

FOREWORD

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

Applicable models: GSJ10, GSJ15 series

This manual is divided into 3 sections.

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

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

CAUTION	A potentially hazardous situation which could result in injury if instructions are ignored.
NOTICE	Damage to the vehicle or components may occur if instructions 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.
• 2007 FJ Cruiser Repair Manual	RM0240U
• 2007 FJ Cruiser Electrical Wiring Diagram	EM0240U

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.

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EXTERIOR APPEARANCE



0240MO01Z



0240MO02Z

NEW MODEL OUTLINE

MODEL CODE

GSJ15 L - GKFSKA

1
2
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8

1	BASIC MODEL CODE		
	CODE	ENGINE	DRIVE TYPE
	GSJ10	1GR-FE	2WD
	GSJ15		4WD

5	GEAR SHIFT TYPE
	F : 6-Speed Manual, Floor A : 5-Speed Automatic, Floor

2	STEERING WHEEL POSITION
	L : Left-Hand Drive

6	GRADE
	S : SR

3	MODEL NAME
	G : FJ CRUISER

7	ENGINE SPECIFICATION
	K : DOHC and SFI

4	BODY TYPE
	K : Access Door Wagon

8	DESTINATION
	A : U.S.A. and Canada

MODEL LINE-UP

DESTINATION	ENGINE	BODY TYPE	DRIVE TYPE	TRANSMISSION		
				6-Speed Manual	5-Speed Automatic	
				RA61F	A750E	A750F
U.S.A.	1GR-FE	Access Door Wagon	2WD	-	GSJ10L-GKASKA	-
U.S.A. and Canada			4WD	GSJ15L-GKFSKA	-	GSJ15L-GKASKA

EXTERIOR

Front View

- ▶ The headlights and radiator grille evoke an image of the original Land Cruiser FJ-40 series.
- ▶ The high cabin and rounded design create a modern image.



0240MO03Z

Rear View

- ▶ The quarter windows that extend partway around the rear of the vehicle and the placement of the license plate evoke an image of the original Land Cruiser FJ-40 series.
- ▶ The rear bumper creates a rugged image that suits an off road vehicle.



0240MO04Z

NEW MODEL OUTLINE

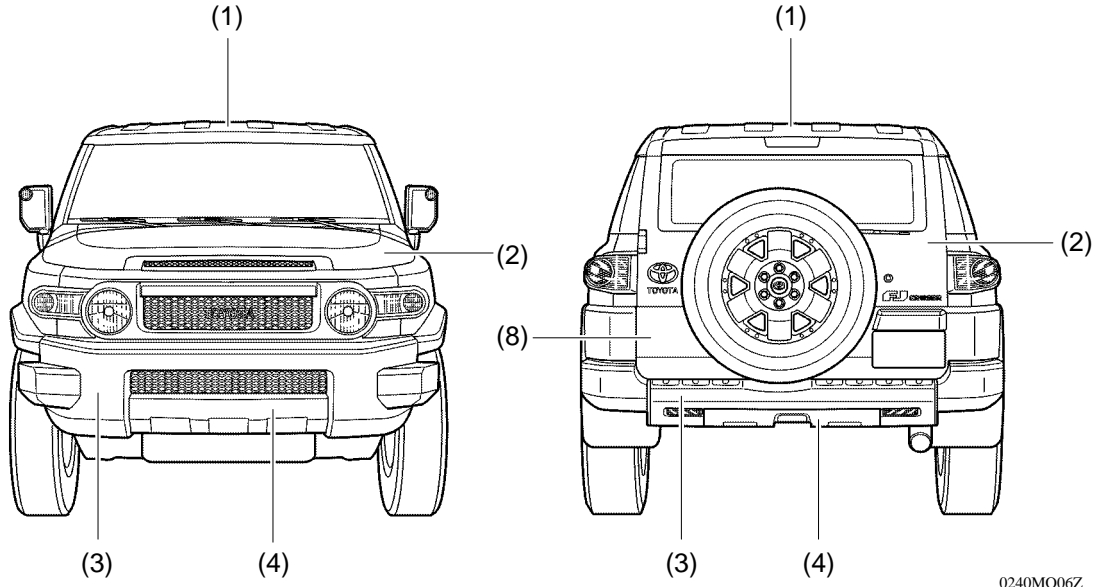
Side View

- ▶ The quarter pillar and over fenders express a sense of individuality and create a dynamic image.
- ▶ The black rocker panel area creates a three-dimensional appearance.
- ▶ The rear access doors create a stylish profile.

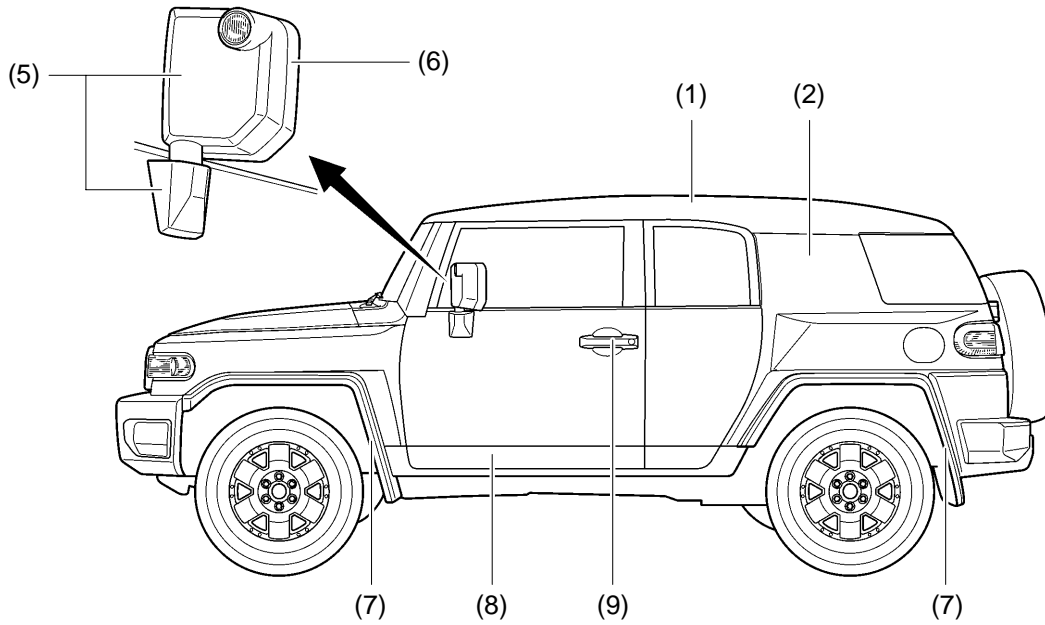


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Exterior Color



0240MO06Z

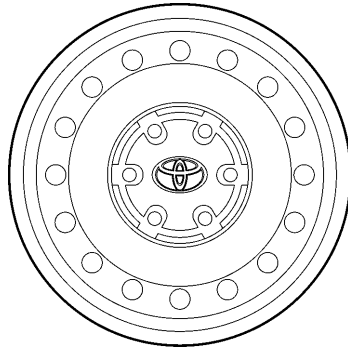
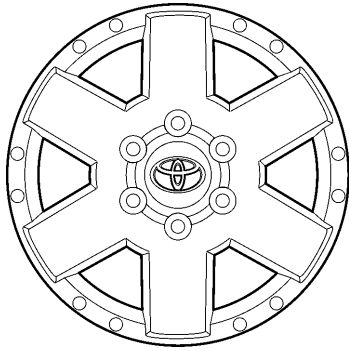


0240MO07Z

Parts	Color No.	Color Name	Parts	Color No.	Color Name
(1)	058	White	(4)	11CR07	Silver Metallic
(2)	1D4	Silver Metallic	(5)	11CR07	Silver Metallic
	211	Black Mica			
	3P2	Bordeaux Mica	(7)	11BK10	Black
	5A3	Yellow	(8)	11BK10	Black
	8T6	Blue	(9)	11CR07	Silver Metallic
(3)	11BK10	Black	-	-	-

NEW MODEL OUTLINE

Tire & Disc Wheel

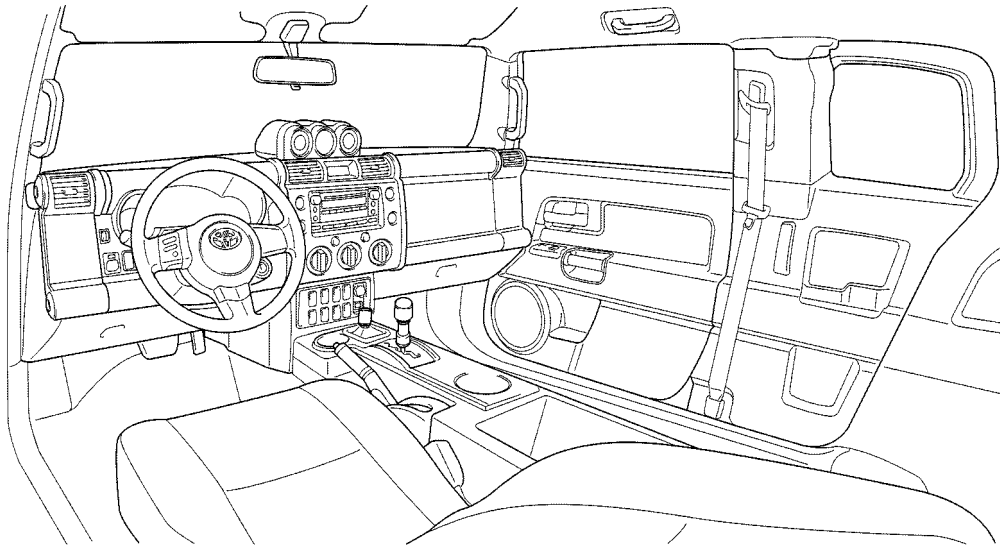
Tire Size		P265/70R17	
Disc Wheel	Size	17 × 7 1/2J	
	Material	Steel	Aluminum
P. C. D.*	mm (in.)	139.7 (5.5)	139.7 (5.5)
Off Set	mm (in.)	15 (0.6)	
Wheel Design			
		0240MO08C	0240MO09C
Equipment		Standard	Option

*: P.C.D. (Pitch Circle Diameter)

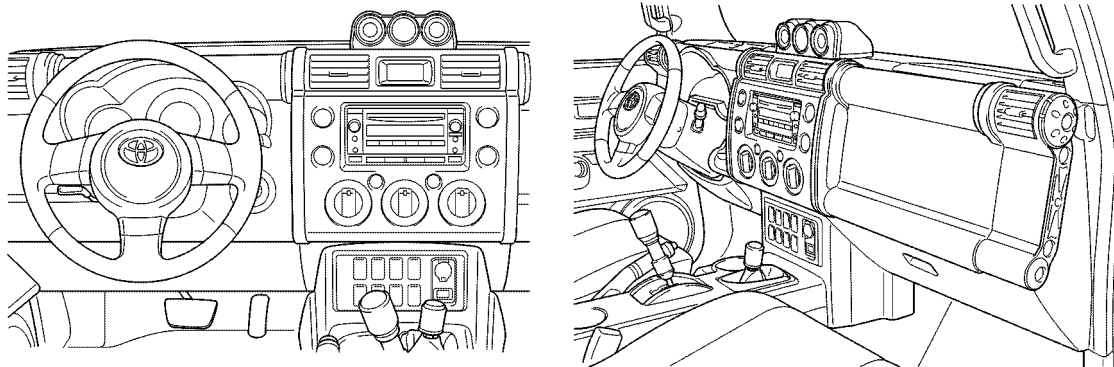
INTERIOR

The flexible cabin space and functional design give a modern rugged image to the interior.

- ▶ The instrument panel has a distinct design that creates an image of two pipes.
- ▶ The door trim panel has a straight arm rest and pipe-shaped door grip, providing both a dynamic image and usability.



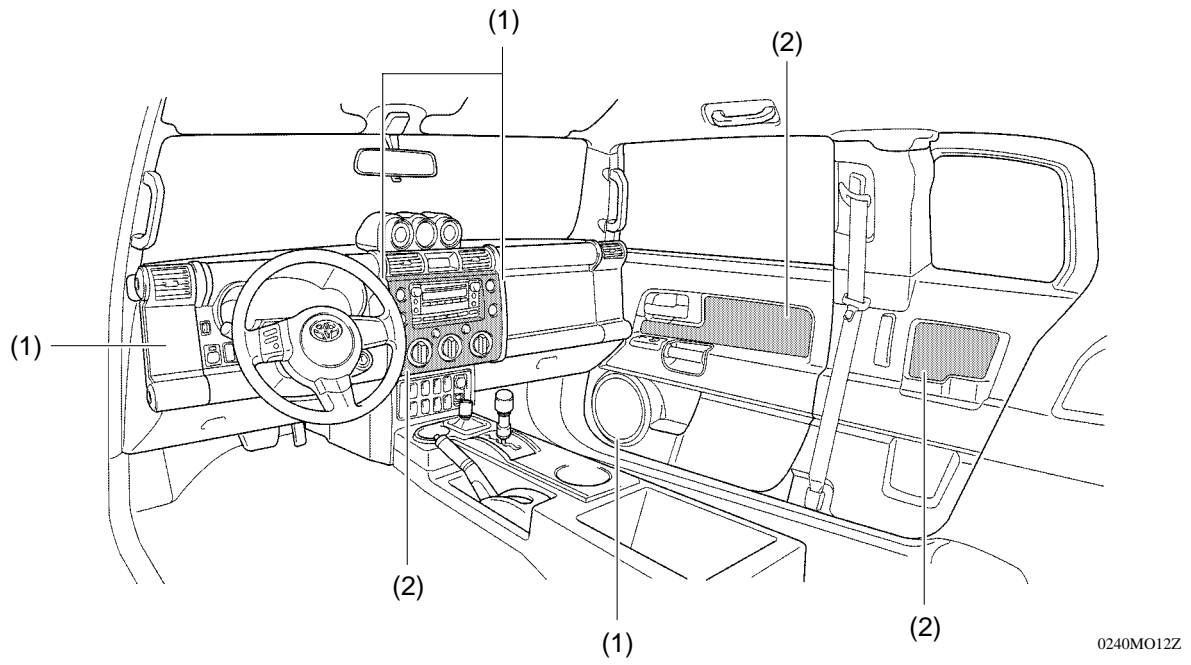
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0240MO11Z

NEW MODEL OUTLINE

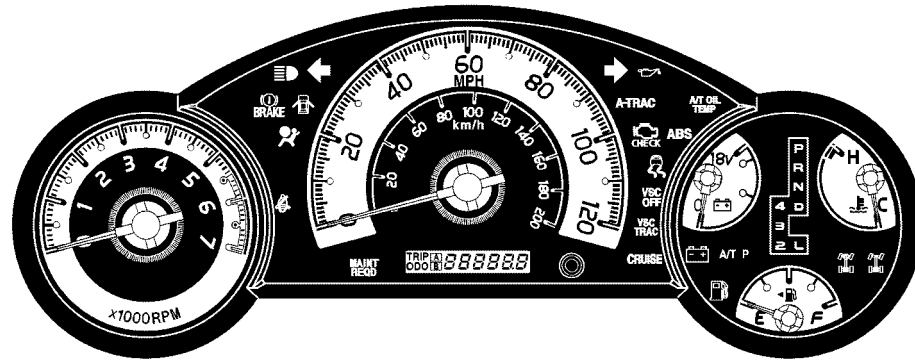
Interior Color



Color No.		Color Name	Color No.		Color Name
(1)	21SV31	Silver Metallic	(2)	3P2	Bordeaux Mica
(2)	1D4	Silver Metallic		5A3	Yellow
	211	Black Mica		8T6	Blue

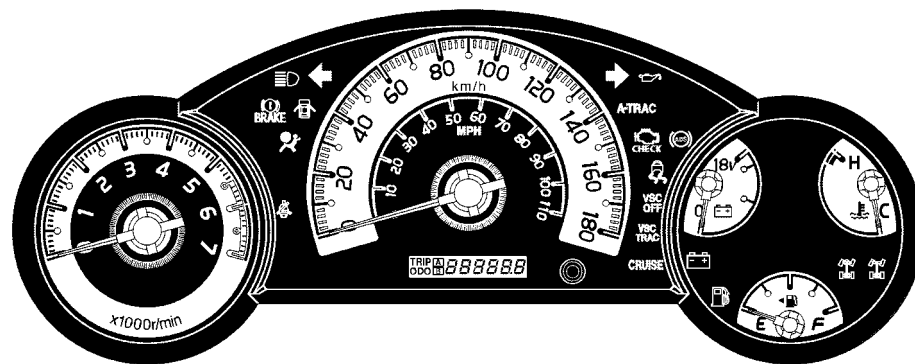
Combination Meter

The tachometer and the three (engine coolant, fuel, voltage) gauges are arranged to create a sense of individuality.



4WD models with Automatic Transmission for U.S.A.

0240MO13Z

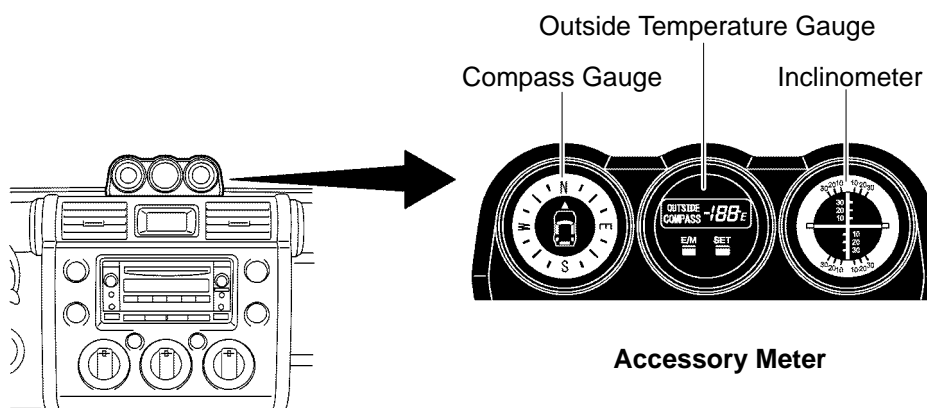


4WD models with Manual Transmission for Canada

0240MO14Z

Accessory Meter

The accessory meter with three additional gauges creates a rugged image.



Accessory Meter

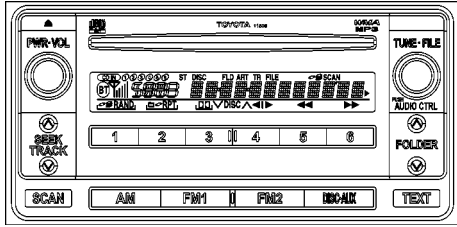
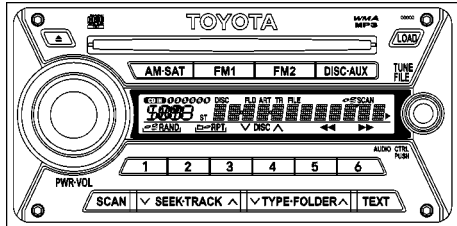
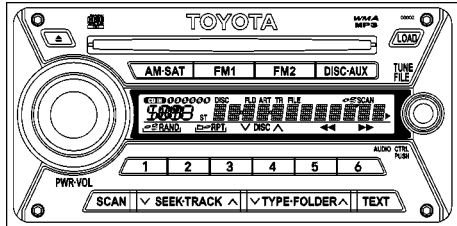
0240MO15Z

EQUIPMENT

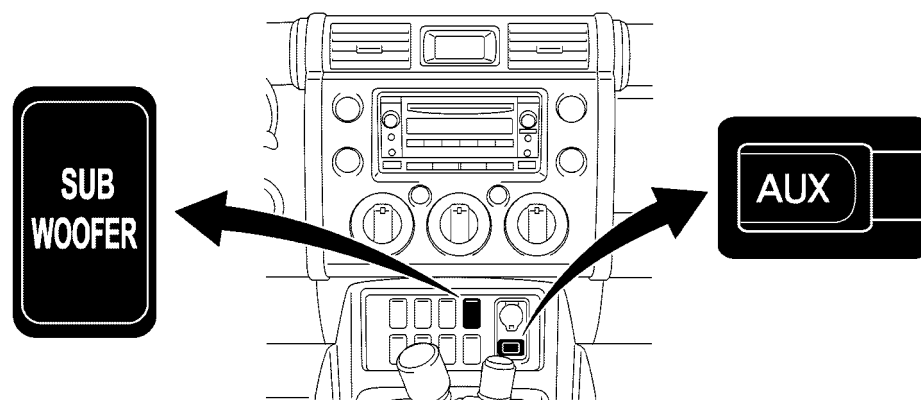
Audio System

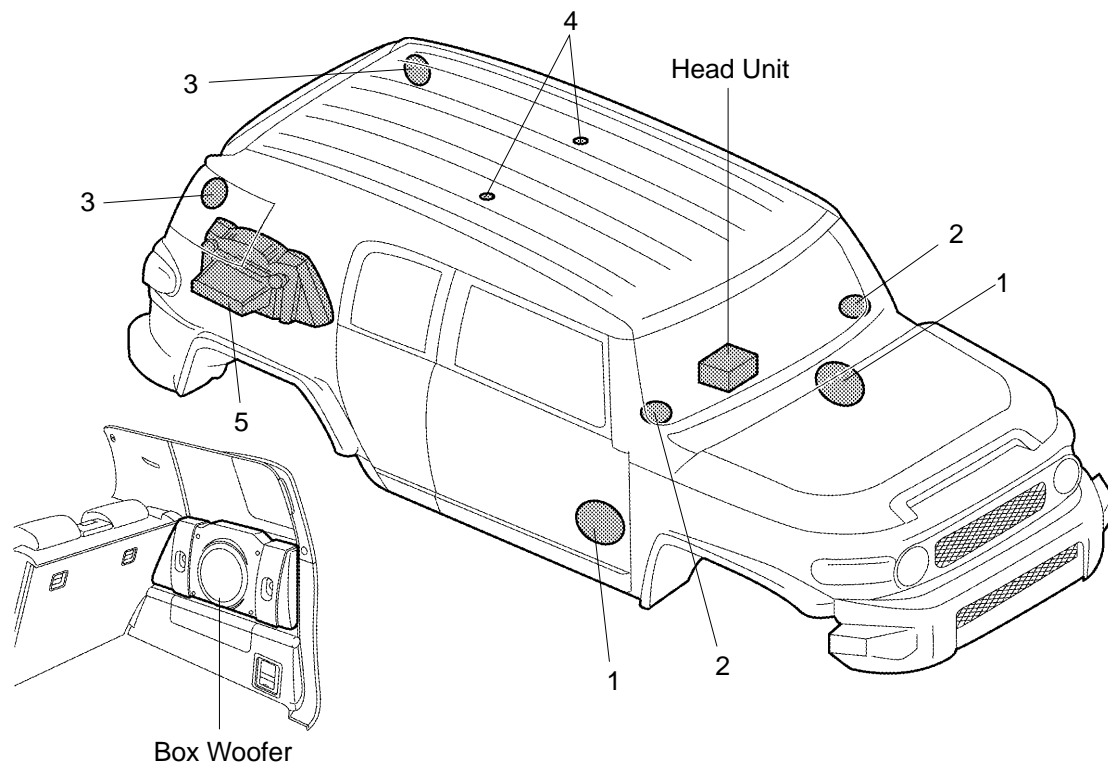
The ceiling speaker with exciter creates a space which encompasses the passenger's body with a shower of sound.

▶ Three types of audio systems are available:

Audio Head Unit Design	Audio System	Equipment
 <p>0240MO16C</p>	<ul style="list-style-type: none"> ▶ AM/FM Tuner ▶ In-dash CD ▶ Audio Head Unit: FUJITSU TEN ▶ 6-Speaker 	Standard
 <p>0240MO17C</p>	<ul style="list-style-type: none"> ▶ AM/FM Tuner ▶ In-dash 6-CD Changer ▶ Audio Head Unit: FUJITSU TEN ▶ 8-Speaker 	Option
 <p>0240MO17C</p>	<ul style="list-style-type: none"> ▶ AM/FM Tuner ▶ In-dash 6-CD Changer ▶ Audio Head Unit: FUJITSU TEN ▶ 9-Speaker 	Option

- ▶ An AUX input jack is provided as an input terminal for a portable audio device.
- ▶ A sub-woofer ON/OFF switch, which allows the user to turn the deep bass of the subwoofer on and off, is provided.



Speaker Layout

0240MO19C

Speaker Specification

Speaker (Maker)		Specification			Equipment
		Caliber	Impedance	Input Rating	
(1)	Full Range (PANASONIC)	15 × 23 cm (6 × 9 in.)	4 Ω	20 W	Standard
(2)	Tweeter (FUJITSU TEN)	6.5 cm (2.6 in.)	8 Ω	9 W	Standard
(3)	Tweeter (FUJITSU TEN)	6.5 cm (2.6 in.)	8 Ω	9 W	Option
(4)	Ceiling Speaker with Exciter (FUJITSU TEN)	-	4 Ω	20 W	Standard
(5)	Sub-woofer (FUJITSU TEN)	20 cm (8 in.)	2/1.9 Ω	60 W	Option*

*: 9-speaker system only.

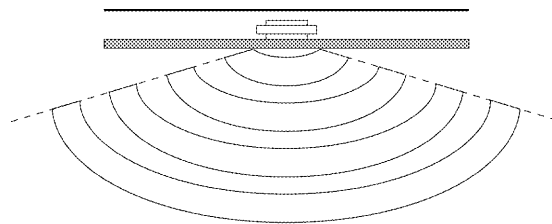
NEW MODEL OUTLINE

Ceiling Speaker with Exciter

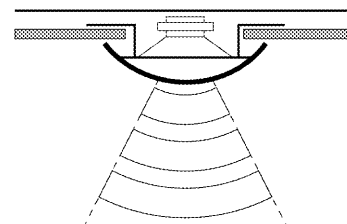
The ceiling speaker with exciter utilizes the roof headlining as a diaphragm. This speaker has the following features:

- ▶ The exciter is mounted on the roof headlining. This helps create a better soundscape which otherwise cannot be provided only by the door speakers mounted in lower positions. This widens the top of the soundscape and creates a natural acoustic space.
- ▶ The ceiling speaker with exciter has become thinner and lighter due to the adoption of the NXT flat panel speaker technology.

NXT is a trademark or registered trademark of New Transducers Limited in the UK.



Ceiling Speaker with Exciter



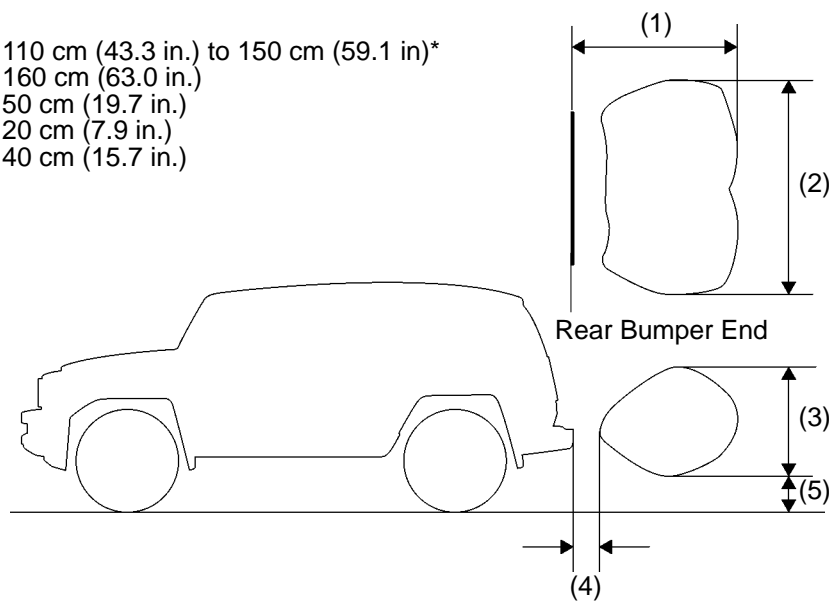
Conventional Speaker

0240MO20C

Intuitive Parking Assist System

The Intuitive parking assist system informs the driver of the approx. distance between the sensors and the obstacles relative to the vehicle by sounding a clearance warning buzzer.

- (1): Approx. 110 cm (43.3 in.) to 150 cm (59.1 in.)*
- (2): Approx. 160 cm (63.0 in.)
- (3): Approx. 50 cm (19.7 in.)
- (4): Approx. 20 cm (7.9 in.)
- (5): Approx. 40 cm (15.7 in.)



0240MO21C

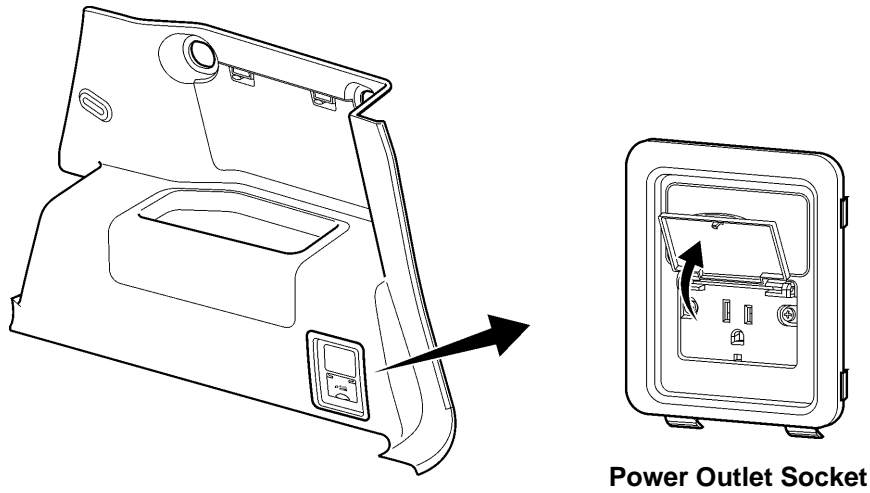
Detection Area

*: The maximum detection range will vary depending on the type of obstacles.

Power Outlet Socket

In order to meet multi-purpose outdoor needs, an AC 115 V 400 W power outlet socket is available in the right-hand deck.

► In order to protect the vehicle, the output of the power outlet socket is limited to 100 W while the vehicle is running.

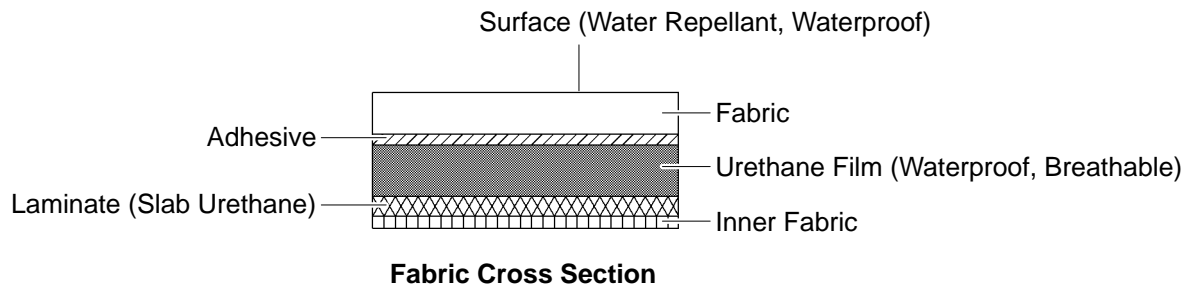
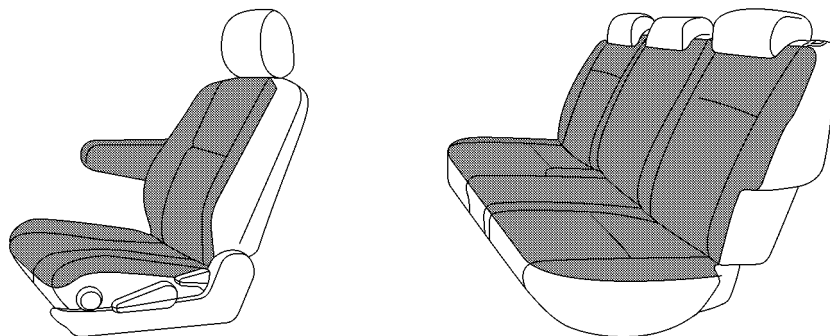


0240MO23C

Seat

A water repellant and waterproof fabric is used for the seat surface to allow easy wipe-down of dirt and water. The fabric uses a urethane film to prevent dampness. The urethane film allows the seat to “breathe”, while also preventing water from soaking in.

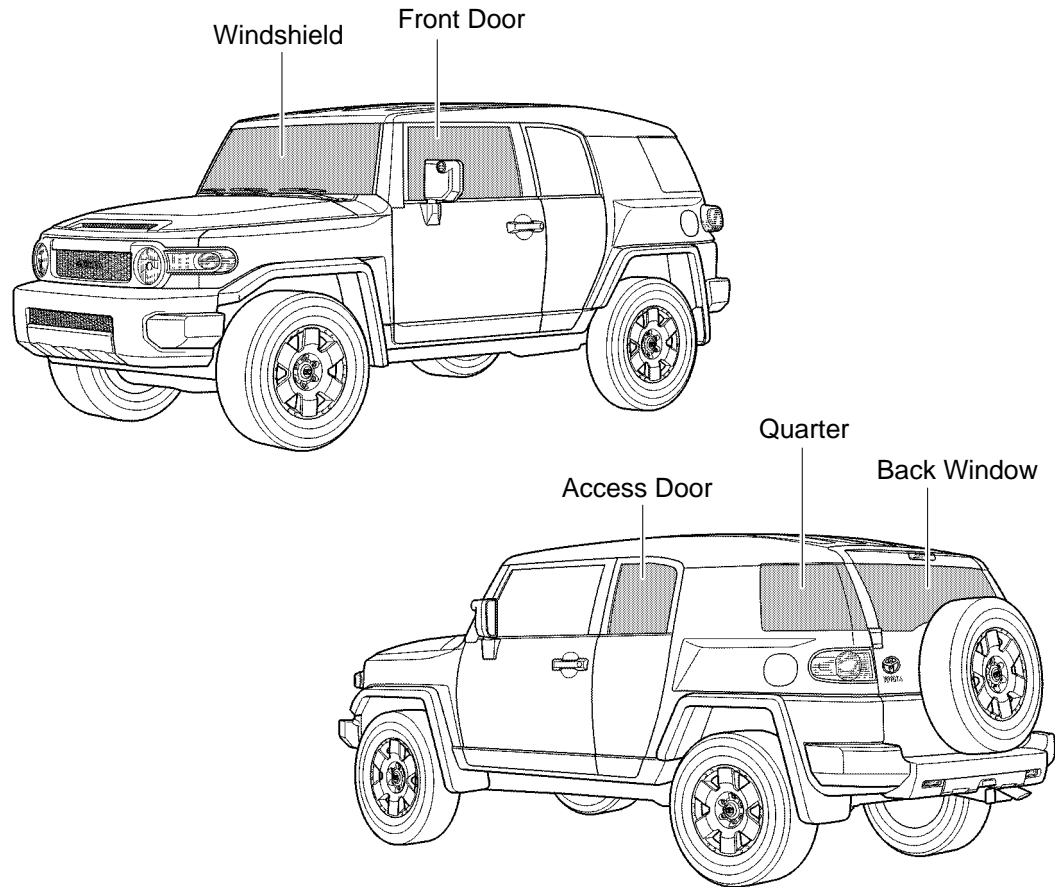
■ : Water Repellant and Waterproof Fabric



0240MO34C

NEW MODEL OUTLINE

Glass



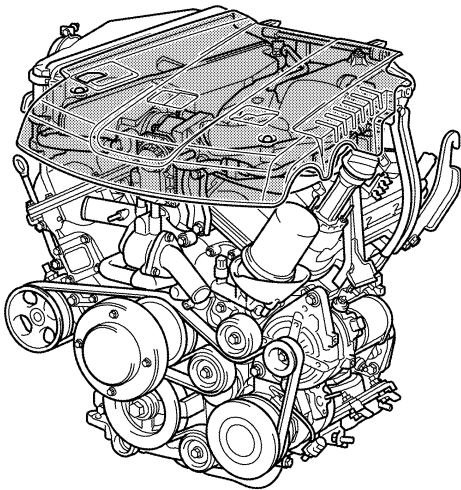
0240MO22Z

Glass Portion	Color	Glass Type	Ultraviolet Reduction Rate	Visible Light Penetration Rate	Equipment
Windshield	Green	Laminated	100 %	75 %	Standard
Front Door	Green	Tempered & UV Cut	90 %	70 %	Standard
Access Door	Green	Tempered & UV Cut	90 %	75 %	Standard
	Glau	Tempered & Privacy	95 %	20 %	Option
Quarter	Green	Tempered & UV Cut	90 %	75 %	Standard
	Glau	Tempered & Privacy	95 %	20 %	Option
Back Window	Green	Tempered & UV Cut	90 %	70 %	Standard
	Glau	Tempered & Privacy	95 %	10 %	Option

PERFORMANCE

Power Train

1GR-FE Engine



0240MO24Z



0240MO25Z

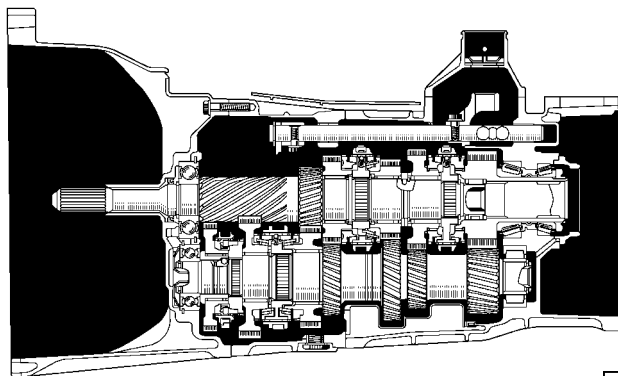
No. of Cyls. & Arrangement	6-Cylinder, V-Type
Valve Mechanism	24-Valve DOHC with VVT-i
Fuel System	SFI
Displacement	3956 cm ³ (241.4 cu. in.)
Max. Output*	178 kW @ 5200 rpm (239 HP @ 5200 rpm)
Max. Torque*	377 N·m @ 3700 rpm (278 ft·lbf @ 3700 rpm)

*: Maximum output and torque rating is determined by revised SAE J1349 standard. For detail, refer to "Major Technical Specifications".

NEW MODEL OUTLINE

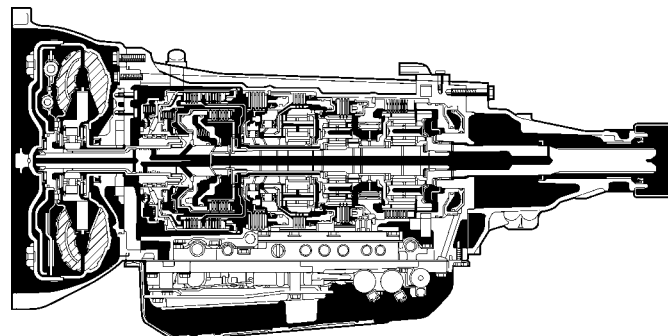
Transmission

		Manual	Automatic	
Type		RA61F	A750E	A750F
Combination with Engine		1GR-FE (4WD)	1GR-FE (2WD)	1GR-FE (4WD)
Combination with Transfer		VF4B (Full-time)	-	VF2A (Part-time)
Gear Ratio	1st	4.171	3.520	3.520
	2nd	2.190	2.042	2.042
	3rd	1.488	1.400	1.400
	4th	1.193	1.000	1.000
	5th	1.000	0.716	0.716
	6th	0.799	-	-
	Reverse	3.607	3.224	3.224



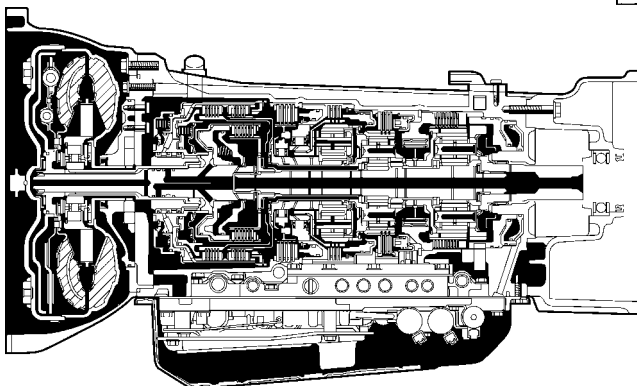
276PD06

RA61F Manual Transmission



0240CH73C

A750E Automatic Transmission



0240CH74C

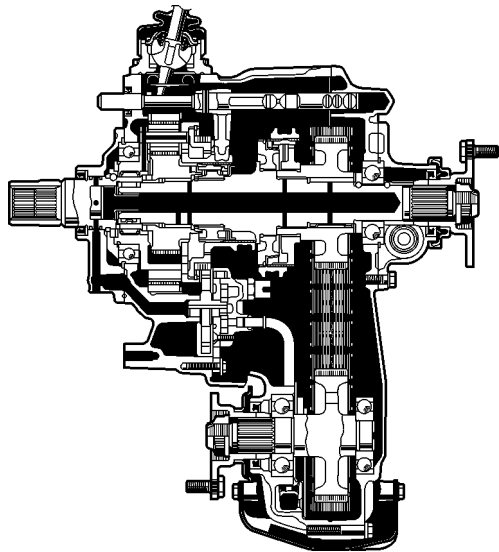
A750F Automatic Transmission

Transfer (4WD Models)

Type		VF2A (Part-time)	VF4B (Full-time)
Combination with Transmission		A750F AT	RA61F MT
Gear Ratio	H2/H and H4/HL	1.000	1.000
	L4/LL	2.566	2.566
Center Differential Type		-	TORSEN*1 LSD
A.D.D.*2		With	-

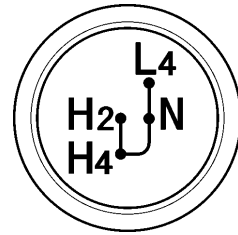
*1: TORSEN is JTEKT CORPORATION's registered trademark.

*2: Automatic Disconnecting Differential



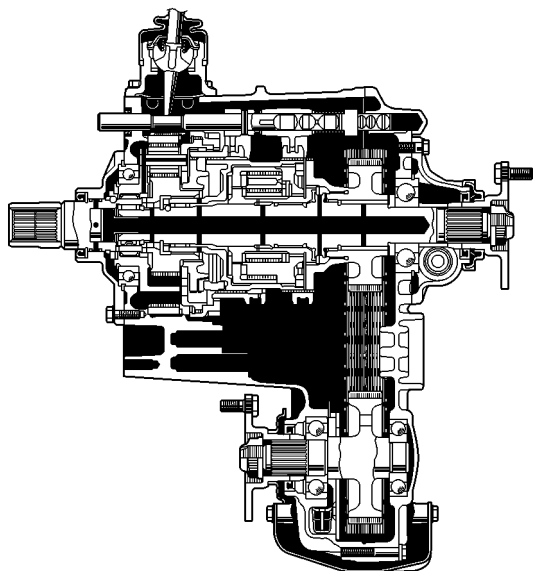
0240MO35C

VF2A (Part-time)



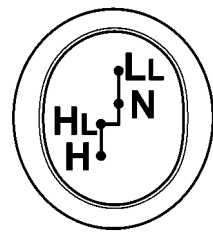
0240MO26C

Shift Pattern



233CH23

VF4B (Full-time)



233CH24

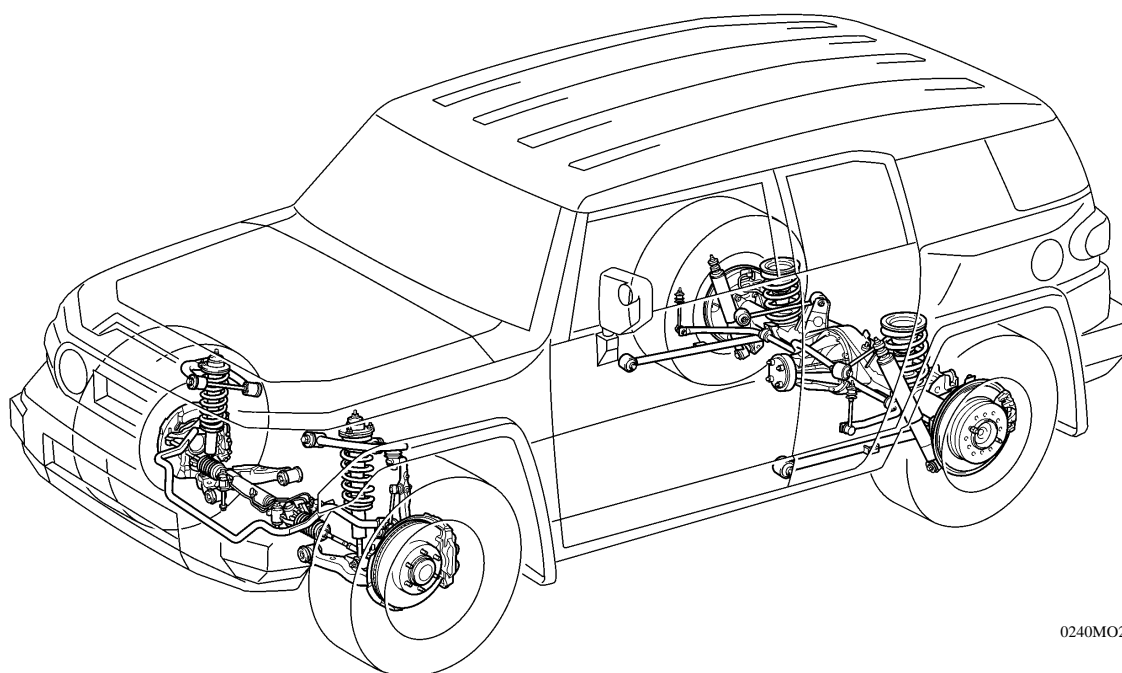
Shift Pattern

NEW MODEL OUTLINE

Chassis

Suspension

Front Suspension Type	Double Wishbone Type Independent Suspension
Rear Suspension Type	4-link Coil Spring with Lateral Rod Type Suspension



0240MO27Z

Steering

Type	Hydraulic Power Steering
------	--------------------------

Brake

Model		2WD	4WD (MT)	4WD (AT)
Front Brake	Type	Ventilated Disc	Ventilated Disc	Ventilated Disc
	Rotor Size	319 (12.6) mm (in.)	319 (12.6) mm (in.)	319 (12.6) mm (in.)
Rear Brake	Type	Ventilated Disc	Ventilated Disc	Ventilated Disc
	Rotor Size	312 (12.3) mm (in.)	312 (12.3) mm (in.)	312 (12.3) mm (in.)
Brake Booster		Hydraulic	Hydraulic	Hydraulic
Brake Control System	Standard	ABS with EBD, Brake Assist, TRAC, AUTO LSD, VSC	ABS with EBD, Brake Assist, TRAC, VSC	ABS with EBD, Brake Assist, TRAC, VSC
	Option	-	A-TRAC*	A-TRAC*

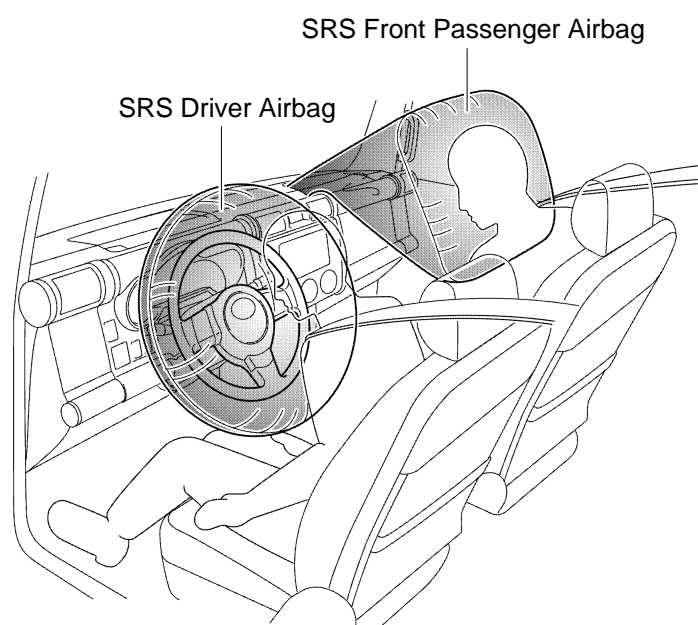
*: A-TRAC option includes a rear differential lock.

SAFETY

SRS Airbag System

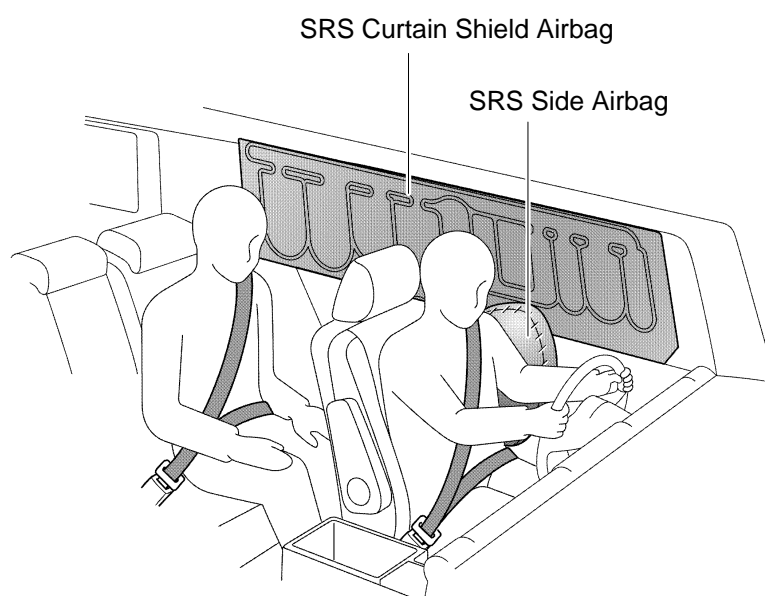
The SRS (Supplemental Restraint System) driver and front passenger airbags are used to help reduce shocks to the head and chest of the driver in the event of frontal impact collision and as supplements to the seat belts.

- ▶ The deployment force of the SRS driver and front passenger airbags is optimally controlled in dual-stages, in response to the following information:



0240MO32Z

The SRS side and curtain shield airbags are used to help reduce shocks to the head and chest of the driver, front passenger, and rear outer passenger in the event of side impact collision.



0240MO33Z

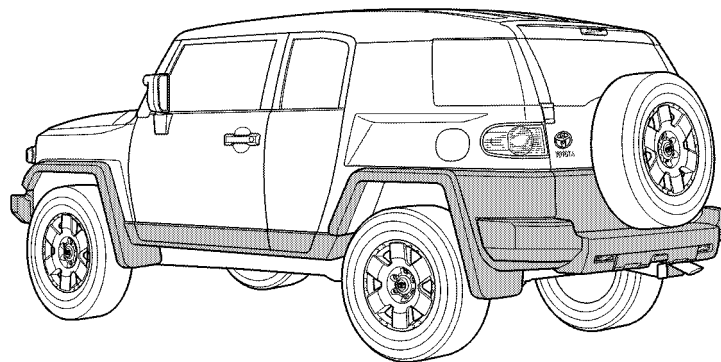
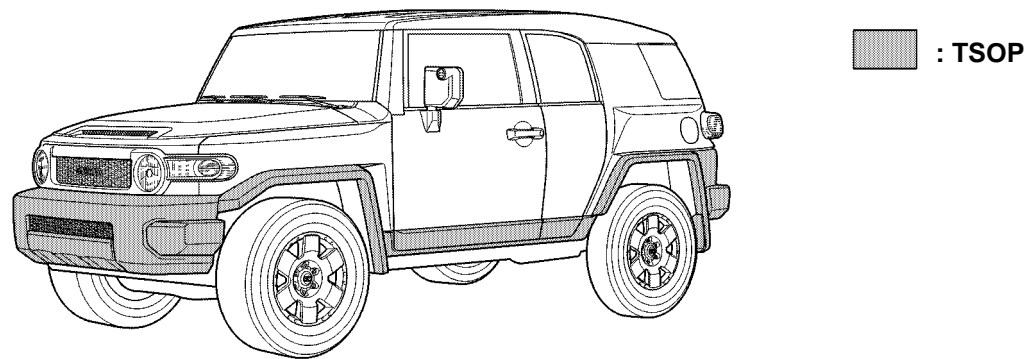
NEW MODEL OUTLINE

ENVIRONMENT

Recycling

TSOP (TOYOTA Super Olefin Polymer), which can easily be recycled, is used for many parts.

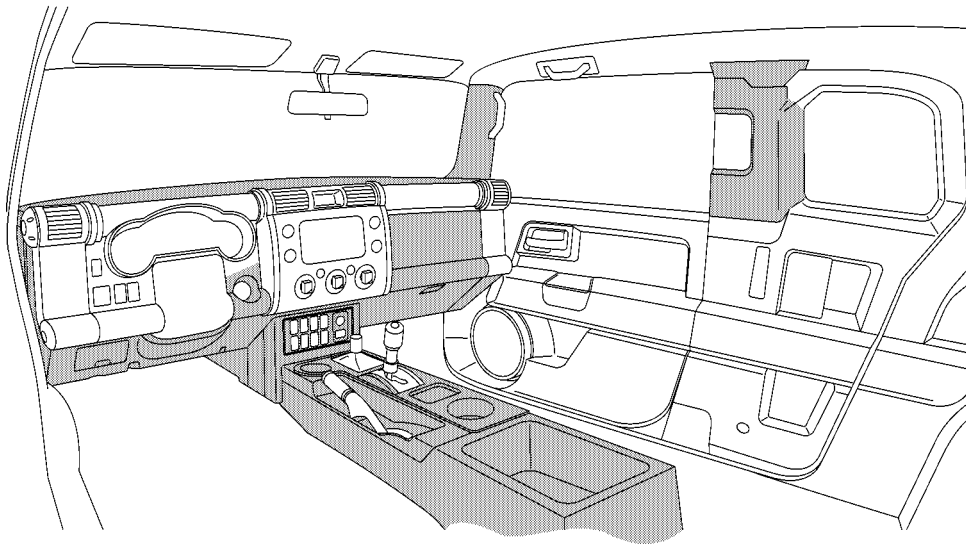
Exterior



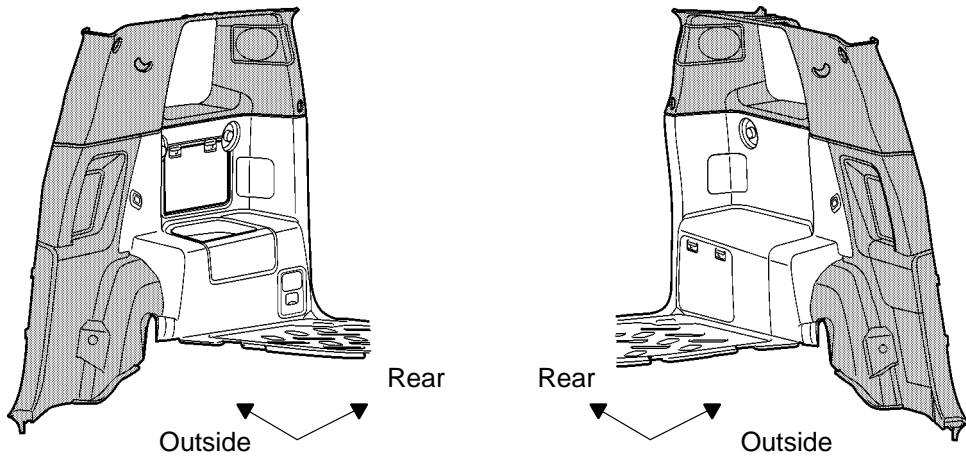
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Interior

▨ : TSOP



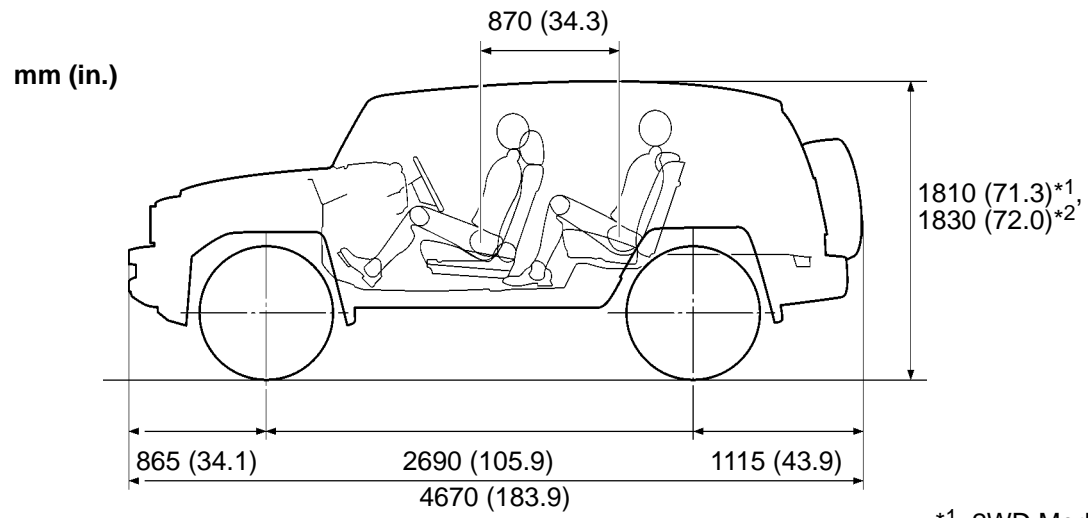
0240MO29C



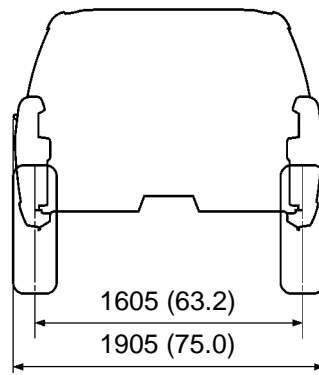
0240MO30C

NEW MODEL OUTLINE

DIMENSIONS



*1: 2WD Models
*2: 4WD Models



0240MO31C

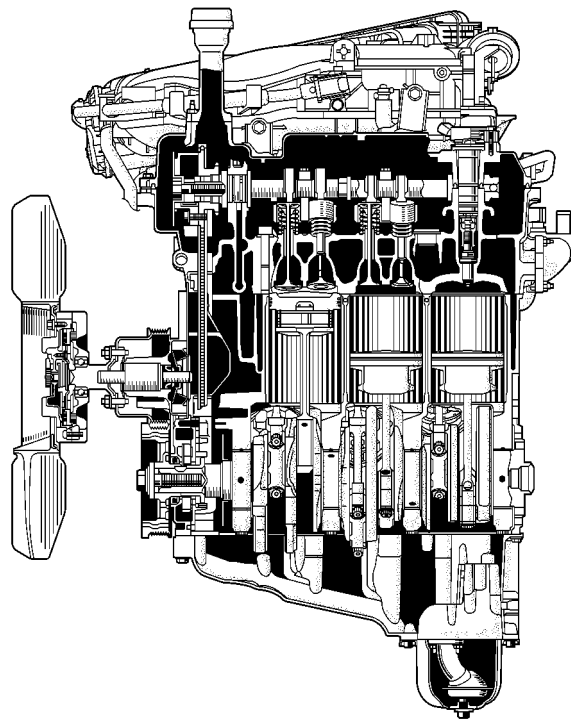
EQUIPMENT LIST

▶: Standard ○: Option

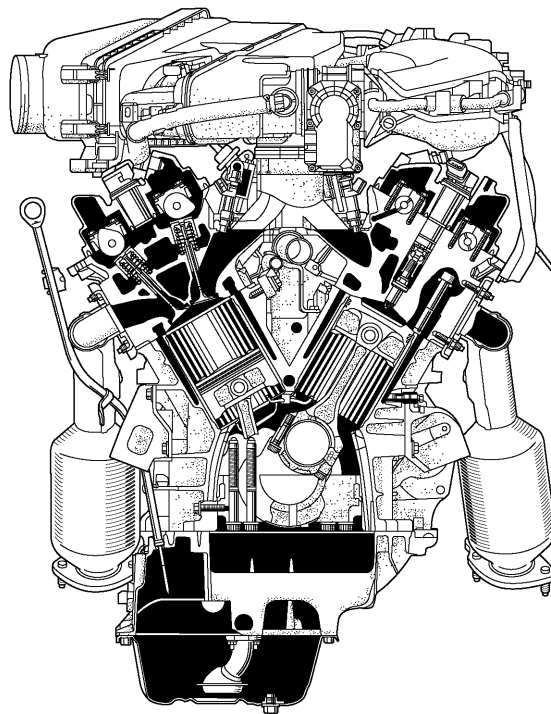
CHASSIS			2WD	4WD
Tire	P265/70R17		▶	▶
Disc Wheel	17 × 7 1/2J Steel		▶	▶
	17 × 7 1/2J Aluminum		○	○
Brake Control	ABS with EBD, Brake Assist, TRAC, AUTO LSD, VSC		▶	-
	ABS with EBD, Brake Assist, TRAC, VSC		-	▶
	ABS with EBD, Brake Assist, TRAC, A-TRAC, VSC		-	○
Rear Diff. Lock			○	○
Steering	Hydraulic Power Steering		▶	▶
Steering	Wheel	Urethane	▶	▶
		Leather	○	○
		Steering Pad Switch	○	○
	Column	Manual Tilt	▶	▶
BODY ELECTRICAL				
Lighting	Headlight	Halogen	▶	▶
	Mirror Light		○	○
	Daytime Running Light		○	○ (U.S.A.) ▶ (Canada)
	Light Auto-turn OFF		▶	▶
	Illuminated Entry		▶	▶
Wiper	Front		▶	▶
	Rear		○	○
Meter	Accessory Meter		○	○
Air Conditioning	Manual		▶	▶
	Clean Air Filter	Micro Dust and Pollen Filter	▶	▶
Wireless Door Lock System			○	○
Intuitive Parking Assist System			○	○
Audio	AM/FM, In-dash CD, 6-speaker		▶	▶
	AM/FM, In-dash 6-CD Changer, 8-speaker		○	○
	AM/FM, In-dash 6-CD Changer, 9-speaker		○	○
	AUX Input Jack		▶	▶
SRS Airbag System	Driver and Front Passenger		▶	▶
	Side and Curtain Shield		○	○
Cruise Control System			○	○
Outside Rear View Mirror	Manual		▶	▶
	Remote Control		○	○
Power Outlet Socket (AC 115 V 400 W)			○	○

ENGINE**1GR-FE ENGINE****■ DESCRIPTION**

The 1GR-FE engine is a 4.0-liter, 24-valve DOHC V6 engine. This engine uses the VVT-i (Variable Valve Timing-intelligent) system, DIS (Direct Ignition System), ACIS (Acoustic Control Induction System), and ETCS-i (Electronic Throttle Control System-intelligent). These control functions achieve improved engine performance, fuel economy, and clean emissions.



238EG01



238EG02

ENGINE — 1GR-FE ENGINE

► **Engine Specification** ○

Engine Type		1GR-FE	
No. of Cyls. & Arrangement		6-Cylinder, V Type	
Valve Mechanism		24-Valve DOHC, Chain Drive (with VVT-i)	
Combustion Chamber		Pentroof Type	
Flow of Intake and Exhaust Gasses		Cross-Flow	
Fuel System		SFI	
Ignition System		DIS	
Displacement		cm ³ (cu. in.)	3956 (241.4)
Bore × Stroke		mm (in.)	94.0 × 95.0 (3.70 × 3.74)
Compression Ratio		10.0 : 1	
Max. Output (SAE-NET)* ¹		178 kW @ 5200 rpm (239 HP @ 5200 rpm)	
Max. Torque (SAE-NET)* ¹		377 N·m @ 3700 rpm (278 ft·lbf @ 3700 rpm)	
Oil Capacity	Dry	6.0 liters (6.3 US qts, 5.3 Imp. qts)	
	With Oil Filter	5.2 liters (5.5 US qts, 4.6 Imp. qts)	
	Without Oil Filter	4.9 liters (5.2 US qts, 4.3 Imp. qts)	
Oil Grade		ILSAC	
Engine Coolant	Type	TOYOTA Genuine Super Long Life Coolant or the following* ²	
	Capacity	M/T	9.4 liters (9.9 US qts, 8.3 Imp. qts)
		A/T	9.8 liters (10.4 US qts, 8.6 Imp. qts)
Spark Plug	Type	DENSO	K20HR-U11 (Nickel)
		NGK	LFR6C11 (Nickel)
	Plug Gap	mm (in.)	1.0 - 1.1 (0.0394 - 0.0433)
Firing Order		1 - 2 - 3 - 4 - 5 - 6	
Fuel Octane Rating		91 or higher	
Emission Regulation	Tailpipe	California	LEVII, SFTP
		Except California	Tier2-Bin5, SFTP
	Evaporative	LEVII, ORVR	
Engine Service Mass* ³ (Reference)		kg (lb)	166 (366)

*¹: Maximum output and torque rating is determined using the revised SAE J1349 procedure.

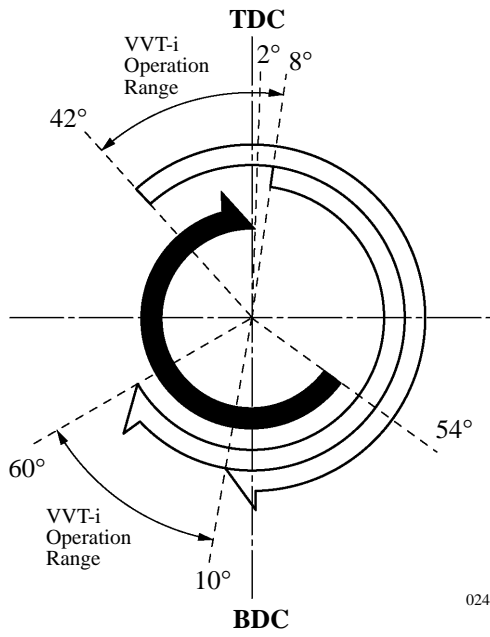
*²: Similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, and non-borate coolant with long-life hybrid organic acid technology. (Coolant with hybrid organic acid technology consists of a combination of low phosphates and organic acids.)

*³: The figure shown is the weight of the part including the coolant and oil.

► Valve Timing ○

◁ : Intake Valve Opening Angle

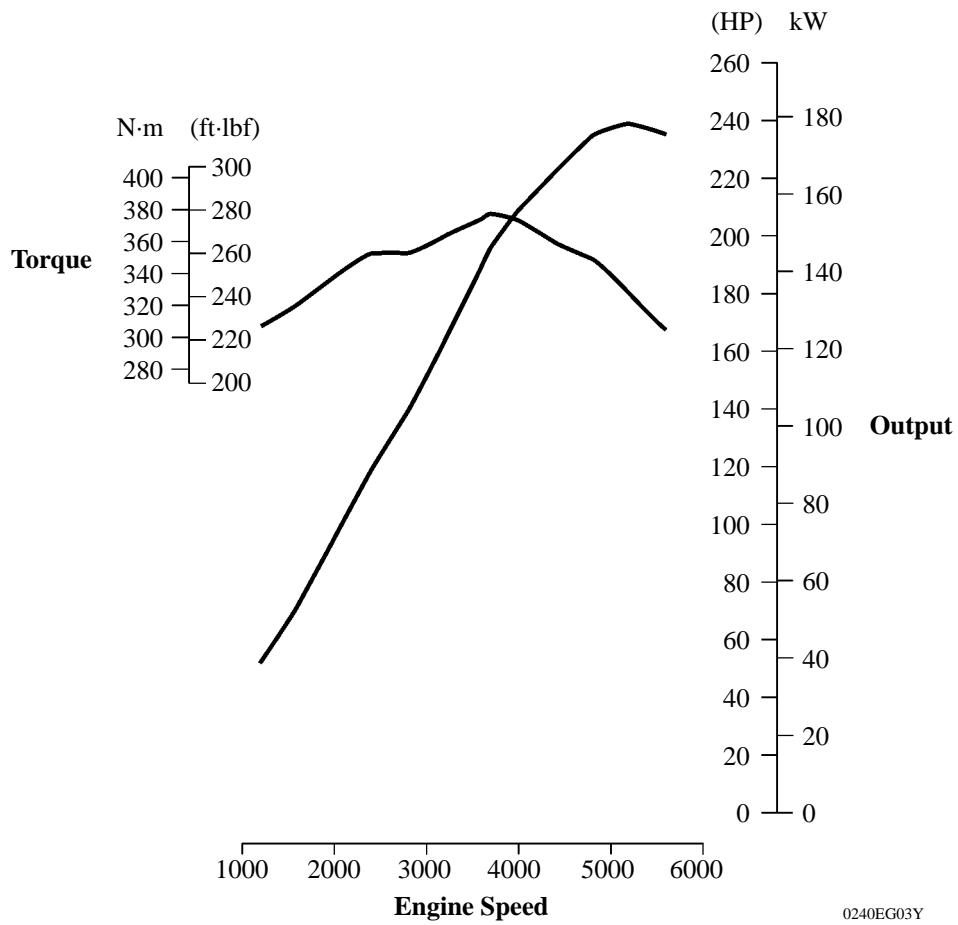
▴ : Exhaust Valve Opening Angle



Intake	Open	-8° to 42° BTDC
	Close	60° to 10° ABDC
Exhaust	Open	54° BBDC
	Close	2° ATDC

0240EG02C

► Performance Curve ○



0240EG03Y

ENGINE — 1GR-FE ENGINE

► FEATURES OF 1GR-FE ENGINE

The 1GR-FE engine has achieved the following performance through the use of the items listed below.

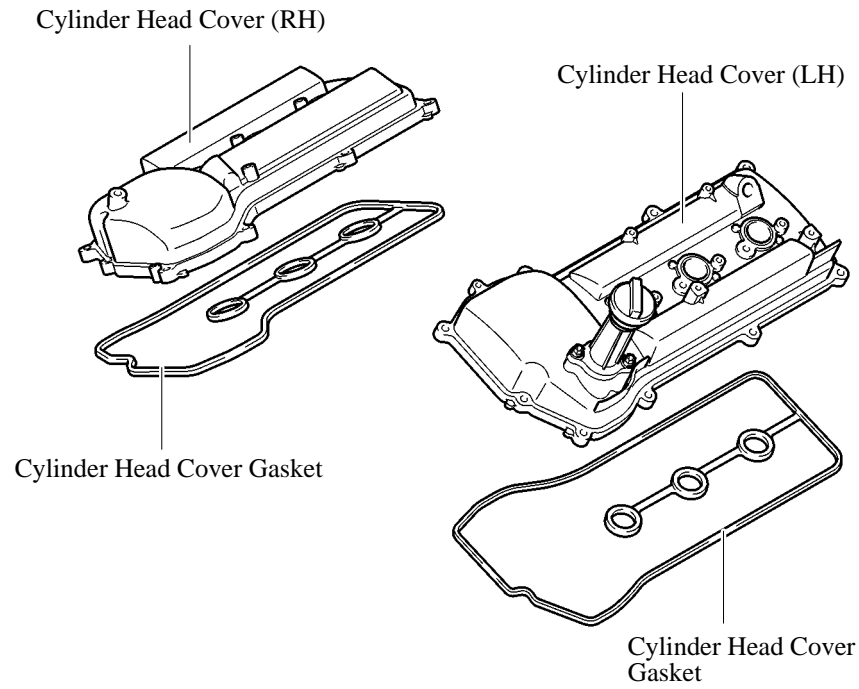
- (1) High performance and reliability
- (2) Low noise and vibration
- (3) Lightweight and compact design
- (4) Good serviceability
- (5) Clean emission and fuel economy

Item		(1)	(2)	(3)	(4)	(5)
Engine Proper	Upright intake ports are used.	○		○		
	A taper squish shape is used for the combustion chamber.	○				○
	A steel laminate type cylinder head gasket is used.	○				
	A cylinder block made of aluminum alloy is used.			○		
	The skirt portion of the piston has a resin coating applied to reduce friction.	○	○			○
	An oil pan (oil pan No.1) made of aluminum alloy is used.		○	○		
Valve Mechanism	A VVT-i (Variable Valve Timing-intelligent) system is used.	○				○
	Shim-less type valve lifters are used.	○		○		
	A timing chain and chain tensioner are used.	○	○	○		
Cooling System	The engine coolant that is used is the TOYOTA genuine SLLC (Super Long Life Coolant).				○	
Intake and Exhaust System	A cable-less type throttle body is used.			○	○	
	An intake air chamber made of plastic is used.			○		
	A stainless steel exhaust manifold is used.			○		
Fuel System	12-hole type fuel injectors are used to improve the atomization of fuel.	○				○
	A fuel delivery pipe that is made of plastic is used.			○		
Ignition System	The DIS (Direct Ignition System) makes ignition timing adjustment unnecessary.	○			○	○
Charging System	A segment conductor type generator is used.	○		○		
Serpentine Belt Drive System	A serpentine belt drive system is used.			○	○	
Engine Control System	MRE (Magnetic Resistance Element) type VVT sensors are used.	○				
	The ETCS-i (Electronic Throttle Control System-intelligent) is used.	○				○
	An ACIS (Acoustic Control Induction System) is used.	○				○
	An evaporative emission control system is used.					○

○ENGINE PROPER

1. Cylinder Head Cover

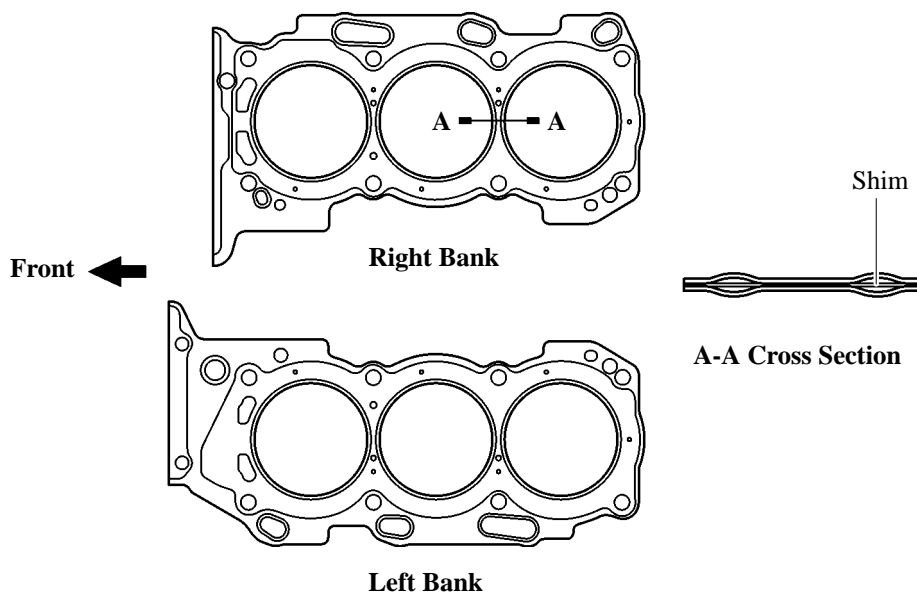
- ▶ Lightweight yet high-strength aluminum cylinder head covers are used.
- ▶ An oil filler extension housing is provided on the left bank cylinder head cover for use when filling the engine oil to improve serviceability.



238EG05

2. Cylinder Head Gasket

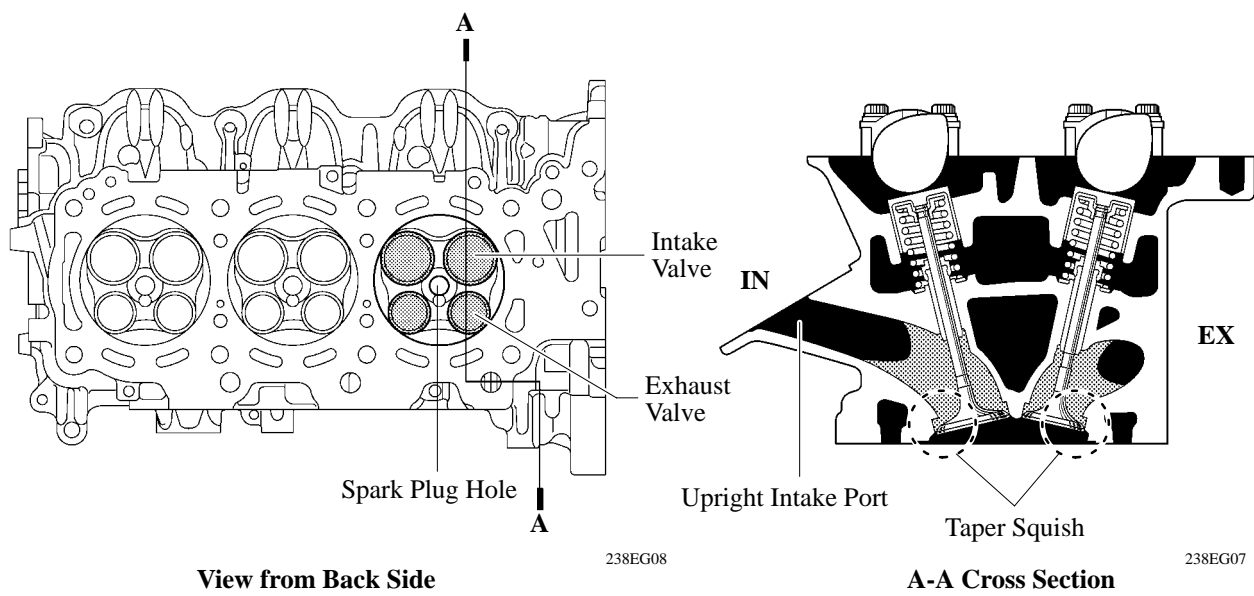
Steel-laminate type cylinder head gaskets are used. Shims are used around the cylinder bores of these gaskets. This improves sealing performance and durability.



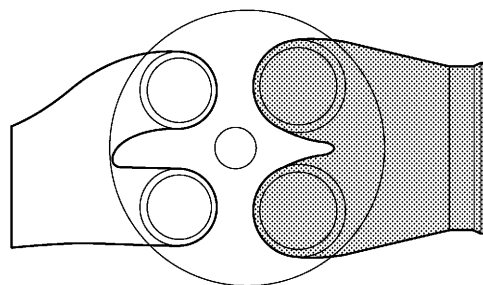
0240EG40C

3. Cylinder Head

- ▶ The cylinder head, which is made of aluminum, contains a pentroof-type combustion chamber. The spark plug is located in the center of the combustion chamber in order to improve the engine's anti-knocking performance.
- ▶ The intake ports are on the inside and the exhaust ports are on the outside of the left and right banks respectively.
- ▶ Upright intake ports are used to improve the intake efficiency.
- ▶ A taper squish combustion chamber is used to improve anti-knocking performance and intake efficiency. In addition, engine performance and fuel economy are improved.
- ▶ Siamese type intake ports are used to reduce the overall surface area of the intake port walls. This prevents the fuel from adhering to the intake port walls, thus reducing HC exhaust emissions.

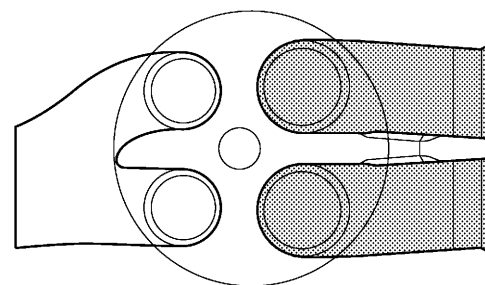


— REFERENCE —



Siamese Type

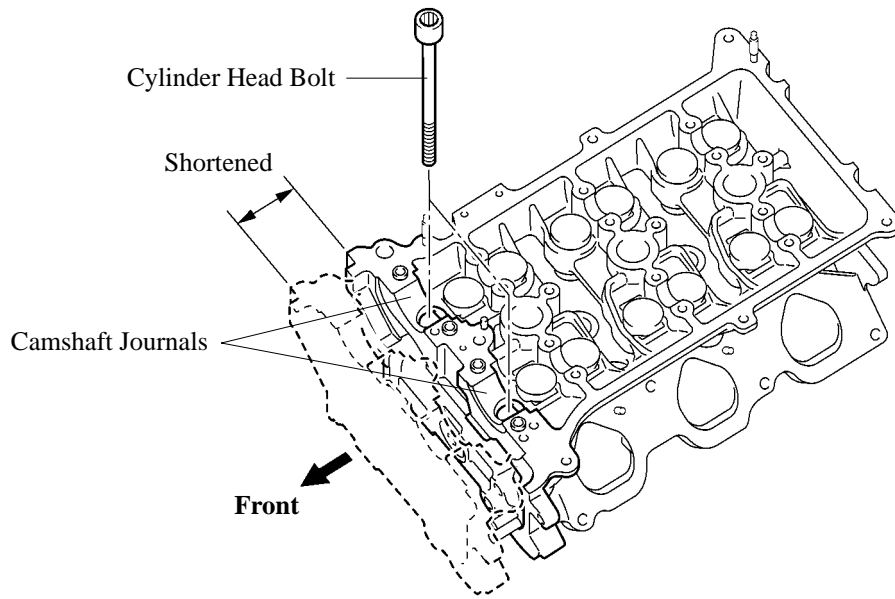
215EG18



Independent Type

215EG19

- ▶ The cylinder head bolts are positioned below the camshaft journal in the front of the right bank, and holes are provided in the camshaft journals to allow installation of the bolts. Thus, the front end of the right bank is shortened, resulting in the overall length of the engine being shorter.

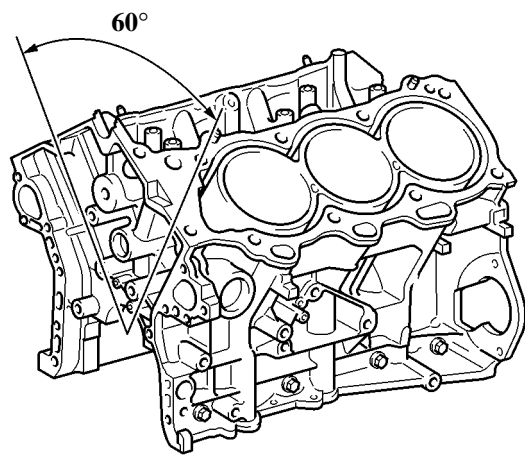


238EG09

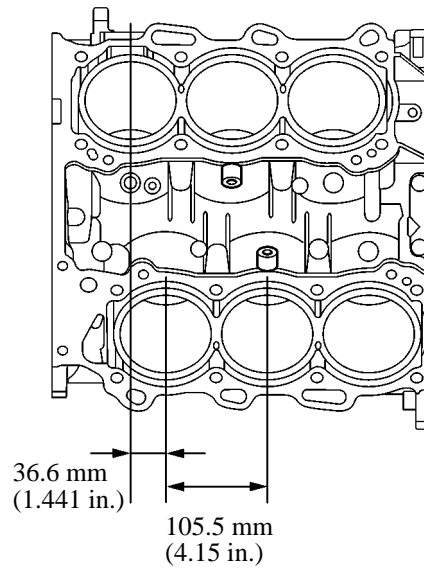
Right Bank Cylinder Head

4. Cylinder Block

- ▶ The cylinder block is made of aluminum alloy.
- ▶ The cylinder block has a bank angle of 60°, a bank offset of 36.6 mm (1.441 in.) and a bore pitch of 105.5 mm (4.15 in.), resulting in a compact block in its length and width considering its displacement.



238EG10

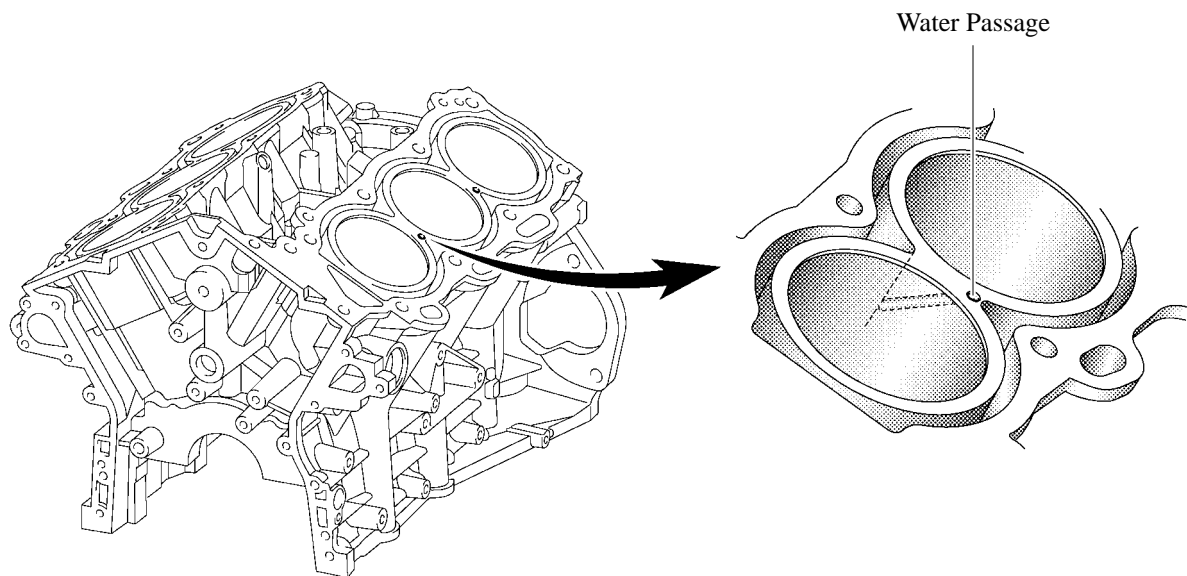


238EG11

View of Top Side

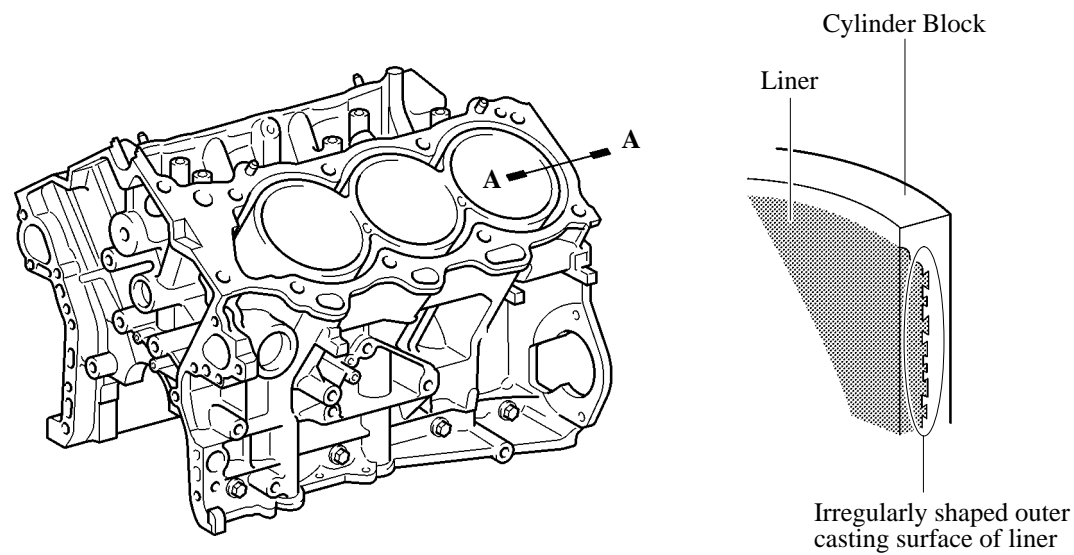
ENGINE — 1GR-FE ENGINE

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



238EG12

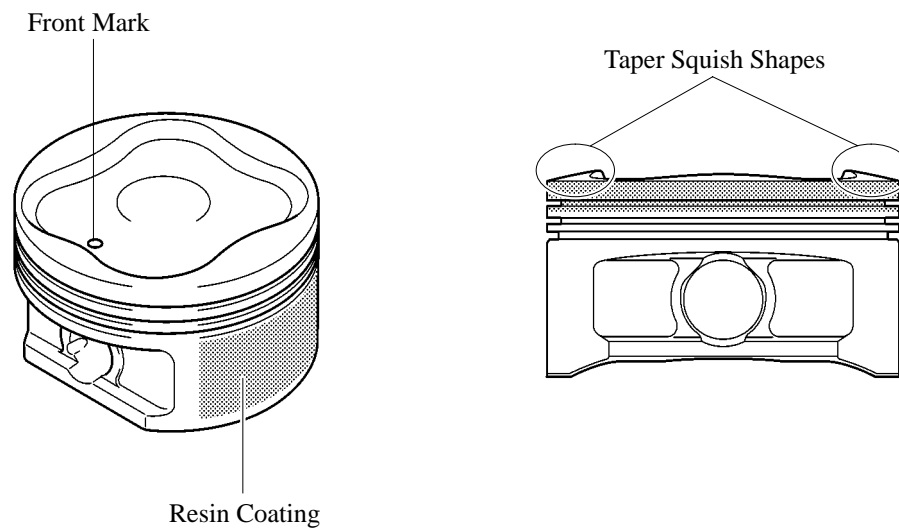
- ▶ A compact block is achieved by producing the thin cast-iron liners and cylinder block as a unit. It is not possible to bore a block with this type of liner.
- ▶ The liners are a spiny-type, which have been manufactured so that their casting exterior forms a large irregular surface in order to enhance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



238EG13

5. Piston

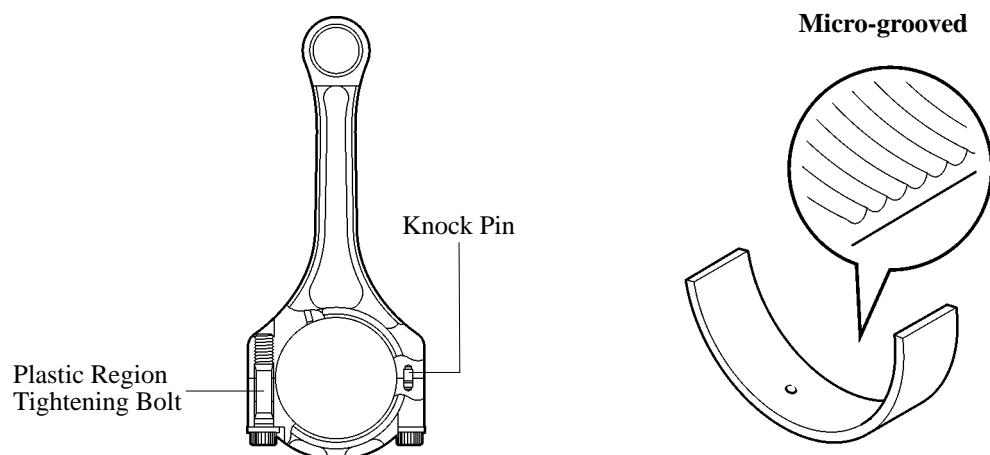
- ▶ The pistons are made of aluminum alloy.
- ▶ The piston head portion uses a taper squish shape to accomplish fuel combustion efficiency.
- ▶ The piston skirt is coated with resin to reduce friction losses.
- ▶ The groove of the top ring is coated with anodic oxide to improve wear resistance and corrosion resistance.
- ▶ This piston is common to all cylinders. Therefore, the pistons are not shaped especially for the right or the left bank. As a result, serviceability has been improved.
- ▶ By increasing the machining precision of the cylinder bore diameter, only one size piston is required.



238EG14

6. Connecting Rod and Connecting Rod Bearing

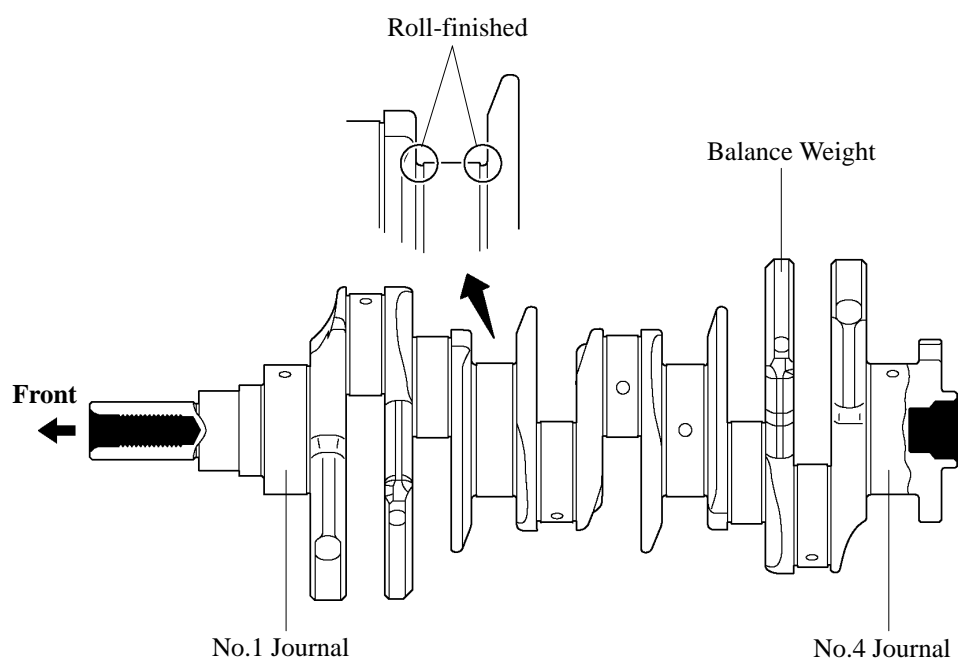
- ▶ Connecting rods that are forged for high strength are used for weight reduction.
- ▶ Knock pins are used at the mating surfaces of the bearing caps of the connecting rod to minimize the shifting of the bearing caps during assembly.
- ▶ Plastic region tightening bolts are used.
- ▶ Aluminum bearings are used for the connecting rod bearings.
- ▶ The lining surface of the connecting rod bearing is micro-grooved to realize an optimal amount of oil clearance. As a result, cold-engine cranking performance is improved and engine vibration is reduced.



0240EG39C

7. Crankshaft

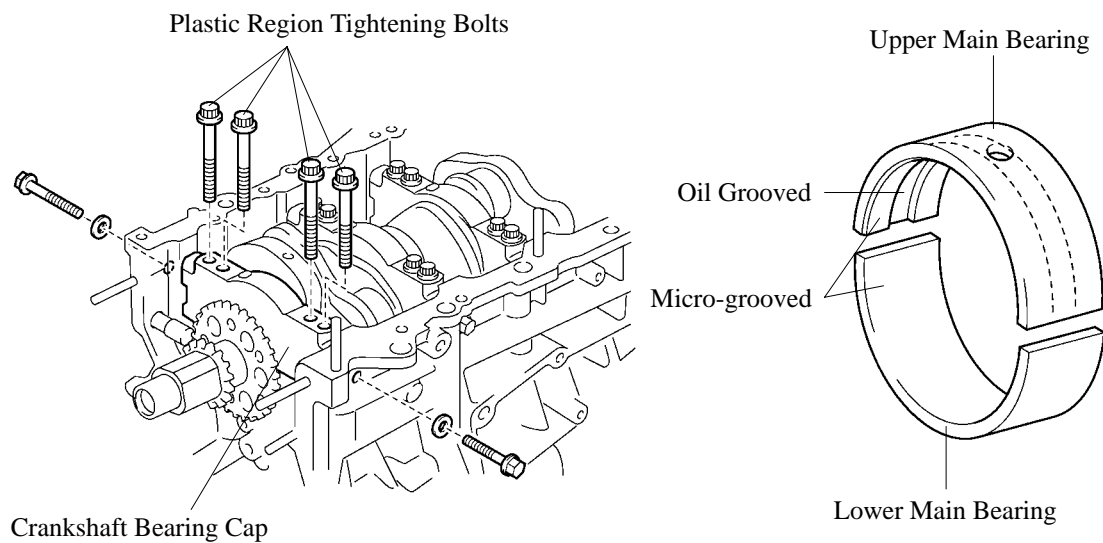
- ▶ A crankshaft made of steel, which excels in rigidity and wear resistance, is used.
- ▶ The crankshaft has 4 main bearing journals and 9 balance weights.
- ▶ All pin and journal fillets are roll-finished to maintain adequate strength.



0240EG01C

8. Crankshaft Bearing and Crankshaft Bearing Cap

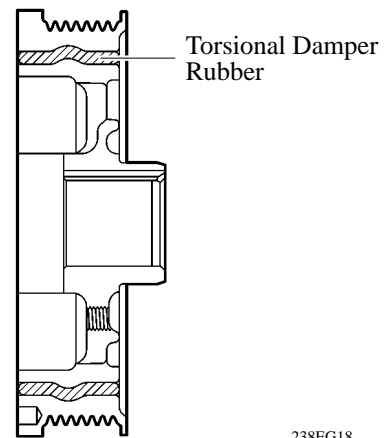
- ▶ The crankshaft main bearings are made of aluminum alloy.
- ▶ Similar to the connecting rod bearings, the lining surface of the crankshaft bearings is micro-grooved to realize an optimal amount of oil clearance. As a result, cold-engine cranking performance is improved and engine vibration is reduced.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



238EG17

9. Crankshaft Pulley

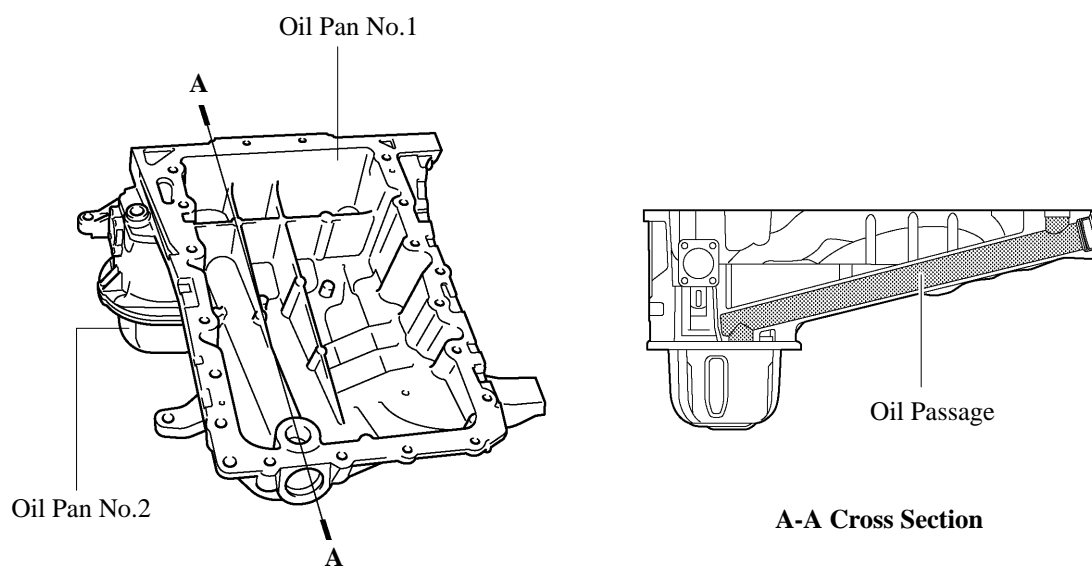
The rigidity of the torsional damper rubber is optimized to reduce noise.



238EG18

10. Oil Pan

- ▶ The oil pan No.1 material is made of aluminum alloy.
- ▶ The oil pan No.2 material is made of steel.
- ▶ An oil passage is integrated in the oil pan No.1 to simplify the construction of the oil strainer.
- ▶ The oil pan No.1 is secured to the cylinder block and the torque converter housing and is increasing rigidity.

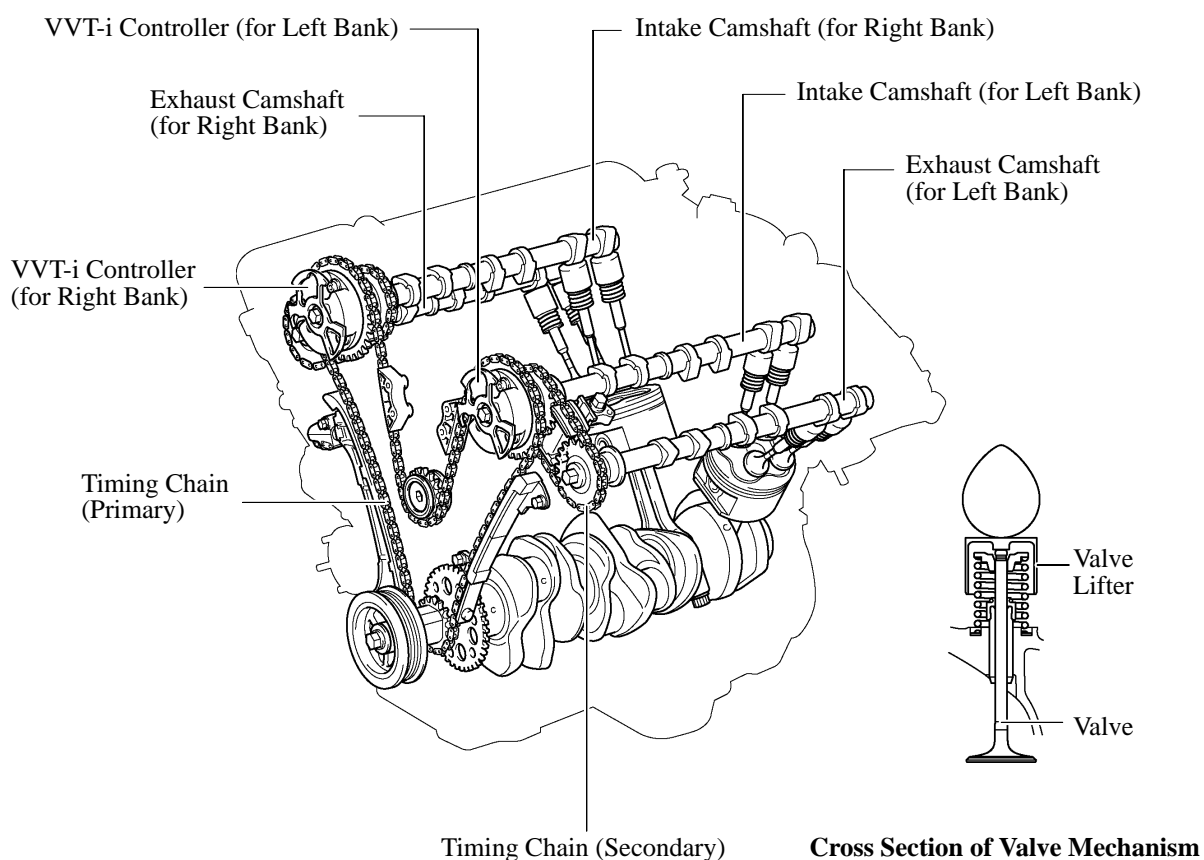


0240EG04C

○ VALVE MECHANISM

1. General

- ▶ The intake camshafts are driven by the crankshaft via the primary timing chain. The intake camshaft of the respective bank drives the exhaust camshafts via the secondary timing chain.
- ▶ The valves are directly opened and closed by 4 camshafts.
- ▶ The VVT-i controller is installed on the front of the intake camshaft to vary the timing of the intake valves.
- ▶ Along with increase in the amount of valve lift, a shimless type valve lifter is used. This valve lifter raises the cam contact surface.



0240EG05C

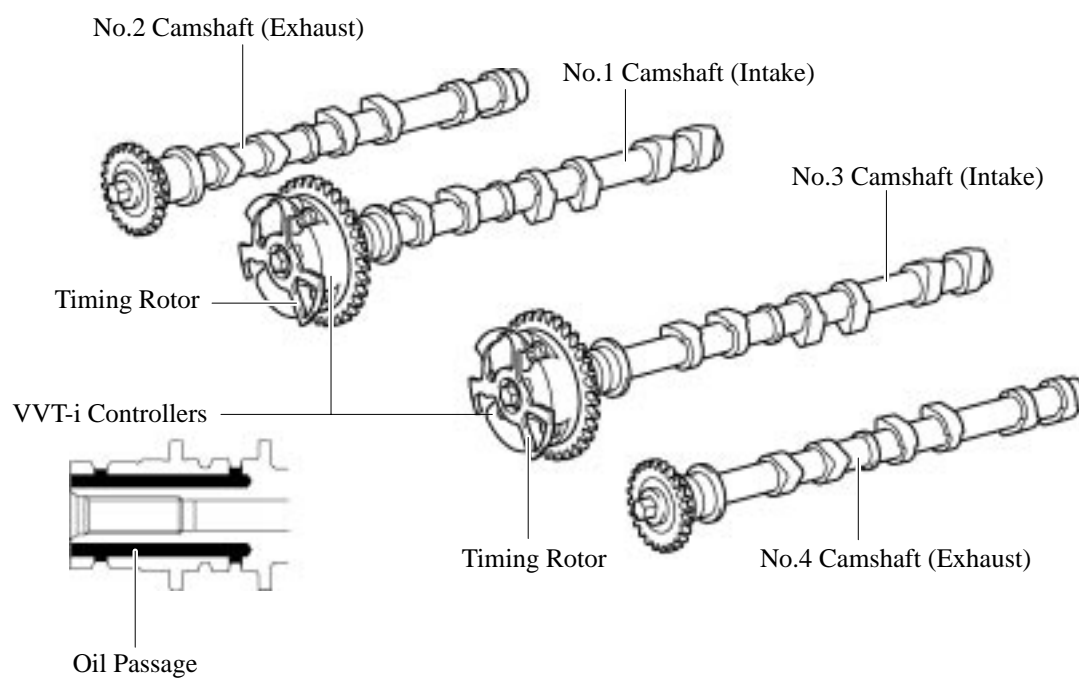
Service Tip

The adjustment of the valve clearance is accomplished by selecting and replacing the appropriate valve lifters.

A total of 35 valve lifters are available in 0.020 mm (0.008 in.) increments, from 5.060 mm (0.199 in.) to 5.740 mm (0.226 in.). For details, refer to the 2007 FJ Cruiser Repair Manual (Pub. No. RM0240U).

2. Camshaft

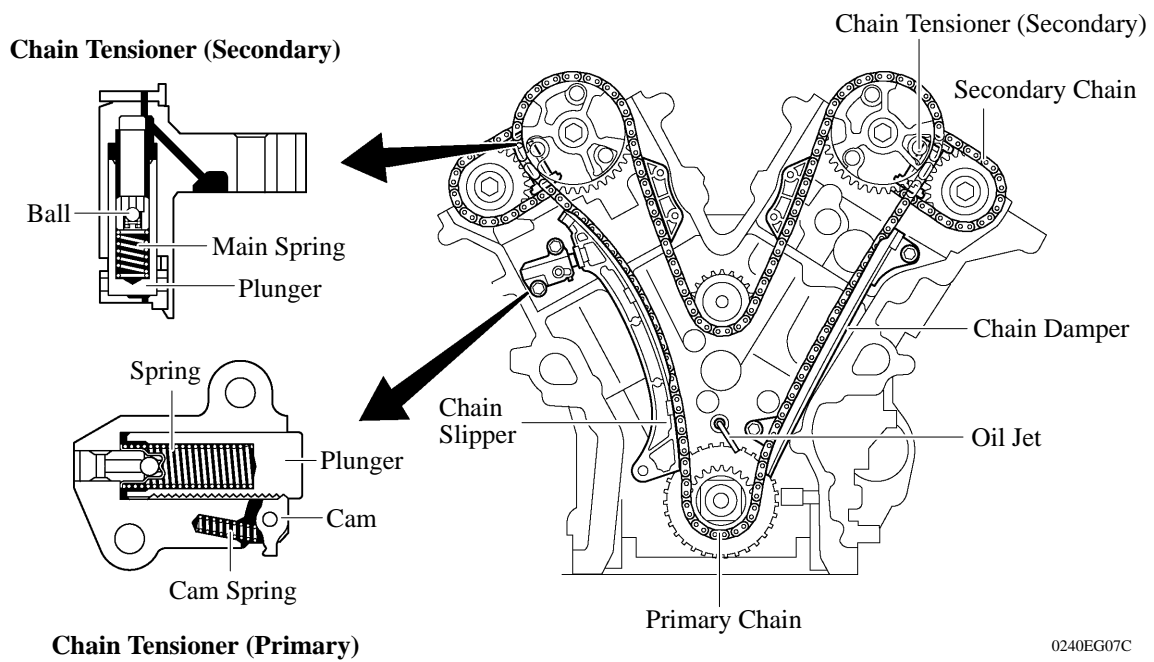
- ▶ The camshafts are made of a cast iron alloy.
- ▶ An oil passage is provided in the intake camshaft in order to supply engine oil to the VVT-i system.
- ▶ A timing rotor is provided in front of the VVT-i controller to detect the actual position of the intake camshaft.



Cross Section of the End of the Intake Camshaft

3. Timing Chain and Chain Tensioner

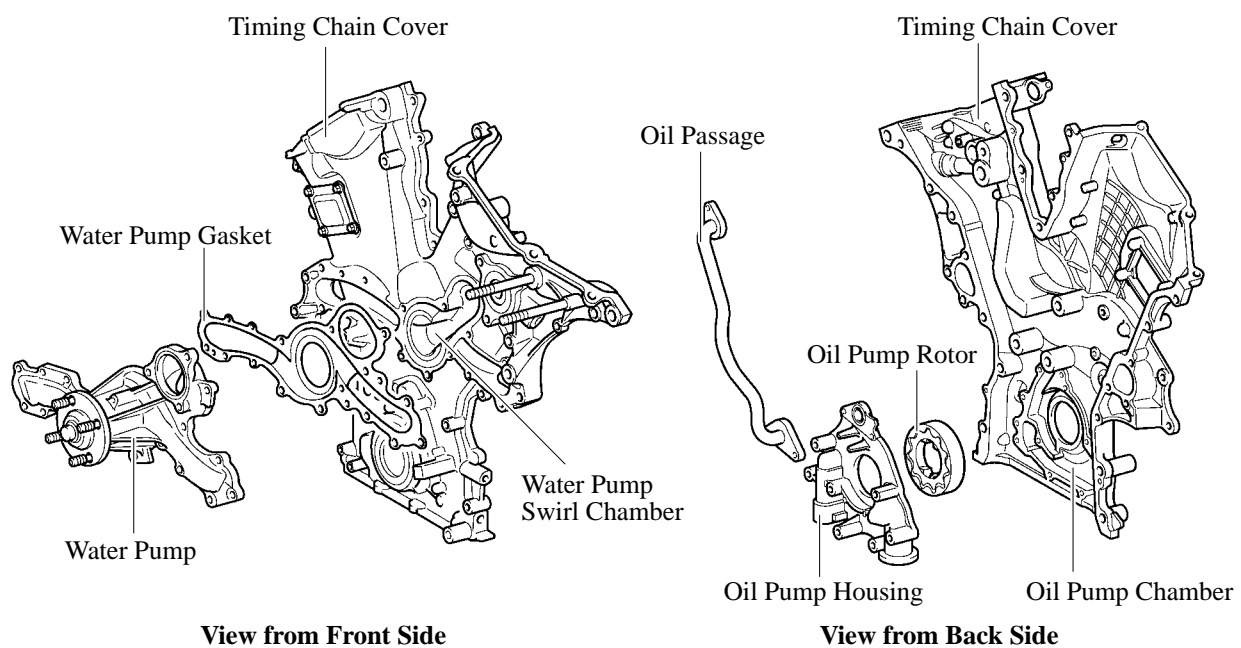
- ▶ Both the primary and secondary timing chains use roller chains with a pitch of 9.525mm (0.375 in.).
- ▶ The timing chain is lubricated by an oil jet.
- ▶ The primary chain uses one timing chain tensioner and each of the secondary chains for the right and left banks uses one timing chain tensioner.
- ▶ Both the primary and secondary chain tensioners use a spring and oil pressure to maintain proper chain tension at all times. They suppress noise generated by the timing chains.
- ▶ The chain tensioner for the primary chain is the ratchet type with a non-return mechanism.



0240EG07C

4. Timing Chain Cover

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

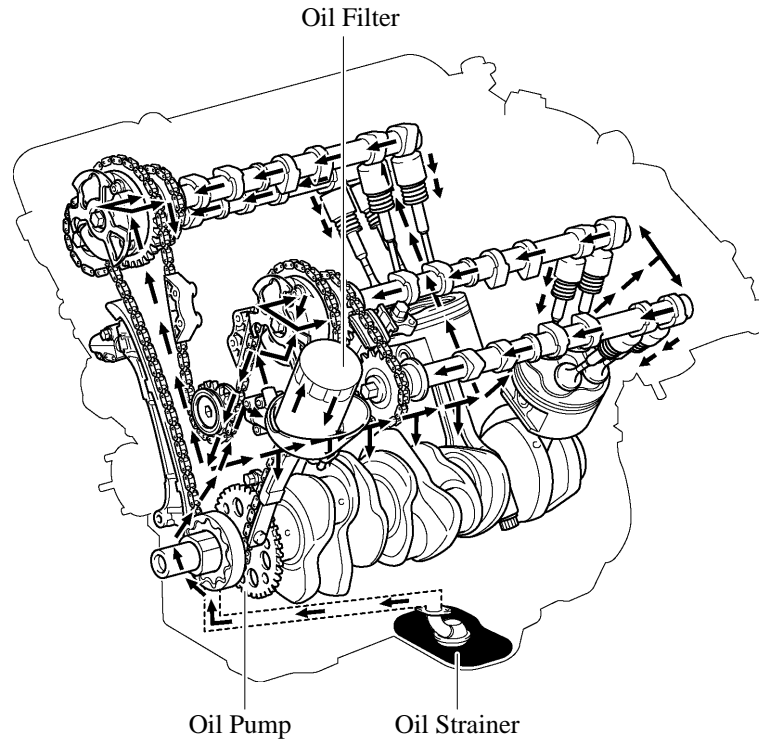


238EG23

◦ LUBRICATION SYSTEM

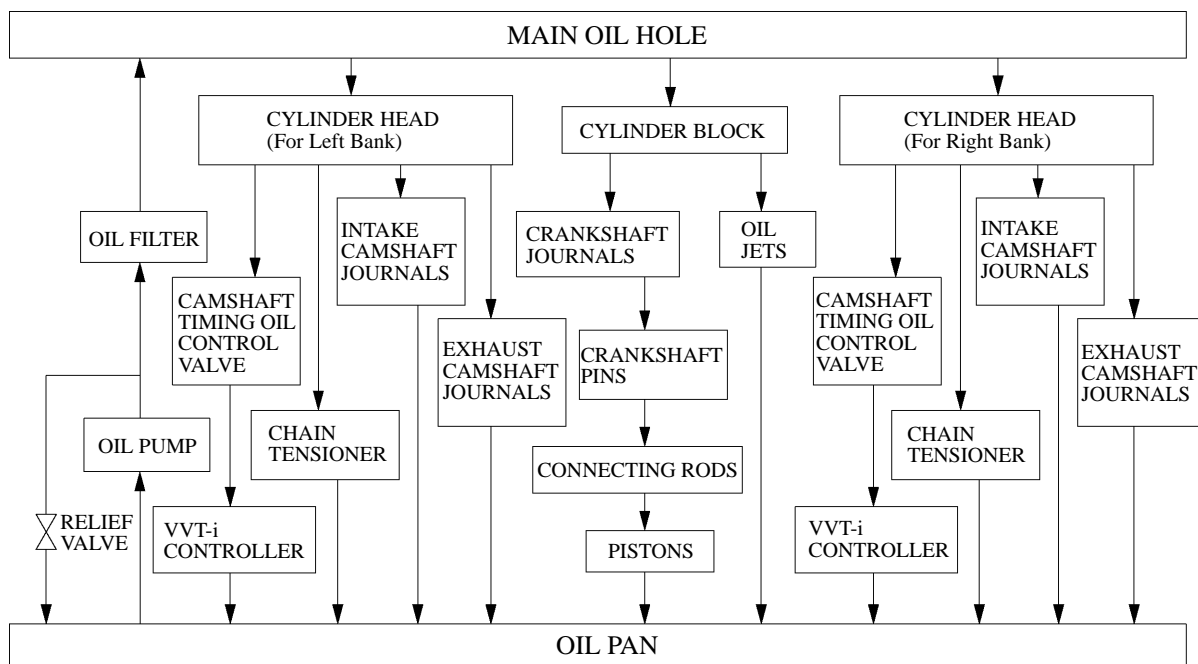
1. General

- The lubrication circuit is fully pressurized and oil passes through an oil filter.
- A cycloid rotor type oil pump is used. This oil pump is integrated with the timing chain cover. This pump is directly driven by the crankshaft.



0240EG08C

► Oil Circuit ○

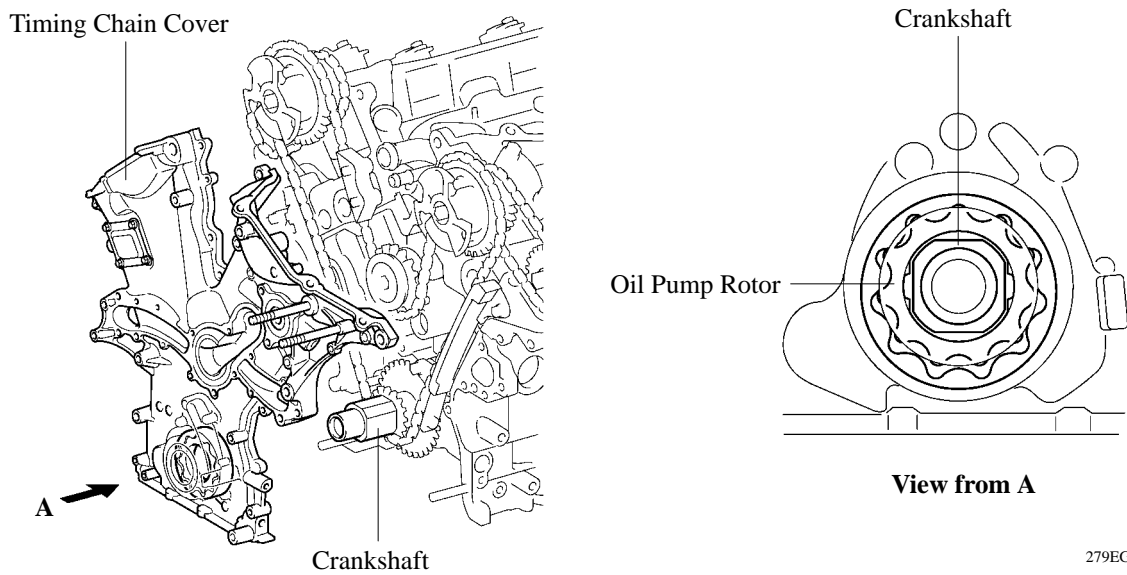


0240EG09C

2. Oil Pump

Ordinarily, the timing chain cover with oil pump construction has only a single position for mounting the oil pump rotor to the crankshaft, when installing the timing chain cover.

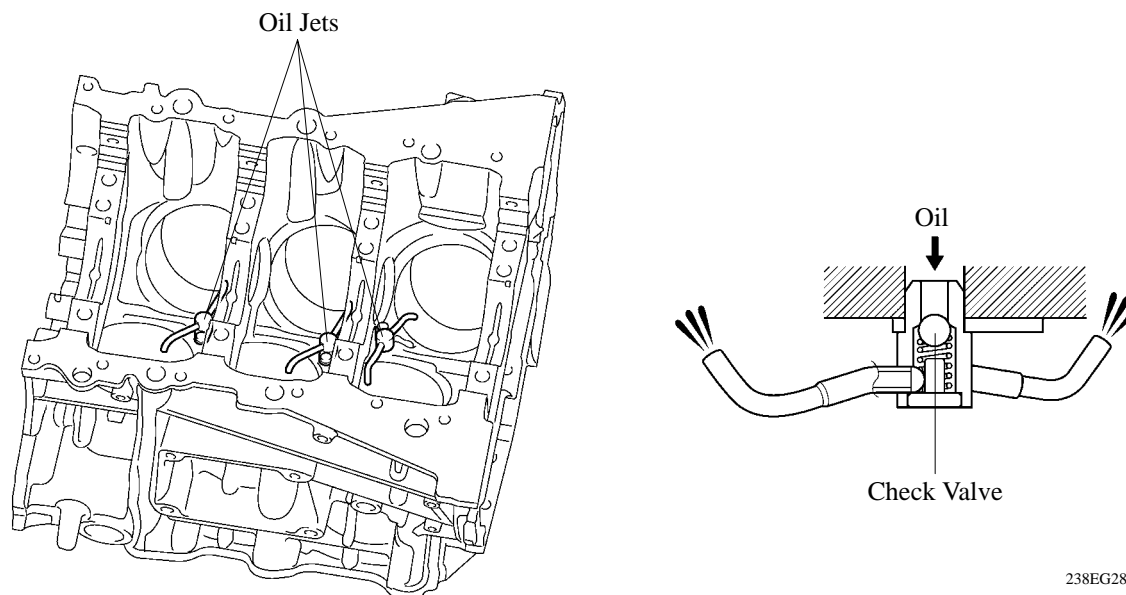
However, in this engine, the inner shape of the oil pump rotor and the shape of the area of the crankshaft on which the rotor is mounted are designed to provide 4 different assembly patterns. Thus, the serviceability for assembling the timing chain cover is improved.



279EG10

3. Oil Jet

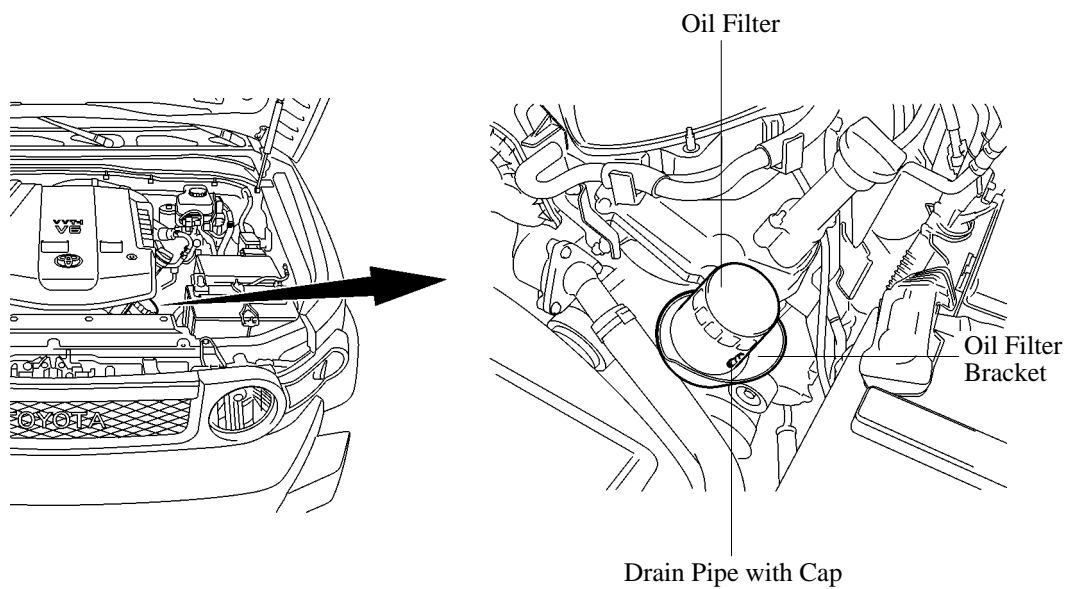
- Oil jets for cooling and lubricating the pistons are provided in the cylinder block, in the center of the right and left banks.
- These oil jets contain a check valve to prevent oil from being fed when the oil pressure is low. This prevents the overall oil pressure in the engine from dropping.



238EG28

4. Oil Filter Bracket

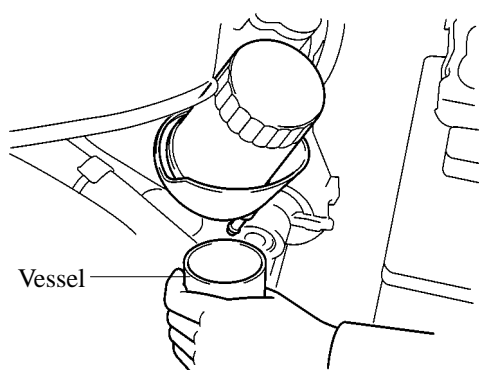
- The oil filter is mounted on an oil filter bracket placed on the left bank. Therefore, the oil filter can be replaced easily.
- During an oil filter replacement, the filter is removed from the top. Therefore, the oil filter bracket is designed to catch the oil that leaks from the oil filter. The oil that is initially caught by the oil filter bracket is discharged from a drain pipe that is provided underneath it.



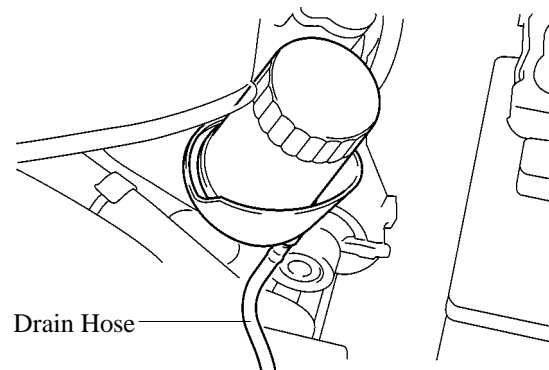
0240EG10C

Service Tip

- Before removing the oil filter, prepare to catch the oil that will be discharged from the drain pipe. Use a container to catch the oil as illustrated below, or attach a hose to the drain pipe and catch the oil on a tray.
- After completing the oil drain operation, do not forget to replace the rubber cap on the drain pipe.



0240EG11C

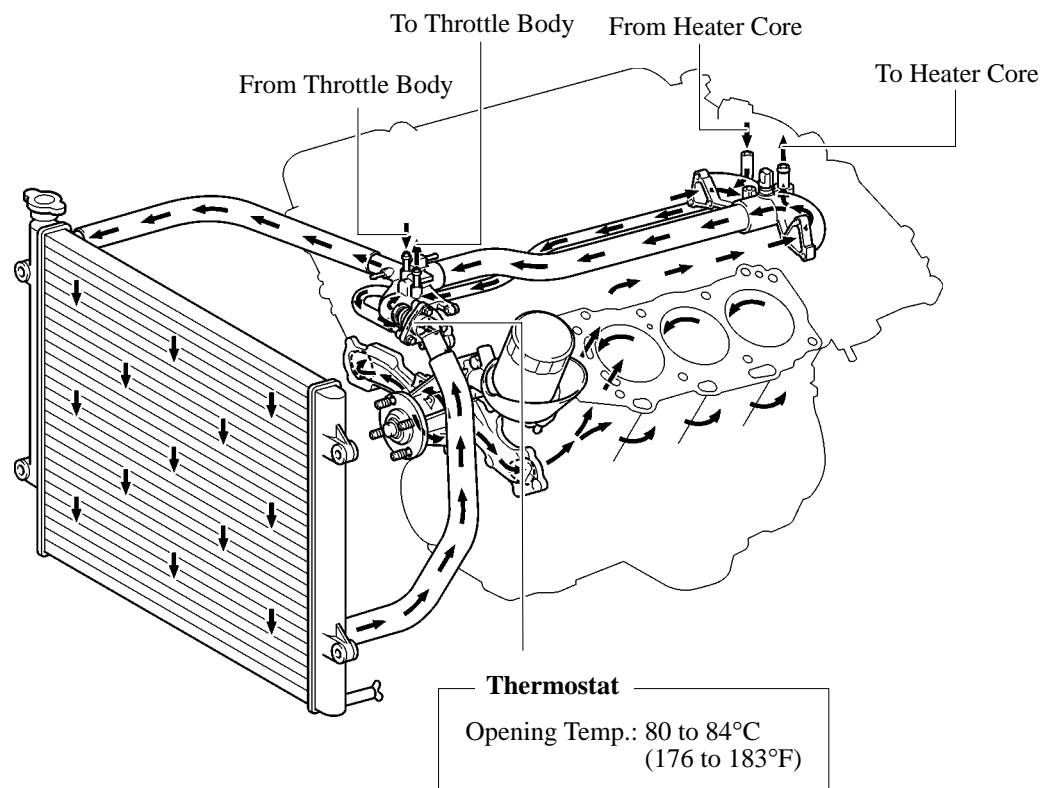


0240EG12C

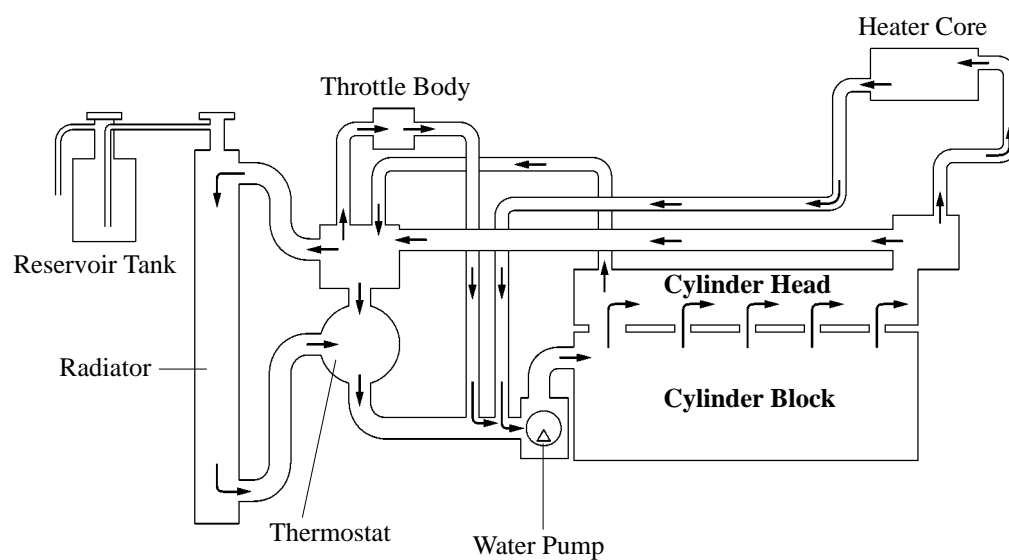
○ COOLING SYSTEM

1. General

- ▶ The cooling system is a pressurized, forced-circulation type.
- ▶ A thermostat with a bypass valve is located in the water inlet housing to maintain suitable temperature distribution in the cooling system.
- ▶ A viscous coupling type cooling fan is used.
- ▶ The engine coolant that is used is TOYOTA genuine SLLC (Super Long Life Coolant).



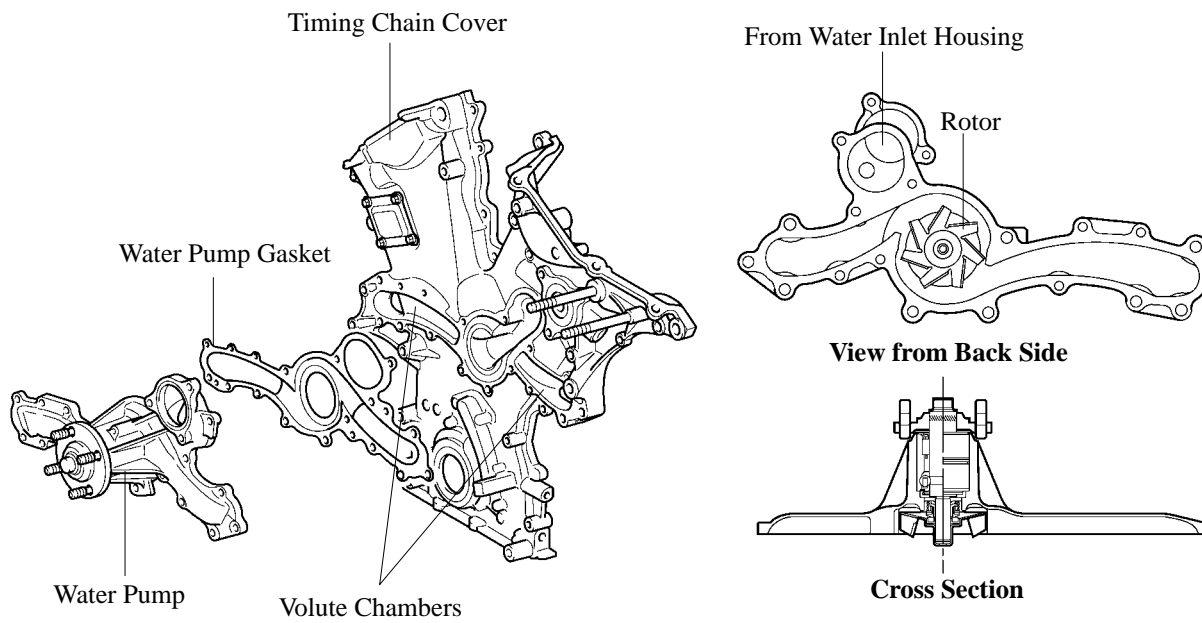
0240EG13C



0240EG14C

2. Water Pump

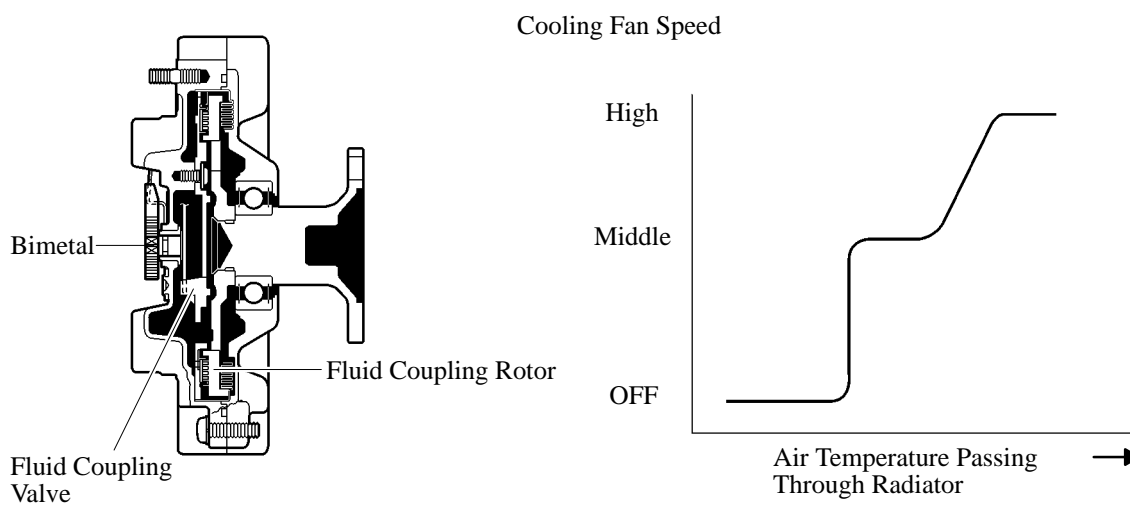
The water pump has two volute chambers, and circulates coolant uniformly to the left and right banks of the cylinder block.



238EG35

3. Cooling Fan

A viscous coupling type cooling fan is used. This fan utilizes the characteristics of a bimetal to switch the fluid passages and appropriately control the silicon oil, in order to change the fan speed in three stages: OFF, middle, and high. The fan speed changes from middle to high speed in response to the temperature of the air passing through the radiator.



238EG36

4. TOYOTA Genuine SLLC

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

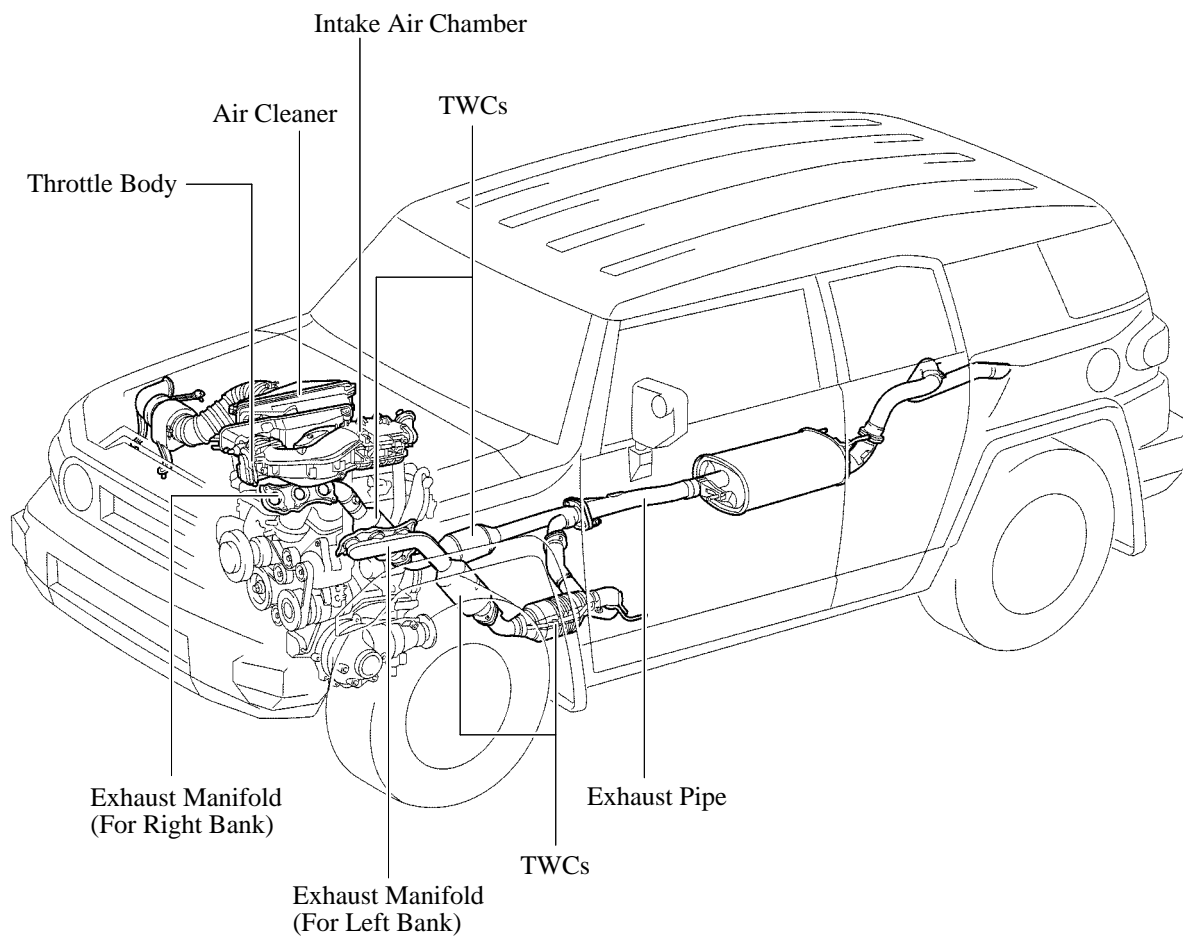
Type		TOYOTA Genuine SLLC
Maintenance Intervals	First Time	100000 miles (160000 km)
	Subsequent	Every 50000 miles (80000 km)
Color		Pink

- ▶ SLLC is pre-mixed (50 % coolant and 50 % deionized water), so no dilution is needed when adding or replacing SLLC in the vehicle.
- ▶ If LLC is mixed with SLLC, the interval for LLC (every 25000 miles (U.S.A.), 32000 km (Canada) or 24 months whichever come first) should be used.
- ▶ You can also apply the new maintenance interval (every 50000 miles/80000 km) to vehicles initially filled with LLC (red-colored), if you use SLLC (pink-colored) for the engine coolant change.

○INTAKE AND EXHAUST SYSTEM

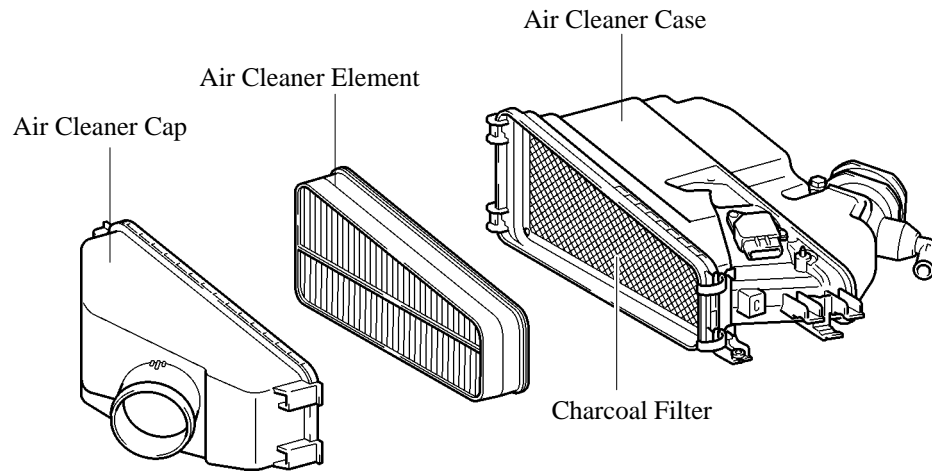
1. General

- ▶ A cable-less type throttle body is used and it realizes excellent throttle control.
- ▶ The ETCS-i (Electronic Throttle Control System-intelligent) is used to ensure excellent throttle control in all operating ranges. For details, see page EG-50.
- ▶ The ACIS (Acoustic Control Induction System) is used to improve the engine performance in all speed ranges. For details, see page EG-57.
- ▶ An intake air chamber made of plastic is used for weight reduction.
- ▶ A lightweight aluminum alloy is used for the intake manifold.
- ▶ Stainless steel exhaust manifolds and exhaust pipes are used for weight reduction.



2. Air Cleaner

- ▶ A full-fabric type air cleaner element is used.
- ▶ A charcoal filter, which adsorbs the HC that accumulates in the intake system when the engine is stopped, is used in the air cleaner case in order to reduce evaporative emissions. This filter is maintenance-free.

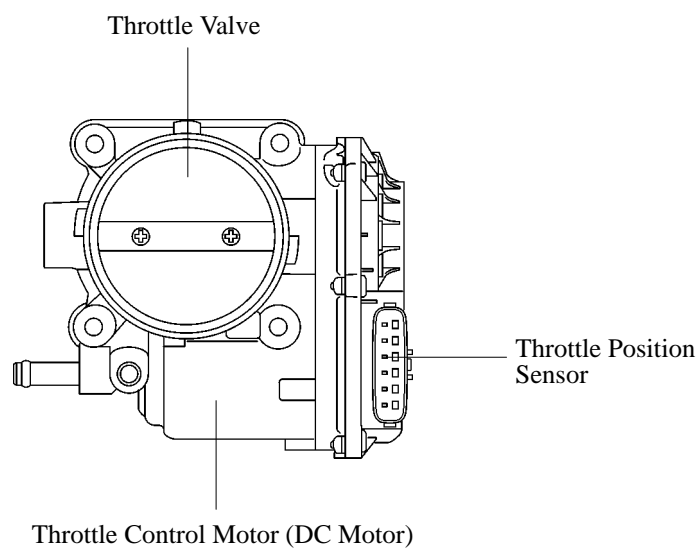


0240EG16C

3. Throttle Body

A cable-less type throttle body in which the throttle position sensor and the throttle control motor are integrated is used. It realizes excellent throttle valve control. For details, see page EG-50.

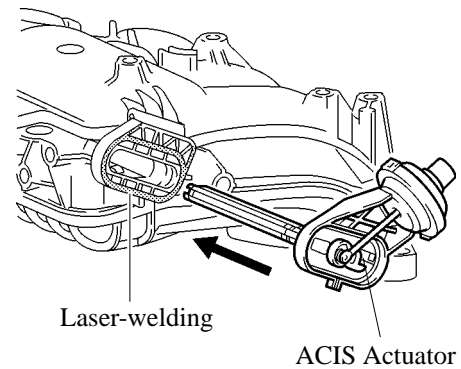
- ▶ In the throttle control motor, a DC motor with excellent response and minimal power consumption is used. The ECM performs the duty ratio control of the direction and the amperage of the current that flows to the throttle control motor in order to regulate the throttle valve angle.



0240EG30C

4. Intake Air Chamber

- ▶ The intake air chamber contains an ACIS (Acoustic Control Induction System) actuator. The ACIS actuator actuates the intake air control valve that is used to change the intake pipe length to improve engine performance in all engine speed ranges. For details, see page EG-57.
- ▶ The ACIS actuator is laser-welded onto the intake air chamber.



0240EG17C

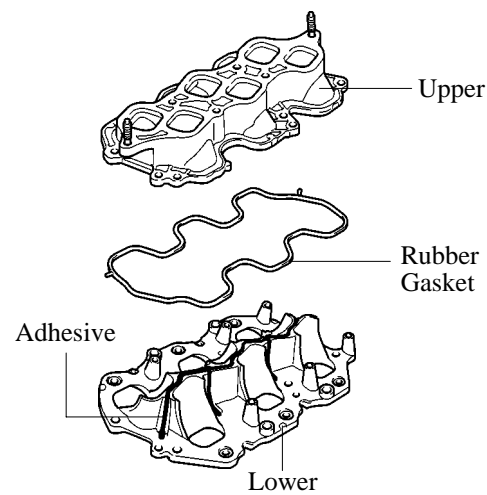
— REFERENCE —

Laser-welding:

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

5. Intake Manifold

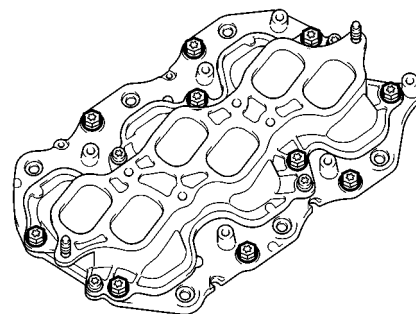
This intake manifold consists of two pieces, the upper and lower, which are sealed with a rubber gasket and adhesive.



0240EG18C

Service Tip

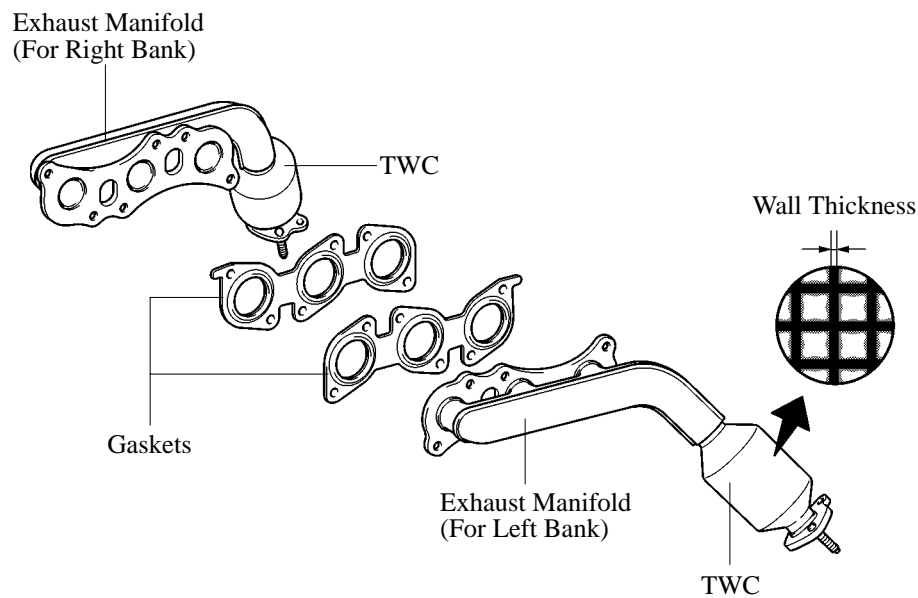
- ▶ Do not disassemble the upper and lower portions of the two-piece intake manifold, which are sealed with a rubber gasket and adhesive. To remove the intake manifold, remove the 10 bolts that are shown in illustration.
- ▶ These bolts have hexagonally shaped heads.



238EG40

6. Exhaust Manifold

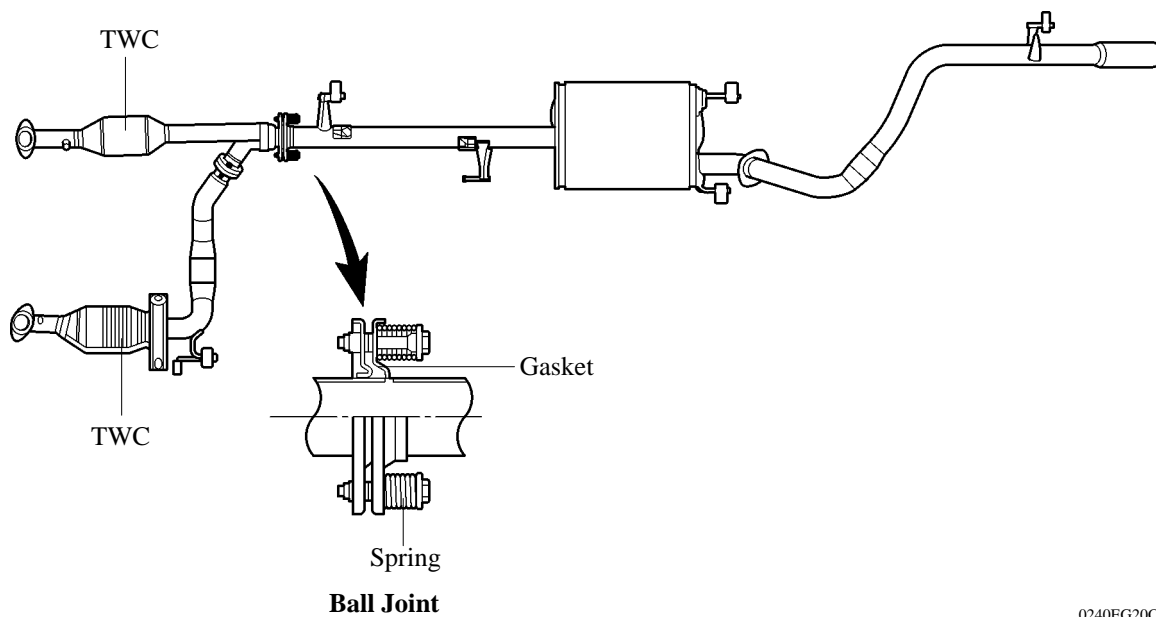
- ▶ A stainless steel exhaust manifold with an integrated TWC (Three-Way Catalytic converter) is used for warm-up of the TWC and for weight reduction.
- ▶ An ultra thin-wall, high-cell density, ceramic type TWC is used. One of this type of TWC is incorporated for each of the right and left banks. The TWC enables an improvement in the reduction of exhaust emissions by optimizing the cell density and the cell wall thickness.



0240EG19C

7. Exhaust Pipe

- ▶ A stainless steel exhaust front pipe with an integrated TWC (Three-Way Catalytic converter) is used.
- ▶ A ball joint is used to join the exhaust front pipe and exhaust center pipe. As a result, in-vehicle sound is muffled and vibration is minimized.

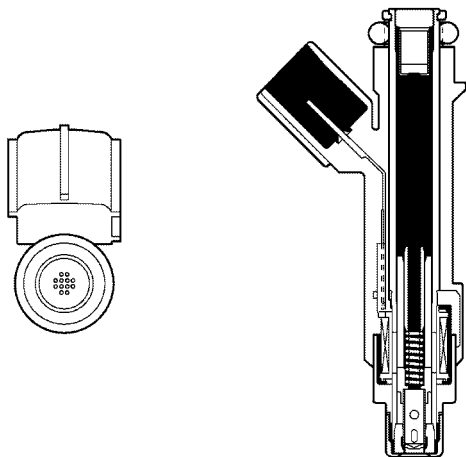
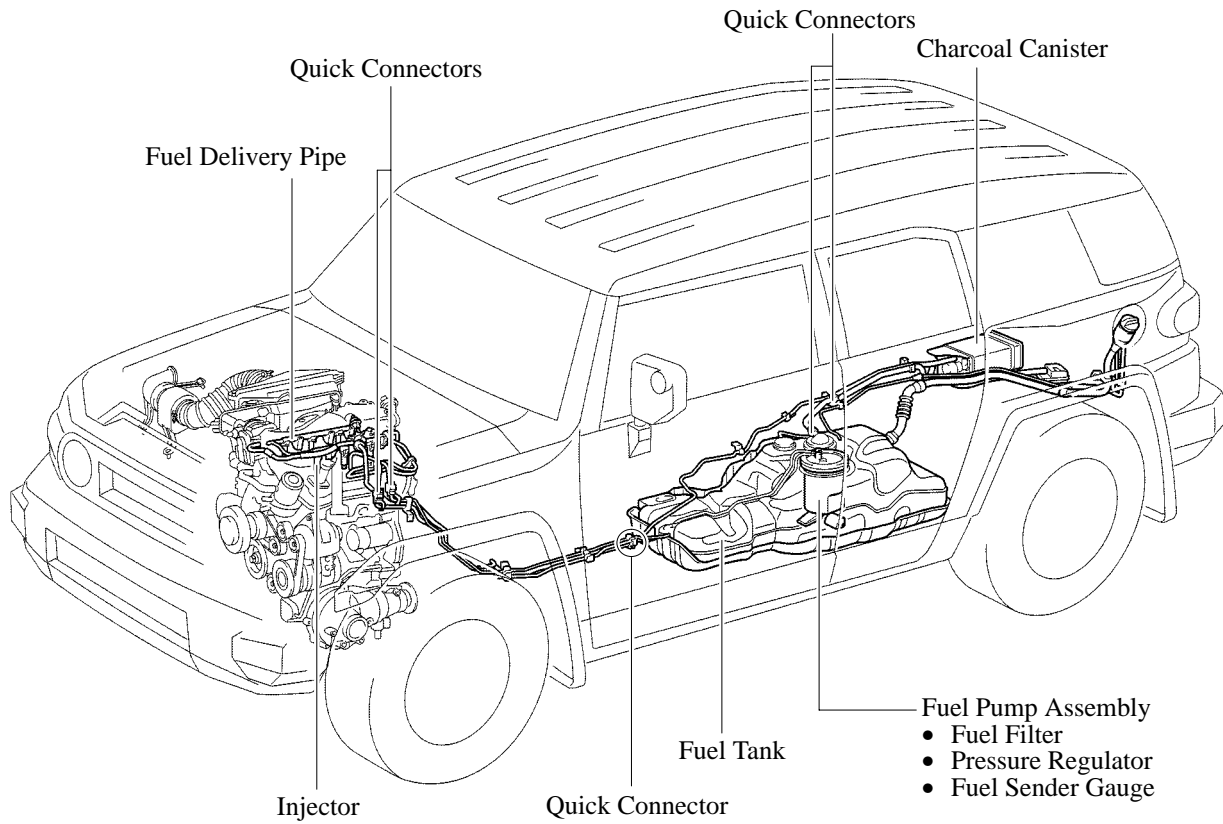


0240EG20C

○ FUEL SYSTEM

1. General

- ▶ A fuel return system is used.
- ▶ A fuel cut control is used to stop the fuel pump when the SRS airbag is deployed in a frontal or side collision. For details, see page EG-60.
- ▶ Compact 12-hole type fuel injectors are used to improve the atomization of fuel.
- ▶ Fuel delivery pipes made of plastic are used to realize weight savings.
- ▶ A quick connector is used to connect the fuel line for ease of serviceability.
- ▶ A multi-layer plastic fuel tank is used to address environmental concerns.
- ▶ A fuel drain mark is provided on the fuel tank.
- ▶ An ORVR (Onboard Refueling Vapor Recovery) system is used. For details, see page EG-66.

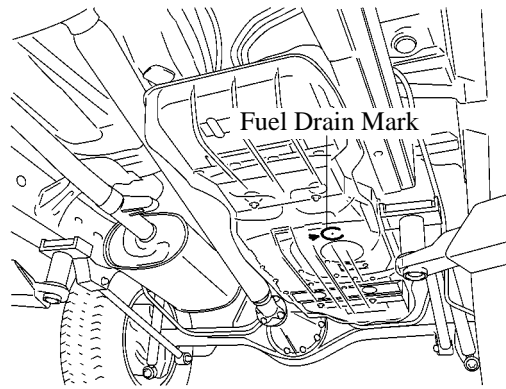


Injector

ENGINE — 1GR-FE ENGINE

Service Tip

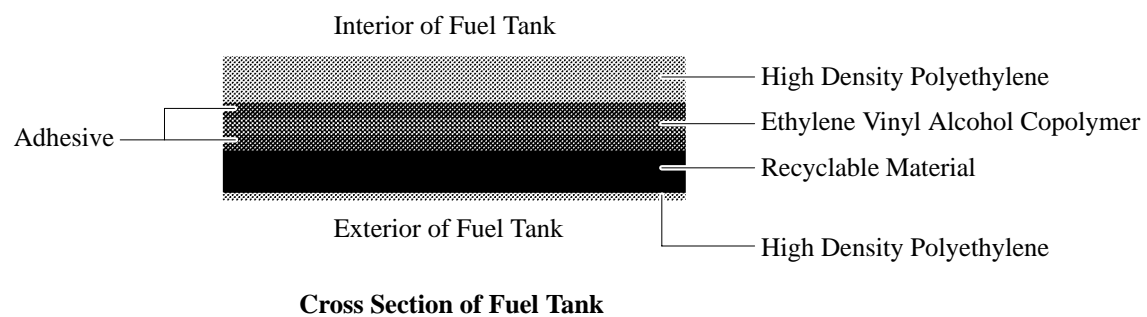
The fuel drain mark has been provided at the fuel tank. When dismantling (scrapping) the vehicle, drain fuel by making a hole at this mark.



0240EG22C

2. Fuel Tank

The multi-layer plastic fuel tank consists of six layers of four types of materials, and one of those is a recyclable material to address environmental concerns.

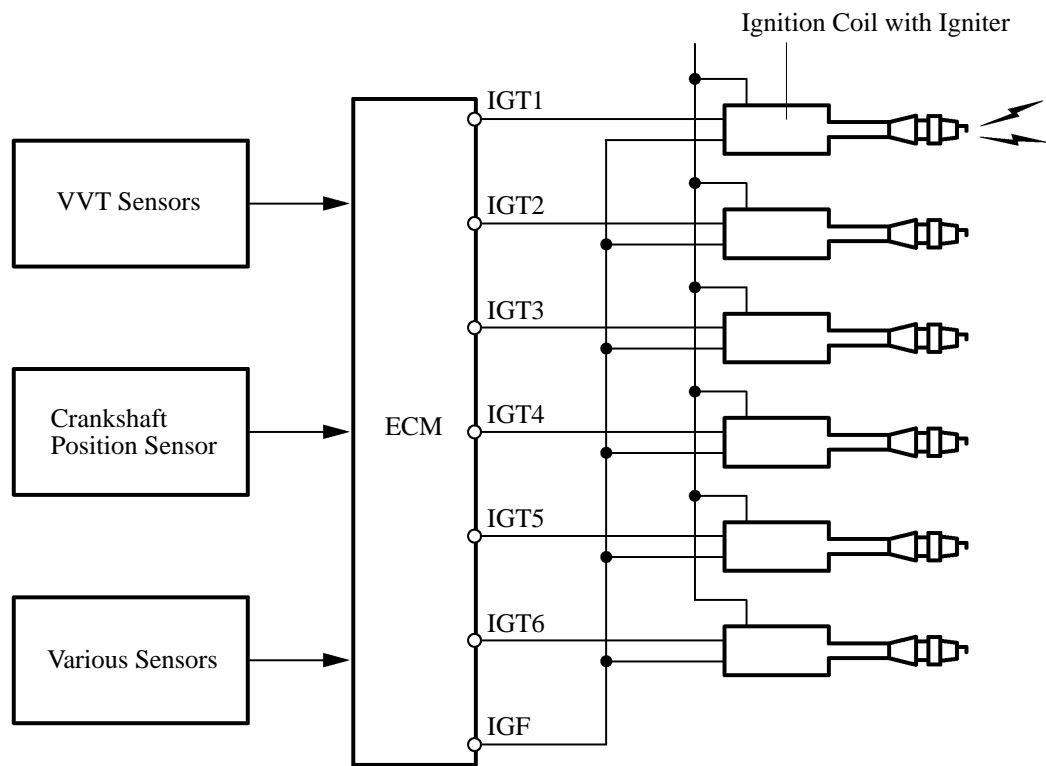


D13N27

► **IGNITION SYSTEM**

1. General

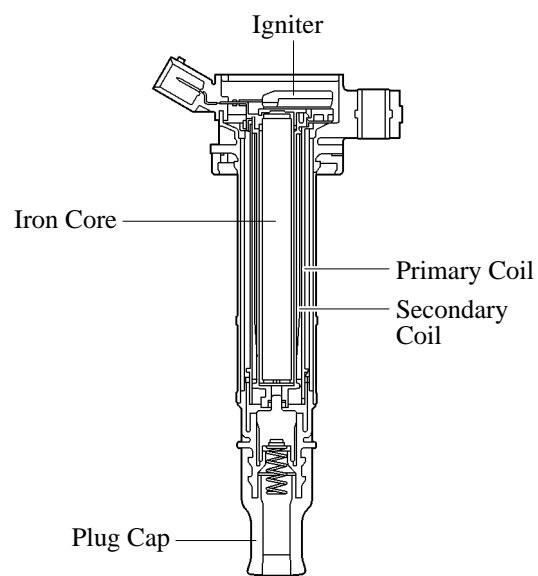
A DIS (Direct Ignition System) is used. The DIS improves ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor. The DIS is an independent ignition system which has one ignition coil (with an integrated igniter) for each cylinder.



238EG68

2. Ignition Coil

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



Ignition Coil Cross Section

238EG69

3. Spark Plug

Long-reach type spark plugs are used. This type of spark plugs allows the area of the cylinder head to receive the spark plugs to be made thick. Thus, the water jacket can be extended near the combustion chamber, contributing to cooling system performance.

