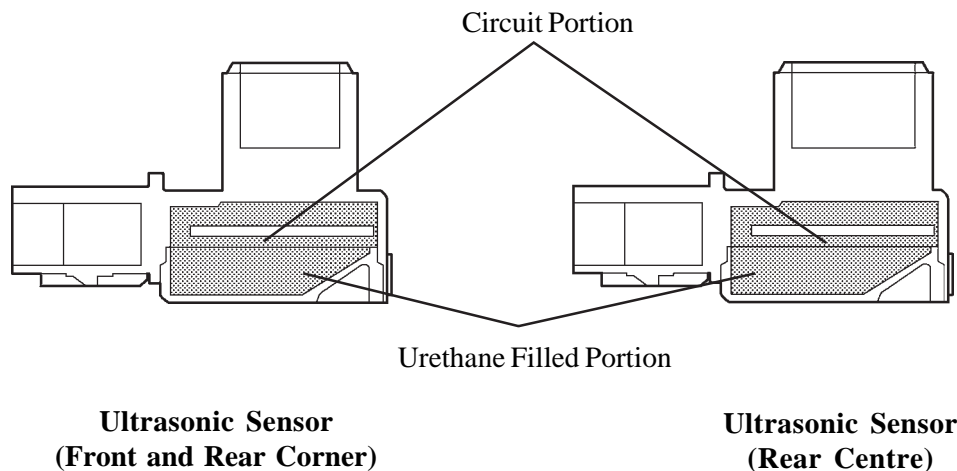
## FUNCTION OF MAIN COMPONENTS

Component		Function
Ultrasonic Sensor		Detects the approximate distance between the vehicle and an obstacle and transmits the signal to the clearance sonar ECU.
Clearance Warning Buzzer		Sounds a buzzer to warn the driver according to the distance to the obstacle.
Combination Meter	Multi-information Display	<ul style="list-style-type: none"> <li>• Displays the location of the obstacle and the approximate distance between the vehicle and the obstacle.</li> <li>• Informs the driver if the ultrasonic sensors malfunction, or if they freeze or become dirty.</li> <li>• Transmits the vehicle speed signal to the clearance sonar ECU via the clearance sonar ECU.</li> </ul>
	Master Warning Light	Illuminates when the multi-information display indicates that the ultrasonic sensors are malfunctioning or frozen.
Toyota Parking Assist System Switch		Operating this switch allows the operation of the Toyota parking assist system to be enabled or disabled.
Clearance Sonar ECU		<ul style="list-style-type: none"> <li>• Judges the approximate distance between the vehicle and an obstacle based on signals from the ultrasonic sensors. Output signals are sent to the multi-information display.</li> <li>• Sounds the buzzer.</li> </ul>
Main Body ECU		Receives signals from the combination meter and engine ECU and transmits those signals to the clearance sonar ECU.
Engine ECU		Transmits the shift position signal to the clearance sonar ECU via the main body ECU.

## CONSTRUCTION AND OPERATION

### 1. Ultrasonic Sensor

- The ultrasonic sensors are provided with a distance calculation function in order to digitize the signals between the clearance sonar ECU and the ultrasonic sensor. As a result, the number of wiring harnesses has been reduced.
- There are two different types of ultrasonic sensors, for the front and rear corners and the rear centre. Each ultrasonic sensor consists of a sensor portion that transmits and receives ultrasonic waves and a pre-amplifier that amplifies them. The distance calculation circuit calculates the distance between the vehicle and the obstacle based on the received ultrasonic waves. The ultrasonic sensors transmit the calculated distance signals to the clearance sonar ECU.
- The circuit portion is filled with urethane to prevent water from entering.



### 2. Clearance Warning Buzzer

- Depending on the detection distance and the detection area, the sound pattern of the clearance warning buzzer will vary.

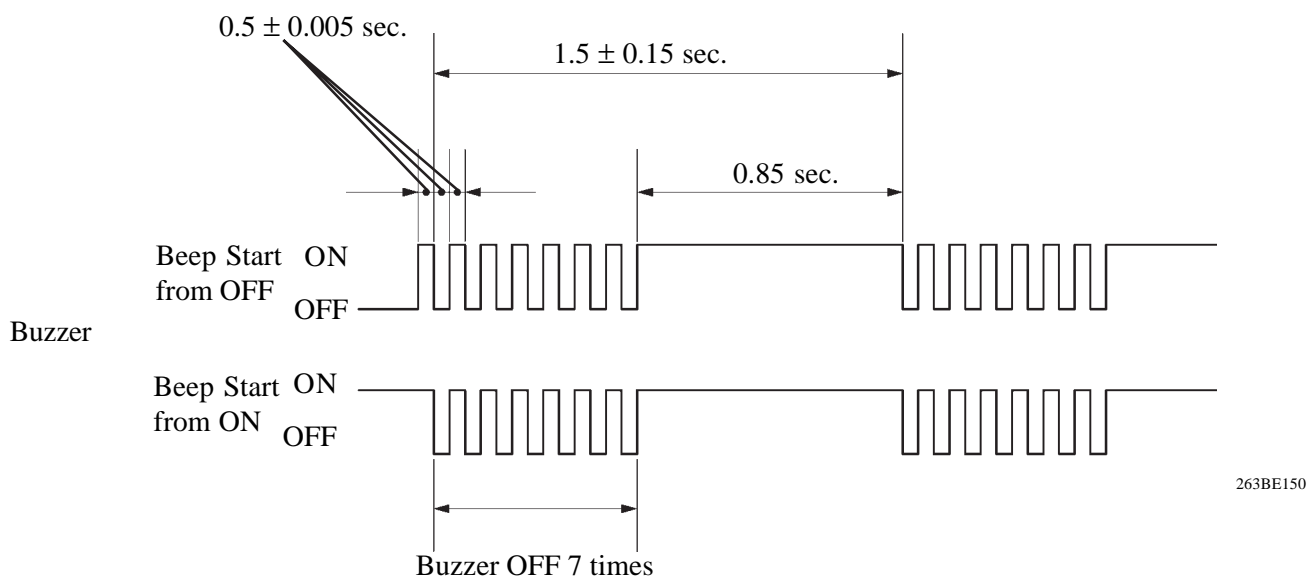
Detection Area	Detection Distance cm		Buzzer Sound Pattern ON/ OFF Time (sec.)
Corner	Long	$50 \pm 5$ to $37.5 \pm 4$	0.15/ 0.15
	Middle	$37.5 \pm 5$ to $25 \pm 3$	0.075/ 0.075
	Short	$25 \pm 3$ or less	Continuous Sound/ 0
Rear Centre	Longest	$150 \pm 15$ to $60 \pm 6$	0.15/ 0.15
	Long	$60 \pm 6$ to $45 \pm 5$	0.15/ 0.15
	Middle	$45 \pm 5$ to $35 \pm 4$	0.075/ 0.075
	Short	$35 \pm 4$ or less	Continuous Sound/ 0

- When the front and rear sensors detect obstacles at the same time, the buzzer sounds as follows.

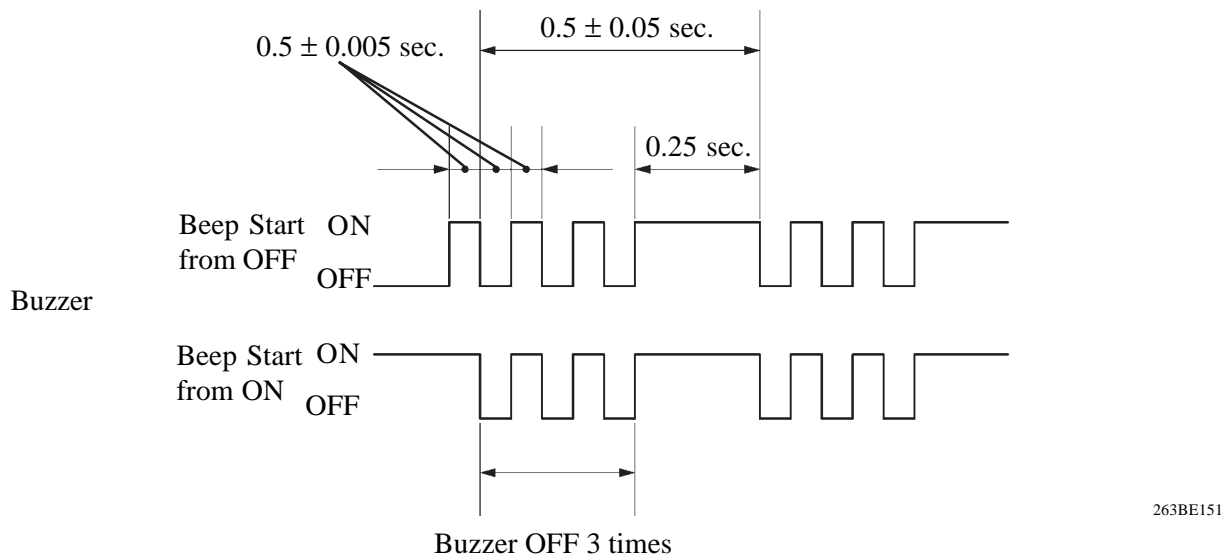
Buzzer Frequency (sec.)

Front Rear	Short	Middle	Long	Not detected
Short	Buzzer Timing 2	Buzzer Timing 1	Buzzer Timing 1	Continuous Sound/ 0
Middle	Buzzer Timing 1	0.15	0.15	0.15
Long	Buzzer Timing 1	0.15	0.3	0.3
Longest	Buzzer Timing 1	0.15	0.3	0.8
Not detected	Continuous Sound/ 0	0.15	0.3	None

### ► Buzzer Timing 1 ◀

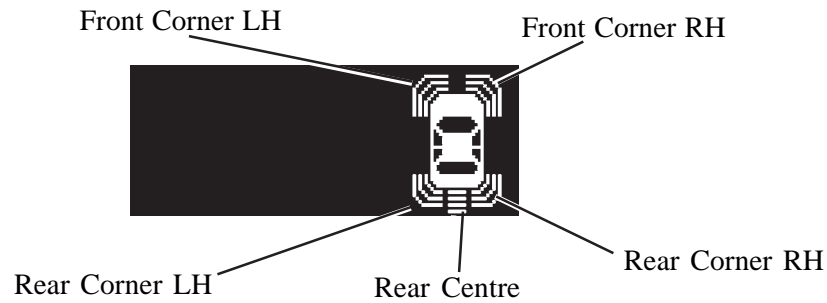









### ► Buzzer Timing 2 ◀



### 3. Multi-information Display

- The items displayed by the multi-information display are the location of the obstacle, the approximate distance between the vehicle and the obstacle, and warning messages relating to sensor malfunction, sensor freezing, or presence of dirt on the sensor. When any warning messages are displayed, the master warning light illuminates and the clearance warning buzzer sounds.
- The number of lines shown on the display changes based on the actual distance and flashes when the distance is short.

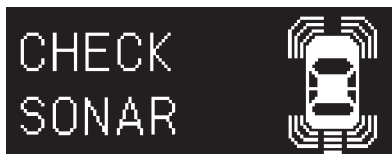


Detection Area	Detection Distance	Multi-information Display Condition	
Corner	Long $50 \pm 5$ to $37.5 \pm 4$		Line: Illuminates 02KBE50TE
	Middle $37.5 \pm 5$ to $25 \pm 3$		Line: Illuminates 02KBE101TE
	Short $25 \pm 3$ or less		Line: Flashes 02KBE102TE
Rear Centre	Longest $150 \pm 15$ to $60 \pm 6$		Line: Illuminates 02KBE103TE
	Long $60 \pm 6$ to $45 \pm 5$		Line: Illuminates 02KBE104TE
	Middle $45 \pm 5$ to $35 \pm 4$		Line: Illuminates 02KBE105TE
	Short $35 \pm 4$ or less		Line: Flashes 02KBE106TE

02KBE49TE

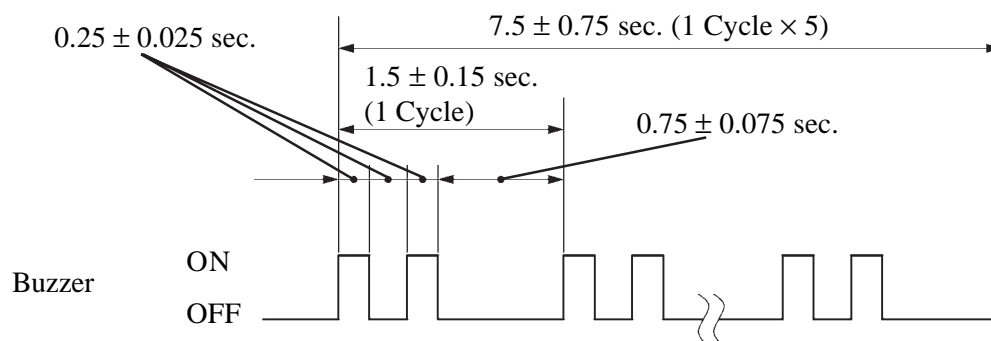


## ▸ Warning Message ◀

**Ultrasonic Sensor Malfunction Warning****Ultrasonic Sensor Freeze/  
Contamination Warning**

02KBE110TE

## ▸ Buzzer Timing ◀



02KBE111Y

## POWER WINDOW SYSTEM

### ✱ DESCRIPTION

- The power window motor with built-in ECU on the driver side door has the one-touch auto up-and-down and jam protection functions only for the driver side door.
- The power window motor without built-in ECU for all doors has the one-touch auto down functions only for the driver side door.
- The power window system has the following functions:

Function	Outline
Manual up-and-down (All Doors)	This function causes the driver door window to open or close while the power window switch is being pulled halfway up or pushed halfway down. Windows other than the driver door window can be opened or closed by fully pulling up or fully pushing down the switch. The window stops as soon as the switch is released.
One-touch auto up-and-down (Driver Door)	The one-touch auto up-and-down function enables the window to be fully opened or closed with a single touch of the power window switch.
Jam Protection (Driver Door)	A jam protection function automatically stops the power window and moves it downward if a foreign object gets jammed in the window during one-touch auto-up operation.
Remote Control (All Doors)	The power window master switch can control the up-and-down operations of the windows.
Window Lock	Power window operation of the 3 passenger windows is disabled when the window lock switch is pressed.
Key Off Operation	This function makes it possible to operate the power windows for approximately 43 seconds after the power source is turned to OFF, if the driver door or the front passenger door is not opened.
Diagnosis	When the power window ECU detects the following conditions, the self-diagnosis function switches the ECU to failsafe mode. The illumination (LED) of the power window master switch flashes to inform the user. <ul style="list-style-type: none"> <li>• An abnormality in the Hall IC that detects the position, speed and direction of the window.</li> <li>• An error in the window detection position and the upper limit position recorded in the power window ECU.</li> </ul>
Fail-Safe	If the Hall IC in the power window ECU malfunctions, some power window functions will be prohibited by the failsafe mode: <ul style="list-style-type: none"> <li>• Power windows can be operated using the power window switches within 40 seconds of failsafe mode being entered.</li> <li>• Each power window operates when the corresponding power window switch is fully pushed down or pulled up and held in that position.</li> </ul>

**Service Tip**

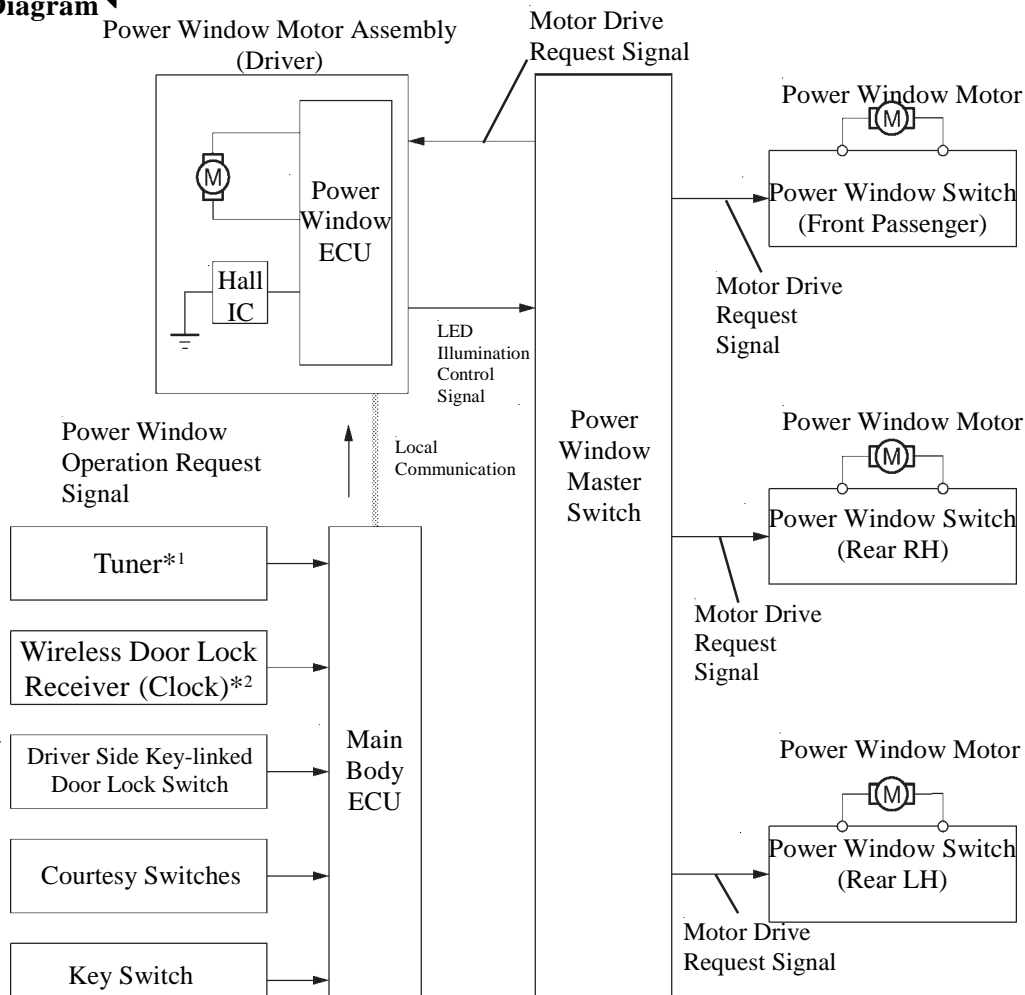
The power window motor assembly with a jam protection function stores the initial position of each door window. The memory is not cleared if battery terminals, fuses or power window motor assembly connectors are disconnected. However, after the power window motor assembly and power window regulator assembly are replaced, the stored initial position data must be cleared and the initialisation of the power window motor assembly must be performed. When necessary, perform the initialisation as follows:

**Initial Position Memory Erasure Procedure**

- Turn the power supply off (for example, remove a power window motor assembly connector or fuse) while the power window motor is operating.
- Check that the power window switch illumination blinks after the power source is turned on.

**Initialisation procedure**

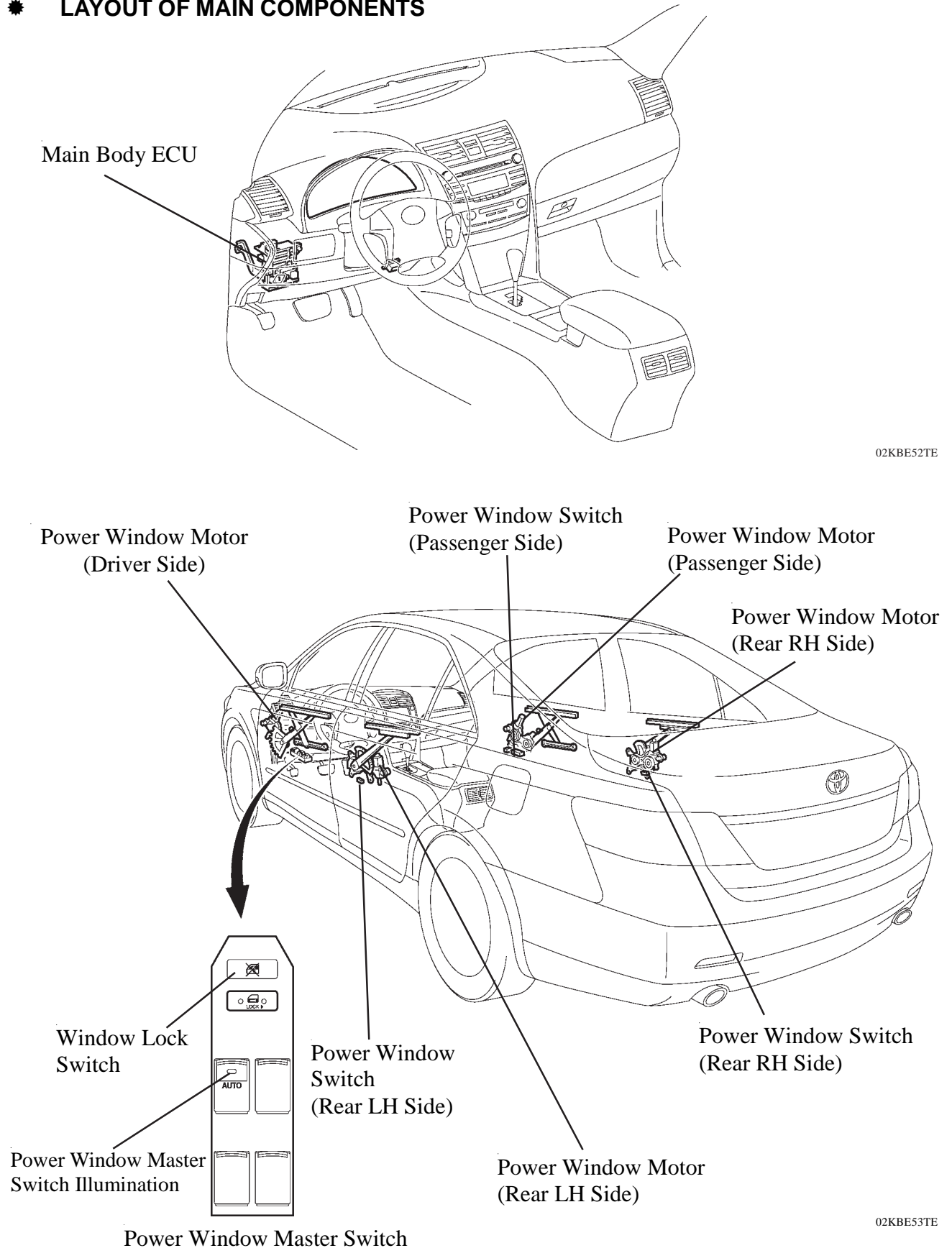
- Pull up the power window switch to the AUTO UP position and hold it until the window is fully closed.
- Hold the power window switch in the AUTO UP position for at least 1 second after the window is fully closed.
- Make sure that the window opens and closes automatically using the one touch function. For details, see the Aurion Repair Manual.

**System Diagram**

02KBE57Y

**Driver door with jam protection function**

✱ LAYOUT OF MAIN COMPONENTS



02KBE52TE

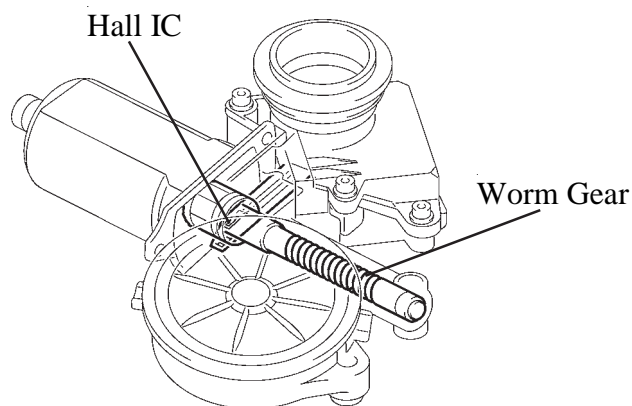
02KBE53TE

## ✱ JAM PROTECTION FUNCTION

- A jam protection function automatically stops the power window and moves it downward if a foreign object gets jammed in the door window during one-touch auto up operation.
- The operation of the jam protection function is described below.

Door window distance from fully closed position	Operation
200 mm or more	Down operation of 50 mm or one second.
200 mm or less	Down operation until door window operation of 200 mm is reached or five seconds.

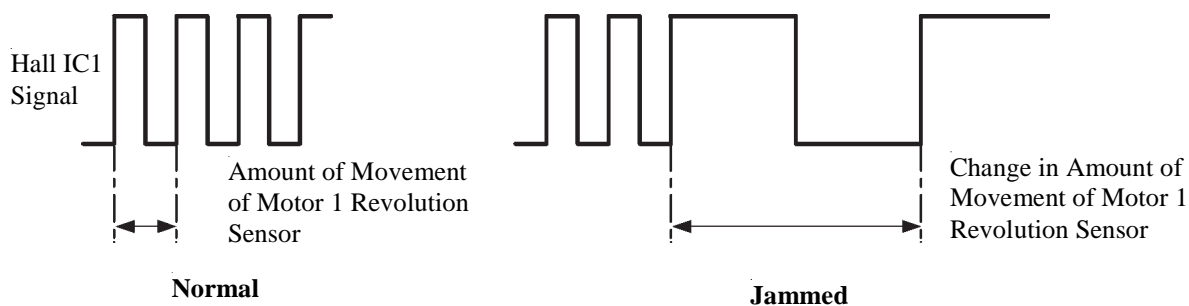
- The worm gear and Hall IC in the power window motor assembly are used to enable the power window jam protection.



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- The Hall IC converts the changes in the magnetic flux that occur through the rotation of the worm gear into pulse signals and outputs them to the power window ECU.
- To control the jam protection function, the ECU determines the amount of movement and jamming of the window glass based on the pulse signals from the Hall IC.

### ▶ Judgment of Movement and Jamming ◀



232BE34

## DOOR LOCK CONTROL SYSTEM

### ✱ DESCRIPTION

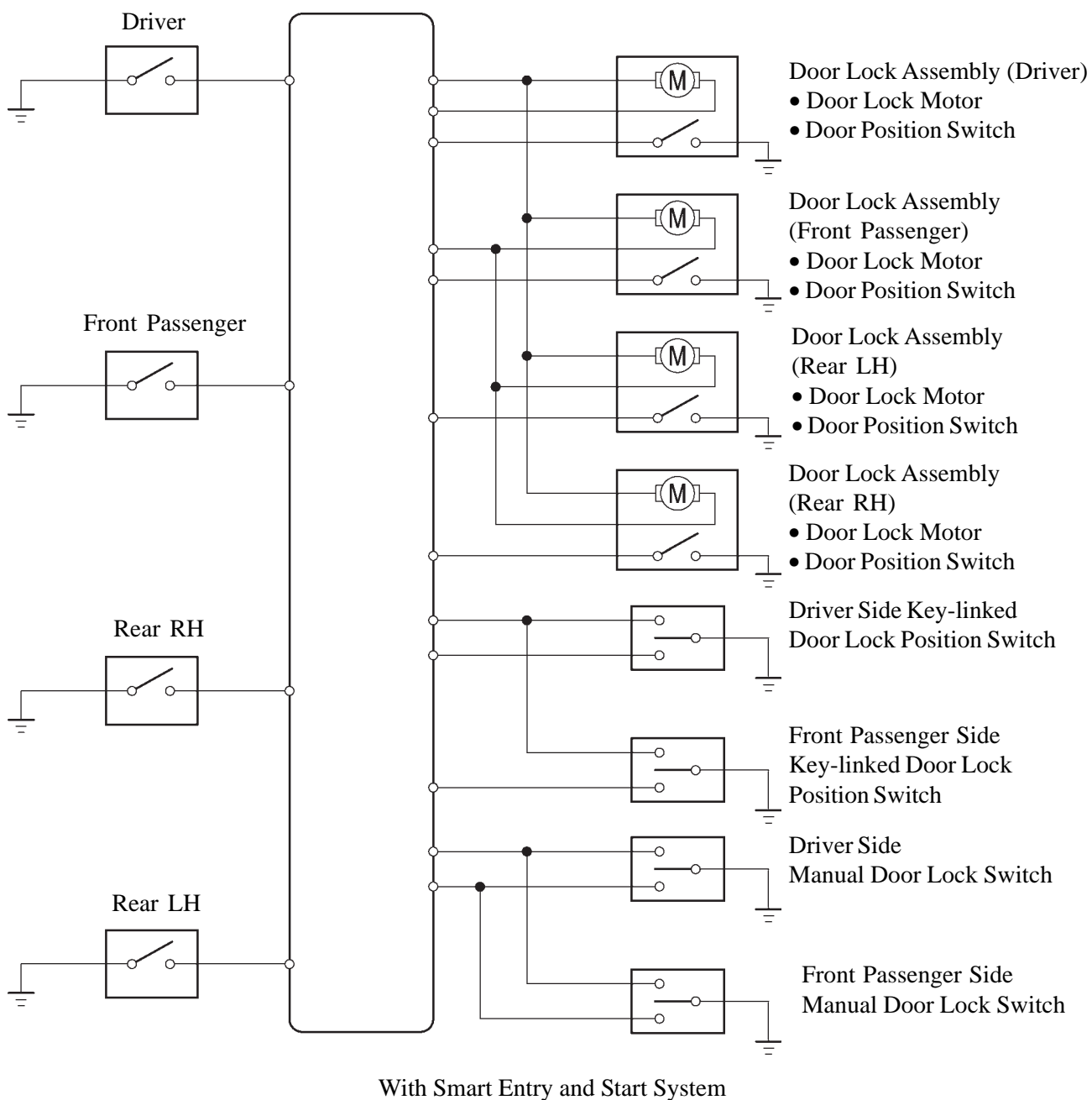
The door lock control system has the following functions:

Function	Outline
Manual unlock prohibition function	Performing the door lock operation with a transmitter (wireless remote) or a key prohibits the unlock operation by the door lock control switch (door mounted interior lock switch).
One-motion open	When the door is locked, this function enables the door to be unlocked by merely pulling the inside handle lever of the door.
Key-linked lock and unlock function	This function, which is linked with the door key cylinder, can lock or unlock all the doors when a lock or unlock operation is effected using the mechanical key.
2-step unlock function* <sup>1</sup>	This function is provided to unlock the driver's door by turning the key cylinder first and to unlock remaining doors by turning it a second time.
Key confine prevention function	When the key is inserted into the ignition key cylinder, if the door lock operation is performed with the driver's door open, all the doors are unlocked.

\*<sup>1</sup>: The 2-step unlock function is initially set to OFF. The setting functions can be changed using the customised body electronics system. For details, refer to Customised Body Electronics System section on page BE-11.

# ▸ System Diagram ◀

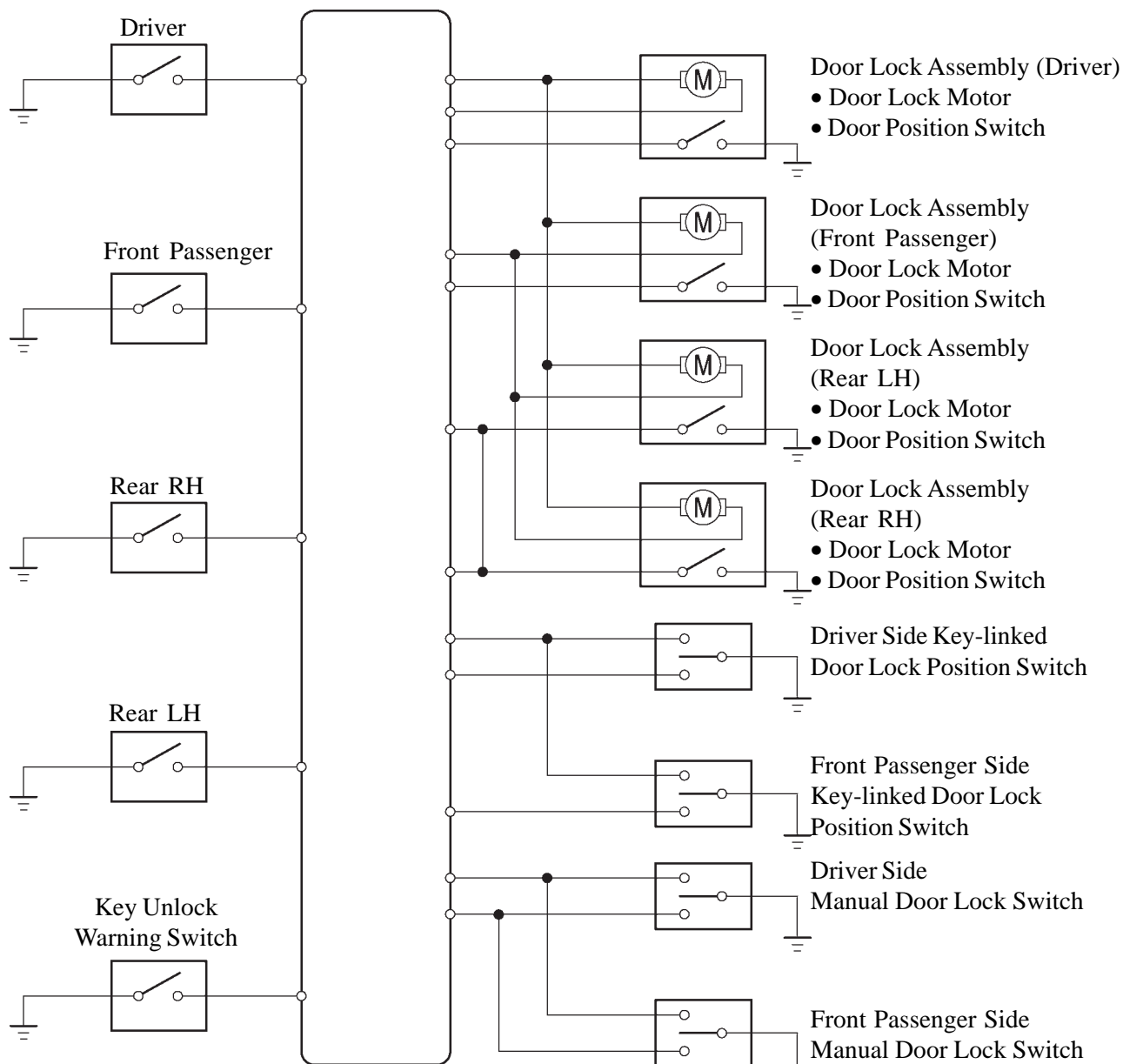
## Courtesy Switches



02KBE72TE

(Continued)

Courtesy Switches

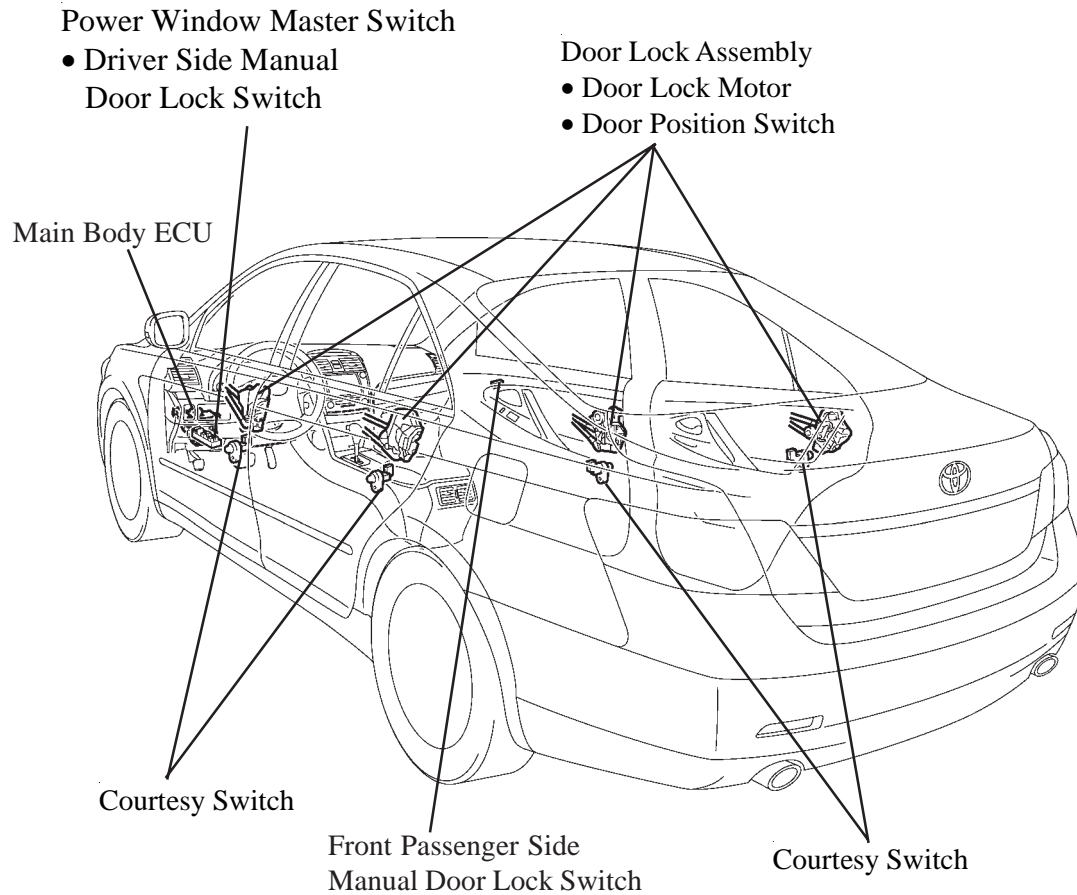


02KBE73TE

Without Smart Entry and Start System



## ✱ LAYOUT OF MAIN COMPONENTS



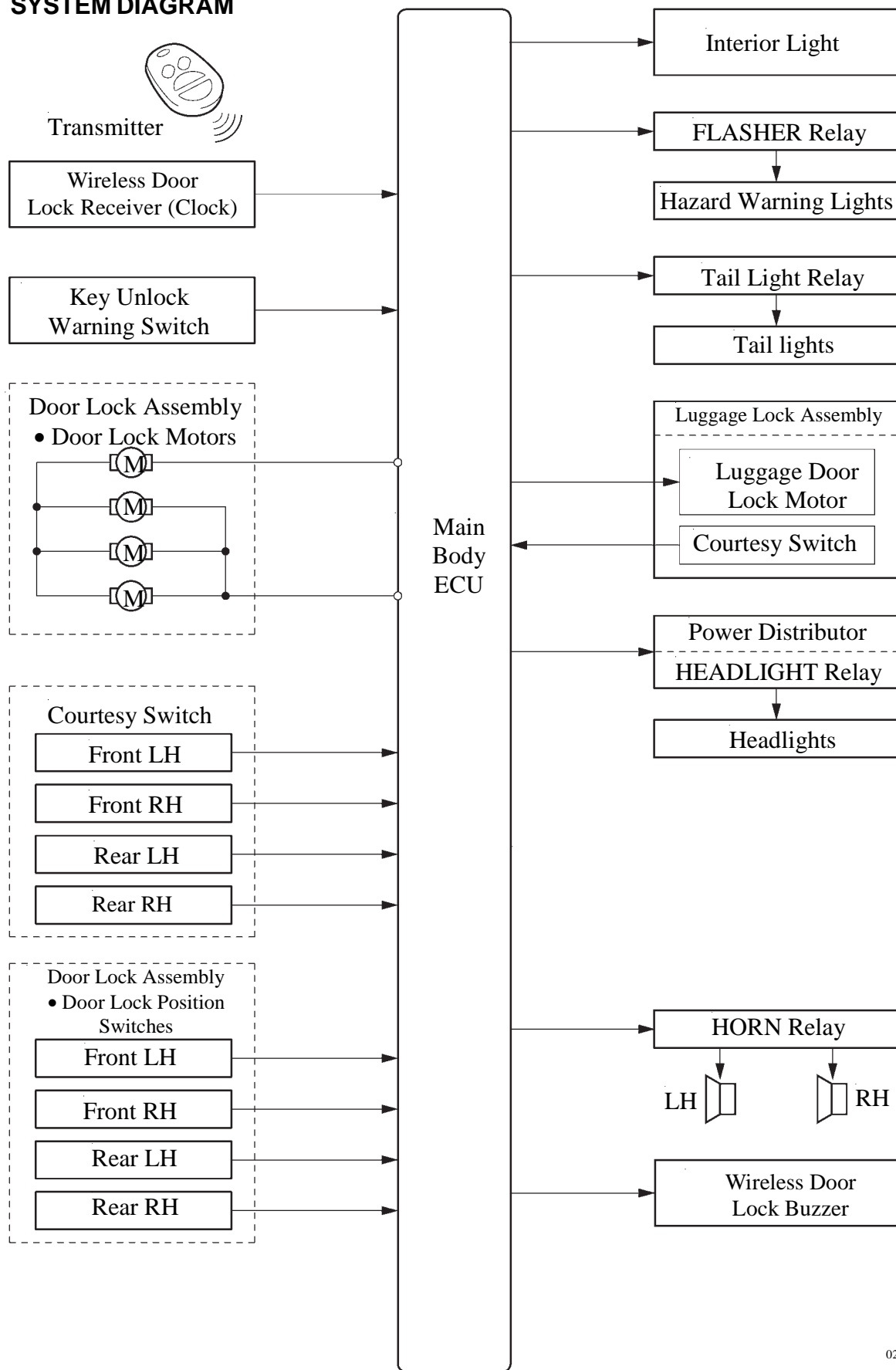
02KBE55TEb

## WIRELESS DOOR LOCK REMOTE CONTROL SYSTEM

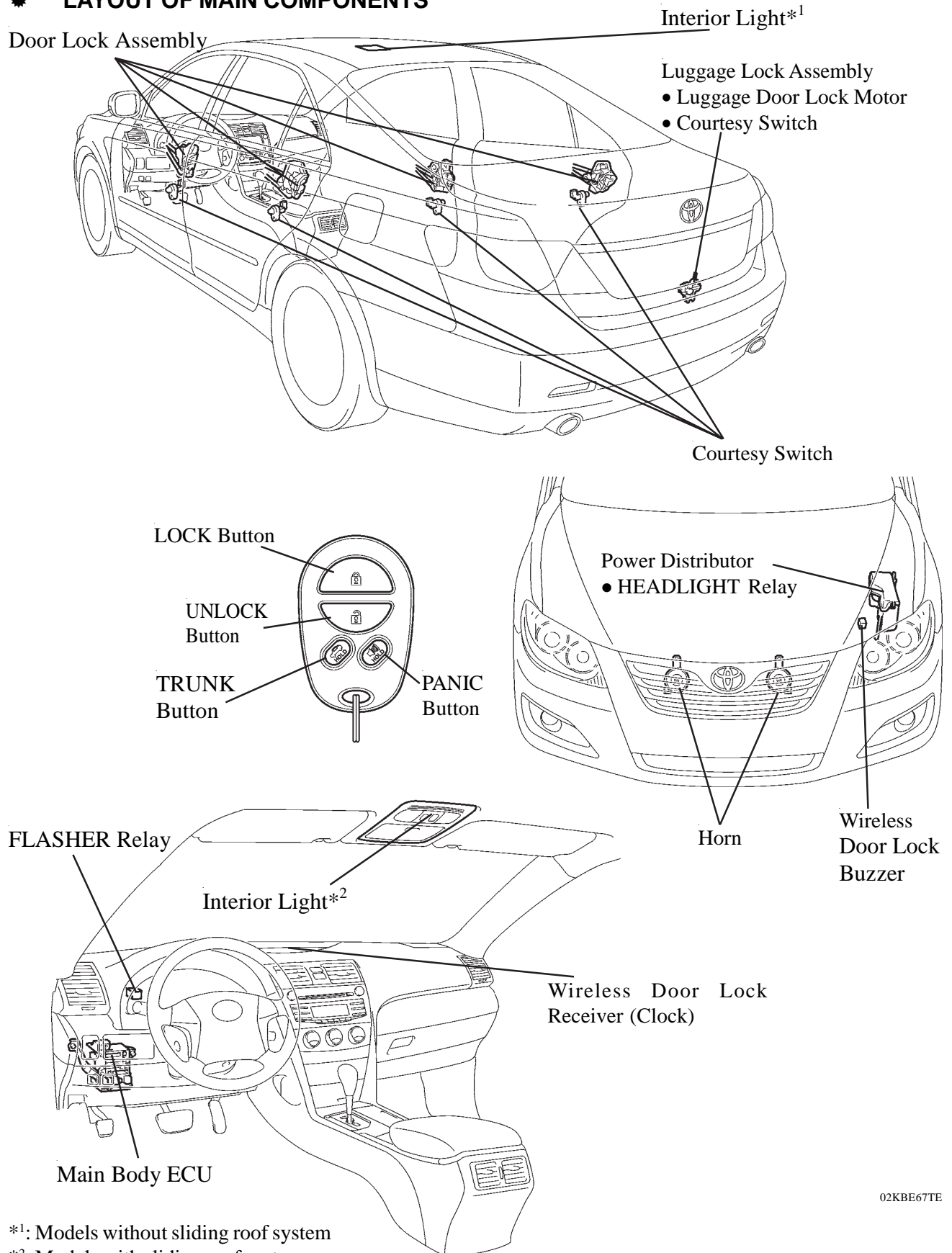
### ✱ DESCRIPTION

- The wireless door lock remote control system is used as standard on all grades without smart entry and start system.
- This system is controlled mainly by the main body ECU on models without the smart entry and start system and by the certification ECU on models with the smart entry and start system. For details about this system on models with smart entry and start system, refer to Entry Function Operation in Smart Entry and Start System. (See page BE-86).
- This system is controlled mainly by the main body ECU.
- This system is a convenient system for locking and unlocking all the doors from a distance. It has the following features:
  - The wireless door lock receiver performs the code identification process and sends the lock or unlock signal to the main body ECU. Then the main body ECU effects the door lock control.
  - A transmitter without a key is used, and it incorporates the following four buttons: LOCK, UNLOCK, TRUNK and PANIC.

● **SYSTEM DIAGRAM**



## ● **LAYOUT OF MAIN COMPONENTS**



\*1: Models without sliding roof system

\*2: Models with sliding roof system

LHD

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## FUNCTION

### 1. General

The wireless door lock remote control system has the following functions:

Function	Outline
All Doors Lock	Pressing the LOCK button on the transmitter locks all doors.
All Doors Unlock	Pressing the UNLOCK button on the transmitter unlocks all doors.
All Doors Unlock (2-step Unlock)* <sup>1</sup>	Pressing the UNLOCK button on the transmitter once unlocks the driver's door. If the UNLOCK button is pushed again within 3 seconds, all doors unlock.
Trunk Opener* <sup>2</sup>	Keeping the TRUNK button on the transmitter pressed for longer than about 0.6 seconds opens the boot lid.
Answer Back* <sup>2</sup>	<ul style="list-style-type: none"> <li>• The hazard lights flash once when locking and twice when unlocking, to inform that the operation has been completed.</li> <li>• The wireless door lock buzzer sounds once when locking, and sounds twice when unlocking, to inform that the operation has been completed.</li> </ul>
Panic Alarm	Keeping the PANIC button of the key pressed for longer than about 1 second causes the following alarms to activate. <ul style="list-style-type: none"> <li>• Sounds the horns, security horn.</li> <li>• Flashes the hazard warning lights, head lights, and tail lights.</li> <li>• Illuminates the interior light.</li> </ul>
Automatic Lock* <sup>2</sup>	If none of the doors are opened within 30 seconds of being unlocked by the wireless door lock remote control, all the doors are locked again automatically.
Repeat	If a door is not locked in response to the locking operation of the key, the main body ECU outputs a lock signal after the unlock operation.
Illuminated Entry* <sup>2</sup>	When all the doors are locked, pressing the UNLOCK button causes the interior lights to illuminate simultaneously with the unlock operation.
Transmitter Recognition Code Registration Function	Enables the registering (writing or storing) of 4 types of transmitter recognition codes in the EEPROM that is contained in the integration relay.

\*<sup>1</sup>: The 2-step unlock function is initially set to OFF. The setting function can be changed using the customised body electronics system.

\*<sup>2</sup>: The setting function can be changed using the customised body electronics system.

For details, refer to Customised Body Electrical System section on page BE-11.

## 2. Transmitter Recognition Code Registration Function

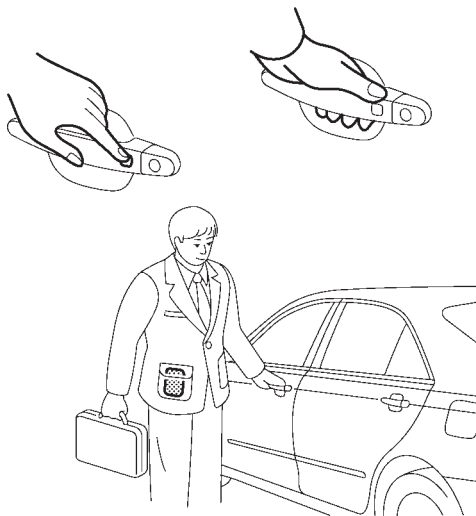
The table below shows the 4 special code ID registration function modes through which up to 4 different codes can be registered. The codes are electrically registered (written to and stored) in the EEPROM. For details of the recognition code registration procedure, refer to the Aurion Repair Manual.

Mode	Function
Rewrite Mode	Erases all previously registered codes and registers only the newly received codes. This mode is used whenever a wireless door lock receiver is replaced.
Add Mode	Adds a newly received code while preserving any previously registered codes. This mode is used when adding a new key. If the number of codes exceeds 4, the oldest registered code is erased first.
Confirm Mode	Confirms how many codes are currently registered. When adding a new code, this mode is used to check how many codes already exist.
Prohibit Mode	To delete all the registered codes and to prohibit the wireless door lock function. This mode is used when transmitters are lost.

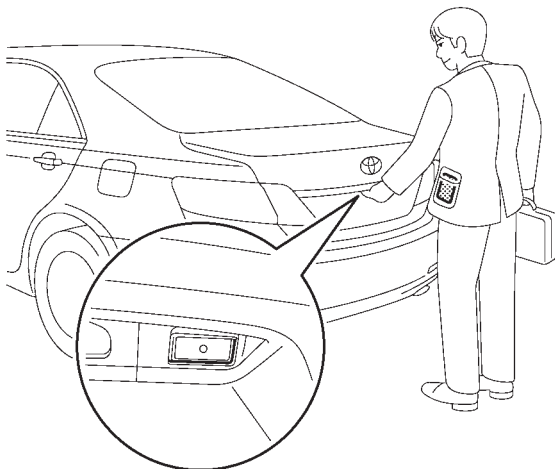
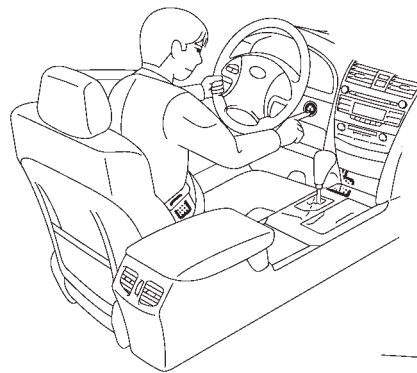
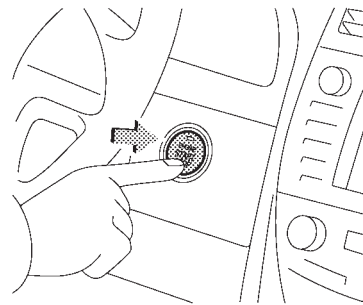
## SMART ENTRY AND START SYSTEM

### ✱ DESCRIPTION

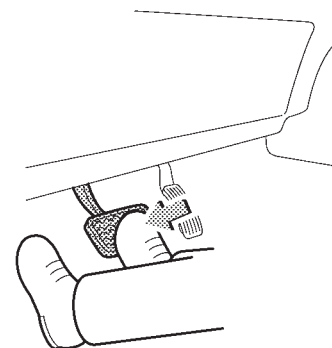
- The system settings vary depending on the destinations and engine types. For details, see the equipment list in Model Outline (see page MO-27).
- The smart entry and start system not only has a wireless door lock remote control function and engine immobiliser function, but by carrying the key the following functions (entry function and push button start function) are also possible without having to use a key or transmitter button. It is an extremely convenient system.
  - The engine can be started by simply pressing the engine switch while depressing the brake pedal (Push Button Start Function)
  - Door unlock / lock (Entry Unlock / Entry Lock Functions)
  - The trunk can be opened (Trunk Open Function)
  - Wireless door lock control function.



**Entry Unlock / Lock Functions**



**Trunk Open Function**

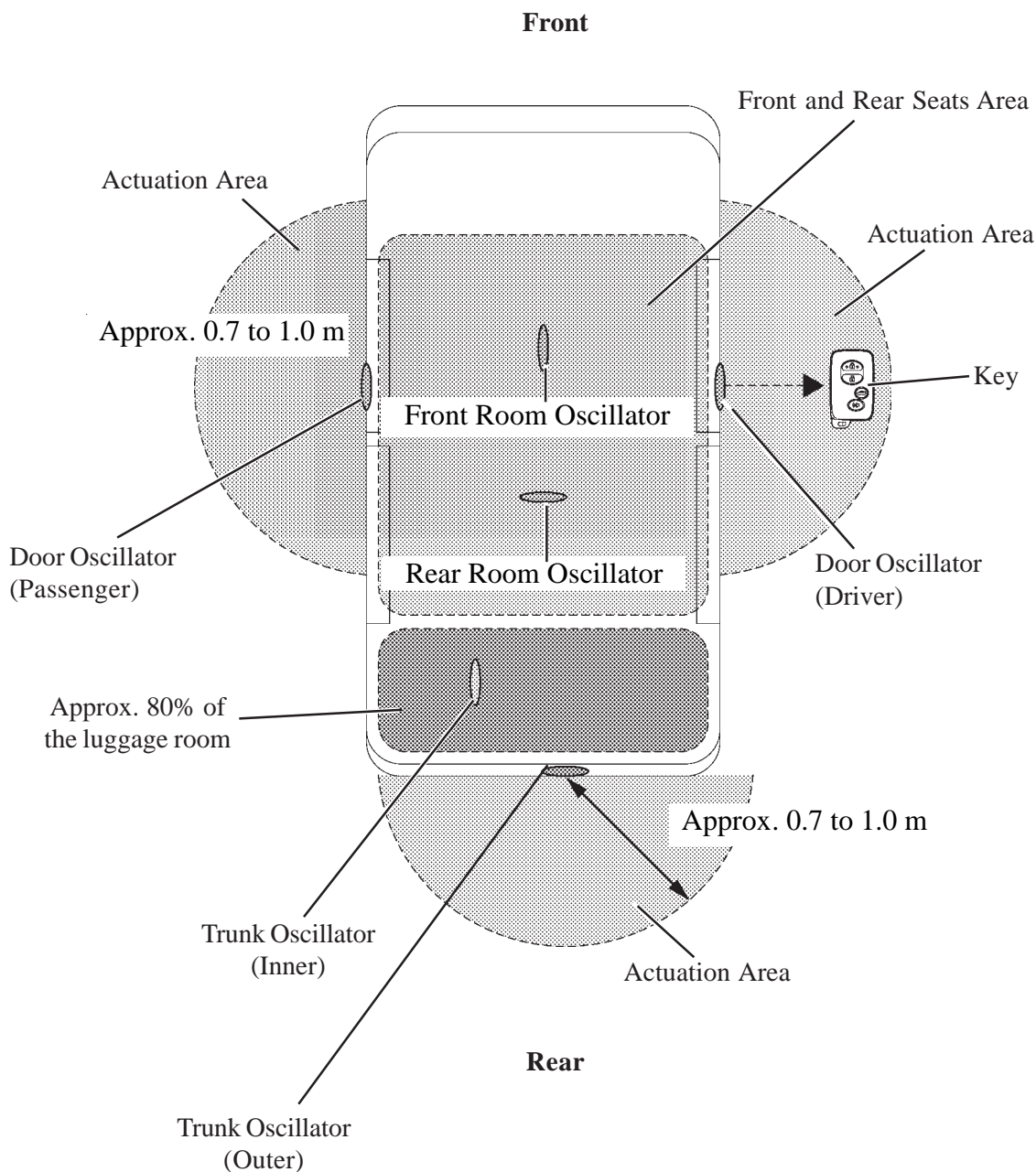


**Start Function**

## \* **ACTUATION AREA**

The special functions of the smart entry and start system only work when the key is in the actuation area formed by the eight oscillators.

- The front and rear room oscillators form the actuation area of the push button start function.
- Front door oscillators and inner and outer trunk oscillators form the actuation area of the entry function.



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## ✱ START FUNCTION

### 1. General

- While the ignition key must be inserted into the ignition key cylinder and turned from OFF to the START position in order to start the engine on models without the smart entry and start system, models on which the smart entry and start system is installed start the engine when the push-type engine switch is pressed while the brake pedal is depressed and a key is carried by the driver.
- This function has different power source control patterns to suit the state of the brake pedal and shift lever position. For details, see page BE-94.
- Along with the adoption of the start function, an engine cranking hold function is used. For details, see page EG-69.



**With Smart Entry and Start System**

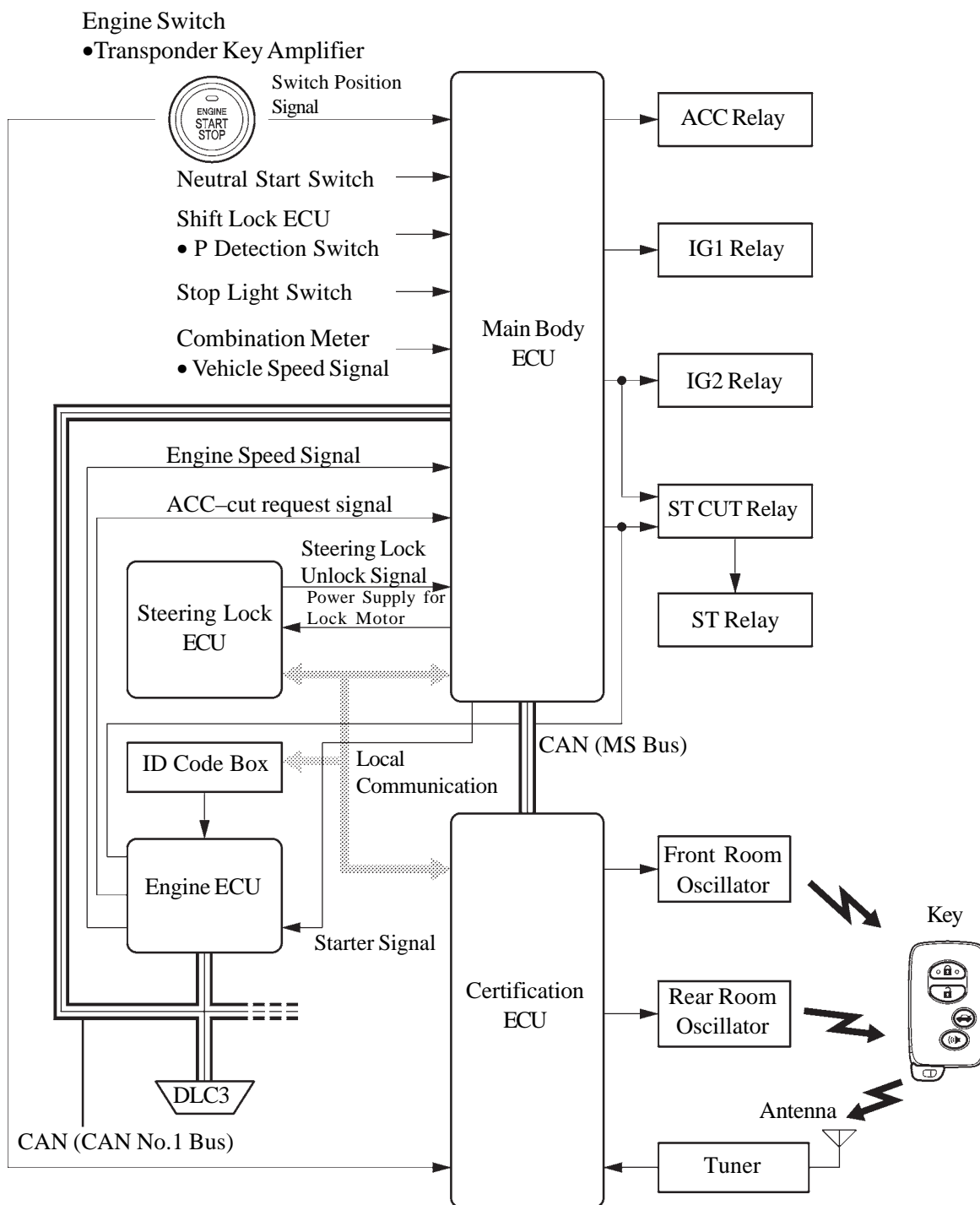


**Without Smart Entry and Start System**

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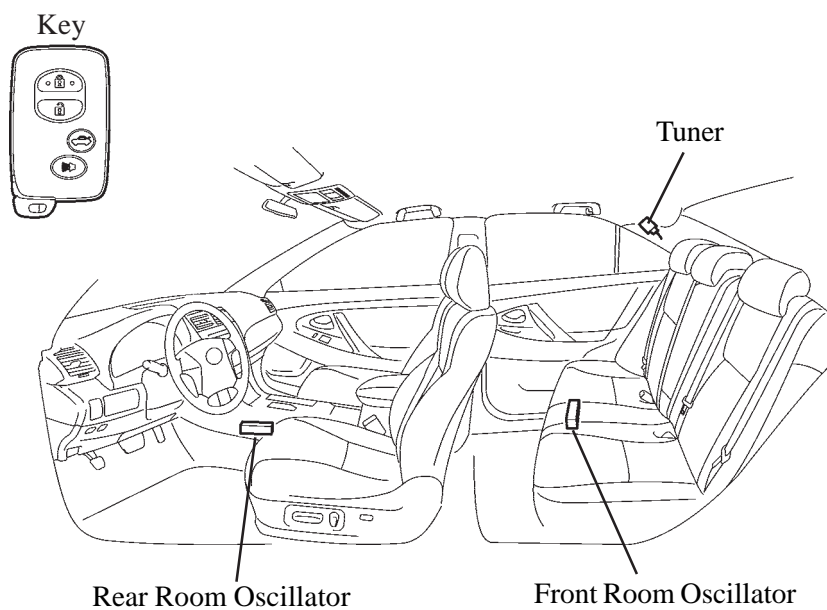
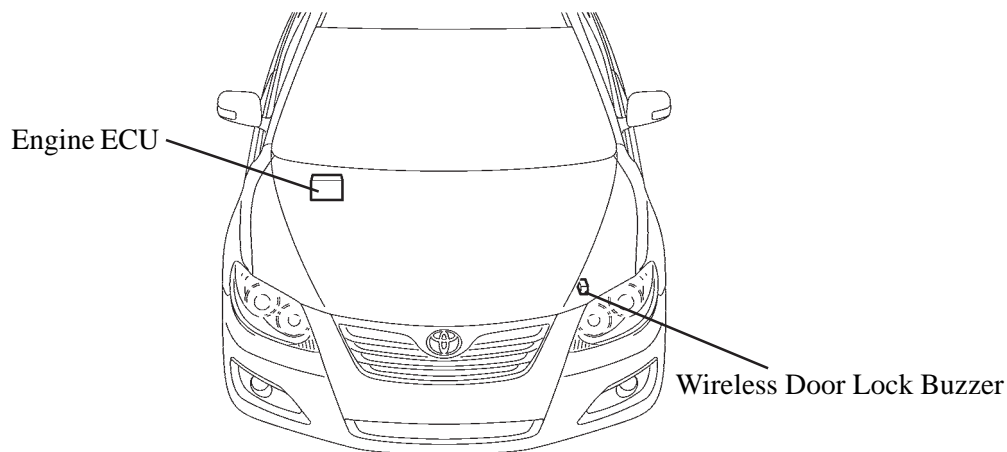
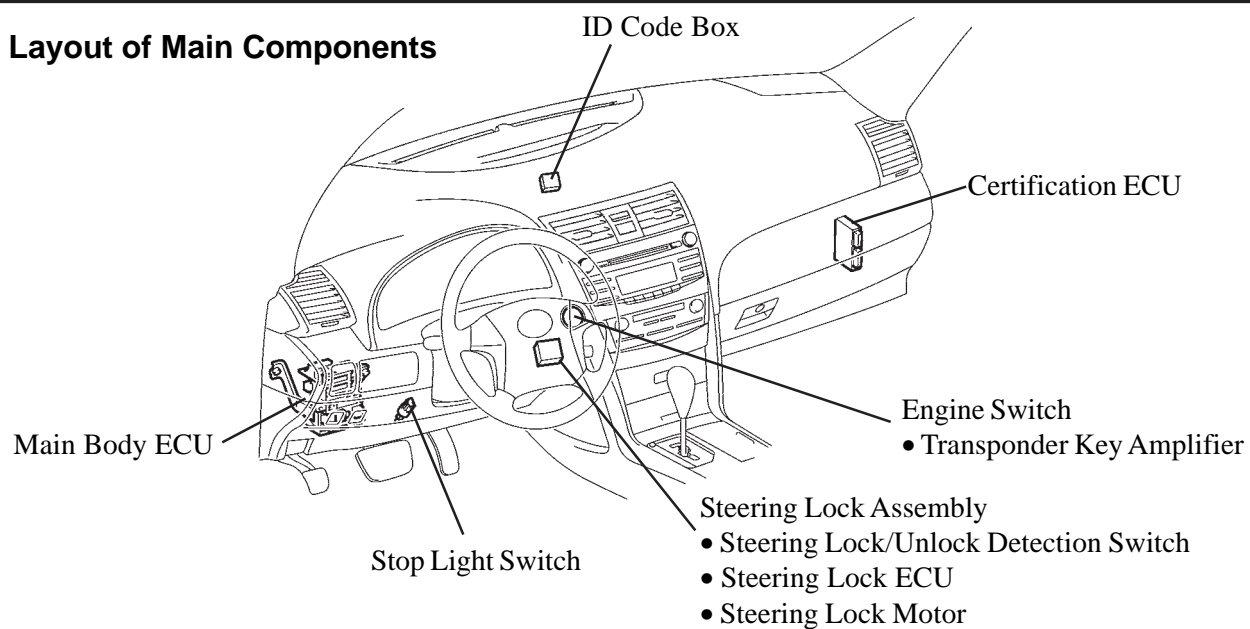
## 2. System Diagram

The main body ECU controls the push button start function. The system diagram below shows the components that relate to this function.



02KBE155TE

### 3. Layout of Main Components



02KBE91TE

#### 4. Function of Main Components

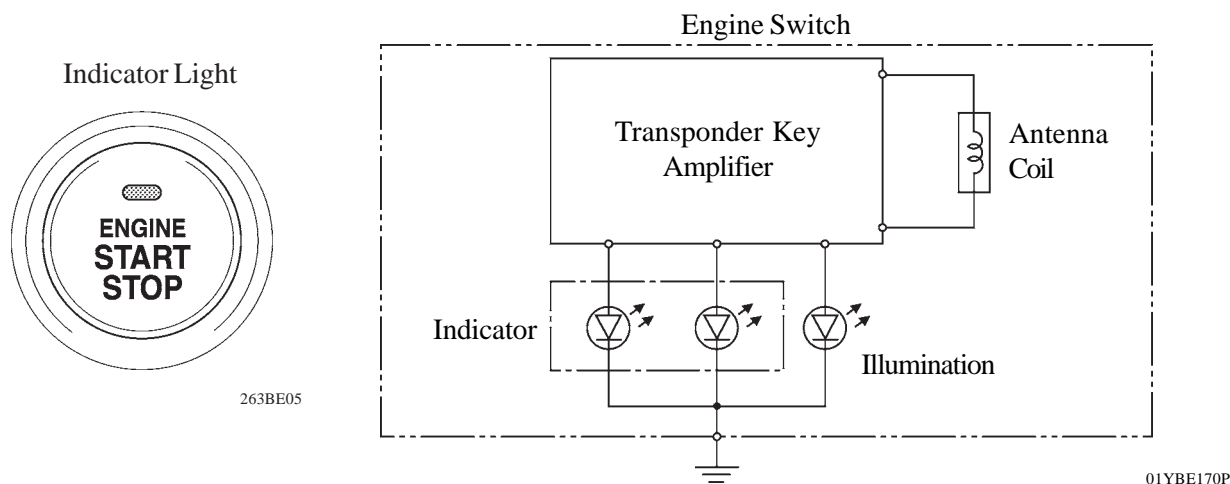
Component		Function
Engine Switch • Transponder Key Amplifier		<ul style="list-style-type: none"> <li>• Transmits the engine switch signal to the main body ECU.</li> <li>• Informs the driver of any power source or system abnormality through the illumination stage of the indicator light.</li> <li>• Receives the ID code and transmits it to the certification ECU when the key battery is too weak to respond to the tuner based on the room oscillators.</li> </ul>
Key		Receives the signals from the oscillators and returns the ID code to the tuner. For details, see page BE-105.
Room Oscillator • Front and Rear		Receives a request signal from the certification ECU and forms the actuation area in the vehicle interior.
Tuner		Receives the ID code from the key and transmits it to certification ECU.
Main Body ECU		<ul style="list-style-type: none"> <li>• Switches the power source among four modes (OFF, ACC, IG-ON, START) in accordance with the shift position and the state of the stop light switch.</li> <li>• Controls the smart entry and start system in accordance with the signals received from the switches and each ECU.</li> </ul>
Certification ECU		Certifies the ID code received from the tuner and transmits the certification results to the ID code box and steering lock ECU.
Stop Light Switch		Outputs the state of the brake pedal to main body ECU.
ID Code Box		Receives the steering unlock or engine immobiliser disengage/engage signals from the certification ECU, certifies them, and transmits each disengage/engage signal to the steering lock ECU or engine ECU.
Steering Lock ECU		Receives the steering unlock/lock signal from ID code box, and activates the steering lock motor.
Engine ECU		<ul style="list-style-type: none"> <li>• Receives the engine start request signal from the main body ECU, turns ON the ST relay, and starts the engine.</li> <li>• Receives the signal from the ID code box and performs engine ignition and injection.</li> </ul>
Combination Meter	Multi-information Display	Informs the driver of malfunctions in the smart entry and start system.
	Master Warning Light	Illuminates simultaneously with a buzzer sound to inform the driver of malfunctions in the smart entry and start system.

## 5. Construction and Operation

### Engine Switch

The engine switch consists of a momentary type switch, two colour (Amber, Green) LEDs, and transponder key amplifier.

- The amber and green LEDs are for the indicator light.
- The driver can determine the present power source and check whether the engine can start or not in accordance with the illumination state of the indicator light.
- When the main body ECU detects an abnormality with the smart entry and start system, it makes the amber indicator light flash. If the engine is stopped in this state, it might not be possible to restart it.

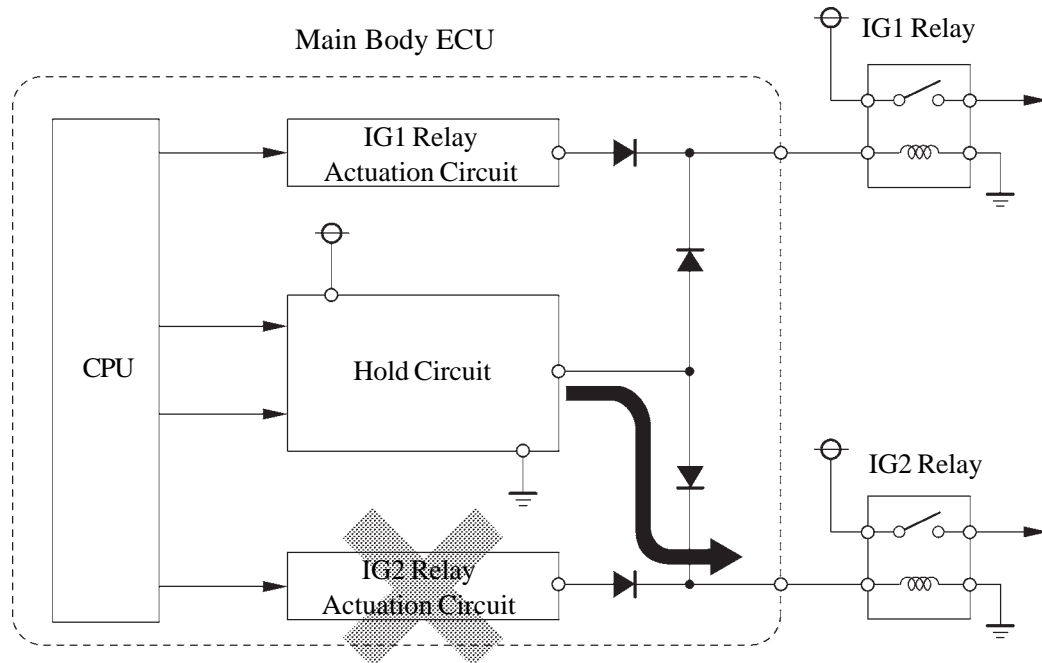


### Indicator Light Condition

Power Source Condition	Indicator Light Condition	
	Brake pedal released	Brake pedal depressed with shift lever in "P" or "N"
OFF	OFF	ON (Green)
ACC, IG-ON	ON (Amber)	ON (Green)
Engine Running	OFF	OFF
Steering lock not unlocked	Flashes (Green) for 15 seconds	Flashes (Green) for 15 seconds
Smart Entry and Start System Malfunction	Flashes (Amber) for 15 seconds	Flashes (Amber) for 15 seconds

## Main Body ECU

- Main body ECU consists of the IG1 relay and IG2 relay actuation circuits, CPU, and hold circuit.
- The hold circuit is installed to prevent the power supply to the relays from being cut off when an abnormality occurs in IG1 relay and / or IG2 relay actuation circuits while driving.



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### Service Tip

The main body ECU constantly stores the present power source state in its memory. Therefore, if the power to main body ECU is interrupted due to the removal of the battery, the main body ECU restores the power source after the battery is reconnected.

For this reason, if the battery is removed when the engine switch is in a state other than OFF, the power will be restored to the vehicle at the same time the power is restored to main body ECU (by reconnecting the battery).

Therefore, before removing the battery, be sure to turn the engine switch OFF.





























## 6. Start Function Operation

### General

The start function has different power source patterns to suit the brake pedal state and shift lever position.

Pattern	Brake Pedal	Shift Lever	Power Source Pattern
A	Depressed	P or N Position	When the engine switch is pushed once. • OFF → IG ON (after the engine is started)
B	Released	P Position	The power source mode changes repeatedly in the following sequence when the engine switch is pushed: OFF → ACC → IG ON → OFF
C		Any position other than P	The power source mode changes repeatedly in the following sequence when the engine switch is pushed : OFF → ACC → IG ON → ACC
D	—	P Position	When the engine switch is pushed in the IG-ON condition. • IG ON (engine is started or not started) → OFF
E	—	Any position other than P	When the engine switch is pushed in the IG-ON condition. • IG ON (engine is started or not started) → ACC

### ► Transition of Power Source ◄

Shift Position		P			N		Any position other than P or N	
Pattern		B or D	A or D	-	C or E	A or E	C or E	-
Engine Switch		Push	Push	-	Push	Push	Push	Push
Brake		-	Depressed	-	-	Depressed	-	Depressed
Hour		-	-	After 1 hour	-	-	-	-
Power Source	OFF							
	ACC							
	IG							
	Engine Start							

 : Transition

 : Only when the key certification is OK

 : Only when the vehicle is stopped

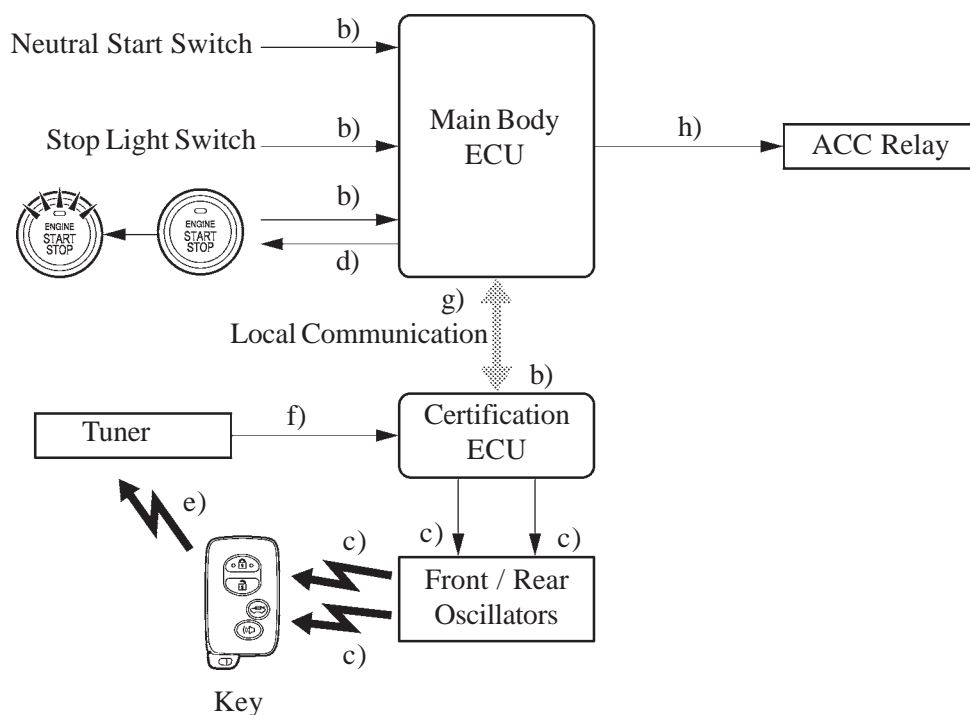
### NOTE:

- Normally, the operation of the engine switch is disabled while the vehicle is being driven. However, in an emergency, the driver can stop the engine while the vehicle is in motion by pressing the engine switch for approximately 3 seconds or more to turn the power source from IG ON to ACC.
- If no signals are transmitted to the main body ECU due to malfunctions in the stop light switch, the engine may not start when the engine switch is pressed with the brake pedal depressed. In such cases, performing the following procedure may enable the engine to start: 1) press the engine switch to turn the power source from OFF to ACC, and 2) press the engine switch again and hold it for 15 seconds or more.
- The above two operations must be applied only in emergency situations. Under normal conditions, the engine must not be stopped by pressing the engine switch during driving or started without depressing the brake pedal when the shift lever is in any position other than P or N.



**Pattern A: OFF → IG-ON (after the engine is started)**

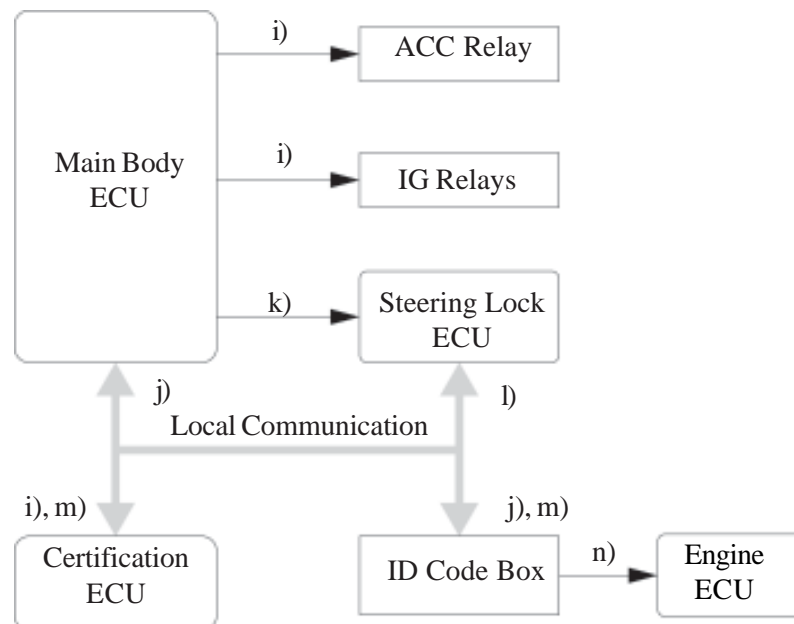
Step	System Operation
a)	The driver holds the key and enters the vehicle.
b)	When the driver presses the engine switch once with the following conditions satisfied, the main body ECU recognises the engine switch signal and transmits the key certification request to the certification ECU. <ul style="list-style-type: none"> <li>• Shift position is “P” or “N”.</li> <li>• Brake pedal depressed.</li> <li>• Power source is at “OFF”.</li> </ul>
c)	The certification ECU receives the certification request and transmits a request signal to the front / rear oscillators. These oscillators then transmit the request signal.
d)	The brake pedal is depressed, so the main body ECU turns ON the green indicator light of the engine switch.
e)	The moment the key receives the request signal, it transmits its ID code to the tuner. The signal includes the response code.
f)	The tuner receives this code and transmits it to the certification ECU.
g)	The certification ECU judges and certifies the ID code, and transmits a key certification OK signal to the main body ECU.
h)	After receiving the key certification OK signal, the main body ECU turns ON the ACC relay.



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(Continued)

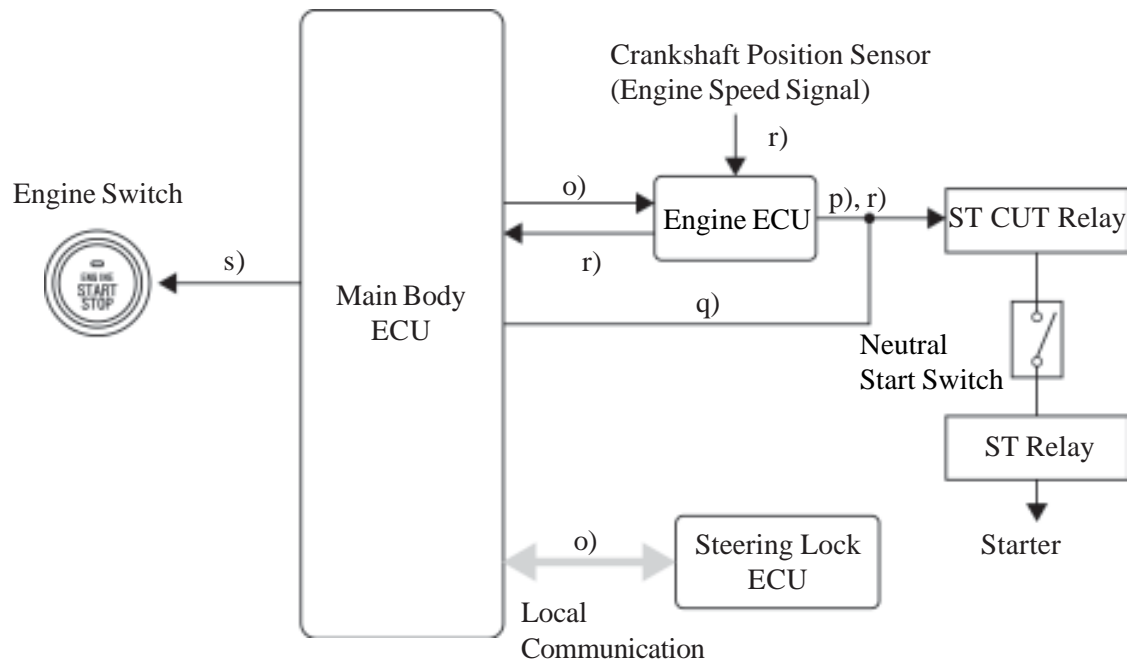
Step	System Operation
i)	The main body ECU turns ON the ACC relay, and then turns ON the IG relays.
j)	The certification ECU checks that the power source has switched from OFF to IG-ON, and transmits a steering unlock signal to the main body ECU and ID code box.
k)	The main body ECU receives this signal and supplies power to the steering lock ECU.
l)	The steering lock ECU receives the steering unlock signal via the ID code box, and releases the steering lock.
m)	After checking the steering unlock condition, the certification ECU transmits an engine immobiliser disengage signal to the ID code box.
n)	The ID code box certifies the disengage signal of the certification ECU, transmits the engine immobiliser disengage signal to the engine ECU, and disengages the engine immobiliser.



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(Continued)

Step	System Operation
o)	After checking that the steering is in the unlocked condition, the main body ECU transmits a starter request (STSW) signal to the engine ECU.
p)	The engine ECU receives this signal, outputs an ST relay (STAR) signal, and actuates the starter. (For details see the cranking hold function on page EG-69.)
q)	The engine ECU and main body ECU both output the starter relay signal in order to actuate the starter. Both the engine ECU and main body ECU output the signal in order to prevent situations where the starter may fail to operate, such as when the battery voltage supplied to the engine ECU is low.
r)	When the engine ECU judges from the engine speed that engine start is completed, it stops the starter relay (STAR) signal, and stops the starter.
s)	The main body ECU receives this signal, checks that engine start is completed, and turns OFF the indicator light of the engine switch.



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**Pattern B: OFF → ACC → IG ON → OFF****1) OFF → ACC**

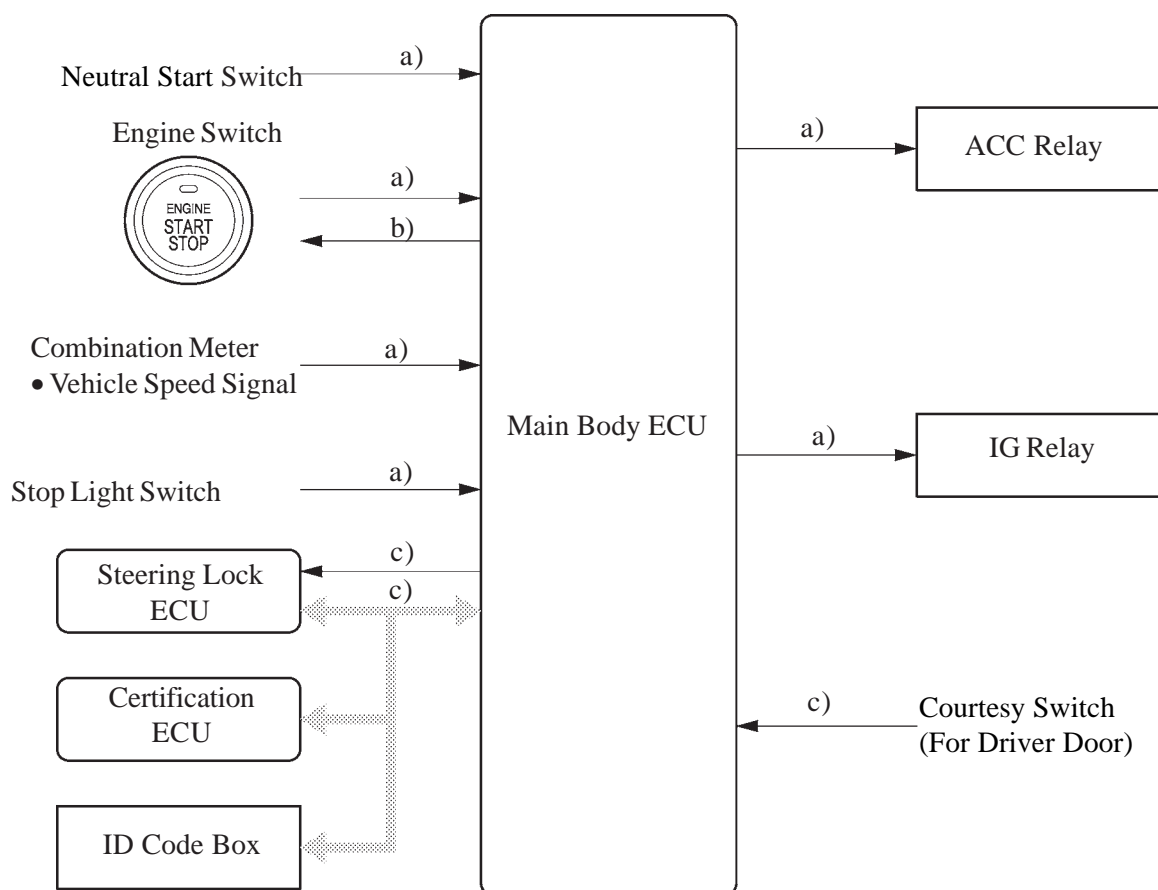
Step	System Operation
a)	The driver has the key in their possession and enters the vehicle.
b)	When the driver presses the engine switch once with the following conditions satisfied, the main body ECU recognises the engine switch signal and transmits the key certification request to the certification ECU. <ul style="list-style-type: none"> <li>• Shift position is “P”.</li> <li>• Brake pedal is released.</li> <li>• Power source is “OFF”.</li> </ul>
c)	Due to the brake pedal not being depressed, the main body ECU will turn ON the amber indicator light of the engine switch.
d)	The rest of the system operation is the same as <b>d) to h) in pattern “A”</b> . For details, see page BE-96.

**2) ACC → IG ON**

Step	System Operation
a)	When the power source is at “ACC” and the driver pressed the engine switch again, the main body ECU recognises the engine switch signal and turns ON the IG relays.
b)	The rest of the system operation is the same as <b>j) to n) in pattern “A”</b> . For details, see page BE-96.

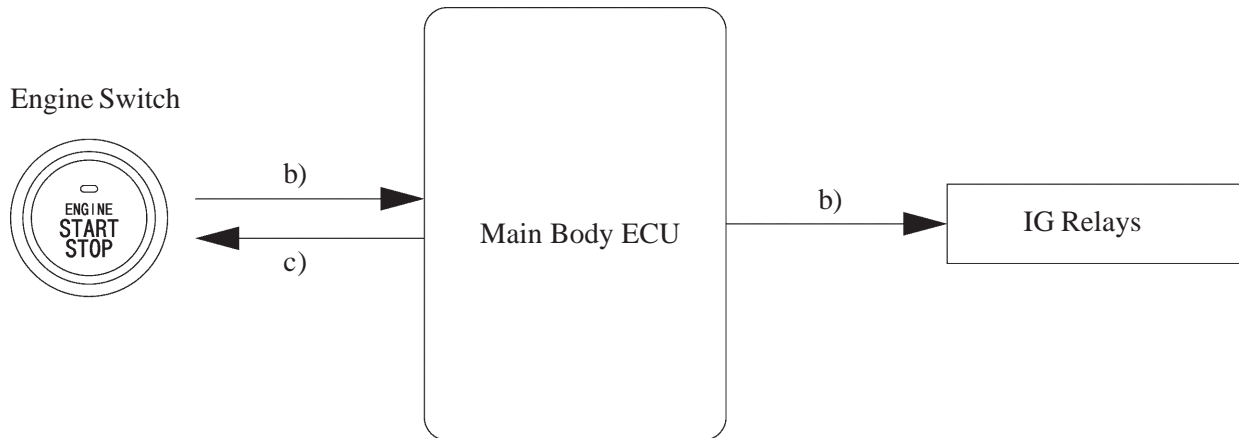
**3) IG ON → OFF**

Step	System Operation
a)	When the engine switch is pressed once with the following conditions satisfied, the main body ECU recognises the engine switch signal and turns OFF the ACC and IG relays. <ul style="list-style-type: none"> <li>• Shift position is “P”.</li> <li>• Brake pedal is released.</li> <li>• Vehicle speed is 0 km/h (0 mph).</li> <li>• Power source is in “IG-ON” mode.</li> </ul>
b)	When the power source is switched from IG-ON to OFF, the main body ECU turns OFF the indicator light of the engine switch.
c)	When the driver’s door is opened, the main body ECU receives a signal from the courtesy switch (for driver door). The certification ECU monitors the courtesy switch signal and transmits the steering lock signal to the main body ECU and ID code box accordingly. Then, the main body ECU receives this signal and supplies power to the steering lock ECU. The steering lock ECU receives the steering lock signal via the ID code box, and locks the steering.



**Pattern C: OFF → ACC → IG ON → ACC**

Step	System Operation
a)	The system operations for the power source “OFF → ACC → IG ON” are the same as those in pattern B. For details, see page BE-121.
b)	When the engine switch is pressed once with the following conditions satisfied, the main body ECU recognises the engine switch signal and turns OFF the IG relays. <ul style="list-style-type: none"> <li>• Shift position is in any position except “P”.</li> <li>• Brake pedal is released.</li> <li>• Vehicle speed is 0 km/h (0 mph).</li> <li>• Power source is in “IG-ON” mode.</li> </ul>
c)	Even after the power source switches from IG ON to ACC, the indicator light of the engine switch will remain illuminated in amber.



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**Pattern D: IG ON → OFF**

This system operation is the same as IG ON → OFF for pattern “B”. For detail, see page BE-120.

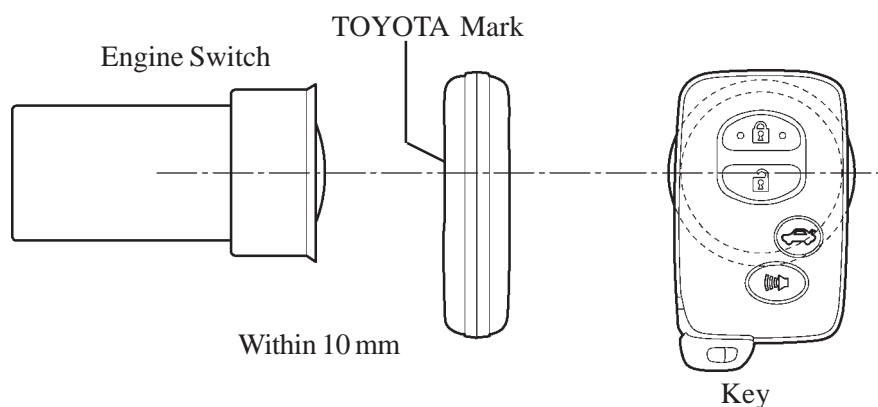
**Pattern E: IG ON → ACC**

This system operation is the same as pattern “C”. For details, see page BE-102. However, the indicator light of the engine switch will illuminate as follows:

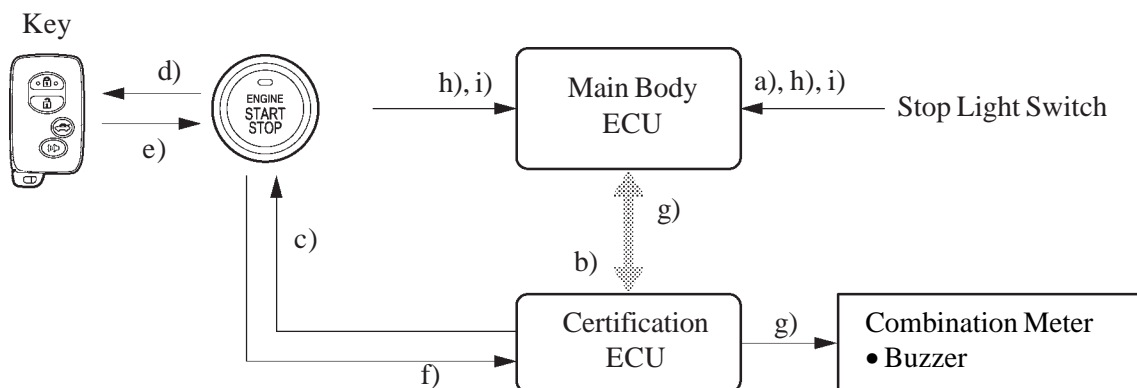
- When the power source is switched from IG-ON to ACC, the main body ECU makes the amber indicator light of the engine switch continue to illuminate.
- When the power source is switched from engine running to OFF, the main body ECU turns OFF the indicator light of the engine switch.

**When key battery is low**

Step	System Operation
a)	To operate the smart entry and start system when the key battery is low, hold the key against the engine switch as shown below while depressing the brake pedal.
b)	The main body ECU receives the stop light switch signal and transmits a key certification request signal to the certification ECU.
c)	The certification ECU does not receive an ID code response from the tuner, so it actuates the transponder key amplifier built into the engine switch.
d)	The transponder key amplifier outputs an engine immobiliser radio wave to the key.
e)	The key receives the radio wave, and returns a radio wave response to the transponder key amplifier.
f)	The transponder key amplifier combines the key ID codes with the radio wave response, and transmits it to the certification ECU.
g)	The certification ECU judges and verifies the ID code, and transmits a key certification OK signal to the main body ECU. The buzzer in the combination meter sounds at the same time.
h)	After the buzzer sounds, if the engine switch is pressed within five seconds while the brake pedal is depressed, the power source switches to start the engine running, the same as with normal smart entry and start operation.
i)	After the buzzer sounds, if the engine switch is pressed within five seconds while the brake pedal is released, the power source will be switched to ACC or IG-ON, the same as with normal smart entry and start operation.



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LHD

## 7. Diagnosis

The main body ECU and certification ECU can detect malfunctions in the smart entry and start system when the power source is in the IG-ON mode.

When the ECUs detect a malfunction, the amber indicator light of the engine switch flashes to warn the driver. At the same time, the ECUs may store 5-digit DTCs (Diagnostic Trouble Codes) in their memories depending on the malfunction.

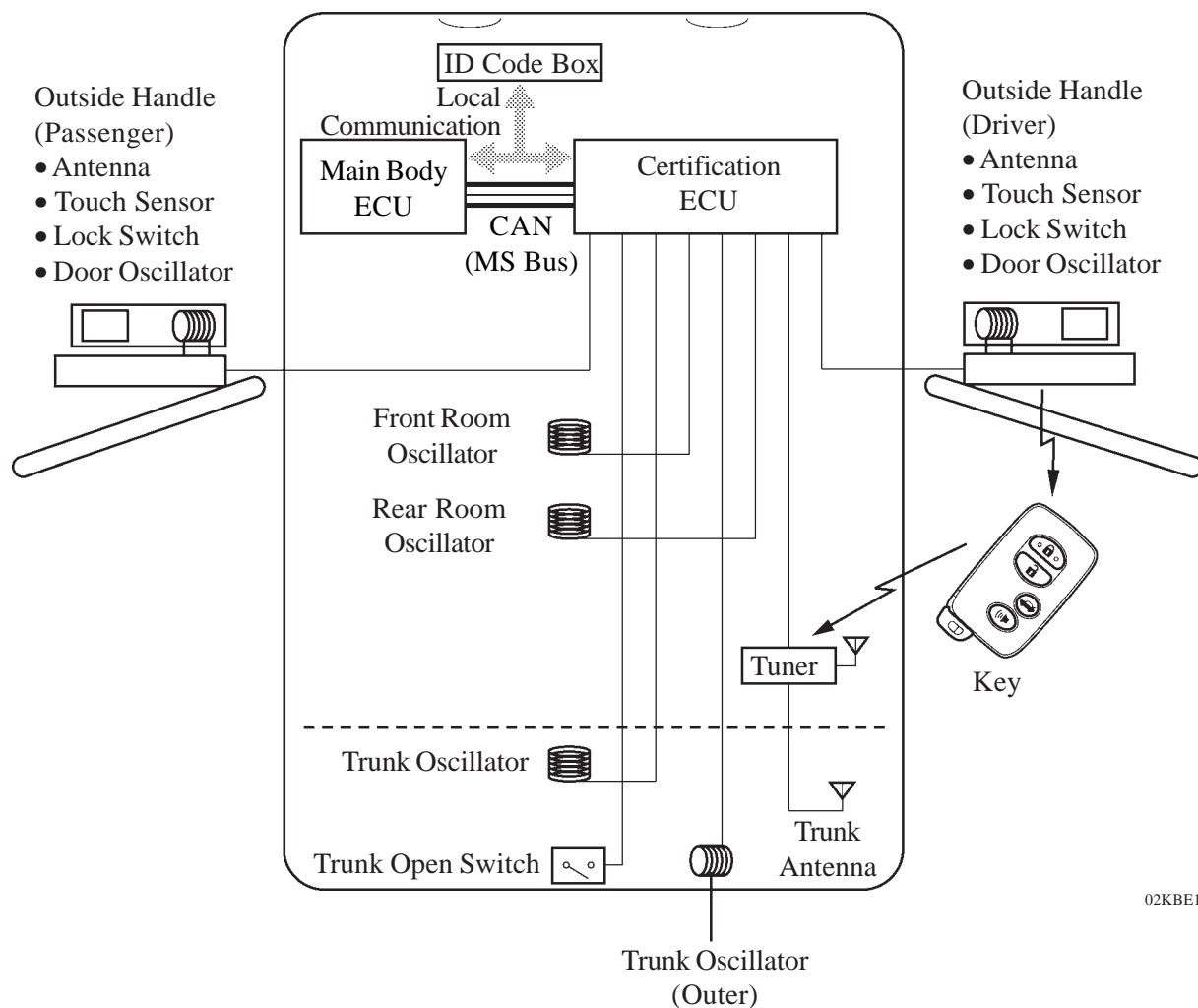
- The indicator light warning continues for 15 seconds even after the power source is switched to OFF.
- The DTC can be read by connecting an intelligent tester II to the DLC3.
- The smart entry and start system may not operate successfully if a malfunction occurs.



## ✱ ENTRY FUNCTION

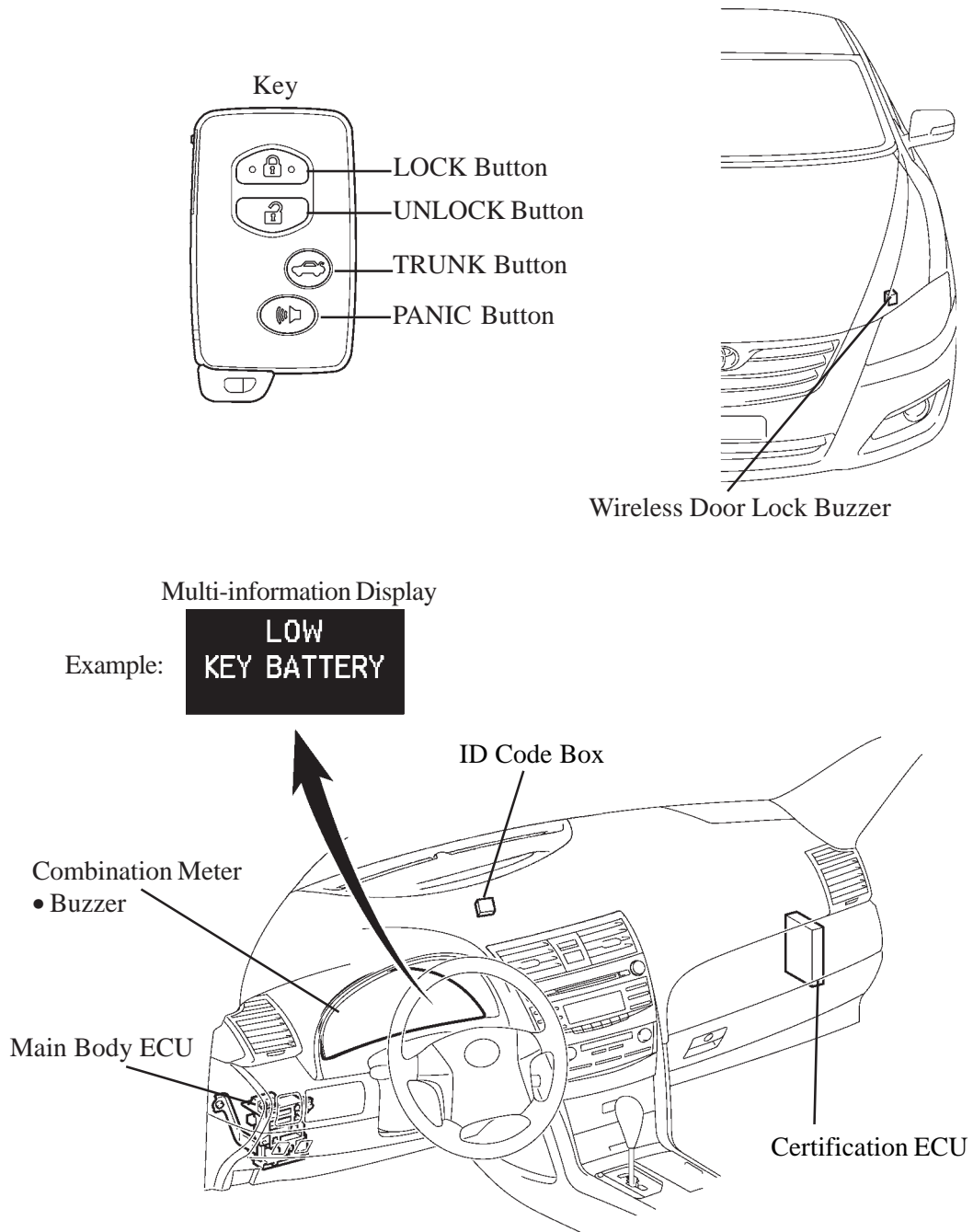
### 1. System Diagram

The certification ECU controls the entry function. The system diagram below shows the main components that relate to the function.



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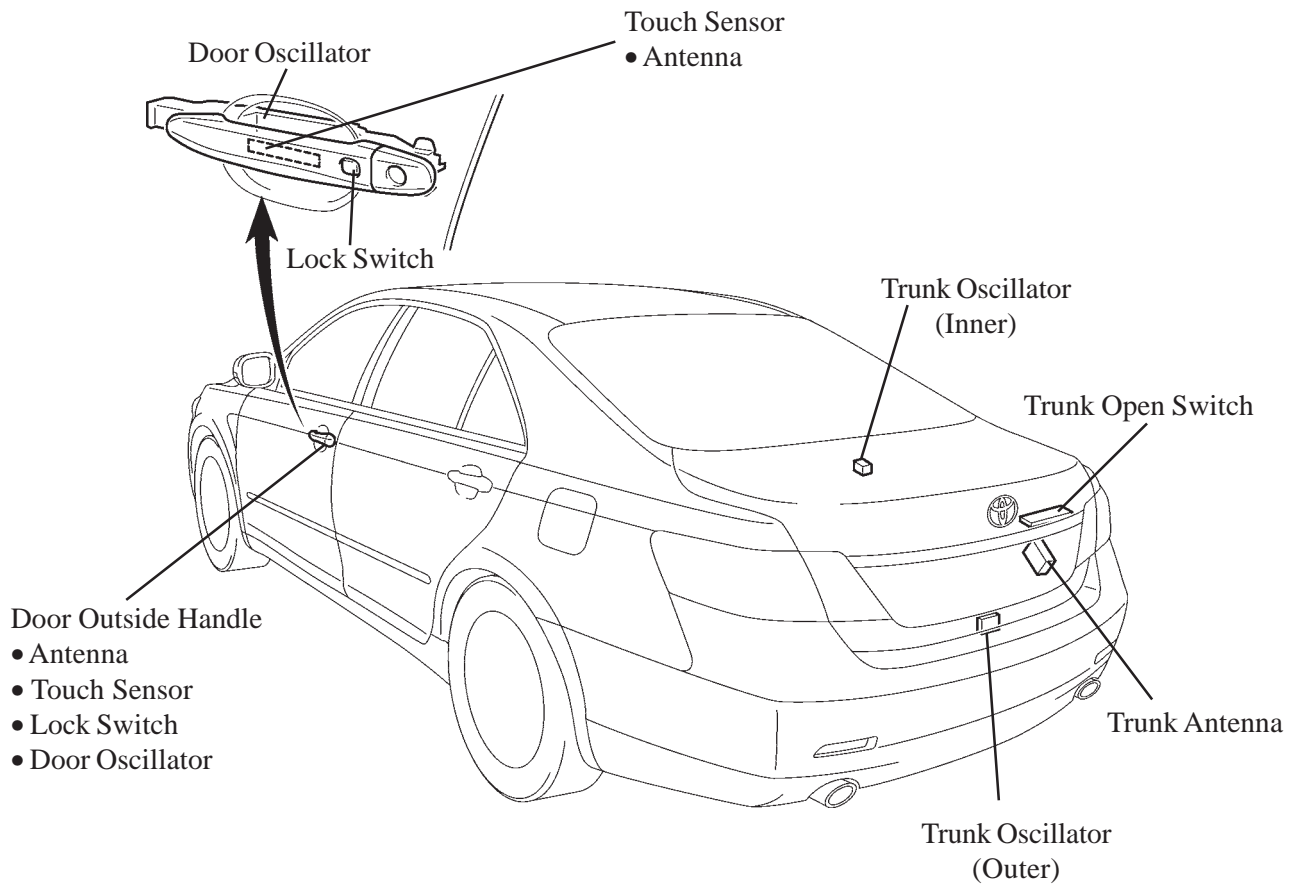
## 2. Layout of Main Components



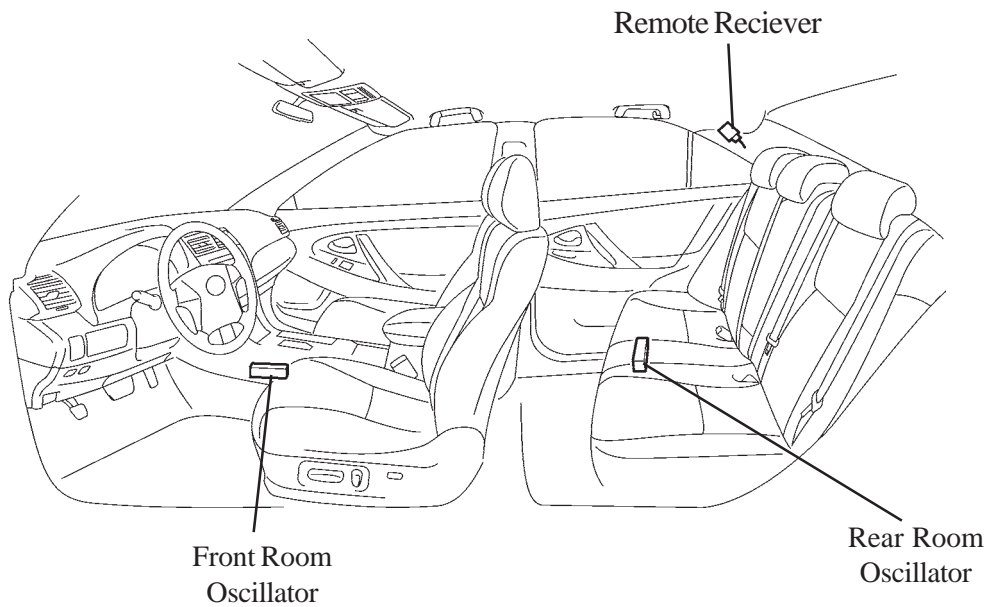
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### 3. Function of Main Components

Component		Function
Key		The key consists of a mechanical key, the transmitter for the wireless door lock remote control, the transceiver for the smart entry and start system and a transponder chip for the engine immobiliser control.
Certification ECU		Controls the smart entry and start system in accordance with the signals from each oscillator, various switches, ECUs and the key. <ul style="list-style-type: none"> <li>• Judges and certifies the ID code from the tuner.</li> <li>• Transmits the engine immobiliser deactivation signal to the ID code box.</li> <li>• Transmits steering unlock signals to the steering lock ECU.</li> </ul>
Main Body ECU		Controls the smart entry and start system in accordance with the signals from the various switches, ECUs and combination meter. <ul style="list-style-type: none"> <li>• Transmits the key certification request signal to the certification ECU in accordance with the engine switch signal, and turns the relays ON and OFF.</li> <li>• Receives the request signal from the certification ECU and actuates the door lock motor to unlock or lock the door.</li> <li>• Transmits the condition each door to the certification ECU.</li> </ul>
ID Code Box		Receives and certifies the engine immobiliser deactivation signal transmitted from the certification ECU, and sends it to the engine ECU.
Outside Handle (Driver and Front Passenger)	Antenna	Transmits the request signals.
	Touch Sensor	Detects when a person touches the inside of an outer door handle.
	Lock Switch	Transmits door lock request signals to the certification ECU.
	Door Oscillator	Receives the request signal from the certification ECU, and creates an actuation area around front door.
Room Oscillator • Front and Rear		Receives the request signal from the certification ECU, and forms the actuation area in the vehicle interior.
Trunk Oscillator • Inner		Receives the request signal from the certification ECU, and forms the actuation area in the trunk.
Trunk Oscillator • Outer		Receives the request signal from the certification ECU, and forms the actuation area around the trunk lid.
Tuner		<ul style="list-style-type: none"> <li>• Receives the ID code from the key in the actuation area and transmits it to certification ECU.</li> <li>• Receives the ID code from the key in the trunk and transmits it to certification ECU.</li> </ul>
Trunk Antenna		Receives the ID code from the key in the luggage room and transmits it to the tuner.
Trunk Open Switch		Transmits a trunk lid open request signal to certification ECU.
Wireless Door Lock Buzzer		Sounds as an answerback for entry lock or unlock to inform the driver.
Combination Meter	Multi-information Display	When the certification ECU detects human error, it warns the driver by sounding the wireless door lock buzzer and the buzzer in the combination meter, and by illuminating a warning on the multi-information display and the master warning light, in accordance with the request signal from the certification ECU.
	Master Warning Light	
	Buzzer	

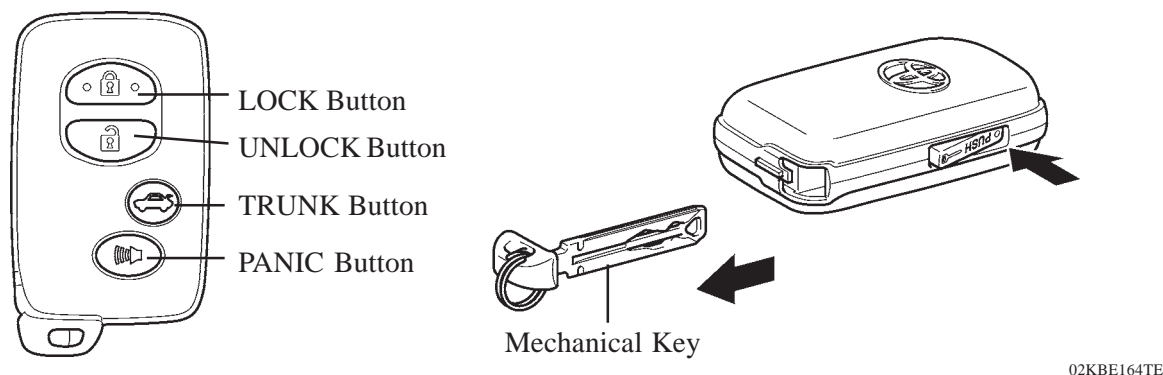
## 4. Construction and Operation

### Key

The key consists of a mechanical key, a transmitter for the wireless door lock remote control and a transceiver for the smart entry and start system, and a transponder chip for the engine immobiliser control.

- The transceiver function of the key receives the signals from the oscillators and returns the ID code to the tuner.
- The transmitter function for the wireless door lock remote control has a LOCK button, UNLOCK button, TRUNK button, and PANIC button.
- The transponder chip in the key for the engine immobiliser control returns a signal to the engine switch as a response to the radio wave it received from the engine switch.
- This mechanical key operates the driver door lock cylinder, glove box lock cylinder and trunk storage extension lock cylinder but cannot be used to start the engine.

A total of four keys can be registered. For details, see the Aurion Repair Manual.



### Oscillator (Driver and Front Passenger Door, Front and Rear Rooms, Trunk Inner, Trunk Outer)

Each oscillator functions based on a request signal received from the certification ECU, and creates a key actuation area that is used to detect the presence of a key.

The actuation area formed by the front door oscillator and trunk outer oscillator is approximately 0.7 to 1.0 m from the outside handle of the front doors, or the centre of the rear bumper.

- The actuation area of front door oscillator is formed by transmitting a request signal every 0.25 second while the engine switch is OFF and each door is locked. In this way it detects the proximity of a key. When locking the door using the lock switch on the outer door handle, the actuation area is formed when the lock switch is pressed.
- The actuation area of the trunk outer oscillator is formed when the trunk open switch is ON. It is formed twice to allow the key to be verified.
- The actuation area of the front and rear room oscillator is formed when the driver door is opened or closed, when the start button is pressed, when a warning is activated, or when the lock switch is ON.
- The actuation area of the trunk inner oscillator forms when the trunk lid is closed or the trunk open switch is pressed, and is formed twice to allow the key to be verified.

## 5. Entry Function Operation

### General

The entry function has the following functions.

Function	Outline
Mechanical Key (See page BE-109)	The key consists of a mechanical key, a transmitter for the wireless door lock remote control and a transceiver for the smart entry and start system, and a transponder chip for the engine immobiliser control.
Wireless Door Lock Remote Control (See page BE-111)	This function is a convenient system for locking and unlocking all the doors or trunk, at a distance. The operation is same as wireless door lock remote control system.
Entry Illumination (See page BE-25)	When a key enters the actuation area of front door oscillators, the front interior light, and engine switch illumination illuminate.
Entry Unlock (See page BE-112)	When a key is located in the actuation area front door oscillators, the door will unlock after the inside of an outside door handle is touched.
Entry Unlock Mode Switching (See page BE-113)	Allows selection of one of two modes that can be operated with the entry unlock function. <ul style="list-style-type: none"> <li>• Driver Door Mode</li> <li>• All Door Mode</li> </ul>
Entry Lock (See page BE-114)	When a key is located in the actuation area of either front door oscillator and the power source is OFF, the door can be locked by merely pressing the lock switch on the outside door handle.
Trunk Open (See page BE-115)	When a key is in the actuation area of the trunk outer oscillator, the trunk can be opened by merely pressing the trunk open switch.
Prevention of Key Confinement (See page BE-116)	<ul style="list-style-type: none"> <li>• Prevents the confinement of the key in the vehicle by the door being locked with the outside door handle while the key is still inside the vehicle.</li> <li>• If the trunk lid is closed while the key is still in the luggage compartment, the warning buzzer sounds. If the trunk open switch is operated the trunk lid can be opened.</li> </ul>
Warning (See page BE-118)	<p>When any of the situations below occur, the smart entry and start system causes the certification ECU to sound the buzzer in the combination meter and the wireless door lock buzzer, and indicate a warning on the multi-information display in order to the alert the driver.</p> <ul style="list-style-type: none"> <li>• An exit warning if the shift lever is in a position other than P and the power source is a mode other than OFF.</li> <li>• An exit warning if the shift lever is in P and the power source is a mode other than OFF.</li> <li>• A warning if the occupant leaves with the key in inappropriate circumstances.</li> <li>• A warning if the entry lock button on the door handle is operated while the key is inside the vehicle.</li> </ul> <p>When any of the situations below occur, the smart entry and start system causes the certification ECU to sound the buzzer in the combination meter and indicate a warning on the multi-information display in order to the alert the driver.</p> <ul style="list-style-type: none"> <li>• A warning if the engine switch is operated while the key is outside the actuation area.</li> <li>• A warning if the key battery is weak.</li> </ul>

Continued \....

Function	Outline
Battery Saving (See page BE-128)	If the key remains within the actuation area of the front door oscillators, the system maintains periodic communication with key. Therefore, if the vehicle remains parked in that state for a long time, the key battery and the vehicle battery could be drained.
Key Cancel (See page BE-129)	The following key functions can be cancelled by following certain procedures. <ul style="list-style-type: none"> <li>• Entry unlock / lock</li> <li>• Trunk open</li> <li>• Prevention of key confinement</li> <li>• Warning</li> </ul>
Key Code Registration (See page BE-129)	A total of four keys can be registered. Enables the registering (writing and storing) of transmitter recognition codes in the EEPROM that is contained in the certification ECU.

### Wireless Door Lock Remote Control Function

The wireless door lock remote control function has the following functions:

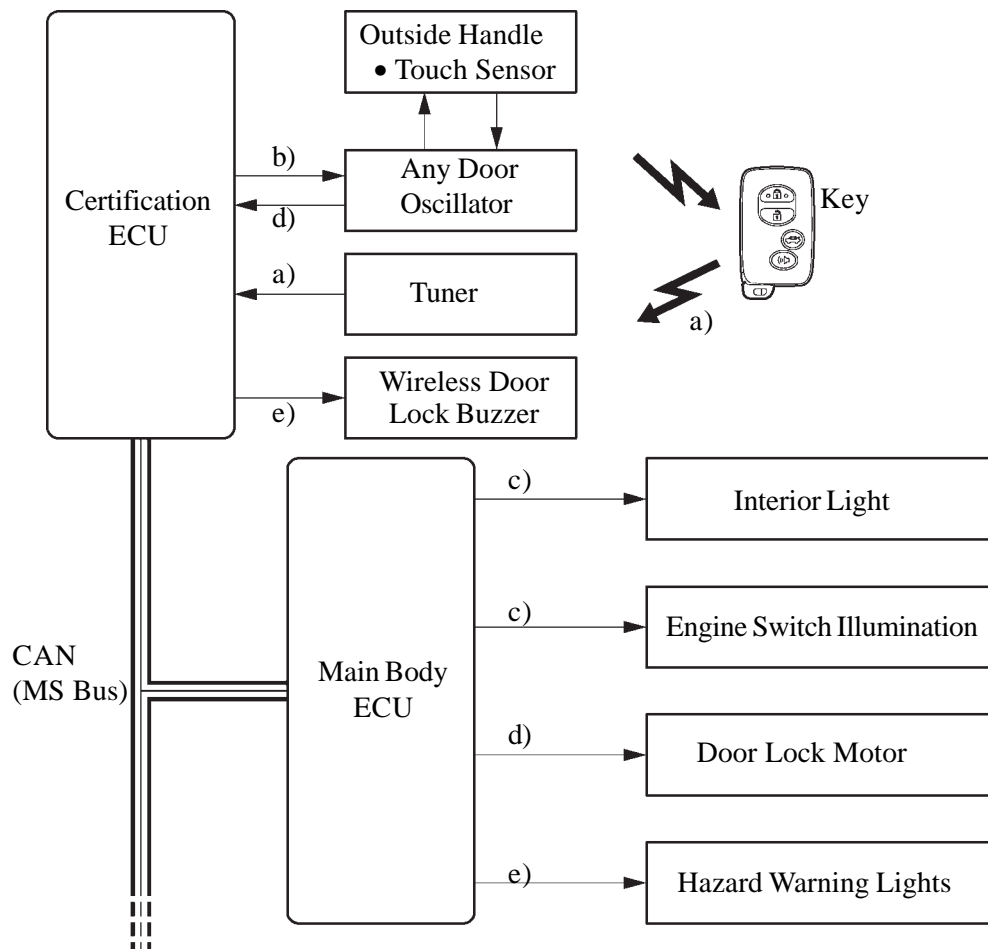
Function	Outline
All Doors Lock	Pressing the LOCK button of the transmitter (key) locks all doors.
All Doors Unlock	Pressing the UNLOCK button of the transmitter (key) unlocks all doors.
All Doors Unlock (2-step Unlock) * <sup>1</sup>	Pressing the UNLOCK button on the transmitter once unlocks the driver's door. If the UNLOCK button is pushed again within 3 seconds, all doors unlock.
Trunk Opener* <sup>2</sup>	Keeping the TRUNK button of the transmitter pressed longer than about 1 second opens the trunk lid.
Answer Back* <sup>2</sup>	When all doors are locked, the hazard light flashes and buzzer sounds once. When all doors are unlocked, the hazard light flashes and buzzer sounds twice* <sup>2</sup> , in order to indicate that the operation has been completed.
Panic Alarm	Keeping the PANIC button of the transmitter pressed longer than about 1 of a second causes the following functions of the alarm to activate. <ul style="list-style-type: none"> <li>• Sounds the horn, security horn.</li> <li>• Flashes the hazard lights, headlights, and tail lights.</li> <li>• Illuminates the interior light (If the interior light switch is in the DOOR position).</li> </ul>
Automatic Lock* <sup>2</sup>	If none of the doors are opened within 30 seconds of being unlocked by the wireless door lock remote control, all the doors will be locked again automatically.
Door Ajar Warning* <sup>1</sup>	If any door is open or ajar, pressing the LOCK button of the transmitter will cause the wireless door lock buzzer to sound for about ten seconds.
Repeat	If a door is not locked in response to the locking operation of the transmitter, the certification ECU will output a lock signal after approximately 1 second.
Illuminated Entry	When all the doors are locked, pressing the UNLOCK button causes the interior lights to illuminate simultaneously with the unlock operation.
Security	Sends an operation signal as a rolling code.

\*<sup>1</sup>: The 2-step unlock function is initially set to OFF. The setting function can be changed using the customised body electronics system. For details, refer to Customised Body Electrical System section on page BE-11.

\*<sup>2</sup>: The function setting can be changed using the customised body electronics system. For details, refer to Customised Body Electronics System section on page BE-11.

## Entry Unlock

- When a key enters any actuation area of the door oscillators, the certification ECU judges and certifies the key ID code received from the tuner.
- After the key certification OK is confirmed, the certification ECU transmits an unlock stand-by signal to the touch sensor of the relevant door.
- At the same time, the certification ECU transmits the lighting signals to the interior lights (engine switch illumination and interior light), and turns ON these illuminations (Entry Illumination Function).
- If the touch sensor is touched under the above condition, the certification ECU transmits a door unlock signal to the main body ECU, and unlocks the door.
- The certification ECU sounds the wireless door lock buzzer twice and main body ECU blinks the hazard warning lights twice through the flasher as an answerback for entry unlock.

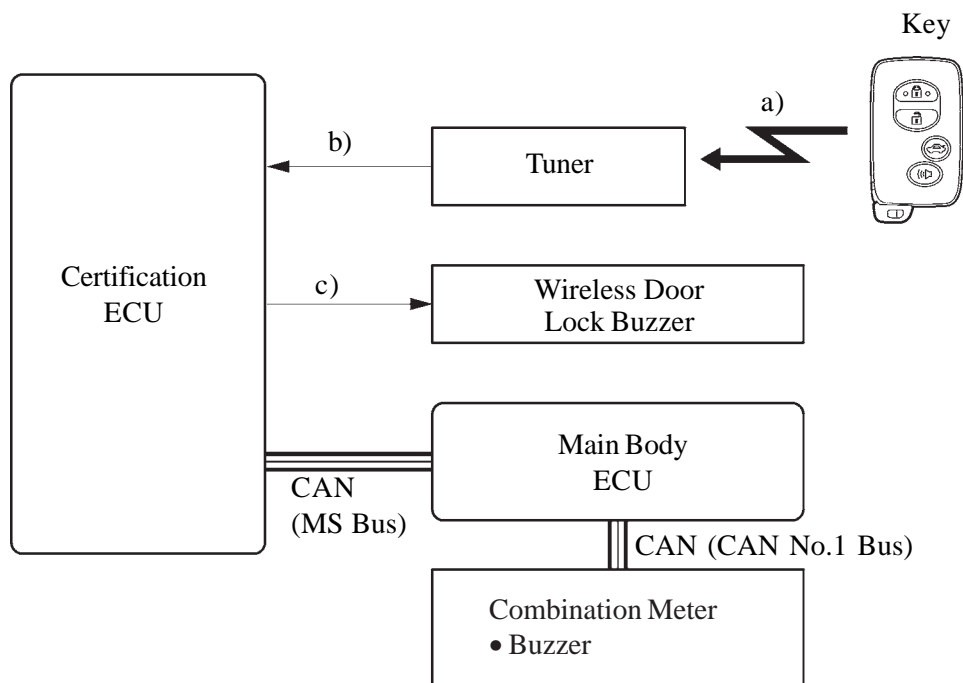


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### Entry Unlock Mode Switching

- When the power source is OFF, press the lock button and one of the other three buttons on the key at the same time for approximately 5 seconds while the key is in the actuation area.
- The certification ECU receives this signal from the tuner and switches the entry unlock mode.
- The certification ECU sounds the wireless door lock buzzer and the buzzer of the combination meter to inform the user that the mode has been switched.
- If the entry unlock mode needs to be switched again, press the lock button and one of the other three buttons on the key at the same time for approximately 5 seconds after the LED of the key goes off.



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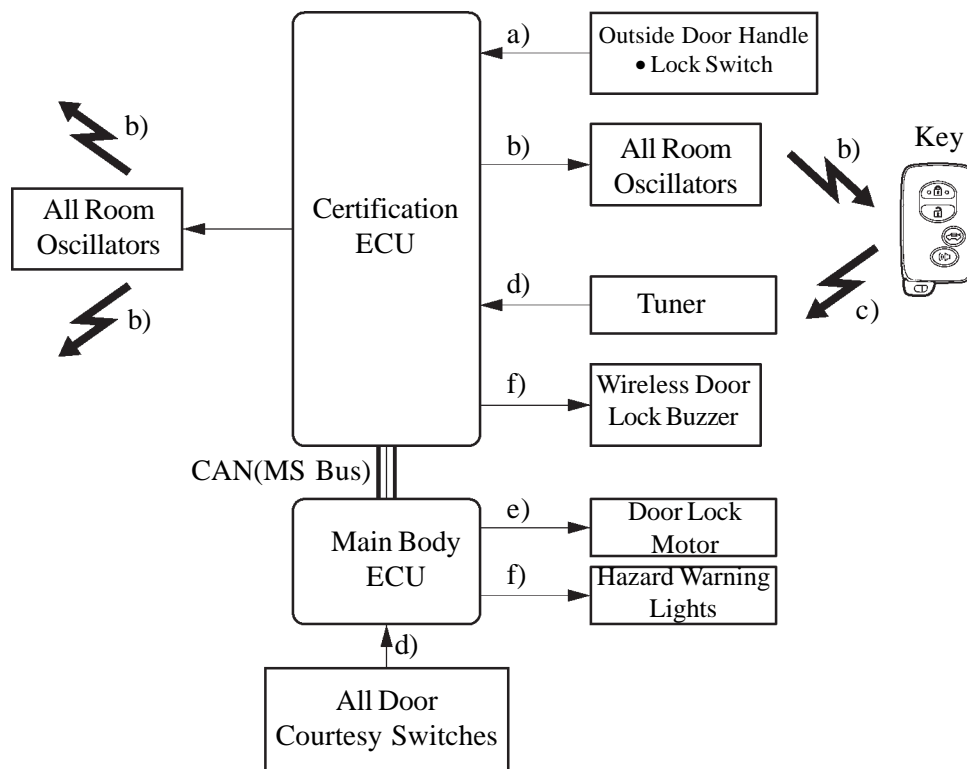
Mode	Wireless Door Lock Buzzer	Buzzer in Combination Meter
Driver Door (Customised)	 <p>Sounds three times</p>	Sounds once
All Doors (Default)	 <p>Sounds once</p>	Sounds once

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**NOTE:** This function only switches the entry unlock mode of the smart entry and start system. It is not applied to the unlock function using the wireless door lock remote control.

## Entry Lock Function

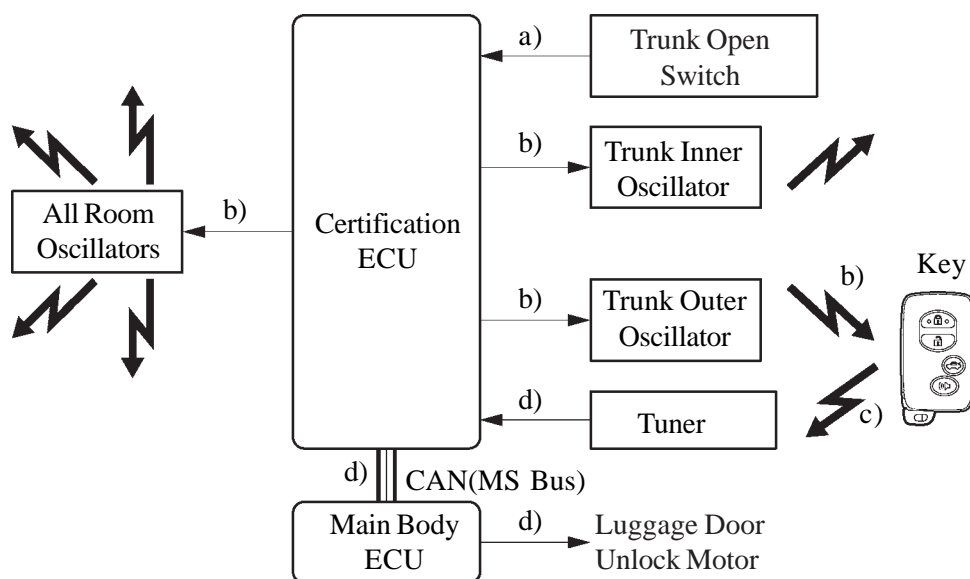
- This door lock signal is transmitted to the certification ECU when the driver (who has the key in their possession), exits the vehicle and presses the lock switch on the outside door handle.
- The certification ECU transmits a request signal for all door and room oscillators to form actuation areas.
- The key receives this signal and returns the ID code to the tuner.
- The certification ECU judges and certifies the ID code from the tuner. It then checks the location of the key and, if all the doors are closed, the ECU transmits a door lock signal to the main body ECU.
- The main body ECU receives this signal and actuates the door lock motors to lock the doors.
- The main body ECU blinks the hazard warning lights once through the flasher relay, and the certification ECU sounds the wireless door lock buzzer once as an answer back for the entry lock function.



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## Trunk Open Function

- This signal is transmitted to the certification ECU when the driver (who has the key in their possession) pushes the trunk open switch on the outside of the trunk lid.
- The certification ECU transmits a request signal for all the room, trunk inner and outer oscillators to form actuation areas.
- The key receives this signal and returns the ID code to the tuner.
- The certification ECU judges and certifies the ID code, and checks the location of the key. The ECU transmits a trunk open signal to the main body ECU.
- The main body ECU receives this signal and actuates the luggage door unlock motor to open the trunk.



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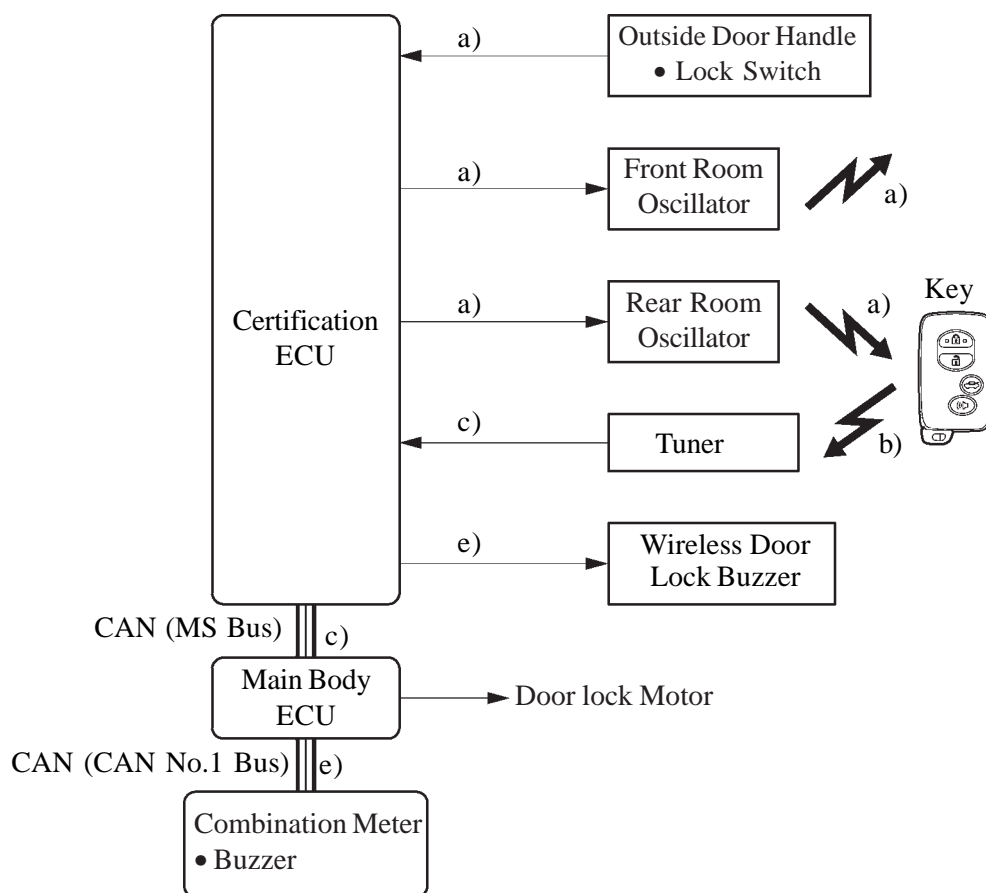
## Prevention of Key Confinement

### 1) General

This function has two system operations: inside room (cabin) and inside luggage compartment.

### 2) Inside Room

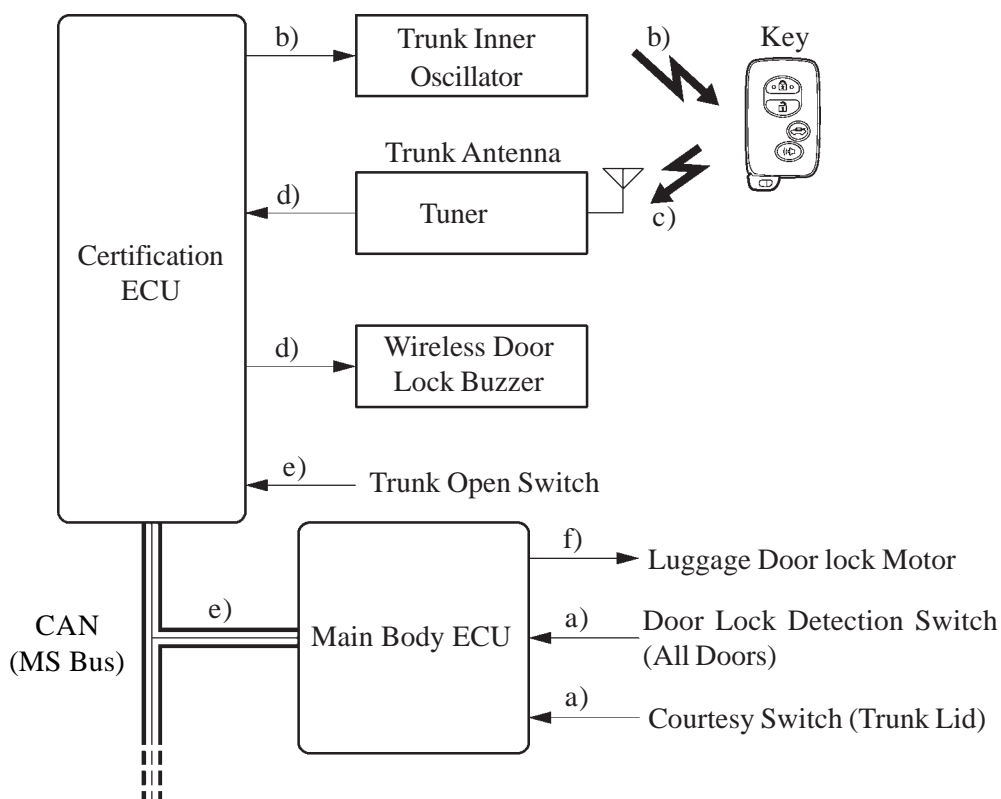
- When the door is locked with the outside door handle while the key is still inside the vehicle, the certification ECU receives this signal and transmits a request signal for the front and rear room oscillators to form an actuation area.
- The key receives this signal and returns the ID code to the tuner.
- The certification ECU judges and certifies the ID code, and checks the location of the key. The ECU transmits a door unlock signal to the main body ECU.
- The main body ECU receives the signal and operates each door lock motor to unlock the doors.
- The certification ECU sounds the wireless door lock buzzer and the buzzer of the combination meter as an answerback for the unlock function that was performed.



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### 3) Inside Luggage Room

- a) When the trunk lid is closed while the key is still inside the luggage room and all doors are locked, the certification ECU recognizes that a trunk lid close condition has occurred based on signals from the main body ECU.
- b) The certification ECU receives this signal, and transmits a request signal for the trunk inner oscillator to form an actuation area.
- c) The key receives this signal and returns the ID code to the tuner.
- d) The certification ECU judges and certifies the ID code, and checks the location of the key. The ECU sounds the wireless door lock buzzer for 2 seconds to inform the driver.
- e) If the trunk open switch is turned ON (pressed) while the key is inside the luggage room, the certification ECU sends another request signal for the trunk inner oscillator to form an actuation area. The ECU judges and certifies the key and checks its location, before transmitting a trunk open signal to the main body ECU.
- f) The main body ECU receives the signal and operates the luggage door lock motor to open the trunk.



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**Warning****1) General**

When any of the situations below occur, the smart entry and start system causes the certification ECU to sound a buzzer in the combination meter and the wireless door lock buzzer, and illuminate the multi-information display in order to alert the driver.

Situation	Condition
A	The engine is left running and the shift lever is in a position other than P when the driver gets out of the vehicle. (See page BE-118)
B	The key is left in the vehicle. (See page BE-120)
C	The engine is left running and the shift lever is in the P position when the driver gets out of the vehicle. (See page BE-121)
D	A door is ajar. (See page BE-122)
E	The engine is left running when a passenger gets out of the vehicle holding the key. (See page BE-123)
F	The key is not within the actuation areas. (See page BE-124)
G	The key is left in the cabin. (See page BE-124)
H	The key is left in the luggage room. (See page BE-125)
I	The key battery is weak. (See page BE-125)
J	Steering lock does not release. (See page BE-126)
K	The steering lock mechanism is malfunctioning. (See page BE-126)
L	The main body ECU is malfunctioning. (See page BE-127)
M	An engine start method is displayed. (See page BE-127)

**2) Situation: A**

There are two patterns for situation A.





- Pattern 1: When the engine is left running and the shift lever is in a position other than P, the driver opens the door and attempts to get out of the vehicle.
- Pattern 2: Under the conditions of pattern 1, the driver closes the door and attempts to leave the vehicle holding the key.

In these situations, the following control is performed:

**Pattern 1.**

Possible Effects without Warning		Sudden vehicle start, Vehicle theft, Vehicle roll-away
Warning Condition		<p>The warning is activated when all of the following conditions are met:</p> <ul style="list-style-type: none"> <li>• Power source is in a mode other than OFF.</li> <li>• Shift lever is in any position except P.</li> <li>• Vehicle speed is 0 km/h.</li> <li>• Driver door is opened.</li> </ul>
Combination Meter	Buzzer	Continuous sound
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		<p>The warning is stopped when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• Power source is OFF.</li> <li>• Shift lever is in the "P" position.</li> <li>• Vehicle speed is above 0 km/h.</li> </ul>

**Pattern 2.**

Possible Effects without Warning		Sudden vehicle start, Vehicle theft, Vehicle roll-away
Warning Condition		<p>The warning is activated when all of the following conditions are met:</p> <ul style="list-style-type: none"> <li>• Shift lever is in any position except P.</li> <li>• Power source is in a mode other than OFF.</li> <li>• Vehicle speed is 0 km/h.</li> <li>• Key is not in the vehicle.</li> <li>• Driver door is opened → closed.</li> </ul>
Combination Meter	Buzzer	Continuous sound
	Multi-information Display	<p>The following warnings are alternately displayed:</p> <div>   </div> <div> <small>025BE99P</small> <small>025BE100P</small> </div>
	Master Warning Light	Flash
Wireless Door Lock Buzzer		Sounds continuously
Engine Switch Indicator Light		—
Warning Stop Condition		<ul style="list-style-type: none"> <li>• Key is in the vehicle. <ul style="list-style-type: none"> <li>• The wireless door lock buzzer stops.</li> <li>• Multi-information Display: <div>  <small>025BE99P</small> </div> </li> </ul> </li> </ul>
		<ul style="list-style-type: none"> <li>• Vehicle speed is above 0 km/h. <ul style="list-style-type: none"> <li>• The wireless door lock buzzer stops.</li> <li>• Multi-information Display: <div>  <small>025BE100P</small> </div> </li> </ul> </li> </ul>
		<ul style="list-style-type: none"> <li>• Power source is OFF.</li> </ul>
		All warning operations stop.



**3) Situation: B**

There are two patterns for situation B.

- Pattern 1: When the driver's door is open, the driver changes the power source mode to ACC and attempts to leave the vehicle.
- Pattern 2: When the driver's door is open, the driver changes the power source mode from ON to OFF and attempts to leave the vehicle.

In these situations, the following control is performed:

**Pattern 1. and Pattern 2.**

Possible Effects without Warning		Vehicle theft
Warning Condition		<p>The warning is activated when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• Power source is in ACC mode and the driver door is opened.</li> <li>• Power source is in OFF mode the steering is unlocked, and the driver door is opened.</li> </ul>
Combination Meter	Buzzer	Continues to sound at short and even intervals
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		<p>The warning is stopped when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• Power source is in ON mode.</li> <li>• Driver door is closed.</li> <li>• Power source is in OFF mode and the steering is locked</li> </ul>


**4) Situation: C**

There are two patterns for situation C.

- Pattern 1: When the engine is left running and the shift lever is in the P position, the driver closes the driver's door and attempts to leave the vehicle while holding the key.
- Pattern 2: Under the conditions of pattern 1, the driver presses the lock switch on the door outside handle.

In these situations, the following control is performed:

**Pattern 1.**

Possible Effects without Warning		Vehicle theft, Engine cannot be restarted, Discharged battery
Warning Condition		<p>The warning is activated when all of the following conditions are met:</p> <ul style="list-style-type: none"> <li>• Shift lever is P.</li> <li>• Power source is in a mode other than OFF.</li> <li>• Key is not in the vehicle.</li> <li>• Driver door is opened → closed.</li> </ul>
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 025BE100P
	Master Warning Light	Flash
Wireless Door Lock Buzzer		Sounds three times
Engine Switch Indicator Light		—
Warning Stop Condition		<p>The warning is stopped when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• Power source is OFF</li> <li>• Key is in the vehicle.</li> </ul>

**Pattern 2.**

Possible Effects without Warning		Vehicle theft, Discharged battery
Warning Condition		<p>The warning is activated when all of the following conditions are met:</p> <ul style="list-style-type: none"> <li>• Shift lever is P.</li> <li>• Power source is in a mode other than OFF.</li> <li>• All doors are closed.</li> <li>• The key is outside the vehicle (within one of the actuation areas).</li> </ul>
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds for 2 seconds
Engine Switch Indicator Light		—
Warning Stop Condition		<p>The warning is stopped when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• The power source is OFF and the key is not within the actuation areas.</li> <li>• Key is in the vehicle.</li> </ul>


**5) Situation: D**

The lock switch on the door outside handle is pressed to perform entry lock with a door open.  
In this situation, the following control is performed:

Possible Effects without Warning		Vehicle theft
Warning Condition		<p>The warning is activated when all of the following conditions are met:</p> <ul style="list-style-type: none"> <li>• Power source is OFF.</li> <li>• Any doors are opened.</li> <li>• Entry lock button on the outer door handle is operated.</li> </ul>
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds continuously
Engine Switch Indicator Light		—
Warning Stop Condition		<p>The warning is stopped when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• Power source is in a mode other than OFF</li> <li>• All doors are closed.</li> <li>• Wireless door lock remote function is unlocked.</li> <li>• Entry unlock is operated</li> <li>• 10 seconds have elapsed since the wireless door lock buzzer was activated.</li> </ul>

**6) Situation: E**


When the engine is left running, a passenger leaves the vehicle holding the key.  
In this situation, the following control is performed:

Possible Effects without Warning		Engine cannot be restarted
Warning Condition		<p>The warning is activated when all of the following conditions are met:</p> <ul style="list-style-type: none"> <li>• Power source is in a mode other than OFF.</li> <li>• Door except driver door is opened → closed.</li> <li>• Vehicle speed is 0 km/h.</li> <li>• Key is not in the vehicle.</li> </ul>
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 025BE100P
	Master Warning Light	Flash
Wireless Door Lock Buzzer		Sounds 3 times
Engine Switch Indicator Light		—
Warning Stop Condition		<p>The warning is stopped when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• Power source is OFF.</li> <li>• Vehicle speed is above 0 km/m.</li> <li>• Key is in the vehicle.</li> </ul>

**7) Situation: F**

When the key is not in the cabin or the key battery is dead, the driver attempts to start the engine or change the power mode to ON.

In this situation, the following control is performed:

Possible Effects without Warning		Confuses the user
Warning Condition		The warning is activated when all of the following conditions are met: <ul style="list-style-type: none"> <li>• Engine switch is pushed.</li> <li>• Key is not in the vehicle.</li> </ul>
Combination Meter	Buzzer	Sounds once
	Multi-information Display	
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		Check if the key is in the detection area. If the key is in the detection area, press the wireless door lock switch and confirm that the indicator comes on. If the indicator does not come on, replace the key battery with a new one.

**8) Situation: G**

The lock switch on the door outside handle is pressed to perform entry lock with the key left in the cabin.

In this situation, the following control is performed:

Possible Effects without Warning		Vehicle theft
Warning Condition		The warning is activated when all of the following conditions are met: <ul style="list-style-type: none"> <li>• Power source is OFF.</li> <li>• All doors are closed.</li> <li>• Key is in the vehicle.</li> <li>• Lock switch on the door outside handle switch is ON.</li> </ul>
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds for 2 seconds
Engine Switch Indicator Light		—
Warning Stop Condition		The key is removed from the cabin and the lock switch on the door outside handle is pressed again.

**9) Situation: H**

The luggage door is closed with the key left in the luggage room.


In this situation, the following control is performed:

Possible Effects without Warning		Key Confinement
Warning Condition		The warning is activated when all of the following conditions are met: <ul style="list-style-type: none"> <li>• Vehicle speed is 0 km/h.</li> <li>• All doors are closed.</li> <li>• Trunk lid is closed.</li> </ul>
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds for 2 seconds
Engine Switch Indicator Light		—
Warning Stop Condition		The luggage room is opened using the trunk open function and the key is removed from the luggage room.

**10) Situation: I**

The vehicle is driven using a key that has a low battery.


In this situation, the following control is performed:

Possible Effects without Warning		Smart entry and start system does not function
Warning Condition		The warning is activated when all of the following conditions are met: <ul style="list-style-type: none"> <li>• Power source switches to OFF after being left in IG-ON for over 20 minutes.</li> <li>• Key battery voltage is low.</li> <li>• Key is in the vehicle.</li> </ul>
Combination Meter	Buzzer	Sounds once
	Multi-information Display	
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		The key battery is replaced with a new one.

**11) Situation: J**

Steering lock cannot be released.


In this situation, the following control is performed:

Possible Effects without Warning		Steering usability function
Warning Condition		The steering lock cannot be released, thus the engine is prevented from starting.
Combination Meter	Buzzer	—
	Multi-information Display	 025BE102P Displayed for 15 seconds (and then automatically turned off)
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		The green indicator blinks at 1-second intervals (goes off automatically in 15 seconds).
Warning Stop Condition		The engine switch is pressed while the steering wheel is turned left and right, and the steering lock successfully disengages.

**12) Situation: K**

A malfunction of the steering lock ECU is detected.

In this situation, the following control is performed:

Possible Effects without Warning		Malfunction detection
Warning Condition		A malfunction of the steering lock ECU is detected.
Combination Meter	Buzzer	—
	Multi-information Display	 025BE103P
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		The amber indicator blinks at 2-second intervals.
Warning Stop Condition		The steering lock ECU returns to normal.

**13) Situation: L**

A malfunction of the main body ECU is detected.


In this situation, the following control is performed:

Possible Effects without Warning		Malfunction detection
Warning Condition		A malfunction in the main body ECU is detected.
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		The amber indicator blinks at 2-second intervals.
Warning Stop Condition		The main body ECU returns to normal.

**14) Situation: M**

A warning message appears on the meter when the driver does not follow the proper procedure to start the vehicle.

In this situation, the following control is performed:

Possible Effects without Warning		Usability function
Warning Condition		<p>The warning is activated when all of the following conditions are met:</p> <ul style="list-style-type: none"> <li>• The power source is in a mode other than ON.</li> <li>• Any doors are closed → opened.</li> <li>• The power source is changed from OFF to ACC more than once with the engine off and brake pedal released.</li> </ul>
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 025BE104P
	Master Warning Light	—
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		<p>The warning is stopped when one of the following conditions is met:</p> <ul style="list-style-type: none"> <li>• 10 seconds have elapsed since a warning message was displayed.</li> <li>• The engine switch is pushed with the brake pedal depressed.</li> <li>• The power source is OFF.</li> </ul>



**Battery Saving****1) Vehicle Battery Saving Function**

In the smart entry and start system, signals are emitted outside the vehicle at a prescribed interval (250 msec.) when the doors are locked. Therefore, the vehicle battery could be drained if the vehicle remains parked for a long time. For this reason, the controls listed below are effected.

Condition	Control
No response from key for more than 5 days	Signal transmission interval is extended from 250 msec. to 750 msec.
No response from key for more than 14 days	Automatically deactivates the smart entry and start system.

**▸ Reinstatement Conditions ◀**

- A wireless door lock remote control signal (lock, unlock, or trunk lid open) is input and the ID matches.
- A user carries the key and pushes a lock switch signal for the outside door handle.
- A door is locked or unlocked using the mechanical key.

**2) Key Battery and Vehicle Battery Saving Function**

In the smart entry and start system, if the key is constantly located within the vehicle exterior actuation area of the doors, the system will maintain periodic communication with the key. Therefore, if the vehicle remains parked in that state for a long time, the key battery and the vehicle battery could be drained. For this reason, if this state continues longer than 10 minutes, the smart entry and start system automatically becomes deactivated.

**▸ Reinstatement Conditions ◀**

- A wireless door lock remote control signal (lock, unlock, or trunk lid open) is input and the ID matches.
- A user who has the key in their possession pushes a lock switch signal on an outside handle.
- A door is locked or unlocked using the mechanical key.

## Key Cancel

Key cancel is operated when certain operations are performed with the vehicle in the following condition:

- Power source is OFF.
- Driver door is closed.
- Driver door is unlocked.

The operation procedure is as follows:

- 1) Unlock once with the UNLOCK button of the key.
- 2) Open the driver door within 5 seconds.
- 3) Unlock twice with the UNLOCK button of the key within 5 seconds.
- 4) Repeat open → close twice for the driver door within 30 seconds, and open again.  
(Driver Door: Open → Close → Open → Close → Open)
- 5) Unlock twice with the UNLOCK button of the key within 30 seconds.
- 6) Repeat open → close once for the driver door within 30 seconds, and open again.  
(Driver Door: Open → Close → Open)
- 7) Close the driver door within 5 seconds.

When key cancel is activated, the wireless door lock buzzer sounds once.

To return to the original condition, perform the procedures again. When key cancel is returned, the wireless door lock buzzer sounds twice.

## Key Code Registration Function

The table below shows the four special coded ID registration function modes through which up to four different codes can be registered. The codes are electronically registered (written to and stored) in the EEPROM. For details of the recognition code registration procedure, refer to the Aurion Repair Manual.

Mode	Function
Rewrite	Erases all previously registered codes and registers only the newly received codes. This mode is used whenever a transmitter or the integration relay is replaced.
Add	Adds a newly received code while preserving previously registered codes. This mode is used when adding a new transmitter. If the number of codes exceeds 7, the oldest registered code is erased first.
Confirm	Confirms how many codes are currently registered. When adding a new code, this mode is used to check how many codes already exist.
Prohibit	To delete all the registered codes and to prohibit the wireless door lock function. This mode is used when a transmitter (key) is lost.

## ENGINE IMMOBILISER SYSTEM

### ✱ DESCRIPTION

The engine immobiliser system compares the ID code that is registered in the transponder key ECU with the ID code of the transponder chip that is embedded in the ignition key. The system disables if these ID codes match. Thus, the transponder key ECU and the engine ECU communicate with each other to authorise fuel injection and ignition, enabling the engine to start.

- The system is standard equipment on models without the smart entry and start system.
- An engine immobiliser function is provided on models with the smart entry and start system. For details, see page BE-86.

#### Service Tip

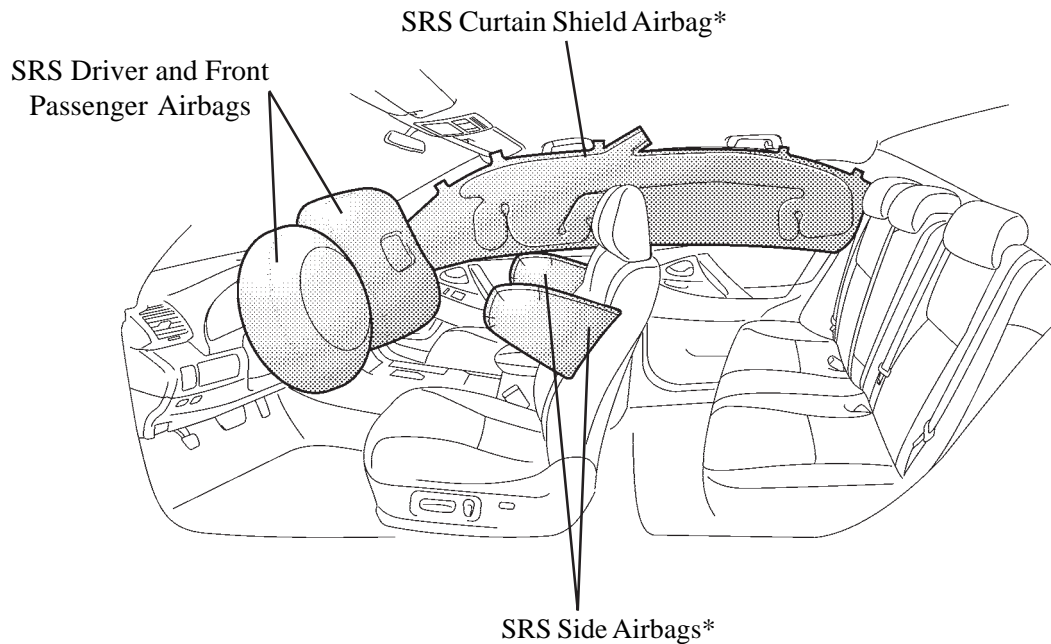
When replacing the transponder key ECU or making a new ignition key, and the key's recognition code must be registered.

- When the transponder key ECU has been replaced, the automatic registration mode begins. At this time, the total number of keys that can be registered is three (master key: two, sub key: one).
- The recognition code of additional keys must be registered. At this time, the total number of keys that can be registered is eight (master key: five, sub key: three).

## SRS AIRBAG SYSTEM

### ✱ DESCRIPTION

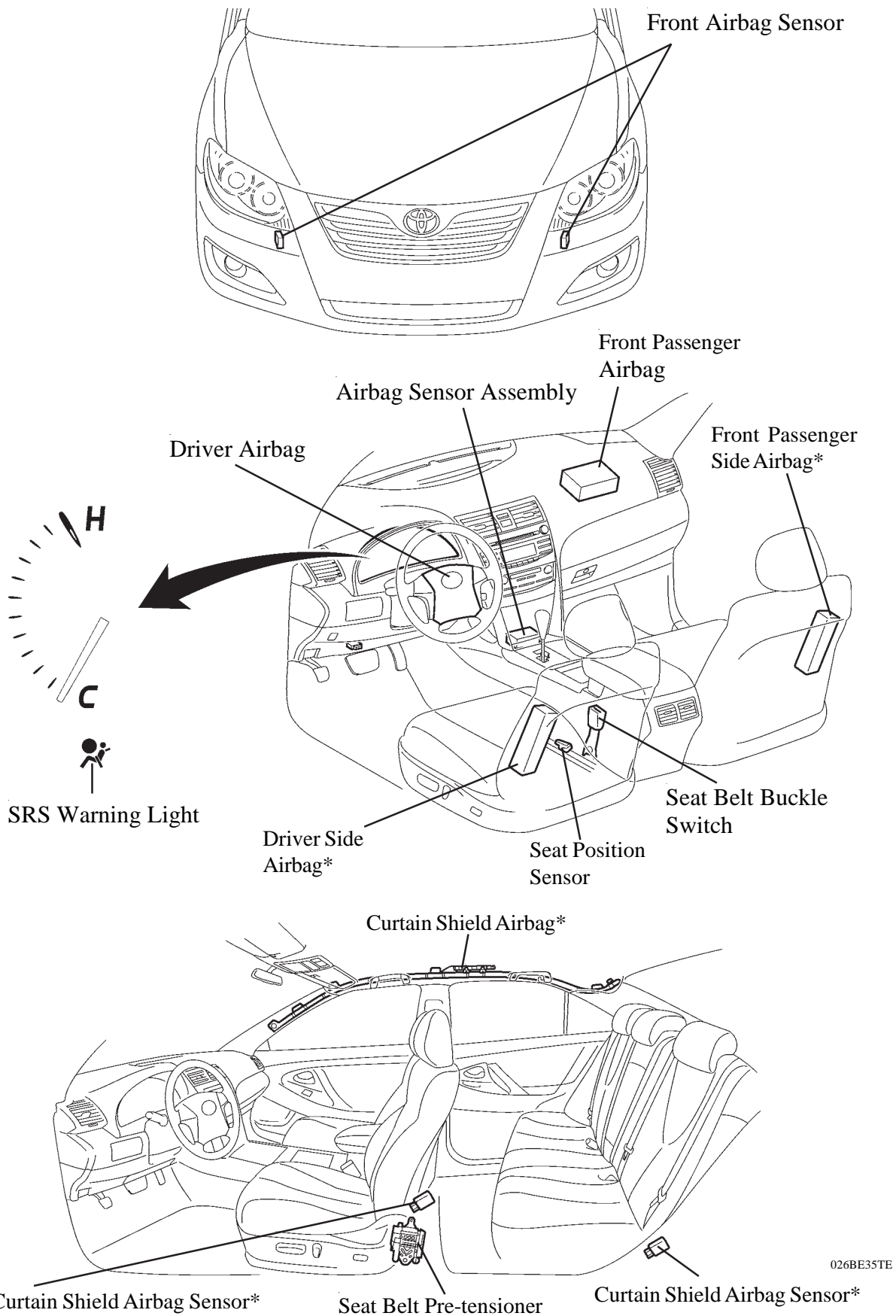
- All grades are fitted with dual stage driver and front passenger SRS (Supplemental Restraint System) airbags, which supplement the seat belts to help to reduce impacts to the heads and chests of the driver and front passenger in the event of a frontal collision.
- The SRS side and curtain shield airbags help to reduce the shocks to the head and chest of the driver, and the front passenger in the event of a side collision.
- The front passenger airbag door is designed to be invisible. This means that when the airbag inflates, the instrument panel will split along the cleavage line.
- A fuel cut control that stops the fuel pump when any airbags are deployed, is used. For details, see page EG-66.



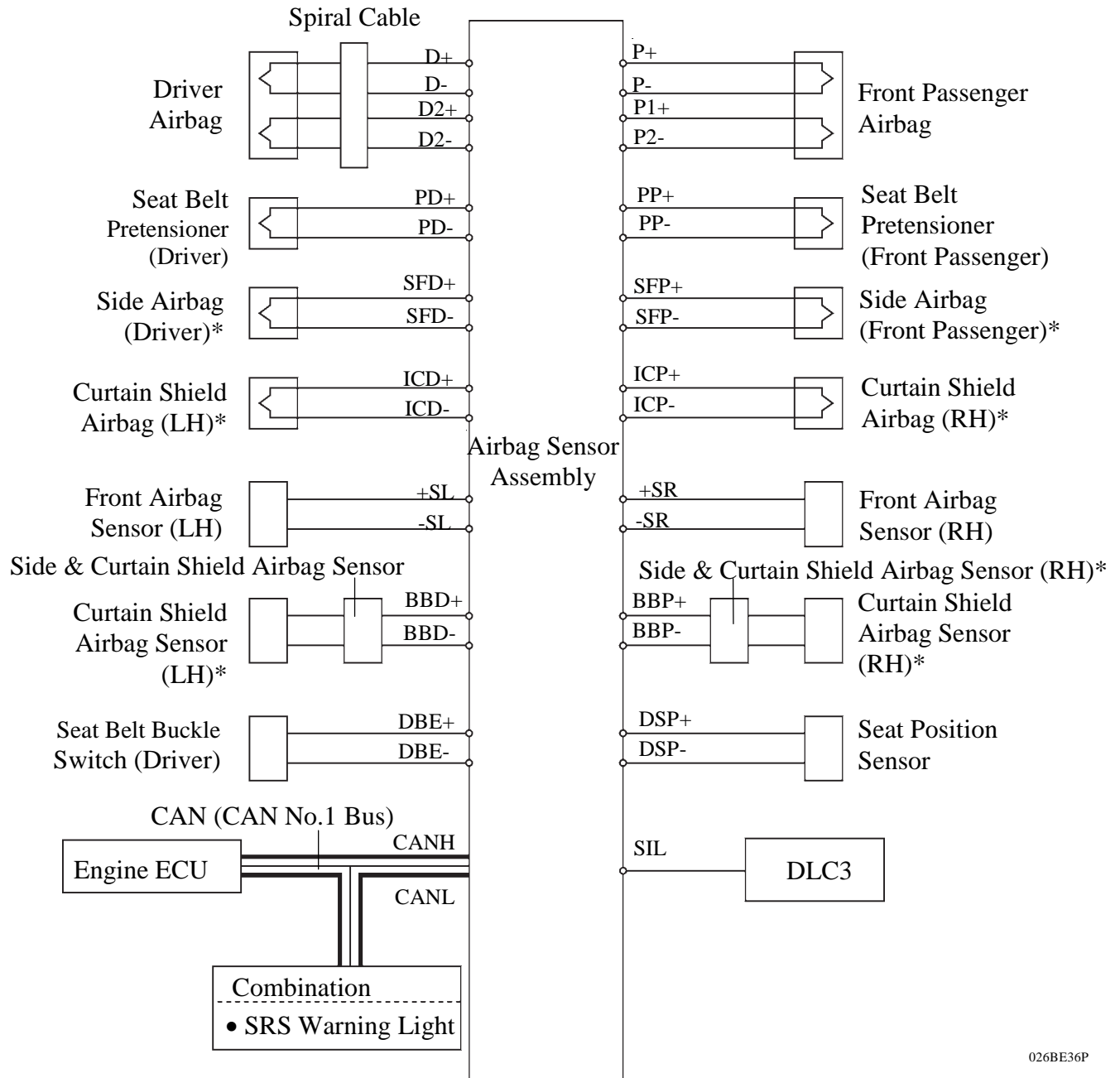
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\*: Option for Grande

## ✱ LAYOUT OF MAIN COMPONENTS



# **WIRING DIAGRAM**



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\*: Models with SRS side &amp; curtain shield airbag.

## **Dual-stage SRS Airbag System**

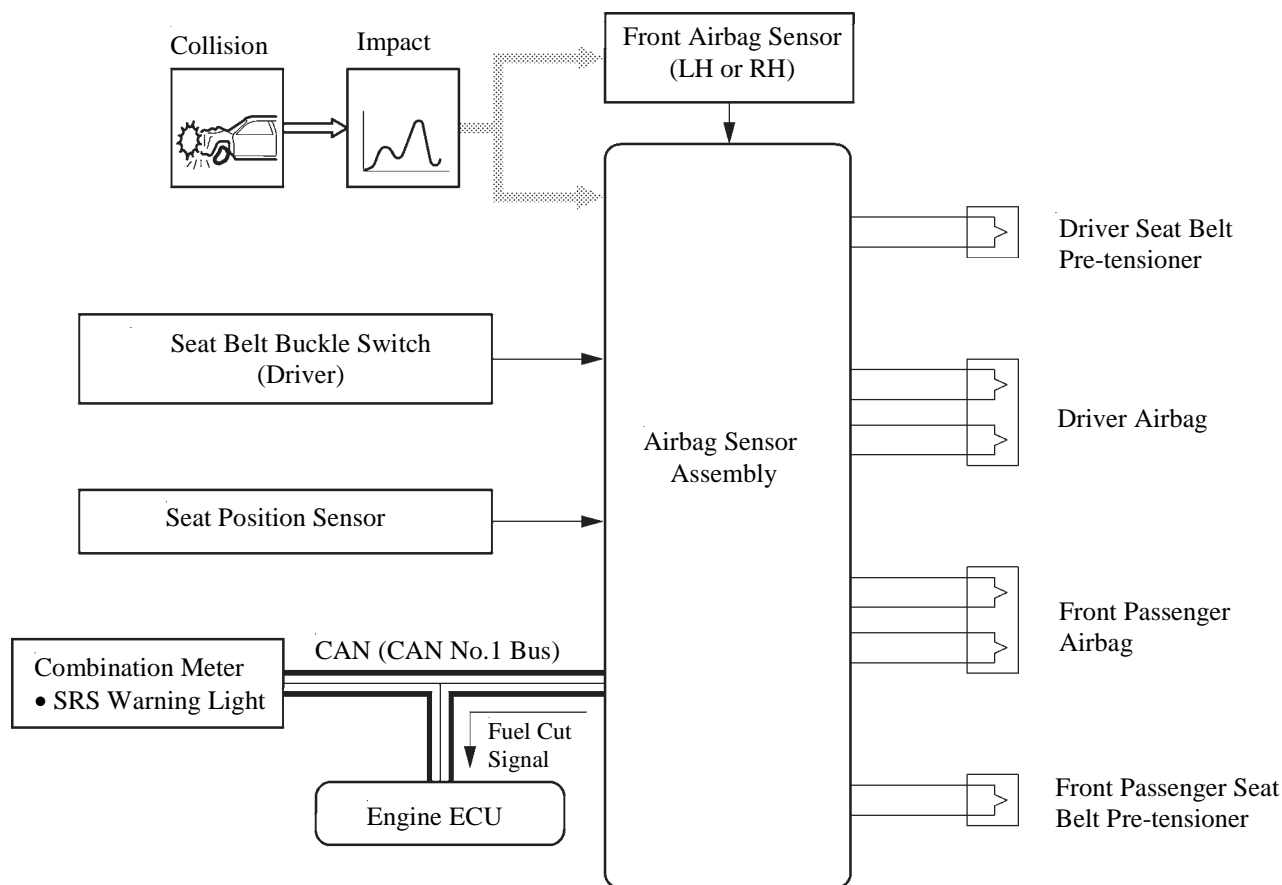
(Continued)

## ✳ AIRBAG FOR FRONTAL COLLISION

### 1. General

- In conjunction with their impact absorbing structure for frontal collisions, the driver and front passenger SRS airbags deploy simultaneously, and are supplements to the seat belts. The driver and front passenger dual-stage SRS airbags have been designed to help reduce injuries to the head and chest in the event of a frontal collision.
- The deceleration sensor is enclosed in the front airbag sensor. Due to the deceleration of the vehicle during a front collision, a distortion is created in the sensor and converted into an electrical signal. Accordingly, the extent of the initial collision can be detected in detail.

### ► Front Airbag Operation ◀



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(Continued)

## 2. Dual-stage SRS Airbag System

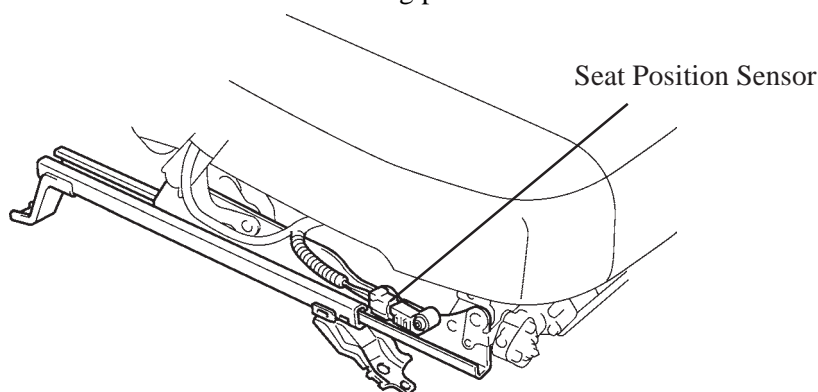
### General

In this system, when the front airbag sensors and airbag sensor assembly detect a front collision, the airbag sensor assembly judges the extent of impact, seat position and whether or not the seat belts are fastened, thus optimising the airbag inflating output by delaying the inflation timing of the 2nd initiator and the 1st initiator.

### Seat Position Sensor

#### 1) General

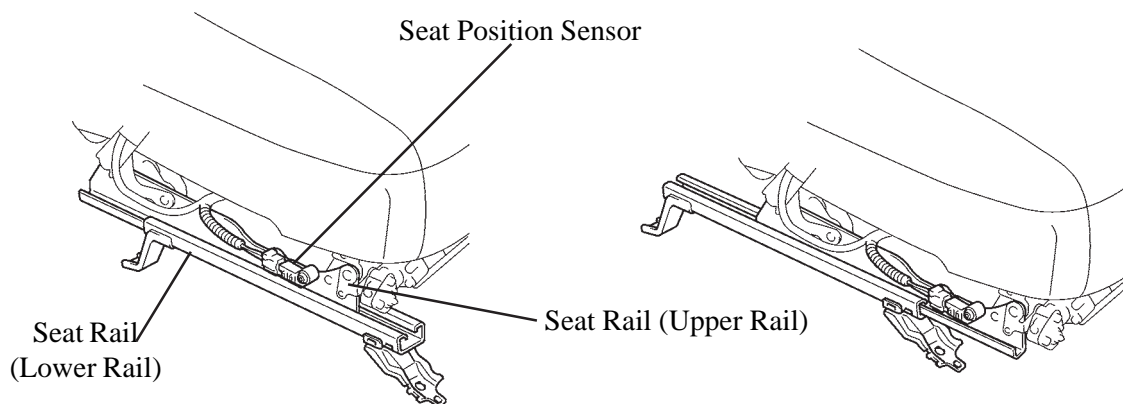
The seat position sensor is mounted on the upper rail portion of the driver seat rail, and includes a Hall IC and a magnet. This sensor is used to detect the sliding position of the driver seat.



#### 2) Operation

When the seat is in the rearward position, the lower rail portion of the seat rail is close to the seat position sensor. When it is in the forward position, the distance between the lower rail portion and the sensor becomes larger.

Thus, the magnetic flux of the magnet inside the seat position sensor varies depending on the seat position. The Hall IC detects this variation and outputs signals to the airbag sensor assembly.



Seat position is rearward

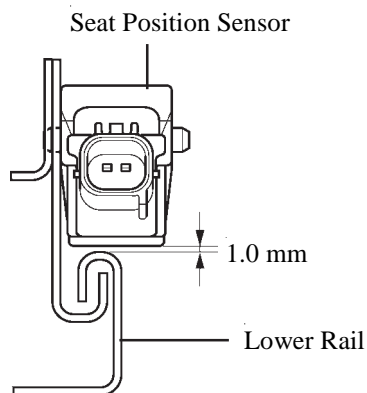
Seat position is forward



### Service Tip

Follow the procedure indicated below to install the seat position sensor.

- 1) Insert a 1.0 mm feeler gauge between the seat position sensor and the lower rail portion.
  - 2) Tighten the mounting bolt to the specified torque with the seat position sensor pushed down as shown.
- For details, see the Aurion Repair Manual.

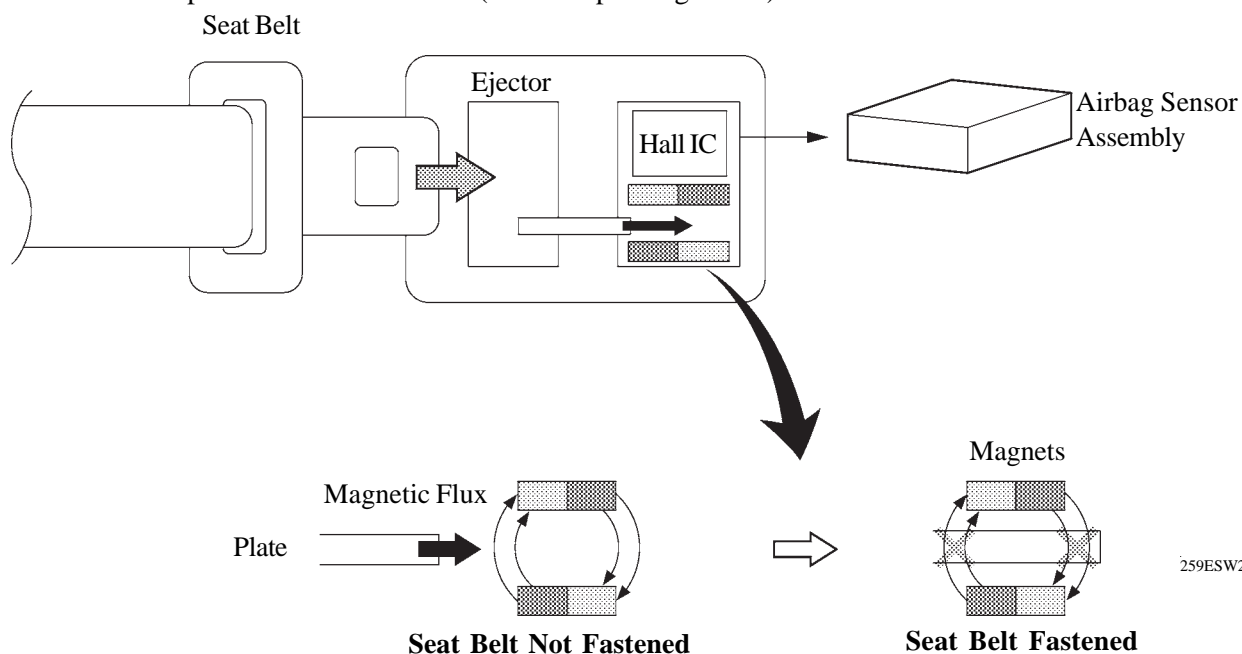


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### Seat Belt Buckle Switch

The seat belt buckle switch detects whether or not the seat belt is fastened.

- The non-contact type switch is composed of a Hall IC and two magnets, installed into the front seat inner belt assembly.
- The ejector inside the front seat inner belt assembly and the plate installed to the ejector move when the seat belt is removed or inserted. The movement of the plate changes the magnetic flux density of the magnet.
- The Hall IC detects the changes in the magnetic flux density in accordance with the seat belt removal or insertion, and outputs a signal to the airbag sensor assembly (for driver seat) and occupant classification ECU (for front passenger seat).



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### **3. SRS Driver and Front Passenger Airbags**

Dual-stage SRS driver and front passenger airbags contain two sets of initiators and propellants. The airbag sensor assembly helps optimise the airbag inflation speed by controlling the inflation timing of these initiators.

### **4. Front Airbag Sensor**

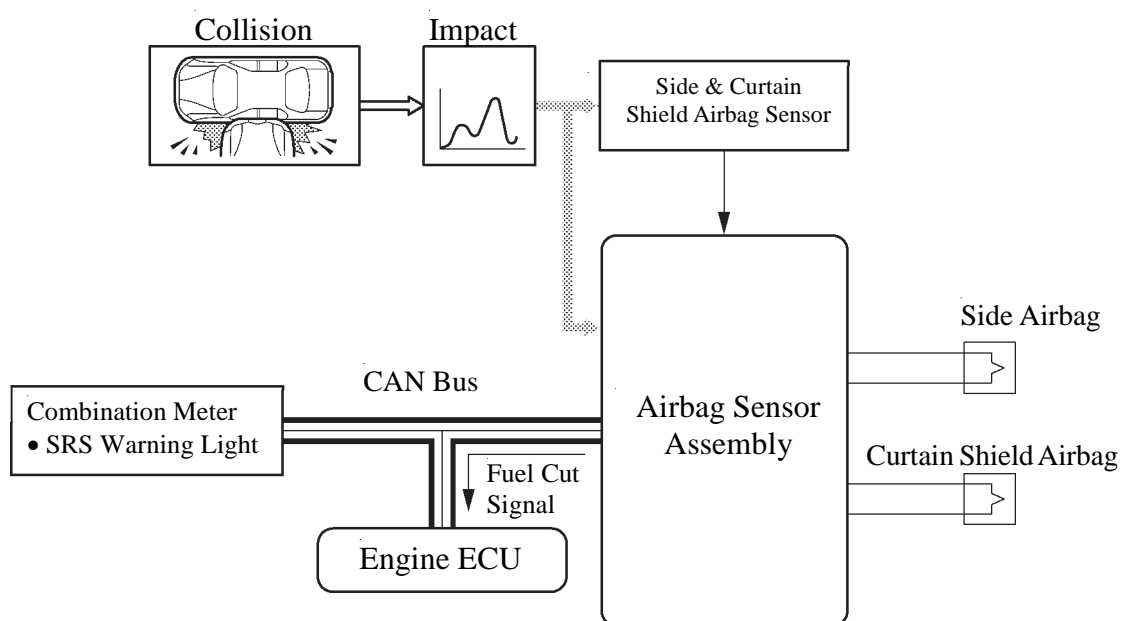
Front airbag sensor uses an electrical type deceleration sensor. Based on the deceleration of the vehicle during a frontal collision, distortion is created in the sensor and converted into an electrical signal. Accordingly, the extent of the initial collision can be accurately detected.

## ✱ AIRBAG FOR SIDE/ REAR OF SIDE COLLISION (Option for Grande)

### 1. General

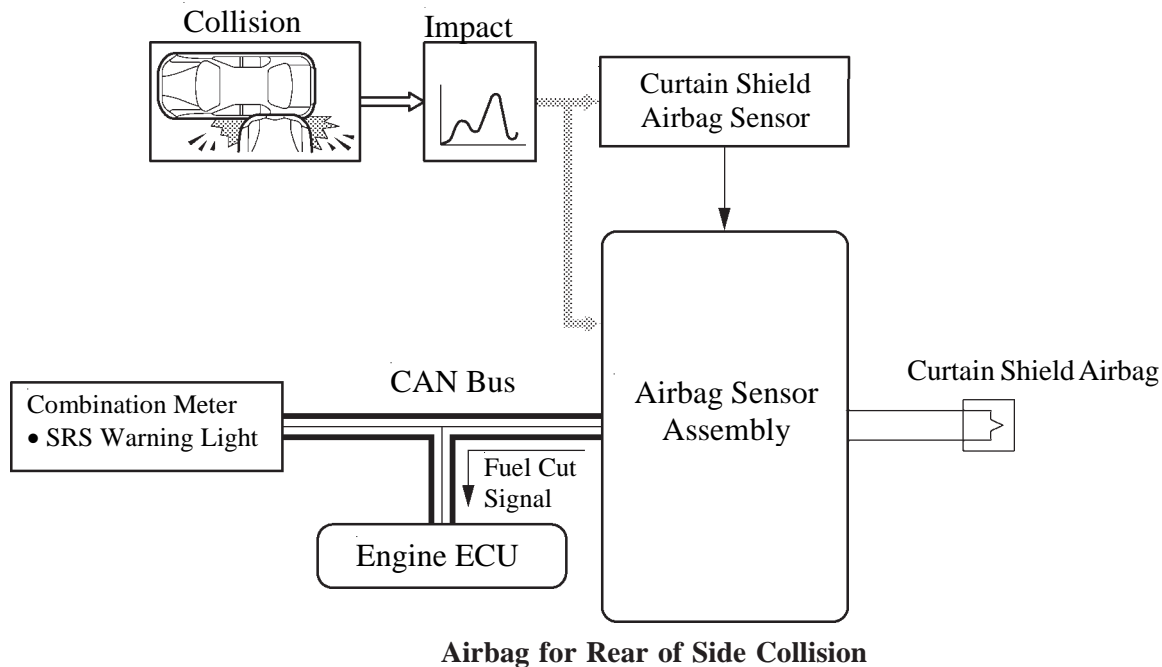
- With the airbag for side collisions, if the side & curtain shield airbag sensor detects an impact, the airbag sensor assembly causes the front side and curtain shield airbags to be deployed simultaneously.
- With the airbag for rear of side collisions, if the curtain shield airbag sensor detects an impact, the airbag sensor assembly causes the curtain shield airbag to be deployed.

### ▸ System Operation ◀



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Airbags for Side Collision



## 2. SRS Side Airbag

SRS side airbags are installed in the backs of the driver seat and the front passenger seat. The SRS airbag is a one-piece design, consisting of an inflator, a bag, and a cover.

## 3. SRS Curtain Shield Airbag

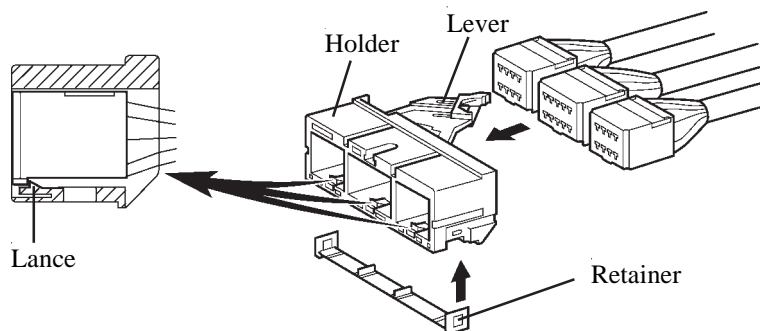
SRS curtain shield airbags are located in the areas that extend from the driver's and front passenger's front pillars to the rear pillars in the rear seat areas. Each SRS airbag is a one-piece design, consisting of an inflator, a bag, and a cover.

## 4. Side & Curtain Shield Airbag Sensors

Side & curtain shield airbag sensor uses an electrical type deceleration sensor. Based on the deceleration of the vehicle during a side or rear of side collision, distortion is created in the sensor and converted into an electrical signal. Accordingly, the extent of the initial collision can be accurately detected.

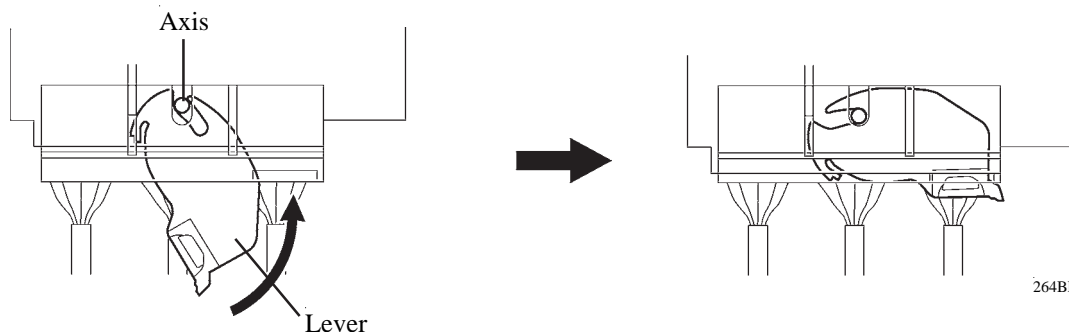
## ✱ IMPROPER CONNECTION PREVENTION LOCK MECHANISM

- This improper connection prevention lock mechanism consists of the airbag sensor assembly and the holder.
- The airbag sensor assembly has a connector lock pin.
- The holder has a lever with a lock groove. The holder and the connectors are locked via a retainer and a lance.



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- When connecting the holder and connectors to the airbag sensor assembly, the lever is pushed into position end by rotating it around the axis of the connector lock pin in order to lock the holder securely.



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## ✱ AIRBAG SENSOR ASSEMBLY

- It reaches a deploy judgment to deploy the driver's and front passenger's airbags and pre-tensioners based on the signals received from the front airbag sensor and the airbag sensor assembly. In addition, it can reach a deploy judgment to deploy the SRS side airbags and SRS curtain shield airbags based on signals received from the side & curtain shield airbag sensors and curtain shield airbag sensors. Furthermore, it is equipped with a diagnosis function to perform self-diagnosis in case of system malfunctions.
- Each signal is transmitted as follows:

Target ECU	Signal	Communication path
Engine ECU	Fuel Cut Signal	CAN communication circuit
Combination Meter	SRS Warning Light ON Demand Signal Seat Belt Remainder Light ON Demand Signal	CAN communication circuit

## ✱ DIAGNOSIS

If the airbag sensor assembly detects a malfunction in the SRS airbag system, the airbag sensor assembly stores the malfunction data in memory, in addition to illuminating the SRS warning light.

- There are 2 types of DTC for the SRS airbag system: 5-digit and 2-digit.
- The 5-digit DTC can be read by connecting an intelligent tester II to DLC3.
- The 2-digit DTC can be read by connecting the SST (09843-18040) to the Tc and CG terminals of the DLC3 and reading the blinking of the SRS warning light.
- If the SRS airbags deploy, the airbag sensor assembly will turn ON the SRS warning light. However, differing from the ordinary diagnosis function, a DTC will not be memorised. The SRS warning light can be turned OFF only by replacing the airbag sensor assembly with a new one.
- For details, refer to see the Aurion Repair Manual.

## SEAT BELT REMINDER SYSTEM

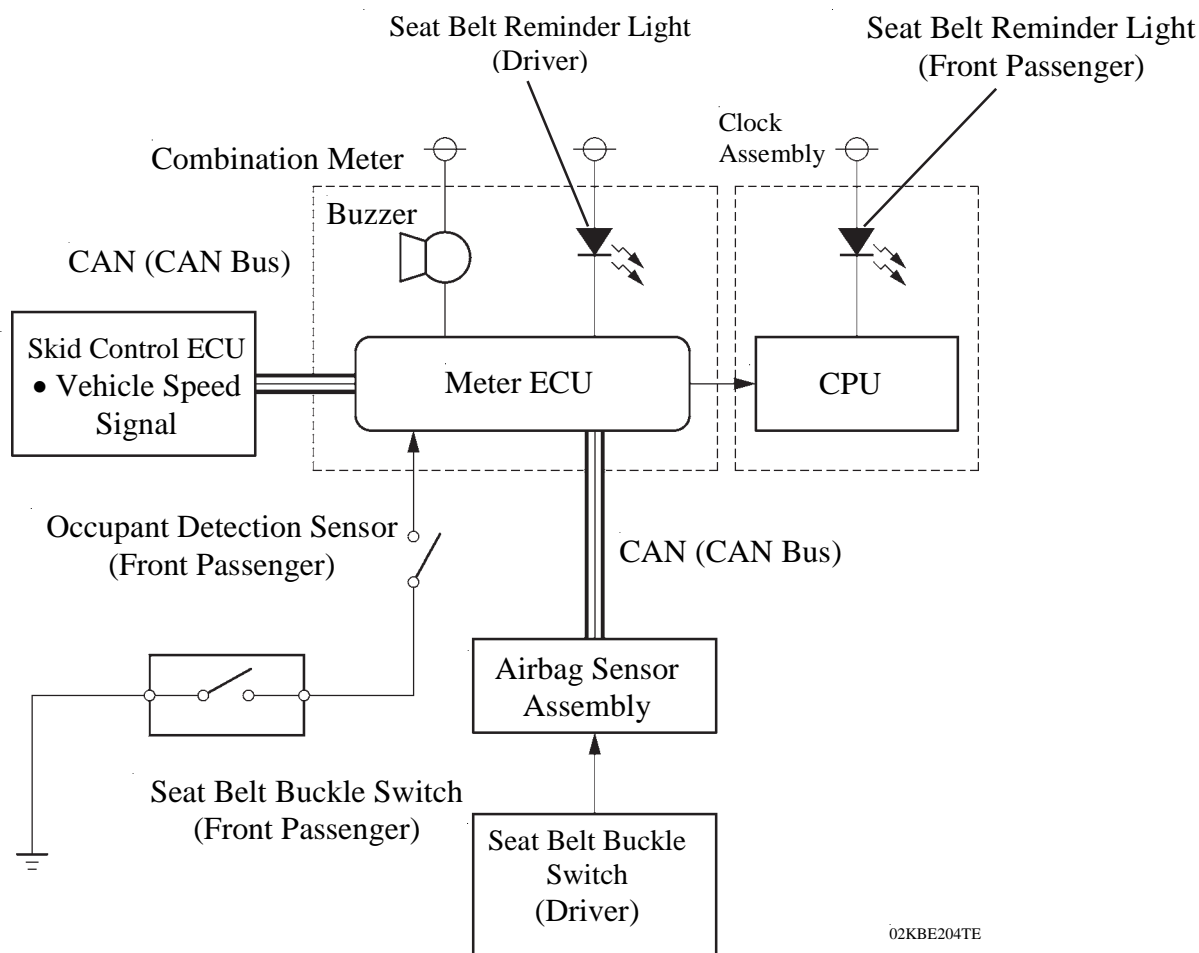
### DESCRIPTION

- If a seat belt is not fastened, this system flashes the seat belt reminder light and sounds the buzzer in the combination meter as a reminder.
- When the ignition\*<sup>1</sup> / engine\*<sup>2</sup> switch is turned ON, this system detects the condition of the seat belts based on the signal from the seat belt buckle switches (for the driver and passenger) and the occupant detection sensor.

\*<sup>1</sup>: Models without smart entry and start system

\*<sup>2</sup>: Models with smart entry and start system

### System Diagram



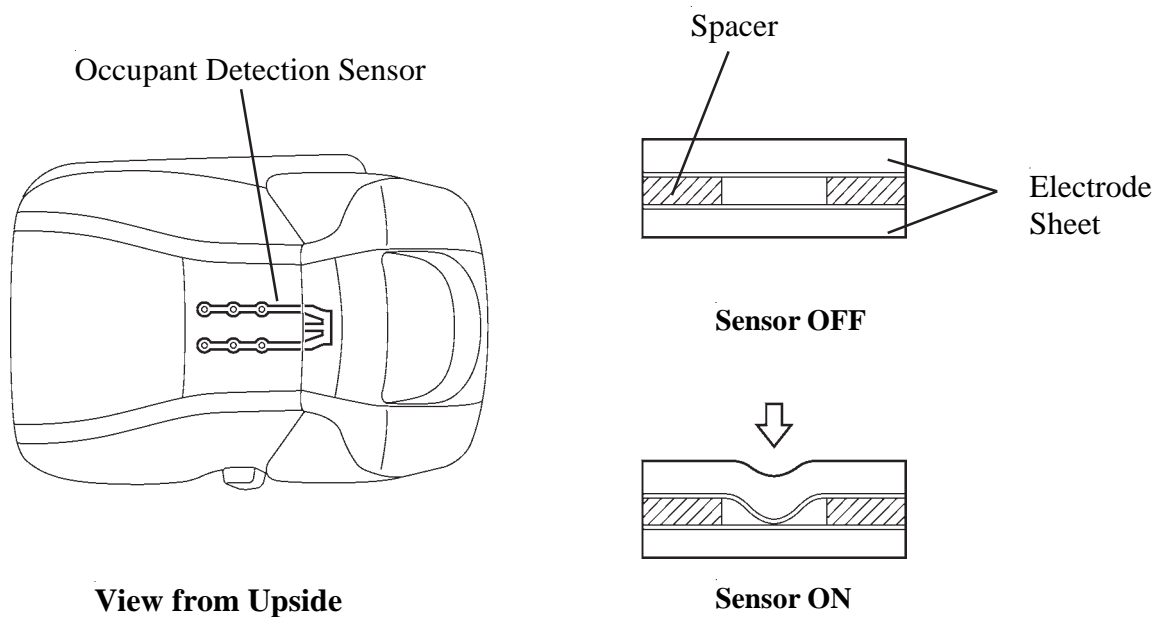
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## ☀ FRONT OCCUPANT DETECTION SENSOR

The occupant detection sensor, which is enclosed in the seat cushion of the front passenger seat, is used to detect whether or not the front passenger seat is occupied.

This sensor, which is shaped as illustrated below, consists of a construction in which two sheets of electrodes sandwich a spacer. When the occupant is seated, the electrode sheets come in contact with each other through the hole that is provided in the spacer portion, thus enabling the current to flow.

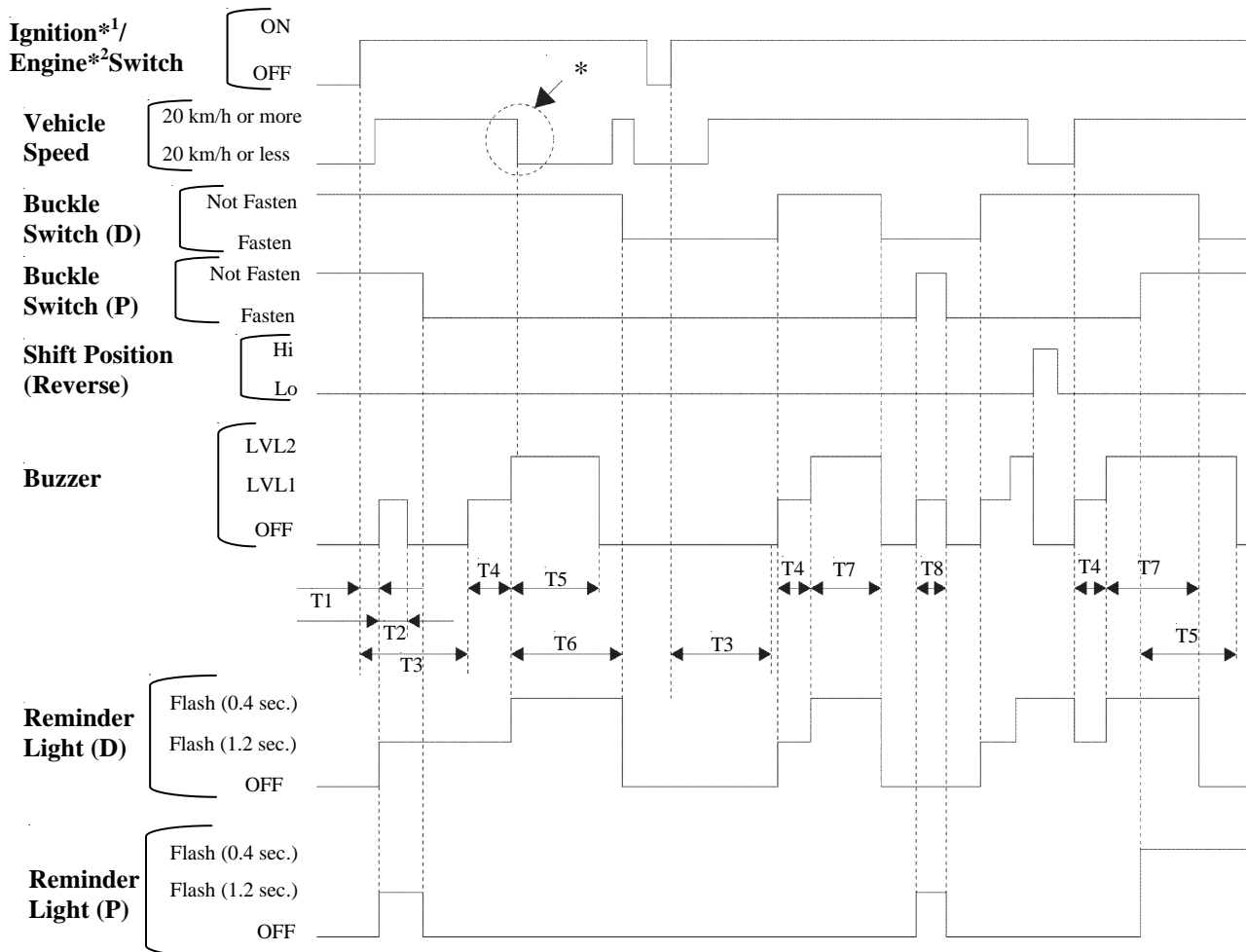
Thus, the sensor detects whether or not an occupant is seated in the front passenger seat.





## REMINDER METHOD

The timing chart of the buzzer and details of the reminder method are shown below.



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T1: About 1.8 sec.

T5: About 20 sec.

T2: About 1.2 sec. x 5

T6: About 20 sec. or more

T3: About 13.8 sec.

T7: About 20 sec. or less

T4: About 9.6 sec.

T8: About 9.6 sec. or less

\*1: Models without smart entry and start system

\*2: Models with smart entry and start system

\*: If the vehicle speed drops below the setting level for seat belt warning after a buzzer begins to sound, the buzzer will continue to sound.

# CRUISE CONTROL SYSTEM

## DESCRIPTION

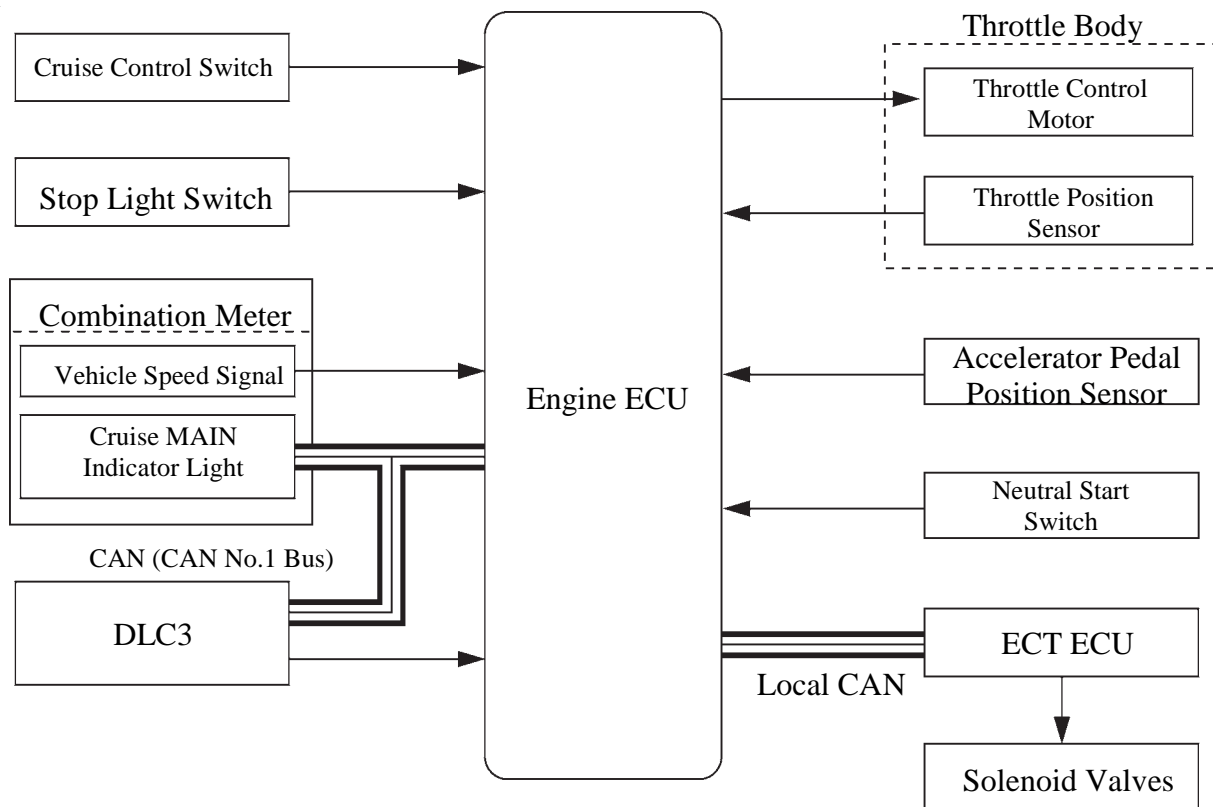
Cruise Control is fitted to all grades and maintains the vehicle speed set by the driver.

### 1. General

When the system is set to a desired vehicle speed, the throttle valve position is adjusted automatically to maintain the vehicle speed without the driver having to depress the accelerator pedal.

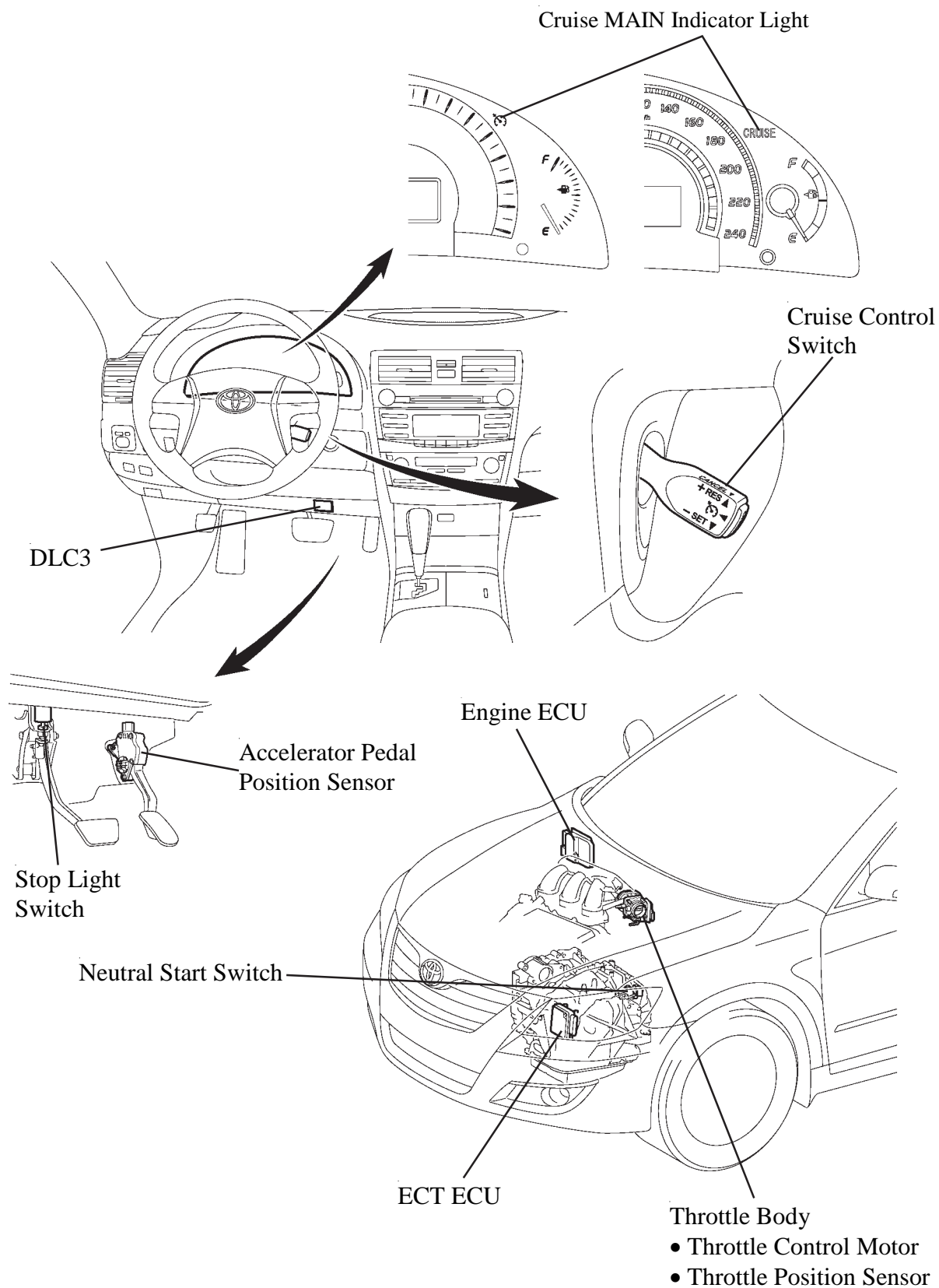
This system effects control through the ETCS-i (Electronic Throttle Control System-intelligent).

#### System Diagram



025BE123P

## 2. Layout of Main Components



### 3. System Control

#### General

The cruise control has the following control.

Control	Outline
Constant Speed Control	The engine ECU compares the actual vehicle speed and the set speed and if the vehicle speed is higher than the set speed, it uses the throttle control motor to decrease the throttle opening. If the actual vehicle speed is lower than the set speed, it uses the throttle control motor to increase the throttle opening.
Set Control	While this system fulfils the following conditions, and the cruise control switch is pressed to the SET/ - side and released when the ON-OFF button on the cruise control switch has been pressed to turn the system on, the engine ECU stores the vehicle speed and maintains the vehicle constantly at that speed. <ul style="list-style-type: none"> <li>• The vehicle is running at a vehicle speed of about 40 km/h or more.</li> </ul>
Low Speed Limit Control	The low speed limit is the lowest speed that cruise control can be set at and it is designed to be approx. 40 km/h. The cruise control cannot be set below that speed. If the vehicle speed drops below that speed while running in the cruise control, the cruise control will be cancelled automatically. However the set speed in the memory is kept.
COAST Switch Control	While the cruise control switch is held to the SET/ - side, the vehicle speed and the set vehicle speed change as follows. <ul style="list-style-type: none"> <li>• The vehicle decelerates constantly.</li> <li>• The set vehicle speed changes to the speed that the vehicle is travelling at when the COAST switch is released.</li> </ul>
Tap Down Control	When the cruise control switch is pushed momentarily (approx. 0.6 sec.) to the SET/ - side, the vehicle speed and the vehicle setting speed change as follows. <ul style="list-style-type: none"> <li>• The vehicle will decelerate in increments of approx. 1.6 km/h for each time the switch was pressed.</li> <li>• However, if the difference between the actual vehicle speed and the vehicle setting speed is greater than 5 km/h, the vehicle setting speed will change to the speed at which the vehicle was being driven at the time the switch was released.</li> </ul>
ACC Switch Control	When the cruise control switch is pushed to the RES/ + side and held, the vehicle speed and the vehicle setting speed change as follows. <ul style="list-style-type: none"> <li>• The vehicle accelerates constantly.</li> <li>• The set vehicle speed changes to the speed as which the switch is releases.</li> </ul>
Tap Up Control	When the cruise control switch is pushed momentarily (approx. 0.6 sec.) to the RES/ + side, the vehicle speed and the vehicle setting speed change as follows. <ul style="list-style-type: none"> <li>• The vehicle accelerates in increments of approx. 1.6 km/h for each time the switch was pressed.</li> <li>• However, if the difference between the actual vehicle speed and the vehicle setting speed is greater than 5 km/h, the vehicle setting speed does not change.</li> </ul>

(Continued)

Control	Outline
RES Switch Control	If cruise control is cancelled for any reason other than a malfunction or main switch operation and vehicle speed is more than the low speed limit, the vehicle speed is returned to the speed before the cancellation of cruise operation by setting the cruise control switch to the RES/+ side. The cruise control mode can be resumed even if the vehicle speed drops below the low speed limit, because the speed in the memory is not cleared.
Shift Down Control	<b>ECT ECU isolated from engine ECU (U660E Automatic Transaxle):</b> When the vehicle is cruising uphill, shift-down control may be performed by the ECT (Electronic Control Transmission). The engine ECU transmits the shift up request signal to the ECT ECU when the engine ECU judges the end of cruising uphill based on the throttle valve angle. If shift-down control is performed during ACC or RES switch control, the engine ECU transmits the shift up request signal to the ECT ECU after ACC or RES switch control is completed.
Manual Cancel Control	When any of the following conditions occur during cruise control driving, the cruise control is cancelled. <ul style="list-style-type: none"> <li>• The stop light switch ON signal is sent to the engine ECU when the brake pedal is depressed.</li> <li>• The CANCEL switch ON signal is sent to engine ECU when the cruise control switch moved to CANCEL side.</li> <li>• The cruise control OFF signal is sent to the engine ECU when the cruise control switch ON-OFF button is pushed off.</li> <li>• The shift lever is moved from the D position to the N position.</li> <li>• The 3rd, 2nd or 1st gear is selected when the shift lever is in the S position.</li> </ul>
Automatic Cancel Control	When any of the following conditions occur during cruise control operation, the speed that is set in the memory is cleared and the cruise control is cancelled. <ul style="list-style-type: none"> <li>• Stop light switch open or short circuit</li> <li>• The vehicle speed signal is not input for a predetermined period of time.</li> <li>• ETCS-i malfunction</li> </ul> Furthermore, the cruise MAIN indicator light will blink until the ON-OFF button on the cruise control switch is used to turn the system off, and the operation of the cruise control will be disabled until the ON-OFF button is turned ON again.
	When any of the following conditions occur during cruise control driving, the speed that is set in the memory is cleared and the cruise control is cancelled. <ul style="list-style-type: none"> <li>• Stop light switch input signal is abnormal.</li> <li>• Cruise control switch input signal is abnormal.</li> </ul> Furthermore, the cruise MAIN indicator light will blink until the ON-OFF button on the cruise control switch is used to turn the system off, and the operation of the cruise control will be disabled until the ignition* <sup>1</sup> /engine* <sup>2</sup> is turned ON again.

\*<sup>1</sup>:Models without smart entry and start system\*<sup>2</sup>:Models with smart entry and start system

(Continued)

Control	Outline
Automatic Cancel Control	<p>When any of the following conditions occur during cruise control driving, the cruise control is cancelled.</p> <ul style="list-style-type: none"> <li>• Vehicle speed is below the low speed limit (approx. 40 km/h) or less.</li> <li>• Vehicle speed decreases by 16 km/h or more below the speed at which the cruise control was set.</li> <li>• The VSC* is activated.</li> </ul>
Diagnosis	<p>When the engine ECU does not receive a vehicle speed signal for a predetermined period of time during cruising, or when cruise control is cancelled (automatic cancel) due to a malfunction of the cruise control, stop light switch or vehicle speed signal, the engine ECU immediately blinks the cruise MAIN indicator light due to the malfunction. The contents relating to the malfunction will be stored in the engine ECU.</p>

\*: Vehicles with VSC

## Diagnosis

If a malfunction occurs in the cruise control system, during cruise control operation, the engine ECU actuates the automatic cancel control and blinks the cruise MAIN indicator light to inform the driver of a malfunction. At this time, the engine ECU memorises the malfunction in the form of 5-digit and 2-digit DTC (Diagnostic Trouble Code).

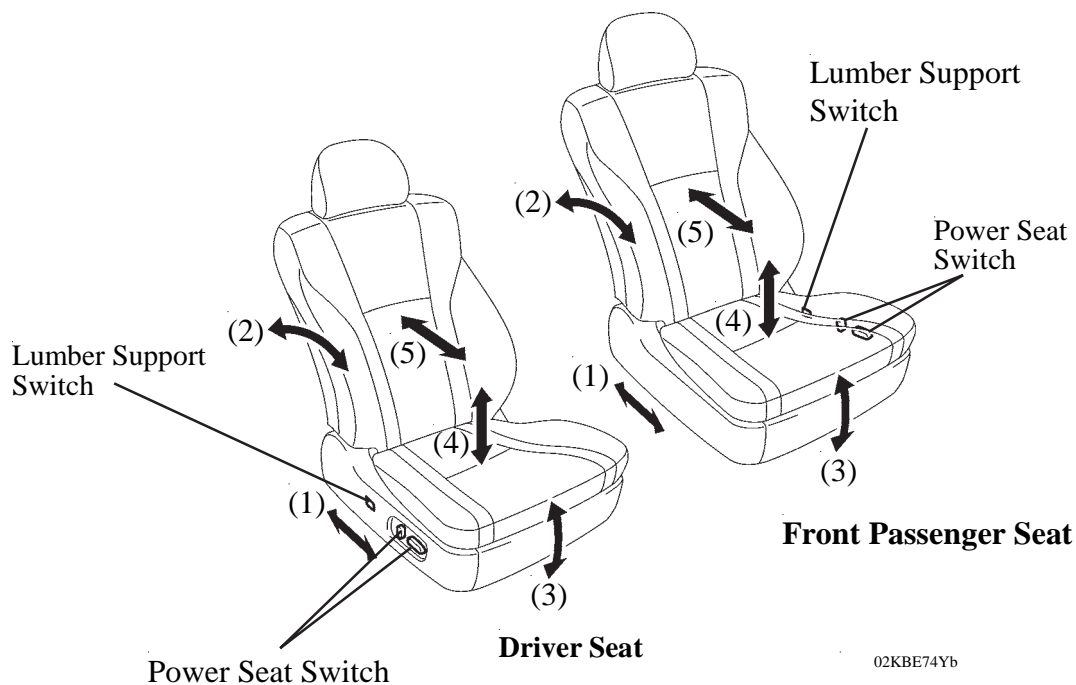
- The 5-digit DTC can be read by connecting an intelligent tester II to the DLC3.
- The 2-digit DTC is output to the cruise MAIN indicator light when the Tc and CG terminals of the DLC3 connector are connected through the use of the SST (09843-18040). Thus, these DTC are obtained by counting the number of blinks of the cruise MAIN indicator light.

## POWER SEAT SYSTEM

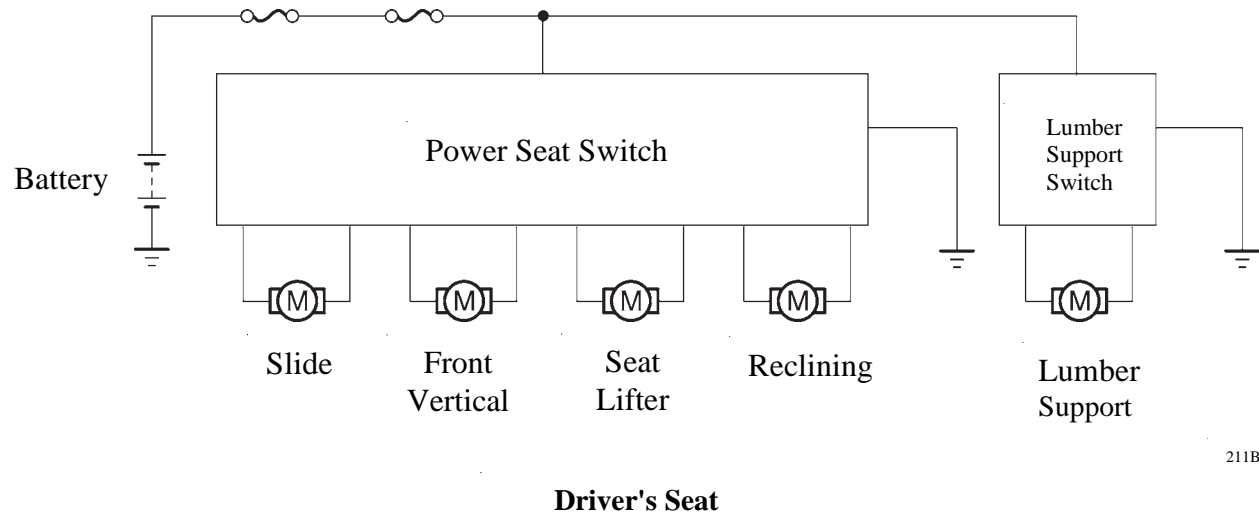
### ✱ DESCRIPTION

- The settings of the power seat system vary depending on the grade. For details, see the equipment list in model outline (see page MO-27).
- The power seat system for the driver and front passenger seats has the following functions:

Function		Stroke	
		Driver	Front Passenger
(1)	Seat Slide	260 mm	
(2)	Reclining	78 degrees	
(3)	Front Vertical	24 mm	-
(4)	Rear Vertical (Lifter)	45 mm	-
(5)	Lumbar Support	21 mm	



## ▸ System Diagram ◀



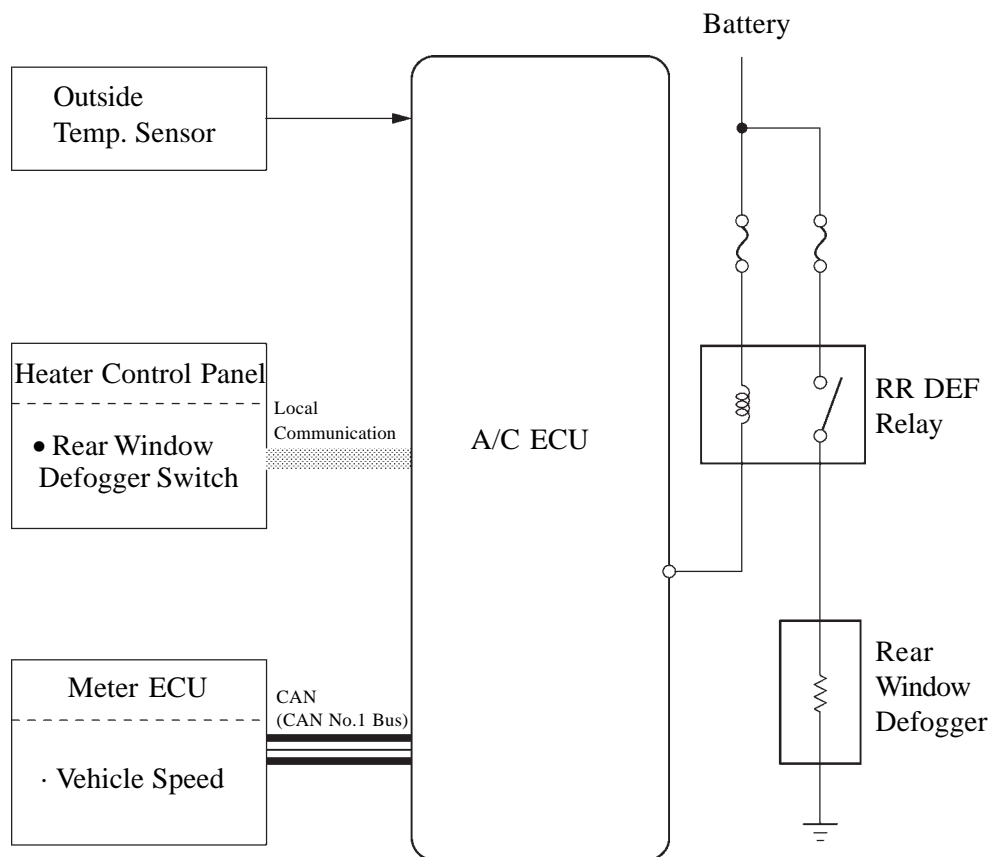


## REAR WINDOW DEFOGGER SYSTEM

### ✱ DESCRIPTION

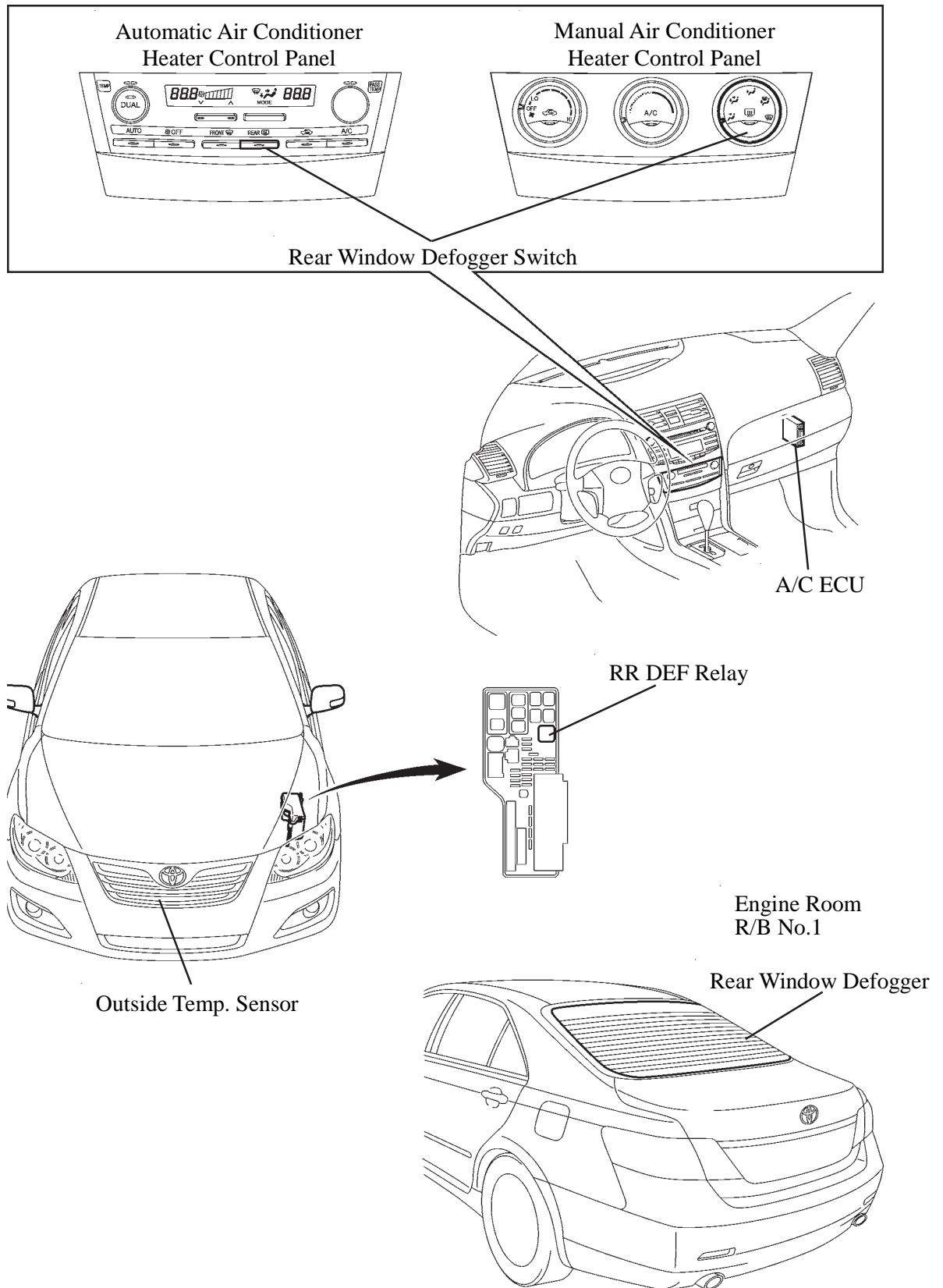
- The rear window defogger system uses the heater wire on the rear window glass to defog the rear window glass.
- This system is standard equipment on all models.
- This system is activated when the power source is turned on and the rear window defogger switch is pushed. This switch is provided with a timer function to turn off the defogger after approx. 15 minutes. The operation period of the timer may extend to approximately 45 minutes depending on the outside air temperature and vehicle speed.

### ▸ System Diagram ◀



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● LAYOUT OF MAIN COMPONENTS



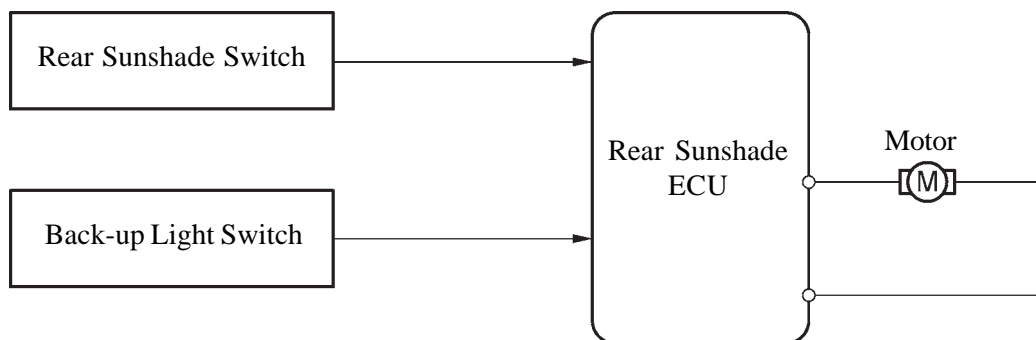
## REAR SUNSHADE SYSTEM

### ✱ DESCRIPTION

An electrically-operated rear sunshade system blocks direct sunlight from entering through the rear window in order to ensure the comfort of the rear seat passengers.

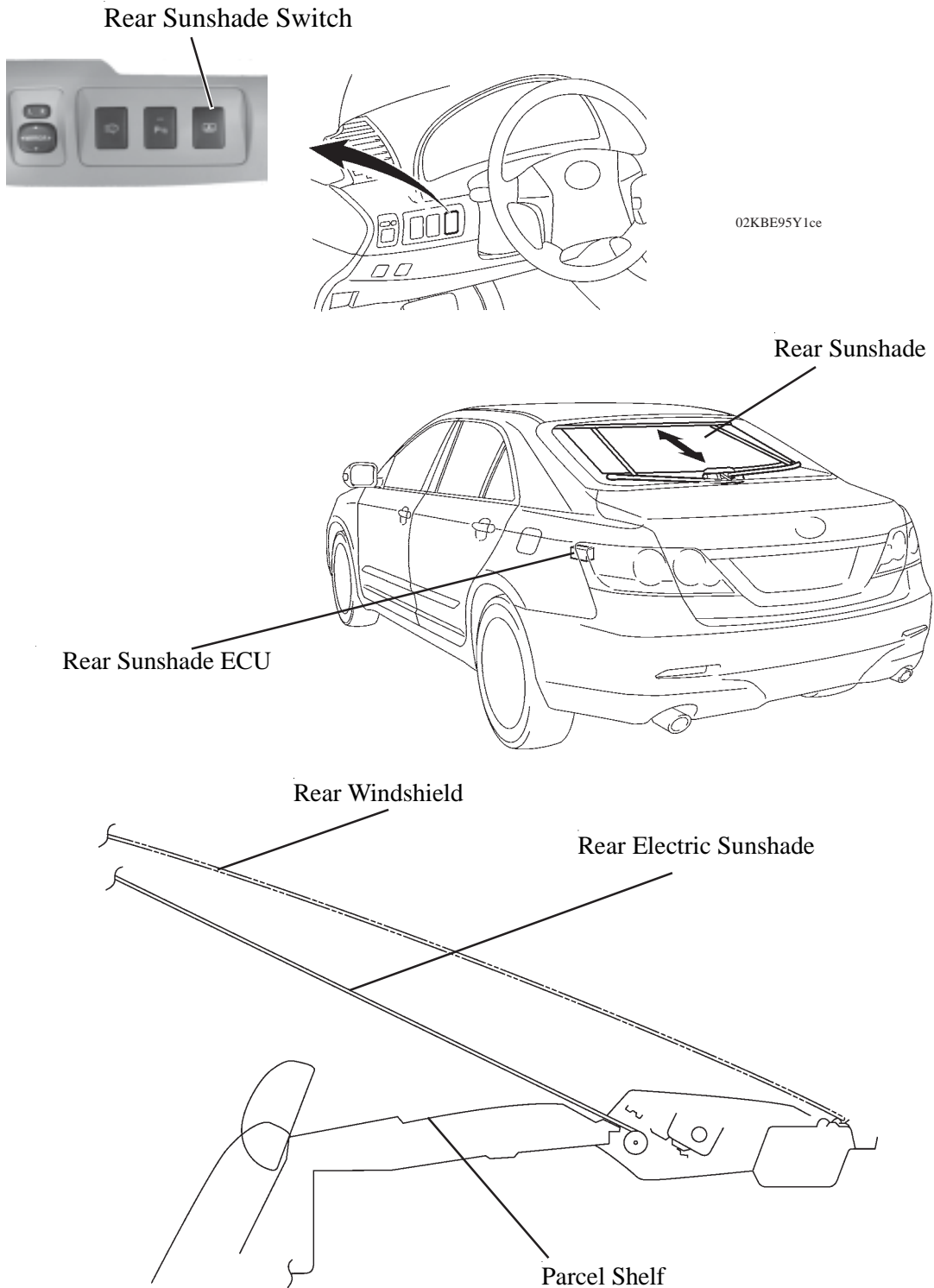
- This system is available on some grades. Refer to the Model Outline section page MO-27 for details.
- This system is control by the sunshade ECU and has the the following functions;

Function	Outline
Manual Up / Down	Moves the rear sunshade up or down in accordance with the rear sunshade switch operation.
Reverse-linked Auto-down	Moves the rear sunshade down automatically in accordance with the reverse signal.



02KBE94Y

✱ LAYOUT OF MAIN COMPONENTS

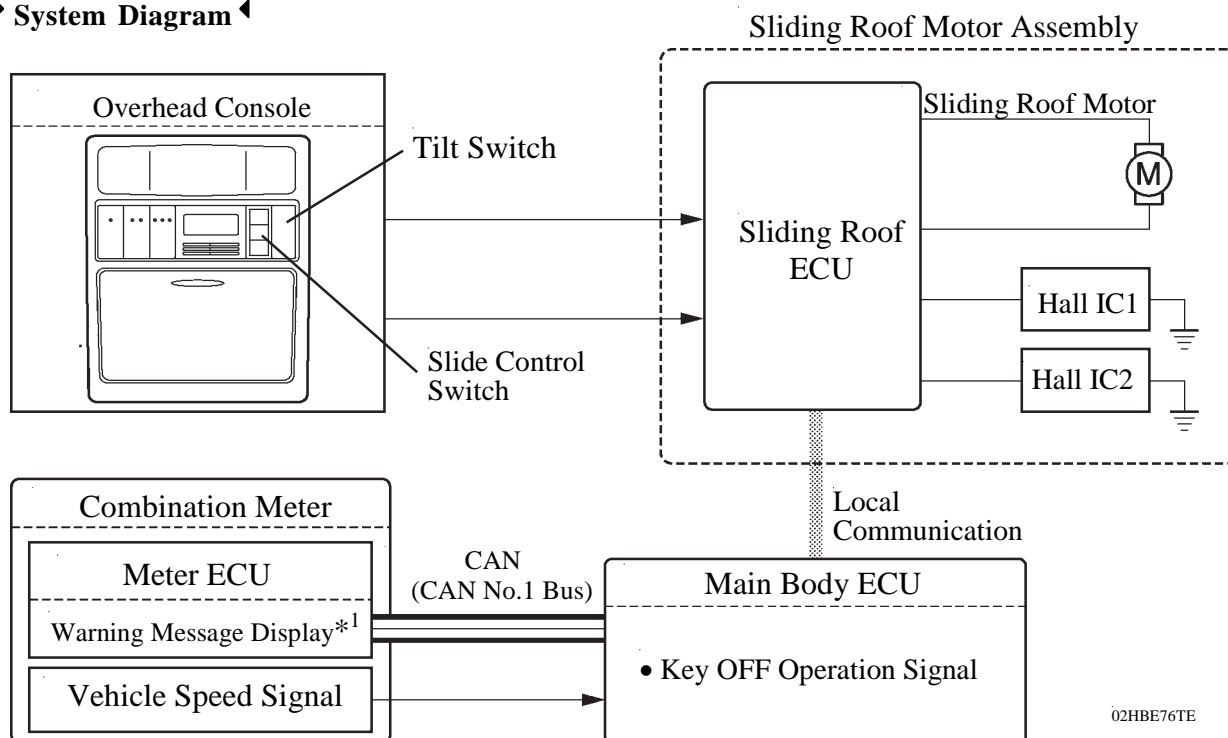


## SLIDING ROOF SYSTEM

### DESCRIPTION

- The sliding roof system available on some grades. For details, see the equipment list in Model Outline (see page MO-27).
- The sliding roof ECU uses 2 type Hall ICs to detect the position of the sliding roof. Sliding roof ECU and the 2 Hall ICs are integrated into the sliding roof motor assembly.

### System Diagram



\*1: Model with multi-information display

### Service Tip

The memory is not cleared if battery terminals are disconnected. However, initialisation is necessary after the sliding roof motor assembly is replaced. Perform the initialisation as follows:

#### Initial Position Memory Erasure Procedure

- Turn the power supply off (for example, remove a power roof motor assembly connector or fuse) while the power sliding roof motor is operating.
- Check to ensure the auto function of the power sliding roof is inoperative.

#### Initialisation procedure

- Keep pressing the TILT UP or SLIDE CLOSE switch until the initialisation completely. This will enable the sliding roof ECU to start initialising and perform the tilt up, tilt down, open, and close operations of the sliding roof in sequence.
- Keep the switch pressed for 1 second after the tilt-up operation is completed.
- The sliding roof ECU performs the tilt down, open, and close operations.
- The initialisation process ends when the close operation is completed.

Keep the tilt-up or slide close switch pressed during initialisation. If the tilt up or close switch is released during initialisation, the system will not be able to complete the initialisation. If this occurs, perform the steps from the beginning again.

## FUNCTION

### 1. General

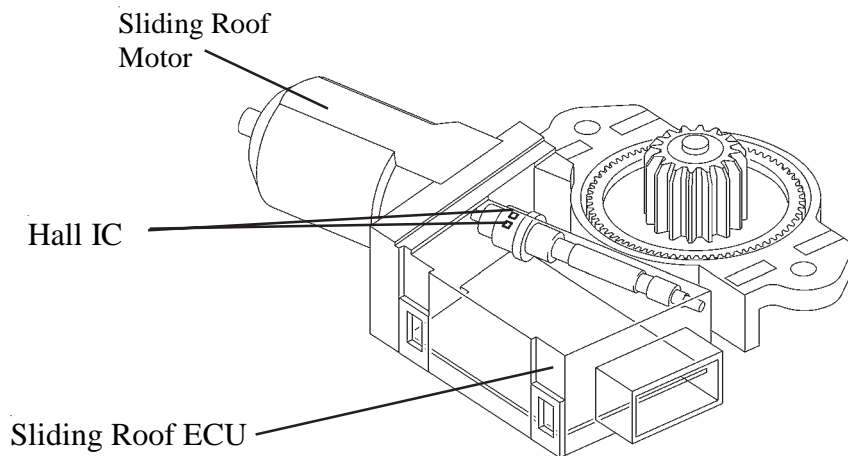
This sliding roof system has the following functions:

Function	Outline
Manual open-and-close	This function causes the sliding roof to open (or close) while the SLIDE OPEN switch (or SLIDE CLOSE switch) is momentarily pressed. The sliding roof stops as soon as the switch is released.
One touch auto open-and-close	This function enables the sliding roof to be fully opened (or closed) by a 0.3 sec. or longer press of the SLIDE OPEN switch (or SLIDE CLOSE switch).
Manual tilt up-and-down	This function causes the sliding roof to tilt up (or tilt down) while the TILT UP switch (or TILT DOWN switch) is momentarily pressed. The sliding roof stops as soon as the switch is released.
One touch auto tilt up-and-down	This function enables the sliding roof to be fully tilted up (or down) by a 0.3 sec. or long press of the TILT UP switch (or TILT DOWN switch).
Jam protection	The "jam protection" function automatically stops the sliding roof and moves it open half way (or fully tilt up) if a foreign object gets jammed in the sliding roof during close or tilt down operation.
Key-off operation	The "key-off operation" function makes it possible to operate the sliding roof for approximately 43 seconds after the ignition switch is turned to the ACC or OFF position, if the front doors are not opened.
Sliding roof open warning (See Page BE- 200)	When the power source* is changed from IG-ON to OFF and the driver door is opened with the sliding roof open, the buzzer in the combination meter sounds once. Then, a warning message appears on the multi-information display.

\*: Power source conditions can be changed by pressing the engine switch on models with the smart entry and start system and by operating the ignition switch on models without the smart entry and start system.

## 2. Jam Protection Function

- The Hall IC converts the changes in the magnetic flux that occur due to the rotation of the worm gear into pulse signals and outputs them to the ECU.

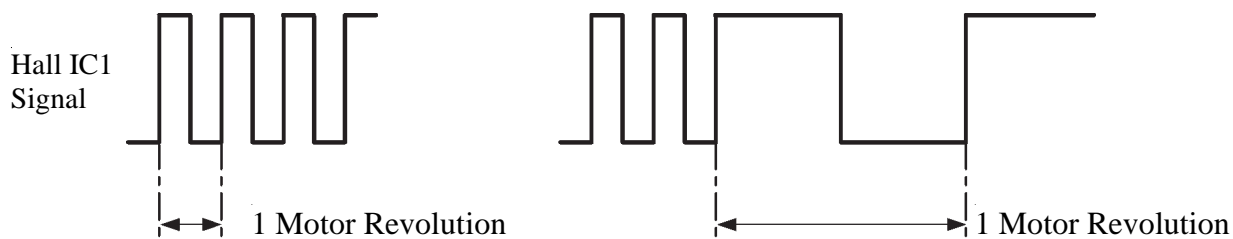


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**Sliding Roof Motor Assembly**

- To control the jam protection function, the ECU monitors the amount of movement and judges jamming of the moon roof based on the pulse signals from the Hall IC1, and the moving direction of the moon roof from the phase difference between the pulsed from the Hall IC1 and Hall IC2.

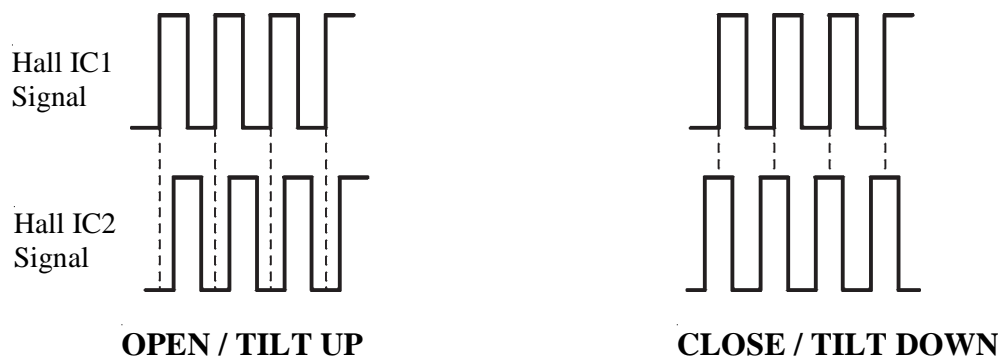
### ▶ Monitoring Amount of Movement Judgment of Jamming ◀



232BE34

**Normal**

**Jammed**




232BE35

### 3. Sliding Roof Open Warning

When the power source\* is changed from ON to OFF and the driver door is opened when the sliding roof is open, the sliding roof ECU sounds the buzzer in the combination meter. Then, a warning message appears on the multi-information display.

\*: Power source conditions can be changed by pressing the engine switch on models with the smart entry and start system and by operating the ignition switch on models without the smart entry and start system.

Warning Condition		The warning is activated if all of the following conditions are met: <ul style="list-style-type: none"> <li>• Sliding roof is not fully closed.</li> <li>• Power source* is "OFF"</li> <li>• Driver door is opened.</li> </ul>
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 025BE179P
	Master Warning Light	Flash
Warning Stop Condition		The warning is stopped when one of the following conditions is met. <ul style="list-style-type: none"> <li>• 8 seconds have elapsed after the warning condition is detected</li> <li>• Power source* is "ON"</li> <li>• Driver door is closed.</li> <li>• Sliding roof is closed.</li> </ul>

\*: Power source conditions can be changed by pressing the engine switch on models with the smart entry and start system and by operating the ignition switch on models without the smart entry and start system.

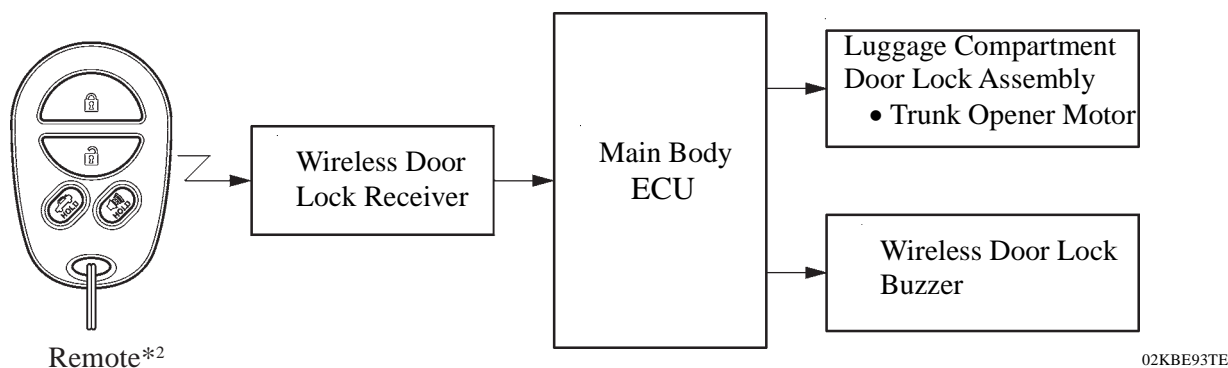


## TRUNK OPENER

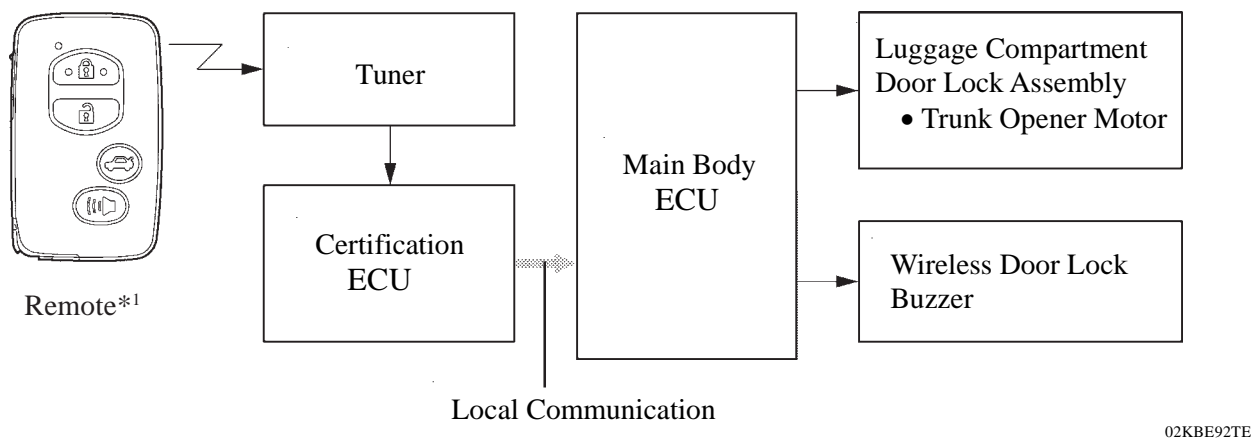
### DESCRIPTION

The trunk opener can be operated through the transmitter or lever. For models equipped with the wireless door lock remote control system, see page BE-110.

#### System Diagram



#### Without Smart Entry and Start System

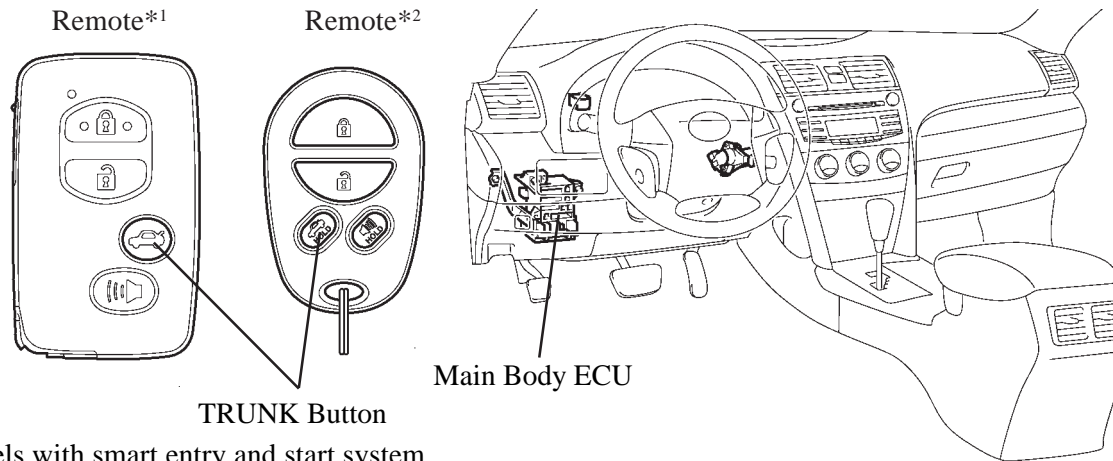


#### With Smart Entry and Start System

\*1: Models with smart entry and start system

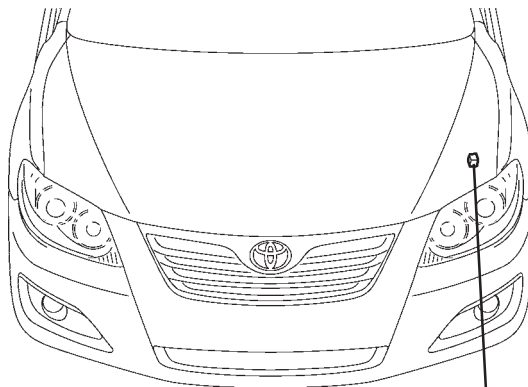
\*2: Models without smart entry and start system

# ● LAYOUT OF MAIN COMPONENTS

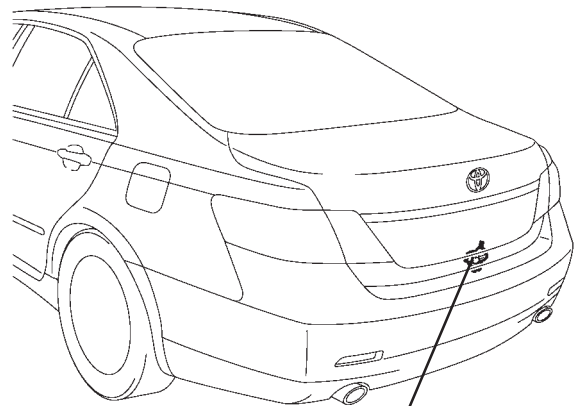


\*1: Models with smart entry and start system

\*2: Models without smart entry and start system



Wireless Door Lock Buzzer



02KBE97TE

Luggage Compartment  
Door Lock Assembly  
● Trunk Opener Motor

## STEERING PAD SWITCH

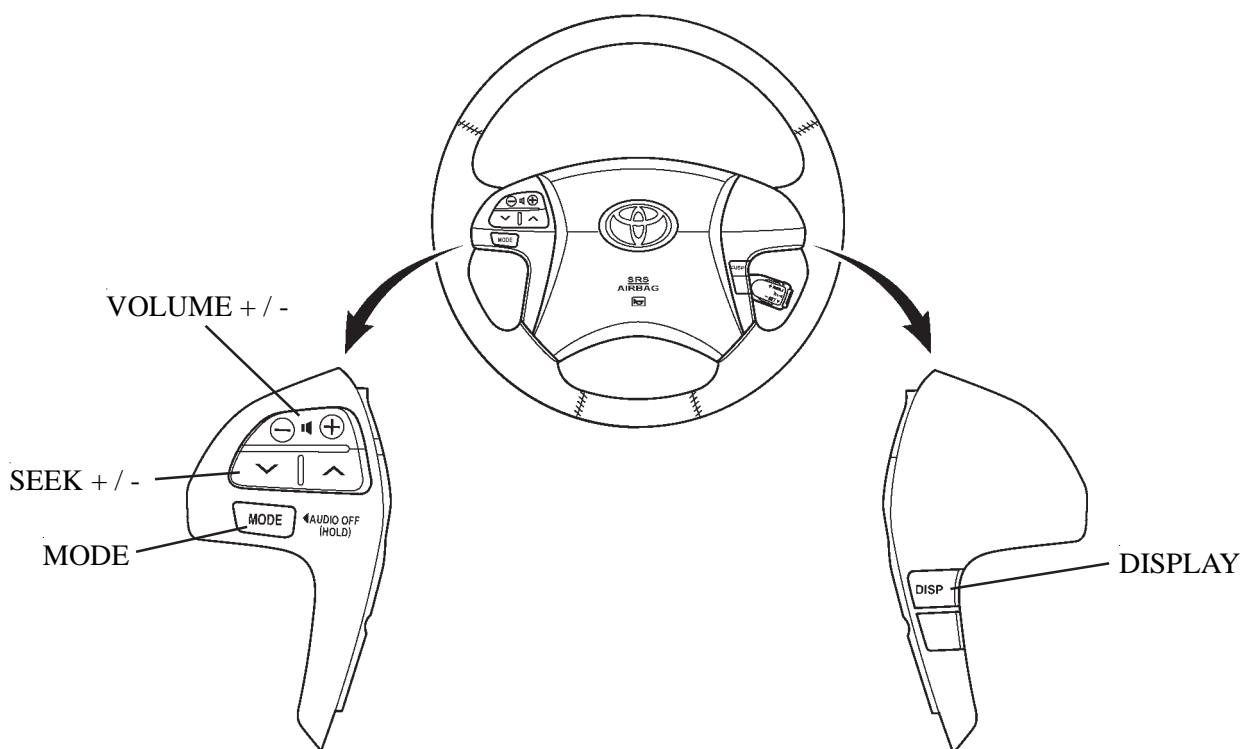
### ✱ DESCRIPTION

- The settings of the steering pad switches vary depending on the destinations and optional equipment.
- For systems that can be operated by the steering pad switches, refer to the following table.

System	Switch
Audio* <sup>1</sup> , * <sup>2</sup>	<ul style="list-style-type: none"> <li>• VOLUME + / -</li> <li>• SEEK + / -</li> <li>• MODE</li> </ul>
Multi-information Display (Combination Meter)* <sup>2</sup>	DISP

\*1: With optional audio on Touring, standard on Grande

\*2: Models with multi-information display (Grande)



**4 Spoke Steering Wheel**

025BE182Y

# APPENDIX

Item			Area		G.C.C. Countries	
Body Type					Sedan	
Vehicle Grade					Touring	Grande
Model Code					GSV40L-JETDKV	GSV40L-JETGKV
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4825 (190.0)	4825 (190.0)	
		Width	mm (in.)	1820 (71.7)	1820 (71.7)	
		Height	mm (in.)	1470(57.9)	1470(57.9)	
	Wheel Base		mm (in.)	2775 (109.3)	2775 (109.3)	
	Tread	Front	mm (in.)	1575 (62.0)	1575 (62.0)	
		Rear	mm (in.)	1565 (61.6)	1565 (61.6)	
	Room	Length	mm (in.)	2130 (83.8)	2130 (83.8)	
		Width	mm (in.)	1525 (60.0)	1525 (60.0)	
		Height	mm (in.)	1200 (47.2), 1140 (44.9)* <sup>1</sup>	1200 (47.2), 1140 (44.9)* <sup>1</sup>	
	Overhang	Front	mm (in.)	965 (38.0)	965 (38.0)	
		Rear	mm (in.)	1085 (42.7)	1085 (42.7)	
	Min. Running Ground Clearance		mm (in.)	150 (5.9)	150 (5.9)	
	Curb Weight	Front	kg (lb)	970 to975 (2138 to 2150)	980 to990 (2161 to 2183)	
		Rear	kg (lb)	620 to 630 (1367 to 1389)	625 to 635 (1378 to 1400)	
		Total	kg (lb)	1590 to 1605 (3505 to 3538)	1605 to 1625 (3538 to 3583)	
	Gross Vehicle Weight	Front	kg (lb)	1060 (2337)	1080 (2381)	
		Rear	kg (lb)	1035 (2282)	1015 (2238)	
		Total	kg (lb)	2095 (4619)	2095 (4619)	
Fuel Tank Capacity		ℓ (US.gal, Imp .gal)	70 (18.5, 15.5)	70 (18.5, 15.5)		
Luggage Capacity (VDA)		m <sup>3</sup> (cu.ft.)	0.535 (18.9)	0.535 (18.9)		
Performance	Max. Speed		km/h	228	228	
	Max. Permissible Speed	1st Gear	km/h	60	60	
		2nd Gear	km/h	104	104	
		3rd Gear	km/h	139	139	
		4th Gear	km/h	198	198	
	Min. Turning Radius	5th Gear	km/h	—	—	
		Tyre	m	5.5	5.5	
		Body	m	5.9	5.9	
Engine	Engine Type		2GR-FE		2GR-FE	
	Valve Mechanism		24-valve, DOHC with Dual VVT-i	24-valve, DOHC with Dual VVT-i		
	Bore × Stroke		mm (in.)	94.0 x 83.0 (3.70 x3.27)	94.0 x 83.0 (3.70 x3.27)	
	Displacement		cm <sup>3</sup> (cu.in)	3456(210.9)	3456(210.9)	
	Compression Ratio		10.8:1		10.8:1	
	Carburetor Type		EFI		EFI	
	Research Octane No.		RON	91 or higher	91 or higher	
	Max. Output (EEC)		kW @rpm	200 @ 6200* <sup>3</sup>	200 @ 6200* <sup>3</sup>	
Engine Electrical	Max. Torque (EEC)		N m @rpm	336 @ 4700* <sup>3</sup>	336 @ 4700* <sup>3</sup>	
	Battery Capacity (5HR)		Voltage & Amp.hr	12-48	12-48	
	Alternator Output		Watts	1200	1200	
Starter Output		kW	1.7	1.7		
Chassis	Transaxle Type		U660E		U660E	
	Gear Ratio	In First	3.300		3.300	
		In Second	1.900		1.900	
		In Third	1.420		1.420	
		In Fourth	1.000		1.000	
		In Fifth	0.713		0.713	
		In Sixth	0.608		0.608	
		In Reverse	4.148		4.148	
	Differential Gear Ratio		3.685* <sup>2</sup>		3.685* <sup>2</sup>	
	Brake Type	Front	Ventilated Disc		Ventilated Disc	
		Rear	Solid Disc		Solid Disc	
	Parking Brake Type		Duo-servo		Duo-servo	
	Brake Booster Type and Size		Single, 10"		Single, 10"	
	Proportioning Valve Type		—		—	
	Suspension Type	Front	MacPherson Strut		MacPherson Strut	
		Rear	MacPherson Strut		MacPherson Strut	
	Stabilizer Bar	Front	Standard		Standard	
		Rear	Standard		Standard	
Steering Gear Type		Rack & Pinion		Rack & Pinion		
Power Steering Type		Hydraulic Type		Hydraulic Type		

\*<sup>1</sup>: With sliding roof\*<sup>2</sup>: Counter gear ratio included