

1. Introduction

DEVELOPMENT OBJECTIVES

As Toyota's high-performance flagship car, the Toyota Supra continues to make full use of available advanced technology.

In its fourth full model change, the Toyota Supra has been reborn, making great strides in becoming recognized as a full-fledged, world class sports car.

The major development objectives of the new Toyota Supra are as follows:

Styling

Timeless exterior design worthy of a muscular high-performance sports car

Interior

Dynamic interior design with a sporty image

Power Train

Boasting overwhelming power and response

Chassis

Offering communicative steering feel and superb response through stable and precise handling

Safety

High safety factors matching its high-speed driving capability

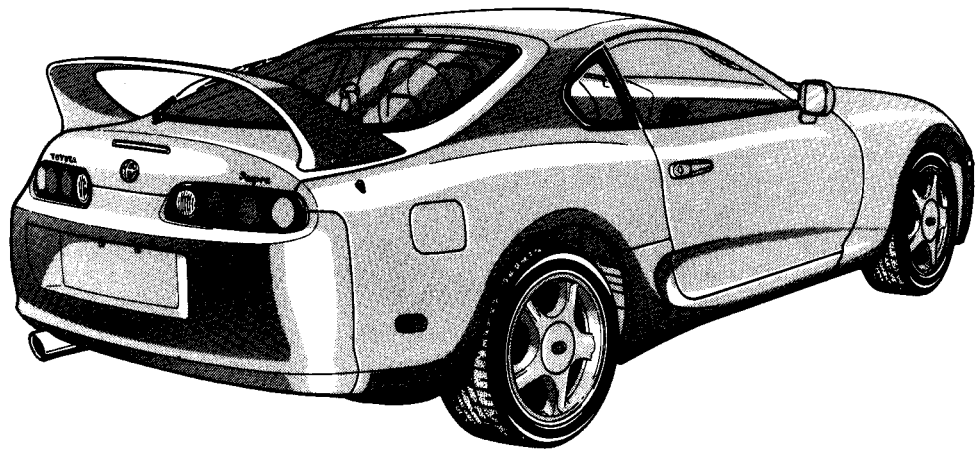
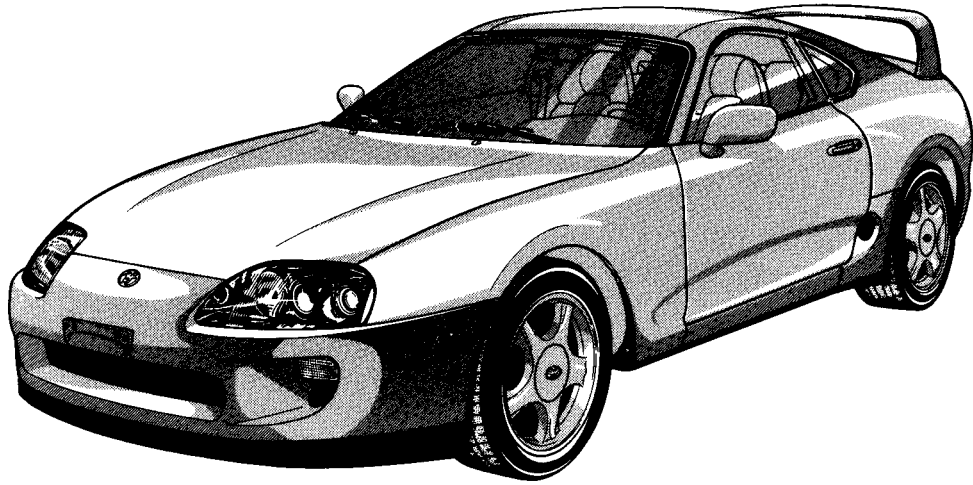
Weight Reduction

Trimming extra weight to realize the vehicle's full potential

Environment

The new refrigerant R134a is used for the air conditioning system

EXTERIOR APPEARANCE



FOREWORD

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

Applicable models: JZA80 series

This manual is divided into 4 sections.

1. **Introduction** —Development objectives of the new model and model line-up.
2. **New Model Outline** —Explanation of the product to give a general understanding of its features.
3. **Technical Description**—Technical explanation of the construction and operation of each new system and component.
4. **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 instructions on what to do or not do are ignored.
NOTICE	Damage to the vehicle or components may occur if 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 detailed service specifications and repair procedures, refer to the following Repair Manuals:

Manual Name	Pub. No.
☞1993 Toyota Supra Repair Manual Vol. 1	RM343U1
Vol. 2	RM343U2
☞1993 Toyota Supra Electrical Wiring Diagram	EWD174U

All information contained herein is the most up-to-date at the time of publication. We reserve the right to make changes without prior notice.

TOYOTA MOTOR CORPORATION

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MODEL CODE AND MODEL LINE-UP

MODEL CODE

JZA80 L – A J M V F A

(1) (2) (3) (4) (5) (6) (7) (8)

	BASIC MODEL CODE
(1)	JZA80 : With 2JZ-GE or 2JZ-GTE Engine

	STEERING WHEEL POSITION
(2)	L : Left-Hand Drive

	MODEL NAME
(3)	A : Toyota Supra

	BODY TYPE
(4)	L : Liftback J : Liftback with Sports Roof

	GEARSHIFT TYPE
(5)	F : 6-Speed Manual M : 5-Speed Manual P : 4-Speed Automatic

	GRADE
(6)	V : —

	ENGINE SPECIFICATION
(7)	F : SFI* [EFI] and DOHC Z : SFI [EFI] and DOHC with Turbocharger

	DESTINATION
(8)	A : U.S.A. K : Canada

*SFI (Sequential Multiport Fuel Injection)

MODEL LINE-UP

TRANSMISSION				5-Speed Manual	6-Speed Manual	4-Speed Automatic	
DESTINATION	ROOF	GRADE	ENGINE	W58	V160	A340E	A340E*
U.S.A.	Standard	—	2JZ-GE	JZA80L-ALMVFA		JZA80L-ALPVFA	
	Sport			JZA80L-AJMVFA		JZA80L-AJPVFA	
	Standard		2JZ-GTE		JZA80L-ALFVZA		JZA80L-ALPVZA
	Sport				JZA80L-AJFVZA		JZA80L-AJPVZA
Canada	Sport	—	2JZ-GTE		JZA80L-AJFVZK		JZA80L-AJPVZK

* Electronically Controlled Transmission with an intelligent sporty control

2. New Model Outline

MAJOR COMPONENTS

The basic components of the new Toyota Supra are as follows.

Model		New	Previous
Item			
Drive System		FR (Front Engine, Rear Wheel Drive)	←
DOHC Engine	Type	2JZ-GE: In-line 6, 3.0-Liter	7M-GE: In-Line 6, 3.0-Liter
	Displacement cm ³ (cu. in.)	2997 (182.9)	2954 (180.3)
	Valve Mechanism	24 Valve, DOHC	←
	Fuel System	SFI* ¹ [EFI]	MFI* ² [EFI]
	Max. Output [SAE-NET] kW @ rpm (HP @ rpm)	164 @ 5800 (220 @ 5800)	149 @ 6000 (200 @ 6000)
	Max. Torque [SAE-NET] N-m @ rpm (ft-lbf @ rpm)	285 @ 4800 (210 @ 4800)	255 @ 3600 (188 @ 3600)
DOHC with Turbocharger	Type	2JZ-GTE: In-line 6, 3.0-Liter	7M-GTE: In-Line 6, 3.0-Liter
	Displacement cm ³ (cu. in.)	2997 (182.9)	2954 (180.3)
	Valve Mechanism	24 Valves, DOHC	←
	Fuel System	SFI* ¹ [EFI]	MFI* ² [EFI]
	Max. Output [SAE-NET] kW @ rpm (HP @ rpm)	239 @ 5600 (320 @ 5600)	173 @ 5600 (232 @ 5600)
	Max. Torque [SAE-NET] N-m @ rpm (ft-lbf @ rpm)	427 @ 4000 (315 @ 4000)	344 @ 3200 (254 @ 3200)
Clutch		Dry Type, Single Plate	←
Transmission	Manual	W58: 5-Speed (For 2JZ-GE) V160: 6-Speed (For 2JZ-GTE)	W58: 5-Speed (For 7M-GE) R154: 5-Speed (For 7M-GTE)
	Automatic	A340E: 4-Speed (For 2JZ-GE) A340E* ³ : 4-Speed (For 2JZ-GTE)	A340E: 4-Speed (For 7M-GE) A340E: 4-Speed (For 7M-GTE)
Brakes		4-Wheel Ventilated Disc	←
Suspension		4-Wheel Double Wishbone	←
Steering	Gear Type	Rack and Pinion	←
	Power Steering	Vehicle Speed Sensing Hydraulic Reaction Type Electronically Controlled PPS* ⁴	←

*¹ SFI: Sequential Multiport Fuel Injection

*² MFI: Multiport Fuel Injection

*³ Electronically Controlled Transmission with an intelligent sporty control

*⁴ PPS: Progressive Power Steering

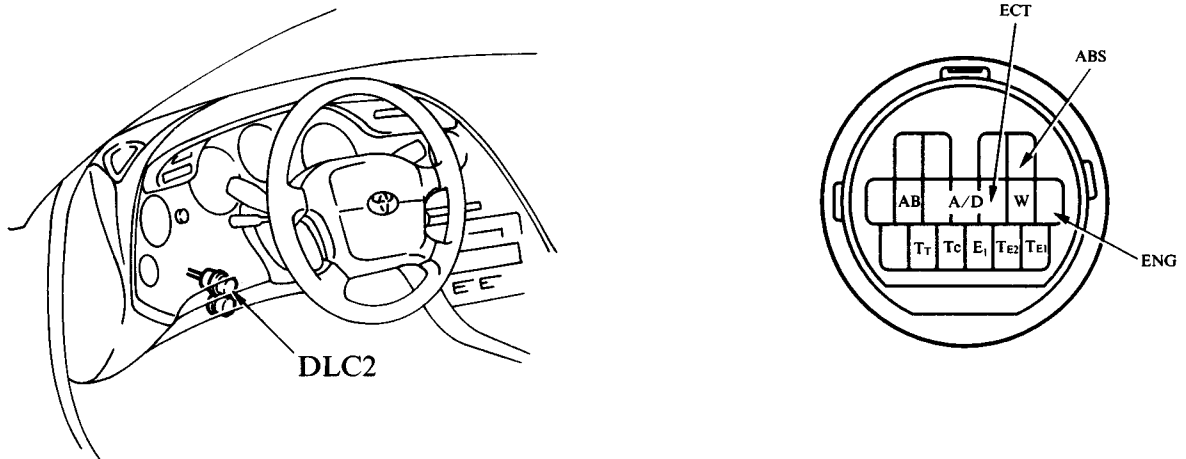
SERVICEABILITY IMPROVEMENT

DATA LINK CONNECTOR 2 [TOYOTA DIAGNOSTIC COMMUNICATION LINK]

- ⑥ The new Toyota Supra has the same DLC2* [TDCL: Toyota Diagnostic Communication Link] as the Camry.

The DLC2 has been provided inside the cabin as a connector exclusively for diagnosis of the Engine Control, Transmission Control, ABS, Cruise Control and SRS Airbag to improve serviceability.

* DLC2 (Data Link Connector 2)



- ⑥ Connecting the following terminals of the DLC2 to terminal E₁ selects the diagnosis mode.

Terminal	System
T _{E1}	Engine Control (Normal Mode)
T _{E1} and T _{E2}	Engine Control (Test Mode)
T _C	ABS, Cruise Control System, SRS Airbag
T _T	Transmission Control

NOTICE

Never make a mistake with the terminal connection position as this will cause a malfunction.

ENGINE

ENGINE LINE-UP

The following are the two newly developed engines that are available for the new Toyota Supra:

Displacement	Engine Type	Max. Output [SAE-NET]	Max. Torque [SAE-NET]	Features
3.0 L	2JZ-GE	164 kW @ 5800 rpm (220 HP @ 5800 rpm)	285 N·m @ 4800 rpm (210 ft·lbf @ 4800 rpm)	An in-line 6, 3.0-liter DOHC engine, adopting ACIS* and dual exhaust manifold, offering high-performance and low fuel consumption at high level.
3.0 L	2JZ-GTE	239 kW @ 5600 rpm (320 HP @ 5600 rpm)	427 N·m @ 4000 rpm (315 ft·lbf @ 4000 rpm)	A turbocharged in-line 6, 3.0-liter DOHC engine with a charge air cooler [intercooler], featuring high response and power output.

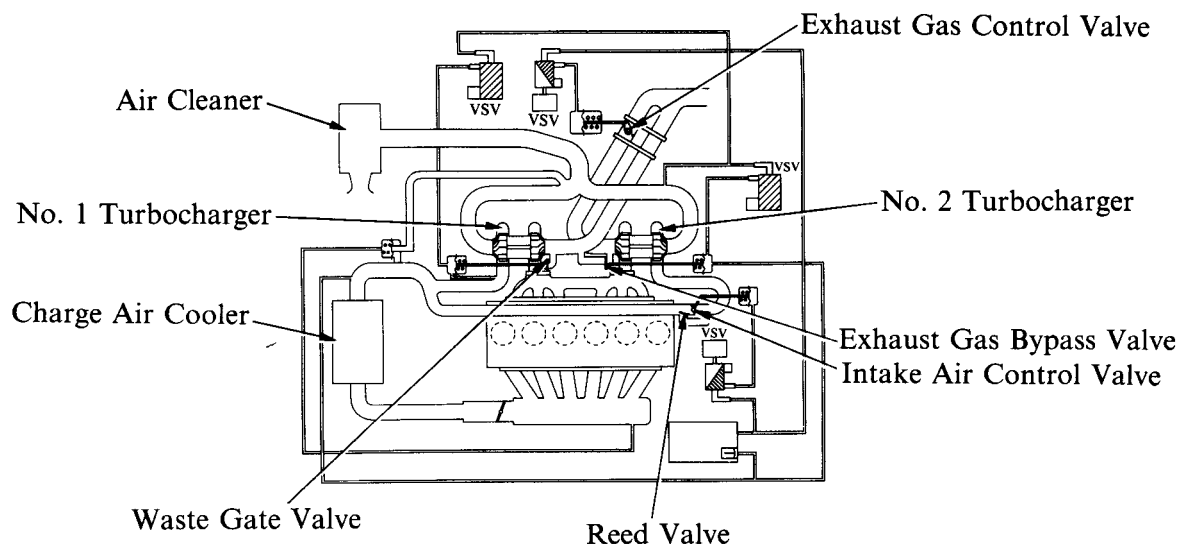
*ACIS: An Acoustic Control Induction System, equivalent to the Intake Air Control System used in the 7M-GE engine of the previous model.

2JZ-GTE ENGINE

- Ⓔ The 2JZ-GTE is newly developed turbocharged in-line 6, 3.0-liter, 24-valve DOHC engine with a charge air cooler [intercooler]. Along with the two-way twin turbocharger system, this engine features two compact turbines, and a large-capacity, air-cooled charge air cooler which improves turbo response, and provides high engine response and performance.
- Ⓔ The two-way twin turbocharger system uses two small turbochargers numbered 1 and 2, and their operation is controlled by the ECM* [engine ECU] in accordance with the driving condition. This system applies boost from the No. 1 turbocharger to improve turbo response during a low-speed operation, and from both the No. 1 and No. 2 turbochargers to provide high power output during a high-speed operation.

*ECM (Engine Control Module)

Two-Way Twin Turbo System ◀



CHASSIS

By combining the basic functions of a vehicle, “to run, to turn, and stop”, at high level, the chassis of the new Toyota Supra aims to realize a ride that is worthy of the world-class sports car.

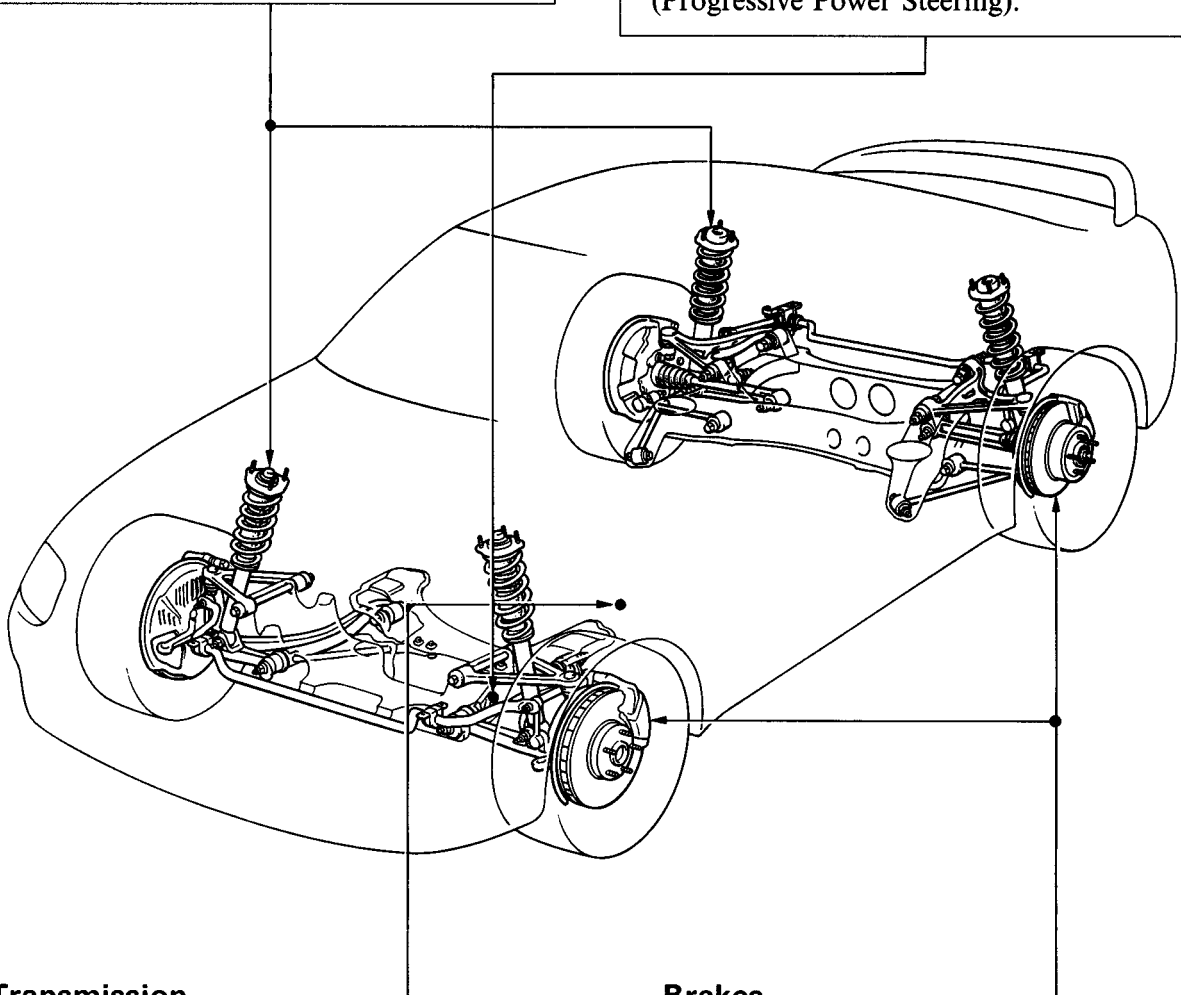
MAJOR COMPONENTS

Suspension

Double wishbone type suspension is used for all wheels, providing both steering stability and ride comfort.

Steering

The steering is highly rigid rack and pinion type with vehicle-speed-sensing hydraulic reaction type electronically controlled PPS (Progressive Power Steering).



Transmission

Four types of transmission are used.

Transmission Engine	Manual		Automatic	
	W58	V160	A340E	A340E*
2JZ-GE	●	—	●	—
2JZ-GTE	—	●	—	●

Brakes

Ventilated disc brakes are used on all wheels and the brake booster is the 8" + 9" tandem type.

The Anti-lock Brake System (ABS) is a standard feature on all models, and the Traction Control System is available on the 2JZ-GTE engine model only.

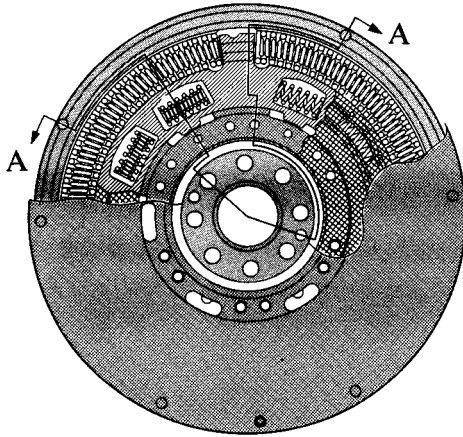
*Electronically Controlled Transmission with an intelligent sporty control

CHASSIS

CLUTCH

1. Flywheel Damper

The six-speed manual transmission model uses super-long travel flywheel damper made by LUK GmbH (Germany) to reduce the noise and vibration of the drivetrain.

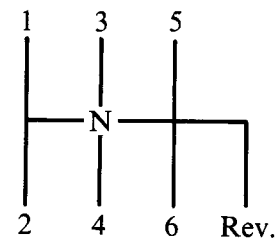
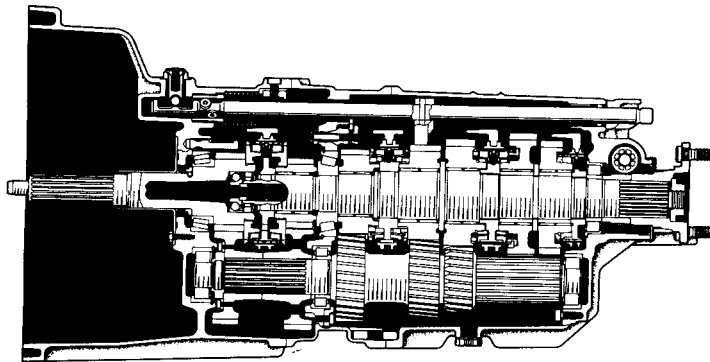


A-A Cross Section

MANUAL TRANSMISSION

1. V160 Manual Transmission

The 2JZ-GTE engine model adopts a newly developed transmission with six-speed forward gears and a one-speed reverse gear made by GETRAG GmbH (Germany) to ideally match the performance of the engine.



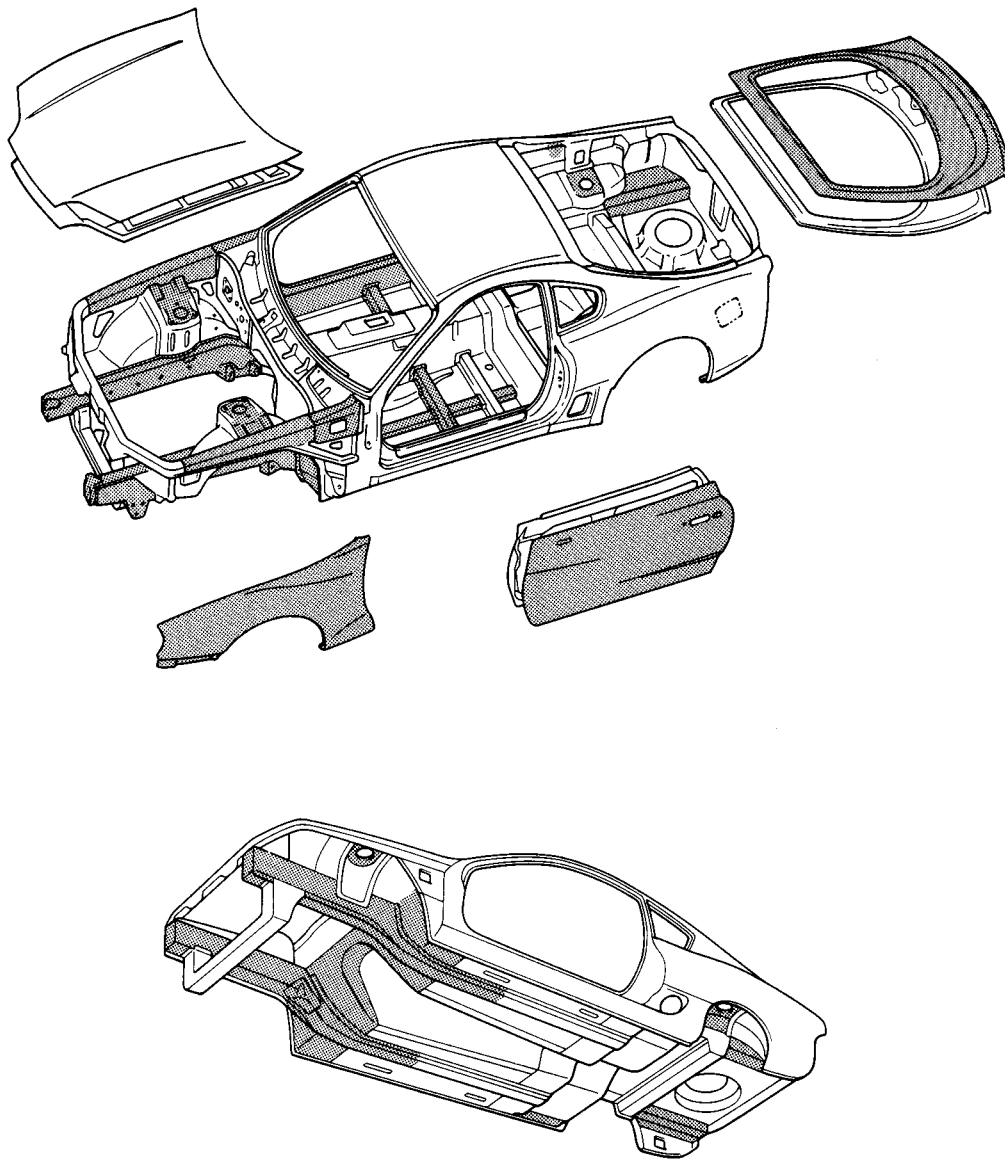
Shift Pattern

BODY

By optimally locating the frame components and redesigning their joint structures, the body shell of the new Toyota Supra achieves an ideal rigidity. Also, all panel areas are made seamless by using a single steel sheet, and a newly developed sheet aluminum alloy is adopted for the engine hood and the roof (sports roof model only) for weight reduction.

The vehicle's rust resistance is increased and the noise and vibration are reduced through an expanded application of the anti-corrosion steel sheet as well as the optimally located vibration damping steel sheet and asphalt sheet.

■ : High Strength Sheet Steel



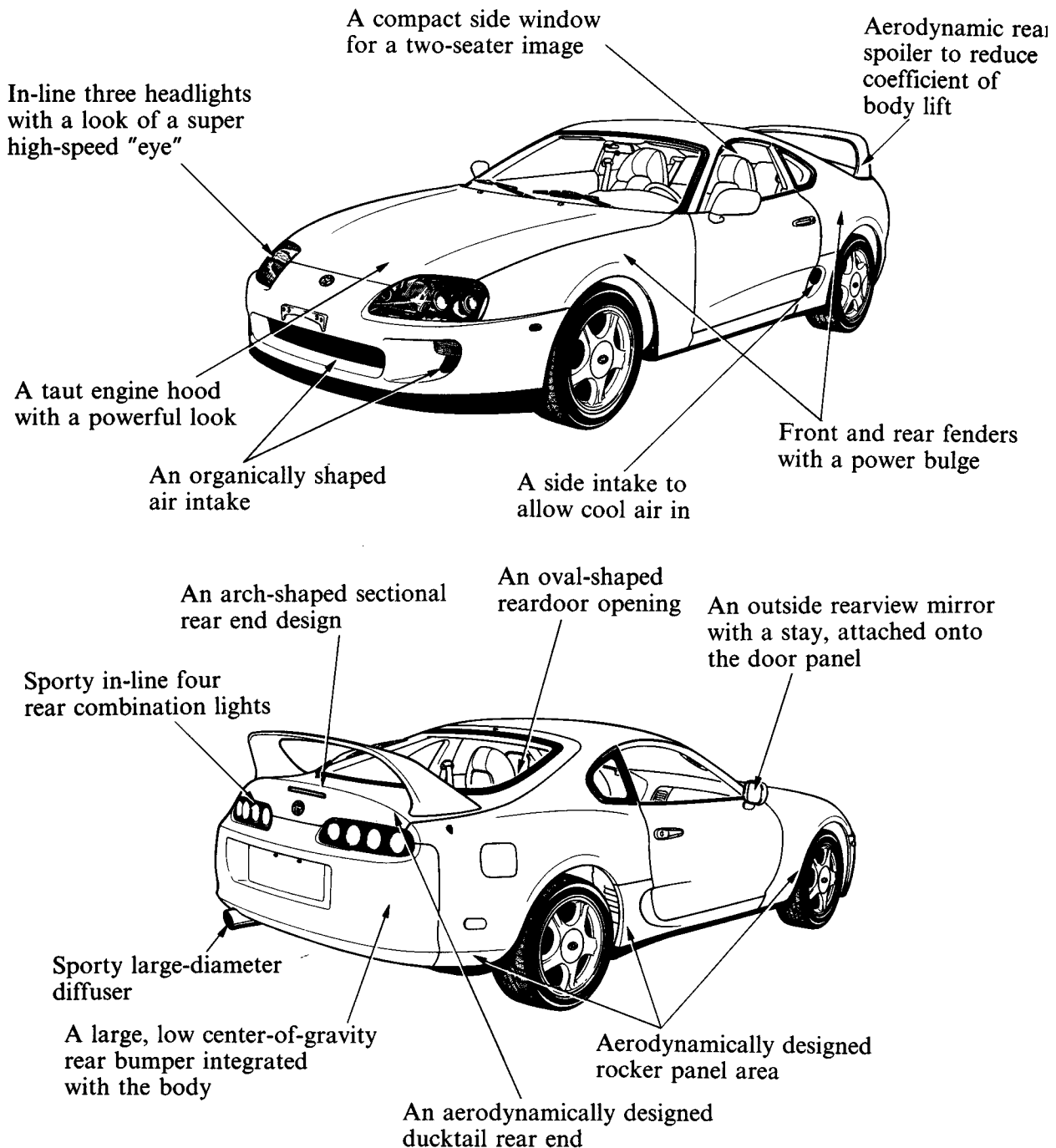
EXTERIOR

STYLING

The styling objective of the new Toyota Supra is to produce a high-performance, genuine world-class sports car with an individuality that sets it apart from other sports cars.

The styling has the following features:

- ◀ A dynamic composite dimension reminiscent of the firm musculature and physique of a speeding beast.
- ◀ A rational design with details devoted to the driving functionality.

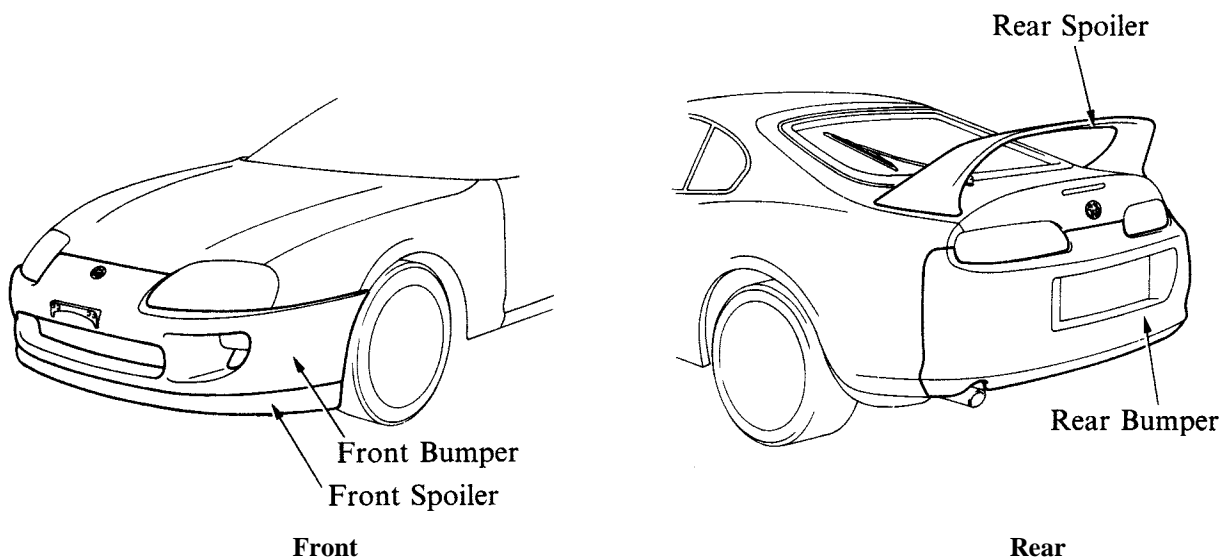


EXTERIOR

EXTERIOR EQUIPMENT

BUMPERS

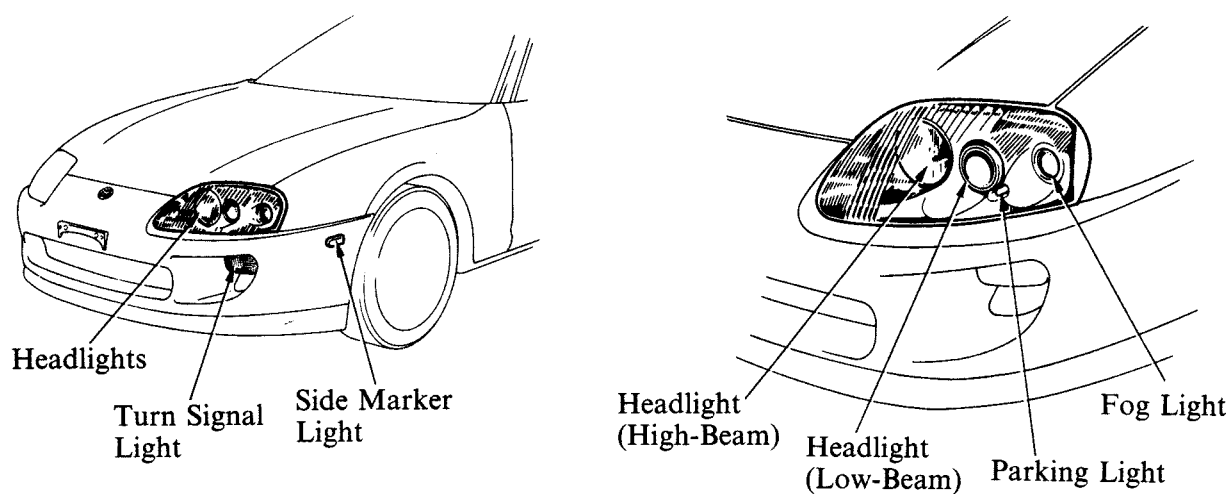
- ◀ Large, lightweight bumpers that are integrated flush against the body, are used in the front and rear.
- ◀ A front spoiler, integrated with the front bumper, is provided as a standard equipment.
- ◀ A large, lightweight rear spoiler is available as an option for the 2JZ-GTE model.



LIGHTS

1. Front Lights

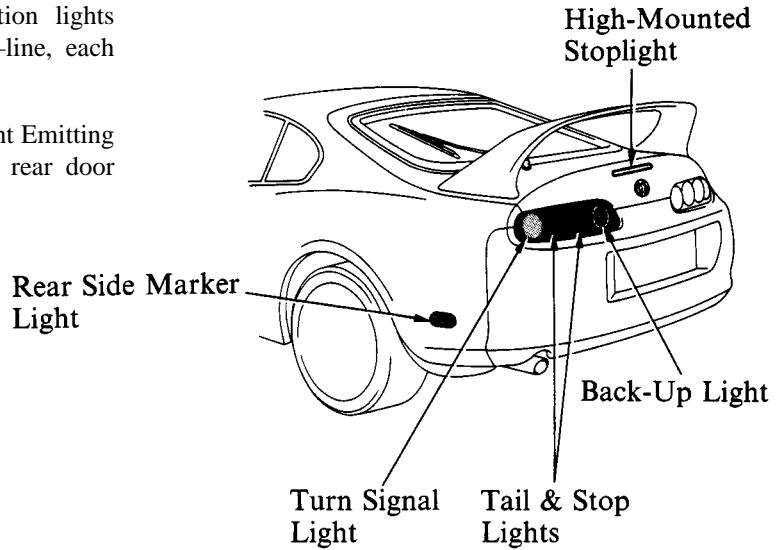
- ◀ The headlight is four-light system which integrates the fog lights and parking lights in one unit.
- ◀ Both the low-beam headlights and the fog lights are the projector type.



EXTERIOR

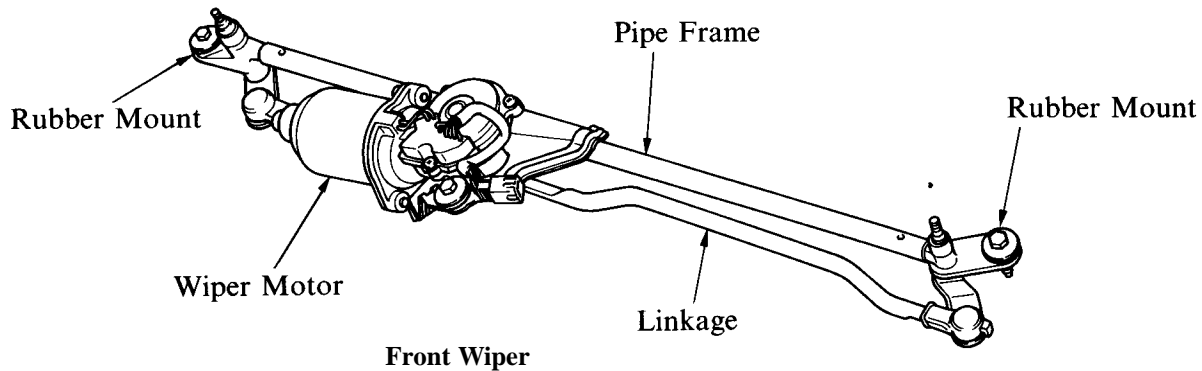
2. Rear Lights

- ◀ The sporty looking rear combination lights consist of four lenses arranged in-line, each having a separated function.
- ◀ A high-mounted stoplight with Light Emitting Diodes (LED) is embedded in the rear door panel.



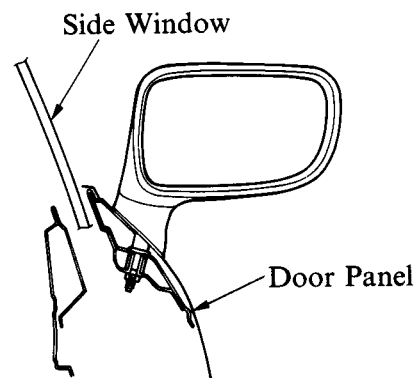
WIPERS

- ◀ The front wipers consist of the wiper motor and the linkage integrated in its full-floating type pipe frame structure, designed to reduce the noise and irregular wiping angle.
- ◀ The intermittent rear wiper is provided as a standard equipment.



OUTSIDE REAR VIEW MIRRORS

- ◀ The outside rear view mirrors are mounted onto the door panel.
- ◀ The heated, electrical remote-controlled mirrors are standard equipment.

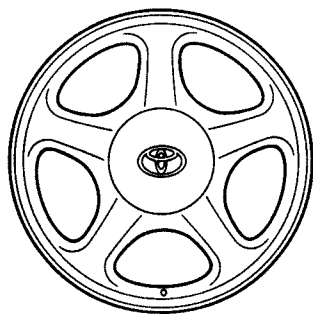


EXTERIOR

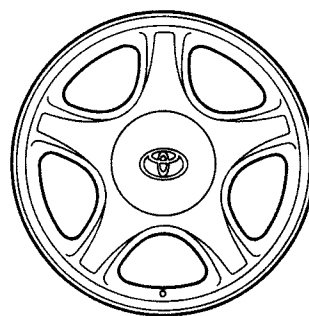
DISC WHEELS

The two types of sporty, five-spoke aluminum wheels are prescribed as follows:

Wheel Type	Engine	Wheel Size (in.)		Wheel Color	Tire Size (Front : Rear)
		Front	Rear		
A	2JZ-GE	16 x 8JJ	16 x 9JJ	Silver	225/50 : 245/50
B	2JZ-GTE	17 x 8JJ	17 x 9.5JJ	Silver	235/45 : 255/40



Type A



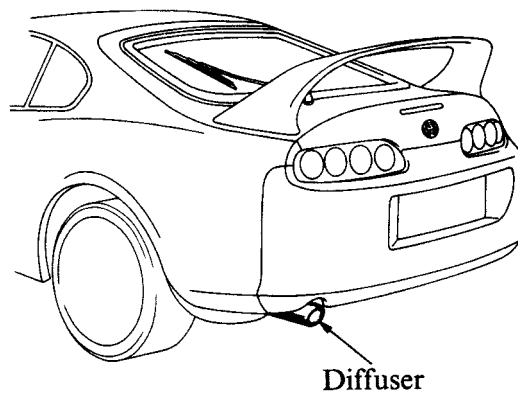
Type B

NOTICE

Your Supra has been fitted with specially developed tires which provide exceptional dynamic performance under general road conditions. However, (on vehicles equipped with the 2JZ-GTE engine,) you may also notice that your tires wear more rapidly than standard tires as a result of their superior performance.

TAILPIPE DIFFUSER

A prominent diffuser, with a large diameter (100 mm) suitable for a sports car, is provided on the tailpipe.

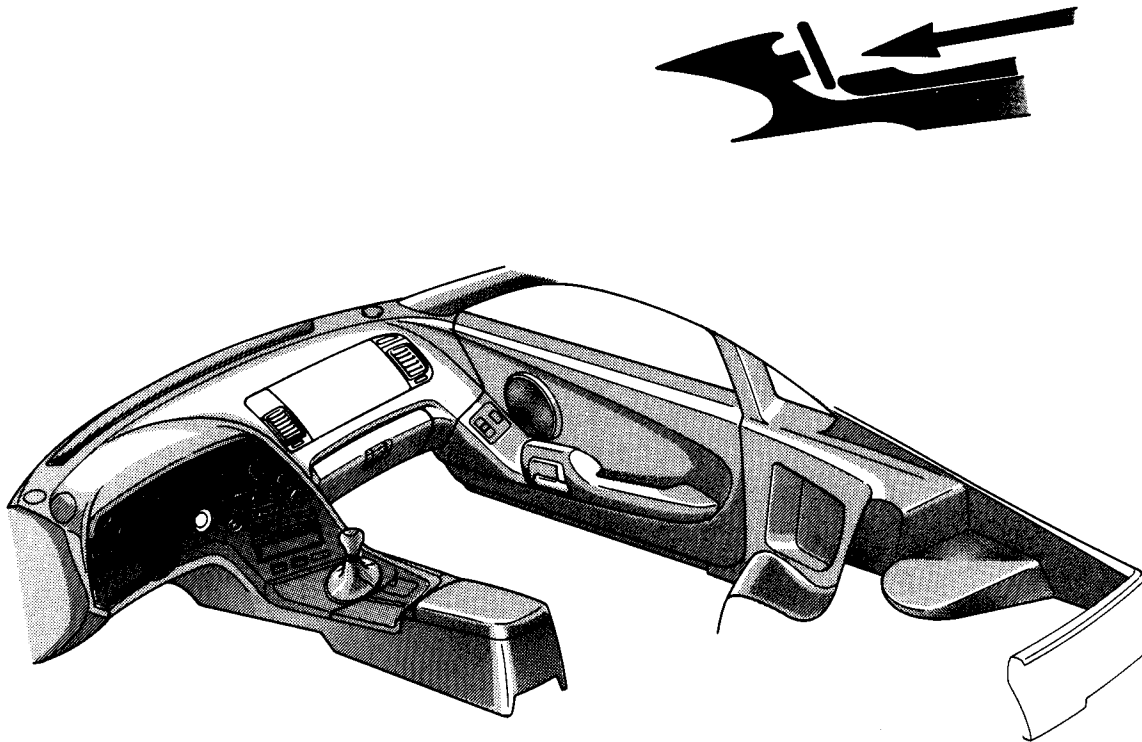


INTERIOR

The new Toyota Supra pursues an interior design concept to provide a magnificent space in which a powerful sports-minded form and a superb maneuverability worthy of a high-performance vehicle are incorporated.

CABIN

- Ⓜ The instrument panel and door trim are configured to provide a down-force form to look as if the vehicle is flush against the road surface.
- Ⓜ Sleek, curved design seats that express their supporting role.
- Ⓜ The instruments and switches are sensibly laid out for better maneuverability and visibility during high-speed driving.
- Ⓜ The location of the steering wheel and easy-to-grip shift lever knob permits a relaxed driving position.
- Ⓜ The overall performance has improved due to the detailed refinements.



INTERIOR

SEATS

1. General

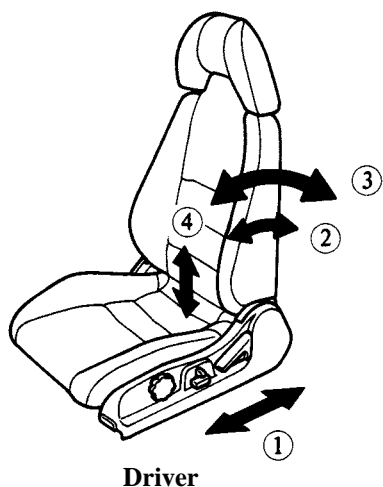
- Ⓡ The bucket type sport seats, with excellent holding capability, are provided for all models. The rear seat is an integrated foldable type.
- Ⓡ Genuine leather seats are available as an option for all models. The vehicles destined for Canada are also available with seat heaters on their genuine leather seats.

2. Front Seat

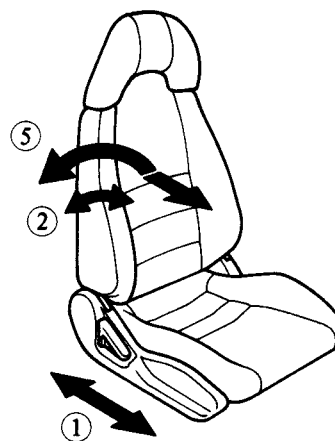
- Ⓡ The seat has the following adjustments

Seat		Driver	Passenger
Adjustment Function			
(1)	Fore-and-aft Slide	①	○
(2)	Reclining	Angle adjustment	①
(3)		Front-folding	○
(4)	Rear Vertical Height	○	—
(5)	Walk-in Mechanism	—	○

○: Manual
①: Power

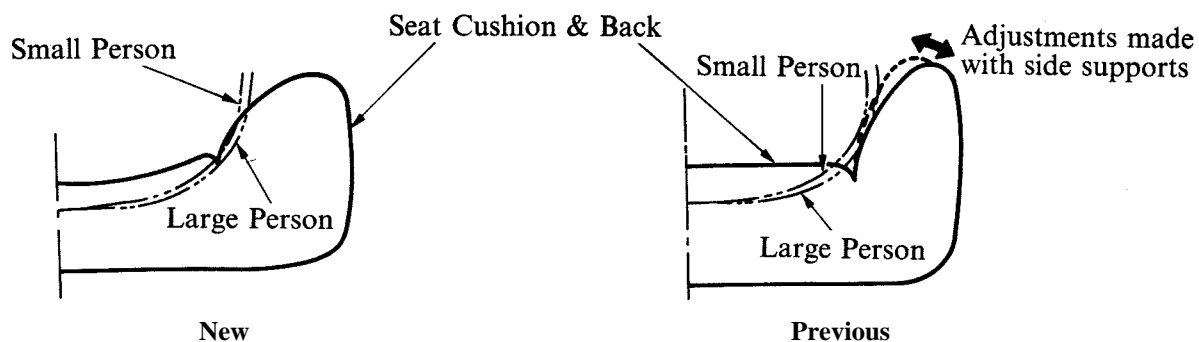


Driver



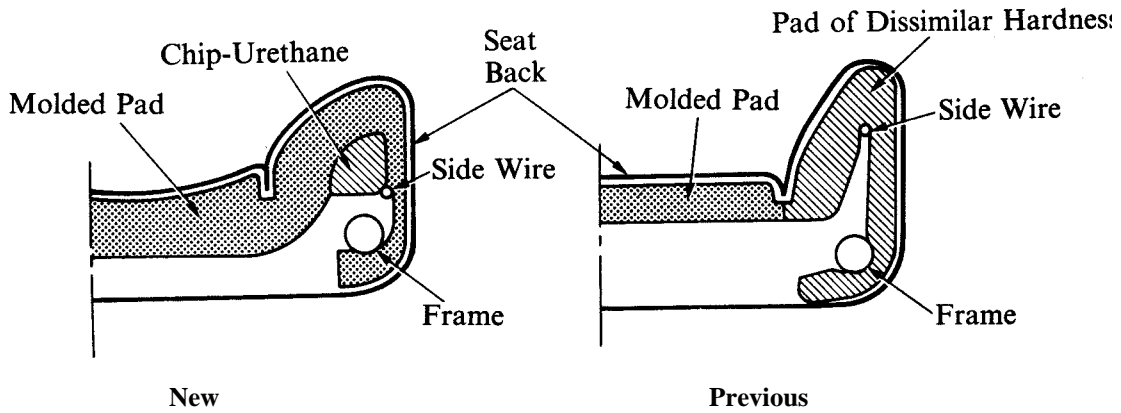
Passenger's

- Ⓡ The seat cushion & back are made concave to accommodate the contour of the occupant. The individual physical differences are absorbed by the seat, giving the occupant a snug fit.



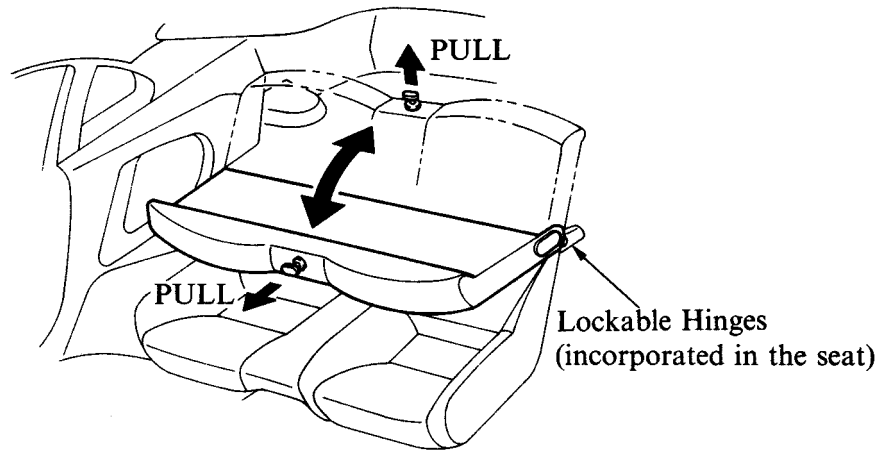
INTERIOR

Ⓡ The seatpad of the seatback is constructed of two layers as illustrated below. The soft surface comes in contact with the occupant, while the hard chip-urethane inside supports the occupant when the vehicle makes a turn.

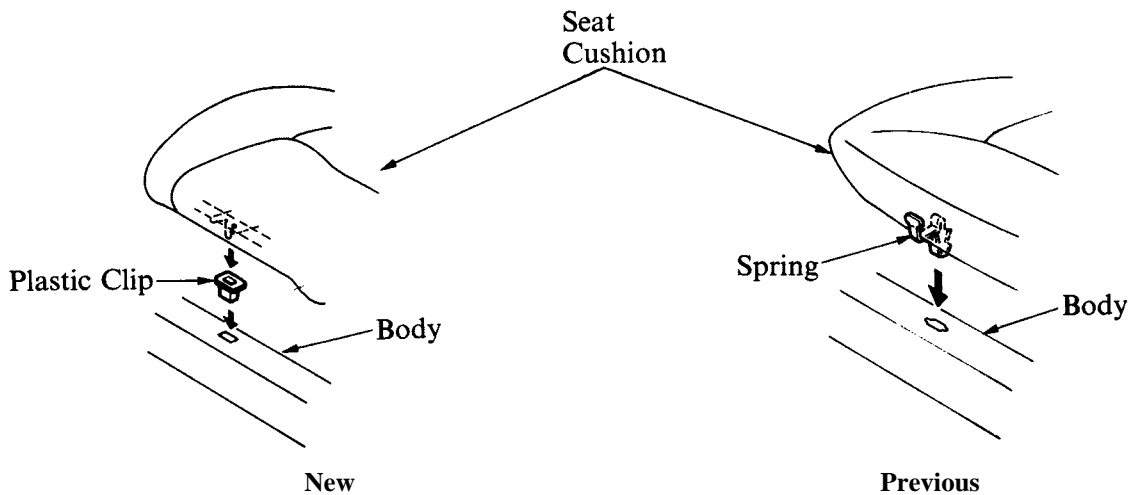


3. Rear Seat

Ⓡ A rear seat with an integrated folding seatback is used. This rear seat uses lockable hinges, which can be locked when the seatback is in either the upright or folded position.



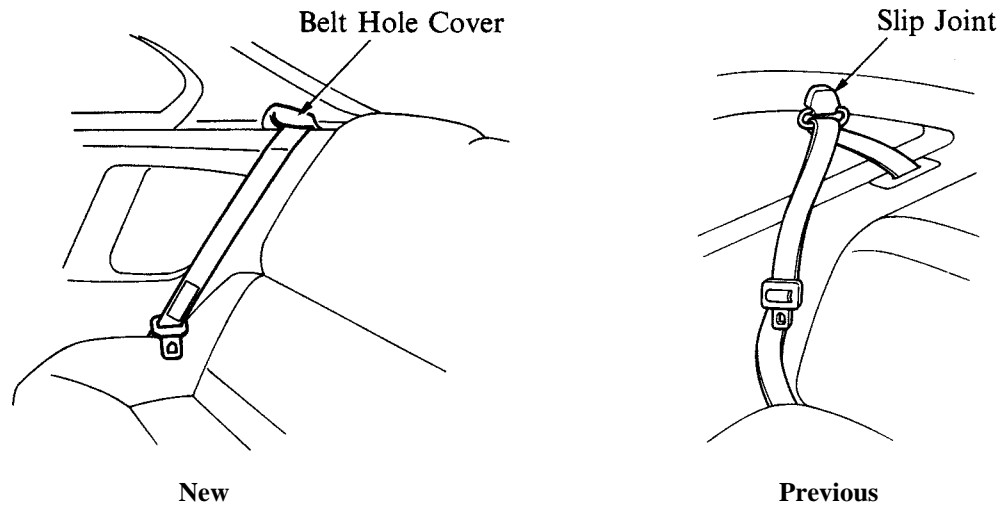
Ⓡ The method of securing the seat cushion has been changed from the conventional spring-hook type to the plastic clip type to improve appearance.



INTERIOR

SEAT BELTS

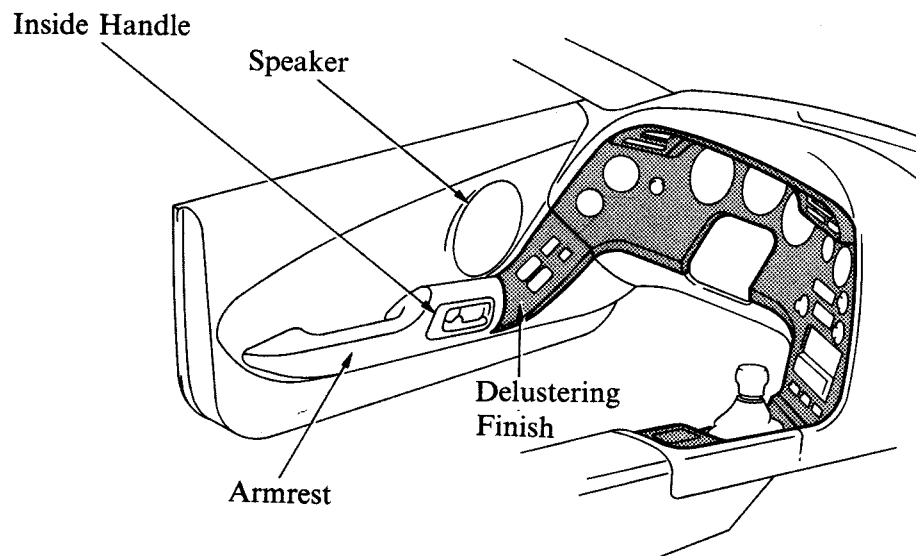
- ⑥ The front seats are provided with the 3-point ELR (Emergency Locking Retractor) seat belts with an electronically operated tension reduction mechanism as standard equipment. The passenger seat is additionally provided with an ALR (Auto-Locking Retractor) mechanism.
- ⑥ The front seat belt inner buckle is attached to the seat adjuster. The buckle moves with the seat itself.
- ⑥ The rear seat belts feature a 3-point ELR with an ALR mechanism. The slip joint is enclosed in the pillar to improve appearance.



TRIM

1. Door Trim

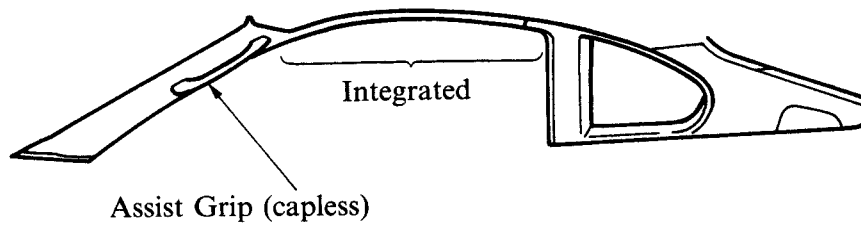
The door trim is designed to continue the curve which started at the instrument panel.



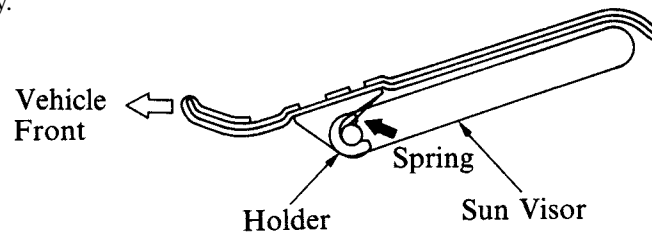
INTERIOR

2. Ceiling Area

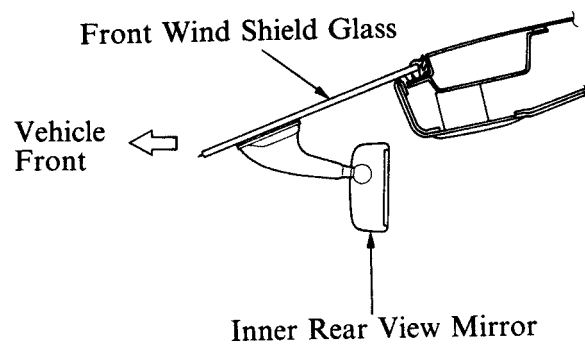
- Ⓡ A molded type roof headlining used.
- Ⓡ The front and rear roof side inner garnishes have been integrated for a more attractive appearance.



- Ⓡ A spring mechanism has been provided in the sun visor holder to improve its operability.



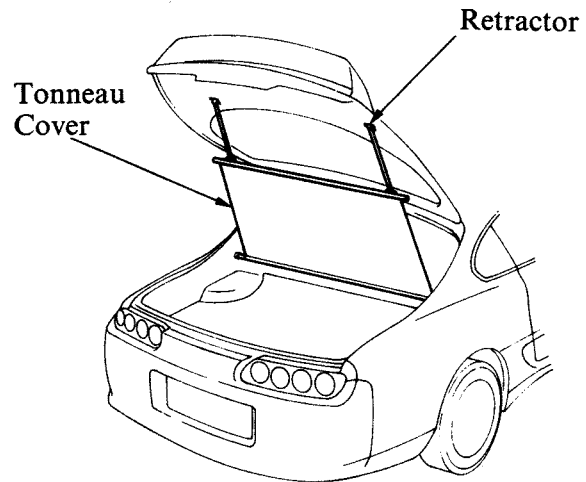
- Ⓡ The inner rear view mirror is attached to the inside of the front windshield.



INTERIOR

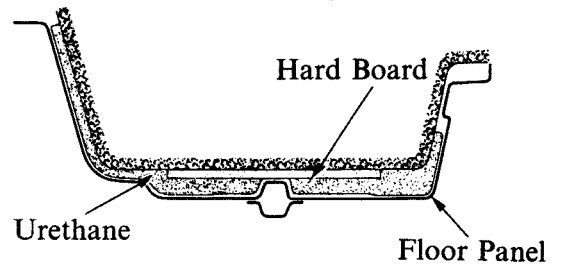
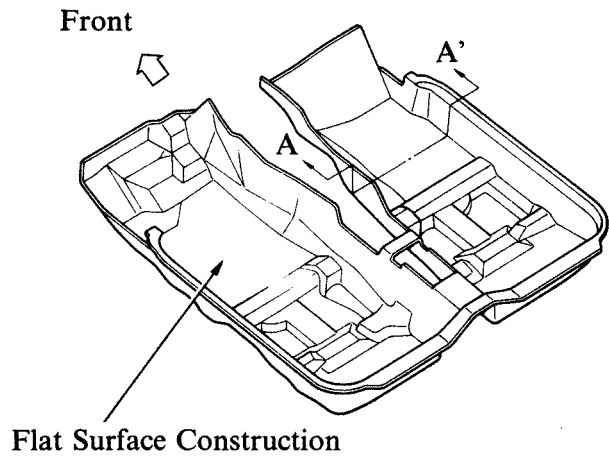
☞ TONNEAU COVER

A lightweight tonneau cover is used.



☞ FLOOR CARPET

The floor carpet is one piece from the front to the rear. The floor carpet is filled with urethane on the underside. This not only gives the surface a flat structure but also improves noise damping.



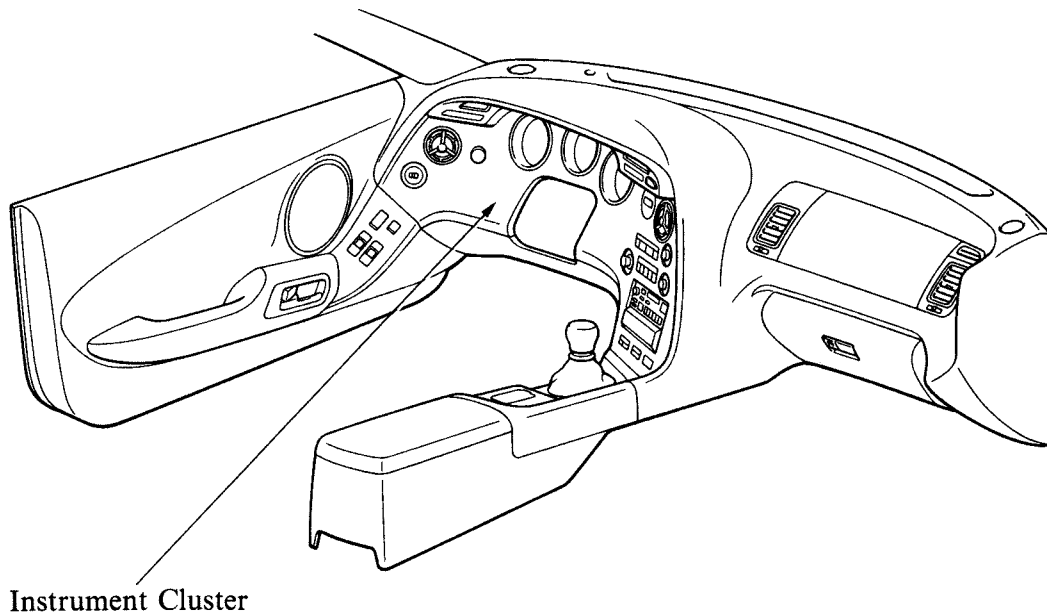
A-A' Cross Section

INTERIOR

INSTRUMENT PANEL, SWITCH LAYOUT AND EQUIPMENT

The instrument panel of the new Toyota Supra maintains design continuity with the center console, and it wraps the driver with its large-curve cockpit design. All the instruments are enclosed in an instrument cluster featuring a new glare-proof and soft-to-the-touch finish.

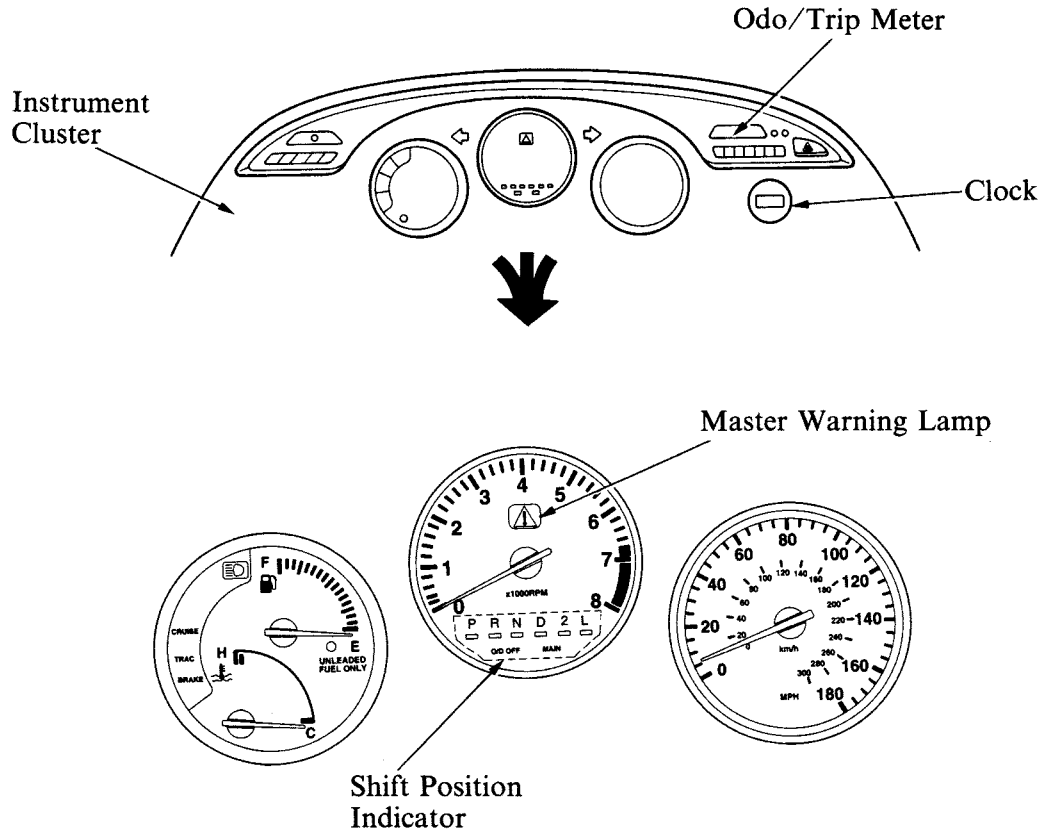
The switches are strategically located with improved operability and visibility during high-speed driving.



INTERIOR

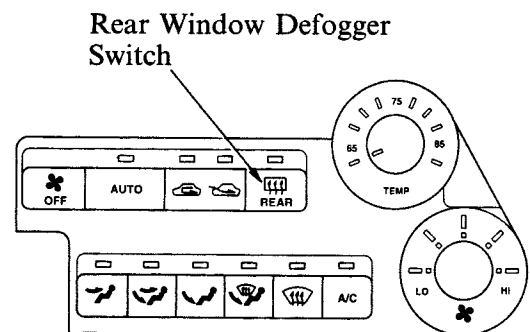
☞ COMBINATION METER

- Ⓡ The three sporty looking, large instruments are arranged side by side for good visibility.
- Ⓡ A cableless, electric speedometer is used. In addition, an electronic odo/trip meter, which is separate from the speedometer, is used.
- Ⓡ A master warning lamp for the various warning lamps is newly equipped in the tachometer.
- Ⓡ A shift position indicator is provided in the tachometer for the automatic transmission model only.



☞ AIR CONDITIONING

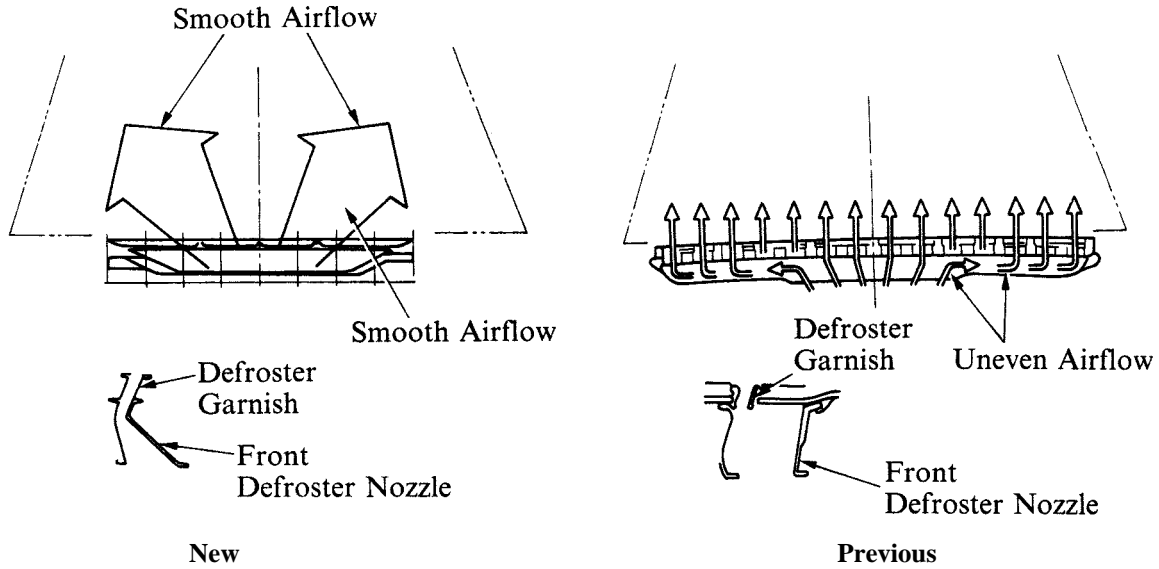
- Ⓡ All models come with fully automatic air conditioning, controlled by an air conditioning ECU, as standard equipment.
- Ⓡ This air conditioning uses the new R134a refrigerant.
- Ⓡ The control panel adopts switches that excel in their ease-of-use, including a rear window defogger switch.



Control Panel

INTERIOR

- Ⓡ The defroster performance is enhanced through the adoption of radial-flow type front defroster nozzles that produce a smooth airflow, as well as the enlarged opening of the driver side defroster nozzle.



AUDIO SYSTEM

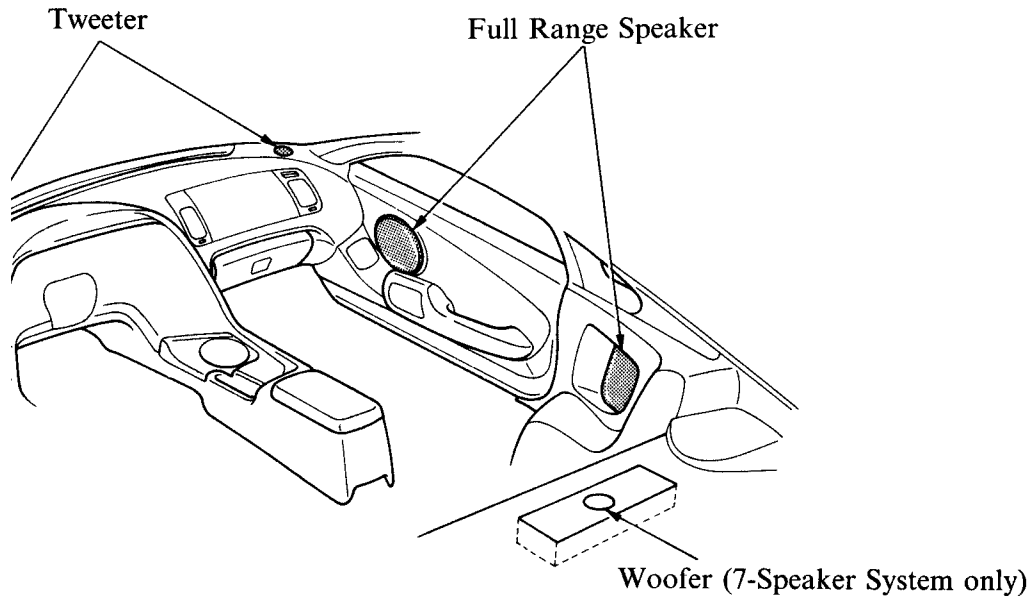
- Ⓡ An AM-FM multiplex ETR (Electronic Tuning Radio) with cassette deck is standard, and a CD (Compact Disc) player is an option.
- Ⓡ A diversified antenna system like that in the previous model is used.
- Ⓡ An anti-theft system like that in the previous model is used.

Availability ◀

Standard	Option
<p>The standard unit features a cassette slot, an 'ANTI-THEFT SYSTEM' indicator, a digital display showing '89.7 FM 98.8', and various control buttons including 'EJECT', 'SCAN', 'TUNE SEEK', 'REW', 'FF', 'PROG', 'APS', 'RPT', 'SKIP', 'CD B C R M', and 'LEVEL'.</p>	<p>The option unit includes a CD slot, 'EJECT' and 'SCAN' buttons for the CD, and a digital display showing '89.7 FM 98.8'. It also features 'TUNE SEEK', 'REW', 'FF', 'PROG', 'APS', 'RPT', 'SKIP', 'CD B C R M', and 'LEVEL' controls.</p>
<ul style="list-style-type: none"> Ⓡ AM/FM ETR with Cassette Deck, 6-Speaker System Ⓡ Separate Power Amplifier Ⓡ 30 W (Max.) x 4 Channel 	<ul style="list-style-type: none"> Ⓡ AM/FM ETR with Cassette Deck and CD Player, 7-Speaker System Ⓡ Separate Power Amplifier Ⓡ 30 W (Max.) x 4 Channel + 50 W (for Woofer)

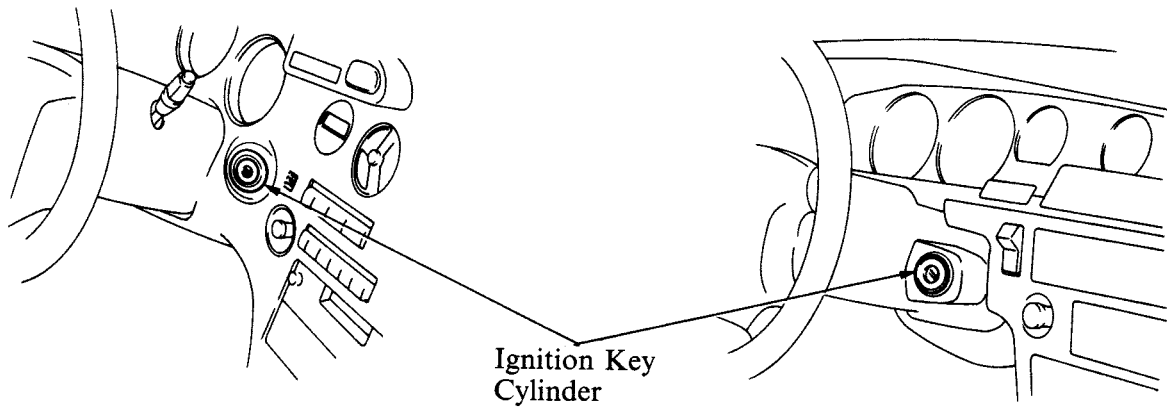
INTERIOR

Layout of Speakers◀



IGNITION KEY CYLINDER

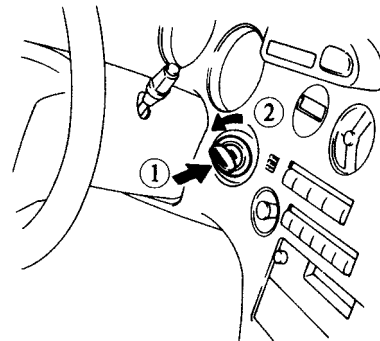
- Ⓡ The ignition key cylinder has been relocated from the side of the steering column to the instrument panel for easier operation.



New

Previous

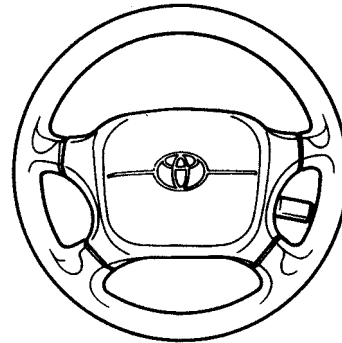
- Ⓡ The previous button type ignition key cylinder has been replaced with a push-in type. The ignition key is simply pushed in first to turn it from the ACC to LOCK position. Models with an automatic transmission have a shift lock system. Accordingly, the shift lever must be in "P" range before pushing the key.



SAFETY AND ENVIRONMENT

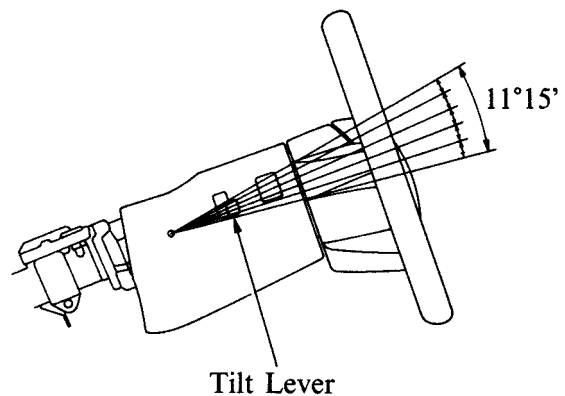
☞ STEERING WHEEL

All models use a four-spoke type $\phi 370$ mm steering wheel covered with genuine leather.



☞ TILT STEERING

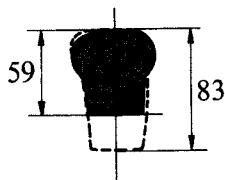
- Ⓜ A tilt steering is standard for all models.
- Ⓜ When the tilt lever is turned up, the steering wheel moves to the highest position to provide space for easier entry and exit. When the tilt lever is kept in the raised position, the steering wheel position can be changed to any of the five positions within a range of $11^{\circ}15'$.



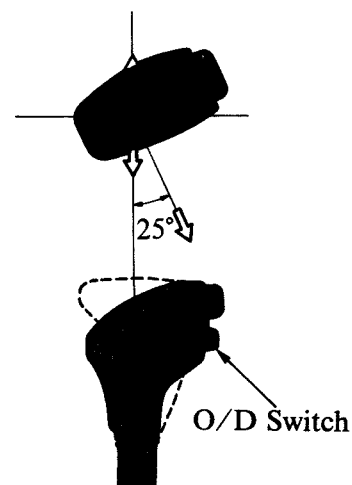
☞ TRANSMISSION SHIFT LEVER KNOB

The transmission shift lever knob is made compact and easily adaptable to the driver's hand, for that sporty shift performance.

■ : New
 □ : Previous



Manual Transmission

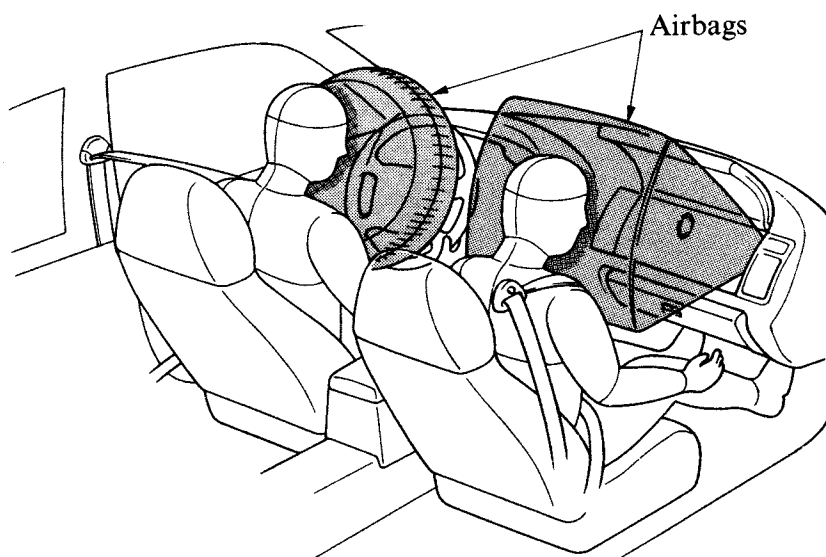


Automatic Transmission

INTERIOR

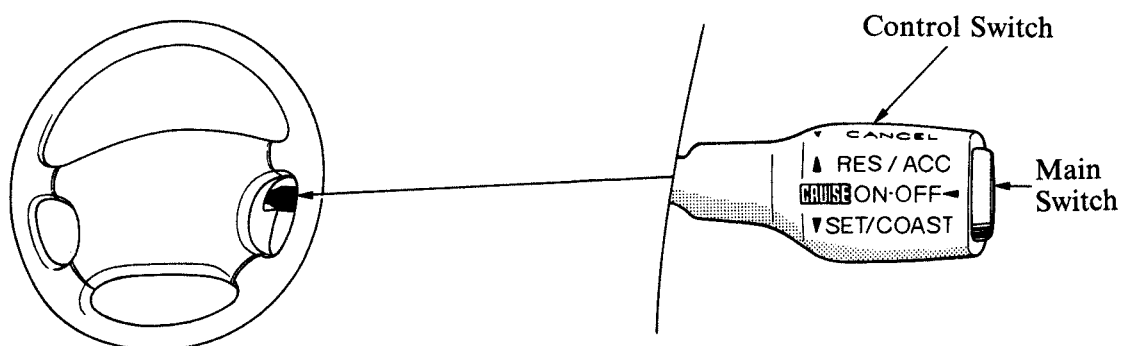
☞ SRS AIRBAG

In addition to the standard driver's airbag in the steering pad, the new Toyota Supra offers a front passenger airbag located in the instrument panel above the glove box.



☞ CRUISE CONTROL SYSTEM

- Ⓡ The cruise control system is standard equipment
- Ⓡ The main switch and control switch are on the one lever, which is installed on the steering column and can be operated easily.
- Ⓡ The motor-type actuator is used.



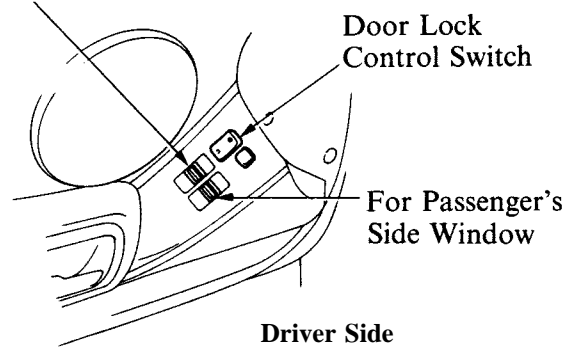
INTERIOR

☞ POWER WINDOW SYSTEM

A power window system is standard equipment. The power window system includes one-touch auto down.

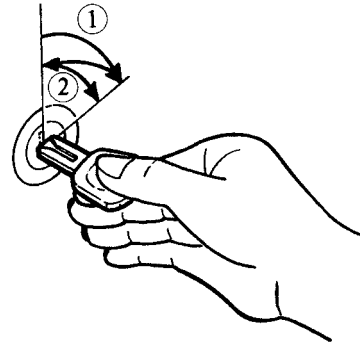
The one-touch auto down function automatically opens the driver's side window fully.

For Driver's Side Window



☞ DOOR LOCK CONTROL SYSTEM

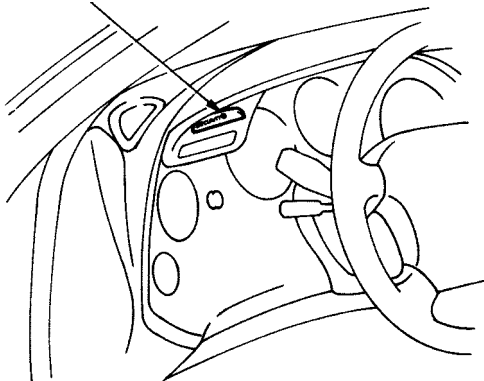
The door lock control system with 2-step unlock function is standard equipment. With the 2-step unlock function, turning the key in the driver's side door once will unlock the driver's side door only, and turning it twice unlocks both doors.



☞ THEFT DETERRENT SYSTEM

Ⓡ A theft deterrent system is used to prevent vehicle theft. When the system is set, the horn and headlights operate if the front door, hood or back door is forcibly opened.

Indicator Light



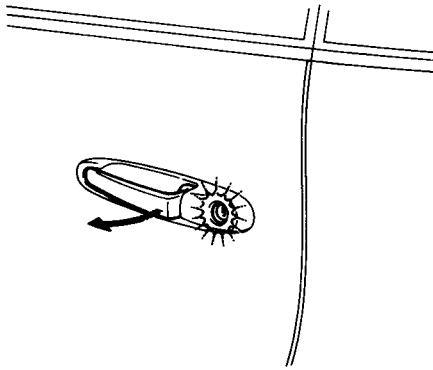
Indicator Light	
Ⓡ When system is set -Flashes	
Ⓡ When the system has been activated -Lights up	

Ⓡ The audio system also has an anti-theft system, whereby the radio and cassette deck is disabled if the radio body is stolen from the vehicle.

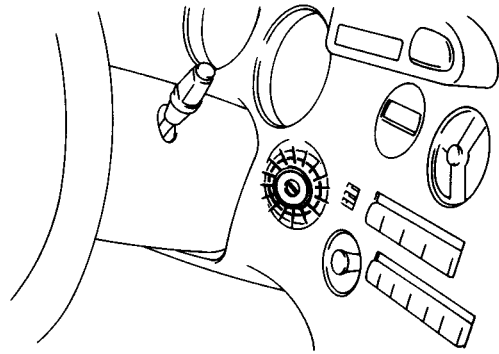
INTERIOR

ILLUMINATED ENTRY SYSTEM

- Ⓡ An illuminated entry system is standard equipment in all models. This system makes it easy to enter and exit the new Toyota Supra at night, etc.
- Ⓡ The illuminated entry system turns on the dome light and the door key and ignition key illumination lights for 15 seconds after either door is closed when passengers are entering or leaving the vehicle. During the 15 seconds that these lights are on, if the ignition switch is turned to the ACC or ON position, or if all doors are locked, the dome light and all other illumination lights go off immediately.



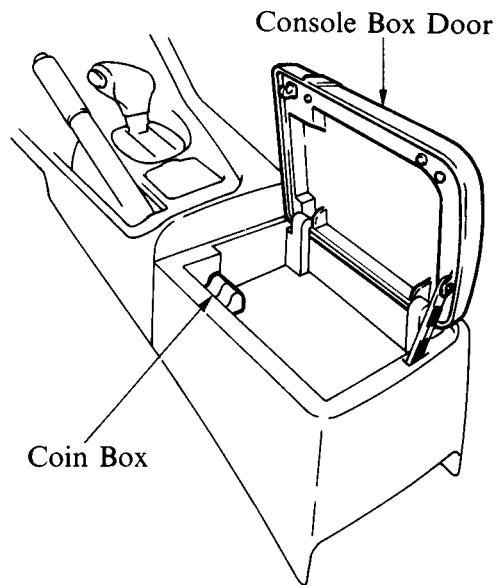
Door Key



Ignition Key

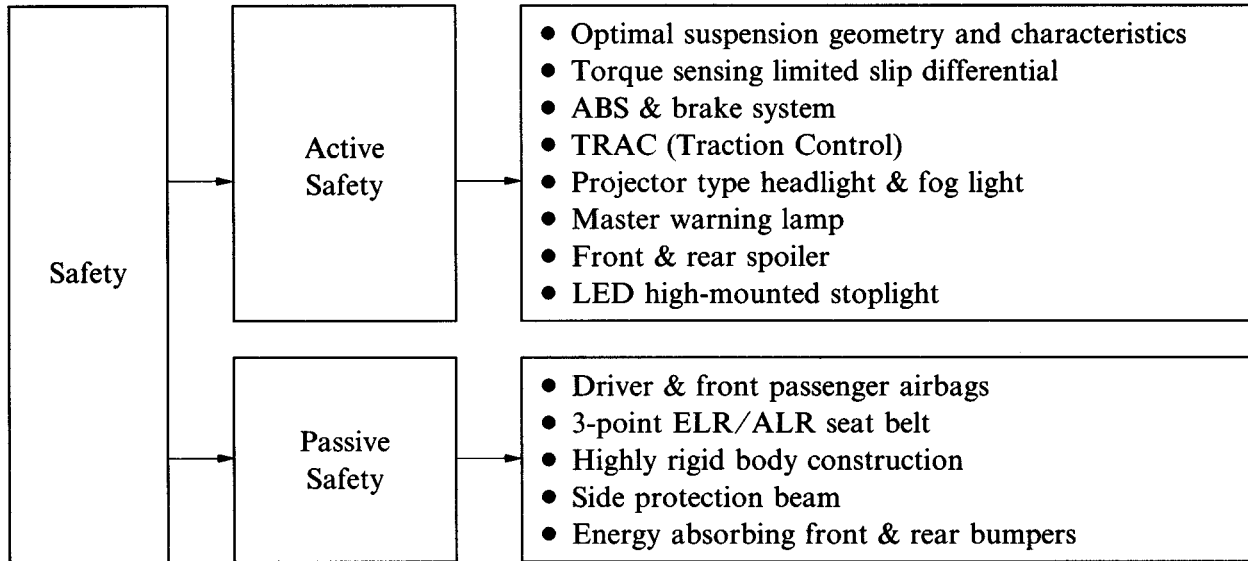
CONSOLE BOX

A console box, with a door that opens sideways is used. Also, there is a coin box provided within.

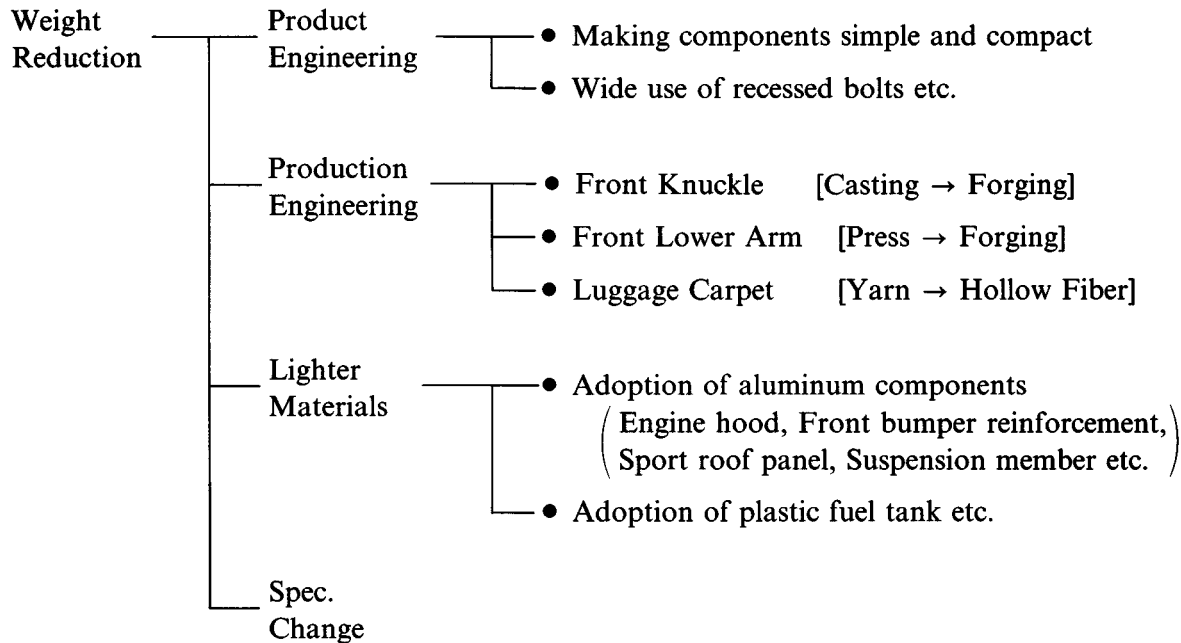


SAFETY AND WEIGHT REDUCTION

A number of safety features are used in consideration of high performance engine and high speed driving capability.



After due consideration for safety, a detailed weight reduction effort has been able to realize the vehicle's full potential.



3. Technical Description

ENGINE

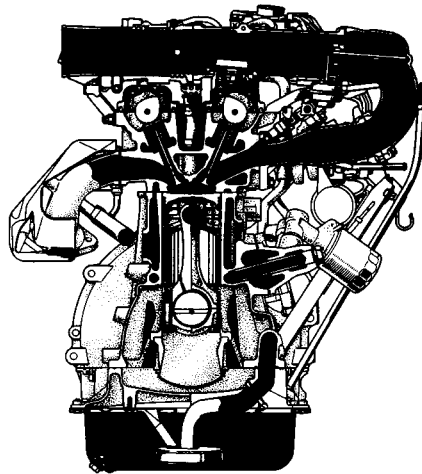
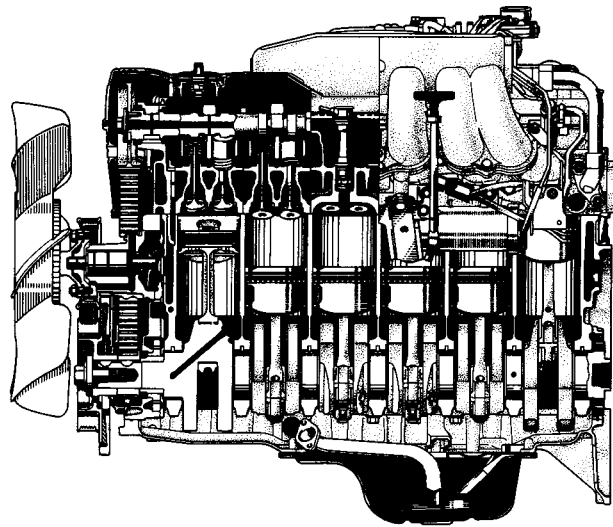
2JZ-GE ENGINE

DESCRIPTION

The 2JZ-GE engine, which is newly-developed in place of the previous 7M-GE engine, is an in-line 6, 3.0 liter, 24-valve DOHC engine designed to run best at medium to high speeds. With such features as a higher compression ratio, ACIS* (Acoustic Control Induction System) and dual exhaust manifolds, all contributing to a higher intake and exhaust efficiency, this engine provides both high power output and high fuel efficiency at high levels. Additionally, in California specification models, an Air Assist System and stainless steel exhaust manifolds are used to reduce HC emissions.

*: The ACIS is identical to the Intake Air Control System in the 7M-GE engine.

Except California Specification Models ◀

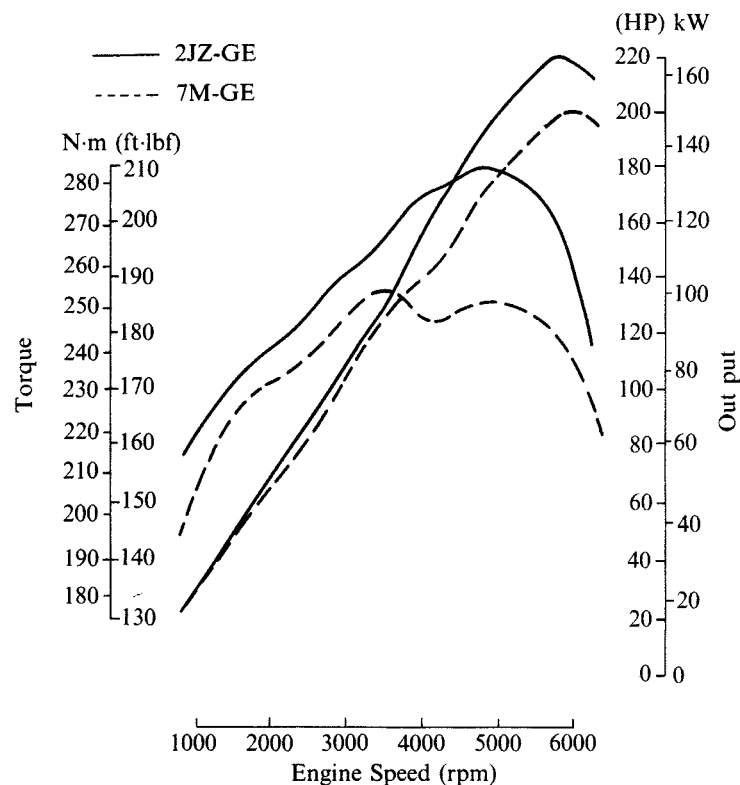


 ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

Engine			2JZ-GE	7M-GE
Item				
No. of Cyls. & Arrangement			6-Cylinder, In-Line	←
Valve Mechanism			24-Valve DOHC, Belt Drive	←
Combustion Chamber			Pentroof Type	←
Manifold			Cross-Flow	←
Fuel System			SFI* ¹ [EFI]	MFI* ² [EFI]
Displacement	cm ³ (cu. in.)		2997 (182.9)	2954 (180.3)
Bore x Stroke	mm (in.)		86.0 x 86.0 (3.39 x 3.39)	83.0 x 91.0 (3.27 x 3.58)
Compression Ratio			10.0 : 1	9.2 : 1
Firing Order			1-5-3-6-2-4	←
Max. Output [SAE-NET]			164 kW @ 5800 rpm (220 HP @ 5800 rpm)	149 kW @ 6000 rpm (200 HP @ 6000 rpm)
Max.Torque [SAE-NET]			285 N·m @ 4800 rpm (210 ft·lbf @ 4800 rpm)	255 N·m @ 3600 rpm (188 ft·lbf @ 3600 rpm)
Valve Timing	Intake	Open	3° BTDC	6° BTDC
		Close	50° ABDC	40° ABDC
	Exhaust	Open	53° BBDC	←
		Close	3° ATDC	←
Fuel Octane Number RON			96	91
Oil Grade			API SG, EC-II	API SG

*1: SFI (Sequential Multiport Fuel Injection)

*2: MFI (Multiport Fuel Injection)



FEATURES OF 2JZ-GE ENGINE

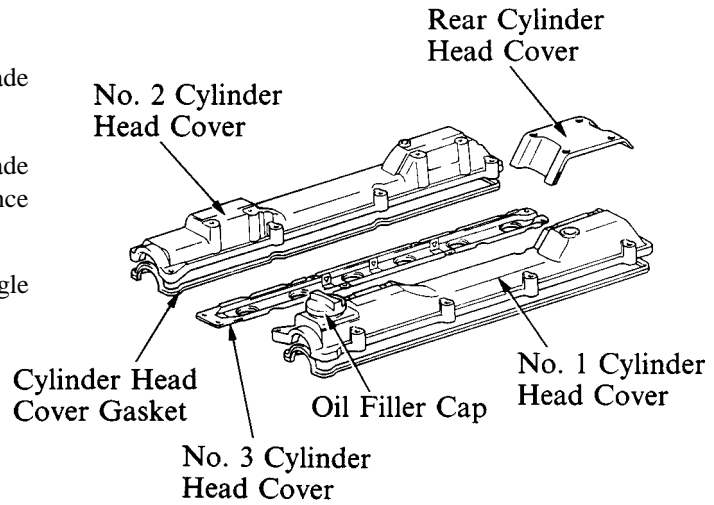
Features of the 2JZ-GE engine are listed below.

Features	Contents
High Performance and Economy	<ul style="list-style-type: none"> ⓂA pentroof type combustion chamber plus high compression ratio. ⓂA valve angle carefully determined to ensure best results in medium and high speeds. ⓂA large valve diameter plus a high valve lift. ⓂACIS (Acoustic Control Induction System) and dual exhaust manifolds. ⓂA large-capacity air cleaner. ⓂTwin knock sensors
Lightweight and Compact Design	<ul style="list-style-type: none"> ⓂA compact, lightweight accessory drive system by means of a serpentine single belt and bracketless accessory installation. ⓂThe oil pan, engine mounting bracket, engine mounting insulator housing and crankshaft pulley's torsional damper hub are made of aluminum. ⓂThe water pump rotor is made of resin.
Low Noise and Vibration	<ul style="list-style-type: none"> ⓂAn aluminum oil pan having an integral stiffener. ⓂAluminum engine mount brackets and liquid filled compound engine mounts. ⓂA rigid and accurately balanced crankshaft assembly. ⓂAn aluminum torsional damper hub for the crankshaft pulley. ⓂBracketless accessory installation.
Good Serviceability	<ul style="list-style-type: none"> ⓂAutomatic tensioners for the timing belt and V-ribbed belt. ⓂAn engine oil level sensor. ⓂA highly durable timing belt. ⓂA test mode is added to the diagnosis function.

ENGINE PROPER

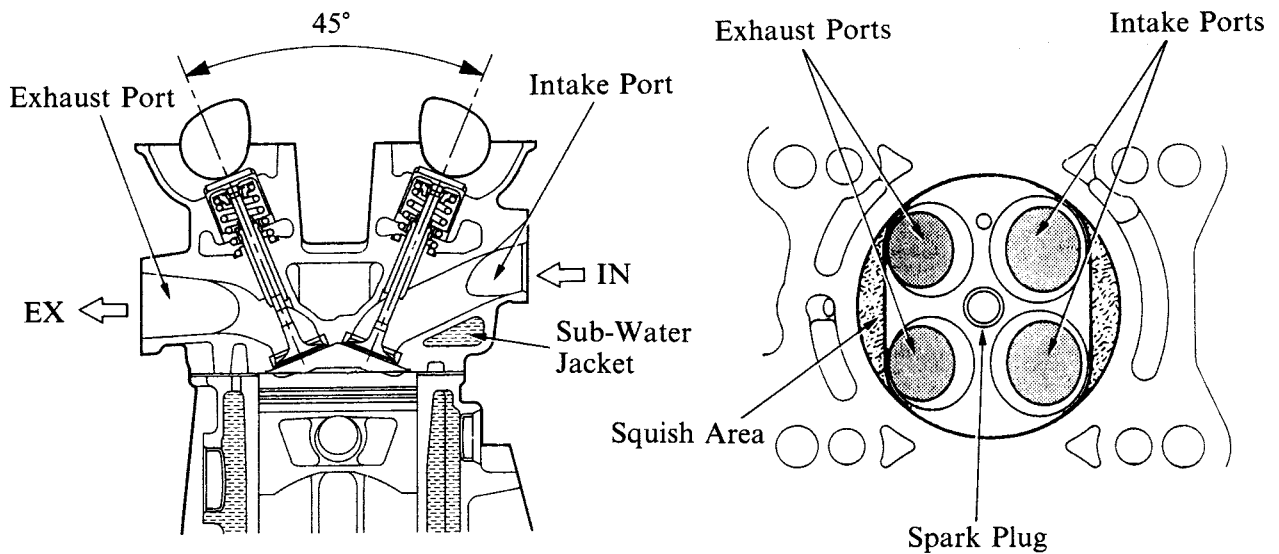
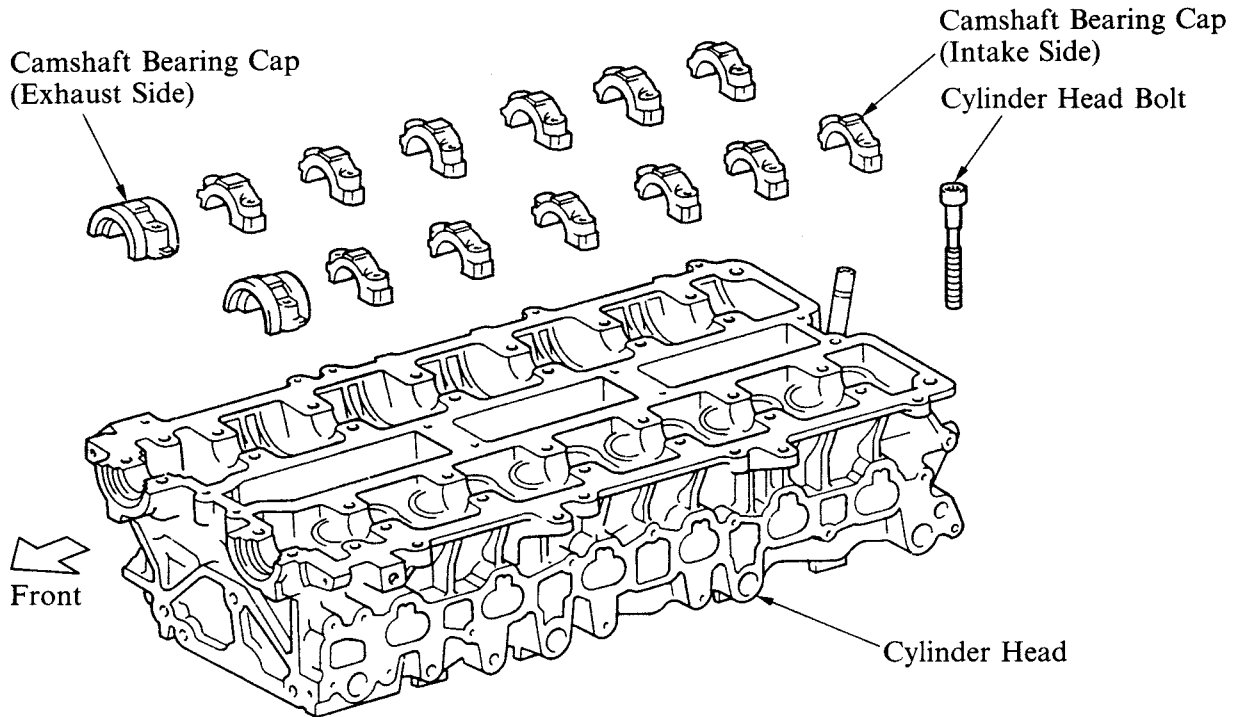
1. Cylinder Head Cover

- ◀ A 3-part type cylinder head cover is used.
- ◀ No. 1 and No. 2 cylinder head covers are made of magnesium to reduce weight.
- ◀ The cylinder head cover gaskets used are made of acrylic rubber with a superior heat resistance capacity.
- ◀ The oil filler cap locks in place easily by a single twist of the cap.



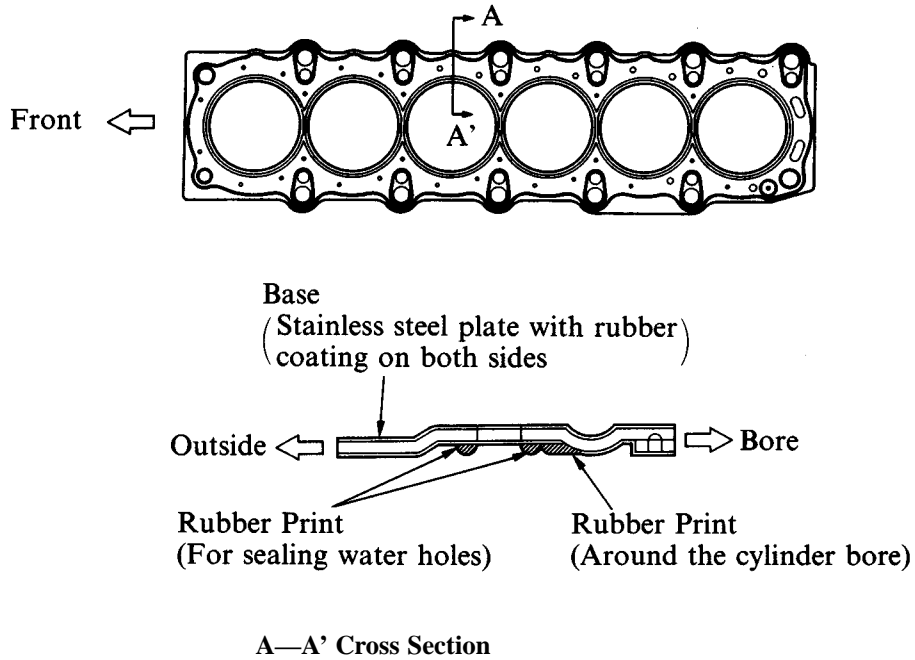
2. Cylinder Head

- ◀ The cylinder head is made of an aluminum alloy having good thermal conductivity.
- ◀ The combustion chamber is a 4-valve pentroof type with the valve angle at 45 degrees. The spark plugs are located at the near center of the combustion chamber to increase anti-knocking performance and combustion efficiency.
- ◀ To increase torque at low to medium speeds, this engine adopts upright and small-diameter intake ports and sub-water jackets for cooling the intake ports.
- ◀ Plastic region tightening bolts are used for the cylinder head.
- ◀ The heat-treated, highly rigid and durable camshaft bearing caps are used.



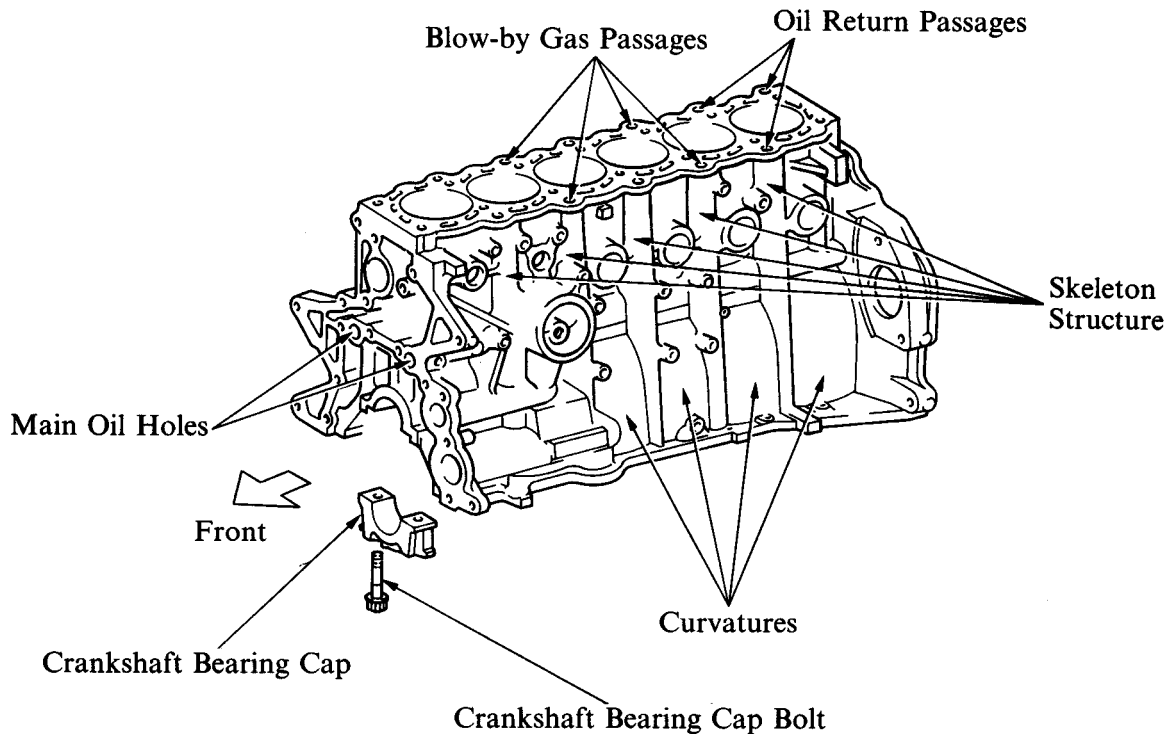
3. Cylinder Head Gasket

A single-layered metal gasket provides good sealing performance and durability.



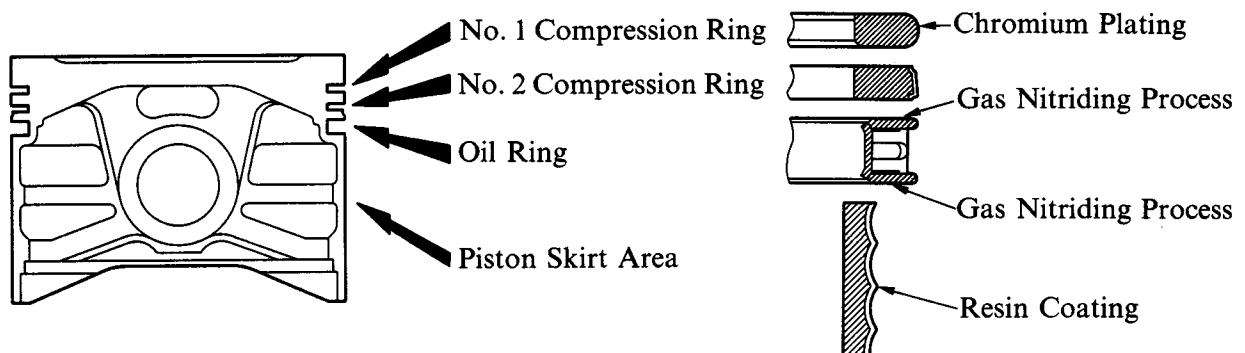
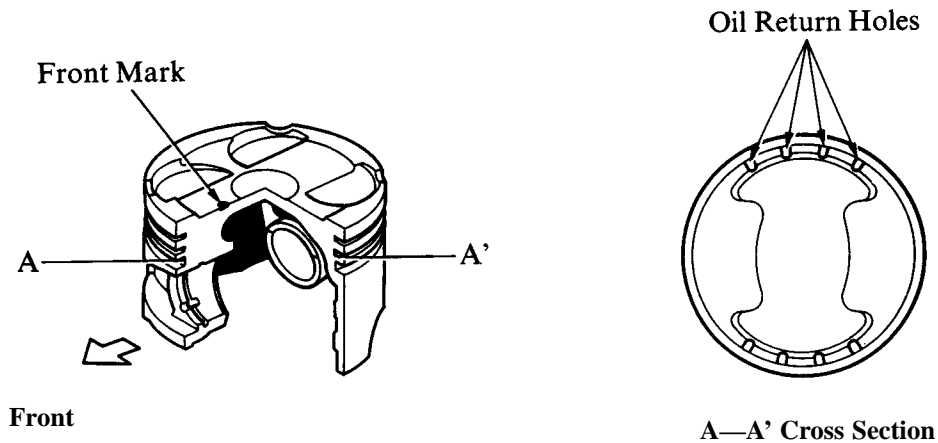
4. Cylinder Block

- ◀ The cylinder block is made of cast iron having a skeleton structure consisting of 11 oil return and blow-by gas passages and 2 main oil holes. The external block walls are curved to reduce noise while enhancing rigidity.
- ◀ The air conditioning compressor, generator [alternator] and other auxiliary components are attached directly to the cylinder block to reduce weight and vibration.
- ◀ The crankshaft bearing caps are fitted using plastic region tightening bolts.



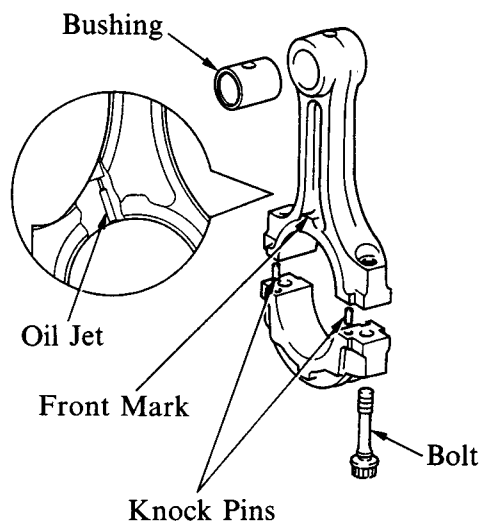
5. Piston

- ◀ Pistons are made of aluminum alloy having outstanding high-temperature strength.
- ◀ Slotless type oil return holes are provided in the oil ring grooves to lower the temperature in the top ring groove, thereby enhancing the engine's reliability.
- ◀ The piston skirt area has been coated with resin for decreased friction characteristics.
- ◀ The piston rings used are highly friction-resistant. The side rails of the oil ring are treated with gas nitriding process, and the No. 1 compression ring surface is chromium plated.



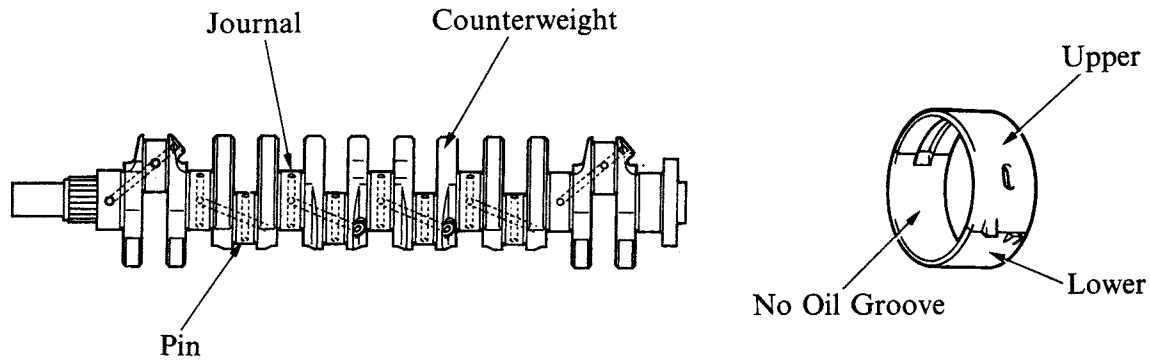
6. Connecting Rod

- ◀ A hot-forged connecting rod is used having high strength and little weight imbalance.
- ◀ The connecting rod and the connecting rod cap are joined with knock pins and plastic region tightening bolts to improve assembly precision.
- ◀ A bimetal bushing is press-fit into the piston pin hole at the small end of the connecting rod. An oil jet is provided in the large end for cooling the piston.



7. Crankshaft

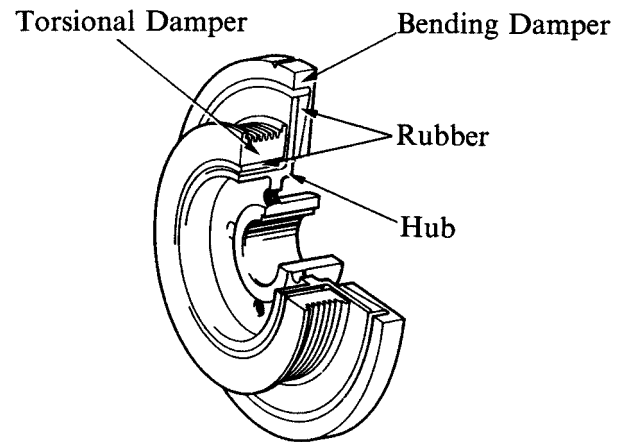
- ◀ The crankshaft has seven journals and twelve counterweights. The pins and journals are induction-hardened to increase rigidity thereby reducing vibration and noise.
- ◀ Aluminum alloy bearings are used to improve wear resistance; and to reduce noise, no oil groove is provided in the cap side bearings.



Crankshaft Bearing

8. Crankshaft Pulley

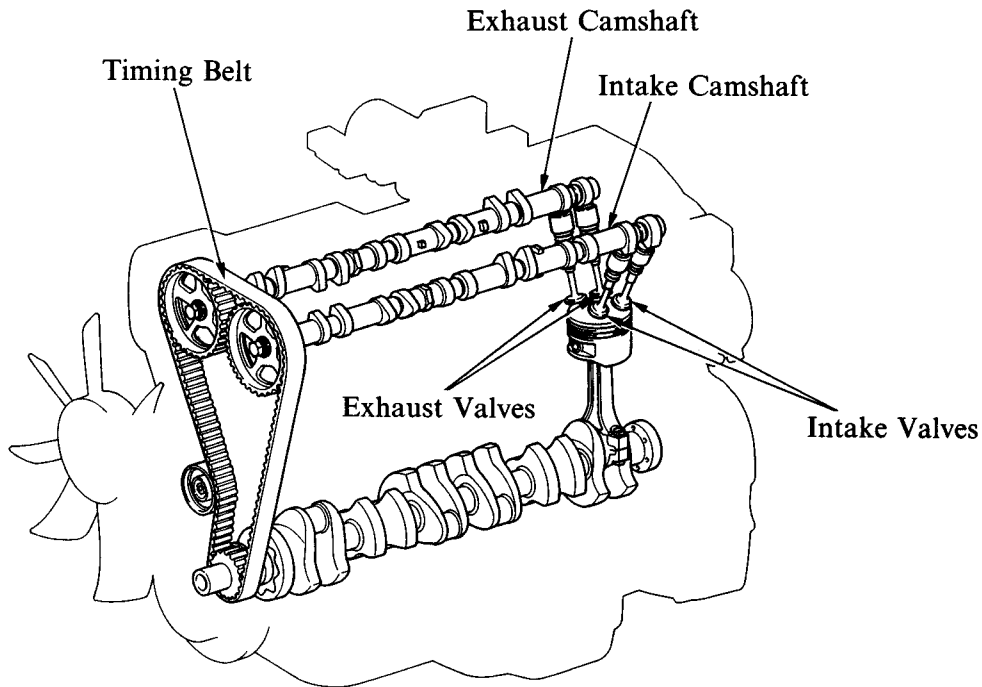
- ◀ The dual-mode damper pulley combines a torsional damper and bending damper to reduce two types of crankshaft vibration—torsional vibration and bending vibration.
- ◀ An aluminum hub is used to reduce weight as well as noise.



VALVE MECHANISM

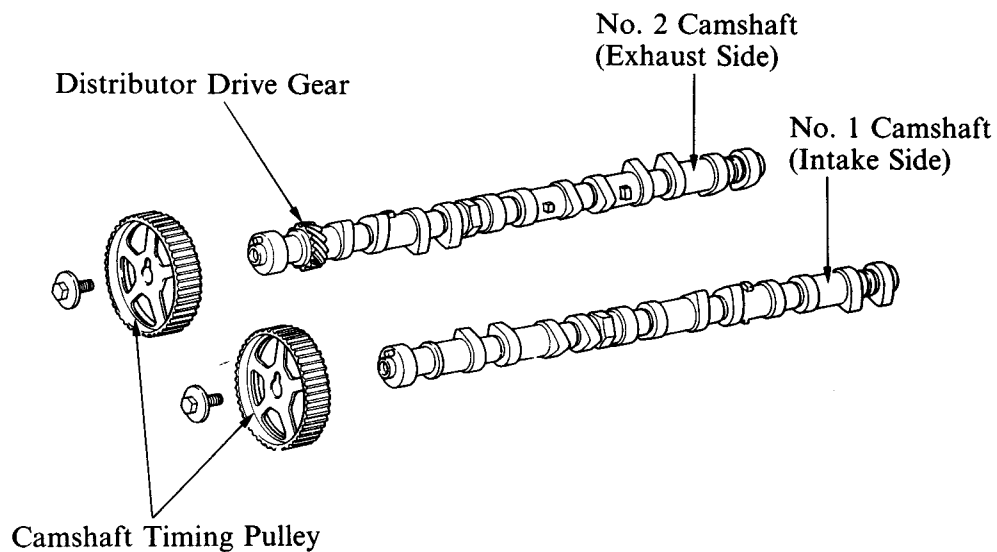
1. General

- Ⓔ Each cylinder is equipped with two intake valves and two exhaust valves. Intake and exhaust efficiency has been increased due to the larger total port areas.
- Ⓔ The valves are directly opened and closed by two belt-driven camshafts.



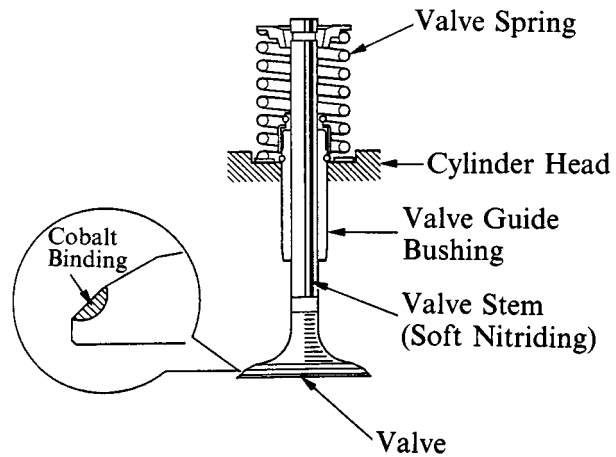
2. Camshafts

- Ⓔ Each cast steel camshaft has seven journals, six of which are located between two cams.
- Ⓔ The distributor is driven by the drive gear attached to the exhaust camshaft.



3. Intake and Exhaust Valves

- Ⓡ The intake and exhaust valves are made of heat resistant steel. Also, through the application of the soft nitriding process to the valve stem, and cobalt alloy binding to the valve face, as shown, the valves have been made highly wear-resistant.
- Ⓡ The valve spring used is relatively short, and offer excellent valve-trailing capability during high rpm operation.

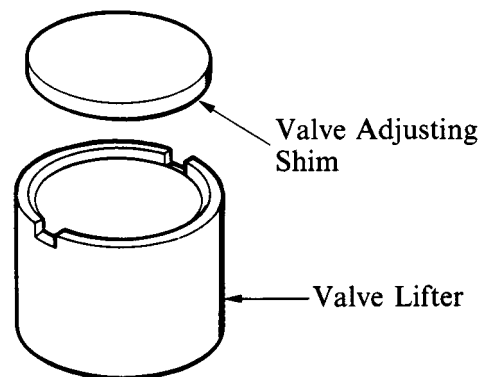


Specifications ◀

		Engine
Item		2JZ-GE
Valve Diameter mm (in.)	Intake	33.5 (1.32)
	Exhaust	29.0 (1.14)
Valve Lift mm (in.)	Intake	8.26 (0.325)
	Exhaust	8.41 (0.331)

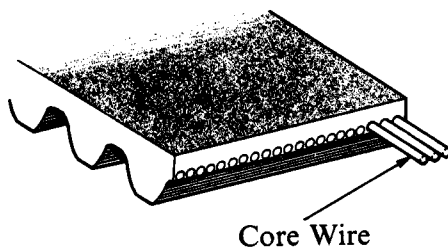
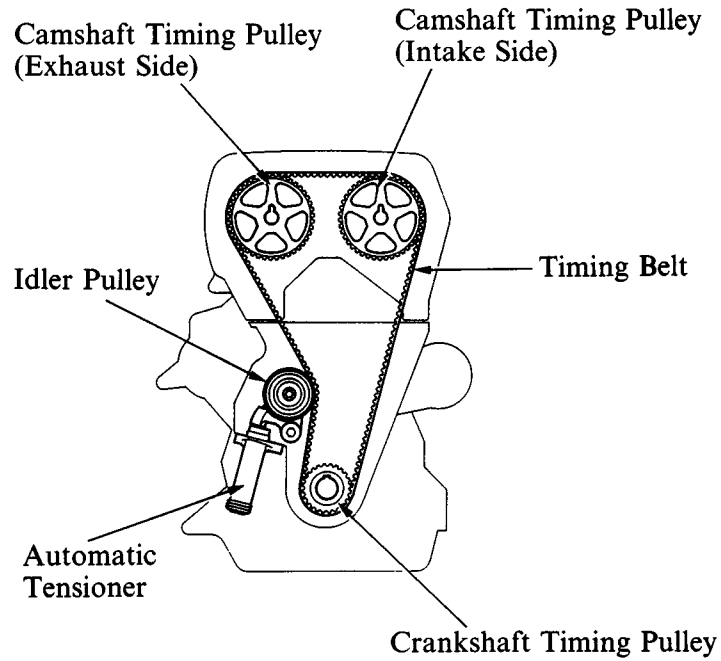
4. Valve Lifters and Valve Adjusting Shims

Outer shim type valve adjusting shims, located in the top of the valve lifters, are used to improve serviceability.

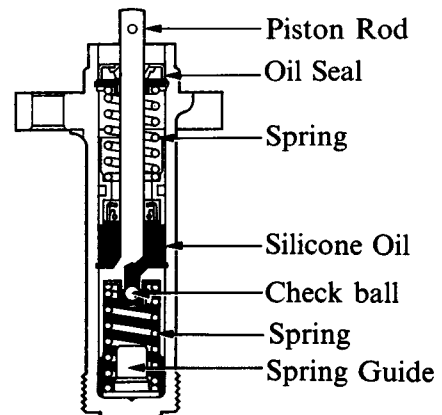


5. Timing Belt

- Ⓔ The timing belt has high heat resistance and durability. The tooth profile of the timing belt is shown in the illustration below. This design ensures a quiet operation and high-load transmission.
- Ⓕ The automatic tensioner is made up of a spring and oil damper, and maintains proper timing belt tension at all times. The automatic tensioner suppresses noise generated by the timing belt.



Timing Belt

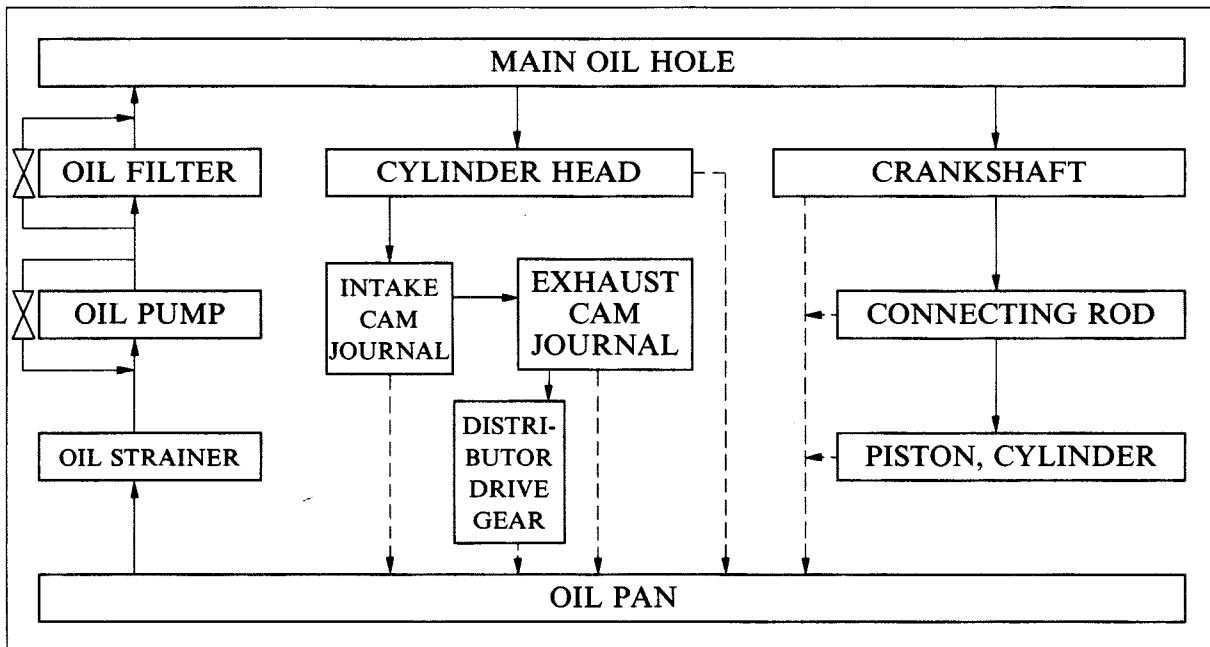
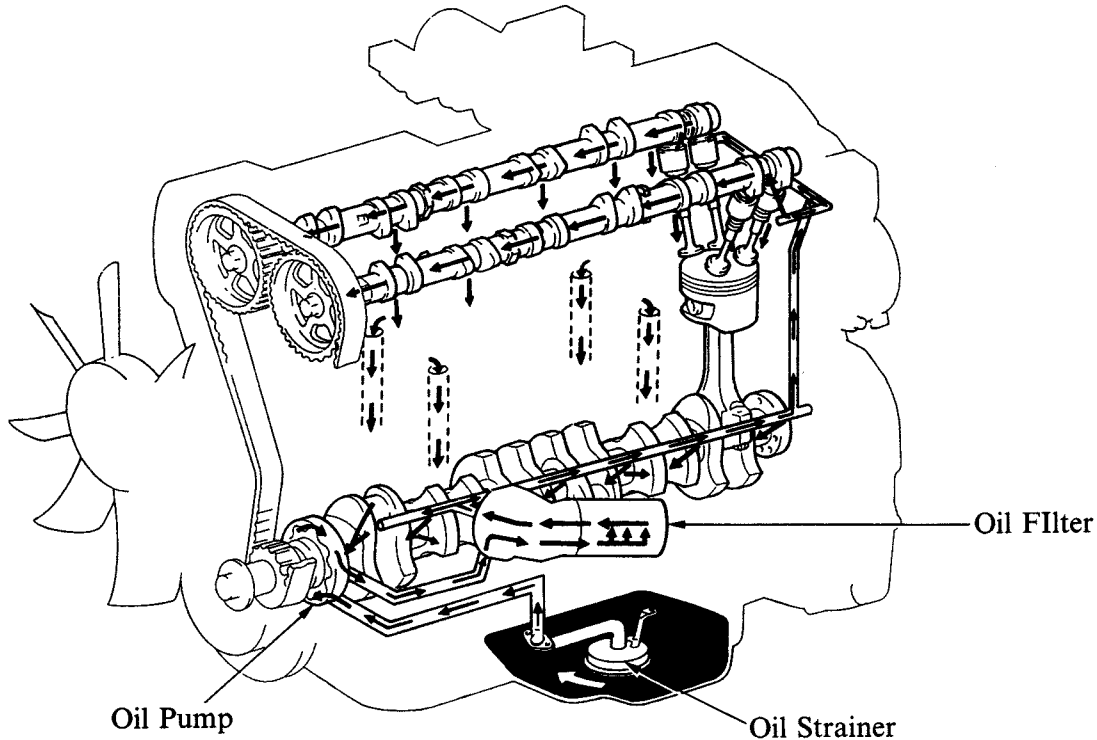


Automatic Tensioner

LUBRICATION SYSTEM

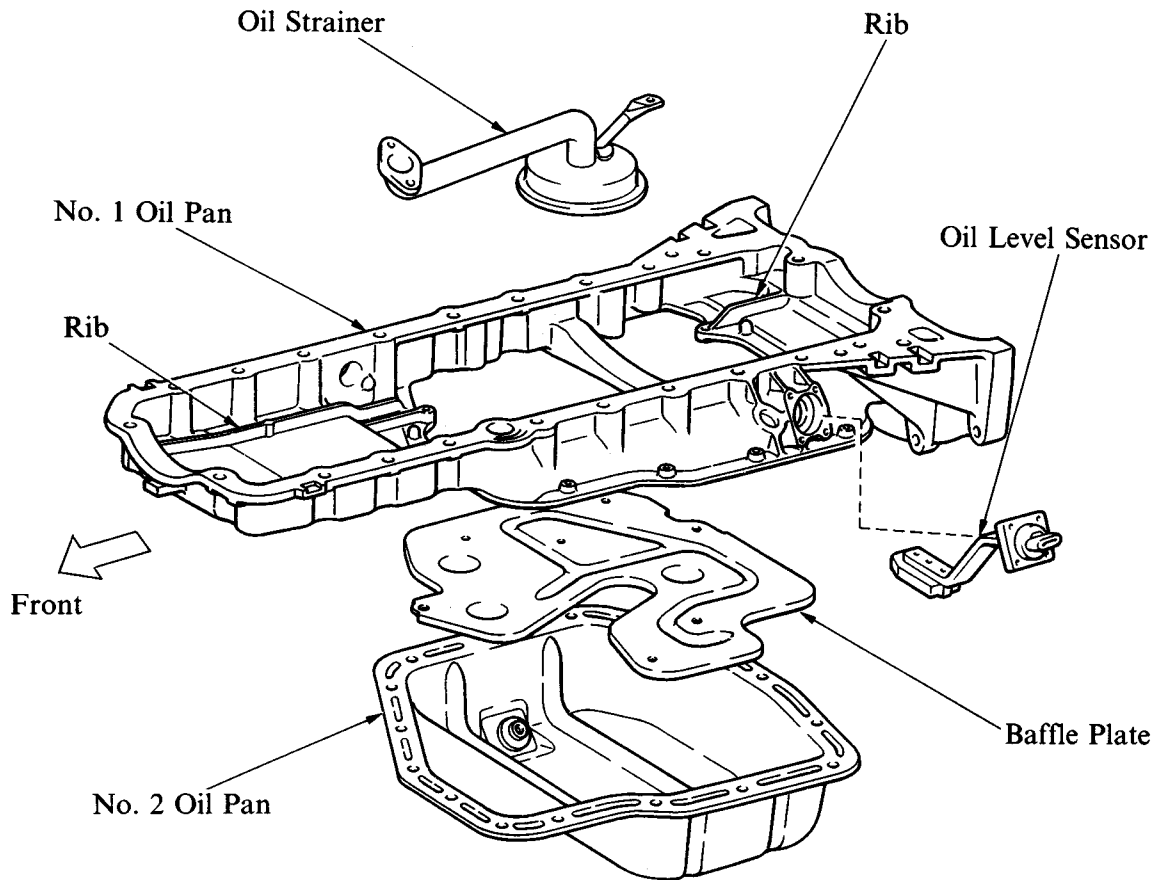
1. General

- ◀ The lubrication is fully pressurized and all oil passes through an oil filter
- ◀ The oil pump is a trochoid gear type and is directly driven by the crankshaft.



2. Oil Pan

- ◀ The oil pan is made up of two pieces. No. 1 oil pan is made of aluminum alloy and No. 2 oil pan is made of steel.
- ◀ The No. 1 oil pan section is secured to the cylinder block and transmission housing, increasing rigidity.
Partitions in the form of ribs have been provided in the No 1 oil pan to improve strength of the oil pan and to provide smoother flow of oil returning from the cylinder block.
- ◀ The sealing surface of the oil pan uses an FIPG (Formed-In-Place Gasket) for a superior seal.
- ◀ The oil level sensor is located on the left side of the No. 1 oil pan.



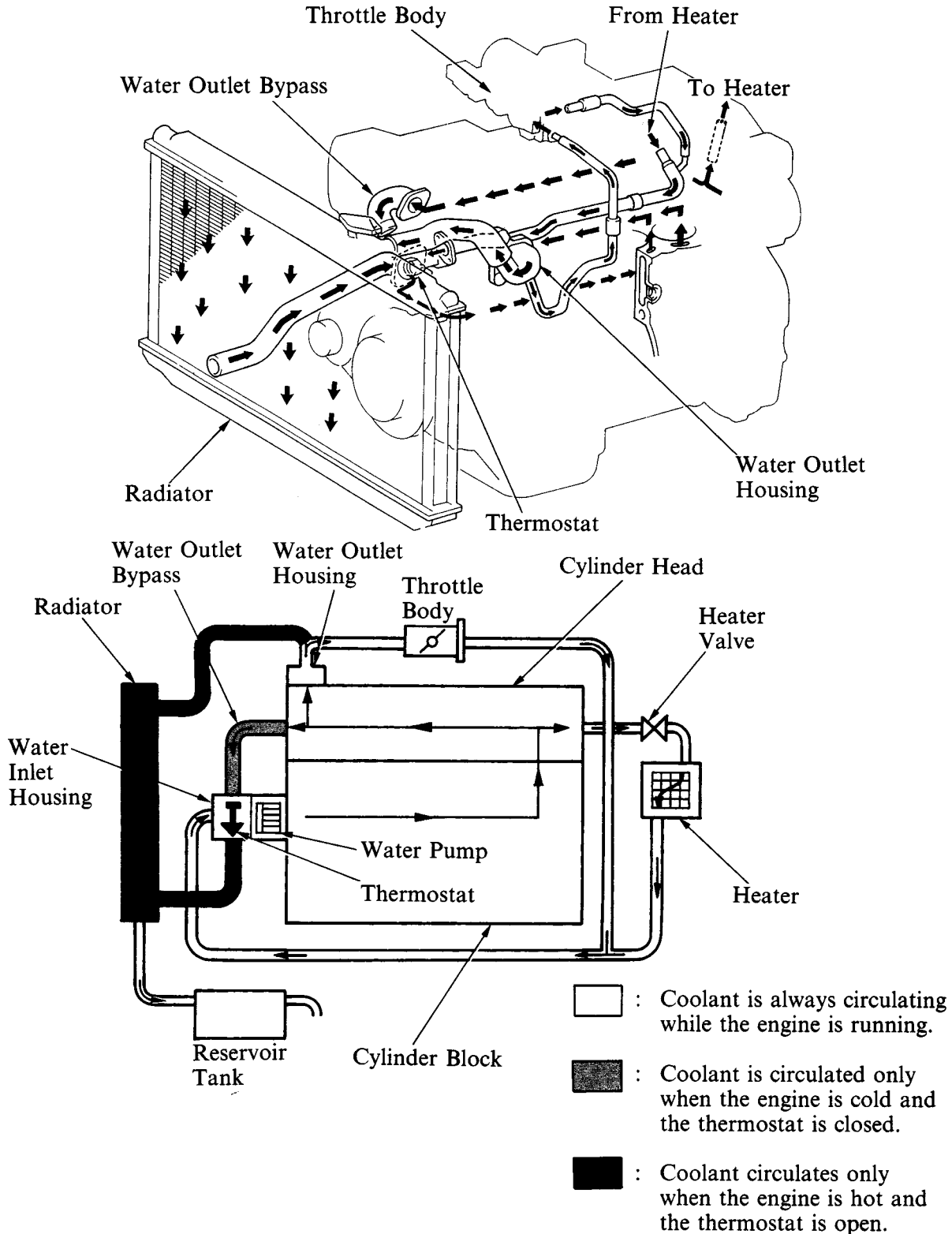
COOLING SYSTEM

1. General

◀ The cooling system is of the pressurized, forced-circulation type.

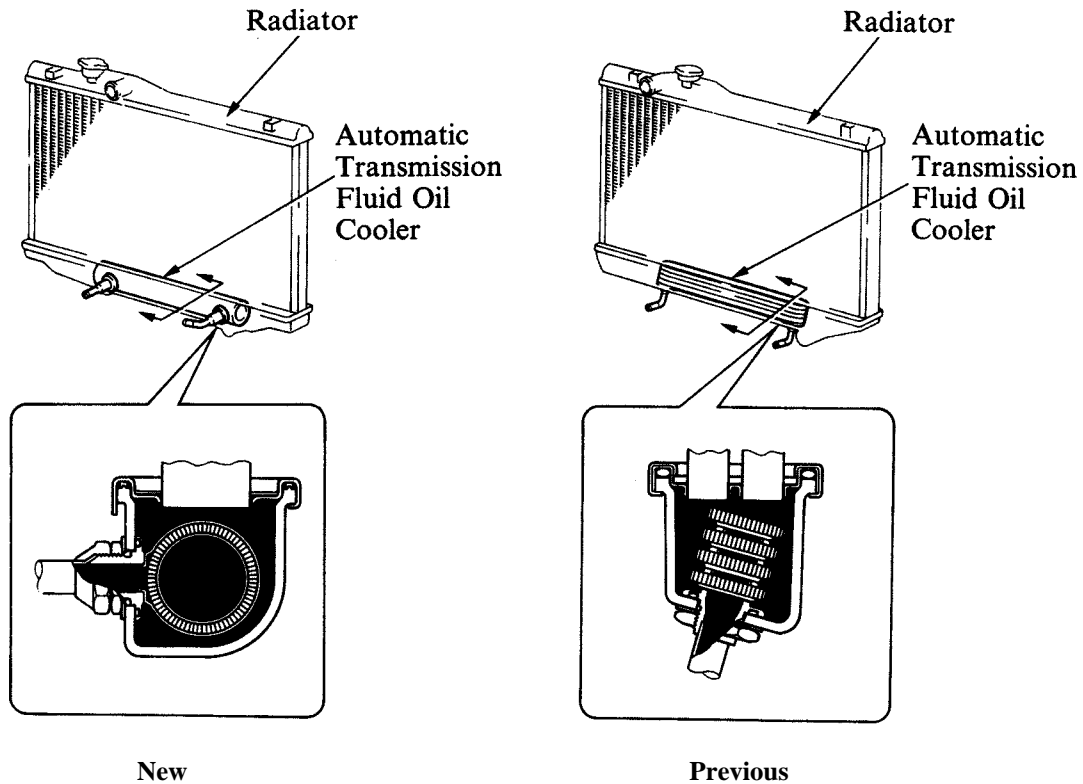
◀ A thermostat with a bypass valve is located on the water pump inlet side of the cooling circuit.

As the coolant temperature rises, the thermostat opens and the bypass valve closes, so the system maintains suitable temperature distribution in the cylinder head.



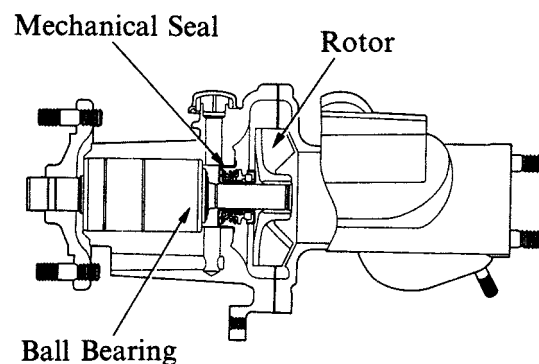
2. Radiator

- ◀ The radiator core is made of a type of aluminum which offers both lightweight and rust-resistant qualities.
- ◀ The automatic transmission model is equipped with an automatic transmission fluid oil cooler in the lower tank, as in the previous model. However, as the Toyota Supra with 7M-GTE engine from the '90 model year did, the new 2JZ-GE engine model uses twin-tube type oil cooler with inner fins in place of the four-stage multiplate type oil cooler used in the previous 7M-GE engine model.



3. Water Pump

- ◀ The water pump is driven by the V-ribbed belt.
- ◀ The rotor is made of resin.



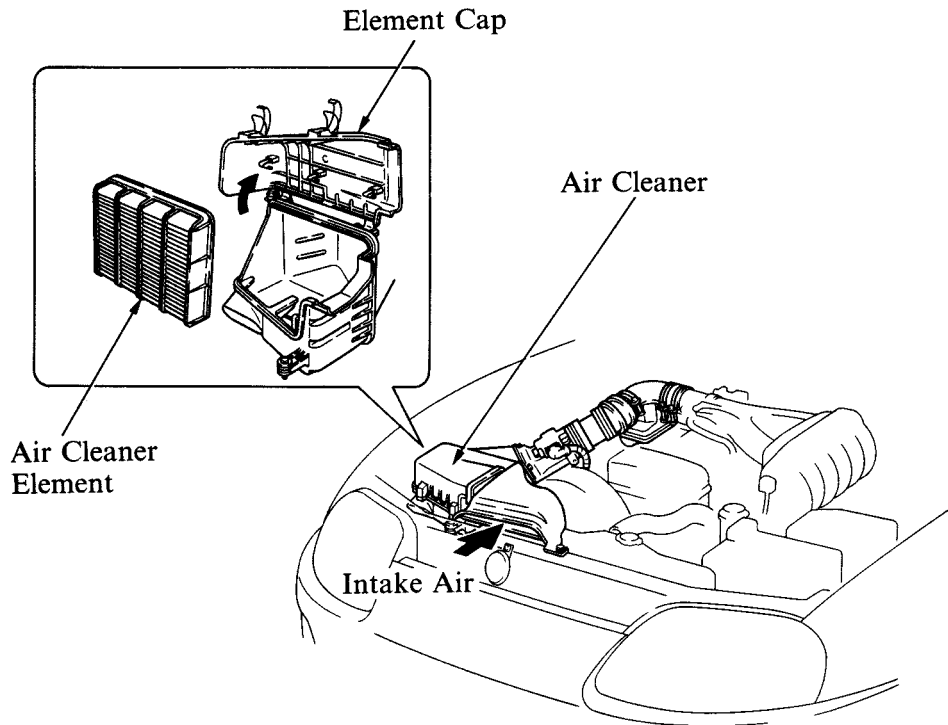
4. Coupling Fan

A 3-stage temperature-controlled fluid coupling is used. The fluid coupling is basically the same in construction and operation as that of 7M-GE engine for the previous Toyota Supra.

INTAKE AND EXHAUST SYSTEM

1. Air Cleaner

The large-capacity air cleaner is used in the new Toyota Supra. An element cap is attached to the air cleaner case to increase ease of servicing.

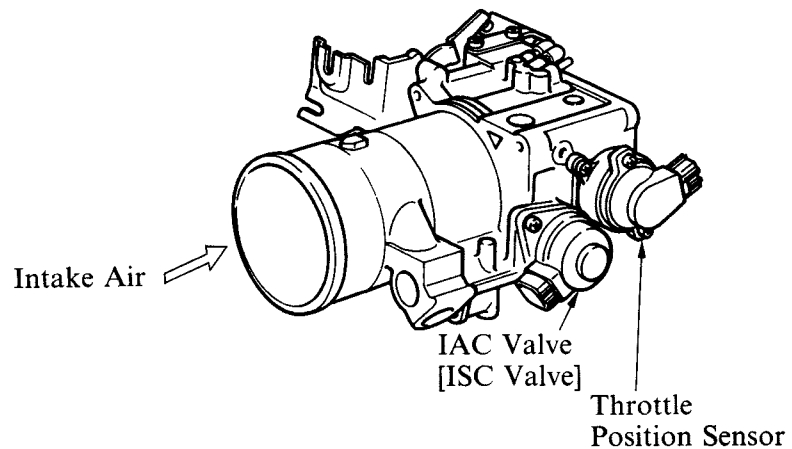


2. Throttle Body

The throttle body and IAC*¹ [ISC*²] valve are integrated into a single unit to reduce weight and the number of component parts.

*¹ : IAC (Idle Air Control)

*² : ISC (Idle Speed Control)

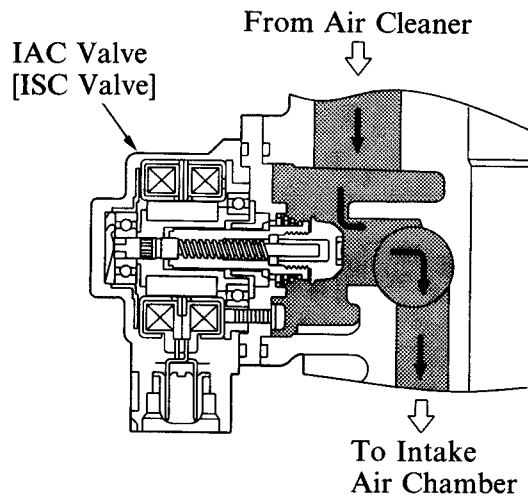


3. IAC*¹ Valve [ISC*² Valve]

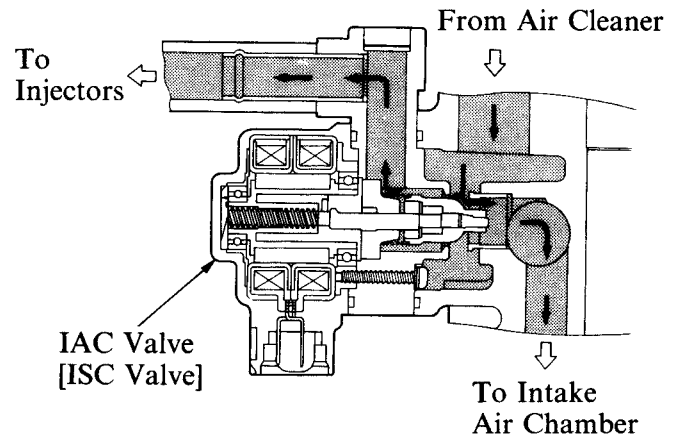
The construction and operation of the IAC*¹ valve [ISC*² valve] in the 2JZ-GE engine are basically the same as those of the 7M-GE engine on the previous Toyota Supra. However, the California specification models use their own IAC*¹ valve [ISC*² valve] in conjunction with the adoption of the Air Assist System. This valve is used not only in the passage to the intake air chamber, but also in the passage to the Air Assist System (see page 51). Air is distributed to the injectors of each cylinder from this passage to promote atomization of the fuel.

*¹: IAC (Idle Air Control)

*²: ISC (Idle Speed Control)



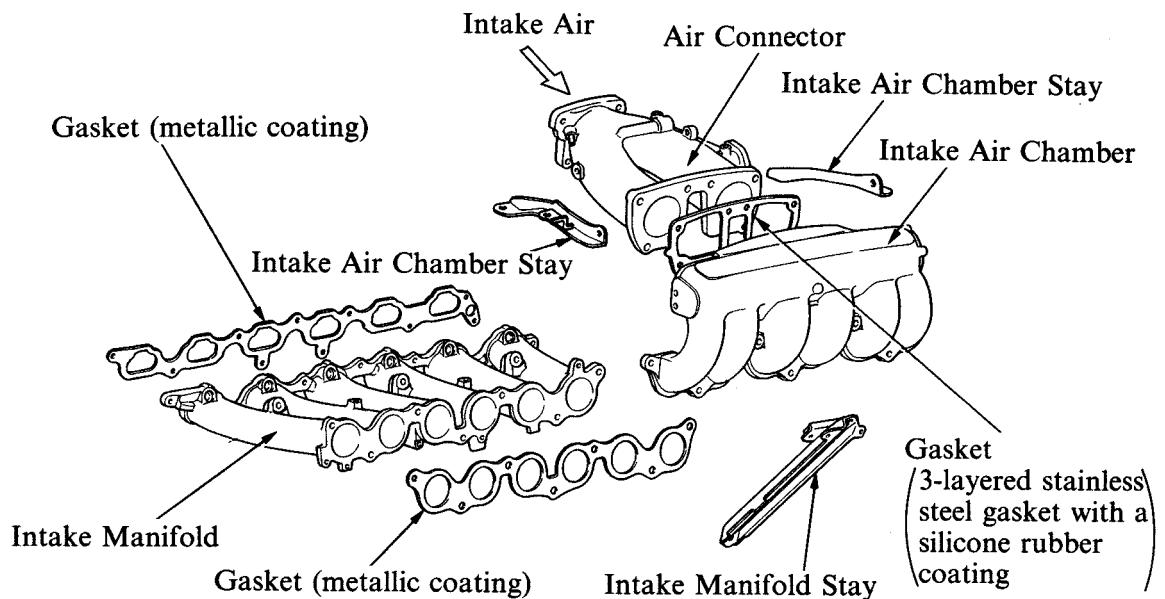
Except for California specification models



For California specification models

4. Air Connector, Intake Air Chamber and Intake Manifold

- Ⓐ The intake air passing through the throttle body is directed to the cylinders via an air connector, intake air chamber and intake manifold.
- Ⓑ The intake air chamber is fitted to the air connector via a re-usable, 3-layered stainless steel gasket having a silicone rubber coating. The intake manifold is fitted to the intake air chamber and the cylinder head via a gasket having a metallic coating to improve sealing performance.
- Ⓒ The intake manifold is supported by a single stay and the intake air chamber by 2 stays to reduce vibration.



5. Exhaust Manifold

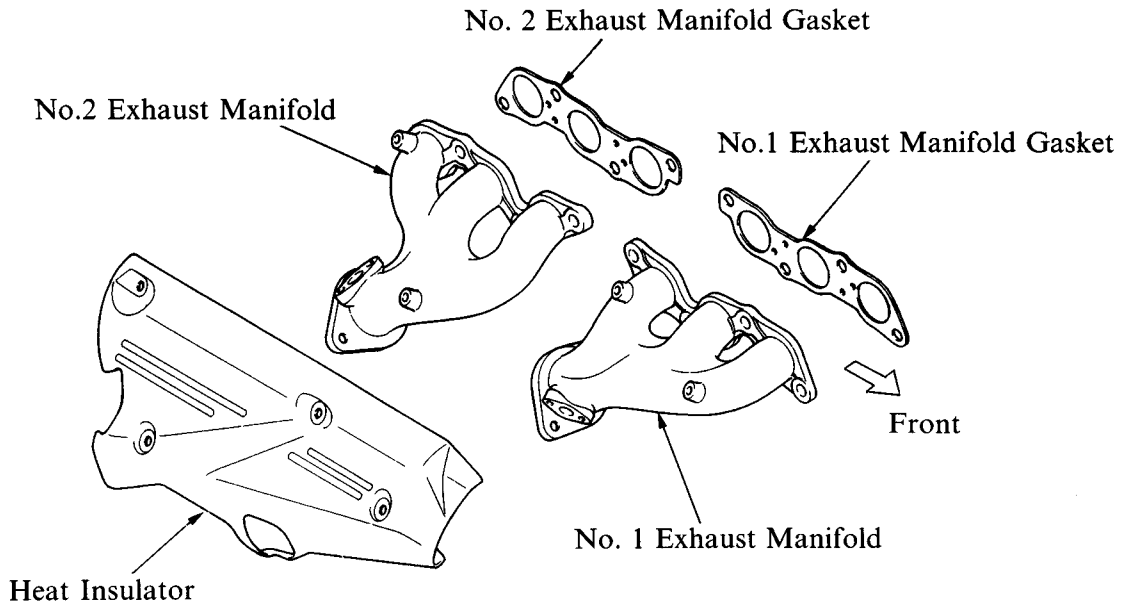
The exhaust manifold is made up of 2 parts, No. 1 and No. 2, to reduce exhaust gas interference and thereby improve the engine performance. They are fitted via a stainless steel gaskets having a laminated structure to increase sealing performance.

In the models except for California, the exhaust manifold is made of cast iron having outstanding resistance against high temperatures, and the heat insulator has a double-layered structure to suppress noise.

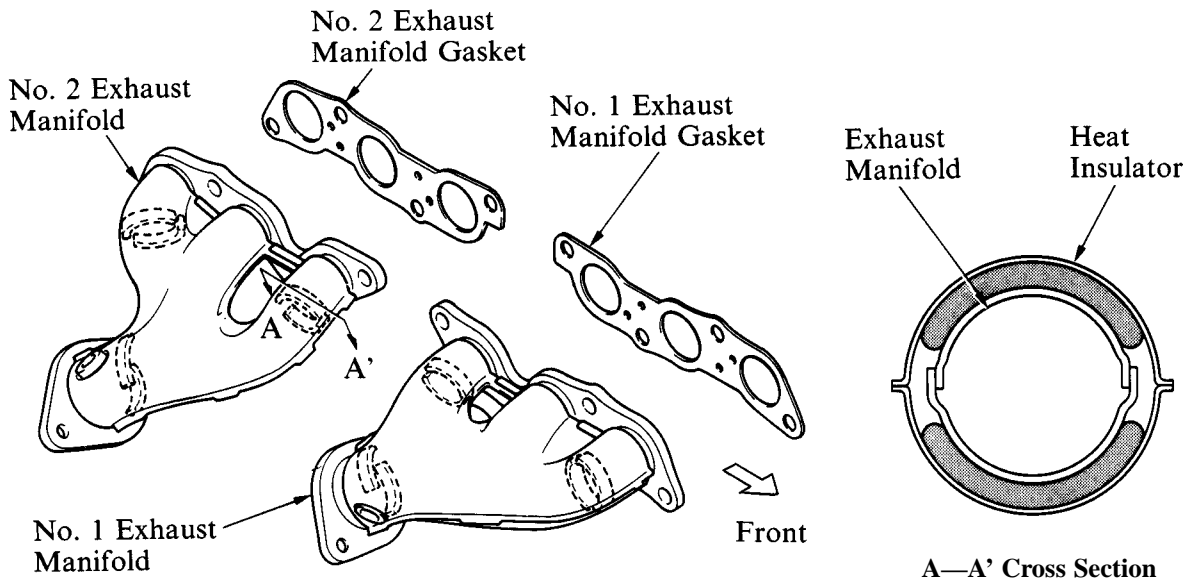
In the California specification models, the stainless steel exhaust manifolds are adopted.

And a heat insulator surrounds each exhaust manifolds, providing a double-structured integrated manifolds, as shown below. Using these exhaust manifolds reduces HC emissions when engine is being warmed up and reduces engine weight.

Except California Specification Models ◀

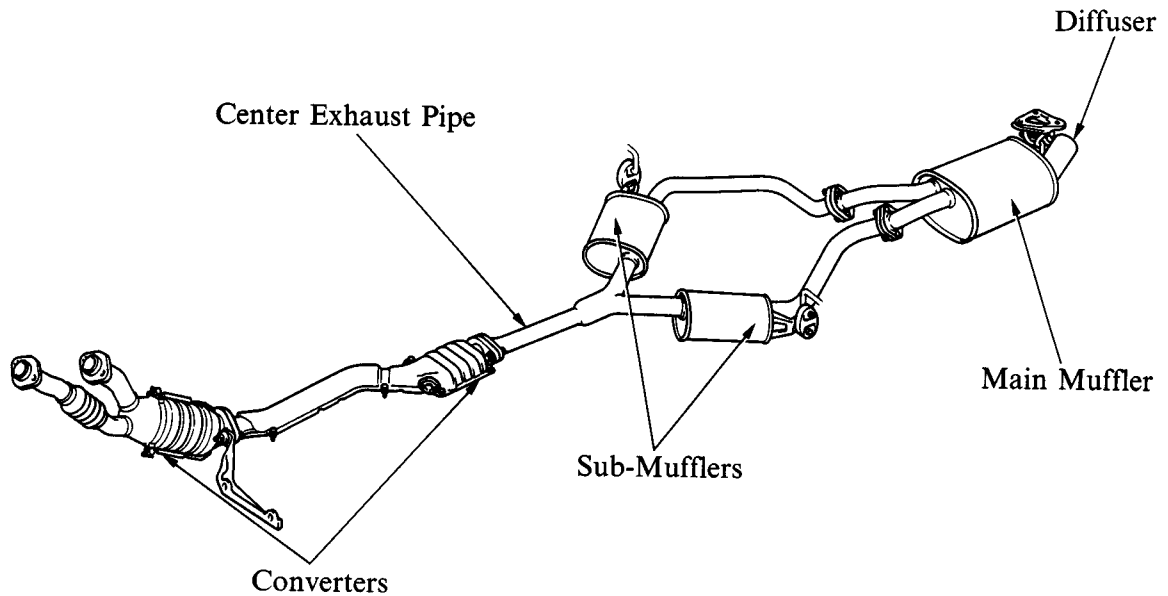


California Specification Models ◀



6. Exhaust Pipe

- ⑧ The exhaust pipes are made of stainless steel.
- ⑧ The catalytic converters are monolithic type three-way catalytic converters.
- ⑧ The center exhaust pipe separates into a “Y” in the middle, and each pipe after the “Y” is provided with its own muffler. The total muffler capacity is thus increased to suppress the noise and vibration.

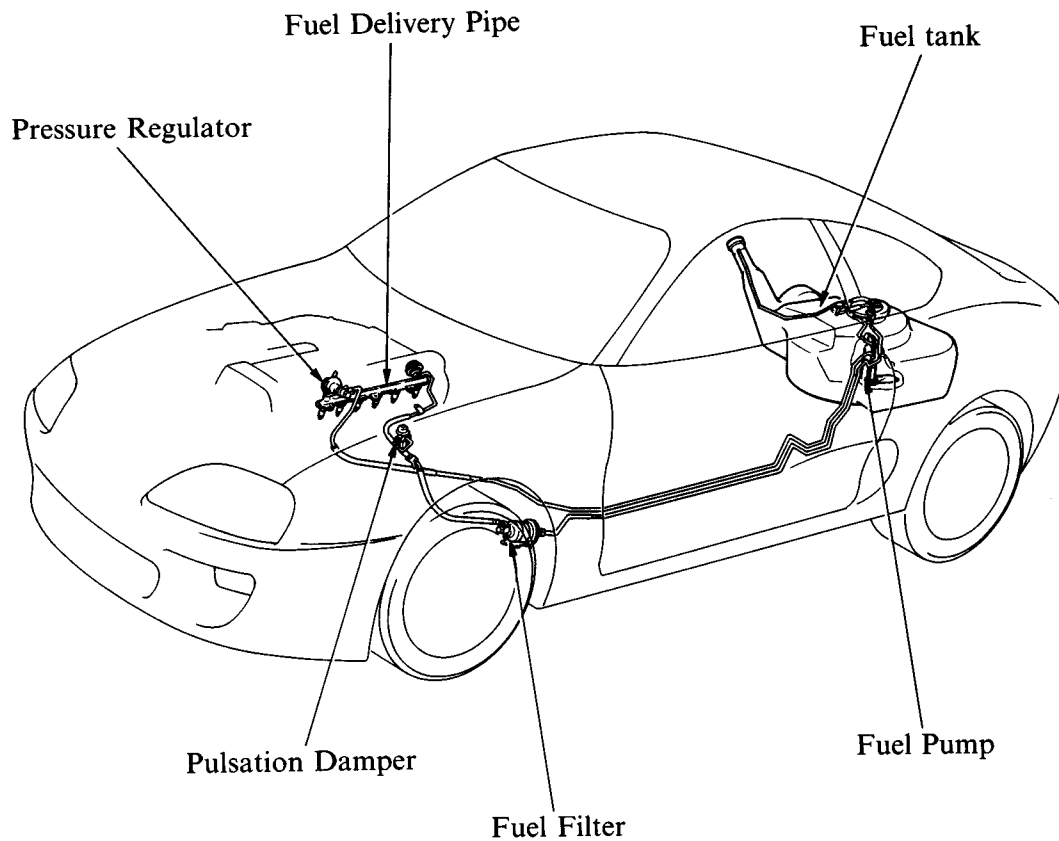


FUEL SYSTEM

1. General

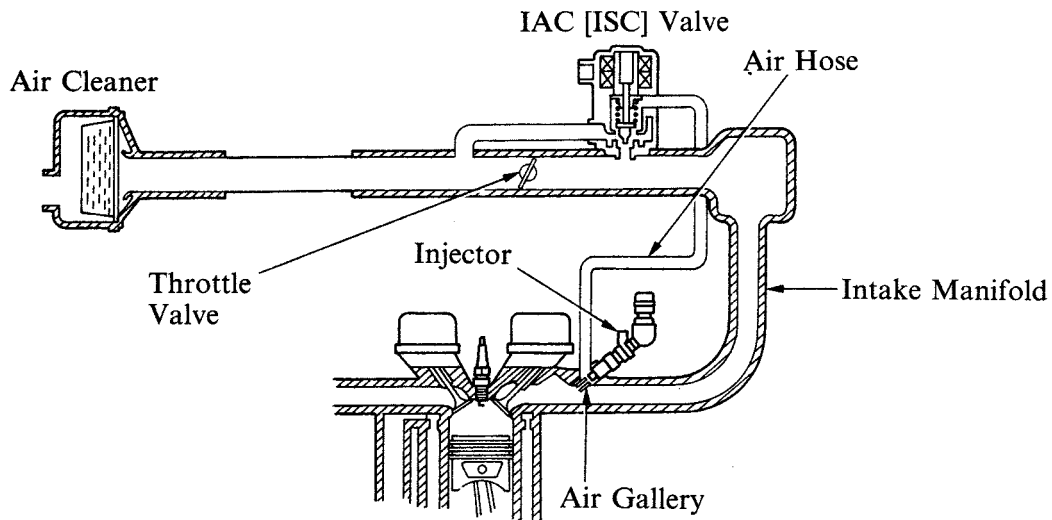
The fuel system of the 2JZ-GE engine is basically the same as that of the 7M-GE engine used on the previous Toyota Supra. However, it has undergone the changes listed below, including a plastic fuel tank, and, for the California specification models, the adoption of the Air Assist System.

- ◀ A plastic fuel tank is used to reduce vehicle weight.
- ◀ A service hole for the fuel tank is provided in the luggage compartment to improve serviceability.
- ◀ Air Assist System is adopted for California specification models to reduce HC emissions.
- ◀ Along with the adoption of the Air Assist System on California specification models, injectors designed specifically for the Air Assist System are used.
- ◀ A cold start injector is not used in the 2JZ-GE engine.



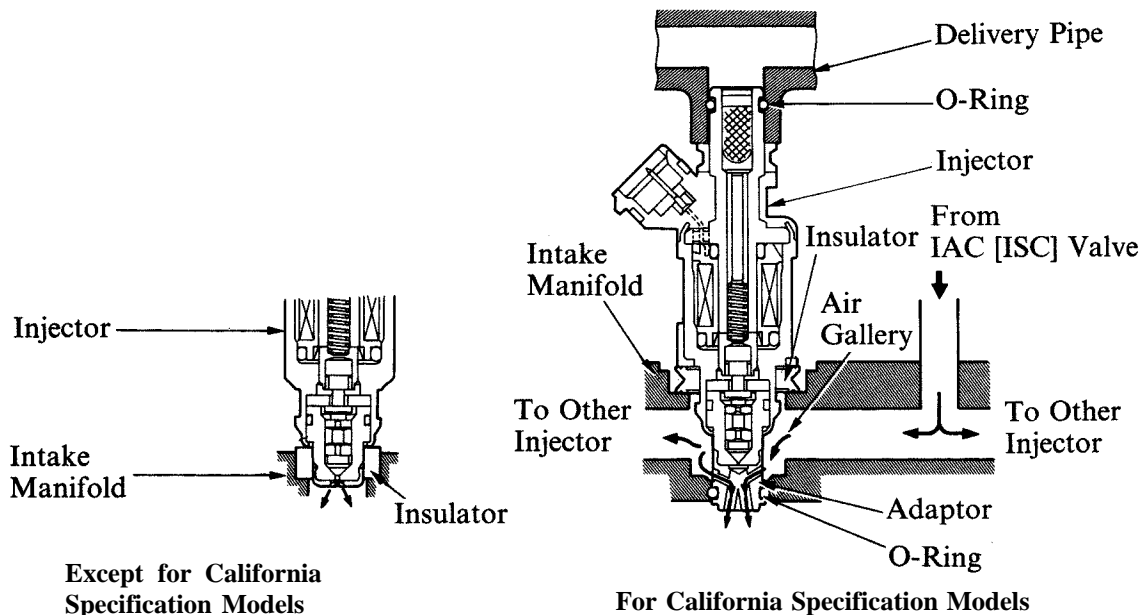
2. Air Assist System

This system was adopted to the 3VZ-FE engine for the '92 Camry, but it has also been adopted for the new Toyota Supra to reduce HC emissions. This system directs part of the air which bypasses the throttle valve to the injection port of the fuel injector. The full mixed with this air flow is thus injected into the cylinder, helping to accelerate the atomization of the fuel.



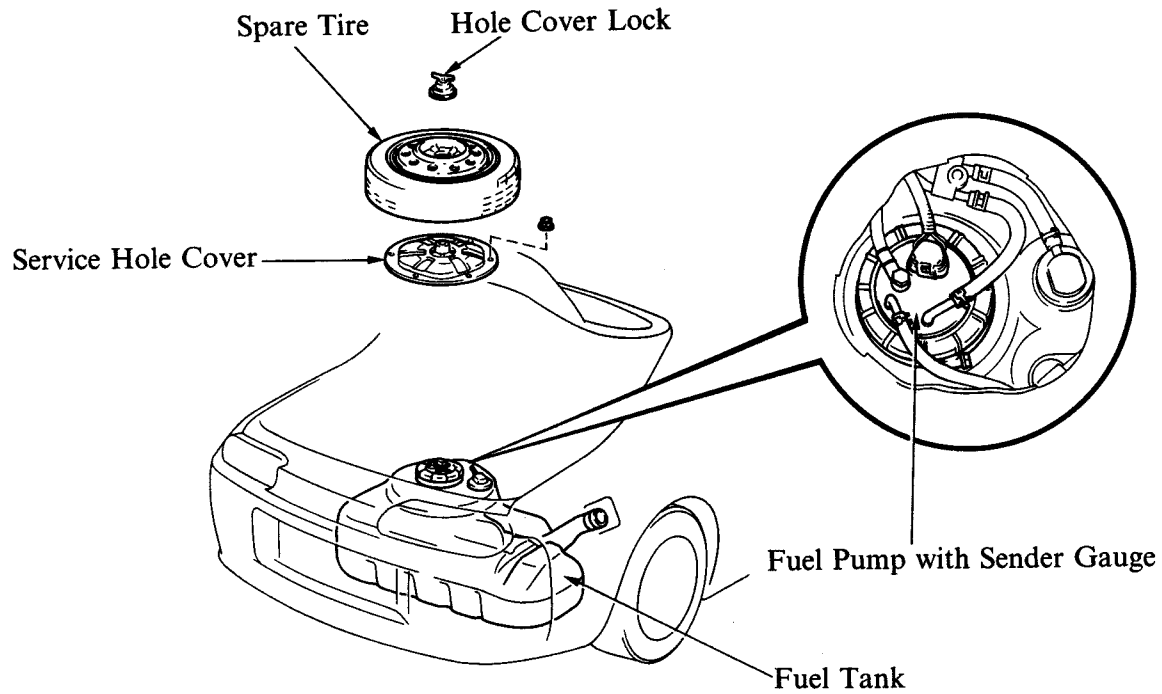
3. Fuel Injector

- ◀ The 2-hole type fuel injectors, used in the 7M-GE engine, are also used in the 2JZ-GE engine to maintain good engine response.
- ◀ In the California specification models, together with the use of the Air Assist System, a fuel injector with adaptor is used. Air introduced from the IAC [ISC] valve, air hose and air gallery flows through the air chamber formed by the O-ring and insulator under the fuel injector and then is mixed with the fuel. This design promotes atomization of the fuel.



4. Fuel Tank

- ◀ The adoption of a plastic fuel tank greatly improves its rust resistance, and reduces the vehicle weight.
- ◀ The serviceability of the fuel tank, fuel pump, and fuel sender gauge has been improved by providing a service hole in the luggage compartment.



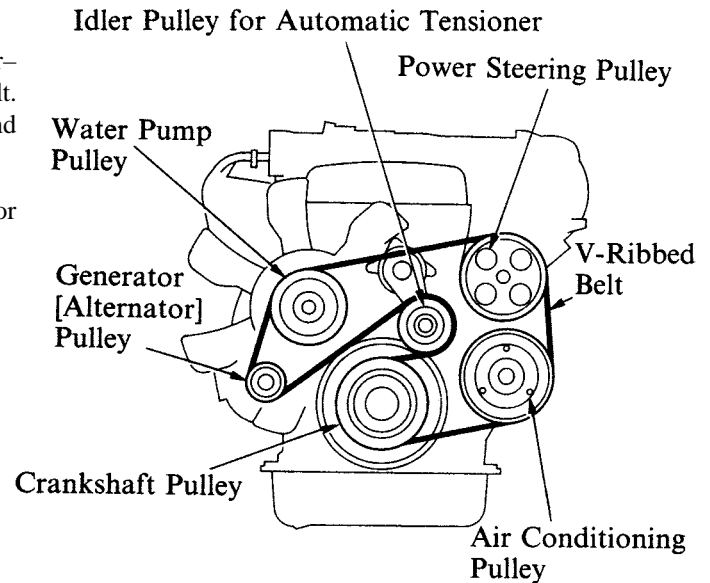
IGNITION SYSTEM

The ignition system in the 2JZ-GE engine is basically the same as that in the 7M-GE engine for the previous Toyota Supra.

☞ 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.

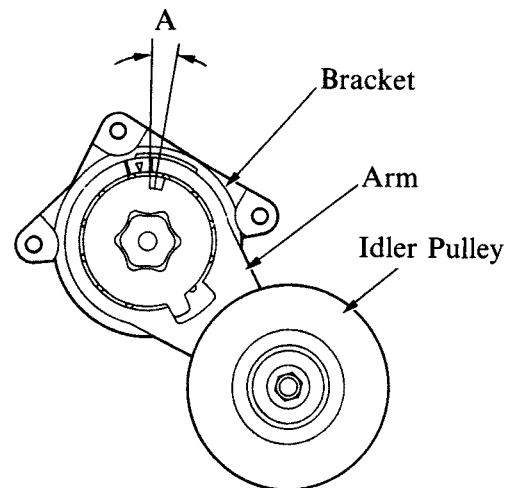


2. Automatic Tensioner

General

The automatic tensioner uses the torsional force of a coil spring to keep the belt tension constant, making belt adjustments unnecessary. In addition, scale marks on the arm and bracket indicate when the V-ribbed belt must be replaced.

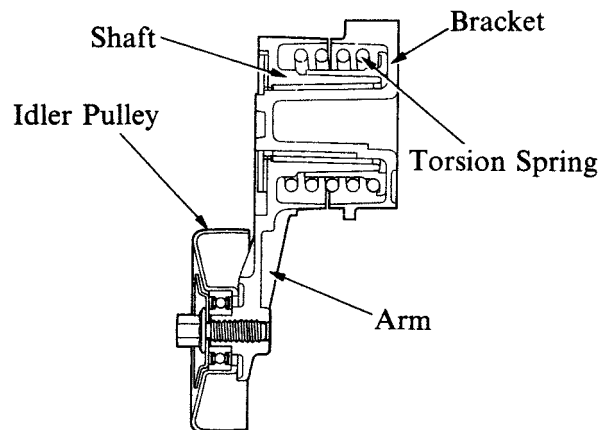
NOTE: New belt— within the “A” range, as illustrated on the right.



Automatic Tensioner

Construction

The automatic tensioner consists of an idler pulley, arm and bracket. The bracket is mounted on the engine, and the arm moves on the bracket shaft as its axis. An idler pulley shaft is integrated at the end of the arm. The torsion spring exerts force on the arm, and the idler pulley applies tension to the belt.

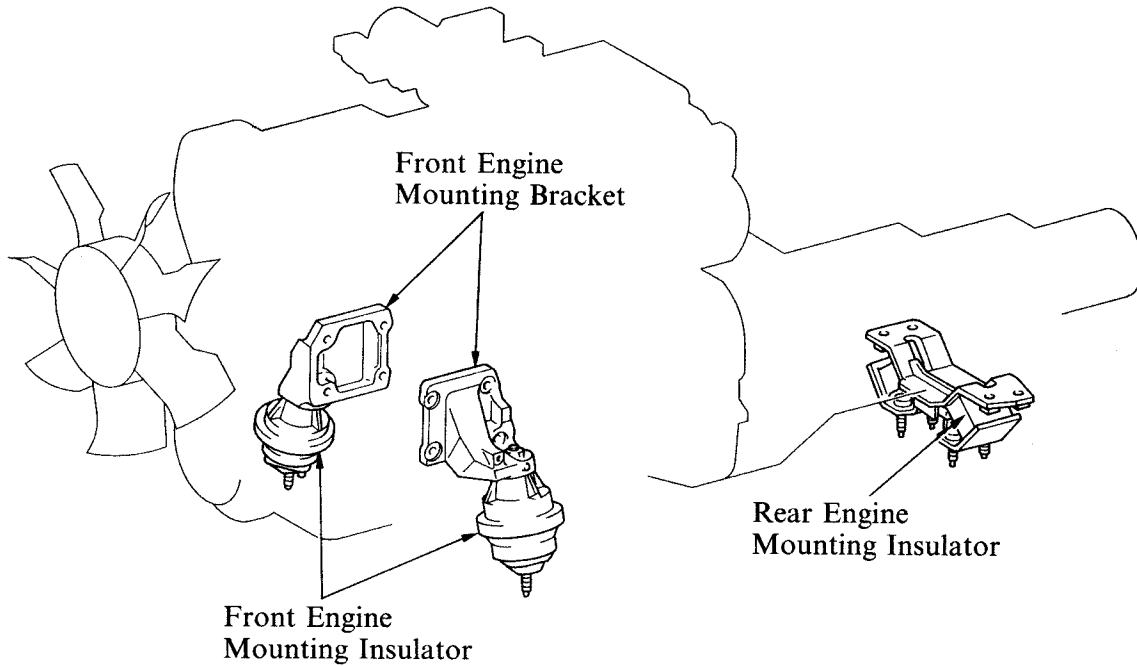


Automatic Tensioner Cross Section

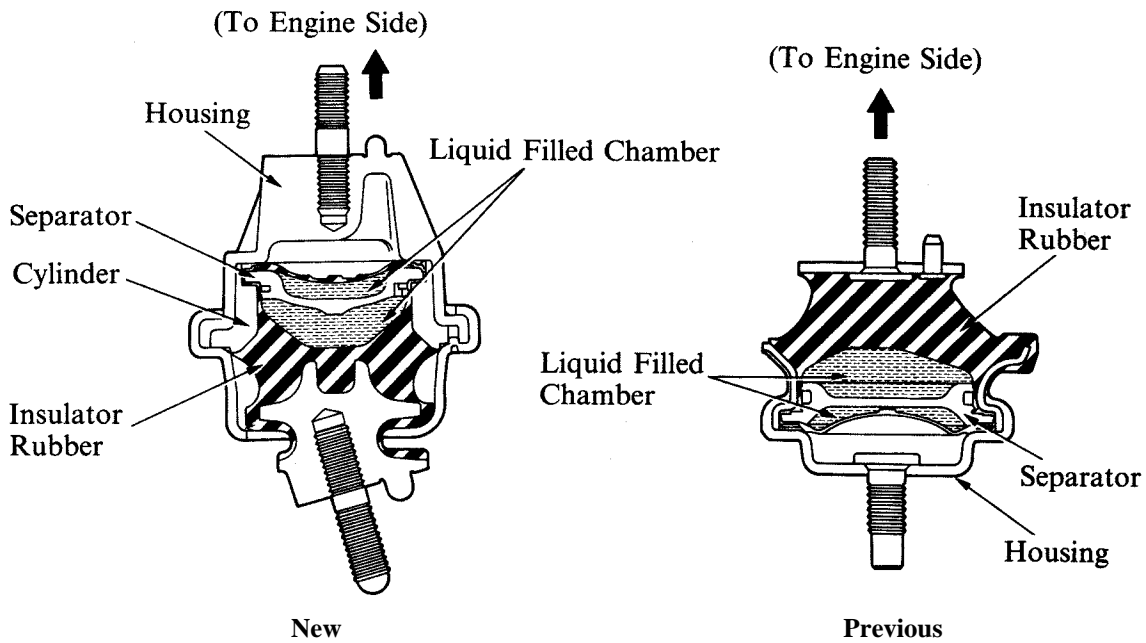
ENGINE MOUNTING

In the new Toyota Supra, the engine is supported by liquid filled compound mounts fitted on both sides of the engine to reduce vibration and noise at all speeds as same as the previous model. Aluminum engine brackets also reduce engine vibration and noise while minimizing the total engine weight.

The current model change features the adoption of an aluminum housing and nylon separator, which helps reduce weight. In addition, the newly adopted nylon cylinder around the liquid filled chamber, and the orienting of the chamber towards the engine, help reduce the transfer of engine heat to the insulator rubber. This helps alleviate the hardening of the rubber material due to heat, and increases its durability.



Front Engine Mounting Insulator Cross Section ◀



○ ENGINE CONTROL SYSTEM

1. General

The engine control system of the 2JZ-GE engine is basically the same in construction and operation as that of the 7M-GE engine for the previous Toyota Supra. However, in automatic transmission models, the ECM*¹ [engine ECU] and PCM*² [transmission ECU] have been integrated into a single unit of ECM*¹ [engine ECU], carrying out overall control of the engine and automatic transmission. Also to suit the 2JZ-GE engine, the sequential multiport fuel injection system is adopted.

Comparison of the engine control system between the 2JZ-GE engine and 7M-GE engine is as follows.

*¹ : ECM (Engine Control Module)

*² : PCM (Powertrain Control Module)

System	Outline	2JZ-GE	7M-GE
SFI (Sequential Multiport Fuel Injection) [EFI] ☞ Page 62	An L-type SFI [EFI] system directly detects the intake air volume with an optical Karman-Vortex type volume air flow meter.		—
	An L-type MFI (Multiport Fuel Injection) [EFI] system directly detects the intake air volume with a vane type volume air flow meter.	—	
	The fuel injection system is a sequential multiport fuel injection system.		—
	The fuel injection system is a 3-group type and injects to 2 cylinders each.	—	
Cold Start Injector	When the coolant temperature is low, the injection duration of the cold start injector is controlled by the ECM* ¹ [engine ECU] and start injector time switch.	—	
ESA (Electronic Spark Advance) ☞ Page 63	Ignition timing is determined by the engine ECM* ¹ [engine ECU] based on signals from various sensors. Corrects ignition timing in response to engine knocking.		
	ECM* ¹ calculates the primary current (ignition coil) energizing start timing.		—
	2 knock sensors are used of further improve knock detection.		—
	In vehicles equipped with automatic transmission, the torque control correction during gear shifting has been used to minimize the shift shock.		—
IAC Idle Air Control [ISC] ☞ Page 66	A step motor type IAC [ISC] system controls the fast idle and idle speeds.		
ACIS (Acoustic Control Induction System) ☞ Page 67	The intake air passages are switched according to the engine speed and throttle valve opening angle to provide high performance in all speed ranges.		* ²

*¹ : ECM (Engine Control Module)

*² : In the 7M-GE engine, this is called Intake Air Control System


System	Outline	2JZ-GE	7M-GE
Fuel Pump Control ☞ Page 67	Under light engine loads, pump speed is low to reduce electric power loss.		
Fuel Pressure Control ☞ Page 68	In hot engine conditions, the fuel pressure is increased to improve restartability.	*3	—
Oxygen Sensor Heater Control ☞ Page 68	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	*3	*3
Air Conditioning Control ☞ Page 69	By turning the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.		—
EGR Cut-Off Control	Cuts off EGR according to the engine condition to maintain drivability of the vehicle and durability of the EGR components.		
Evaporative Emission Control ☞ Page 70	The ECM* ¹ [engine ECU] controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.		—
Diagnosis ☞ Page 71	When the ECM* ¹ detects a malfunction, the ECM* ¹ makes a diagnosis and memorizes the failed section.		
	A test mode function has been adopted to the diagnosis system (normal mode) to detect malfunctions such as poor contact and momentary wire disconnection.		—
Fail-Safe ☞ Page 74	When the ECM* ¹ detects a malfunction, the ECM* ¹ stops or controls the engine according to the data already stored in memory.		

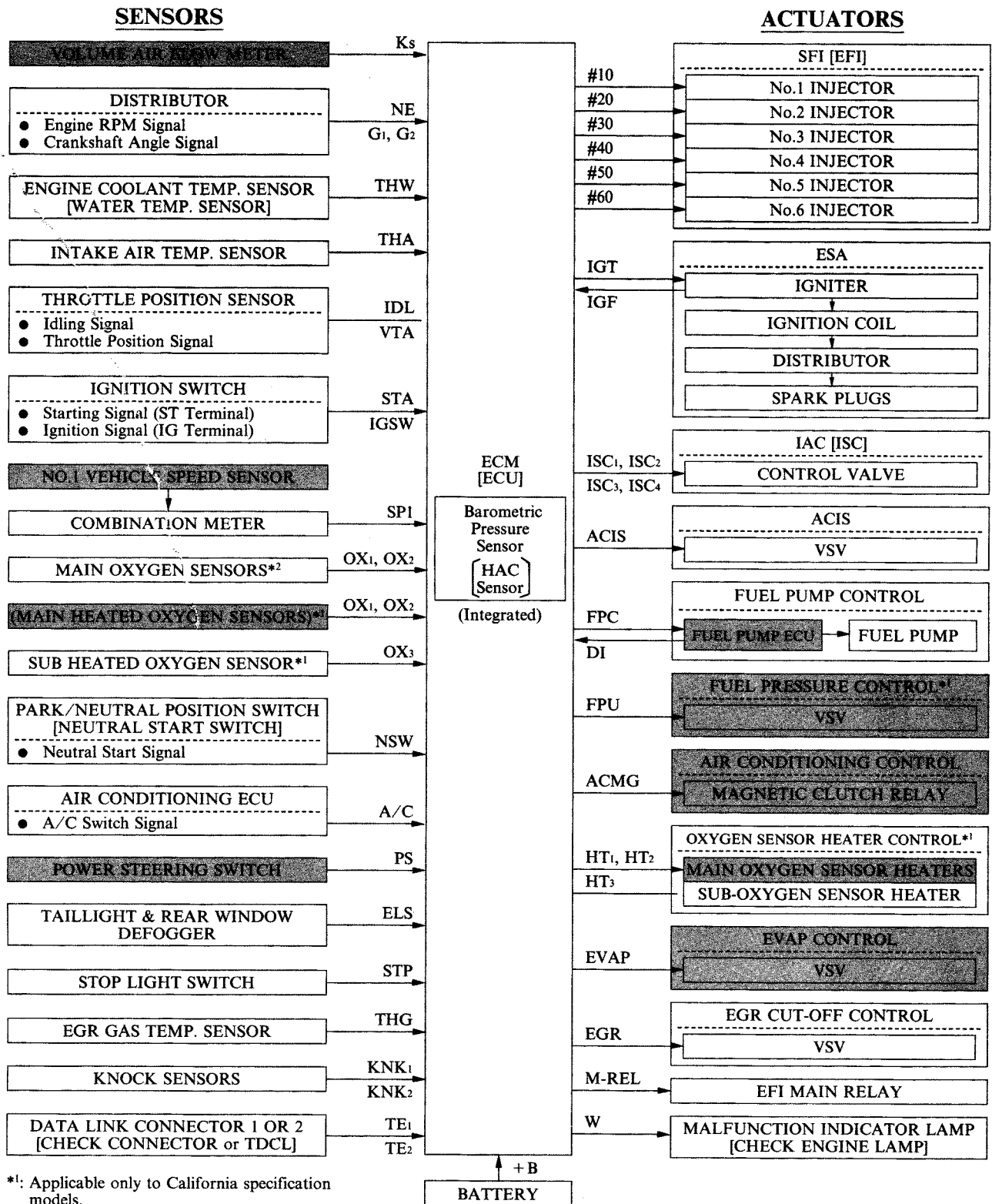
*¹ : ECM (Engine Control Module)

*³ : Applicable only to California specification models

2. Construction

The configuration of the engine control system which can be broadly divided into three groups: the ECM [engine ECU], the sensors and the actuators is shown in the following chart.

Shaded portions  are different from the 7M-GE engine for the previous models.



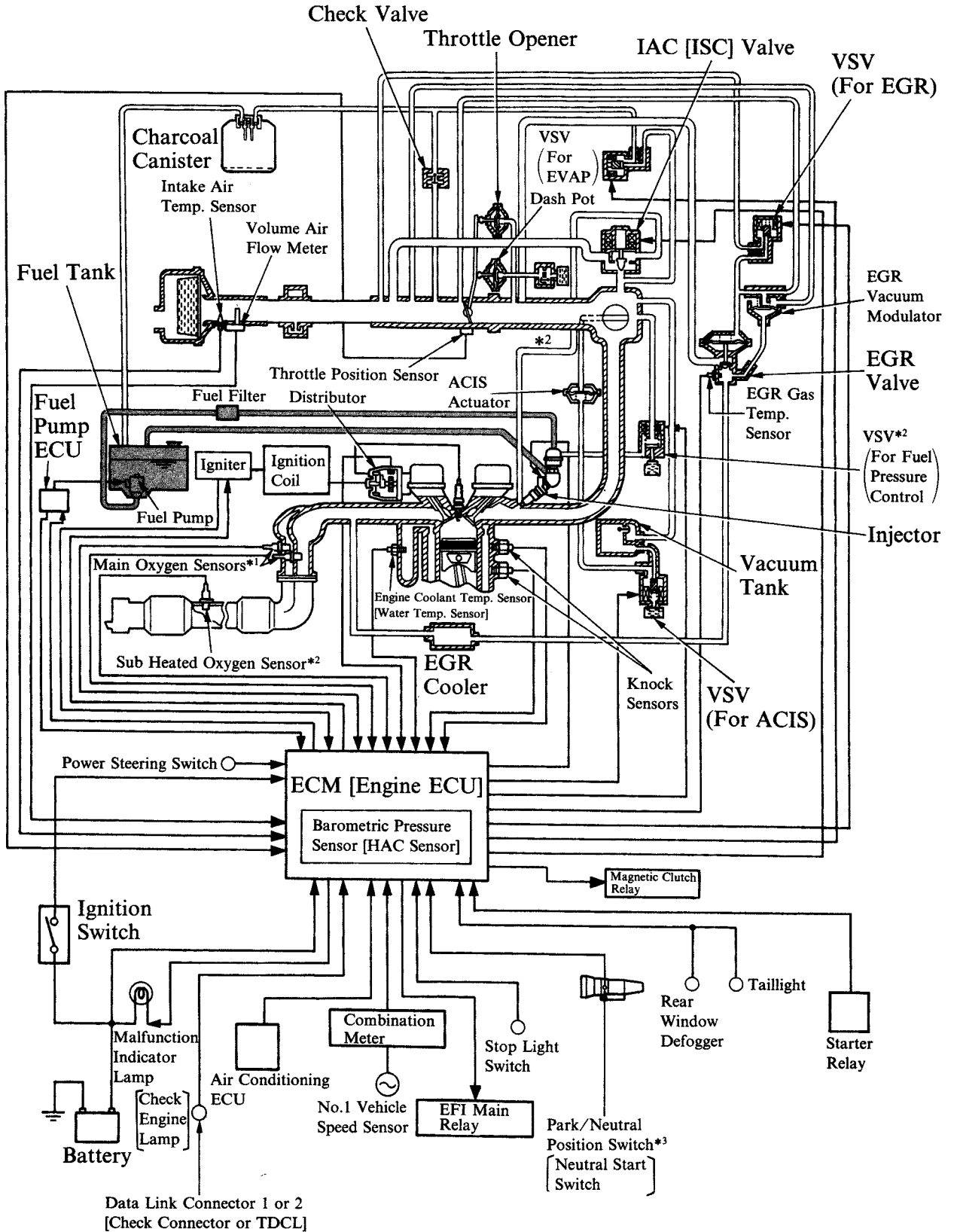
3. Summary of Engine Control System

The following list summarizes each system and control item of the 2JZ-GE engine, including related sensors, ECM [ECU] and others. Shaded portions are different from the 7M-GE engine for the previous Toyota Supra.

CONTROL ITEMS		SENSORS																					
		NE	G ₁	G ₂	IDL	VTA	Ks	THA	THW	OX ₁	OX ₃	SPI	STA	IGSW	NSW	KNK ₁	TE ₁	HAC	+B	A/C			
SFI [EFI]	Fuel Injection Timing Control	●	●	●	●			●											●				
	Fuel Injection Duration Control	Starting Injection Control	●						●				●							●	●		
		After-Start Injection Control	Basic Injection Duration	●					●	●										●	●	●	
			Injection Corrections				●	●		●	●										●	●	●
			After-Start Enrichment	●			●	●		●	●										●	●	●
			Warm-Up Enrichment	●						●	●										●	●	●
			Intake Air Temp. Correction						●	●											●	●	●
			Power Enrichment	●			●	●		●	●										●	●	●
	Air-Fuel Ratio Feedback Correction	●			●	●		●	●	●	●								●	●	●		
	Voltage Correction																		●	●	●		
Fuel Cut-Off	●			●				●				●						●	●	●			
ESA	After-Start Ignition Control	Start Ignition Control	●	●	●							●							●	●	●		
		Basic Ignition Advance Angle Control	Warm-Up Correction	●	●	●	●		●	●						●		●	●	●	●	●	
			Stable Idling Correction	●	●	●	●			●			●				●		●	●	●	●	
			Knocking Correction	●			●		●								●	●		●	●	●	
			Temperature Control Correction	●						●										●	●	●	
	Igniter Control	●	●	●															●	●	●		
IAC [ISC]	Initial Set-Up	●																	●	●	●		
	After-Start Control	●						●				●						●	●	●			
	Warm-Up Control	●						●										●	●	●			
	Feedback Control	●			●	●		●	●			●			●				●	●	●		
	Engine Speed Change Estimate Control	●						●	●						●				●	●	●		
EGR Cut-Off Control	●			●	●		●	●						●				●	●	●			
ACIS (Acoustic Control Induction System)	●			●														●	●	●			
Fuel Pump Control	●				●		●					●	●					●	●	●			
Fuel Pressure Control*							●	●	●	●	●	●						●	●	●			
Main Oxygen Sensor Heater Control*							●	●	●		●							●	●	●			
Sub-Oxygen Sensor Heater Control* ¹	●						●	●	●									●	●	●			
Air Conditioning Control	●			●	●						●	●			●			●	●	●			
Evaporative Emission Control	●			●	●						●	●			●			●	●	●			

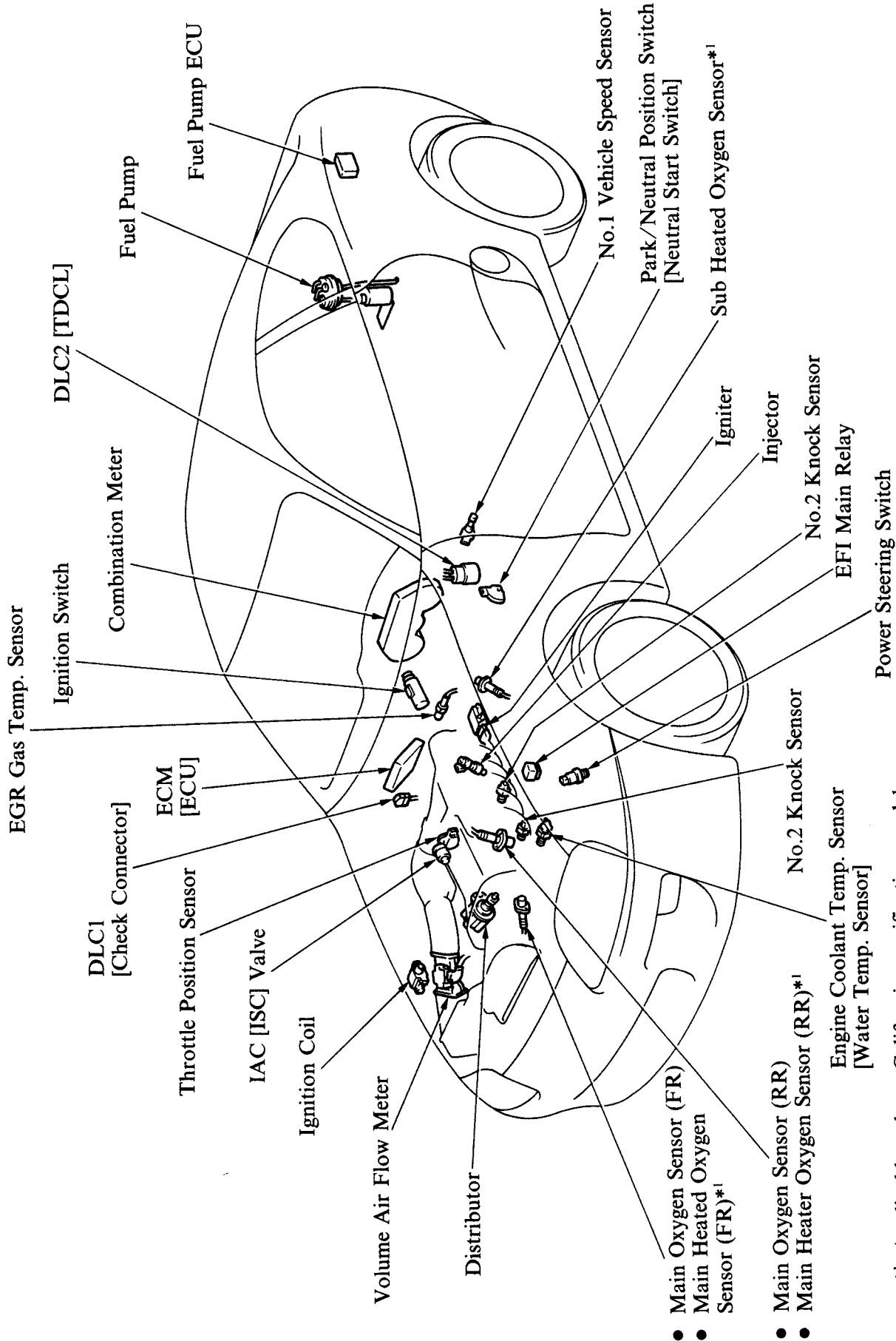
*1 : Applicable only to California specification models.

4. Engine Control System Diagram



*1 : 'Main Heated Oxygen Sensor' for California specification models.
 *2 : Applicable only to California specification models.
 *3 : Applicable only to automatic transmission models.

5. Layout of Components



*!: Applicable only to California specification models.

6. Main Components of Engine Control System

General

The following table compares the main components of the 2JZ-GE engine and 7M-GE engine.

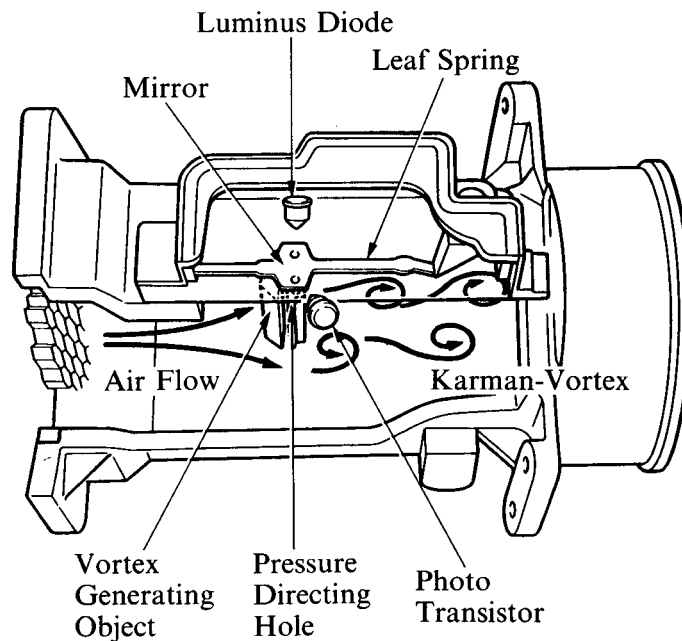
Engine		2JZ-GE	7M-GE
Component			
Volume Air Flow Meter		Karman-Vortex Type	Vane Type
Distributor Crankshaft Angle Sensor and Engine Speed Sensor		3 Pick-Up Coils	←
Throttle Position Sensor		Linear Type	←
Knock Sensor		Built-In Piezoelectric Type, 2	Built-In Piezoelectric Type, 1
Oxygen Sensor	Main	Without Heater Type, 2 With Heater Type, 2*	Without Heater Type, 1
	Sub	With Heater Type, 1*	
Injector		2-Hole Type	←
IAC [ISC] Valve		Step Motor Type	←

*: Applicable only to California specification models.

Volume Air Flow Meter

An optical Karman-Vortex type volume air flow meter has been adopted in the 2JZ-GE engine. This volume air flow meter measures the intake air flow volume by utilizing the vortices (also called Karman-Vortex) that are generated in the wake of the object which is in the path of a gaseous current. This is basically the same as that used in the 7M-GTE engine for the previous Toyota Supra.

For details, see page 85 in 1987 model New Car Features (Pub. No. NCF013U).



7. SFI (Sequential Multiport Fuel Injection) [EFI]

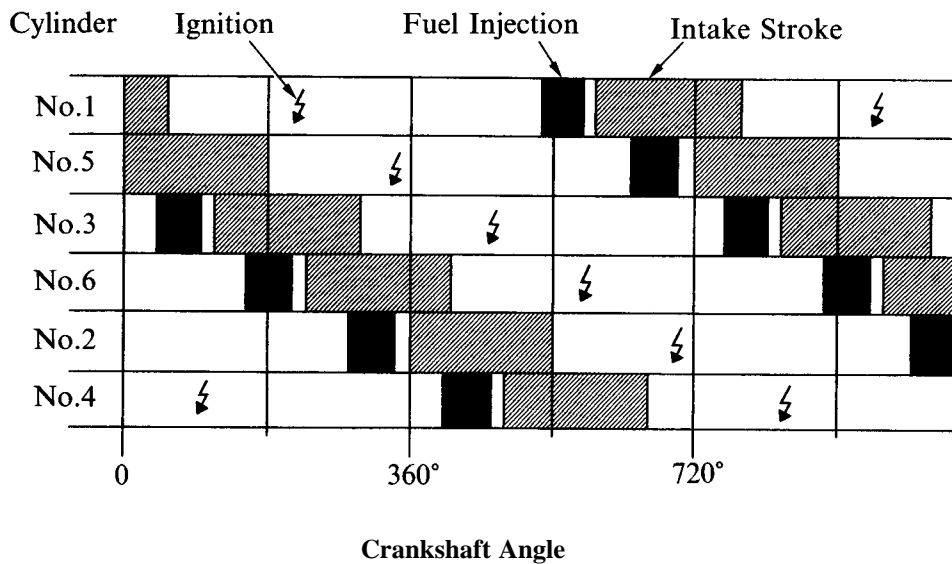
The 2JZ-GE engine uses the L-type SFI [EFI] system with an optical Karman-Vortex type volume air flow meter, in place of the L-type MFI (Multiport Fuel Injection) [EFI] system with a vane type volume air flow meter used in the 7M-GE engine of the pervious Toyota Supra. The following are the main differences of the fuel injection system in the new 2JZ-GE engine, as compared to the previous 7M-GE engine:

Adopts an optical Karman-Vortex type volume air flow meter.

Uses a sequential multiport fuel injection pattern in place of the 3-group type used in the 7M-GE engine.

The 2JZ-GE engine uses a sequential multiport fuel injection. In this system, the air-fuel mixture is introduced into each cylinder every time the engine completes two revolutions, and the injection timing is regulated optimally according to the engine condition.

Furthermore, this system temporarily adopts the 3-group type fuel injection during the engine start-up, for a stabler operation when the engine speed is under 600 rpm.



8. ESA (Electronic Spark Advance)

General

The ESA system of the 2JZ-GE engine differs from the system of the 7M-GE engine in the following areas:

In the 2JZ-GE engine, 2 knock sensors are used to further improve knock detection. In addition, torque control correction has been added to ignition timing control in automatic transmission models.

The ECM* [engine ECU] directly controls the primary current energizing start timing in place of the igniter.

*: ECM (Engine Control Module)

Ignition Timing Control

On the automatic transmission model, a torque control correction has been newly adopted for the ignition timing control, to reduce the shift shock associated with gear shifting.

1) Torque Control Correction

When the ECM [ECU] judges a gear shift timing according to signals from various sensors, it activates the shift control solenoid valves to perform gear shifting. When the gear shifting starts, the ECM retards the engine ignition timing to reduce the engine torque.

As a result, engagement force of the clutches and brakes of the planetary gear unit is weakened and the gear shift change is performed smoothly.

RELEVANT SIGNALS

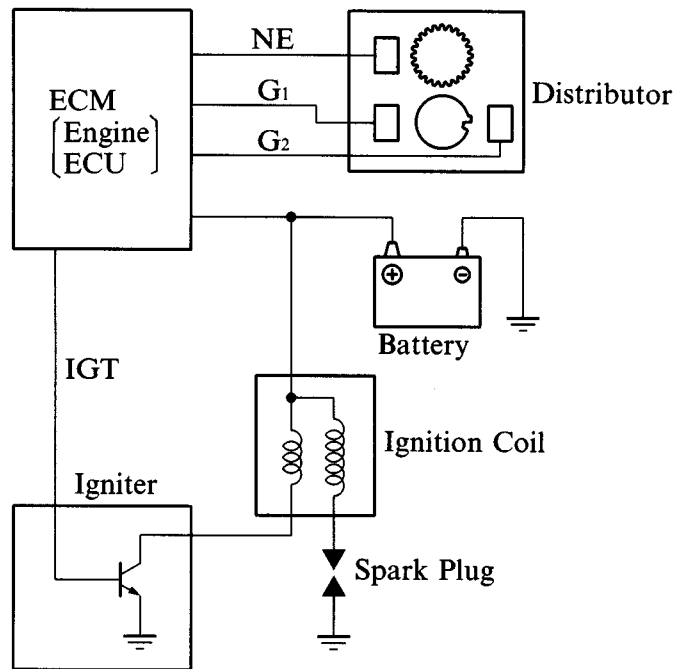
Coolant temperature (THW)

Battery voltage (+B)

Engine speed (NE)

Igniter Control

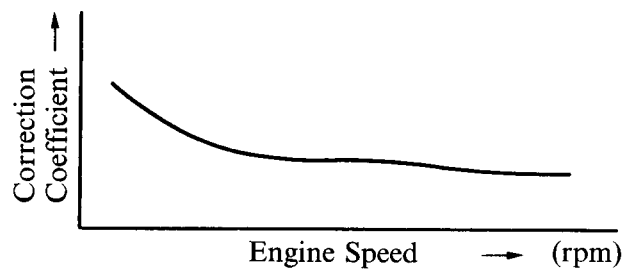
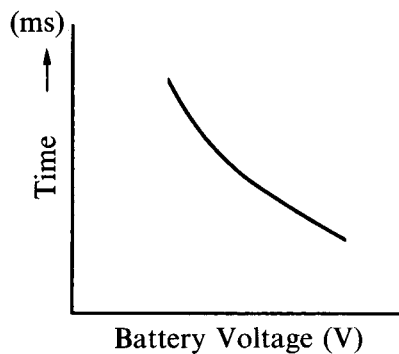
In the 2JZ-GE engine, the ECM [engine ECU] outputs the IGT signal based on the primary current energizing time it has calculated.



1) Calculation of Primary Current Energizing Time

In order to control primary current energizing start time via the IGT signal, the ECM of the 2JZ-GE engine calculates the primary current energizing time according to the following formula:

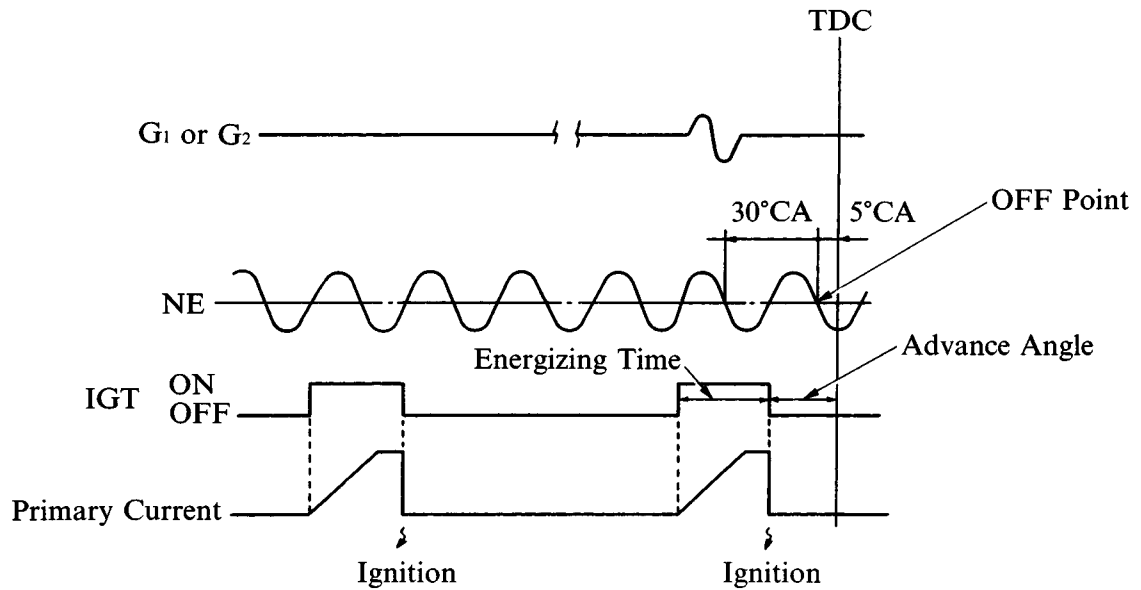
$$\text{Energizing Time} = \text{Energizing Time for Battery Voltage} * \text{Correction for Engine Speed}$$



2) Ignition Timing Signal (IGT Signal)

When the ignition timing is set 10° BTDC (initial ignition timing; IDL signal ON, terminals TE₁ and E₁ in DLC1 or 2* connected), the OFF point of the subsequent NE signal after the G2 (or G1) signal falls on 5° BTDC for the No. 1 (or No. 6) cylinder. Based on this OFF point, the ECM supplies the IGT signal to the igniter according to the ignition timing and energizing time.

*: DLC1 or 2 (Data Link Connector 1 or 2) [Check Connector or TDCL]



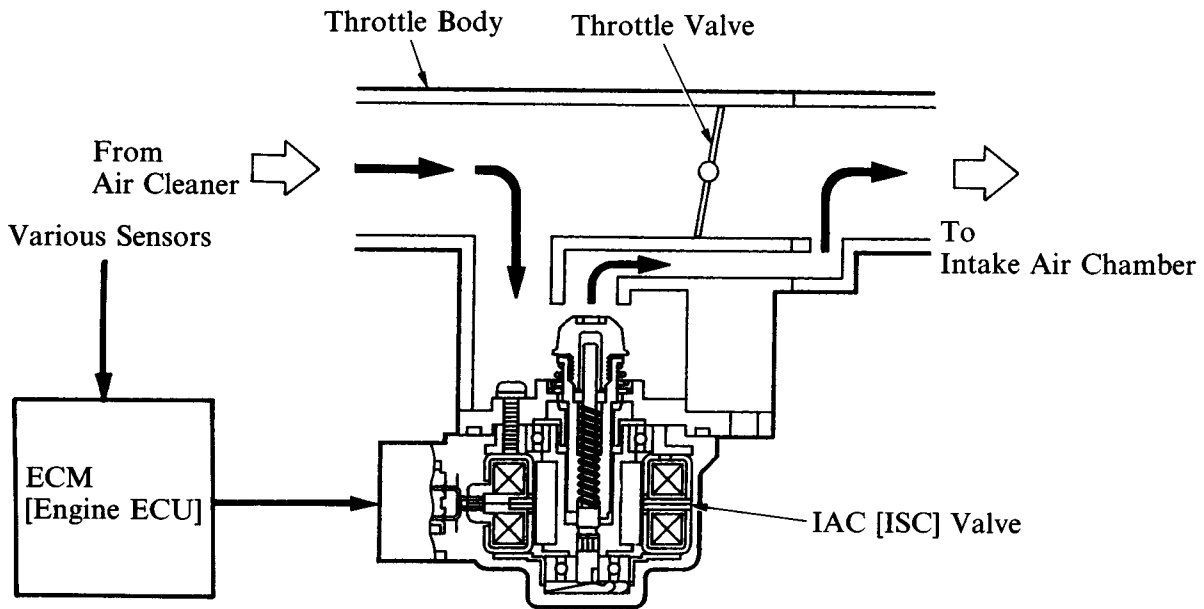
9. IAC (Idle Air Control) [ISC]

In the IAC [ISC] system of the 2JZ-GE engine, as same as the previous 7M-GE engine, the step motor type IAC [ISC] valve is used, and the ECM* [engine ECU] controls the idle speed at a target speed based on the signals from the various sensors by adjusting the volume of air bypassing the throttle valve.

Compared with the 7M-GE engine, a power steering switch, taillight system and rear window defogger system used as a sensor for feedback control are additionally adopted. The power steering switch is a pressure switch fitted in the hydraulic line of the power steering pump, and detects pressure build-up generated during pivoting (steering without driving) and other occasions.

The ECM* corrects the target idling speed according to the signals from these sensors, thereby suppressing fluctuation of the idling speed due to the power steering pump load and/or electrical load.

* : ECM (Engine Control Module)



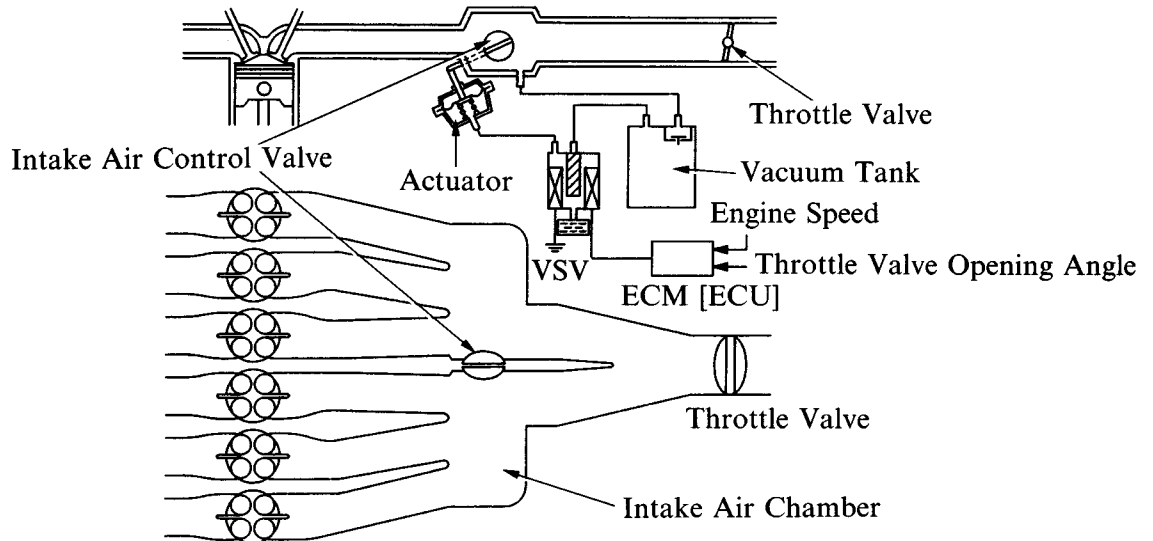
◀ Target Idling Speeds®

	Electrical Load	Air Conditioning Switch	Park/Neutral Position Switch [Neutral Start Switch]	Engine Speed N (rpm)	Power Steering Switch: ON	
					NSW: OFF	NSW: ON
Automatic Transmission	OFF	OFF	OFF	650	N + 50	N + 100
			ON	700		
		ON	OFF	650		
			ON	800		
	ON	OFF	650			
		ON	800			
Manual Transmission	OFF	OFF	—	700	N + 100	
		ON	—	900		
	ON	OFF	—	800		
		ON	—	900		

10.ACIS (Acoustic Control Induction System)

The ACIS uses a bulkhead to divide the intake air chamber into two stages, with a intake air control valve in the bulkhead to vary the effective length of the intake manifold. This increases the power output in all ranges from low to high speeds.

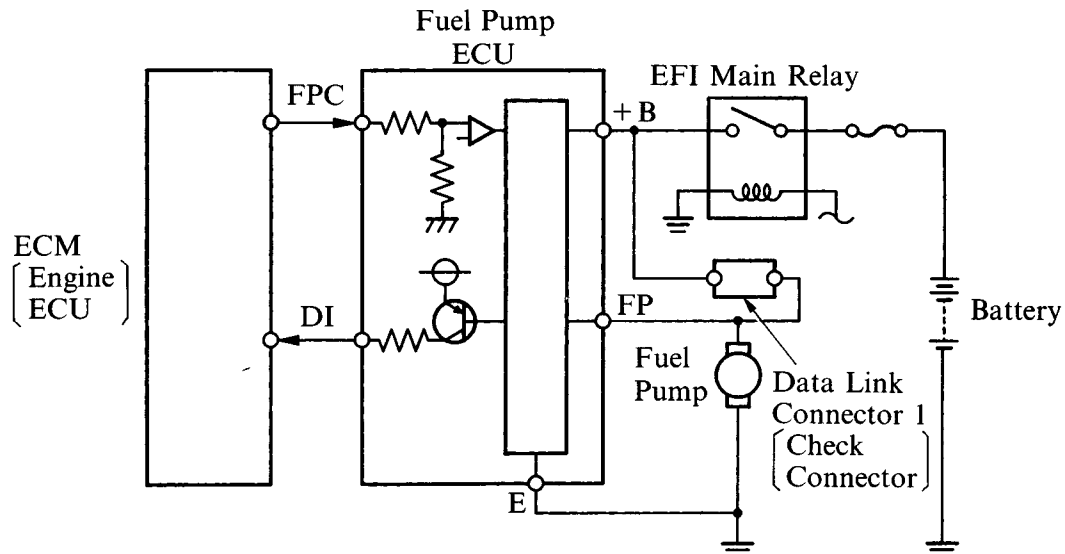
This system is basically the same as the Intake Air Control System of the 7M-GE engine for the previous Toyota Supra.



11.Fuel Pump Control

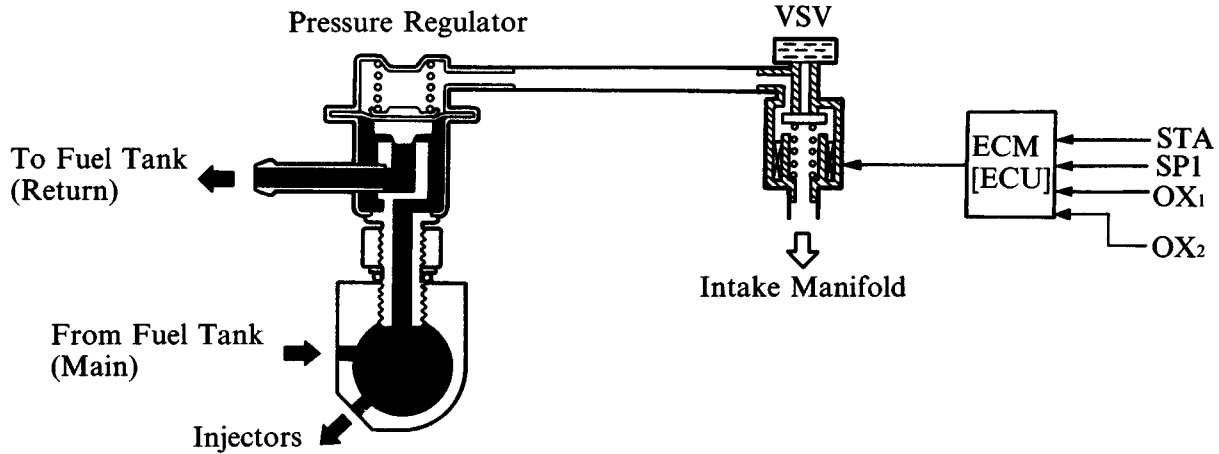
As in the 7M-GE engine, this system switches the fuel pump speed between high and low speed according to engine conditions, reducing the electrical load. However, in the 2JZ-GE engine, the fuel pump speed switching component has been changed from the fuel pump control relay and resistor of the 7M-GE engine to the fuel pump ECU.

The fuel pump ECU is wired as shown in the following diagram. Signals from this ECU are used to switch the fuel pump speed back and forth between 2 steps. In addition, the fuel pump ECU is equipped with a fuel pump system diagnosis function. When trouble is detected, signals are sent from the DI terminal to the ECM [ECU]. For details, see page 73. Fuel pump speed switching conditions are basically the same as in the 7M-GE engine.



12. Fuel Pressure Control

When starting engine at high temperature, the ECM [ECU] turns on a VSV to draw atmospheric pressure into the diaphragm chamber of the pressure regulator. There by the fuel pressure is increased to prevent fuel vapor lock in order to help engine start.



13. Oxygen Sensor Heater Control

In the 2JZ-GE engine, two main oxygen sensors are used, and ECM [engine ECU] controls both front and rear side main oxygen sensors simultaneously.

In the California specification models, the main oxygen sensors and a sub oxygen sensor are each equipped with a heater. Furthermore, the ECM [engine ECU] controls the main and sub oxygen sensors independently of each other, with control conditions being the same for both main and sub sensors.

RELEVANT SIGNALS

(For Main Oxygen Sensors)

- Vehicle speed (SP1)
- Intake air volume (Ks)
- Engine coolant temperature (THW)

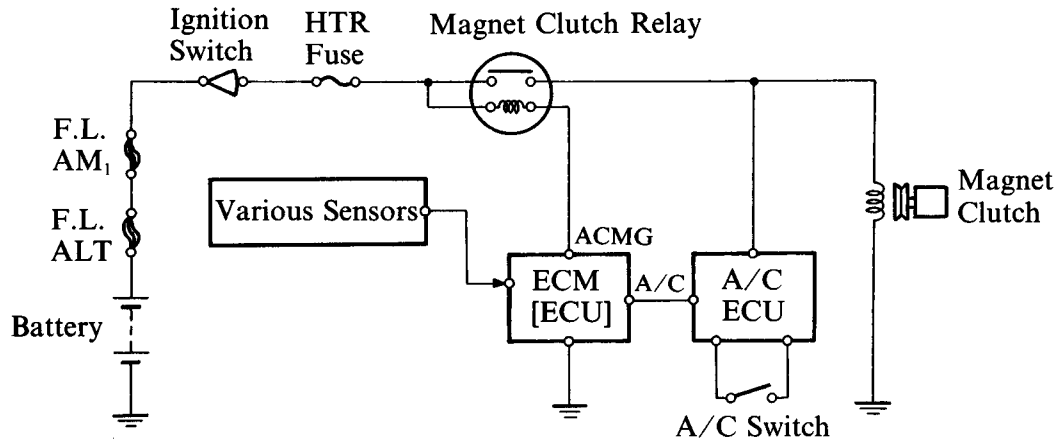
(For Sub Oxygen Sensor)

- Intake air volume (Ks)
- Engine coolant temperature (THW)
- Engine speed (NE)
- Battery voltage (+B)

14. Air Conditioning Control

General

To maintain drivability and prevent idle speed from dropping, the 2JZ-GE engine adopted a function which temporarily retards or cuts off the air conditioning operation according to the engine condition.



Air Conditioning Compressor Delay Control

When the ECM [engine ECU] detects a signal (A/C) from the air conditioning ECU that the air conditioning switch is turned on, the ECM outputs a magnet clutch signal (ACMG) to the magnet clutch relay and turns it on.

The compressor magnetic clutch operation is delayed about 0.5 seconds after the air conditioning switch is turned on. During this time, the ECM opens IAC [ISC] valve to maintain drivability and offset the drop in the engine rpm due to the operation of the air conditioning compressor.

Air Conditioning Compressor Cut-Off During Acceleration

The ECM turns the magnet clutch relay off during acceleration to maintain drivability. The magnet clutch is turned off and the air conditioning operation is cut-off until the magnet clutch relay is turned on again.

RELEVANT SIGNALS

Park/Neutral position switch
[Neutral start switch] (NSW)
Vehicle speed (SP1)
Throttle position (VTA)

Air Conditioning Compressor Cut-Off During Steering

When the vehicle is steered at low speeds such as when pivoting (steering without driving), the engine load increases momentarily due to operation of the power steering pump and the engine speed drops as a result. The ECM therefore cuts off the magnet clutch relay for 0.5 seconds when the power steering switch goes on, thus increasing the idling speed and preventing fluctuation of the engine speed.

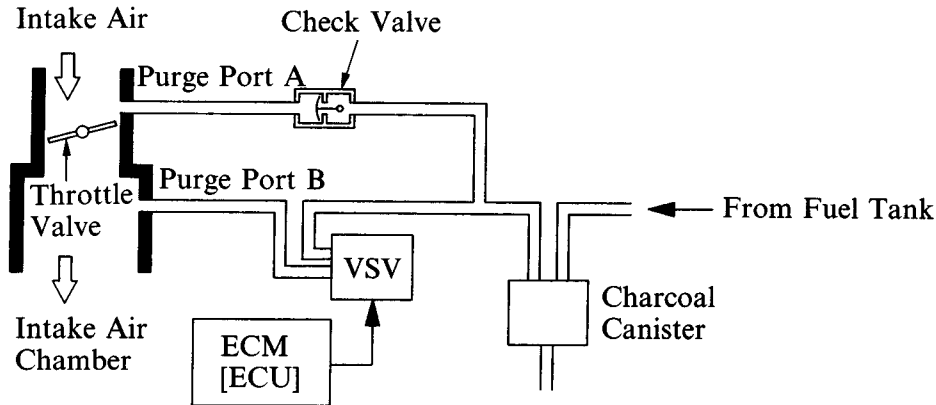
RELEVANT SIGNALS

Park/Neutral position switch
[Neutral start switch] (NSW)
Vehicle speed (SP1)
Throttle position (IDL)
Power steering switch (PS)

15. Evaporative Emission Control

General

The evaporative emission control is a system which utilizes the intake manifold vacuum to draw the evaporative emissions into the intake air chamber and mix them in with the intake air. The 2JZ-GE engine has adopted a duty-cycle type VSV (Vacuum Switching Valve) controlled by the ECM [engine ECU] to purge the evaporative emissions from the charcoal canister.



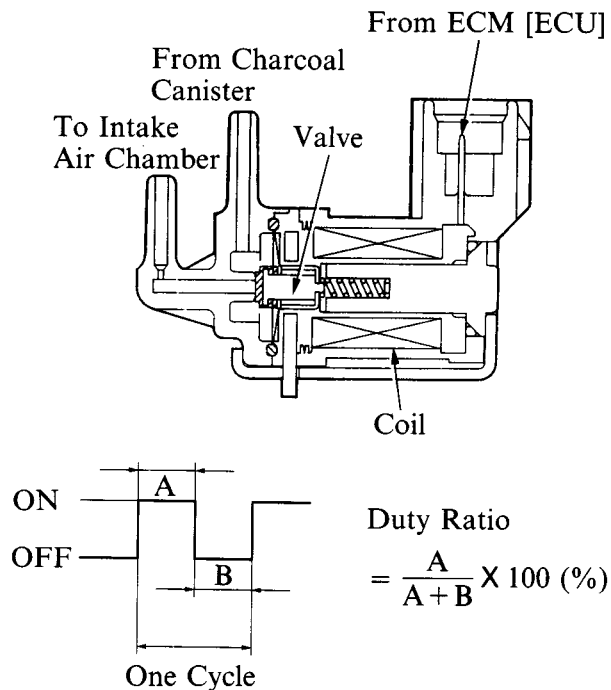
Construction and Operation

1) Construction

a. VSV

The VSV consists of a coil and a valve. This valve is normally close type, so the valve is attached (opened) when current flows to the coil. The action of turning the coil on and off is carried out at high speeds. By changing the duty ratio* of the on and off cycle, the amount the valve is open is adjusted, thus changing the amount of air that passes through.

*: The duty ratio is the ratio of the interval during which current flows in one cycle of a signal. The figure on the right shows one cycle during which current flows and then does not flow.



2) Operation

Purge port A is connected to the charcoal canister via the check valve. When the throttle valve opens, manifold pressure is applied to port A, drawing the evaporative emissions purged by the charcoal canister. Purge port B is connected to the charcoal canister via the VSV.

If the engine operating condition reaches predetermined parameters, the ECM [ECU] sends current to the VSV and the valve opens, thus purging the evaporative emissions.

RELEVANT SIGNALS

- Throttle position (IDL)
- Engine Speed (NE)
- Intake air volume (Ks)
- Engine coolant temperature (THW)
- Vehicle speed (SP1)

16. Diagnosis

The 2JZ-GE engine adopts two mode functions, the normal and test modes, in its diagnostic system. While the normal mode offers the same detecting functions as those of the 7M-GE engine of the previous Toyota Supra, the test mode can detect malfunctions, such as poor contact between terminals or a momentary wire disconnection, two symptoms that are difficult to detect in the normal mode. These two mode functions greatly enhance the capability of the self-diagnostic system and simplify troubleshooting. For details, see the '89 Cressida New Car Features (Pub. No. NCF044U) on page TD-20.

Diagnostic Items

Code No.	Item	Malfunction Indicator Lamp*1		Diagnosis	Malfunction Stored in Memory
		Normal Mode	Test Mode		
12	RPM Signal	ON	N.A.	No "NE" or "G1" and "G2" signal to ECM [ECU] within 2 seconds after cranking. Open in "G(-)" circuit.	Yes
13	RPM Signal	ON	N.A.	No NE signal to ECM [ECU] for 0.1 sec. or more at 1000 rpm or more.	Yes
		N.A.	ON	No 12 pulses of NE to ECM [ECU] during the interval between G1 and G2 pulses.	
14	Ignition Signal	ON	N.A.	No IGF signal to ECM [ECU] for 6 consecutive IGT signals.	Yes
16	Automatic Transmission Control Signal	ON	N.A.	Fault in communications between the engine CPU and automatic transmission CPU in the ECM [ECU].	No
21	Main Oxygen Sensor Signal (on front side)	ON	ON	Main oxygen sensor signal voltage is reduced to between 0.35 V and 0.70 V for 90 sec. under condition (a)-(d). (a) Coolant temp.: Between 80°C and 95°C (176°F and 203°F). (b) Engine speed: 1500 rpm or more. (c) Load driving (E.g. automatic transmission in 4th speed (5th for M/T, A/C ON, Flat road, 80 km/h [50 mph]). (d) Main oxygen sensor signal voltage: Alternating above and below 0.45 V.	Yes
		ON	N.A.	*2 Open or short in heater circuit of main heated oxygen sensor for 0.5 sec. or more.	
22	Engine Coolant Temperature Sensor Signal	ON	ON	Open or short in engine coolant temp. sensor [water temp. sensor] circuit for 0.5 sec. or more.	Yes
24	Intake Air Temp. Sensor Signal	ON	ON	Open or short circuit in intake air temp. sensor circuit for 0.5 sec. or more.	Yes

*1: Malfunction Indicator Lamp ["CHECK" Engine Warning Light]

"ON" displayed on the diagnosis mode column indicates that the Malfunction Indicator Lamp ["CHECK" Engine Warning Light] is lighted up when a malfunction is detected. "OFF" indicates that the "CHECK" does not light up during malfunction diagnosis, even if a malfunction is detected. "N.A." indicates that the item is not included in malfunction diagnosis.

*2: Only for California specification models.

Code No.	Item	Malfunction Indicator Lamp*1		Diagnosis	Malfunction Stored in Memory
		Normal Mode	Test Mode		
25	Air-Fuel Ratio Lean Malfunction	ON	ON	(1) Main oxygen sensor voltage is 0.45 V or less (lean) for 90 sec. under conditions (a) and (b). (a) Coolant temp: 70°C (158°F) or more. (b) Engine speed: 1500 rpm or more.	Yes
26	Air-Fuel Ratio Rich Malfunction			(2) Difference of air-fuel ratio feedback compensation value between front (No. 1 ~ 3 cylinders) and rear (No. 4 ~ 6 cylinders) is more than 15 percentage for 20 sec. or more under conditions (a) and (b). (a) Engine speed: 2000 rpm or more. (b) Coolant temp: Between 60°C and 95°C (140°F and 203°F) (3) Engine speed varies by more than 15 rpm over the preceding crank angle period during a period of 20 sec. or more under conditions (a) and (b). (a) Engine speed: Idling. (b) Coolant temp. Between 60°C and 95°C (140°F and 203°F)	
27*2	Sub-Oxygen Sensor Signal	ON	N.A.	(1) Open or short in heater circuit of sub-oxygen sensor for 0.5 sec. or more.	Yes
		ON	ON	(2) Main oxygen sensor signal is 0.45 V or more and sub-oxygen sensor signal is .045 V or less under conditions (a), (b) and (c). (a) Coolant temp. 80°C (176°F) or more. (b) Engine speed: 1500 rpm or more. (c) Accel. pedal: Fully depressed for 2 sec. or more.	
28	Main Oxygen Sensor Signal (on rear side)	ON	ON	Same as Code No. 21	Yes
31	Volume Air Flow Meter Signal	ON	N.A.	All conditions below are detected. (a) No volume air flow meter signal to ECM[ECU] for 2 sec. when engine speed is above 300 rpm. (b) Engine stall.	Yes
35	Barometric Pressure Sensor [HAC Sensor] Signal	ON	ON	Open or short in barometric pressure [HAC sensor] circuit for 0.5 sec. or more.	YES
41	Throttle Position Sensor Signal	ON	ON	(1) Open or short in throttle position sensor circuit for 0.5 sec. or more.	Yes
				(2) IDL contact is ON and VTA output exceeds 1.5 V for 0.5 sec. or more.	

*1: Malfunction Indicator Lamp [“CHECK” Engine Warning Light]
“ON” displayed on the diagnosis mode column indicates that the Malfunction Indicator Lamp [“CHECK” Engine Warning Light] is lighted up when a malfunction is detected. “OFF” indicates that the “Check” does not light up during malfunction diagnosis, even if a malfunction is detected. “N.A.” indicates that the item is not included in malfunction diagnosis.

*2: Only for California specification models.

Code No.	Item	Malfunction Indicator Lamp*1		Diagnosis	Malfunction Stored in Memory
		Normal Mode	Test Mode		
42	No. 1 Vehicle Speed Sensor Signal (for ECT)	OFF	OFF	All conditions below are detected continuously for 8 sec. or more. (a) Vehicle speed signal: 0 pulses (b) Engine speed: 3000 rpm or more (c) Park/neutral position switch [Neutral start switch] (NSW): OFF (d) Stop light switch: OFF	Yes
	No. 1 Vehicle Speed Sensor Signal (for M/T)			All conditions below are detected continuously for 8 sec. or more. (a) Vehicle speed signal: 0 pulses (b) Engine speed: Between 2000 rpm and 5000 rpm. (c) Coolant temp: Between 80°C (176°F) or more. (d) Load applied	
43	Starter Signal	N.A.	OFF	No starter signal to ECM [ECU].	No
52	No. 1 Knock Sensor Signal	ON	N.A.	No No. 1 knock sensor signal to ECM [ECU] for 4 crank revolutions with engine speed between 1600 rpm ~ 5200 rpm.	Yes
53	Knock Control Signal	ON	N.A.	Engine control computer (for knock control) malfunctions at engine speed between 650 rpm and 5200 rpm.	Yes
55	No. 2 Knock Sensor Signal	ON	N.A.	No No. 2 knock sensor signal to ECM [ECU] for 4 crank revolutions with engine speed between 1600 rpm ~ 5200 rpm.	Yes
71	EGR System Malfunction	ON	ON	EGR gas temp. is 70°C (158°F) or below for 1 ~ 4 min. under conditions (a) or (b). (a) Coolant temp: 63°C (145°F) or more. (b) EGR operation possible (E.g. automatic transmission in 3rd speed (5th for M/T), A/C ON, 96 km/h [60 mph], flat road).	Yes
78	Fuel Pump Control Signal	N.A.	ON	(1) Open or short in fuel pump circuit for 1 sec. or more with engine speed 1000 rpm or less.	Yes
				(2) Open in input circuit of fuel pump ECU (FPC) with engine speed 1000 rpm or less.	
				(3) Open or short in diagnostic signal line (DI) of fuel pump ECU with engine speed 1000 rpm or less.	
51	Switch Condition Signal	N.A.	OFF	(1) 3 sec. or more after engine starts, idle switch [closed throttle position switch]. OFF (IDL). (2) Park/neutral position switch [Neutral start switch] OFF (NSW). (Shift position in "R", "D", "2", or "L" ranges). (3) A/C switch ON.	No

*1: Malfunction Indicator Lamp ["CHECK" Engine Warning Light]

"ON" displayed on the diagnosis mode column indicates that the Malfunction Indicator Lamp ["CHECK" Engine Warning Light] is lighted up when a malfunction is detected. "OFF" indicates that the "CHECK" does not light up during malfunction diagnosis, even if a malfunction is detected. "N.A." indicates that the item is not included in malfunction diagnosis.

17.Fail Safe

As in the 7M-GE engine for the previous Toyota Supra, the 2JZ-GE engine has a fail-safe function and back-up function. The basic function and operation are the same as in the 7M-GE engines.

Fail-Safe Function

The following table compares the fail safe function of the 2JZ-GE and 7M-GE engines.

Circuit with Abnormal Signals	Fail Safe Function	2JZ-GE	7M-GE
Ignition Confirmation Signal (IGF)	Fuel injection is stopped.		
Engine Coolant Temp. Sensor Signal* (THW) Intake Air Temp. Sensor Signal (THA)	Fixed values(standard values) are used; 80°C (176°F) for coolant temp. and 20°C (68°F) for intake air temp.		
Volume Air Flow Meter Signal (Ks)	Fixed (standard) values based on the condition of the STA signal and IDL contacts are used for the fuel injection duration and the ignition timing (5° BTDC), making engine operation possible.		—
Barometric Pressure Sensor Signal (HAC)	A fixed value of 101 kPa (760 mmHg) is used.		—
Throttle Position Sensor Signal (VTA)	A fixed value of 0° throttle valve opening angle is used.		
Knock Sensor Signal (KNK) Knock Control System	The corrective retard angle value is set to the maximum value.		
Transmission Control Signal	Torque control correction by the ESA is prohibited.		

*: Engine Coolant Temp. Sensor [Water Temp. Sensor]

Back-Up Function

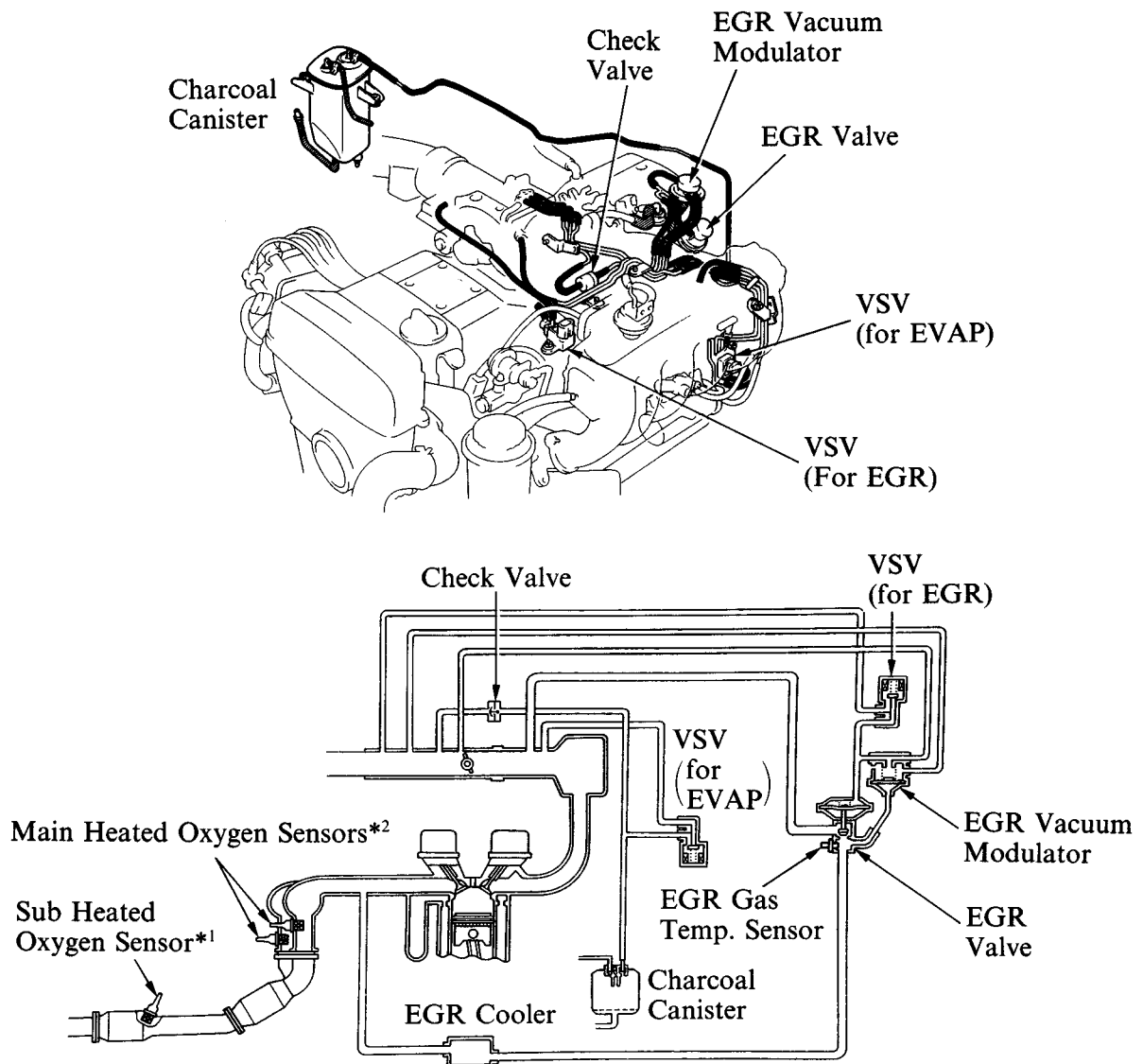
The back-up function of the 2JZ-GE engine is basically the same as in the 7M-GE engine.

EMISSION CONTROL SYSTEM

1. System Purpose

System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow-by gas (HC)
Evaporative emission control	EVAP	Reduces evaporative HC
Exhaust gas recirculation	EGR	Reduces NOx
Three-way catalytic converter	TWC	Reduces HC, CO and NOx
Sequential multiport fuel injection [Electronic fuel injection]	SFI [EFI]	Regulates all engine conditions for reduction of exhaust emission

2. Components Layout and Schematic Drawing



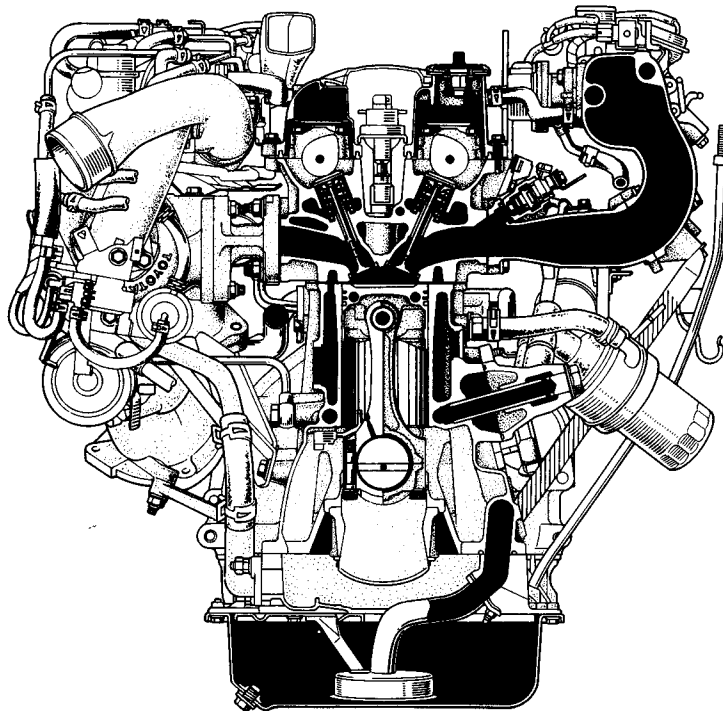
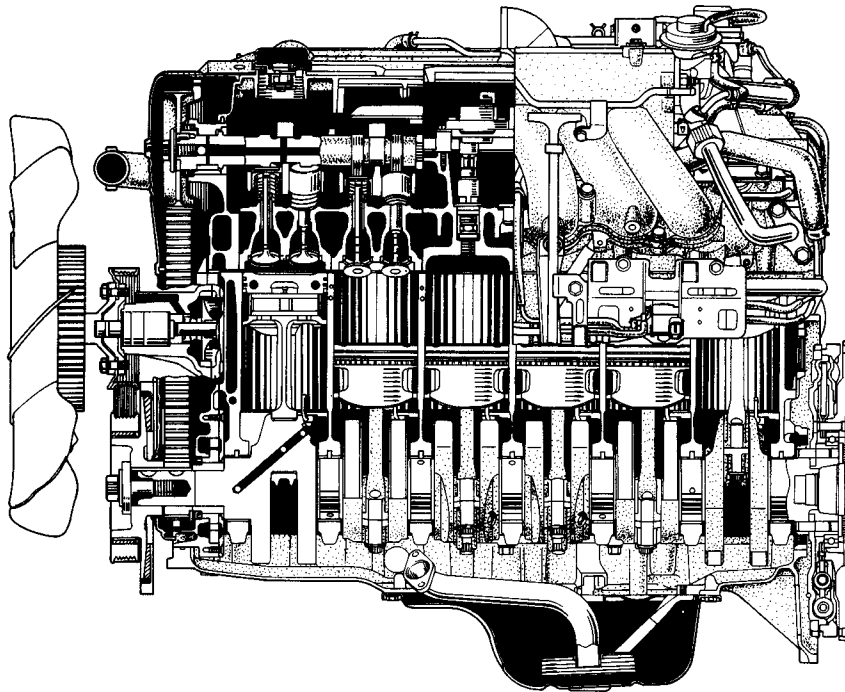
*1: Applicable only to California specification models.

*2: "Main Heated Oxygen Sensors" are used in California specification models. The other models use "Main Oxygen Sensors".

2JZ-GTE ENGINE

DESCRIPTION

An inline 6-cylinder, 3.0-liter, 24-valve DOHC engine with twin turbochargers and charge air cooler [intercooler], the 2JZ-GTE engine is a newly developed engine which replaces the previous 7M-GTE engine. By using two turbochargers, this Two-Way Twin Turbo System offers both superior power output and responsiveness. Furthermore, this engine adopts the DIS (Direct Ignition System) which discontinues the use of distributor and high-tension cords for an efficient secondary current delivery to the spark plugs. These improvements have made the 2JZ-GTE engine the most powerful and responsive engine in the 3.0-liter class.

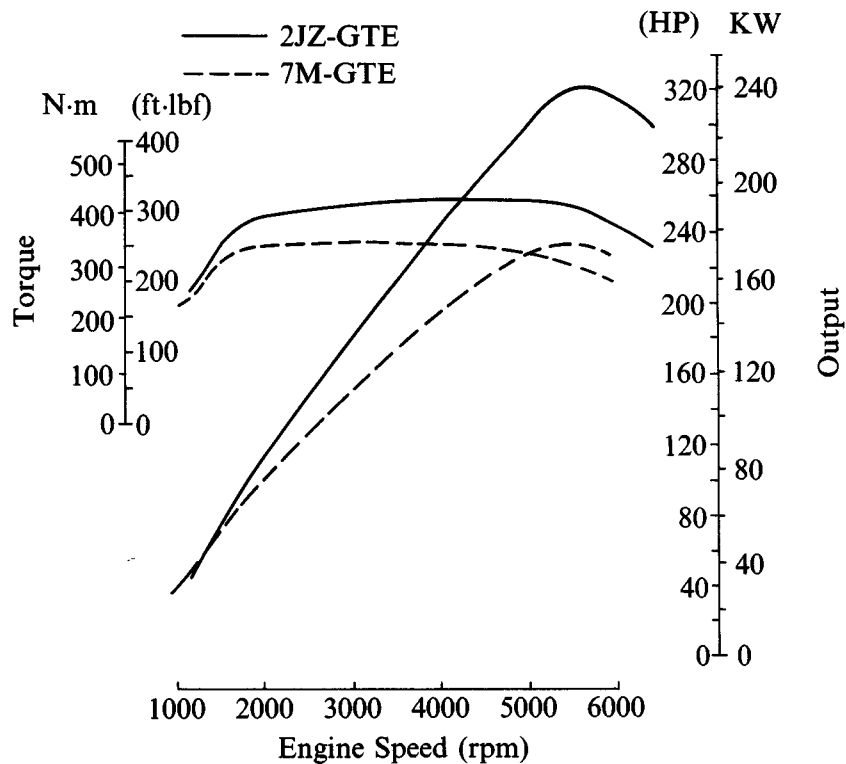


ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

Engine		2JZ-GTE	7M-GTE	
Item				
No. of Cyls. & Arrangement		6-Cylinder, In-Line	←	
Valve Mechanism		24-Valve DOHC, Belt Drive	←	
Combustion Chamber		Pentroof Type	←	
Manifold		Cross-Flow	←	
Fuel System		SFI* ¹ [EFI]	MFI* ² [EFI]	
Displacement	cm ³ (cu. in.)	2997 (182.9)	2954 (180.3)	
Bore x Stroke	mm (in.)	86.0 x 86.0 (3.39 x 3.39)	83.0 x 91.0 (3.27 x 3.58)	
Compression Ratio		8.5 : 1	8.4 : 1	
Firing Order		1-5-3-6-2-4	←	
Max. Output	[SAE-NET]	239 kW @ 5600 rpm (320 HP @ 5600 rpm)	173 kW @ 5600 rpm (232 HP @ 5600 rpm)	
Max.Torque	[SAE-NET]	427 N·m @ 4000 rpm (315 ft·lbf @ 4000 rpm)	344 N·m @ 3200 rpm (254 ft·lbf @ 3200 rpm)	
Valve Timing	Intake	Open	3° BTDC	6° BTDC
		Close	50° ABDC	←
	Exhaust	Open	52° BBDC	53° BBDC
		Close	4° ATDC	3° ATDC
Fuel Octane Number	RON	96	91	
Oil Grade		API SG, EC-II	API SG	

*1: SFI (Sequential Multiport Fuel Injection)

*2: MFI (Multiport Fuel Injection)



FEATURES OF 2JZ-GTE ENGINE

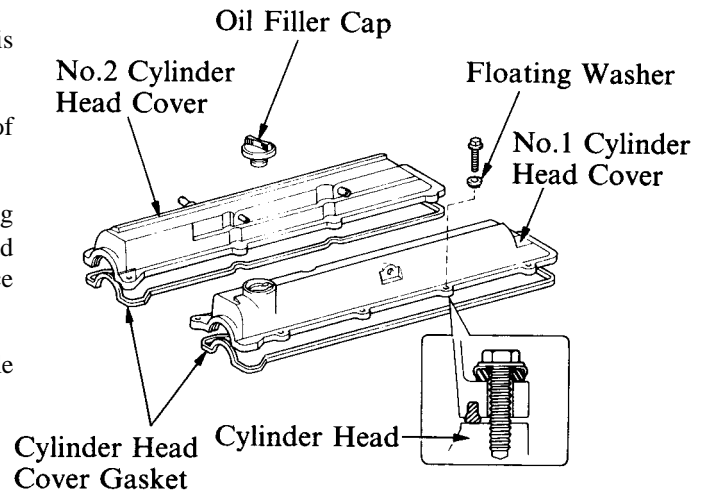
Features of the 2JZ-GTE engine are as listed below.

Features	Contents
High Performance and Economy	<ul style="list-style-type: none"> ◀ The Two-Way Twin-Turbo System, in which two small turbochargers are used, offers high power output and response. ◀ The DIS (Direct Ignition System) contributes to the high powerful output by providing a powerful spark to the engine. ◀ The hot-wire type mass air flow meter improves the accuracy of the intake air volume measurement. ◀ Together with the adoption of the pentroof type combustion chamber, the cylinder head intake port has been offset from the combustion chamber center. This causes a swirl to generate in the cylinder and improve the combustion efficiency. ◀ Higher intake and exhaust efficiency is realized by a large valve diameter and a high valve lift. ◀ A water-cooled, multi-plate full-flow type oil cooler is adopted. ◀ A large-capacity air cleaner is adopted. ◀ Twin knock sensors.
Lightweight and Compact Design	<ul style="list-style-type: none"> ◀ A compact, lightweight accessory drive system by means of a serpentine single belt and bracketless accessory installation. ◀ The oil pan, engine mounting bracket, engine mounting insulator housing and crankshaft pulley's torsional damper hub are made of aluminum.
Low Noise and Vibration	<ul style="list-style-type: none"> ◀ An aluminum oil pan having an integral stiffener. ◀ Aluminum engine mount brackets and liquid filled compound engine mounts. ◀ A rigid and accurately balanced crankshaft assembly. ◀ An aluminum torsional damper hub for the crankshaft pulley. ◀ Bracketless accessory installation. ◀ In addition to the automatic tensioner for the V-ribbed belt provided on the newly adopted V160 manual transmission model, a hydraulic damper is used to prevent the occurrence of belt deflection and whine in conjunction with a variation in engine rpm.
Good Serviceability	<ul style="list-style-type: none"> ◀ The new DIS makes the ignition timing adjustment unnecessary. ◀ Automatic tensioners are provided the timing belt and V-ribbed belt. ◀ An engine oil level sensor is used. ◀ A highly durable timing belt is used.

ENGINE PROPER

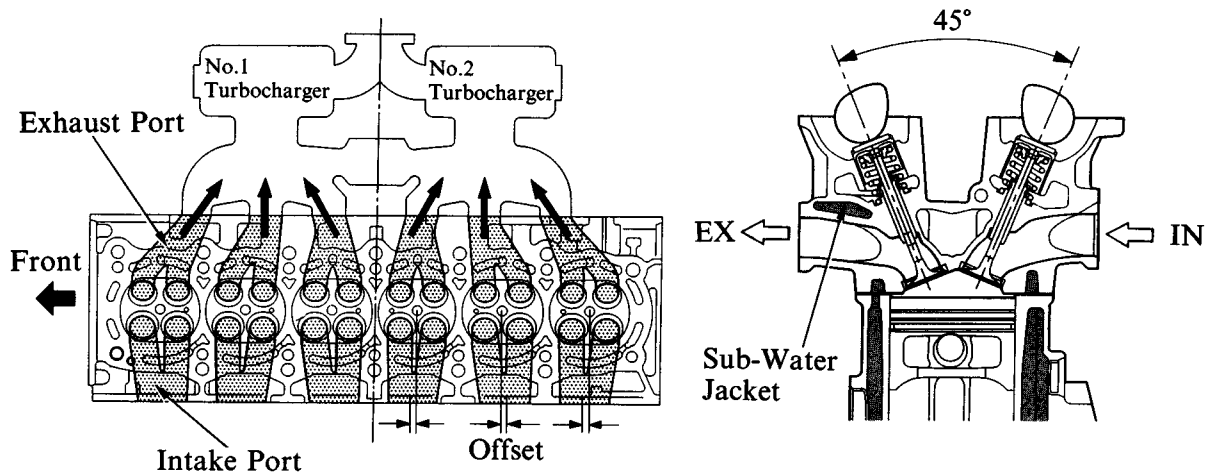
1. Cylinder Head Cover

- ◀ A 2-part type aluminum cylinder head cover is used.
- ◀ The cylinder head cover gaskets are made of acrylic rubber with superior heat resistance.
- ◀ The floating rubber washers used in fastening the cylinder head covers to the cylinder head allow the covers to float and helps to reduce noise.
- ◀ The oil filler cap locks in place easily by a single twist of the cap.



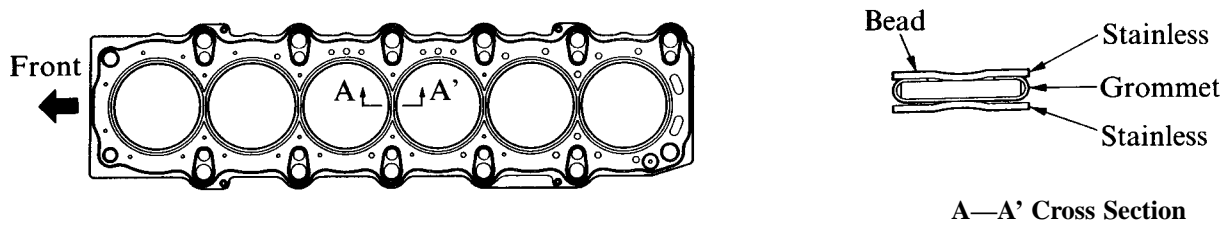
2. Cylinder Head

- ◀ The cylinder head is made of an aluminum alloy with superior thermal conductivity.
- ◀ The combustion chamber is a 4-valve pentroof type with the valves angled at 45 degrees from each other. The spark plugs are located near the center of the combustion chamber for improved anti-knocking performance and combustion efficiency.
- ◀ By offsetting the intake port center line away from the center of the combustion chamber, a swirl is generated in the cylinder. This promotes fuel atomization and improves the engine's combustion efficiency and anti-knocking performance.
- ◀ As illustrated below, the exhaust ports 1, 2, and 3 are grouped together, and so are the exhaust ports 4, 5 and 6. The exhaust pressure transmission efficiency is improved by directing the exhaust gas flow to each of the turbochargers in this manner.
- ◀ A sub-water jacket is provided above the exhaust port to accommodate the cooling needs of this high-performance engine.
- ◀ Plastic region tightening bolts are used for the cylinder head.



3. Cylinder Head Gasket

A 4-layer metal gasket with a superior durability is used for the cylinder head gasket. In addition, formed beads are applied onto the two outer stainless steel plates to improve the gasket's sealing ability.

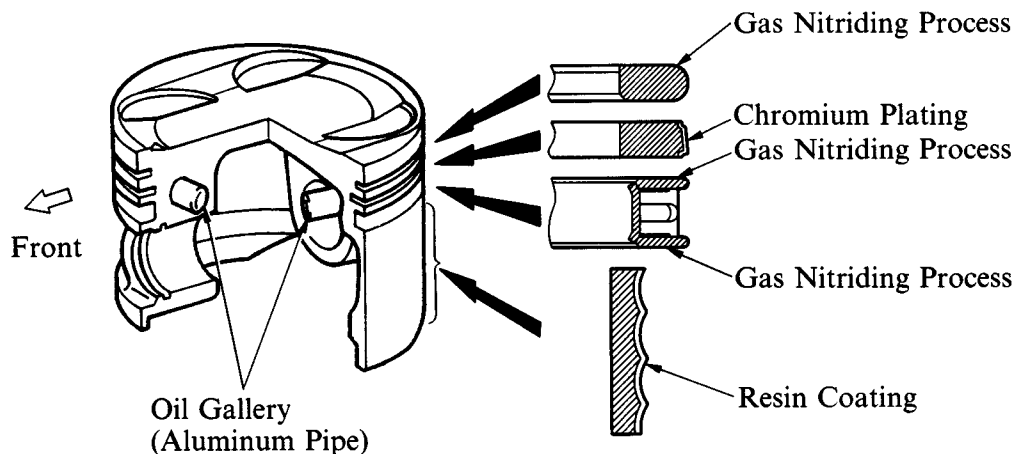


4. Cylinder Block

The cylinder block of the 2JZ-GTE engine is basically the same as that of the 2JZ-GE engine. For more information on the features of the 2JZ-GTE engine cylinder block, see page 36 of the engine section of the 2JZ-GE engine.

5. Pistons

- ◀ Pistons are made of aluminum alloy having outstanding high-temperature strength.
- ◀ An oil gallery in the form of an aluminum pipe is cast into the upper part of the piston in order to improve the piston's cooling performance. For more information on the oil gallery, see page 83 of the Lubrication System.
- ◀ The piston rings used are highly abrasion-resistant. The No. 1 compression ring surface and the oil ring side rails have been gas-nitrided, and the No. 2 compression ring surface chromium plated.
- ◀ The piston skirt area has been coated with resin for enhanced abrasion resistance.



6. Connecting Rods, Crankshaft and Crankshaft Pulley

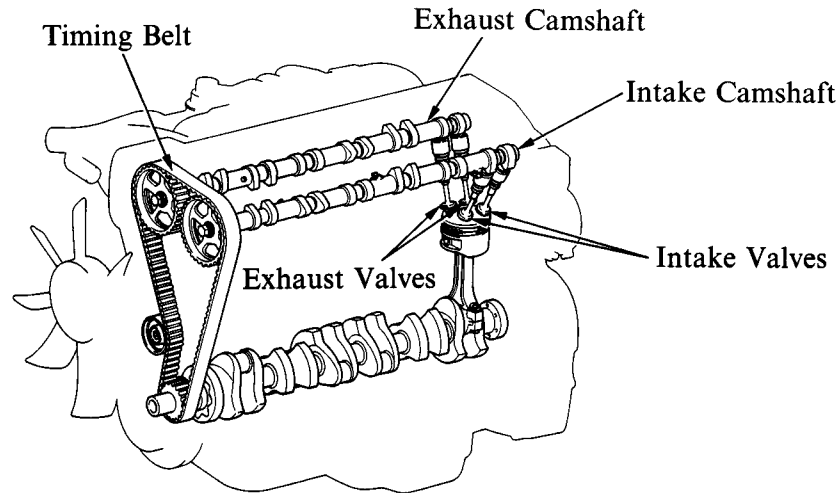
The connecting rods, crankshaft, and crankshaft pulley of the 2JZ-GTE engine are the same as those of the 2JZ-GE engine. For more information on the features of these components, see page 37 and 38 of the 2JZ-GE engine section.

VALVE MECHANISM

1. General

The valve mechanism of the 2JZ-GTE engine is basically the same as that of the 2JZ-GE engine. However, the valve timing and valve lift specifications have been revised to best suit the 2JZ-GTE engine.

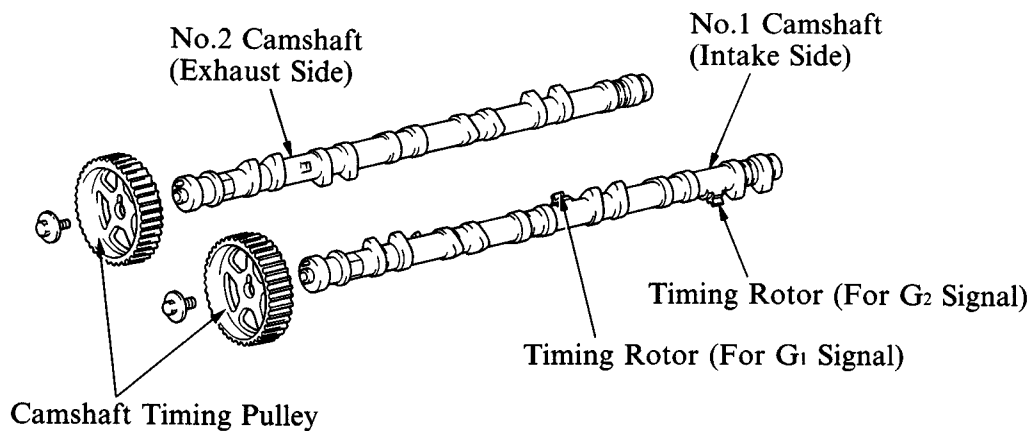
In conjunction with the use of the DIS (Direct Ignition System), the intake camshaft is provided with timing rotors to trigger the camshaft position sensors.



2. Camshafts

The 2JZ-GTE engine camshafts differ from those of the 2JZ-GE engine in the following areas:

- Ⓔ In conjunction with the use of the DIS (Direct Ignition System), the intake camshaft is provided with timing rotors to trigger the camshaft position sensors.
- Ⓔ The valve timing and valve lift specifications have been revised to best suit the 2JZ-GTE engine.



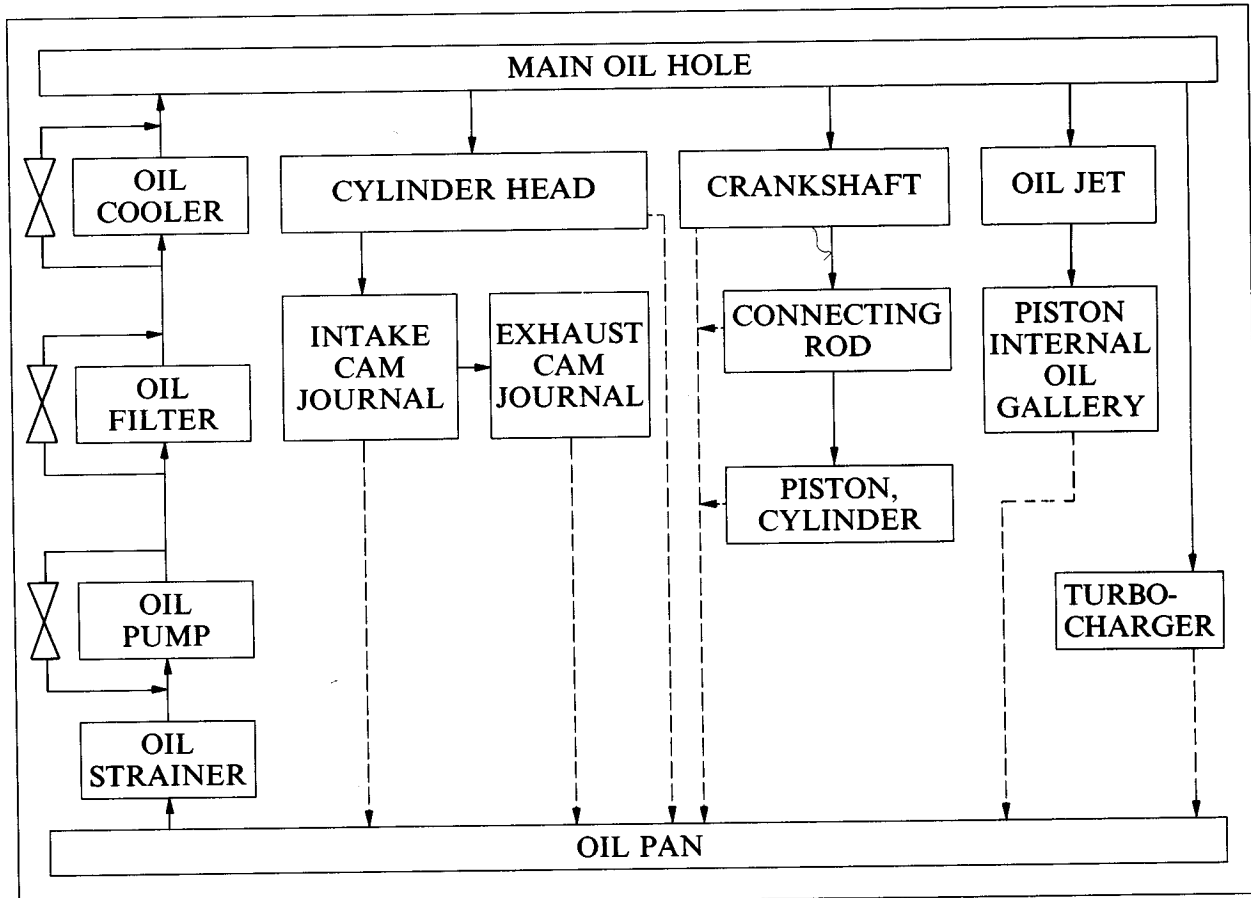
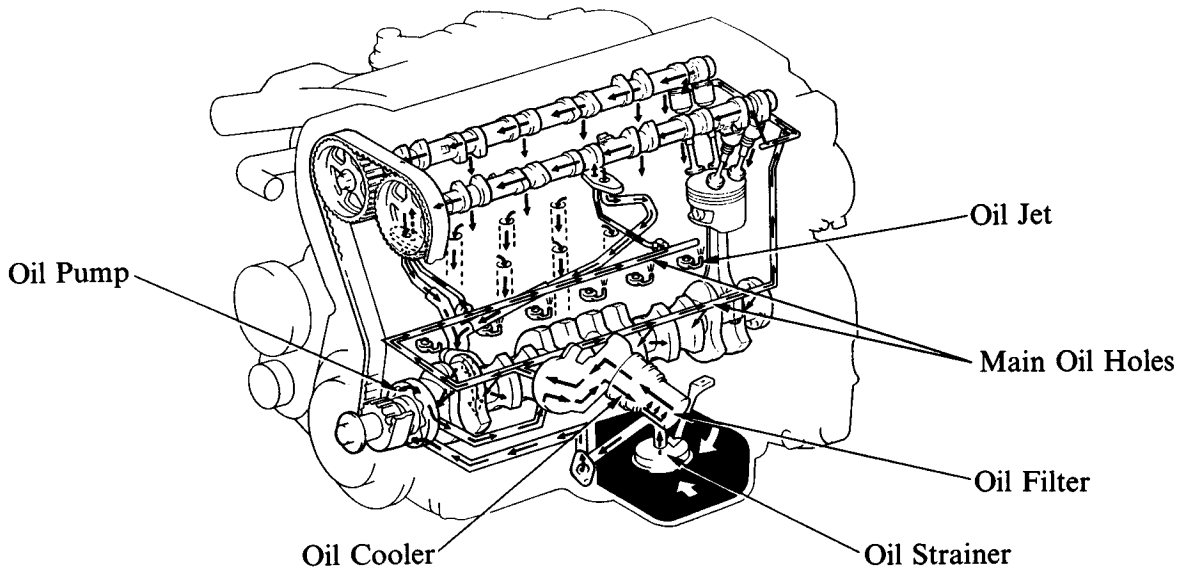
Specifications ◀

Valve Lift mm (in.)	IN	8.25 (0.325)	
	EX	8.40 (0.331)	
Valve Timing	IN	Open	3° BTDC
		Close	50° ABDC
	EX	Open	52° BBDC
		Close	4° ATDC

LUBRICATION SYSTEM

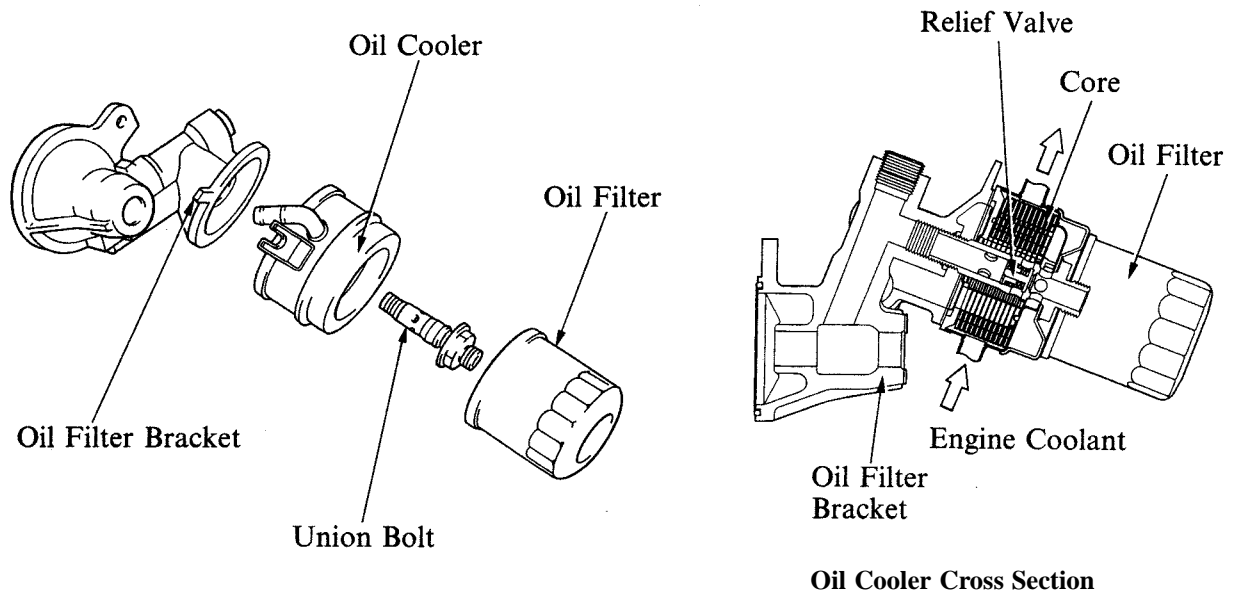
1. General

The lubrication system in the 2JZ-GTE engine is basically the same as that of the 2JZ-GE engine. However, a water-cooled oil cooler is equipped in the 2JZ-GTE engine to cool the engine oil, and oil jets are provided in the cylinder block to cool the pistons.



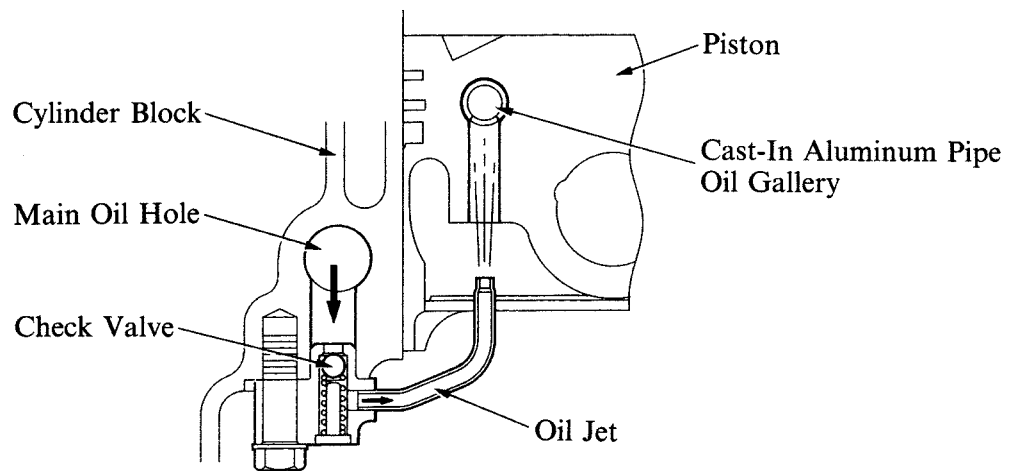
2. Oil Cooler

The 2JZ-GTE engine is equipped with a water-cooled, multi-plate, full-flow type oil cooler between the oil filter and oil filter bracket, to cool the engine oil. The oil filter bracket is made of a lightweight magnesium alloy.



3. Oil Jets

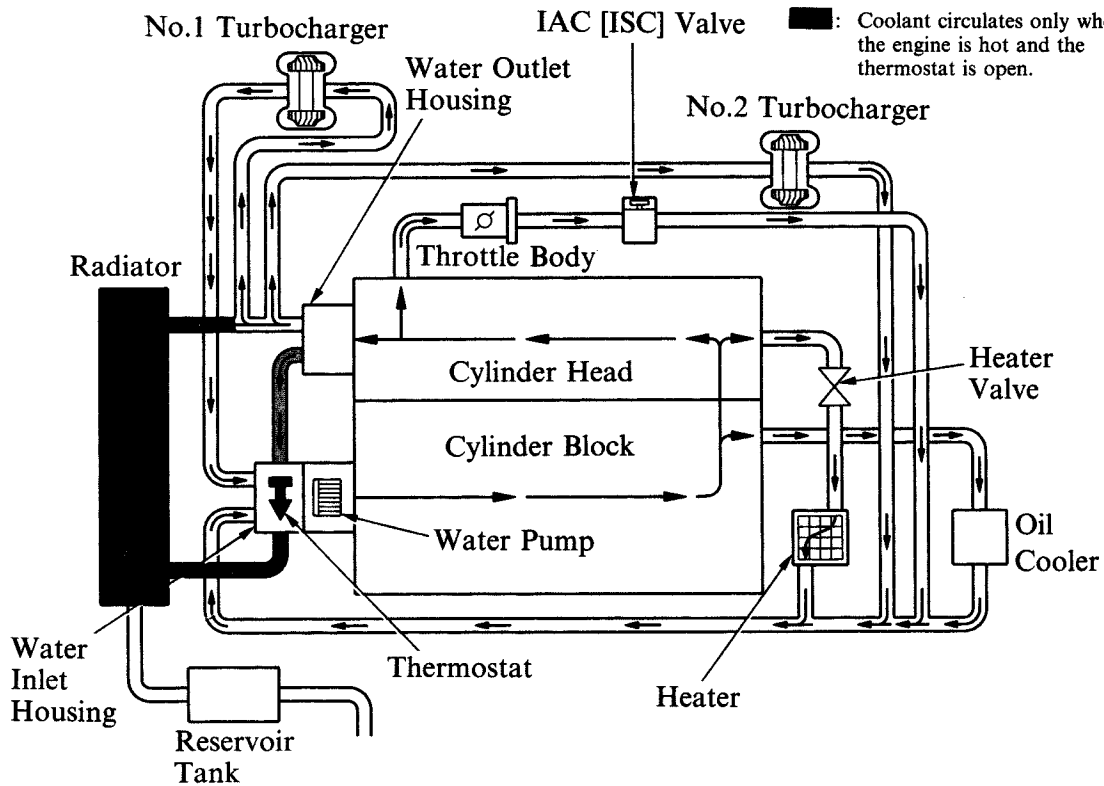
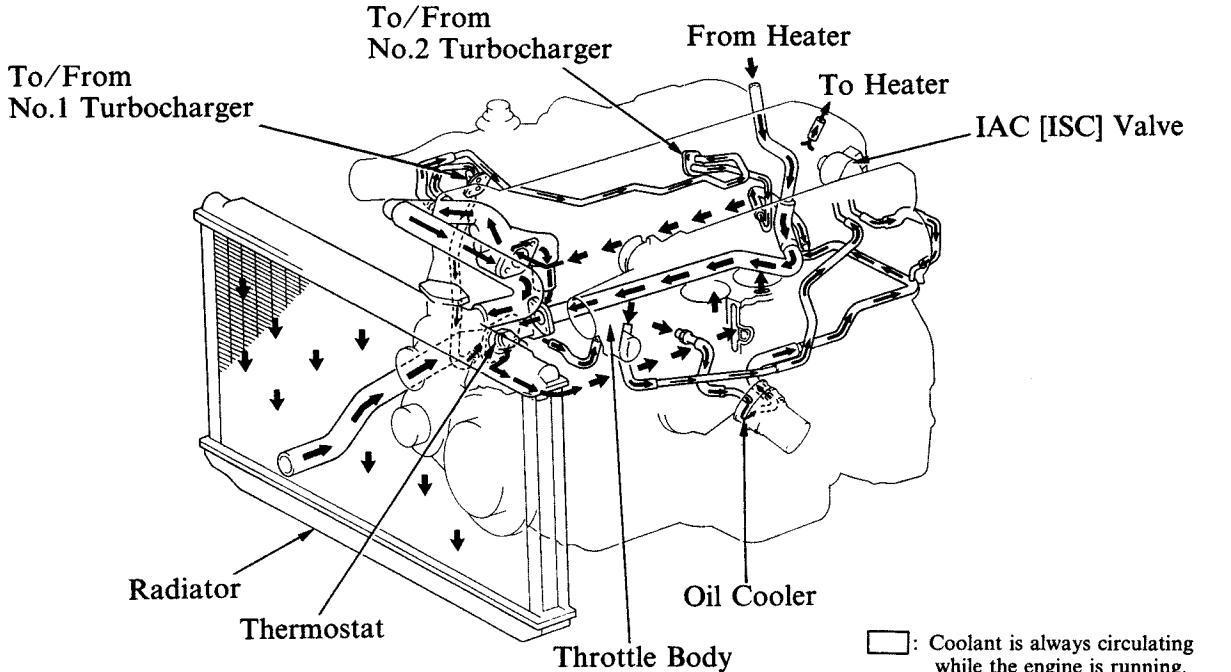
One of the methods adopted by the 2JZ-GTE engine to cool the piston is to spray engine oil on the bottom of the piston, on the side of the connecting rod. Accordingly, there is an oil jet provided for each cylinder. The oil that is sprayed onto the bottom of the piston enters the piston hole located directly above the oil jet, and flows into the oil gallery (an aluminum pipe which is cast into the piston) to cool the piston from the inside. The oil will then come out from the hole located opposite to the hole through which it has entered the oil gallery.



COOLING SYSTEM

1. General

The 2JZ-GTE engine cooling system is the same pressurized, forced-circulation type as that used in the 2JZ-GE engine. In order to optimally match the high performance of the 2JZ-GTE engine with its Two-Way Twin Turbo System, a cooling circuit has been provided for the turbochargers as well as for the engine oil cooler.



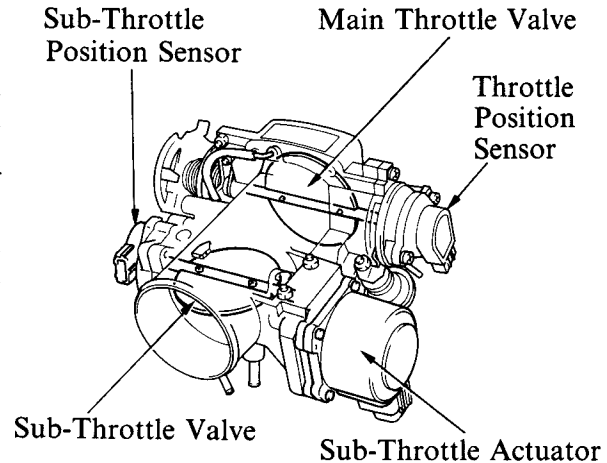
INTAKE AND EXHAUST SYSTEM

1. Air Cleaner

The 2JZ-GTE engine is equipped with the same large-capacity air cleaner adopted in the 2JZ-GE engine, with a filter element cap provided on the air cleaner case for ease of servicing.

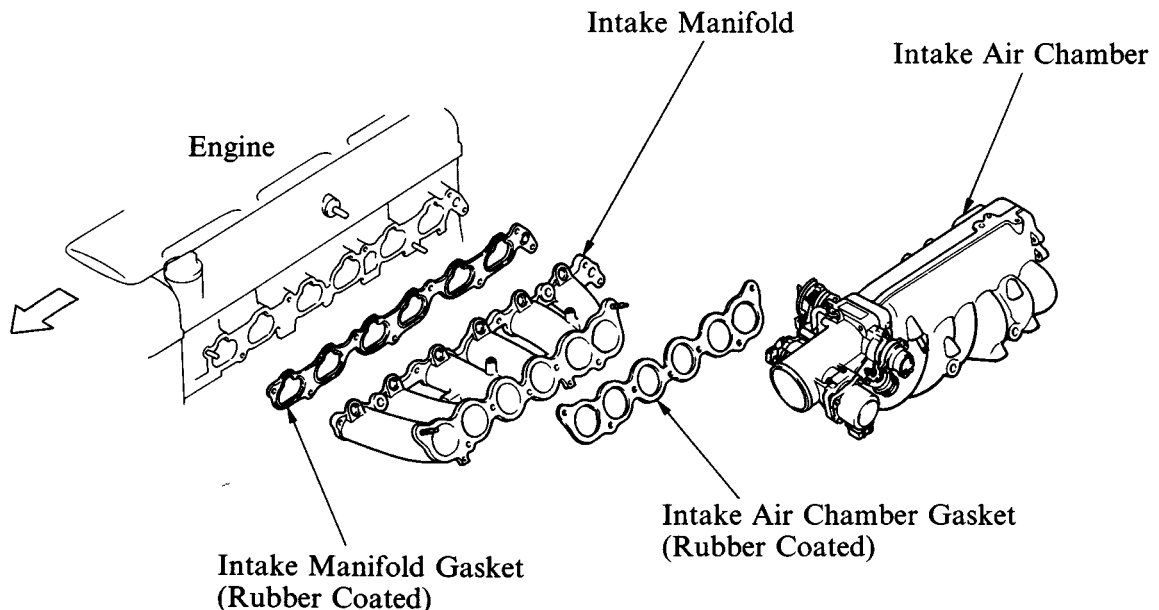
2. Throttle Body

In conjunction with adoption of the TRAC (Traction Control) system, the throttle body of the 2JZ-GTE engine comes newly equipped with a sub-throttle valve (with sub-throttle actuator and sub-throttle position sensor). Having these parts integrated into one unit reduced the number of components, and contributed in reducing weight. Furthermore, in order to prevent the drive wheel from slipping during a takeoff or sudden acceleration, the TRAC system is designed to close the sub-throttle valve to reduce the engine speed, and to effect braking.



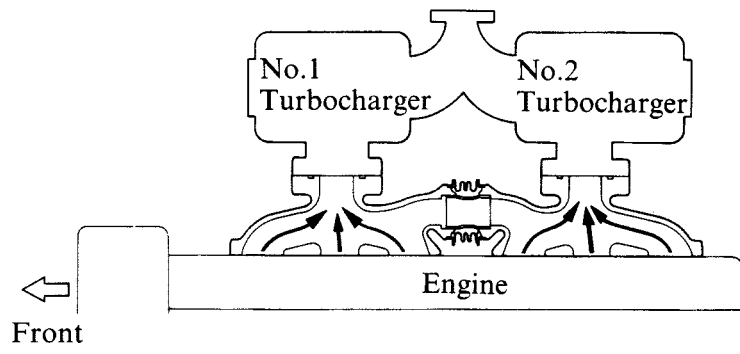
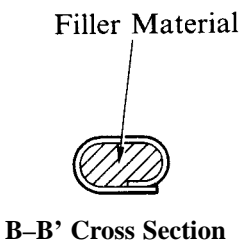
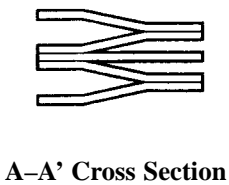
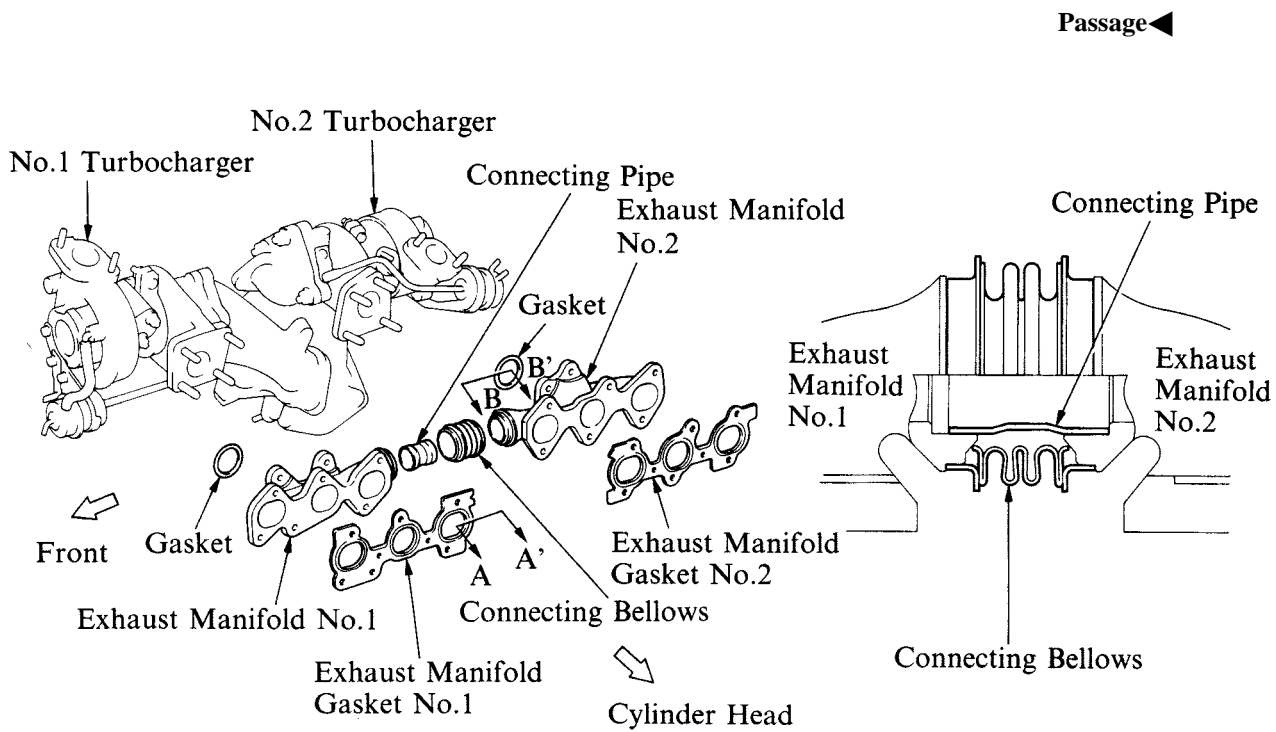
3. Intake Manifold and Intake Air Chamber

- Ⓡ The intake manifold and intake air chamber are made of cast aluminum alloy.
- Ⓡ The intake passages of the intake air chamber are separated into two parts, each part handling three cylinders.
- Ⓡ The intake manifold gasket and intake air chamber gasket have rubber coating applied onto both surfaces, and offers a superior durability.



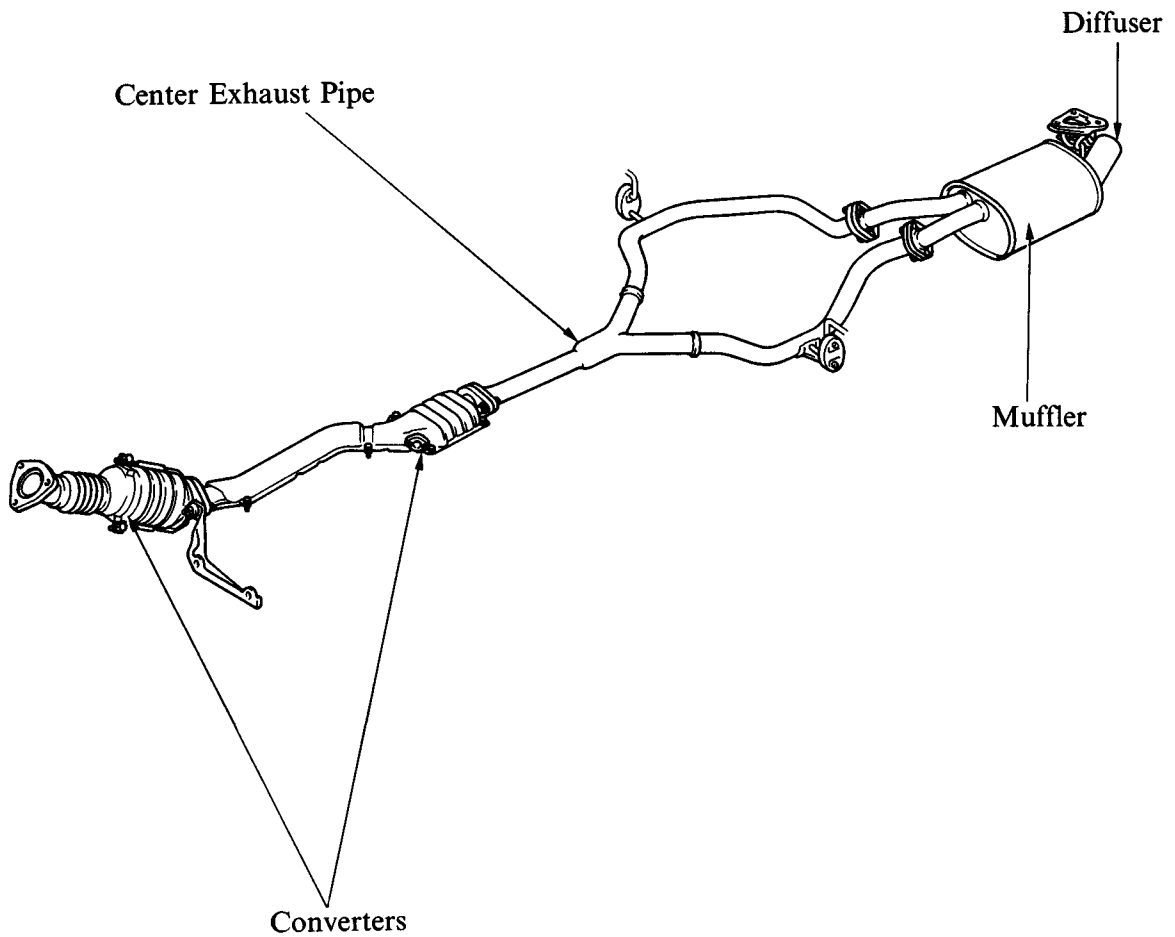
4. Exhaust Manifold

- Ⓡ The exhaust manifolds are made of heat-resistant cast steel with superior heat-resisting and acid-resisting capacities. The exhaust manifolds are separated into two parts, each part handling three cylinders grouped 1, 2, 3, and 4, 5, 6. The exhaust pressure transmission efficiency is improved in this manner by having each exhaust manifold direct the exhaust gas flow to each of the turbochargers.
- Ⓡ In conjunction with the adoption of the Two-Way Twin Turbo System, a passage has been provided between the No. 1 and No. 2 exhaust manifolds. As illustrated below, this passage is of a dual construction consisting of a stainless-steel connecting pipe and connecting bellows. This construction allows the connecting bellows to dissipate heat without directly coming into contact with the hot exhaust gas, and minimize the warpage of the exhaust manifolds due to heat.
- Ⓡ The highly durable 5-layer stainless laminate type gaskets are used for the exhaust manifold gaskets.
- Ⓡ Stainless-plate rings containing filler material are used for the gaskets between the exhaust manifold and the turbochargers.



5. Exhaust Pipe

The exhaust pipe for the 2JZ-GTE engine is the same stainless steel type used for the 2JZ-GE engine. Also, monolithic type, three-way catalytic converters containing metallic substrate are used in this exhaust system. The exhaust pipe outputs an exhaust sound to match the vehicle's sporty image.

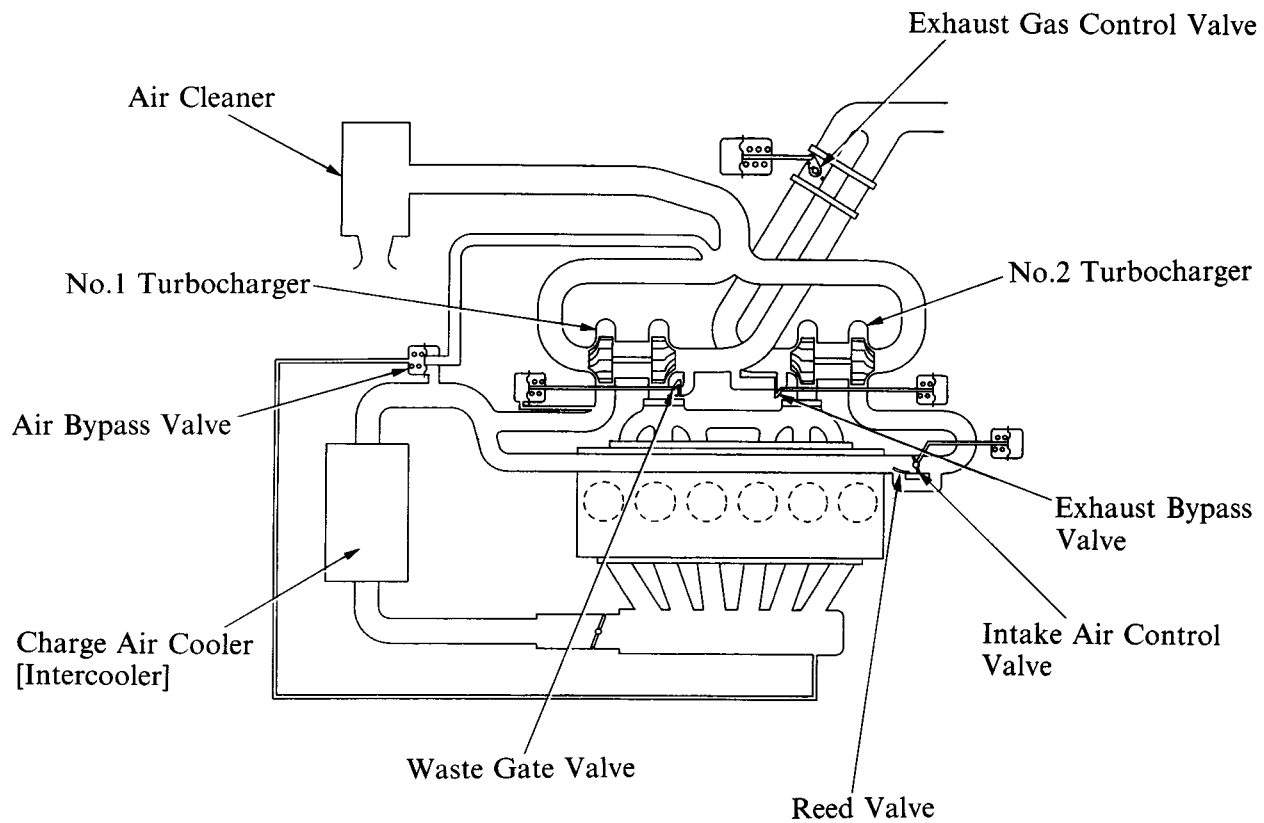


TURBOCHARGER SYSTEM

1. General

In the place of the single turbocharger system used in the 7M-GTE engine, the 2JZ-GTE engine adopts the Two-Way Twin Turbo System which uses two turbochargers. Under this system, the two compact turbochargers provide separate functions according to the engine running condition. While one turbocharger gives boost at low rpm and low engine load conditions, the two turbochargers together give boost at high rpm and high engine load conditions for increased output.

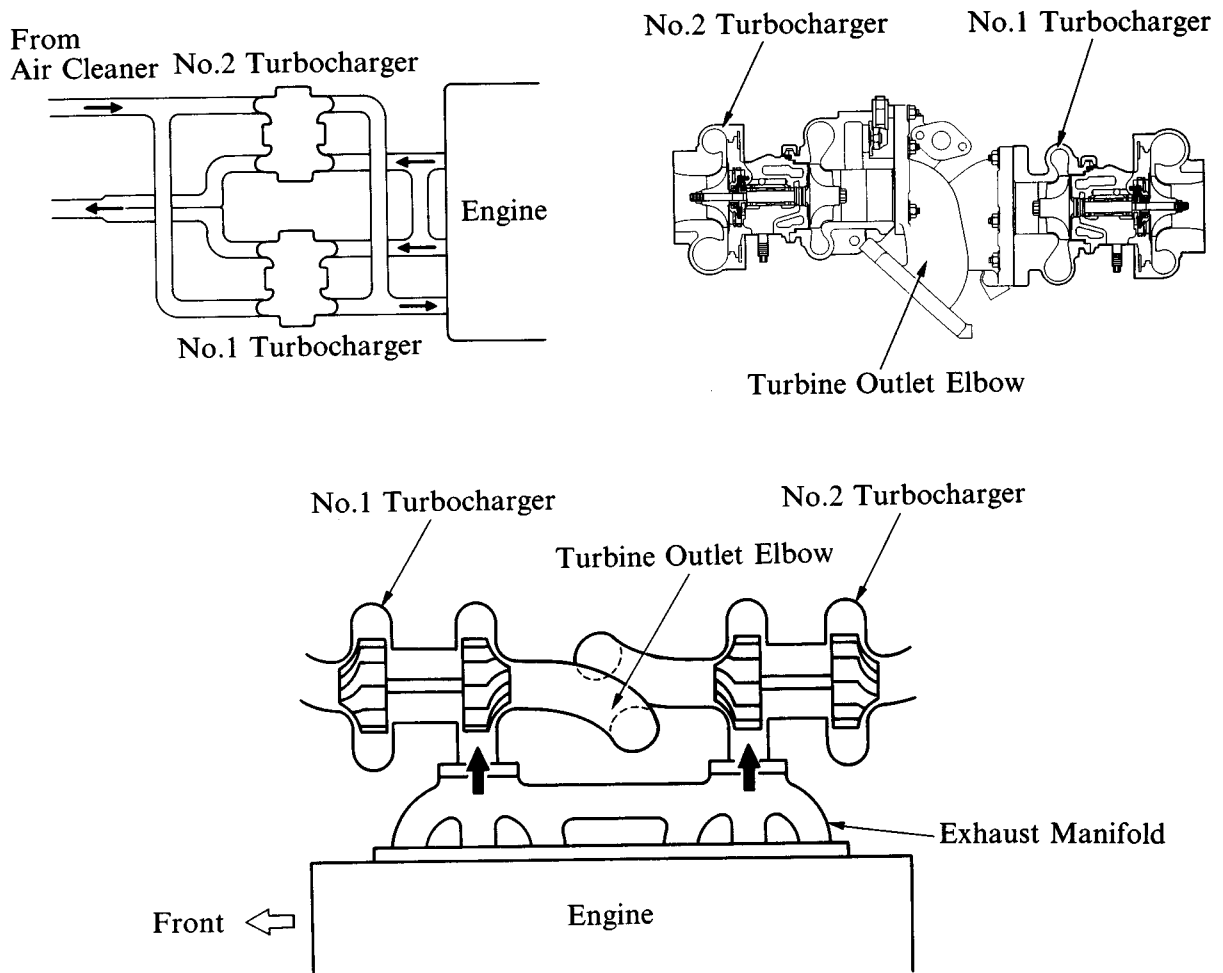
System Diagram ◀



2. Components of Turbocharger System

Twin Turbochargers

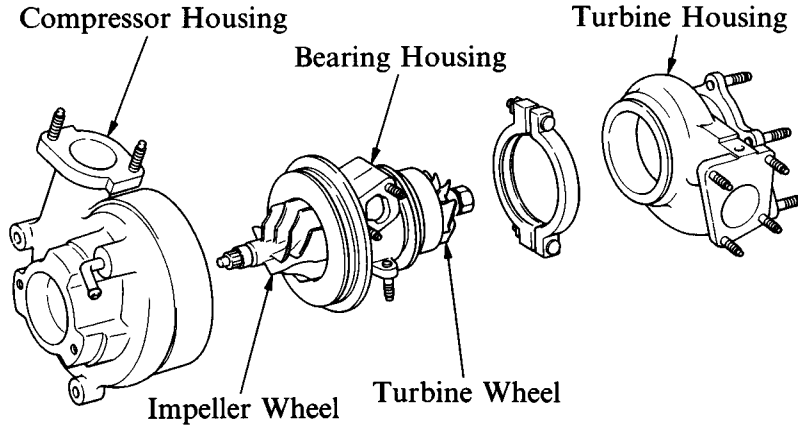
- ⑥ As illustrated below, the 2JZ-GTE engine is equipped with two lightweight and compact turbochargers placed parallel to the line of flow from the intake to exhaust.
- ⑥ The twin-turbocharger assembly consists of the No. 1 turbocharger, No. 2 turbocharger, and turbine outlet elbow, as illustrated below.
- ⑥ By directly mounting the twin-turbocharger assembly onto the exhaust manifolds, the exhaust gas travel is made extremely short and direct. This results in an efficient transmission of power to the turbochargers with a minimal exhaust gas pressure loss.



1) Turbocharger Housing

Each of the turbochargers can be broadly divided in the following three housings: compressor, bearing and turbine housings.

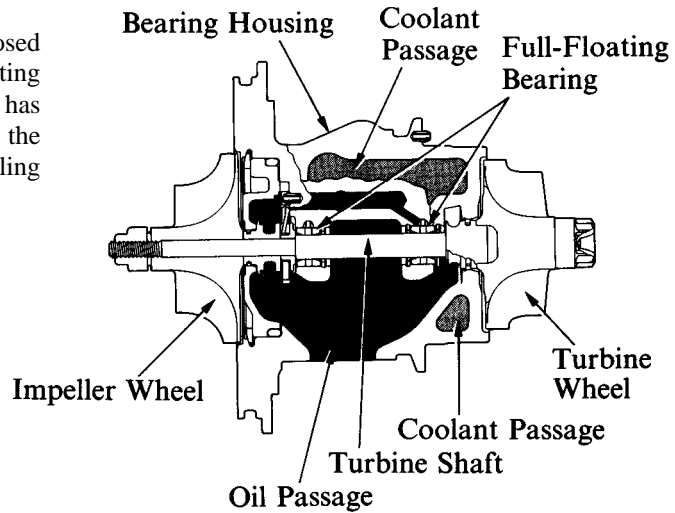
The compressor housing is made of cast aluminum alloy, and the turbine housing of highly heat-resistant steel. The bearing housing is made of gray cast steel, in which compact and lightweight impeller and turbine wheels are enclosed.



No. 1 Turbocharger

a. Bearing housing

The impeller and turbine wheels are enclosed in the bearing housing via full-floating bearings. In addition, a coolant passage has been provided in the housing around the turbine wheel for improving the cooling efficiency of its shaft.

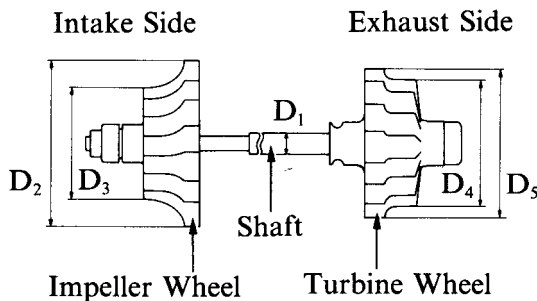


i) Turbine Wheel and Impeller Wheel

Both the No. 1 and No. 2 turbochargers features compact and lightweight turbine and impeller wheels. The turbine wheel is made of metal. The acceleration response of these turbochargers has been improved by making their shafts and wheels compact and lightweight.

Specifications ◀

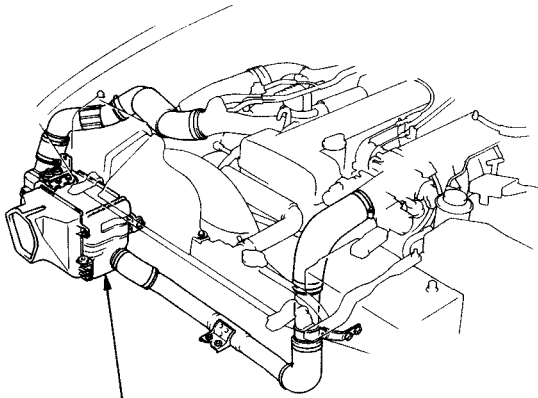
mm (in.)



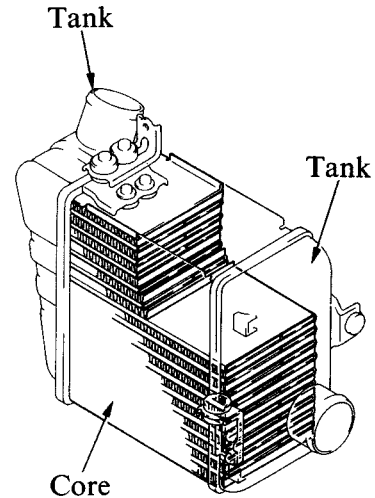
Engine			
Item		2JZ-GTE	7M-GTE
Shaft Diameter		D ₁	7.5 (0.295) / 10.0 (0.394)
Impeller Wheel	Outlet Diameter	D ₂	58.0 (2.283) / 65.0 (2.559)
	Inlet Diameter	D ₃	39.0 (1.535) / 46.0 (1.811)
Turbine Wheel	Outlet Diameter	D ₄	44.0 (1.732) / 52.0 (2.047)
	Inlet Diameter	D ₅	52.0 (2.047) / 68.0 (2.677)

Charge Air Cooler [Intercooler]

- Ⓡ This turbocharger system adopts an air-cooled, tube type charge air cooler [intercooler] located in the front part of the right front wheel housing.
- Ⓡ Large-diameter air tubes and hoses are used to accommodate large airflow and reduce its pressure loss.
- Ⓡ The charge air cooler [intercooler] tank and air tubes are made lightweight using plastic.



Charge Air Cooler [Intercooler]

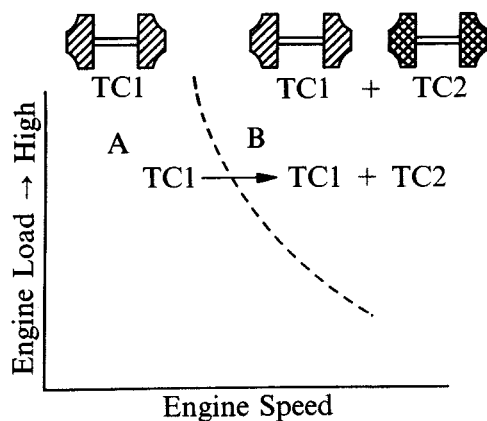


Charge Air Cooler [Intercooler]

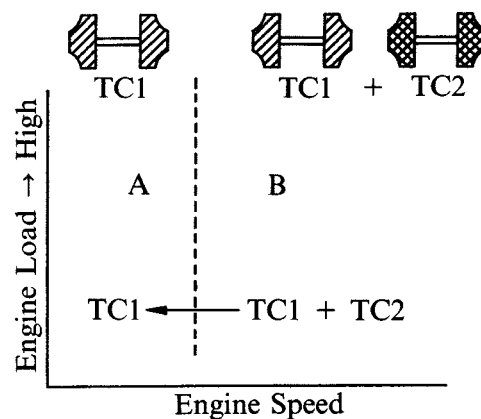
3. Operation of Twin Turbochargers

In this system, the separate functions of the two turbochargers are achieved by controlling the operation of the No. 2 turbocharger. This is accomplished by using control valves to allow or stop the intake air and exhaust gas flow. Although the No. 2 turbocharger's basic start/stop operation timing is determined by the engine speed as illustrated below, the timing is varied according to the engine load.

No. 2 turbocharger start control ◀



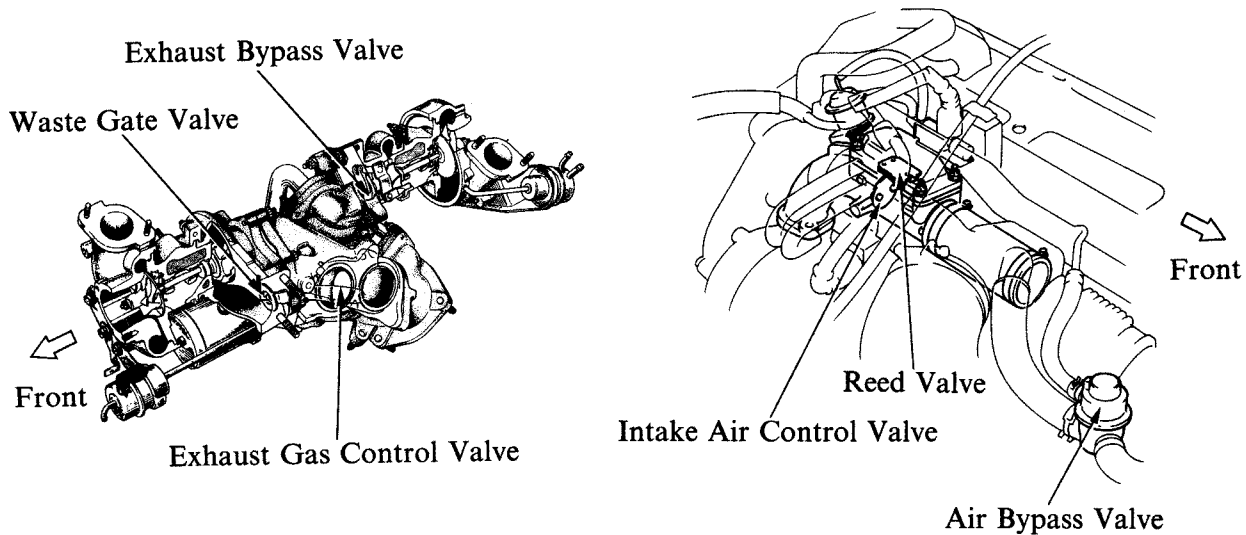
No. 2 turbocharger stop control ◀



- Region "A" : low rpm, low engine load
- Region "B" : high rpm, high engine load
- TC1 : Only the No. 1 turbocharger operating
- TC1 + TC2 : Both the No. 1 and No. 2 turbochargers operating

Control Valves

There is a total of six control valves used in the Two-Way Twin Turbo System. The details of these valves are as follows.



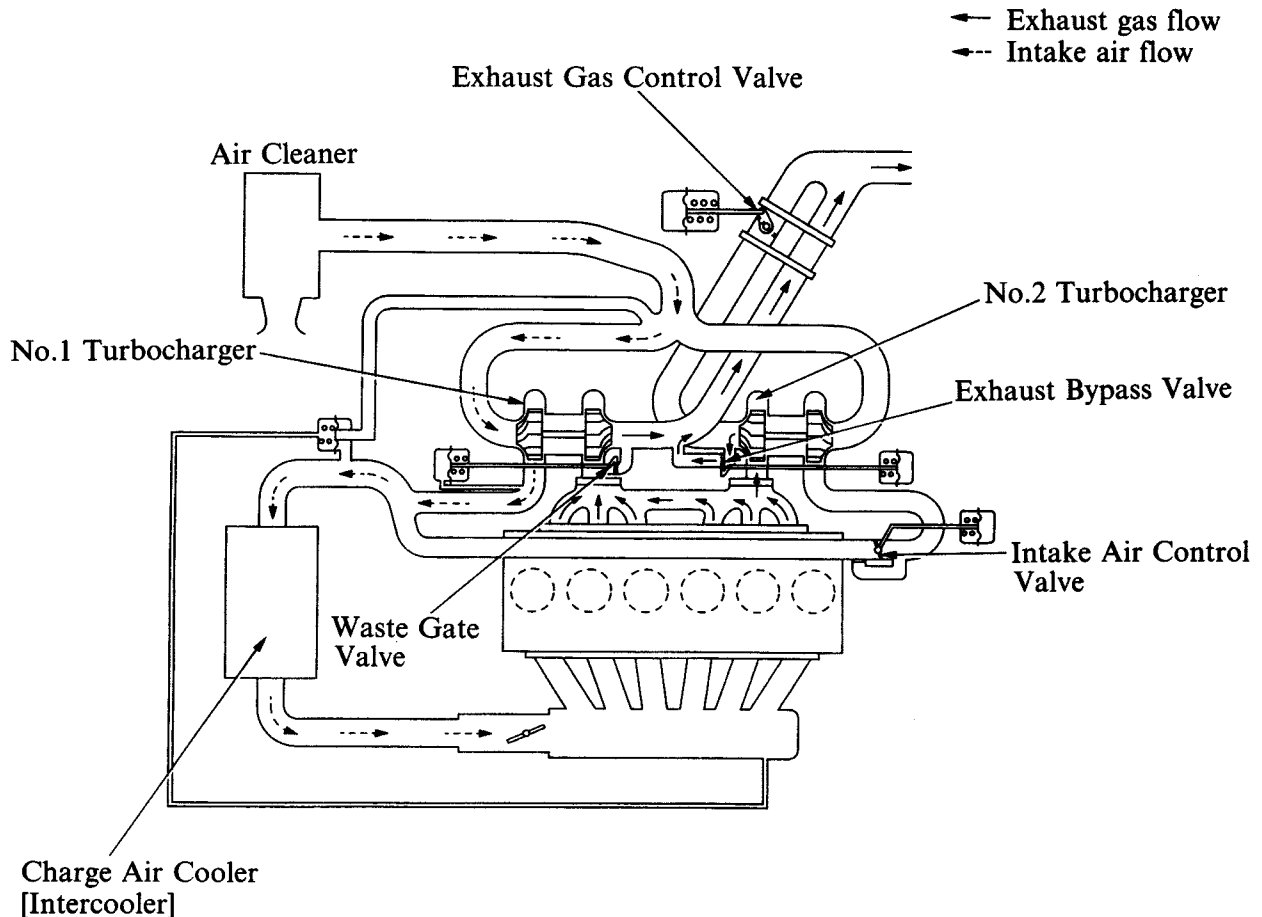
Valve	Operation
Intake Air Control Valve	Located downstream of the No. 2 turbocharger intake airflow, during No. 2 turbocharger start/stop operation it permits or stops the flow of intake air through the No. 2 turbocharger.
Exhaust Gas Control Valve	Made of ceramic, and located downstream of the No. 2 turbocharger exhaust gas flow, during No. 2 turbocharger start/stop operation it permits or stops the flow of exhaust gas through the No. 2 turbocharger.
Waste Gate Valve	Integrated into the No. 1 turbocharger, this valve controls the boost pressure of the entire system by bypassing a portion of the exhaust gas flowing through the No. 1 turbocharger during a two-turbocharger boost operation.
Exhaust Bypass Valve	Integrated into the No. 2 turbocharger, this valve controls the boost pressure of the entire system by bypassing the exhaust gas from the No. 2 turbocharger during a single-turbocharger boost operation (when only the No. 1 turbocharger is boosting). At the same time, this bypass allows the turbine wheel of the No. 2 turbocharger to start spinning ahead of the starting of the No. 2 turbocharger operation.
Reed Valve	Immediately following the start of the No. 2 turbocharger operation, the intake air control valve is closed. This causes a quick rise in the intake air pressure between the No. 2 turbocharger and the intake air control valve. The reed valve controls the intake air pressure by bypassing a portion of this high-pressure intake air downstream of the reed valve.
Air Bypass Valve	When the throttle valve is quickly released during boosting, the intake air pressure between the turbocharger and the throttle valve increases rapidly. The air bypass valve diverts a portion of this high-pressure intake air upstream of the turbocharger, thereby controlling the boost pressure, and reducing the pulsing noise.

Operation of Single Turbocharging

Since the actuators for the intake air control valve and exhaust gas control valve are inactive during low engine rpm operation, these valves remain closed.

The waste gate valve is also closed, and only the No. 1 turbocharger will provide the boost pressure. When the intake air turbocharging pressure downstream from the No. 1 turbocharger reaches a predetermined level, the exhaust bypass valve executes a boost pressure control. At the same time, the exhaust bypass valve opens to supply the exhaust gas to the turbine side of the No. 2 turbocharger, causing the No. 2 turbocharger turbine wheel to start rotating.

Accordingly, when the No. 2 turbocharger starts boosting, this process can smooth out the joining of the boost pressures.



Valve Condition (Single Turbocharging) ◀

Intake Air Control Valve	Exhaust Gas Control Valve	Exhaust Bypass Valve	Waste Gate Valve
Close	Close	Activated	Close

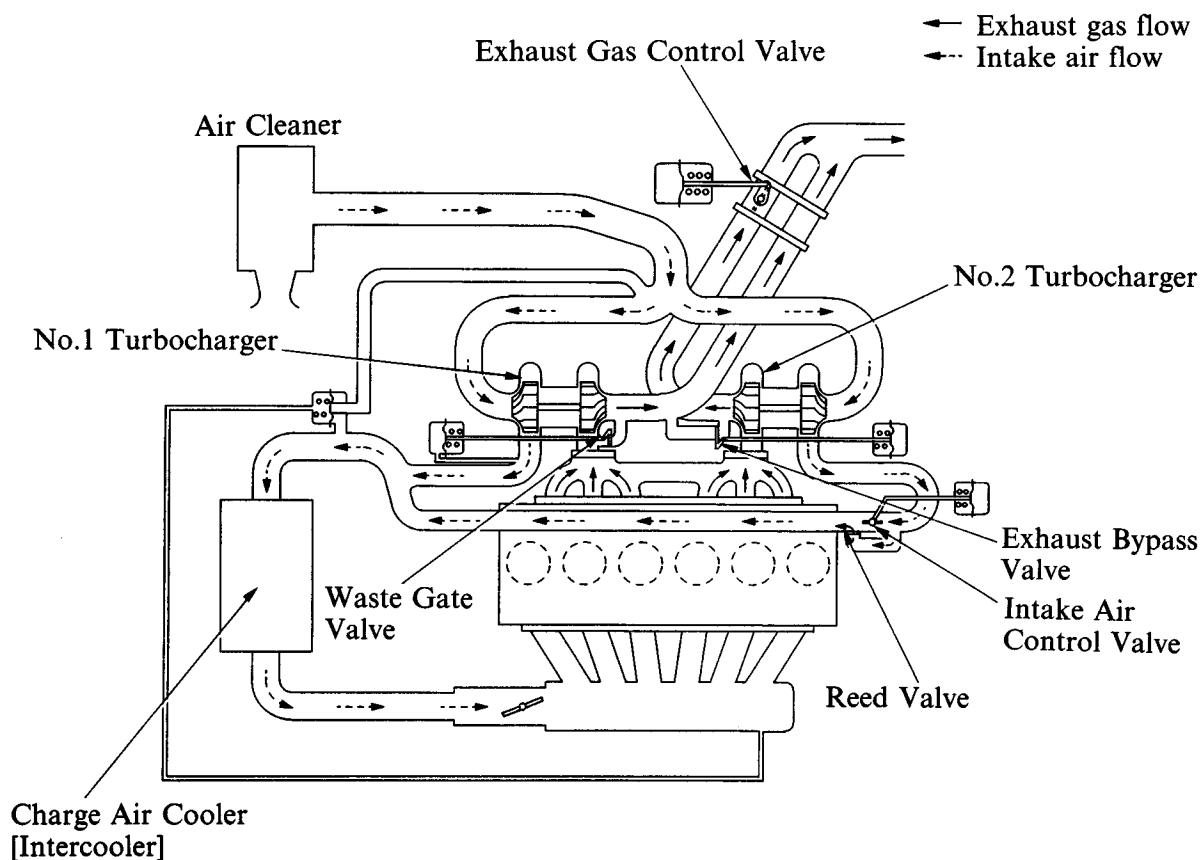
Single Turbocharging and Twin Turbocharging Operations

When the engine operation passes from the low-rpm to the high-rpm region, at first the exhaust gas control valve opens, and this is followed by the opening of the intake air control valve. When the exhaust gas control valve opens, it causes the No. 2 turbocharger turbine wheel, which had already begun its rotation, to quickly raise its rpm. Thus, the pressure of the intake air flowing through the No. 2 turbocharger becomes higher than that of the intake air of the No. 1 turbocharger.

Since this high pressure intake air pushes open the reed valve described below, and flows to the No. 1 turbocharger side, further rise in pressure is averted.

Then, when the intake air control valve opens, the highly pressurized intake air smoothly joins the intake air coming from the No. 1 turbocharger (see illustration below).

Conversely, when the engine operation passes from the high-rpm to low-rpm region, in order to stop the No. 2 turbocharger, the valves close in an order opposite to the one described above. The intake air control valve closes first, followed by the closing of the exhaust gas control valve.



Valve Condition (Single Turbocharging → Twin Turbocharging) ◀

Intake Air Control Valve	Exhaust Gas Control Valve	Exhaust Bypass Valve	Waste Gate Valve
Close → Open	Close → Open	Activated → Open	Close

Valve Condition (Twin Turbocharging → Single Turbocharging) ◀

Intake Air Control Valve	Exhaust Gas Control Valve	Exhaust Bypass Valve	Waste Gate Valve
Open → Close	Open → Close	Open	Activated → Close

Operation of Twin Turbocharging

The exhaust gas control valve and intake air control valve are open, allowing the No. 1 and No. 2 turbochargers to boost. At this time, even if the exhaust bypass valve operates, it cannot effect any boost pressure control, since it is located downstream of the No. 2 turbocharger. During a high rpm operation, it is the waste gate valve that executes the boost pressure control of the entire system, in place of the exhaust bypass valve.

Valve Condition (Twin Turbocharging) ◀

Intake Air Control Valve	Exhaust Gas Control Valve	Exhaust Bypass Valve	Waste Gate Valve
Open	Open	Open	Activated

FUEL SYSTEM

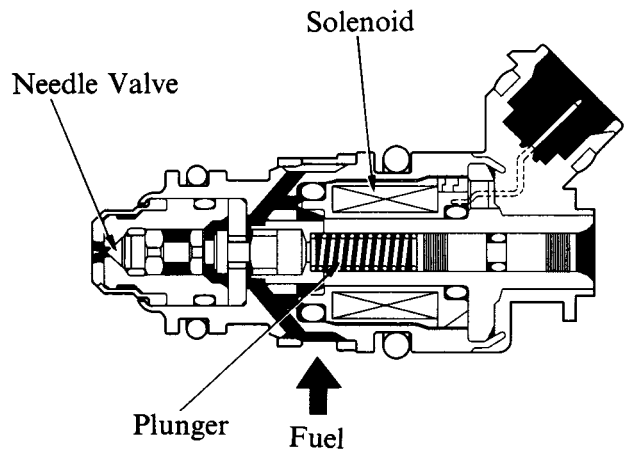
1. General

The fuel system in the 2JZ-GTE engine has the same basic construction and operation as those in the 2JZ-GE engine. The fuel system of the 2JZ-GTE engine differs from that of the 2JZ-GE engine in the following areas:

- Ⓔ Side-feed type low resistance fuel injectors adopted.
- Ⓔ Jet pump system adopted.

2. Fuel Injector

- Ⓔ Side-feed type low resistance fuel injectors, having a fuel inlet on the side, are adopted. This type of fuel injector enables the hot injector to be cooled by the supply fuel flowing through it. At the same time, this system can quickly release the vapor generated inside the injector for improved hot starting and driveability.
- Ⓔ The two-hole type injectors designed for aiming fuel directly at each intake valve also enhance fuel atomization and boost response.



3. Jet Pump System

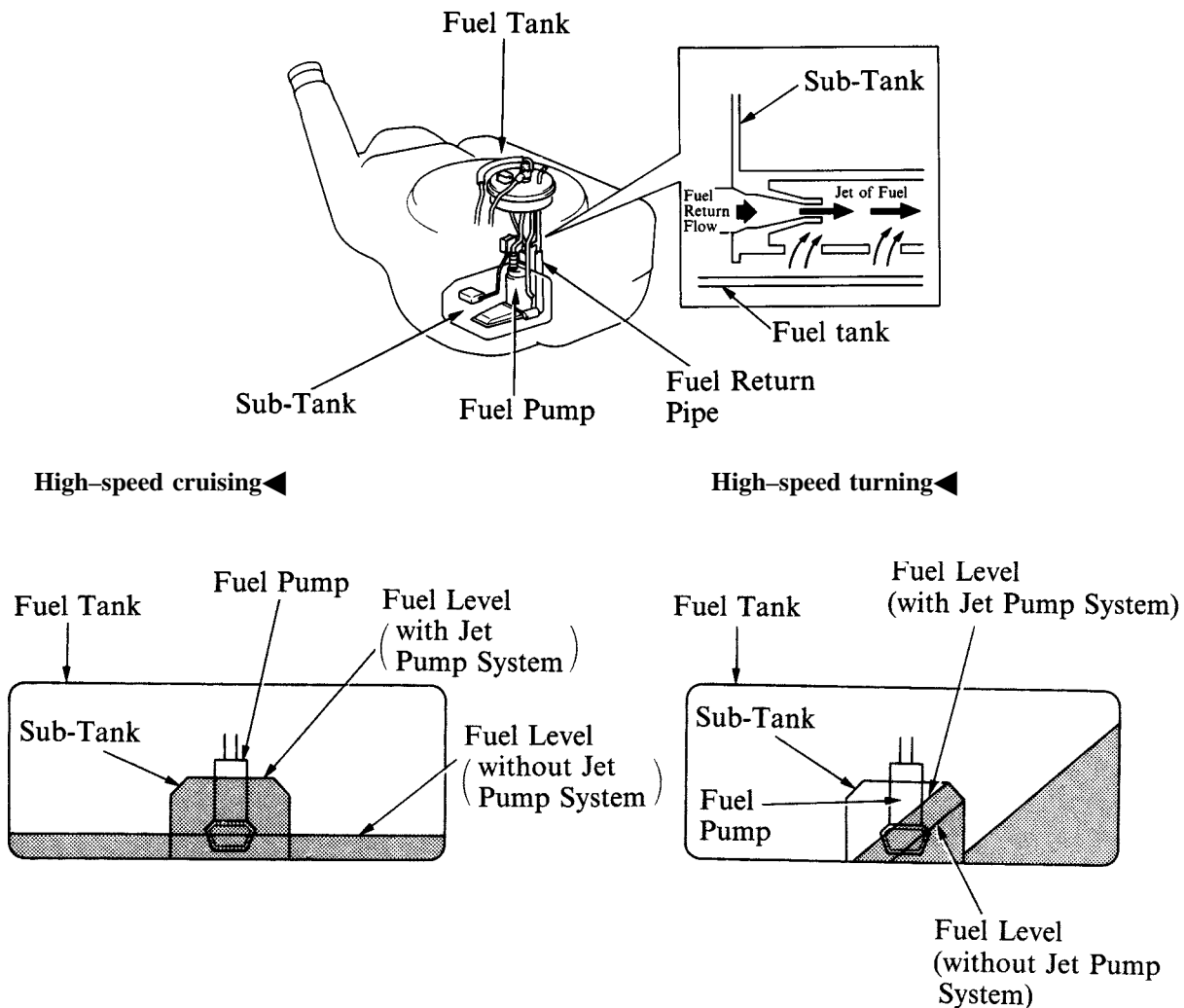
After the fuel pressurized by the fuel pump reaches the injectors, any unused fuel returns to the fuel tank. The fuel tank is provided with a sub-tank which prevents the fuel from sloshing. This is to prevent the fuel supply from being disrupted, or the fuel tank from generating a noise during sudden brake applications or rough-road driving.

The fuel tank of the 2JZ-GTE engine model adopts a jet pump system utilizing both the fuel return flow and sub-tank. When the fuel level is low, this system helps prevent the fuel supply from being interrupted as the fuel collects on one side of the tank as the vehicle makes a high-speed turn.

Construction and Function

When the return fuel proceeds to the sub-tank, it passes through a nozzle provided at the sub-tank entrance, and accelerates into the fuel jet which is then blown into the sub-tank. Then, a negative pressure is created around the fuel jet, and this negative pressure causes the fuel below the sub-tank to be drawn into the sub-tank through the suction inlet.

This system increases the driving range of the vehicle at high speeds when the fuel level is low. In particular, it is effective in preventing the fuel supply from being interrupted when the fuel collects on one side of the tank (illustrated below) as the vehicle makes a high-speed turn.



IGNITION SYSTEM

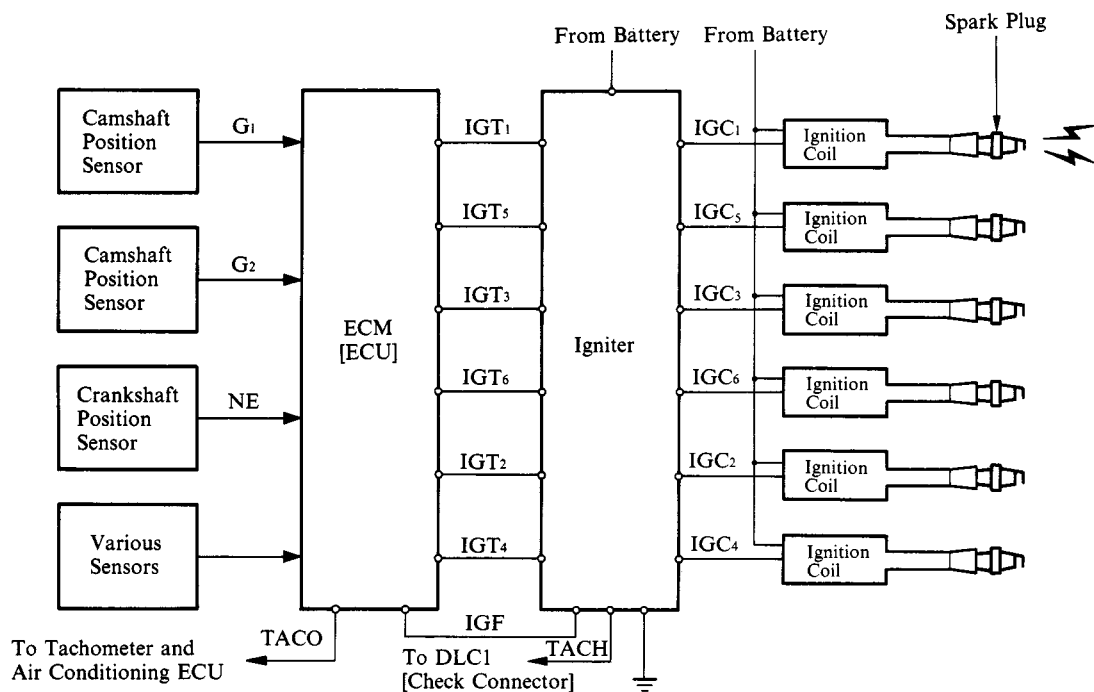
1. General

In place of the DLI (Distributor-Less Ignition) system used in the 7M-GTE engine, the DIS (Direct Ignition System) is newly adopted in the 2JZ-GTE engine.

While both systems do not use a distributor, the DIS differs from the DLI in the following areas:

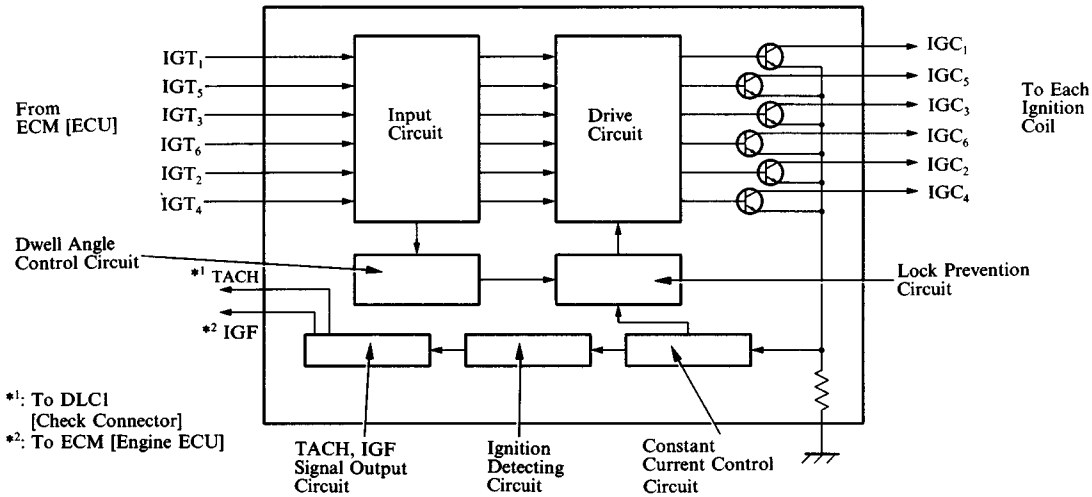
- ◀ There are six ignition coils provided, and each of the coils fits over each spark plug. High-tension cords have been eliminated, greatly decreasing the losses involved in the high-voltage transmission, and increasing the ignition reliability.
- ◀ Each cylinder is provided with an independent wire harness through which the ignition trigger signal (IGT) from the ECM* [engine ECU] is output.
- ◀ Each cylinder is provided with independent ignition in place of the 2-cylinder simultaneous ignition of the DLI system for the 7M-GTE engine.

* : ECM (Engine Control Module)



2. Igniter

The internal system diagram of the igniter is shown below. A characteristic of this igniter is that it contains the 6 power transistors as illustrated. Based on the IGT signals input for each cylinder, the drive circuit activates the respective power transistors to control the primary ignition signals (IGC) for all cylinder.

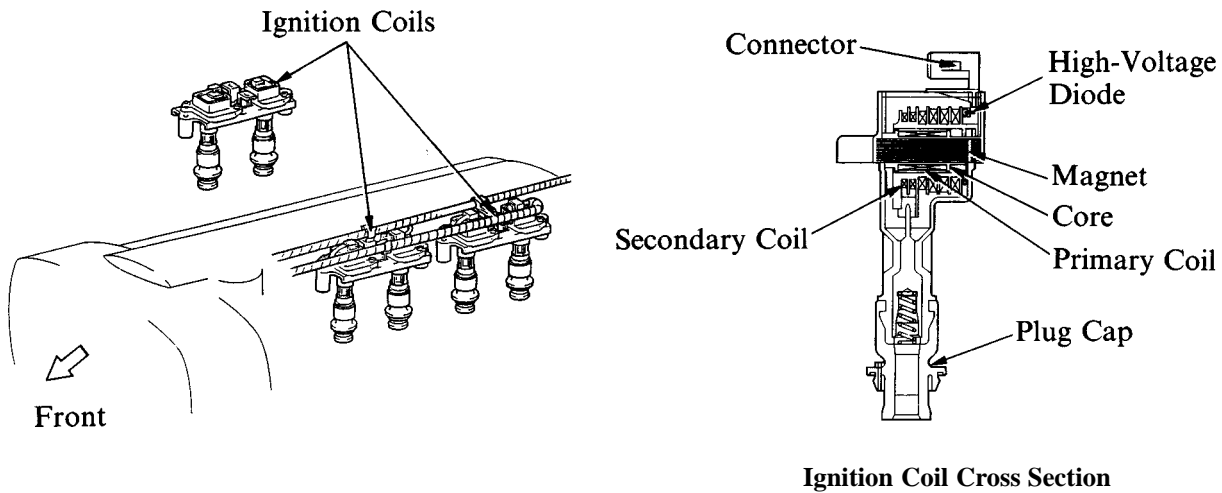


3. Ignition Coils

In the DIS system, there are six ignition coils provided, and each cylinder is provided with a coil. A plug cap is integrated with each ignition coil to provide direct contact with each spark plug. High-tension cords have thus been eliminated, allowing the secondary voltage to be supplied directly to each spark plug. This greatly decreases the losses involved in the high-voltage transmission and helps provide a strong spark.

These ignition coils have a magnet instead of an iron core. Since the magnetic flux is thus strengthened, the number of coiled wires within the coil can be reduced, making the coil compact and lightweight.

By accommodating the coils and harnesses between the cylinder head covers through the adoption of these ignition coils, the appearance of the 2JZ-GTE engine under the hood has been enhanced.

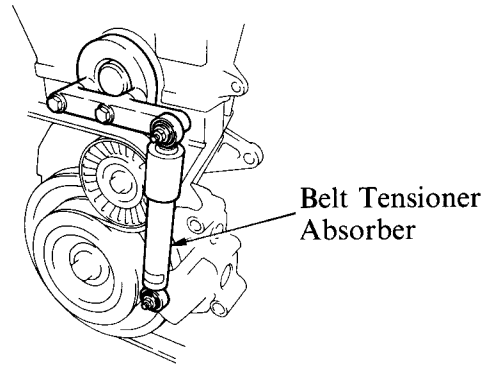


Service Tip

Since the secondary coil in this ignition coil is equipped with a high voltage diode inside, coil resistance cannot be measured. In order to determine whether or not the coil is defective, first swap the coil in question with another coil, and check for a spark.

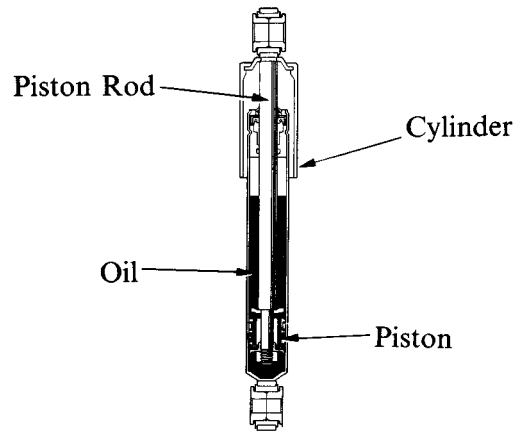
☞ SERPENTINE BELT DRIVE SYSTEM

The serpentine belt drive system of the 2JZ-GTE engine is basically the same as that of the 2JZ-GE engine. However, along with the adoption of the flywheel damper, the 2JZ-GTE engine with the manual transmission is provided with a belt tensioner absorber which prevents the belt from vibrating or whining during a sudden engine rpm variation.



1. Belt Tensioner Absorber

The belt tensioner absorber used is a monotube, oil filled damper type shock absorber. This absorber is provided as an auxiliary mechanism in the automatic tensioner damping mechanism for the V-ribbed belt.



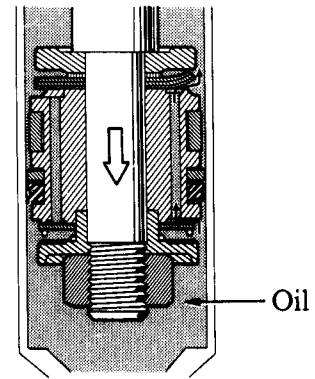
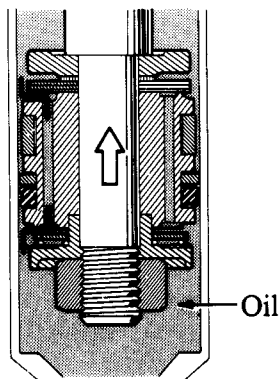
Operation

This absorber is freed when it is extended (V-ribbed belt is loosened), without affecting the automatic tensioner operation. Conversely, when it is retracted (V-belt is tightened), its damping effect is activated to help the damping mechanism of the automatic tensioner.

Belt Tensioner Absorber Cross Section

Absorber extended ◀

Absorber retracted ◀



☞ ENGINE MOUNTING

The engine mounting of the 2JZ-GTE engine is basically the same as in the 2JZ-GE engine.

See page 54 in the 2JZ-GE engine section for details.

○ ENGINE CONTROL SYSTEM

1. General

The engine control system of the 2JZ-GTE engine is basically the same in construction and operation as that of the 7M-GTE engine for the previous Toyota Supra. However, as in the 2JZ-GE engine, the sequential multiport fuel injection system is adopted, and the ECM*¹ [engine ECU] and PCM*² [transmission ECU] have been integrated into a single unit of ECM*¹.

Additionally, the ECM*¹ controls the “TWO-WAY TWIN TURBO” system.

Comparison of the engine control system between the 2JZ-GTE engine and 7M-GTE engine is as follows.

*¹ : ECM (Engine Control Module)

*² : PCM (Powertrain Control Module)

System	Outline	2JZ-GTE	7M-GTE
SFI (Sequential Multiport Fuel Injection) [EFI] ☞ Page 110	An L-type SFI [EFI] system directly detects the intake air volume with a hot wire type volume mass air flow meter.		—
	An L-type MFI (Multiport Fuel Injection) [EFI] system directly detects the intake air volume with an optical Karman-Vortex type volume air flow meter.	—	
	The fuel injection system is a sequential multiport fuel injection system.		—
	The fuel injection system is a 3-group type and injects to 2 cylinders each.	—	
Cold Start Injector	When the coolant temperature is low, the injection duration of the cold start injector is controlled by the ECM* [engine ECU] and start injector time switch.	—	
ESA (Electronic Spark Advance) ☞ Page 111	Ignition timing is determined by the engine ECM* [Engine ECU] based on signals from various sensors. Corrects ignition timing in response to engine knocking.		
	In vehicles equipped with automatic transmission, the torque control correction during gear shifting has been used to minimize the shift shock.		—
	ECM* calculates the primary current (ignition coil) energizing start timing.		—
	2 knock sensors are used to further improve knock detection.		
IAC Idle Air Control [ISC] ☞ Page 112	A step motor type IAC [ISC] valve controls the fast idle and idle speeds.		
Turbocharger Control ☞ Page 112	ECM* controls the operation of each actuators in the “TWO-WAY TWIN TURBO” system via the each VSV.		—
Fuel Pump Control ☞ Page 115	Under light engine loads, pump speed is low to reduce electric power loss.		


* : ECM (Engine Control Module)

System	Outline	2JZ-GTE	7M-GTE
Fuel Pressure Control ☞ Page 115	In hot engine conditions, the fuel pressure is increased to improve restartability.		
Oxygen Sensor Heater Control ☞ Page 115	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.		
Air Conditioning Control ☞ Page 115	By turning the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.		—
EGR Cut-Off Control	Cuts off EGR according to the engine condition to maintain drivability of the vehicle and durability of the EGR components.		
Evaporative Emission Control ☞ Page 115	The ECM* [engine ECU] controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.		—
Diagnosis ☞ Page 115	When the ECM* detects a malfunction, the ECM* makes a diagnosis and memorizes the failed section.		
	A test mode function has been adopted to the diagnosis system (normal mode) to detect malfunctions such as poor contact and momentary wire disconnection.		—
Fail-Safe ☞ Page 115	When the ECM* detects a malfunction, the ECM* stops or controls the engine according to the data already stored in memory.		

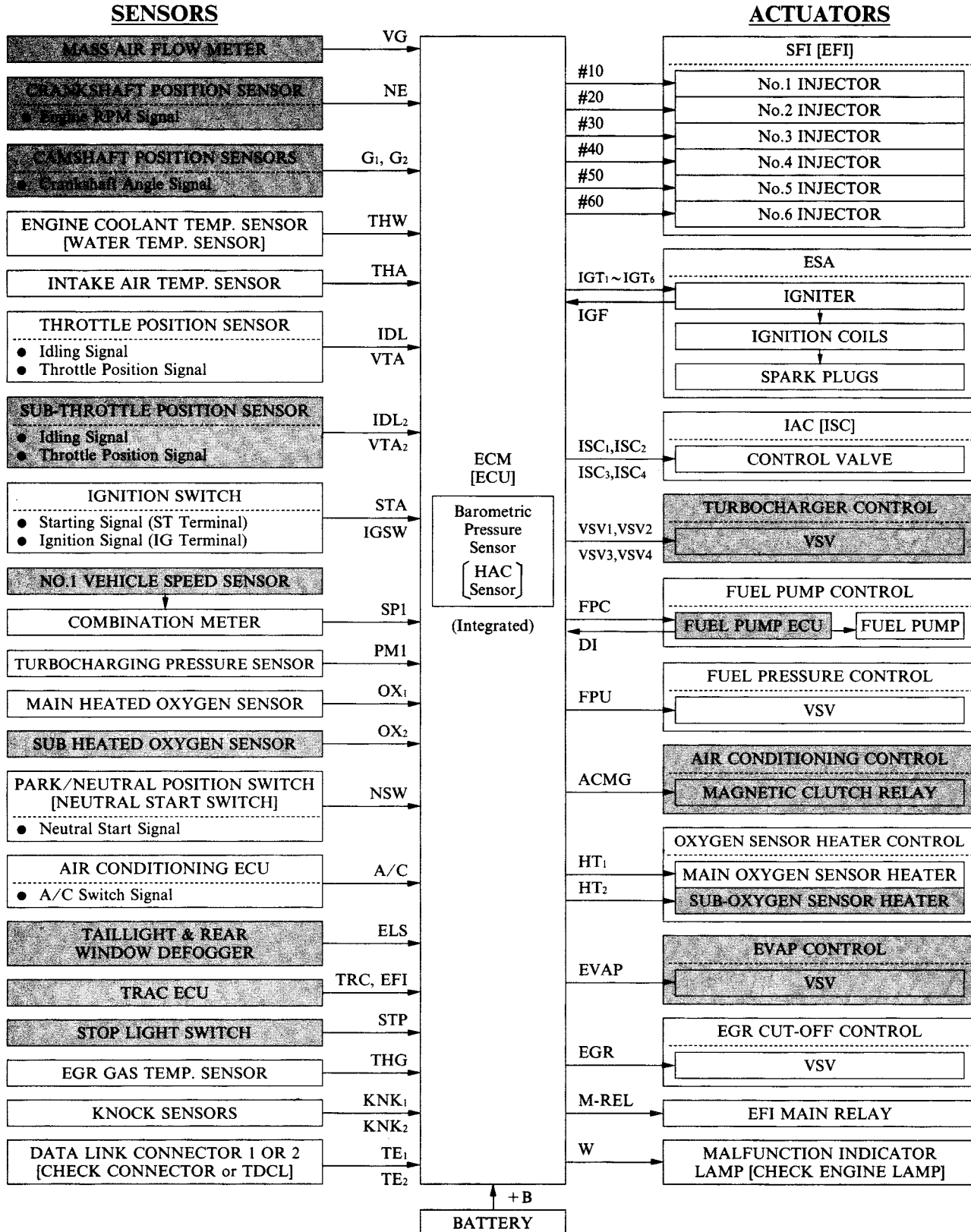
* : ECM (Engine Control Module)

2. Construction

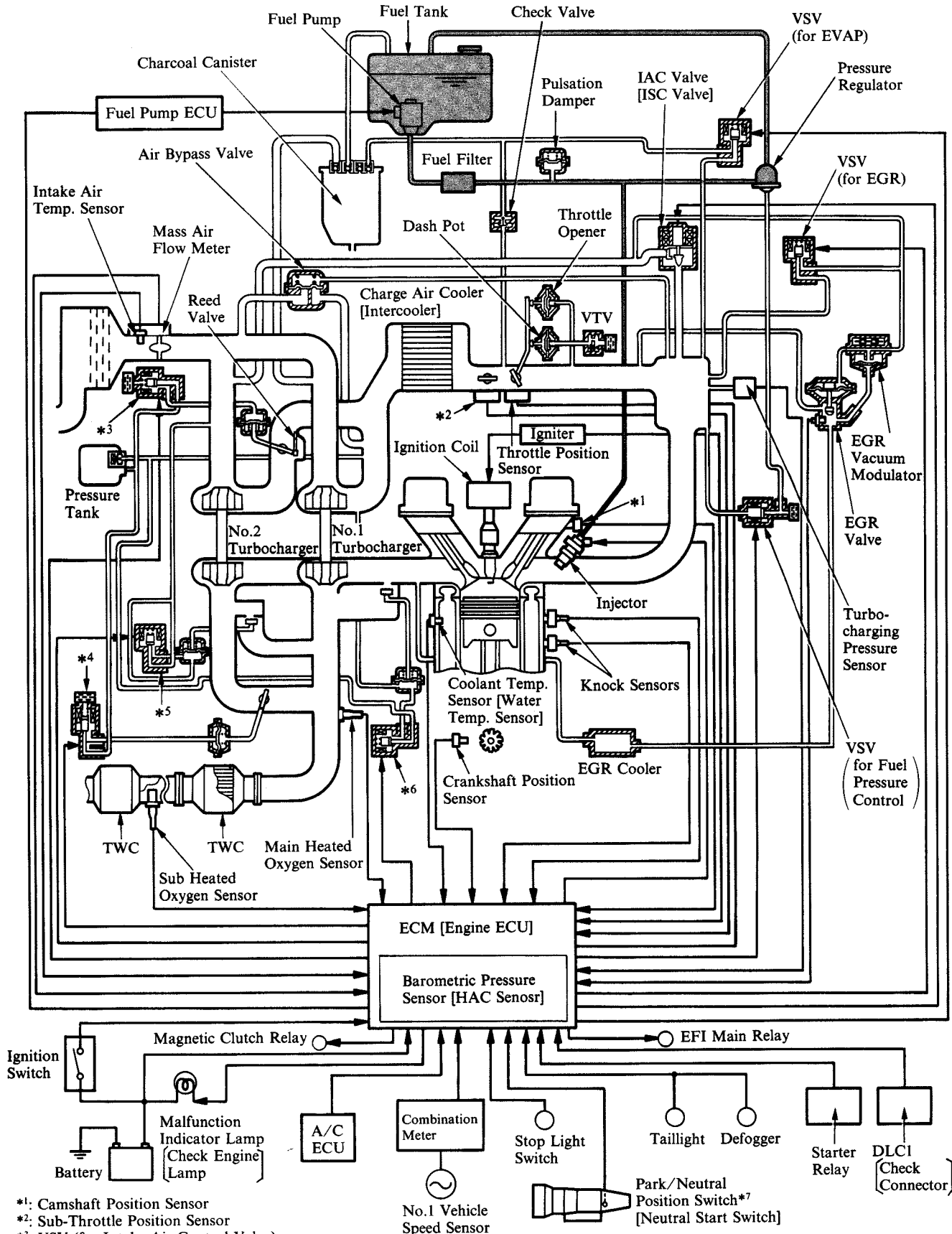
The configuration of the engine control system which can be broadly divided into three groups: the ECM* [engine ECU], the sensors and the actuators is shown in the following chart.

Shaded portions  are different from the 7M-GTE engine for the previous models.

* : ECM (Engine Control Module)



4. Engine Control System Diagram



6. Main Components of Engine Control System

General

The following table compares the main components of the 2JZ-GTE engine and 7M-GTE engine.

Engine		2JZ-GTE	7M-GTE
Components			
Mass Air Flow Meter		Hot-Wire Type	—
Volume Air Flow Meter		—	Karman-Vortex Type
Crankshaft Position Sensor		Pick-Up Coil Type, 1	—
Crankshaft Position Sensors		Pick-Up Coil Type, 2	—
Crankshaft Angle Sensor and Engine Speed Sensor		—	Three Pick-Up Coils (built into cam position sensor)
Throttle Position Sensor		Linear Type	←
Knock Sensor		Built-In Piezoelectric Type, 2	←
Oxygen Sensor	Main	With Heater Type, 1	Without Heater Type, 1
	Sub	With Heater Type, 1	—
Injector		2-Hole Type	←
IAC [ISC] Valve		Step Motor Type	←

Mass Air Flow Meter

1) Description

The 2JZ-GTE engine adopts the hot-wire type mass air flow meter designed for direct electrical measurement of the intake air mass flow.

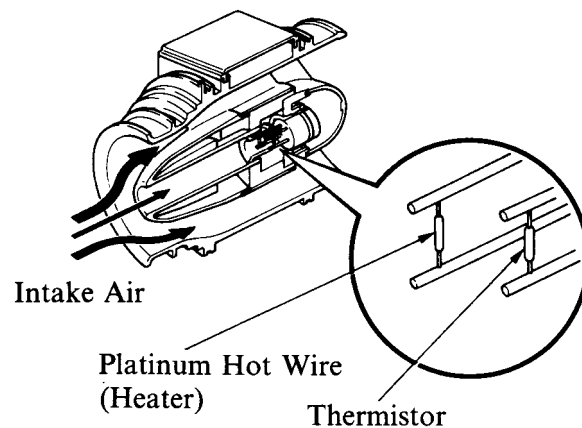
This mass air flow meter offers superior measuring precision and its plastic housing is shaped for minimal flow resistance. In addition to the sensor itself being miniscule, this system measures the bypass air, which is unlikely to be affected by the air cleaner drift current, and has the following features:

Compact and lightweight, the pressure loss caused by this sensor is small, and offers only slight intake air flow resistance.

Superior response and measuring accuracy.

Ability to measure a wide airflow range.

Having no mechanical functions, it offers a superior durability.



2) Principle

When the hot wire is placed in a constant gaseous current, the hot wire temperature varies in accordance with the amount of the air mass flow. If the temperature difference between the hot wire and air mass at the time is “ ΔT ”, air mass flow is “ G ”, and the dissipated heat is “ Q ”, the relationship between them can be described with the following formula:

$$Q = (a + b\sqrt{G}) \cdot \Delta T \text{ ("a" and "b" are constants)}$$

Furthermore, this heat value can be electrically represented. If the hot wire resistance is “ R ”, electrical current flowing through the hot wire is “ I ”, the heat value “ Q ” can be described with the following formula.

$$Q = I^2 R$$

Accordingly, the two formulas above can be described as follows:

$$I^2 R = (a + b\sqrt{G}) \cdot \Delta T$$

If current “ I ” is flowed in order to make the temperature difference “ ΔT ” consistent, since “ R ”, “ a ”, “ b ”, and “ ΔT ” are all constant, a proportional relationship is created between the air mass flow “ G ” and the current “ I ”, enabling the air mass flow “ G ” to be represented by the current “ I ”. By converting this current “ I ” into voltage, the hot-wire type mass air flow meter outputs the air mass flow signals to the ECM [engine ECU].

3) Construction and Operation

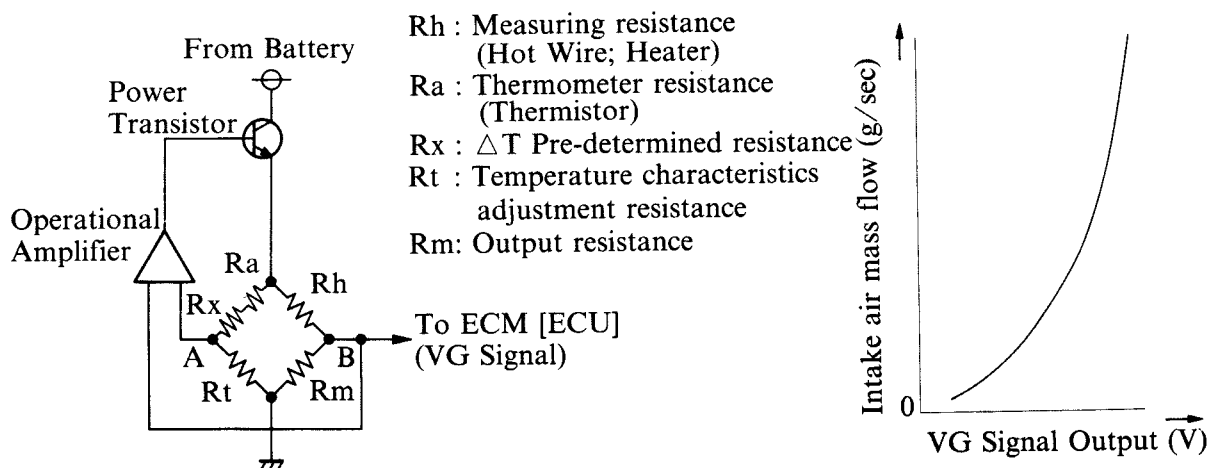
To keep the temperature of the platinum hot wire constant with the sum of the intake air temperature measured by the thermistor and the predetermined temperature difference (ΔT), this hot-wire type mass air flow meter has an electric bridge circuit which includes the hot wire and other resistances. Combined with an operational amplifier and power transistor, the feedback loop, as described below, is achieved.

In this circuit, when the electrical potential at points “A” and “B” becomes equal, the resistors are selected to make the temperature difference between the hot wire and air mass constant. When the hot wire is cooled by the intake air, its resistance value decreases. As a result, the voltage at point “B” becomes higher than that of the point “A”. At this time, the operational amplifier detects this electrical potential difference, and controls the power transistor so that the electrical potentials of the points “A” and “B” becomes equal, and flows the current to the circuit.

This mass air flow meter outputs the voltage at point “B”, immediately following the hot wire.

The ECM uses this voltage (VG signal) to determine the intake mass flow according to the aforementioned principle.

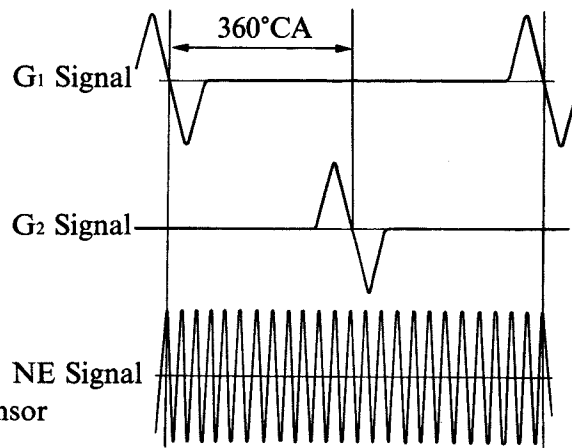
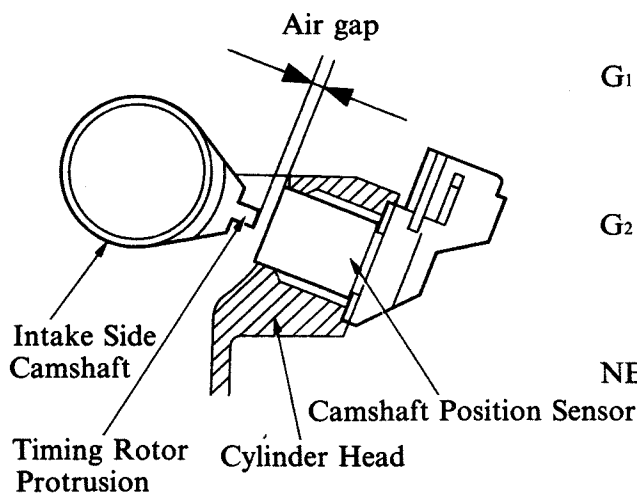
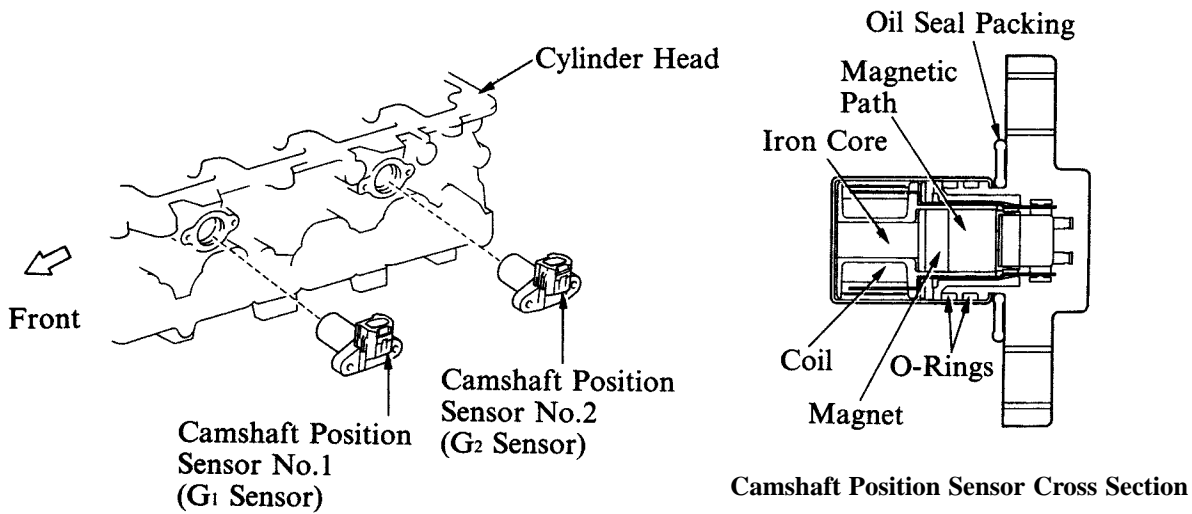
The VG signal, which varies in accordance with the intake air mass flow, is continuously output from the mass air flow meter. The relationship between the output voltage of the VG signal and the intake air mass flow can be represented as a parabolic curve shown below.



Camshaft Position Sensors (G₁ and G₂ Signals)

The camshaft position sensors consist of a magnet, coil and iron core, and are mounted onto the intake side of the cylinder head. The timing rotor is integrated with the intake side camshaft.

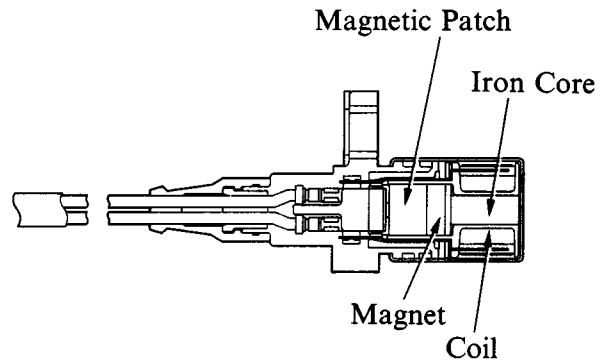
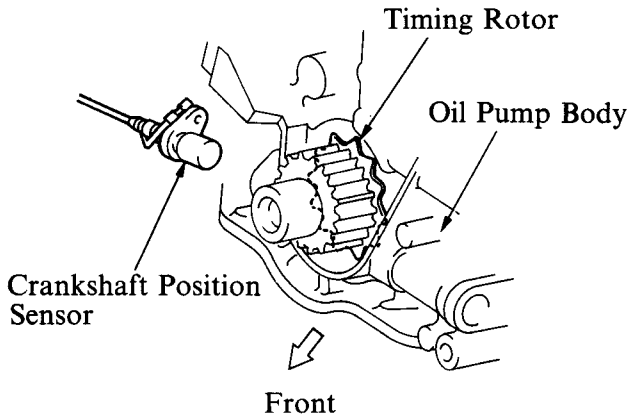
Each time the camshaft rotates, the air gap between the pickup coil and the protrusion integrated onto the camshaft is varied. This causes the magnetic flux passing through the pickup coil to increase and decrease, generating an electromotive force. Since the voltage generated when the camshaft protrusion approaches the pickup coil is the opposite of when it departs, an alternate electrical current is produced. The G₁ timing rotor is positioned so that the camshaft protrusion is closest when the No. 6 piston is at its compression TDC, and the G₂ timing rotor is positioned so that the camshaft protrusion is closest when the No. 1 piston is at its compression TDC. By detecting this voltage variation, the cylinders and their TDC positions (basic positions) can be determined.



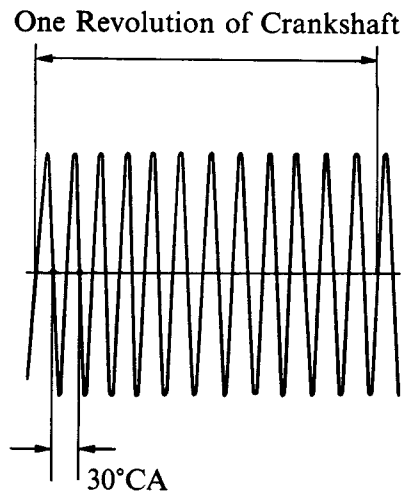
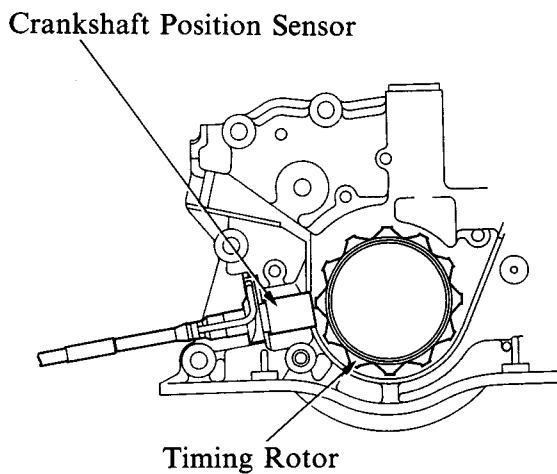
Crankshaft Position Sensor (NE Signal)

The crankshaft position sensor consists of a magnet, coil and iron core, and is mounted onto the right side of the oil pump body as illustrated below. The timing rotor is installed on the guide area of the crankshaft timing pulley.

The timing rotor attached to the crankshaft has 12 teeth, enabling the pickup coil to produce 12 pulses per each revolution of the crankshaft. Each 30 degrees of the crankshaft angle can thus be detected by these pulses.



Crankshaft Position Sensor Cross Section



7. SFI (Sequential Multiport Fuel Injection) [EFI]

In place of the L-type MFI (Multiport Fuel Injection) [EFI] system with an optical Karman-Vortex type volume air flow meter used in the 7M-GTE engine, the 2JZ-GTE engine uses the L-type SFI [EFI] system with a hot-wire type mass air flow meter. Compared to the 7M-GTE engine, the 2JZ-GTE engine with SFI [EFI] offers the following characteristics:

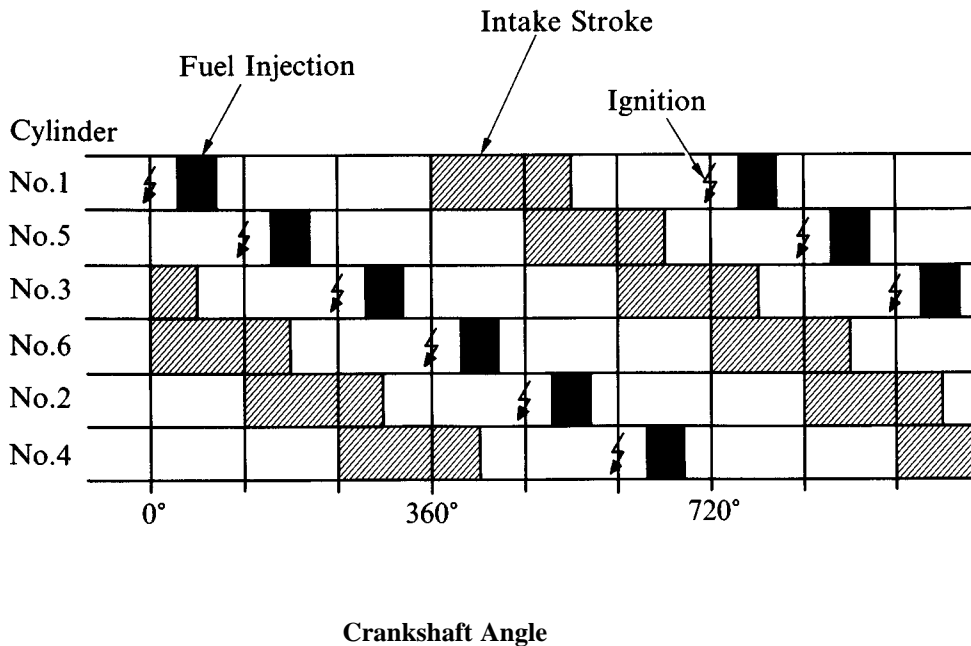
Adopts a hot-wire mass air flow meter with superior measuring precision. For more details on the hot wire type mass air flow meter, see page 106.

In place of the 3-group type fuel injection pattern used by the 7M-GTE engine, the 2JZ-GTE adopts a sequential multiport fuel injection type pattern.

Fuel Injection Pattern and Fuel Injection Timing

The 2JZ-GTE engine adopts a sequential multiport fuel injection system in which the air-fuel mixture is introduced into each cylinder every time the engine completes two revolutions. It also optimally regulates the injection timing according to the engine condition.

In addition, when the engine is first started and the engine speed is less than 600 rpm, this system momentarily provides a simultaneous all-injection to ensure an improved starting condition.



8. ESA (Electronic Spark Advance)

The ESA system of the 2JZ-GTE engine is basically the same in construction and operation as that of the 2JZ-GE engine. However, in the 2JZ-GTE engine, the output method of the ignition trigger signal (IGT) from the ECM* [Engine ECU] to the igniter has been changed to reflect the adoption of the DIS (Direct Ignition System).

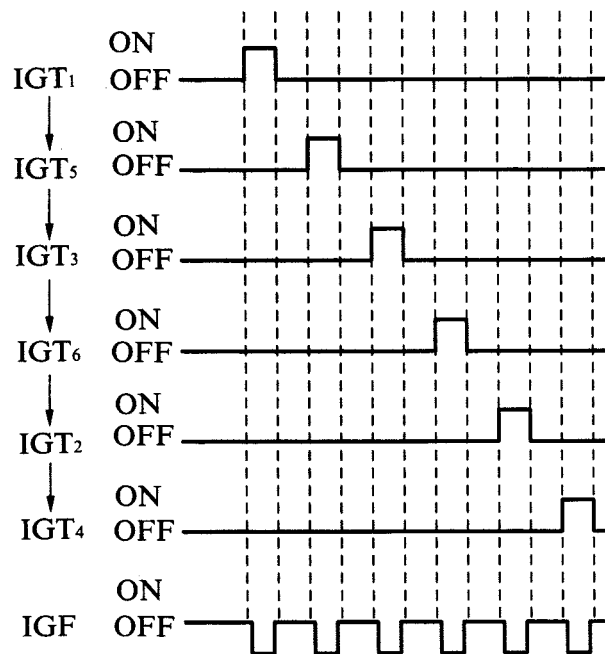
* : ECM (Engine Control Module)

Igniter Control

1) IGT Signals

After determining the ignition timing based on the signals from the camshaft position sensors (G_1 , G_2) and the crankshaft position sensor (NE), the ECM [Engine ECU] output an ignition trigger signal (IGT) to the igniter in accordance with this ignition timing. Since a cylinder identification circuit is contained within the ECM, the ECM will use this circuit at this time to output individual IGT signals (IGT1 to IGT6) to each of the igniters, using a wire harness which is dedicated to each cylinder.

In response to the IGT signals, the igniter returns IGF signals to the ECM. In the DIS, the ON (HI) and OFF (LO) signals of the IGF waveform are opposite of those from other models.



9. IAC (Idler Air Control) [ISC]

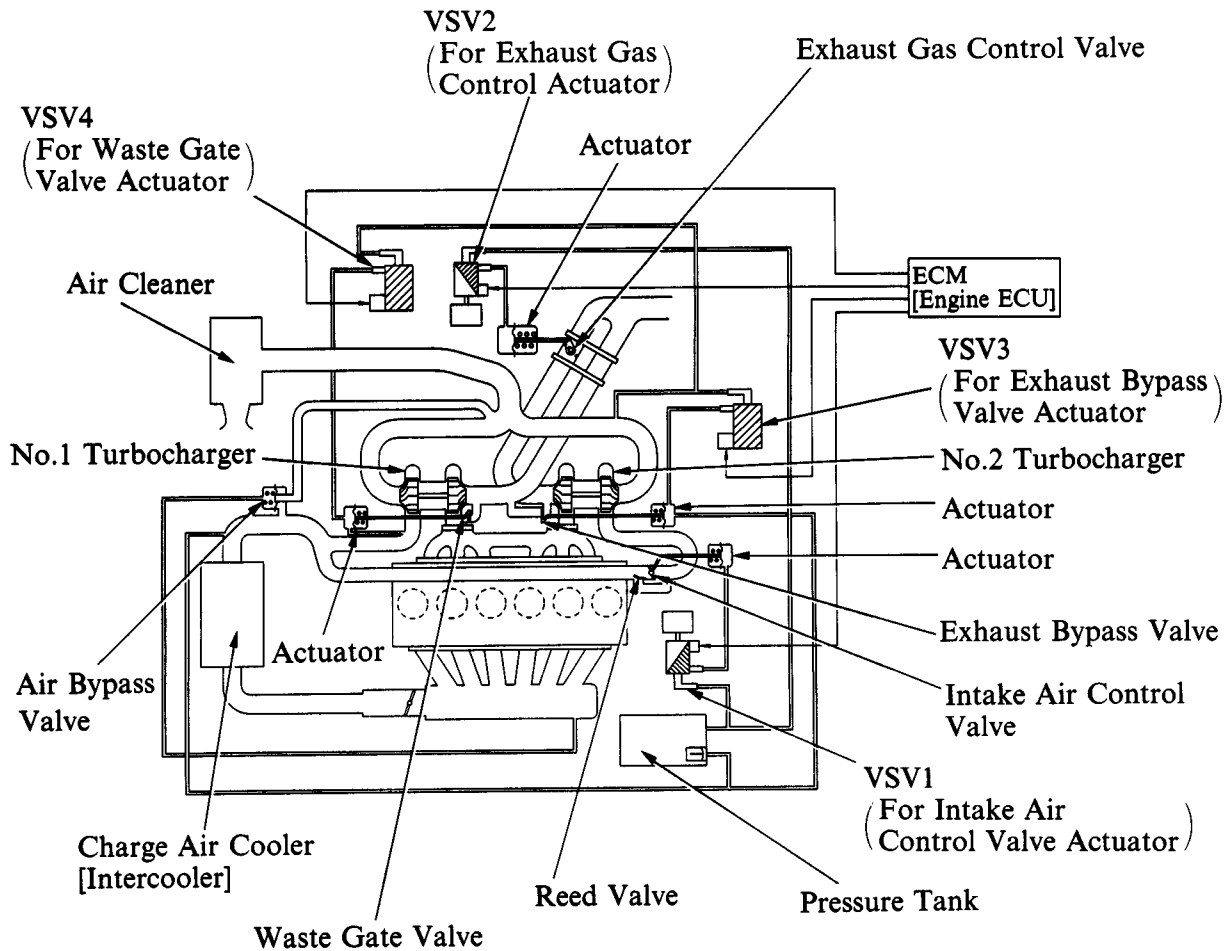
The IAC [ISC] system of the 2JZ-GTE engine is basically the same in construction and operation as that of the 2JZ-GE engine. See 2JZ-GE engine section on page 66.

10. Turbocharger Control


The Two-Way Twin Turbo System is equipped with an ECM*¹ [engine ECU] to control the start and stop operation of the No. 2 turbocharger, and the boost pressure of the entire system. This system uses four VSVs (vacuum switching valves) to operate the actuators and valves indicated below.

*¹ : ECM (Engine Control Module)

◀System Diagram®



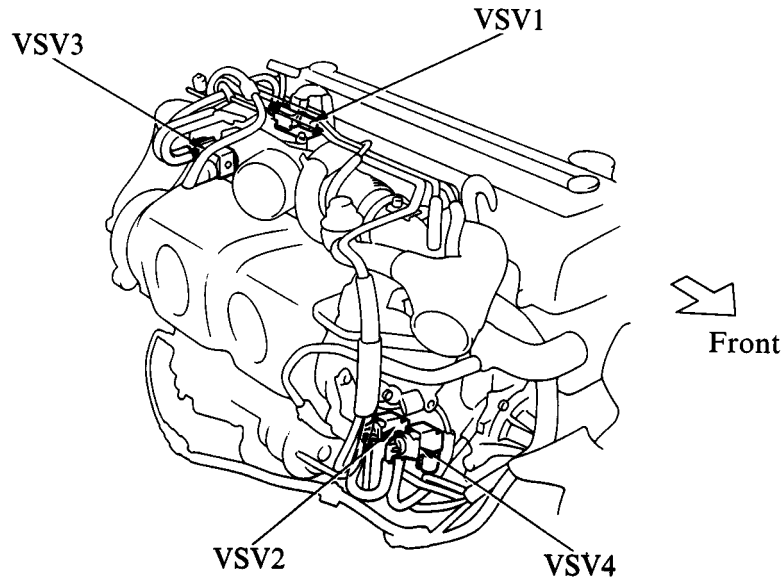
 : ON/OFF Control Type VSV

 : Duty Cycle*² Control Type VSV

*²: See next page

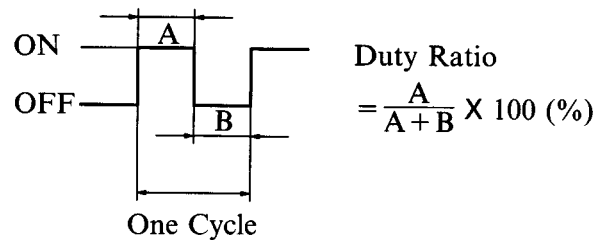
Control VSV

In this system, there are four VSVs provided in the pressurized air circuit for the actuators which operate the valves. By controlling these VSVs, the ECM [engine ECU] can control the operation of the No. 2 turbocharger and the boost pressure of the entire system. The details of the VSVs, and how they relate to the valve operations, are discussed below.



VSV	Controlled Actuator	VSV Type	Circuit air pressure when the VSV is:		When VSV is ON, the controlled valve is:
			ON or Duty 100%	OFF or Duty 0%	
VSV1	Actuator for the intake air control valve	ON/OFF Control	Turbocharging Pressure	Atmospheric Pressure	Open
VSV2	Actuator for the exhaust gas control valve	ON/OFF Control	Turbocharging Pressure	Atmospheric Pressure	Open
VSV3	Actuator for the exhaust bypass valve	Duty Cycle* Control	Atmospheric Pressure	Turbocharging Pressure	Close
VSV4	Actuator for the waste gate valve	Duty Cycle* Control	Atmospheric Pressure	Turbocharging Pressure	Close

*: In terms of controlling the VSV1 or VSV2 to remain ON only or OFF only, the duty cycle is the ratio of the time in which current flows in the one cycle of a cycle. The figure on the right represents one cycle in which current flows and does not flow.



ECM [ECU] Function

1) Exhaust Gas Control Valve Control

When the engine is accelerated from a speed of approximately 3,000 to 4,000 rpm, the ECM [ECU] turns the VSV2 ON to open the exhaust gas control valve, in accordance with the degree of the acceleration. This causes the turbine wheel revolution to go suddenly from a freewheeling state to high rpm.

RELEVANT SIGNALS

Engine speed (NE)
 Throttle position (VTA)
 Ignition switch (IGSW)
 Intake air volume (VG)
 Intake air temperature (THA)
 Park/neutral position switch
 [Neutral start switch] (NSW)
 Vehicle speed (SP1)

2) Intake Air Control Valve Control

When the exhaust gas control valve remains open longer than a predetermined time, the ECM turns ON VSV1 to open the intake air control valve. This causes the No. 2 turbocharger to provide a full boost, effecting a twin turbocharging operation.

RELEVANT SIGNALS

Throttle position (VTA)
 Vehicle speed (SP1)
 Engine speed (NE)

3) Exhaust Bypass Valve Control

When the exhaust gas control valve is closed (only the No. 1 turbocharger is providing boost), and the intake air boost pressure exceeds a predetermined value, the ECM applies a feedback control of the exhaust bypass valve via VSV3. In addition to providing the boost pressure control for the entire system, this feedback control also enables the No. 2 turbocharger turbine wheel to freewheel.

RELEVANT SIGNALS

Turbocharging pressure sensor (PM1)
 Park/neutral position switch
 [Neutral start switch] (NSW)
 Throttle position (VTA)
 Intake air volume (VG)

4) Waste Gate Valve Control

When only the No. 1 turbocharger is applying the boost pressure, the ECM maintains the waste gate valve closed.

When the two turbochargers are boosting, the ECM applies a feedback control of the waste gate valve via VSV4 to control the boost pressure of the entire system. In case of a failure of the turbocharging pressure sensor, the ECM fixes the duty cycle to 0% so that the valve can be operated by the intake air boost pressure.

RELEVANT SIGNALS

Turbocharging pressure sensor (PM1)
 Park/neutral position switch
 [Neutral start switch] (NSW)
 Throttle position (VTA)
 Engine speed (NE)

11. Fuel Pump Control

The fuel pump control system of the 2JZ-GTE engine is basically the same in construction and operation as that of the 2JZ-GE engine. See 2JZ-GE engine section on page 67.

12. Fuel Pressure Control

The fuel pressure control system of the 2JZ-GTE engine is basically the same in construction and operation as that of the 2JZ-GE engine. See 2JZ-GE engine section on page 68.

13. Oxygen Sensor Heater Control

The 2JZ-GTE engine uses main and sub oxygen sensors, and both are equipped with a heater. The ECM [engine ECU] controls both the main and sub oxygen sensors heaters simultaneously, applying the same control conditions to both.

RELEVANT SIGNALS

- Battery voltage (BAT)
- Engine coolant temperature (THW)
- Intake air volume (VG)
- Engine speed (NE)

14. Air Conditioning Control

In the same way as the 2JZ-GE engine did, the 2JZ-GTE engine newly adopts functions which momentarily delay the engagement of the air conditioning in accordance with the engine condition, or disengages the air conditioning during acceleration. These two functions are basically the same in construction and operation as those of the 2JZ-GE engine. See 2JZ-GE engine section on page 69.

15. Evaporative Emission Control

In the same way as the 2JZ-GE engine did, the 2JZ-GTE engine is provided with a system which controls the purging of the evaporative emissions from the charcoal canister by using a VSV. For details, see the 2JZ-GE engine section on page 70.

16. Diagnosis

The 2JZ-GTE engine has the same normal and test mode functions in its diagnostic system as on the 2JZ-GE engine.

The diagnostic items are basically the same as those on the 2JZ-GE engine. However, code numbers 34, 35, and 47 have been added in conjunction with the adoption of the Two-Way Twin Turbo and the TRAC (Traction Control) systems. For details on the diagnostic items, see '93 Toyota Supra Repair Manual (Pub. No. RM343U1).

17. Fail-Safe

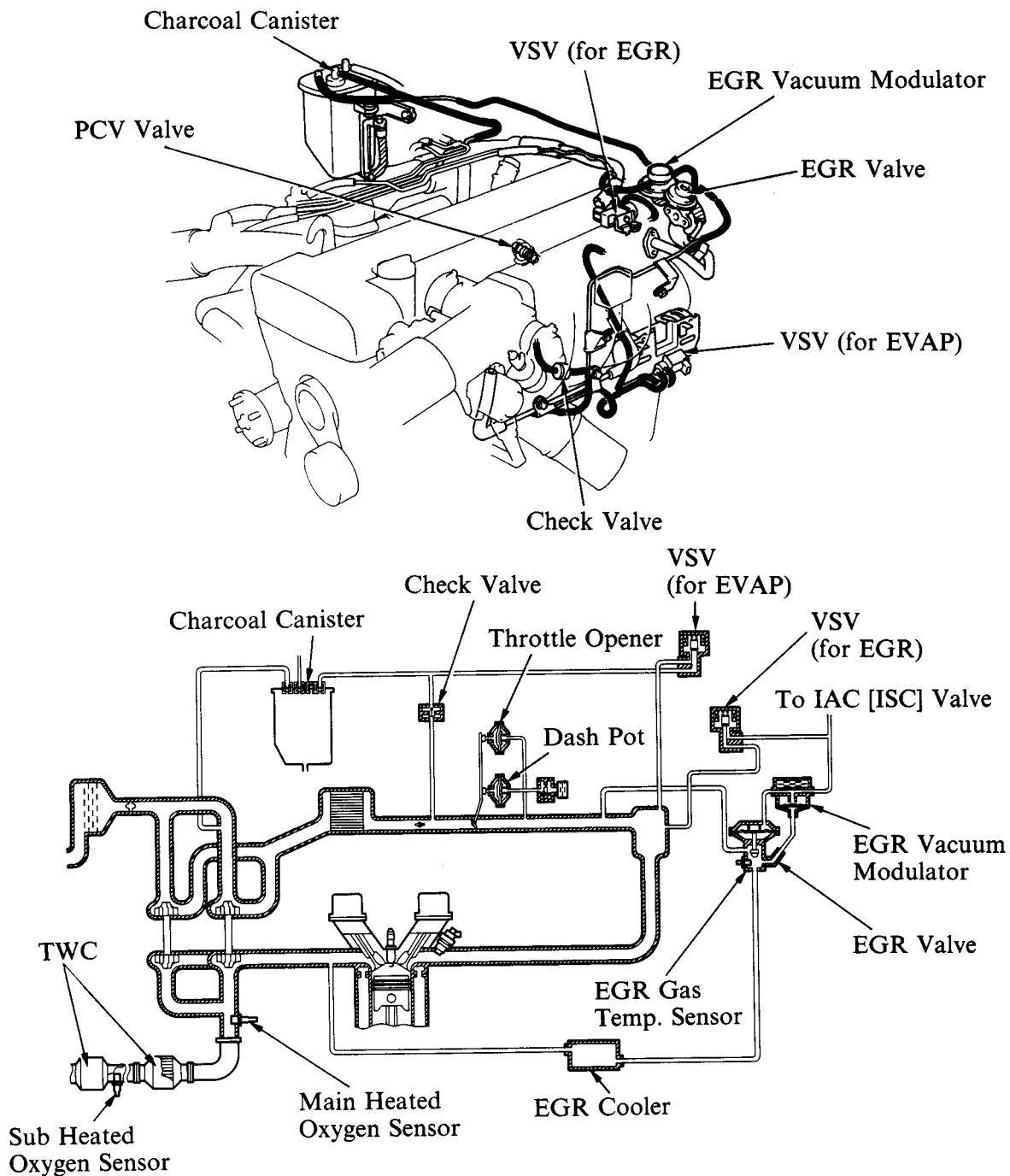
The 2JZ-GTE engine also offers the same fail-safe and back-up functions as in the 2JZ-GE engine. However, the 2JZ-GTE engine provides additional fail-safe function items relative to the turbocharging pressure sensor and the sub-throttle position sensors, which have been adopted in conjunction with its Two-Way Twin Turbo and TRAC (Traction Control) systems. For details, see '93 Toyota Supra Repair Manual (Pub. No. RM343U1).

EMISSION CONTROL SYSTEM

1. System Purpose

System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow-by gas (HC)
Evaporative emission control	EVAP	Reduces evaporative HC
Exhaust gas Recirculation	EGR	Reduces NOx
Three-way catalytic converter	TWC	Reduces HC, CO and NOx
Sequential multiport fuel injection [Electronic fuel injection]	SFI [EFI]	Regulates all engine conditions for reduction of exhaust emission

2. Components Layout and Schematic Drawing



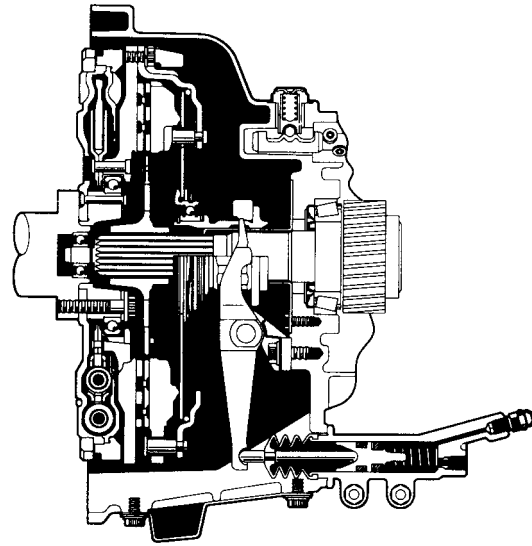
CLUTCH PEDAL

DESCRIPTION

- Ⓑ The new model's hydraulic a single-plate clutch is the same as that used in the previous model. The 2JZ-GE engine model uses a push-type clutch cover with the same basic construction and operation as those of the previous 7M-GE engine model.

Although the 2JZ-GTE engine model uses a pull-type clutch cover, in the way the previous 7M-GTE engine model did, it also adopts a flywheel damper to reduce drivetrain vibration and noise.

- Ⓑ On both the 2JZ-GE and 2JZ-GTE engine models, the turnover mechanism, which helps reduce the clutch pedal effort, has a initial assist spring which is designed to further reduce the initial pedal effort.



For 2JZ-GTE Engine Model

Specifications ◀

Model		New		Previous	
Engine Type		2JZ-GE	2JZ-GTE	7M-GE	7M-GTE
Item					
Clutch	Type	Dry Type Single Plate Clutch, Diaphragm Spring			←
	Operation	Hydraulic	←	←	←
Clutch Cover	Type	DST*1	←	←	←
	Size mm (in.)	239 (9.41)	253 (9.96)	239 (9.41)	243 (9.57)
Clutch Disc	Facing Size*2 mm (in.)	236 x 150 x 3.5 (9.29 x 5.91 x 0.14)	250 x 150 x 4.0 (9.84 x 5.91 x 0.16)	236 x 150 x 3.5 (9.29 x 5.91 x 0.14)	240 x 160 x 3.5 (9.45 x 6.30 x 0.14)
	Facing Area cm ² (in. ²)	260 (40.3)	314 (48.7)	260 (40.3)	251 (38.9)
Master Cylinder	Type	Conventional	←	←	←
	Cylinder Dia. mm (in.)	15.87 (0.62)	←	←	←
Release Cylinder	Type	Non-Adjustable	←	←	←
	Cylinder Dia. mm (in.)	20.64 (1.81)	22.20 (0.87)	20.64 (0.81)	22.2 (0.87)

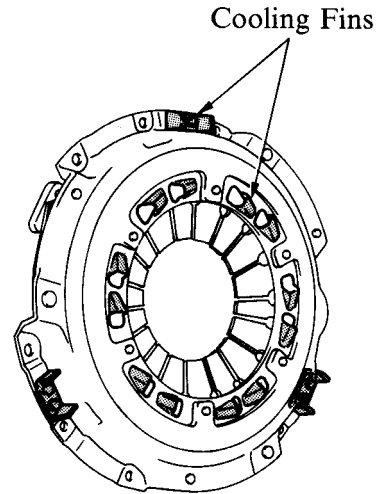
*1: DST (Diaphragm Spring Turnover)

*2: Outer Diameter x Inner Diameter x Thickness

CLUTCH COVER

The 2JZ-GE engine model uses the same push-type clutch cover as that used in the previous 7M-GE engine model.

Although its basic construction and operation are the same as those of the previous model, the pull-type clutch cover for the 2JZ-GTE engine is now made of steel plate instead of cast iron. In addition to being lighter in weight, the adoption of cooling fins helps increase the cooling efficiency in the clutch housing.



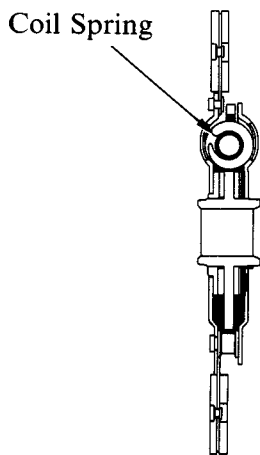
For 2JZ-GTE Engine

CLUTCH DISC

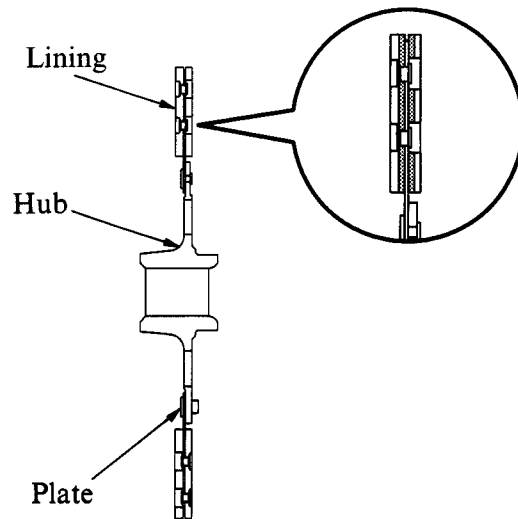
As with the clutch covers, there are 2 types of clutch discs used, one for the 2JZ-GE engine, and the other for the 2JZ-GTE engine.

Although the clutch disc for the 2JZ-GE engine has the same basic construction and operation as those for the 7M-GE engine, it uses highly rigid coil springs instead of torsion rubber.

Due to the adoption of the flywheel damper, the clutch disc for the 2JZ-GTE engine is not provided with a torsion mechanism. The clutch disc is therefore a solid type, in which the hub and plate are integrated. In addition, it uses a double-layer clutch lining.



For 2JZ-GE Engine

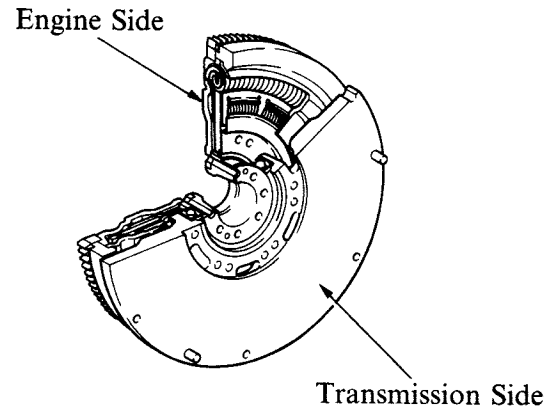


For 2JZ-GTE Engine

FLYWHEEL DAMPER

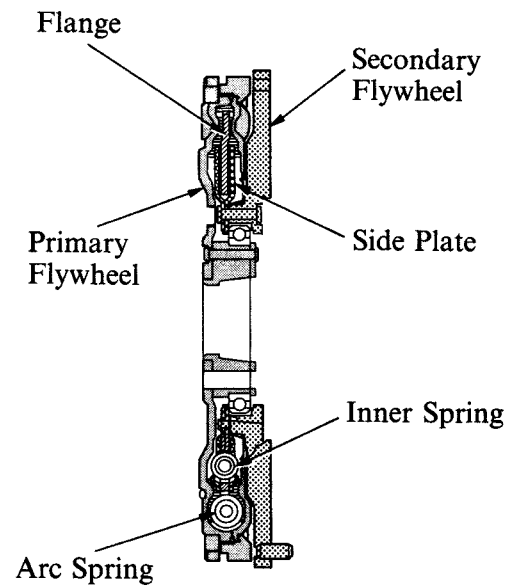
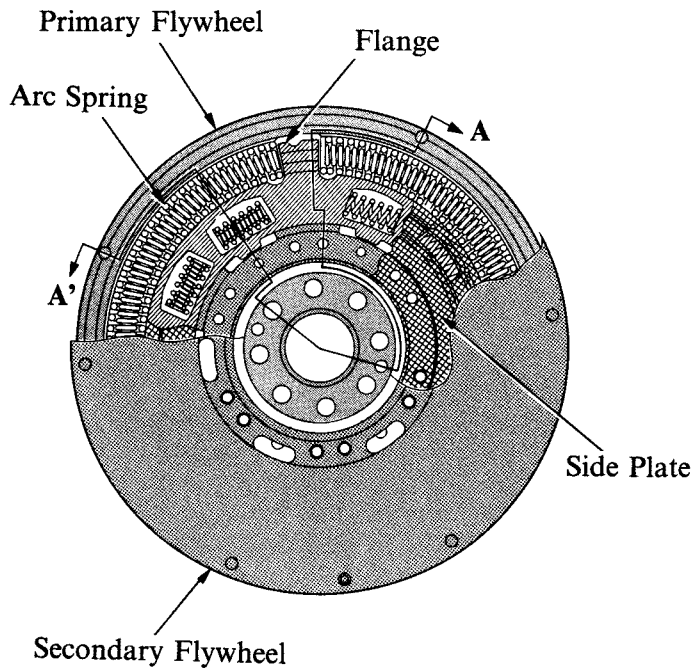
1. General

The 2JZ-GTE engine model uses a super-long travel type flywheel damper. It contains a decoupling mechanism, consisting of springs, which divides the flywheel into the engine and transmission sections. By decreasing the fluctuation of torque transmitted from the engine to the transmission, these springs contribute in reducing drivetrain vibration and noise.



2. Construction

The flywheel damper is fastened to the crankshaft via bolts, in the same way as the conventional flywheels. The flywheel damper consists of the primary flywheel which receives direct torque, arc springs and inner springs positioned in-line by way of a flange, and side plates riveted onto the secondary flywheel. The clutch disc and cover are attached to the secondary flywheel.

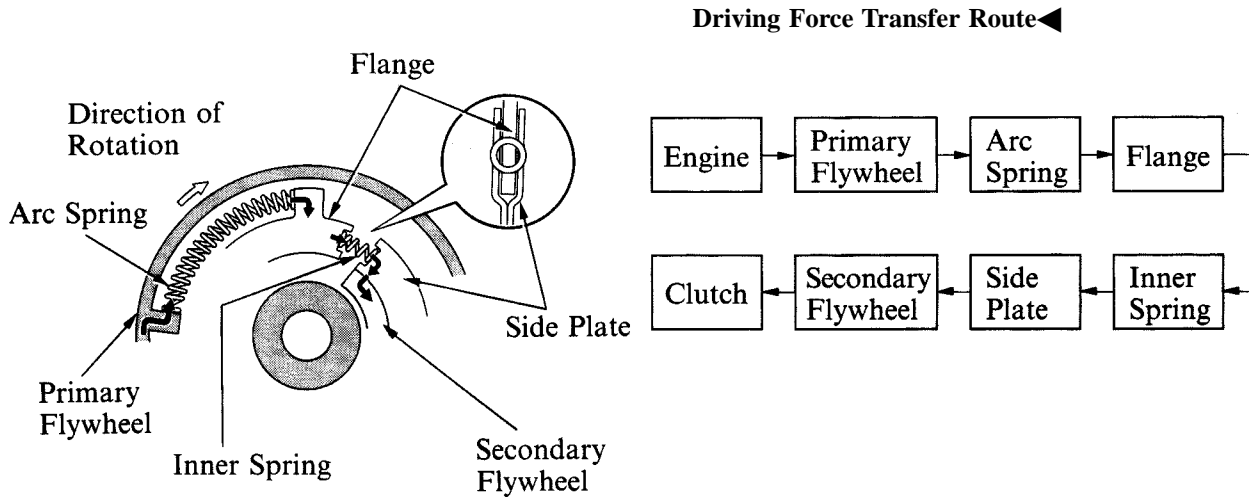


A-A' Cross Section

3. Operation

The driving force of the engine is first transmitted from the primary wheel to the arc springs. It is then transmitted from the arc springs to the flange and inner springs, causing the inner springs to be pressed against the side plates. The driving force is then transmitted to the clutch, since the side plates are riveted onto the secondary flywheel. These processes help restrain torque fluctuation.

Further, These inner springs are arc springs achieve high torque capacity combined with a low spring constant. They offer an optimum spring constant and hysteresis for all driving conditions.

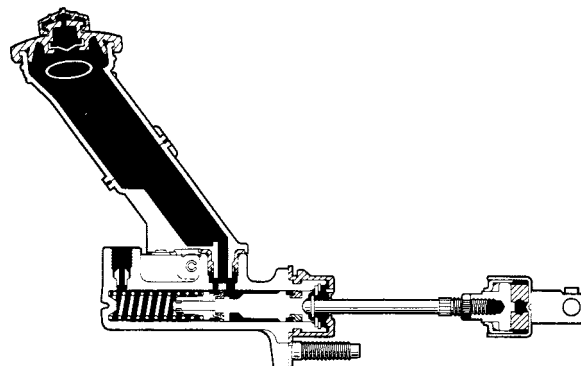


NOTICE

- Ⓡ The Flywheel damper cannot be disassembled. In case of malfunction, it is necessary to determine whether the source of the problem is in the engine, drivetrain, or in the flywheel damper itself. For troubleshooting and diagnosis procedures, refer to the '93 Toyota Supra Repair Manual (Pub. No. RM343U2).
- Ⓡ In case a defect or wear is found on the secondary flywheel clutch disc friction surface, replace the flywheel damper as a unit, instead of attempting to machine it. Any attempts to repair it will risk damaging the damper components or seals.

MASTER CYLINDER

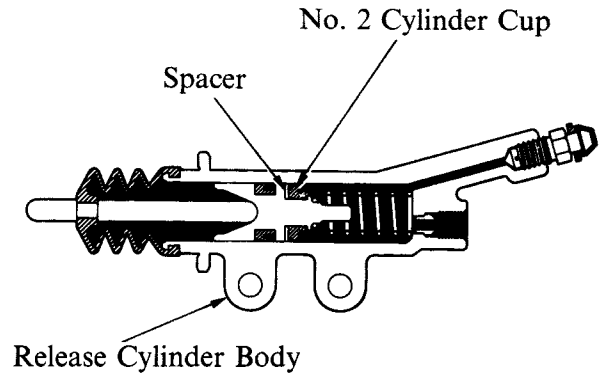
A conventional type master cylinder is used as in the previous model. Its basic construction and operation remain the same as those of the previous model.



RELEASE CYLINDER

The non-adjustable release cylinder used is the same type used in the previous model.

Although its basic construction and operation are the same as those of the previous model, the body of the release cylinder for the 2JZ-GTE engine model is now made of aluminum to reduce weight. In addition, a plastic spacer is provided on the back of the No. 2 cylinder cup to improve durability.

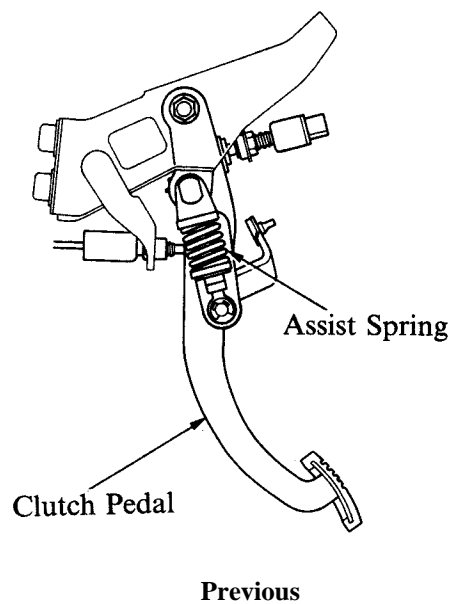
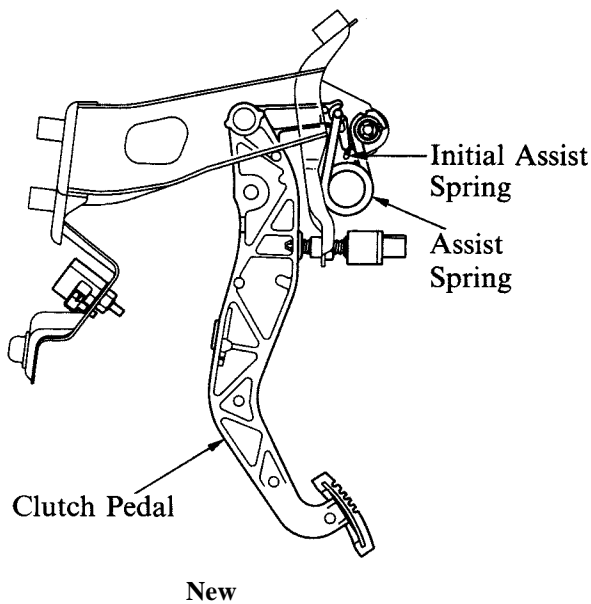
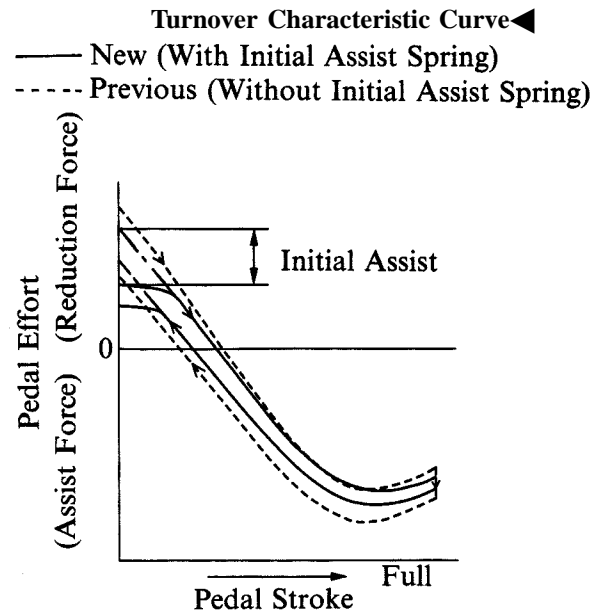


For 2JZ-GTE Engine Model

CLUTCH PEDAL

1. General

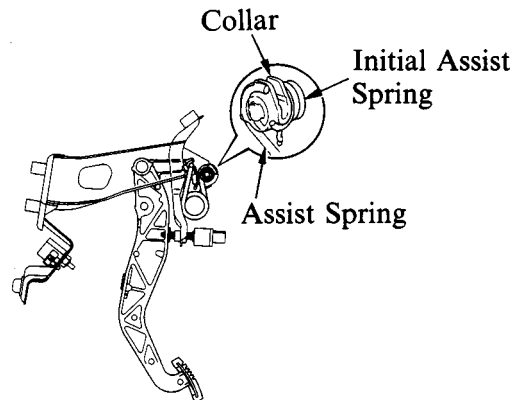
- Ⓡ The clutch pedal is provided with a turnover mechanism similar to that of the previous model. However, in the new model, the assist spring has been changed from the compression type of the previous model to the torsion type. This results in improved clutch response as well as economy of space. In addition, an initial assist spring has been added to this mechanism to reduce the initial pedal effort and to improve pedal response.
- Ⓡ The clutch pedal is made of aluminum to reduce weight.



2. Turnover Mechanism

Construction

The turnover mechanism consists of a clutch pedal, assist spring, initial assist spring, and a collar. The ends of the assist spring are attached to the clutch pedal and collar, respectively, and the spring applies constant outward pressure. The ends of the initial assist spring are attached to the pedal bracket and collar, respectively, and the spring applies counterclockwise force upon the collar.

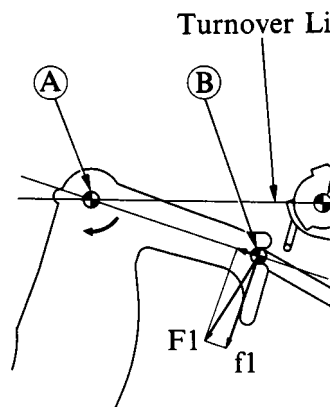


Operation

1) Assist Spring Application Force

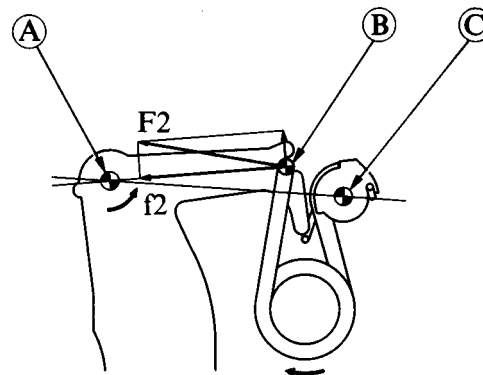
a. Clutch Pedal Depressed

When the clutch pedal is depressed, the pedal moves clockwise on fulcrum (A). Then, point (B), onto which the assist spring is attached to the clutch pedal, overcomes the “turnover line” (i.e., the line connecting fulcrum (A) of the clutch pedal with (C), the other attachment point of the assist spring) and resolves force “F1” applied to fulcrum (B). This generates force “f1” illustrated on the right, and since this force “f1” is directed towards the same direction as that of the clutch pedal, it helps reduce the effort required in depressing the pedal.



b. Clutch Pedal Released

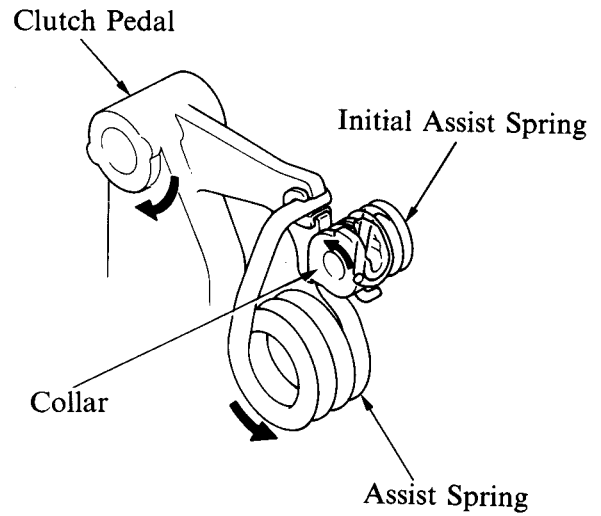
When the clutch pedal is released, with the help of the clutch master cylinder push rod reaction, the clutch pedal overcomes the extension force of the assist spring and causes the clutch pedal to move counterclockwise on fulcrum (A). Then, point (B), onto which the assist spring is attached to the clutch pedal overcomes the “turnover line” (i.e., the line connecting fulcrum (A) of the clutch pedal with (C), the other attachment point of the assist spring) and resolves force “F2” applied to the fulcrum (B). This generates force “f2” illustrated on the right, and since this force “f2” is directed towards the same direction as that of the clutch pedal, it helps the push rod in retracting the pedal.



2) Initial Assist Spring Application

When the clutch pedal is not being depressed, the force of the initial assist spring, by way of collar, applies a counterclockwise rotational force onto the front of the assist spring. In addition, the assist spring applies a clockwise rotational force onto the clutch pedal. Hence, this clockwise rotational force enables the clutch pedal to be operated with a smaller pedal effort than if the initial assist spring were not there.

When the clutch pedal is depressed, the initial assist spring passes through its initial stage in an elongated form, preventing it from applying its spring force on to the collar. Thus, the large reaction force at the initial stages immediately following the depressing of the pedal, is reduce.



A340E AUTOMATIC TRANSMISSION

DESCRIPTION

Based on the previous model's A340E automatic transmission, 2 types of A340E automatic transmissions have been perfectly matched to the new 2JZ-GE and 2JZ-GTE engine models. These transmissions offer a highly responsive and smooth driving experience worthy of a sports car.

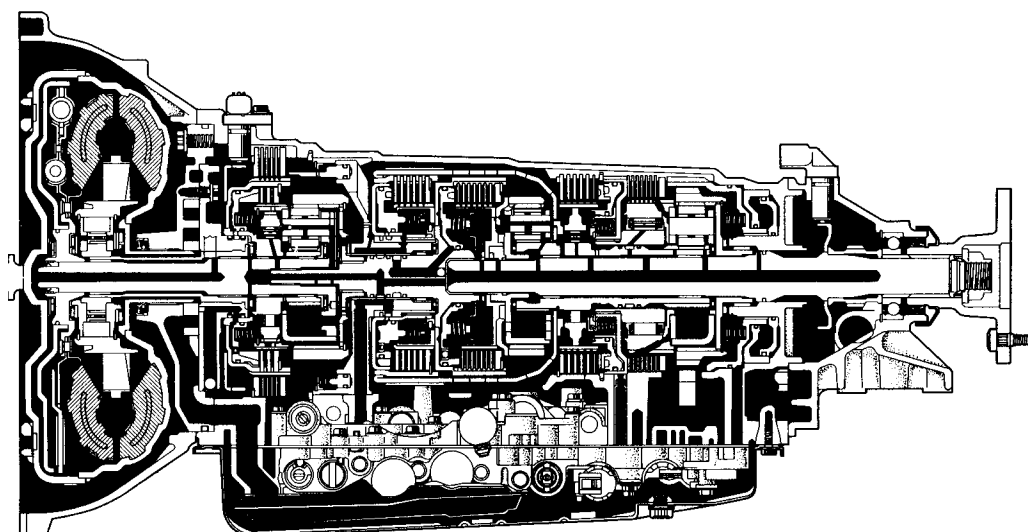
New Features ◀

Items	For 2JZ-GE	For 2JZ-GTE
The TCM* ² (Transmission ECU) is consolidated with the ECM* ¹ (Engine ECU) to provide an integrated engine/transmission control.		
Based on the conventional electronically controlled transmission system, the new model adopts a new electronically controlled transmission system* ³ with improved control accuracy.	—	
To give the driver full “at will” driving control <input type="radio"/> a “Manual” pattern is newly adopted as one of the shift patterns. <input type="radio"/> a kickdown switch is newly adopted.		
In place of the conventional throttle cable, a new line pressure control with a solenoid valve is adopted.	—	
High-performance ATF Type T-II is used.	—	

*¹ ECM (Engine Control Module)

*² TCM (Transmission Control Module)

*³ In order to differentiate these 2 systems, at Toyota, the latter is called “Electronically Controlled Transmission with an Intelligent Sporty Control”.



For 2JZ-GTE Engine Model

Specifications ◀

Model		New		Previous	
Transmission Type		A340E	A340E	A340E	A340E
Engine Type		2JZ-GE	2JZ-GTE	7M-GE	7M-GTE
Item					
Gear Ratio	1st	2.804	←	←	
	2nd	1.531	←	←	
	3rd	1.000	←	←	
	4th (Overdrive)	0.705	←	←	
	Reverse	2.393	←	←	
Fluid Capacity Liters (US qts, Imp.qts)		7.2 (7.6, 6.3)	8.2 (8.7, 7.2)	7.2 (7.6, 6.3)	
Fluid Type		ATF Type DEXRON® II	ATF Type T-II	ATF Type DEXRON® II	

☞ **TORQUE CONVERTER AND PLANETARY GEAR UNIT**

The specifications of the torque converter and planetary gear unit have been revised to match the power output of the new engine.

Torque Converter ◀

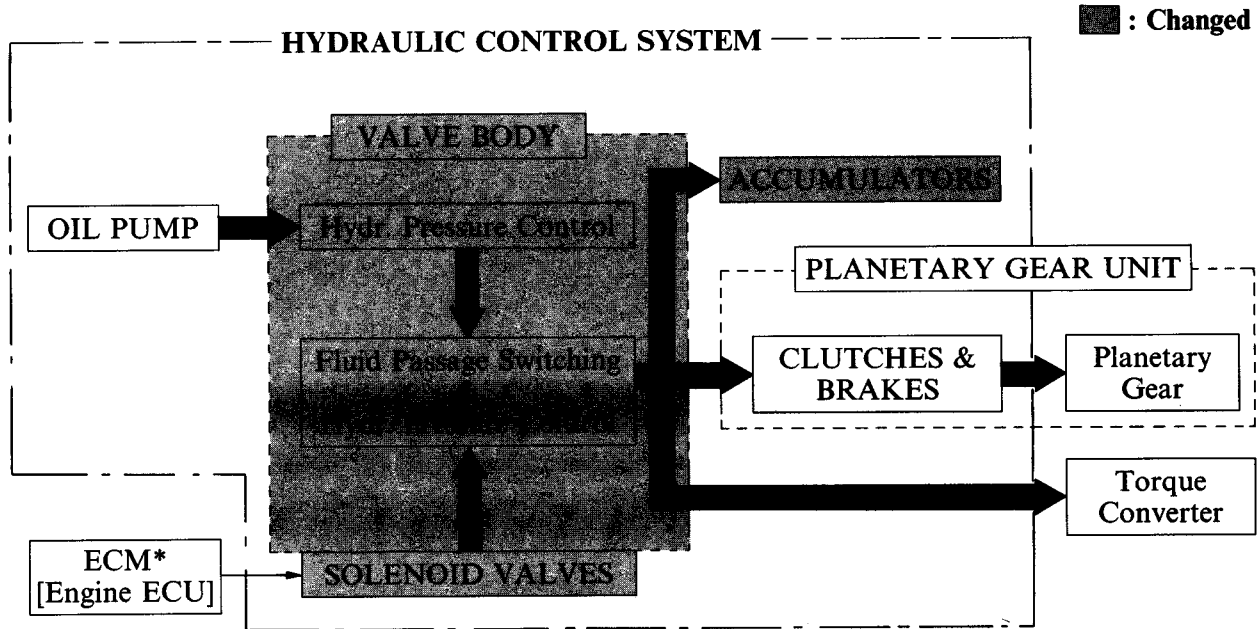
Model		New		Previous	
Transmission Type		A340E	A340E	A340E	A340E
Engine Type		2JZ-GE	2JZ-GTE	7M-GE	7M-GTE
Item					
Converter Type		3-Element, 1-step, 2-Phase, with Lock-Up Mechanism		←	
Small Torque Ratio		1.900	2.000	←	2.100
Nominal Diameter mm (in.)		254 (10.00)	272 (10.71)	254 (10.00)	←

Planetary Gear Unit ◀

Model			New		Previous	
Transmission Type			A340E	A340E	A340E	A340E
Engine Type			2JZ-GE	2JZ-GTE	7M-GE	7M-GTE
Item						
C ₀	OD Direct Clutch	No. of Discs	2	←	←	←
C ₁	Forward Clutch		5	7	5	6
C ₂	Direct Clutch		4	5	4	←
B ₀	OD Brake	No. of Discs	4	5	←	←
B ₁	2nd Coast Brake	Band Width mm (in.)	40 (1.57)	←	←	←
B ₂	2nd Brake	No. of Discs	5	←	←	←
B ₃	1st & Reverse Brake		6	7	6	7
F ₀	OD One-Way Clutch	No. of Sprags	24	←	←	←
F ₁	No. 1 One-Way Clutch		22	←	←	←
F ₂	No. 2 One-Way Clutch		28	←	←	←
Front Planetary Gear		No. of Sun Gear Teeth	42	←	←	←
		No. of Pinion Gear Teeth	19	←	←	←
		No. of Ring Gear Teeth	79	←	←	←
Rear Planetary Gear		No. of Sun Gear Teeth	33	←	←	←
		No. of Pinion Gear Teeth	23	←	←	←
		No. of Ring Gear Teeth	79	←	←	←
OD Planetary Gear		No. of Sun Gear Teeth	33	←	←	←
		No. of Pinion Gear Teeth	23	←	←	←
		No. of Ring Gear Teeth	79	←	←	←

HYDRAULIC CONTROL SYSTEM

Along with the adoption of the new electronically controlled transmission system, the valve body (which controls the hydraulic pressure) in the A340E automatic transmission for the 2JZ-GTE engine has been modified. However, the A340E automatic transmission for the 2JZ-GE engine remains basically the same as the A340E of the previous model.



* ECM (Engine Control Module)

1. Construction and Operation

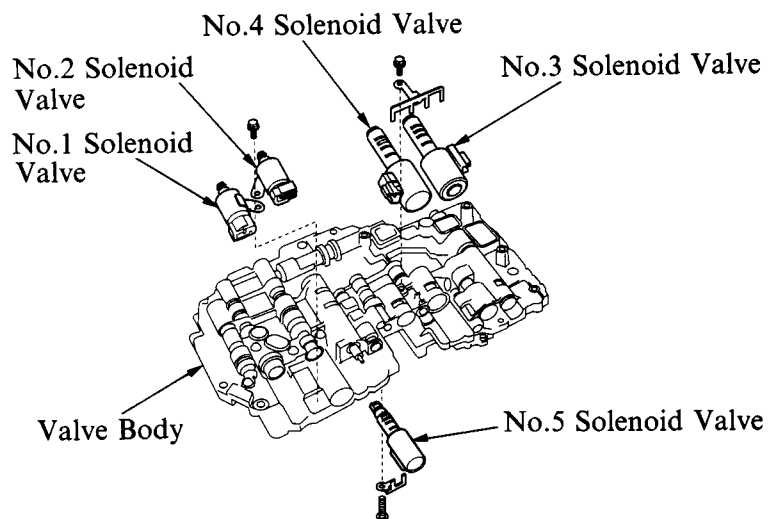
Valve Body

1) Outline

The valve body consists of upper and lower valve bodies which contain valves that control fluid pressure and switch fluid flow from one passage to another.

The following valves and accumulator have added in the A340E for the 2JZ-GTE engine model to provide electronic modulation of accumulator back pressure, line pressure, and lock-up control pressures.

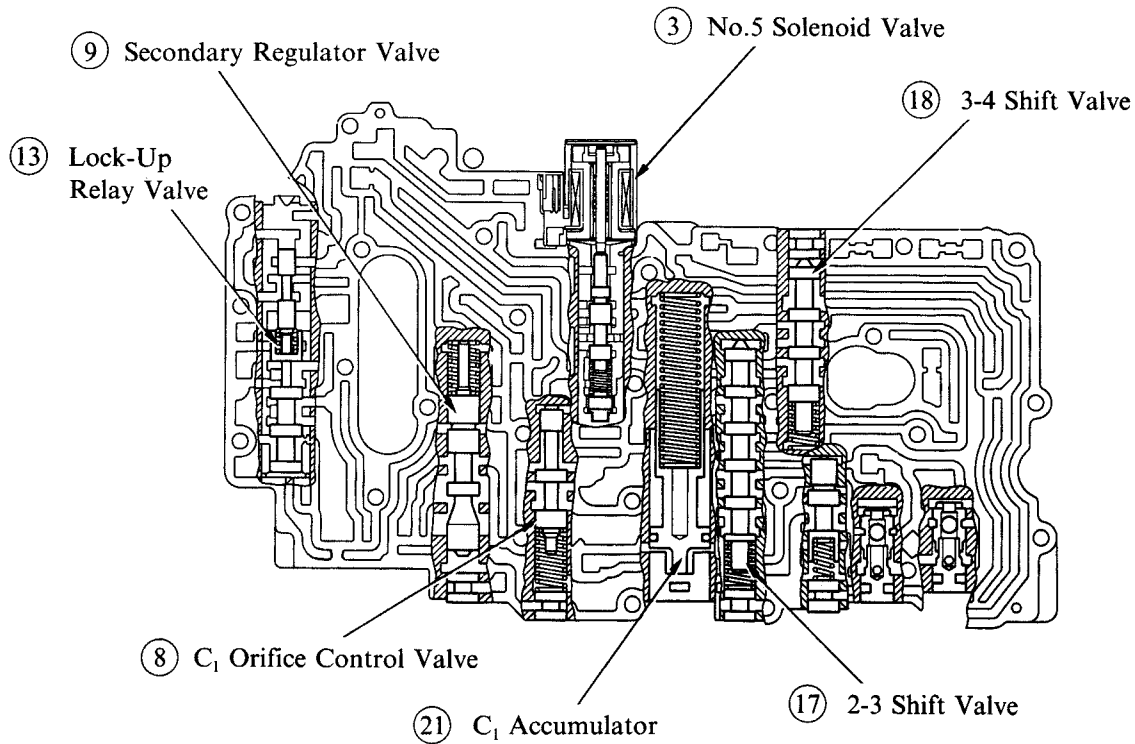
- Cut-Off Valve
- C₁ Orifice Control Valve
- Solenoid Modulator Valve
- Solenoid Relay Valve
- Lock-up Control Valve
- C₁ Accumulator
- 2 Check Valves



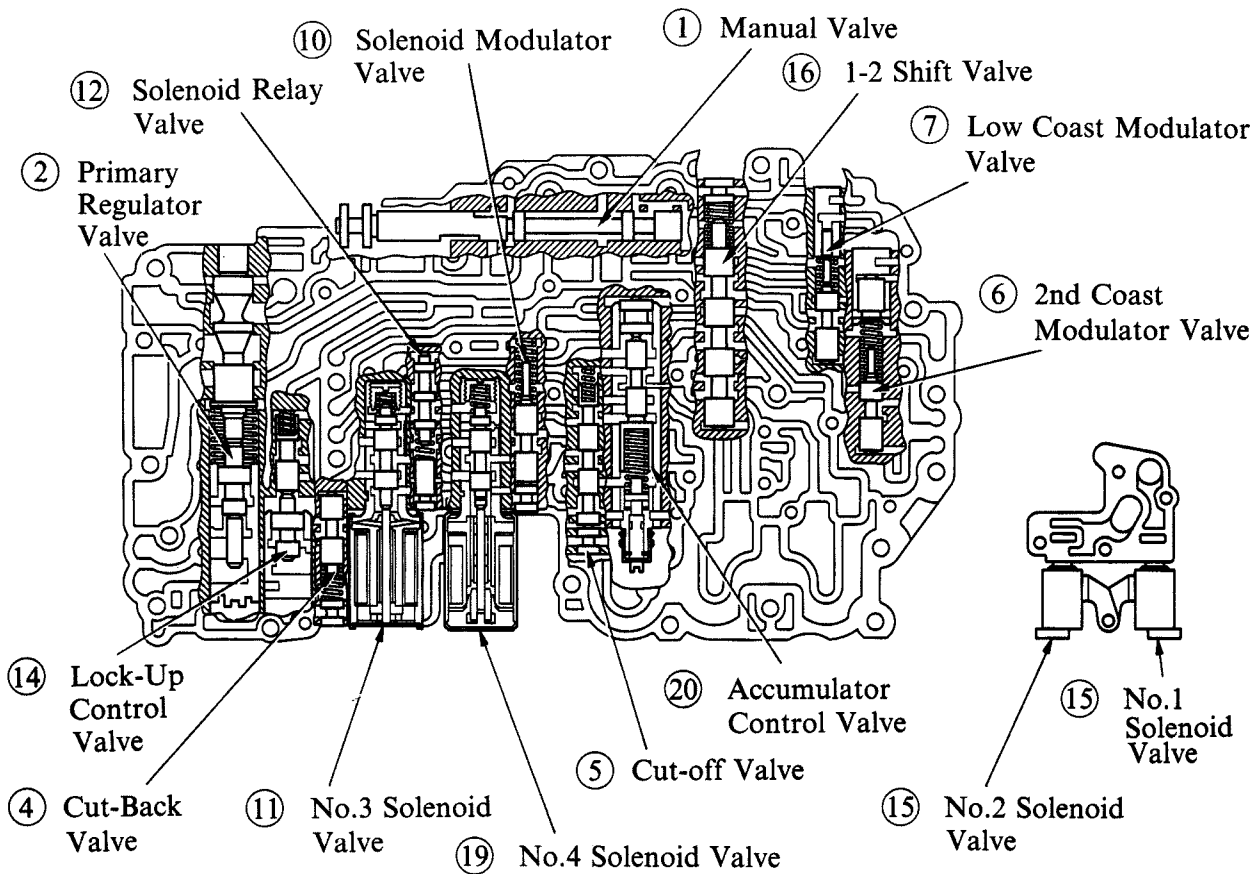
2) Construction

The following illustration shows the valve layout in the upper and lower valve bodies:

Upper Valve Body ◀



Lower Valve Body ◀



3) Function

The following are the functions of the valves used in the A340E automatic transmission of the 2JZ-GTE engine model and those used in the A340E of the 7M-GTE engine model.

No.	Transmission		Component	Function
	A340E (For 2JZ-GTE)	A340E (For 7M-GTE)		
(1)			Manual Valve	Connected to the shift lever, this valve regulates line pressure from the primary regulator valve according to the shift lever position.
(2)			Primary Regulator Valve	Regulates the line pressure from the oil pump to each component according to the engine load.
(3)		—	No. 5 Solenoid Valve	Controlled by ECM* [Engine ECU], this valve regulates the solenoid pressure, generates regulated throttle pressure, and applies the throttle pressure to the primary regulator valve.
(4)			Cut-Back Valve	Regulates the throttle pressure applied on the primary regulator valve to effect secure engagement of the clutches and brakes in 1st, reverse, or "2" range 2nd gear.
(5)		—	Cut-Off Valve	The rate of 2nd modulator pressure supplied to the 2nd coast brake (B ₁) is controlled by switching the orifices to reduce the time lag while shifting manually from the "D" to "2" range. This also reduces the impact when the transmission shifts from 1st to 2nd gear while it is in the "2" range.
(6)			2nd Coast Modulator Valve	While in 2nd gear in the "2" range, this valve regulates the line pressure from the 1-2 shift valve. This produces the 2nd modulator pressure which is applied to the 2nd coast brake, ensuring a smoother 2nd coast brake engagement.
(7)			Low Coast Modulator Valve	While in the "L" range, this valve regulates the line pressure from the 2-3 shift valve. This produces the low modulator pressure which is applied to the 1st and reverse brake (B ₃), ensuring a smoother 1st and reverse brake engagement.
(8)		—	C ₁ Orifice Control Valve	The switching of orifices changes the flow of line pressure from the manual valve directed to the forward clutch (C ₁) and controls the engaging speed of C ₁ .
(9)			Secondary Regulator Valve	Controls the hydraulic pressure directed to the torque converter, oil cooler, and for lubrication.
(10)		—	Solenoid Modulator Valve	This valve regulates the line pressure applied to the No. 3 and No. 4 solenoid valves and stabilizes the solenoid pressure.
(11)			No. 3 Solenoid Valve	This valve is controlled by ECM* [Engine ECU] signals which regulates the line pressure from the solenoid relay valve. The solenoid pressure that has thus been created is applied to the lock-up relay valve and the lock-up control valve.
(12)		—	Solenoid Relay Valve	The solenoid pressure from the No. 3 solenoid valve is switched between the lock-up relay valve, lock-up control valve, or C ₂ orifice control valve, to permit or prevent lock-up operation.
(13)			Lock-Up Relay Valve	Switches the flow of torque converter pressure between the torque converter lock-up clutch and oil cooler.

* ECM (Engine Control Module)

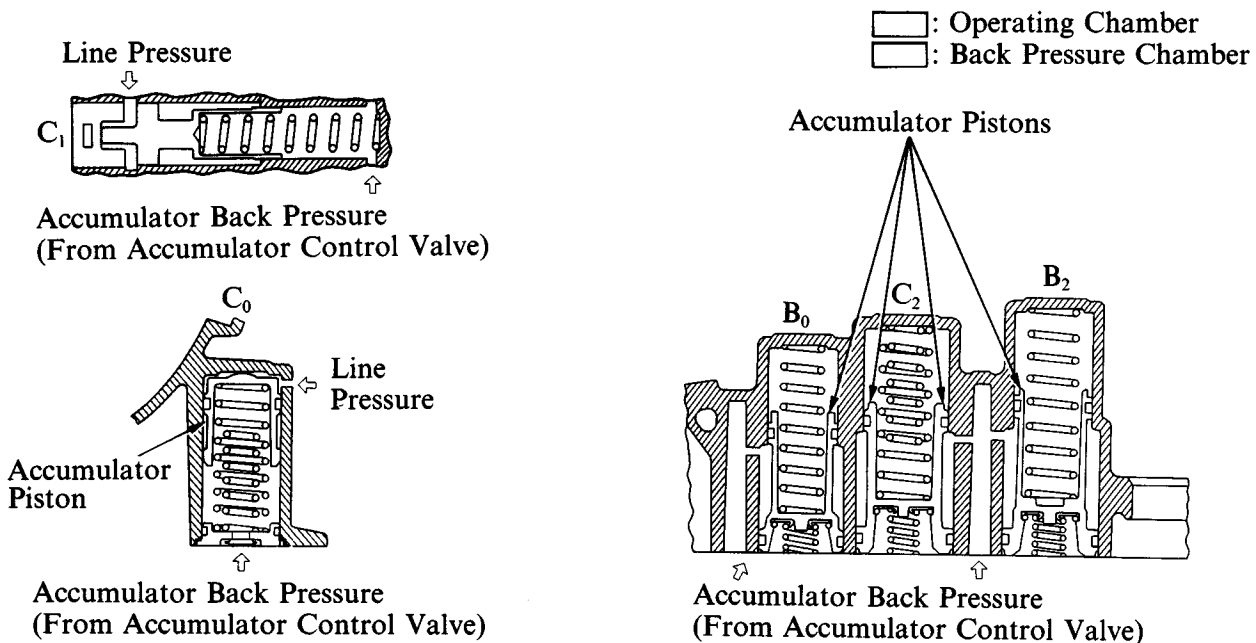
No.	Transmission		Component	Function
	A340E (For 2JZ-GTE)	A340E (For 7M-GTE)		
(14)		—	Lock-Up Control Valve	Controls the pressure differential when the lock-up clutch is switched on and off.
(15)		—	No. 1 and No. 2 Solenoid Valves	These valves are turned on or off by the ECM* [Engine ECU] to effect 1-2, 2-3, and 3-4 gear shifting.
(16)			1-2 Shift Valve	Switches line pressure to shift between 1st and 2nd gears.
(17)			2-3 Shift Valve	Switches line pressure to shift between 2nd and 3rd gears.
(18)			3-4 Shift Valve	Switches line pressure to shift between 3rd gear and OD.
(19)		—	No. 4 Solenoid Valve	This valve is controlled by ECM* [Engine ECU] signals which regulates the line pressure from the solenoid modulator valve. The solenoid pressure that has thus been created is applied to the accumulator control valve.
(20)			Accumulator Control Valve	Controls the line pressure. The resulting accumulator control pressure is directed to the accumulator to ensure a smoother engagement of the clutches and brakes.
(21)		—	C ₁ Accumulator	Incorporated in parallel with the forward clutch hydraulic path, the gradual application of line pressure during "N" to "D" shifting decreases impact.

* ECM (Engine Control Module)

Accumulators

The A340E automatic transmission for the 2JZ-GTE engine has the following 5 accumulators: one for the direct clutch (C₂), the OD direct clutch (C₀), the 2nd brake (B₂), the OD brake (B₀). The C₁ accumulator is located in the upper valve body. Other accumulators are located in the transmission case as in the A340E transmission for the 7M-GE engine does not use an accumulator for the forward clutch.

Accumulator	Smooth Engagement for
C ₁	"N" Range → "D" Range
C ₂	2nd → 3rd
C ₀	OD → 3rd
B ₂	1st → 2nd
B ₀	3rd → OD



ELECTRONIC CONTROL SYSTEM

The consolidation of the TCM*¹ [Transmission ECU] with the ECM*² [Engine ECU] has allowed for an integrated engine/transmission control. Within the ECM*² [Engine ECU] under this system, engine operating conditions such as the engine speed and throttle valve opening angle, are constantly relayed from the engine control section to the transmission control section. Likewise, transmission operating conditions, such as the shifting information and the required engine torque values, are continuously transmitted from the transmission control section to the engine control section. This communication within the ECM*² [Engine ECU] makes it possible to effect smooth and highly responsive shifting characteristics. The new model offers the following control systems:

*¹ TCM (Transmission Control Module)

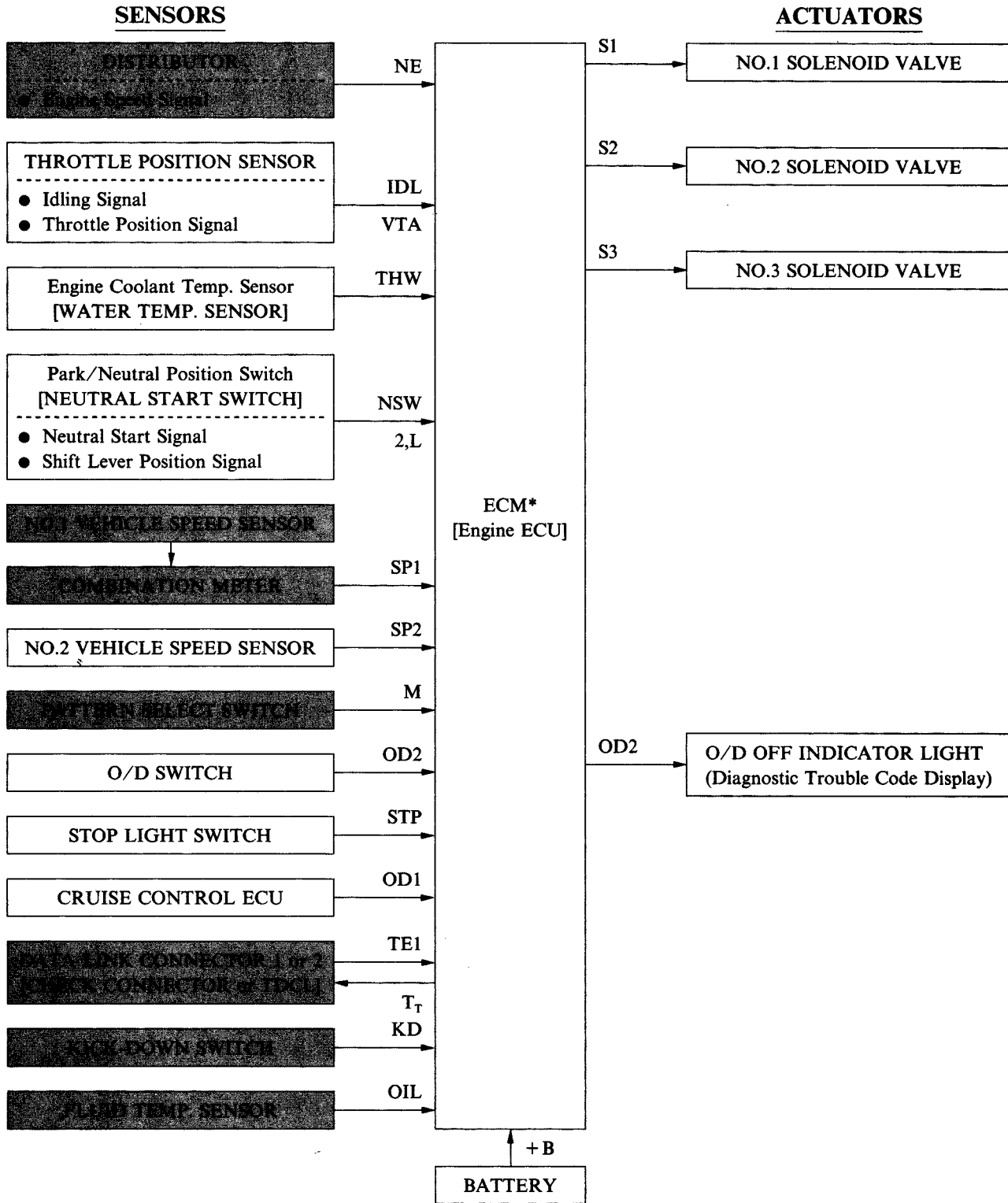
*² ECM (Engine Control Module)

System	Function	A340E (For 2JZ-GE)	A340E (For 2JZ-GTE)
Shift Timing Control	The optimum shift pattern is selected from 2 shift patterns in the ECM* [Engine ECU] by the pattern select switch. The ECM* [Engine ECU] sends current to the No. 1 and /or No. 2 solenoid valves based on signals from each sensor and shifts the gear.		
Lock-Up Timing Control	The Optimum lock-up pattern is selected from 2 lock-up patterns in the ECM* [Engine ECU] by the pattern select switch. The ECM* [Engine ECU] sends current to the No. 3 solenoid valve based on signals from each sensor and engages or disengages the lock-up clutch.		
Line Pressure Control	Based on the throttle opening angle, the ECM* [Engine ECU] sends a signal to No. 5 solenoid valve to generate line pressure according to the engine output, to effect a smooth gear shift change.	—	
Lock-Up Pressure Control	The ECM* [Engine ECU] gradually alters the current flow to No. 3 solenoid valve according to the gear position and the throttle opening angle to provide smooth engagement and disengagement of the lock-up clutch.	—	
Accumulator Back Pressure Control	The ECM* [Engine ECU] sends signals to No. 4 solenoid valve when gear shift occurs to temporarily lower the accumulator back pressure so that the gear shift is completed smoothly.	—	
"N" to "D" Squat Control	When the shift lever is shifted from "N" to "D" range, the gear is temporarily shifted to 3rd and then to 1st to reduce vehicle squat.		—
Engine Torque Control	Retards the engine ignition timing temporarily to improve shift feeling during up or down shifting.		
Self-Diagnosis	Causes the O/D OFF indicator light to blink to inform the driver when the electrical circuit malfunctions. The indicator light also informs the location of the malfunction by blinking code numbers.	6 items	10 items
Fail-Safe	Controls other normally operating components, permitting continued driving when malfunctions occur in the electrical circuit.		

* ECM (Engine Control Module)

1. Construction (For 2JZ-GE Engine)

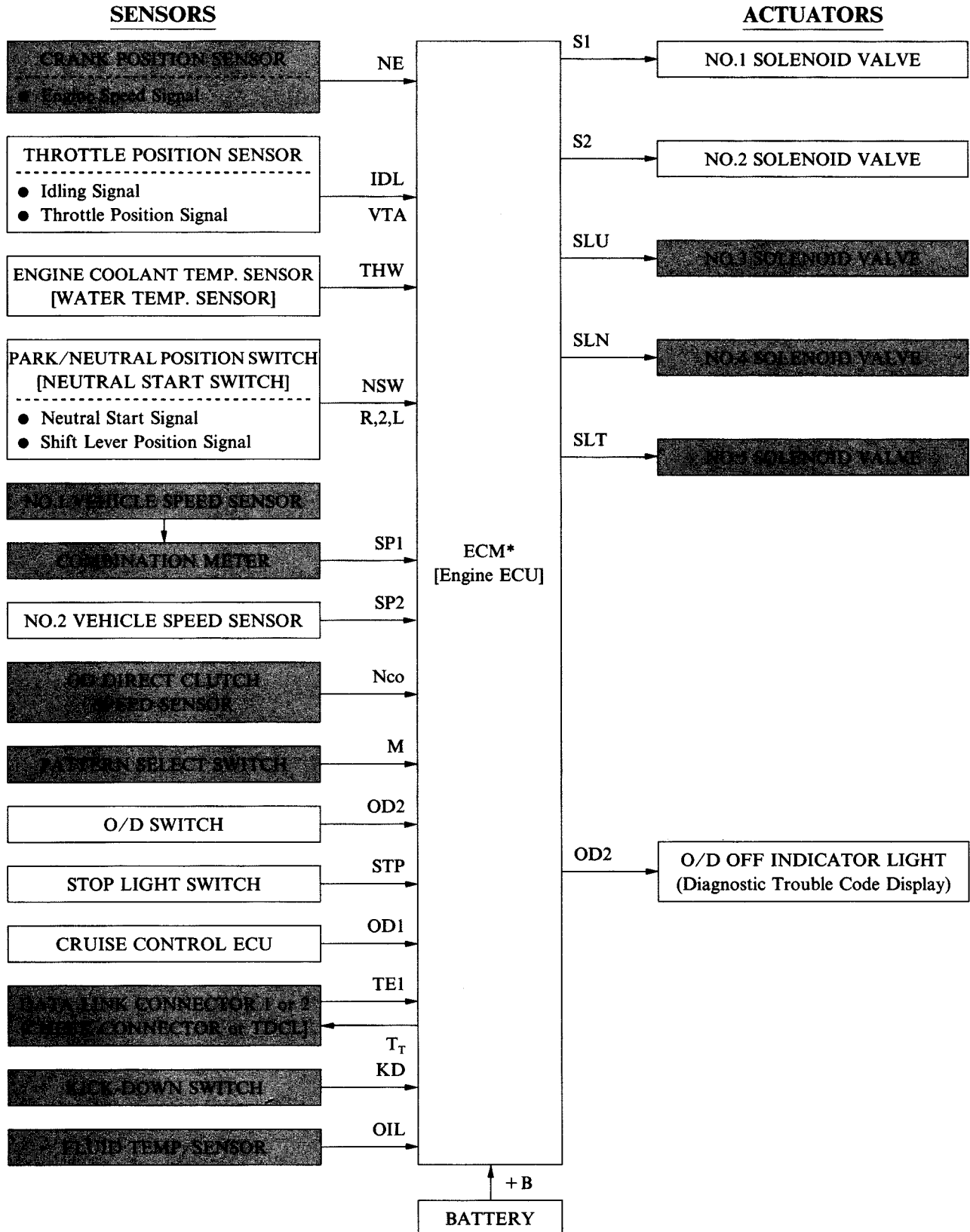
The electronic control system can be broadly divided into 3 groups: The sensors, ECM* [Engine ECU], and the actuators. The shaded sections which appear below, denote the areas in which the A340E automatic transmission for the 2JZ-GE engine model differs from the previous A340E.



* ECM (Engine Control Module)

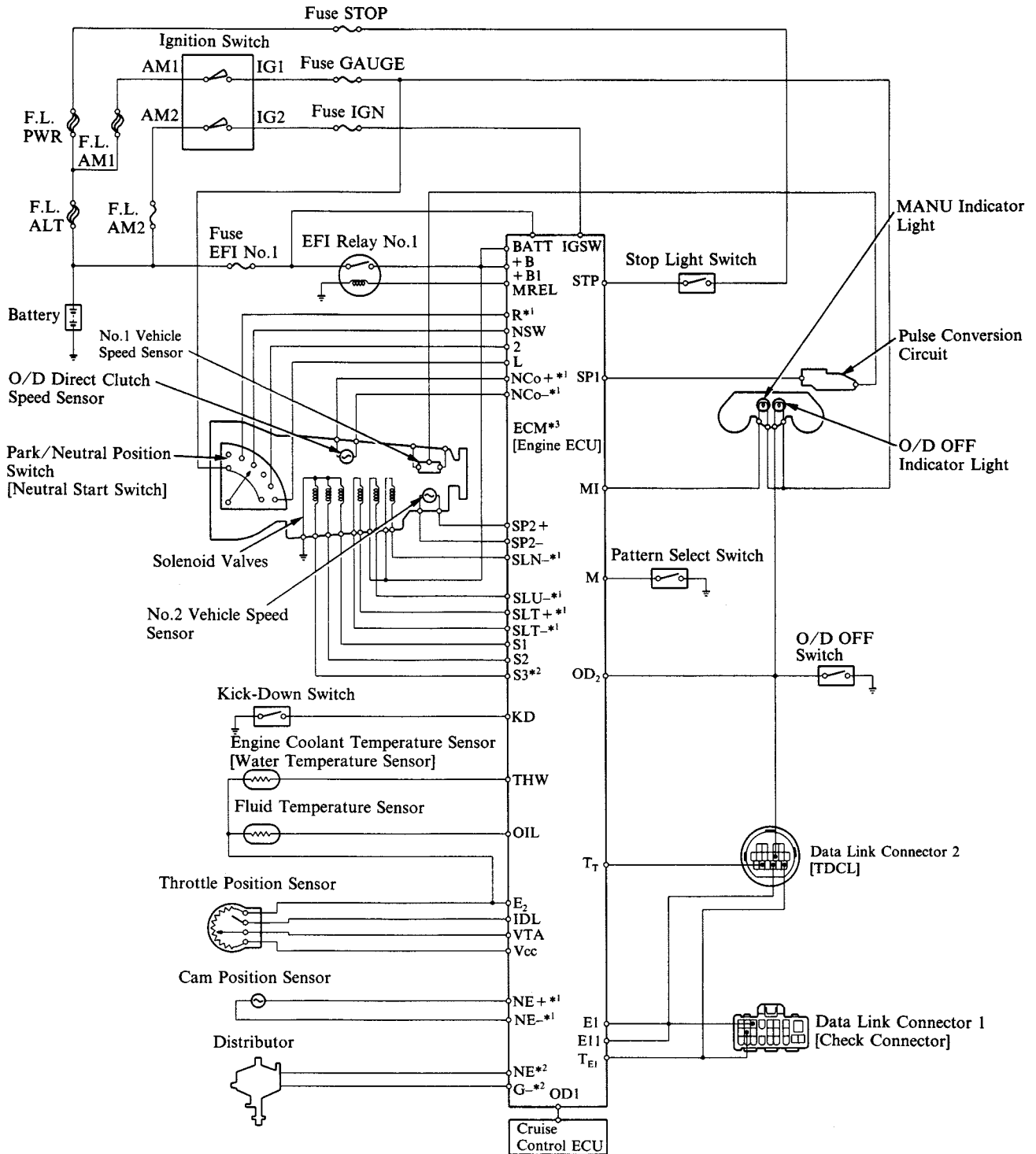
2. Construction (For 2JZ-GTE Engine)

The electronic control system of the A340E for the 2JZ-GTE engine has the same 3 groups also found in the system of the 2JZ-GE engine model. The shaded sections denote the areas in which the new A340E differs from the previous A340E.



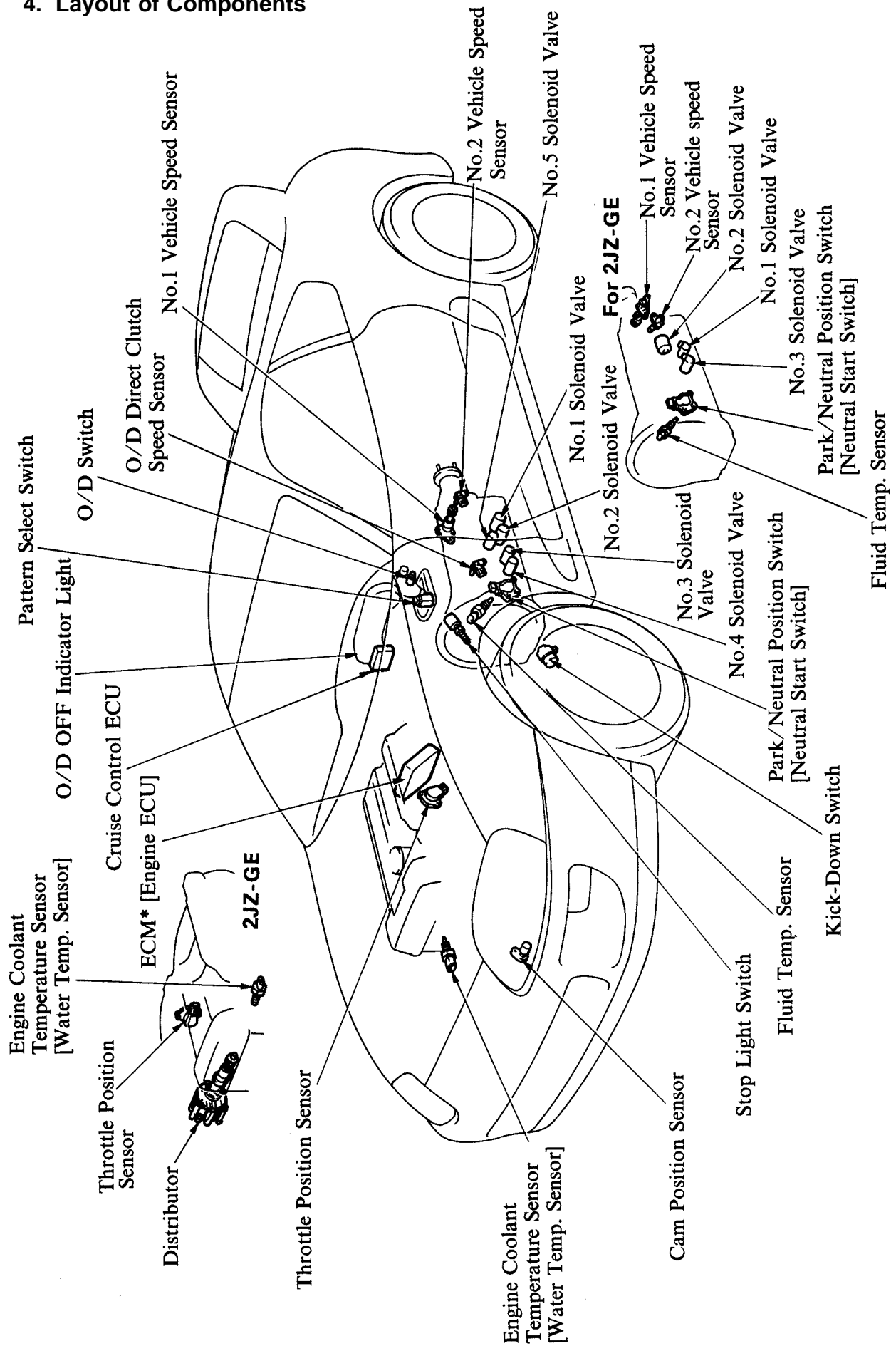
* ECM (Engine Control Module)

3. Wiring Diagram



*1 For 2JZ-GTE Engine Model
 *2 For 2JZ-GE Engine Model
 *3 ECM (Engine Control Module)

4. Layout of Components



5. Modification of Main Components

General

Both types of A340E transmissions, additionally equipped with a kick-down switch and a fluid temperature sensor, have modified versions of the No. 2 vehicle speed sensor and pattern select switch. Furthermore, the A340E for the 2JZ-GTE model has an additional OD direct clutch speed sensor, and a modification and addition of the solenoid valve, along with the adoption of the new electronically controlled transmission system.

Pattern Select Switch

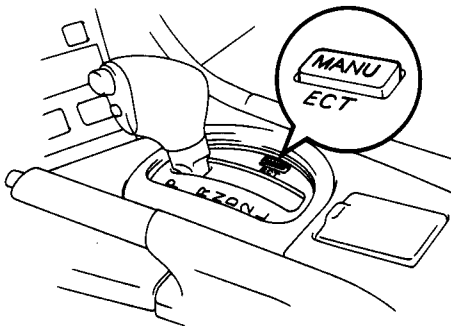
In conjunction with adopting the new “MANU” mode, the pattern select switch has been changed. The modes available in this switch are “NORM” and “MANU”. As shown on the table below, the shift program in the manual mode is different from the normal and power modes of the previous model. Under this mode, the driver can use the shift lever to select a desired gear in the same way the shift lever is used when driving a vehicle with manual transmission.

When the manual mode is selected, the “MANU” indicator light in the combination meter becomes lit.

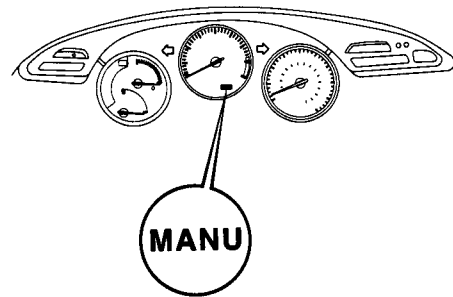
Shift Program ◀

Model		New		New	
Mode		Normal	Manual	Normal	Manual
Shift Position					
D	O/D Switch ON	1st ↔ 2nd ↔ 3rd ↔ 4th	3rd*	1st ↔ 2nd ↔ 3rd ↔ 4th	←
	O/D Switch OFF	1st ↔ 2nd ↔ 3rd	3rd*	1st ↔ 2nd ↔ 3rd	←
2		1st ↔ 2nd	2nd	1st ↔ 2nd ↔ 3rd	←
L		1st	←	←	←

* At takeoff, the transmission is in the 2nd gear.



Pattern Select Switch



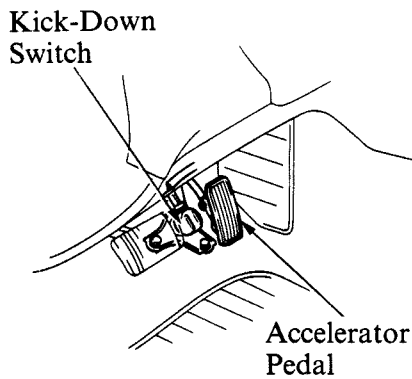
Indicator Light

Kick-down Switch

1) Function

The kick-down switch is fitted to the floor panel directly under the accelerator pedal. When the accelerator pedal is depressed beyond the full-throttle opening, the pedal presses and thus turns on the kick-down switch. The accelerator pedal is designed in such a way that a greater pedal effort is necessary to activate the kick-down switch than to depress the pedal to the full-throttle position. When the kick-down switch is turned on, the ECM* [Engine ECU] controls gear shifting according to programmed shift diagrams.

* ECM (Engine Control Module)

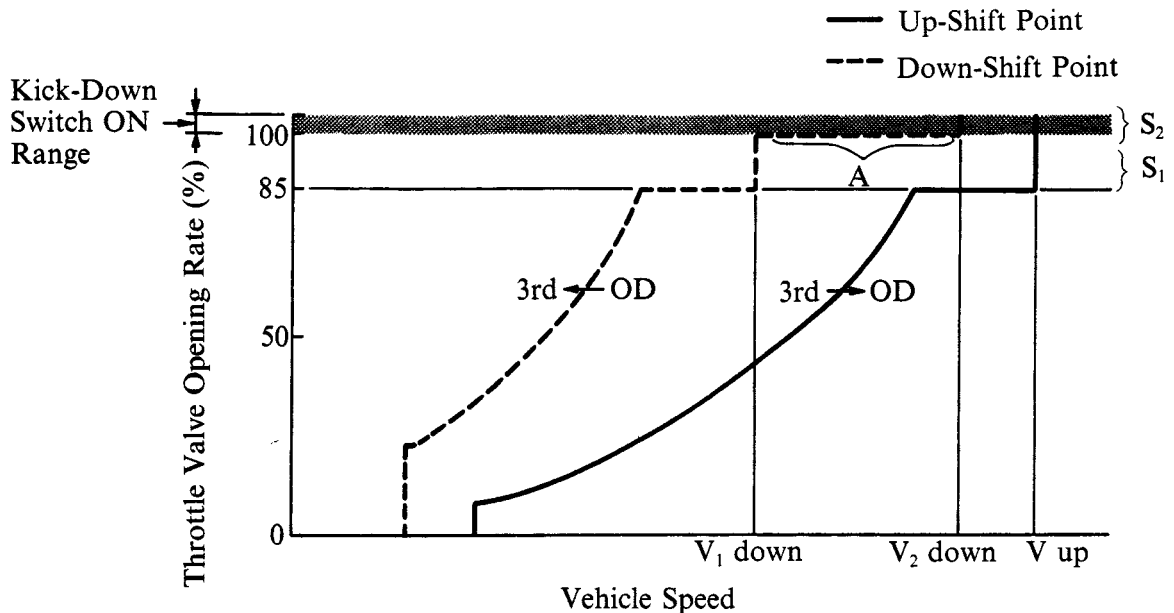


Accelerator Pedal Condition			
Item			
Throttle Valve	Fully Closed	Fully Opened	Fully Opened
Kick-Down Switch	OFF	OFF	ON

2) Operation of Gear Shift Change

The ECM* [Engine ECU] controls the No. 1 and No. 2 shift control solenoid valves to turn them on and off based on the signals from the throttle position sensor, kick-down switch and vehicle speed sensor.

* ECM (Engine Control Module)



a. S₁ Range (Throttle Valve Opening 85% or more, Kick-Down Switch OFF)

When the vehicle is running in S₁ range, the gear is shifted to the OD gear when the vehicle reaches the V up speed. The kick-down switch to the 3rd gear is not allowed even if the throttle valve opening is changed. Down-shifting to the 3rd gear is made as soon as the vehicle speed drops to the V₁ down speed.

b. S₂ Range (Throttle Valve Opening 100% or more, Kick-Down Switch ON)

When the vehicle is running in S₂ range, up-shifting to the OD gear is made when the vehicle reaches the V up speed and kick-down to the 3rd gear is not allowed. Down-shifting to the 3rd gear is made as soon as the vehicle speed drops to the V₂ down speed.

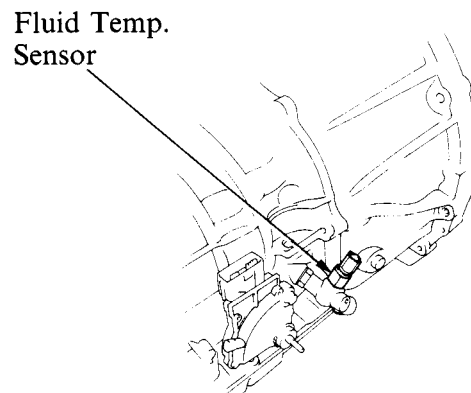
c. When the accelerator pedal is depressed S₁ to S₂

When the accelerator pedal is further depressed and the kick-down switch is turned on, the gear can be kicked down from the OD gear to the 3rd gear if the vehicle speed falls within the range “A” from the V up speed or more in the diagram.

In this way, kick-down from the OD gear to the 3rd gear is prohibited when the vehicle is running at a high speed with the throttle valve opening more than 85%.

Fluid Temperature Sensor

The fluid temperature sensor, which senses the fluid temperature in the outlet to the oil cooler, has been added in the elbow. This fluid temperature sensor is a thermistor type, and sends signals to the ECM* [Engine ECU].

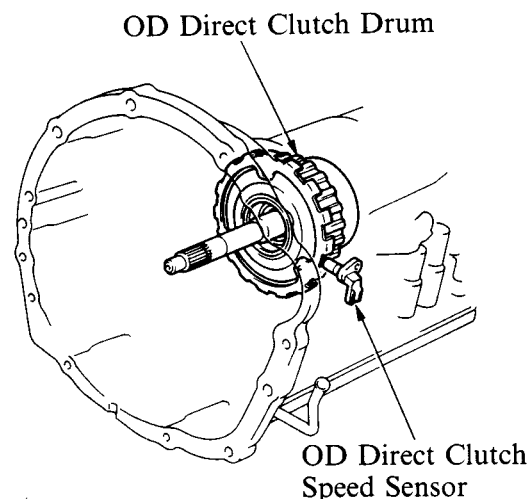
**OD Direct Clutch Speed Sensor**

The A340E transmission for the 2JZ-GTE engine model uses a direct clutch speed sensor.

Fitted to the transmission case, this sensor detects the revolution of the OD input shaft from the 1st through 3rd gears, based on the revolution of the OD direct clutch drum.

According to the signals received from this sensor, ECM* [Engine ECU] controls the input shaft revolution so that it will effect a predetermined rpm change. This sensor's construction and operation are the same as those of the No. 2 vehicle speed sensor.

* ECM (Engine Control Module)

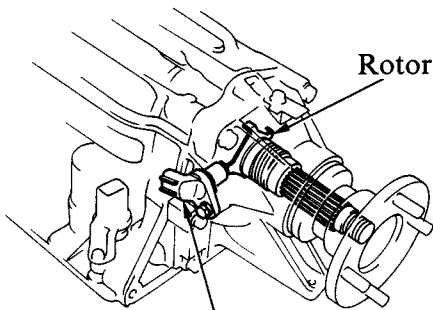


No. 2 Vehicle Speed Sensor (Main Sensor)

The No. 2 vehicle speed sensor used in both types of the new A340E transmission has been changed from the previous lead-switch type to the pick-up coil type.

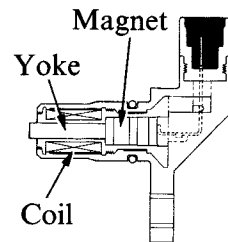
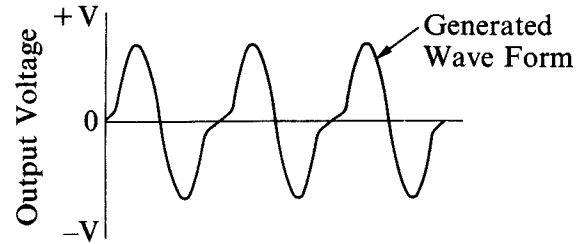
This sensor consists of a permanent magnet, coil and yoke. A rotor having 4 teeth is installed to the transmission output shaft and rotates as a unit.

When the transmission output shaft rotates, the clearance between the yoke (front end) and the rotor decreases and increases because of the teeth. Accordingly, the number of lines of magnetic force passing through the yoke increase or decreases, and the AC voltage is generated in the coil. The frequency of this AC voltage is proportional to the speed of the rotor and is used to detect the vehicle speed.



No.2 Speed Sensor

For 2JZ-GTE Engine



Solenoid Valves

1) Outline

The application of the solenoid valves are indicated in the table on the right.

The solenoids of the A340E transmission for the 2JZ-GE engine model are the same as those of the previous model. However, the No. 3 solenoid valve in the 2JZ-GTE engine model has been changed to the liner type, and the liner type No. 4 and No. 5 solenoid valves have been newly added.

The liner type solenoid valve controls the hydraulic pressure by regulating the opening area according to the amount of electric current applied.

The functions and connections of the newly adopted solenoid valves that were indicated in the right table are shown below.

Solenoid Valve Application ◀

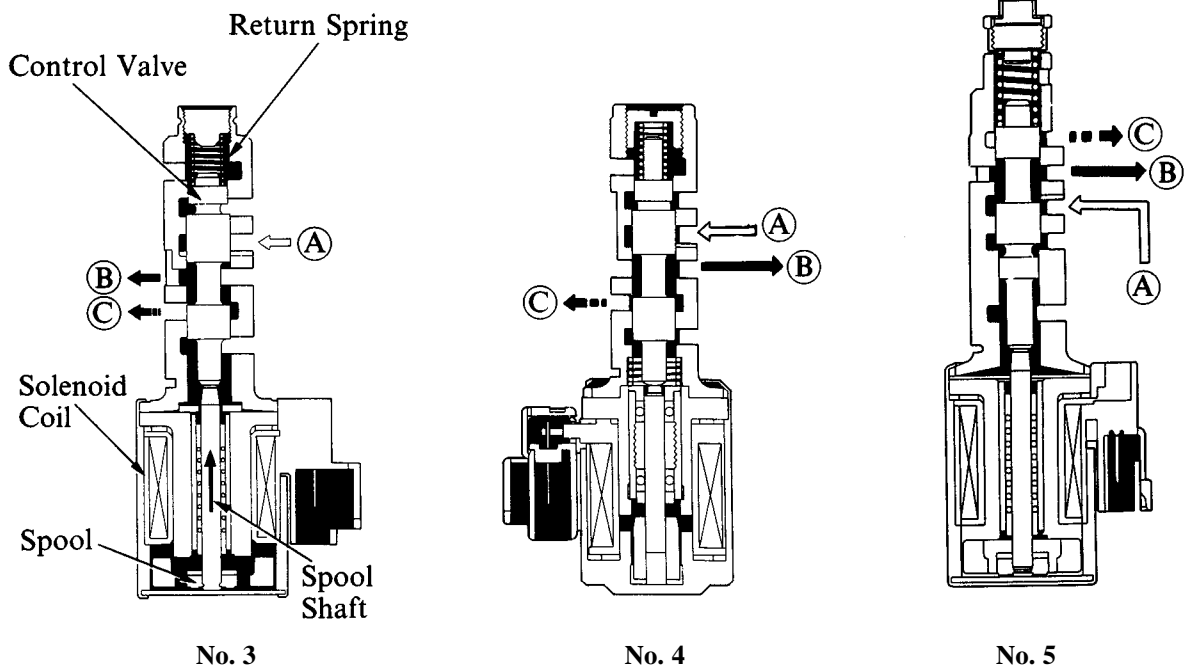
Solenoid Valve	Type	Comment	For 2JZ-GE	For 2JZ-GTE
No. 1	ON-OFF	No Change		
No. 2	ON-OFF	No Change		
No. 3	ON-OFF	No Change		—
	Liner	Newly Adopted	—	
No. 4	Liner	Newly Adopted	—	
No. 5	Liner	Newly Adopted	—	

Function and Connections of Solenoid Valves ◀

Solenoid Valve	Functions	Connections
No. 3	Modulates solenoid pressure into lock-up control pressure, according to duty cycle signals provided by ECM* [Engine ECU].	(A) Solenoid Modulator Valve (B) Solenoid Relay Valve (C) Drain
No. 4	Modulates solenoid pressure into accumulator control pressure, according to duty cycle signals provided by ECM* [Engine ECU].	(A) Solenoid Modulator Valve (B) Accumulator Control Valve (C) Drain
No. 5	Modulates solenoid pressure into throttle pressure according to duty cycle signals provided by ECM* [Engine ECU].	(A) Solenoid Modulator Valve (B) Primary Regulator Valve (C) Drain

* ECM (Engine Control Module)

Solenoid Valves ◀



Function of ECU

1) General

The shift and lock-up timing has been changed in connection with the adoption of the manual mode.

Moreover, an engine torque control has been added to provide a smooth gear shifting operation. On the 2JZ-GTE engine model, a lock-up pressure control, accumulator back pressure control, and line pressure control have been added to provide smooth shifting characteristics.

2) Shift and Lock-Up Timing Control

On the new model, “normal” and “manual” modes can be selected with the select switch.

When the manual mode signals are input to ECM* [Engine ECU] by engaging the pattern select switch to the manual mode, ECM sends control signals to the No. 1 and No. 2 solenoid valves so that each gear is engaged according to the shift lever position. (Hence, the transmission is in 1st gear when the shift lever is in “L”, 2nd gear when it is in “2”, and 3rd gear when it is in “D”.)

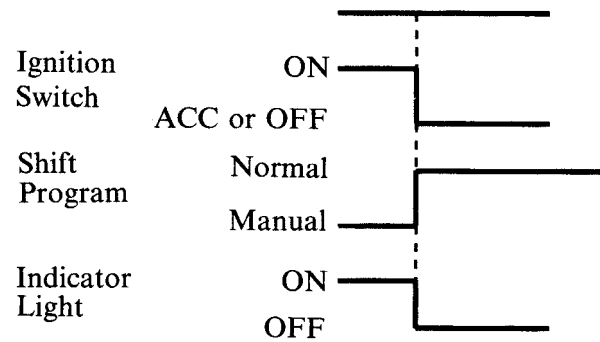
However, takeoff in the D range is effected in the 2nd gear.

To summarize, the manual mode of the new model does not effect automatic shift-up and shift-down operations as the normal and power modes of the previous model did. Instead, the shift lever position selected is the gear speed selected.

a. Shift Program Switchover Control

i) When Restarting Engine

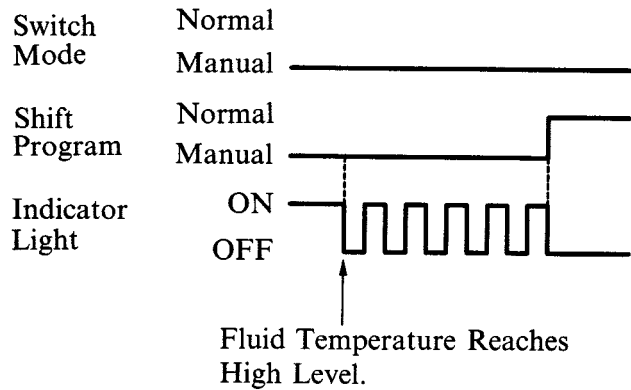
To prevent the driver from forgetting to release the manual mode of the pattern select switch, even if the pattern select switch remains in manual mode the shift program automatically changes the mode to the normal mode when the ignition switch is turned from ON to ACC or OFF, or it is then turned back to ON again. In addition, the “MANU” mode indicator light in the combination meter is turned off.



ii) During High Fluid Temperature Operation

In order to prevent an abnormal rise in the fluid temperature, when the fluid temperature reaches a high level with the shift lever in “D” and the pattern select switch in manual mode, the ECM* [Engine ECU] changes the shift program from manual to normal mode, even if the pattern select switch remains in the manual mode. At the same time, the ECM causes the “MANU” mode indicator light in the combination meter to flash 5 times, and then turn off.

* ECM (Engine Control Module)

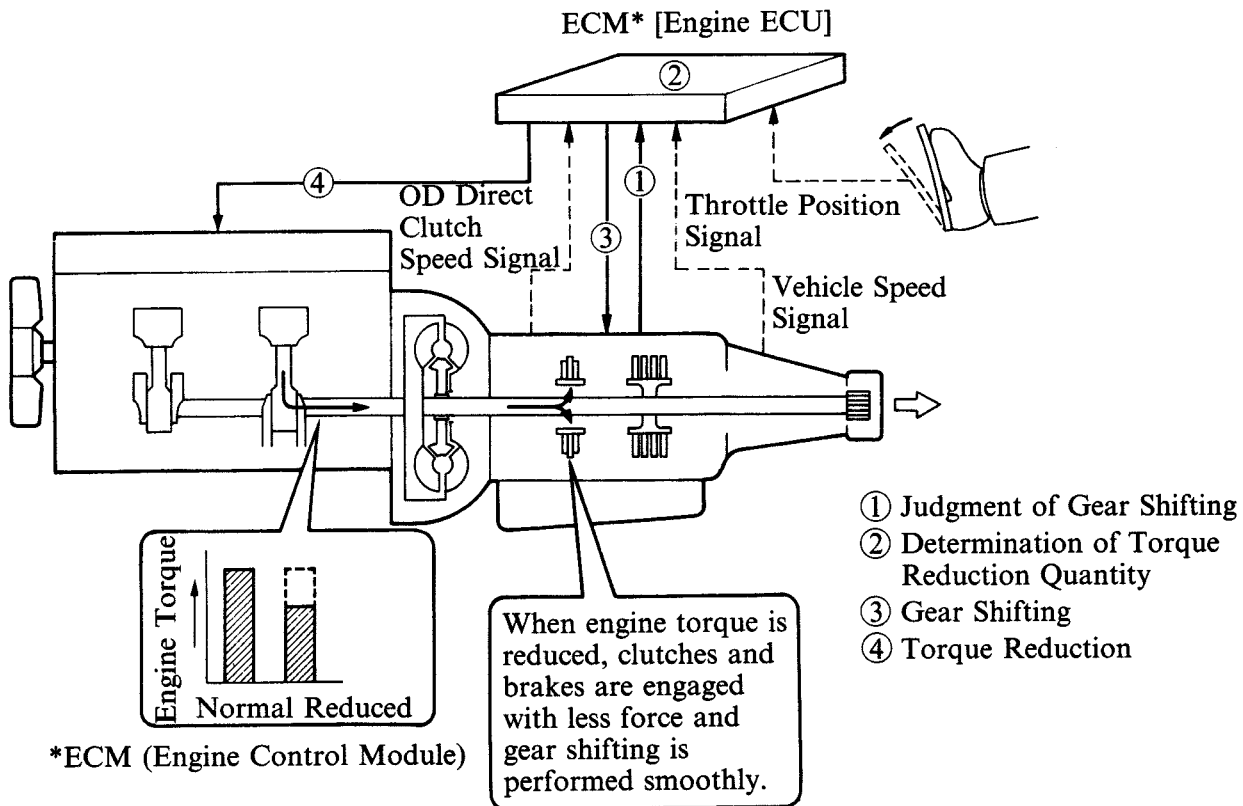


3) Engine Torque Control

Engagement of the clutches and brakes of the planetary gear unit in the transmission is controlled smoothly by momentarily reducing the engine torque when gears are shifted up or down in the transmission.

When the ECM* [Engine ECU] judges a gear shift timing according to signals from sensors such as the throttle position and vehicle speed sensor, it activates the shift control solenoid valves to perform gear shifting. When the gear shifting starts, the ECM* [Engine ECU] reduces the engine torque. As a result, engagement force of the clutches and brakes of the planetary gear units is weakened and the gear shift change is performed smoothly.

An outline of the engine torque control is illustrated below.



4) Lock-Up Pressure Control

Lock-up control is performed by electronically controlling the lock-up control valve which modulates the engagement pressure acting on the lock-up clutch, and lock-up pressure which activates the lock-up relay valve that switches engagement and disengagement of the clutch. As a result, these valves are activated gradually and smooth engagement and disengagement are performed.

Lock-up pressure control is performed by changing the duty signal to the No. 3 solenoid valve which is sent to the valve body from the ECU* [Engine ECU]. When the ECU* [Engine ECU] according to the memorized lock-up pattern selected based on the gear shift position and throttle valve opening angle, implements lock-up ON or OFF, it changes the duty ratio of the signals to the solenoid valve, and engages or disengages the clutch smoothly. However, the clutch is disengaged immediately when the foregoing lock-up prohibit conditions are present while the lock-up clutch is engaged.

5) Accumulator Back Pressure Control

During gear shifting, the accumulator temporarily accumulates the line pressure according to a difference between the line pressure (which acts on the operation chamber of the piston and engages the clutches and brakes of the planetary gear unit) and the accumulator back pressure acting on the back pressure chamber. The accumulator then gradually applies the stored line pressure to the clutches and brakes to perform gear shifting smoothly. The accumulator back pressure that acts on the back pressure chamber is controlled electronically. Therefore, gear shifting is performed smoothly regardless of a fluctuation in the engine torque or a change in the friction characteristics.

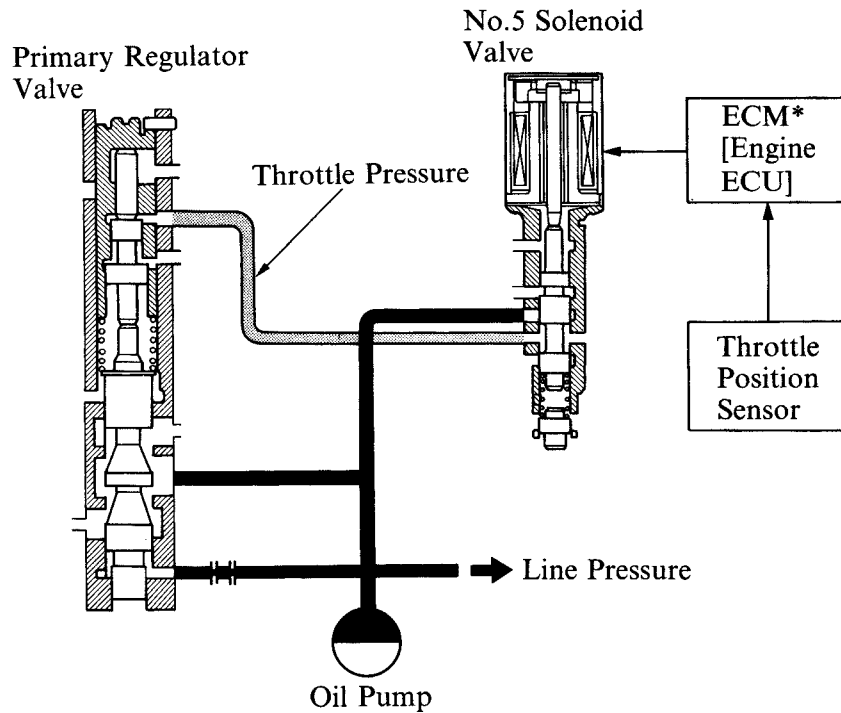
The accumulator back pressure is controlled by the No. 4 solenoid valve fitted to the valve body. The solenoid valve itself is controlled by the ECM* [Engine ECU] changing the duty ratio to the valve according to the gear shifting mode, the throttle valve opening angle, the OD direct clutch drum speed and the vehicle speed.

*ECM (Engine Control Module)

6) Line Pressure Control

The throttle pressure that is applied to the primary regulator valve (which modulates line pressure) causes the No. 5 solenoid valve, under electronic control, to precisely and minutely modulate and generate line pressure according to the accelerator pedal effort, or engine power output detected. This reduces the fluctuation of the line pressure and provides smooth shifting characteristics.

Upon receiving the throttle valve opening angle signal, ECM* [Engine ECU] controls the line pressure by sending a predetermined duty ratio to the No. 5 solenoid valve located in the valve body, activating the solenoid valve, modulating the line pressure, and generating the throttle pressure.



* ECM (Engine Control Module)

7) Self-Diagnosis

The functions of the self-diagnosis are the same as those of the previous model. However, along with the increase in the number of sensors and solenoid valves, the diagnostic trouble codes have been increased as follows:

Diagnosis Trouble Code ◀

New Added

Code No.	Diagnosis	2JZ-GE	2JZ-GTE
38	Open or short circuit in fluid temperature sensor.		
42	No. 1 speed sensor signal malfunction.		
46	Open or short circuit in No. 4 solenoid valve.		
61	No. 2 speed sensor signal malfunction.	—	
62	Open or short circuit in No. 1 solenoid valve.		
63	Open or short circuit in No. 2 solenoid valve.		
64	Open or short circuit in No. 3 solenoid valve.	—	
67	OD direct clutch speed sensor signal malfunction.	—	
77	Open or short circuit in No. 5 solenoid valve.		
89	<input type="radio"/> Open or short circuit in communication circuit between TRAC ECU and ECM* [Engine ECU], or between ECM* [Engine ECU] and TRAC ECU. <input type="radio"/> TRAC ECU malfunction.	—	

* ECM (Engine Control Module)

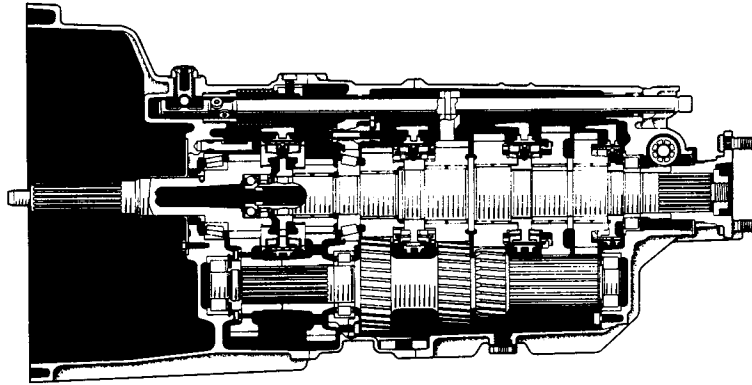
NOTE: Malfunction with code No. 64 is not indicated to the driver. But the code number is stored in the memory.

MANUAL TRANSMISSION

☞ Descriptions

The 2JZ-GE engine model is equipped with a W58 manual transmission, whereas the 2JZ-GTE engine model is equipped with a V160 manual transmission.

- The W58 has the same basic construction and operation as those of the W58 of the previous 7M-GE engine model. However, the operability of its shift control system has been improved by making the shift stroke shorter.
- The V160 is a newly developed 6-speed transmission of a lightweight and compact design. The reverse gear of this transmission is a constant mesh type, and all gears, including the reverse gear, use synchromesh mechanisms. The transmission oil used is the TOYOTA GEAR OIL V160 or ESSO ATF DEXRON® D-21065. All these features contribute in making this transmission dynamic, quiet, and fuel-efficient.



V160 Manual Transmission

Specifications ◀

Transmission Type		W58		V160	R154
Model		New	Previous	New	Previous
Engine Type		2JZ-GE	7M-GE	2JZ-GTE	7M-GTE
Item					
Gear Ratio	1st	3.285	←	3.827	3.251
	2nd	1.894	←	2.360	1.955
	3rd	1.275	←	1.685	1.310
	4th	1.000	←	1.312	1.000
	5th	0.783	←	1.000	0.753
	6th	—	←	0.793	—
	Reverse	3.768	←	3.280	3.180
Oil Capacity Liters (US qts, Imp. qts)		2.6 (2.7, 2.3)	←	1.8 (1.9, 1.6)	3.0 (3.2, 2.6)
Oil Viscosity		SAE 75W-90 or 80W-90	←	—	SAE 75W-90
Oil Grade		API GL-4 or GL-5	←	—	←
Oil Type		—	—	TOYOTA GEAR OIL V160 or ESSO ATF DEXRON® D-21065	—

☞ W58 MANUAL TRANSMISSIONS

1. General

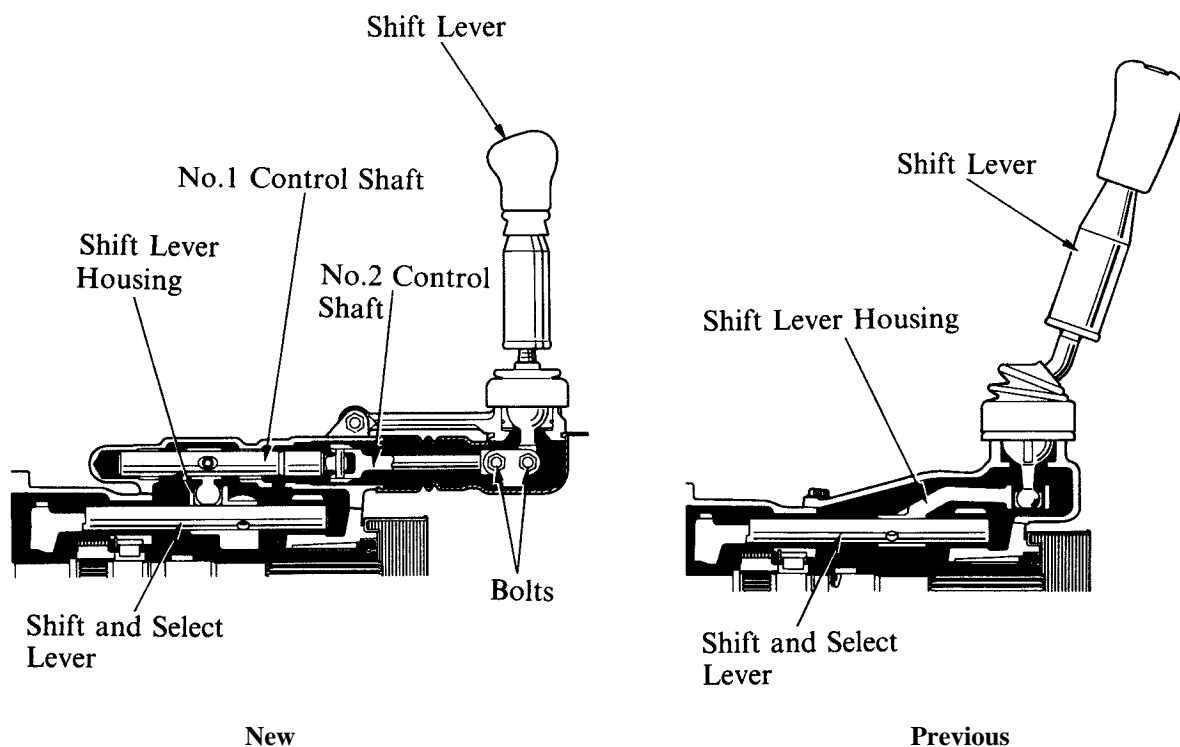
The W58 manual transmission of the new model offers the same basic construction and operation as those of the W58 of the previous model. However, it has been made easier to operate by relocating the shift lever and shortening the shift and select strokes.

2. Shift Control Mechanism

When operating the shift lever of the previous W58 transmission, the force applied onto the lever is transmitted to the shift and select lever via the shift lever housing.

The conventional shift lever housing configuration has been modified on the new W58 transmission by adding 2 control shafts, one of which is attached to the shift lever with bolts. Accordingly, the shift lever has been relocated approximately 100 mm (3.94 in.) rearward from the previous location, making it more upright, and giving the driver a more positive feel.

In addition, the shift lever ratio has been changed by shortening the shift stroke by approximately 15 mm (0.59 in.) and shortening the select stroke by approximately 6 mm (0.24 in.).



☞ V160 MANUAL TRANSMISSION

1. General

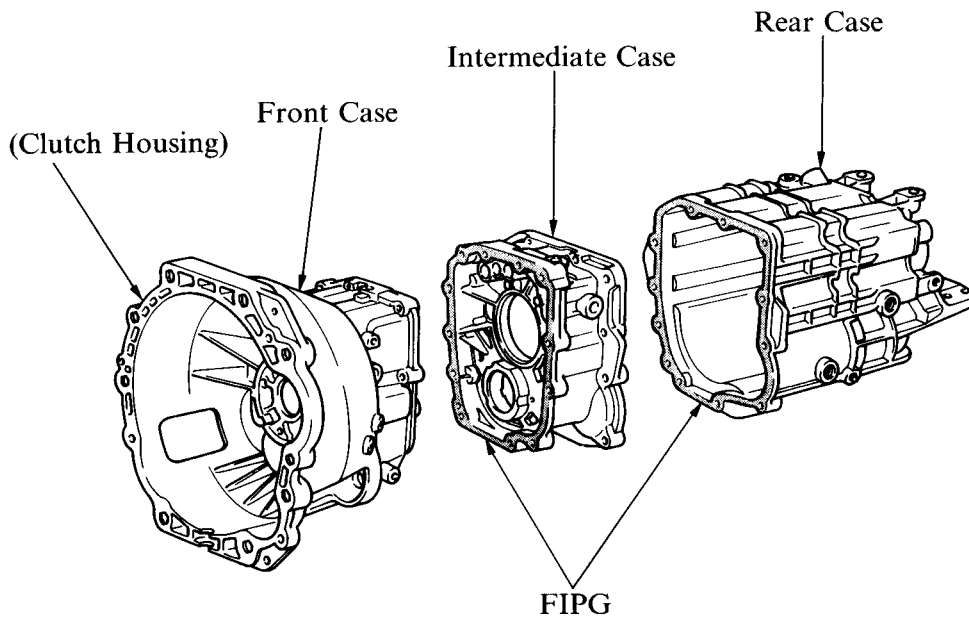
The newly developed V160 is the first Toyota manual transmission with 6 forward speeds. Compact in design, the V160 offers a multi-cone type synchronizer ring in the synchromesh mechanisms of the 1st to 4th gears for improved operability. The transmission case made of lightweight die-cast aluminum is made highly rigid by integrating it with the clutch housing. In the same way as the W58 transmission, the shift lever is made more upright and optimally located for improved operability.

Synchronizer Ring Type ◀

Gear	1st	2nd	3rd	4th	5th	6th	Reverse
Synchronizer ring Type	Triple-Cone		Double-Cone		Single Cone		

2. Transmission Case

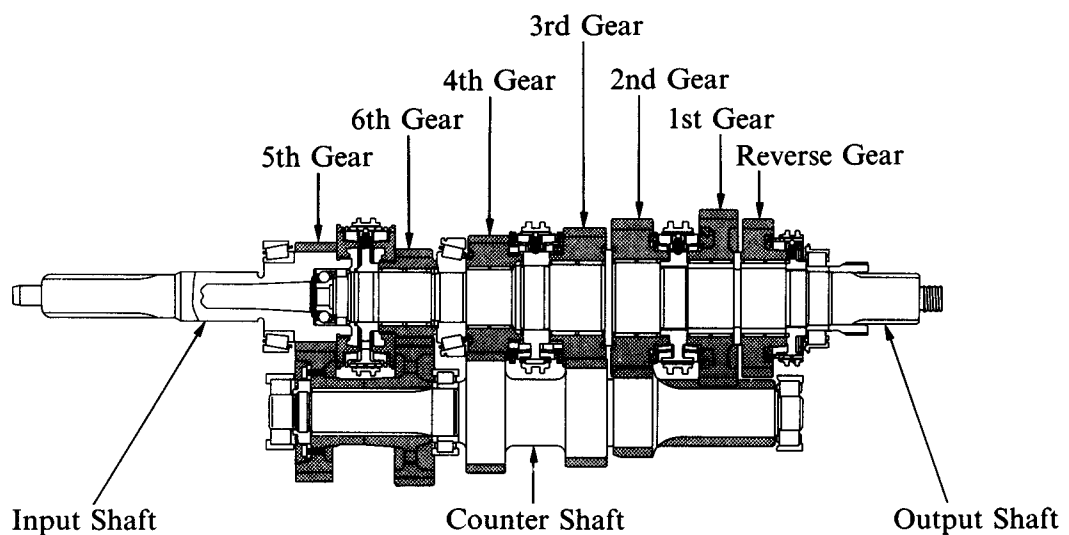
The transmission case consists of the front, intermediate, and rear cases. The clutch housing is integrated with the front case. All the transmission cases, made of lightweight die-cast aluminum, are joined together using FIPG (Formed-In-Place Gasket) to offer superior capacity.



3. Transmission Gear

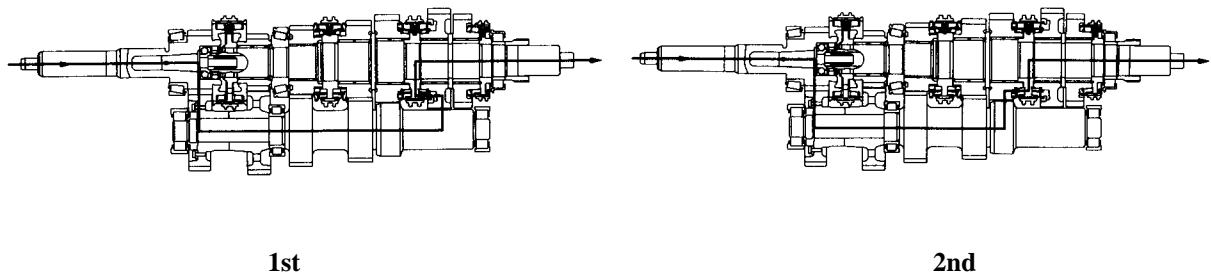
General

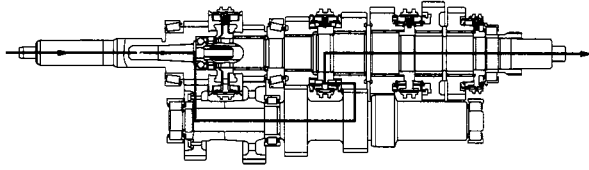
- The V160 manual transmission consists of 3 shaft; input, output, and counter shifts. Power is transmitted from the input shaft to the counter shaft, and then to the output shaft that is coaxially fitted to the input shaft. The input and output shafts mesh directly to each other in 5th gear.
- All the gears are constant mesh type with inertia lock key type synchromesh mechanisms. A multi-cone type synchronizer ring is used in the synchromesh mechanisms of the 1st to 4th gears. The multi-cone type synchronizer ring has already been adopted in other manual transmissions including the previous W58, and its basic construction and operation are the same as those of the previous model. For details, refer to page 85 of '92 Camry New Features (Pub. No. NCF077U).



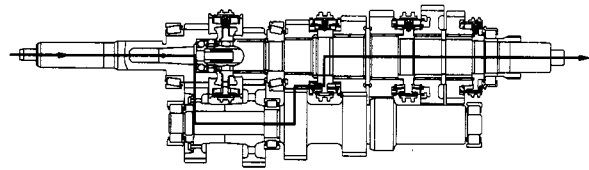
Power Flow Transmission

The driving force transmission is shown below.

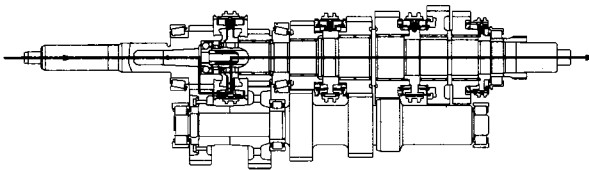




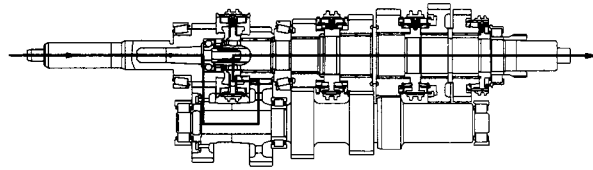
3rd



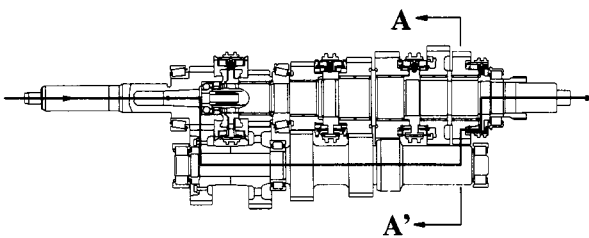
4th



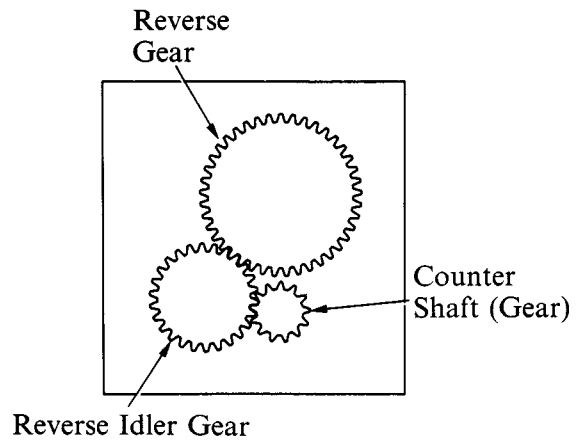
5th



6th



Reverse

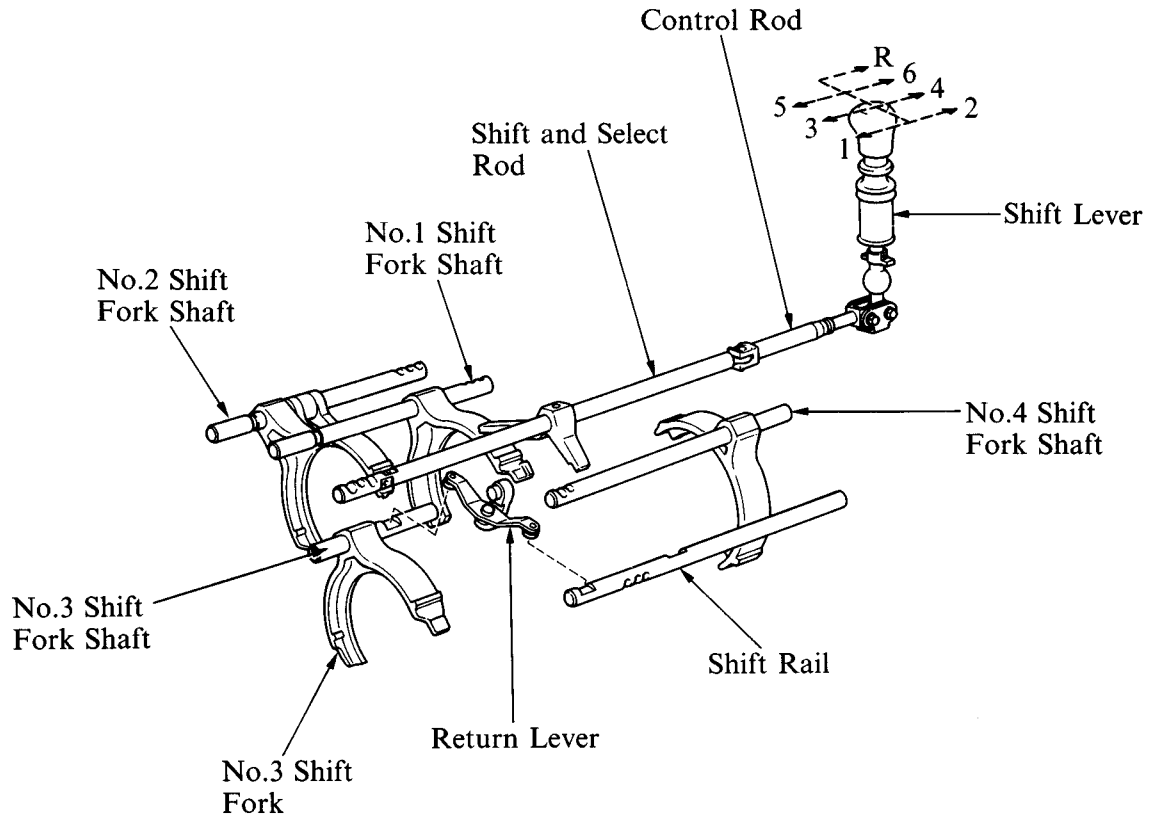


A-A' Cross Section

4. Shift and Select Mechanism

General

- The direct control shift and select mechanisms used are similar to those used in the new W58 manual transmission. However, the V160 has 4 shift fork shafts instead of the 3 being used in the W58. The No. 3 shift fork are attached to the No. 3 shift fork shaft, and the shift rail movement is transmitted via the return lever.
- The shift detent mechanism used is the same detent ball and spring system conventionally used in other transmissions including the W58. However, the double-meshing prevention mechanism does not use the same interlock pin found in the conventional transmission including the W58, but an interlock plate instead.

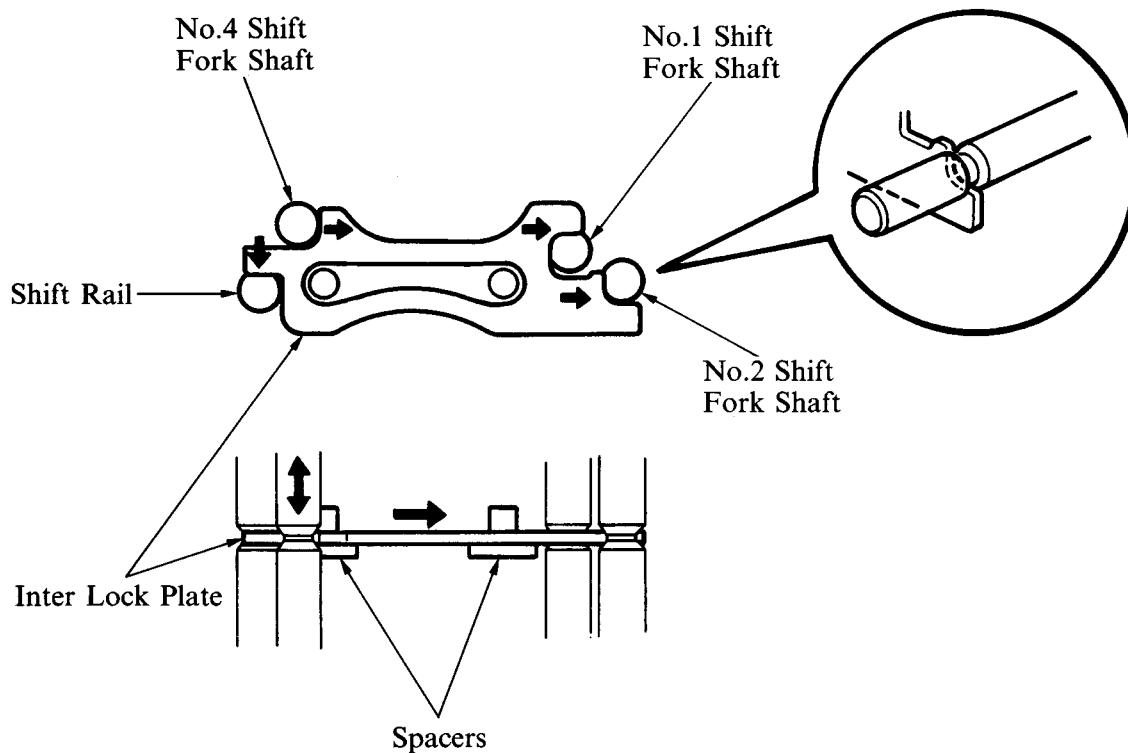


Double-Meshing Prevention Mechanism

Instead of preventing the shift lock movement by way of an interlock pin inserted between the shift fork shafts, as the conventional transmissions including the W58 does, the double-meshing prevention mechanism of the V160 prevents the movement of the shift fork shafts by way of the interlock plate attached to the intermediate case. A groove, into which the interlock plate engages, is provided around the circumference of the 3 shift fork shafts and the shift rail. The movement of the interlock plate, which is attached to the intermediate case via spacers, is limited by the elongated hole and spacers provided within.

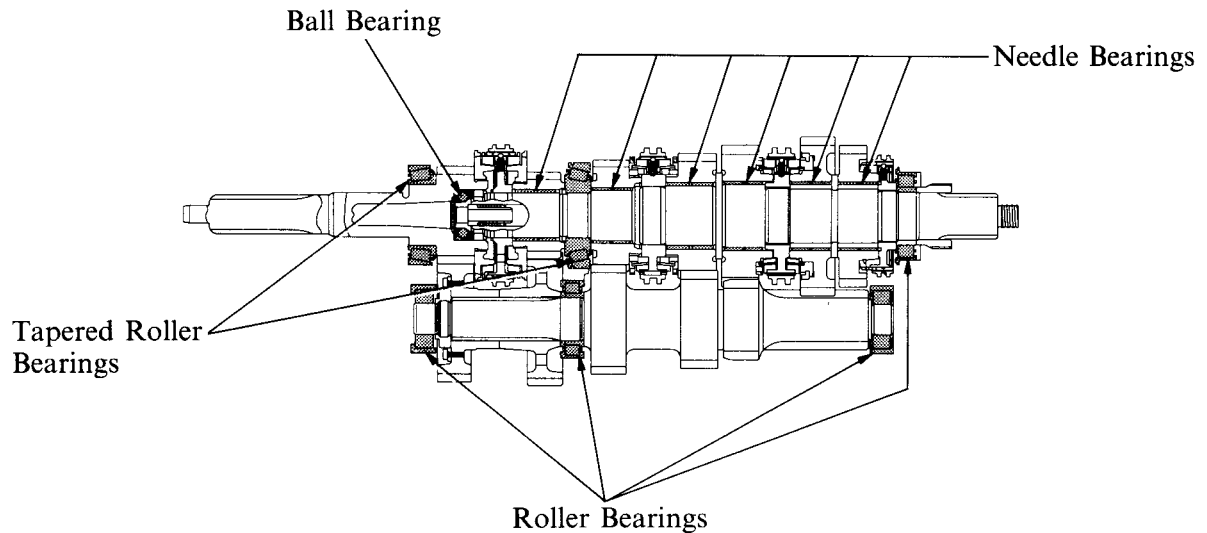
For example, when the No. 4 shift fork shaft is operated, the No. 4 shift fork shaft moves the interlock plate in the upper-right direction. This causes the interlock plate to slip into the grooves of the shift fork shafts and the shift rail, and prevent them from moving.

Likewise, once any shift fork shaft is operated, other shift fork shafts are prevented from moving by this double-meshing prevention mechanism.



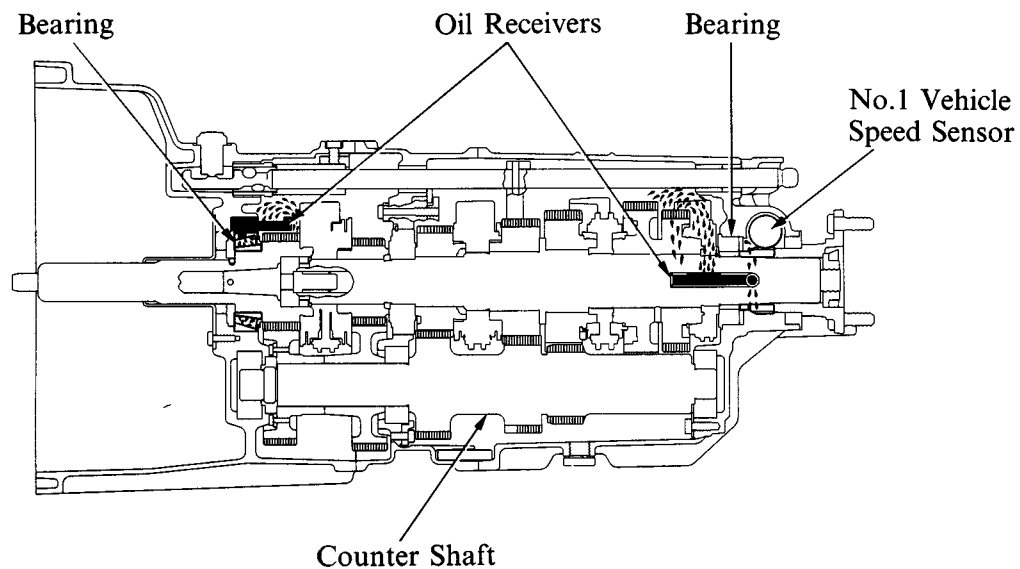
5. Bearings

- Roller bearings, having a large load capacity, are used at the rear of the output shaft and on the counter shaft.
- Ball bearings are used at the front of the output shaft.
- Tapered roller bearings, having a large load capacity, are used at the center of the input and output shafts. The preload of the tapered roller bearings is adjusted by a shim between the ball bearings and the input shaft.
- 1-piece type needle bearings are used with all gears.



6. Lubrication System

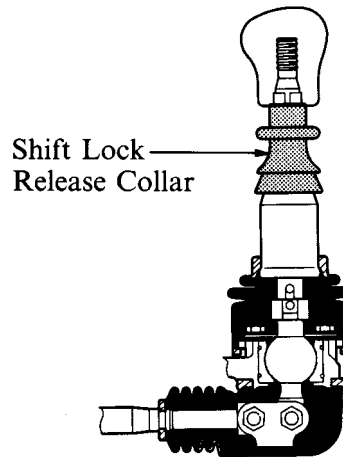
An oil receiver is provided in the front and rear cases to lubricate the input shaft front bearing, output shaft rear bearing, No. 1 vehicle speed sensor drive, and the driven gears. To lubricate the bearings, fluid picked up by the counter gear is directed to the oil hole by the oil receiver.



7. Shift Lever

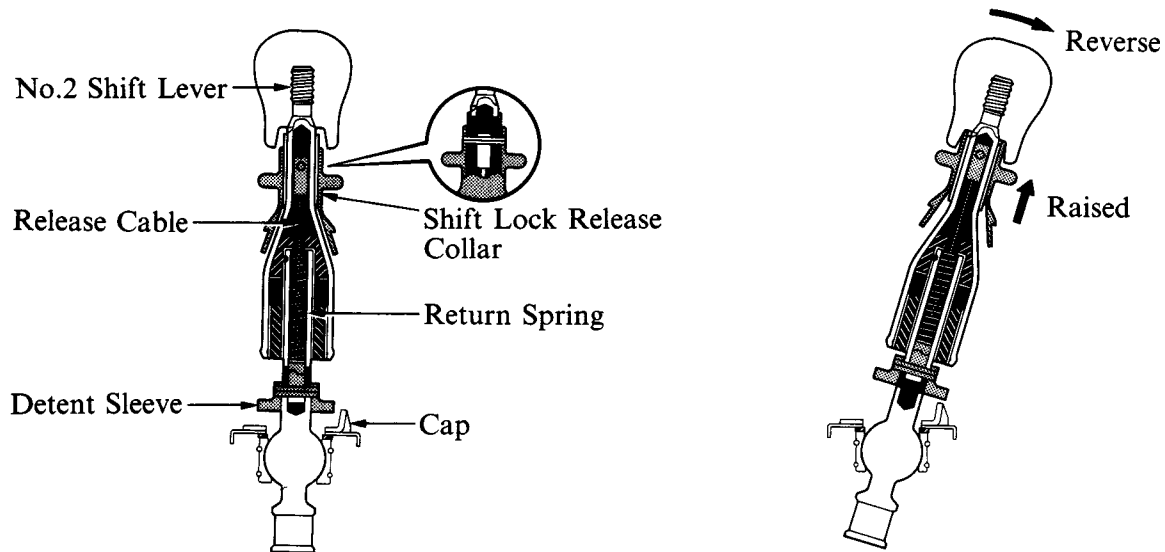
Reverse Mis-Shift Prevention Mechanism

The mechanism prevents shifting into reverse unless the shift lock release collar provided on the shift lever is raised.



1) Construction and Operation

The reverse mis-shift prevention mechanism consists of a shift lock release collar, release cable, detent sleeve, and a cap. The shift lock release collar is connected to the release cable via a pin. When the driver operates the shift lock release collar, it moves up or down around the circumference of the No. 2 shift lever. Since the detent sleeve is connected to the cable via a pin, the movement of the cable causes the sleeve to move up or down around the circumference of the No. 1 shift lever. Therefore, if the driver attempts to engage the shift lever into reverse without raising the shift lock release collar, the detent sleeve will come in contact with the cap and prevent the engagement of the reverse gear. However, once the shift lock release collar is raised, the release cable connected to it raises the detent sleeve. Since the detent sleeve does not come in contact with the cap, it allows the shift lever to be shifted into the reverse position.



**Shift Lock Release Collar –
Not Raised (Cannot Engage Reverse)**

**Shift Lock Release Collar –
Raised (OK to Engage Reverse)**

PROPELLER SHAFT

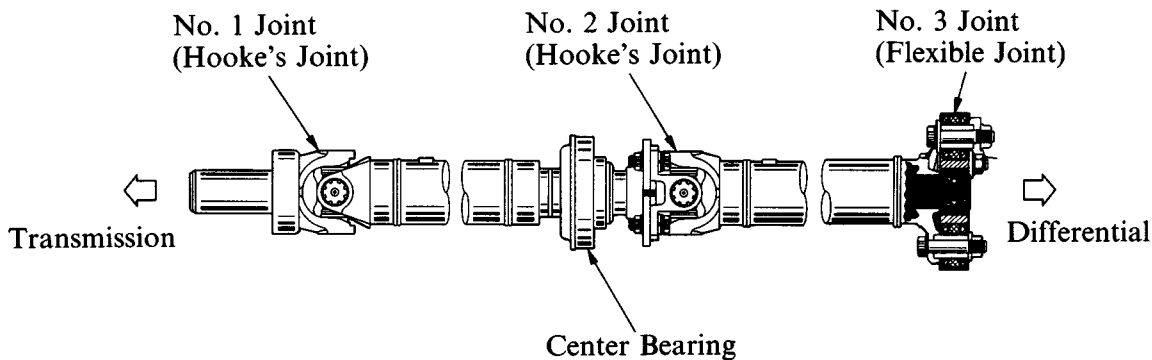
DESCRIPTION

There are 2 separate types of propeller shafts used on the new model, according to the engine model used, either the 2JZ-GE or the 2JZ-GTE.

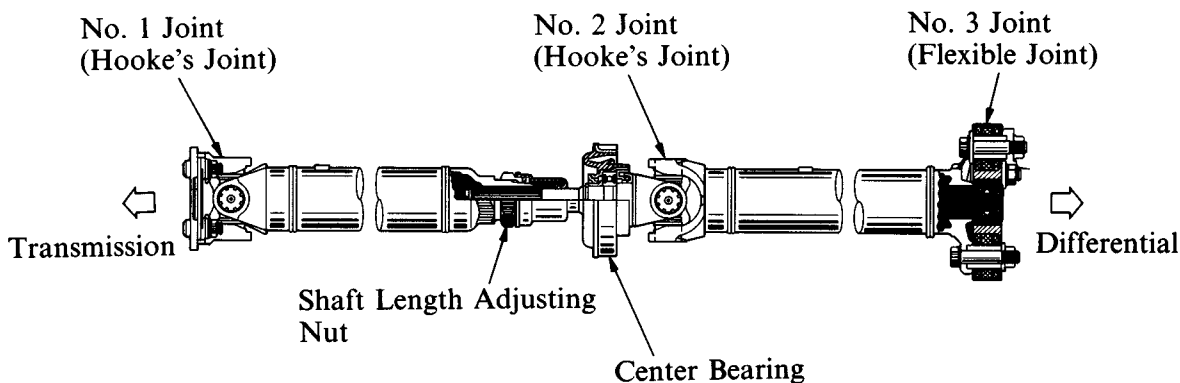
Both of these propeller shafts are 2-part types, each part consisting of a strong tube offering high centering and dimensional precision and a small diameter. In addition, the propeller shafts have No. 1, No. 2, and No. 3 joints. The No. 1 and No. 2 joints are the same Hooke's universal joint used on the previous model. However, the No. 3 joint uses a new flexible rubber coupling which is effective in reducing vibration and noise. The No. 1 joint for the 2JZ-GE engine model connects to the transmission via a sleeve, and the 2JZ-GTE engine model uses a flange.

On both the 2JZ-GE and 2JZ-GTE models, all 3 joints are carefully arranged in such a way that their shaft angles rest on a straight line. This design ensures a precise driveline linearity from the front of the engine through the differential to minimize noise and vibration. In addition, the propeller shaft for the 2JZ-GTE incorporates a shaft length adjustment mechanism for easier removal and reinstallation.

For 2JZ-GE Engine Model ◀



For 2JZ-GTE Engine Model ◀

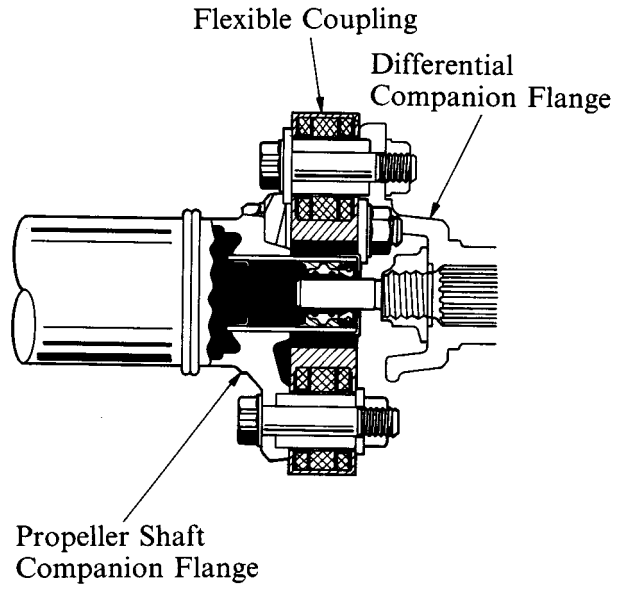


NOTICE

When removing and reinstalling the propeller shaft, make sure to inspect the shaft angle at each of the 3 joints and confirm that they are in the specified range. Refer to the Repair Manual for shaft angle adjustment.

FLEXIBLE JOINT

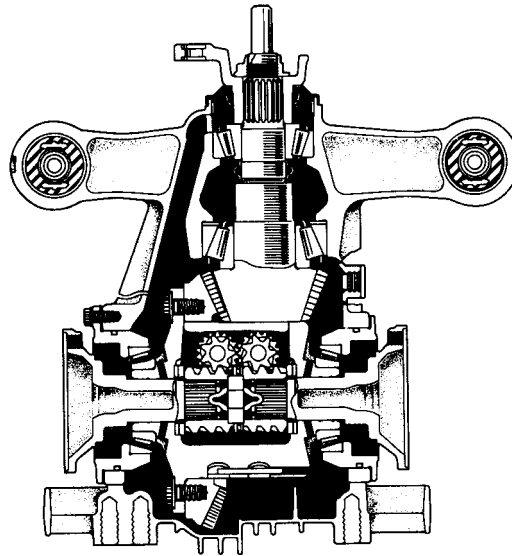
No. 3 joint of the propeller shaft is flexible coupling made of rubber having large vibration absorbing effects and good balancing quality.



DIFFERENTIAL

DESCRIPTION

- Ⓡ There are 2 types of differential used on the new model, which are also used on the previous model: the conventional, and the LSD (Limited Slip Differential) type.
The conventional type differential, which is standard equipment on the 2JZ-GE engine model, is the same 2-pinion type used on the previous model.
The LSD type differential, which is standard equipment on the 2JZ-GTE engine model and an option for the 2JZ-GE engine model, has been changed from the previous multi-plate type to the torque sensing type which utilizes tooth flank friction of the worm gear.
- Ⓡ Both differential are supported by a rear sub-frame via rubber mounts which deter vibration and noise from being transmitted to the body.



LSD (Limited Slip Differential)
(For 2JZ-GTE Manual Transmission Engine Model)

Specifications ◀

Model		New		Previous	
Engine Type		2JZ-GE	2JZ-GTE	7M-GE	7M-GTE
Item					
Differential Gear Ratio		4.272	3.133, 3.769* ¹	4.300	3.727
Drive Pinion	No. of Teeth	11	15, 13* ¹	10	11
Ring Gear	Size	200 (7.87)	220 (8.66), 200 (7.87)* ¹	200 (7.87)	←
	No. of Teeth	47	47, 49* ¹	43	41
No. of Differential Pinion		2, 6*	6	2, 4* ²	4

*¹ Automatic Transmission model

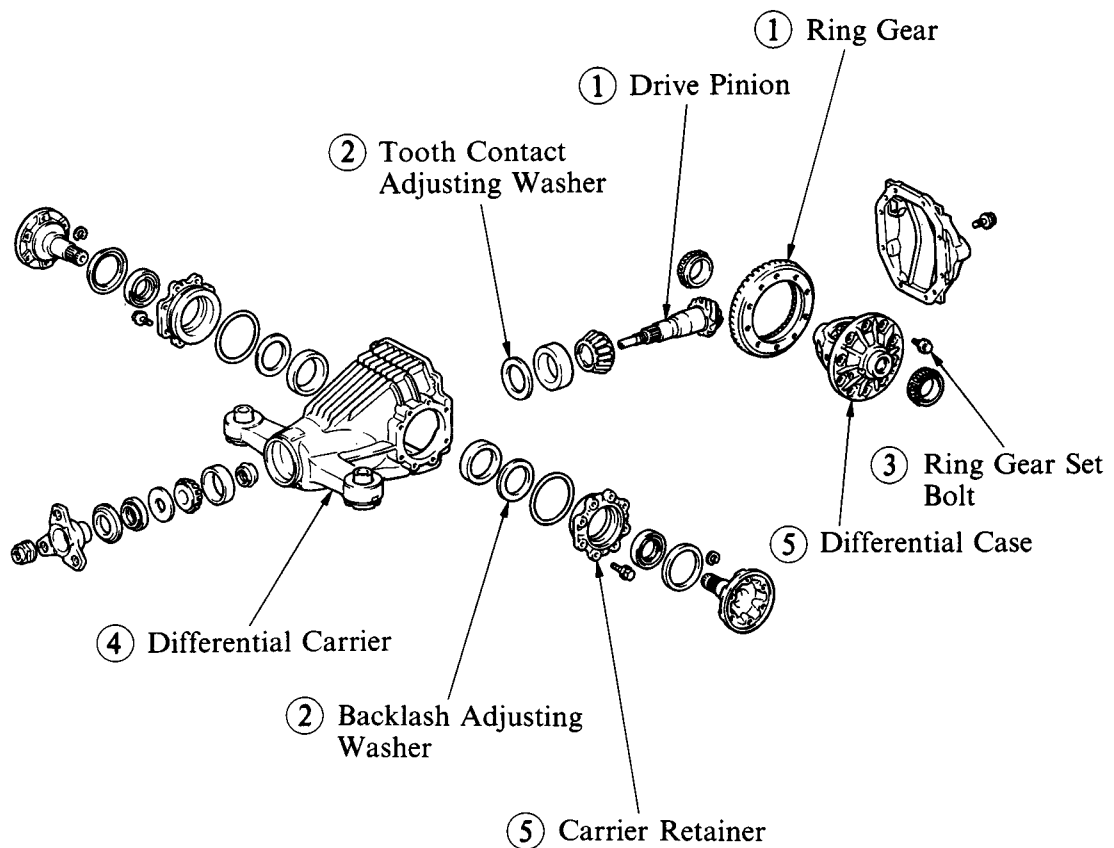
*² Optional LSD (Limited Slip Differential)

CONVENTIONAL TYPE DIFFERENTIAL

Compared to the conventional differential used on the previous model, the new model offers the following low-noise and highly rigid characteristics:

- (1) For a quieter operation, the contact ratio of the hypoid gears (the set of drive pinion and ring gear) is increased by increasing the number to teeth and their facewidth.
- (2) The hypoid gear setup accuracy has been improved through the application of tooth contact and backlash adjusting washers in smaller increments. In addition, the tooth contact adjusting washer has been installed in front of the drive pinion in order to increase the pinion's support rigidity.
- (3) Plastic region tightening bolts are used for the ring gear set bolts to improve axial stability. Also, a thread lock agent is applied onto the bolt threads.
- (4) Cooling fins are provided, on the top and bottom of the differential carrier, to maintain a stabler differential oil temperature.
- (5) The differential case is supported by carrier retainers which offer superior support rigidity.

The afore-mentioned characteristics of the conventional type differential are also available with the LSD type differential, which will be described later.

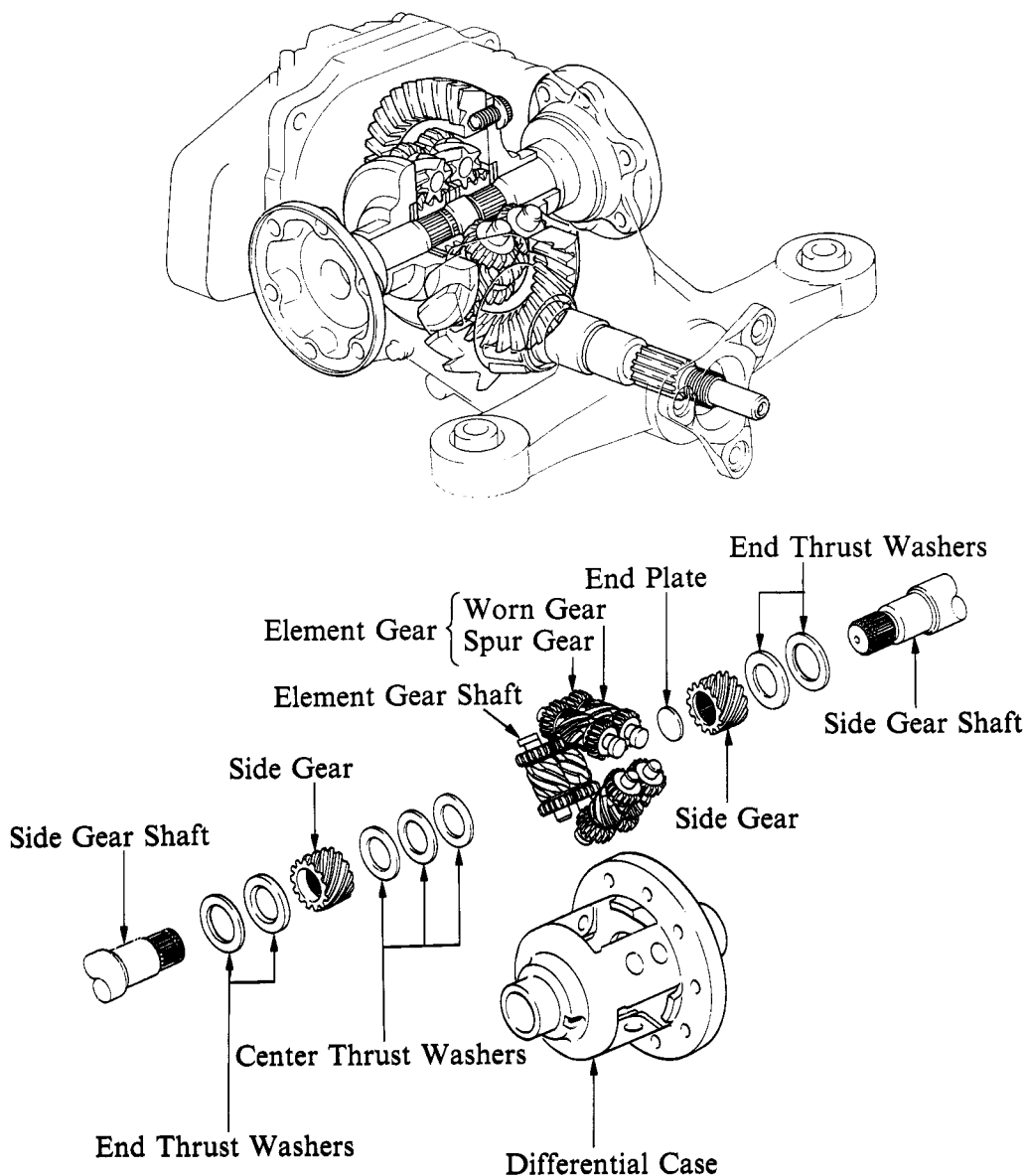


☞ LSD (Limited Slip Differential) TYPE DIFFERENTIAL

The LSD type differential has been changed from the previous multi-plate type to the torque sensing type. Its characteristics are as follows:

- Ⓡ Good traction of high-bias ratio design is obtained through the utilization of the worm gear surface friction and thrust washer friction.
- Ⓡ Quic response and minimum time lag until differential limiting force is generated.
- Ⓡ A compact differential case sub-assembly that is interchangeable with the conventional type differential.
- Ⓡ Ordinary differential oil must be used; do not use special LSD oil.

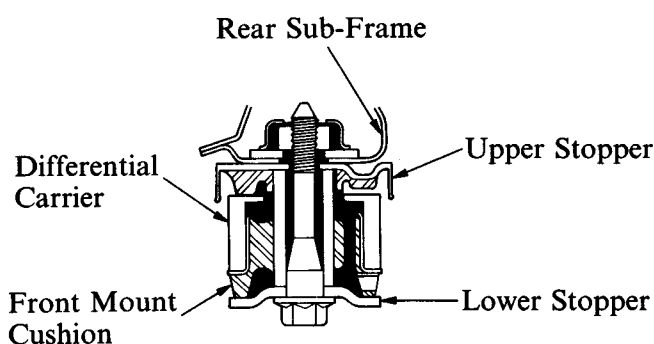
The torque-sensing type LSD has already been adopted on the All-Trac/4WD Celica as optional equipment. Since its construction and operation are identical to that of the Celica, refer to page 138 of '90 Celica New Car Features (Pub. No. NCF056U) for details.



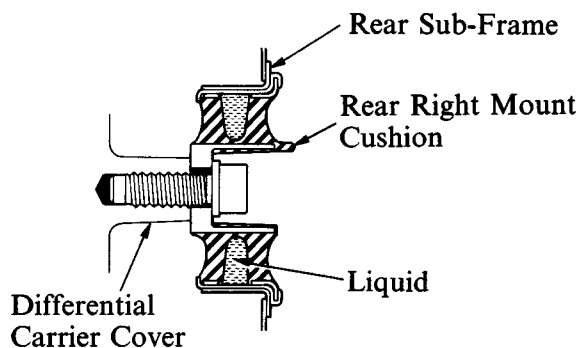
DIFFERENTIAL SUPPORT

The differential is mounted to the rear sub-frame via 3 rubber mounts for the 2JZ-GE engine model, and via 4 rubber mounts for the 2JZ-GTE engine model. On the 2JZ-GTE engine the rear right mount is a liquid-filled to provide quiet operation.

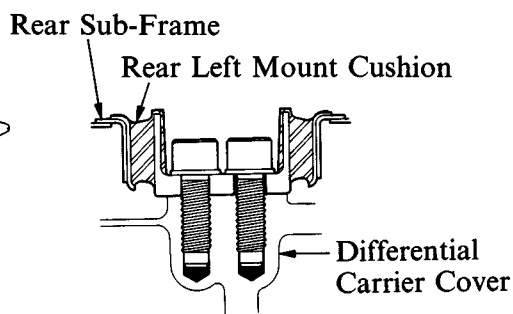
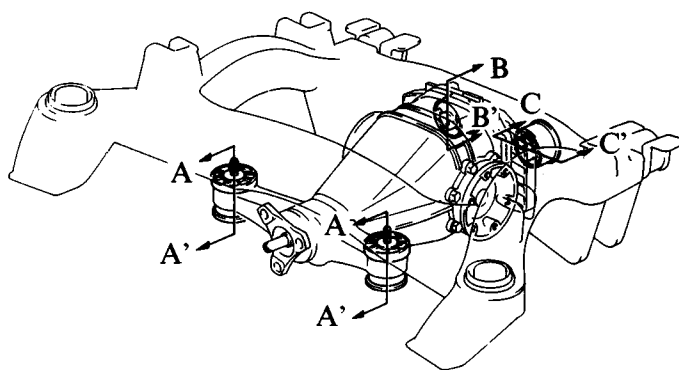
Also, additional rubber mounts are used to mount the sub-frame onto the body. This double vibration-preventive design effectively suppresses transmission of vibration and noise to the body. For detailed information on how the rear sub-frame is mounted, refer to page 209.



A-A' Cross Section



B-B' Cross Section
(For 2JZ-GTE) Engine Model Only



C-C' Cross Section

DRIVE SHAFT

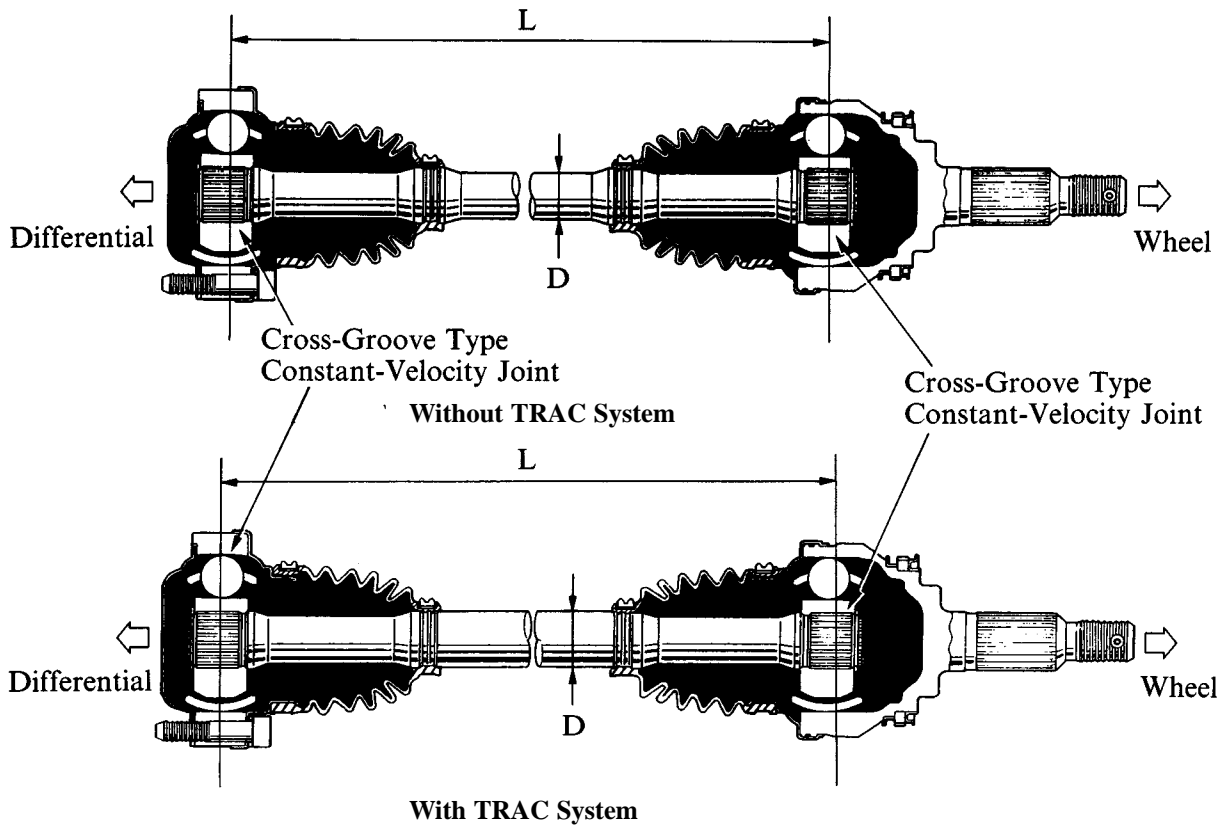
DESCRIPTION

- Ⓡ The driveshaft of the previous model consisted of a tripod type CVJ (Constrant-Velocity Joint) used on the differential side, and a Rzeppa type CVJ on the wheel side. However, on the new model, a compact and lightweight cross-groove type CVJ is used on both sides of the drive shaft.
- Ⓡ The boots of the drive shafts are made of thermoplastic elastomer, which is light, has a low expansion characteristic in response to centrifugal force and also has superior durability.
- Ⓡ The drive shafts to the right and left wheels have different lengths due to the off-center position of the differential. The diameter of the drive shaft at “D” differs between vehicles with the TRAC (Traction Control) system (larger diameter) and without the TRAC system (smaller diameter).

Specifications ◀

mm (in.)

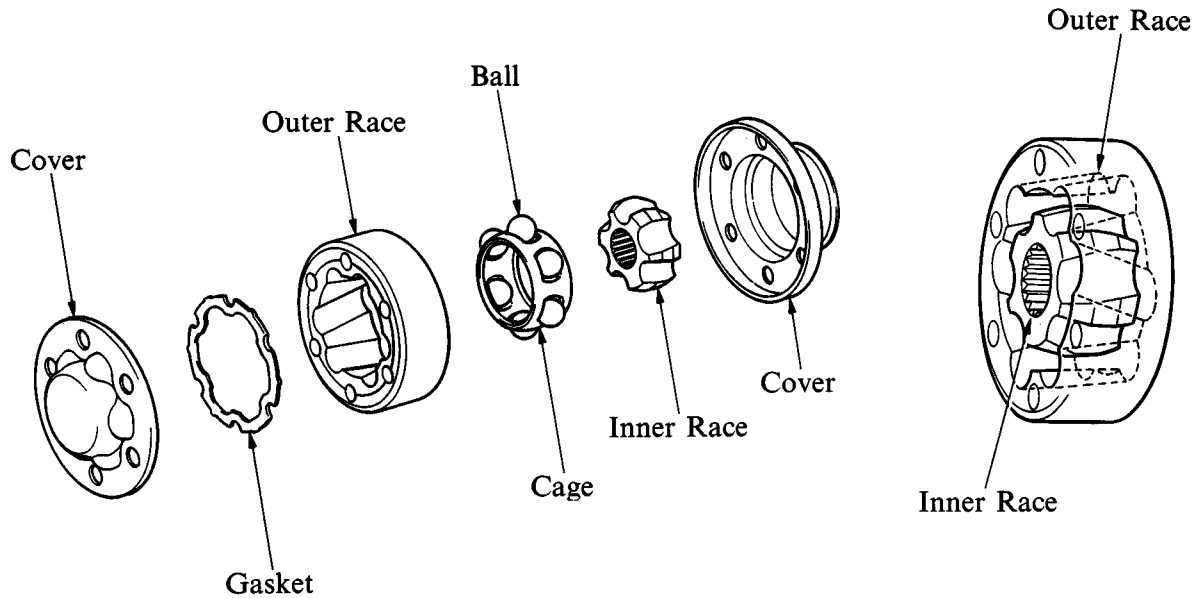
Model		New		Previous
TRAC System		Without	With	—
Item				
Length (L)	Right Side	519 (20.43)	←	455 (17.91)
	Left Side	474 (18.66)	←	455 (17.91)
Shaft Diameter (D)		26.50 (1.04)	29.15 (1.15)	29.60 (1.17)



☞ CROSS-GROOVE TYPE CONSTANT-VELOCITY JOINT

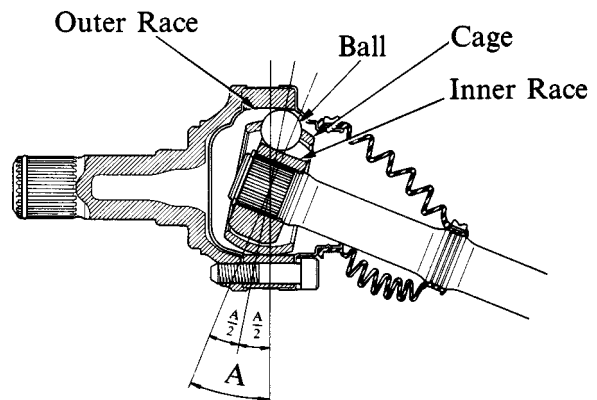
1. Construction

The joint consists of outer and inner races, each with ball grooves, a cage that retains balls, and 6 balls. Ball grooves on the outer race intersect on the inner race.



2. Operation

The cross-groove type constant-velocity joint has ball grooves in the outer and inner races and a cage in which six balls are positioned in a plane that equally divides the joint angle. Thus, the drive shaft rotates at an equal velocity as a result. This joint allows sliding in an axial direction.



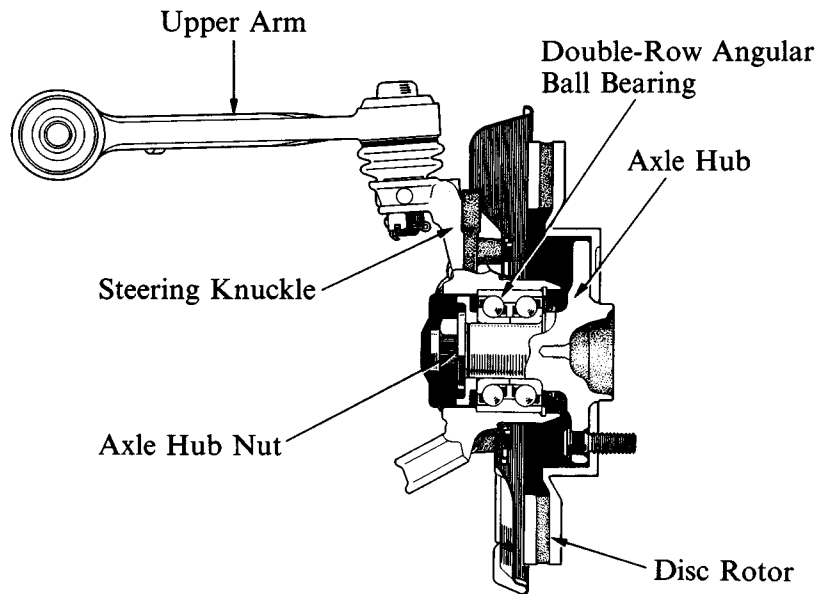
A: Joint Angle

AXLES

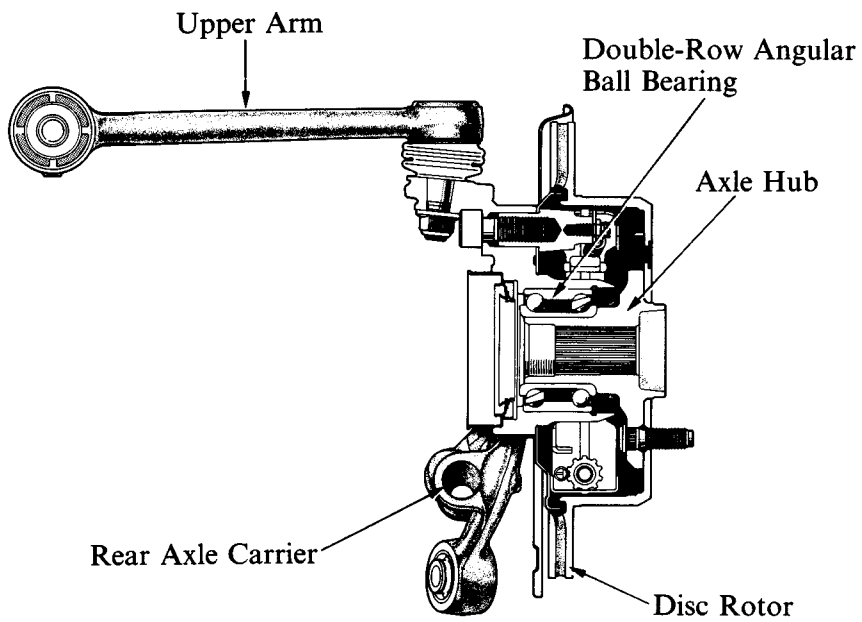
DESCRIPTION

Maintenance-free double-row angular ball bearings with low rolling resistance are used on the front and rear axles in the same way as the previous model.

Front Axle ◀



Rear Axle ◀

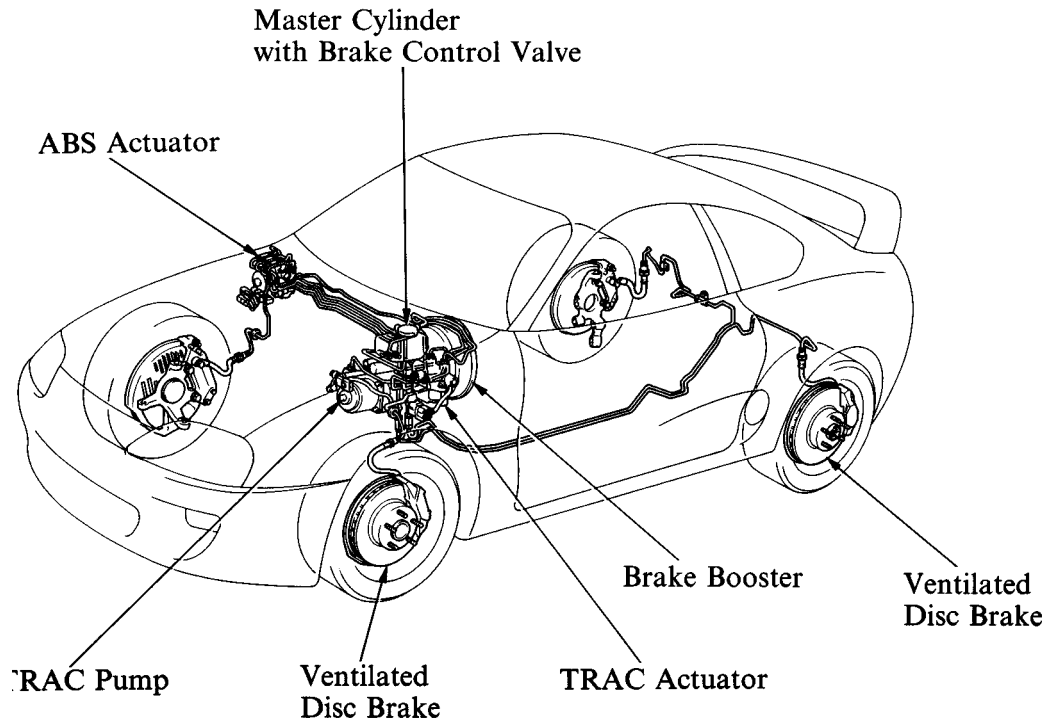


BRAKES

® DESCRIPTION

Both the front and rear brakes of the new model use ventilated discs that offer superior cooling performance. The ABS (Anti-Lock Brake System), which comes as standard equipment, is designed to help prevent wheel lock-up in instances of panic braking, and thus maintain vehicle directional stability and control.

A TRAC (Traction Control) system, which is standard equipment in the 2JZ-GTE engine model, maintains optimal rear wheel driving force according to road conditions and driving requirements during takeoff, acceleration, and turning, by executing total control over the engine torque and rear brakes.



For 2JZ-GTE Engine Model

◀ Specifications

Model		New		Previous	
Engine Type		2JZ-GE	2JZ-GTE	7M-GE	7M-GTE
Item					
Master Cylinder	Type	Tandem	←	←	←
	Diameter mm (in.)	25.4 (1.00)	←	←	←
Brake Booster	Type	Tandem	←	←	←
	Size in.	8" + 9"	←	←	←
Front Brake	Type	Ventilated Disc	←	←	←
	Pad Area cm ² (in. ²)	59.0 (9.15) x 2 x 2	64.3 (9.97) x 2 x 2	50 (7.75) x 2 x 2	←
	Wheel Cylinder Dia. mm (in.)	44.45 (1.75) x 2	42.85 (1.69) x 2 x 2	60.33 (2.38) x 2	←
	Rotor Size (D x T)* mm (in.)	296 x 32 (11.65 x 1.26)	323 x 30 (12.72 x 1.18)	302 x 22 (11.89 x 0.87)	←
Rear Brake	Type	Ventilated Disc	←	←	←
	Pad Area cm ² (in. ²)	33.0 (5.12) x 2 x 2	35.8 (5.55) x 2 x 2	37.5 (5.81) x 2 x 2	←
	Wheel Cylinder Dia. mm (in.)	42.86 (1.69)	40.45 (1.59) x 2	38.10 (1.50)	←
	Rotor Size (D x T)* mm (in.)	307 x 16 (12.09 x 0.63)	324 x 16 (12.76 x 0.63)	291 x 18 (11.46 x 0.71)	←
Brake Control Valve	Type	P & B Valve	←	←	←
	Deflection point of hydraulic pressure kPa (kg/cm ² ; psi)	2942 (30; 427)	2452 (25, 356)	2942 (30, 427)	←
	Pressure reduction gradient	0.37	←	0.6	←
Parking Brake	Type	Dual-Servo	←	←	←
	Size mm (in.)	190 (7.48)	←	←	←
	Lever Type	Center Lever	←	←	←
ABS (Anti-Lock Brake System)		STD	←	OPT	←
TRAC (Traction Control)		—	STD	—	—

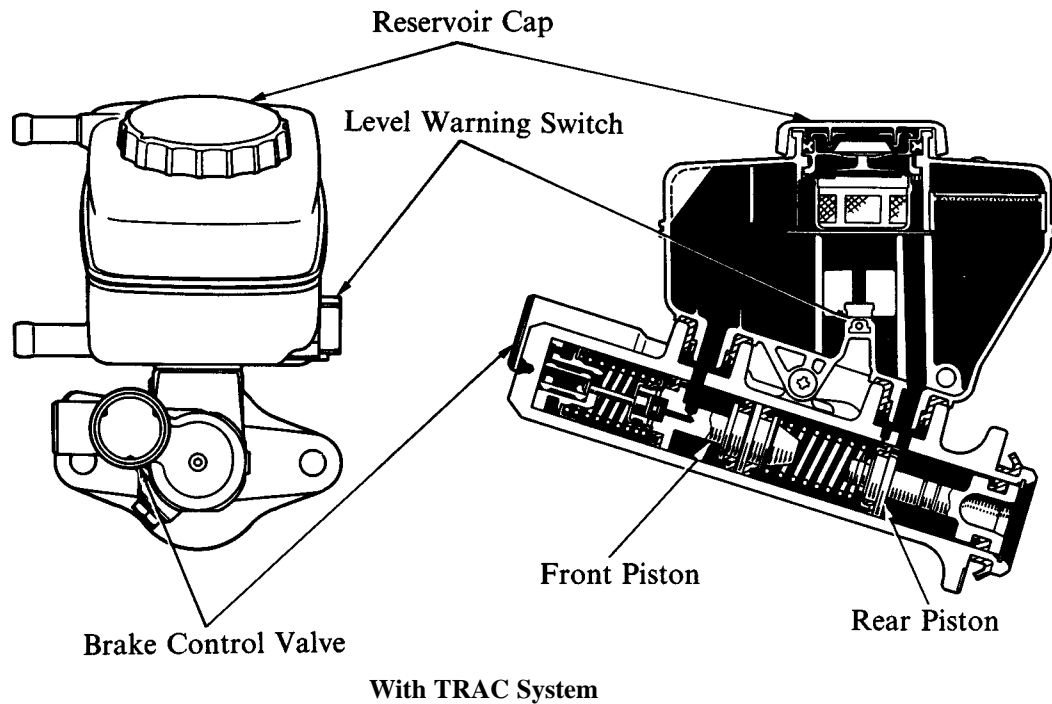
*D : Outer Diameter T : Thickness

® MASTER CYLINDER WITH BRAKE CONTROL VALVE

1. General

The master cylinder is made of aluminum, and has a built-in brake control valve.

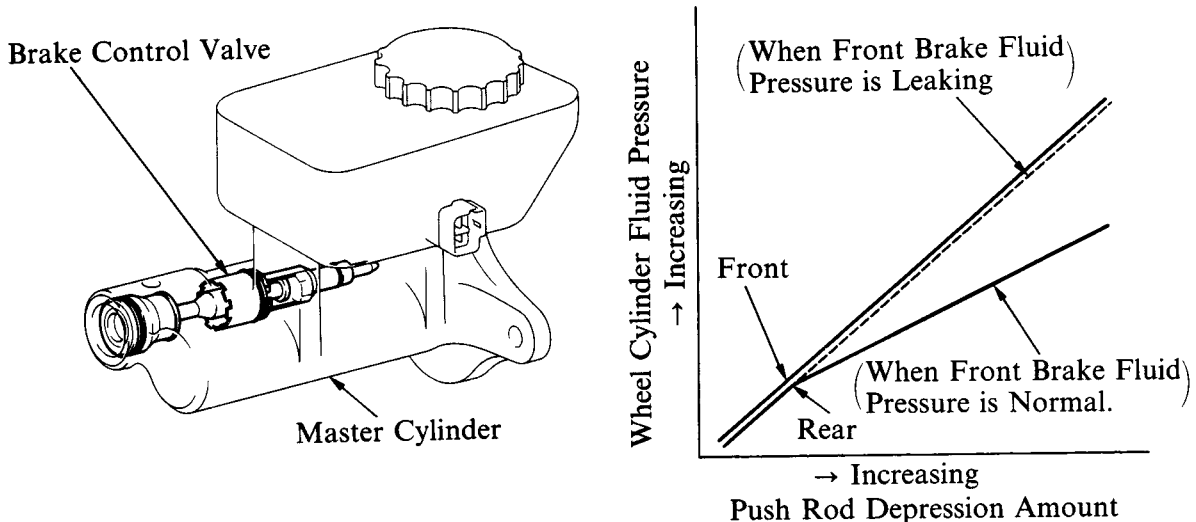
- It uses a portless type piston in the front, and conventional type in the rear, in the same way the previous model equipped with ABS did.
- The reservoir cap, previously made of rubber, is now made of plastic, and a fluid level warning switch is provided at the bottom of the reservoir.
- The master cylinder, previously attached to the booster using 4 nuts, is now fastened with 2 nuts for enhanced serviceability.



2. Brake Control Valve

General

The brake control valve of the new model is a P & B (Proportioning and Bypass) valve that is integrated with the master cylinder, making for a simplified layout of brake components.

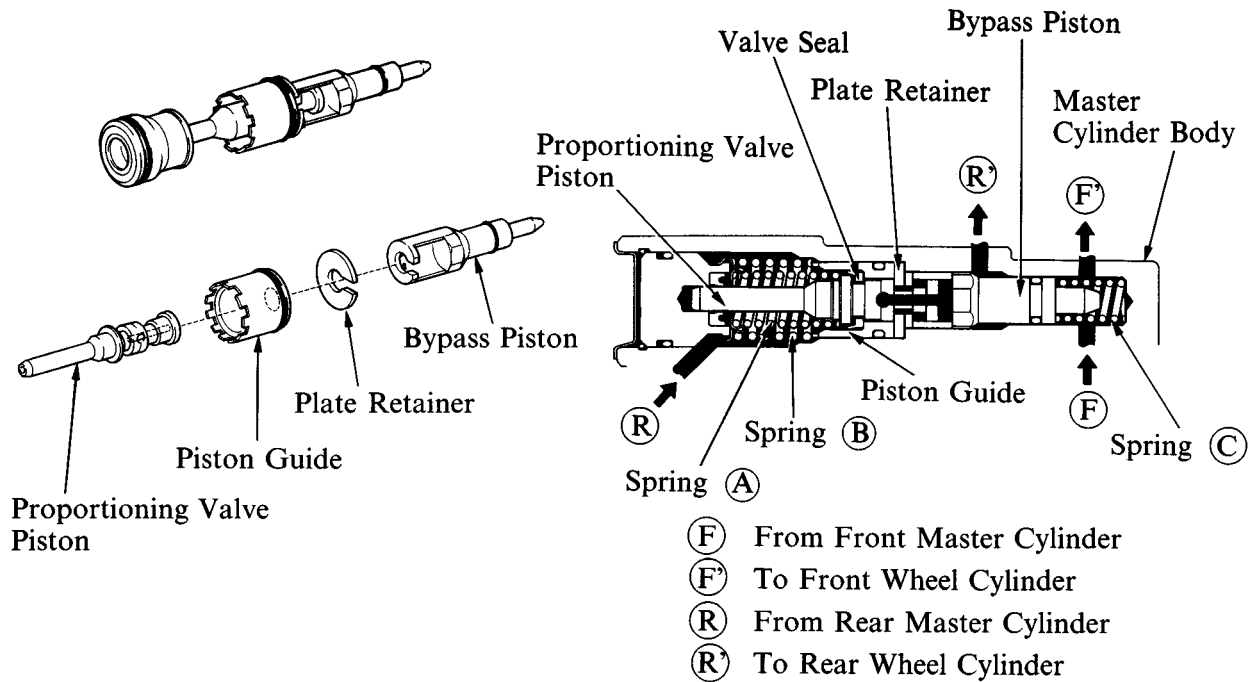


Construction

The brake control valve consists of the following: a proportioning valve, valve seal, and piston guide, which, altogether effect a pressure–reduction control of the hydraulic pressure applied to the rear brake cylinder; a bypass piston that maintains hydraulic pressure of the rear brake cylinder in case of a leak in the front brake cylinder; and a plate retainer that regulates the movement of the proportioning valve piston and piston guide.

When the brake pedal is not being depressed (hydraulic pressure not generated), spring (A) applies pressure to the proportioning valve piston, and spring (B) applies pressure to the piston guide, so that both push the plate retainer forward. The bypass piston, on the other hand, pushes the plate retainer backwards.

Although pressure is applied to the plate retainer from both directions, the tension of spring (C) being lower than the combined tension springs (A) and (B), the proportioning valve piston, piston guide, and bypass piston (as illustrated below) are maintained in such a way that the plate retainer is pushed against the master cylinder body.



Cross Section

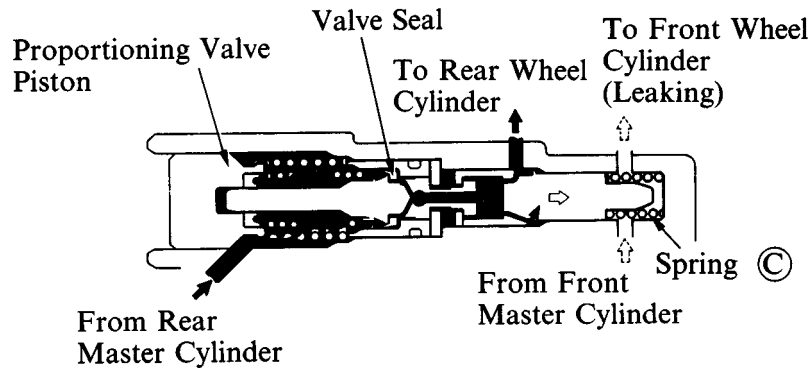
Operation

1) When Front Brake Fluid Pressure is Not Leaking

When normal front brake fluid pressure is maintained (no hydraulic leaks), a pressure–reduction control of the hydraulic pressure applied to the rear brake cylinder is executed by the contact the proportioning valve piston makes with the valve seal, in the same way as the conventional P & B valve did.

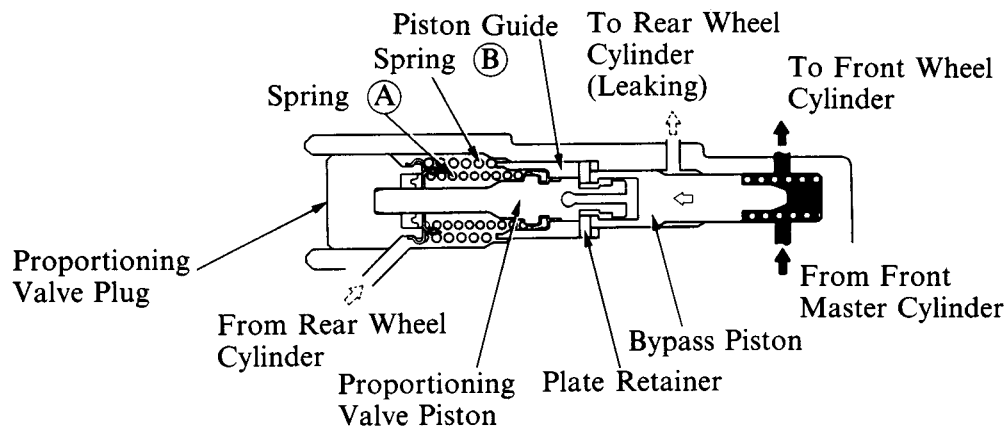
2) When Front Brake Fluid Pressure is Leaking

When the brake pedal is depressed in the absence of brake fluid pressure leaks in the front and rear brakes, rear master cylinder pressure is applied to the rear of the bypass piston shown in the illustration, and front master cylinder pressure is applied to the front of the same piston. In the event of a pressure loss in the front brake hydraulic system, only the rear master cylinder's pressure remains applied to the the bypass piston. This causes the bypass piston to overcome the tension spring (C), and move right side. This move then causes the proportioning valve piston (whose function is to execute a pressure–reduction control of the rear wheel cylinder pressure) to be pushed right side by the shoulder located in the rear of the bypass piston. The resultant separation of this piston away from the valve seal does not allow the execution of pressure–reduction control, so the normal rear master cylinder pressure continues to be applied to the rear wheel cylinders.



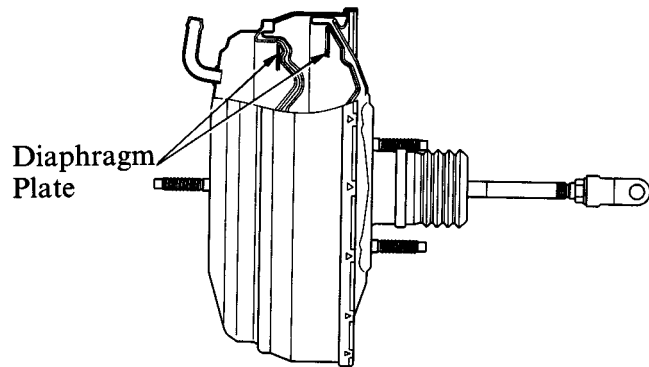
3) When Rear Brake Fluid Pressure is Leaking

Contrary to the condition described below, if there is a leak in the rear brake hydraulic pressure, only the front master cylinder pressure is applied to the bypass piston, causing the bypass piston to move left side, and come in contact with the plate retainer. Furthermore, the bypass piston, overcoming the tension of springs (A) and (B), moves in conjunction with the plate retainer, piston guide, and proportioning valve piston, all the way until the tip of the valve piston comes in contact with the proportioning valve plug. In this condition, the front master cylinder pressure applies its normal pressure to the front wheel cylinders.



® Brake Booster

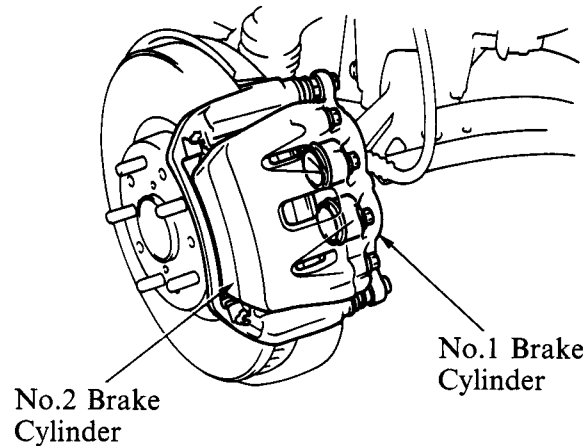
The new model uses the same lightweight and compact 8" + 9" tandem type brake booster used in the previous model, offering high boosting performance. Also, the diaphragm plate of the new model, which moves according to the pressure difference, is made lightweight using aluminum.



® FRONT DISC BRAKE

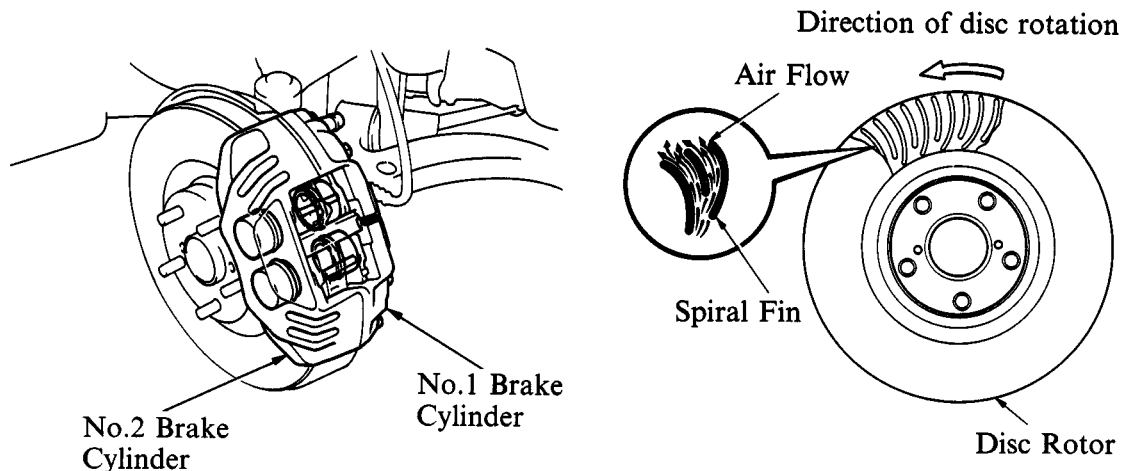
- The front brakes of the 2JZ-GE engine model use single-sided 2-piston type ventilated disc brakes.

The brake cylinders consist of No. 1 brake cylinder made of aluminum, and No. 2 brake cylinder made of cast iron.



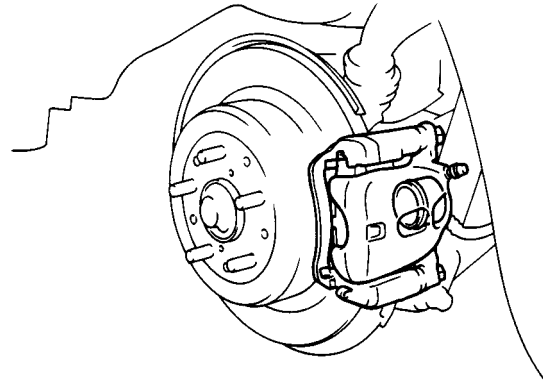
- The front brakes of the 2JZ-GTE engine model use opposed-cylinder, 4-piston type ventilated disc brakes.

In the same way as those of the 2JZ-GE engine model, the brake cylinders consist of No. 1 brake cylinder made of aluminum, and No. 2 brake cylinder made of cast iron. In addition, discs with spiral fins are used to ensure cooling efficiency through a smooth air flow.



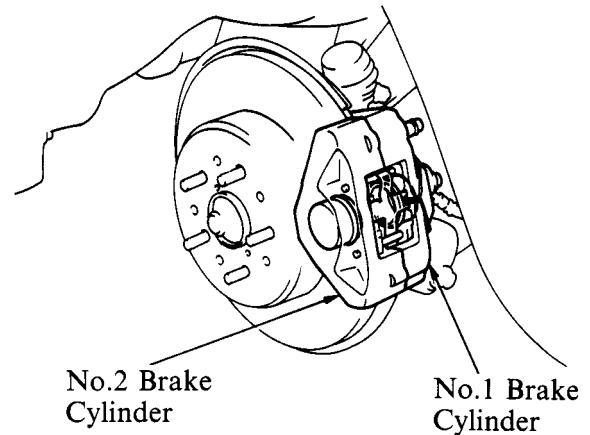
® REAR DISC BRAKE

- The rear brakes of the 2JZ-GE engine model are single-piston ventilated disc brakes which include internal parking brakes.



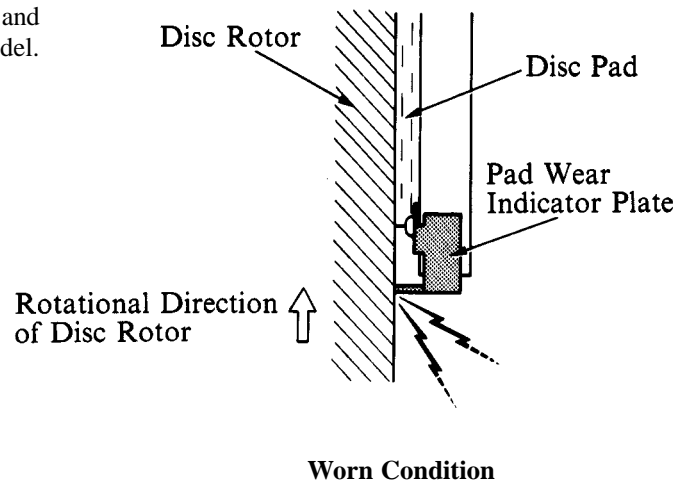
- The rear brakes of the 2JZ-GTE engine model offer the same internal parking brakes found on the 2JZ-GE model; however, they use opposed-cylinder, 2-piston type ventilated disc brakes.

The brake cylinders consist of No. 1 and No. 2 brake cylinders, both made of lightweight aluminum alloy.



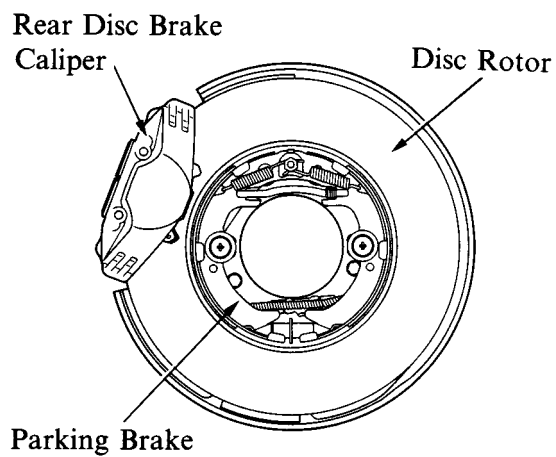
® BRAKE PAD WEAR INDICATOR

Audible pad wear indicators, which warn the driver of worn brake pads, are incorporated in the front and rear brakes in the same way as the previous model.



® PARKING BRAKE

The same dual-servo type parking brake used in the previous model is enclosed in the rear disc rotors of the new model.



For 2JZ-GTE Engine Model

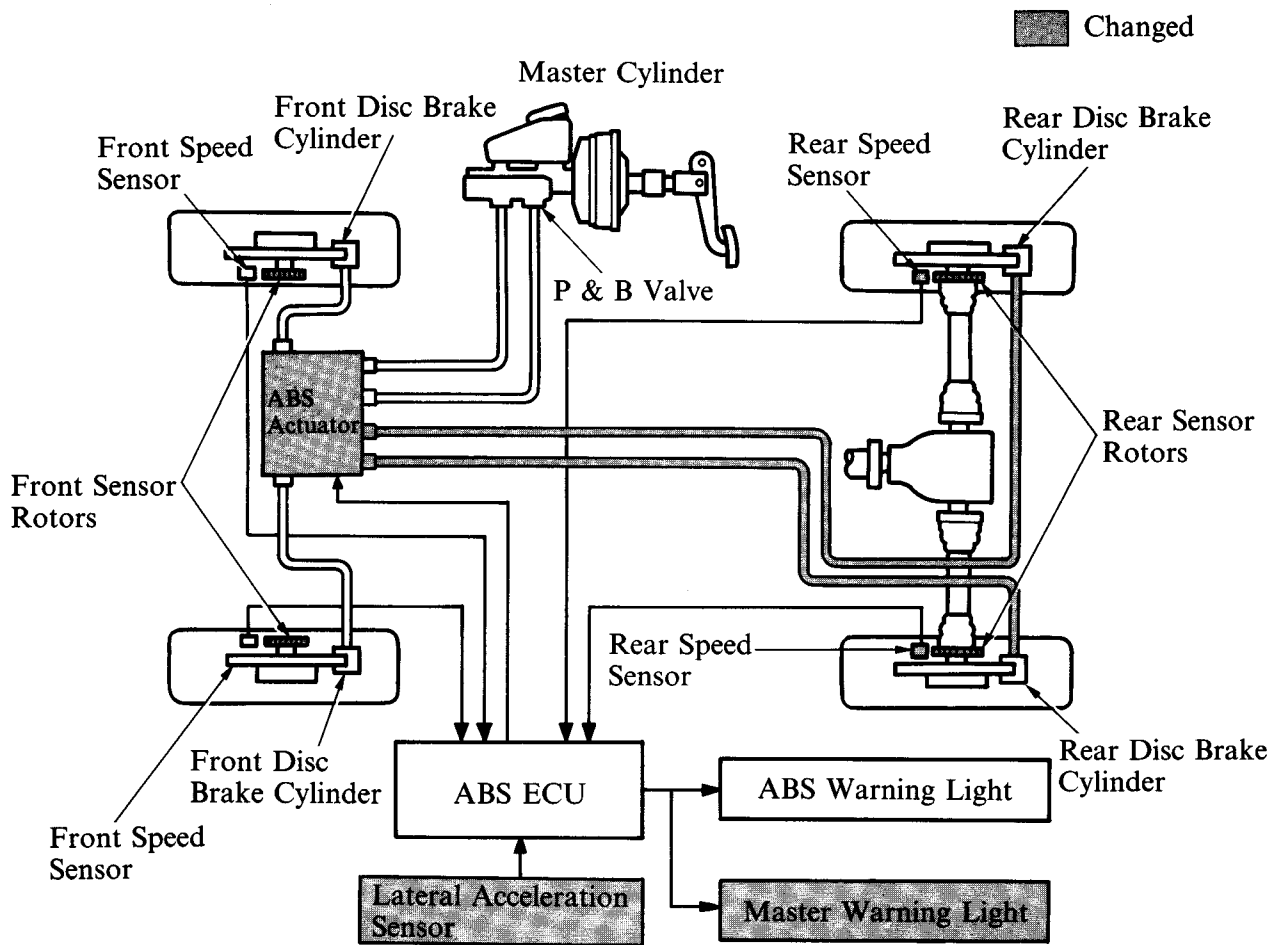
® **ABS (Anti-Lock Brake System)**

1. General

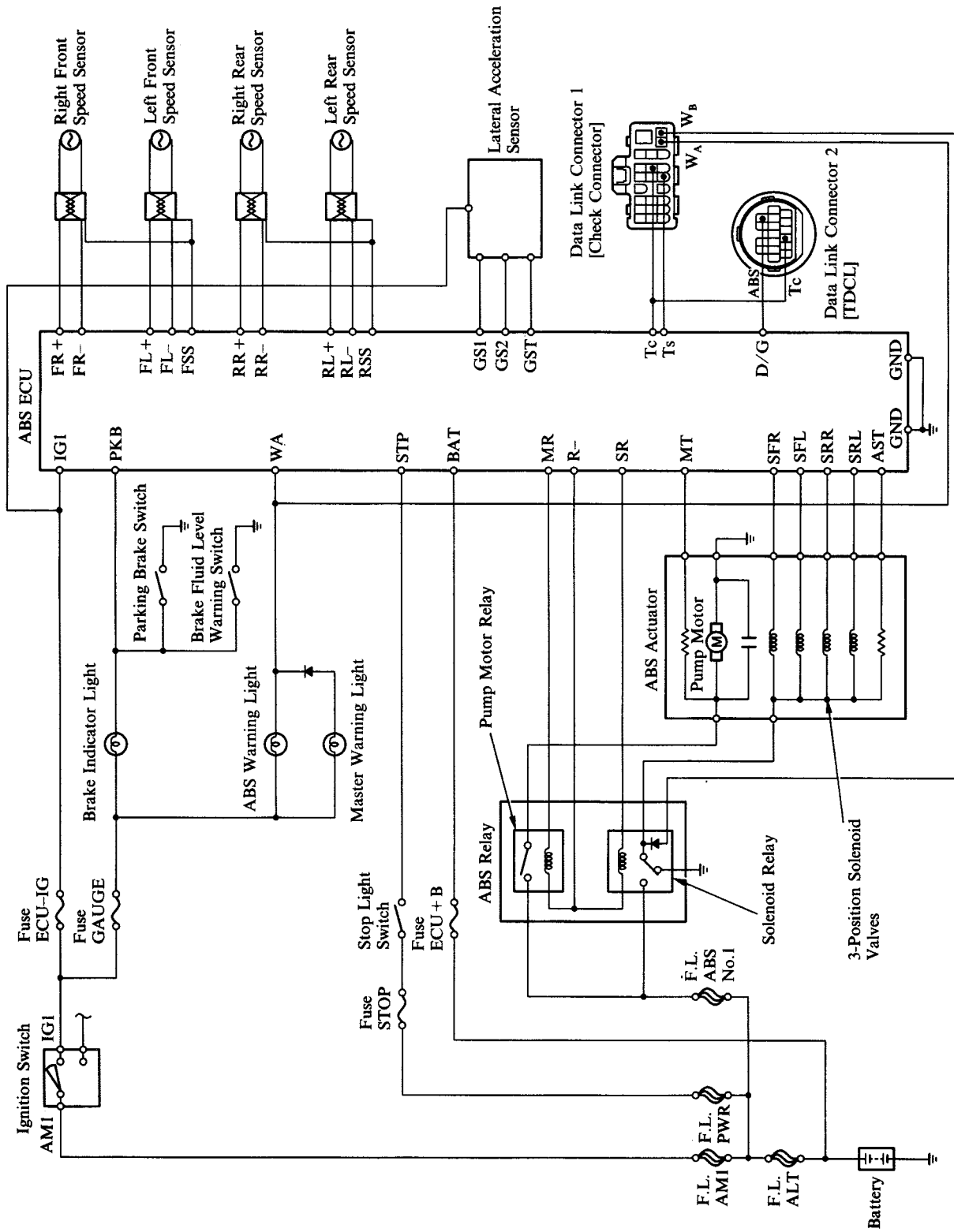
The ABS (Anti-Lock Brake System) used in the previous model is also used in the new model, with the following modifications:

- Previous, there were two 3-position solenoid valves in the ABS actuator for the front brakes, and one 3-position solenoid valve for the rear brakes. In the new model, both the front and rear brakes have 2 valves each.
- Speed sensors, which 2 were previously allocated for the front and 1 for the rear, are now allocated 2 each for the front and rear, enabling the right and left rear wheel speeds to be detected independently.
- A lateral acceleration sensor, which detects the lateral acceleration generated by the vehicle when making a turn, is fitted on the floor inside the center cluster.

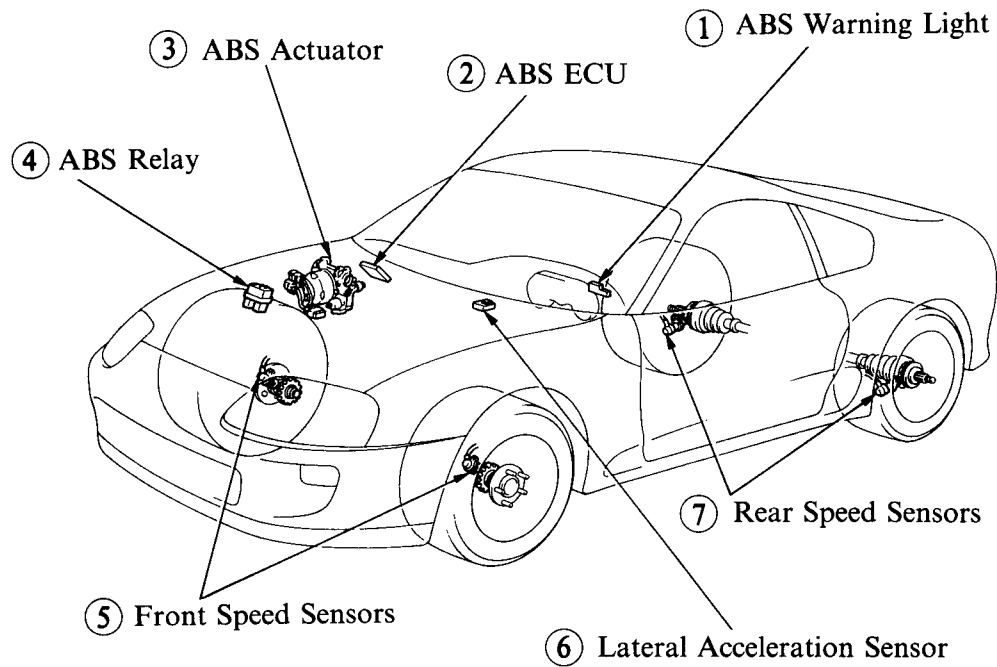
2. System Diagram



3. Wiring Diagram



4. Layout of Components



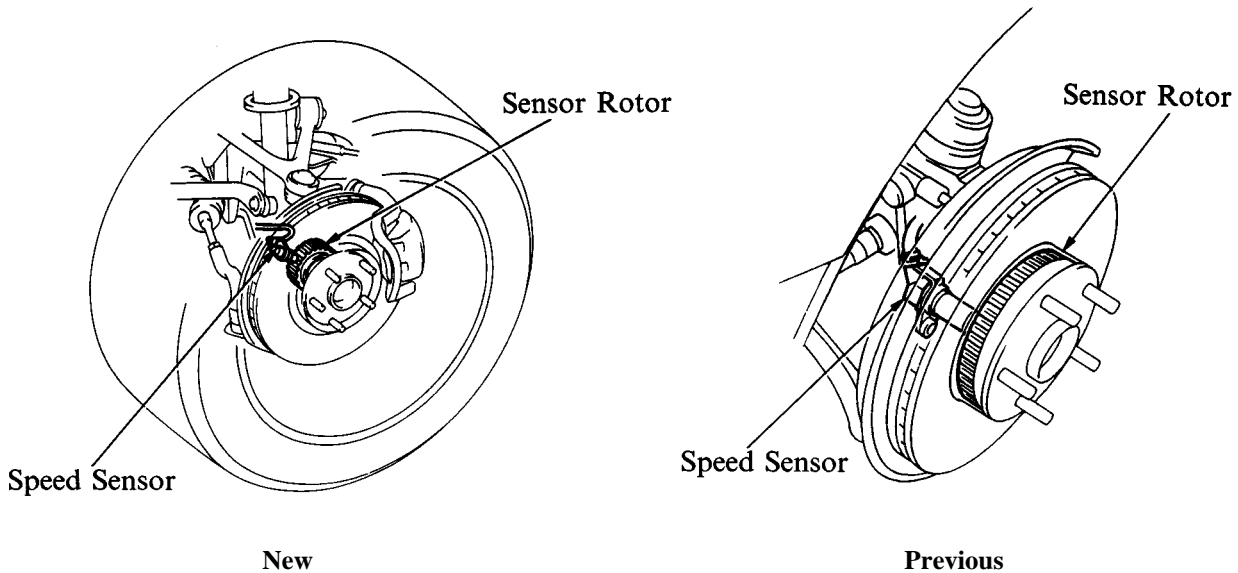
5. Function of Components

No.	Components		Function
(1)	ABS Warning Light		Lights up to alert the driver when malfunction has occurred in the ABS system.
(2)	ABS ECU		Based on the wheel speed signals from each sensor, it calculates acceleration, deceleration and slip values and sends signals to the actuator and relay to control brake fluid pressure.
(3)	ABS Actuator		Controls the brake fluid pressure to each disc brake cylinder by signals from the ECU.
(4)	ABS Relay	Solenoid Relay	Directs electricity to the solenoid valves in the actuator.
		Pump Motor Relay	Controls the pump motor operation in the actuator.
(5)	Front Speed Sensors		Detect the wheel speed of each of the left and right front wheels.
(6)	Lateral Acceleration Sensor		Detects lateral acceleration when making a turn.
(7)	Rear Speed Sensors		Detect the wheel speed of each of the left and right rear wheels.

6. Construction and Operation of Components

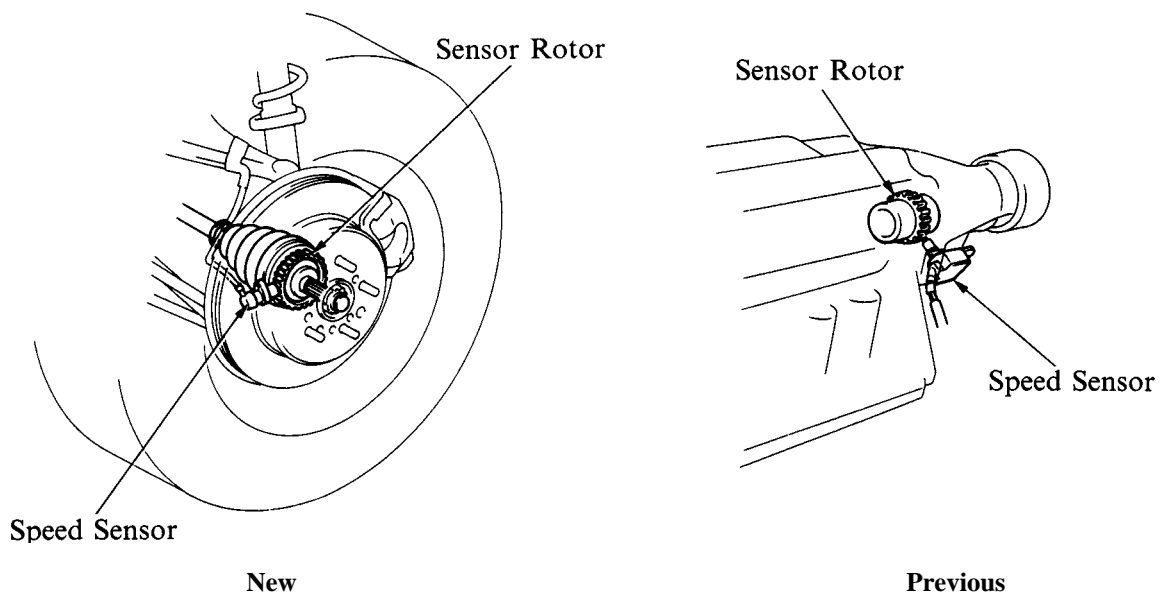
Front and Rear Speed Sensors

- The front speed sensor attached to the steering knuckle detects the wheel speed by the rotation of the sensor rotor installed on the front axle hub.
The sensor rotor, which was integrated with the axle hub in the previous model, is now fastened to the axle hub using nuts, and the number of serration has changed from 96 to 48.



- Previous, there was one rear speed sensor located on the transmission extension housing, but now, there are 2 rear speed sensors, each located on the right and left rear axle carriers. In addition, the number of serration has been changed from 32 to 39* to 48. Furthermore, the adoption of the 2 rear speed sensor system entails a modification from the previous model's detection of average speed between the right and left rear wheels to that of an independent rear speed detection.

*32 serrations on the W58 manual transmission, 39 on the R154 manual and A340E automatic transmissions.

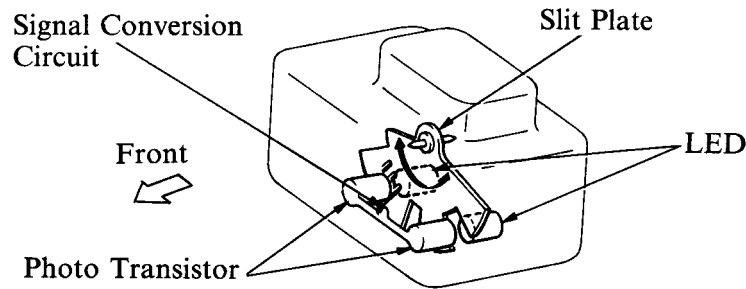


Lateral Acceleration Sensor

The lateral acceleration sensor consists of 2 sets of LED (light-emitting diodes), photo transistor, slit plate, and signal conversion circuit. When lateral acceleration is generated during a turn, the slit plate rotates, and allows the LED lights to be cast onto the photo transistor, or arrests their projection. These functions help detect the lateral acceleration speed of the vehicle.

For details on the construction and operation of the lateral acceleration sensor, refer to the section on the deceleration sensor, on page TD-107 or '88 Celica and Camry All-Trac/4WD New Car Features (Pub. No. NCF033U).

Because the deceleration sensor used in the Celica and Camry All-Trac/4WD detects vehicle deceleration, the orientation of detection itself is different from that of the lateral acceleration sensor. However, the basic functions of these two sensors are identical.

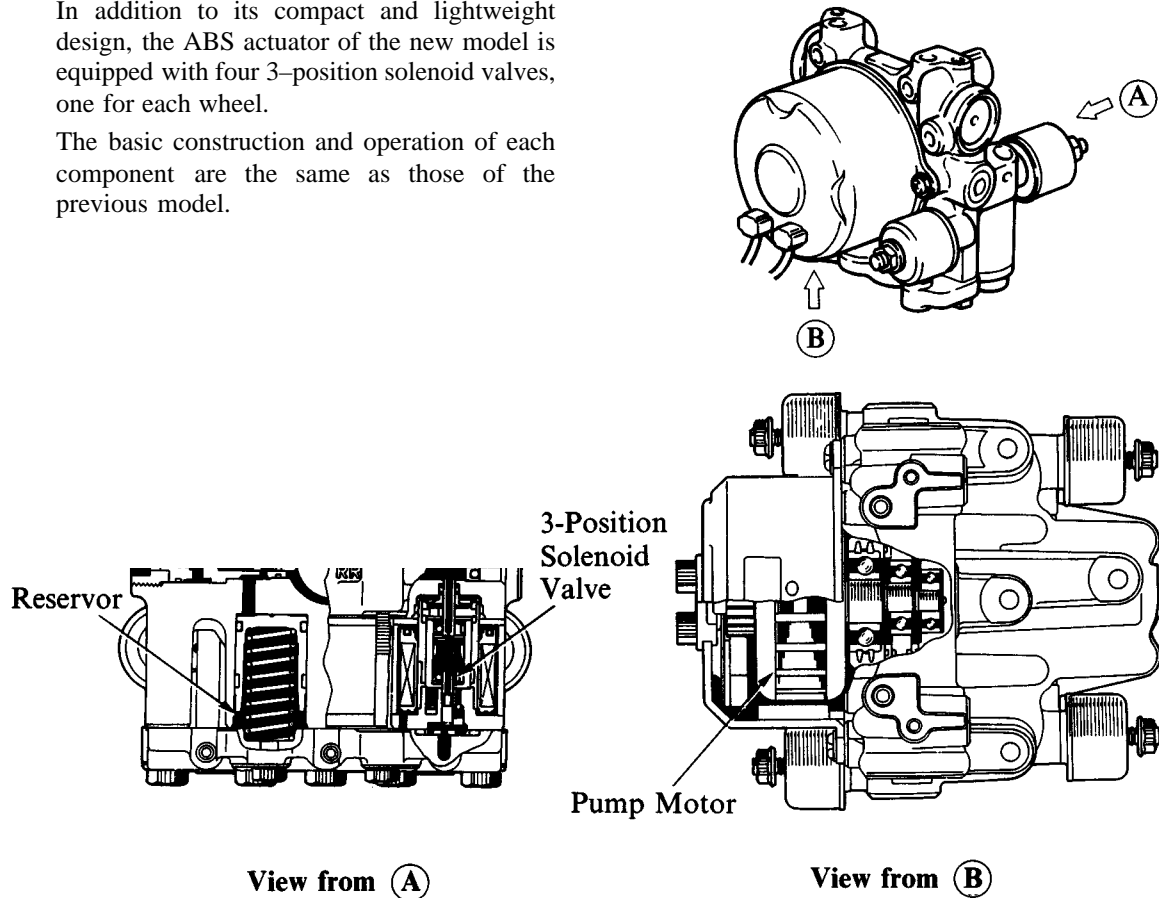


ABS Actuator

1) General

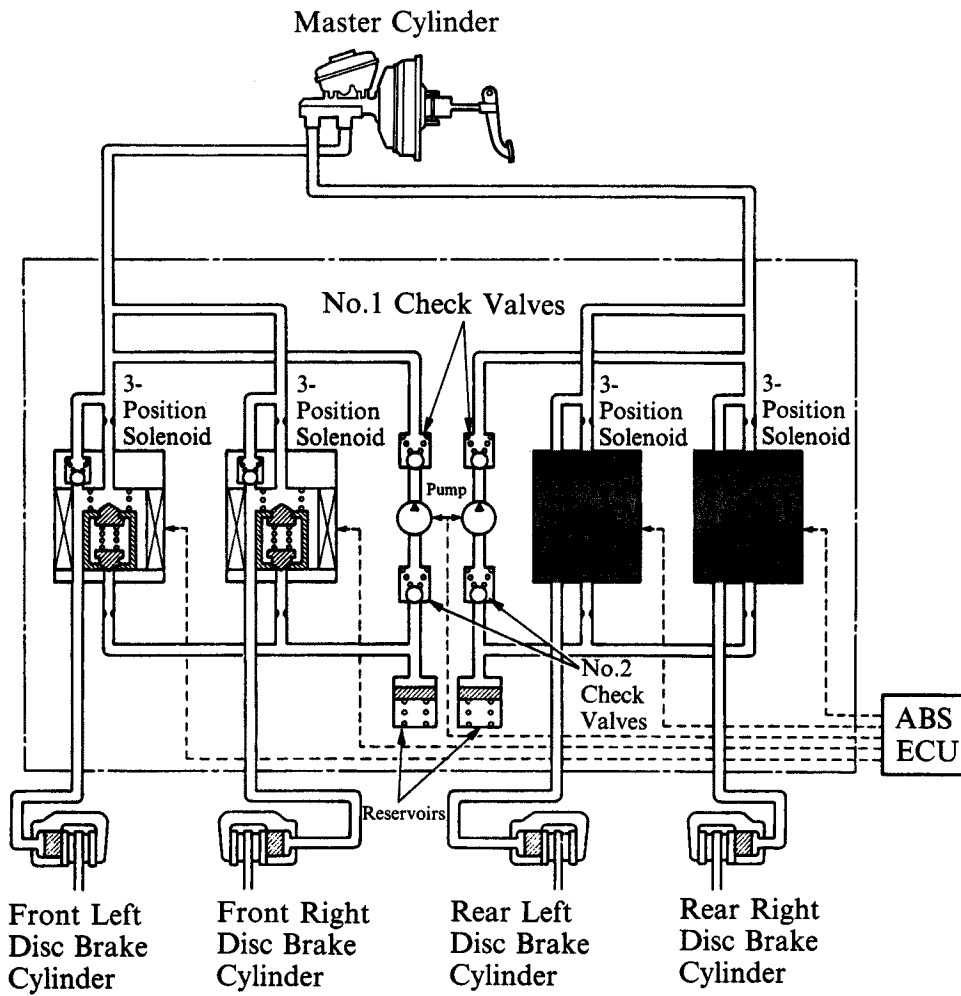
In addition to its compact and lightweight design, the ABS actuator of the new model is equipped with four 3-position solenoid valves, one for each wheel.

The basic construction and operation of each component are the same as those of the previous model.



2) Hydraulic Circuit

■ : Changed



7. Function of ECU

General

- The previous model used 3 speed sensors to control the 2 front wheel speeds independently, and the rear wheel speeds collectively. The new model uses 4 speed sensors to execute speed control of all 4 wheels.
- In conjunction with the adoption of the four 3–position solenoid valves in the ABS actuator, a check pattern for one additional 3–position solenoid valve is added to the initial check functions.
- A sensor check function, designed to check speed sensor functions, has been newly adopted.

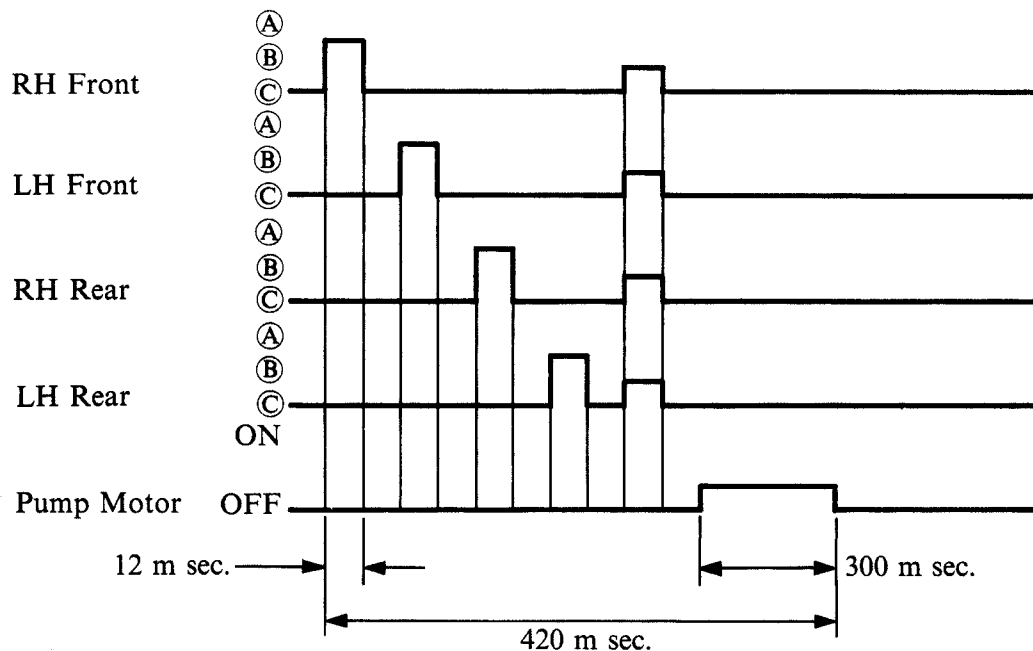
Wheel Speed Control

After determining the slip condition of each wheel, the ECU outputs control signals to each of the 3–position solenoid valves located in the ABS actuator, to effect the wheel speed control. This function of the ECU is the same as that of the previous model. However, the new model has four 3–position solenoid valves, one for each of the wheels, unlike the previous 3–valve system. Therefore, the ECU outputs a control signal independently to each of the four 3–position solenoid valves to execute wheel speed control.

The control signals consists of the same 3 modes (pressure reduction, pressure holding, and pressure increase) found in the previous model.

Initial Function Check

In conjunction with the adoption of the four 3–position solenoid valves in the ABS actuator, a check pattern for one additional 3–position solenoid valve is added to the initial check functions. Furthermore, instead of checking the 3–position valves sequentially as done previously, the ECU of the new model checks the pressure reduction and pressure increase modes sequentially. Afterwards, it checks the pressure holding mode of all the 3–position solenoid valves simultaneously. The checking time for all modes and for the pump motor has been reduced by a total of 1 second.

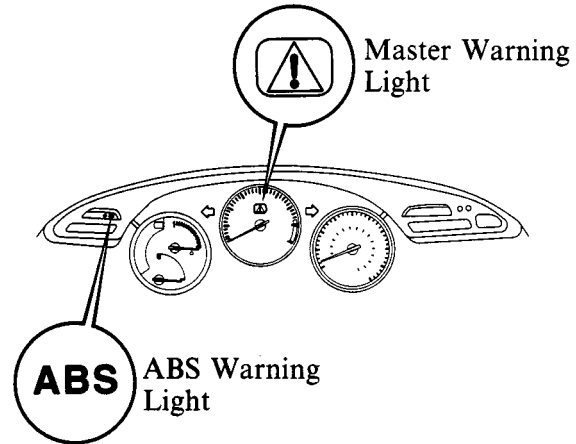


- (A) Pressure Reduction Model
- (B) Pressure Holding Mode
- (C) Pressure Increase Mode

Sensor Check Function

The speed sensor check function is a new function. In this function, the output voltage level of all speed sensors and their fluctuations can be checked under a sensor check mode. For details about this check method, refer to the '93 Toyota Supra Repair Manual (Pub. No. RM343U2). The result of each check is indicated by the blinking pattern of the ABS warning light located in the telltail light. At the same time, the master warning light also lights. For details on the master warning light, refer to page 234.

NOTE: The ABS system does not operation when the ECU is in the sensor check function.



◀Diagnostic Trouble Code of Sensor Check Function▶

Code No.	Diagnosis
71	Low output voltage of front right speed sensor.
72	Low output voltage of front left speed sensor.
73	Low output voltage of rear right speed sensor.
74	Low output voltage of rear left speed sensor.
75	Abnormal change in output voltage of front right speed sensor.
76	Abnormal change in output voltage of front left speed sensor.
77	Abnormal change in output voltage of rear right speed sensor.
78	Abnormal change in output voltage of rear left speed sensor.

Self-Diagnosis

Although the basic functions of the self-diagnosis are the same as those of the previous model, some of the diagnostic codes have been modified or added. Since the self-diagnosis system of the ABS ECU for the 2JZ-GTE engine model with TRAC system includes diagnosis of the TRAC brake actuators details are provided on page 193.

◀Diagnostic Trouble Codes of Self Diagnosis (Excluding the 2JZ-GTE Engine Model)▶

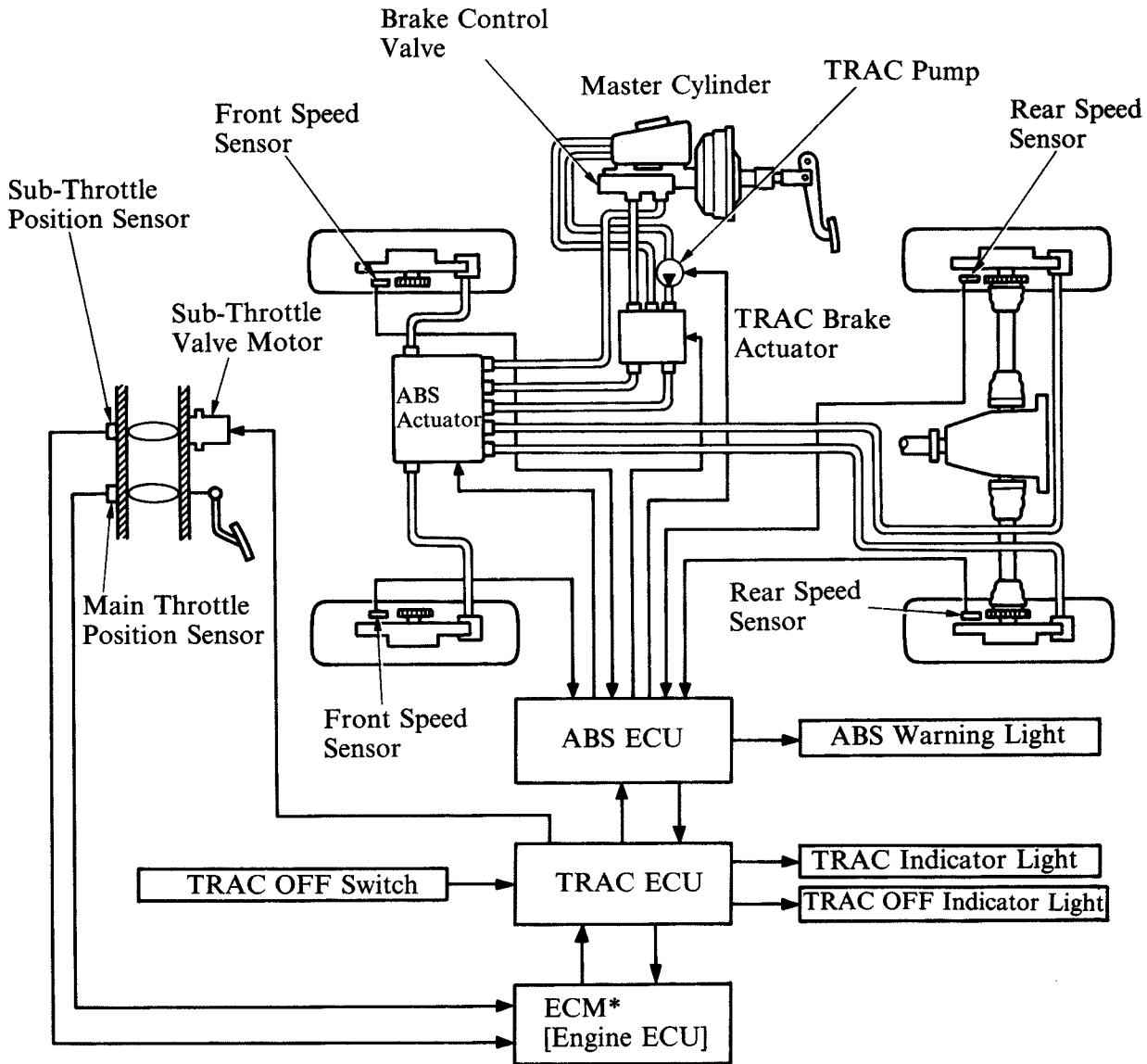
Code No.	Model		Diagnosis
	New	Previous	
11			Open circuit in solenoid relay circuit.
12			Short circuit in solenoid relay circuit.
13			Open circuit in pump motor relay circuit.
14			Short circuit in pump motor relay circuit.
21			Open or short circuit in 3-position solenoid of front right wheel.
22			Open or short circuit in 3-position solenoid of front left wheel.
23		—	Open or short circuit in 3-position solenoid of rear right wheel.
	—		Open or short circuit in 3-position solenoid of rear wheel.
24		—	Open or short circuit in solenoid valve of rear left wheel.
31			Front right wheel speed sensor signal malfunction.
32			Front left wheel speed sensor signal malfunction.
33		—	Rear right wheel speed sensor signal malfunction.
	—		Rear wheel speed sensor signal malfunction.
34		—	Rear left wheel speed sensor signal malfunction.
35		—	Open circuit in front left or rear right speed sensors.
36		—	Open circuit in front right or rear left speed sensors.
41		—	Low battery voltage (9.5 V or lower) or abnormally high battery voltage (17 V or higher).
	—		Low battery voltage (9.5 V or lower).
42	—		Abnormally high voltage (17 V or higher).
44		—	Lateral acceleration sensor signal malfunction.
51			Pump motor locked or open circuit.
Always ON			Malfunction in ABS ECU.

® TRAC (Traction Control)

1. General

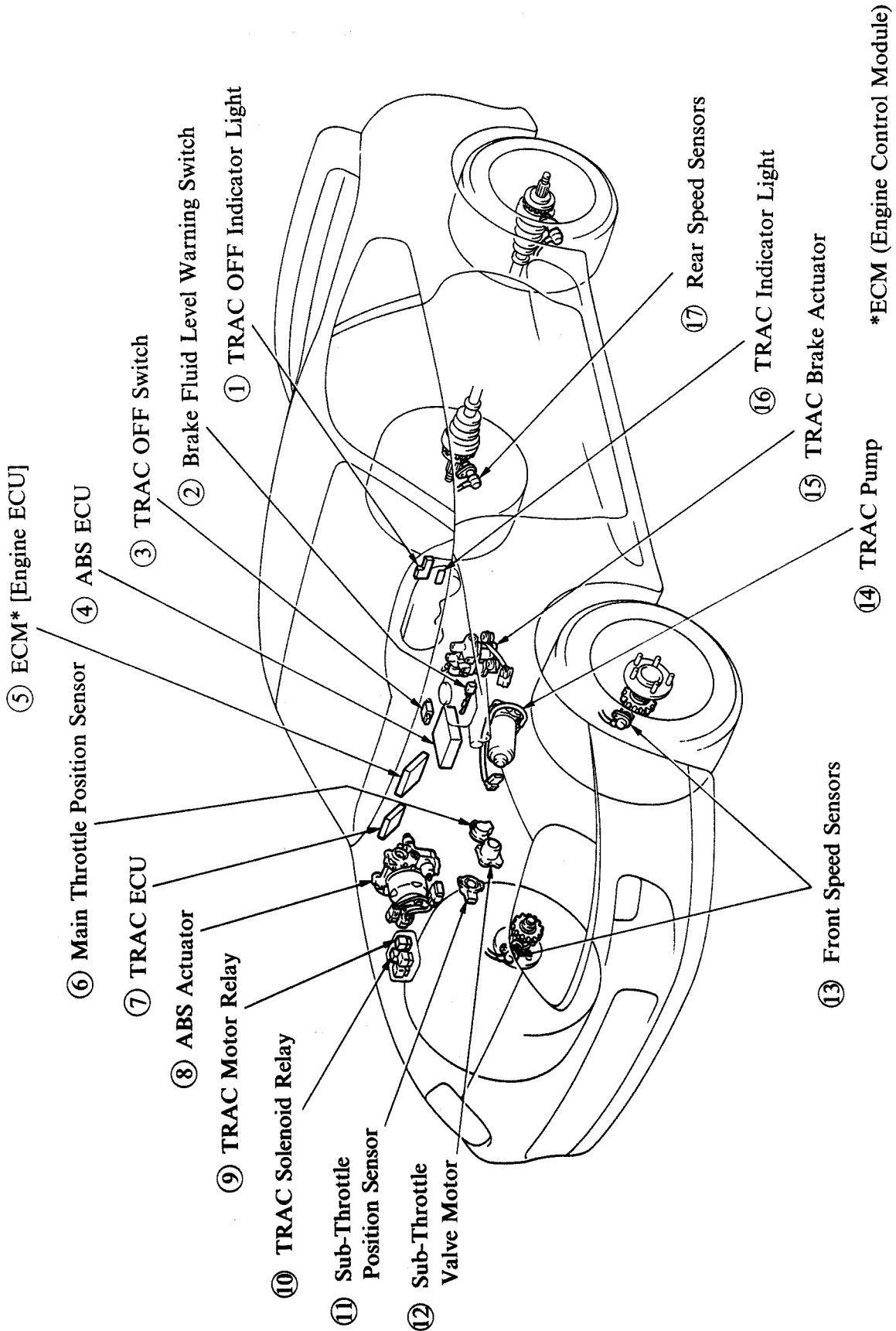
The TRAC (Traction Control) system totally controls the engine torque and the braking of the driving wheels (rear wheels), it helps avoid slippage of the driving wheels that tends to happen during starting and acceleration and to maintain an optimal driving force according to the road surface conditions. The system eliminates the need for a subtle accelerator pedal operation and improves vehicle stability when starting, accelerating or turning on slippery roads.

2. System Diagram



* ECM (Engine Control Module)

4. Layout of Components



5. Function of Components

No.	Components	Function
(1)	TRAC OFF Indicator Light	Informs the driver that the TRAC system is inoperative.
(2)	Brake Fluid Level Warning Switch	Detects the fluid level of the brake master cylinder reservoir.
(3)	TRAC OFF Switch	Turns the TRAC system inoperative.
(4)	ABS ECU	Controls the ABS and TRAC actuators according to the signals received from the front and rear sensors, and TRAC ECU. In addition, it sends the wheel speed signal to the TRAC ECU.
(5)	ECM* [Engine ECU]	Outputs the main throttle and sub-throttle valve position signals and sends them to the TRAC ECU. In addition, it retards the ignition timing when the TRAC system is operating.
(6)	Main Throttle Position Sensor	Detects the main throttle valve opening angle and sends it to the ECM* [Engine ECU].
(7)	TRAC ECU	<ul style="list-style-type: none"> ○ Judges the vehicle driving condition based on signals from front and rear speed sensors and throttle position signals from the ECM* [Engine ECU], and sends control signals to the sub-throttle valve motor and ABS ECU accordingly. ○ In case of the TRAC system malfunction, it turn on the TRAC indicator light to alert the driver. ○ When switched to the diagnostic mode, it displays the item of malfunction by a code No. ○ In case of the ABS ECU or ECM* [Engine ECU] malfunction, it turn on the TRAC OFF indicator light to alert the driver.
(8)	ABS Actuator	Controls the brake fluid pressure to each disc brake cylinder by signals from the ABS ECU. It also controls the right and left rear disc brake cylinders separately when the TRAC system is operating.
(9)	TRAC Motor Relay	Controls the TRAC pump and motor operation.
(10)	TRAC Solenoid Relay	Supplies electricity to the TRAC brake actuator and TRAC motor relay.
(11)	Sub-Throttle Position Sensor	Detects the sub-throttle valve opening angle and sends it the the ECM* [Engine ECU].
(12)	Sub-Throttle Valve Motor	Controls the sub-throttle valve opening angle according to a signal from the TRAC ECU.
(13)	Front Speed Sensors	Detect the wheel speeds of right and left front wheels separately.
(14)	TRAC Pump	Supplies hydraulic pressure to the TRAC brake actuator according to signals received from ABS ECU.
(15)	TRAC Brake Actuator	Supplies fluid pressure to the ABS actuator according to a signal from the ABS ECU.
(16)	TRAC Indicator Light	Informs the driver that the TRAC system is operative; also warns the driver of a system malfunction.
(17)	Rear Speed Sensors	Detect the wheel speeds of right and left rear wheels separately.

* ECM (Engine Control Module)

6. Construction and Operation of Components

TRAC OFF Switch and Indicator Lights

1) TRAC OFF Switch

When pressed, this switch turns the TRAC system inoperative. Pressing it again changes it to operative. It is always operative right after the engine is restarted.

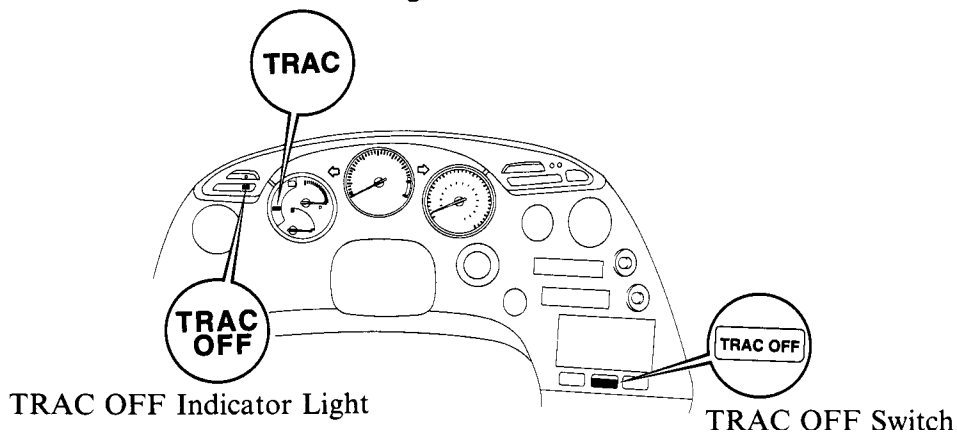
2) TRAC OFF Indicator Light

This light goes on when the TRAC system is set inoperative by the TRAC OFF switch, and informs the driver accordingly. It also goes on when a malfunction occurs in the engine and the TRAC system becomes inoperative (see page 193 for more information).

3) TRAC Indicator Light

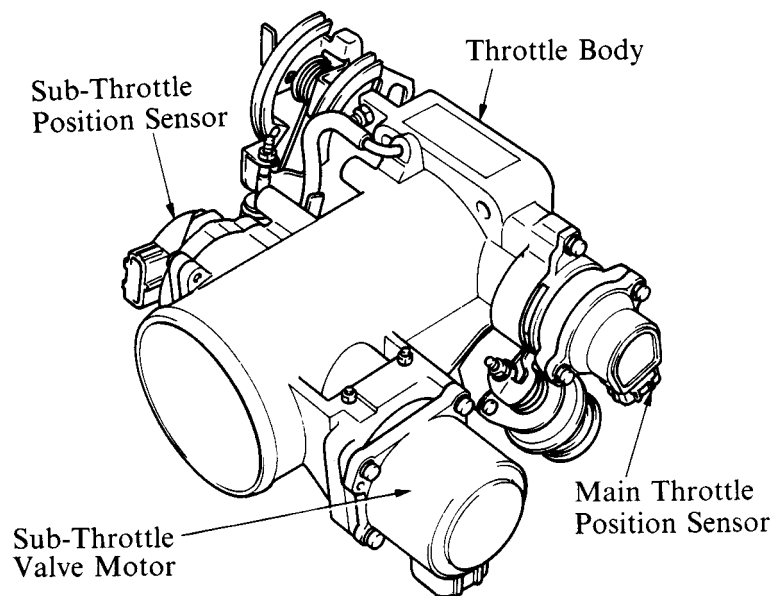
When the TRAC system is operative, this light blinks and informs the driver accordingly. When a malfunction occurs in the system, it remains lit and warns the driver. When the TRAC ECU is set to the diagnostic mode, this light blinks and informs the driver of the self-diagnostic results.

TRAC Indicator Light



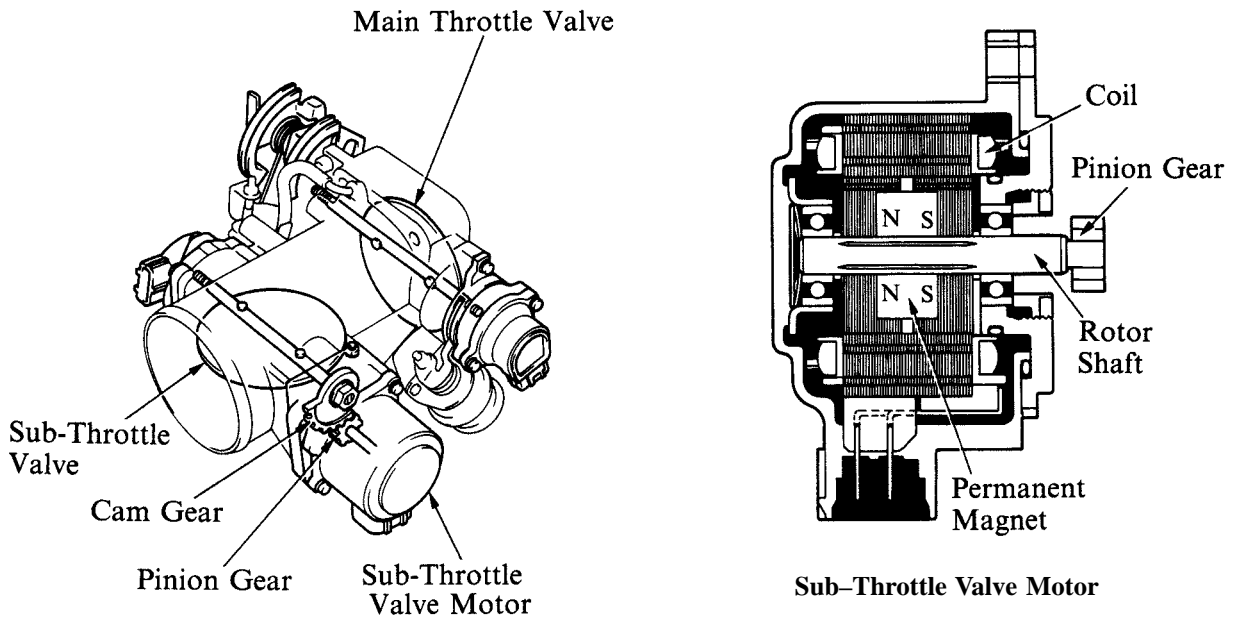
Sub-Throttle Valve Motor

This motor is fitted to the throttle body. It controls the sub-throttle valve according to signals from the TRAC ECU and thus controls the engine output.



1) Construction

The sub-throttle valve motor consists of a permanent magnet, coil and rotor shaft. It is a step motor that rotates by a signal from the TRAC ECU. A pinion gear is fitted at the rotor shaft end and rotates the cam gear fitted to the sub-throttle valve shaft end, thereby controls the sub-throttle valve operation.



2) Operation

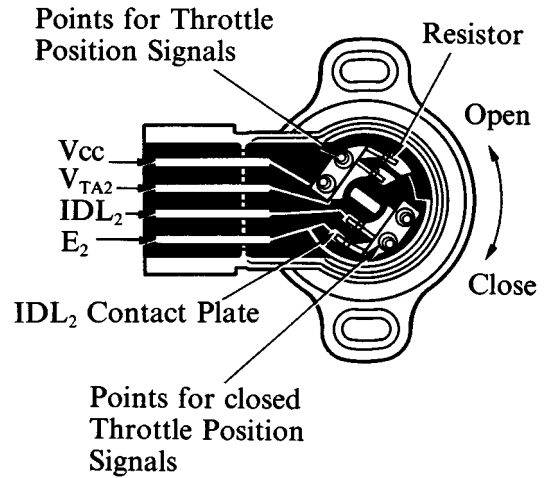
When TRAC Not Operative	When TRAC Operative	
Sub-throttle valve fully opened	Sub-throttle valve 50% opened	Sub-throttle valve fully closed

Sub-throttle Position Sensor

This sensor is fitted to the sub-throttle valve shaft. It converts the sub-throttle valve opening angle to a voltage signal and sends the signal to the TRAC ECU via the ECM* [Engine ECU].

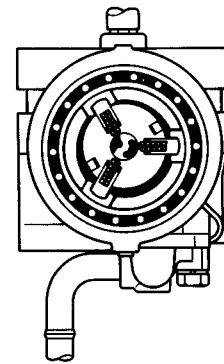
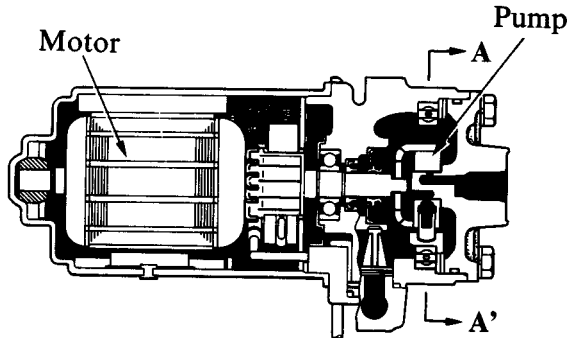
The sub-throttle position sensor is built and operates in the same way as the main throttle valve.

*ECM (Engine Control Module)



TRAC Pump

The function of the TRAC pump is to generate brake fluid pressure necessary for applying pressure to the disc brake cylinders when the TRAC system is operating. It picks up the brake fluid from the master cylinder reservoir, applies pressure to it, and directs it to the TRAC brake actuator. It is a motor-driven, 3-cylinder radial pump.



A-A' Cross Section

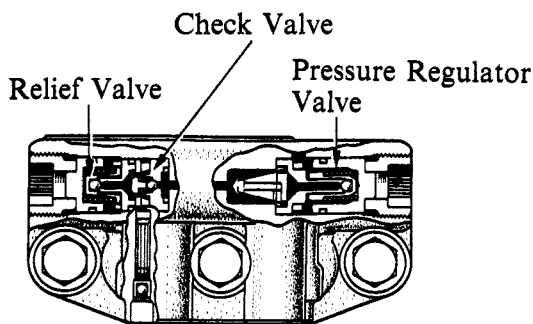
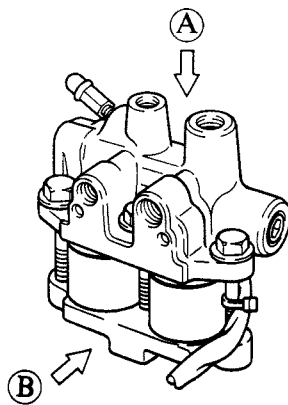
TRAC Brake Actuator

1) General

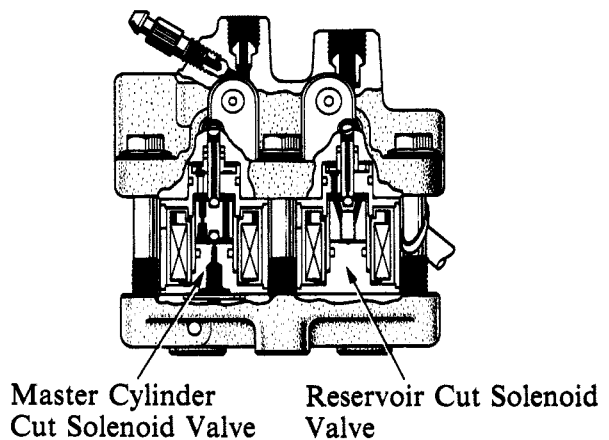
The TRAC brake actuator regulates the brake fluid pressure in the disc brake cylinders of the right and left rear wheels separately via the ABS actuator according to signals from the ABS ECU, controlling the rear wheels.

The TRAC brake actuator consists of the following 5 components:

Components	Function
Master Cylinder Cut Solenoid Valve	Opens and closes the fluid circuit from the master cylinder to ABS actuator, and from the TRAC pump to the ABS actuator. When the TRAC system is operating, it supplies the brake fluid pressure from the TRAC pump to the disc brake cylinders via the ABS actuator, and at the same time, prevents the fluid from flowing out of the ABS actuator pump to the master cylinder.
Reservoir Cut Solenoid Valve	During the TRAC system operation, this solenoid returns the fluid being returned from the disc brake cylinders back to the master cylinder reservoir.
Pressure Regulator Valve	Regulates the brake fluid pressure generated by the TRAC pump to a pressure level needed for TRAC control.
Relief Valve	Opens the valve in case of any abnormalities exist in the TRAC hydraulic system and controls the system's highest pressure.
Check Valve	Prevents the fluid from flowing out of the disc brake cylinder to the TRAC pump.

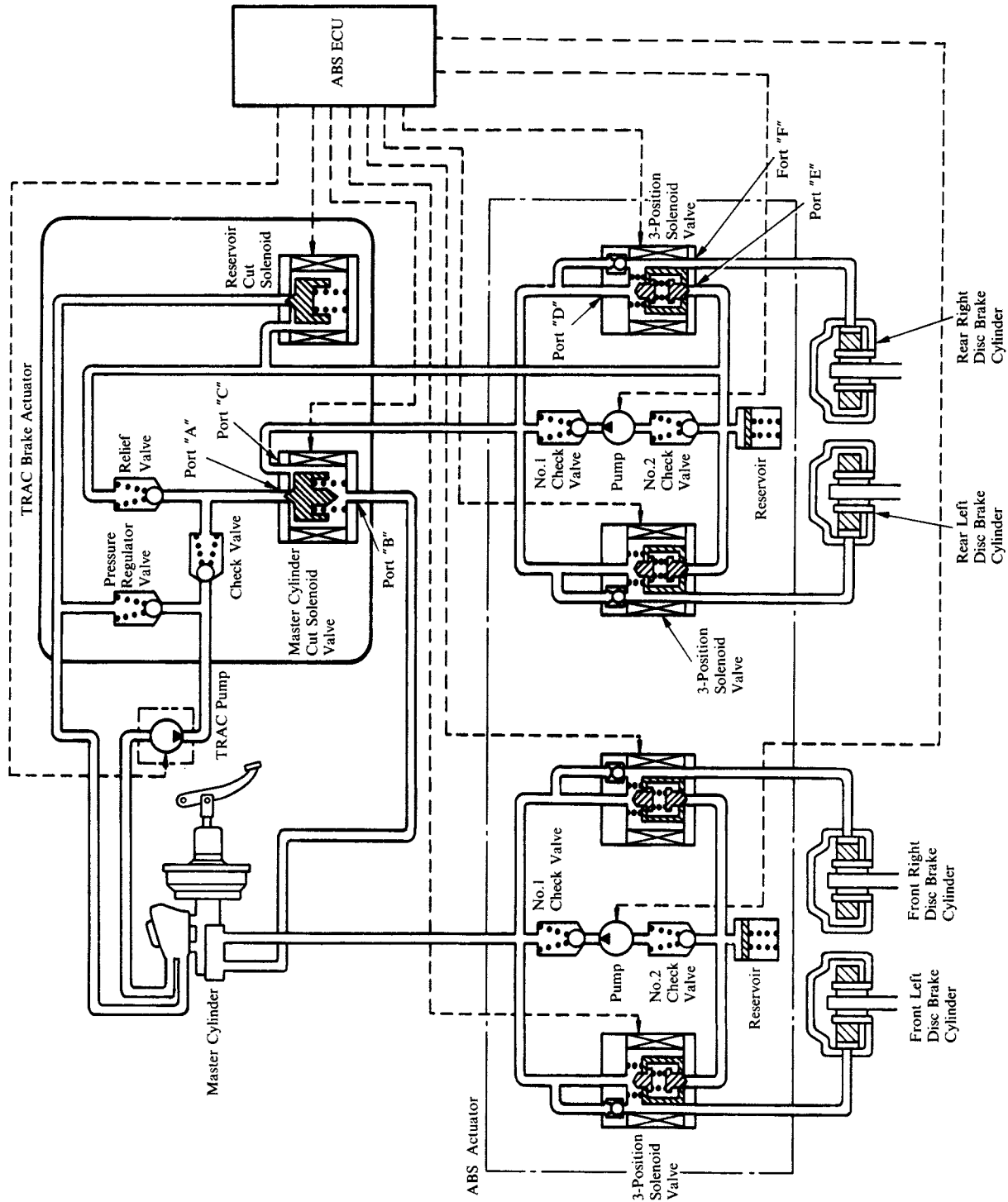


View from (A)



View from (B)

2) Hydraulic Circuit



3) Operation

NOTE: The TRAC system effects and independent brake fluid pressure control of the right and left rear wheels. Although the explanation below deals with the right rear wheel, the operation of the left rear wheel is identical.

a. During Normal (TRAC not Activated)

All solenoid valves of the TRAC brake actuator remain inactive when the brakes are applied. When the brake pedal is depressed at this time, the brake fluid pressure generated by the master cylinder is applied to the disc brake cylinders, via the master cylinder cut solenoid valve, and the 3–position solenoid valves, in the ABS actuator. When the brake pedal is released, the brake fluid pressure returns from the disc brake cylinders to the master cylinder.

◀Condition of Each Component

Components			Operation
TRAC Pump			Stop (OFF)
TRAC Brake Actuator	Master Cylinder Cut Solenoid Valve	Port “A”	Close
		Port “B”	Open
	Reservoir Cut Solenoid Valve		Close
ABS Actuator	3–Position Solenoid Valve	Port “D”	Open
		Port “E”	Close

b. During Vehicle Acceleration (TRAC Operative)

When a rear wheel slips during acceleration, the TRAC system controls the engine output and braking of the rear wheels to help prevent wheel slippage.

The brake fluid pressure applied to the right and left rear wheels is controlled separately according to 3 control modes (pressure increase, holding, and pressure reduction) as explained below.

i) Pressure Increase Mode

When the rear wheel starts to slip just as the accelerator pedal is being depressed, all the solenoid valves in the TRAC brake actuator are activated by signals received from the ABS ECU. At the same time, the 3–position solenoid valves in the ABS actuator are engaged in the pressure increase mode. Under this mode, the master cylinder cut solenoid valve is activated (ports “A” and “C” open), and the reservoir cut solenoid valve is also activated (open). Therefore, the brake fluid pressure generated by the TRAC pump is applied to the disc brake cylinders via the master cylinder cut solenoid valve and the 3–position solenoid valves in the ABS actuator. The TRAC pump discharge pressure is maintained constant by the pressure regulator valve.

◀Condition of Each Component

Components			Operation
TRAC Pump			ON
TRAC Brake Actuator	Master Cylinder Cut Solenoid Valve	Port "A"	Open
		Port "B"	Close
	Reservoir Cut Solenoid Valve		Open
ABS Actuator	3-Position Solenoid Valve	Port "D"	Open
		Port "E"	Close

ii) Holding Mode

When the brake fluid pressure for a disc brake cylinders are increased or decreased as required, the system switches to the holding mode. This mode change is performed by engaging the 3-position solenoid valve in the ABS actuator in the holding mode. This results in blocking the TRAC pump pressure from flowing back to the disc brake cylinder.

◀Condition of Each Component

Components			Operation
TRAC Pump			ON
TRAC Brake Actuator	Master Cylinder Cut Solenoid Valve	Port "A"	Open
		Port "B"	Close
	Reservoir Cut Solenoid Valve		Open
ABS Actuator	3-Position Solenoid Valve	Port "D"	Close
		Port "E"	Close

iii) Pressure Reduction Mode

When it is deemed necessary to decrease the brake fluid pressure applied to a disc brake cylinders, the ABS ECU engages the 3-position solenoid valve in the ABS actuator in the pressure reduction mode. Hence, the brake fluid pressure applied to the disc brake cylinder returns to the master cylinder reservoir via the 3-position solenoid valve and reservoir in the ABS actuator, and the reservoir cut solenoid valve, thus alleviating the brake fluid pressure.

◀Condition of Each Component

Components			Operation
TRAC Pump			ON
TRAC Brake Actuator	Master Cylinder Cut Solenoid Valve	Port "A"	Open
		Port "B"	Close
	Reservoir Cut Solenoid Valve		Open
ABS Actuator	3-Position Solenoid Valve	Port "D"	Close
		Port "E"	Open

7. Function of ECU

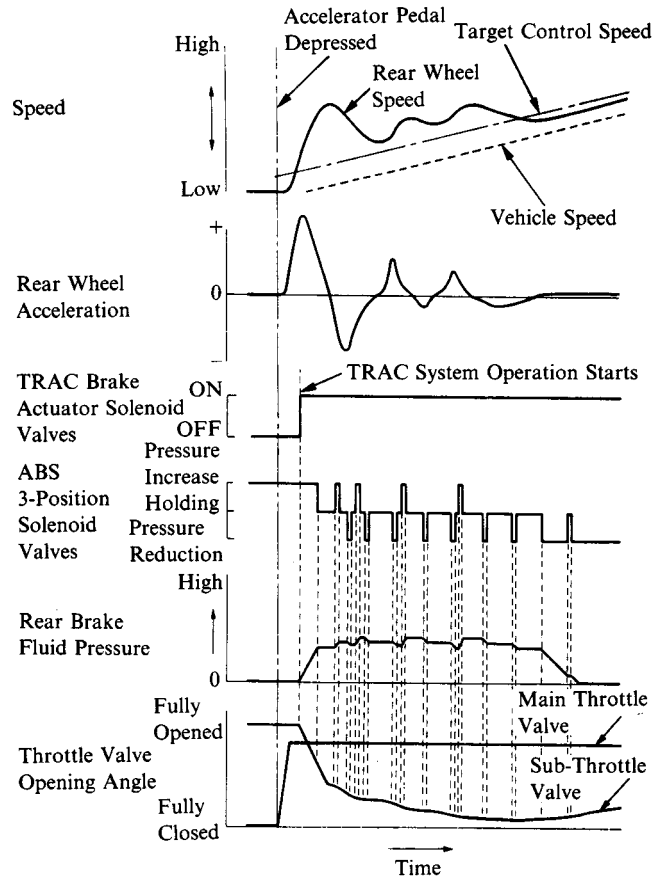
Wheel Speed Control

The TRAC ECU constantly receives signals from the 4 speed sensors and calculates the speed of each wheel. At the same time, it estimates the vehicle speed based on the speeds of the 2 front wheels and sets a target control speed.

When the accelerator pedal is depressed on a slippery road, the rear wheels (driving wheels) begin to slip and the rear wheel speed exceeds the target control speed, the TRAC ECU sends a sub-throttle valve close signal to the sub-throttle valve motor.

At the same time, ABS ECU sends a signal to the TRAC brake actuator and causes it to supply pressurized brake fluid pressure to rear disc brake cylinders, changing the rear disc brakes to the TRAC mode.

The 3-position solenoid valves of the ABS actuator are switched to control the rear brake fluid pressure and thus prevent wheel slippage.

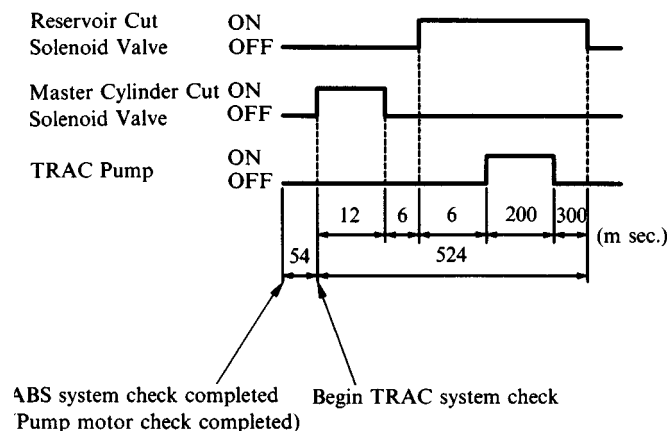


Initial Check Function

1) TRAC Actuator and TRAC Pump

After completing the initial check of the ABS system, the ABS ECU checks the solenoid valves of the TRAC actuator and the function of the TRAC pump.

Refer to page 177 for details on the initial check pattern of the ABS system.



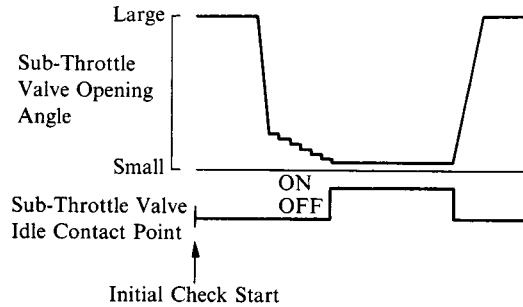
2) Sub-Throttle Valve Motor

When all conditions below are met simultaneously, the TRAC ECU drives the sub-throttle valve motor to fully close the sub-throttle valve. It performs an electric check once immediately after the ignition switch is changed from ACC to ON position.

◀ Conditions

Transmission Shift Lever Position	“P” or “N” Range
Main Throttle Valve	Fully Closed
Vehicle	Stopped

* Automatic Transmission Model only



Self-Diagnosis

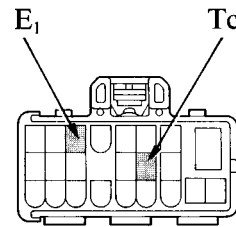
If malfunction occurs in any of the signal systems, the TRAC indicator light on the combination meter will light up and alert the driver that a malfunction has occurred. The TRAC ECU will also store the codes of the malfunction.

1) Diagnostic Trouble Codes

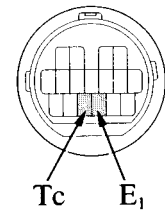
Diagnostic trouble codes are indicated when the following conditions are met:

CONDITIONS

- Ignition switch is turned on.
- Tc and E₁ terminals in the data link connector 1 or 2 [Check connector or TDLC] are connected.



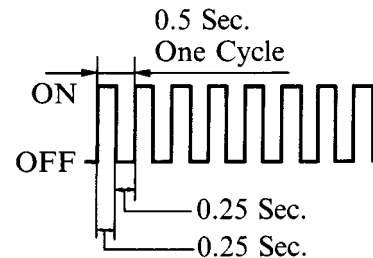
Data Link Connector 1 [Check Connector]



Data Link Connector 2 [TDCL]

○ Normal

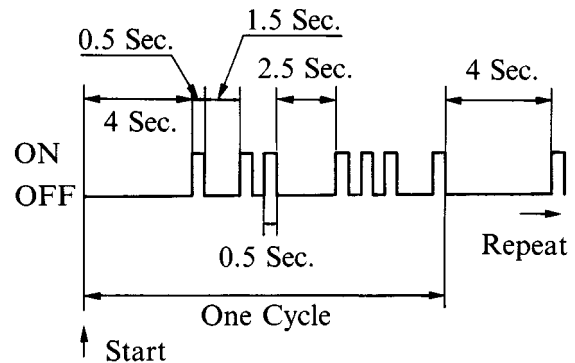
The light will flash 2 times per second as shown on the right.



○ Indication of Malfunction

Diagnostic trouble code(s) will be indicated by the light as shown in the example on the right. In this case, code 12 and 31 are indicated.

If two or more malfunctions are indicated at the same time, the lowest numbered diagnostic trouble code will be displayed first.



NOTE: Diagnostic trouble codes in the TRAC ECU can be cleared after repairs are completed by depressing the brake pedal 8 or more times within 3 seconds with the ignition switch turned on and Tc and E₁ terminals in the data link connector 1 or 2 [check connector or TDCL] connected.

◀ Diagnostic Items of ABS ECU

Code No.	Indicator Lights			Code No. at TRAC ECU*2	Diagnosis
	ABS	TRAC	TRAC OFF		
11*1		—		43	Open circuit in solenoid relay circuit.
12*1		—			Short circuit in solenoid relay circuit.
13*1		—			Open circuit in pump motor relay circuit.
14*1		—			Short circuit in pump motor relay circuit.
15					Open circuit in TRAC solenoid relay circuit.
16			—		Short circuit in TRAC solenoid relay circuit.
17	—				Open circuit in TRAC motor relay circuit.
18	—				Short circuit in TRAC motor relay circuit.
21*1		—			Open or short circuit in 3-position solenoid of front right wheel.
22*1		—			Open or short circuit in 3-position solenoid of front left wheel.
23*1		—			Open or short circuit in 3-position solenoid of rear right wheel.
24*1		—			Open or short circuit in 3-position solenoid of rear left wheel.
25					Open or short circuit in master cylinder cut solenoid valve circuit of TRAC brake actuator.
27					Open or short circuit in reservoir cut solenoid valve circuit of TRAC brake actuator.
31*1		*3			31, 43
32*1		*3		32, 43	Front left wheel speed sensor signal malfunction.
33*1		*3		33, 43	Rear right wheel speed sensor signal malfunction.
34*1		*3		34, 43	Rear left wheel speed sensor signal malfunction.
35*1		—		43	Open circuit in front left and rear right speed sensors.
36*1		—			Open circuit in front right and rear left speed sensors.
41*1		*3		41, 43	Low battery voltage (9.5 V or lower) or abnormally high battery voltage (17 V or higher).
44*1		—	—	—	Lateral acceleration sensor signal malfunction.
51*1		—		43	Pump motor locked or open circuit.
55	—				Fluid level of brake master cylinder reservoir dropped causing master cylinder reservoir level warning switch to go on.
58	—				Open circuit in TRAC motor.
61	—				Open or short circuit in circuit which inputs TRAC system operation to ABS ECU.
62*4	—				Malfunction in ABS ECU (Involving vehicle speed signal input inside ABS ECU).
Always ON *1					Malfunction in ABS ECU.

Diagnostic trouble code indicated


— Not applicable

*1 Both the code number and description of diagnosis are identical to those of the ABS ECU without the TRAC system (2JZ-GE engine model).

*2 To find out which of the indicator lights the TRAC ECU used to output the codes shown in the chart, refer to the chart for the diagnostic items of TRAC ECU shown on page 194.

*3 The indicator light flashes only if the same diagnosis is also detected by the TRAC ECU.

*4 The ABS ECU deletes the stored code No. 62 when it detects the malfunctions numbered from No. 31 to No. 36 (wheel speed sensor signal malfunction).

◀ Diagnostic Items of TRAC ECU 

Code No.	Indicator Lights			Code No. at TRAC ECU*1	Diagnosis
	ABS	TRAC	TRAC OFF		
24	—		—	—	Open or short circuit in step motor circuit of sub-throttle actuator.
25	—		—	—	Step motor does not move to a position decided by TRAC ECU.
26	—		—	—	Leak at sub-throttle position sensor or stuck sub-throttle valve.
31	*2		*2	31	Front right wheel speed sensor signal malfunction.
32	*2		*2	32	Front left wheel speed sensor signal malfunction.
33	*2		*2	33	Rear right wheel speed sensor signal malfunction.
34	*2		*2	34	Rear left wheel speed sensor signal malfunction.
41	—		—	—	Low battery voltage (9.5 V or lower) or abnormally high battery voltage (17 V or higher)
43				—	Malfunction in ABS ECU.
44	—		—	—	Engine speed signal (NE) is not input from the ECM*3 [Engine ECU] during TRAC control.
45	—		—	—	Short circuit in IDL signal circuit of the main throttle position sensor.
46	—	—	—	—	Open or short circuit in VTA1 signal circuit of the main throttle position sensor.
47	—		—	—	Open or short circuit in IDL ² signal circuit of the sub-throttle position sensor.
48	—		—	—	Open or short circuit in VTA2 signal circuit of the sub-throttle position sensor.
51	—	—		—	Malfunction in engine control system causes malfunction indicator lamp [CHECK ENGINE warning lamp] to go on.
53	—		—	—	Malfunction in communication circuit to ECM*3 [Engine ECU].
61	—		—	—	Malfunction in communication circuit to ABS ECU.
Always ON				—	Malfunction in TRAC ECU.

Diagnostic trouble code indicated

— Not applicable

*1 To find out which of the indicator lights the ABS ECU uses to output the codes shown in the chart, refer to the chart for the diagnosis of ABS ECU shown on page 193.

*2 The indicator light flashes only if the same diagnosis is also detected by the ABS ECU.

*3 ECM (Engine Control Module)

Fail-Safe

When a malfunction occurs while the TRAC system is inoperative, the TRAC ECU immediately turns off the TRAC motor relay and TRAC solenoid relay, and stops the TRAC system operation. When the TRAC system is operative, the TRAC ECU continues control, stops the control, or fully opens the sub-throttle valve depending on the types of malfunction.

After the TRAC system becomes inoperative, the engine and brake system operates in the same way as on models without the TRAC system.

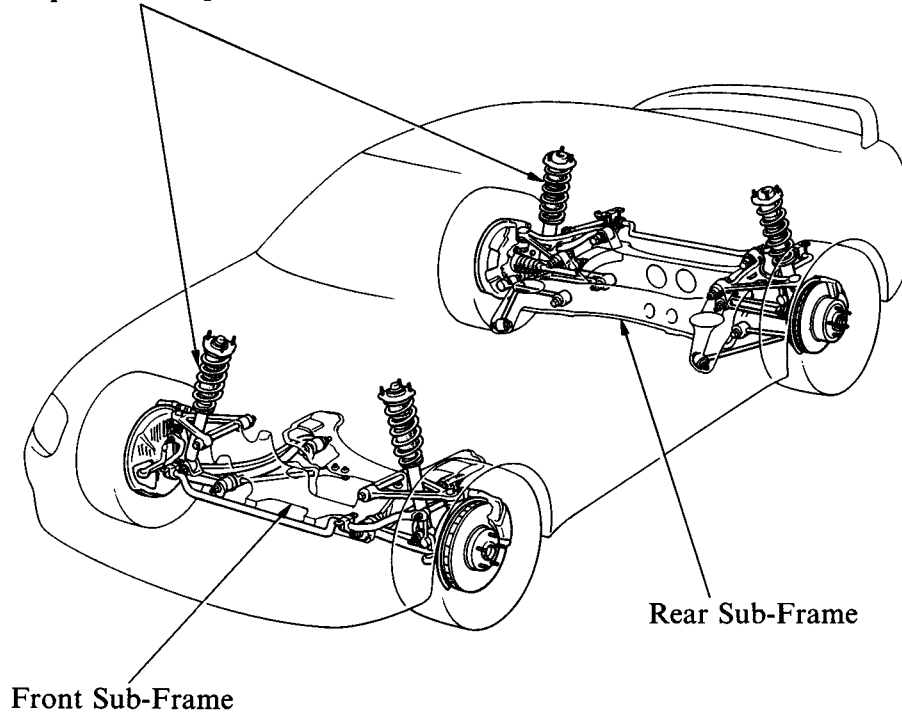
SUSPENSION

DESCRIPTION

The suspension is double wishbone type at both the front and the rear. Optimal suspension geometry and wheel alignment are achieved through analysis of the component design, material and characteristics to provide a high level of controllability and riding comfort.

The support rigidity of the suspension has been realized through the adoption of front and rear subframes.

Double Wishbone Type Independent Suspension



Specifications ◀

Suspension		Front	Rear
Item* ¹			
Tread	mm (in.)	1520 (59.84)	1525 (60.04)
Caster	degrees	3°20', 3°30'* ²	—
Chamber	degrees	-0°20', -0°30'* ²	-1°35', -1°30'* ²
Toe-In	mm (in.)	0	3 (0.12)
King Pin Inclination	degrees	9°35', 9°45'* ²	—

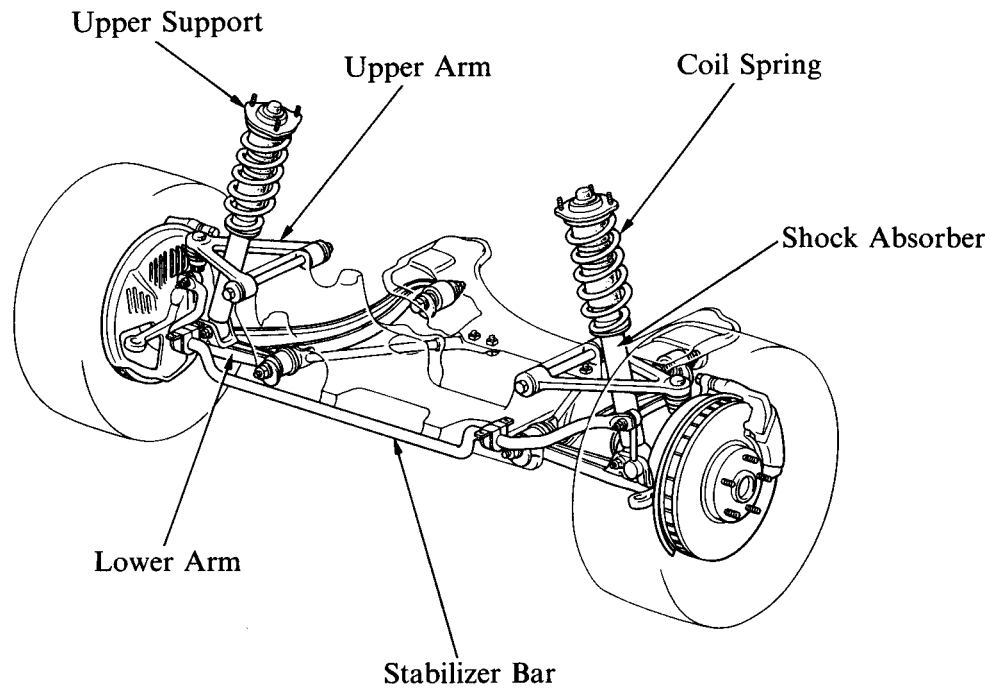
*¹ Value given are for unloaded condition.

*² 2JZ-GTE Engine model.

FRONT SUSPENSION

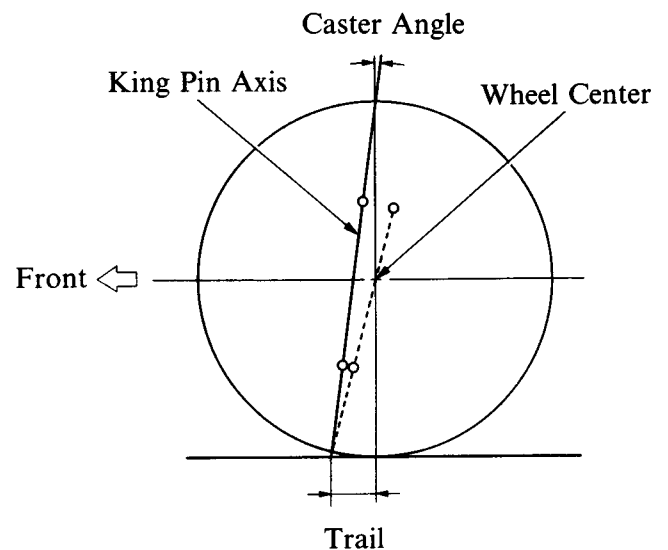
1. General

A double wishbone type independent suspension is used. It permits a greater design freedom and ideal wheel alignment selection. The result is outstanding directional stability at high speeds, and cornering and braking stability. Suspension friction is also reduced in each portion of the suspension components for good vehicle controllability, stability and riding comfort.

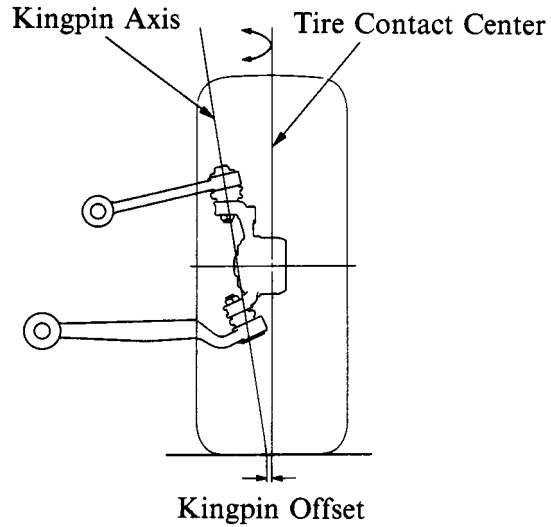


2. Geometry

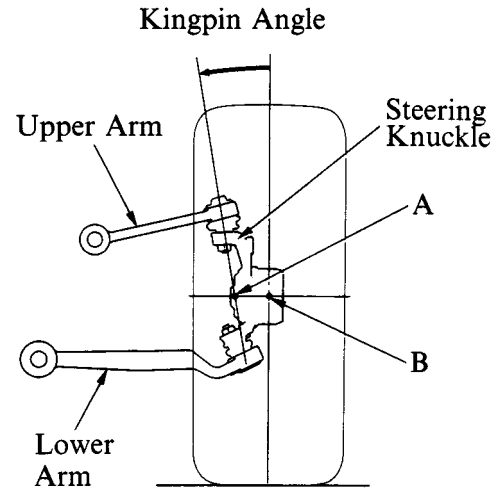
- ⑧ By making the caster angle smaller, high level cornering performance has been provided. In addition, by selecting the optimum caster trail values, steering response during high speed travel is provided and steering force and steering holding force are optimized.



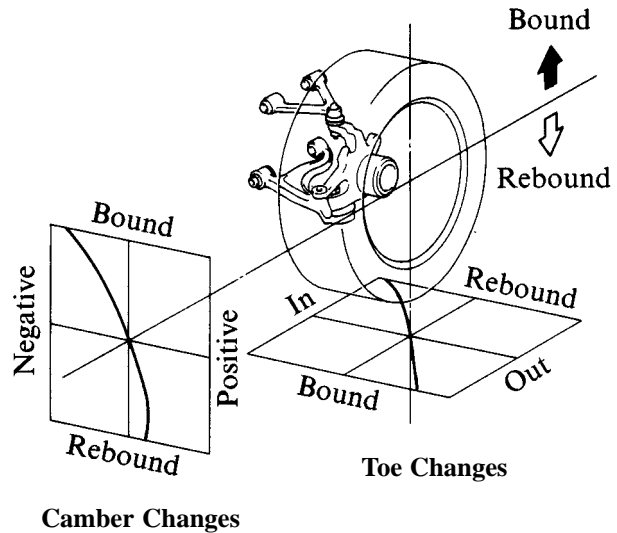
- Ⓡ A small kingpin offset is used and the moment which occurs around the kingpin axis is made small in order to ensure vehicle stability and reduce steering effort when braking or riding over bumps.



- Ⓡ By using the most appropriate steering knuckle shape and position of the upper arm, the kingpin angle has been reduced and the distance between A and B in the diagrams below is shortened to provide excellent directional stability.



- Ⓡ Each arm length has been developed in full consideration of the mounting areas of the upper arm, lower arm, and steering system. This results in linear toe changes on bounds and rebounds. The suspension has also been engineered so that the camber changes on bounds will occur in the direction of negative camber to provide excellent control and stability.



Ⓡ Anti-drive geometry

Optimal positioning of the upper arm and lower arm limits the changes of the vehicle body in the front and rear direction during braking.

Since suspension movements occur in a stroke centered around the virtual center, the position of the virtual center is important. The front virtual center O_f is located where the line drawn from the center of the upper arm ball joint, running parallel with the 2 body installation points of the upper arm, intersects with the line drawn from the lower ball joint. The virtual center is relative, so it moves up and down together with the suspension stroke.

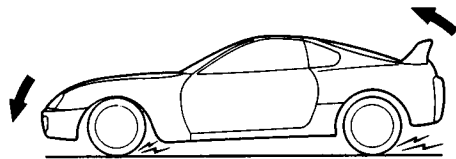
Due to load shifting during braking, the load distribution on the front and rear wheels changes.

The load bearing on the front wheels increases and the load bearing on the rear wheels decreases.

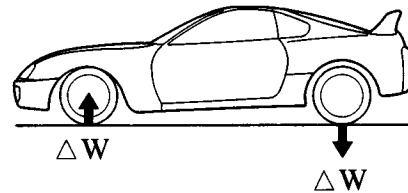
As a result, the front end of the vehicle dives and the rear end rises. If we think of the body's posture as constant, the amount of load shifting (ΔW) is the sum of the respective forces ΔW at the point (A) where each of the tires comes in contact with the ground. In the front, these forces are directed upward, causing the tires to move toward the body, while in the rear these forces are directed downward, pushing the tires away from the body.

During braking, braking force B_f acting on the front tire ground contact point (A) can be resolved into force B_{f1} which acts along a line from the virtual center O_f and the ground contact point (A) and force B_{f2} , which acts perpendicular to the ground at contact point (A). At this time, the downward force B_{f2} combines with the upward force ΔW , greatly increasing the amount of front dive.

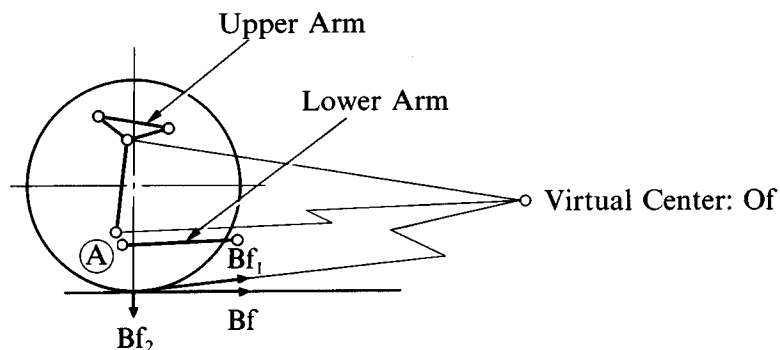
In the new model, optimization of the mounting position of lower arm and the tilt of the upper arms reduces force B_{f2} and thus reduces nose dive.



During Braking

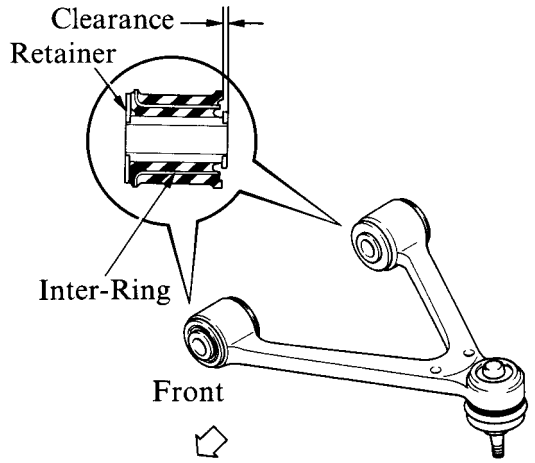


If the Body's Posture
is Constant



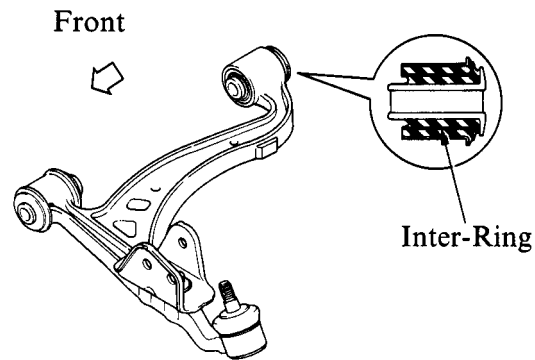
3. Upper Arm

- Ⓡ The upper arms have an A-shaped design with high lateral rigidity. They are made of forged aluminum to reduce the unsprung weight.
- Ⓡ A retainer is used at the front of each bushing, both on the front and rear bushings, to make them rigid in the forward direction, and soft in the rearward direction. In addition, clearance is provided at the back of each bushing to ensure suspension compliance, and an inter-ring is used to reduce the torsion spring constant and increase rigidity.



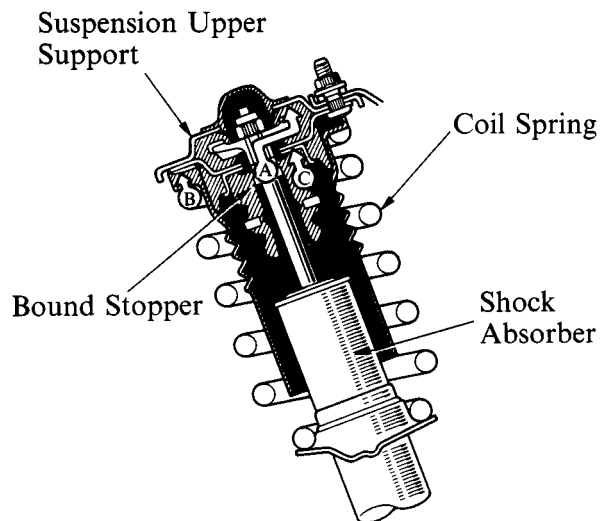
4. Lower Arm

- Ⓡ The lower arms have a highly rigid L-shaped design and forged steel is used.
- Ⓡ Inter-rings are installed in the rear sides of the lower arm bushings. Their characteristics are the same as those of the upper arm bushings.



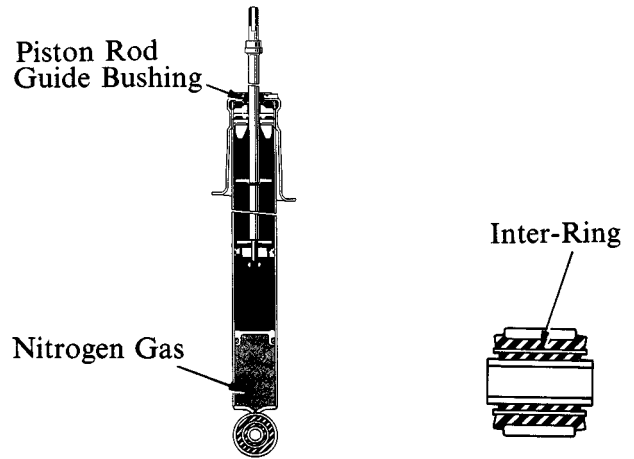
5. Suspension Upper Support

The suspension upper support separately bears force from the shock absorber (A), the coil spring (B) and the bound stopper (C), thus uprating riding comfort and reducing noise and vibration.



6. Shock Absorber

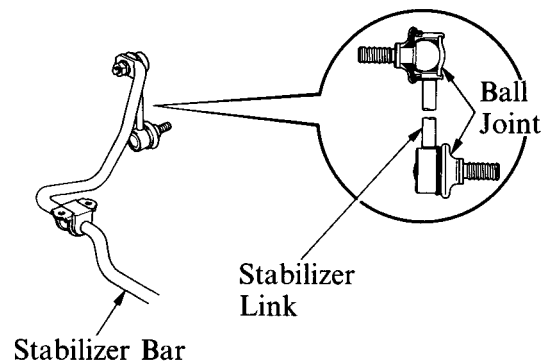
- ⑥ To provide good damping characteristics, the front shock absorbers of the 2JZ-GE engine model contain low pressure nitrogen gas and the 2JZ-GTE engine model uses high pressure nitrogen gas.
- ⑥ The piston rod guide bushing has been given a teflon coating to reduce friction.
- ⑥ Bushings with inter-rings on the inside are used at the points where the bottom ends of the shock absorbers are mounted to improve the damper effect.
- ⑥ On the 2JZ-GTE engine model, the oil chamber and the gas chamber of the shock absorbers are completely separated from each other by the dividing piston designed to deter cavitation from being generated.



For 2JZ-GTE Engine Model

7. Stabilizer Bar

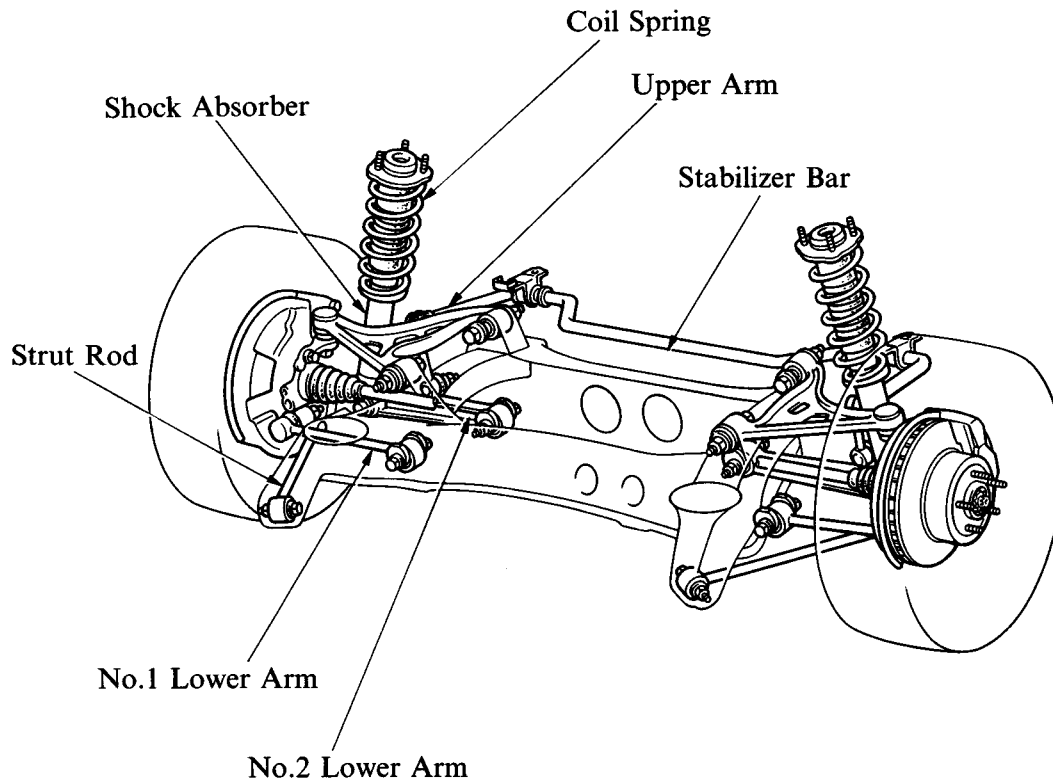
A hollow stabilizer bar is used to reduce weight. Ball joints are used for the joints between the stabilizer bar and stabilizer link and the lower arm and stabilizer link. These work effectively to improve the roll feeling during minute rolls.



REAR SUSPENSION

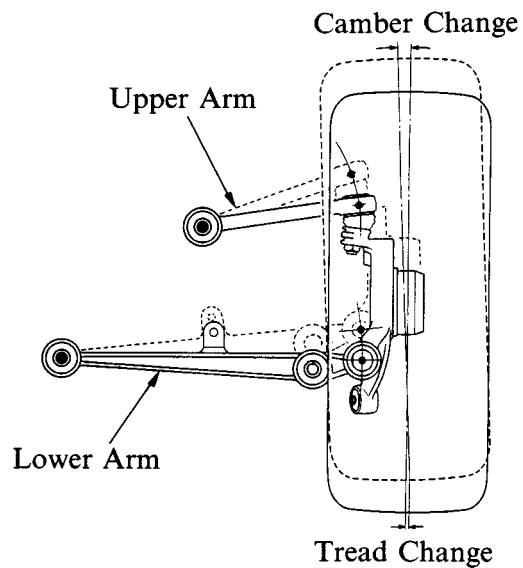
1. General

The rear suspension is the same double wishbone type as the front. The A-shaped aluminum upper arm is combined with two unequal-length, non-parallel lower arms and a strut rod.

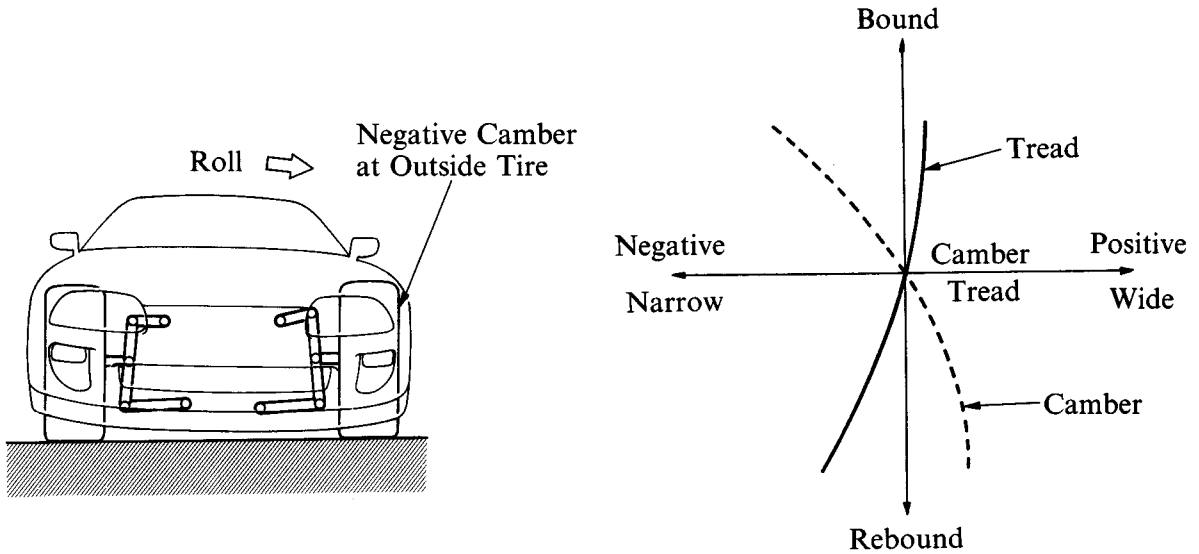


2. Geometry

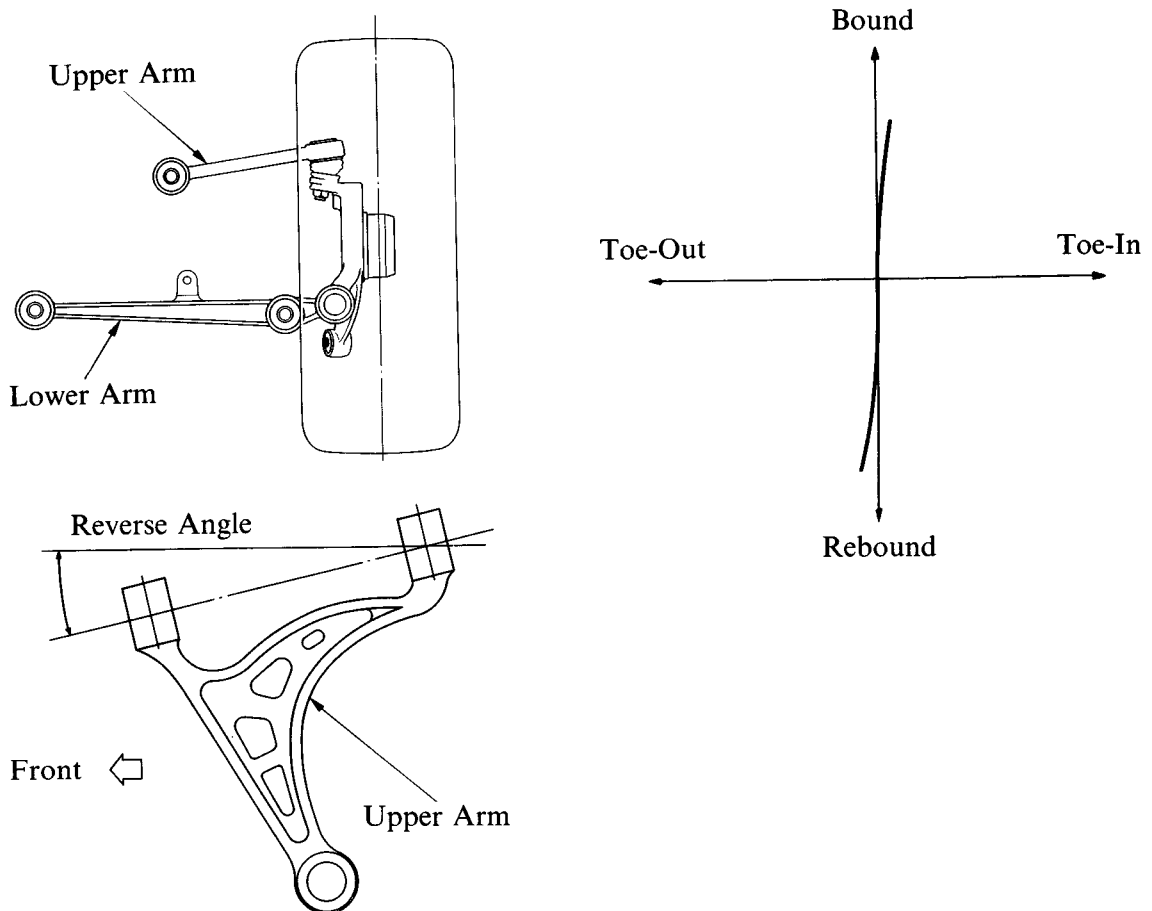
- ® The combination of long lower arm and short upper arm provides optimal camber and tread changes during bound and rebound.



- Ⓡ During cornering, the tire on the outer curve has larger negative camber for excellent cornering performance.
- Ⓡ By lengthening the lower arm, tread change is kept small, and excellent straight-line stability and riding comfort are achieved.



- Ⓡ Through a combination of a long lower arm and a comparatively short upper arm with a sweep back angle, the change in the toe-in in the normal use range is controlled. This provides excellent directional stability on a rough road, etc.



- Ⓡ Optimal length and positioning of the arms and optimal bushing characteristics limit the toe-in change due to cornering and braking force to give good compliance steer characteristics.

When Longitudinal Force is Applied

The No. 1 lower arm is shorter than the No. 2 lower arm. Because of this, when longitudinal force bears on the tire during braking, etc., movement of the wheelside installation point (A) of the No. 1 lower arm to the inside (body side) is large [Fig. 1], but the force bearing on the lower arm causes the bushing (B) of the No. 1 lower arm to be pulled to the outer side (wheel side) [Fig. 2], so that compliance steer is maintained at almost zero.

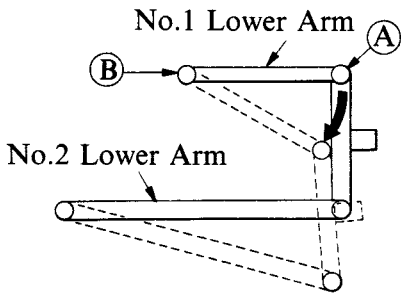
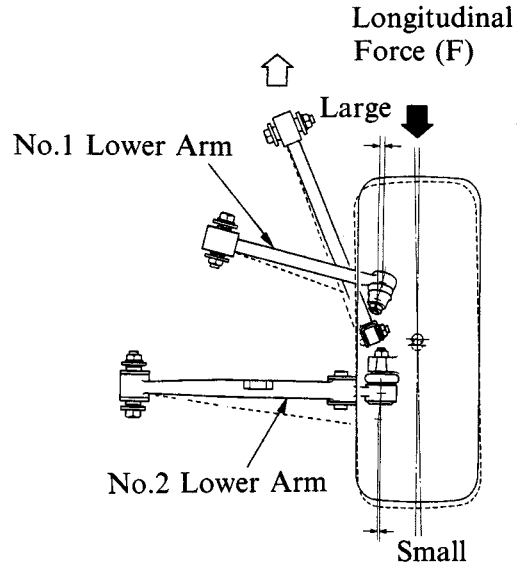


Fig. 1

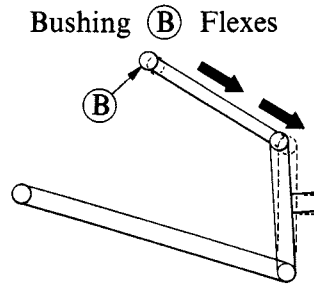
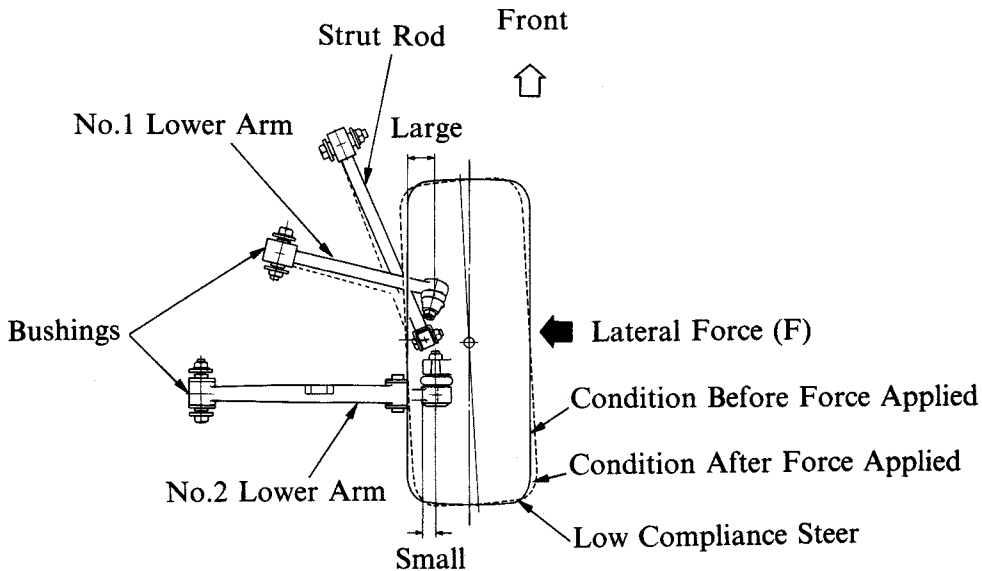


Fig. 2

When Lateral Force is Applied

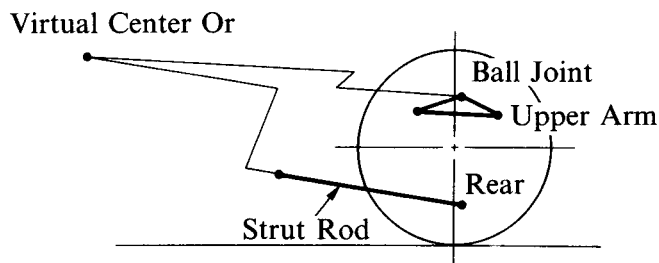
In addition to using optimal lower arm bushings, the wheel center is positioned at the center of the bushings of the rear suspension member to limit the toe-change due to lateral force, and keep compliance steer to almost zero.



Ⓡ Anti-Lift and anti-squat geometry

Optimal positioning of the upper arm and strut rod limits the changes of the vehicle body in the front and rear direction during braking, starting off and acceleration, etc.

Since suspension movements occur in a stroke centered around the virtual center, the position of the virtual center is important. The rear virtual center O_r is located where the line drawn from the center of the upper arm ball joint, running parallel with the 2 body installation points of the upper arm, intersects with the line which is an extension of the line through the front and rear installation positions of the strut rod. The virtual center is relative, so it moves up and down together with the suspension stroke.

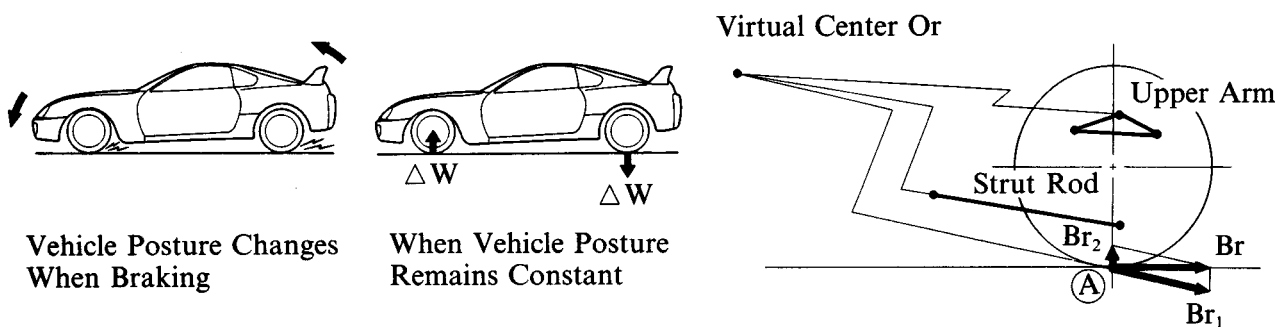


Anti-Lift ◀

Due to load shifting during braking, the load distribution on the front and rear wheels changes. The load on the front wheel increases and the load on the rear wheel decreases, so that the front end of the vehicle dives and the rear end rises.

If we think of the vehicle posture as being constant, the amount of load shifting (ΔW) is the sum of the respective forces ΔW at the point (A) where each of the tires comes in contact with the ground. In the front these forces are directed upward, causing the tires to move toward the body, while in the rear these forces are directed downward, pushing the tires away from the body, resulting in the body rear rising up, called lift phenomenon.

The braking force Br operating on ground contact point (A) on the rear tire during braking can be resolved into the force Br_1 , operating in the direction of an extension of a line from the virtual center (O_r) through ground contact point (A), and force Br_2 which acts perpendicularly to the ground at contact point (A). At this time, the force vector Br_2 acts in the upward direction to cancel out the force ΔW operating downward on the rear tire because of the load change, thus reducing rear lift during braking.



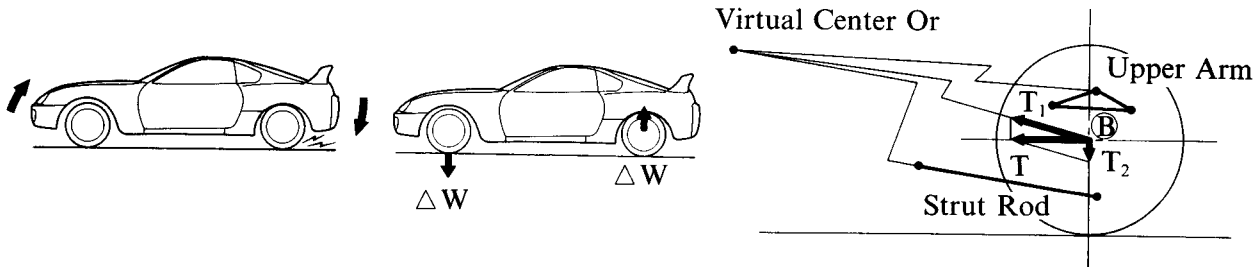
Anti-Squat ◀

Due to load shifting by the drive force generated during starting off and acceleration, opposite to the load shifting which occurs during braking, the load on the front wheels decreases and the load on the rear wheels increases.

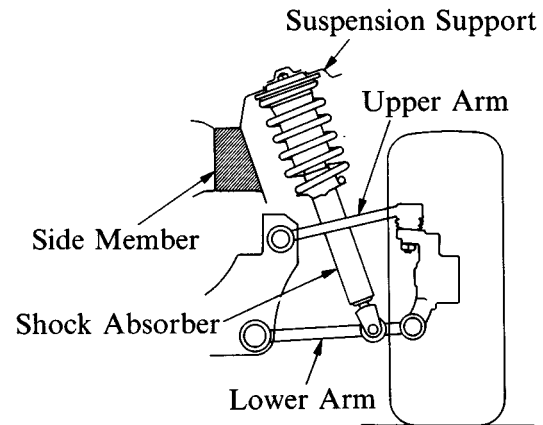
If we think of the vehicle posture as being constant, the amount of change (ΔW) in the load on the axle center causes the front tires to push downward away from the body and causes the rear tires to push up toward the body, resulting in the rear body dropping so that squat occurs.

The drive force T acting on the axle center (B) during starting off and acceleration can be resolved into force T_1 , which acts along a line connecting the virtual center O_r and the axle center (B), and force T_2 , which acts vertically downward from the axle center (B).

At this time, force T_2 acts downward to cancel out the force ΔW acting upward on the axle center due to load shift, thus reducing body squat during starting off and acceleration.

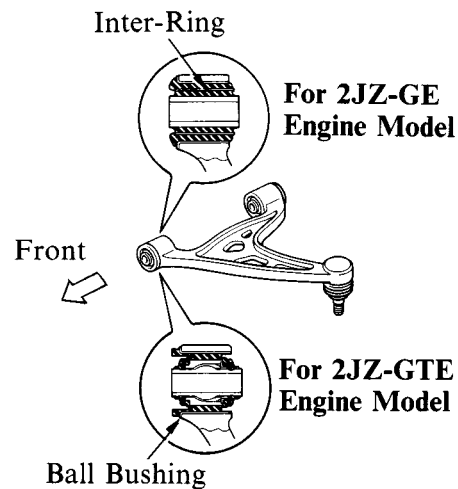


- ⑧ The bottom end of the shock absorber is mounted on the lower arm to reduce road noise. By mounting the bottom end of the shock absorber to the lower arm, the mounting position of the suspension upper support is lowered and is brought nearer to the side member. In this way, the rigidity of the suspension support mount can be increased and road noise can be reduced.



3. Upper Arm

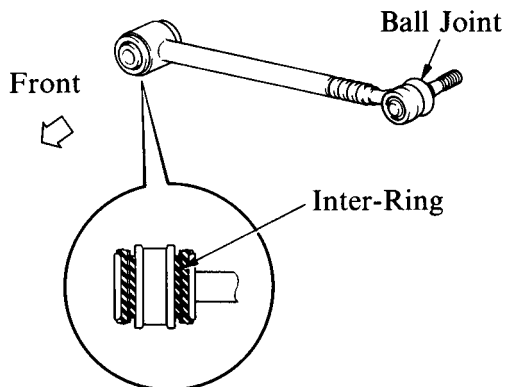
The upper arm is an A-shaped forged aluminum arm with a high lateral rigidity. The 2JZ-GTE engine model has rubber-integrated ball bushings on both the front and rear sides to reduce torsional torque as well as enhancing riding comfort.



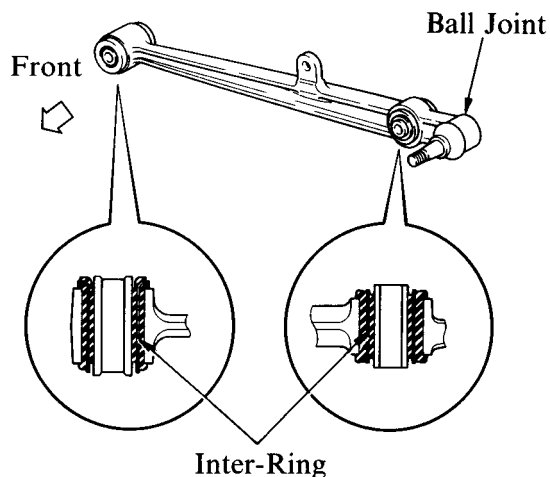
4. Lower Arms

No. 1 lower arm is a hollow bar and No. 2 lower arm is made of a forged steel, maintaining lateral rigidity and reducing weight. Both No. 1 and No. 2 lower arms on the body side use bushings with a steel inter-ring. The other end (wheel side) of the No. 1 and No. 2 lower arms has a ball joint. This design helps reduce both torsional and pinching torques without affecting lateral rigidity. It also ensures excellent turning performance of the vehicle without sacrificing riding comfort.

No. 1 Lower Arm (Front Side) ◀

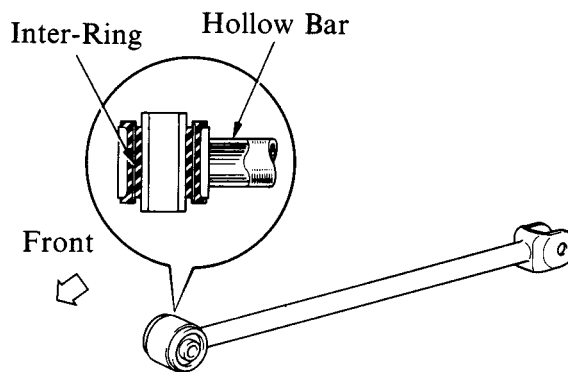


No. 2 Lower Arm (Rear Side) ◀



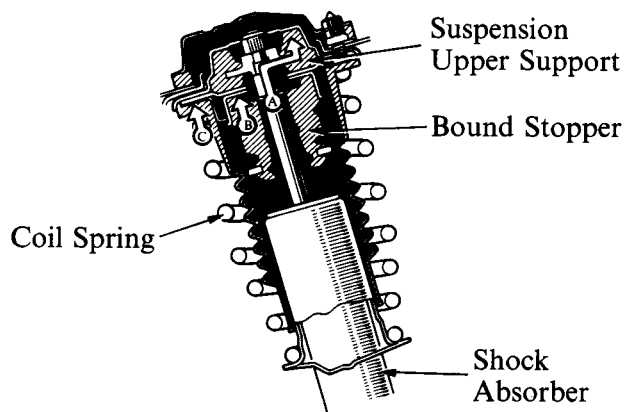
5. Strut Rod

The Strut rod used is a hollow type, designed to reduce unsprung weight. Large-capacity bushing with inter-ring are used at both the body and wheel sides of the strut rod to ensure sufficient suspension compliance and reduce torsional torque.



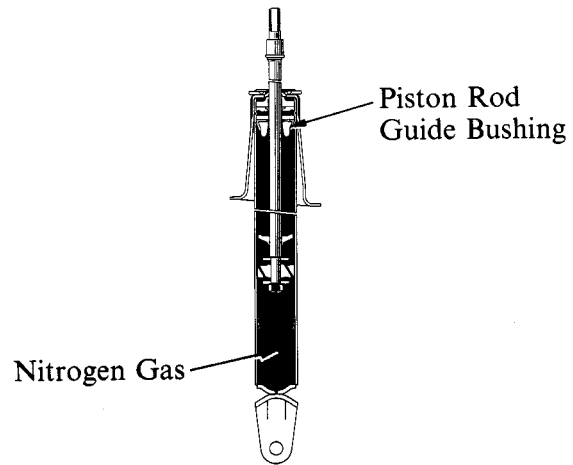
6. Suspension Upper Support

The suspension upper support is the same as that of the front and separately bears force from the shock absorber (A), the coil spring (B) and the bound stopper (C). This design helps upgrade riding comfort and reduce noise and vibration.



7. Shock Absorber

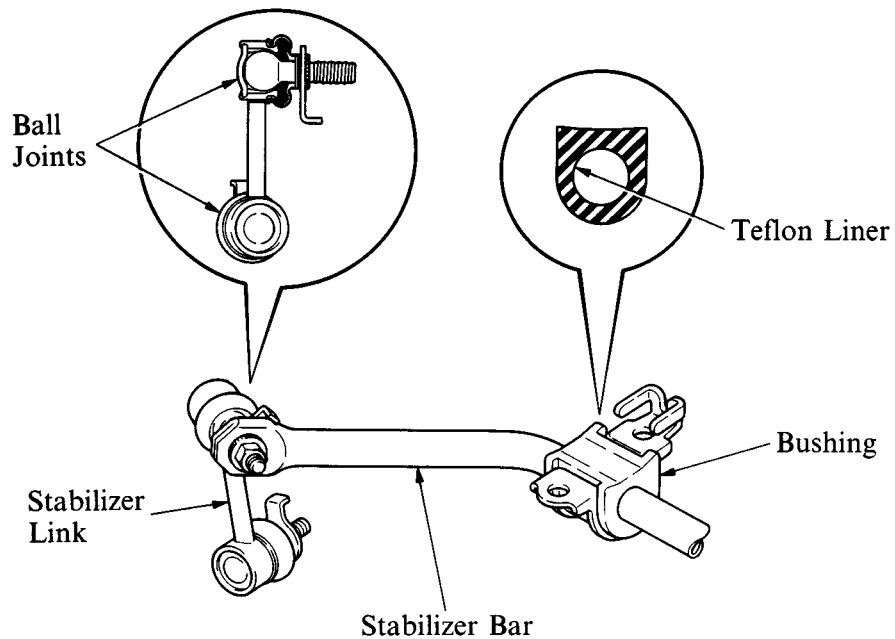
- Ⓡ The basic construction and operation are the same as those of the front shock absorbers. The bottom side of shock absorbers is mounted on the No. 2 lower arm.
- Ⓡ The mount includes the same bushing with inter-ring as is used in the front shock absorbers, but the bushing is mounted on the No. 2 lower arm.



For 2JZ-GTE Engine Model

8. Stabilizer Bar

- Ⓡ The stabilizer bar is a hollow bar and the stabilizer link is made of plastics to reduce weight. The stabilizer link is the ball joint type as in the front to reduce the suspension friction and increase link rigidity. As a result, it performs effectively even for slight rolling and maintains stable roll feeling.
- Ⓡ A Teflon[®] liner applied to the inner surface of the bushing makes the rubber material stiffer and ensures high bushing rigidity.

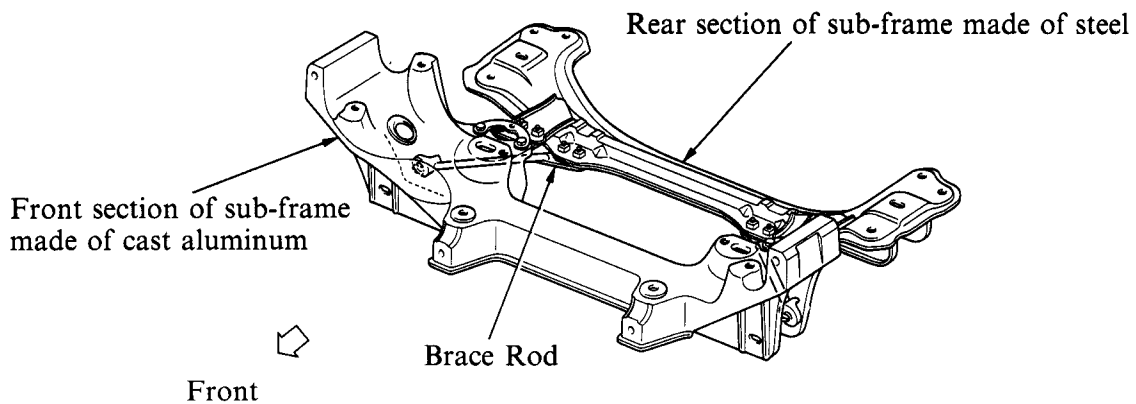


☞ SUB-FRAMES

1. Front Sub-Frame

The new model adopts a front sub-frame which ensures body rigidity, in the same way as the previous model. The suspension arms are mounted onto the sub-frame, and the sub-frame onto the body.

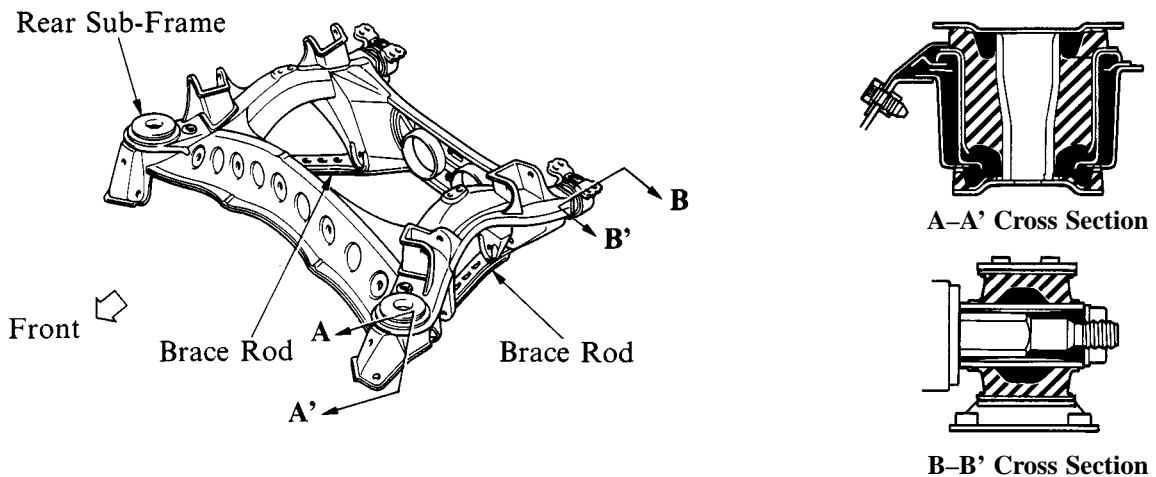
- Ⓡ The front sub-frame has been modified from the previous 1-piece to a 2-piece configuration, consisting of front and rear sections. The front section is made of cast aluminum to reduce weight and road noise.
- Ⓡ The upper arm, lower arm, and steering gear housing are mounted with better precision, since those components are attached against the machined surfaces of the front section of the sub-frame, made of cast aluminum.
- Ⓡ Brace rods span the length between the front section (onto which the front of the lower arm is attached) and the rear section of the sub-frame for improved rigidity.
- Ⓡ Both the front and rear sections of the sub-frame are directly mounted onto the body, affording a superior steering response and feel.



2. Rear Sub-Frame

The floating type rear sub-frame made of steel used on the previous model is also used on the new model, ensuring body rigidity and deterring noise and vibration from being transmitted.

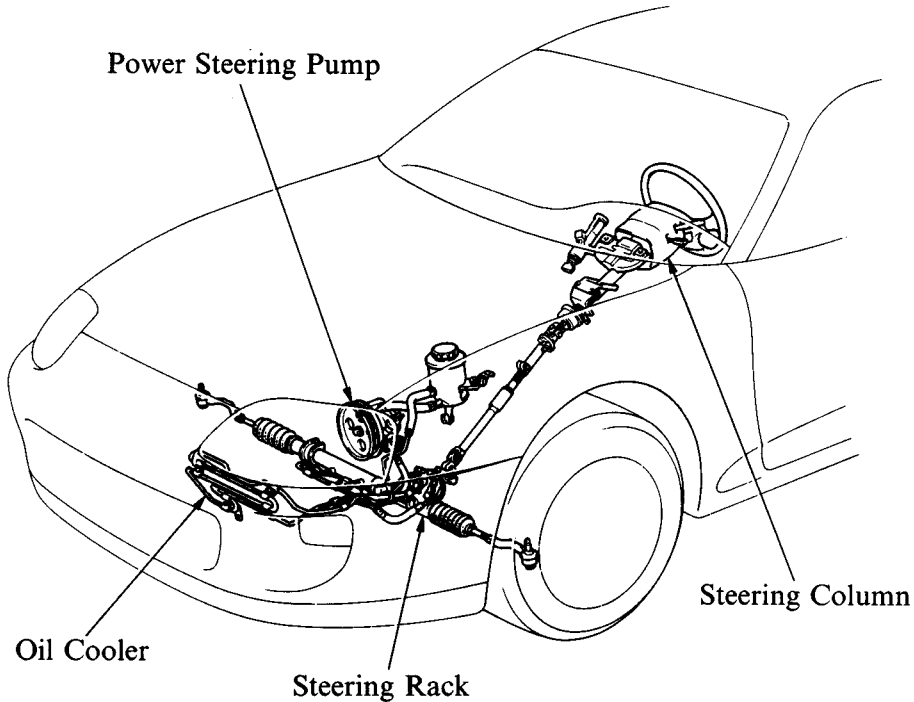
- Ⓡ The location and quantity of the mounts used for attaching the rear sub-frame onto the body have been modified to reduce weight.
- Ⓡ A brace rod spans the length between the attachment areas of the rear sub-frame No. 1 and No. 2 suspension lower arms for improved rigidity.



STEERING

Description

- Ⓡ A lightweight and compact rack and pinion type steering gear with excellent steering response has been adopted. Having the same construction and operation as that of the previous model, it is a vehicle–speed sensing, hydraulic reaction type, electronically–controlled PPS (Progressive Power Steering). In this system, steering effort is regulated to an optimal level according to the vehicle speed.
- Ⓡ A top position locking type tilt mechanism is used in the steering column. This mechanism makes it possible to easily obtain the optimal driving position and improves ease of entry and exit.



2JZ–GTE Engine Model

Specifications ◀

Model	New	Previous
Item		
Steering Gear Type	Rack and Pinion	←
Gear Ratio (Overall)	17.5 : 1	16.5 : 1, 18.5 : 1*
Nos. of Turn Lock to Lock	3.0	3.0, 3.4*
Rack Stroke mm (in.)	139 (5.47)	146 (5.75)
Fluid Volume Liter (US qts, Imp. qts)	1.0 (1.1, 0.9)	←
Fluid Type	ATF Type DEXRON® II	←

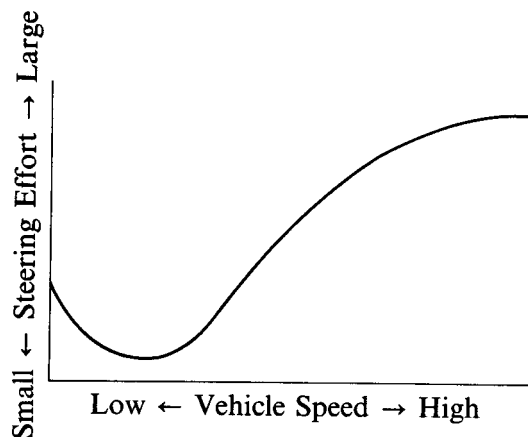
* Vehicle equipped with PPS (Progressive Power Steering)

HYDRAULIC REACTION TYPE PROGRESSIVE POWER STEERING

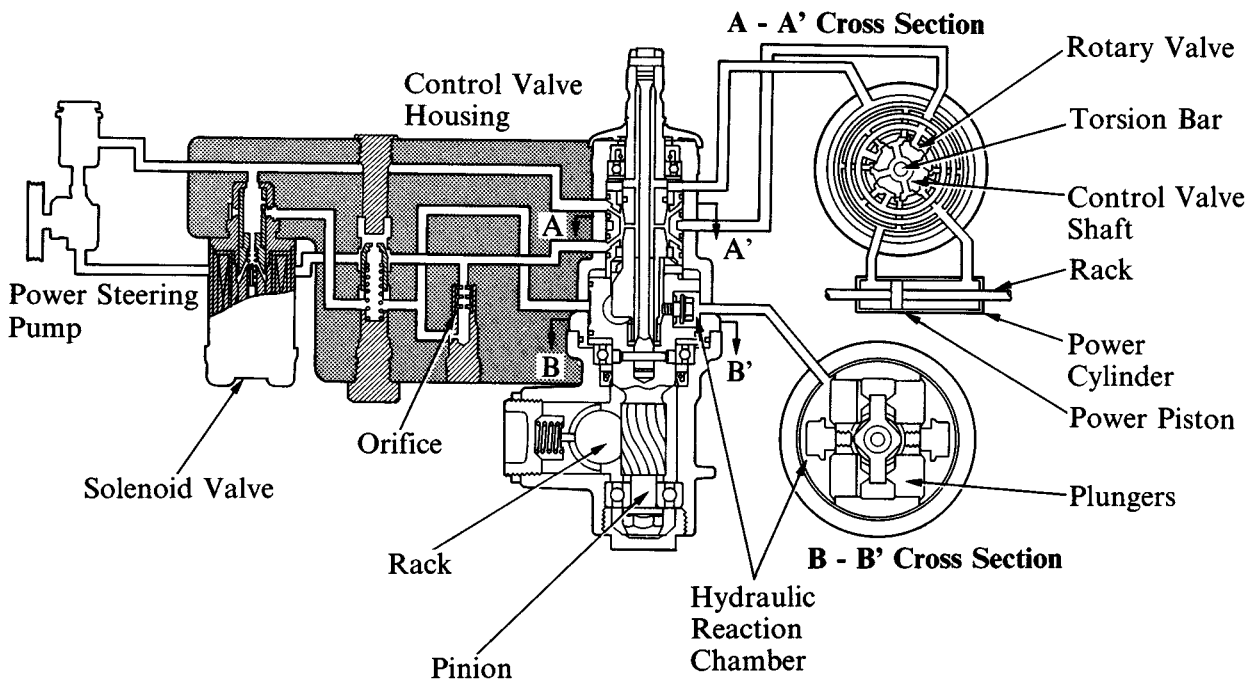
1. General

Hydraulic reaction type electronically controlled PPS (Progressive Power Steering) is standard equipment. The PPS controls hydraulic pressure acting on the hydraulic reaction chamber, changing the power steering characteristics according to the vehicle speed. As a result, the wheels can be turned easily at rest or at low speed while a heavier steering response is provided at medium to high speeds. The basic construction and operation are the same as in the previous model.

Steering Effort Characteristic



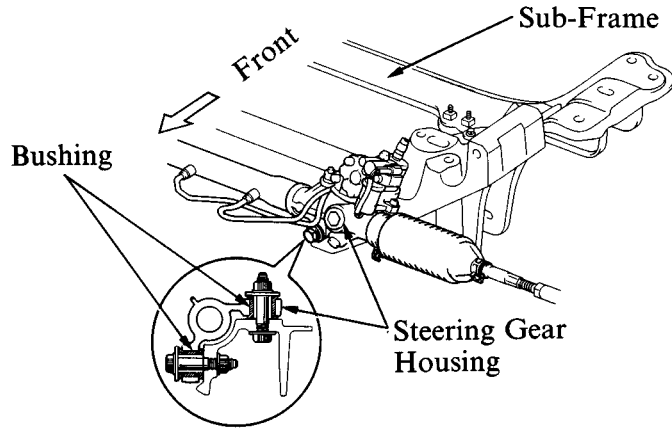
2. System Diagram



STEERING GEAR HOUSING

The steering gear housing is mounted on the sub-frame via a bushing.

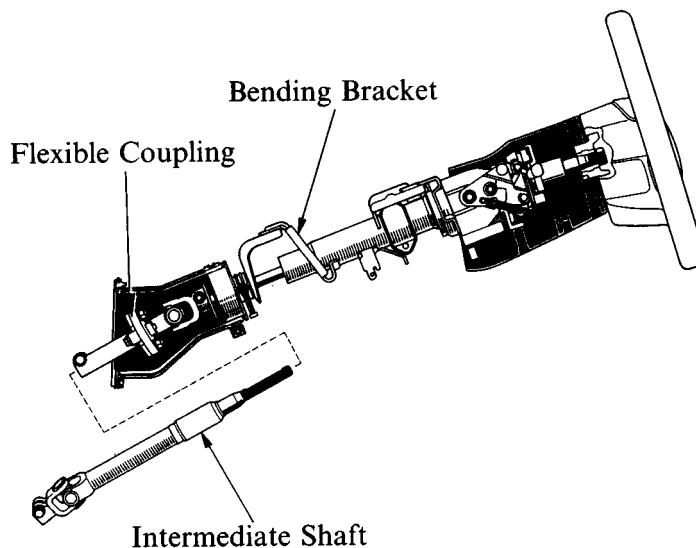
The accuracy of the installation position is further improved and the linearity of the movements of the steering gear housing to the left and right with respect to the housing is maintained by the bushings, providing an excellent steering feeling.



STEERING COLUMN

1. General

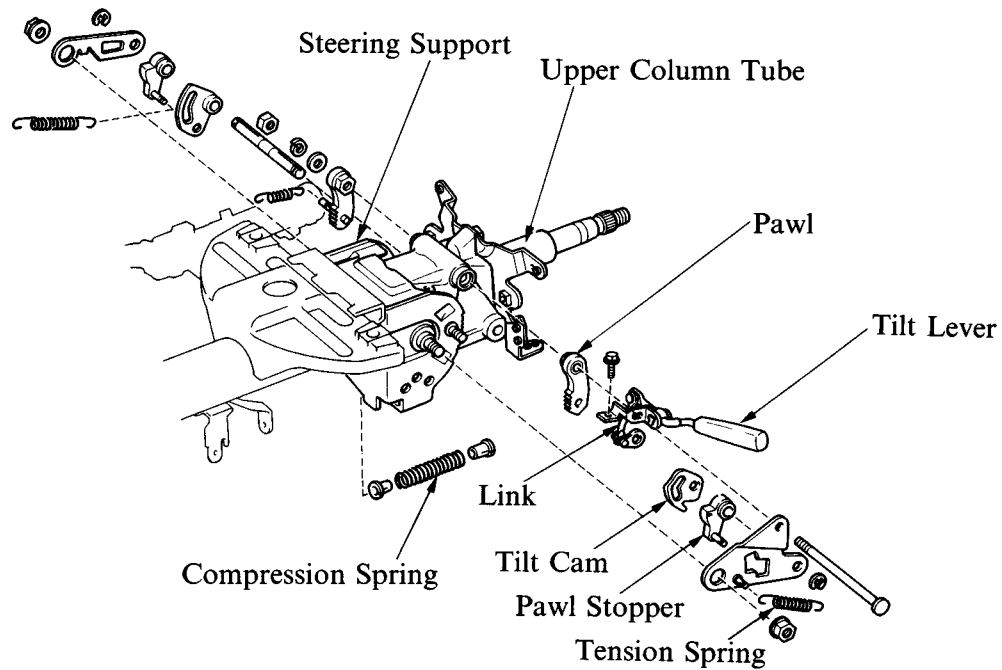
- Ⓡ The tilt mechanism adopted in the steering column is much simpler than the memory tilt and telescopic mechanisms that were adopted on the previous model. In the new model, the tilt mechanism provides a 6-step manual adjustment of the steering wheel position. The tilt lever, which was previously located below the column cover, has been relocated to the left of the column for easier access.
- Ⓡ The energy-absorbing mechanism of the steering column is changed from the ball type to the bending bracket type to simplify its construction.
- Ⓡ The flexible coupling made of rubber material, mounted between the steering main shaft and intermediate shaft, is designed to reduce vibration and ensure excellent maneuverability. Along with this change, the intermediate shaft stroke function now uses a shear pin, instead of the rubber coupling used previously, to improve its rigidity.



2. Tilt Mechanism

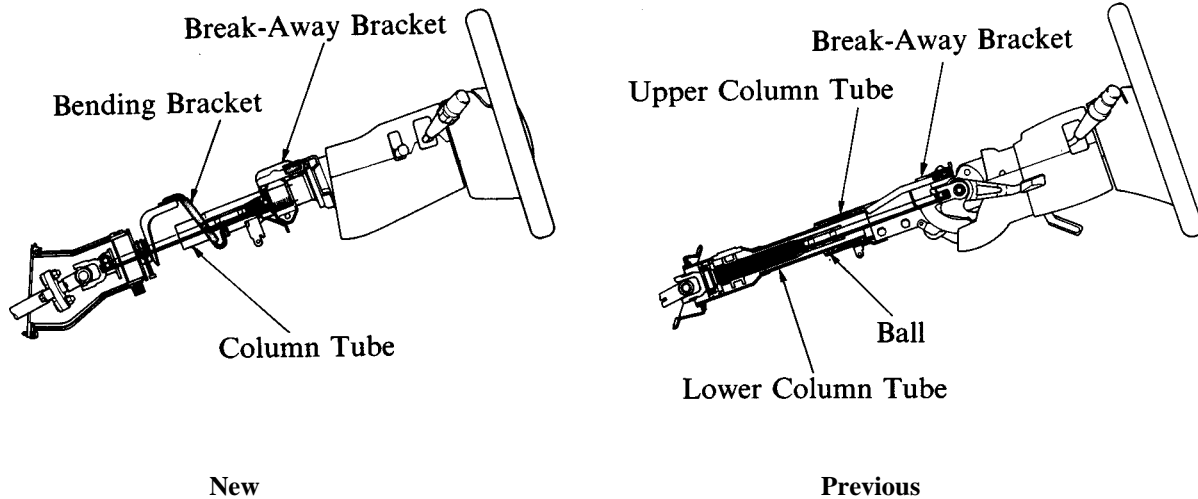
The construction of the tilt mechanism of the new model is as illustrated below, having the upper column tube secured through the engagement of the steering support by the pawl. This engagement is released by raising the tilt lever; the steering wheel can be adjusted to any of the 6-step positions.

The tilt lever and pawl stopper are connected to each other by a link, and the pawl stopper, with its tension spring, applies constant pressure onto the pawl. In addition, a compression spring is provided under the steering support to apply a constant upward pressure to the steering wheel. For details, refer to page TD-57 of the '89 Cressida New Car Features (Pub. No. NCF044U).



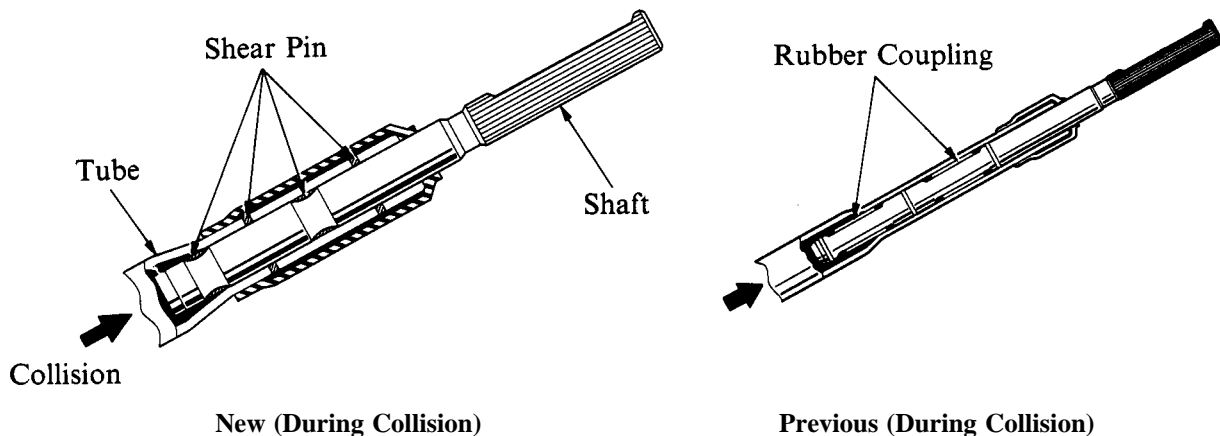
3. Energy Absorbing Mechanism

- Ⓡ The energy absorbing mechanism of the new model consists of a bracket which absorbs the energy by bending when an impact is applied onto the steering wheel. The bending bracket is welded onto the column tube, and the steering column is attached to the instrument panel reinforcement by way of the bending bracket and a break-away bracket. For details, refer to page 137 of the '90 Celica New Car Features (Pub. No. NCF056U).
- Ⓡ In conjunction with the adoption of the bending bracket, the previous 2-column tube has changed to a 1-column tube to make the tube lighter.



4. Intermediate Shaft

The rubber coupling used previously for the intermediate shaft has been changed to a plastic shear pin. When the shear pin breaks during a collision, the tube and shaft travel along a mutual stroke, absorbing the energy of the impact.



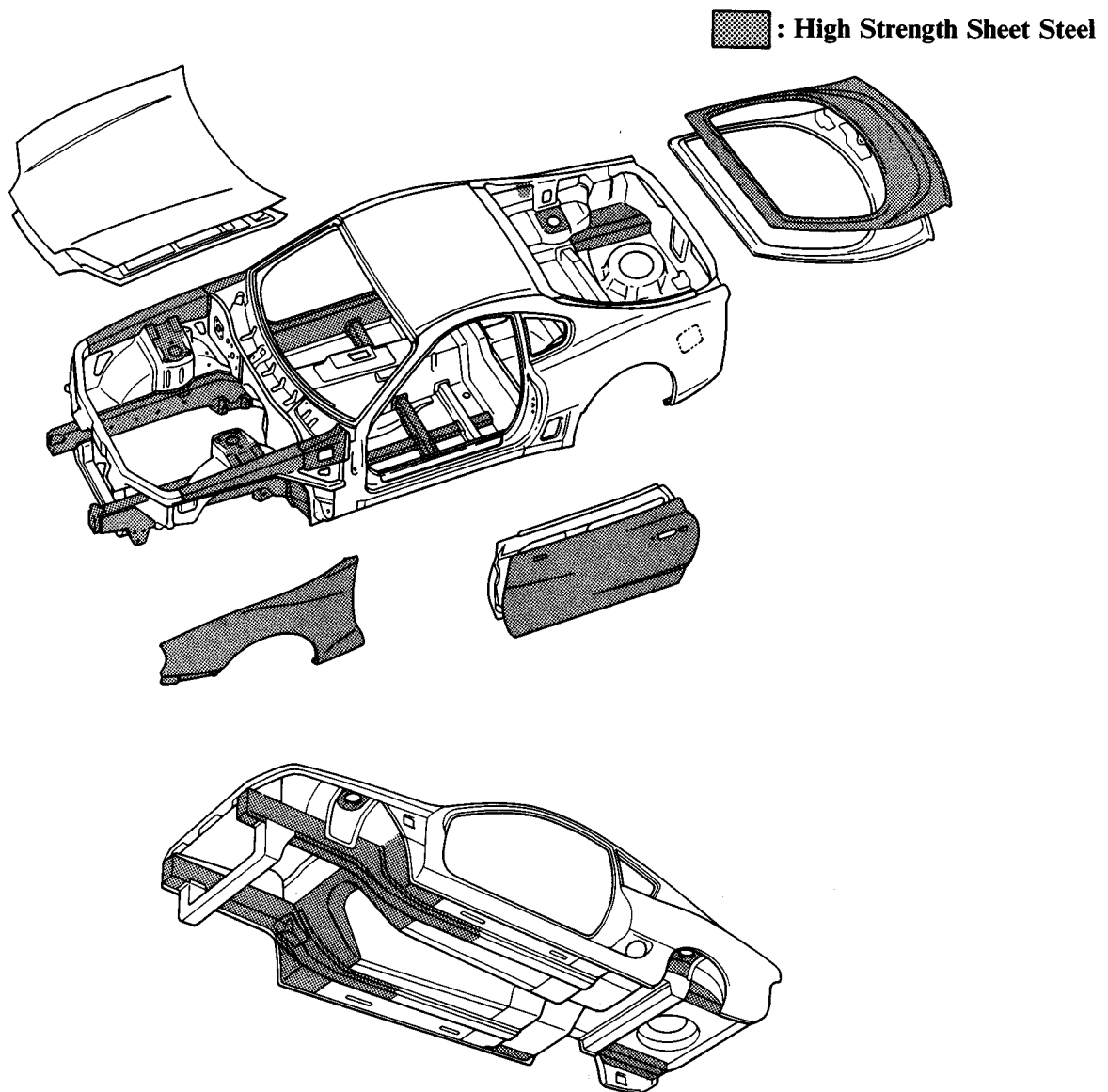
BODY

LIGHTWEIGHT AND HIGHLY RIGID BODY

The body of the new Toyota Supra is made highly rigid through the adoption of seamless and unitized body panels such as the side member outer panel and roof side inner panel, and, through the use of high strength sheet steel. In addition, the engine hood and roof panel (sport roof model only) are made lighter through the use of aluminum.

☞ HIGH STRENGTH SHEET STEEL

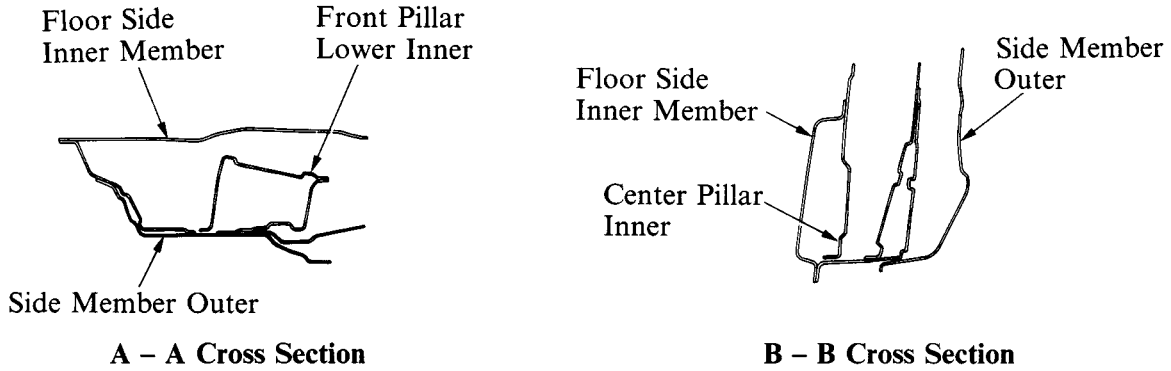
Light weight and highly rigid strength sheet steel is used for the engine hood, door panels, luggage compartment door and members.



BODY SHELL

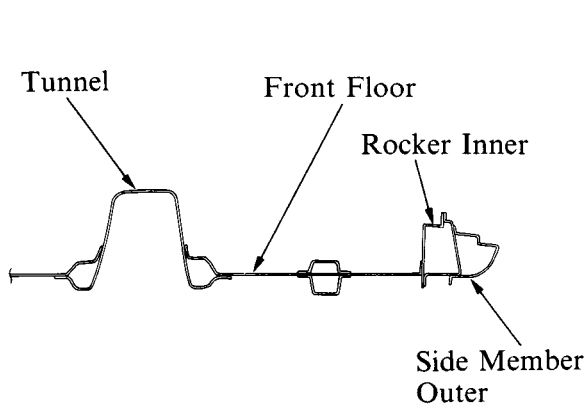
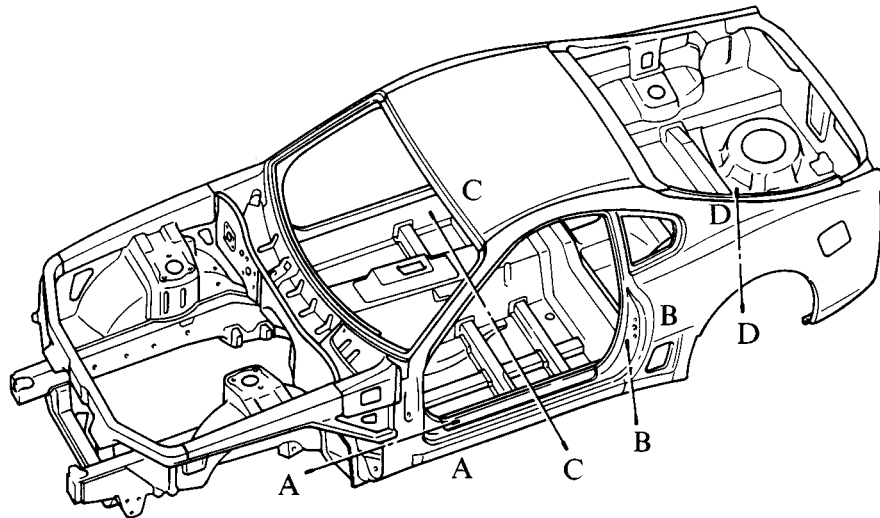
The cross-section lateral body frame and direct panel-to-panel bonding contribute to reduced noise and vibration as well as improving rigidity.

Cross-Section Lateral Body Frame Structure

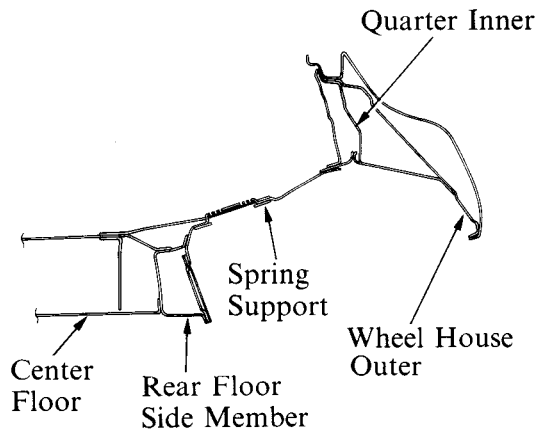


A - A Cross Section

B - B Cross Section

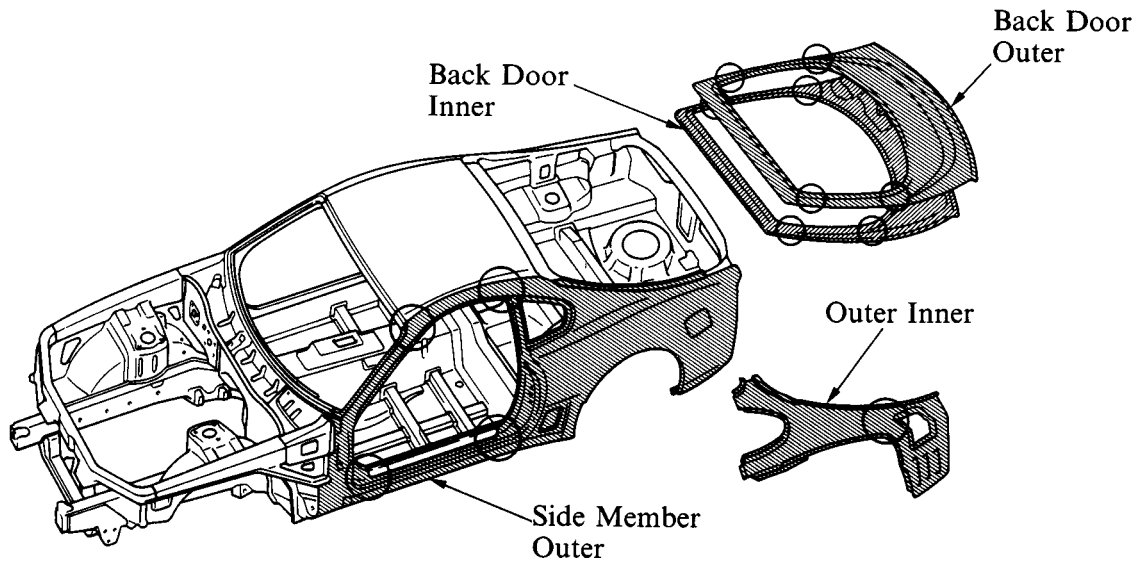


C - C Cross Section



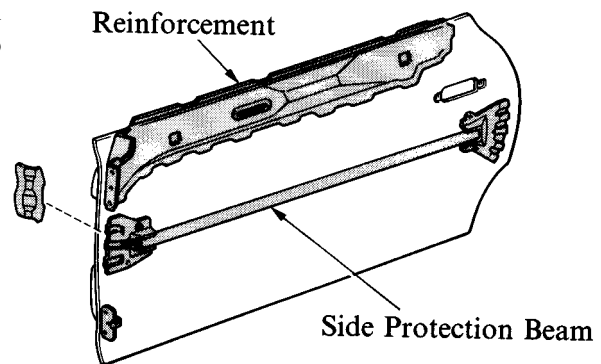
D - D Cross Section

Areas of Improved Panel Bonding ◀

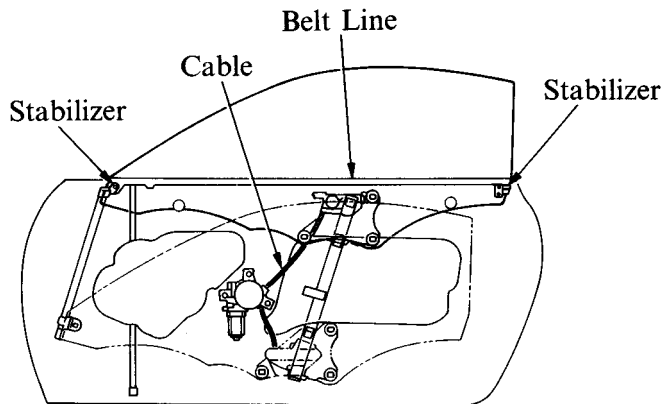


FRONT DOORS

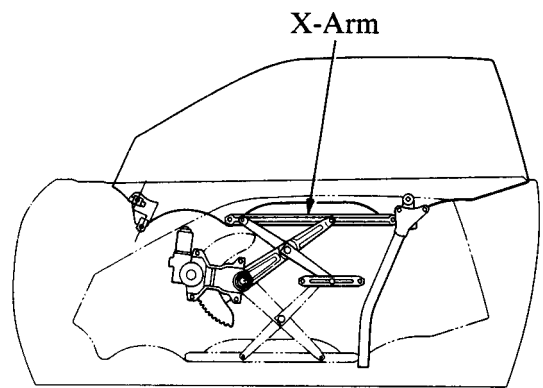
- ⑧ Pipe type side protection beams are mounted in the center space between the door panels to improve door rigidity.



- ⑧ The front door window regulator has been changed from X-arm type to the cable type to provide smoother operation and reduce weight.
- ⑧ The front door belt line is made highly rigid, and the stabilizers used in the front and rear of the belt line increases the rigidity of the glass support.



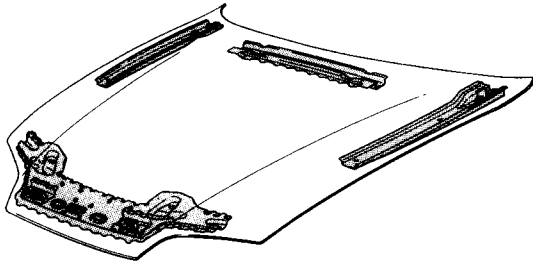
New



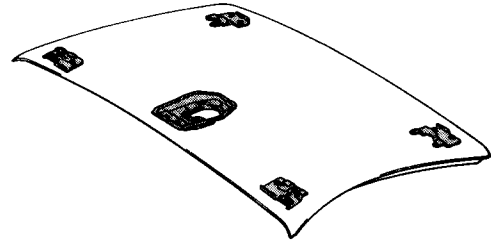
Previous

ENGINE HOOD AND ROOF PANEL

The engine hood and roof panel (sport roof model only) are made lighter through the use of aluminum.



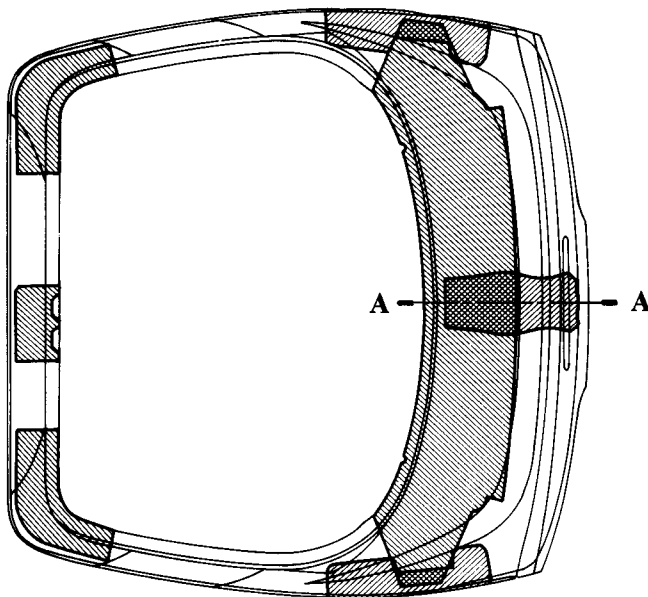
Engine Hood



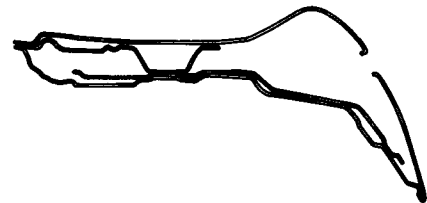
Roof Panel

BACK DOOR

The outer and inner panels of the back door are integrated, and the reinforcements are optimally located to increase the back door rigidity.



 : Reinforcement



A - A Cross Section

RUST-RESISTANT BODY

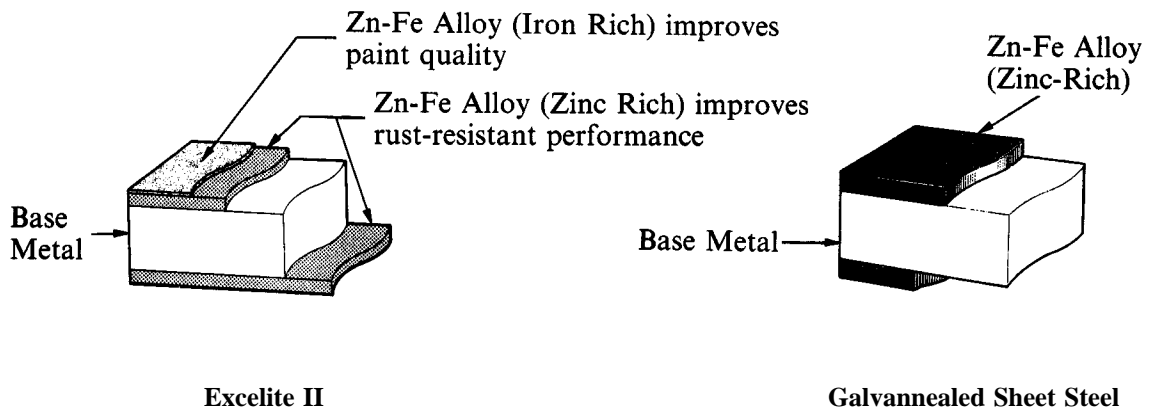
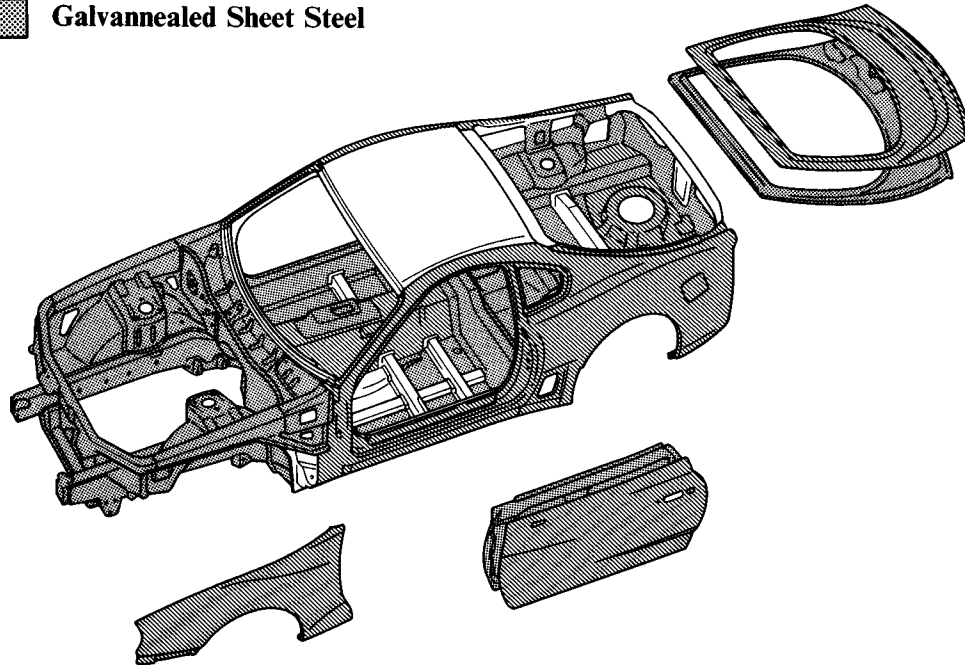
Rust-resistant performance is increased by using anti-corrosion sheet steel and performing anti-corrosion treatment by applying wax, sealer, anti-chipping paint, etc. to easily corroded parts such as the engine hood, doors, rocker panels, etc.

ANTI-CORROSION SHEET STEEL

Two types of anti-corrosion sheet steel are used; Galvannealed sheet steel and Excelite II. Galvannealed sheet steel is used for many inner panels, floor panels, etc. Excelite II is used for major outer panels such as those of the doors, back door and fender & quarter panels. Excelite II is made by the formation of a zinc-rich layer on both sides of the base metal of the panel for rust resistance, then the formation of an iron-rich layer, with good painting characteristics, on the outer surface of the panel.

 **Excelite II**

 **Galvannealed Sheet Steel**

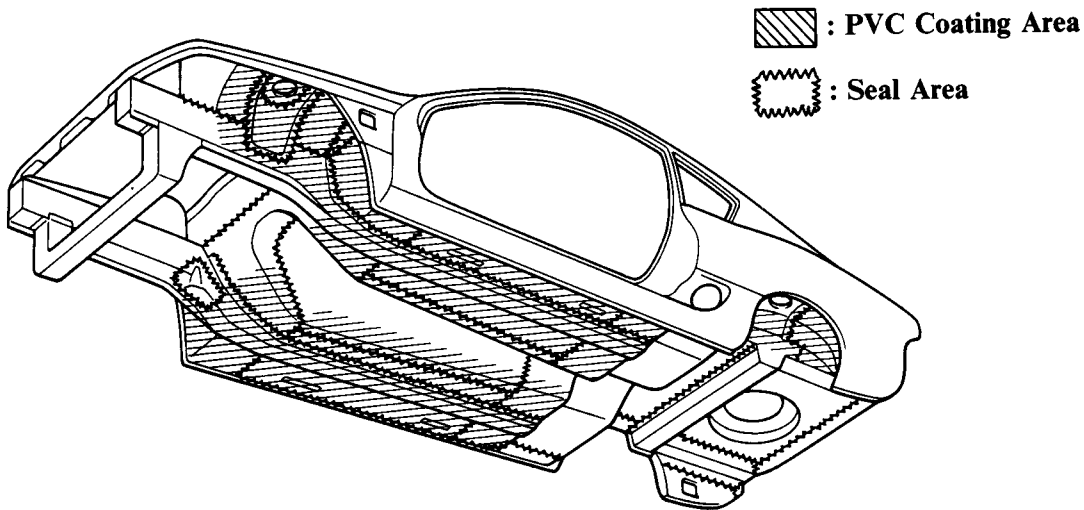


WAX AND SEALER

Wax and sealer is applied to the hemmed portions of the door panels and back door to improve rust-resistant performance.

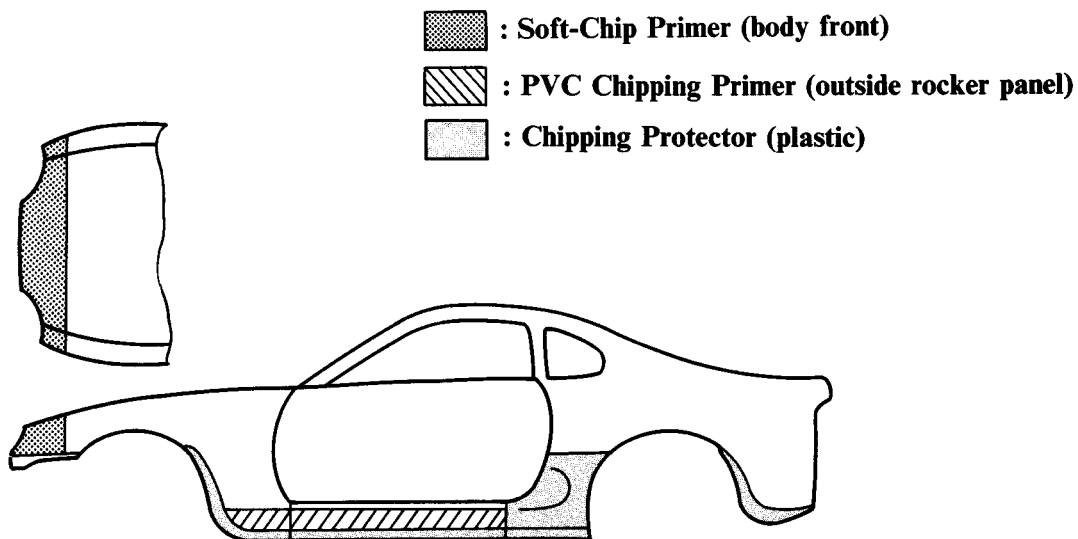
UNDER COAT

PVC (Polyvinyl Chloride) coating is applied to the under side of the body. The bottom side of the cowl panel, the fender apron and other parts which are subject to damage by flying gravel, etc. are given a thick coating to improve rust-resistant performance.



CHIP RESISTANT COAT

Chip-resistant coat is applied to engine hood and rocker panels. In addition, plastic protectors are provided at the lower areas of the front and rear wheels arches and rocker panels to protect them from flying stones.

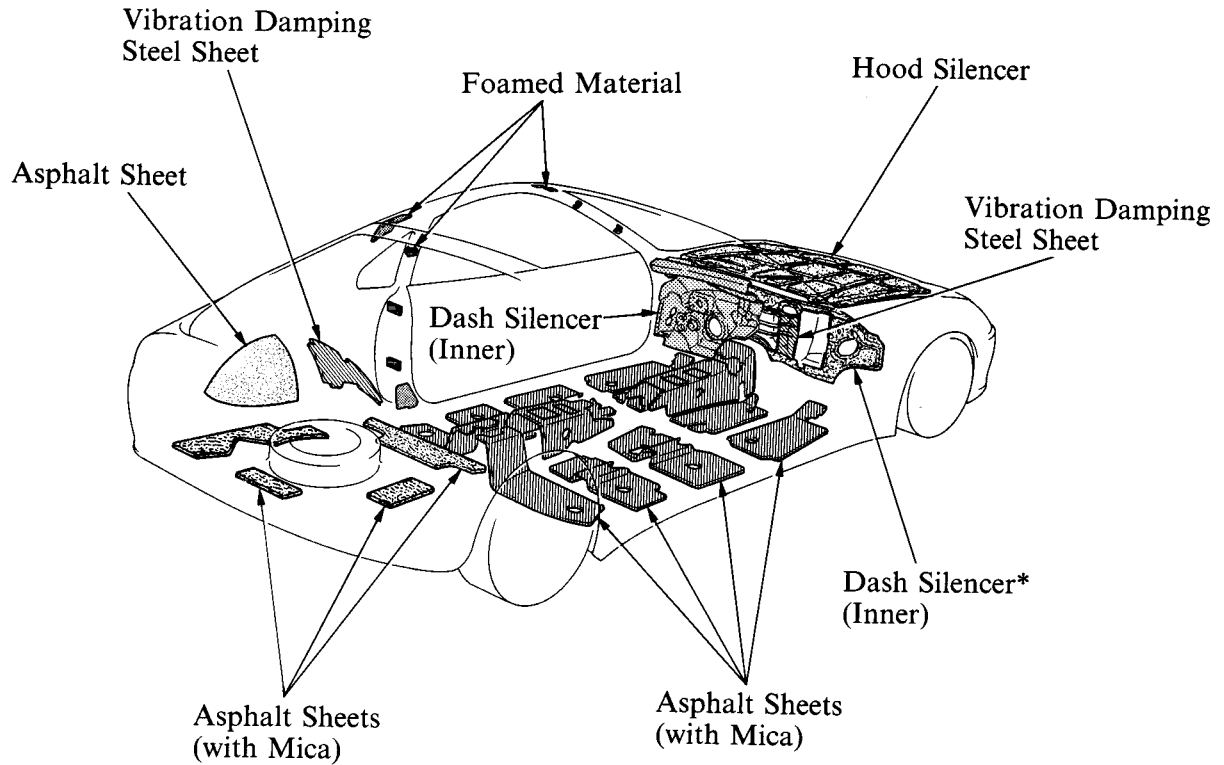


LOW VIBRATION, LOW NOISE BODY

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

SOUND ABSORBING AND VIBRATION DAMPING MATERIALS

- ◀ The vibration damping steel sheet used in the dash panel and rear wheels housings, and the effectively located asphalt sheets reduce engine and road noise, thus improving the vehicle's quietness.
- ◀ Foamed material is applied onto the front pillar and center pillar edges to reduce wind noise.



*with 2JZ-GTE engine only

OUTSIDE REAR VIEW MIRRORS

The triangular patch base which was previously located at the front of the door, has been discontinued. In the new model, the outside rear view mirror is attached directly onto the door body. This results in a smooth flow of air over the window, and reduces wind noise.

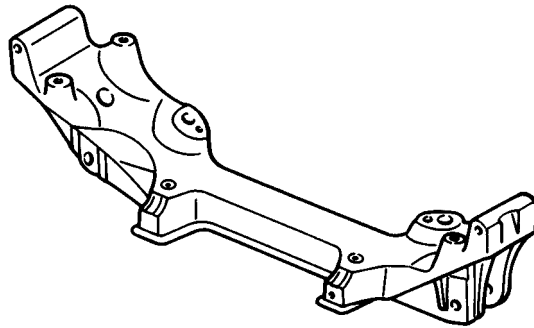


New

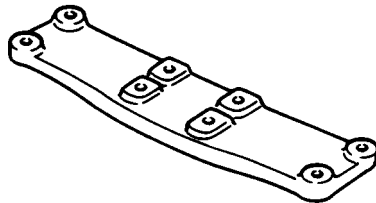
Previous

MEMBERS

Cast aluminum front suspension member and engine rear support member are used to reduce engine noise.



Front Suspension Member

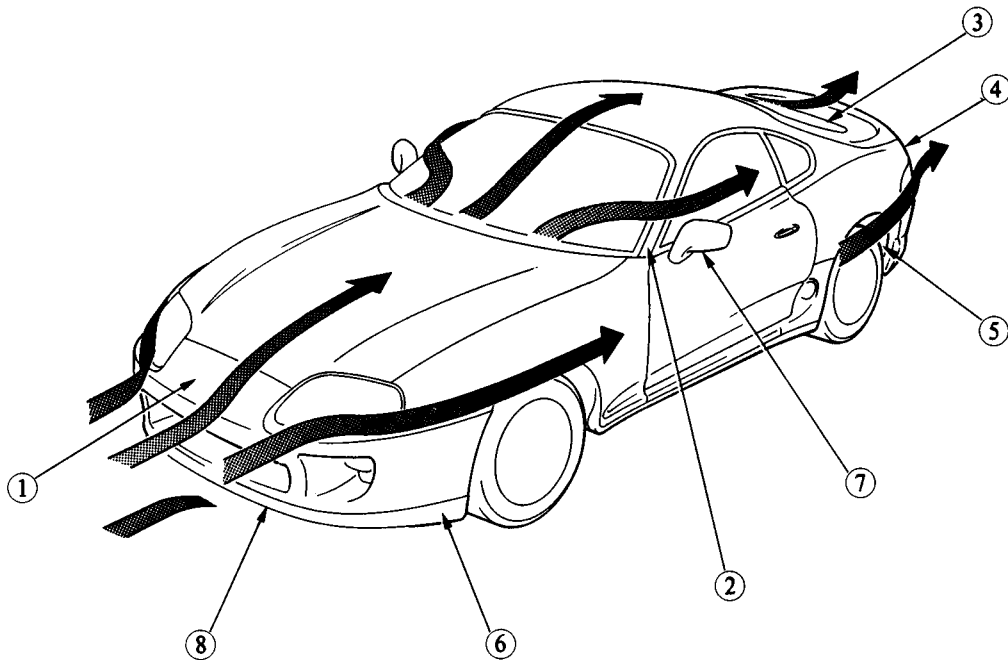


Engine Rear Support Member

AERODYNAMICS

To improve aerodynamic performance, the following measures have been taken.

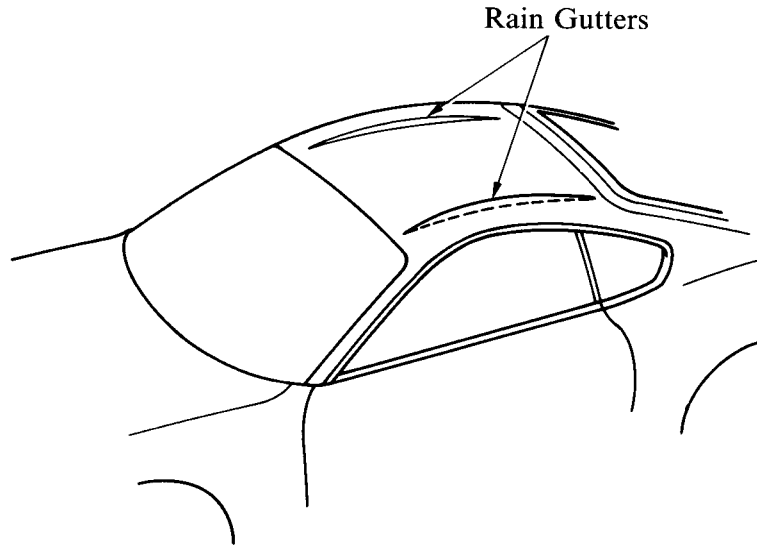
- (1) The front mask is designed without a grille, has headlights conforming to the body shape and also has a large integrated bumper so that the front mask does not have any differences in the level of adjacent surfaces.
- (2) The level differences at the front pillars and window moldings have been minimized.
- (3) Steeply slanted back window and smooth quarter panels.
- (4) Tightly curved rear side corners.
- (5) Smoothly molded flareless wheel arches.
- (6) Front and rear spoilers which guide the flow of air. (Front spoiler : STD, Rear spoiler: OPT)
- (7) Aerodynamic outside rear view mirror.
- (8) Flat, undercover made of resin which guides the flow of air underneath the floor.



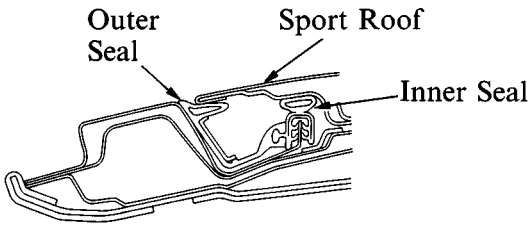
ENHANCEMENT OF PRODUCT APPEAL

ROOF

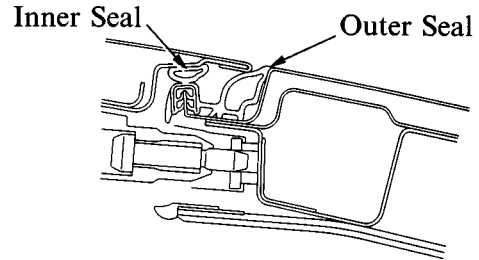
◀ Additional roof panel rain gutters reduce rain dripping from the roof side.



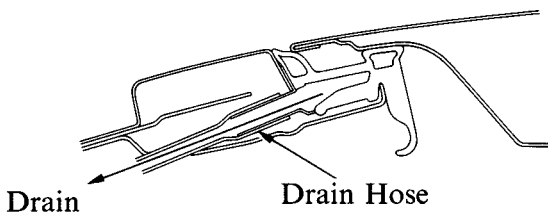
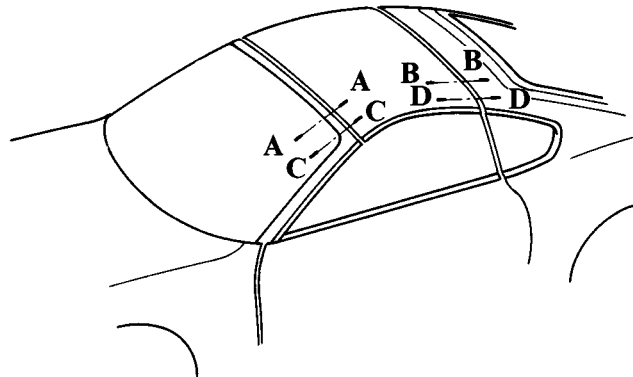
◀ On the sport roof model, double-seal type weatherstrips are used for the front and rear of the sport roof to ensure good sealing. In addition, drain hoses are used to improve the water drainage.



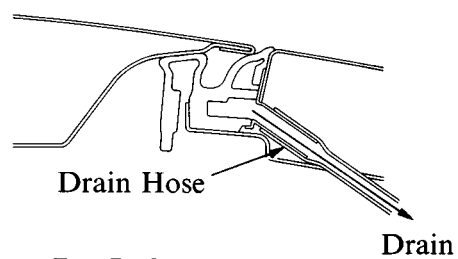
A - A Cross Section



B - B Cross Section



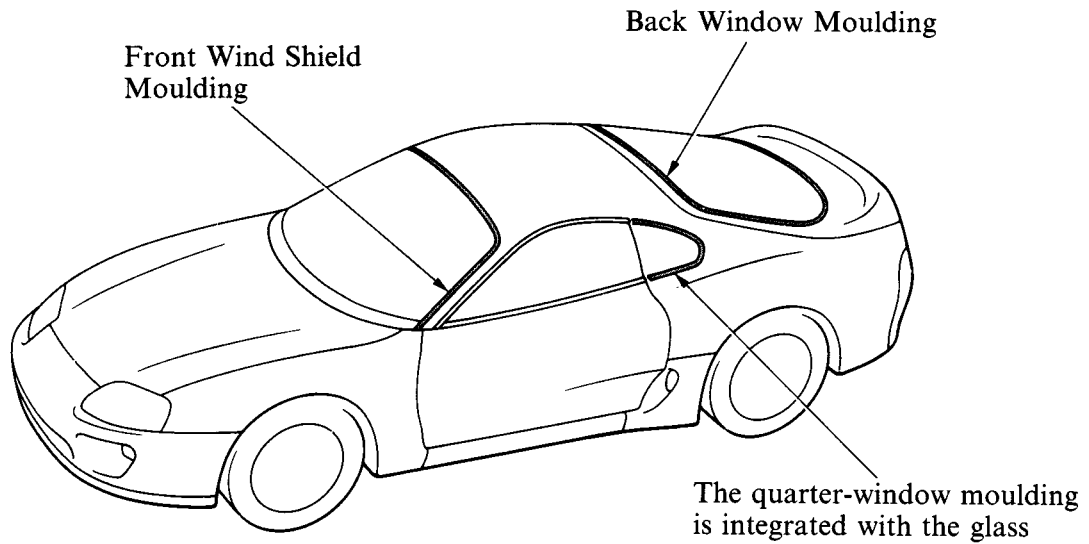
C - C Cross Section



D - D Cross Section

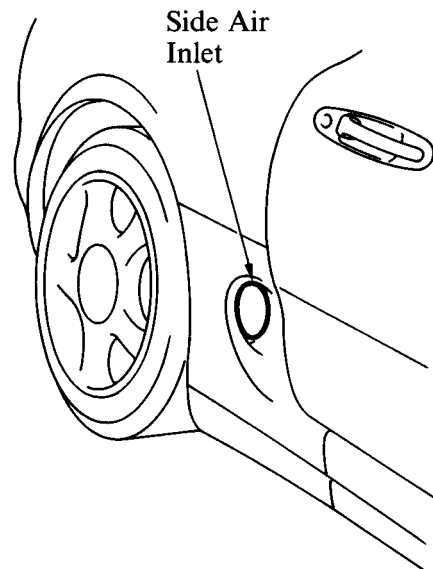
MOULDING

The number of sections making up the windshield moulding has been reduced as much as possible to provide a more unified, elegant appearance.



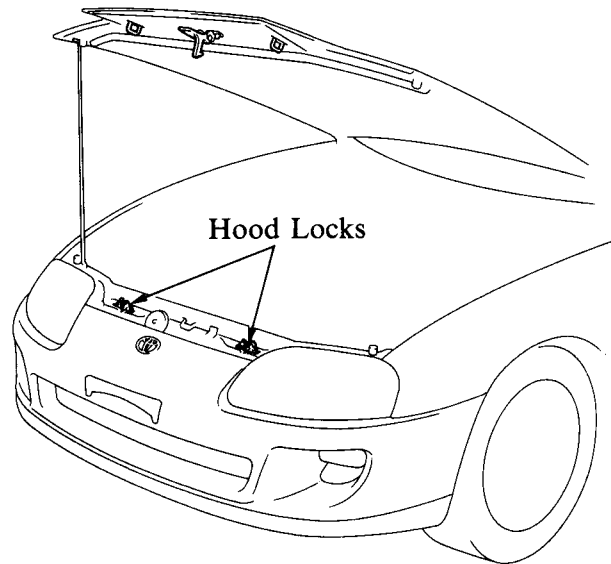
SIDE AIR INLET

Side air inlets are provided at the front of the rear wheel housing, on both sides of the body. When the vehicle is cruising, these inlets are designed to direct air to the rear brakes and thus ensure excellent their cooling performance.



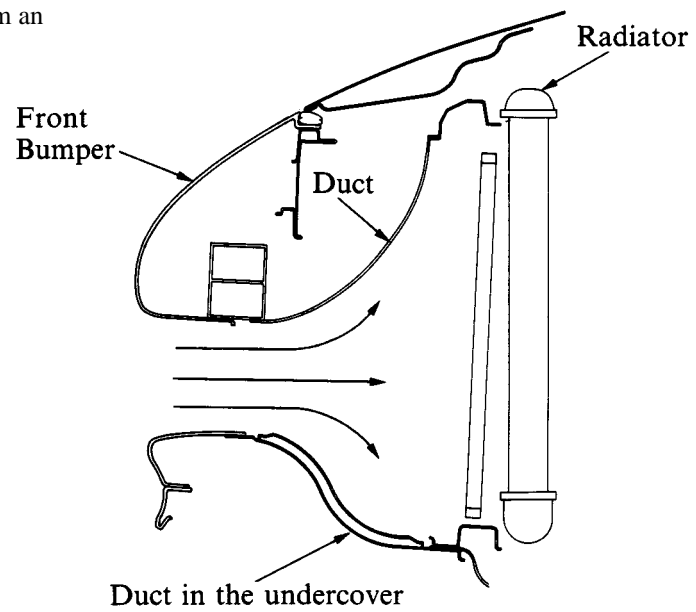
ENGINE HOOD LOCKS

The engine hood is provided with two locks which prevent the engine hood from lifting, and pitching when the vehicle is driven at high speeds.



RADIATOR DUCT

An air duct is used to effectively deliver air from an opening in the front bumper to the radiator.



BODY ELECTRICAL

LIGHTING

DESCRIPTION

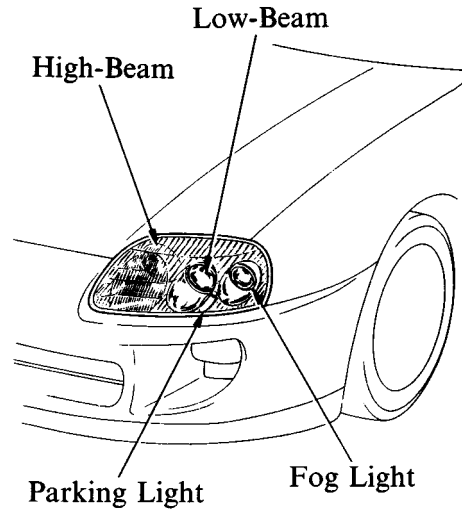
The new Toyota Supra has the following systems:

System	Outline
Headlights	The 4-bulb headlights are integrated with the parking lights and fog lights. A projector light adopted for the low-beam headlights and fog lights enhance visibility. For details, see next page.
Daytime Running Light System	This system is designed to automatically activate the headlights and taillights during the daytime to keep the car highly visible to other vehicles. Unlike the system in the previous Toyota Supra, the headlights are activated at half the normal high-beam intensity when the headlights are manually turned on at high-beam. Also, the low-beam lights remain off. The basic construction and operation are the same as in the Camry. For details, see NCF077U (for '92 Camry), page 125.
Light Auto Turn-Off System	When the ignition key is turned from ON to ACC to LOCK position and the driver's door is opened with the taillights and headlights turned on, this system automatically turns them off. Its basic construction and operation are the same as in the previous Toyota Supra.
Illuminated Entry System	This system is useful when entering the vehicle and inserting the ignition key into the key cylinder in the door. The dome light illumination time is extended from the previous 8.5 seconds (approx.) to about 15 seconds. It also offers the added function of immediately turning off the illumination under certain conditions, even when the system is operating. For details, see page 229.

HEADLIGHTS

1. General

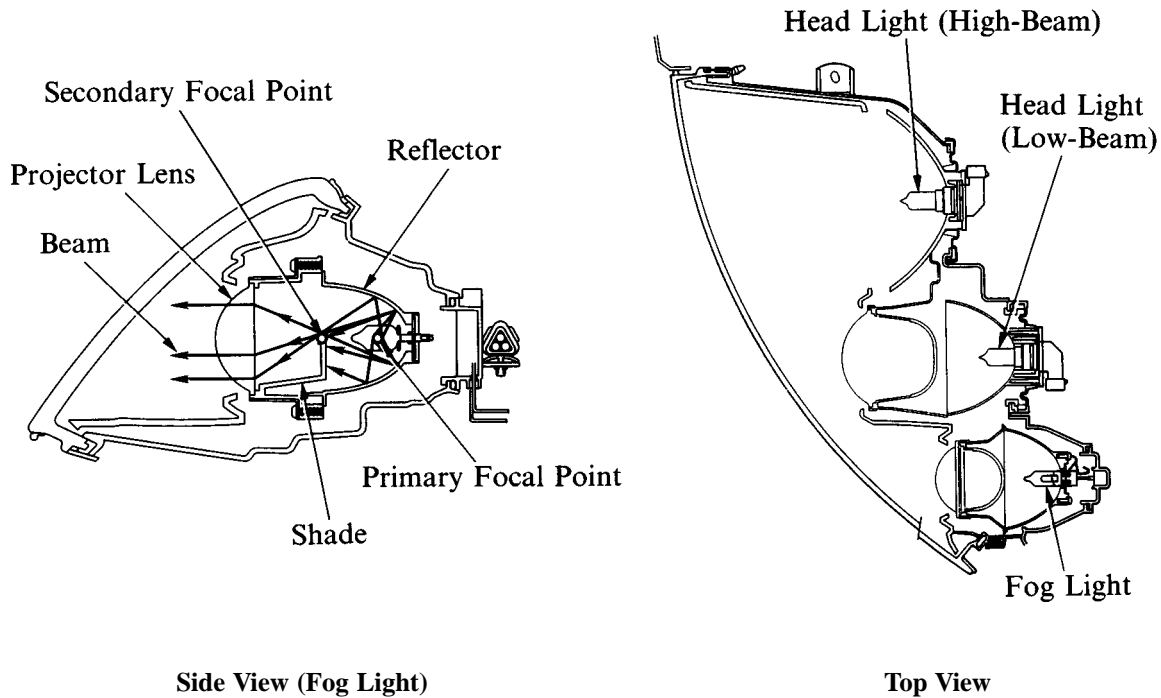
- Ⓡ The 4-bulb headlights are integrated with parking lights and fog lights.
- Ⓡ A newly developed projector light is adopted in the low-beam headlights and fog lights for enhanced visibility.



2. Projector Light

There are 2 focal points in a projector light system, of which the light source is located at the primary focal point. The other is the secondary focal point, upon which the light reflected by an oval-shaped reflector is collected, and refracted through the front projector lens, onto the road.

While this type of light can fully utilize the light beam entering the upper reflector area and thus supply abundant light, it can also be made small. Since the beam from the light source is condensed onto a small area, it offers the advantage of preventing the light from deflecting away from the intended area. The halogen bulbs used are 12V 51W for the low-beams, and 12V 55W for the fog lights.



ILLUMINATED ENTRY SYSTEM

1. General

Whenever the driver’s door outside handle is pulled and released, or the driver’s or passenger’s door is opened, the illuminated entry system turns on the illuminations around the driver’s door key cylinder, ignition key cylinder and dome light (only when the control switch is at DOOR position) simultaneously. It is useful when entering the vehicle and inserting the ignition key into the cylinder in the dark.

In the new models, the light-off conditions have been modified as shown in the table below, for increased usefulness. The illuminations are immediately turned off if the ignition switch is turned to ACC or ON, or if all doors have been closed or locked.

Timer Chart ◀

Components		Condition
Ignition Key	ACC, ON, ST	
	LOCK	
Driver’s and Passenger’s Doors	Open	
	Closed	
Driver’s and Passenger’s Door	Unlock	
	Lock	
Driver’s Door Outside Handle Switch	On	
	Off	
Dome Light and Illuminations	On	
	Off	
Requirement		<p>① ② ③ ④ ⑤ ⑥ ⑦</p>

T₁, T₃ : About 15 seconds, T₂ : About 0.6 seconds.

Case (1) : When the driver’s door outside handle switch is disengaged, the dome and other lights light up for T₁ seconds.

Case (2) or (3) : If any door is opened, the dome and other lights light up, and remain on for T₁ seconds after the all doors are closed.

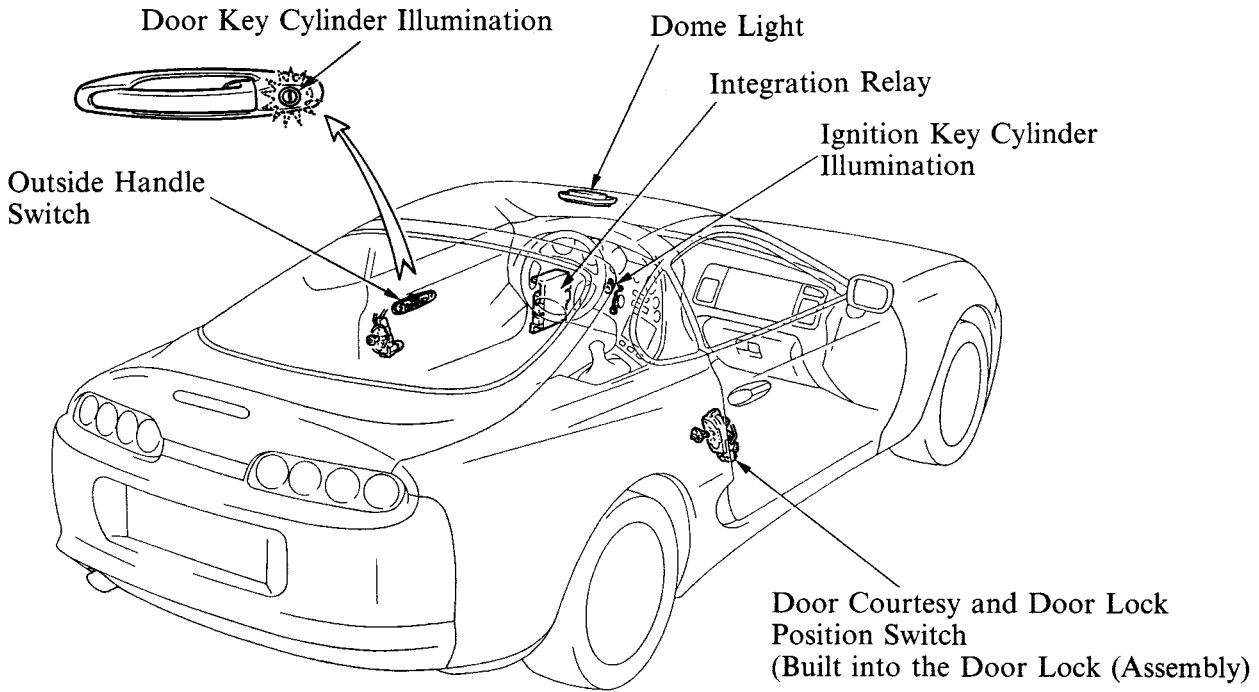
Case (4) : When the ignition switch is at ACC or ON, closing all doors immediately turns off the dome and other lights.

Case (5), (6)* : While the dome and other lights are on (T₁ sec.), turning the ignition switch to ACC or ON, or locking all doors immediately turns off the dome and other lights. Within T₃ seconds thereafter, turning the driver’s door outside handle switch from on to off will not turn on the dome light and others.

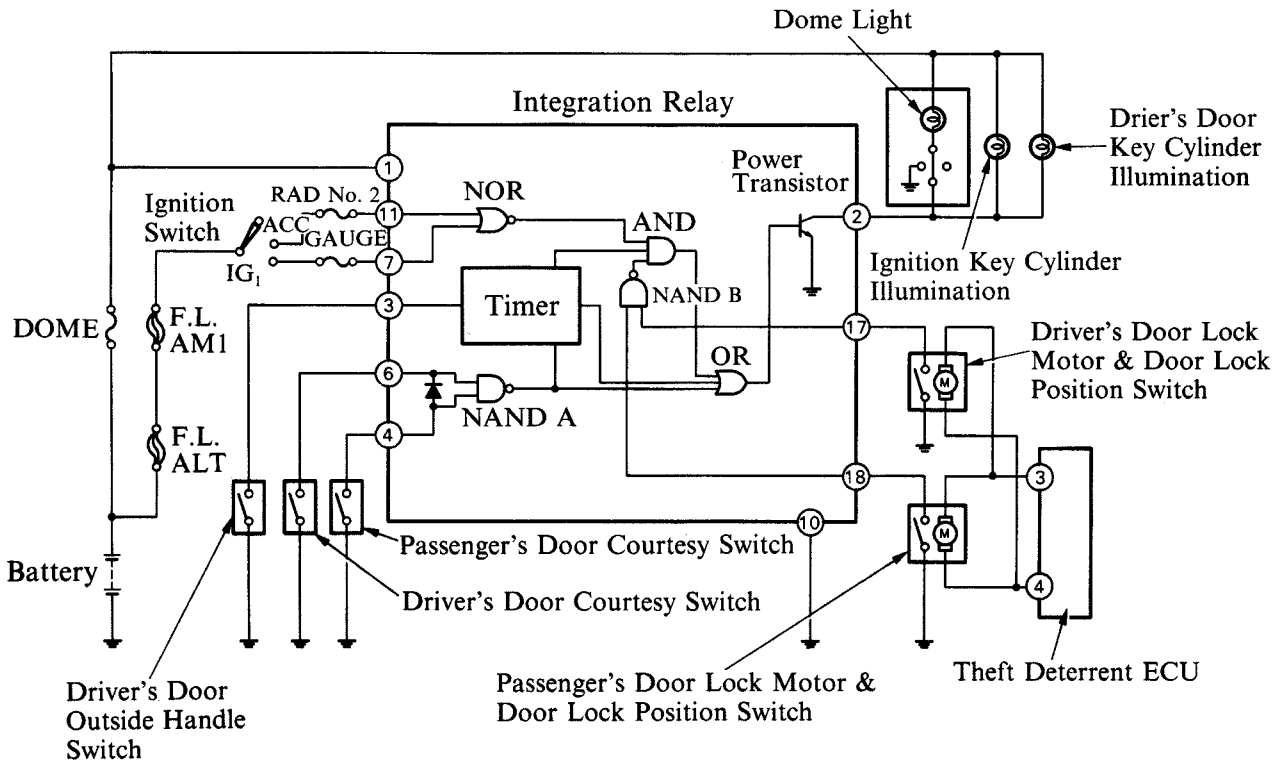
Case (7)* : If any door is opened and then closed with all doors in locked position, it causes the dome light and others to turn off immediately. (This applies to keyless locking operation only.) Within T₃ seconds thereafter, turning the driver’s door outside handles switch from on to off will not turn on the dome light and others.

* : As for cases (6) and (7), the dome and other lights are turned off immediately, provided that the conditions of the “driver’s and passenger’s doors being closed and locked” are fully met.

2. Layout of Components



3. Wiring Diagram



NOTE: When input to the timer circuit changes from "1" to "0", "1" is output for about 15 seconds.

4. System Operation

When the Driver's Door Outside Handle is Pulled and Released

The driver's door outside handle switch engages when the driver's door outside handle is pulled and released. Then the voltage at terminal (3) of the integration relay drops from 0 V to 12 V. This activates the power transistor, which causes the voltage at terminal (2) to drop from 12 V to 0 V and the illuminations to turn on.

After both doors are locked and the illumination is immediately turned off, the system does not accept any signal input from the outside handle switch for 15 seconds. Therefore, even if the driver's door outside handles is operated, it does not cause the illumination to turn on during that time.

When the Driver's or Passenger's Door is Opened

When the driver's or passenger's door is opened, the courtesy switch on the respective door goes on. In this way, terminal (4) or (6) of the integration relay switches from high level (12V) to low level (0V). As a result, the power transistor is turned on and terminal (2) is switched from high level to low level, turning on the illuminations.

When 15 seconds has Passed Since Both Doors were Closed

When both doors are closed and terminals (4) and (6) both go high level, the timer circuit operates. The timer keeps the power transistor on for 15 seconds. After 15 seconds has passed, the illuminations are switched off.

When Both Doors are Closed and the Ignition Key is in a Position other than Lock

When both doors are closed and the ignition key is inserted in the ignition key cylinder and turned to a position other than LOCK, terminals (4) and (6) both become high level and terminal (7) or (11) switches from low to high level. As a result, the power transistor goes off and the illuminations are switched off regardless of the operation of the timer circuit.

When Both Doors are Closed and Both Doors are Locked

When both doors are locked after both doors are closed, or are closed after being locked, terminals (4) and (6) become high level together and terminals (17) and (18) switch from low to high level. As result, the power transistor goes off and the illuminations are switched off regardless of the operation of the timer circuit.

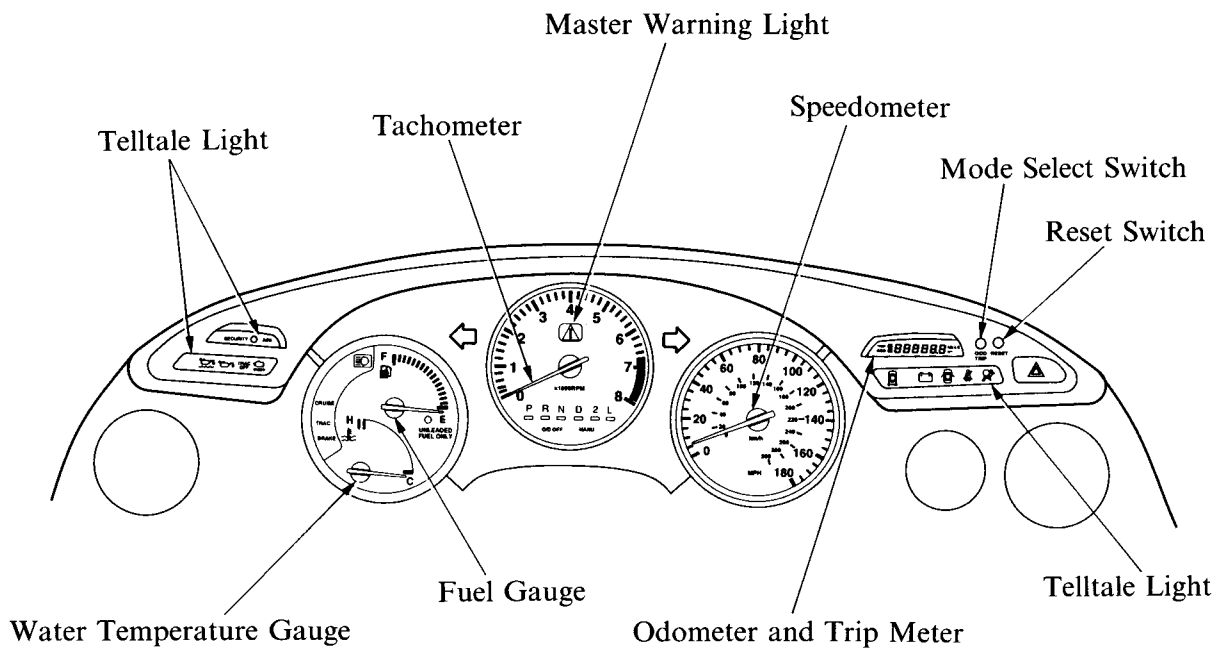
METER

COMBINATION METER

1. General

The triple-eye type analog meters are used for the combination meter, which consists of a speedometer, tachometer, and, fuel and temperature gauges. The improvements listed below are also designed to increase their visibility.

- Ⓡ The electrical analog type speedometer, previously introduced on other models, is used.
The basic construction and operation are the same as in the Camry. For details, see Pub. No. NCF063U (for the '91 Previa), page 123.
- Ⓡ The electronic display odometer (separate from the speedometer) with VFD (Vacuum Fluorescent Display), indicates the running distance.
- Ⓡ The master warning light, located in the upper center of the tachometer, turns on to warn the driver of an abnormal condition, whenever any of the warning lights comes on.
- Ⓡ The indicator and warning lights are located in the combination meter and in the telltale lights on the right and left sides of the instrument cluster panel.



2. Electronic Display Odometer

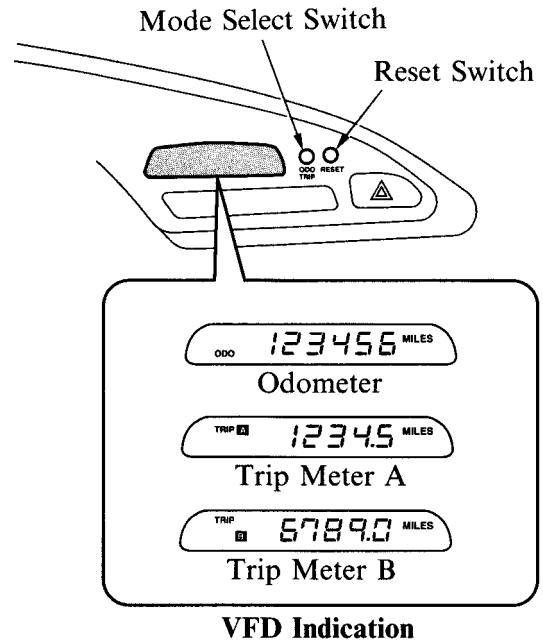
Function

The odometer is an electronic type which functions both as a trip meter and an odometer display.

Pressing the mode select switch changes its operation from “ODO” to “TRIP A”, then to “TRIP B” in sequence.

The reset switch can be used to reset the “TRIP A” or “TRIP B” that is currently displayed.

Even if the +B power source is interrupted by the removal of the car battery, the odometer maintains the running distance data in memory for approximately 5 years.

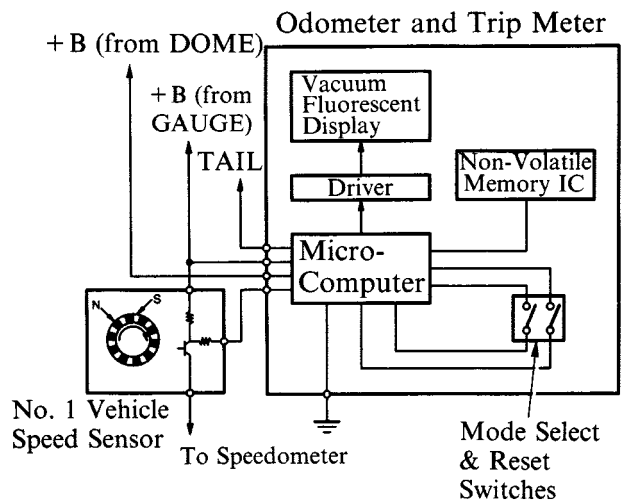


Operation

The 4-pulse vehicle speed signals obtained from the No. 1 vehicle speed sensor are input into the micro-computer to the odometer and trip meter. The signals are then converted into running distance, sent to the driver, and displayed on the VFD (Vacuum Fluorescent Display).

In addition, the signals from the mode select switch and the reset switch are input into the micro-computer to effect a change in the mode and reset the trip meter.

If the power to trip meter is cut off due to battery discharge, etc., the distance recorded in the trip meter memory is then cleared. A non-volatile memory IC (Integrated Circuit) is used in the odometer. This makes it possible to continue to display the distance traveled even when the power supply is cut off.



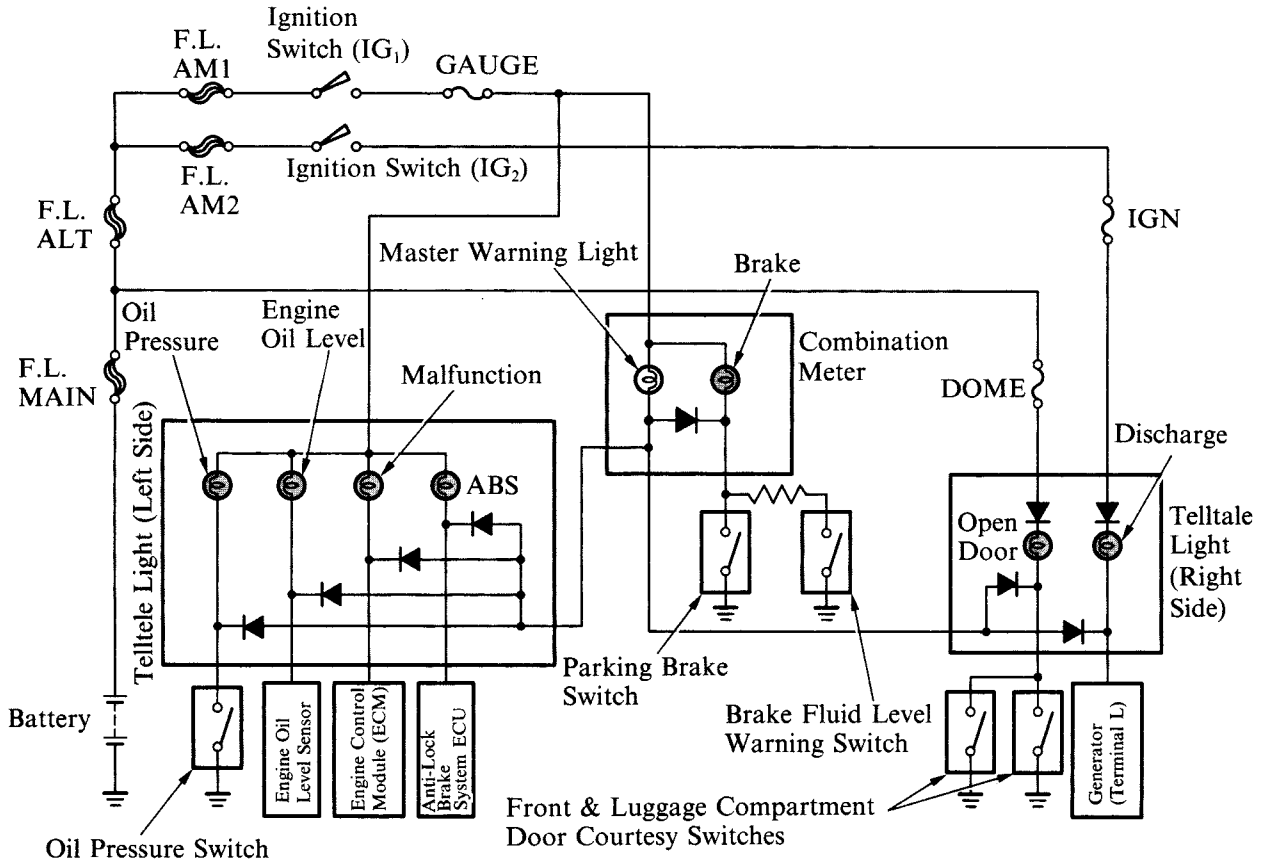
—REFERENCE—

A non-volatile memory IC can hold an electrical load semi-permanently, so it is able to store data whether it is supplied with power or not.

3. Master Warning Light

The master warning light is connected to the ECUs and sensors for all of the systems on the vehicle, as are the rest of the warning lights. In case any malfunction occurs, signals are output from any of these systems to turn on the corresponding warning light and the master warning light. After that system reverts to normal operation, the light will turn off after the ignition switch is turned off.

Wiring Diagram ◀



⊗: The warning lights which may cause the master warning light to come on.

AIR CONDITIONING

DESCRIPTION

1. General

The air conditioning is a fully automatic type controlled by an ECU. The following improvements ensure precise and pleasant climate control:

- Ⓡ The blower, heater, and cooler units are integrated for improved quietness.
- Ⓡ The newly developed dome-type solar sensor used can accurately detect solar radiation even when the sun's position in the sky is low.
- Ⓡ An antiseptic evaporator is adopted to reduce the incidence of unpleasant odor during the air conditioning operation.
- Ⓡ To prevent damage to the ozone layer, a new refrigerant R134a is used in place of the conventional R12. Freon, or chlorofluorocarbon (CFC) reaches the stratosphere in an unresolved state. The photolysis caused by the powerful ultraviolet rays emitted from the sun causes the CFC to release chlorine, which destroys the ozone layer. The newly adopted R134a is a refrigerant that does not include chlorine. The new refrigerant differs from the previous one in both physical sense and in their characteristics, which requires different cycling components and compressor oil. System recharging and repair methods must be altered accordingly. For inspection and repair details, see '94 Toyota Supra Repair Manual (Pub. No. RM343U2).

Performance ◀

Model		New	Previous
Item			
Heater	Heat Output (W [Kcal/H])	4880 [4200]	4300 [3700]
	Air Flow Volume* (m ³ /h)	320	290
	Power Consumption (W)	230	170
Air Conditioning	Heat Output (W [Kcal/h])	5000 [4300]	4520 [3900]
	Air Flow Volume (m ³ /h)	460	420
	Power Consumption (W)	260	215
Defroster	Air Flow Volume (m ³ /h)	350	260

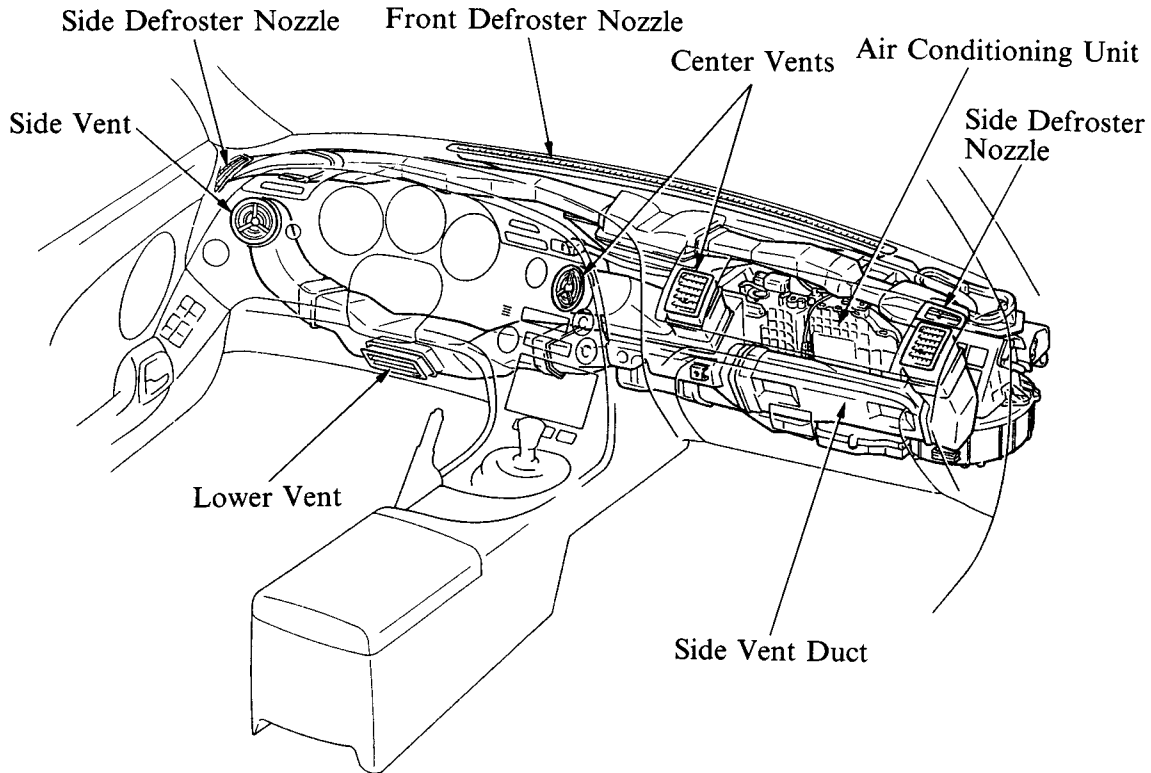
* With side vent opened.

Specifications ◀

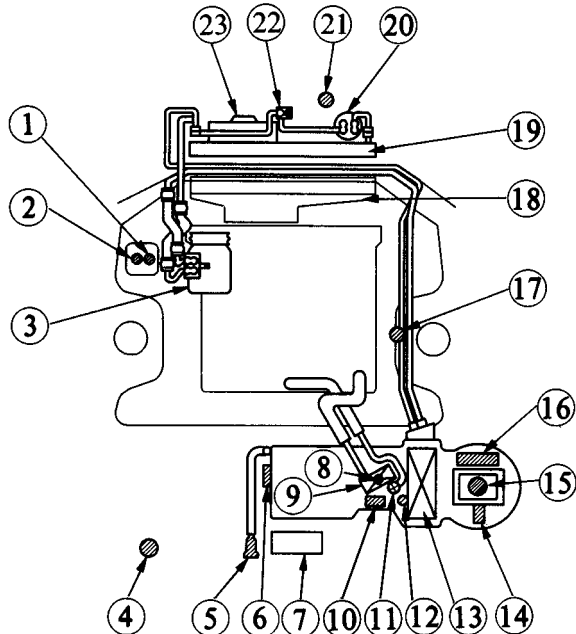
Model		New	Previous	
Item				
Ventilation & Heater	Heater Core	Type	Flat Tube Type	Dimpled Tube Type
		Size W x H x L mm (in.)	156 x 200 x 27 (6.1 x 7.9 x 1.1)	140.5 x 180 x 49 (5.3 x 7.1 x 1.9)
		Fin pitch mm (in.)	2.2 (0.09)	2.6 (0.1)
	Blower	Motor type	S80FS11.5T	70F11W
		Fan size Dia. x H mm (in.)	150 x 65 (5.9 x 2.6)	140 x 65 (5.5 x 2.6)
Air Conditioning	Condenser	Type	Multi Flow Type	2-Passage Flow Type
		Size W x H x L mm (in.)	630 x 369 x 16 (24.8 x 14.5 x 0.6)	586 x 353 x 22 (23.1 x 13.9 x 0.9)
		Fin pitch mm (in.)	3.0 (0.12)	4.5 (0.17)
	Evaporator	Type	Drawn Cup Type	←
		Size W x H x L mm (in.)	294 x 210 x 90 (11.6 x 8.3 x 3.5)	224 x 210 x 105 (8.8 x 8.3 x 4.1)
		Fin pitch mm (in.)	4.5 (0.18)	4.0 (0.15)
	Compressor	Type	10PA17	←
Refrigerant	Type	R134a	R12	

2. Layout of Components

Unit, Ducts and Vents

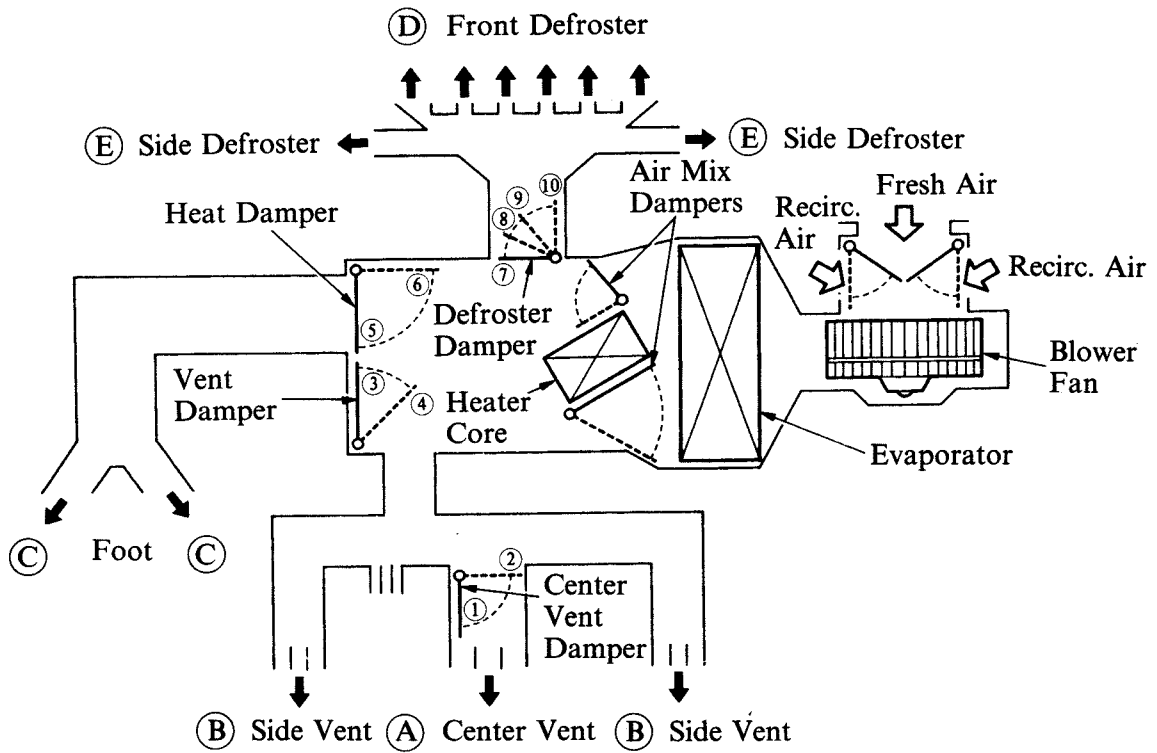


Functional Parts



No.	Part Name	No.	Part Name
(1)	Heater Relay	(13)	Evaporator
(2)	Magnetic Clutch Relay	(14)	Air Inlet Servomotor
(3)	Compressor	(15)	Blower Motor
(4)	Solar Sensor	(16)	Blower Controller
(5)	Room Temperature Sensor	(17)	Pressure Switch (for Cooling Fan Control and High & Low Pressure Cut Control of Magnetic Clutch)
(6)	Air Flow Mode Control Servomotor		
(7)	Air Conditioning ECU		
(8)	Engine Coolant Temperature Sensor	(18)	Cooling Fan
		(19)	Condenser
(9)	Heater Core	(20)	Receiver
(10)	Air Mix Servomotor	(21)	Ambient Temperature Sensor
(11)	Water Valve		
(12)	Evaporator Temperature Sensor	(22)	Sight Glass
		(23)	Electric Fan

3. Damper Position and Air Flow Relationship



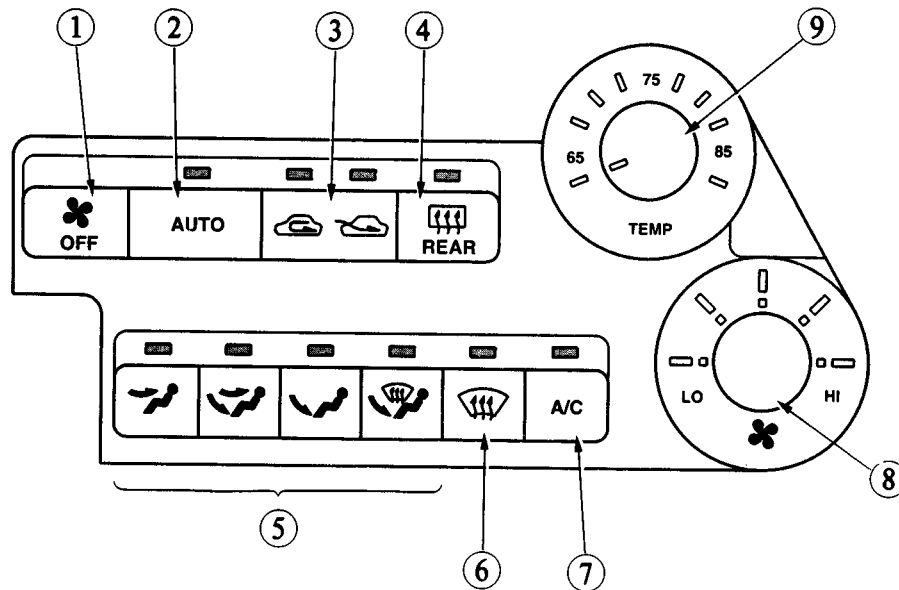
Air Outlet Mode		Mode Control Damper Position	Vent		Foot	Defroster	
			(A) Center	(B) Side	(C) Front	(D) Front	(E) Side
Face		① ③ ⑤ ⑦	○	○			
Bi-Level		① ③ ⑥ ⑦	○	○	○		
Foot*	I	② ④ ⑥ ⑧		○	○	○	○
	II	② ④ ⑥ ⑦		○	○		
Foot/Defroster		② ④ ⑥ ⑨		○	○	○	○
Defroster		② ④ ⑤ ⑩		○		○	○

The size of the circle ○ indicates the proportion of air flow volume.

* Foot I indicates the status during automatic control and Foot II indicates the status during manual control.

4. Air Conditioning Switches

- Ⓡ In the same way as the previous model, a push-button type heater control panel is used, and the rear defogger switch is located in the panel for improved control.
- Ⓡ A manual control adjusts the blower speed over 5 steps for precise control.

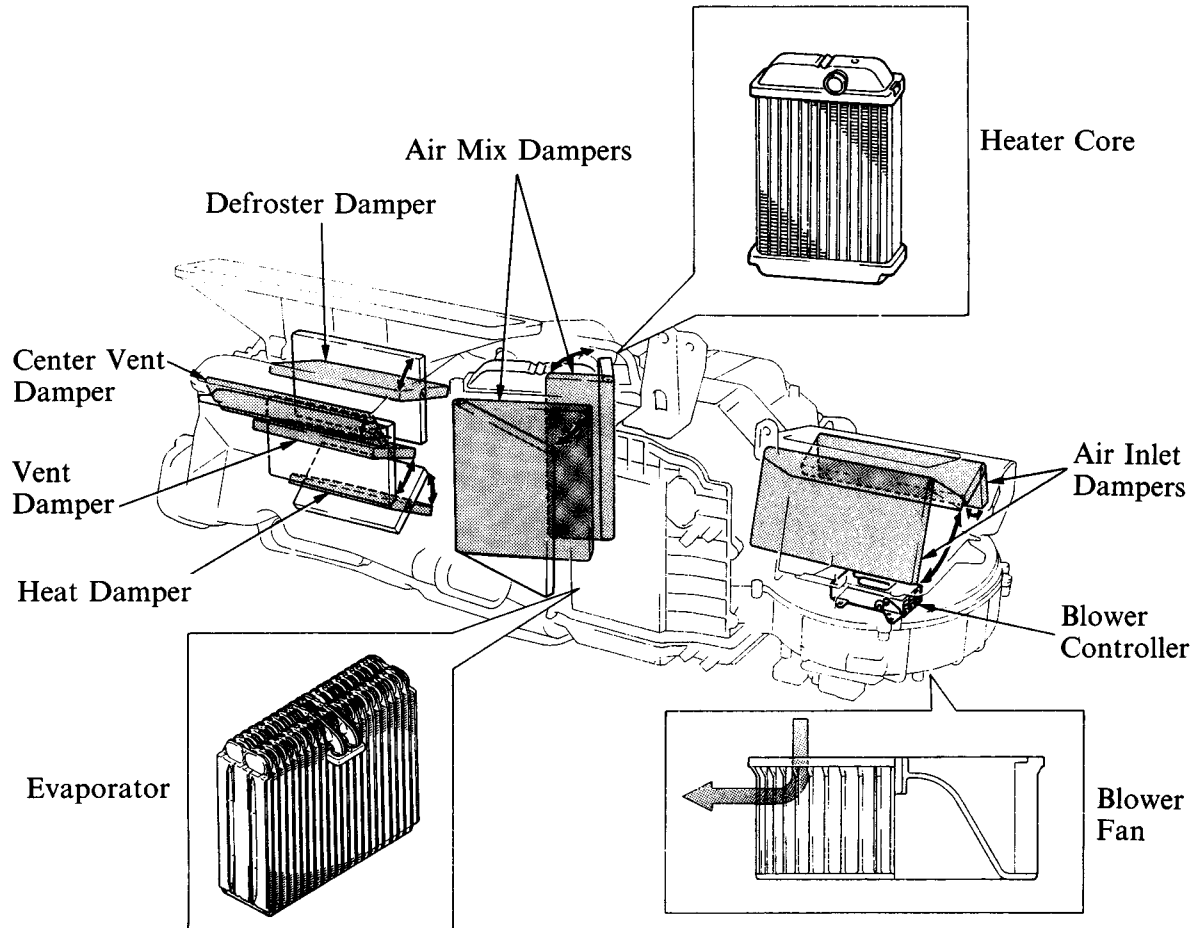


Function ◀

No.	Switch	Function
①	OFF	This switches off all controls (except rear defogger control).
②	Automatic Control	Pushing the button starts fully automatic control of the blower speed, air inlet mode, air outlet mode and compressor operation.
③	Air Inlet Control	Sets air inlet to Fresh or Recirculation mode.
④	Rear Defogger	Turns rear window defogger and mirror heaters on and off. The defogger and mirror heaters automatically turn off approx. 15 minutes after the switch is turned on.
⑤	Mode Select	The air outlet mode can be set to “face”, “bi-level”, “foot” or “foot/def.”.
⑥	Front Defroster	Fixes air outlet mode to “defroster” and also turns on blower and compressor.
⑦	Air Conditioning	Turns compressor on and off. This switch will not activate at OFF mode.
⑧	Blower	The blower speed can be set to 5 steps.
⑨	Temperature Control	By turning the dial, the set temperature can be raised or lowered by gradation of 0.5°C (or 1°F).

1. Air Condition Unit

The air conditioning unit incorporates a blower, heater and cooler units. This provides high rigidity and low ventilating resistance, and improve quietness and performance.



Blower Fan

The blower fan is large to ensure a large air flow volume (Diameter: 150mm [5.91 in.]).

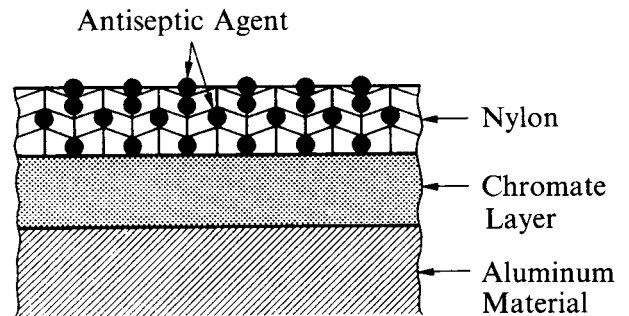
Heater Core

Made of aluminum, lightweight, and with a large capacity, it offers good heat radiation efficiency.

Evaporator

This is the same type of drawn cup type evaporator, with high heat exchange efficiency, which is used in the previous model.

In addition, the nylon coating of the evaporator surface contains antiseptic agent to prevent the propagation of germs which can cause bad odors.



Air Fan Control Dampers

The air flow made and proportions of air flow volume are adjusted by 6 dampers.

Blower Controller

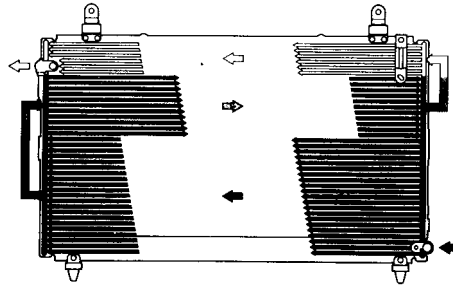
Signals from the air conditioning ECU are input into the blower controller. Then, the electrical current of the signals is modified by the signal-processing circuit of the blower controller, and the blower motor speed and rotation are regulated by the drive circuit.

Servomotors

In the same way as the previous model, the airflow control positions are changed by 3 servomotors. In the new model, the servomotors are made smaller and lighter.

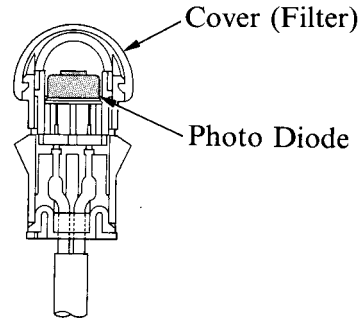
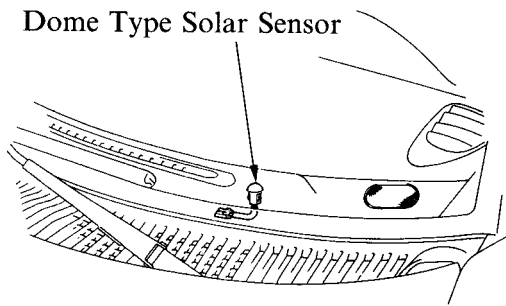
2. Condenser

By changing from the 2-pass flow type to the multi-flow type condenser, a wider heat dissipation area is obtained, thus improving its heat-exchanging efficiency.



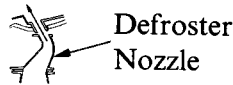
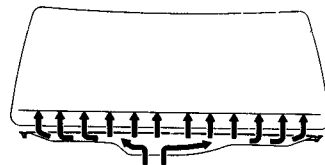
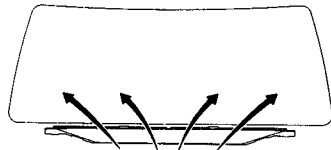
3. Solar Sensor

A dome-type solar sensor, which detects solar radiation by way of a photo diode, is used. The dome-type's sensitivity to overhead light source is lowered, and its diagonal sensitivity difference, the sensor improves the auto air-conditioning control capabilities.



4. Front Defroster Nozzle

The front defroster nozzle inner wall is modified into a radial configuration for a smoother air flow. The defroster performance is thus improved and the blower noise in the defroster mode is reduced.



New

Previous

5. Air Conditioning ECU

- Ⓡ The air conditioning ECU, attached to the upper part of the audio unit in the instrument panel, has full automatic control over the air conditioning. This system automatically regulates the servomotors and blower motor to deliver the required outlet air temperature in accordance with the set temperature.
- Ⓡ The self-diagnosis system used can be controlled and displayed on the heater control panel. Details on the main system and their functions are illustrated below.

Calculation of Required Outlet Air Temperature

After receiving the signals from the sensors and the temperature control switch setting, the air conditioning ECU uses the formula shown below to calculate the required outlet air temperature, to regulate the servomotors and blower motor. This is an outlet air temperature that is required in maintaining the set temperature in a stable manner.

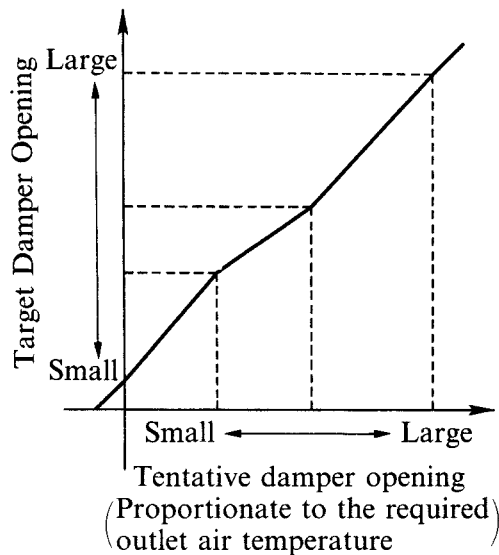
<p>Required Outlet Air Temperature =</p> $A \times TSET - B \times TR - C \times TAM - D \times TS + E$	<p>TSET = Set Temperature TR = Room Air Temperature TAM = Ambient Air Temperature TS = Solar Radiation A ~ E = Constants (Coefficient)</p>
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Temperature Control System

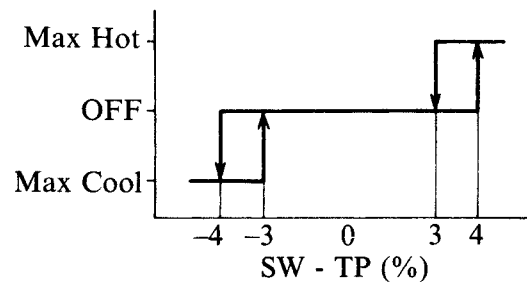
1) Air Mix Damper Control

In response to the temperature control switch setting, the required outlet air temperature, evaporator temperature sensor, and engine coolant temperature sensor compensations are used by the air mix damper control to calculate a tentative damper opening angle, through an arithmetic circuit in the air mix damper, to arrive at a target damper opening. If the difference between the target damper opening and the actual opening is 4% or more, the air mix damper control regulates the servomotor to reduce that difference to 3% or less.

Calculating the target damper opening ◀



Air Mix servomotor control ◀



{SW: Target damper opening}
 {TP: Actual damper opening}

Blower Control System

1) Blower motor startup control

When the blower motor is started up, the blower voltage in the auto mode (low speed) is output to the blower controller for 3 seconds. This is designed to protect the blower controller from a sudden startup voltage surge.

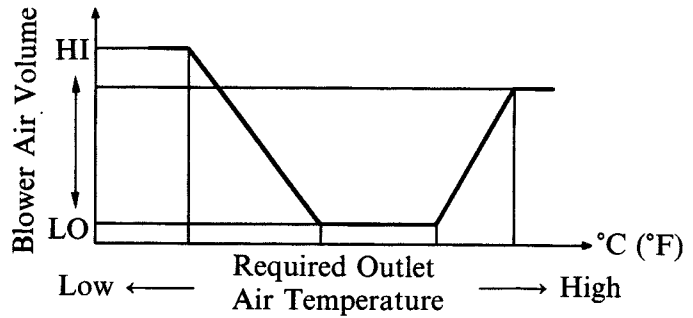
2) Manual Control

Sets the blower speed according to operation of the blower switch (5-steps)

3) Automatic Control

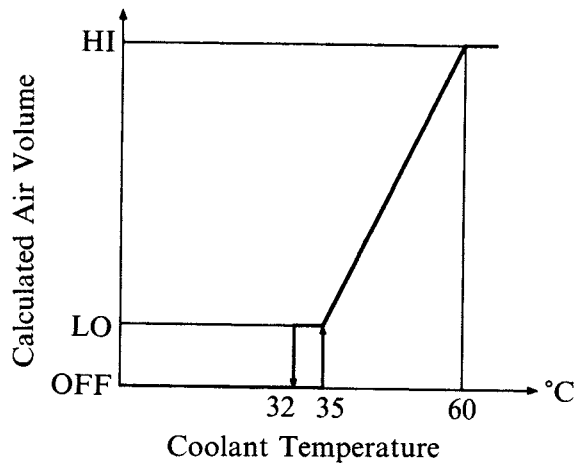
a. Stepless Air Volume Control

As shown on the right, when the AUTO switch on the heater control panel is pushed, the air conditioning ECU automatically regulates the voltage to the blower controller, in accordance with the required outlet air temperature, to deliver stepless air volume.



b. Warm-Up Control

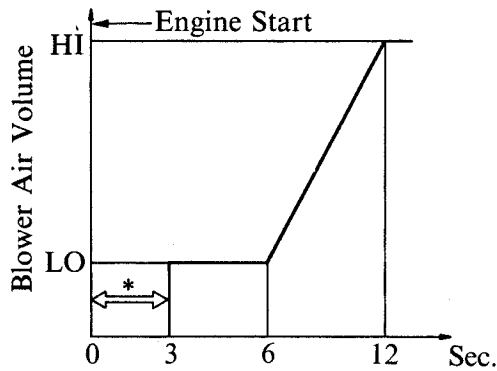
When the coolant temperature detected by the engine coolant temperature sensor is below a predetermined level and the air outlet is in the FOOT or BI-LEVEL mode, the blower does not operate. When the coolant temperature reaches 35°C (95°F), the blower motor operates at low speed. When the coolant temperature is between 35 to 60°C (95 to 140°F), the air flow calculation using the engine coolant temperature sensor signal, and, the air flow calculation using the required outlet air temperature are compared, and the lesser of the two is automatically selected as the air flow to be used. When the coolant temperature reaches 60°C (140°F) or more, the blower motor runs at high speed. Moreover, when the coolant temperature is under 32°C (89.6°F), and the warm-up control is effected (blower motor off), the air outlet is switched to the DEF mode. Later, when the blower motor turns on, the air outlet changes from the DEF mode to the FOOT or BI-LEVEL mode.



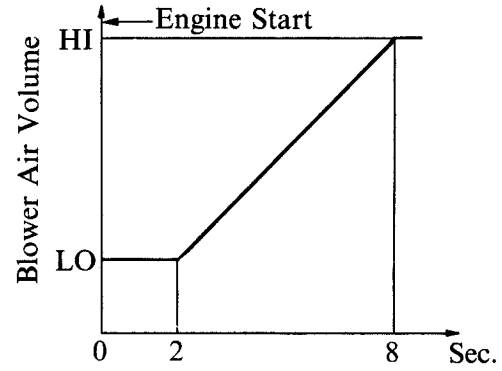
c. Time-Lagged Air Flow Control (For Cool-Down Only)

As with the current Celica, 2 types of time-lagged air flow control (in accordance with the temperature detected by the evaporator temperature sensor) help prevent hot air from being emitted from the FACE or BI-LEVEL vent.

For details, see NCF056U, page 180.



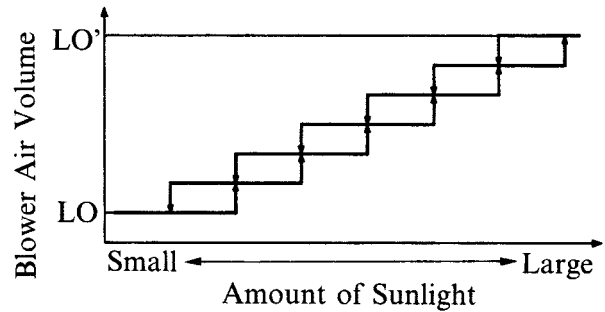
*: Blower fan is off but compressor is on.
Time-Lagged Air Flow Control
 (Temperature Inside Cooling Unit 30°C or Higher)



Normal Operation
 (Temperature Inside Cooling Unit Below 30°C)

d. Sunlight Air Flow Control

Controls the blower speed in accordance with the intensity of the sunlight when the air outlet mode is at FACE or BI-LEVEL. The blower low speed can be adjusted up to 6 steps, in response to the sunlight signal received from the solar sensor.



Air Inlet Control System

1) Manual Control

Drives the air inlet servomotor according to the operation of the air inlet control switch and fixes the dampers in the “fresh” or “recirc.” position.

2) Automatic Control

Switches the damper position between “fresh”, “fresh and recirc. mix” or “recirc.” according to the required outlet air temperature.

3) Forced Fresh Air Intake Control

When the def. switch is pushed, the air inlet setting is forced to the “fresh” mode [although it may be changed to the “recirc.” mode by pushing the recirc. switch]. If the def. switch is pushed again in this condition, the setting is returned automatically to the air inlet mode that existed immediately before the def. switch was pushed.

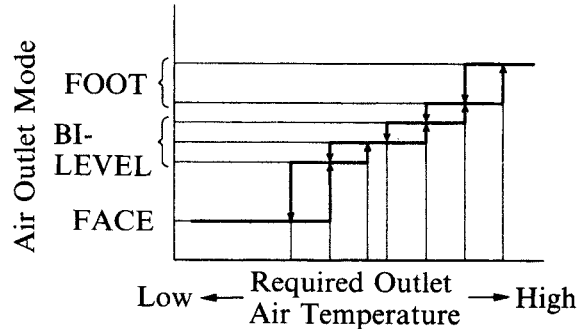
Air Outlet Control System

1) Manual Control

Drives the air outlet servomotor in accordance with the operation of the mode select and front defroster switches and fixes the dampers in the “face”, “bi-level”, “foot”, “foot and def.” or “def.” position.

2) Automatic Control

Controls the air outlet servomotor in response to the required outlet air temperature to automatically change from FACE, BI-LEVEL, and FOOT, step-by-step.



3) Def.-Foot Mode Control

During the warm-up control (the blower motor turned off) with the coolant temperature below 35°C (95°F), the air outlet control is switched from “foot” or “bi-level” to “def” mode automatically. This prevents cold air to be blown to occupants feet due to dynamic ventilation while the vehicle is running. The air outlet control is switched back to “foot” or “bi-level” mode as soon as the coolant temperature rises above 35°C (95°F).

Compressor Control System

The following table explains the functions of the compressor control system.

Item	Function
Manual Control	If the A/C switch is switched on while the blower is turned on, this turns on the magnetic clutch relay and operates the compressor.
Automatic Control	When the AUTO switch is pressed, the magnetic clutch relay is turned on.
Def. Linked Control	When the front defroster switch is turned on, the magnetic clutch relay is activated automatically to engage the compressor. Also, when the blower is turned off, and the front defroster switch is turned on, the blower will turn on in the automatic control condition.
Refrigerant Pressure Malfunction Detection	By monitoring the pressure switch signal this system can judge the refrigerant pressure to be abnormal, and turns off the compressor magnetic clutch relay, if the pressure switch remains off.
Compressor Lock Detection	An engine rpm signal (3 pulses per revolution) is sent from the igniter to the ECU. The ECU also receives a compressor rpm signal (1 pulse per revolution) when the compressor is turned on. The ECU compares these two signals constantly to calculate the slip ratio. If a slip ratio is higher than 80% for over 3 seconds, the ECU judges that the compressor is locking and turns the magnetic clutch off. At the same time, the ECU blinks the A/C switch indicator light to warn the driver (blinking can be stopped by pushing the A/C switch).

Rear Defogger Control

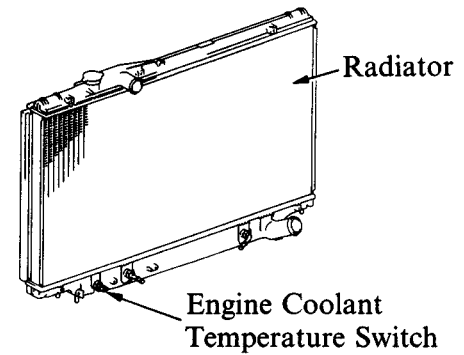
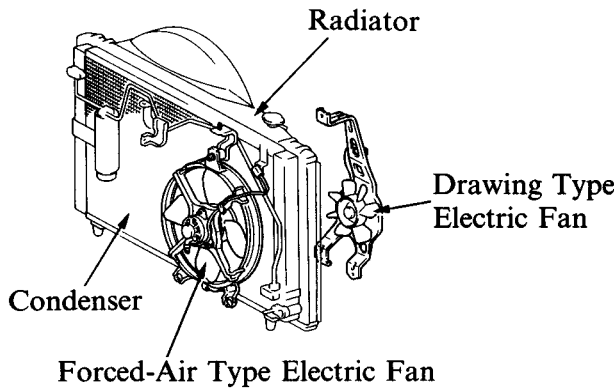
Switches the rear defogger and outside rear view mirror heaters on for 15 minutes when the rear defogger switch is switched on. Switches them off if the switch is pressed while they are operating.

Electric Fans Control

The new Toyota Supra with the 2JZ-GTE engine is equipped with an electric fan which draws the air towards the engine, and the A/T model is equipped with an electric fan in front of the radiator that forces the air through the radiator.

These electric fans operate when either the pressure switch or the engine coolant temperature switch is opened, while the ignition switch is turned ON.

The engine coolant temperature switch located on the radiator lower tank detects the coolant temperature in order to control the electric fan operation.

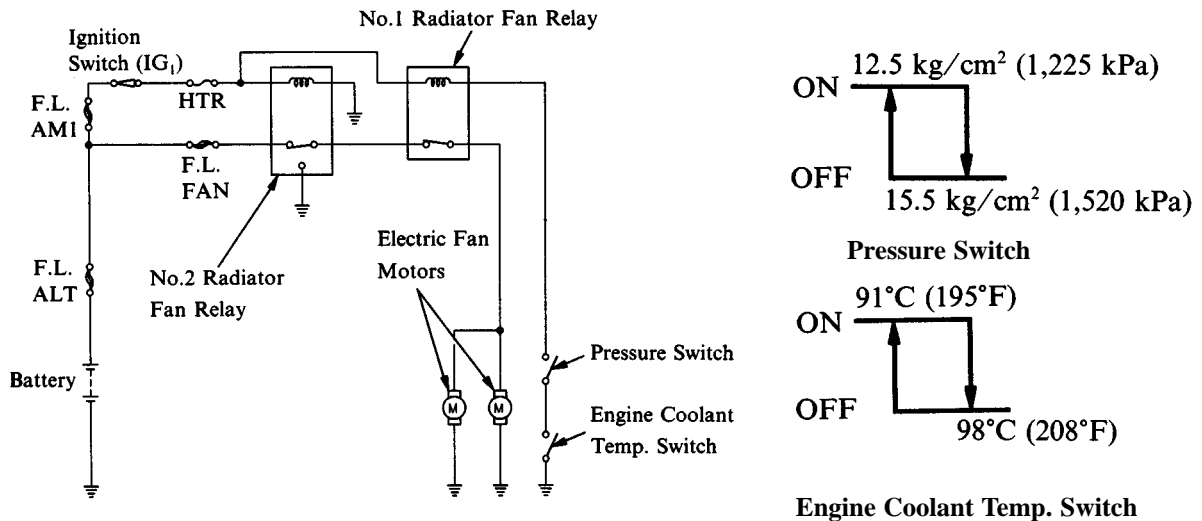


1. Operation

While the ignition switch is turned ON, the electric fan motors operate when No. 1 radiator fan relay closes. The closing of this relay is accomplished by either one of the following conditions:

- a. The refrigerant pressure rises above 15.5 kg/cm² (1,520 kPa) and causes the pressure switch to open.
- b. The engine coolant temperature rises above 98°C (208°F) causes the engine coolant temperature switch to open.

Wiring Diagram



Self-Diagnosis

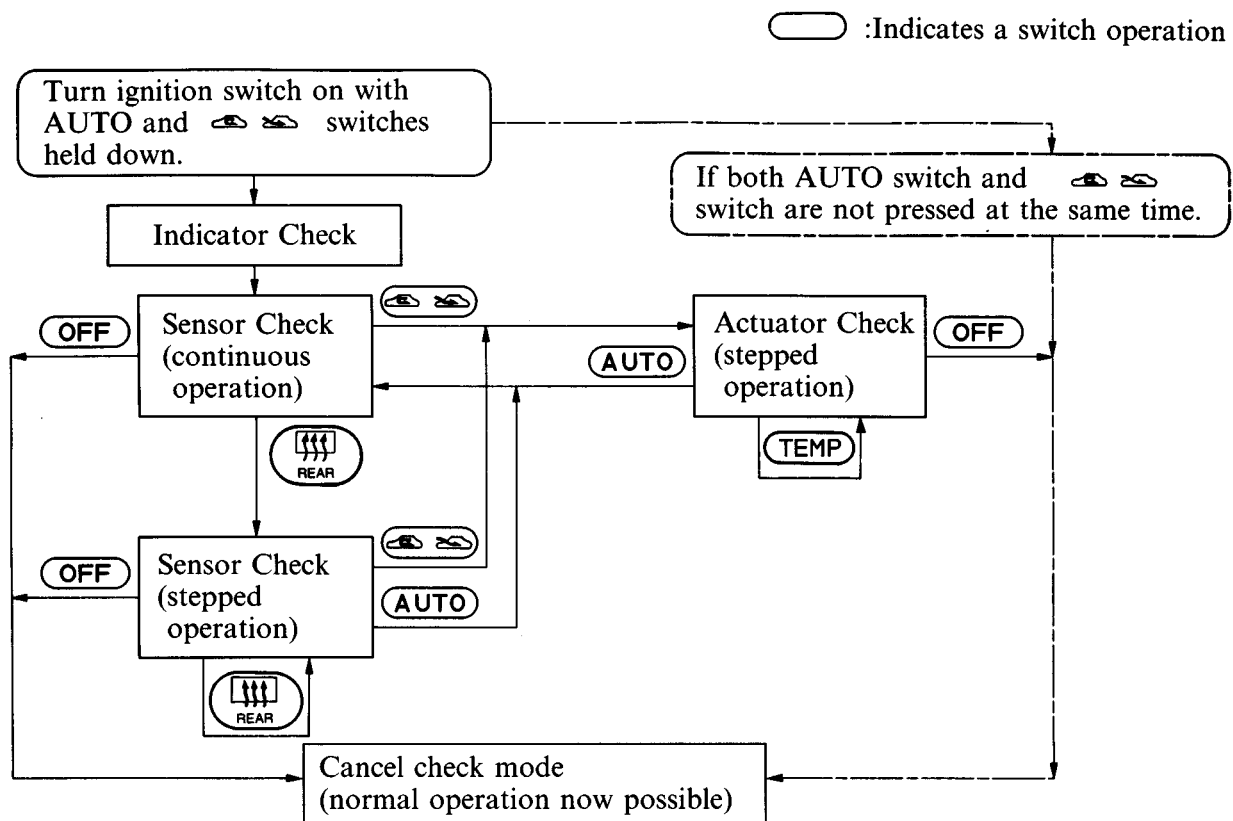
The self-diagnosis function stores any malfunction in memory if the sensors or actuators fail. The locations and descriptions of those malfunctions can be accessed through the malfunction display output (blinking indicator lights) by operating the heater control panel.

1) Function

Check Item	Function
Indicator Check	Checking the operation of the switch indicator lights.
Sensor Check	Checking the past and present malfunctions of the sensors, and clearing the past malfunction data.
Actuator Check	Output of actuator check pattern.

2) Indicator, Sensor and Actuator Checking Procedure

The check function can be started by the following procedure shown below:



For details on the indicator check, sensor check and actuator check functions of this system, refer to the '93 Toyota Supra Repair Manual (Pub. RM343U2).

ACCESSORIES

® DESCRIPTION

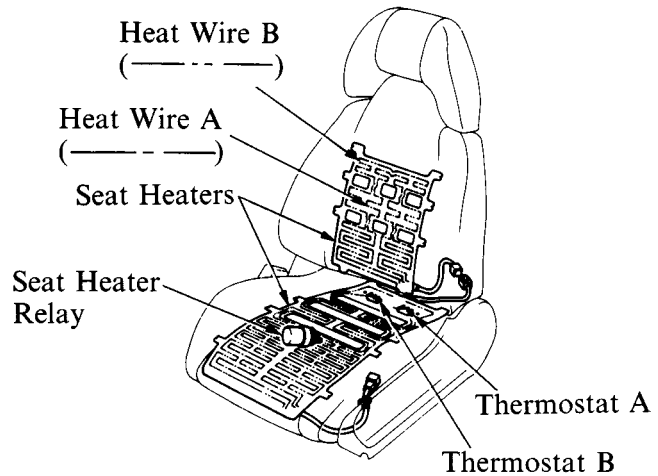
The new Toyota Supra includes the accessory systems shown in the following table.

System	Outline
Power Window	As in the previous model, “one-touch operation”, in which the drivers’s door window can be fully opened by pressing the power window switch once, is offered. The basic construction and operation are the same as in the previous model.
Door Lock Control System	The functions of this system are basically the same as in the previous model, except that the the door lock actuator has been changed from the solenoid type to the motor type. The basic construction and operation of the motor type door lock actuator are the same as in the Celica and other models. For details, see Pub. No. NCF 056U (for '90 Celica), page 144.
Theft Deterrent System	As in the previous model, when an attempt is made to forcibly enter the vehicle or open the hood or luggage compartment door without a key, or when the battery terminals are removed and reconnected, this system sounds the horn and flashes the headlights and tail-lights for about 1 minute to alert the owner. At the same time, it locks all the doors and electrically disconnects the starter. The basic construction and operation are the same as in the previous model.
Power Seat	As in the previous model, a power seat, equipped with fore-and-aft slide and reclining adjustments, is provided for the driver. The basic construction and operation of the adjusting mechanism are the same as that of the driver’s seat in the previous model.
Seat Heater	A 2-stage seat heater is used in the front seats. Unlike the previous model, the high and low heater output temperature changes are no longer made by the seat heater switch. In the new model, these changes are made by 2 thermostats which are detect temperature changes. For details, see next page 249.
Outside Rear View Mirrors	The outside rear view mirrors are the electrical remote control type, the same as in the previous model. Heaters are also included in the outside rear view mirror which are linked to the rear window defogger.
SRS Airbags	The SRS airbag is provided for the driver and front passenger. The supplementary restraint systems have been designed to help protect the upper bodies of the driver and front passenger against secondary impact or injuries caused by a frontal collision. For details, see next page 249.
Cruise Control System	The vacuum type actuator in the previous model is replaced by a motor type actuator (used in the GT-S and All-Trac/4WD grade current Celica models). The basic construction and system operation are the same as in the Celica. However, the functions of the cruise control ECU has changed. For details, see page 251 and Pub. No. NCF056U, page 164.
Key Reminder System	It sounds a buzzer to warn the driver that the ignition key is still in the key cylinder. This helps prevent the driver from getting locked out. The basic construction and operation are the same as in the previous model.

® SEAT HEATER

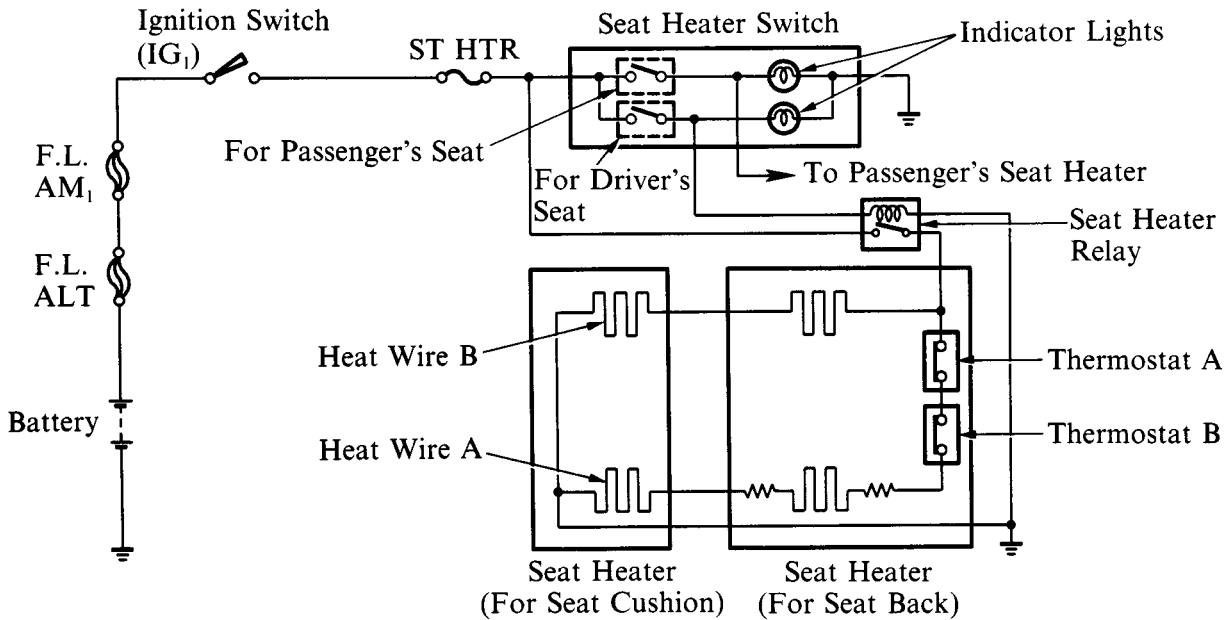
1. General

As shown on the right, the seat heater has 2 separate heating element circuits, A and B. It also contains 2 thermostats which automatically direct the heat output to high or low.



2. Wiring Diagram and Operation

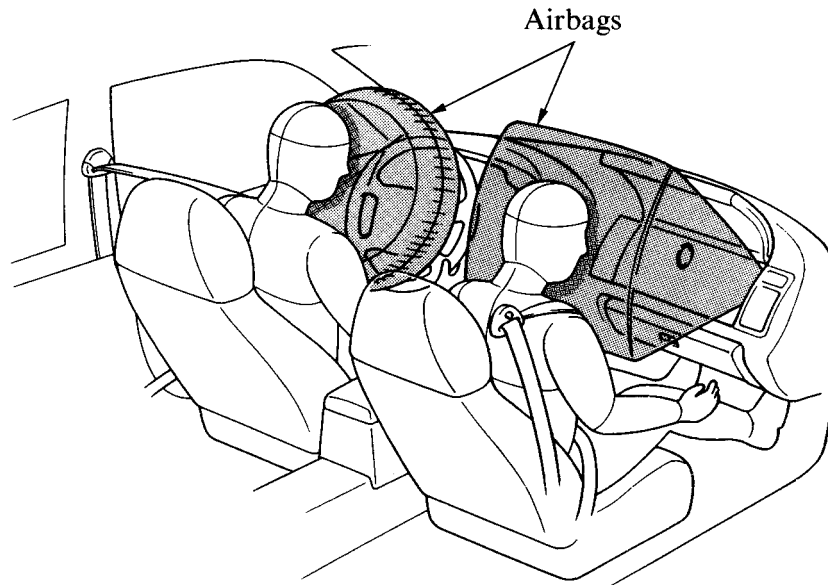
When the seat heater switch is turned on, the seat heater relay is activated, and applies current to heating elements A and B to quickly (high operation) warm up the seat. Once the seat temperature rises, and the surface temperature of the thermostats A and B reaches approximately 40°C (104°F), the thermostats A and B are turned off, disrupting the current flow to the heating element A. Accordingly, the seat is warmed only by the heating element B, generating a low heat output. When the seat temperature drops, and the the surface temperature of the thermostats A and B reaches approximately 30°C (86°F), the thermostats A and B are turned on, applying current to the heating element A.



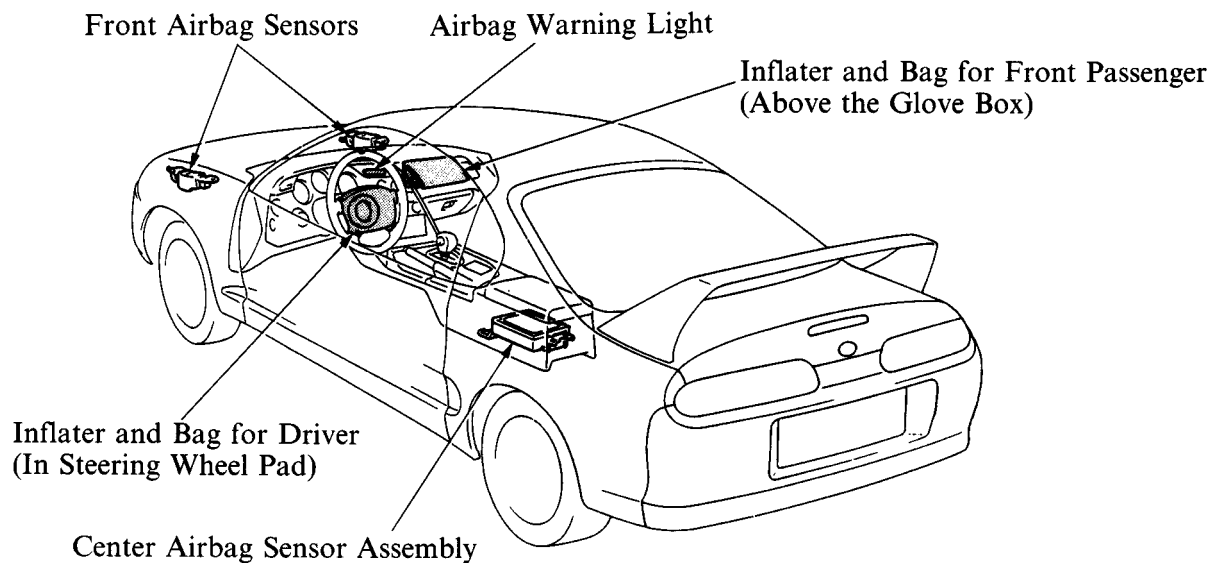
® SRS AIRBAG

1. General

- Besides the SRS airbag for the driver, and SRS airbag for the front passenger has been introduced in the new models. In case of a frontal collision, the airbag sensor senses the impact, and if the shock is higher than a predetermined value, it causes the airbag located above the glove box on the passenger side to inflate, easing the impact applied onto the passenger's upper body.
The driver side airbag operation remains the same as in the previous model.
- The SRS airbag system which is comprised of the driver side and passenger side airbags is controlled by the front airbag sensors and center airbag sensor assembly in the same way as in the previous model.
For details of construction and operation of the main components, except the front passenger airbag inflater and bag, see page 87 of NCF059U. The details of diagnostic functions are listed in the '93 Toyota Supra Repair Manual (Pub. No. RM343U2).

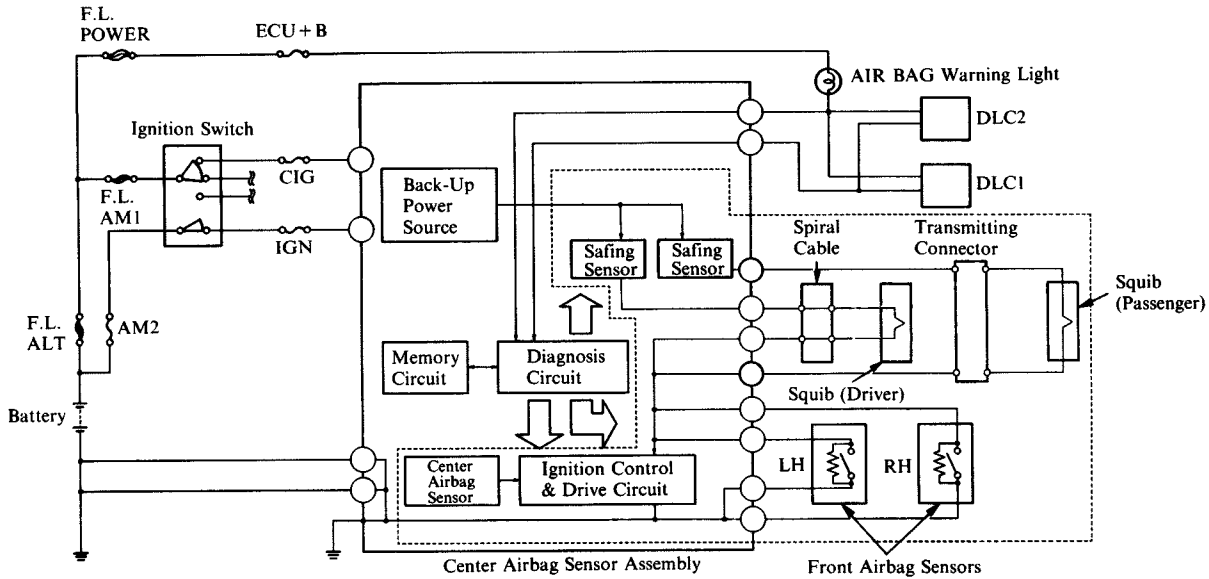


2. Layout of Components



3. Wiring Diagram

Along with the adoption of the airbag for the front passenger side, an additional squib.



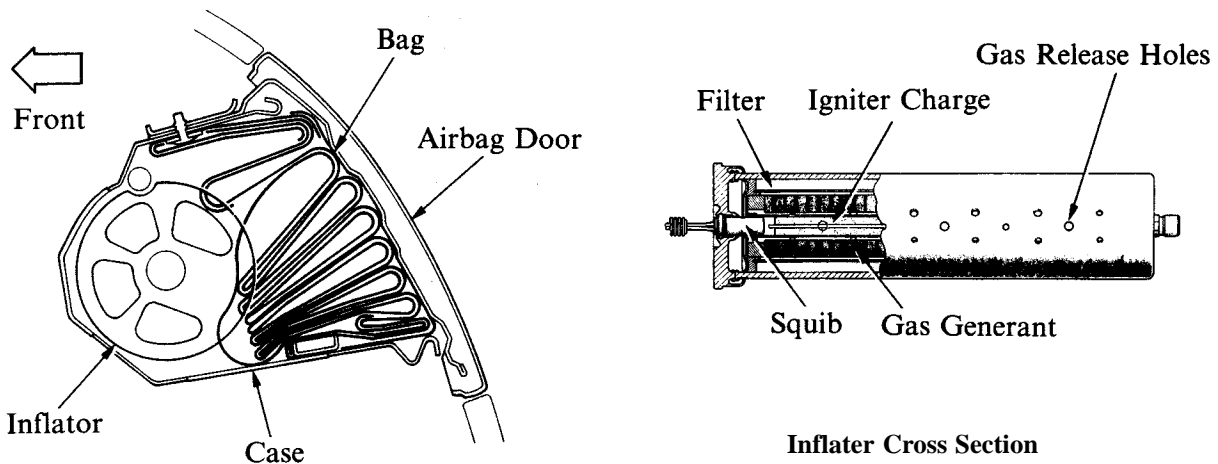
-----: Back-Up System Design Area
 ⇨: Monitoring of Malfunction

4. Construction and Operation

Inflator and Bag for Front Passenger

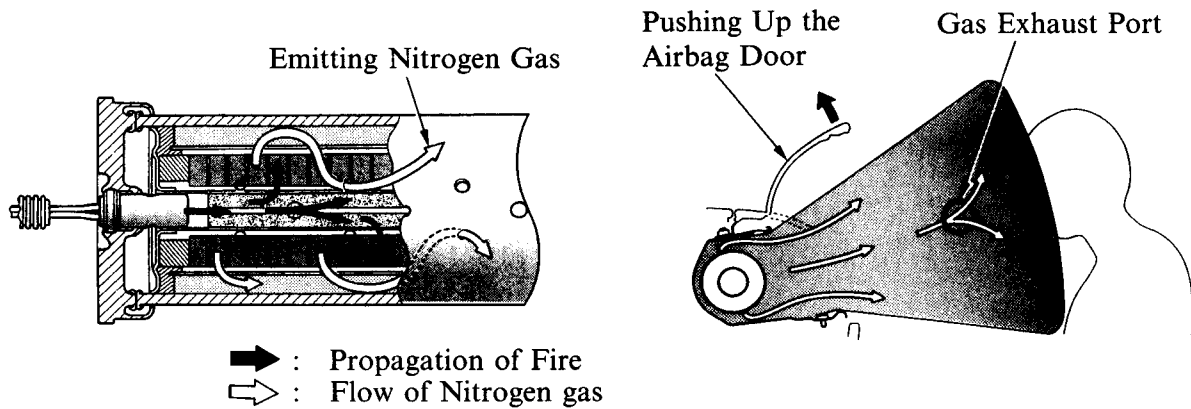
1) Construction

The inflator is comprised of a squib, igniter charge and gas generant. These components are completely sealed within a metal container. The bag is made of strong nylon cloth, and becomes inflated by the nitrogen gas generated by the inflator. The inflator and bag are integrated inside the case and airbag door, and located in the upper part of the glove box.



2) Operation

The sudden velocity decrease caused by a frontal collision engages the airbag sensors. Electric current then ignites the squib located in the inflator, which in turn ignites the gas generant. This produces nitrogen gas, which passes through a filter and fills the bag. The expanding bag causes the airbag door to open, then fully inflates to ease the impact to the passenger.



® Cruise Control

1. General

The new Toyota Supra uses the same motor type actuator as that used in the GT-S and All-Trac/4WD grades of the current Celica. The basic construction and system operation are the same as in the Celica, but the functions of the cruise control ECU are changed follows:

- The cruise control ECU features tap-down and tap-up control in addition to the previous functions. Also, the control methods for the manual and auto-cancel functions are partially modified.
- In addition to the changes made in the warning indication method of the power indicator light, the diagnostic trouble codes for self-diagnostic and activation methods for the input signal check have been modified.

◀ Functions ▶

□ : Changed ■ : Newly Added

Function of the Cruise Control ECU					
1	Constant Speed Control	6	Low Speed Limit Control	11	Magnetic Clutch Control
2	Set	7	High Speed Limit Control	12	Diagnosis
3	Coast	8	Automatic Transaxle Control	13	Fail Safe
4	Accel	9	Manual Cancel	14	Tap-Down Control
5	Resume	10	Auto Cancel	15	Tap-Up Control

2. Cruise Control ECU

Tap-Down Control Function

When the difference between the actual vehicle speed and the set speed is less than 5 km/h (3 mph), the set speed can be lowered approximately 1.5 km/h (1 mph) each time by operating the SET/COAST switch quickly.

Tap-Up Control Function

When the difference between the actual vehicle speed and the set speed is less than 5 km/h (3mph), the set speed can be increased approximately 1.5 km/m (1 mph) each time by operating the RES/ACC switch quickly.

Manual Control Function (modified areas indicated by “*”)

If any of the following signals is sent to the cruise control ECU while the vehicle is running in the cruise control mode, the magnetic clutch of the actuator goes off and the motor is energized in the throttle closing direction. The cruise control mode is cancelled accordingly.

- Stop light switch ON signal (Brake pedal depressed)
- * Clutch switch ON → OFF signal (Clutch pedal depressed)
- Parking brake switch ON signal (Parking brake lever operated)
- Main switch OFF signal
- Cancel switch ON signal of the control switch (Control switch pulled on)
- * Park/Neutral switch ON → OFF signal (transmission shifted to positions other the 'D')

Auto Cancel Function

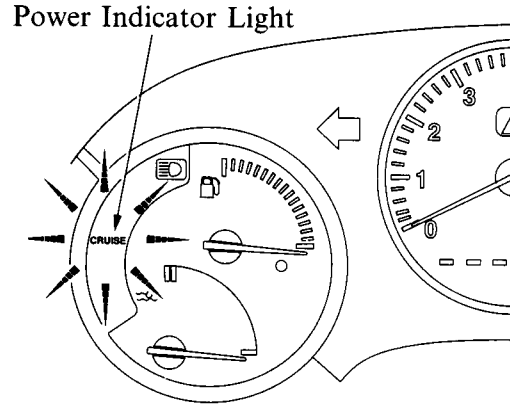
When the vehicle is being driven under cruise control, if any of the conditions listed below is present, the vehicle speed stored in memory is deleted, the control is lifted, the current to the actuator is disrupted, and the power indicator light is made to flash. The methods to reactivate the cruise control at that time, in accordance with that particular condition (malfunction category A or B), are classified in the chart below. Other auto cancel functions are basically the same as those of the previous model.

Conditions	Malfunction Category	How to reactivate
<input type="radio"/> Continuous current applied to the motor's acceleration output. <input type="radio"/> The motor did not move. <input type="radio"/> Voltage abnormality in control switch.	A	Turn off the ignition switch, and turn it back on. Then turn on the main switch.
<input type="radio"/> Excessive current flowed to the motor or magnetic clutch drive transistor. <input type="radio"/> Open circuit in magnetic clutch. <input type="radio"/> An open or short circuit in the potentiometer system <input type="radio"/> The vehicle speed signal is not sent for a predetermined period of time (approx. 140 msec.) <input type="radio"/> The vehicle speed is equal to the set speed minus approximately 16 m/h (10mph) or below. <input type="radio"/> Short circuit in the control switch.	B	Turn the main switch back on.

Diagnosis I Function

1) Warning Indication

- When the cruise control ECU does not receive a vehicle speed signal for a pre-determined period of time during cruising, or when cruise control is cancelled (auto cancel) by a malfunction in the control switch or actuator, the ECU immediately blinks the power indicator light on the combination meter on and off consecutive to alert the driver of the system malfunction. The contents of the malfunctions are coded and stored in the cruise control ECU.



- When the power indicator light is flashing, and the cruise control is released by pressing on the main switch, the power indicator light will be turned off. When the main switch is turned back on, and the cruise control driving is resumed, the power indicator light output pattern, as shown below, differs according to the malfunction categories A or B (see the previous page). When a category A malfunction is occurring, the power indicator light will flash again, but if it a category B malfunction, the indicator light will remain on, indicating that the system is operating.

◀Power Indicator Light Blinking Pattern (Consecutive)▶

Condition		Actuator current is off.		Actuator current is on.	
Operation Method					
Main Switch	ON	[Pulse]		[Pulse]	
	OFF	[Pulse]		[Pulse]	
Power Indicator Light	A*	ON	[Pulse train with 0.5 sec. interval]	[Pulse train with 0.5 sec. interval]	
		OFF	[Pulse train with 2.0 sec. interval]	[Pulse train with 2.0 sec. interval]	
	B*	ON	[Pulse train]	[Pulse train]	
		OFF	[Pulse train]	[Pulse train]	

*: "A" and "B" indicate the malfunction categories

2) Diagnostic Trouble Code Indication and Input Signal Check Function

The basic functions are the same as the previous model, but the diagnosis functions are changed as follows:

- The diagnosis details of Code Nos. 11 and 12 among the self-diagnostic items have changed.
- The function have been added to diagnose and indicate malfunction of the cruise control ECU (Code Nos. 13, 14, 41 and 42), and Code Nos. 22 and 31 have been discontinued.
- The setting method of the input signal check mode has been changed.

For details of inspection and repair procedures, see '93 Toyota Supra Repair Manual (Pub. No. RM343U2).

4. Appendix

MAJOR TECHNICAL SPECIFICATIONS

Item	Area	U.S.A.				
Body Type		2-Door Liftback (Standard Roof)		2-Door Liftback (Sport Roof)		
Vehicle Grade		—				
Model Code		JZA80L-ALMVFA	JZA80L-ALPVFA	JZA80L-AJMVFA	JZA80L-AJPVFA	
Major Dimensions & Vehicle Weights	Overall	Length mm (in.)	4515 (177.8)	←	←	←
		Width mm (in.)	1810 (71.3)	←	←	←
		Height mm (in.)	1265 (49.8)	←	←	←
	Wheel Base	mm (in.)	2550 (100.4)	←	←	←
	Tread	Front mm (in.)	1520 (59.8)	←	←	←
		Rear mm (in.)	1525 (60.0)	←	←	←
	Effective Head Room	Front mm (in.)	953.2 (37.5)	←	946.8 (37.3)	←
		Rear mm (in.)	834.5 (32.9)	←	←	←
	Effective Leg Room	Front mm (in.)	1117.0 (44.0)	←	←	←
		Rear mm (in.)	605.1 (23.8)	←	←	←
	Shoulder Room	Front mm (in.)	1376.3 (54.2)	←	←	←
		Rear mm (in.)	1113.2 (43.8)	←	←	←
	Overhang	Front mm (in.)	950 (37.4)	←	←	←
		Rear mm (in.)	1015 (40.0)	←	←	←
	Min. Running Ground Clearance	mm (in.)	120 (4.7)	←	←	←
	Angle of Approach	degrees	13	←	←	←
	Angle of Departure	degrees	17	←	←	←
	Curb Weight	Front kg (lb)	758 (1670)	767 (1690)	771 (1700)	780 (1720)
Rear kg (lb)		701 (1545)	710 (1565)	714 (1575)	723 (1595)	
Total kg (lb)		1458 (3215)	1476 (3255)	1486 (3275)	1504 (3315)	
Gross Vehicle Weight	Front kg (lb)	921 (2030)	←	←	←	
	Rear kg (lb)	1009 (2225)	←	←	←	
	Total kg (lb)	1930 (4255)	←	←	←	
Fuel Tank Capacity	L (U.S. gal., Imp. gal.)	70 (18.5, 15.4)	←	←	←	
Luggage Compartment Capacity	cu. ft. (m ³)	—	—	—	—	
Performance	Max. Speed	km/h (mph)	150 (93)	←	←	←
	Max. Cruising Speed	km/h (mph)	120 (75)	←	←	←
	Acceleration	0 to 100 km/h sec.	6.8	7.4	6.8	7.4
		0 to 400 m sec.	15.2	15.7	15.2	15.7
	Max. Permissible Speed	1st Gear km/h (mph)	54 (34)	61 (38)	54 (34)	61 (38)
		2nd Gear km/h (mph)	94 (58)	112 (70)	94 (58)	112 (70)
		3rd Gear km/h (mph)	139 (86)	—	139 (86)	—
		4th Gear km/h (mph)	—	—	—	—
Turning Diameter (Outside Front)	Wall to Wall m (ft.)	11.5 (38)	←	←	←	
	Curb to Curb m (ft.)	10.9 (36)	←	←	←	
Engine	Engine Type	2JZ-GE		←	←	
	Valve Mechanism	24 Valve, DOHC		←	←	
	Bore x Stroke	mm (in.) 86.0 x 86.0 (3.39 x 3.39)		←	←	
	Displacement	cm ³ (cu. in.) 2997 (183)		←	←	
	Compression Ratio	10.0 : 1		←	←	
	Carburetor Type	SFI [EFI]		←	←	
	Research Octane No.	RON 96		←	←	
	Max. Output (SAE-NET)	kW/rpm (HP @ rpm) 164 / 5800 (220 @ 5800)		←	←	
Max. Torque (SAE-NET)	N·m/rpm (lb-ft @ rpm) 285 / 4800 (210 @ 4800)		←	←		
Engine Electrical	Battery Capacity (5HR)	Voltage & Amp. hr. 12 – 52		←	←	
	Alternator Output	Watts 1080		←	←	
	Starter Output	kW 1.4		←	←	
Chassis	Clutch Type	Dry, Single Plate		←	←	
	Transmission Type	W58		A340E	W58	A340E
	Transmission Gear Ratio	In First	3.285	2.804	3.285	2.804
		In Second	1.894	1.531	1.894	1.531
		In Third	1.275	1.000	1.275	1.000
		In Fourth	1.000	0.705	1.000	0.705
		In Fifth	0.783	—	0.783	—
		In Sixth	—	—	—	—
	In Reverse	3.768	2.393	3.768	2.393	
	Counter Gear Ratio	4.272		←	←	
	Differential Gear Size	(in.) 200		←	←	
	Brake Type	Front	Ventilated Disc		←	←
		Rear	Ventilated Disc		←	←
	Parking Brake Type	Dual-Servo		←	←	
	Brake Booster Type and Size	(in.) Tandem 8" + 9"		←	←	
Proportioning Valve Type	P & B Valve		←	←		
Suspension Type	Front	Double Wishbone		←	←	
	Rear	Double Wishbone		←	←	
Stabilizer Bar	Front	STD		←	←	
	Rear	STD		←	←	
Steering Gear Type	Rack & Pinion		←	←		
Steering Gear Ratio (Overall)	17.5 : 1		←	←		
Power Steering Type	Integral Type		←	←		

* : Electronically Controlled Transmission with an intelligent sporty control

