



LAND CRUISER **LAND CRUISER PRADO** **New Car Features** **May, 1996**

FOREWORD

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

Applicable models: RZJ90, 95, VZN90, 95, LJ90, 95, KZJ90, 95 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.
<i>REFERENCE</i>	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.
● Land Cruiser/Land Cruiser Prado Chassis and Body Repair Manual	RM517E
● 5VZ-FE Engine Repair Manual	RM519E
● 3RZ-F, 3RZ-FE Engine Repair Manual	RM521E
● 1KZ-TE Engine Repair Manual Supplement	RM522E
● 2L, 3L Engine Repair Manual	RM520E

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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1. Introduction

IN

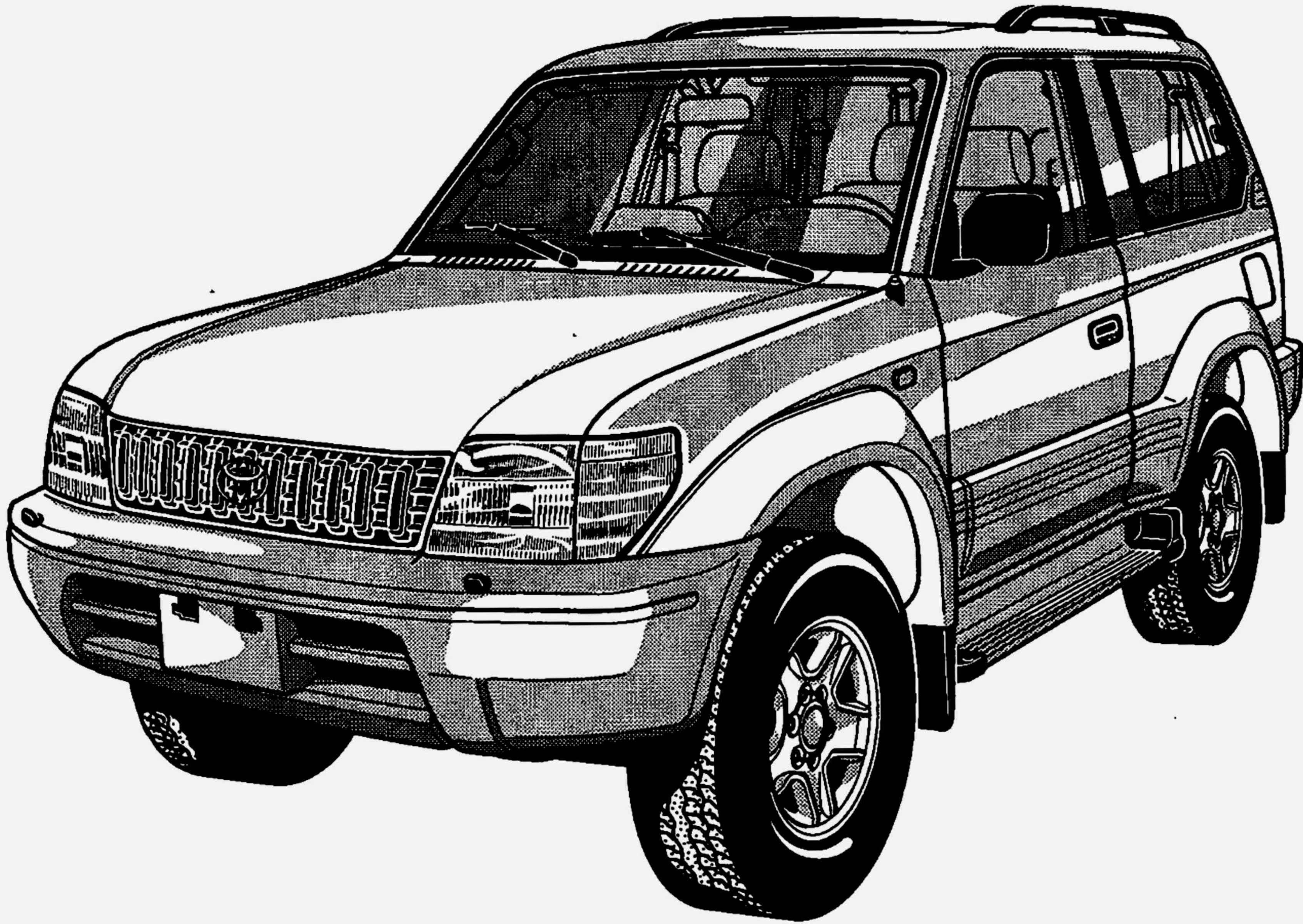
DEVELOPMENT OBJECTIVES

The major development objectives of the Land Cruiser/Land Cruiser Prado are as follows:

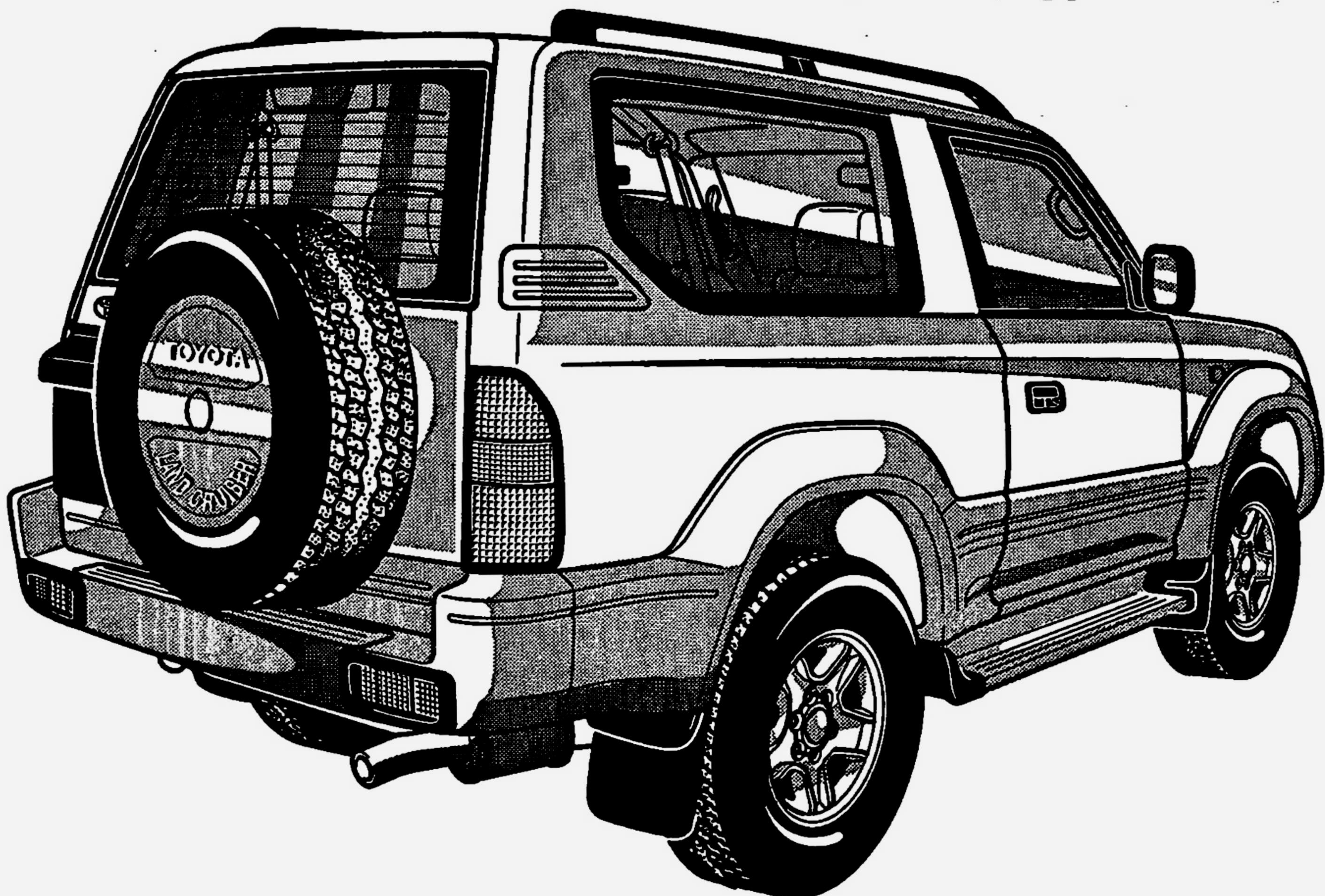
- To realize a 4WD exterior and interior design that is fresh, yet unaffected by trends.
- To offer excellent crash safety by providing substantial safety equipment and revising the body frame construction.
- To provide ample interior space by applying the “big inside, small outside” design concept and provide a comfortable interior equipped with a substantial range of accessories and functions.
- To improve the basic performance of the sports utility vehicle.

EXTERIOR APPEARANCE

3-Door Model

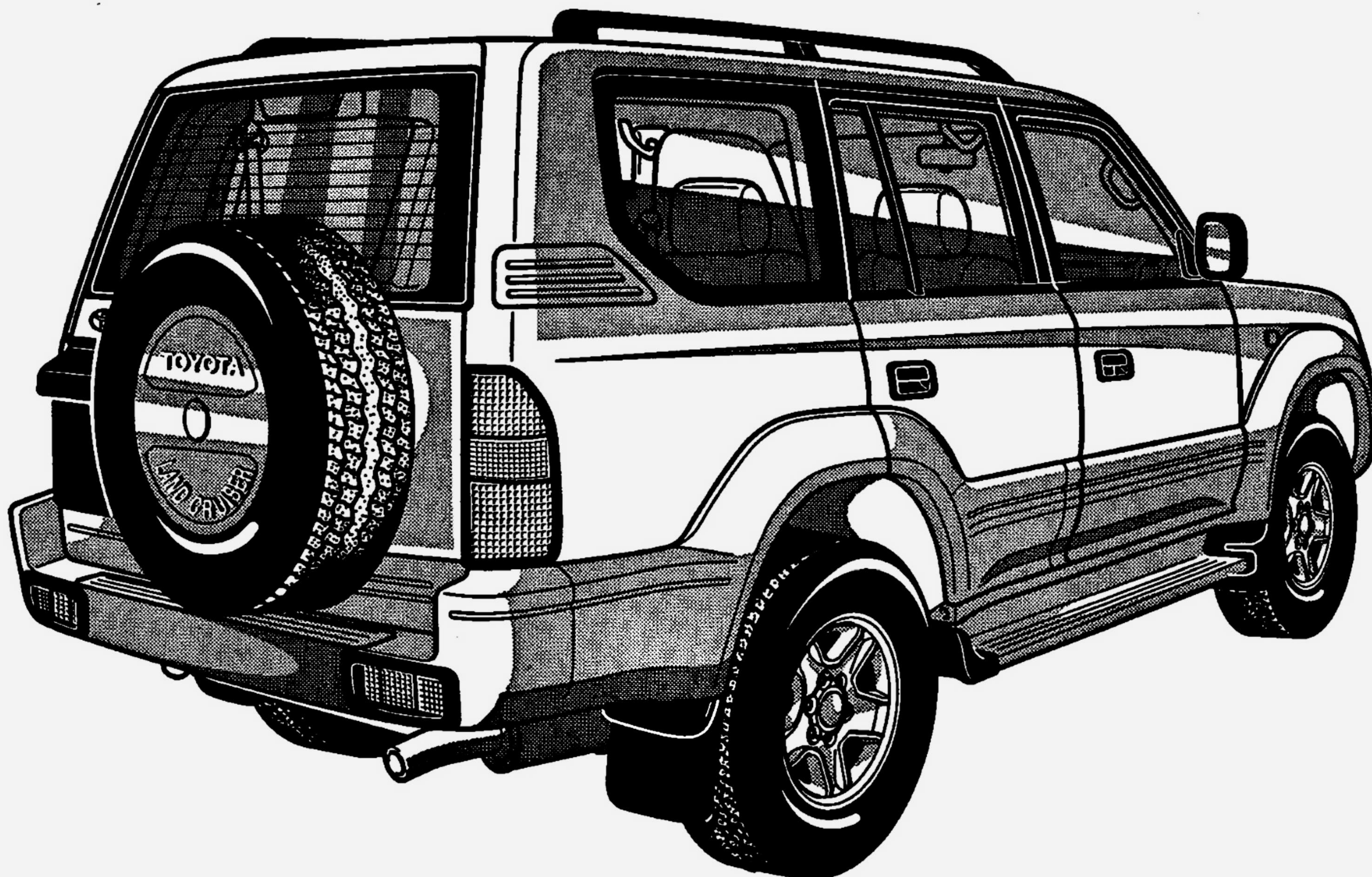
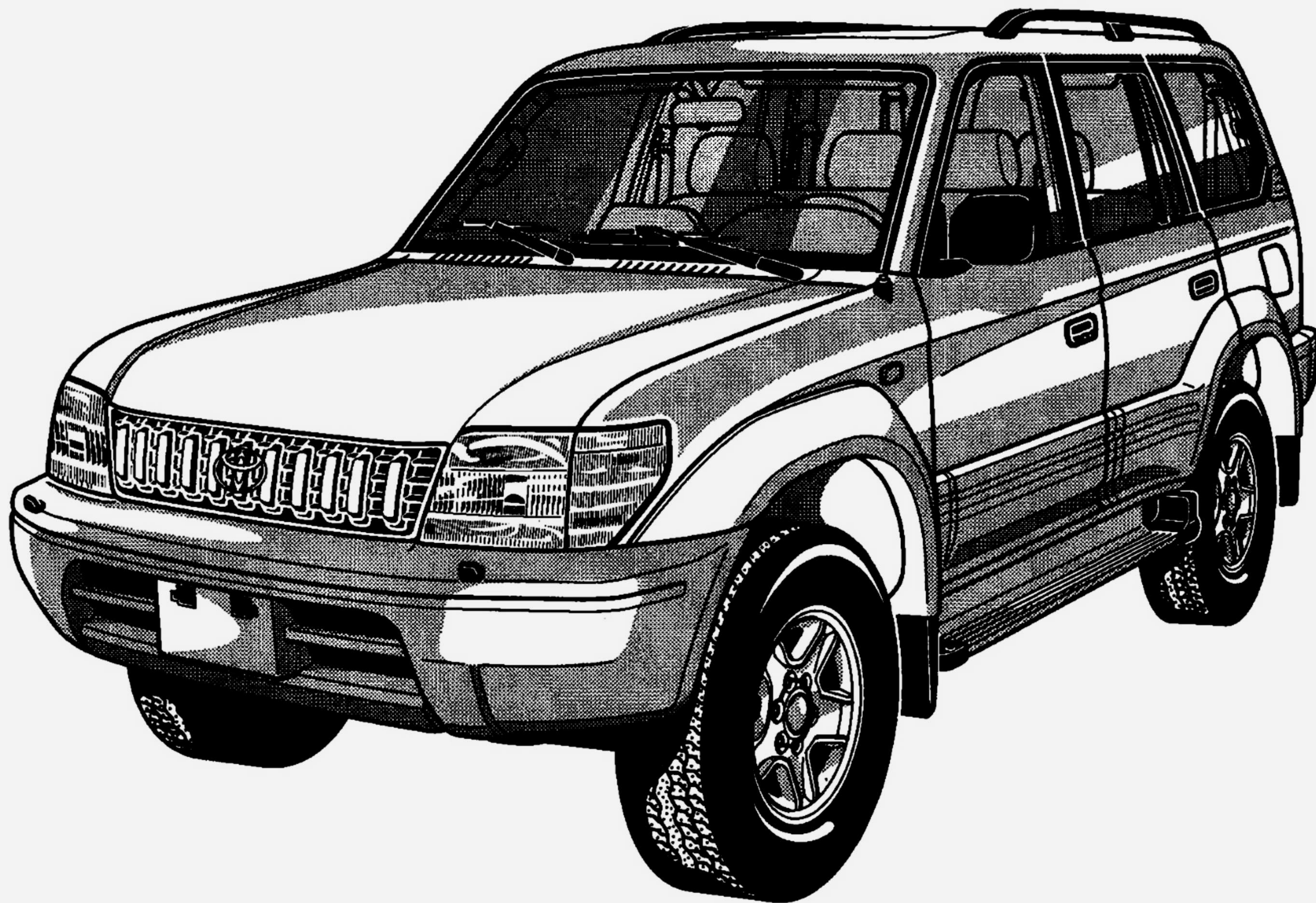


IN



EXTERIOR APPEARANCE

5-Door Model



MODEL CODE

MODEL CODE

IN

VZJ90 L – G K M N K W

①

②

③

④

⑤

⑥

⑦

⑧

①	BASIC MODEL CODE		
	CODE	ENGINE	WHEEL BASE
	RZJ90	3RZ-F or 3RZ-FE	Short
	VZN90	5VZ-FE	
	LJ90	3L	
	KZJ90	1KZ-T or 1KZ-TE	
	RZJ95	3RZ-F or 3RZ-FE	Long
	VZN95	5VZ-FE	
	LJ95	3L	
	KZJ95	1KZ-T or 1KZ-TE	

④	BODY TYPE
	J : 3-Door K : 5-Door

⑤	GEARSHIFT TYPE
	M : 5-Speed Manual P : 4-Speed Automatic

⑥	GRADE
	R : STD N : GX E : VX

⑦	ENGINE SPECIFICATION
	S : Standard U : DOHC and Carburetor K : DOHC and EFI X : Turbocharger T : Turbocharger and EFI

⑧	DESTINATION
	W : Europe Q : Australia V : G.C.C. Countries Blank : General Countries

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

③	ROOF TYPE
	G : Standard Roof

MODEL LINE-UP

MODEL LINE-UP

MODEL NAME	TRANSMISSION						5-Speed Manual			4-Speed Automatic			
	DESTI-NATION	ENGINE	BODY TYPE	WHEEL BASE	GRADE	DRIVE TYPE	G52	W56	R150F				
Land Cruiser	Europe	5VZ-FE	3-Door	Short	-	Full-Time			VZJ90L-GJMNKW	VZJ90L-GJPNKW			
			5-Door	Long					VZJ95L-GKMNKW	VZJ95 ^R _L -GKPNKW			
		1KZ-TE	3-Door	Short					KZJ90 ^R _L -GJMNTW	KZJ90L-GJPNTW			
			5-Door	Long					KZJ95 ^R _L -GKMNTW	KZJ95 ^R _L -GKPNTW			
		3RZ-FE	5-Door					RZJ95R-GKMNKQ	RZJ95R-GKPNKQ				
		5VZ-FE					VZJ95R-GKMNKQ	VZJ95R-GKPNKQ					
Land Cruiser Prado	Australia	3RZ-F	5-Door	Long	GX	Part-Time		RZJ95L-GKMNUV					
		5VZ-FE	3-Door	Short	VX	Full-Time			VZJ90L-GJMEKV				
	G.C.C. Countries	3RZ-F	5-Door	Long					VZJ95L-GKMEKV	VZJ95L-GKPEKV			
			3-Door	Short	STD			RZJ90L-GJMRU					
	General Countries	3RZ-F	5-Door	Long	GX	Part-Time		RZJ95 ^R _L -GKMNU					
			3-Door	Short					RZJ90L-GJMNK				
		3RZ-FE	5-Door	Long	STD			RZJ95R-GKMNK					
			3-Door	Short									
		3L	5-Door	Long	GX		LJ90 ^R _L -GJMRS						
			3-Door	Long			LJ95 ^R _L -GKMRS						
			5-Door				LJ95 ^R _L -GKMNS						
		1KZ-T	5-Door	Long	GX						KZJ90L-GJMNX		
			3-Door	Short							KZJ95L-GKMNX		

2. New Model Outline

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MAJOR COMPONENTS

The basic components of the Land Cruiser/Land Cruiser Prado are as follows:

Item		Type and Specifications					
Drive System		Part-Time 4WD or Full-Time 4WD					
Engine	Type	Gasoline			Diesel		
		3RZ-F	3RZ-FE	5VZ-FE	3L	1KZ-T	1KZ-TE
		In-Line 4, 2.7-Liter	←	V6, 3.4-Liter	In-Line 4, 2.8-Liter	In-Line 4, 3.0-Liter	←
	Displacement cm ³ (cu. in.)	2694 (164.4)	←	3378 (206.1)	2779 (169.6)	2982 (181.9)	←
	Valve Mechanism	16-Valve DOHC	←	24-Valve DOHC	8-Valve OHC	←	←
	Fuel System	Carburetor	EFI	←	Distribution Type	←	←
	Max. Output kW@rpm	97@5200 [SAE-NET] 104@5200 [SAE-GROSS]	112@4800 [EEC]	131@4600 [EEC] 132@4800 [SAE-NET] 149@4800 [SAE-GROSS]	65@4000 [SAE-NET] 60@3800* ¹ [SAE-NET]	88@3600 [SAE-NET]	92@3600 [EEC]
	Max. Torque N·m@rpm	217@3200 [SAE-NET] 226@3200 [SAE-GROSS]	240@4000 [EEC]	303@3600 [EEC] 290@3600 [SAE-NET] 312@3600 [SAE-GROSS]	185@2400 [SAE-NET] 174@2400* ¹ [SAE-NET]	290@2400 [SAE-NET]	295@2400 [EEC]
Clutch		Dry Type, Single Plate					
Transmission	Manual	G52: 5-Speed (For 3L) W56: 5-Speed (For 3RZ-F and 3RZ-FE) R150F: 5-Speed (For 5VZ-FE, 1KZ-T and 1KZ-TE)					
	Automatic	A343F: 4-Speed (For 3RZ-FE, 5VZ-FE and 1KZ-TE)					
Transfer		VF2A: Part-Time (For G52, W56 and R150F* ²) VF3B: Full-Time (For W56* ³ , R150F and A343F)					
Differential	Front	Hypoid Gear					
	Rear	Hypoid Gear: STD Hypoid Gear with L.S.D.* ⁴ : OPT Hypoid Gear with Diff. Lock System: OPT					

*¹: Models for Thailand and Malaysia

*²: Models for General Countries

*³: Model for Australia

*⁴: L.S.D. (Limited Slip Differential)

MAJOR COMPONENTS

Item		Type and Specifications
Brakes	Front	Ventilated Disc
	Rear	Leading Trailing Drum or Ventilated Disc
Suspension	Front	Double Wishbone
	Rear	4-Link Coil Spring with Lateral Rod
Steering	Gear Type	Rack and Pinion
	Power Steering	Integral Type

MO

ENGINE

ENGINE LINE-UP

The Land Cruiser/Land Cruiser Prado has 6 engine types.

Engine Type	Displacement	Destination	Max. Output	Max. Torque	Features
3RZ-F	2.7ℓ	G.C.C. Countries	104 kW@5200 rpm [SAE-GROSS]	226 N·m@3200 rpm [SAE-GROSS]	The 3RZ-F engine is an in-line 4, DOHC gasoline engine. It delivers both high performance and low fuel consumption.
		General Countries	97kW@5200 rpm [SAE-NET]	217 N·m@3200 rpm [SAE-NET]	
3RZ-FE	2.7ℓ	Australia and General Countries	112 kW@4800 rpm [EEC]	240 N·m@4000 rpm [EEC]	The 3RZ-FE engine is an in-line 4, gasoline engine based on the 3RZ-F engine with EFI system.
5VZ-FE	3.4ℓ	Europe	131 kW@4600 rpm [EEC]	303 N·m@3600 rpm [EEC]	Low noise and vibration V6 engine with a compact design which produces high torque in the low-to-mid-speed range.
		Australia	132 kW@4800 rpm [SAE-NET]	290 N·m@3600 rpm [SAE-NET]	
		G.C.C. Countries	149 kW@4800 rpm [SAE-GROSS]	312 N·m@3600 rpm [SAE-GROSS]	
3L	2.8ℓ	General Countries	65 kW@4000 rpm [SAE-NET]	185 N·m@2400 rpm [SAE-NET]	The 3L engine is an in-line 4, OHC diesel engine, whose swirl-chamber type cylinder head is equipped with direct drive valve mechanism.
			60 kW@3800 rpm* [SAE-NET]	174 N·m@2400 rpm* [SAE-NET]	
1KZ-T	3.0ℓ	General Countries	88 kW@3600 rpm [SAE-NET]	290 N·m@2400 rpm [SAE-NET]	The 1KZ-T engine is an in-line 4, OHC diesel engine with turbocharger. It offers high torque in the low-to-mid-speed range.
1KZ-TE	3.0ℓ	Europe	92 kW@3600 rpm [EEC]	295 N·m@2400 rpm [EEC]	The 1KZ-TE engine is an in-line 4, OHC diesel engine with turbocharger. Based on the 1KZ-T engine, it uses an electronically controlled injection pump, thus reducing exhaust emissions, improving fuel economy, and ensuring high performance.

*: Models for Thailand and Malaysia

ENGINE

■ 3RZ-F AND 3RZ-FE ENGINE

The 3RZ-F and 3RZ-FE engines are 2.7-liter, 16-valve DOHC engine.

These engines achieve high performance and fuel economy through the use of the 4-valve mechanism, and reduces engine noise and vibration through the use of balance shafts.

Based on the 3RZ-F engine, the 3RZ-FE engine uses the EFI for its fuel system.

■ 5VZ-FE ENGINE

The 5VZ-FE engine is a V6, 3.4-liter, 24-valve DOHC engine.

This engine has realized high torque in the low-to-mid-speed range and low fuel consumption through the adoption of the 4-valve mechanism.

MO

■ 3L ENGINE

The 3L engine is a 2.8-liter, 8-valve OHC engine with the same basic functions as the previous model.

■ 1KZ-T AND 1KZ-TE ENGINE

The 1KZ-T and 1KZ-TE engines are 3.0-liter, 8-valve OHC engine with turbocharger.

These engines achieve high performance and fuel economy by optimizing the shape of the combustion chamber and the compression ratio. Also, their engine noise and vibration are reduced through the use of balance shafts.

Based on the 1KZ-T engine, the 1KZ-TE engine uses an electronically controlled injection pump to reduce exhaust emissions, improve fuel economy, and ensure high performance.

CHASSIS

The Land Cruiser/Land Cruiser Prado has double wishbone type suspension in the front and 4-link coil spring with lateral rod type suspension in the rear. Coupled with the rack and pinion power steering, they provide both good driving stability and riding comfort.

MAJOR COMPONENTS

Suspension

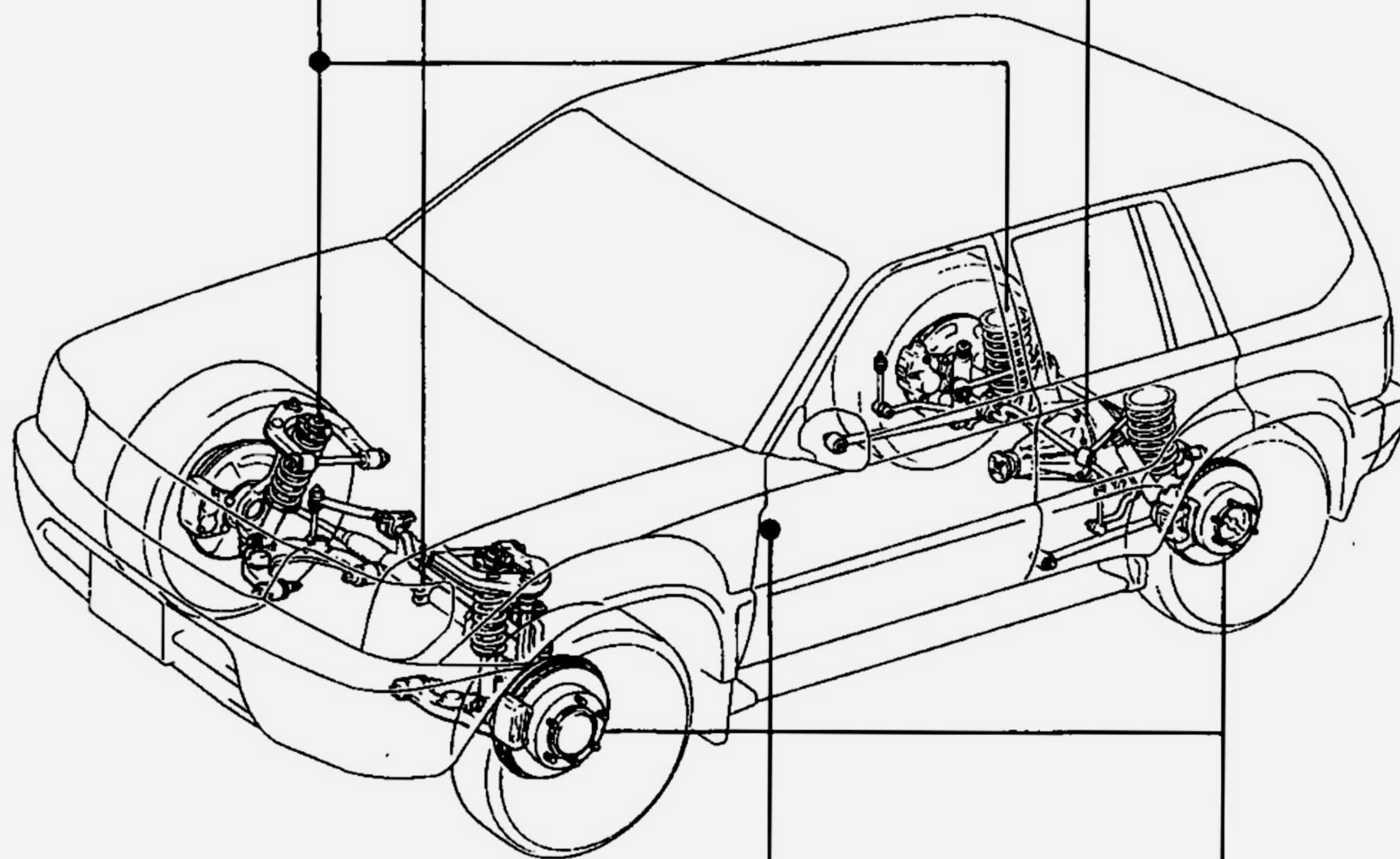
Double wishbone type front suspension and 4-link coil spring with lateral rod type rear suspension are used on all models.

Steering

Rack and Pinion power steering is used in all models.

Rear Differential

- The differential lock system is available as an option for Europe model and 3RZ-F and 1KZ-T engine models for General Countries.
- A rear LSD (Limited Slip Differential) is available as an option on all models.



Transmission and Transfer

4 types of transmissions and 2 types of transfers are used.

Transmission	Manual					Automatic
	G52	W56		R150F		A343F
Transfer	VF2A	VF2A	VF3B	VF2A	VF3B	VF3B
Engine	VF2A	VF2A	VF3B	VF2A	VF3B	VF3B
3RZ-F		●				
3RZ-FE		●	●*			●
5VZ-FE					●	●
3L	●					
1KZ-T				●		
1KZ-TE					●	●

*: For Australia Models

Brakes

- Front ventilated disc brakes and rear drum brakes are used. Rear disc brakes are used on models with ABS, and those with 1KZ-TE and 5VZ-FE engines.
- ABS (Anti-Lock Brake System) is available as an option as shown in the table below.

●: Option

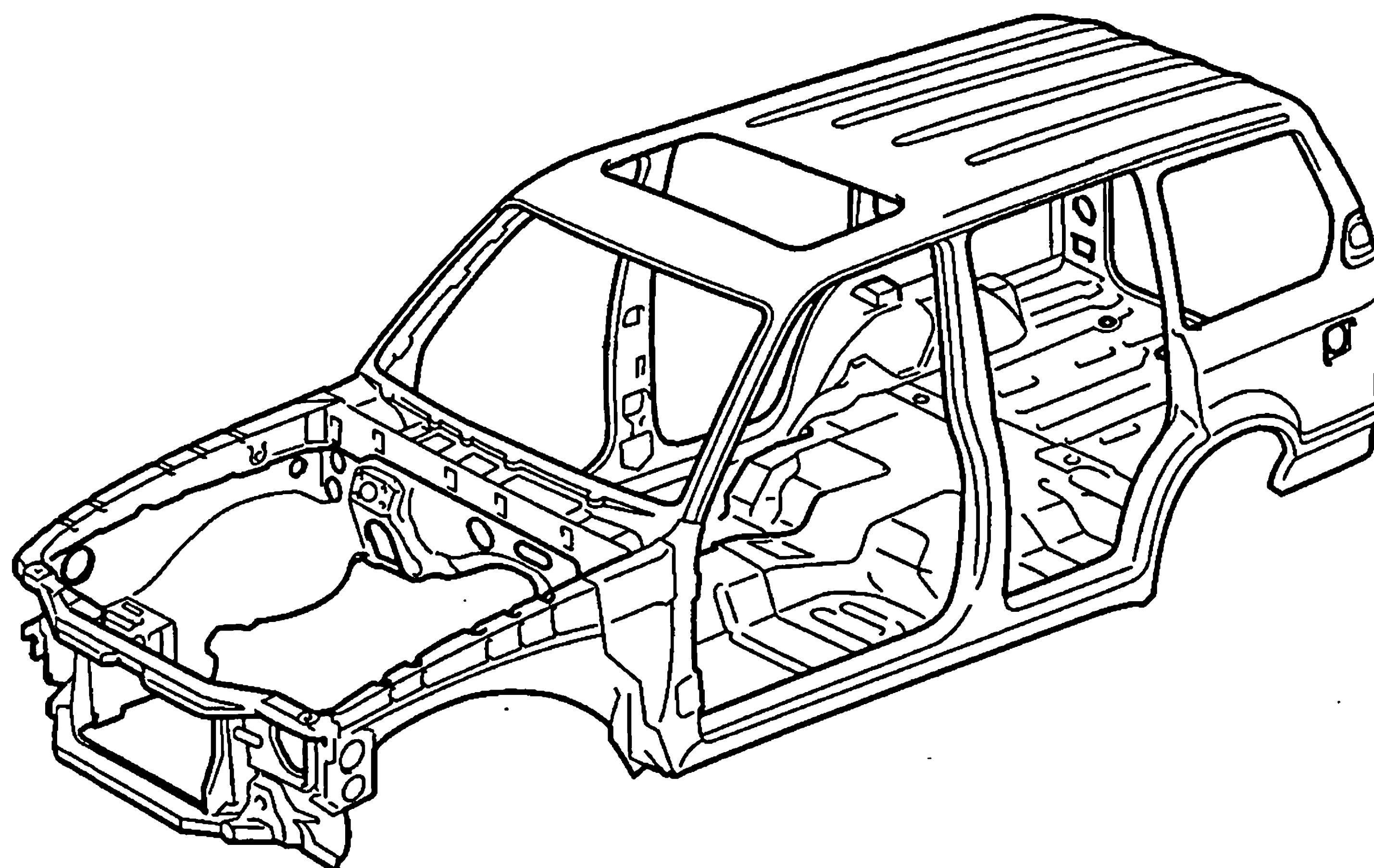
Engine Type	3RZ-F	3RZ-FE	5VZ-FE	1KZ-T	1KZ-TE
Destination	3RZ-F	3RZ-FE	5VZ-FE	1KZ-T	1KZ-TE
Europe			●		●
Australia		●	●		
G.C.C. Countries	●*1		●		
General Countries*1,*2	●	●		●	

*1: Except Models with Front Bench Seat

*2: GX Grade Model

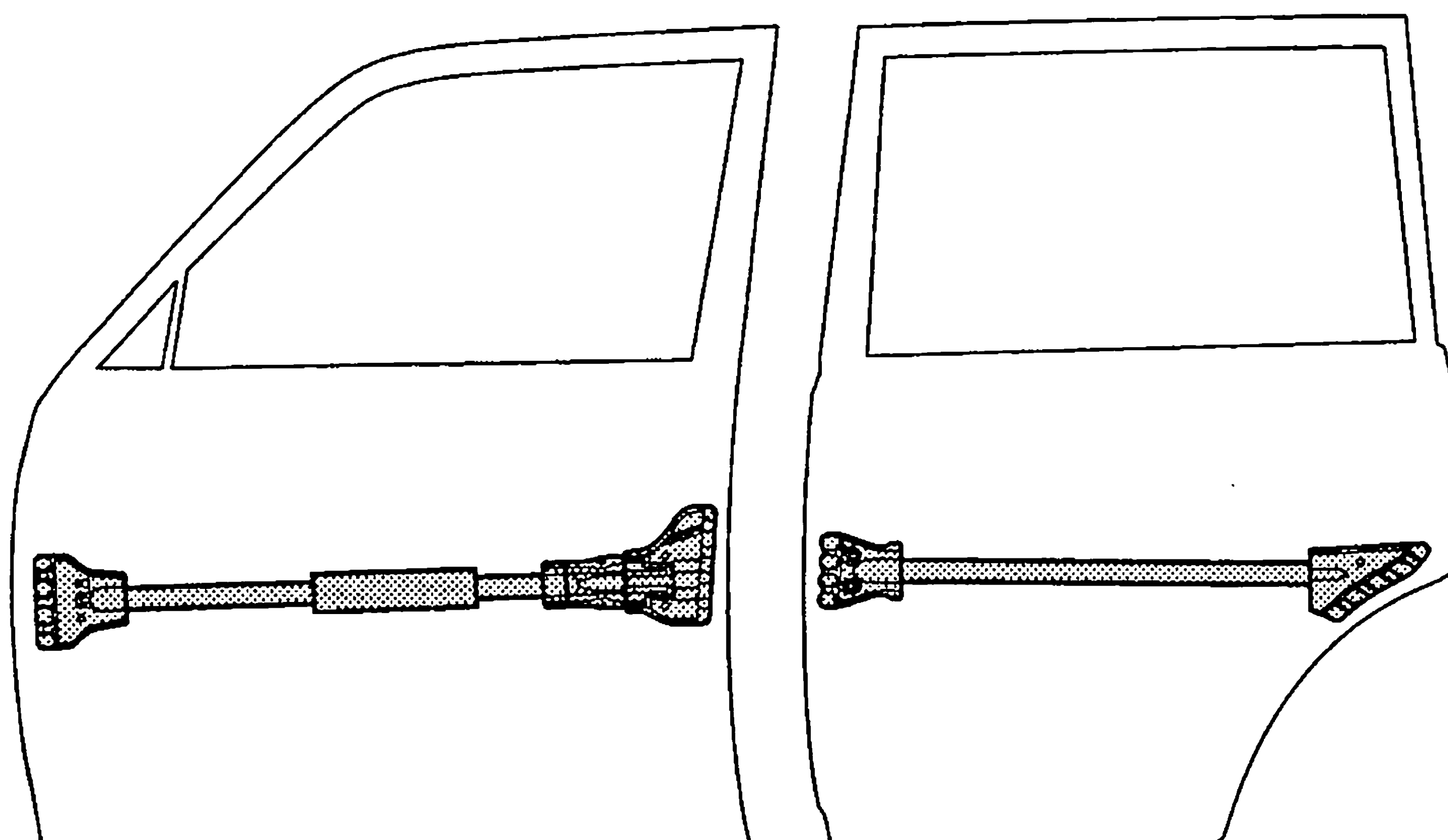
BODY

- Through the optimized allocation of component materials and the generous application of high-strength sheet steel, the body of Land Cruiser/Land Cruiser Prado is now more rigid and lightweight. Furthermore, anti-corrosion sheet steel and various chip-resistance treatments have been generously applied to ensure outstanding corrosion resistance.



5-Door Model

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



EXTERIOR

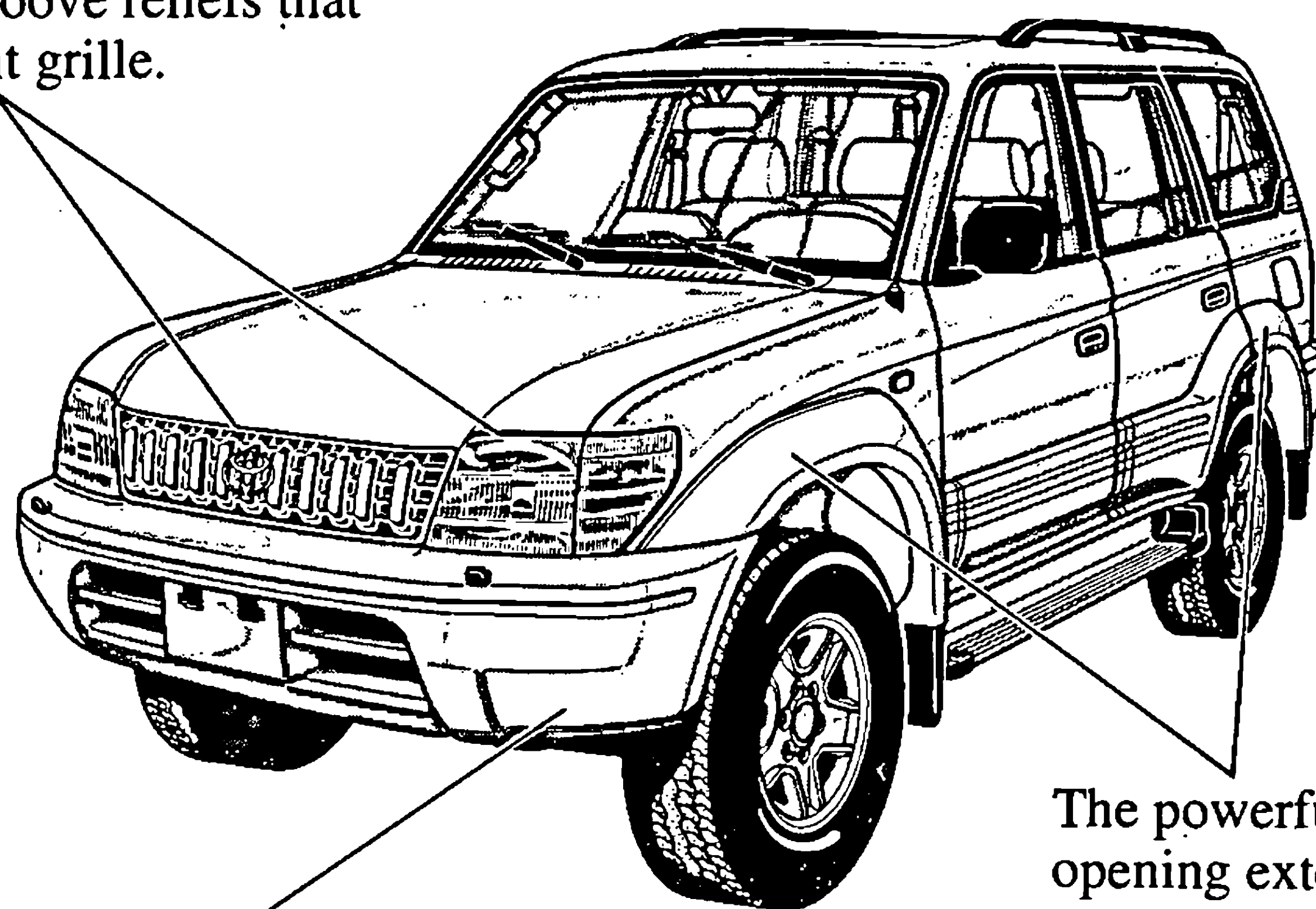
STYLING

The design concept of the Land Cruiser/Land Cruiser Prado is a “a 4WD exterior design that is cosmopolitan and rugged, and expresses toughness, strength, and stability without being affected by trends”.

The styling has the following features:

- A powerful and unique front view.
- A side view that evokes a dynamic sense of driving. (5-door model)
- A side view that evokes a nimble yet powerful sense of movement. (3-door model)
- A rear view that provides a very 4WD-like stability.

A powerful grille design and the characteristic V-groove reliefs that extends to the front grille.

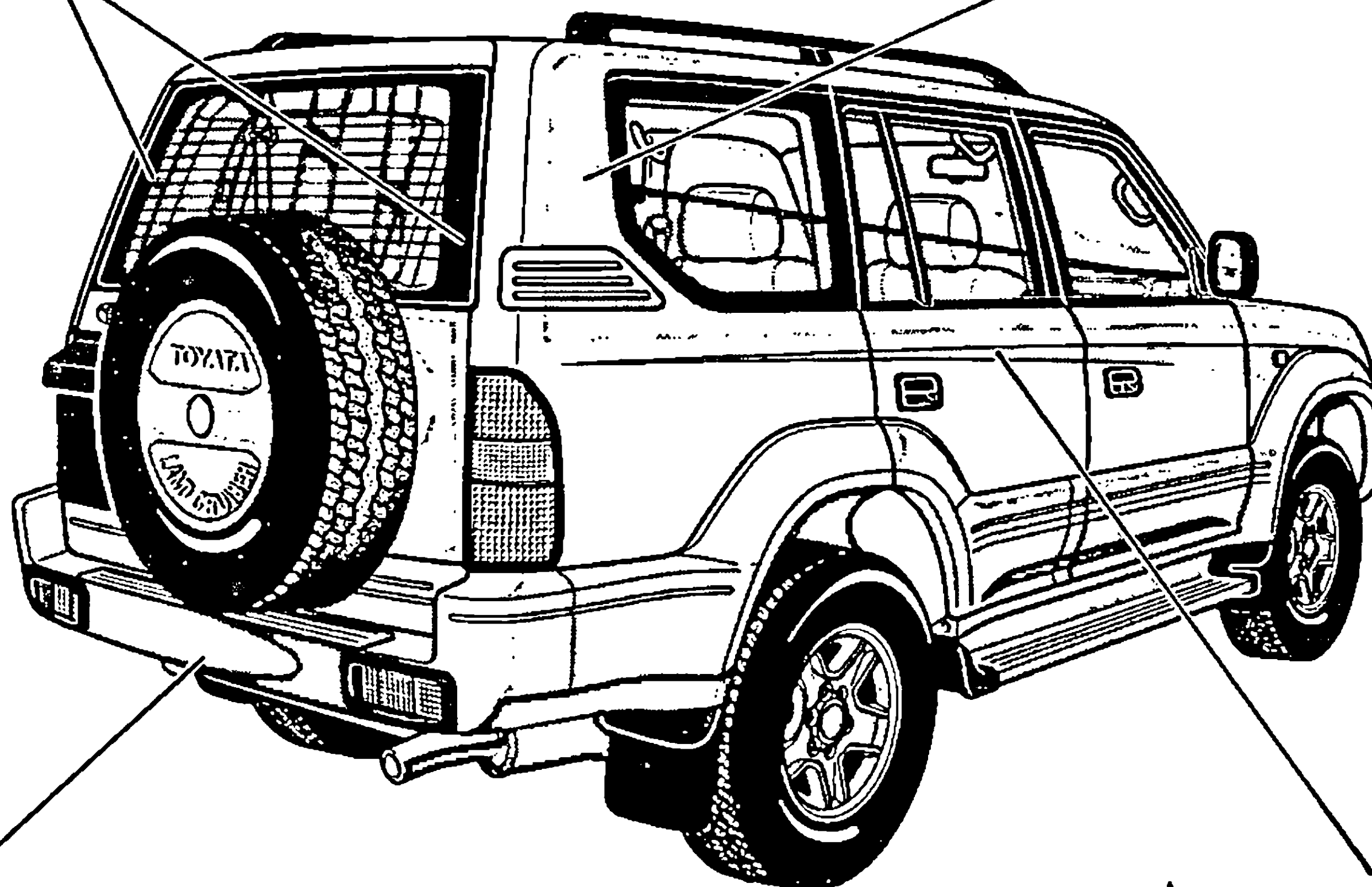


Rugged, functionally strong and powerfully shaped large resin bumper.

The powerfully shaped wheel opening extension that integrates with the character line.

The rear view emphasizes the sense of wideness and cleanliness by having the back door glass built into the door frame.

The unique rear pillar that firms up the wedged character line.



The powerfully shaped large resin bumper.

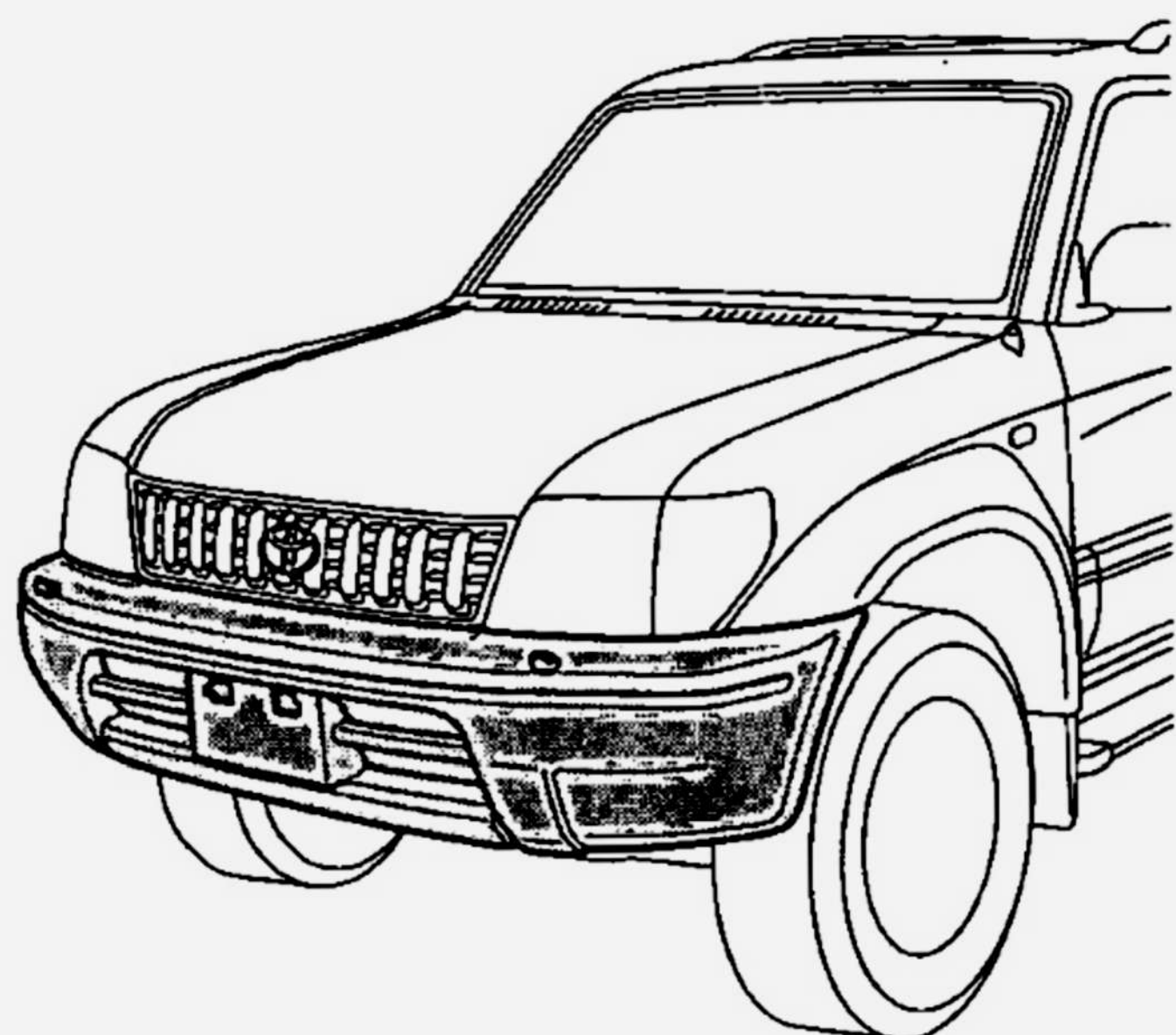
A smart and uninhibited character line.

EXTERIOR

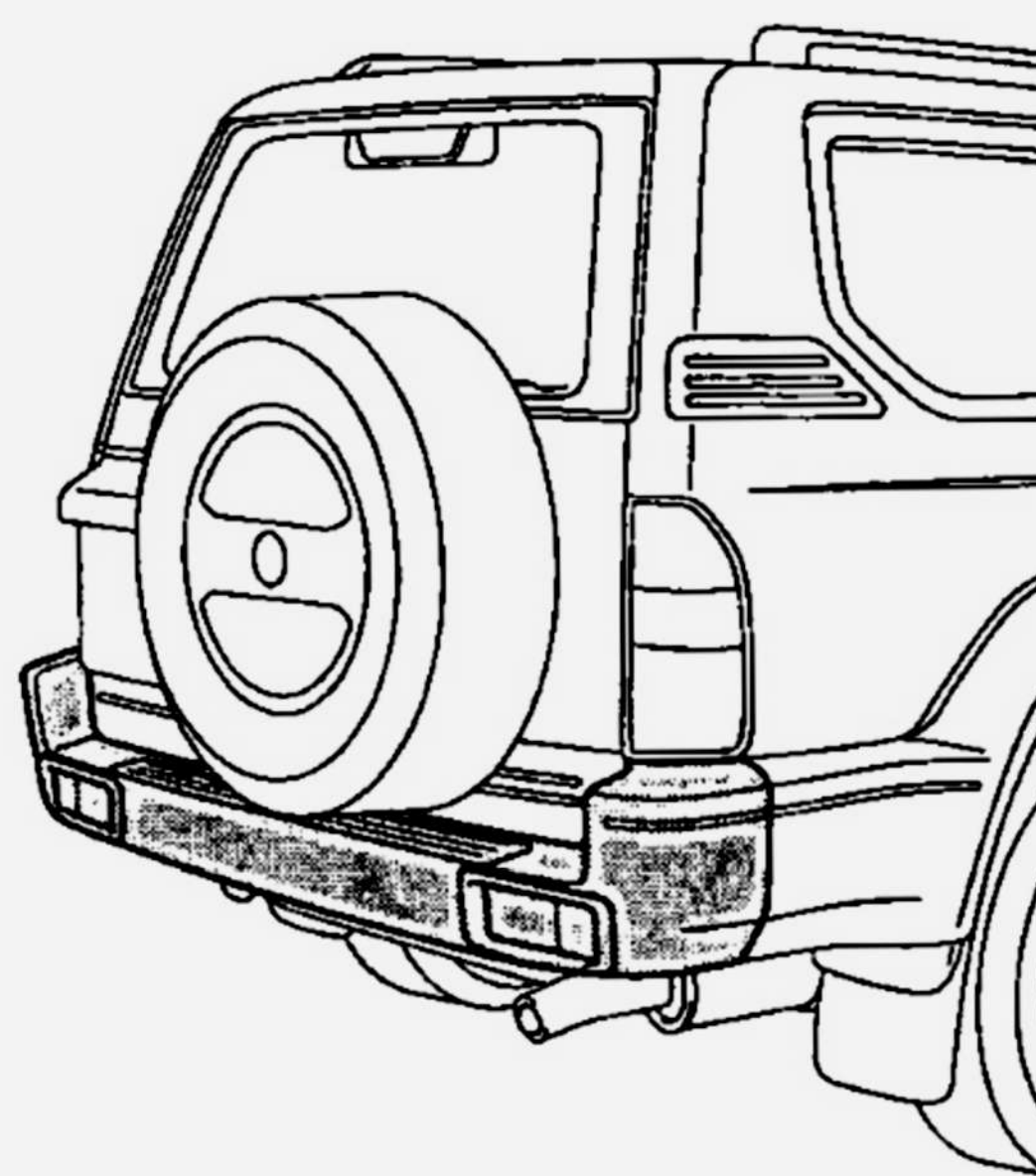
EXTERIOR EQUIPMENT

■ BUMPER

The front and rear bumpers are made of a high-strength, recyclable Toyota Super Olefin Polymer (TSOP) that is far superior to R-RIM (Reinforced-Reaction Injection Molding) urethane and PP (Polypropylene) which are commonly used as bumper material. It is the newest high-performance material for bumpers with the toughness of steel and lightness of polymer.



Front



Rear

MO

■ LIGHTS

1. Front Lights

- 3 types of headlights are used according to the destination and the body type.

●: Standard ○: Option

Destination Body Type		Europe		Australia	G.C.C. Countries		General Countries	
Headlight Type		3-Door	5-Door	5-Door	3-Door	5-Door	3-Door	5-Door
Sculptural Headlights		●	●	●		●		●
Round Lights	Semi-Sealed				●		●	○
	Sealed						○	○

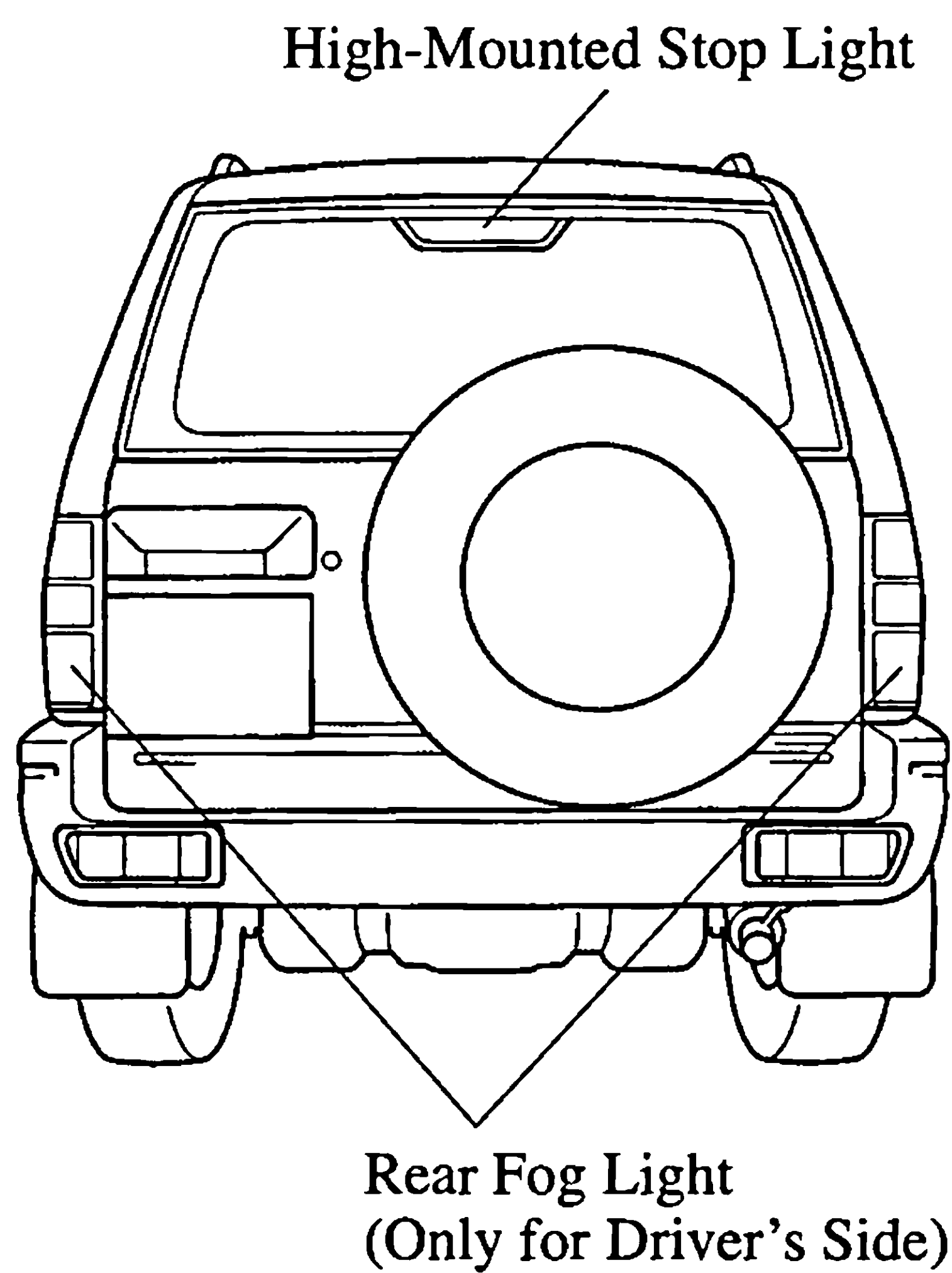
- The daytime running light system is optional equipment on the LHD models for Europe. The daytime running light system turns on both the headlights and taillights when the engine is started.
- The headlight cleaner is optional equipment on models for Europe. When the headlight cleaner switch is turned (pushed) on while the ignition switch and the headlights are turned on, the nozzles on the front bumper spray washer fluid over the headlight lens for about 0.5 seconds. This cleans the lens and provides excellent visibility during night driving.
- A headlight beam level control system, whereby the headlight beam level can be adjusted from inside the cabin, is optional equipment on models for Europe. The headlight beam level can be adjusted using a control switch located near the driver due to the changes in the number of passengers or the load being carried.
- The light reminder system is standard equipment on models for Europe, Australia and VX grade model for G.C.C. Countries, and optional on the GX grade models for G.C.C. Countries and General Countries.

EXTERIOR

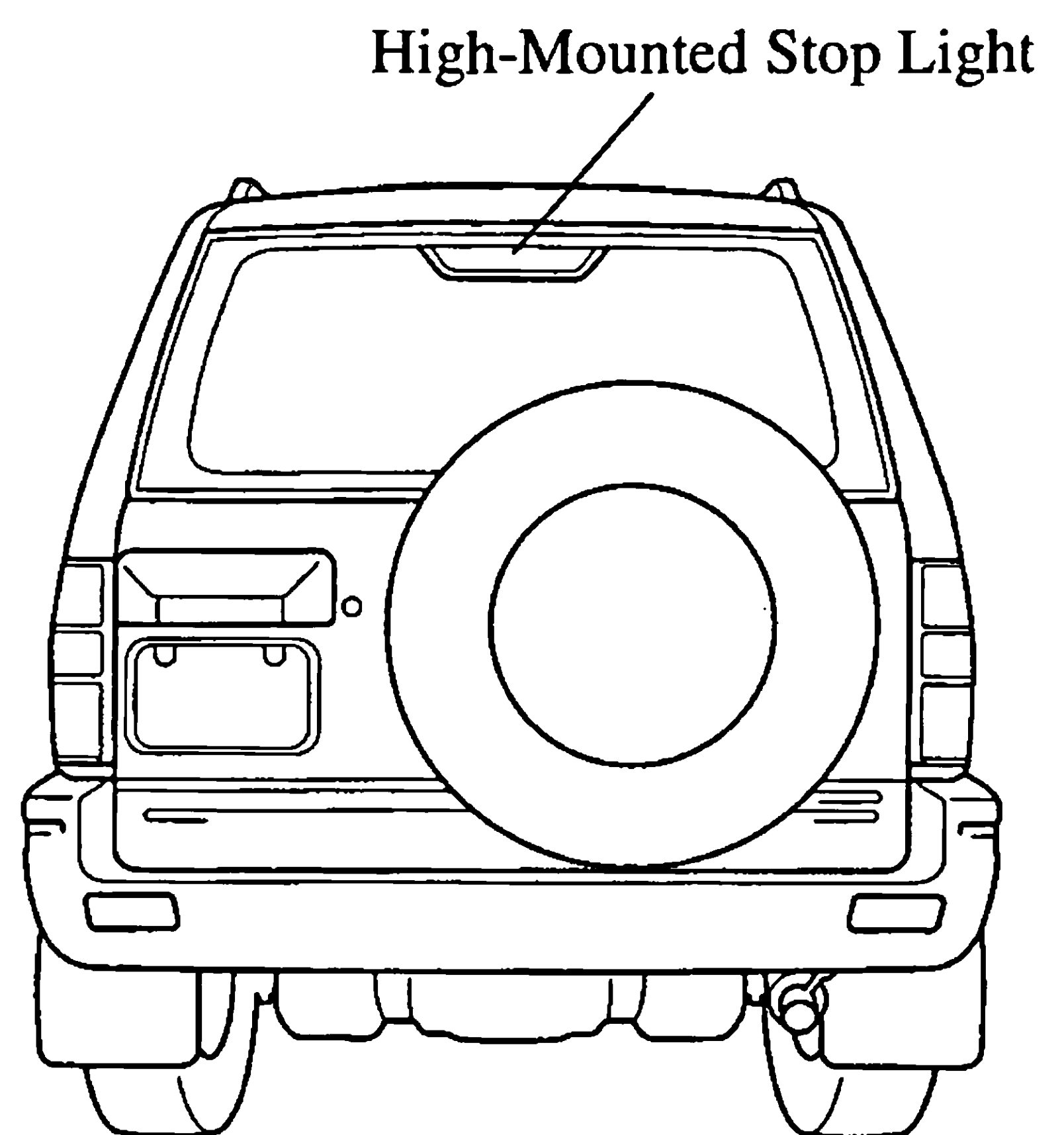
2. Rear Light

- The high-mounted stop light is standard equipment on models for Europe, Australia and G.C.C. Countries, and optional for General Countries.
- The rear fog light is standard equipment on models for Europe.

► Rear Light Layout ◀



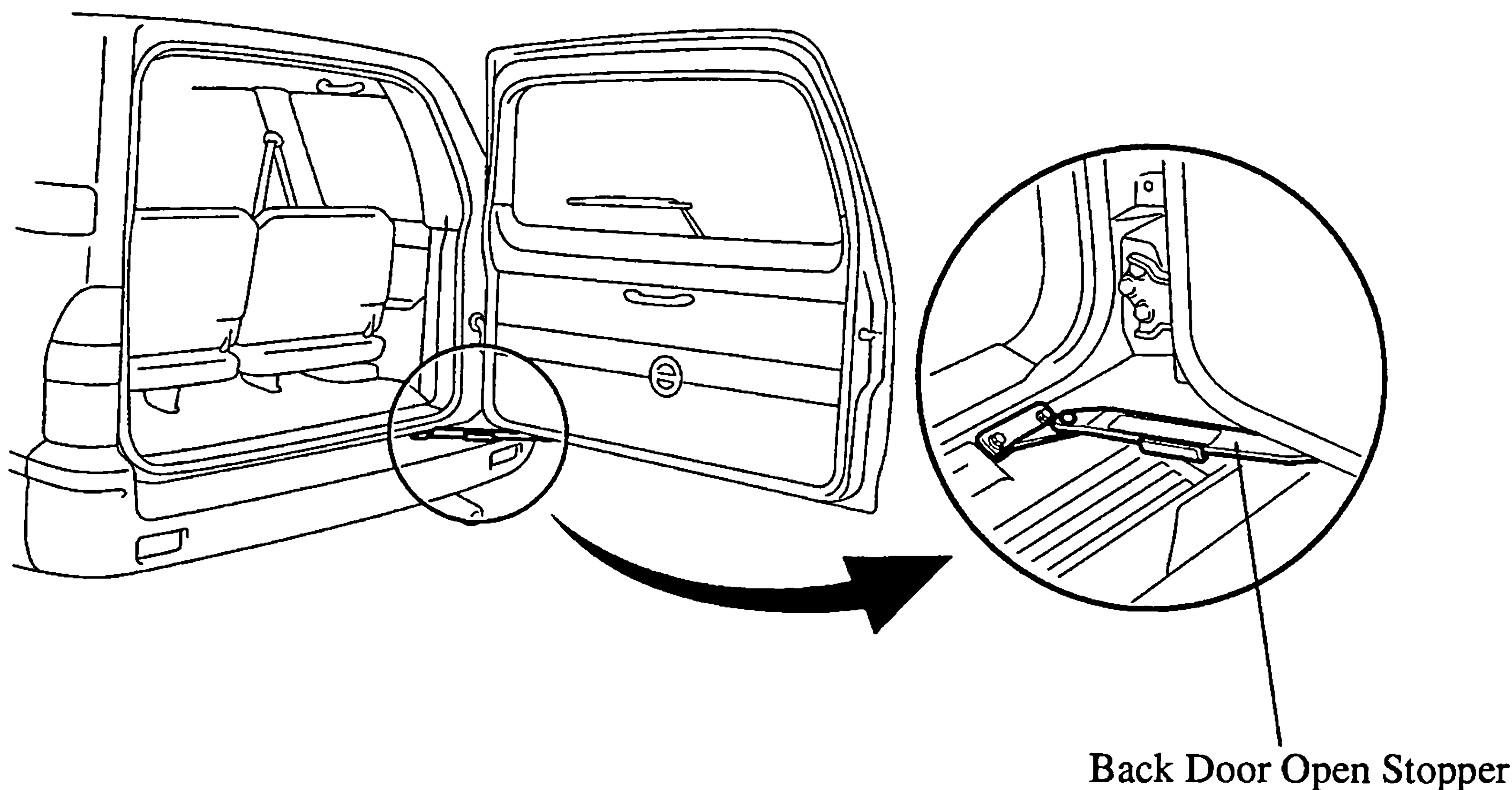
Europe and Australia



G.C.C. Countries and General Countries

■ BACK DOOR

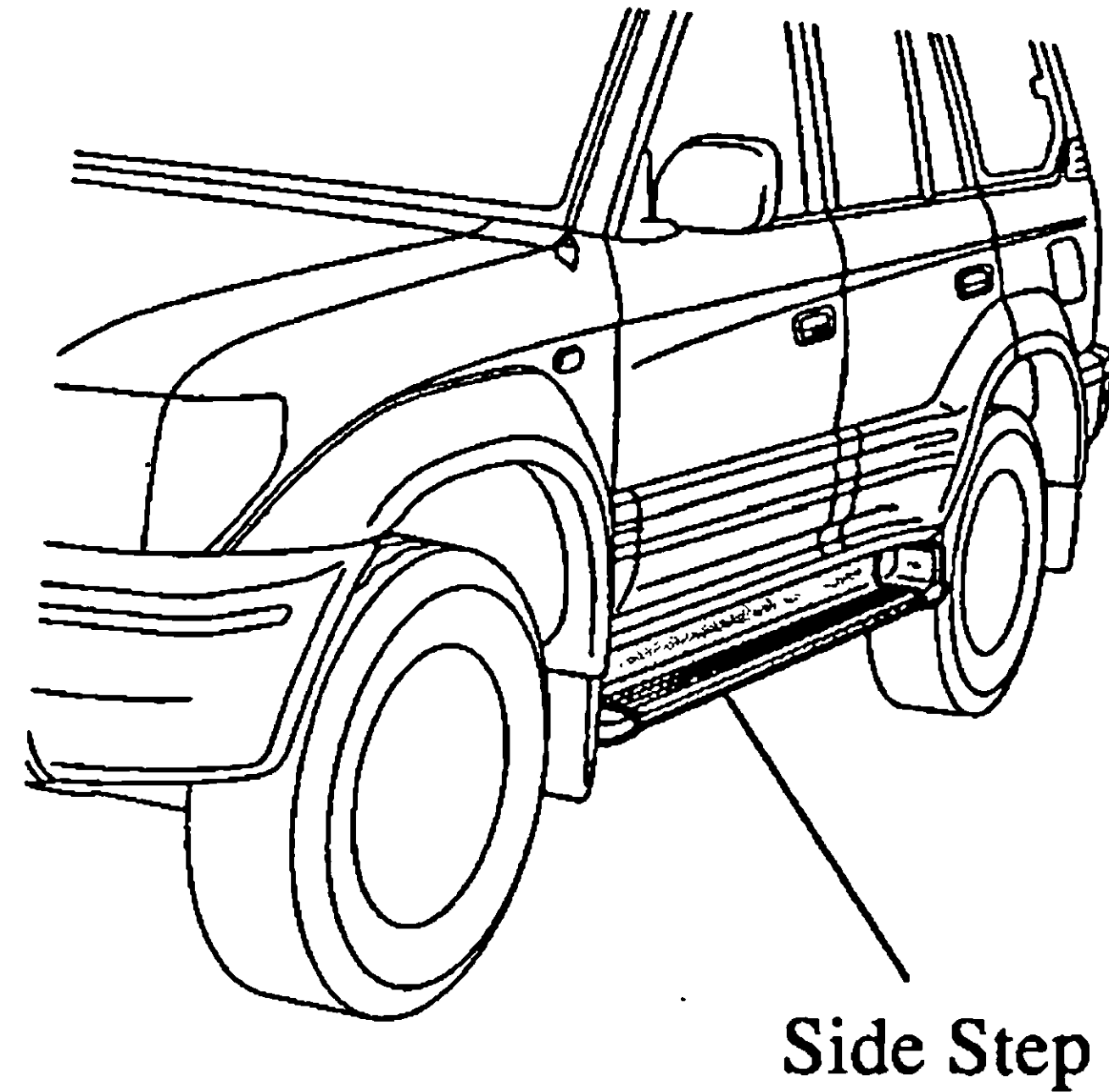
- The back door is a single-piece side-opening type that offers excellent ease of use.
- To lock the fully opened back door, an open stopper that is equipped with a locking mechanism is used.



EXTERIOR

■ SIDE STEP

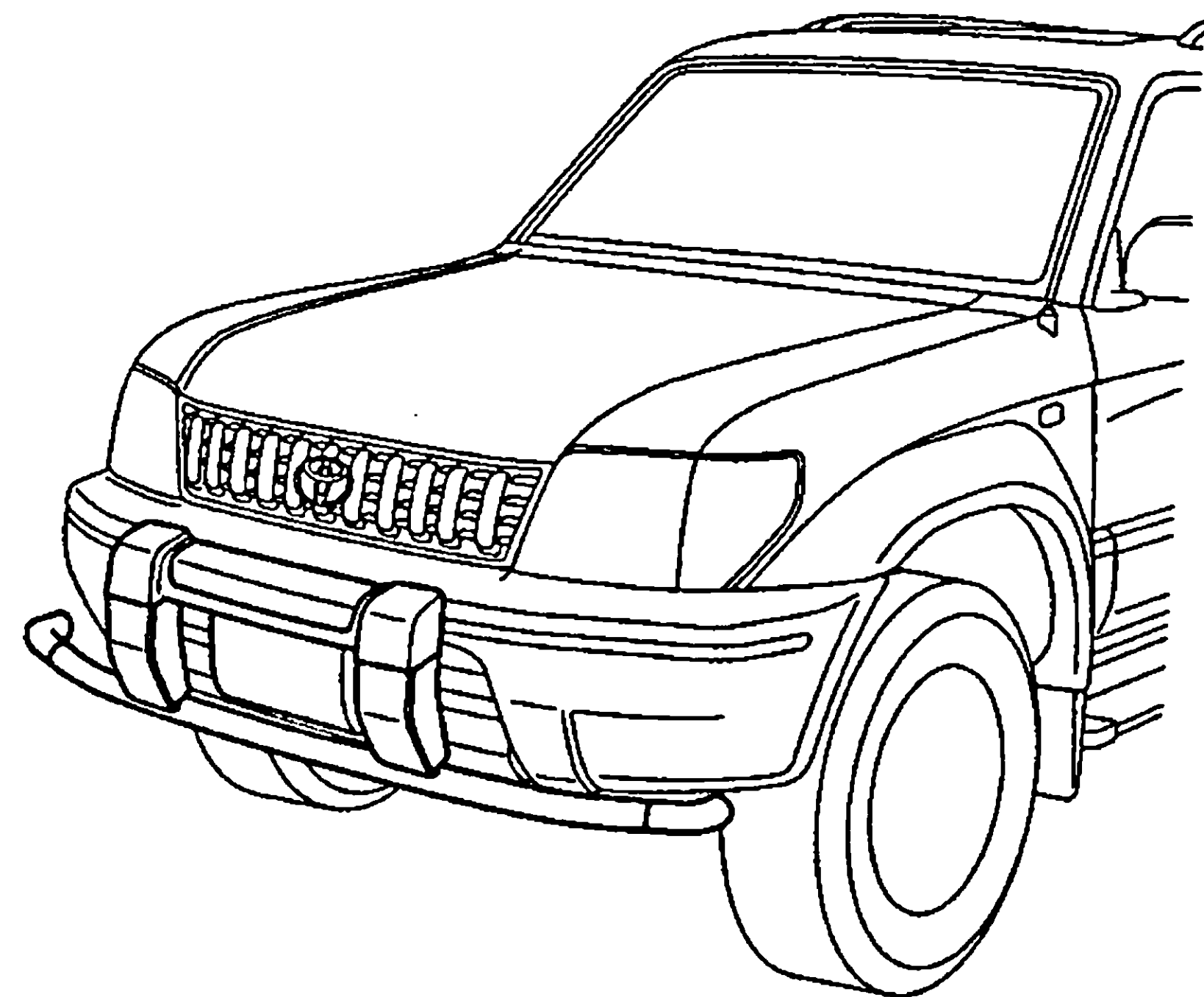
- A side step is optional equipment on all models.
- The side step's surface dimensions and height have been optimized to enhance the ease of in-and-out access.



MO

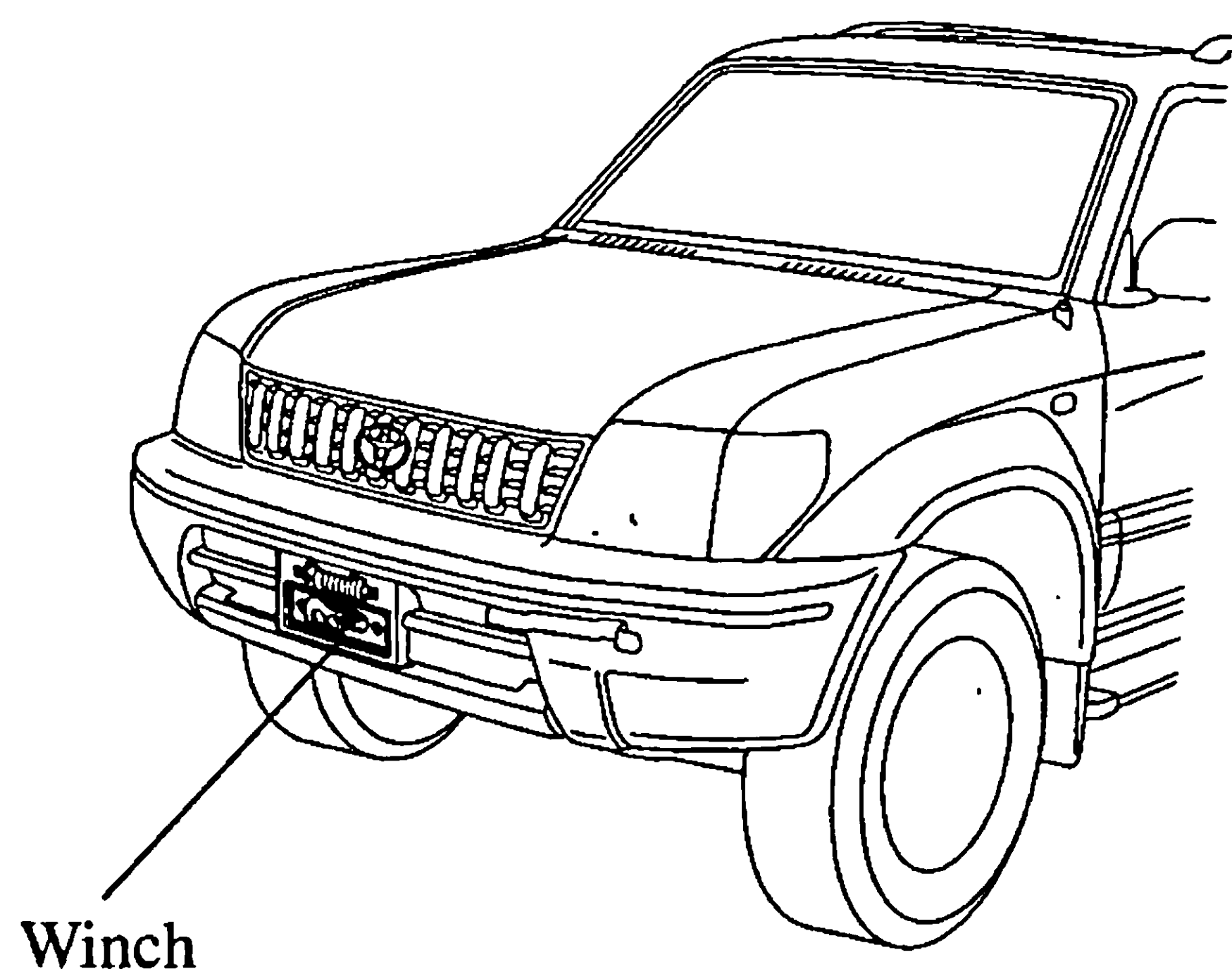
■ BUMPER GUARD

- A bumper guard is optional equipment on models for G.C.C. Countries and General Countries.
- The bumper guard expresses a powerful and stylish design constructed of stainless pipe that is enclosed in a large resin cover made of Toyota Super Olefin Polymer.



■ WINCH

- Electric winch that is enclosed in the front bumper is made available as optional equipment for G.C.C. Countries and General Countries.
- The winch has a cover and is integrated with the bumper to improve the appearance.



EXTERIOR

■ OUTSIDE REAR VIEW MIRROR

- A large outside rear view mirror matching for the body shape is used.
- 2 types of rear view mirrors are used according to the destination and the grade of vehicle.

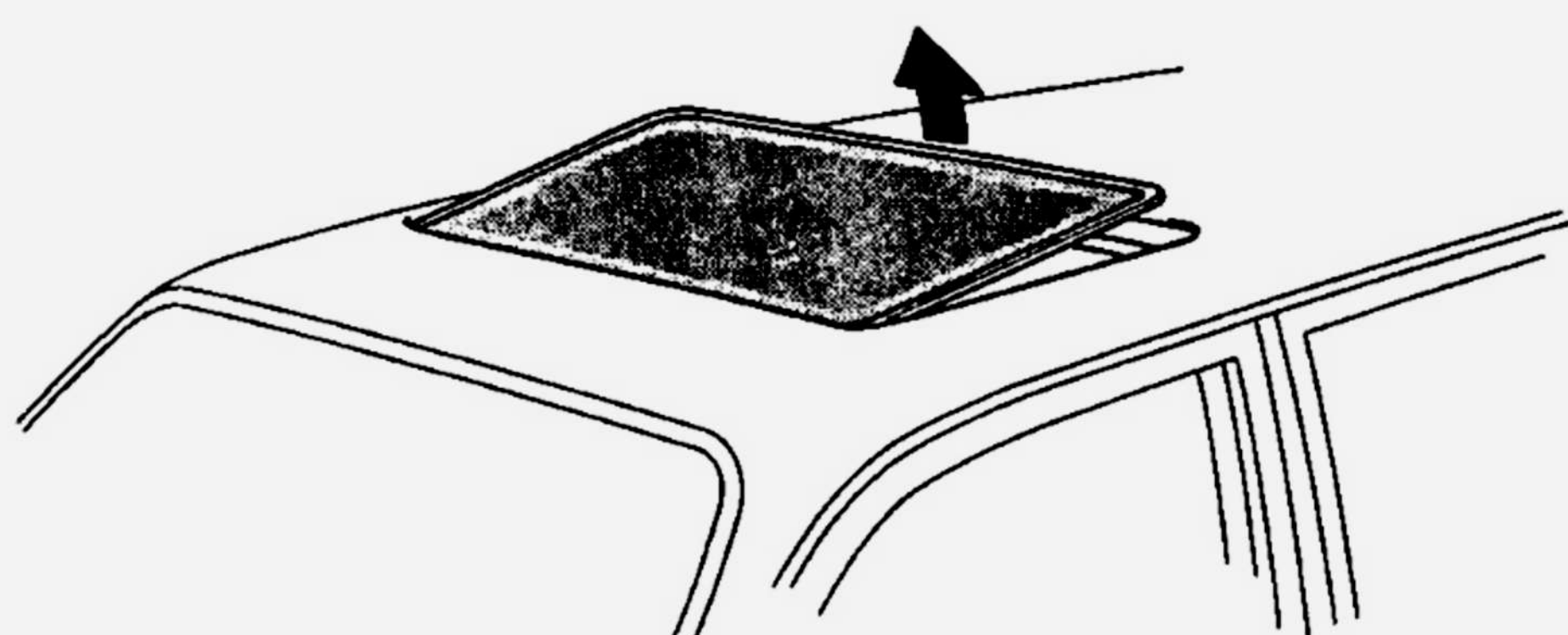
●: Standard ○: Option

Destination Grade Mirror Type	Europe	Australia	G.C.C. Countries		General Countries	
	—	A11	GX	VX	STD	GX
Manual Control	●	●	●	●	●	●
Electrical Remote Control	○*	○		○		○

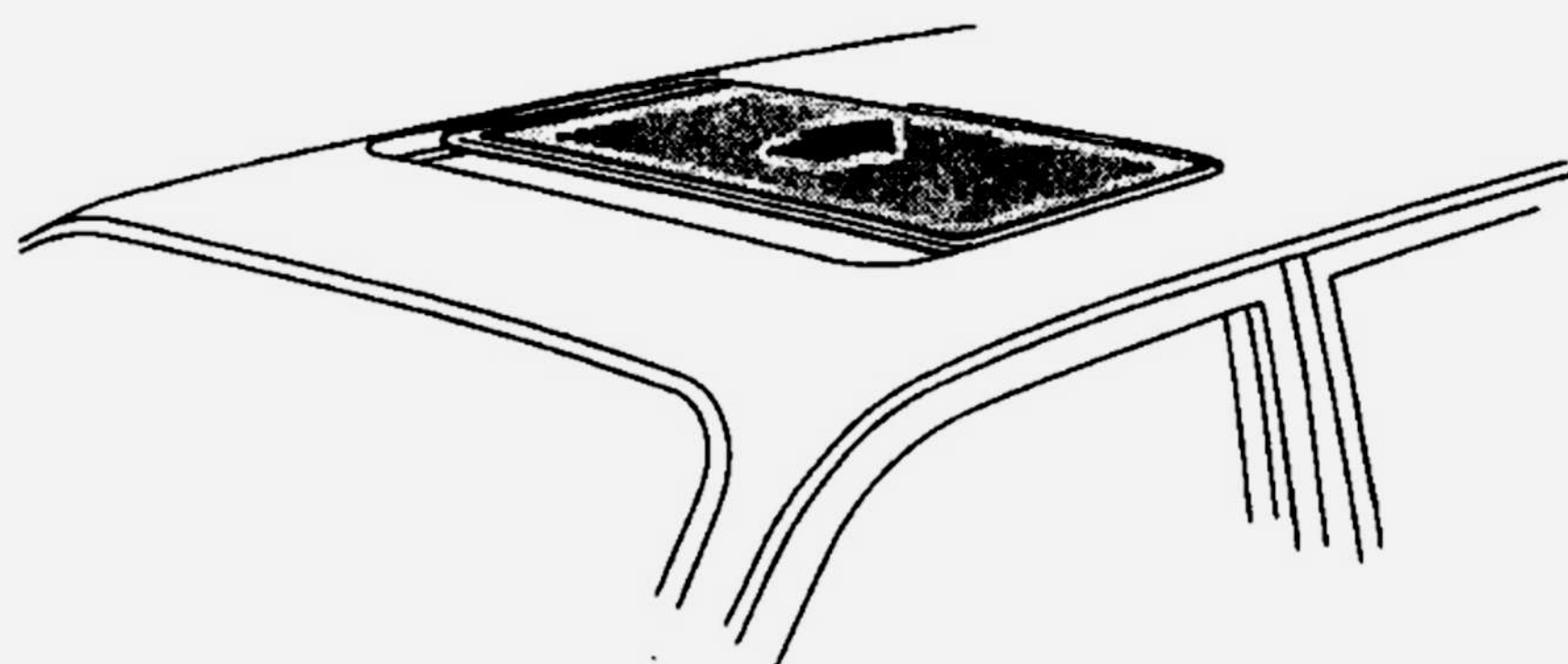
*: With Mirror Heater

■ MOON ROOF

A power tilt-up and sliding moon roof which provides good ventilation and exhilarating open air driving is optional equipment on all models except the STD grade model for General Countries. In the interior of the vehicle, there is a slidable sun shade to reduce glare during daylight hours.



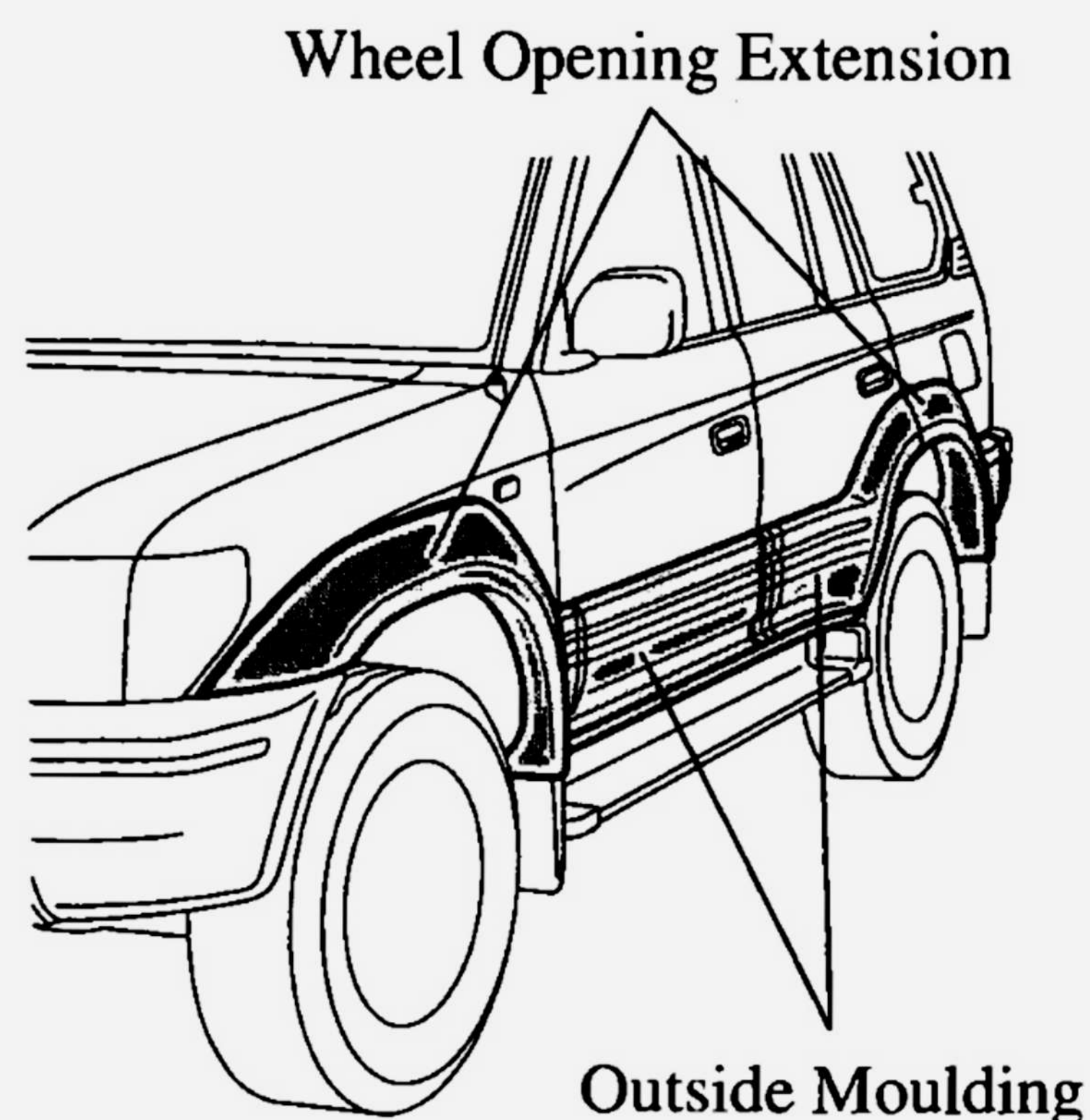
Tilt



Sliding

■ OUTSIDE MOULDING AND WHEEL OPENING EXTENSION

- Outside moulding and wheel opening extension are optional equipment on all models except the STD grade model for General Countries.
- Both the outside moulding and the wheel opening extension are made of lightweight, scratch-resistant, and highly recyclable Toyota Super Olefin Polymer.



EXTERIOR

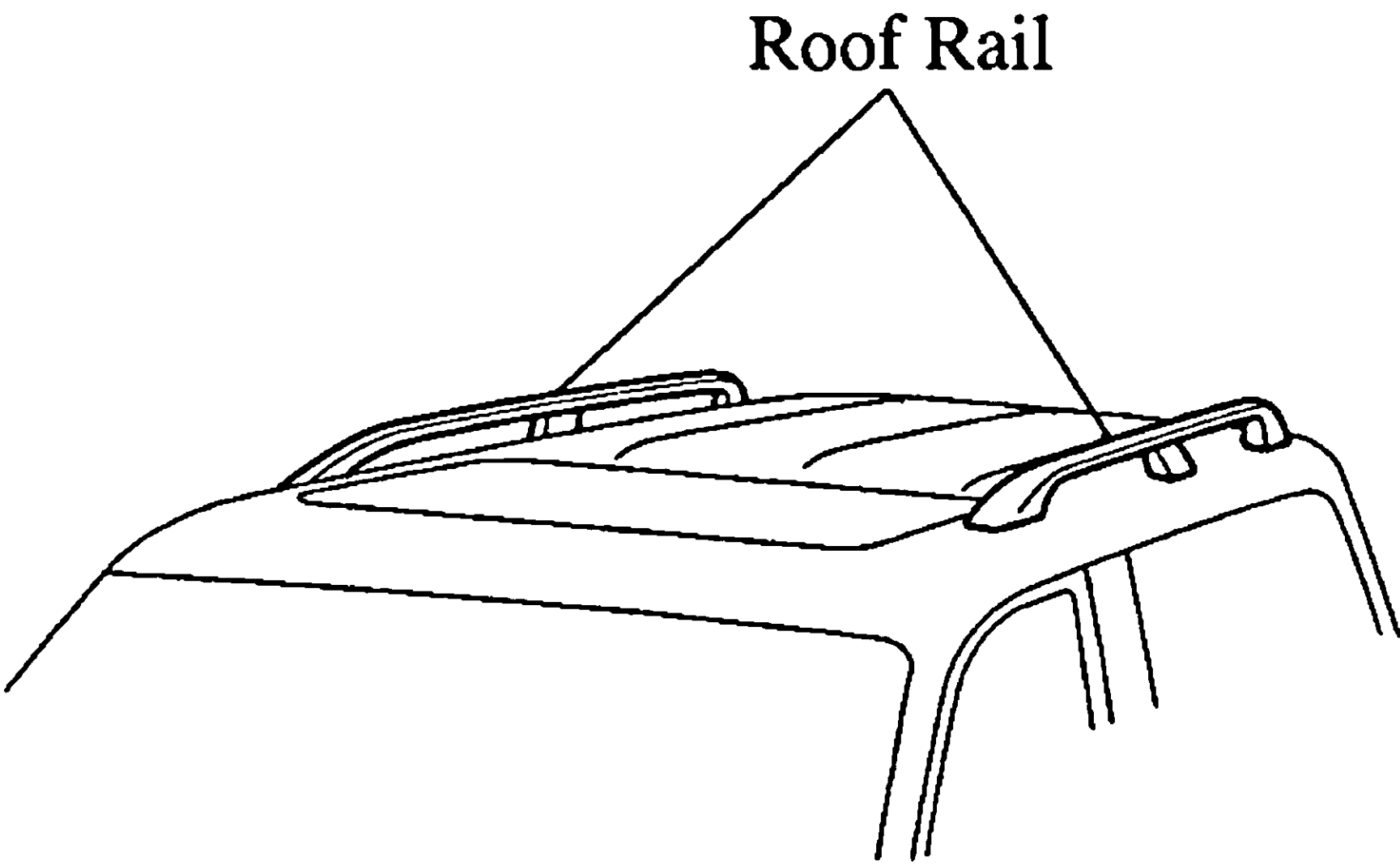
■ ROOF RACK AND ROOF RAIL

The roof rack and roof rail are made available as optional equipment as shown in the table below.

Destination Type	Europe	Australia	G.C.C. Countries	General Countries
Roof Rack	–	–	OPT	OPT
Roof Rail	OPT	–	OPT	OPT*

*: GX grade model only

MO



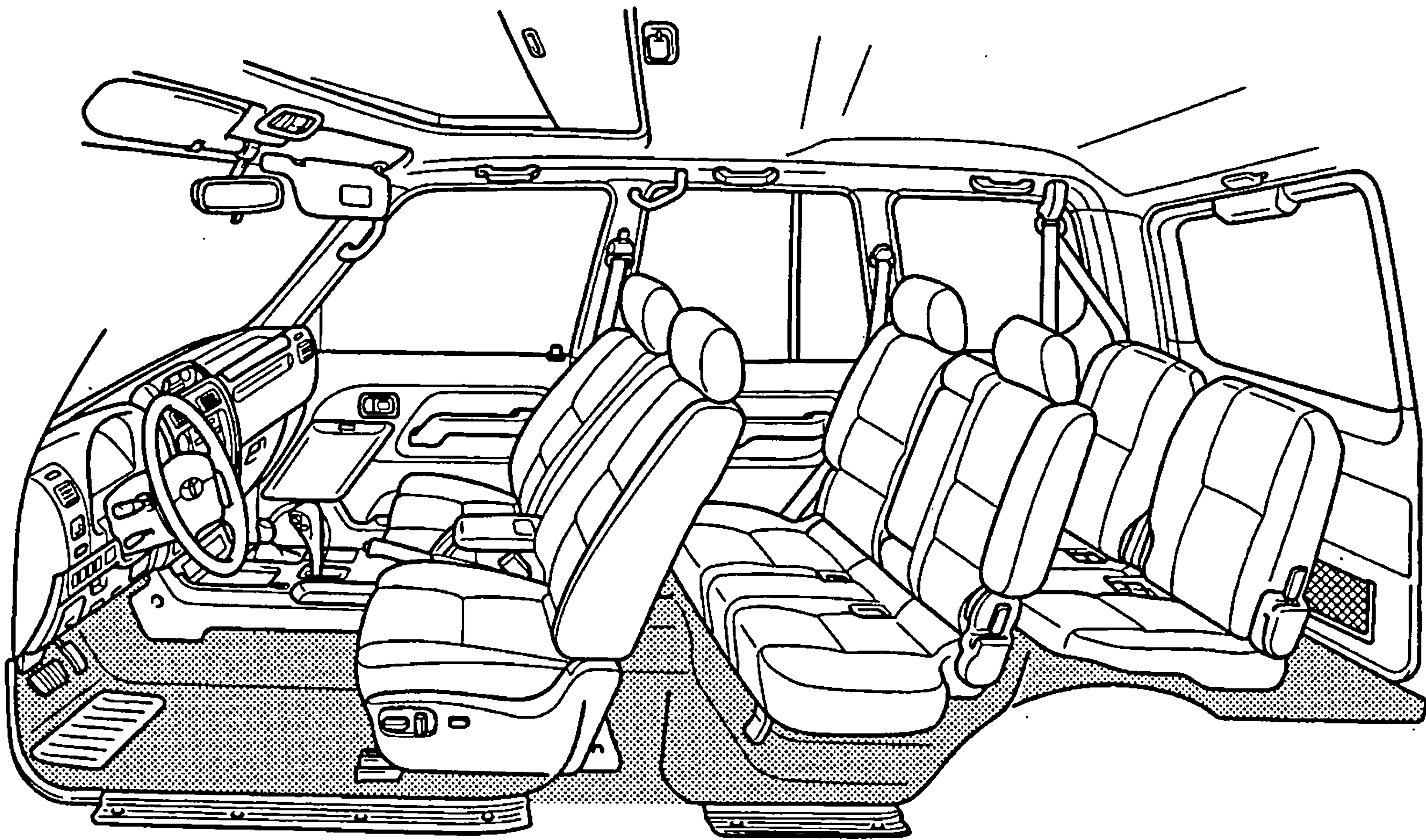
Roof Rail

INTERIOR

The interior design concept of the Land Cruiser/Land Cruiser Prado is to provide an active interior space that offers the functionality of utility and driving fun as well as toughness and high quality.

CABIN

- Offers a combination of utility and pleasure.
- A unique interior space with comfort and enjoyment.



5-Door Model

INTERIOR

SEATS

1. Front Seat

- 3 types of front seats are available: the bench seat, separate seat, and power seat. The availability of the front seat is as follows:

●: Standard ○: Option

Destination Grade Type		Europe	Australia		G.C.C. Countries		General Countries	
		—	—	VX	GX	VX	STD	GX
Bench Seat					●		●*1 ○*2	○*1
Separate Seat	Manual	●	●	●	○	●	●*2	●
	Power	○*1		○		○*1		

*1: 5-Door Models

*2: 3-Door Models

- The front seats are the full reclining type and can be folded to provide a full flat area.
- A seat heater, with 2 levels of heat output that can be selected by operating the seat heater switch, is made available as optional equipment on models for Europe and on the VX grade model for China (with G.C.C. Countries specification).
- A small storage compartment is provided under the passenger seat cushion as standard equipment on all models for Europe and on the VX grade model for Australia and G.C.C. Countries.
- Luxurious, genuine-leather power seats are available as an option on 5-door models for Europe and G.C.C. Countries and models for Australia.

MO

INTERIOR

2. Rear Seat

- 2 types of rear seats are available: the forward-facing and the parallel seats. The availability of the rear seat is as follows:

► 3-Door Model ◀

●: Standard ○: Option

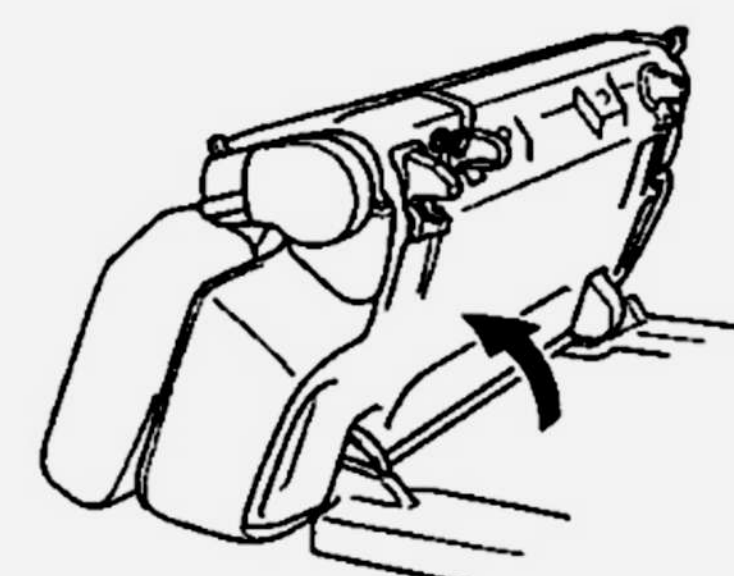
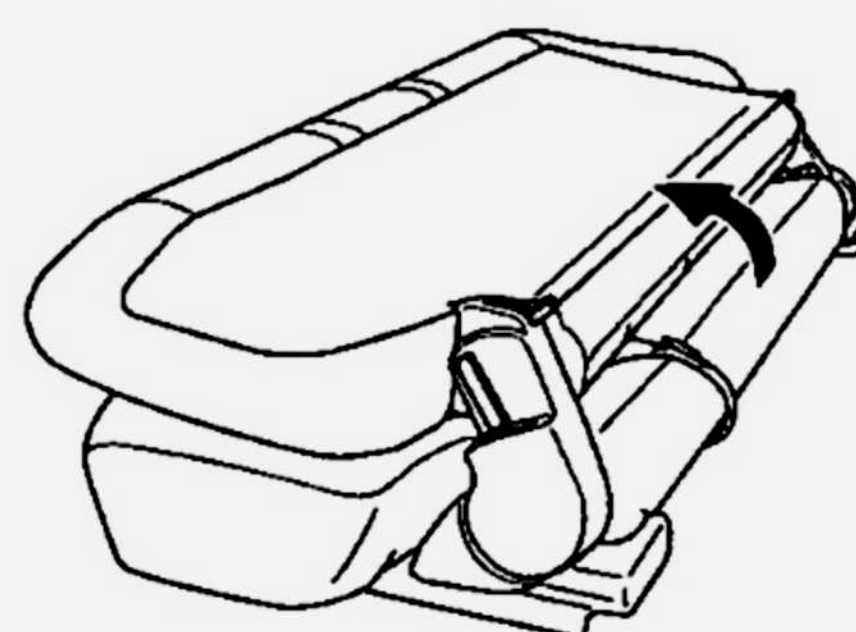
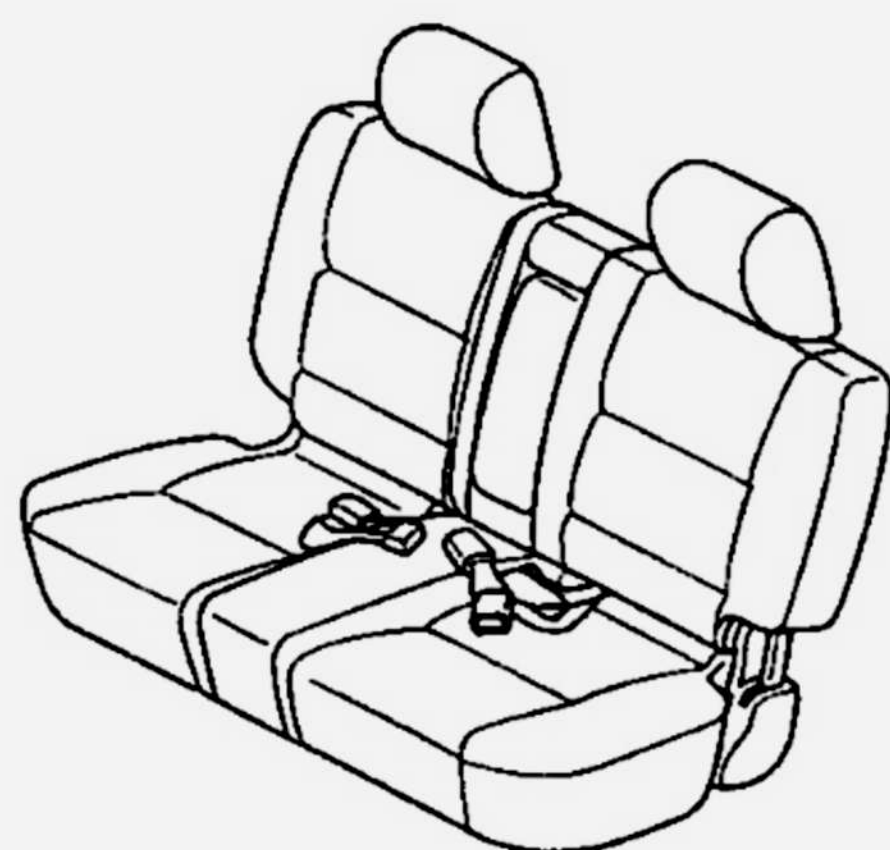
Destination Grade		Europe	G.C.C. Countries	General Countries	
				STD	GX
Type		—	VX		
Forward- Facing Seat	1-Piece Seat Back			●	●
	50/50 Split Seat Back	●	●		
Parallel Seat		○		○	
Without		○			

► 5-Door Model ◀

●: Standard ○: Option

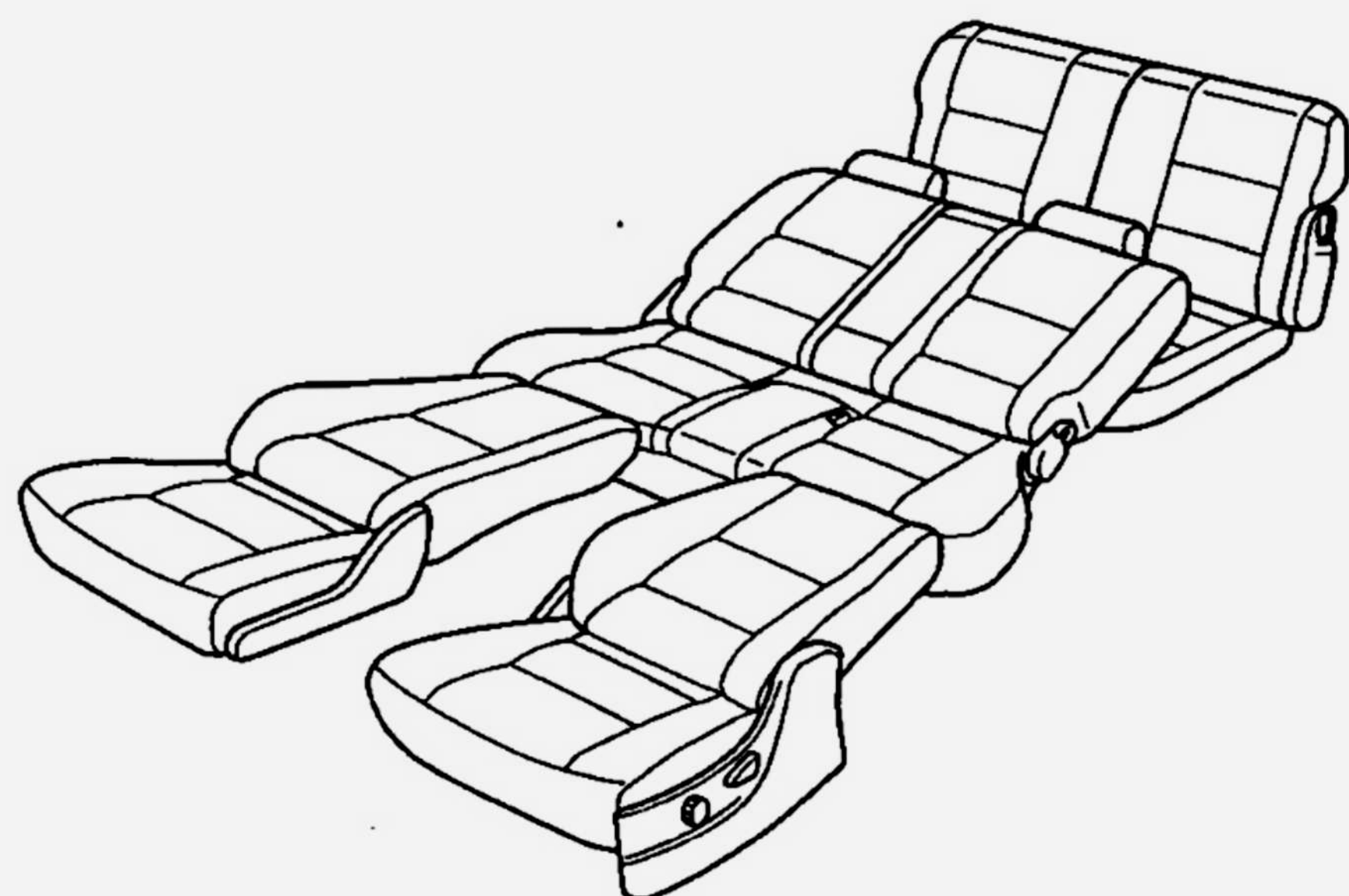
Destination			Europe	Australia		G.C.C. Countries		General Countries	
Grade									
No.1 Seat Type		No.2 Seat Type	—	—	VX	GX	VX	STD	GX
Fixed Type	1-Piece Seat Back	—						●	
		Parallel Seat				●	○	○	○
	50/50 Split Seat Back	—	●	●	●	○			●
Slide Type	1-Piece Seat Back	Forward-Facing Seat		○		○			○
	1-Piece Seat Back with Center Arm Rest		○		○		●		

- The forward-facing seat that is used on both the 3-door and the 5-door models is the full reclining type.
- The forward-facing rear seat of the 3-door model and the No.1 rear seat of the 5-door model can be folded forward for effective use of the rear space.

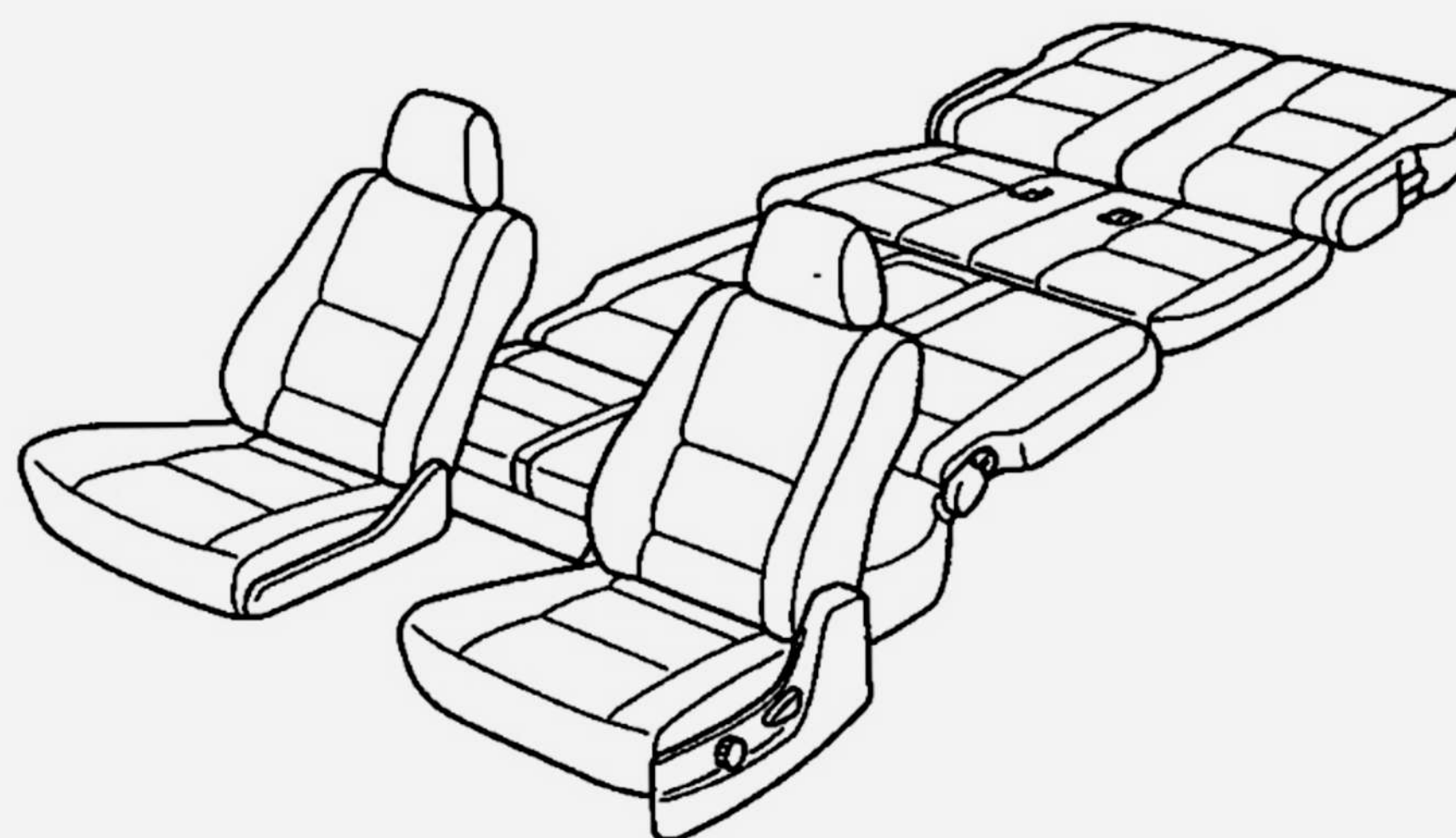


INTERIOR

- On the 3-door model that uses a forward-facing rear seat, both the front and rear seats can be folded for a fully flat layout.
- In addition, on the 5-door model that uses a forward-facing rear seat for the No.2 rear seat, the No.1 and No.2 rear seats can be folded for a fully flat layout.



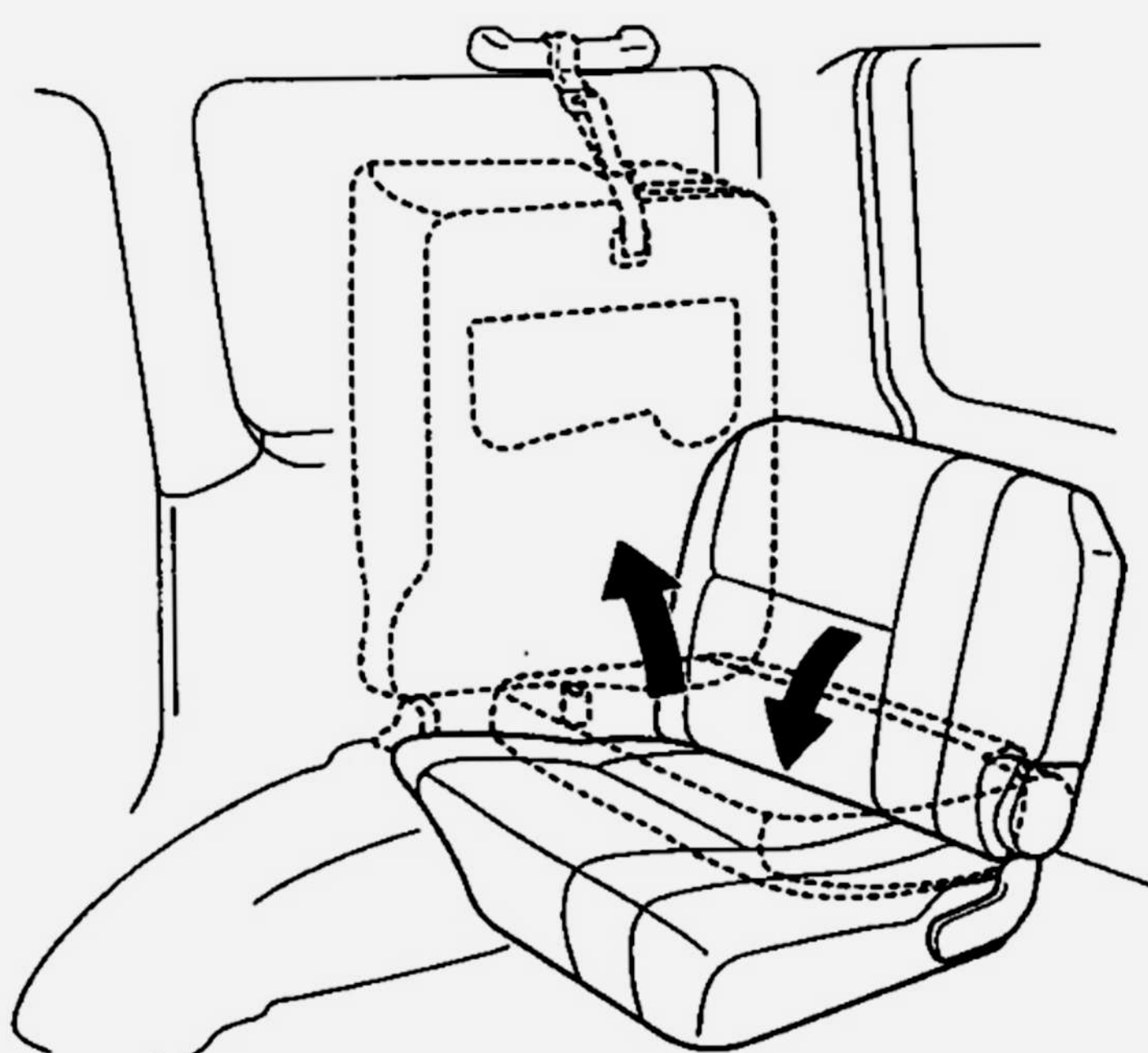
Fully Flat Layout of the Front and No.1 Rear Seat



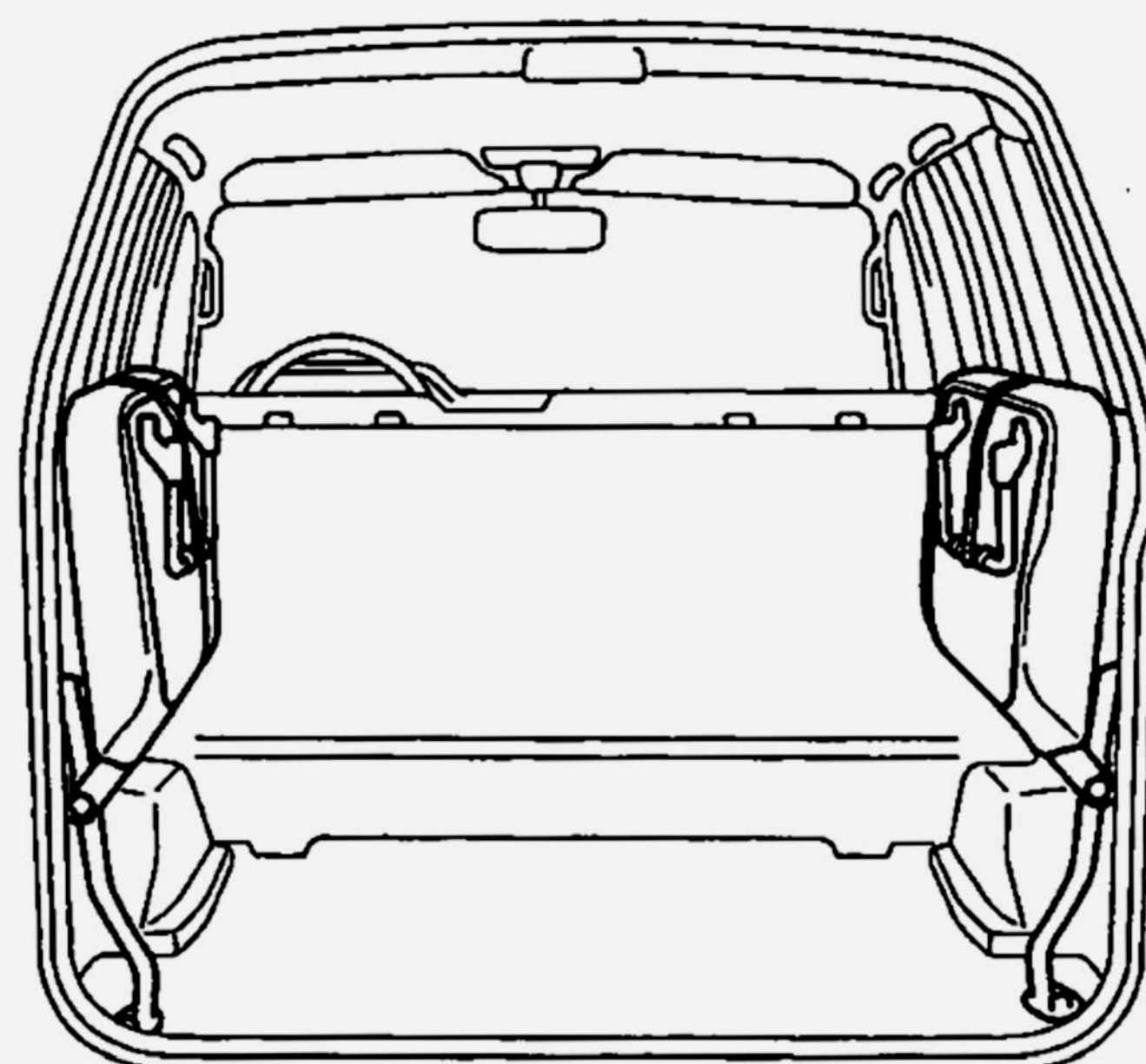
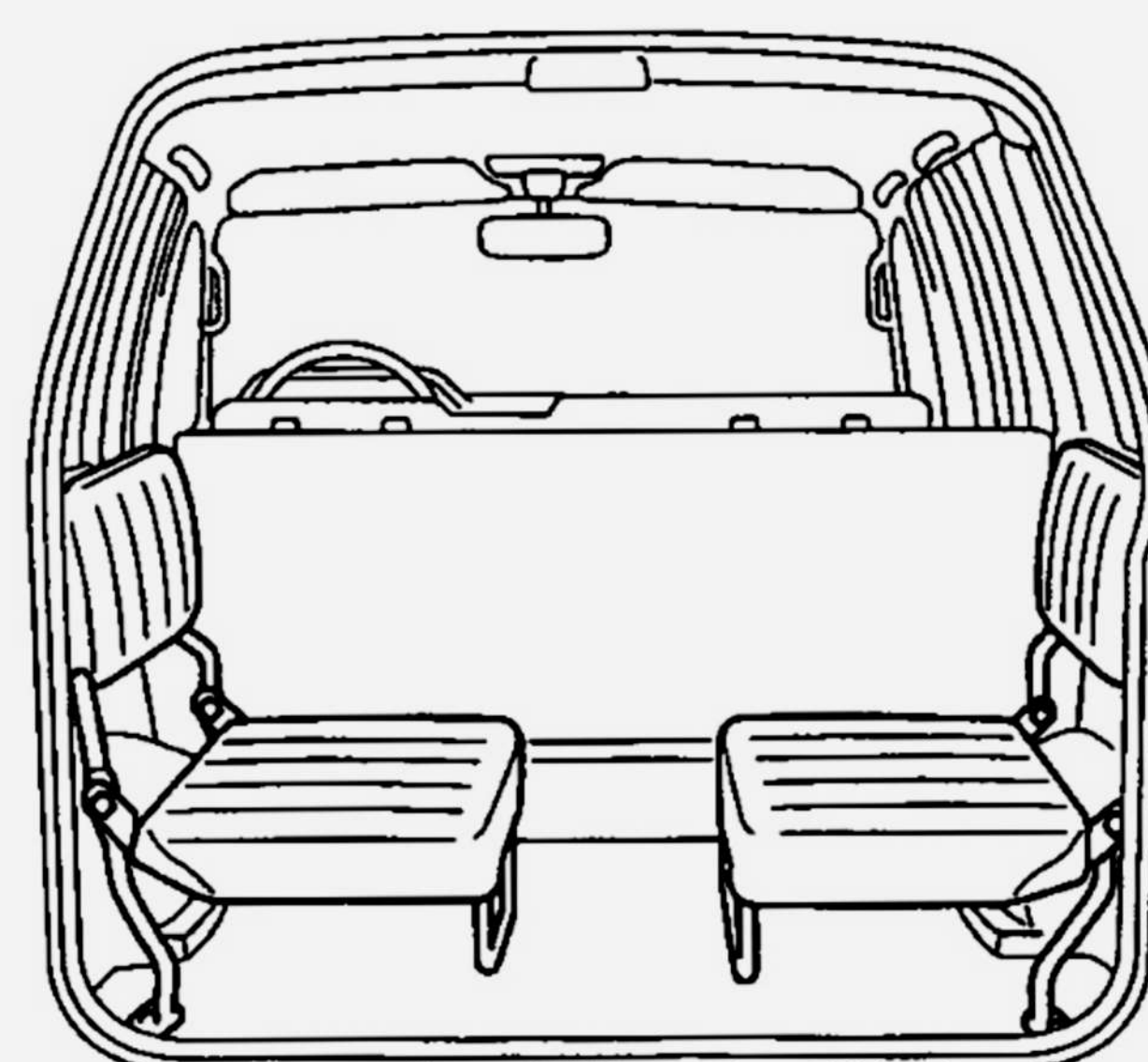
Fully Flat Layout of the No.1 and No.2 Rear Seats

5-Door Models

- On the 5-door model that uses a forward-facing rear seat for the No.2 rear seat, the No.1 rear seat is provided with a walk-in mechanism to facilitate the passengers' in-and-out access to the No.2 rear seat.
- With the No.2 rear seats, both the parallel seats and the forward-facing seats are the foldable type for effective use of interior space.



Forward-Facing Seats



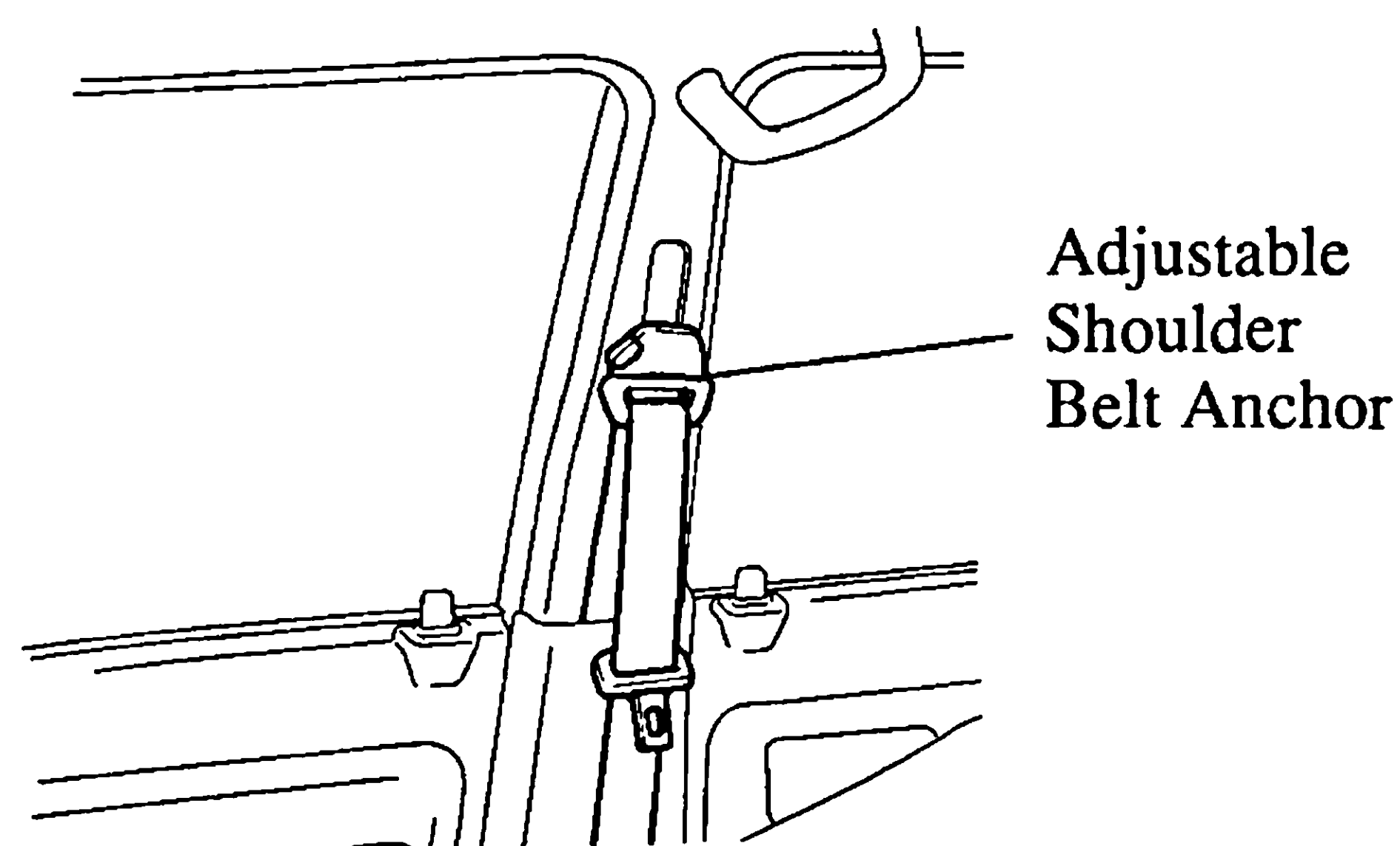
Parallel Seats

INTERIOR

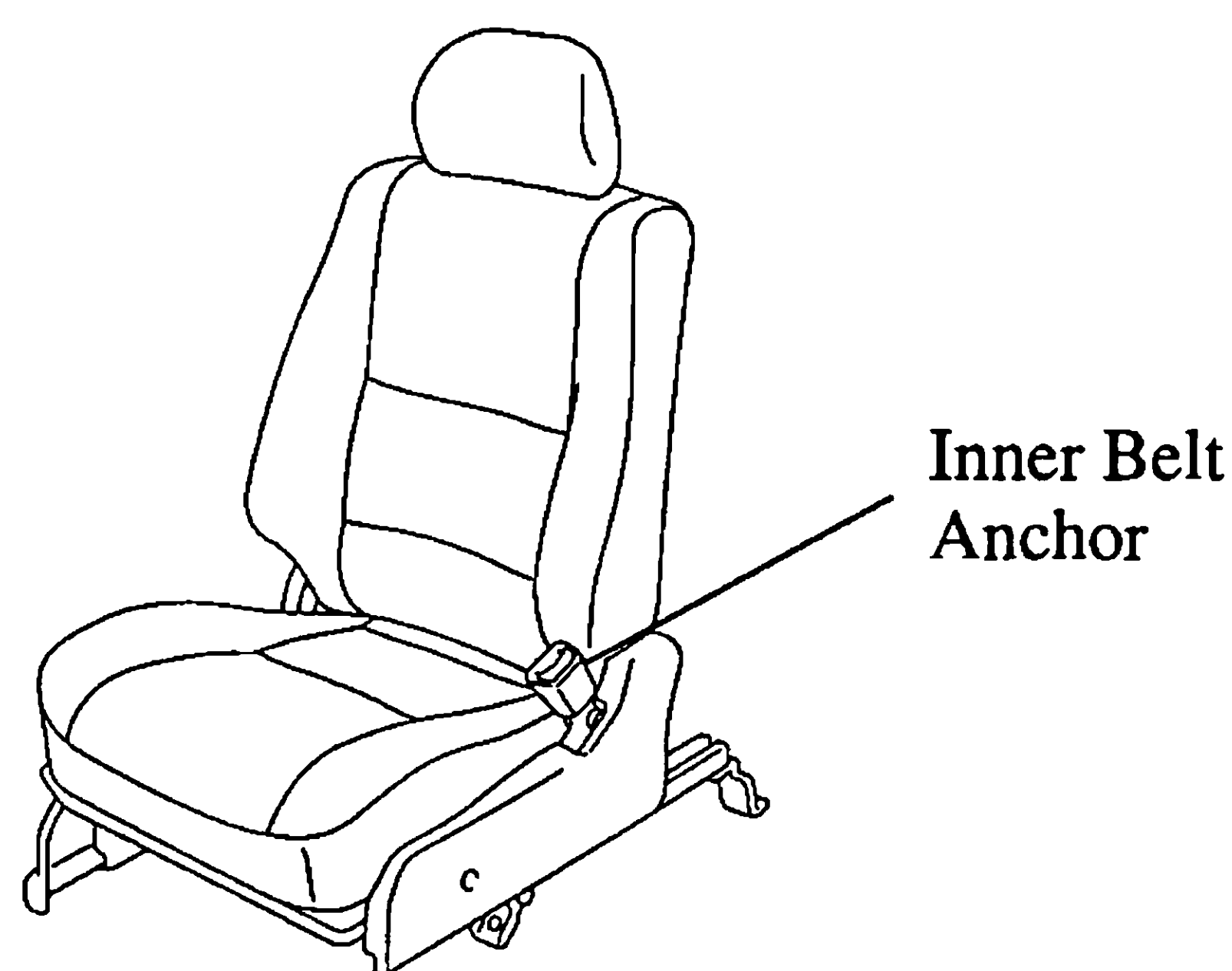
■ SEAT BELTS

1. Front Seat Belt

- On the separate and power seats, 3-point ELR (Emergency Locking Retractor) seat belts are provided as standard equipment.
- On the bench seats, the same seat belts as those used on the separate seats are provided at the outer seating positions, while the center position uses a 2-point NR (Non-Retractor) seat belt.
- A seat belt pretensioner is provided as standard equipment on models for Europe and Australia.
- An adjustable shoulder belt anchor is provided as standard equipment on models for Europe, Australia and G.C.C. Countries, and optional equipment on the GX grade models for General Countries.



- For the separate seat, the inner belt anchor is directly fitted to the seat for easy use.



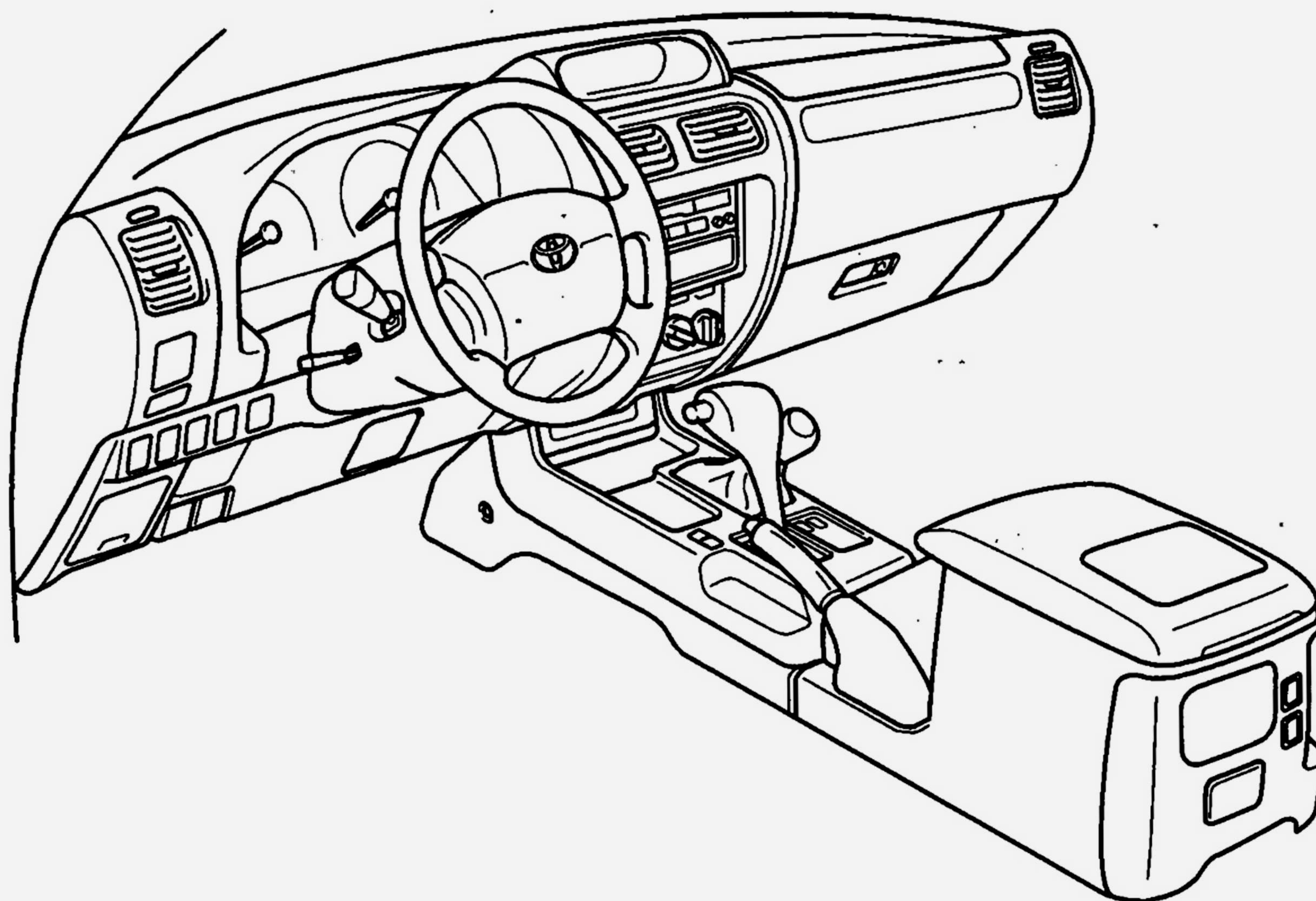
2. Rear Seat Belt

- 3-point ELR seat belts for outer seats and 2-point NR seat belt for center seat are provided as standard equipment on models for G.C.C. Countries and optional equipment for General Countries.
- 3-point ELR with ALR seat belts for outer seats and 2-point NR seat belt for center seat are provided as standard equipment on models for Europe and Australia and optional equipment on models for G.C.C. Countries and General Countries specification models for Russia and New Zealand.
- Space for storing seat belts is provided in the rear seat back. This keeps the rear seat area neat.

INTERIOR

INSTRUMENT PANEL, SWITCH LAYOUT AND EQUIPMENT

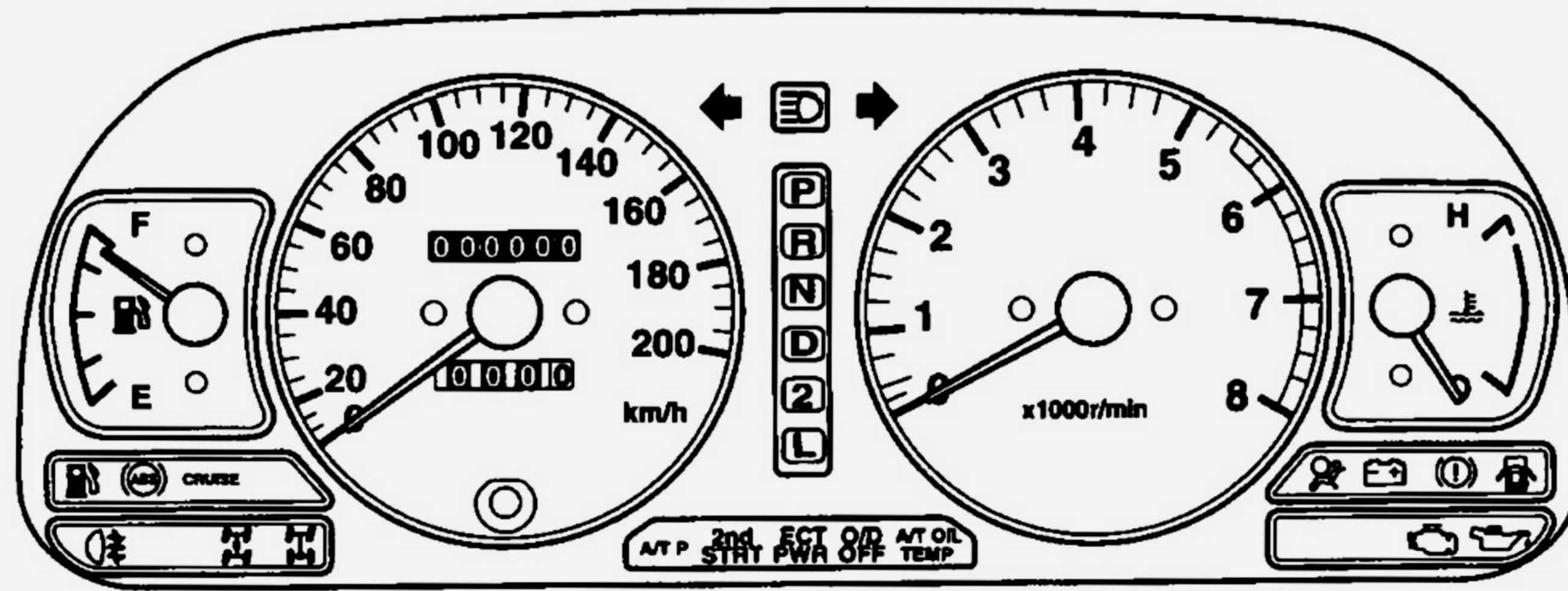
- The instrument panel has a modern design with meters and switches that seem to surround the driver with their dynamic appearance.
- The instrument panel itself, which was previously made of sheet steel, is now made of resin to improve its quality.

**MO**

INTERIOR

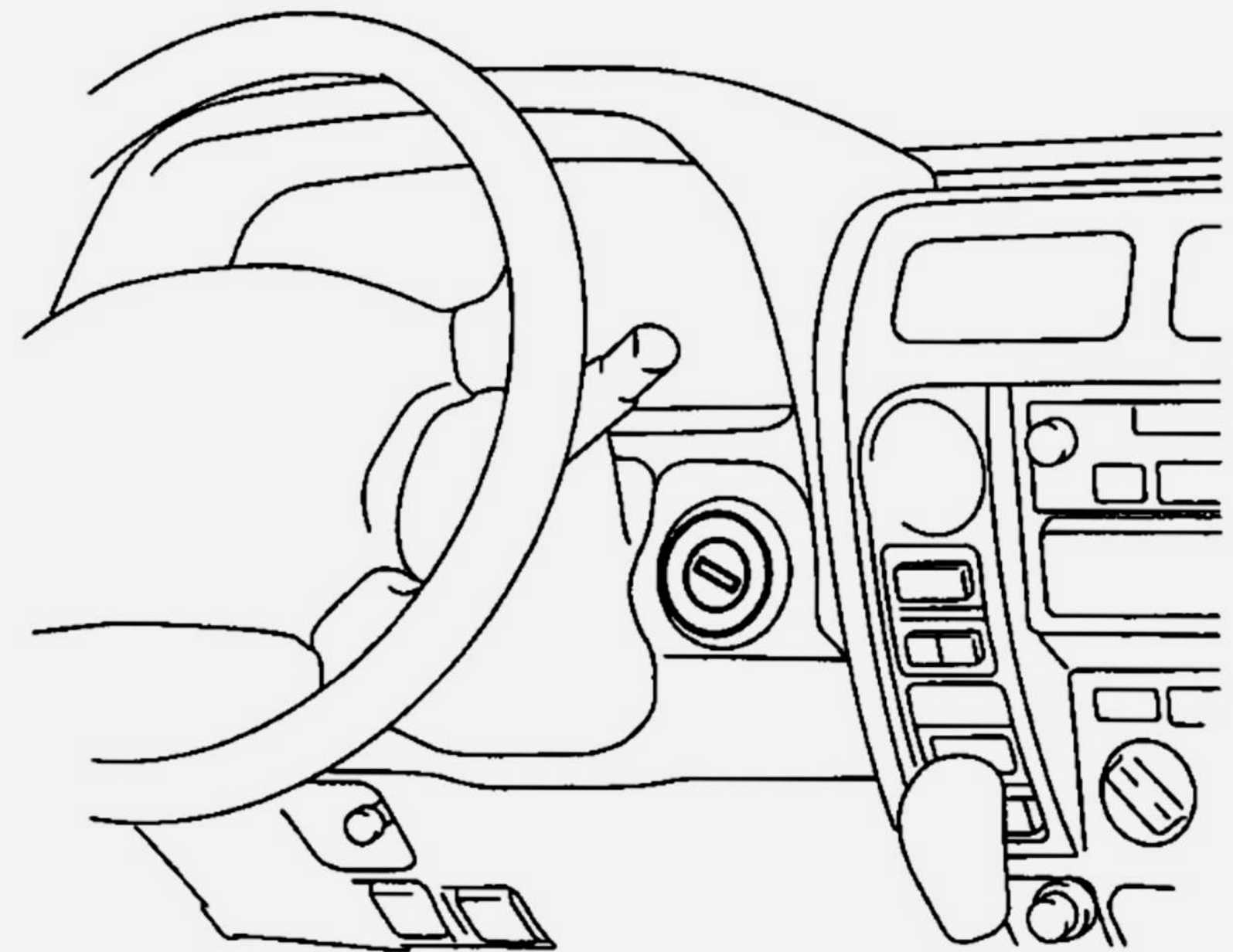
■ COMBINATION METER

- An electronic speedometer is used in the large twin-eye analog combination meters. The warning and indicator lights are grouped at the bottom of the gauge for better visibility.
- On the automatic transmission model, a shift position indicator is provided in the center of the combination meter.

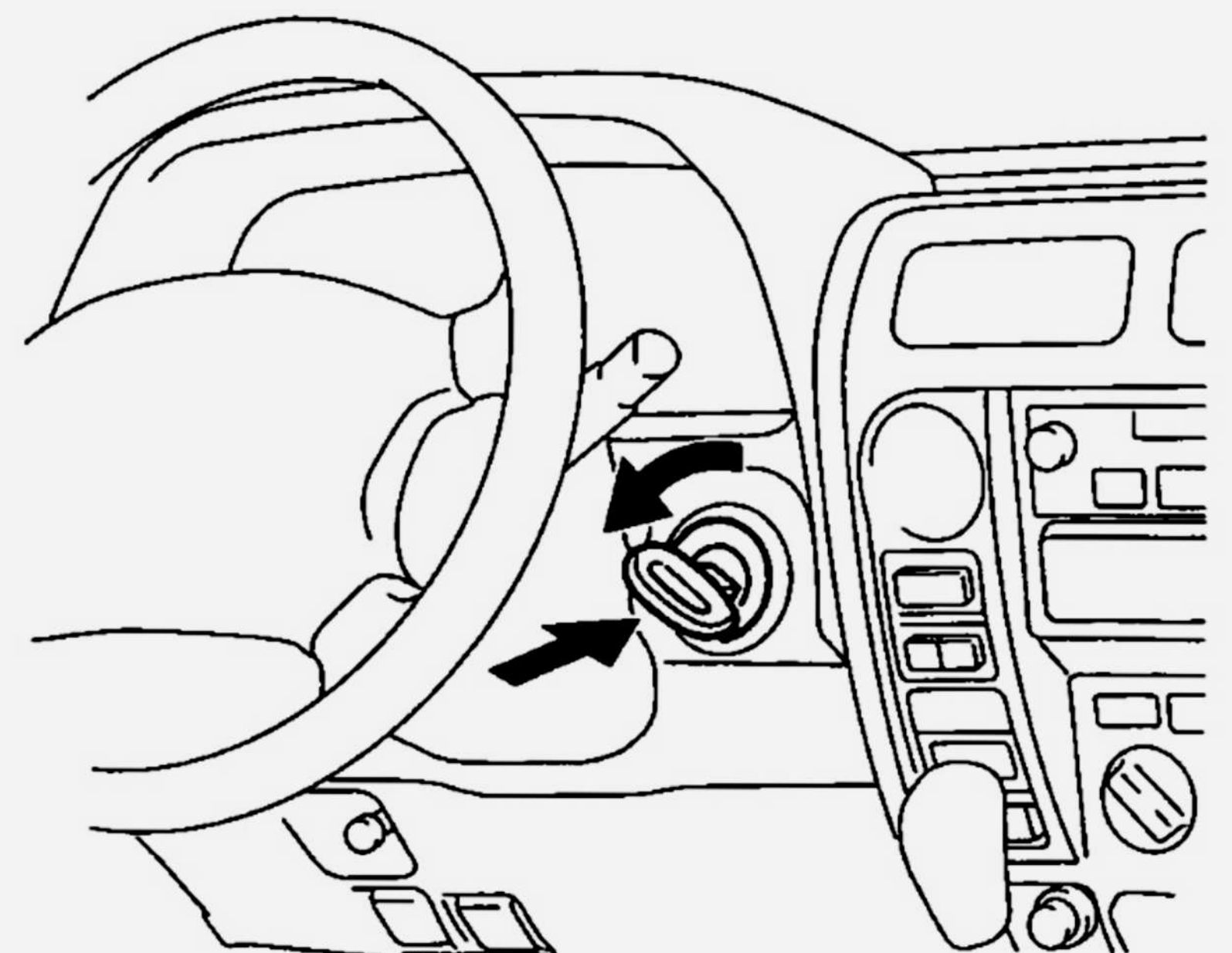


■ IGNITION KEY CYLINDER

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



- 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.



INTERIOR

AIR CONDITIONING

- The availability of the front heater, rear heater and air conditioning are as follows:

●: Standard ○: Option

Destination		Europe	Australia		G.C.C. Countries		General Countries	
Grade								
Item		—	—	VX	GX	VX	STD	GX
Front Heater	Boost Ventilator						●	●*1
	Heater	●	●	●	●	●	○	●*2
Rear Heater		○					○*3	○
Air Conditioning	Front only	○			○	○	○	○
	Front and Rear*4		○	○	○	○		○

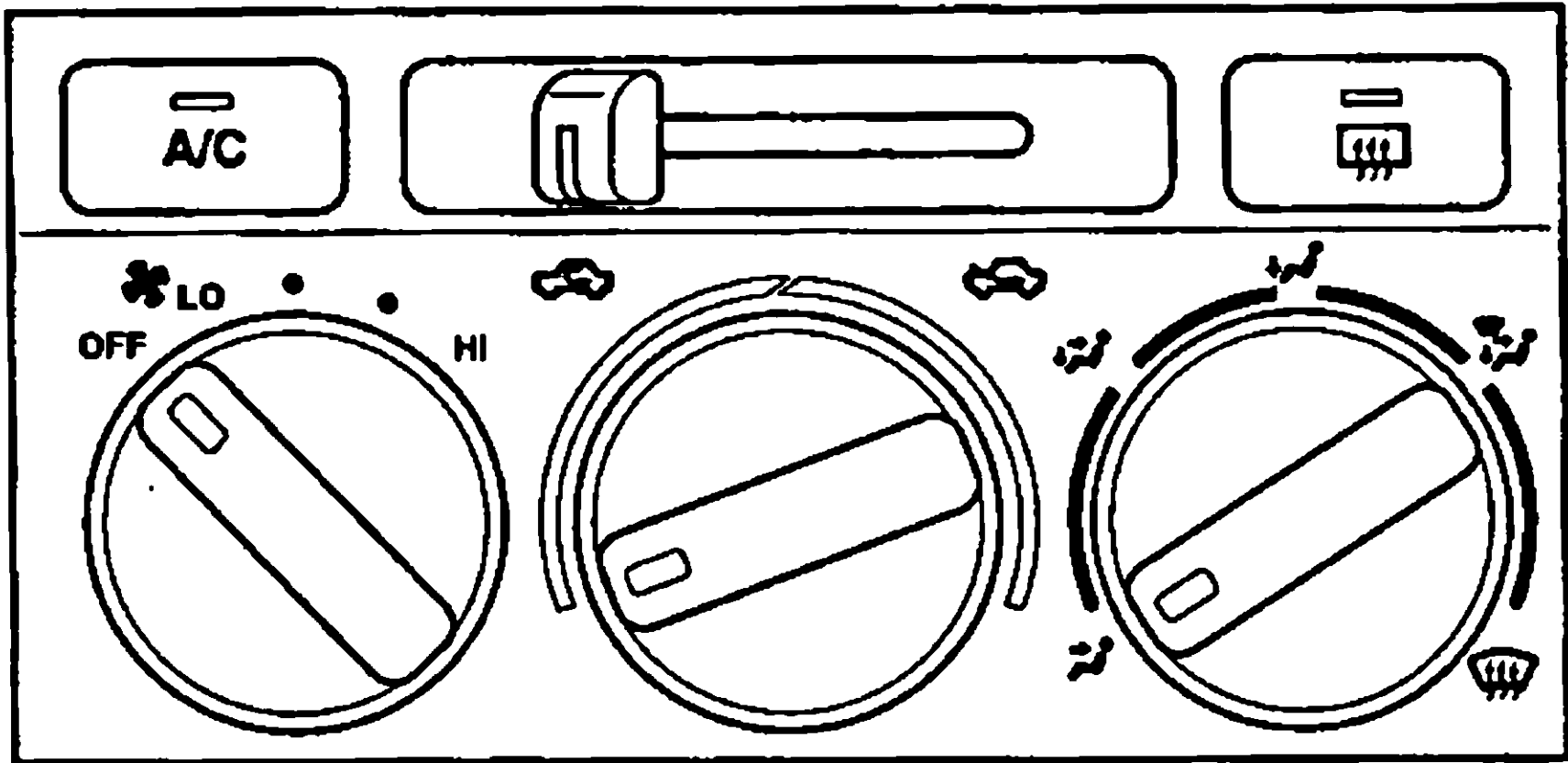
*1: 3RZ-F and 3L Engine Models

*2: 3RZ-FE and 1KZ-T Engine Models

*3: Except for 5-Door with RHD Models

*4: 5-Door Models

- An easy-to-use rotary switch and lever type heater control panel is used on all models.



AUDIO SYSTEM

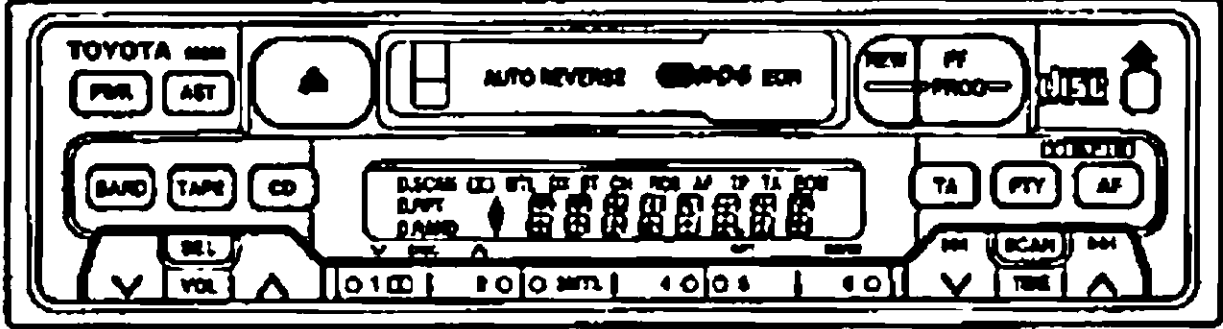
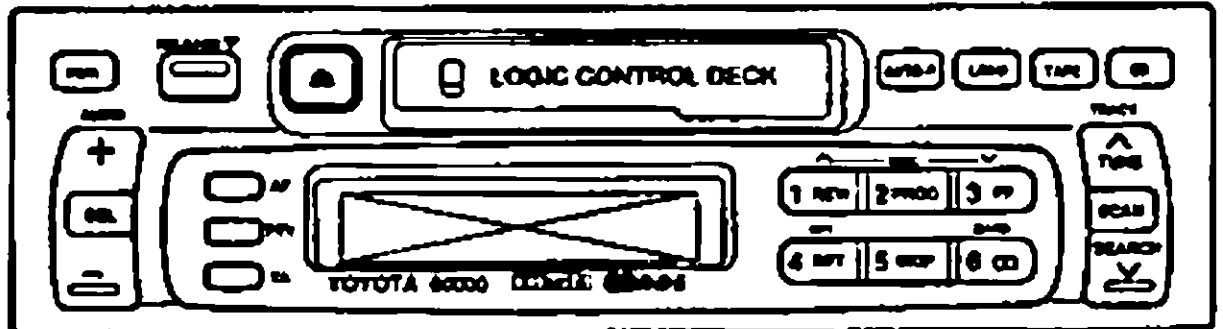
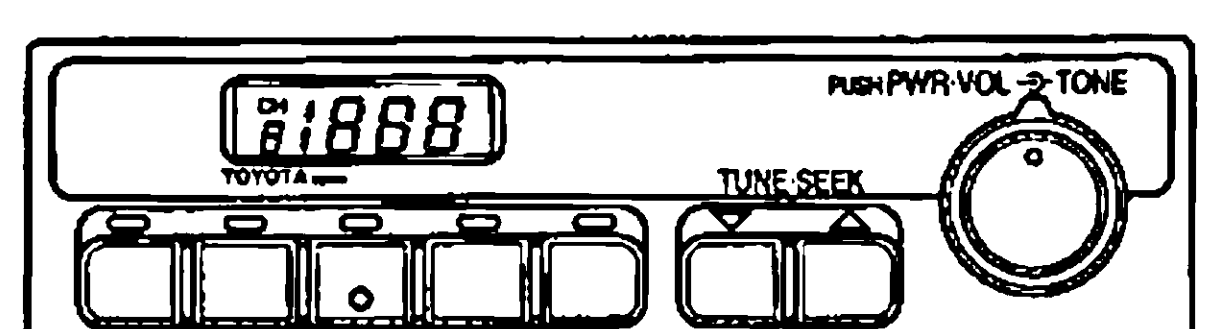
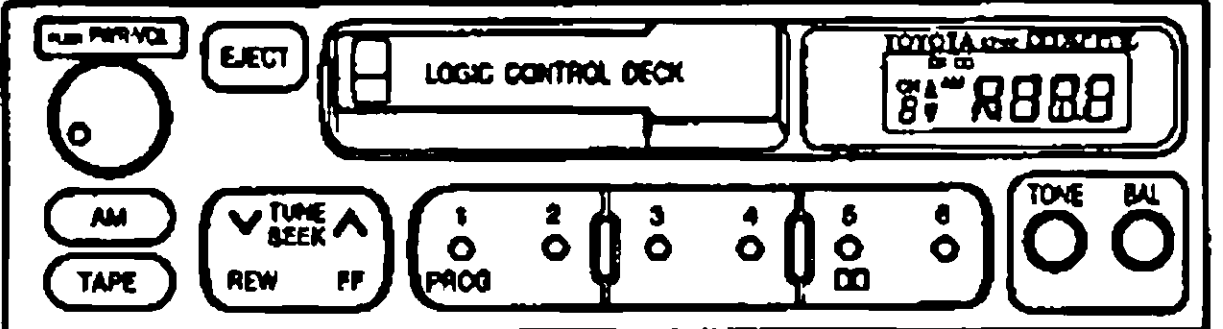
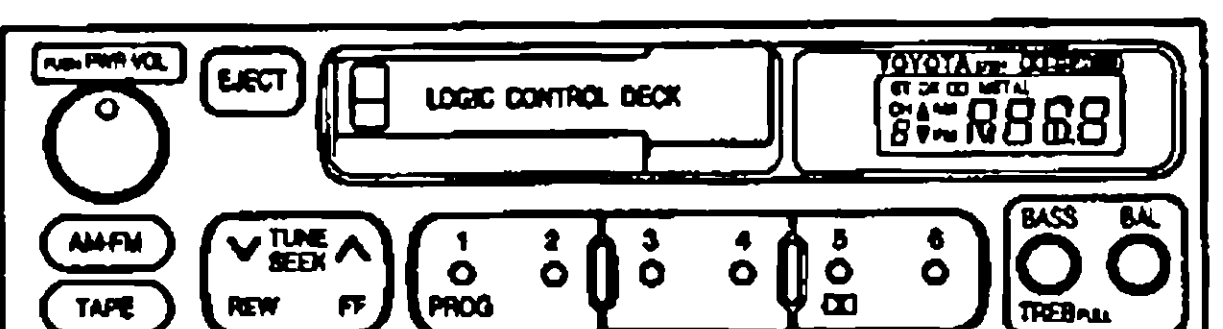
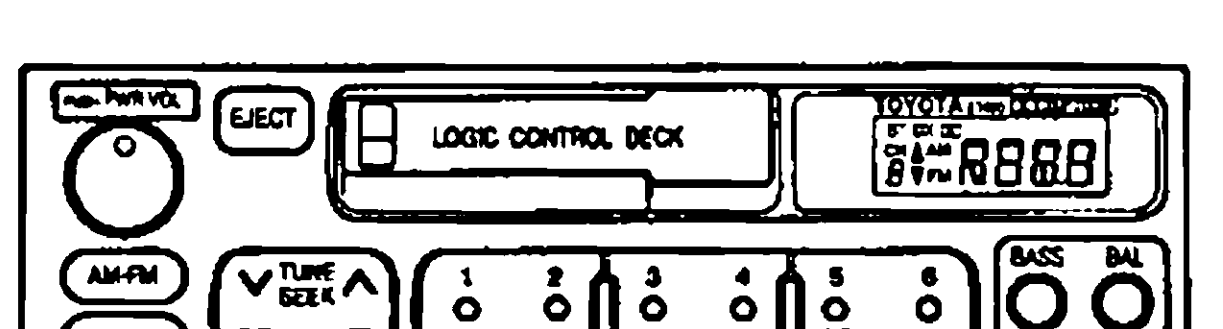
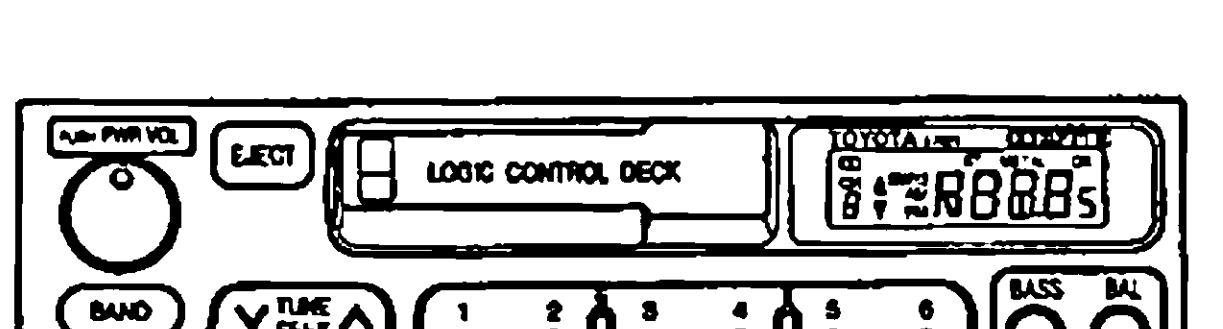
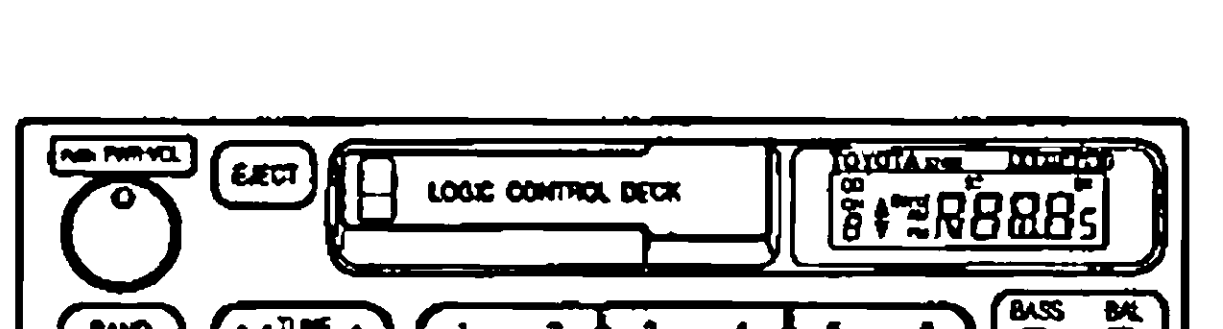
- A radio and cassette deck is standard or optional equipment on models for Europe, G.C.C. Countries and General Countries.
- Two types of antennas are made available: the manual antenna and the power antenna. The power antenna's mast height can be adjusted by operating the switch.
- A single CD (Compact Disc) player is optional equipment on models for G.C.C. Countries and General Countries.
- For European models, the optional radio is equipped with RDS (Radio Data System) features.

MO

INTERIOR

► Audio Unit and Speaker ◀

●: Standard ○: Option

Destination Audio Unit & Speaker		Europe	Australia	G.C.C. Countries	General Countries
	LW/MW/UKW ETR with Cassette Deck ● With RDS ● 20 W (Max.) x 4 Channel ● 4-Speaker System	○	—	—	—
	LW/MW/UKW ETR with Cassette Deck ● With RDS ● 20W (Max.) x 4 Channel ● 4-Speaker System	○	—	—	—
	AM ETR ● 6.5 W (Max.) x 1 Channel ● 1-Speaker System	—	—	●*1	○
	AM ETR with Cassette Deck ● 20 W (Max.) x 2 Channel ● 2-Speaker System	—	—	—	○
	AM/FM ETR with Cassette Deck ● 20 W (Max.) x 2 Channel ● 2-Speaker System	—	—	○*1	○
	AM/FM ETR with Cassette Deck ● 20 W (Max.) x 4 Channel ● 4-Speaker System	—	—	●*2	○*1
	AM/SW/SW2/FM ETR with Cassette Deck ● 20 W (Max.) x 2 Channel ● 2-Speaker System	—	—	○*1	○
	AM/SW/SW2/FM ETR with Cassette Deck ● 20 W (Max.) x 4 Channel ● 4-Speaker System	—	—	○*2	○
—	Without Audio Unit ● 2-Speaker System	—	—	—	○
—	Without Audio Unit ● 4-Speaker System	●, ○*3	○	—	○

*1: GX Grade Model *2: VX Grade Model *3: LHD Models

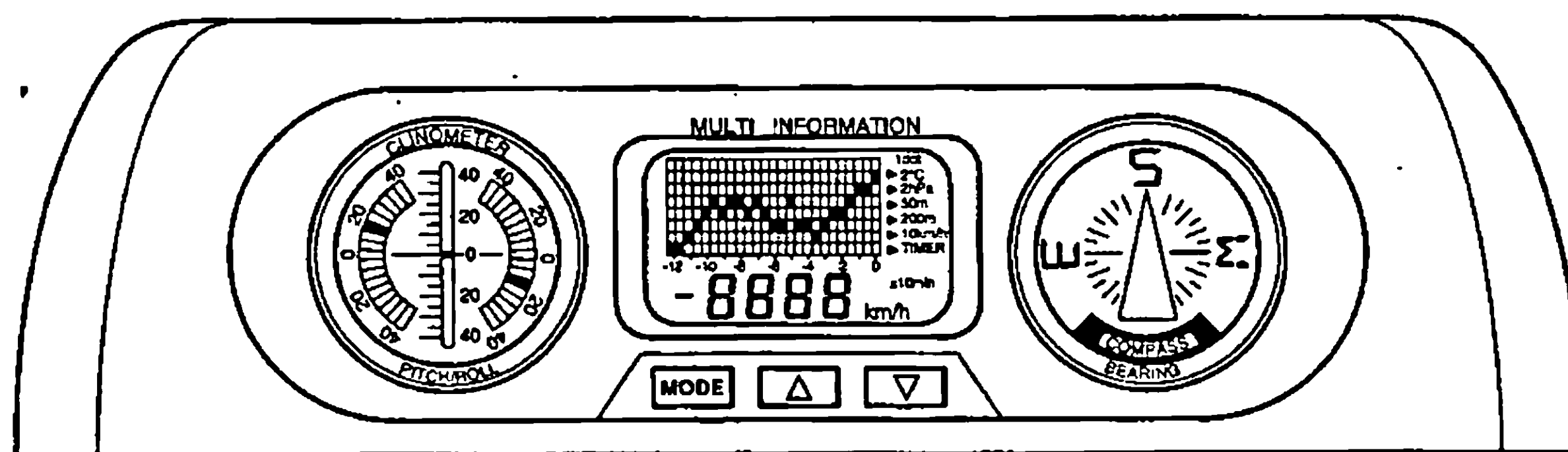
INTERIOR

■ ACCESSORY METER

- An accessory meter, which provides multi-information display in the center, is provided as optional equipment on all models.
- The accessory meter provides the following 7 functions:

① Compass	② Inclinator	③ Exterior Thermometer	④ Barometer
⑤ Altimeter	⑥ Timer	⑦ Average Speedometer	
- The accessory meter is positioned at the top of the center cluster to ensure excellent visibility and access.

MO



■ TILT STEERING

- Tilt steering is standard equipment on models for Europe, Australia and VX grade models for G.C.C. Countries, and optional on the GX grade models for G.C.C. and General Countries.
- The steering wheel position can be changed to any of 6 positions.

■ SRS AIRBAG

- The SRS (Supplemental Restraint System) airbag has been designed to help lessen the shock to the head and chest of the driver and front passenger in the event of a frontal impact collision as a supplement to the seat belt.
- The SRS airbag is provided as standard equipment on models for Europe, and as optional equipment on models for Australia and G.C.C. Countries.

■ POWER WINDOW SYSTEM

- The power window system is standard equipment on VX grade models for Australia and VX grade models for G.C.C. Countries, and optional on the other models except the STD grade model for General Countries.
- The power window system includes a one-touch auto up (models for G.C.C. and General Countries) and down function that automatically opens or closes the driver's side window fully.

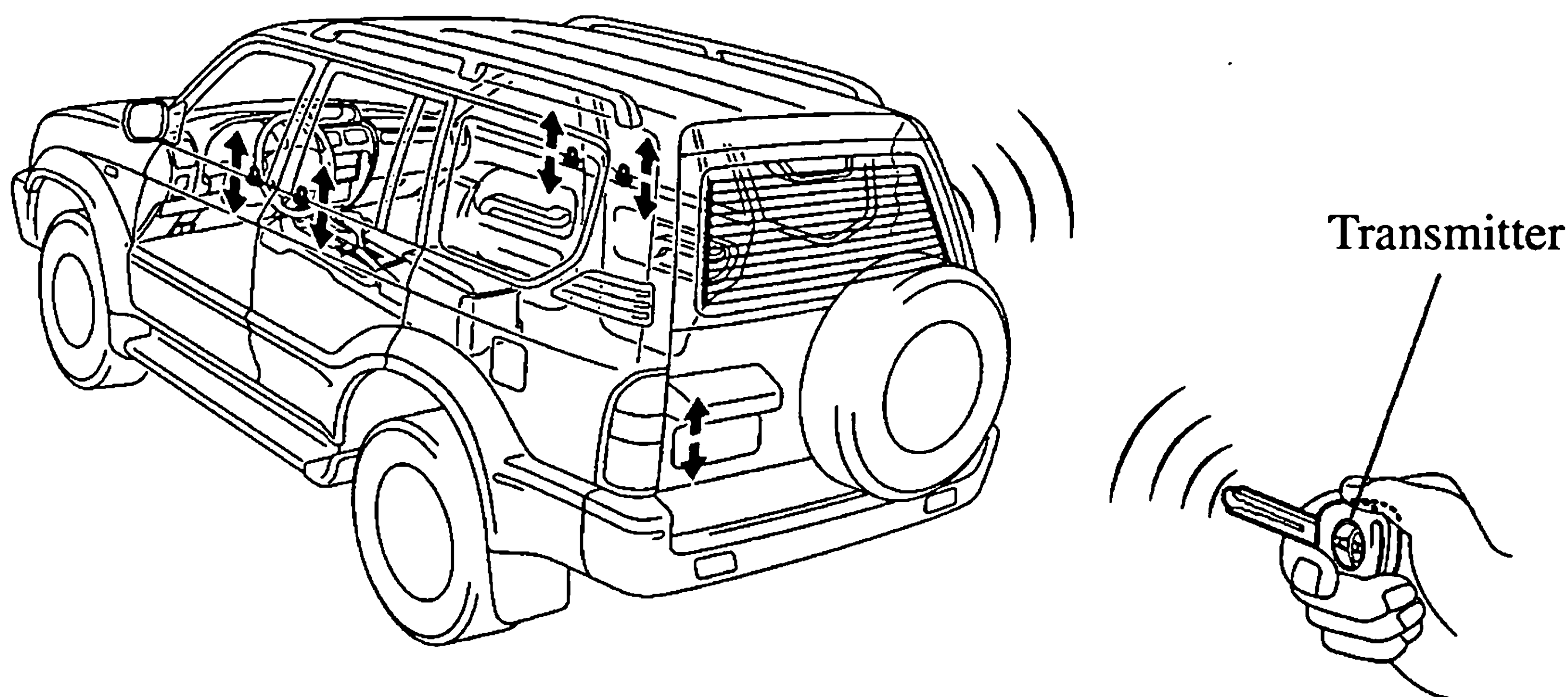
INTERIOR

■ DOOR LOCK CONTROL SYSTEM

- A door lock control system is standard equipment on models for Australia and VX grade models for G.C.C. Countries, and optional on the other models.
- The door lock control system has a door key interlinked function. By locking or unlocking the driver's door with the key, the door key interlinked function automatically locks or unlocks the other door at the same time.

■ WIRELESS DOOR LOCK REMOTE CONTROL SYSTEM

- A wireless door lock remote control system is optional equipment on VX grade models for G.C.C. Countries. With the wireless door lock remote control system, all the doors can be locked and unlocked by signals emitted by the transmitter built into the grip of the master key.
- A wireless door lock ECU with EEPROM (Electrical Erasable Programmable ROM) is used so that the transmitter recognition code can be easily reprogrammed.



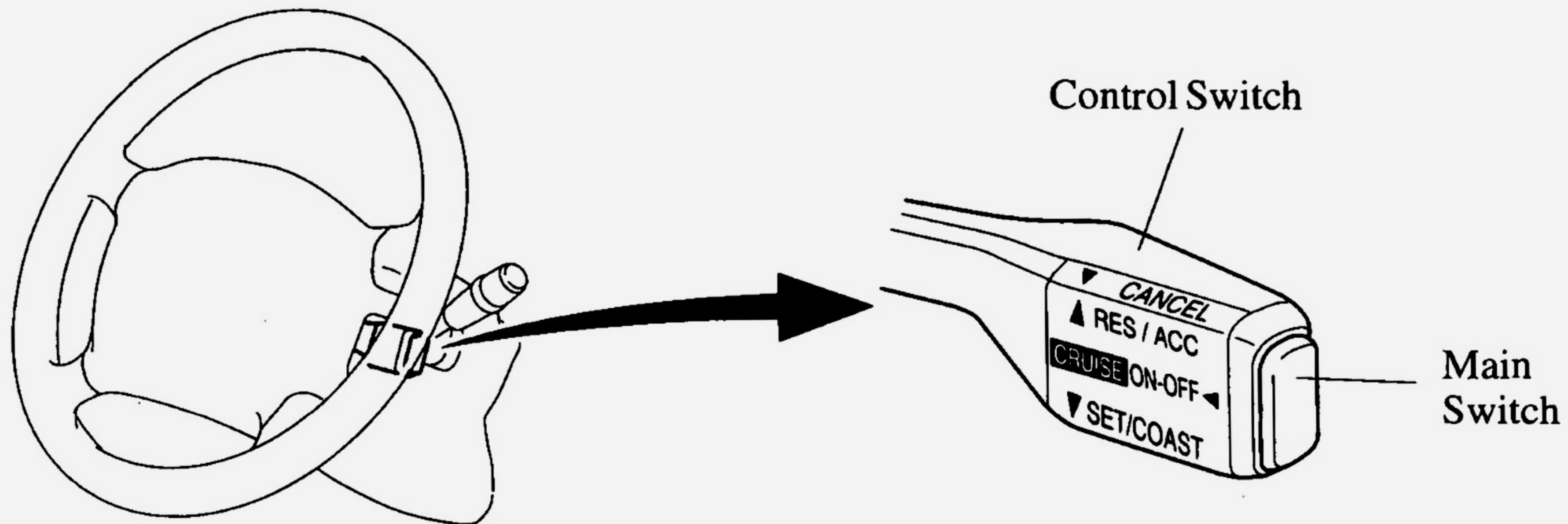
■ ENGINE IMMOBILISER SYSTEM

- The engine immobiliser system is standard equipment on models for Europe, and optional on models for Australia.
- The engine immobiliser system has been designed to prevent the vehicle from being stolen. This system uses a transponder key computer that stores the ID code of the authorized ignition key. If an attempt is made to start the engine using a non-authorized key, the transponder key computer emits a signal to the engine ECU to prohibit fuel delivery and ignition (gasoline engine model only), effectively disabling the engine.

INTERIOR

■ CRUISE CONTROL SYSTEM

- The cruise control system is optional equipment on the 5VZ-FE engine models.
- The main switch and control switch are on one lever, which is installed on the steering wheel and can be operated easily. A motor-type actuator is used.



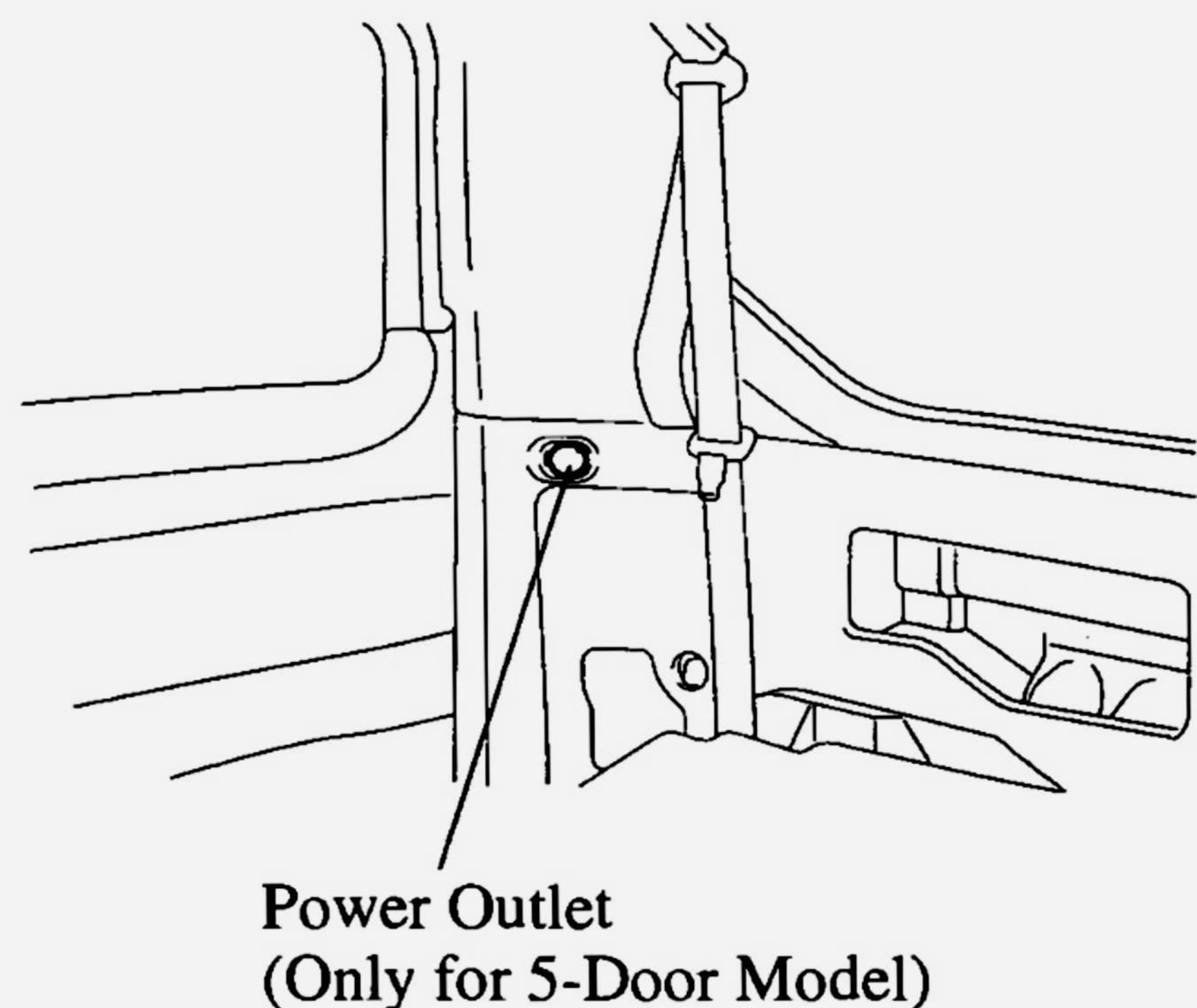
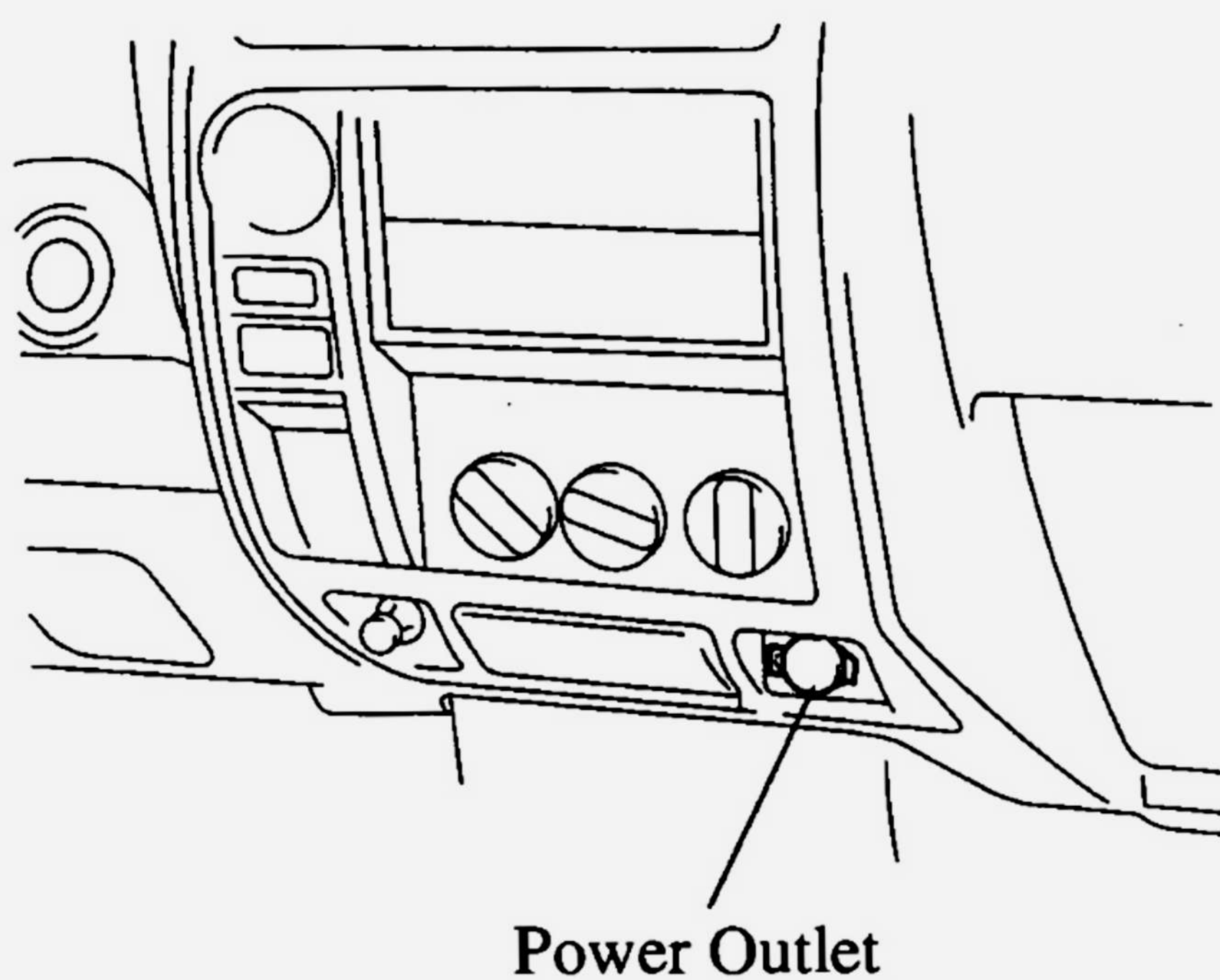
MO

■ KEY REMINDER SYSTEM

- Key reminder system is standard or optional equipment on models for G.C.C. Countries.
- When the ignition key is left inserted in the ignition key cylinder at ACC or LOCK position and the driver's door is opened, this system sounds a warning buzzer to remind the driver to remove the ignition key.

■ POWER OUTLET

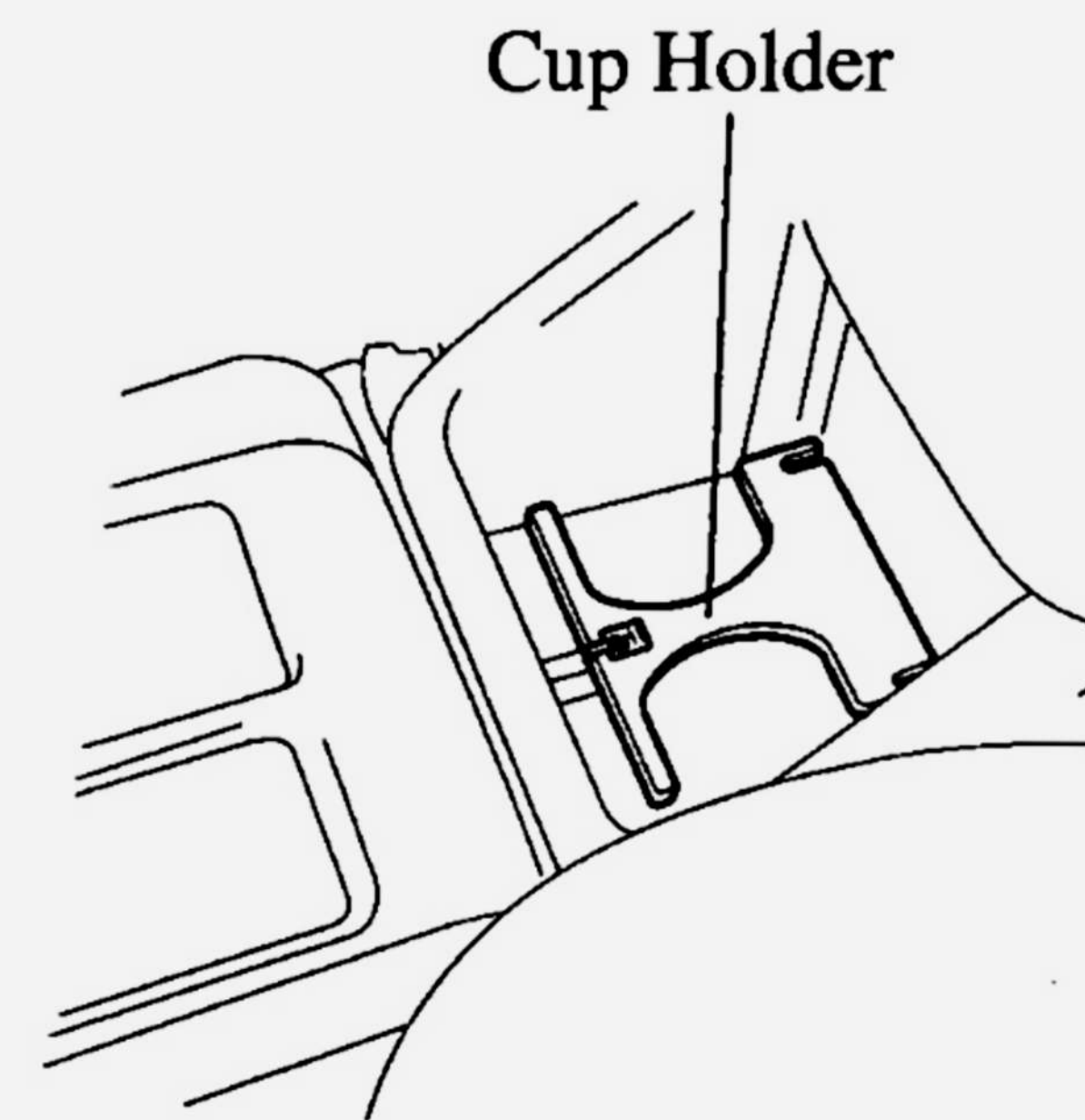
A power outlet is provided at the side of the ashtray in the center cluster. The power outlet can be used to supply power to car accessories such as a refrigerator or a vacuum cleaner. On the 5-door model, a power outlet is also available in the left side quarter panel in addition to the one in the center cluster.



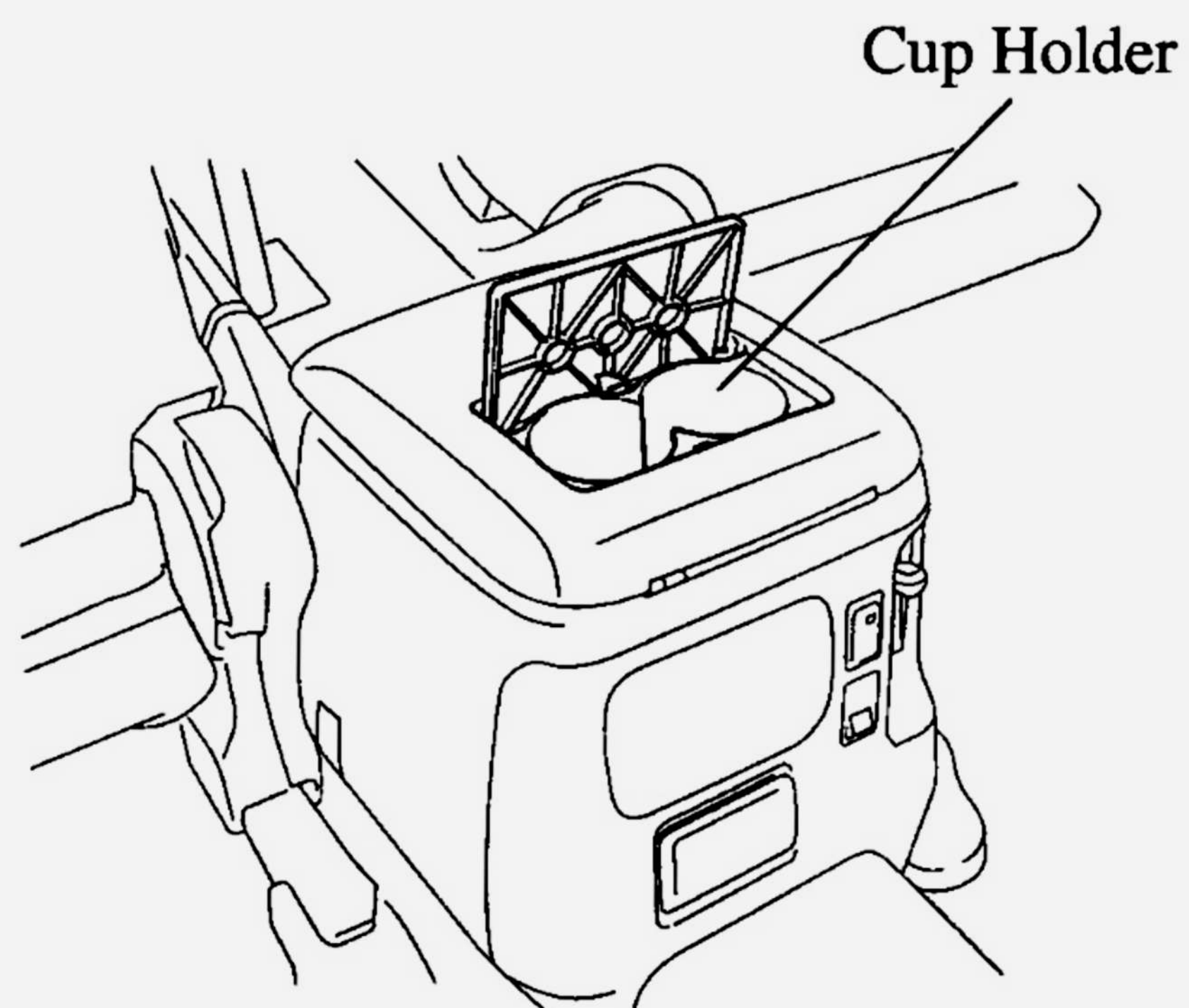
INTERIOR

■ CUP HOLDER

- A rotating cup holder is provided in front of the console box for the front seat passengers. When the cup holder is not used, it can be utilized as a storage space for small items.



- A deep-dish cup holder for rear seat passengers is provided in the rear console box.



Deep-Dish Cup Holder

SAFETY AND ENVIRONMENT

A variety of safety and environmental measures are provided based on the theme of “Gentle to People and the Environment”.

Safety	Active Safety	Double wishbone type front suspension and 4-link coil spring with lateral rod type rear suspension.
		ABS
		Large uniquely designed halogen headlight
		High-mounted stop light
	Passive Safety	Driver and front passenger airbag
		Front seat belt with pretensioner
		3-point ELR or ELR/ALR seat belt
		Pipe type side protection beam
Environment	Attention to the Environment	HFC134a (R134a) air conditioning refrigerant
	Recycling	Adoption of Toyota Super Olefin Polymer
		A material identification mark is placed on the back of resin parts

MO

3. Technical Description

EG

CH

BO

BE

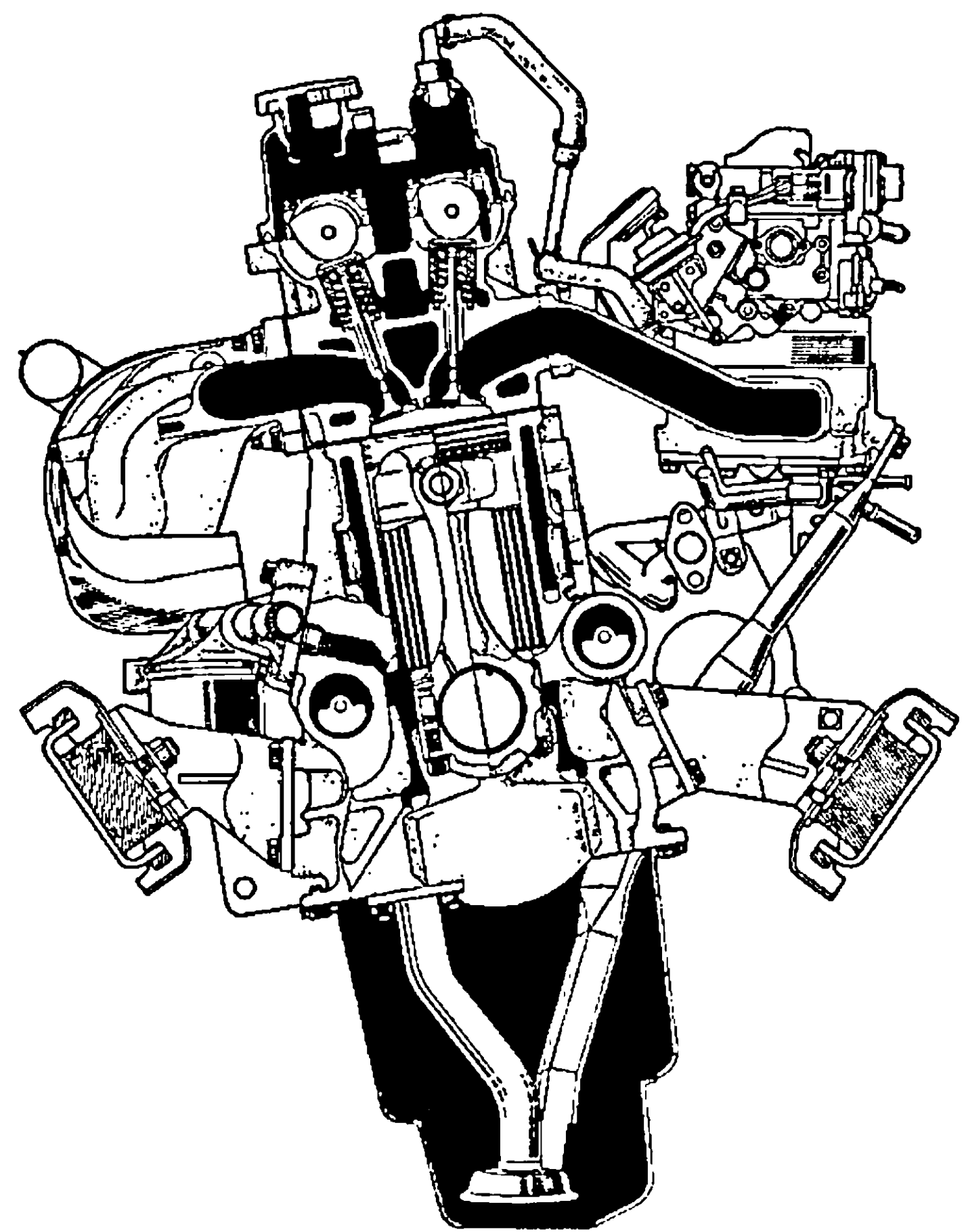
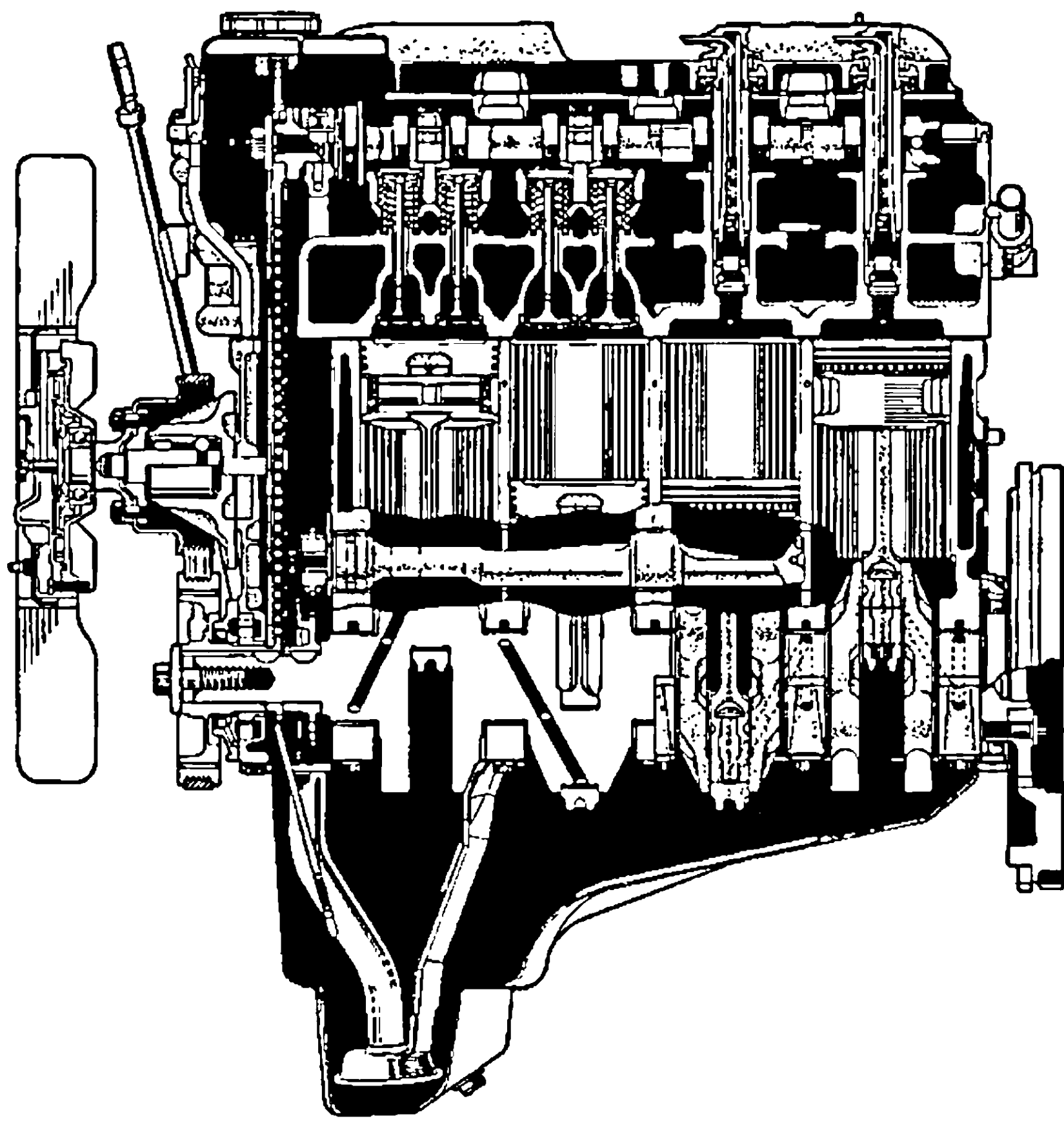
ENGINE

3RZ-F AND 3RZ-FE ENGINE

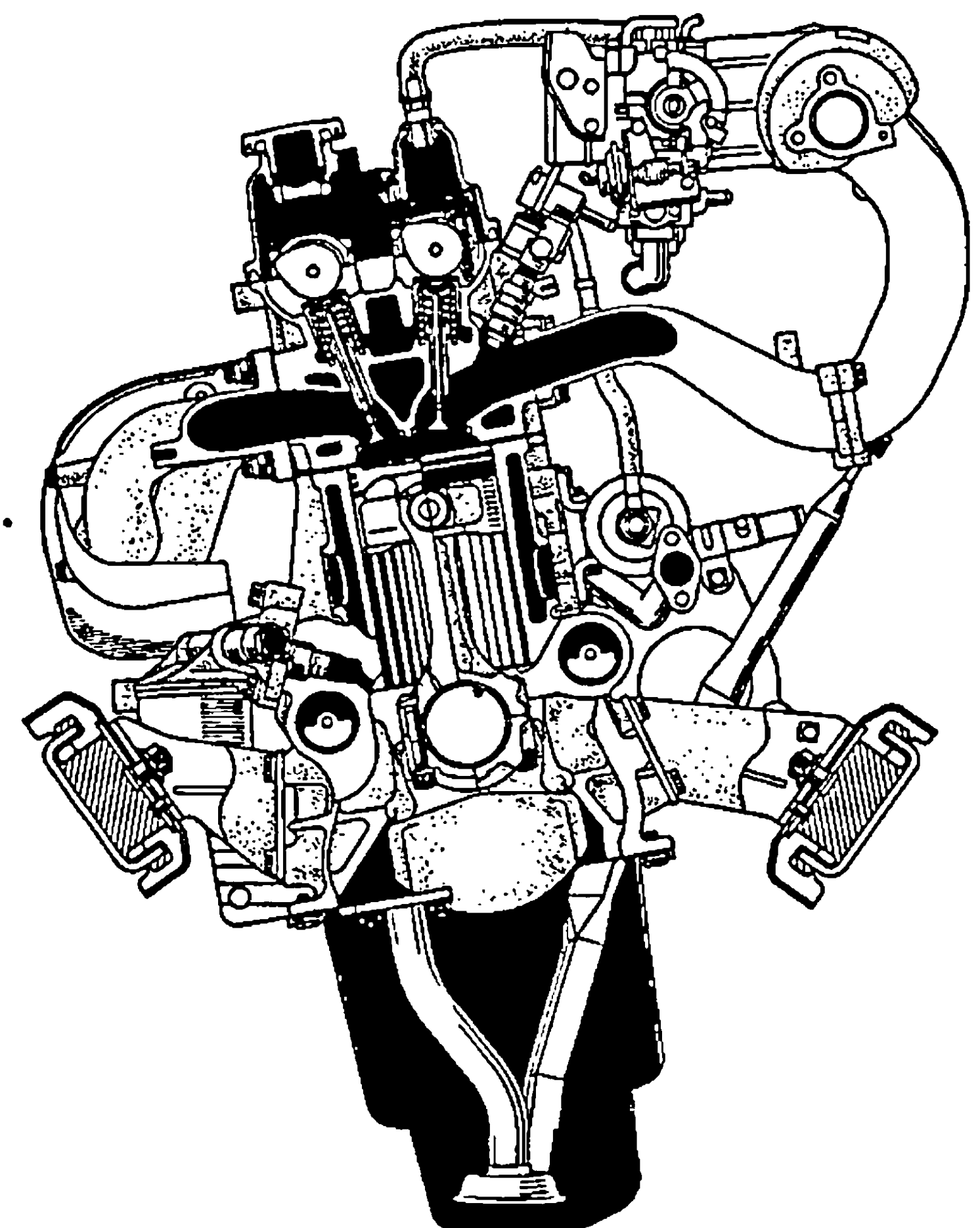
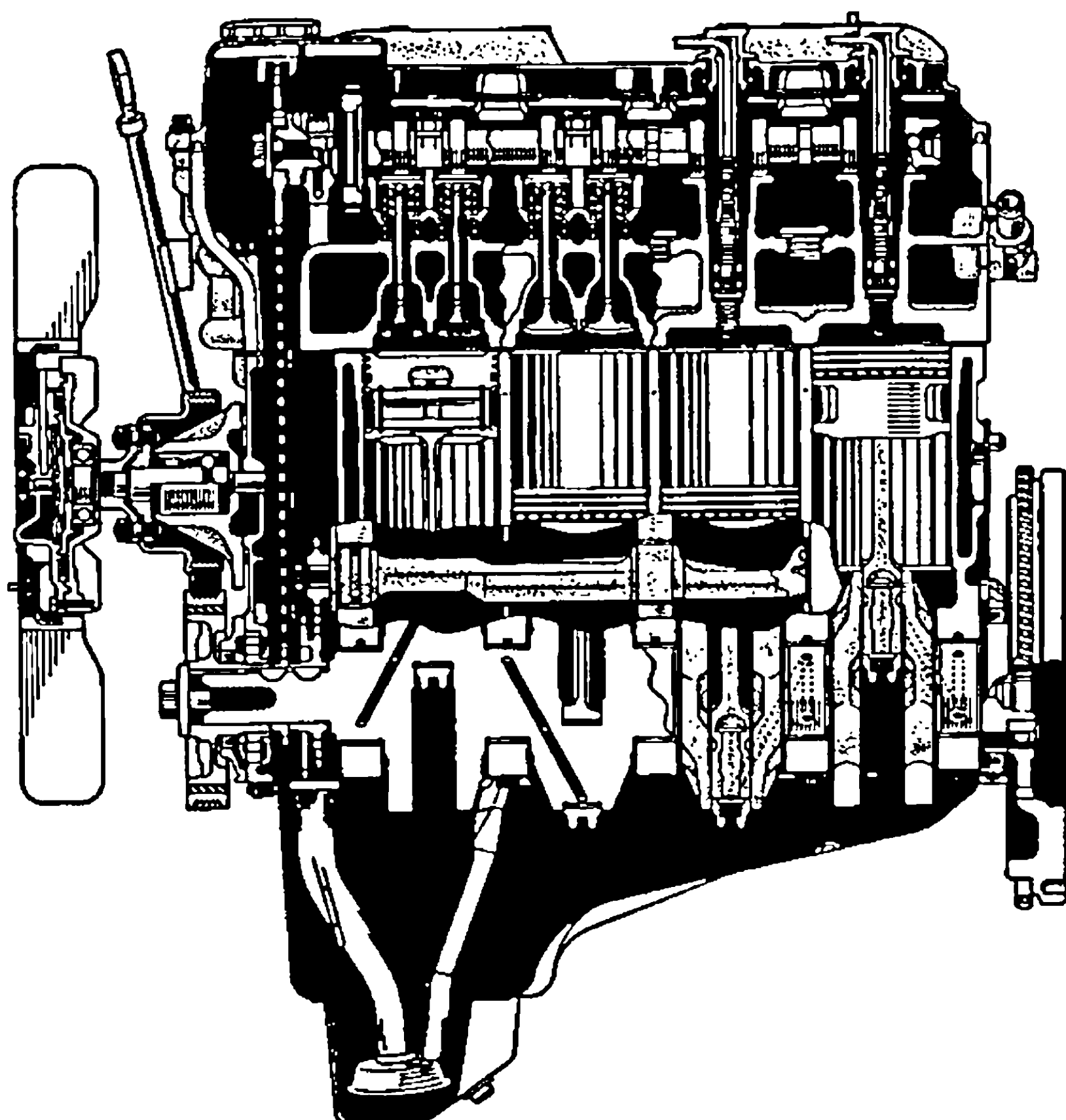
■ DESCRIPTION

The 3RZ-F and 3RZ-FE are 2.7-liter, 16-valve DOHC engines that were developed to replace the previous 22R/22R-E engines. These engines realize high performance and fuel economy through their 4-valve mechanism, and they reduce noise and vibration through their use of balance shafts.

► 3RZ-F Engine ◀



► 3RZ-FE Engine ◀

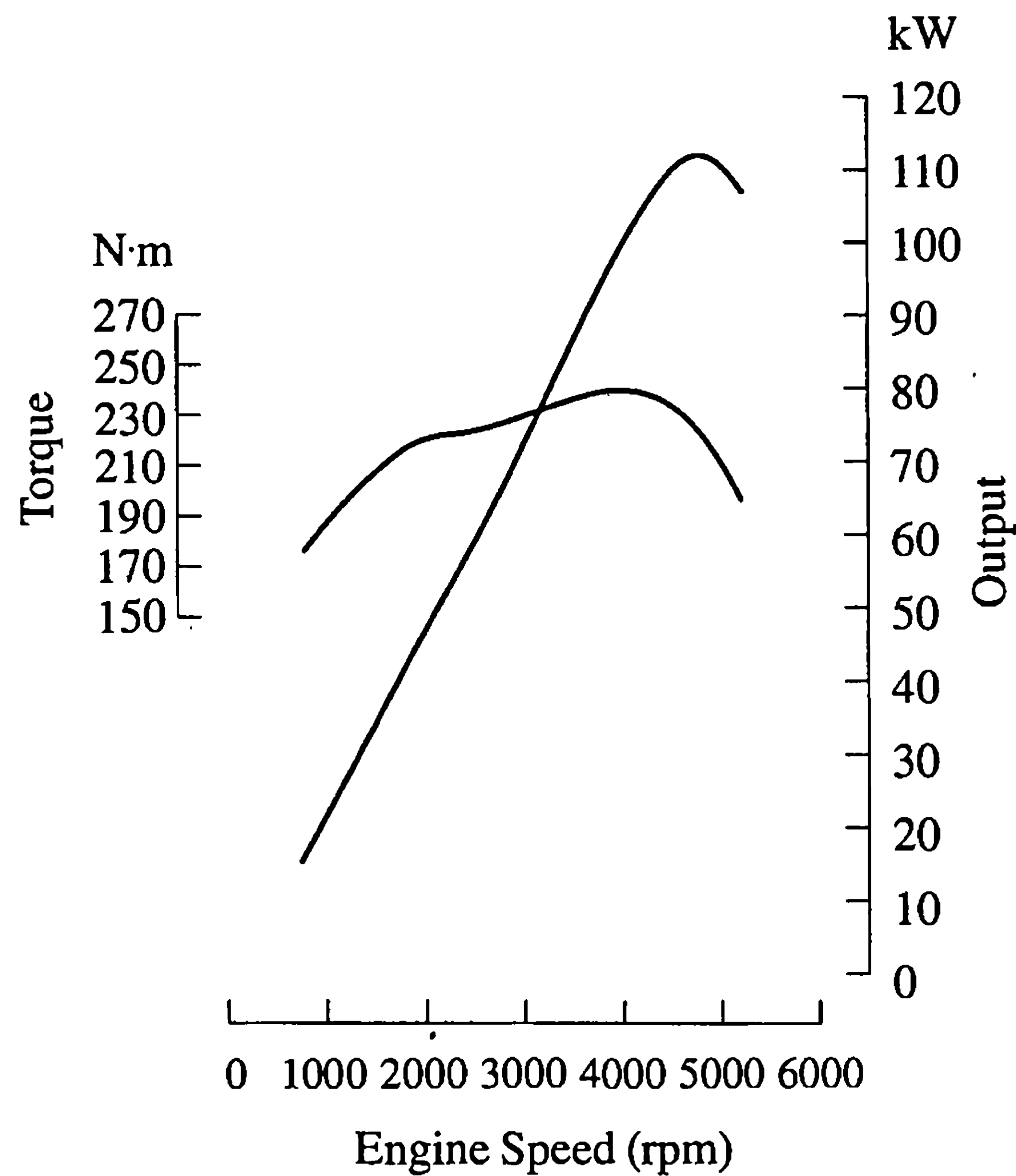


ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

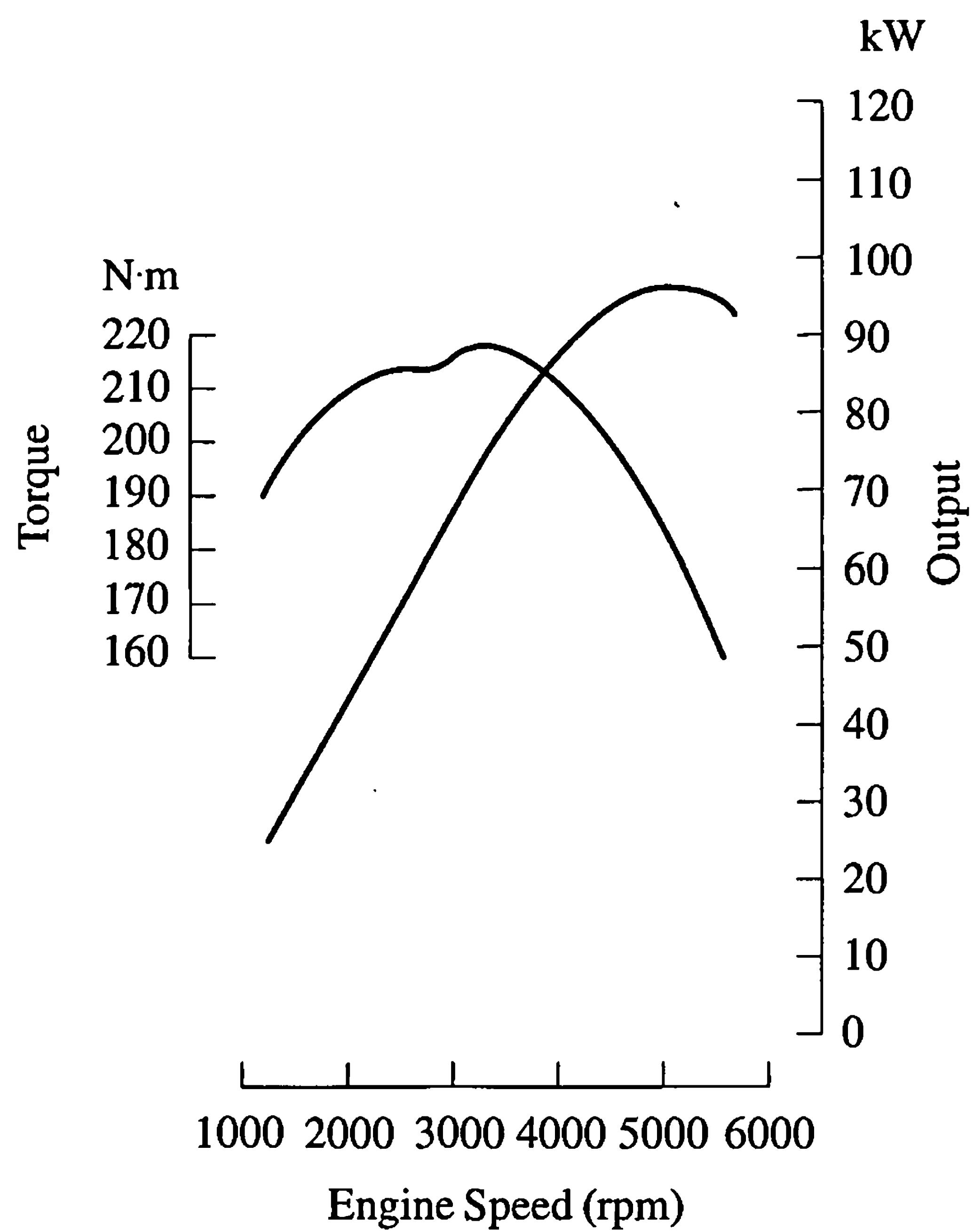
Item		Engine	3RZ-F	3RZ-FE	
No. of Cyls. & Arrangement			4-Cylinder, In-line	←	
Valve Mechanism			16-Valve DOHC	←	
Combustion Chamber			Pentroof Type	←	
Manifold			Cross-Flow	←	
Fuel System			Carburetor	EFI	
Displacement			cm ³ (cu in.)	2694 (164.4)	←
Bore x Stroke			mm (in.)	95.0 x 95.0 (3.74 x 3.74)	←
Compression Ratio			8.5	9.5	
Max. Output		EEC	—	112 kW@4800 rpm	
		SAE-NET	97 kW@5200 rpm	—	
		SAE-GROSS	104 kW@5200 rpm	—	
Max. Torque		EEC	—	240 N·m@4000 rpm	
		SAE-NET	217 N·m@3200 rpm	—	
		SAE-GROSS	226 N·m@3200 rpm	—	
Valve Timing	Intake	Open	5° BTDC	←	
		Close	45° ABDC	←	
	Exhaust	Open	39° BBDC	42° BBDC	
		Close	7° ATDC	2° ATDC	
Fuel Octane Number			RON	90	91 or Higher
Oil Grade			API SG, SH or ILSAC	←	

EG

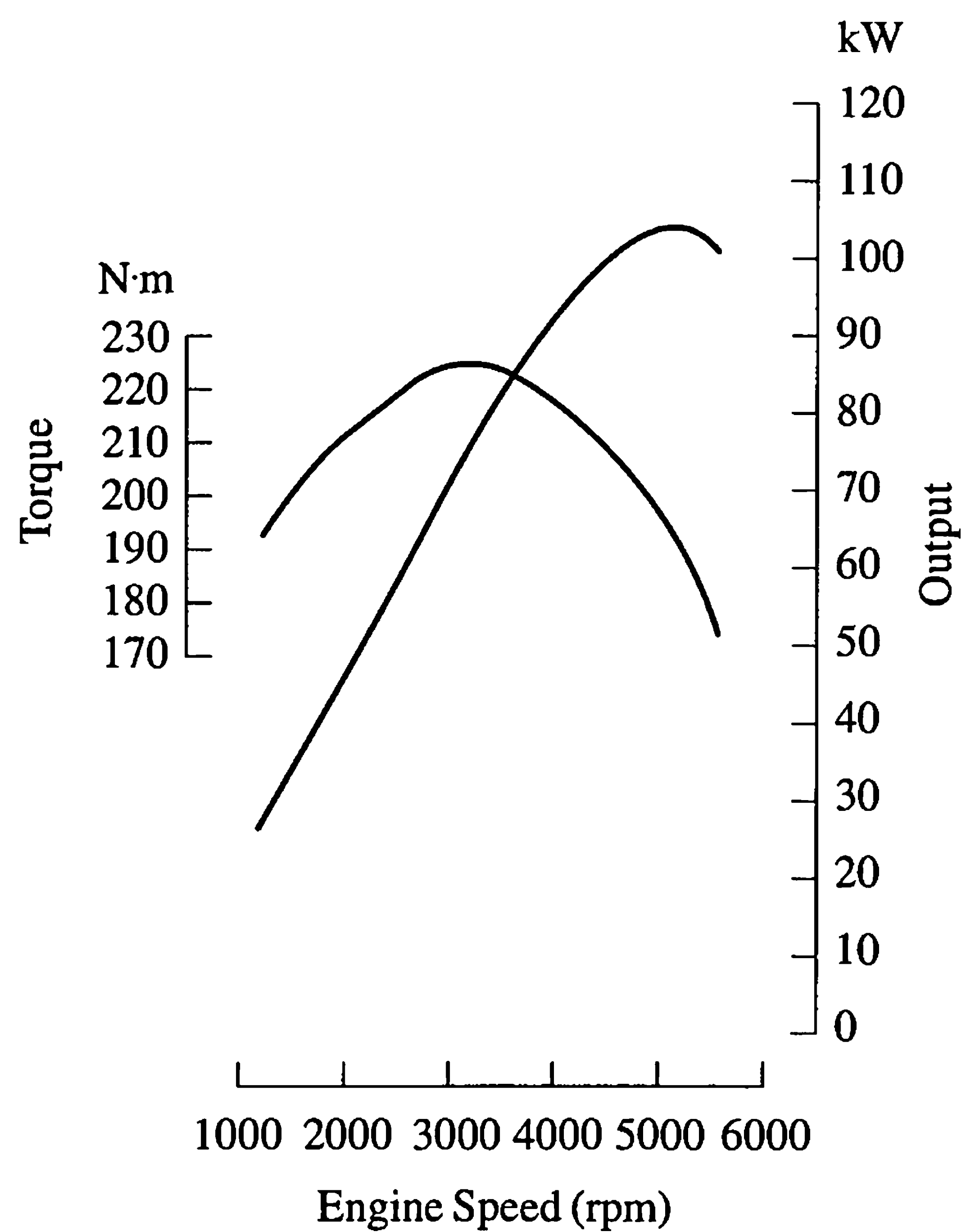
► 3RZ-FE Engine (EEC) ◀



► 3RZ-F Engine (SAE-NET) ◀



► 3RZ-F Engine (SAE-GROSS) ◀



■ FEATURES OF 3RZ-F AND 3RZ-FE ENGINES

Features of the 3RZ-F and 3RZ-FE engines are as follows:

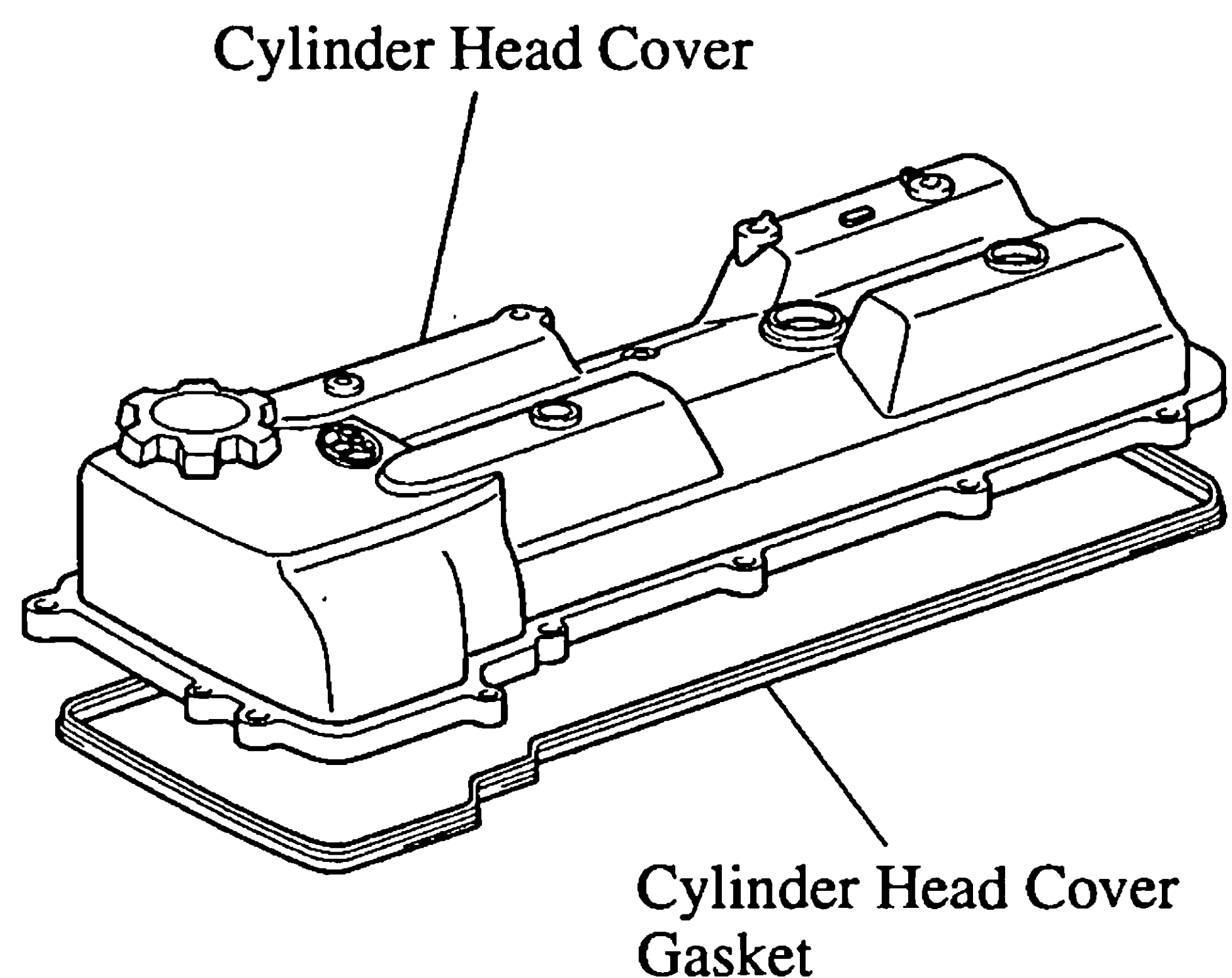
Features	Contents
High Performance and Fuel Economy	● Direct-drive DOHC with a 4-valve cross-flow layout. ● Pentroof type combustion chamber plus high compression ratio. ● EFI system with a hot-wire type mass air flow meter*. ● Rotary solenoid type ISC system and ESA system for precision in accordance with engine operating conditions*.
Low Noise and Vibration	● 2 balance shafts built into the cylinder block. ● A highly rigid full balance crankshaft assembly and cylinder block. ● A coupling fan with a 3-stage temperature-controlled fluid coupling.
Lightweight and Compact Design	● A scissors gear mechanism for the camshaft reduces the size of the cylinder head. ● An aluminum radiator core is used.
Good Serviceability and High Reliability	● Outer shim type valve lifters and adjusting shims. ● A single timing chain with superb wear resistance. ● Aluminum alloy bearings for the connecting rods and the crankshaft.

*: Only for 3RZ-FE Engine

■ ENGINE PROPER

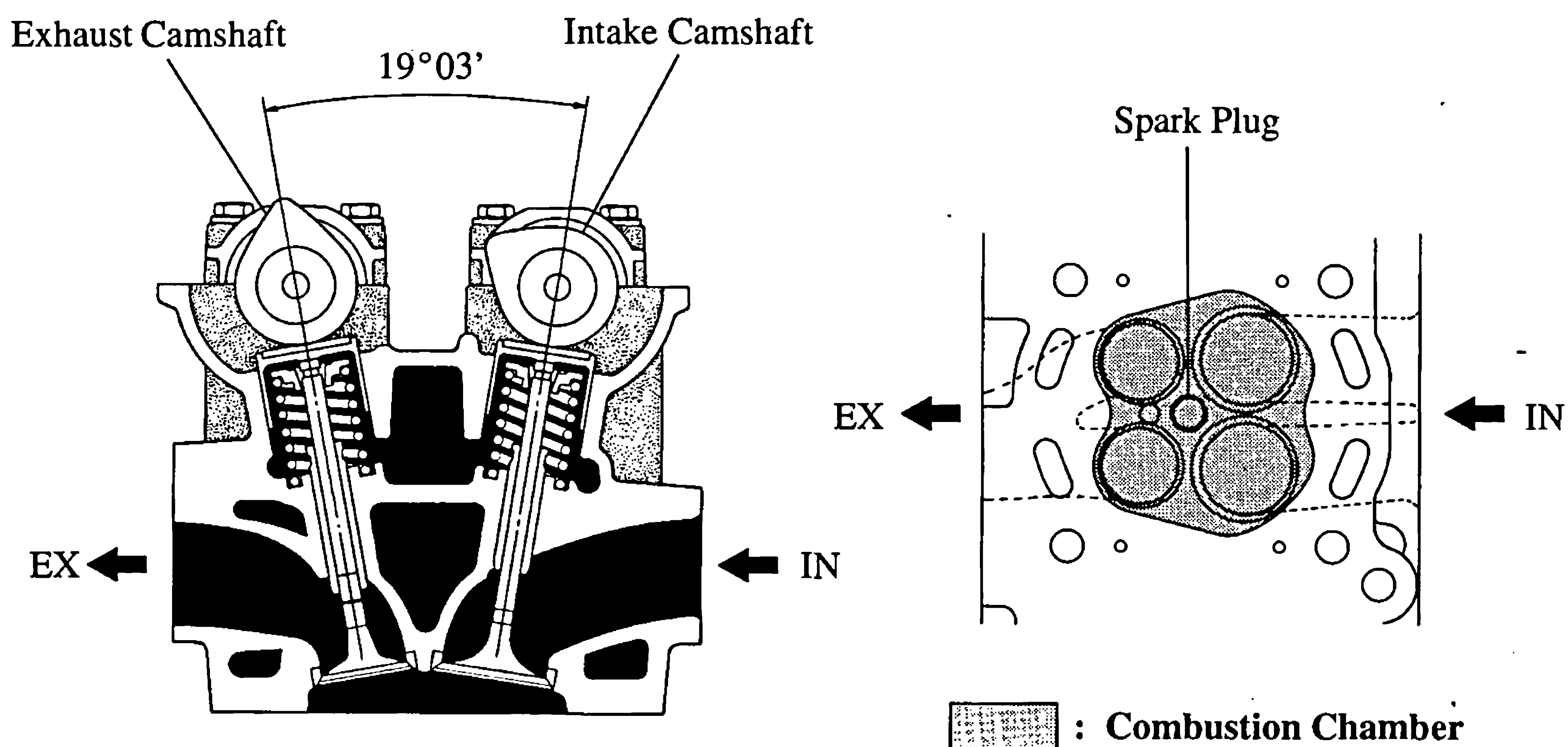
1. Cylinder Head Cover

- The unibody cylinder head cover made of aluminum is made thinner to reduce the overall weight of the engine.
- The cylinder head cover gasket is an acryl rubber ring type with superb sealing properties.



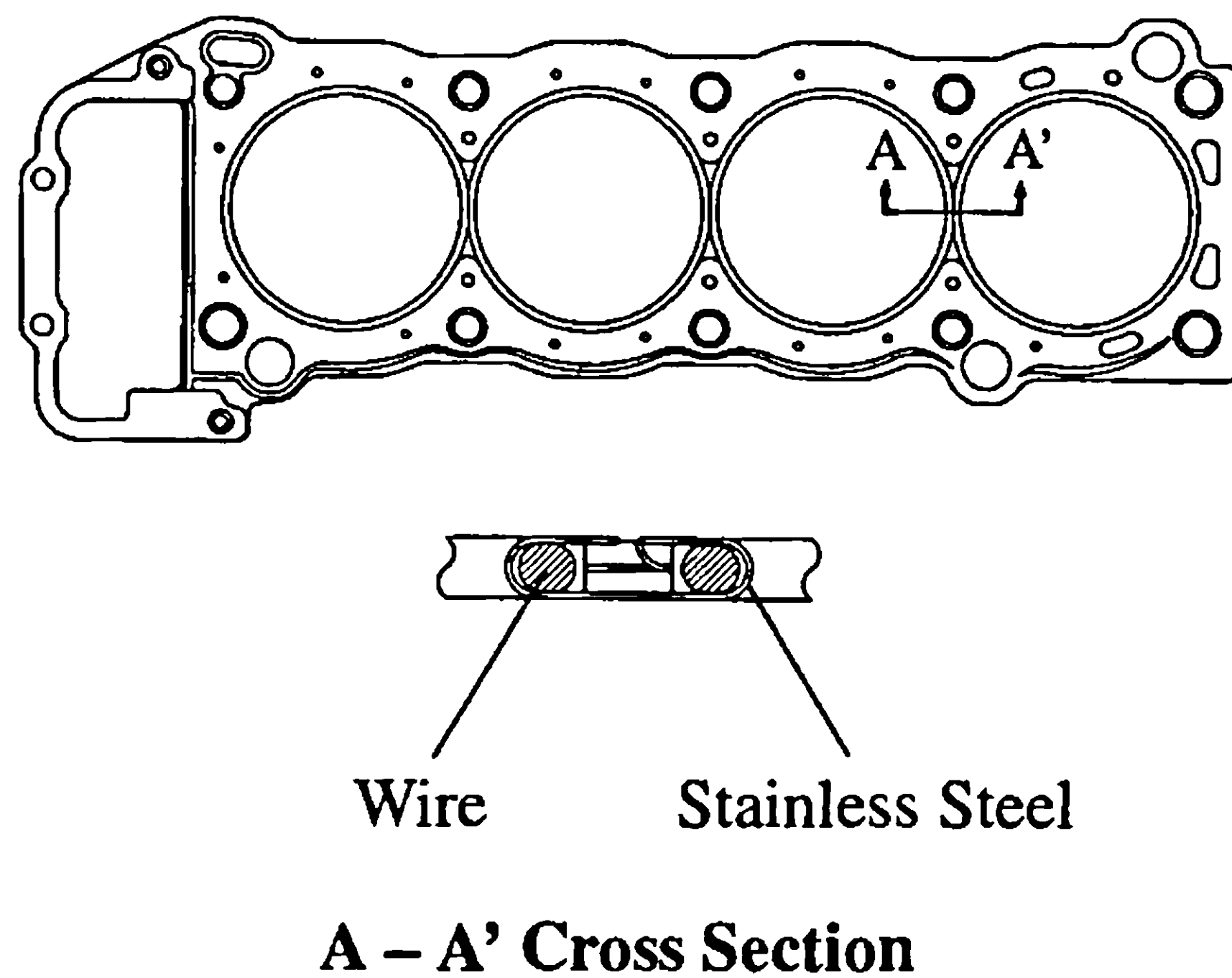
2. Cylinder Head

- The exhaust camshaft is driven by the intake camshaft gear and the valve angle has been narrowed to $19^{\circ}03'$ to achieve a more compact cylinder head. Pentroof combustion chambers, which permit the spark plugs to be located in the center of the combustion chamber, are also used to improve combustion efficiency.
- An aluminum alloy cylinder head with excellent heat transmission characteristics is used. A cross-flow intake and exhaust layout is used and 4 valves per cylinder are provided to improve intake and exhaust efficiency.
- Plastic region tightening is used for the cylinder head bolts for good axial tension.



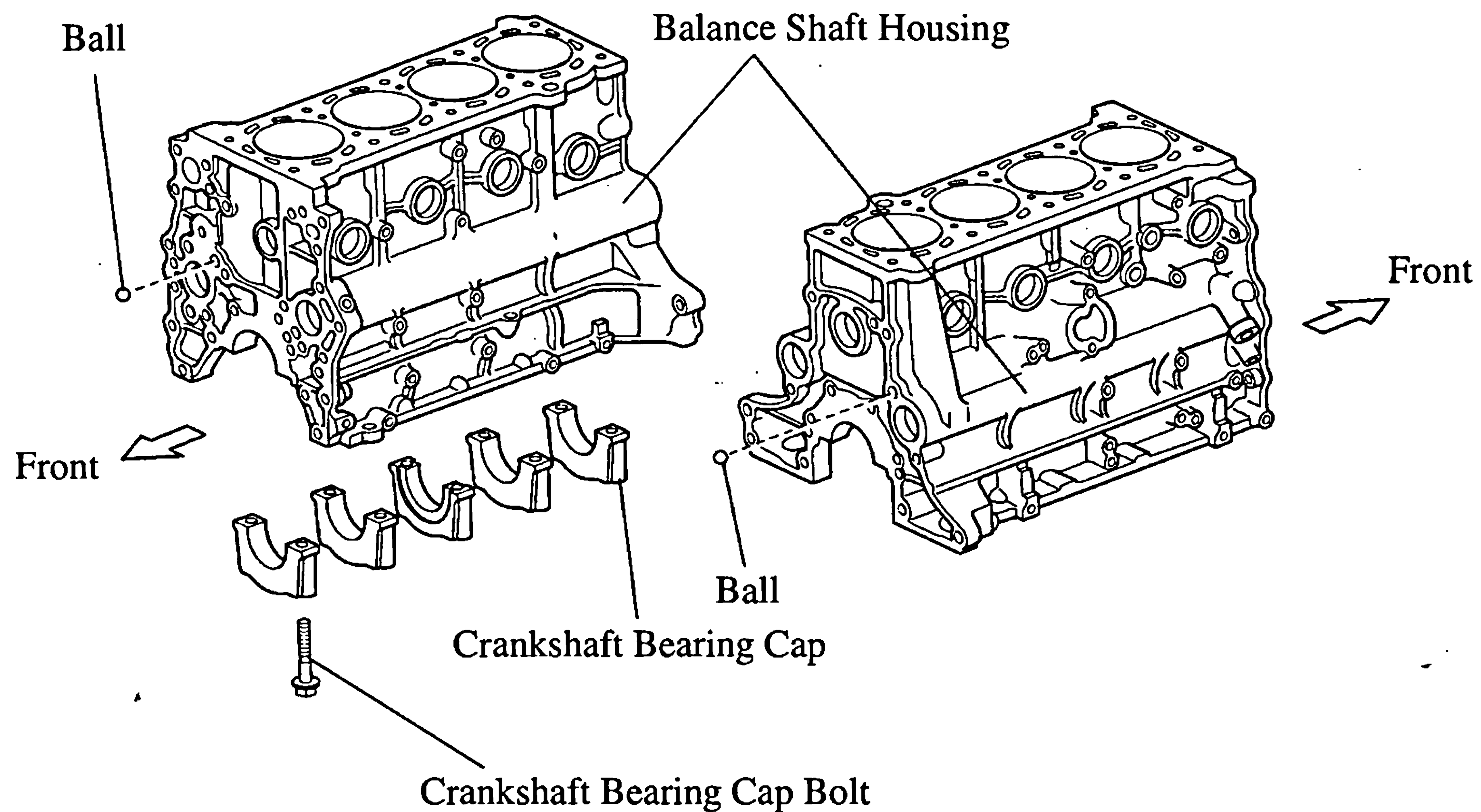
3. Cylinder Head Gasket

A graphite gasket with stainless grommets, which provides excellent pressure resistance and sealability, is used for the cylinder head gasket.



4. Cylinder Block

- The cylinder block is made of cast iron. A curved surface is given to the housing for the 2 balance shafts and the skirt to increase rigidity while reducing vibration and noise.
- Balls have been pressure inserted in the plug holes of oil passages to assure that no oil leakage occurs.
- Plastic region tightening bolts are used for the crankshaft bearing cap bolts.

**EG**

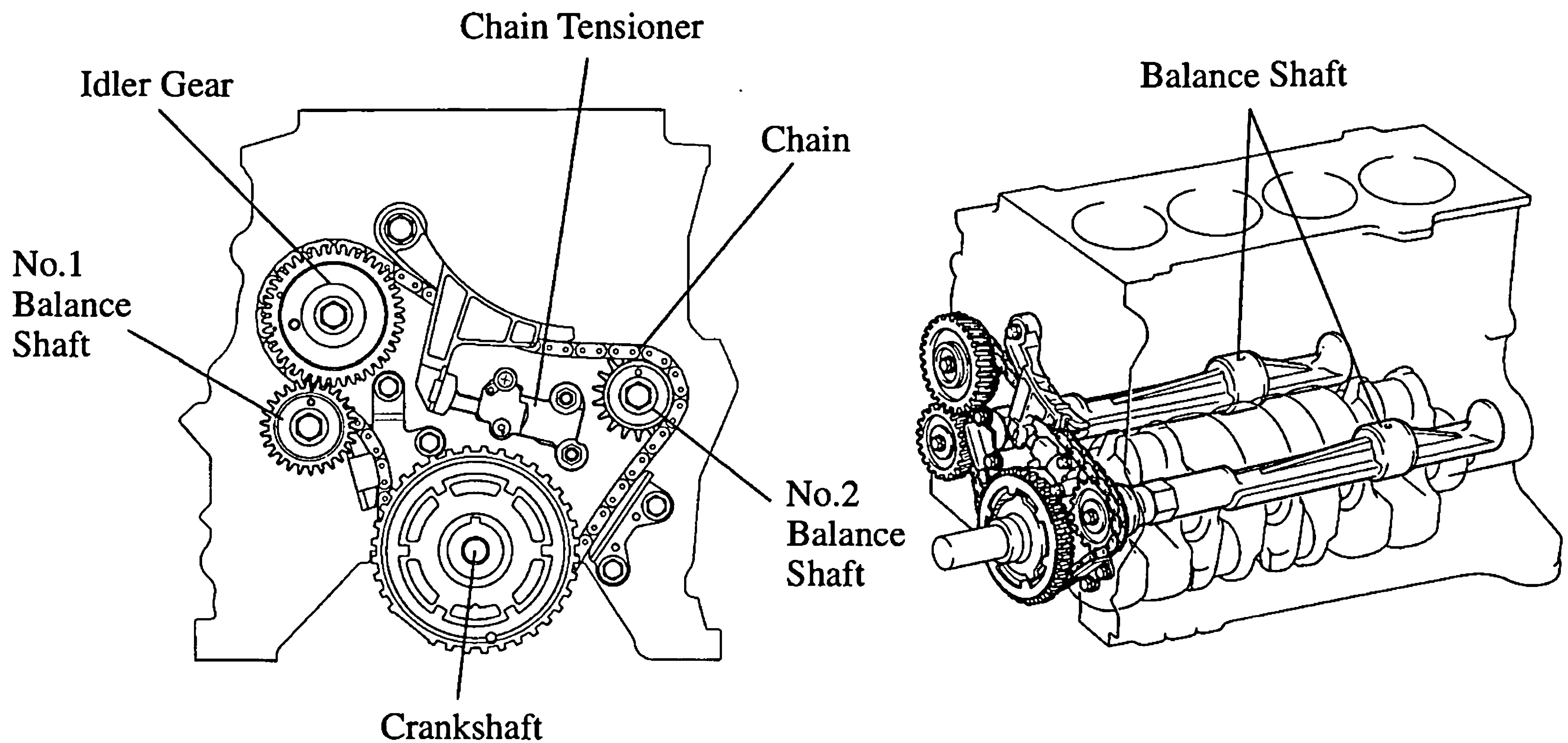
5. Balance Shaft

General

For in-line 4 cylinder engines, the main cause of vibration is imbalanced inertial force of reciprocating parts such as the pistons and connecting rods. The 3RZ-F and 3RZ-FE engine vibration has been reduced by using 2 balance shafts to cancel the imbalanced inertial force, thereby reducing engine noise (booming noise).

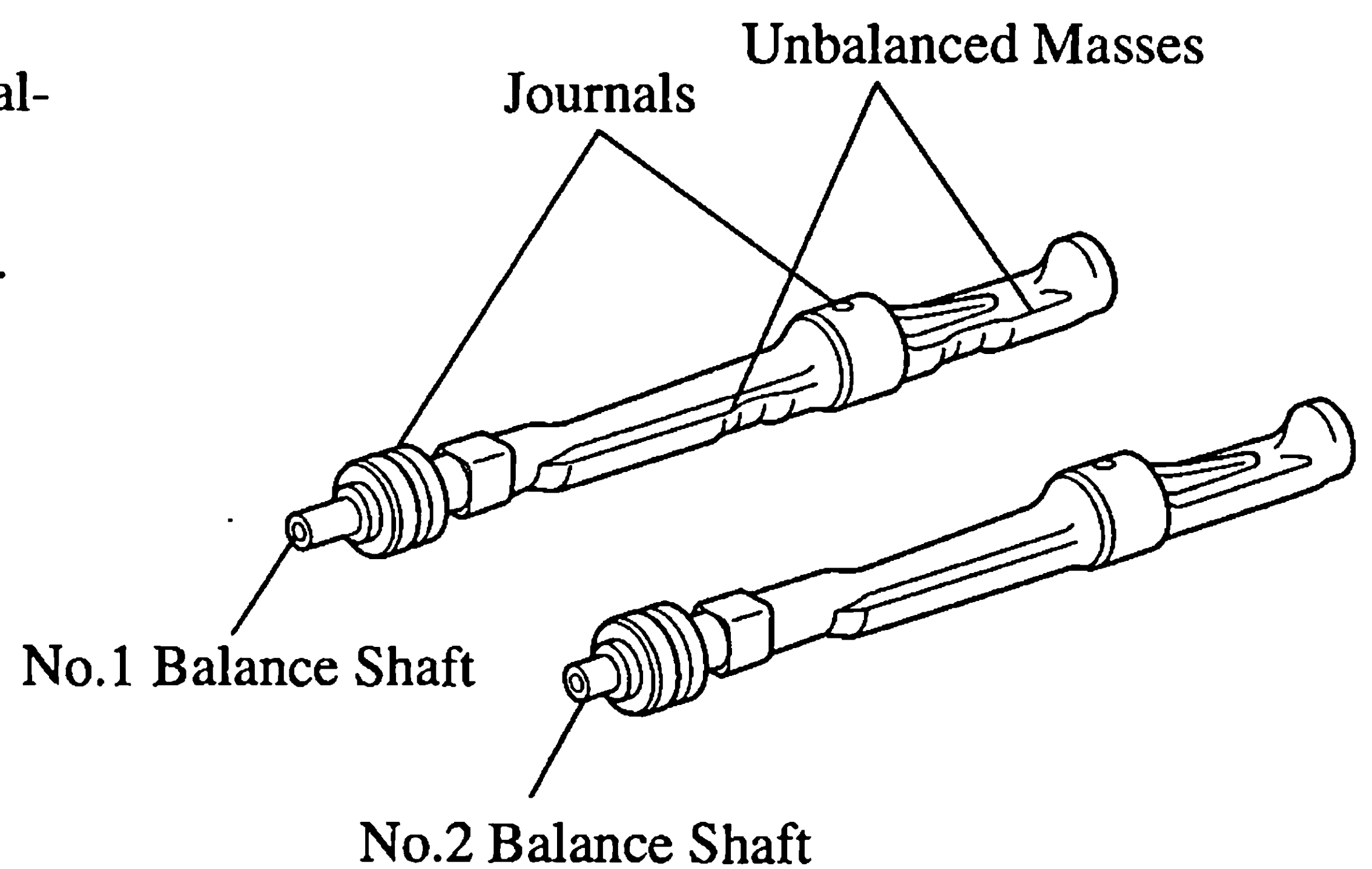
Construction

2 balance shafts are built into the cylinder block. Using a chain and an idler gear, both balance shafts rotate at twice the speed of the crankshaft with each balance shaft rotating in the opposite direction of the other.



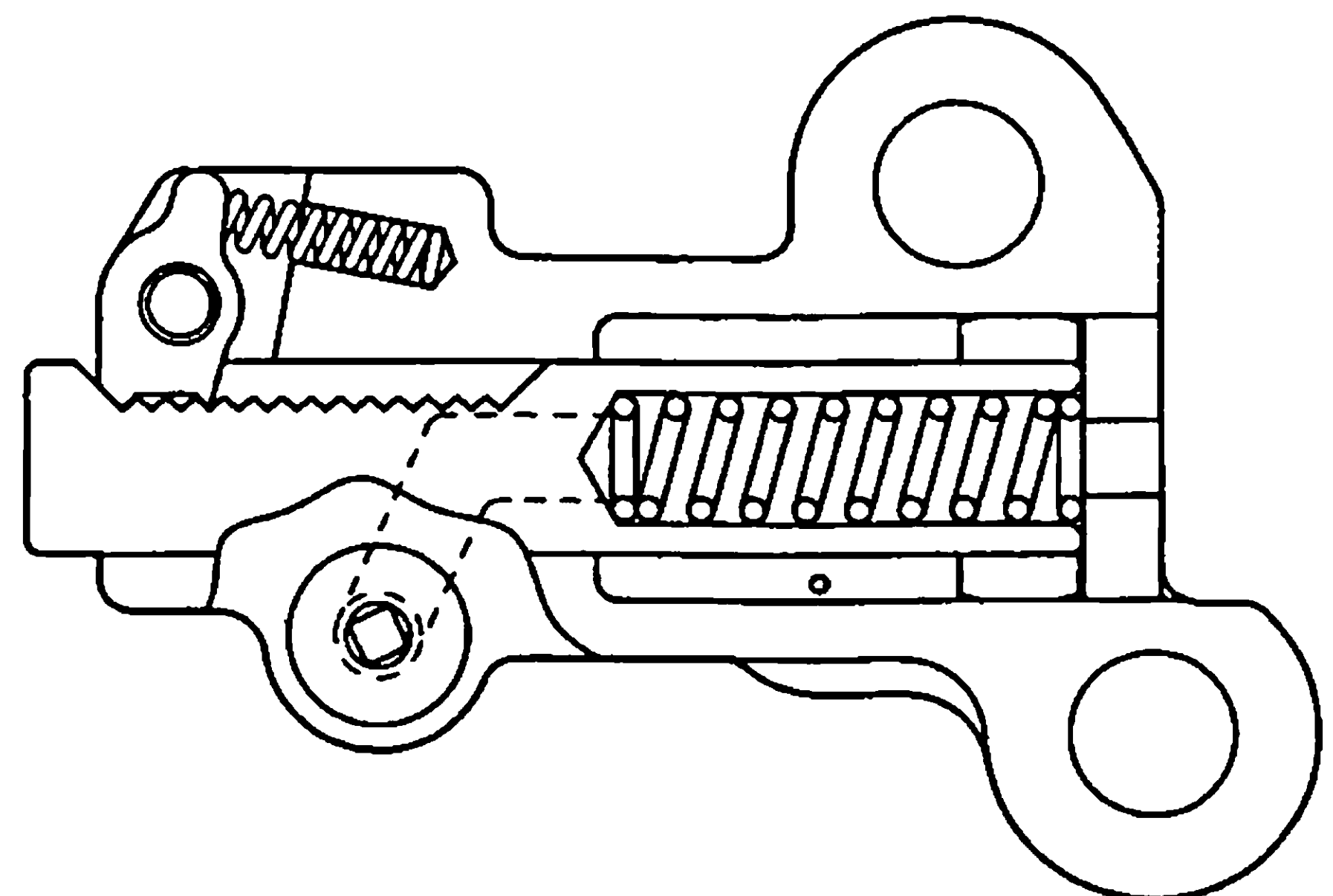
Balance Shaft

- Each balance shaft has 2 journals and 2 unbalanced masses.
- Both balance shafts are made of forged iron.



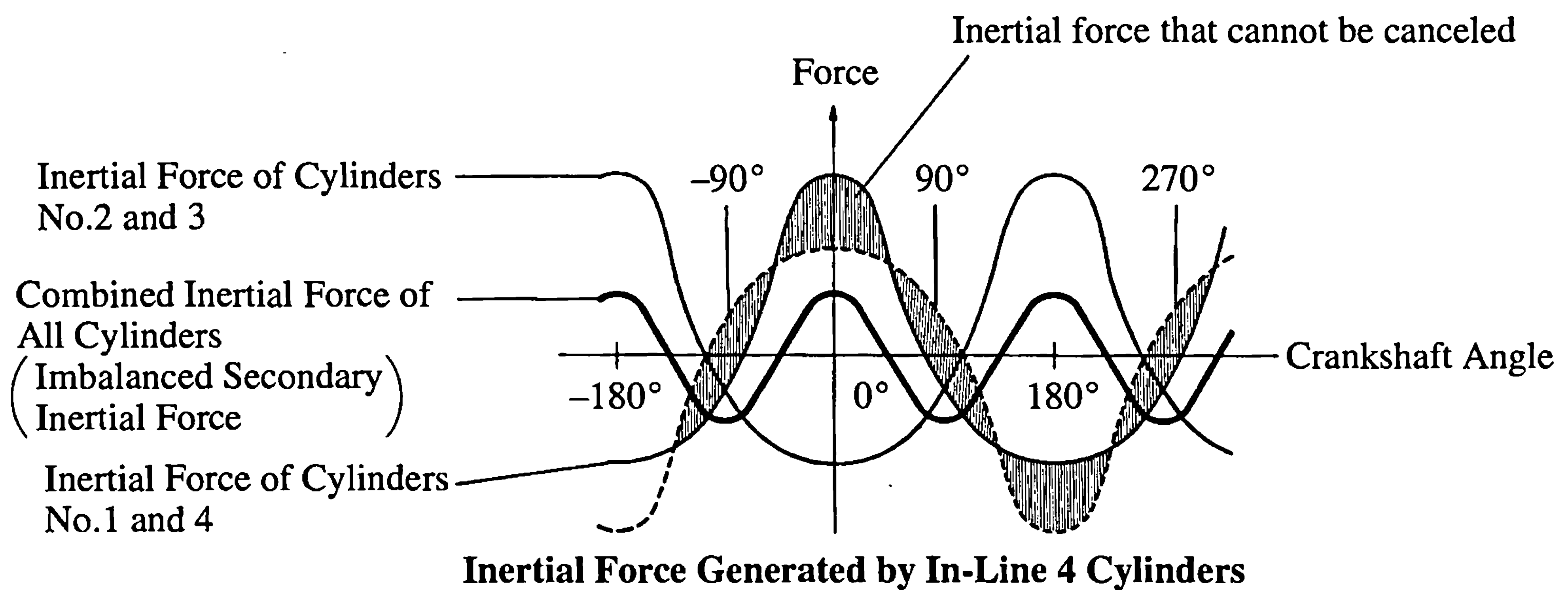
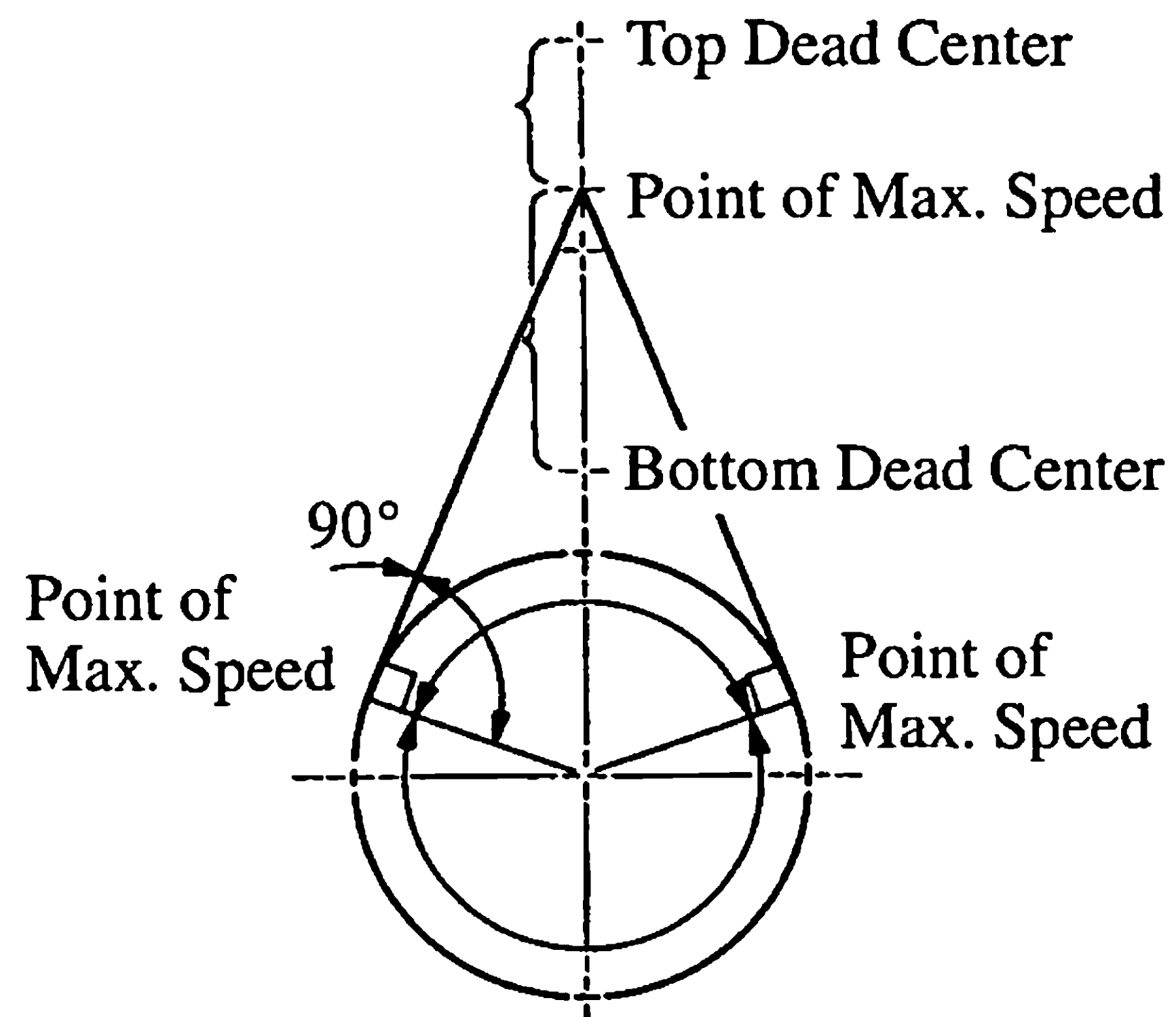
Chain Tensioner

The chain tensioner uses a spring and oil pressure to maintain proper chain tension at all times. A ratchet type non-return mechanism is also included.

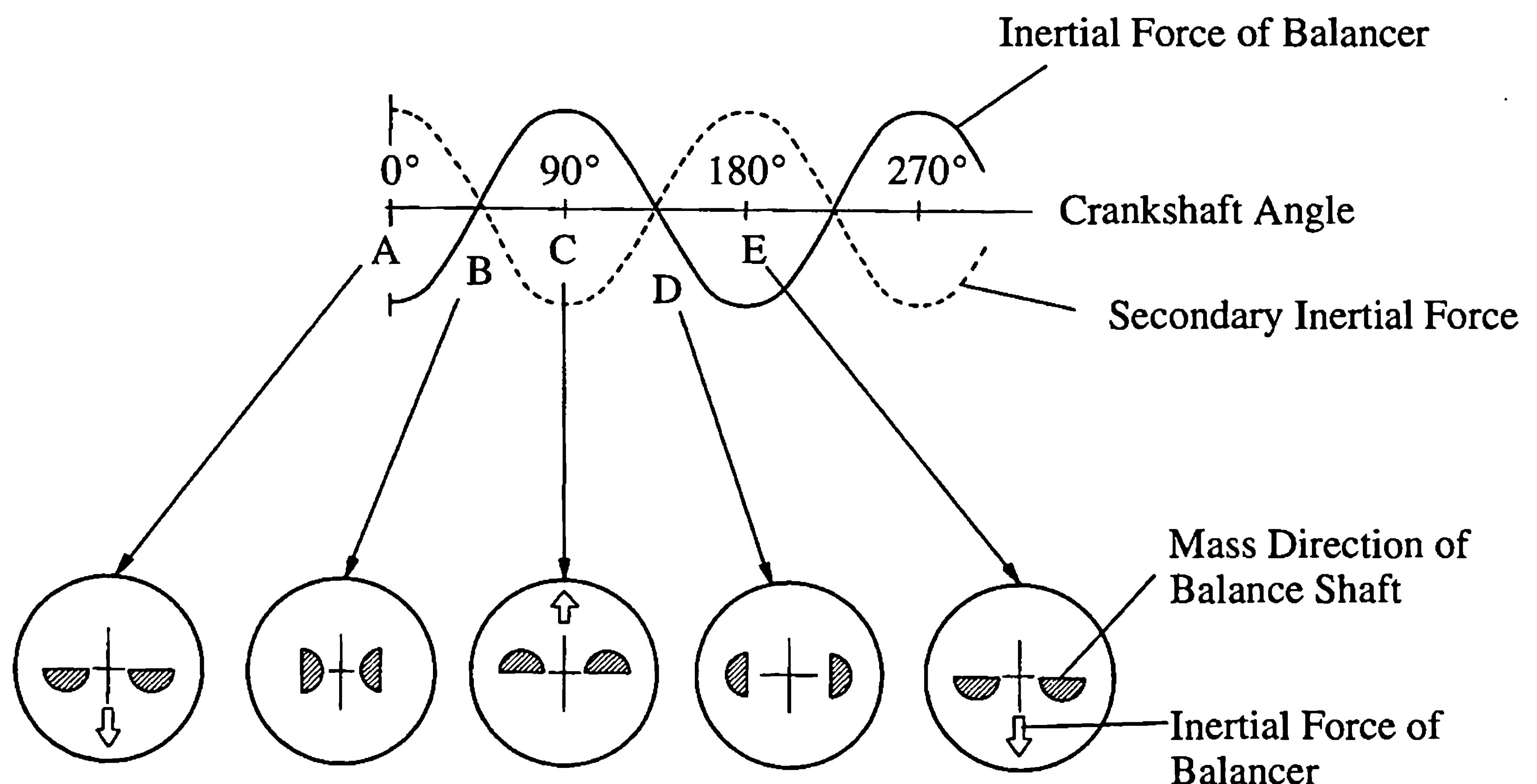


Operation

In the in-line 4-cylinder engine, the crankshaft angle for cylinders No.1 and 4 are exactly at the opposite (180°) position of cylinders No.2 and 3. Therefore, the inertial force of the pistons and the connecting rods of the former 2 cylinders and of the latter 2 cylinders almost cancel each other. However, because the position at which the piston reaches its maximum speed is located toward the top-dead-center from the center of the stroke, the upward inertial force is greater than the downward inertial force. This unbalanced secondary inertial force is generated at twice the crankshaft speed.



To cancel the imbalanced secondary inertial force, 2 balance shafts are rotated at twice the crankshaft speed and generate inertial force in the opposite direction. Also, in order to cancel the inertial force generated by the balance shaft itself, the balance shaft actually consists of 2 shafts rotating in opposite directions.

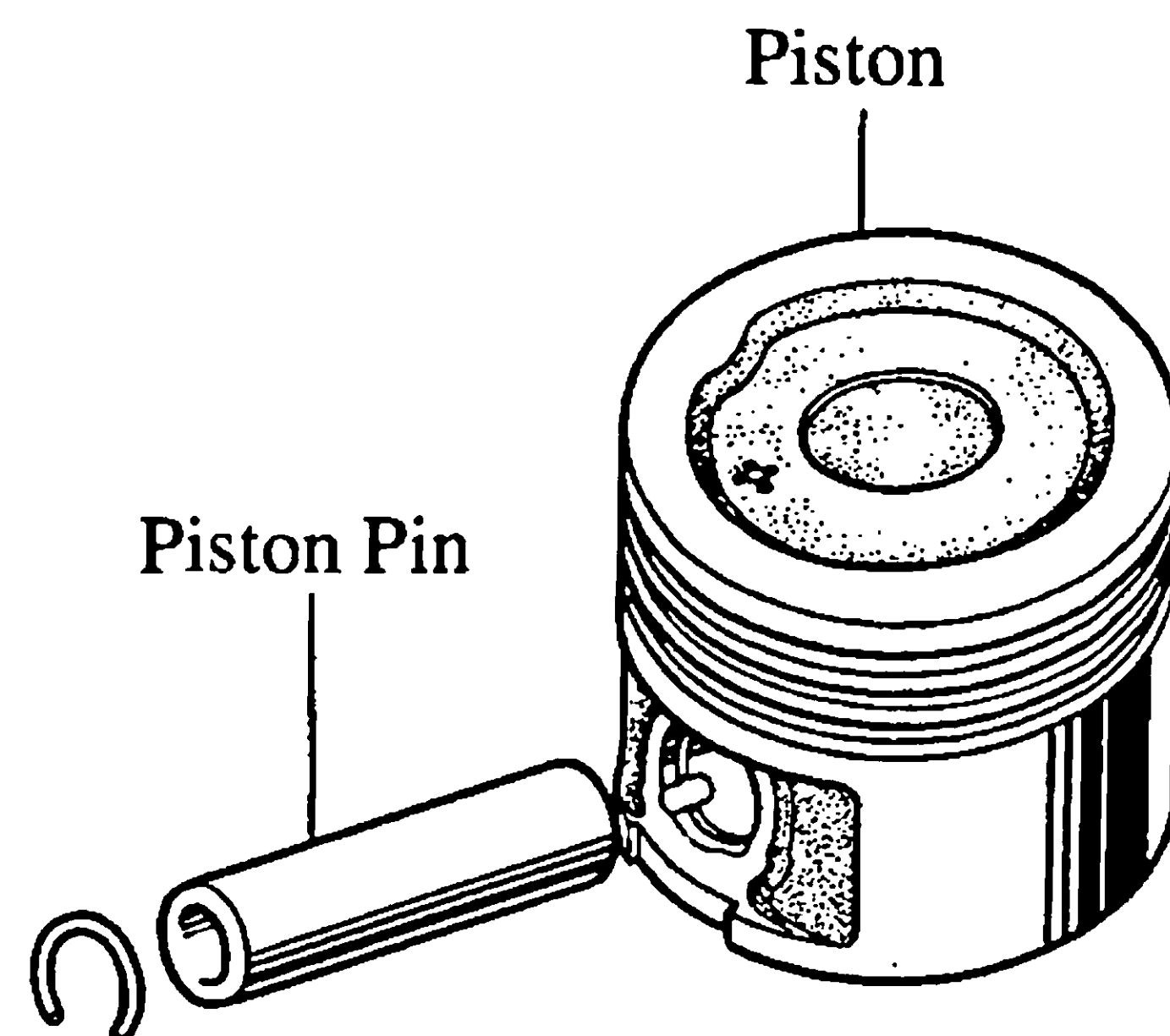


Mass Direction of Balance Shaft at Crankshaft Angle

6. Piston

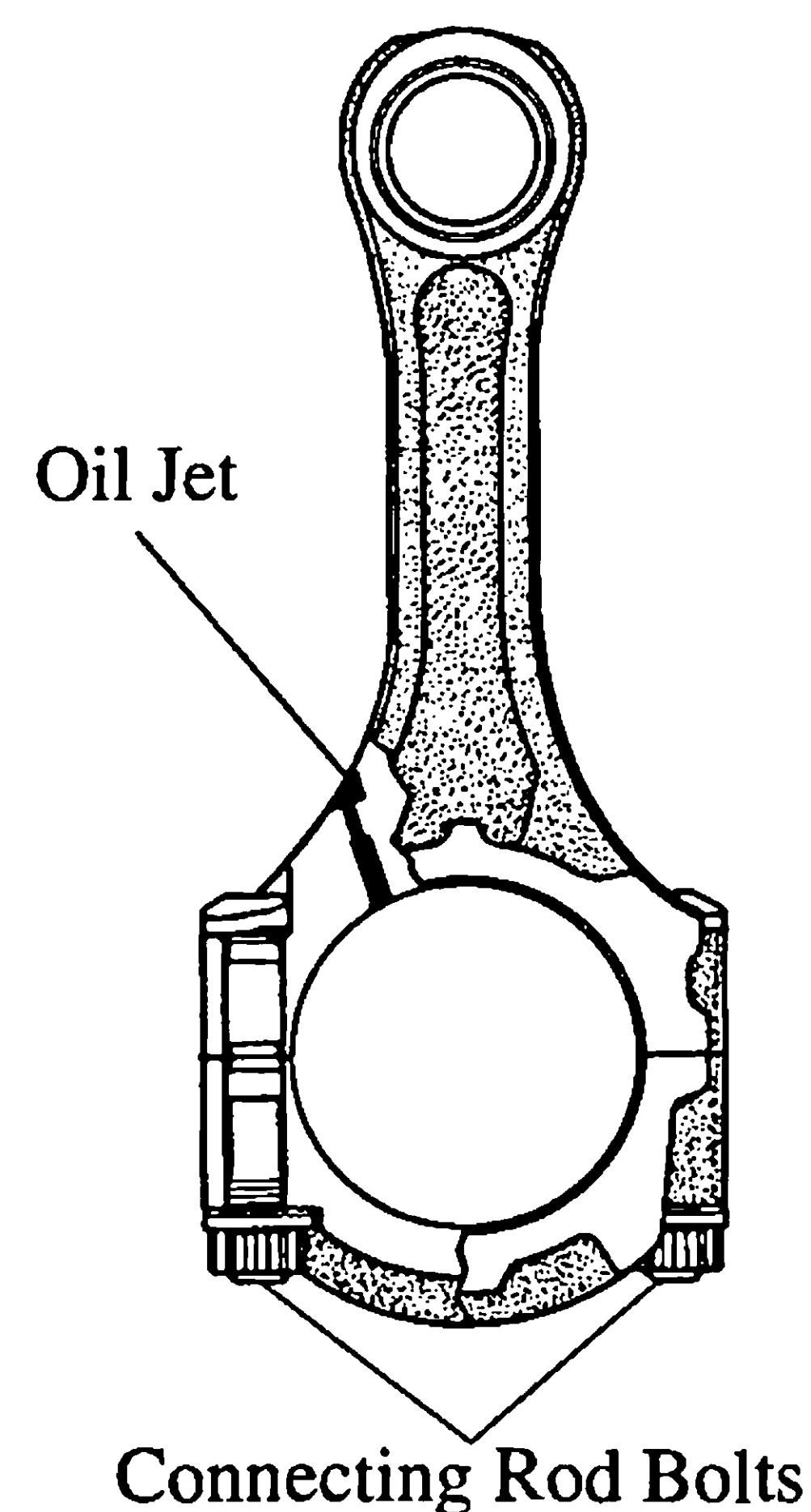
- The piston is made of aluminum alloy and the skirt area has been coated with resin to reduce friction.
- The piston pin is made of chrome steel and is the full-floating type.

► For 3RZ-FE Engine ◀



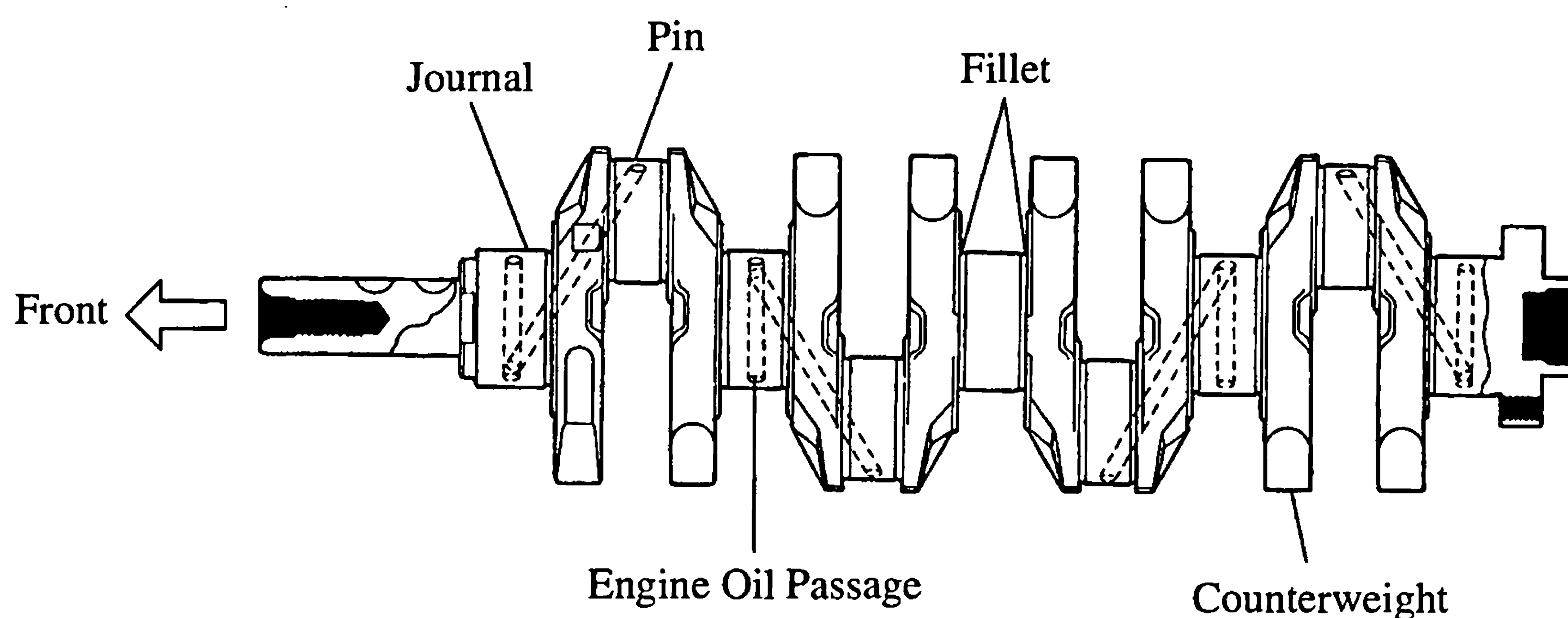
7. Connecting Rod

- Hot forging and double-shot peening processes assure a highly rigid connecting rod.
- An oil jet is provided in the large end for cooling the piston.
- Plastic region tightening is used for the connecting rod bolts.

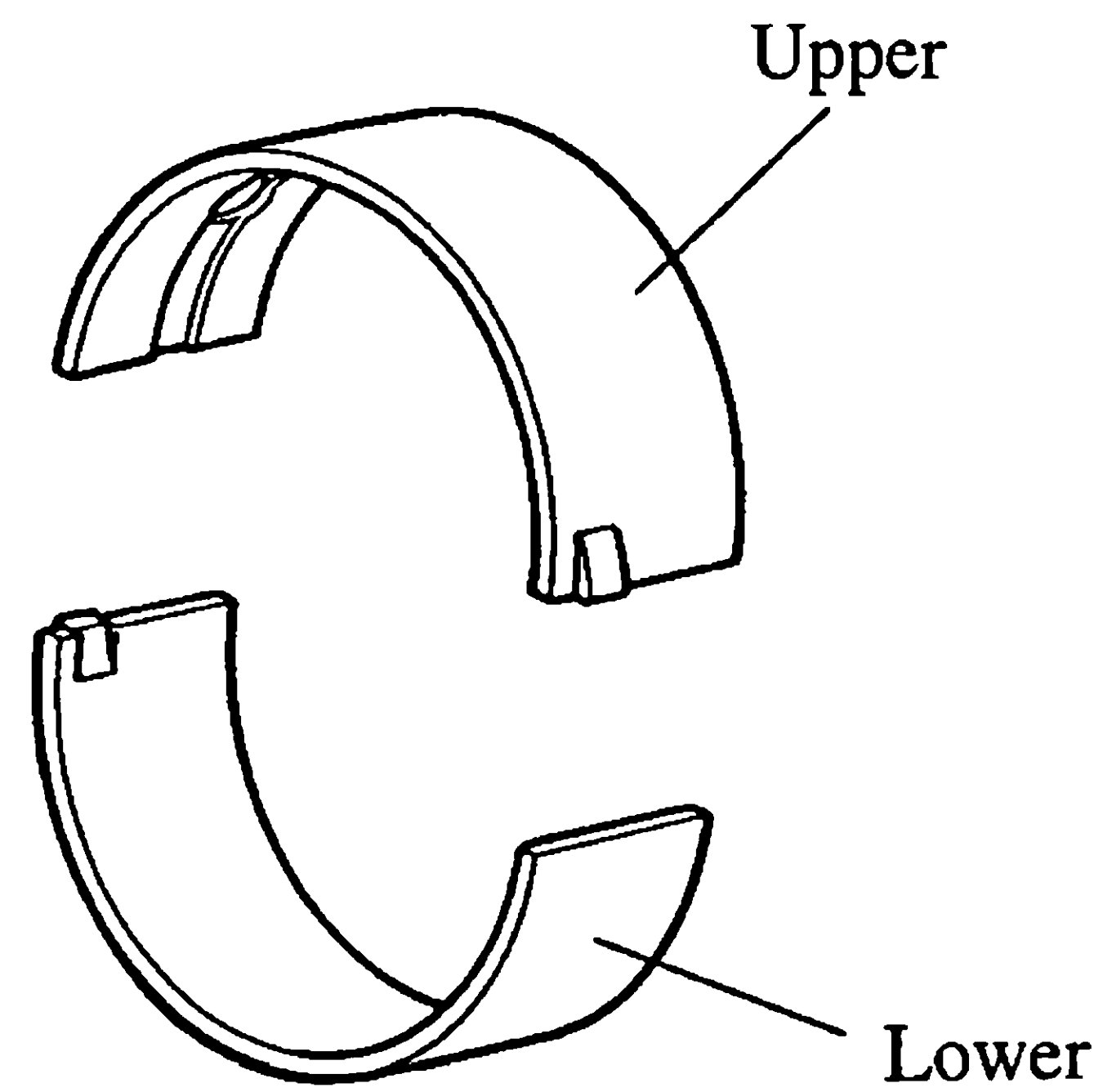


8. Crankshaft

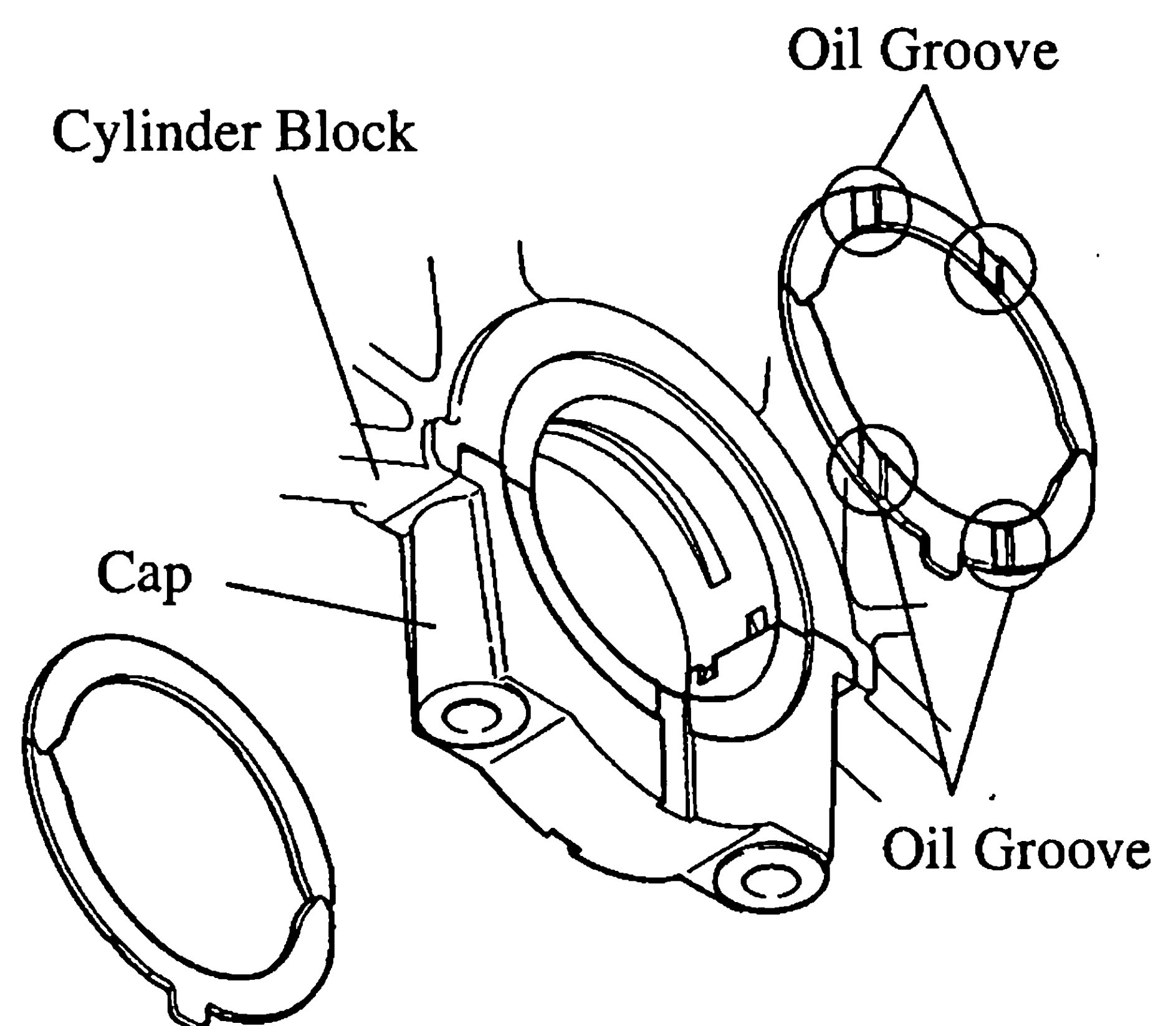
- The crankshaft is made of steel, and has 5 journals and 8 counterweights.
- Pin and journal have been quenched through a high-frequency process for enhanced reliability, and both the fillets have been roll-finished.



- The crankshaft bearing is made of aluminum alloy.



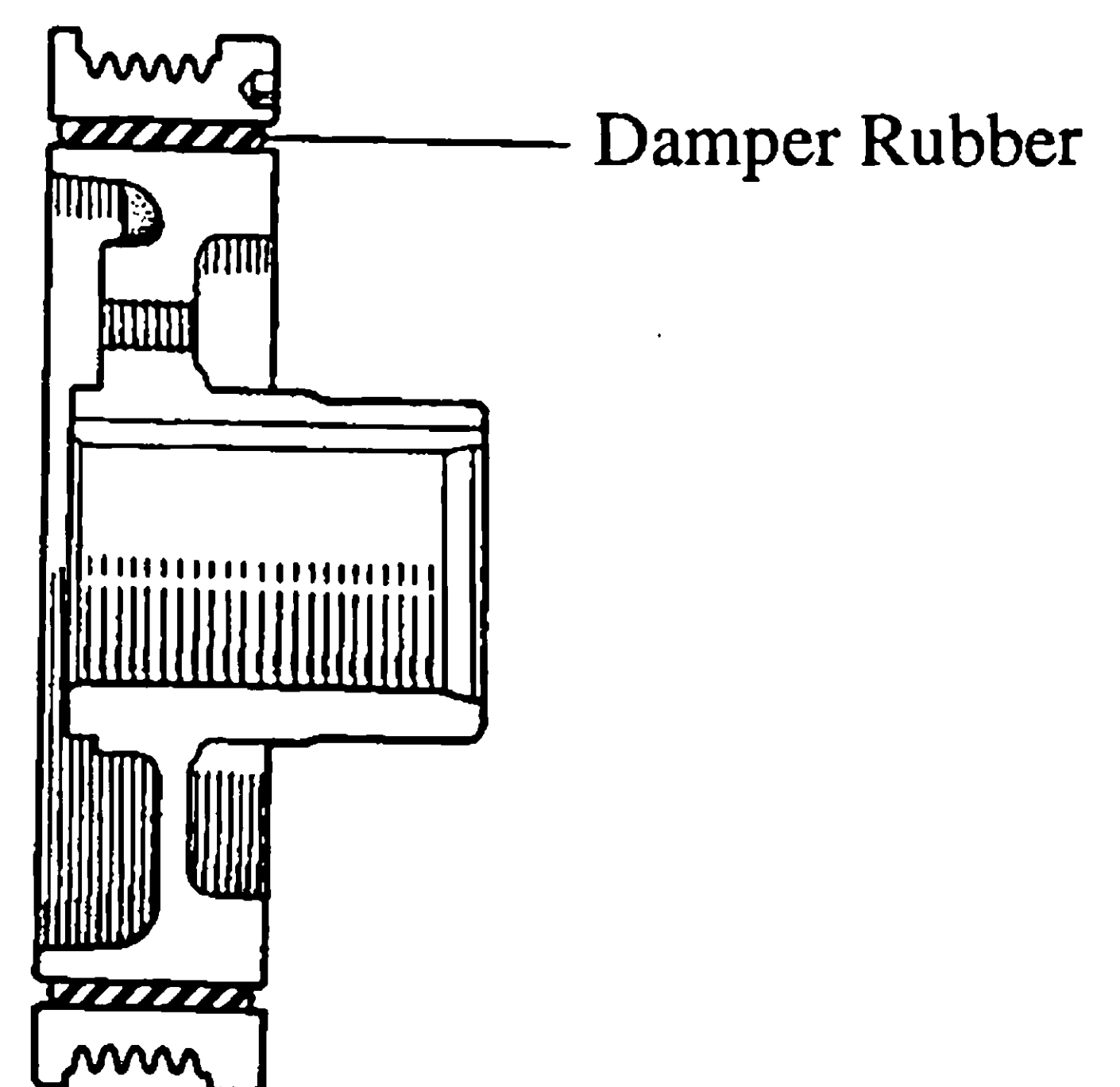
- The thrust washer of the center journal receives the force in the crankshaft's thrust direction.



EG

9. Crankshaft Pulley

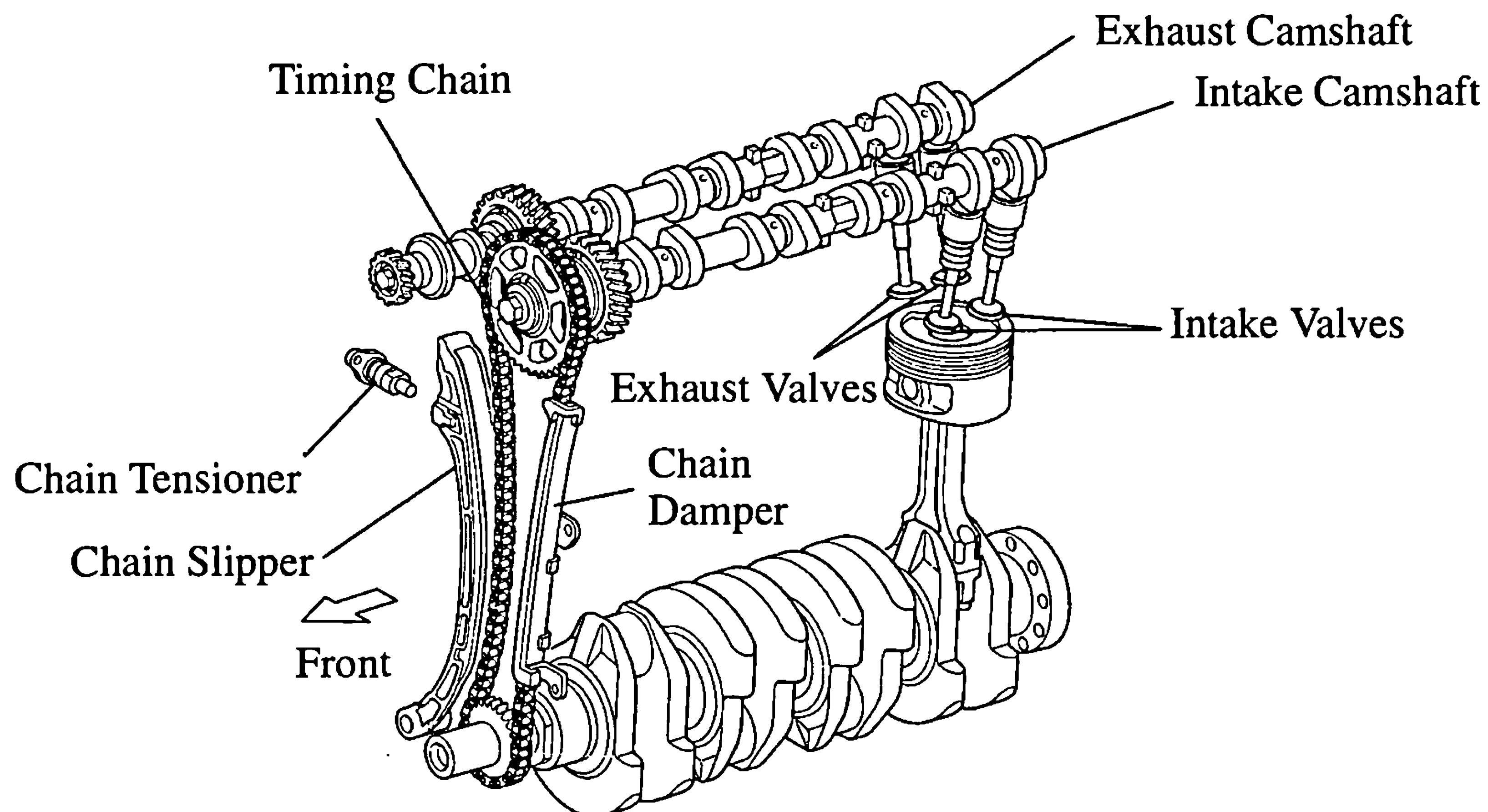
A torsional damper pulley is used and the use of damper rubber which is inserted under high pressure improves reliability.



■ VALVE MECHANISM

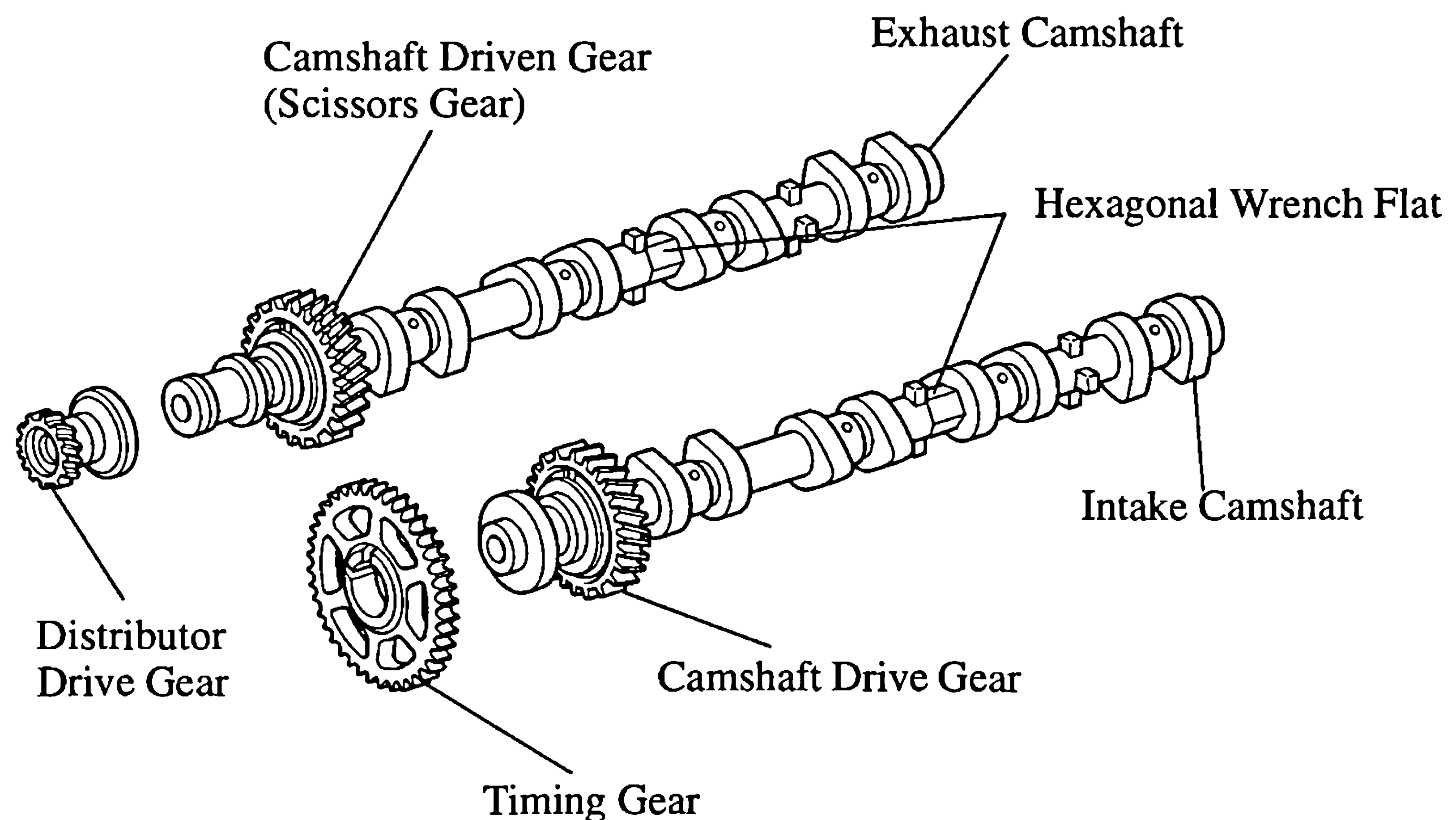
1. General

- Each cylinder is equipped with 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency has been increased due to the larger total port areas.
- The valves are directly opened and closed by 2 camshafts.
- The intake camshaft is driven by a chain, while the exhaust camshaft is driven via a gear on the intake camshaft.



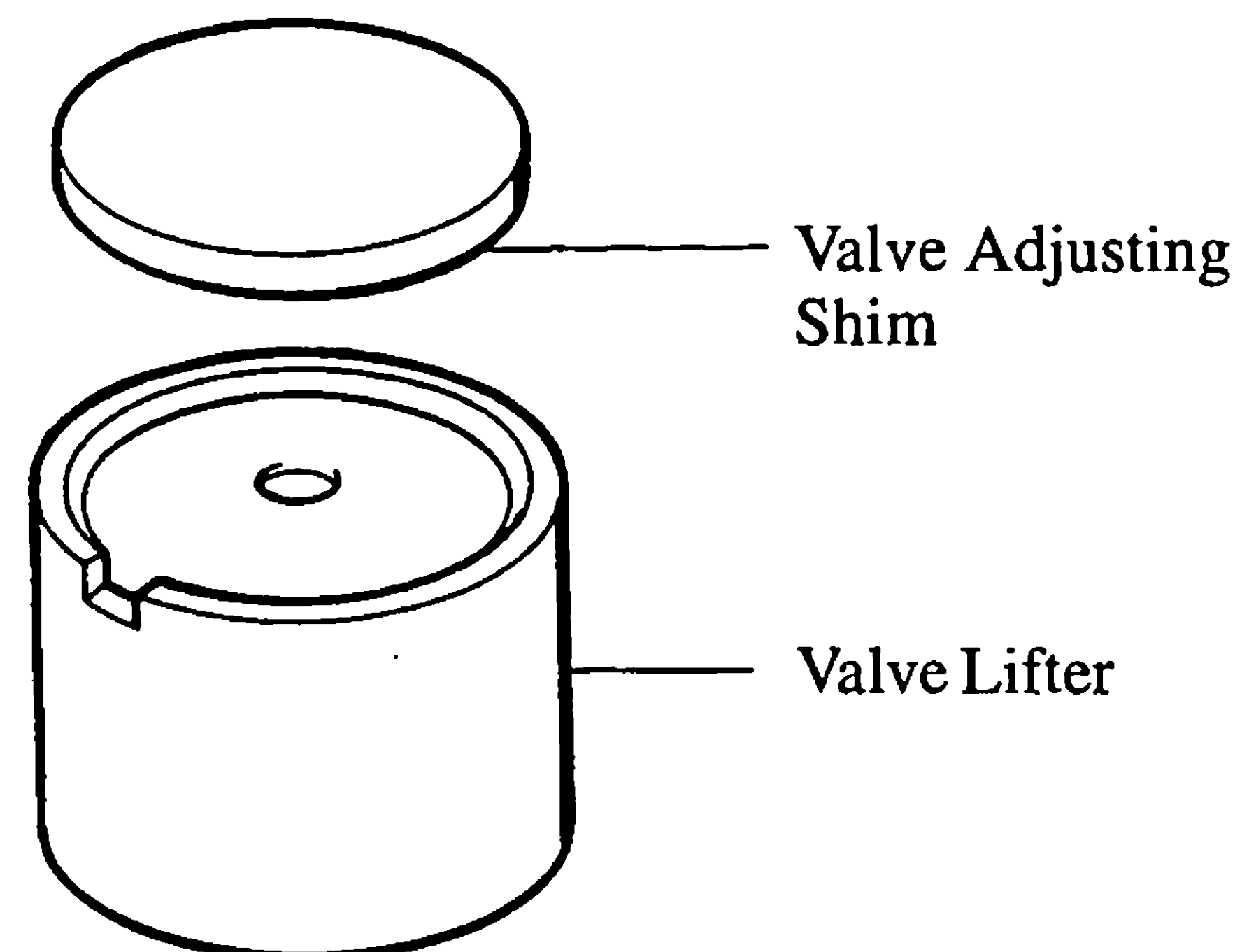
2. Camshaft

- Each camshaft has 5 journals. Thrust force is received by the thrust surface of the No.1 journal.
- The exhaust camshaft is driven by a gear on the intake camshaft. A scissors gear mechanism has been used on the exhaust camshaft to control backlash and reduce noise.
- The distributor is driven by the gear at the front of the exhaust camshaft.
- Hexagonal wrench flats are provided between the No.2 and No.3 journals for easy servicing.
- To drive the fuel pump, the 3RZ-F engine provides a cam in front of the timing gear of the intake camshaft.



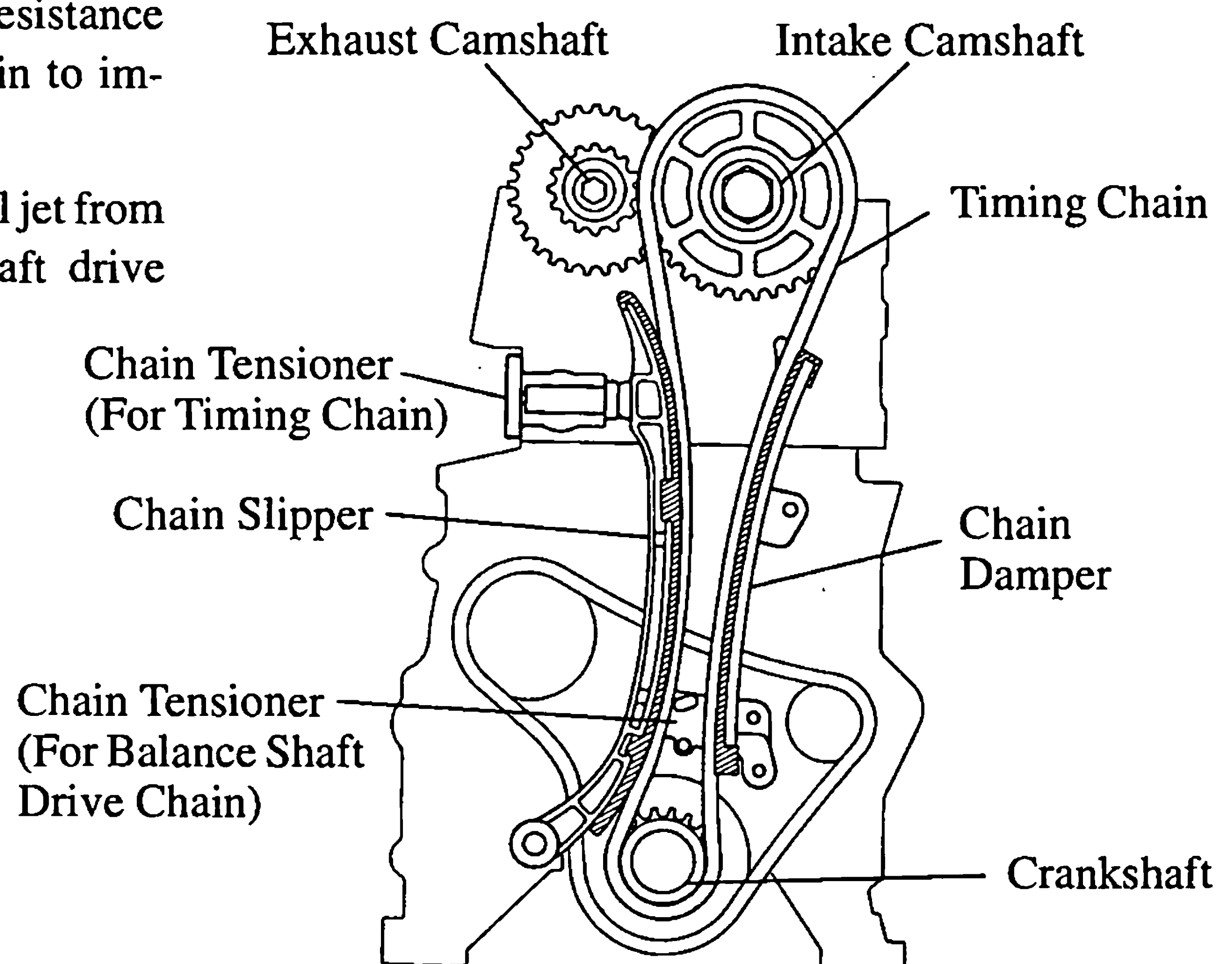
4. Valve Lifter and Valve Adjusting Shim

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



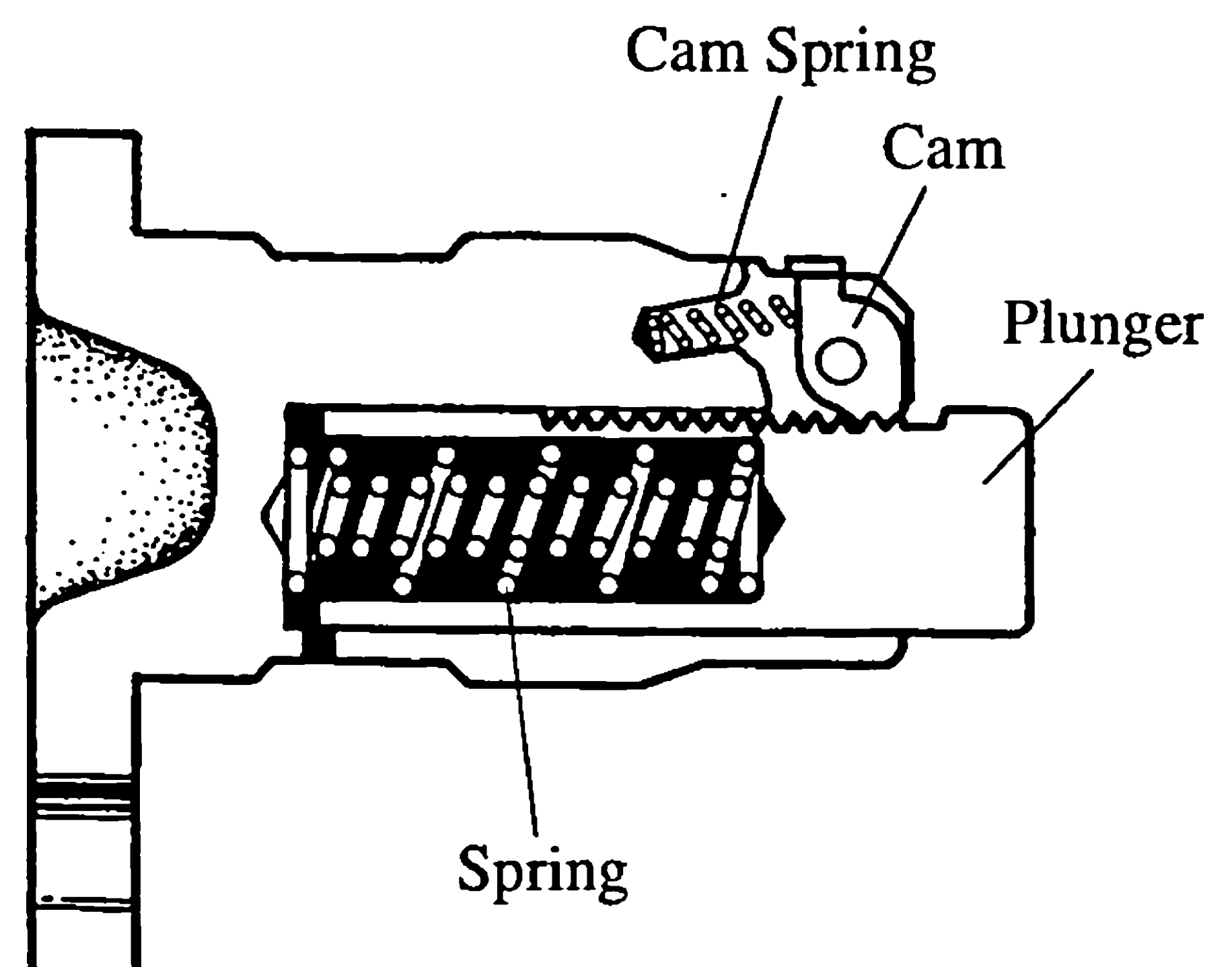
5. Timing Chain

- A material which has excellent wear resistance has been selected for the timing chain to improve reliability.
- The timing chain is lubricated by an oil jet from the chain tensioner (for balance shaft drive chain).



6. Chain Tensioner

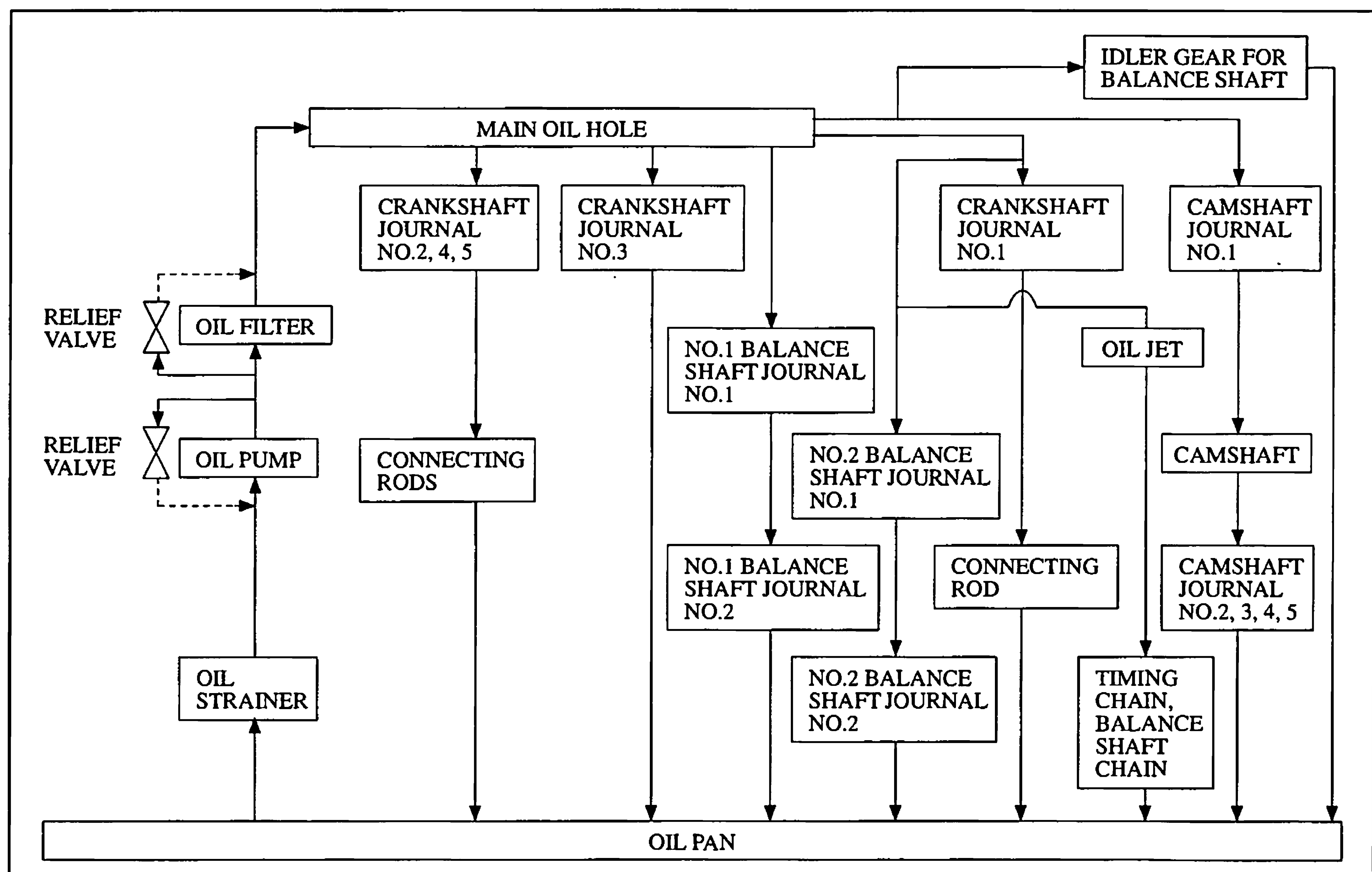
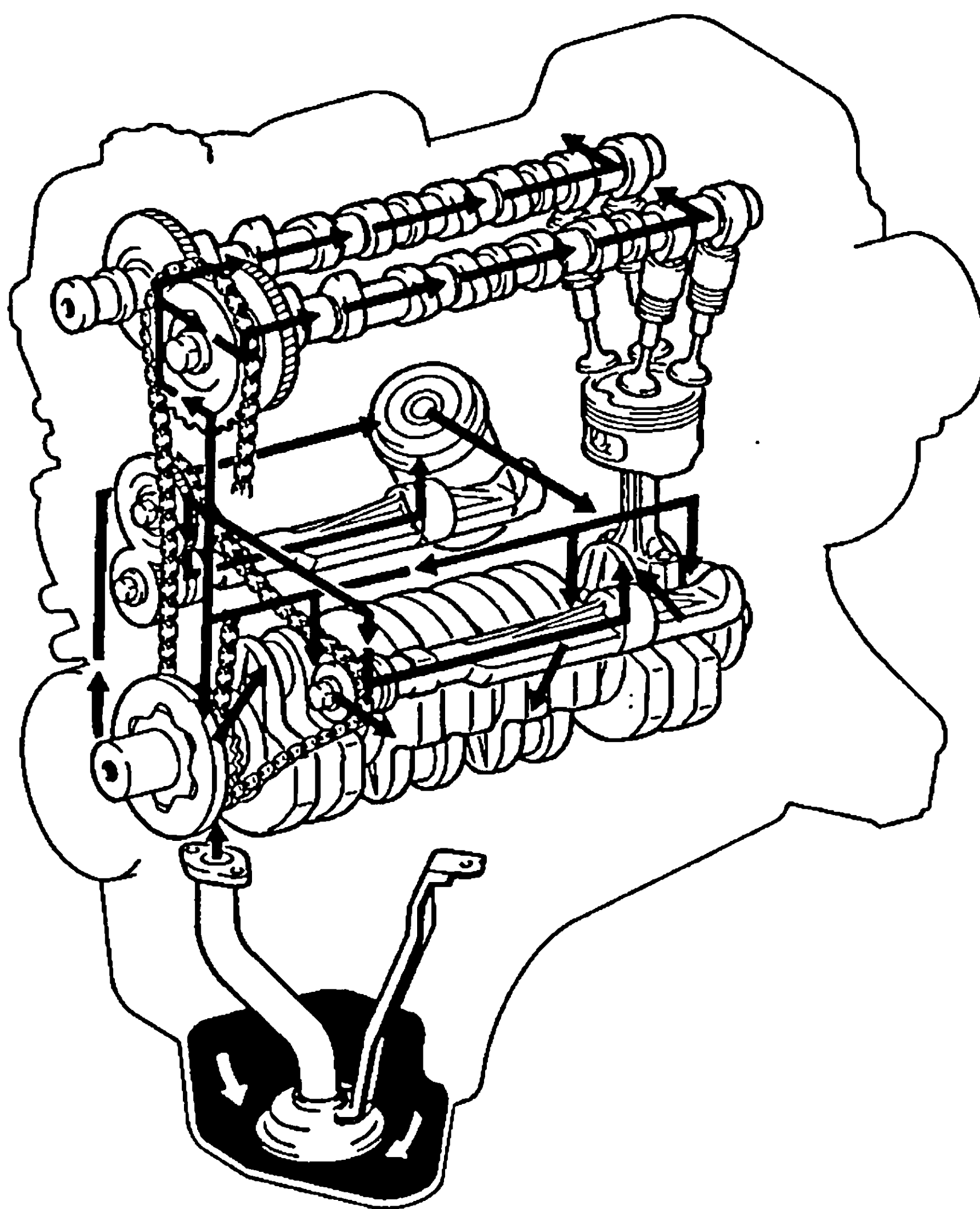
- The chain tensioner uses a spring and oil pressure to maintain proper chain tension at all times.
The chain tensioner suppresses noise generated by the chain.
- A ratchet type non-return mechanism is also used.



■ LUBRICATION SYSTEM

1. General

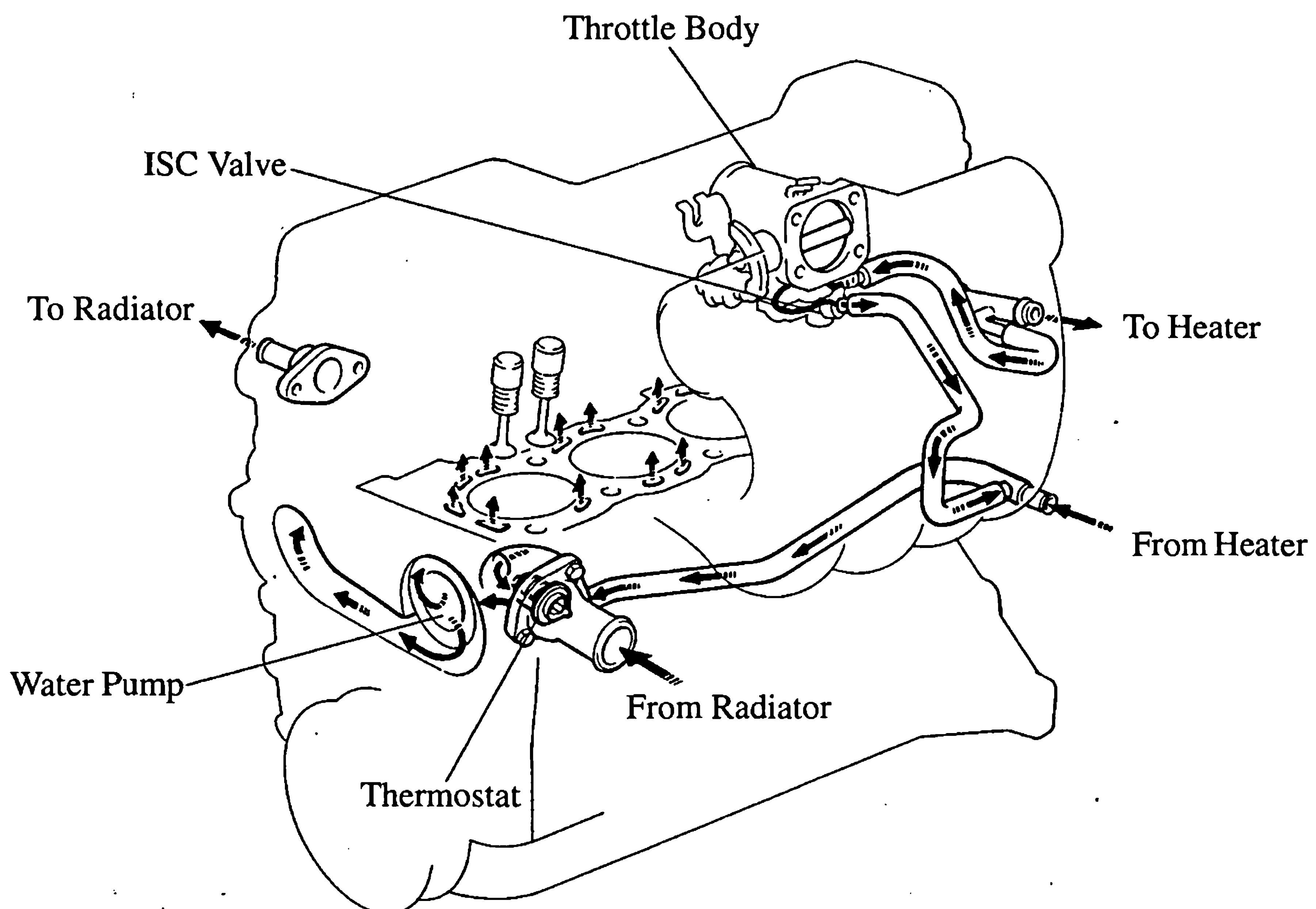
- The lubrication circuit is fully pressurized and all oil passes through an oil filter.
- The trochoid gear type oil pump is directly driven by the crankshaft.



■ COOLING SYSTEM

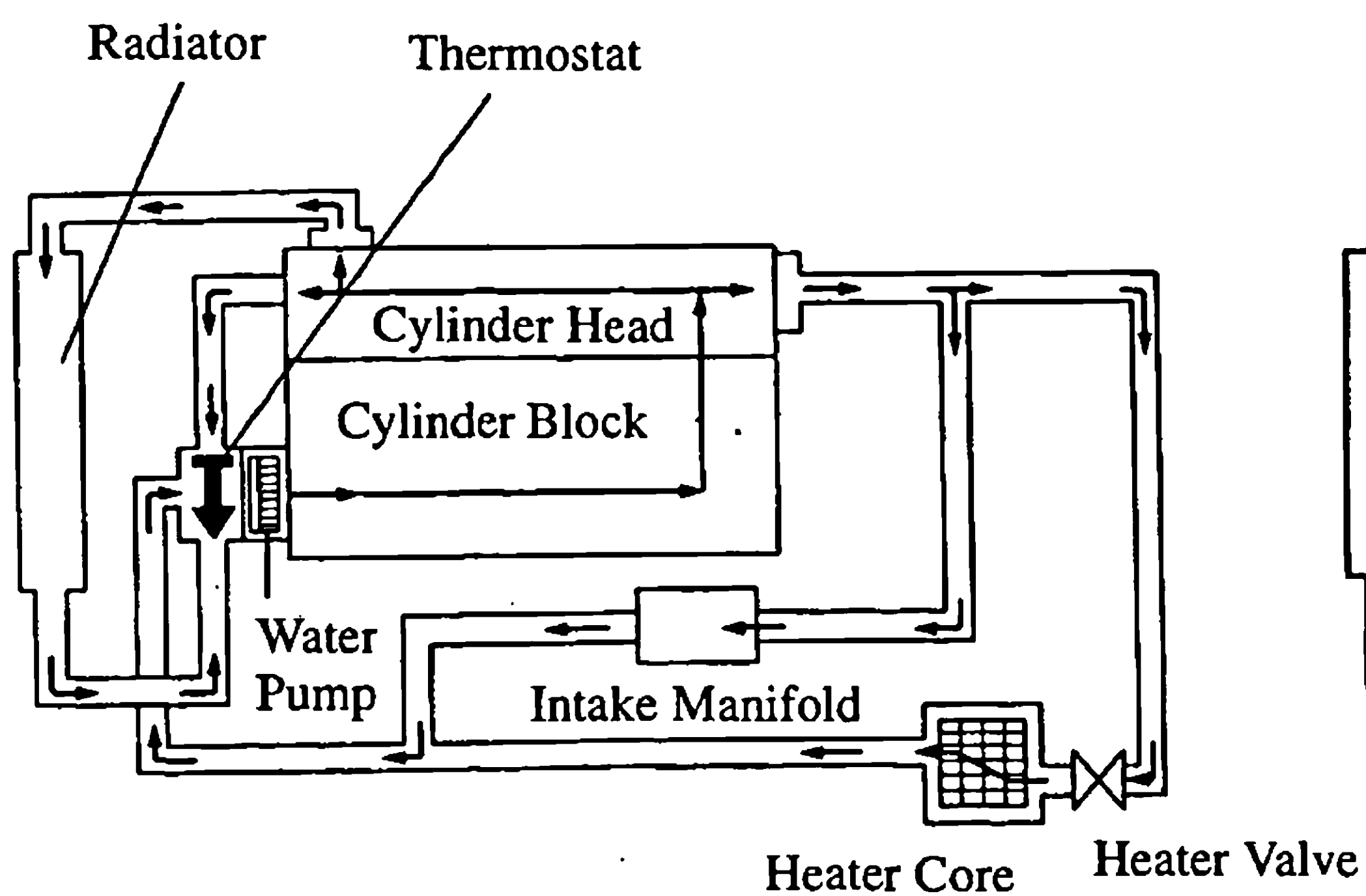
1. General

- The cooling system is a pressurized, forced-circulation type.
- A thermostat with a bypass valve is located on the water inlet housing to maintain suitable temperature distribution in the cooling system.
- An aluminum radiator core is used for weight reduction.

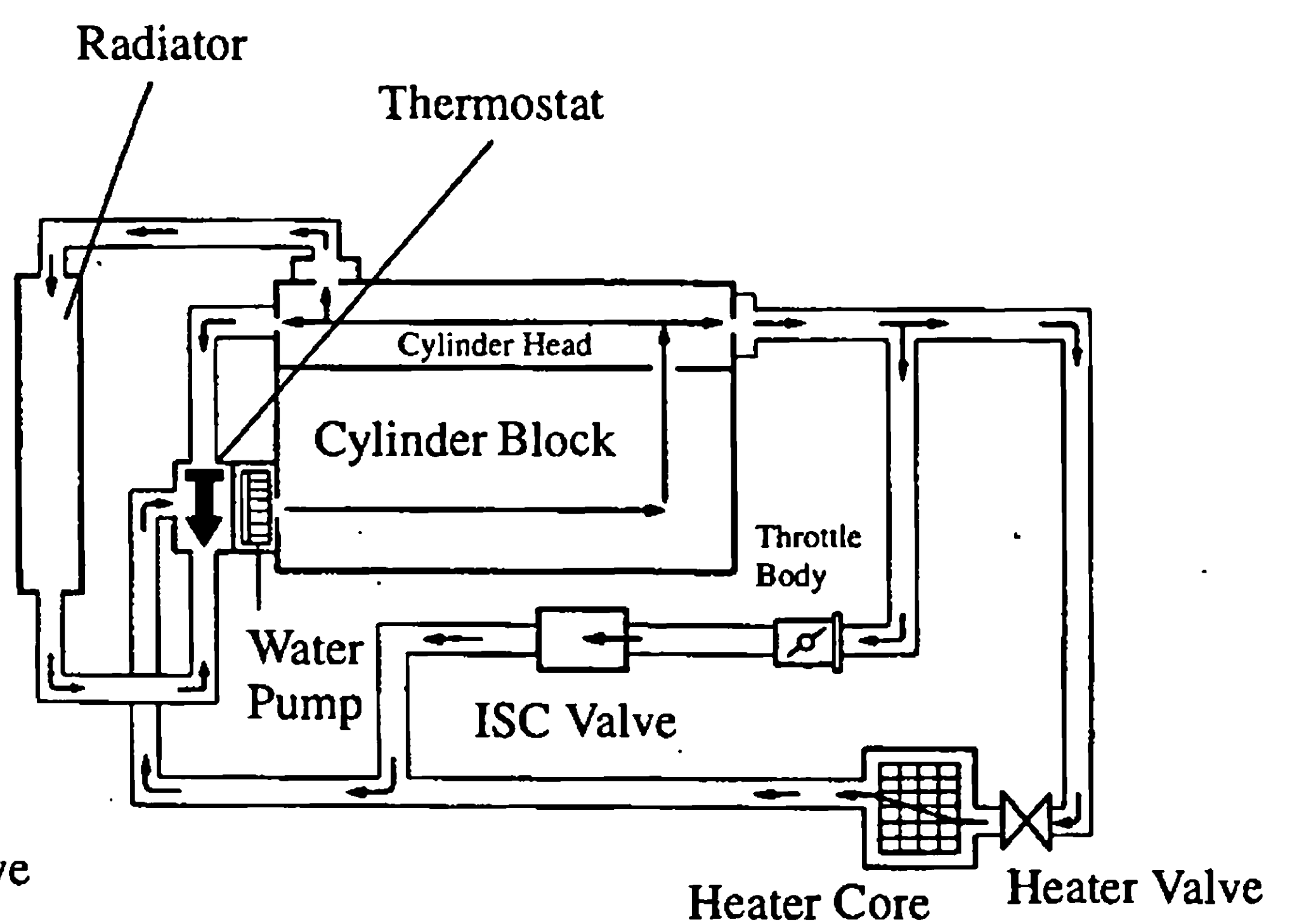


EG

► 3RZ-F Engine ◀

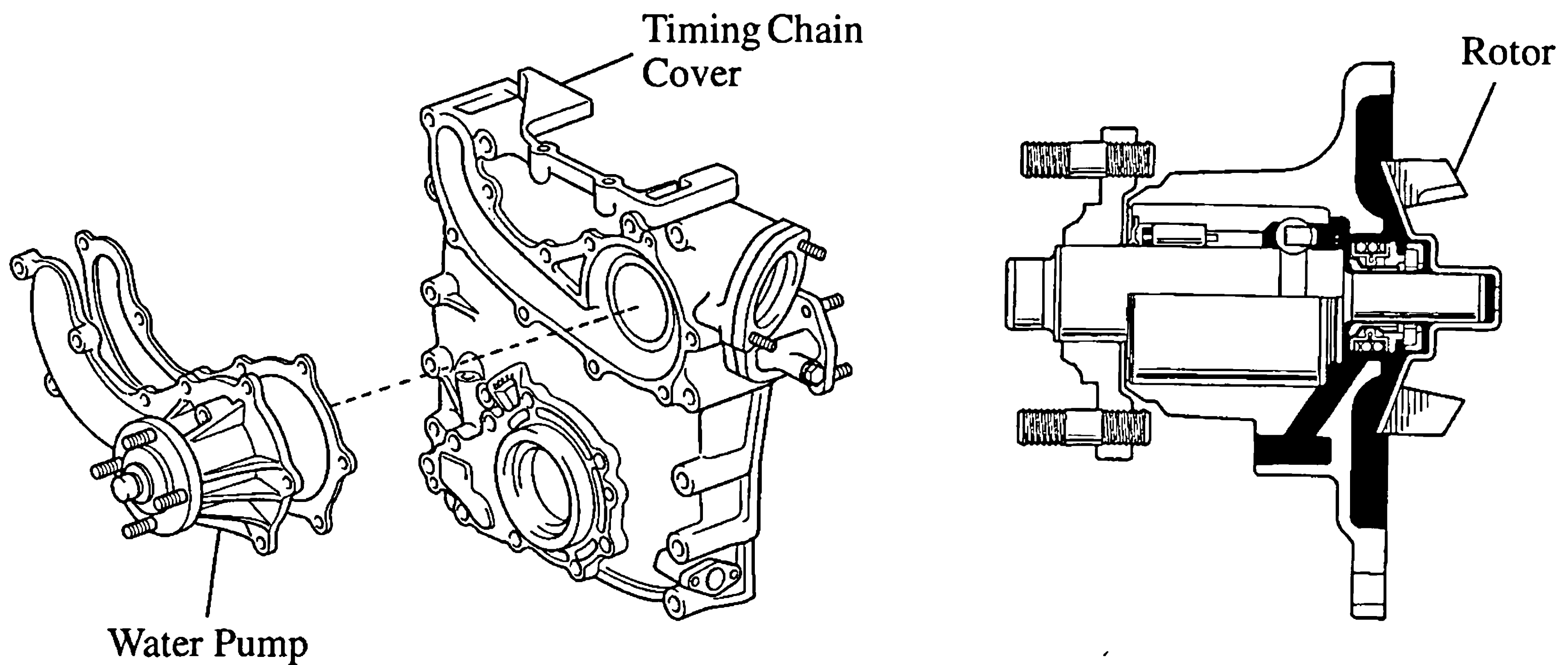


► 3RZ-FE Engine ◀



2. Water Pump

- The water pump is located in the timing chain cover and driven by the V-ribbed belt.
- The 6 rotors are made of stainless steel.



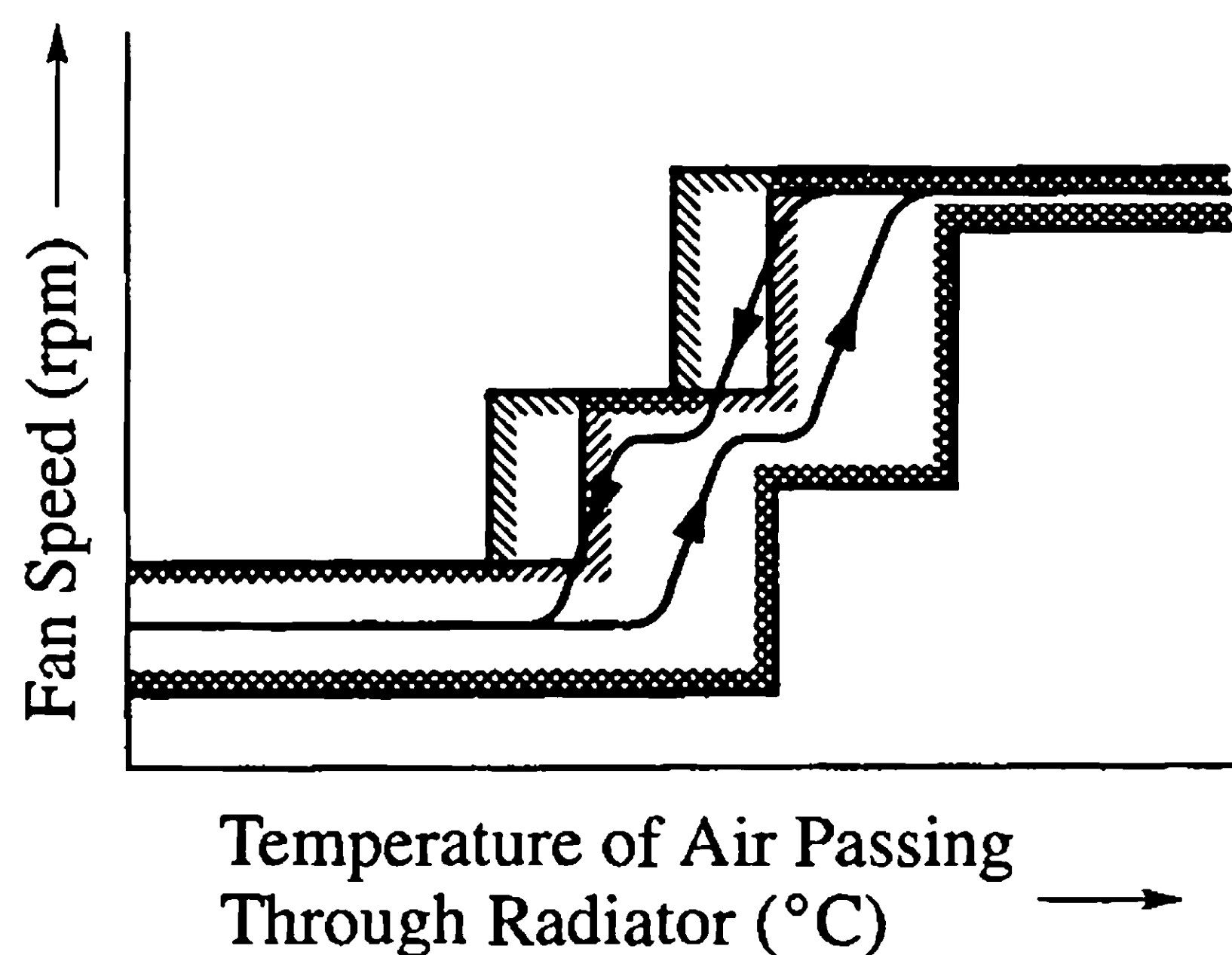
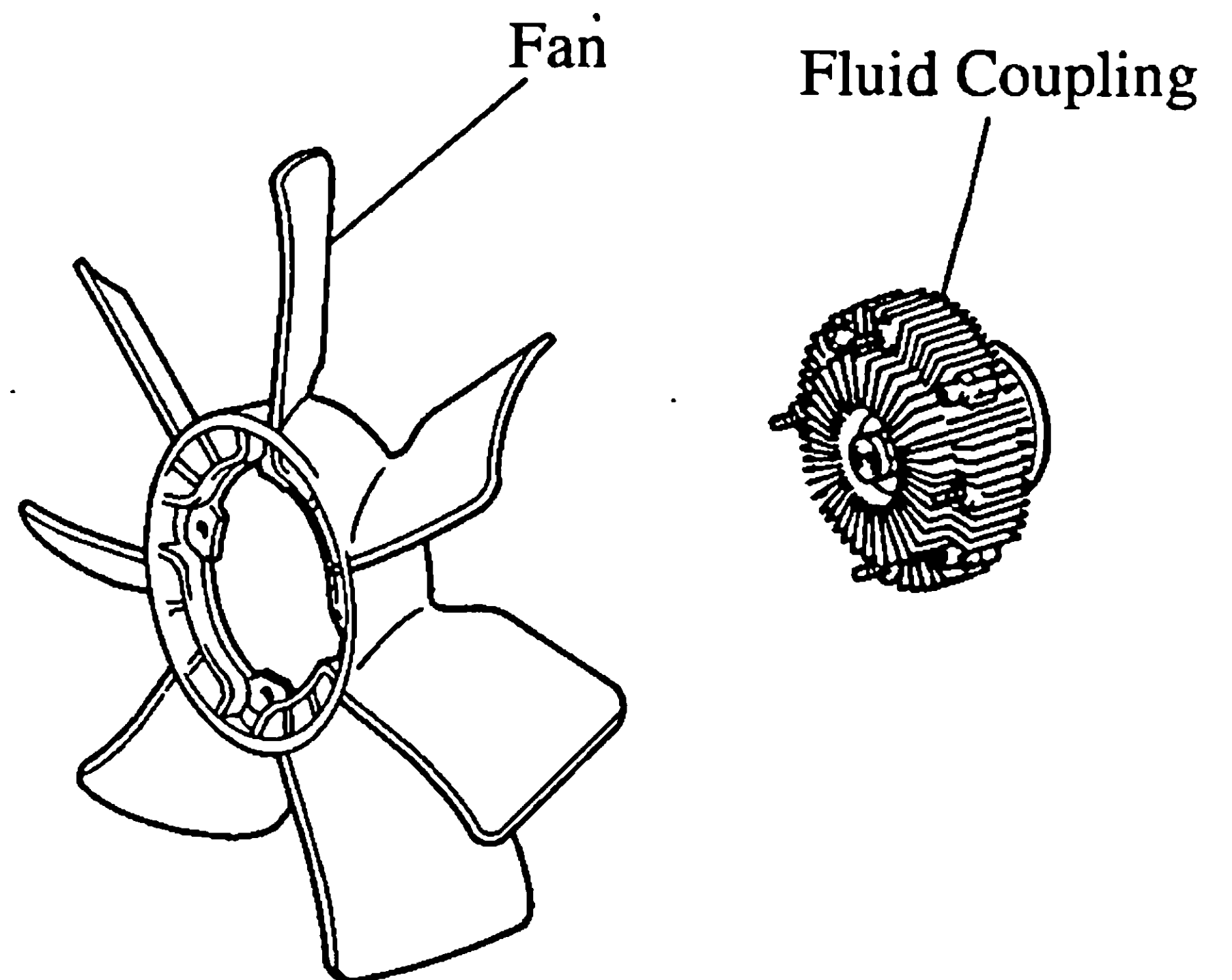
3. Coupling Fan

A 3-stage temperature-controlled fluid coupling is used.

The speed of the fluid coupling changes in 3-stages based on the temperature of the air passing through the radiator.

This keeps the fan speed low when the temperature is low, improving warm-up performance and reducing fan noise.

The fan speed is high when the engine temperature is high, improving cooling performance.



 : Operating range during temperature rise

 : Operating range during temperature drop

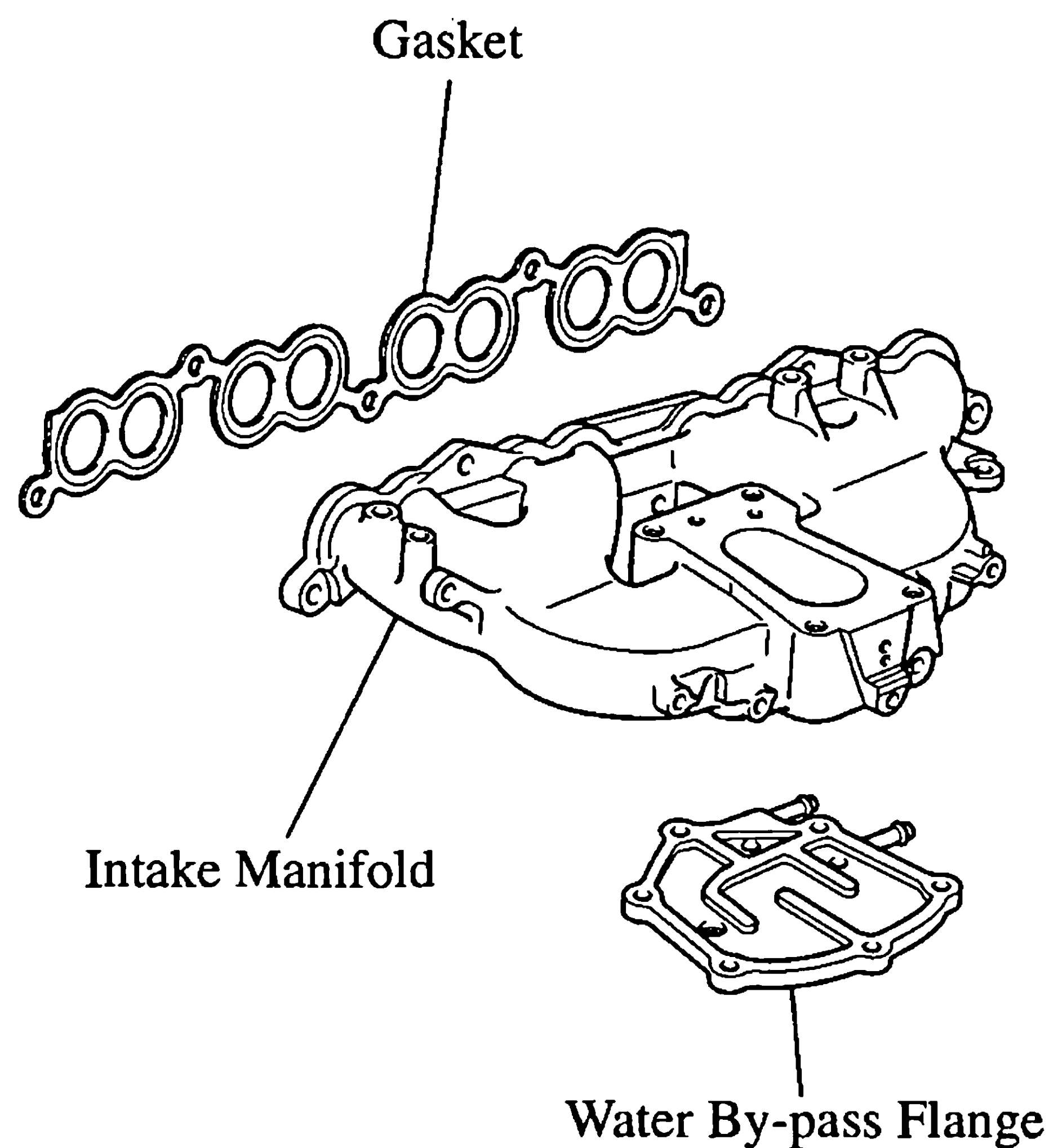
Fluid Coupling Characteristics

■ INTAKE AND EXHAUST SYSTEM

1. Intake Manifold

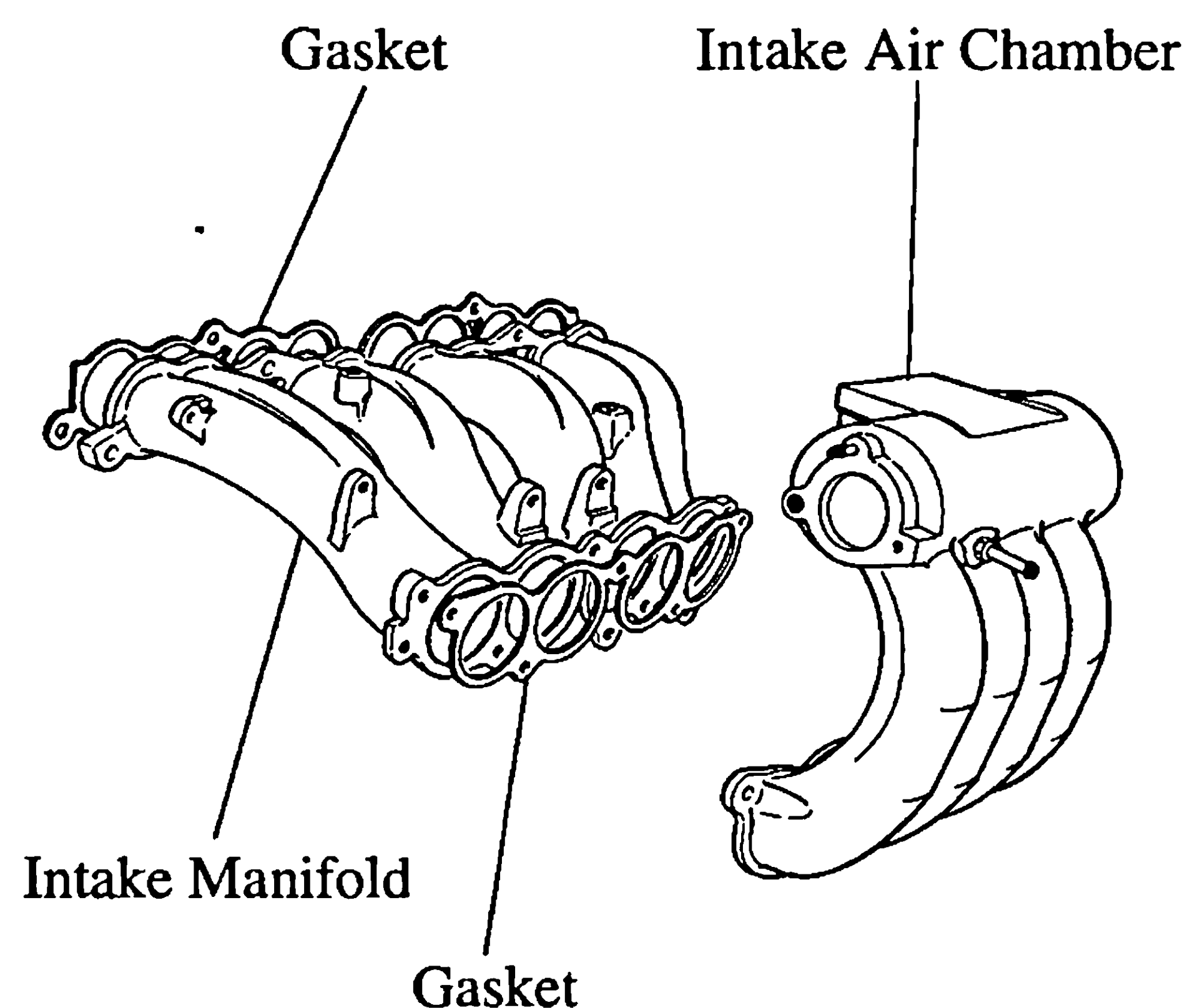
For 3RZ-F Engine

- The system incorporates a tournament port intake manifold to enhance distribution of the air-fuel mixture.
- The riser inside the manifold is heated by the hot coolant. This contributes to better atomizing of the air-fuel mixture when the engine is being warmed up, resulting in enhanced fuel combustion and vehicle drivability.



For 3RZ-FE Engine

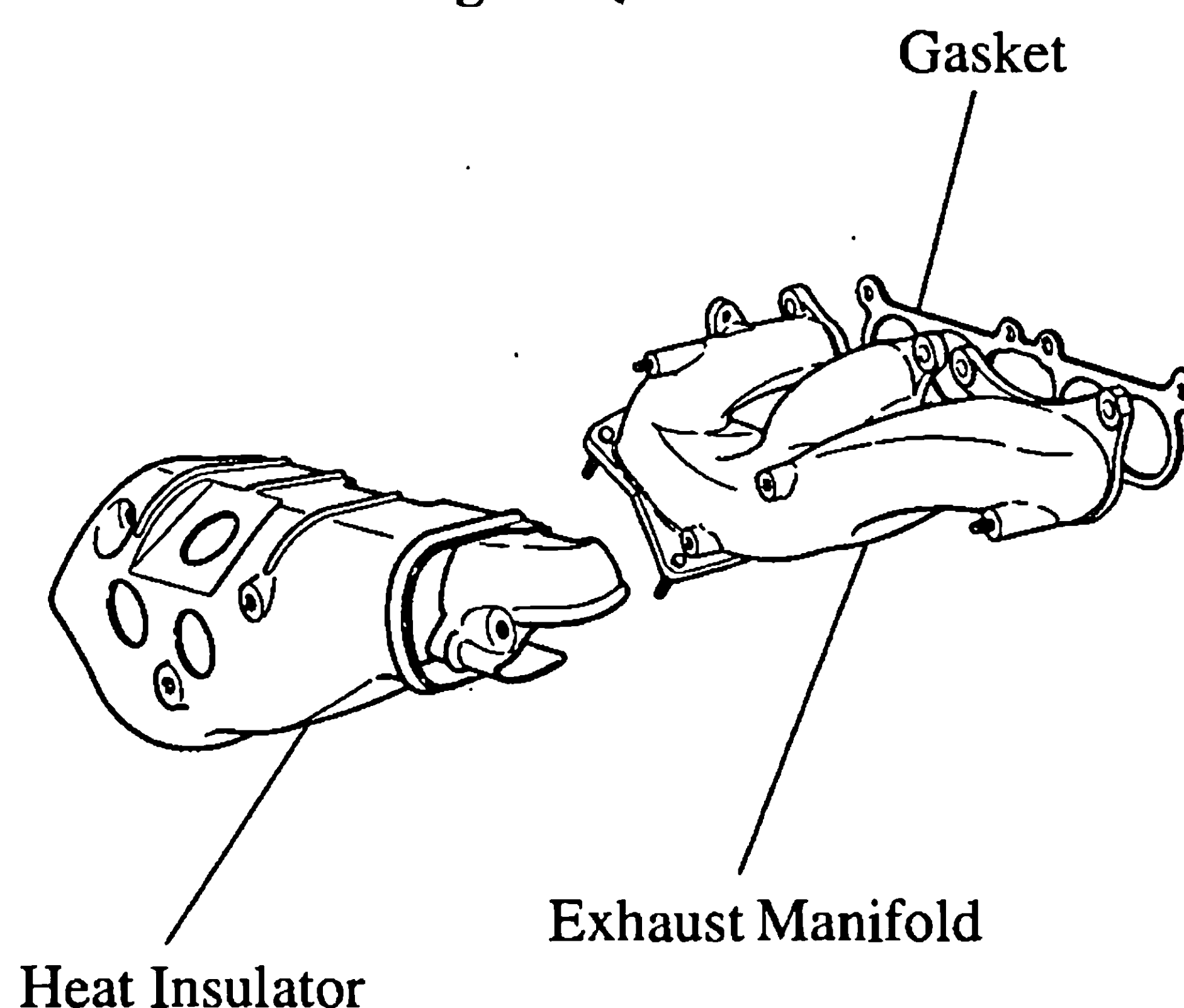
- An intake port is located in the center of the intake air chamber to distribute the optimum intake air volume.
- The intake manifold has long ports. The lower ports are divided into 8 ports for each intake valve.
- The intake manifold and intake air chamber gaskets are made of laminated metal.



2. Exhaust Manifold

- It is a dual-type exhaust manifold.
- A metallic gasket is used with the exhaust manifold for more efficient prevention of exhaust gas leakage.

► For 3RZ-FE Engine ◀

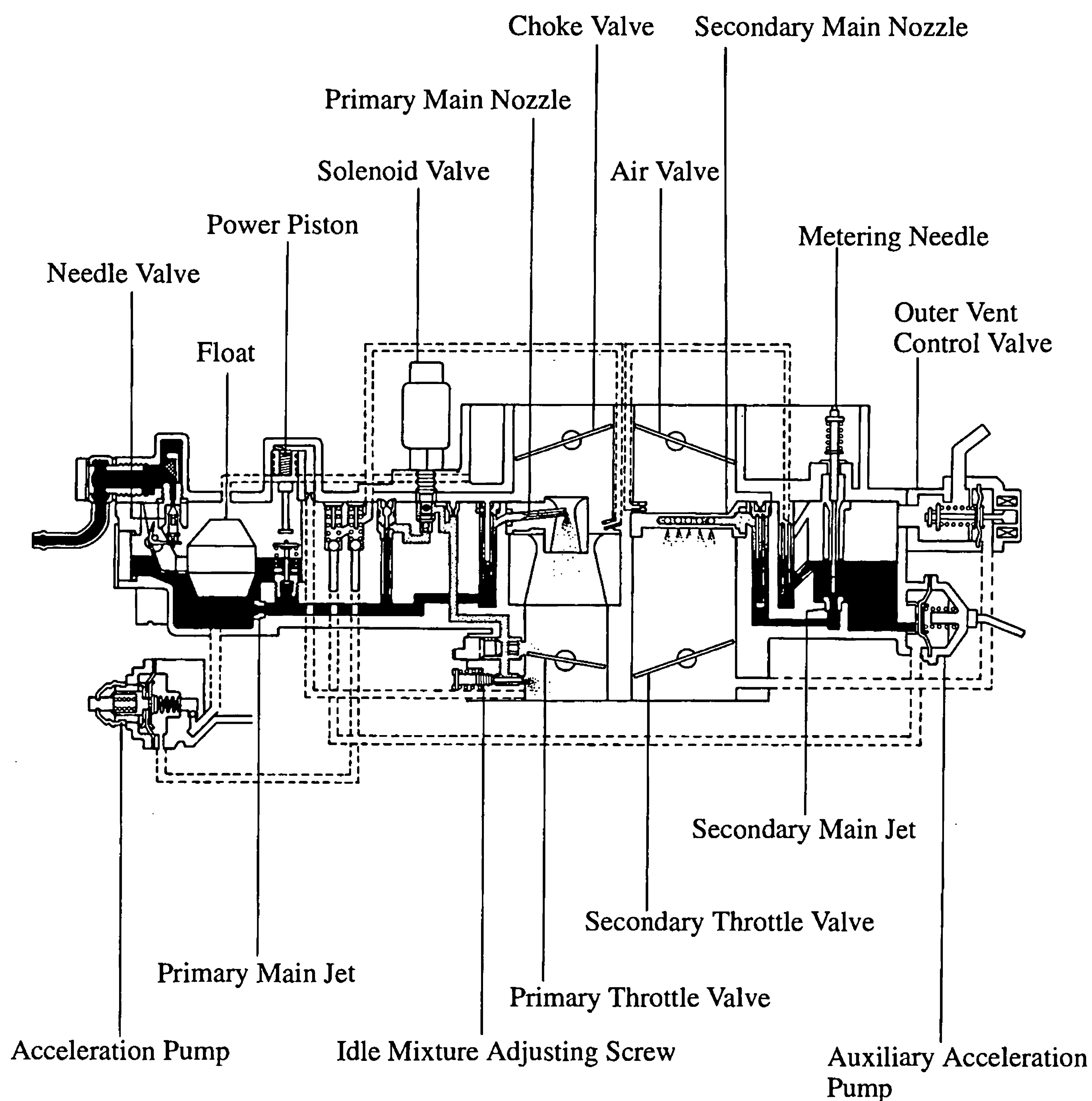


■ FUEL SYSTEM

1. Carburetor (For 3RZ-F Engine)

General

In addition to an air valve type carburetor, a large venturi purge system has been adopted to improve drivability during high engine temperature conditions.



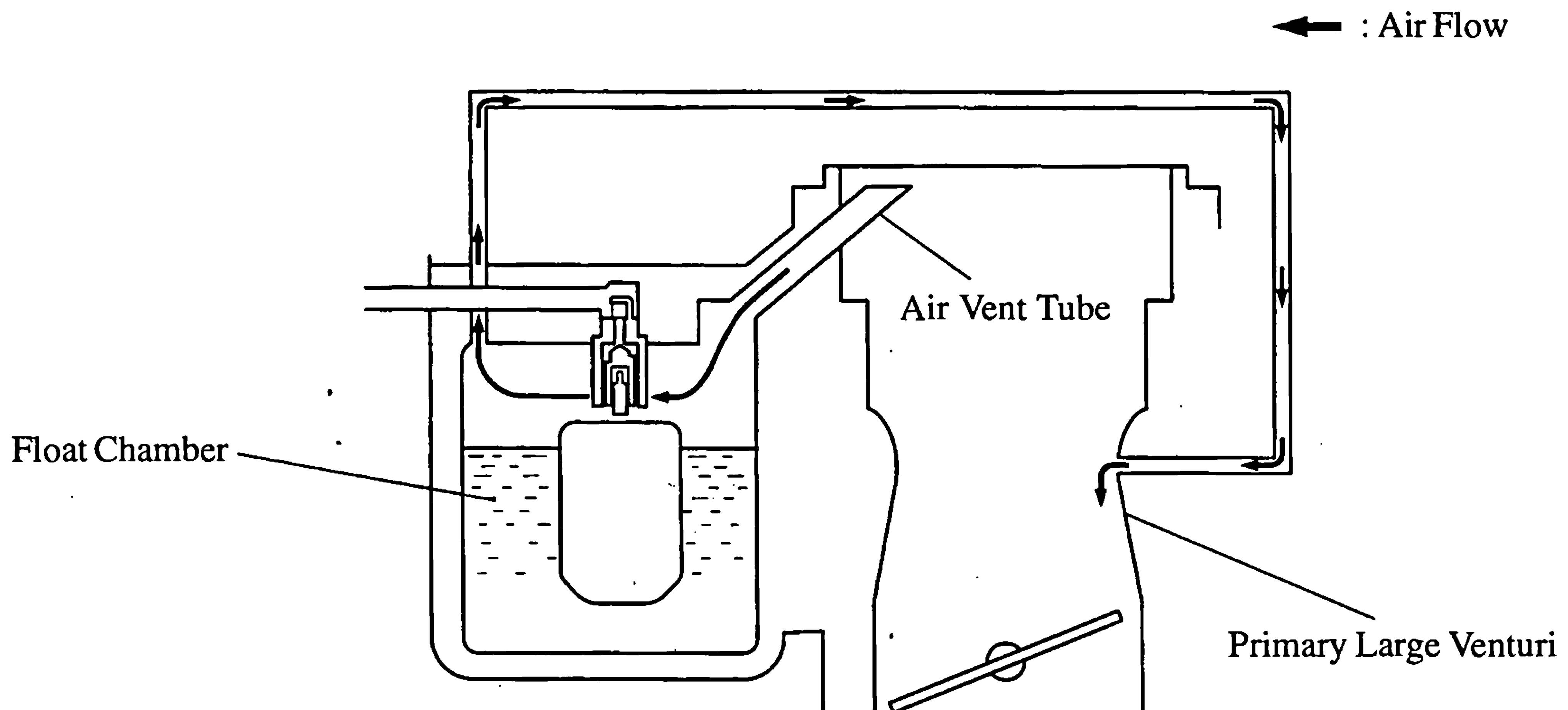
CARBURETOR CIRCUIT

Large Venturi Purge System

The large venturi purge system creates a flow of air in the float chamber, thus reducing the surface temperature of the fuel in the float chamber. This minimizes the evaporation of fuel and improves drivability during high engine temperature conditions.

1) Operation

The vacuum that is generated at the primary large venturi is introduced into the float chamber, where a flow of air is created. This results in minimizing the rise in the surface temperature of the fuel.

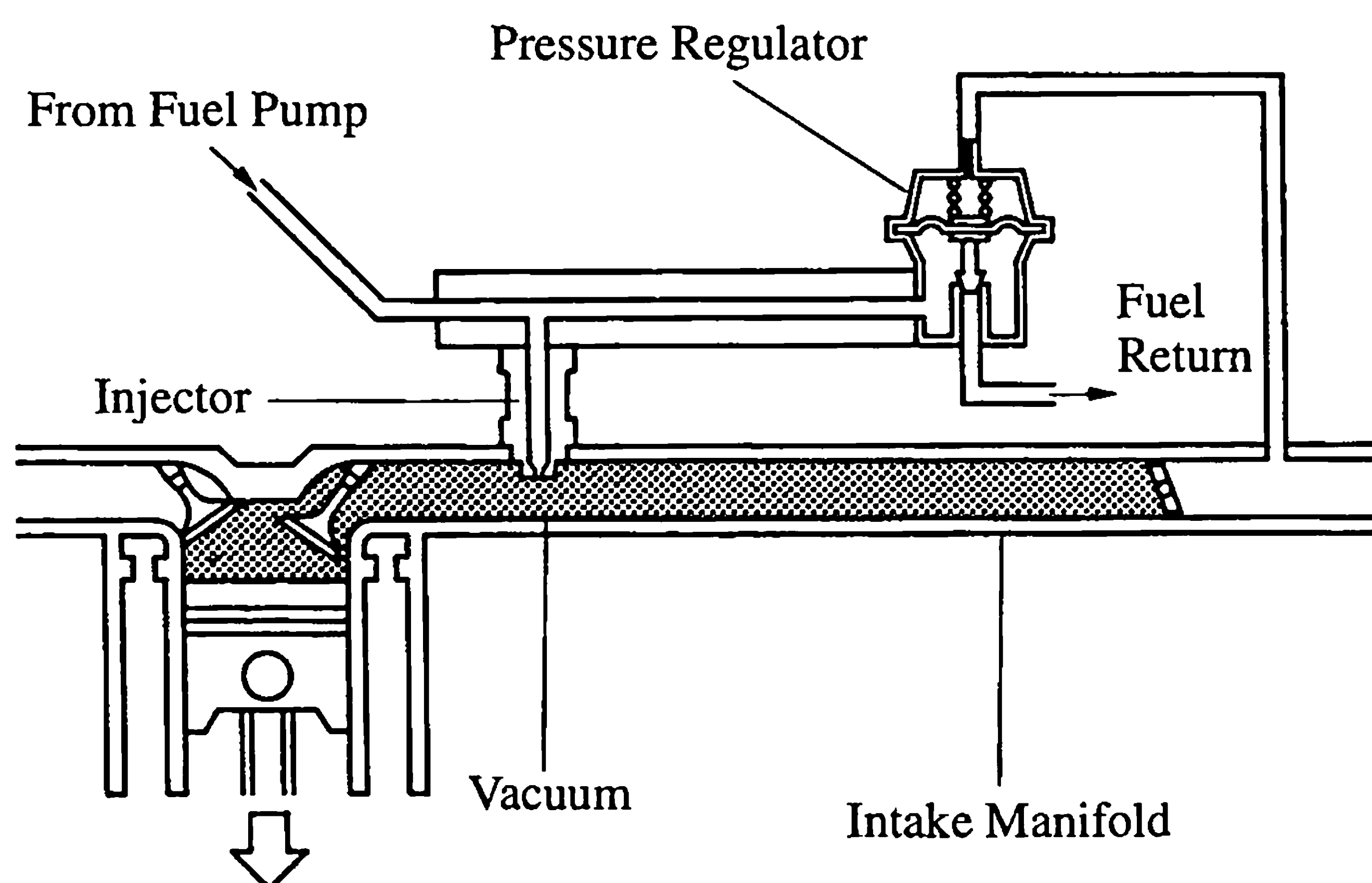


EG

2. Pressure Regulator (For 3RZ-FE Engine)

Previously, the intake manifold vacuum was applied to the diaphragm chamber of the pressure regulator. This method was used to ensure that the fuel pressure applied to the injector was constantly higher than the vacuum in the intake manifold into which the fuel is actually injected.

In the 3RZ-FE engine, atmospheric pressure is applied to the diaphragm chamber of the pressure regulator, ensuring a constant fuel pressure. Any injection volume variances owing to fluctuations in the intake manifold pressure are corrected by the engine ECU that increases or decreases the length of fuel injection time.



3. Sub Fuel Tank System

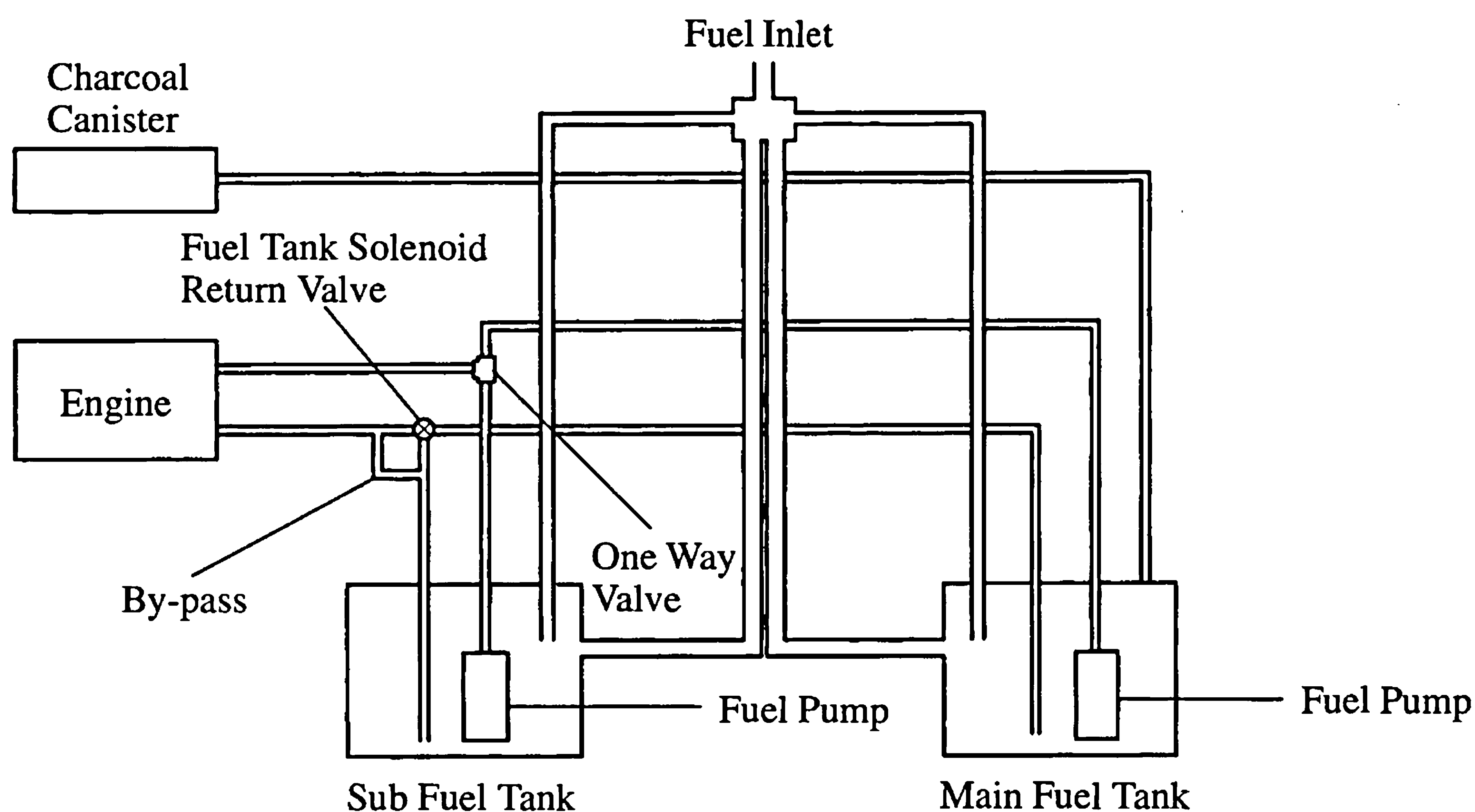
General

Just as in the previous model, a sub fuel tank is available as an option. The 3RZ-F engine model operates in basically the same way as the previous model. In the 3RZ-FE engine model, fuel supply can be switched between the main and sub fuel tanks by changing over the fuel pump (main or sub) and the fuel tank solenoid return valve.

For details, see page 64 in the Engine Control System section.

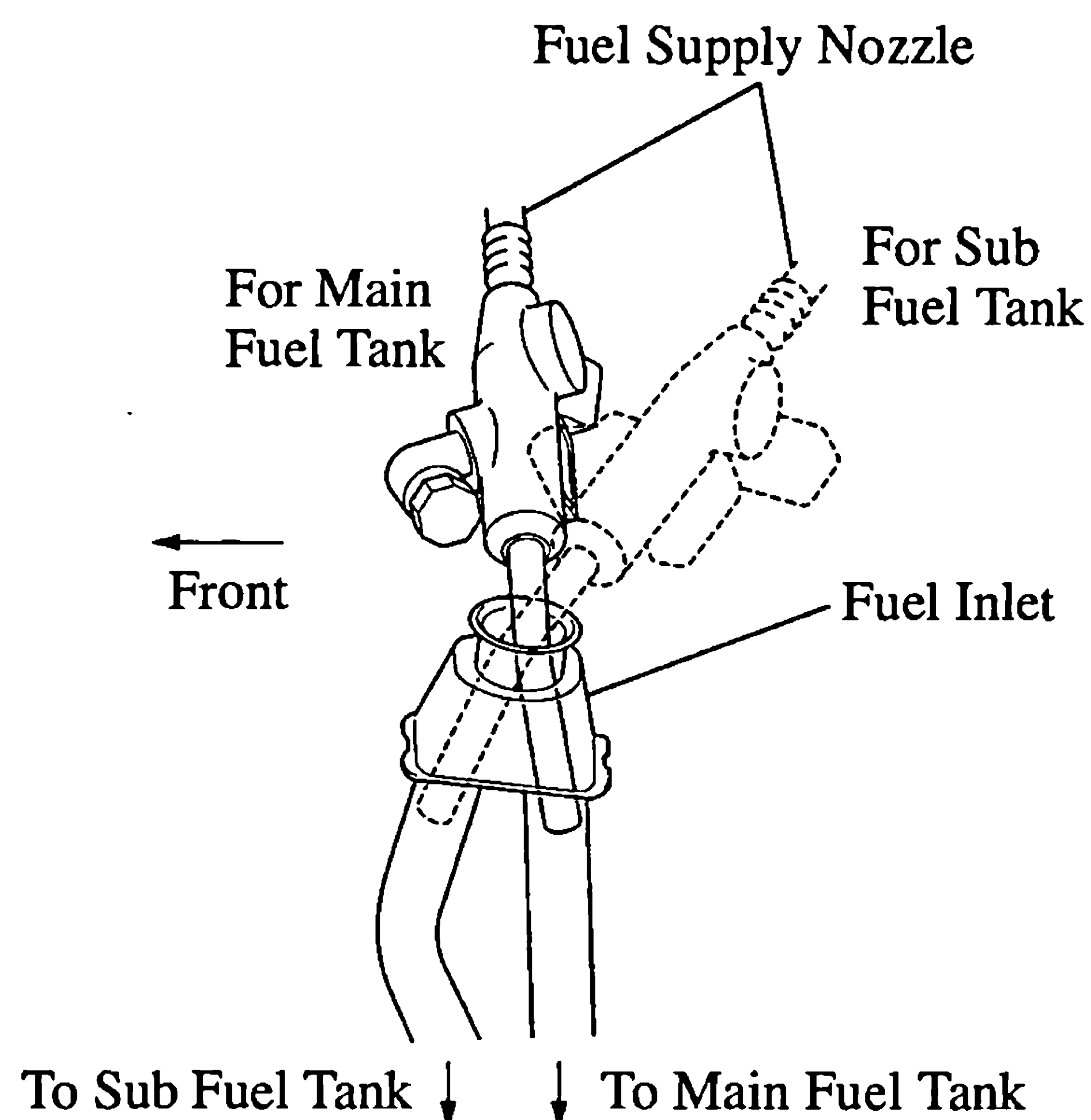
Also, in the 3RZ-FE engine model, a bypass has been provided for the fuel tank solenoid return valve to increase the amount of fuel in the sub tank while the main tank is being used.

► For 3RZ-FE Engine ◀



Fuel Inlet

In the previous model, both the main tank and the sub tank had their own fuel inlet. The sub fuel tank system of the new model has a single fuel inlet, but the fuel from a desired fuel tank can be supplied by interchanging the fuel supply nozzle.

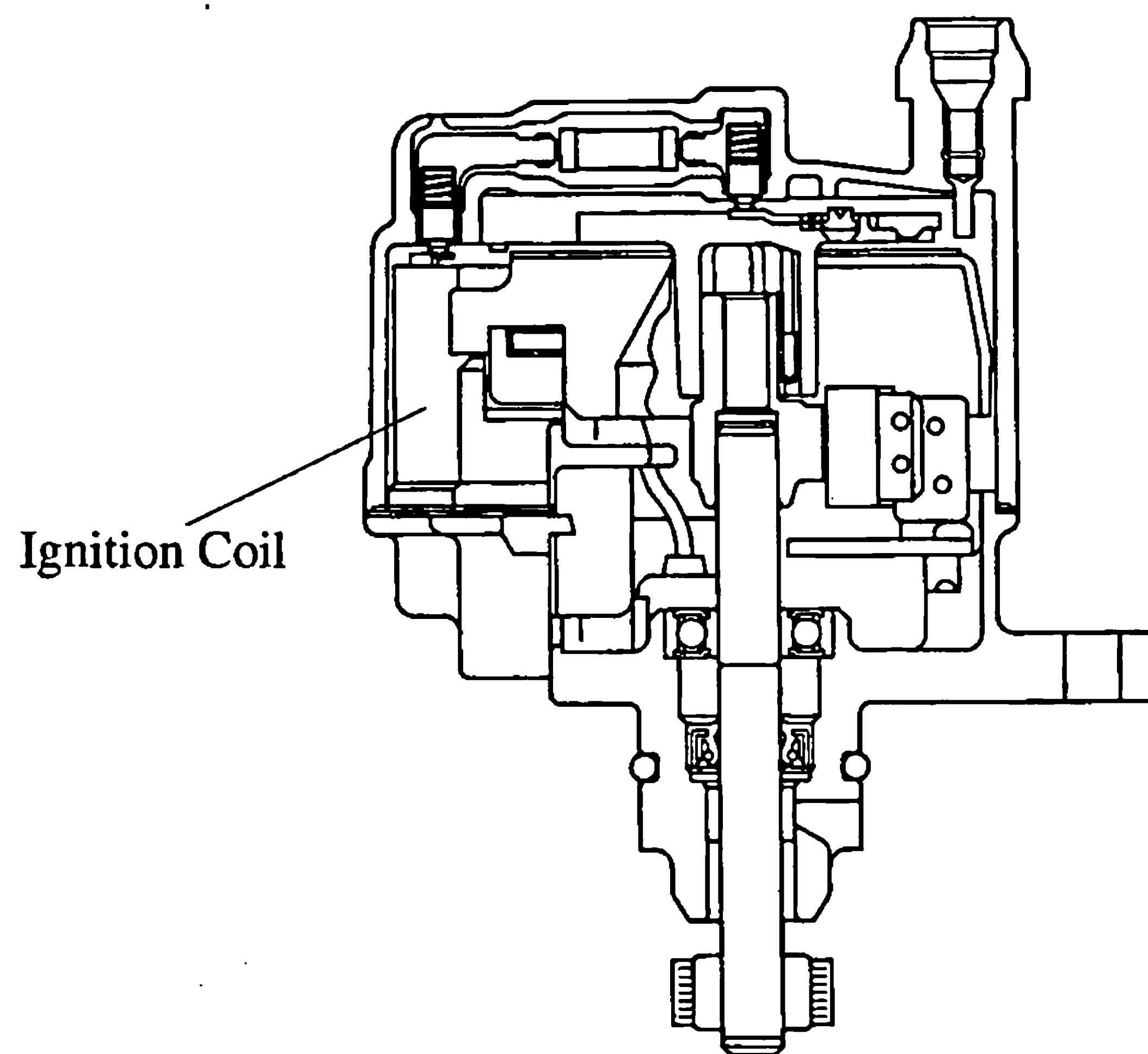


■ IGNITION SYSTEM

1. Distributor

► For 3RZ-FE Engine ◀

An ignition coil integrated distributor is used.



■ ENGINE CONTROL SYSTEM (For 3RZ-FE Engine)

1. General

The engine control system of the 3RZ-FE engine is basically the same in construction and operation as that of the 22R-E engine of the previous model. However, the hot wire type air flow meter is used in the EFI system and the idle speed control system with rotary solenoid valve is adopted. In addition, the engine control system provides an engine immobiliser system.

The engine control system of the 3RZ-FE engine and 22R-E engine are compared below.

System	Outline	3RZ-FE	22R-E
EFI (Electronic Fuel Injection)	An L-type EFI system directly detects the intake air mass with a hot-wire type air flow meter.	○	—
	An L-type EFI system is used, which directly detects the intake air volume with a vane type air flow meter.	—	○
	The fuel injection system is a 2-group type, each of which injects two cylinders simultaneously.	○	—
	The fuel injection system is an all-cylinders simultaneous injection type.	—	○
Cold Start Injector Control	The injection duration of the cold start injector is controlled by the start injector time switch and ECU.	—	○
ESA (Electronic Spark Advance)	Ignition timing is determined by the ECU based on signals from various sensors.	○	○
	It retards ignition timing to suppress knocking when it occurs.	○	○
	In vehicles equipped with automatic transaxle, torque control correction during gear shifting has been used to minimize the shift shock.	○	—
ISC (Idle Speed Control)	A rotary solenoid type ISC system is used to control the fast idle and idle speeds.	○	—
Fuel Pump Control	Fuel pump operation is controlled by signals from the ECU based on the engine speed signal (NE).	○	—
Fuel Pressure Control	In hot engine condition, the fuel pressure is increased to improve restartability.	—	○
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	○*1	○
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.	○	—

*1: Models for Malaysia and Chile only

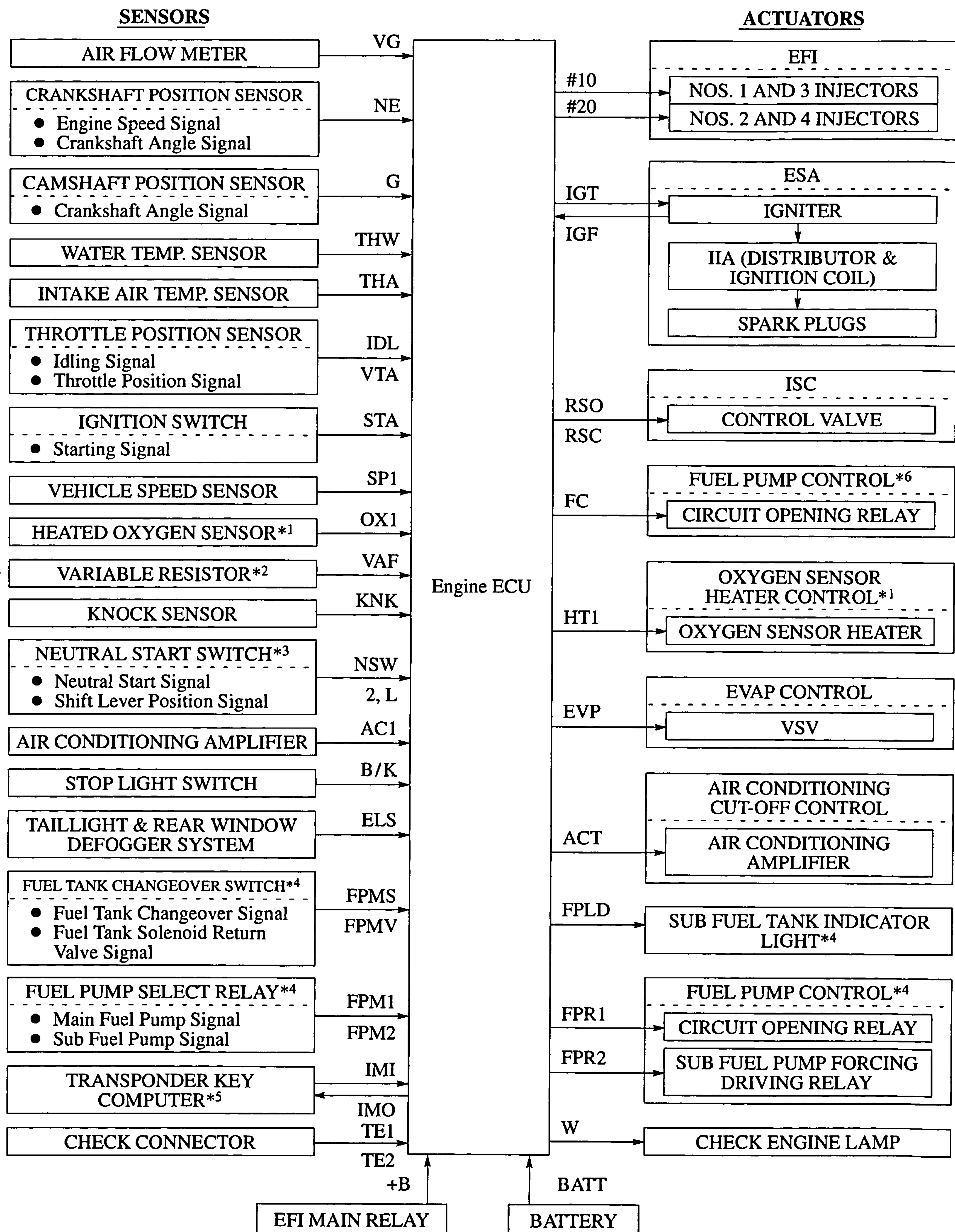
System	Outline	3RZ-FE	22R-E
Air Conditioner Cut-Off Control	By controlling the air conditioner compressor in accordance with the throttle valve opening angle and the vehicle speed, driveability is maintained.	○	—
Sub Fuel Tank Control	Drivers use the fuel tank changeover switch to select the fuel tank (main or sub) they wish to use.	○*2	—
Engine Immobiliser	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.	○*3	—
Diagnosis	When the ECU detects a malfunction, the ECU diagnoses and memorizes the failed section.	○	○
	A test mode function has been added.	○	—
Fail-Safe	When the ECU detects a malfunction, the ECU stops or controls the engine according to the data already stored in memory.	○	○

*2: Only on models equipped with sub tank system.

*3: Only on models for Australia equipped with the engine immobiliser system.

2. Construction

The configuration of the engine control system in the 3RZ-FE engine is as shown in the following chart.



*1: Models for Malaysia and Chile only.

*3: Applicable only to automatic transmission model.

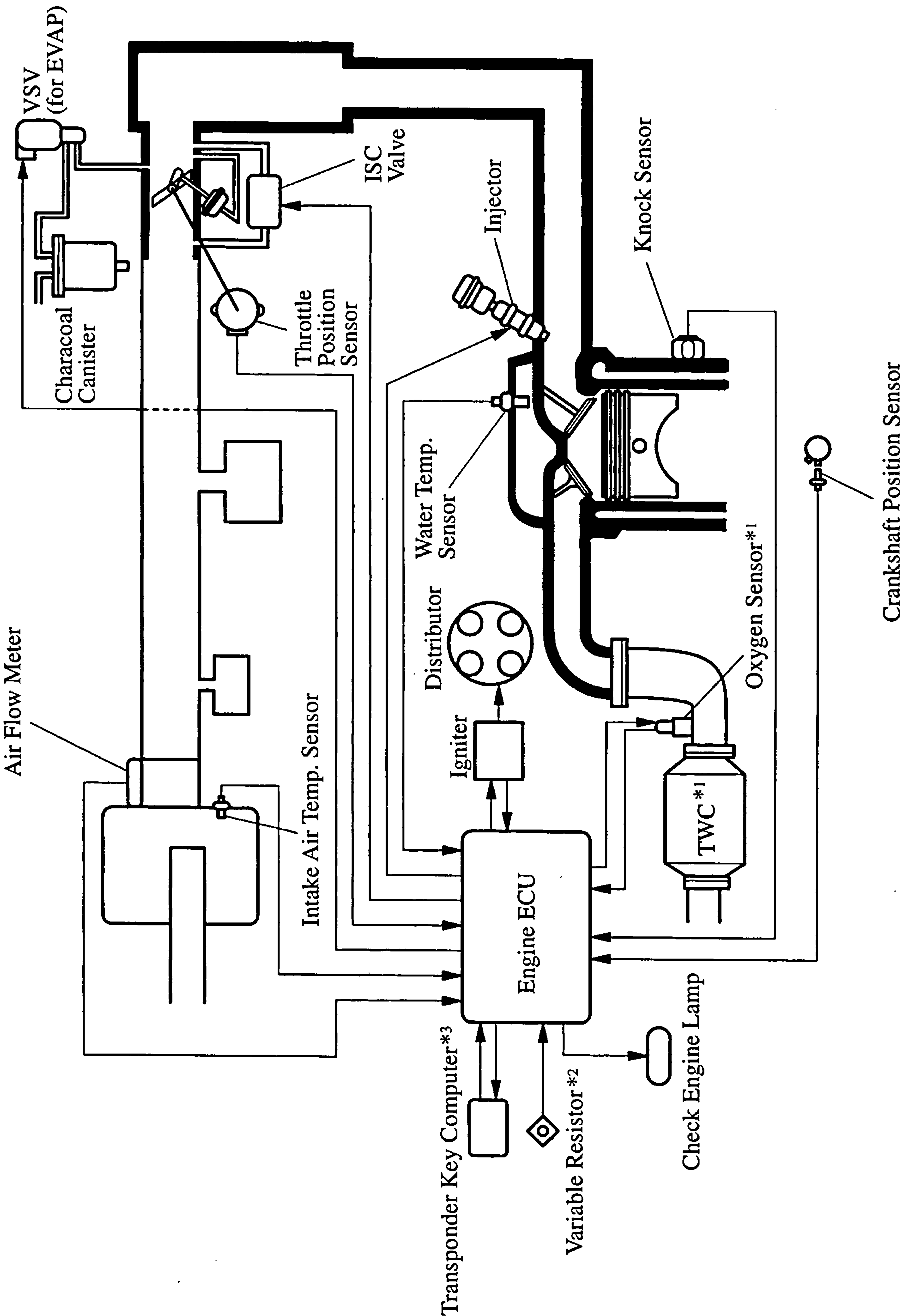
*5: Only on models for Australia equipped with the engine immobiliser system.

*6: Only on models without sub fuel tank system.

*2: Models for Australia only.

*4: Only on models equipped with sub fuel tank system.

3. Engine Control System Diagram

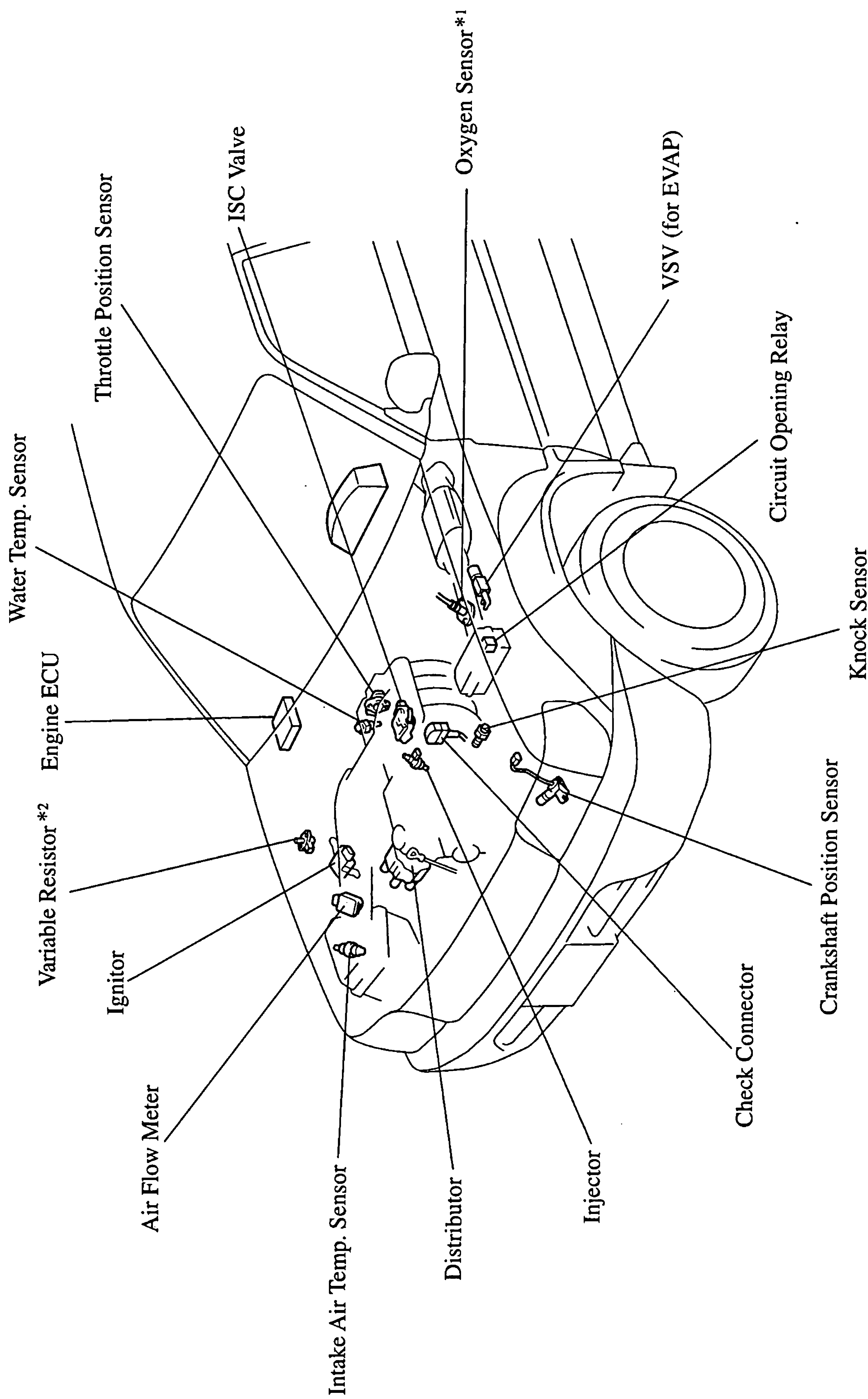


*1 : Models for Malaysia and Chile only

*2 : Models for Australia only

*3 : Only on models for Australia equipped with the engine immobiliser system.

4. Layout of Components



*1 : Models for Malaysia and Chile only
*2 : Models for Australia

5. Main Components of Engine Control System

General

The main components of the 3RZ-FE engine control system are as follows:

Component		Outline
Air Flow Meter		Hot-Wire Type
Distributor	Crankshaft Angle Sensor	Pick-Up Coil Type, 1
Crankshaft Position Sensor		Pick-Up Coil Type, 1
Throttle Position Sensor		Linear Type
Oxygen Sensor		With Heater Type
Knock Sensor		Built-In Piezoelectric
Fuel Injector		2-Hole Type
ISC Valve		Rotary Solenoid Type

EG

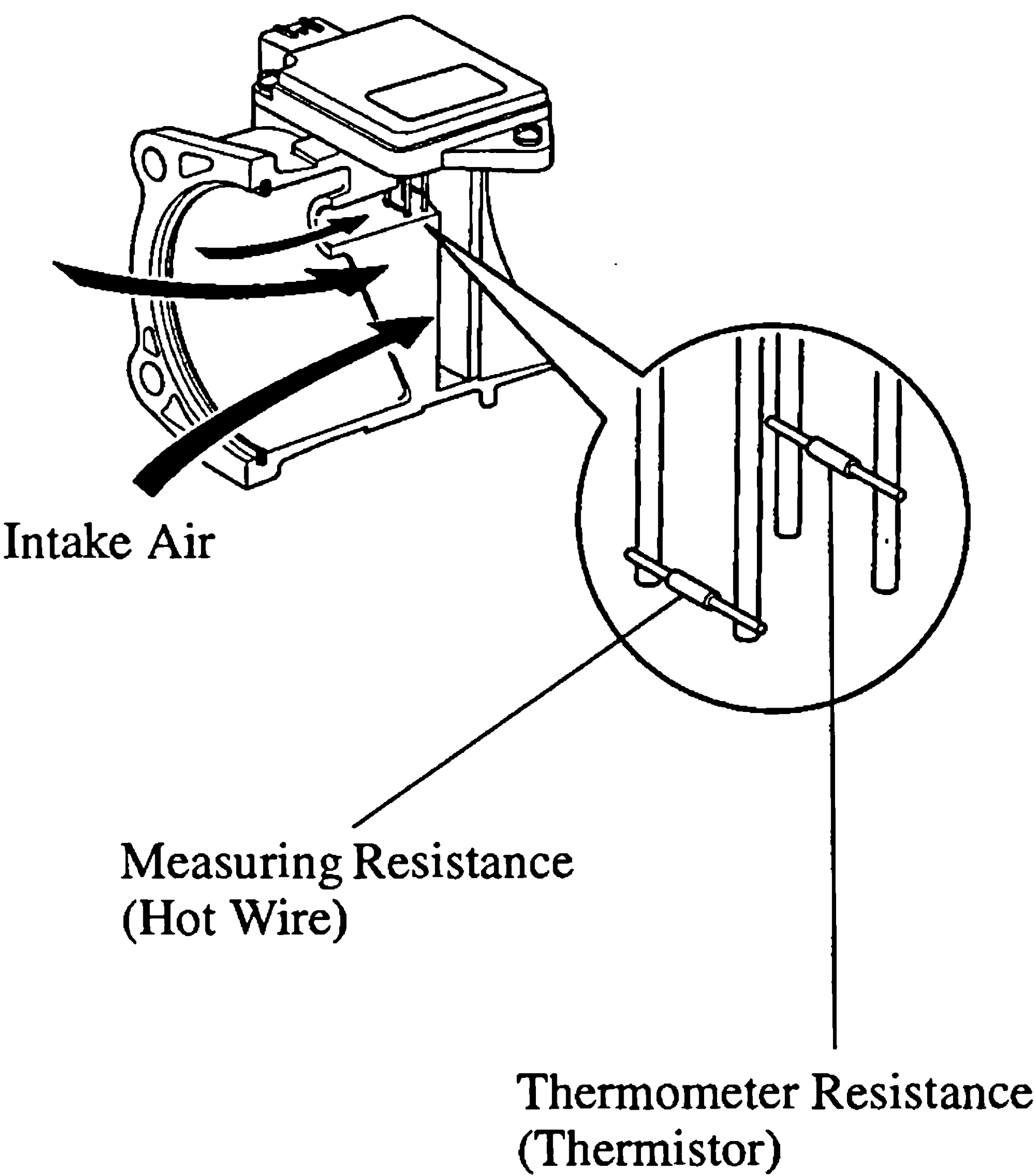
Air Flow Meter

The hot-wire type air flow meter is designed for direct electrical measurement of the intake air mass flow. It has the following features:

- Compact and lightweight
- Ability to measure a wide intake air mass flow
- Superior response and measuring accuracy
- Having no mechanical functions, it offers superior durability.

1) Construction and Operation

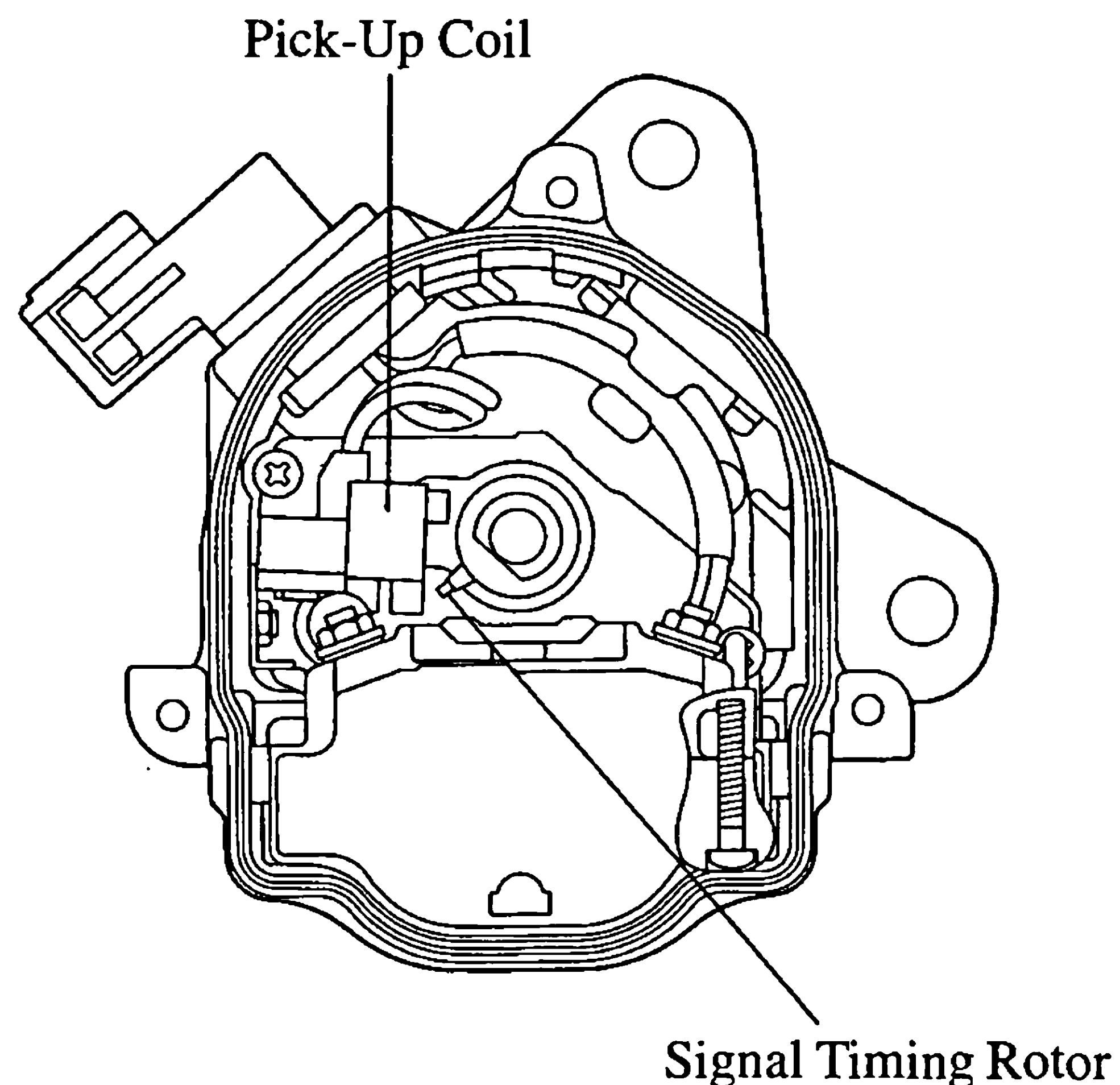
A measuring resistance (hot wire) and a thermometer resistance (thermistor) are installed with the bypass in the housing. The hot wire temperature decreases in accordance with the increase in the intake air flow. To keep the hot wire temperature constant with the sum of the intake air temperature measured by the thermistor and the predetermined temperature difference, the air flow meter outputs voltage. The Engine ECU accurately measures the intake air mass by the changes in the voltage.



Crankshaft Angle Sensor

The crankshaft angle sensor is built into the distributor and detects the crankshaft angle signal (G signal).

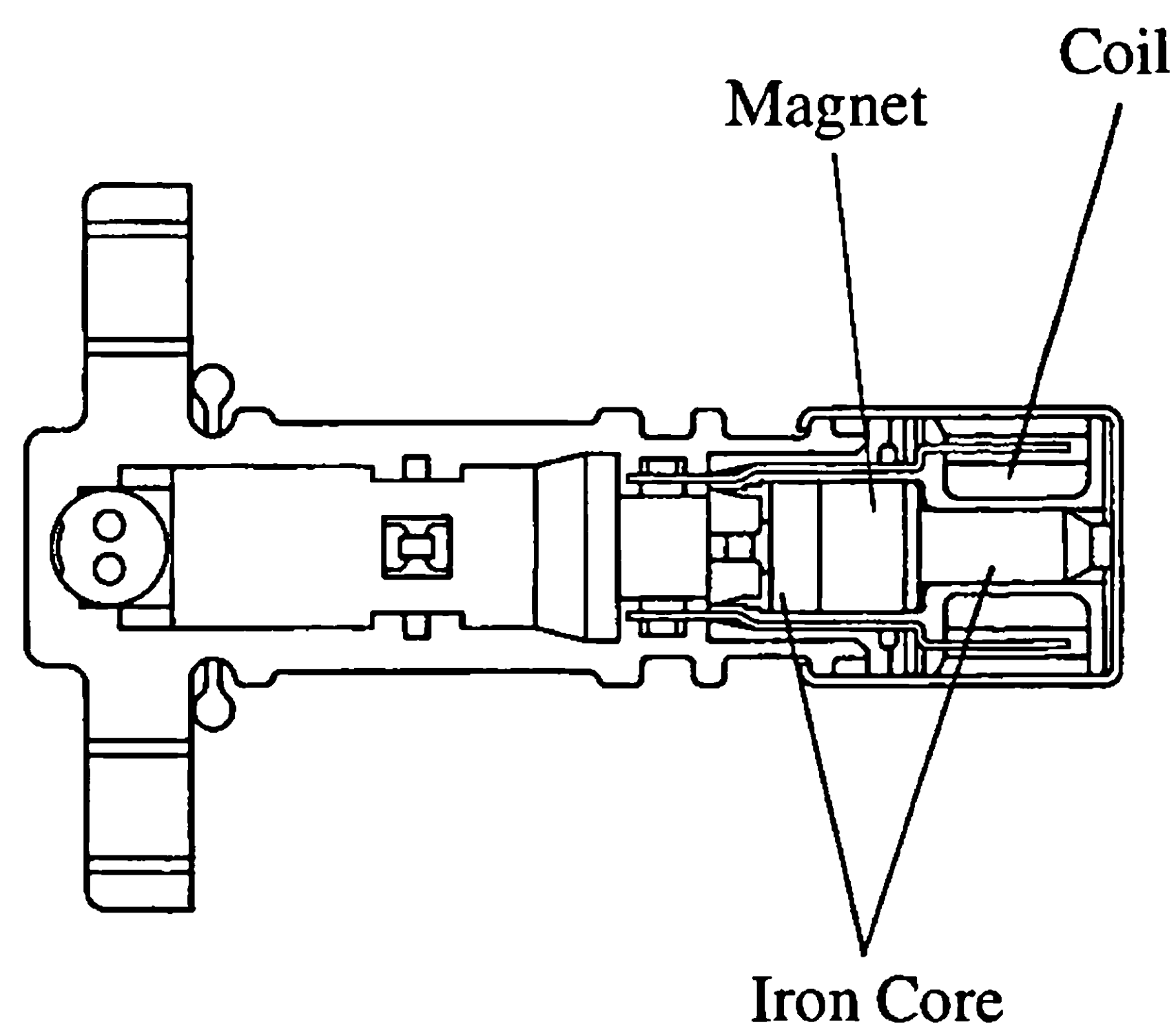
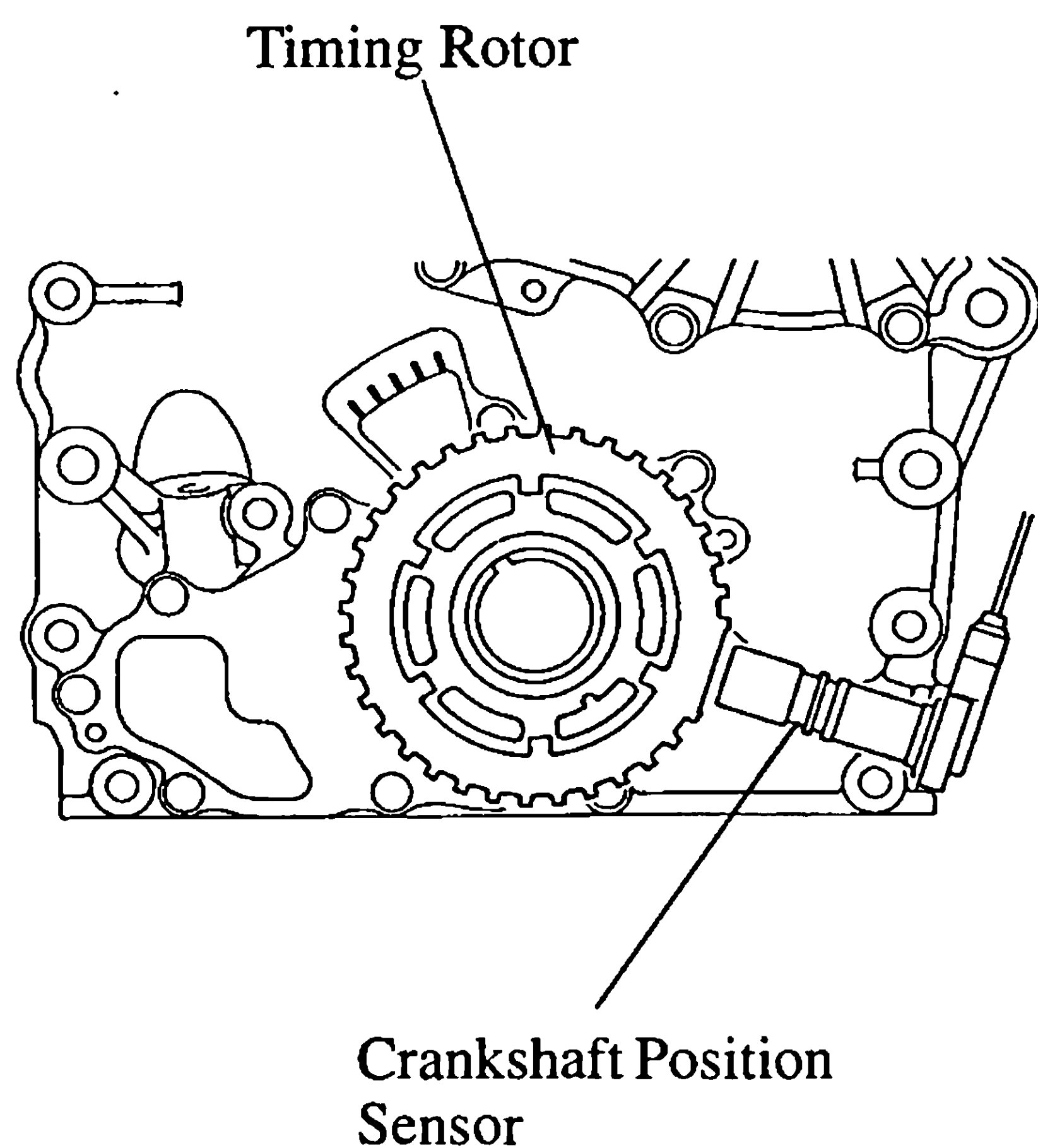
The signal timing rotor is provided with 1 tooth which activates the pick-up coil once every revolution of the distributor shaft.



Crankshaft Position Sensor

The crankshaft position sensor also consists of a magnet, coil and iron core, and is mounted on the timing chain cover as illustrated below.

The timing rotor is integrated with the crankshaft pulley. The rotor's teeth are spaced 10° apart, according to crankshaft angle, but since there are 2 teeth missing, as illustrated below, there is a total of 34 teeth. Accordingly, the engine ECU can detect the crankshaft angle in addition to the crankshaft speed.



Crankshaft Position Sensor Cross Section

6. ISC (Idle Speed Control)

General

The rotary solenoid type ISC valve that is integrated with the throttle body regulates the volume of air that flows through the throttle valve bypass, thus achieving the target rpm that is appropriate for the engine condition. As a result of fast idle and A/C idle-up controls implemented by this system, fuel economy during warm-up has been improved.

Operation

Based on the signals received from the sensors, the engine ECU sends control signals to the ISC valve in order to regulate the idle speed to a target rpm.

1) Starting Control

During the starting of the engine, and for several seconds after starting, the duty ratio is raised to increase the volume of air, thus improving the starting performance of the engine. After the engine starts, the duty ratio changes in proportion to the coolant temperature to regulate the engine rpm.

EG

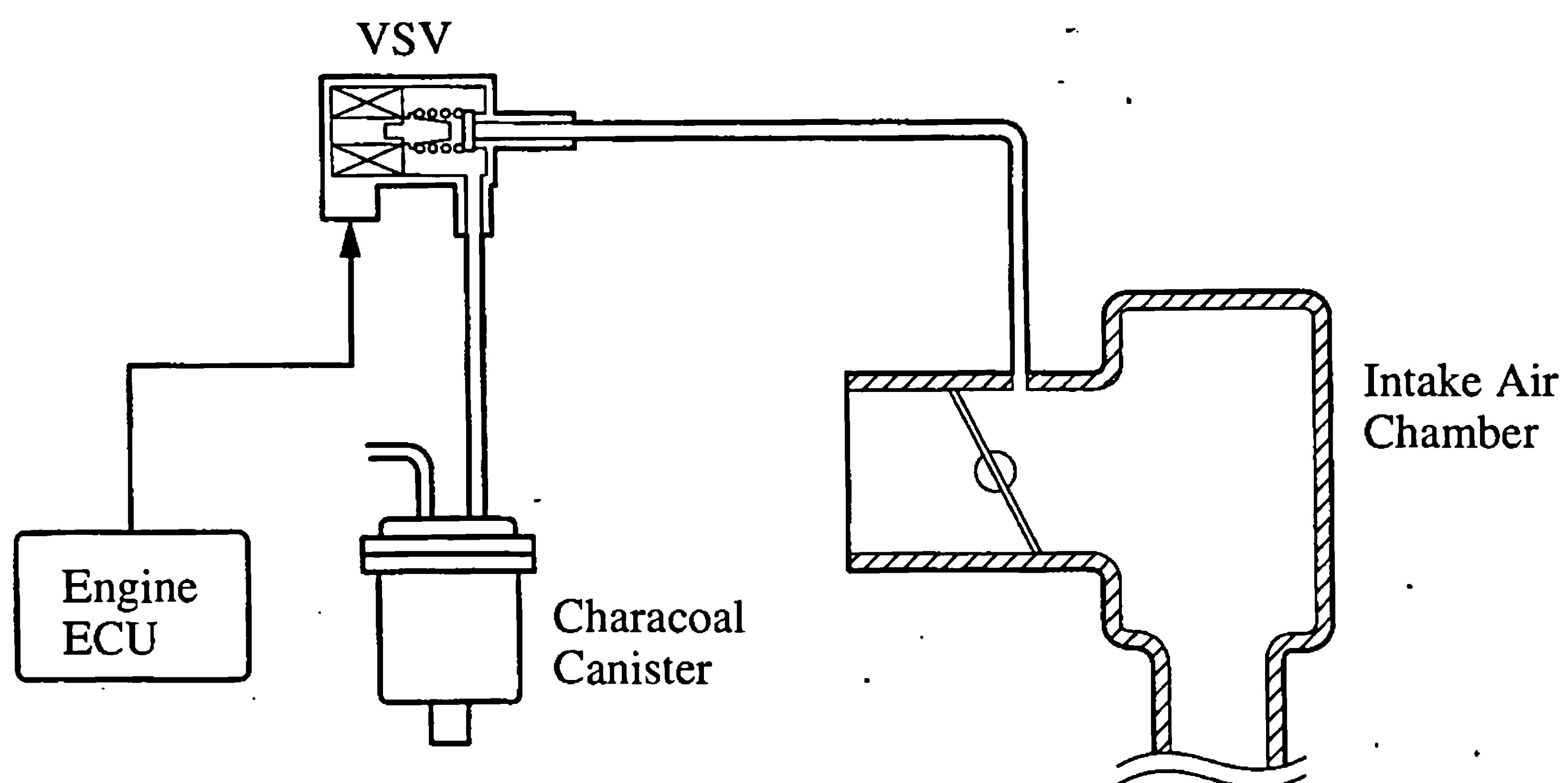
2) Feedback Control

The engine rpm is monitored during a given period of time. If there is a difference between the current and target idle rpm, the ECU sends control signals to the ISC valve to achieve the target idle rpm by regulating the volume of air.

7. Evaporative Emission Control

General

An evaporative emission control system which uses the engine ECU to control the evaporative emissions (HC) from the charcoal canister to the purge port has been adopted.



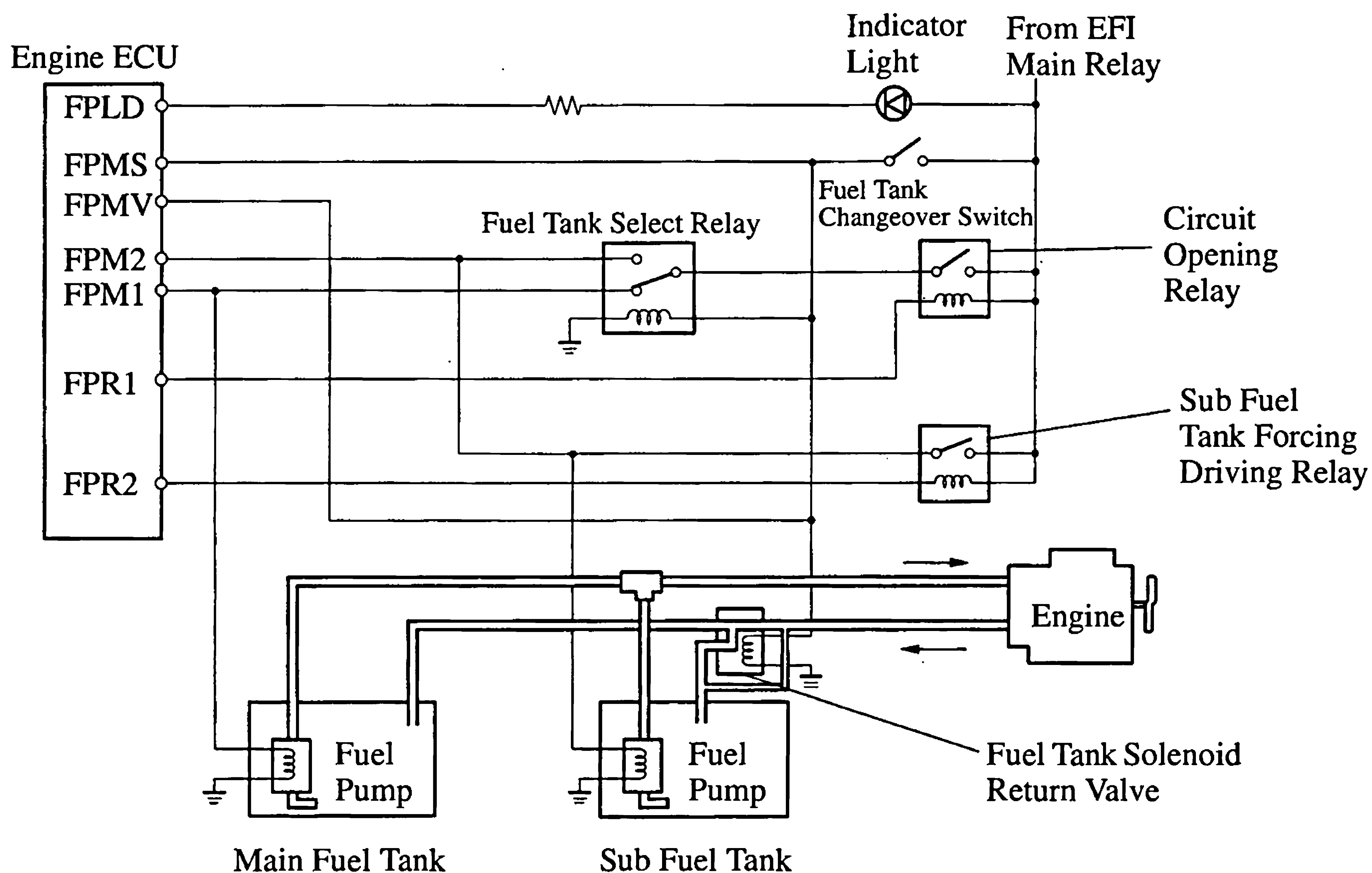
Operation

If the intake airflow volume of the engine is larger than a predetermined amount, the engine ECU controls the VSV through duty control so that evaporative emissions are purged in the amount that is suited to the engine condition.

8. Sub Fuel Tank Control

General

- By activating the fuel pump of the fuel tank (main or sub) that was selected by the fuel tank changeover switch, and by changing over the fuel return valve, fuel is supplied to the engine from the fuel tank selected by the driver.
- If a problem occurs in the electrical circuitry, the indicator light flashes to inform the driver.
- A diagnosis function is included for this system.

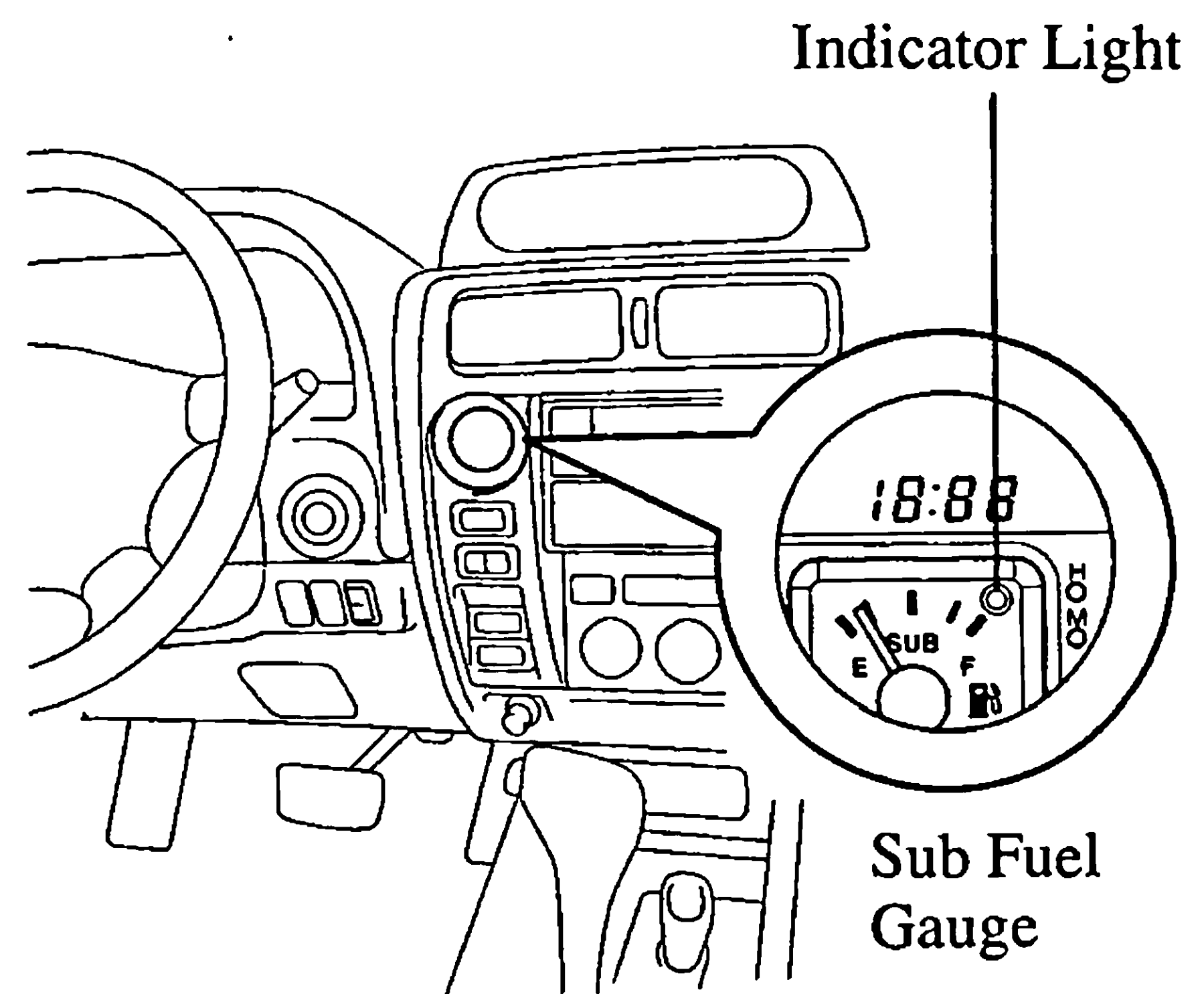


Operation

- Turning the fuel tank changeover switch ON causes the fuel tank select relay to turn ON. This causes the fuel pump for the sub fuel tank to operate and supply the fuel in the sub fuel tank to the engine. At the same time, the fuel tank solenoid return valve turns ON to return the fuel to the sub fuel tank. In addition, the engine ECU turns on the indicator light to inform the driver that fuel is being supplied from the sub fuel tank.
- After the engine has started, if the engine coolant temperature is below a specified value, the engine ECU turns ON the sub fuel pump. This forces the driving relay to operate the sub fuel pump for a given time, thus preventing the sub fuel pump from seizure.

Diagnosis

If malfunction occurs in electrical circuitry, the indicator light will blink and alert the driver that a malfunction has occurred. The ECU will also store the codes of the malfunctions. For the diagnostic code check method, diagnostic code and diagnostic code clearance, see the 3RZ-F, 3RZ-FE Engine Repair Manual (Pub. No. RM521E).

**EG**

9. Engine Immobiliser System

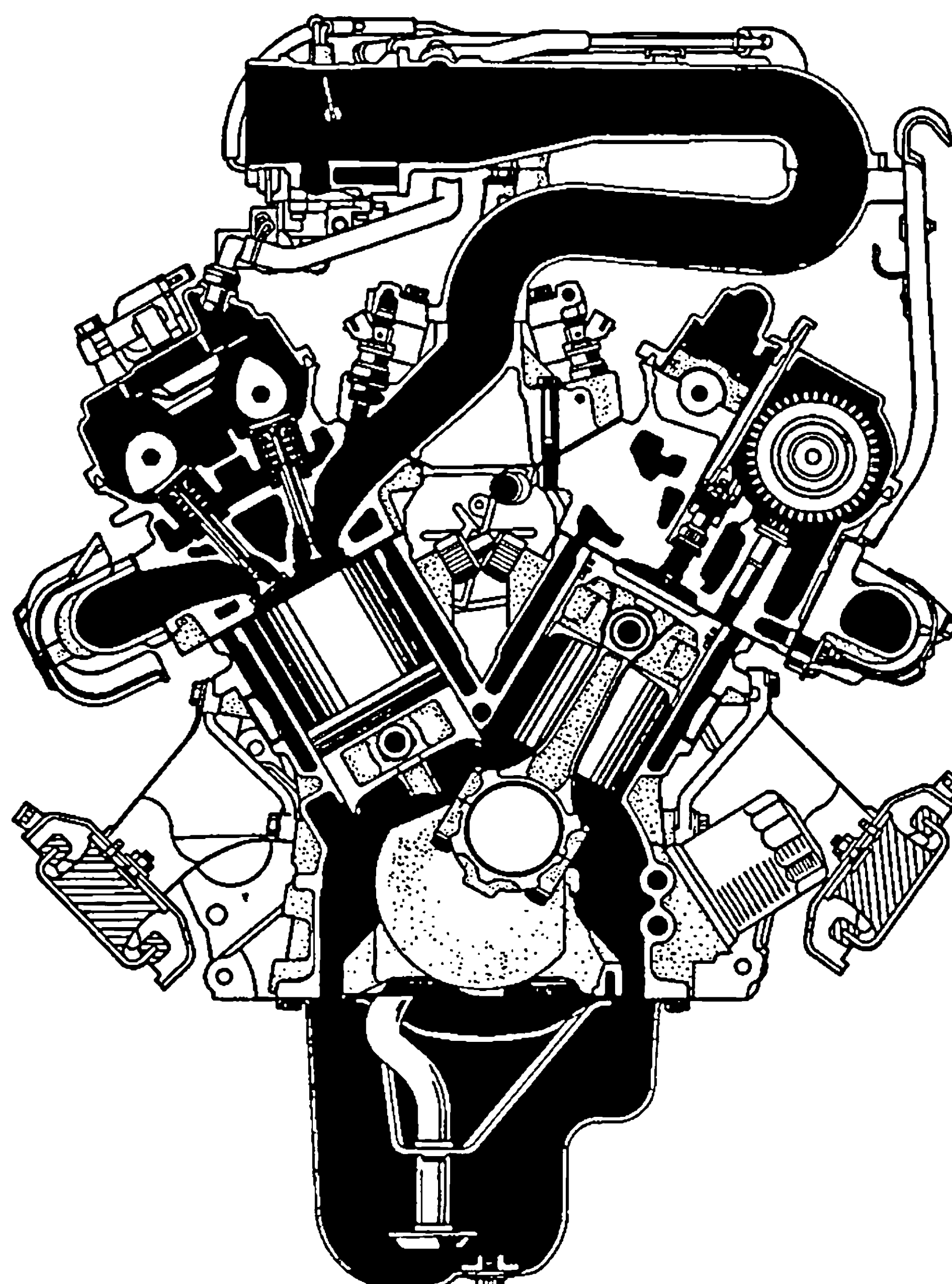
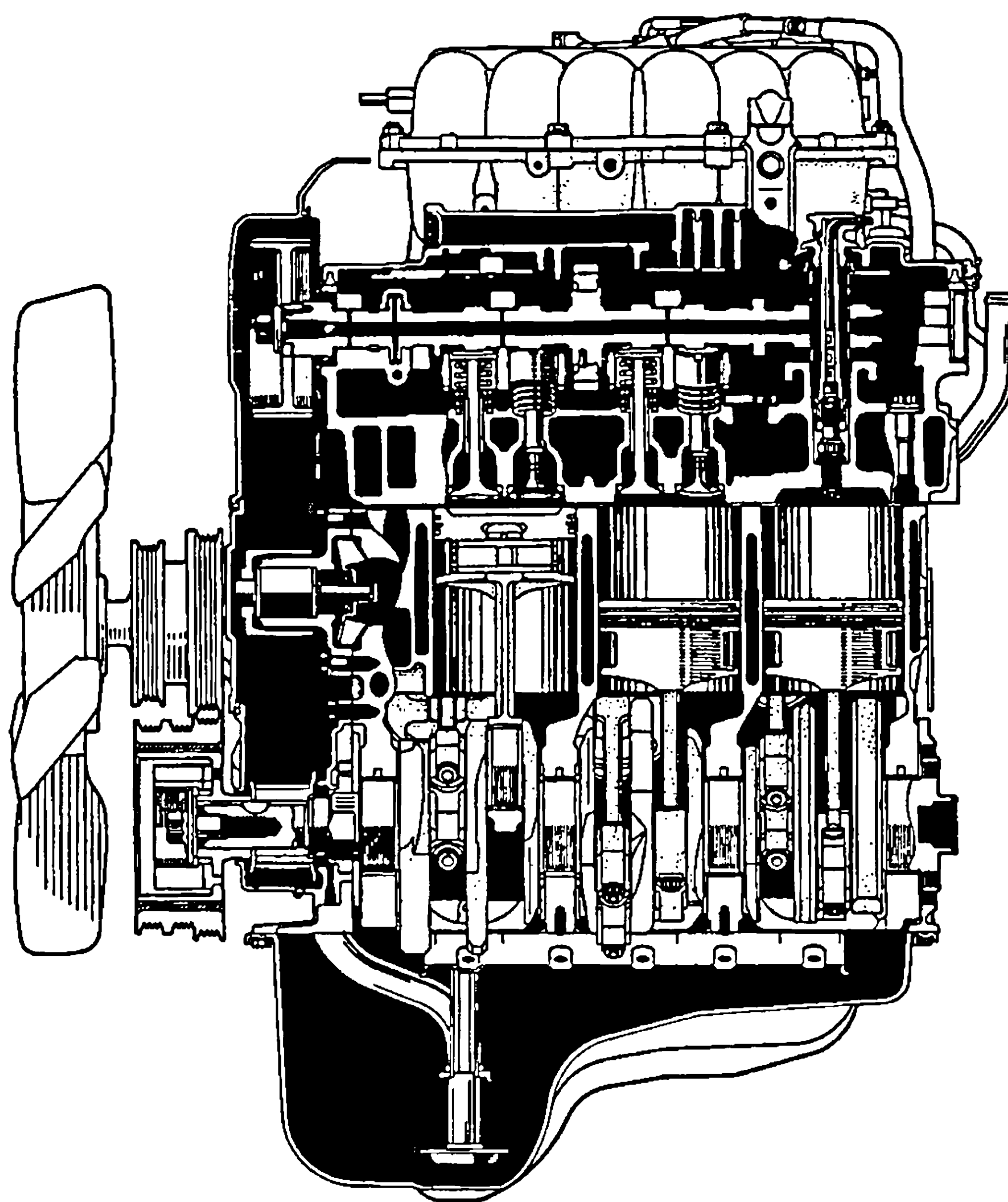
The engine immobiliser system has been designed to prevent the vehicle from being stolen. This system uses a transponder key computer that stores the ID code of the authorized ignition key. If an attempt is made to start the engine using an unauthorized key, the transponder key computer emits a signal to the engine ECU to prohibit fuel delivery and ignition, effectively disabling the engine. For details, see page 212 in the Engine Immobiliser System section.

5VZ-FE ENGINE

■ DESCRIPTION

The newly-developed 5VZ-FE engine is a V6, 3.4-liter, 24-valve DOHC engine.

This engine provides good performance in the low-to-mid-speed range and good fuel economy with low noise and vibration.

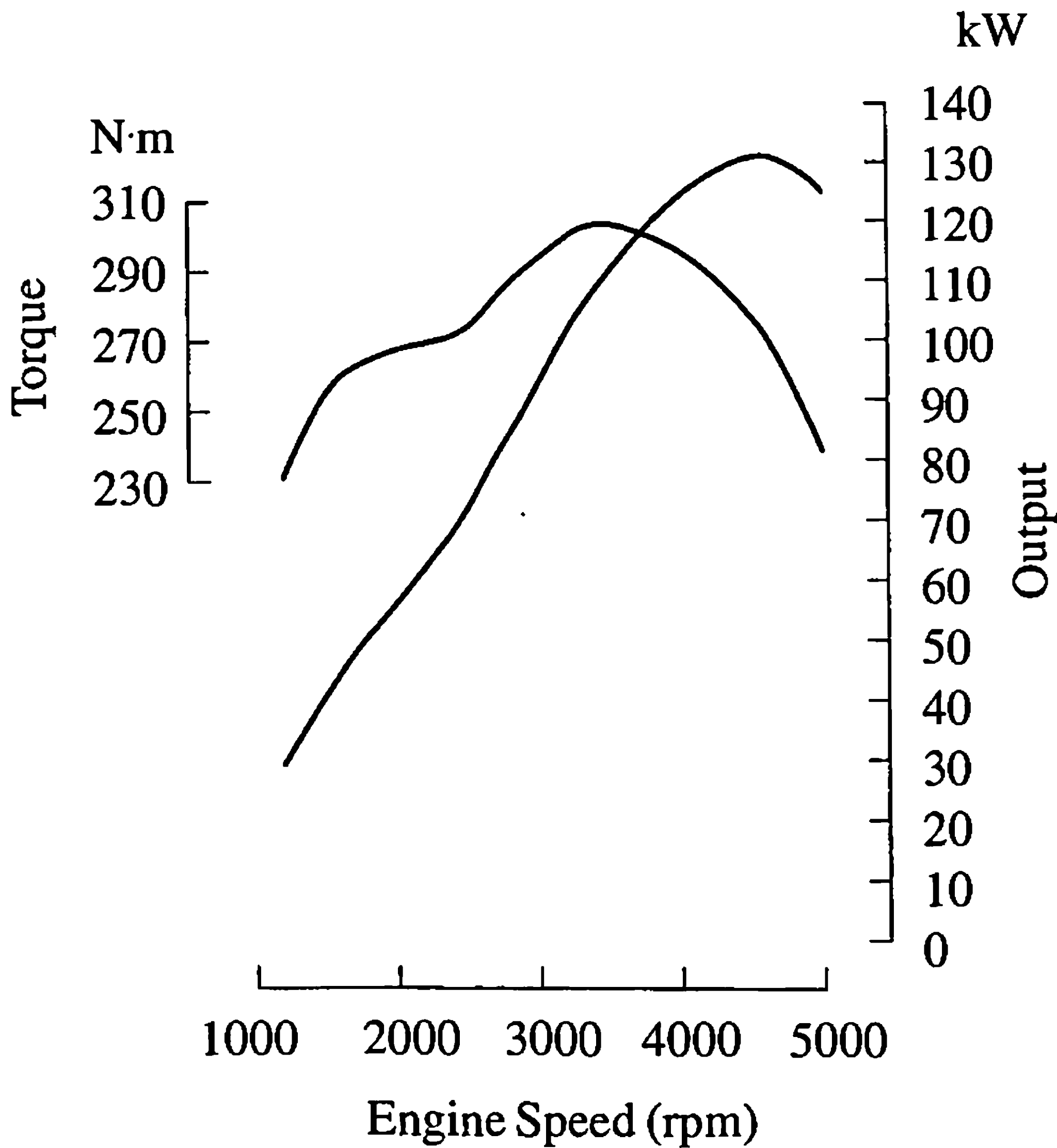


ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

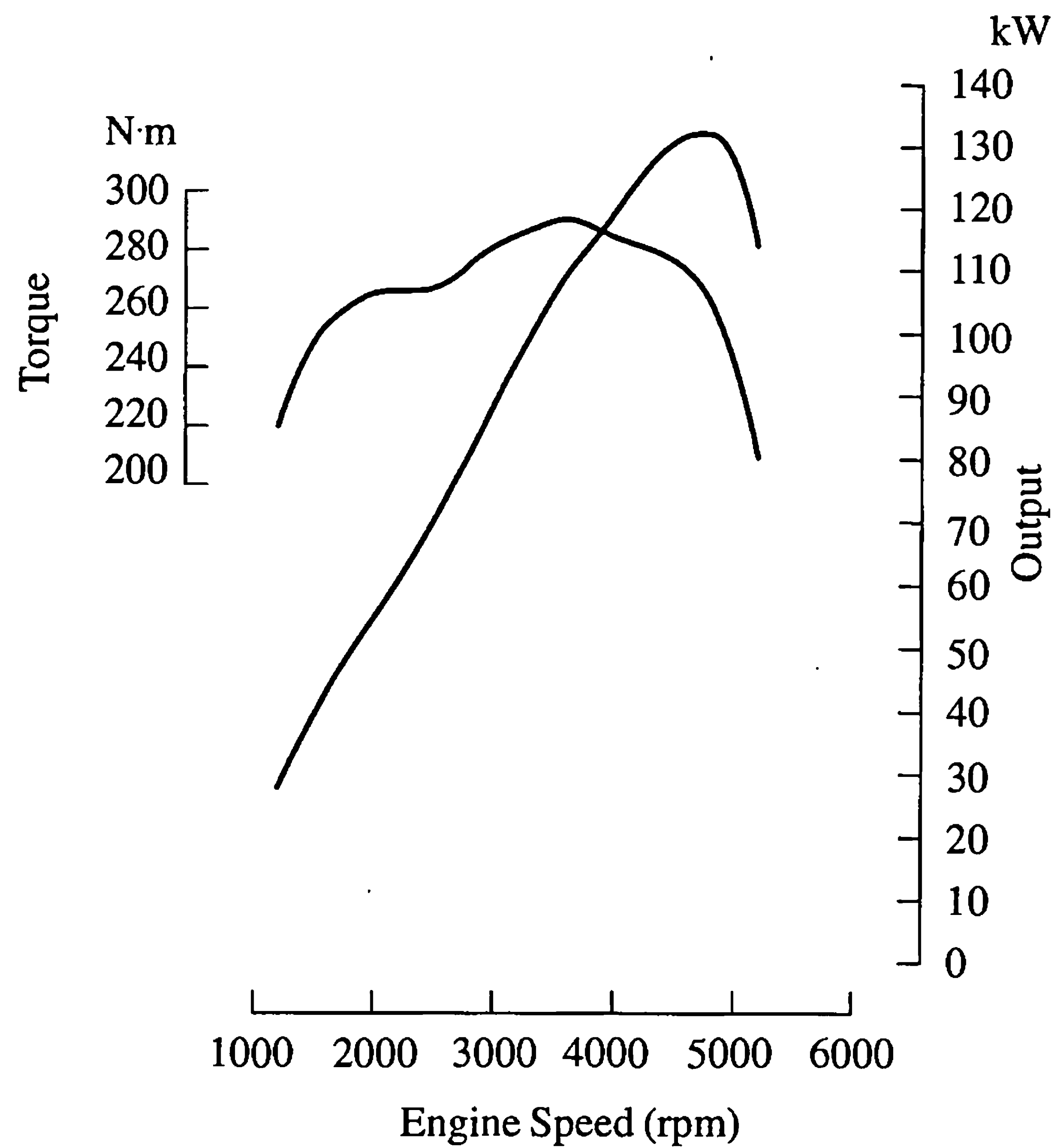
Item		Engine	5VZ-FE
No. of Cyls. & Arrangement			6-Cylinder, V Type
Valve Mechanism			24-Valve DOHC, Belt & Gear Drive
Combustion Chamber			Pentroof Type
Manifold			Cross-Flow
Fuel System			EFI
Displacement		cm ³ (cu in.)	3378 (206.1)
Bore x Stroke		mm (in.)	93.5 x 82.0 (3.68 x 3.23)
Compression Ratio			9.6 : 1
Firing Order			1 → 2 → 3 → 4 → 5 → 6
Max. Output		EEC	131 kW @ 4600 rpm
		SAE-NET	132 kW @ 4800 rpm
		SAE-GROSS	149 kW @ 4800 rpm
Max. Torque		EEC	303 N·m @ 3600 rpm
		SAE-NET	290 N·m @ 3600 rpm
		SAE-GROSS	312 N·m @ 3600 rpm
Valve Timing	Intake	Open	4° BTDC
		Close	42° ABDC
	Exhaust	Open	46° BBDC
		Close	4° ATDC
Fuel Octane Number		RON	95 (for Europe), 93 (for China), 91 (Others)
Oil Grade			API SG, SH or ILSAC

EG

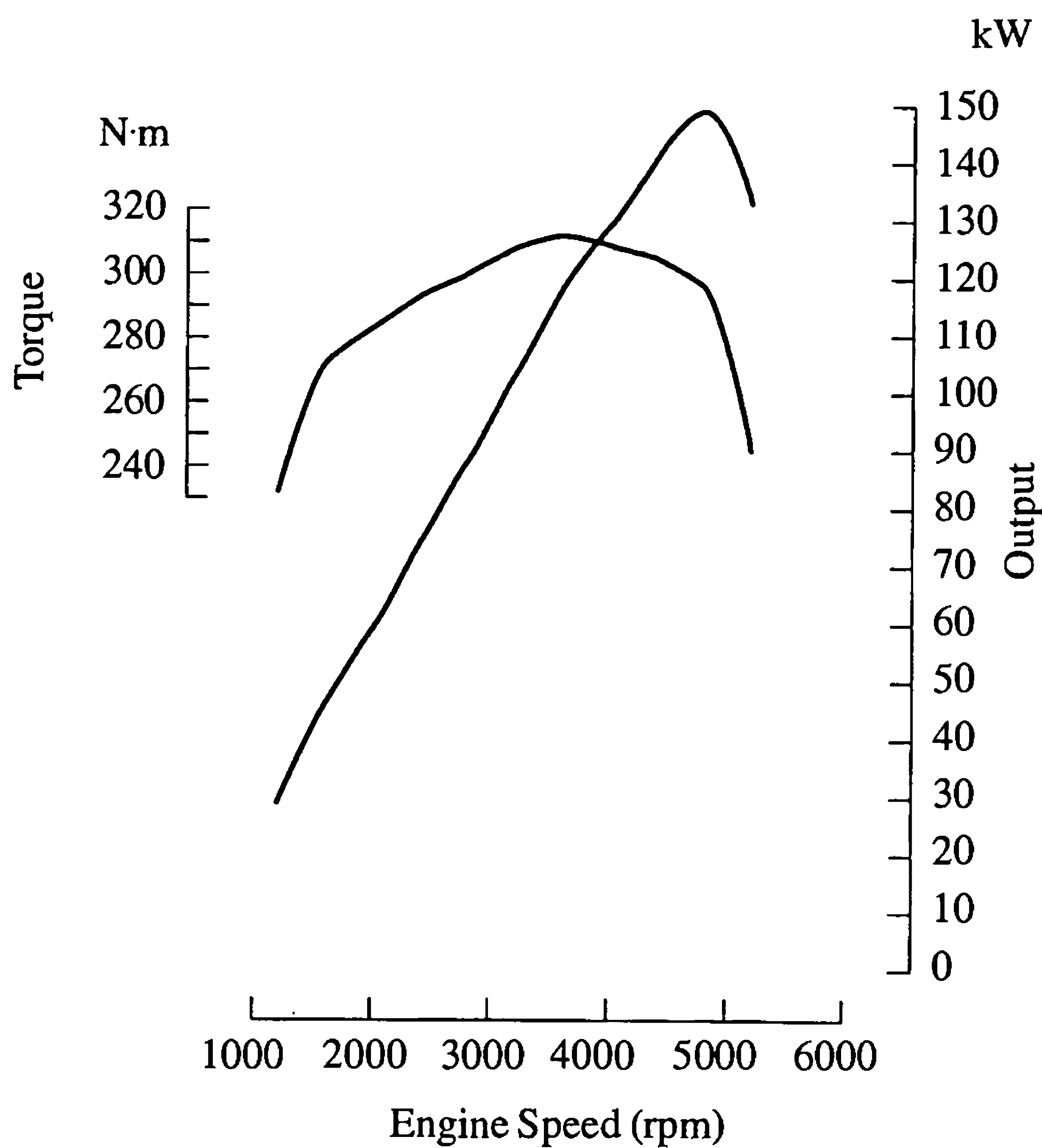
► EEC ◀



► SAE-NET ◀



► SAE-GROSS ◀



■ FEATURES OF 5VZ-FE ENGINE

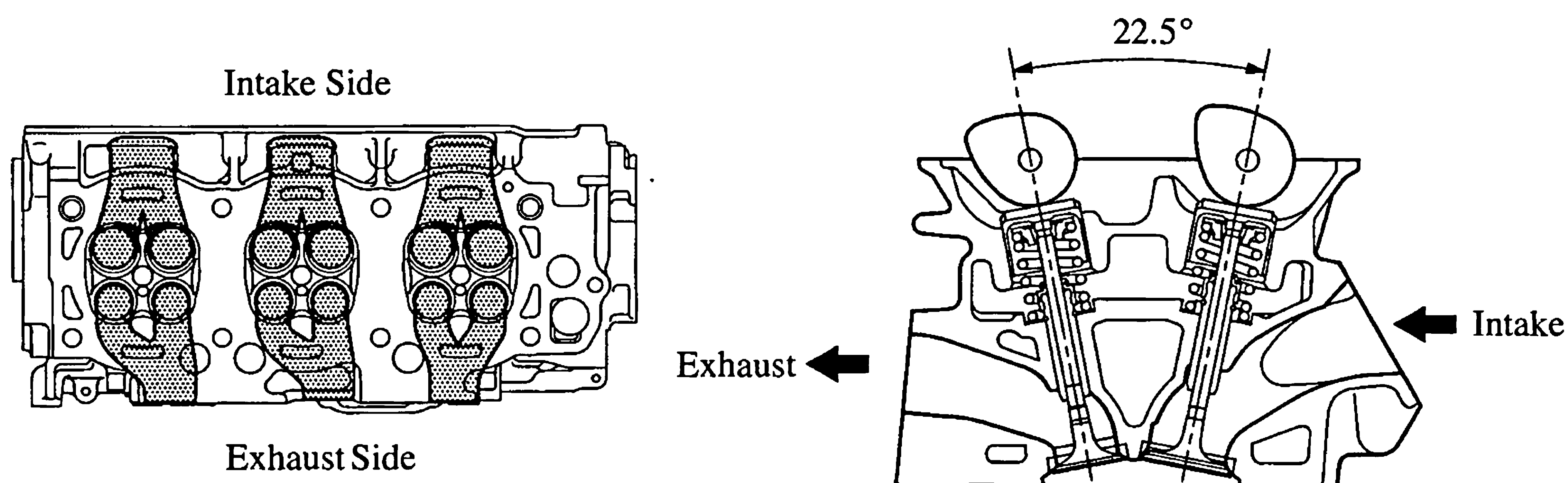
Features of the 5VZ-FE engine is as follows:

Features	Contents
High Performance and Fuel Economy	● EFI system with a hot-wire type air flow meter. ● Rotary solenoid type ISC system and ESA system for precision in accordance with engine operating conditions. ● Direct-drive DOHC with a 4-valve cross-flow layout. ● Pentroof type combustion chamber plus high compression ratio. ● An air-assisted fuel system is used to promote atomizing of the fuel for improved fuel economy. ● A 2-way exhaust control system is used.
Low Noise and Low Vibration	● A highly rigid 5 balance crankshaft and cylinder block. ● A coupling fan with a 3-stage temperature-controlled fluid coupling. ● A crankshaft pulley with dual-mode damper.
Good Serviceability and High Reliability	● Outer shim type valve lifters and adjusting shims. ● An automatic tensioner is provided for the timing belt. ● Aluminum alloy bearings for the connecting rods and the crankshaft.
Light Weight and Compact Design	● A bank angle is 60° for a compact size engine. ● A scissors gear mechanism for the camshaft reduces the size of the cylinder head. ● An aluminum radiator core is used for weight reduction.

■ ENGINE PROPER

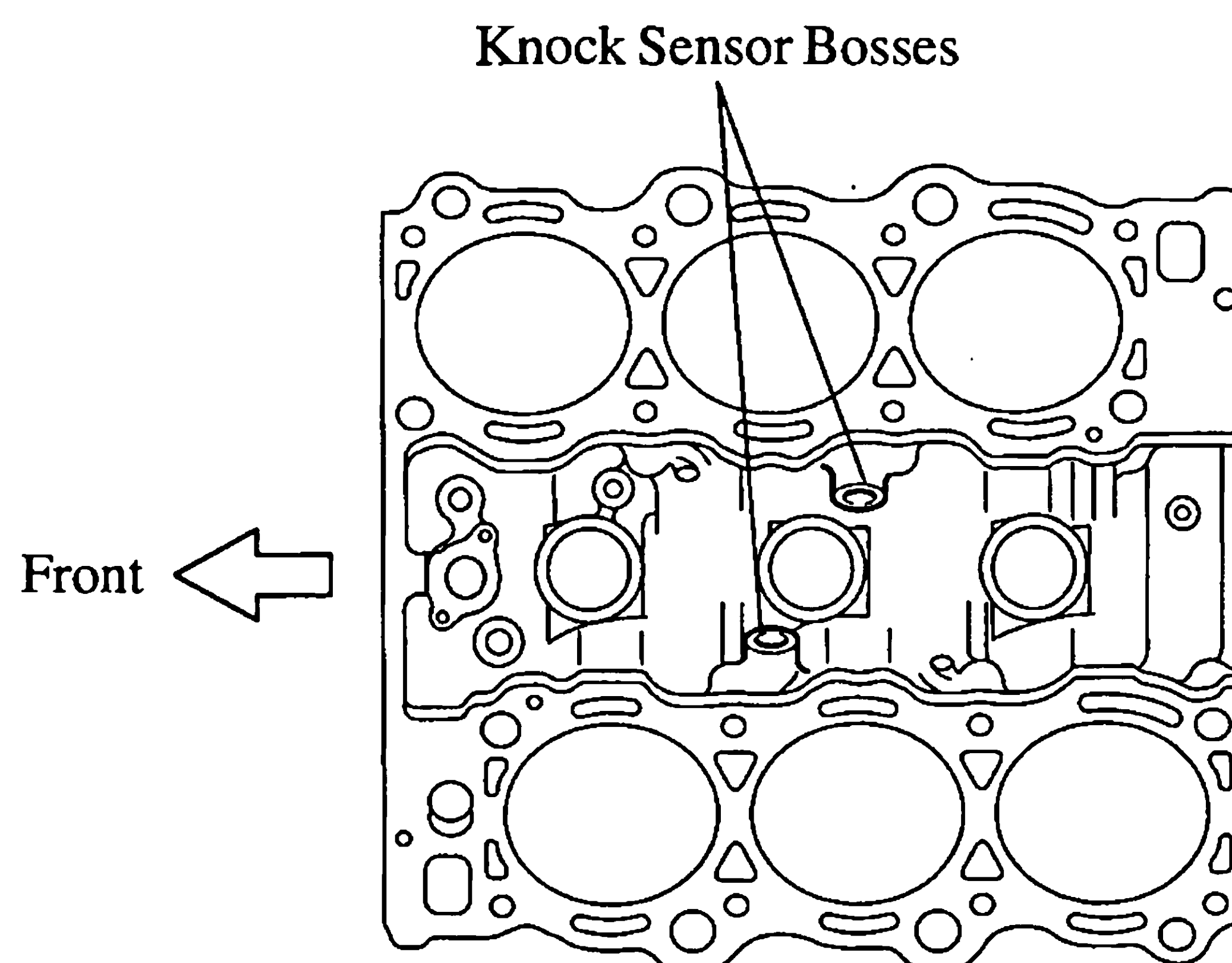
1. Cylinder Heads

- Intake and exhaust ports are cross-flow type, with intake ports on the inside and exhaust ports on the outside of the left and right banks.
- The angle of the intake and exhaust valves is narrowed, set at 22.5° to permit a compact cylinder head.
- Pentroof type combustion chambers with the spark plug located in the center, are used to assure high combustion efficiency.
- The plastic region tightening cylinder head bolts are used.



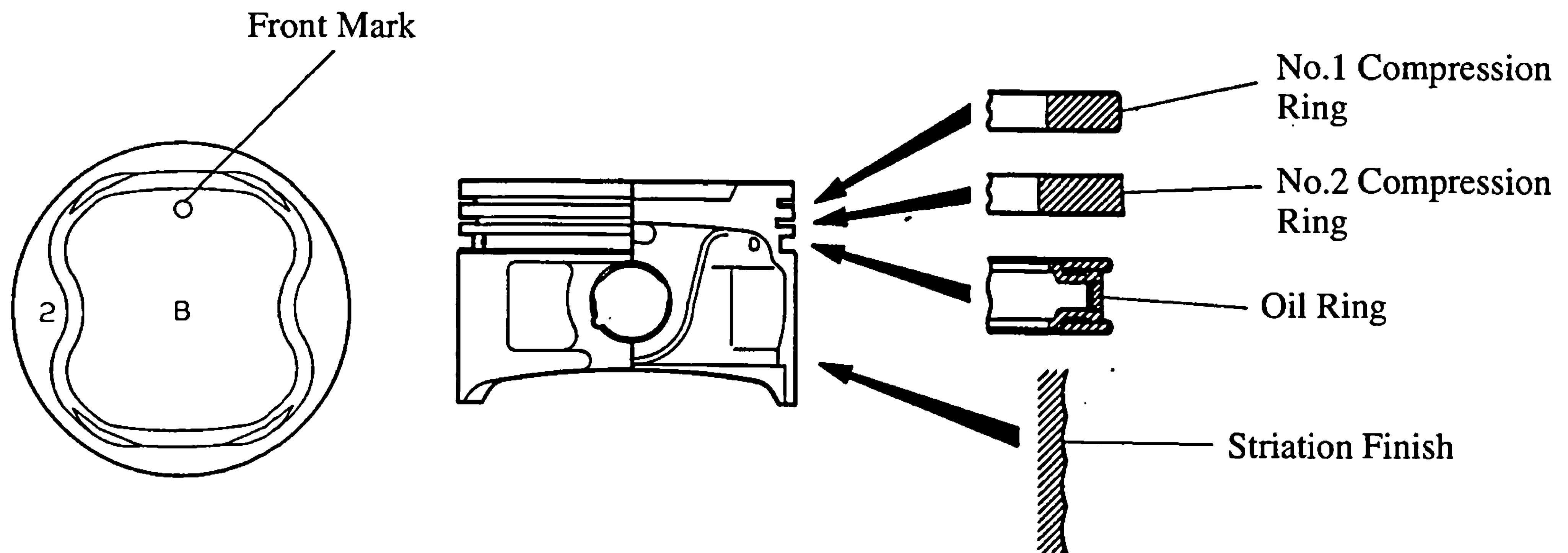
2. Cylinder Block

- The cylinder block has a bank angle of 60° , a bank offset of 38 mm (1.50 in.) and bore pitch of 109 mm (4.29 in.), resulting in a compact block in its length and width.
- Knock sensor bosses are provided at 2 locations in the V-bank.



3. Piston

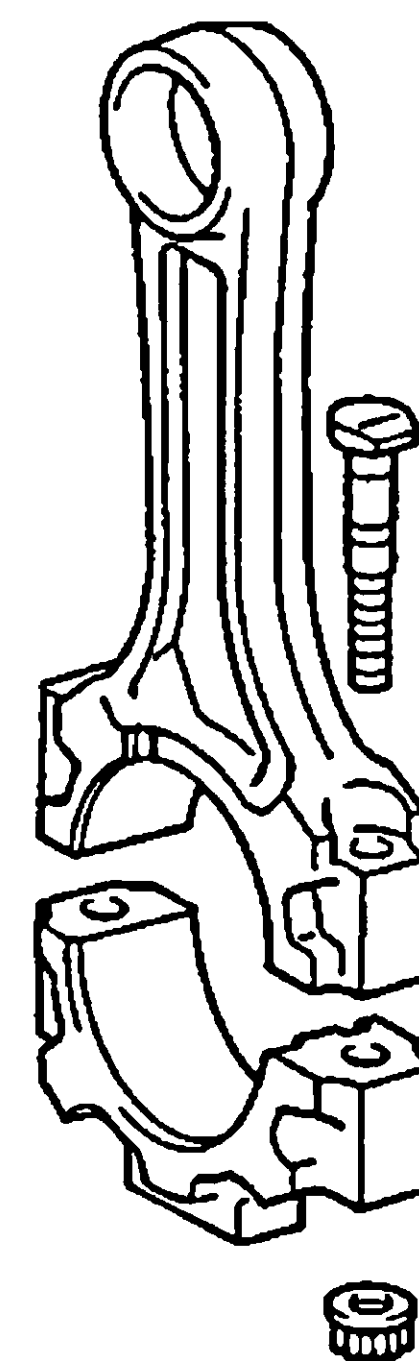
- Pistons are made of aluminum alloy having outstanding high-temperature strength.
- Full floating type piston pins are used.
- Pistons are used in common for both left and right banks.
- The skirt of piston is striation finished (finely grooved) for reducing friction loss.



EG

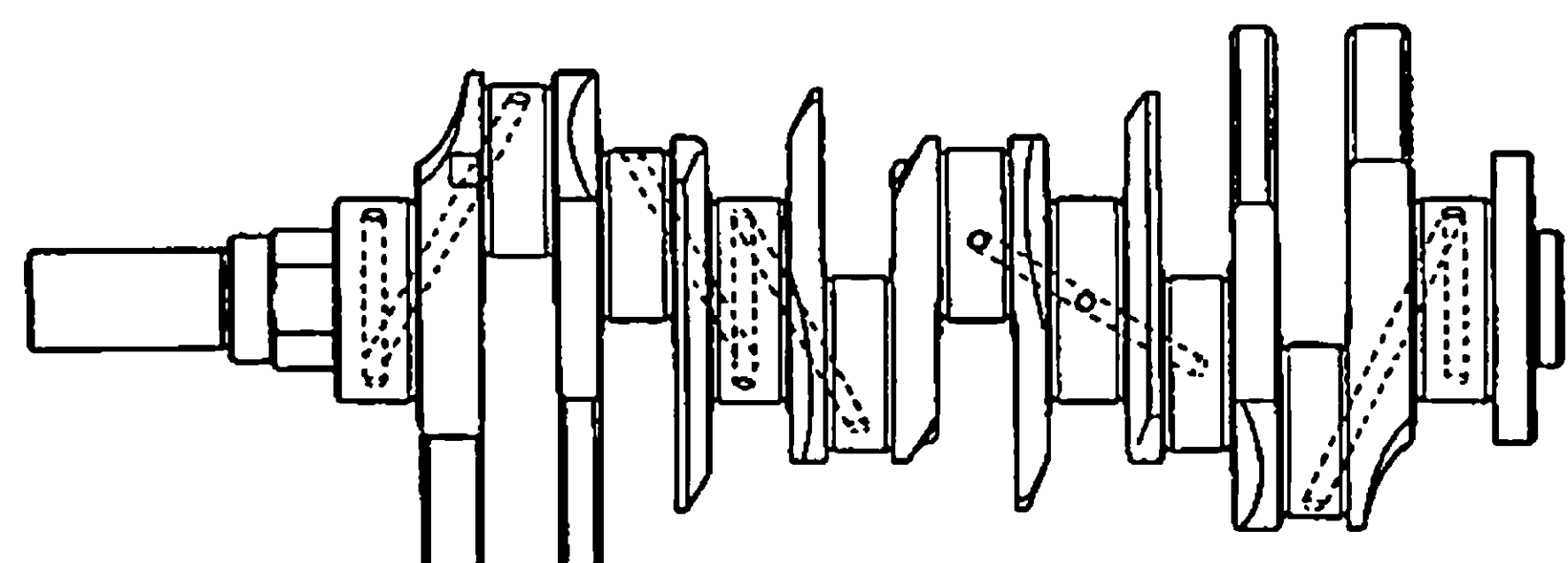
4. Connecting Rod

- Connecting rods are sintered and forged for high strength and low weight variation.
- An aluminum bearing is used for the connecting rod bearings to further enhance their reliability.



5. Crankshaft

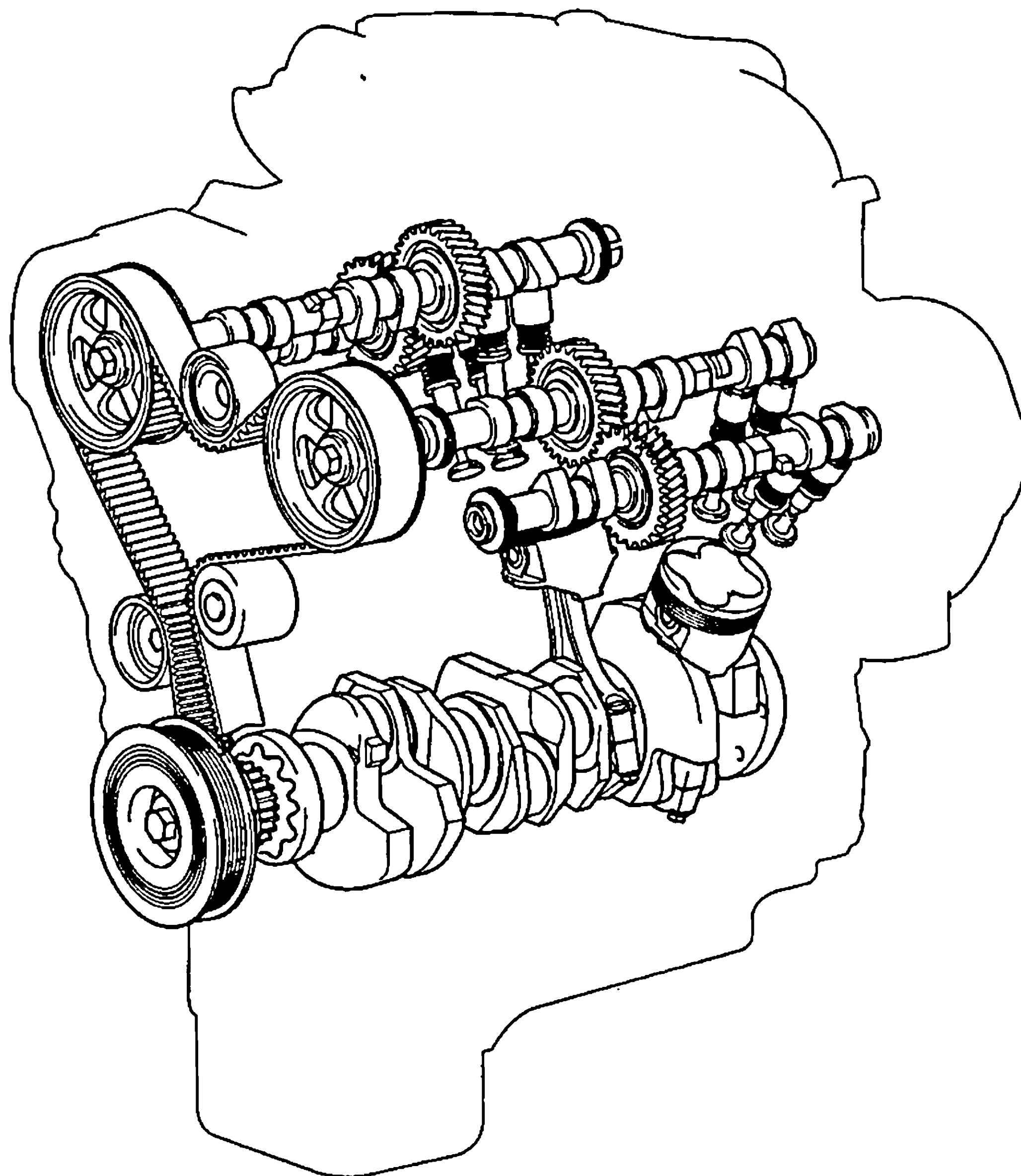
- A cast iron crankshaft with four main journals and 5 balance weights are used.
- Aluminum bearings are used.



■ VALVE MECHANISM

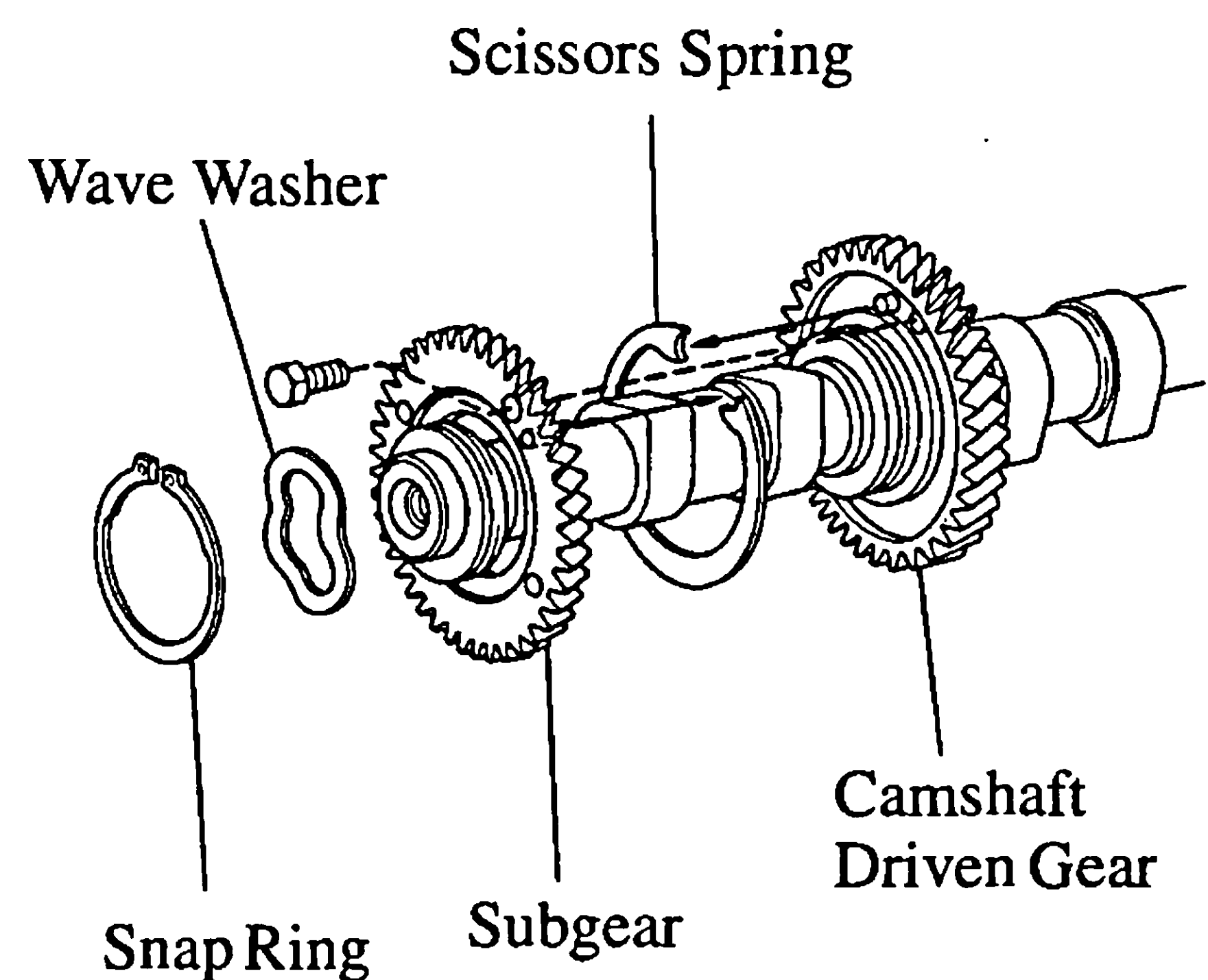
1. General

- Each cylinder has two intake valves and two exhaust valves. Intake and exhaust efficiency is increased by means of the larger total port areas.
- The valves are directly opened and closed by four camshafts.
- The intake camshafts are driven by a timing belt, while the exhaust camshafts are driven through gears on the intake camshafts.



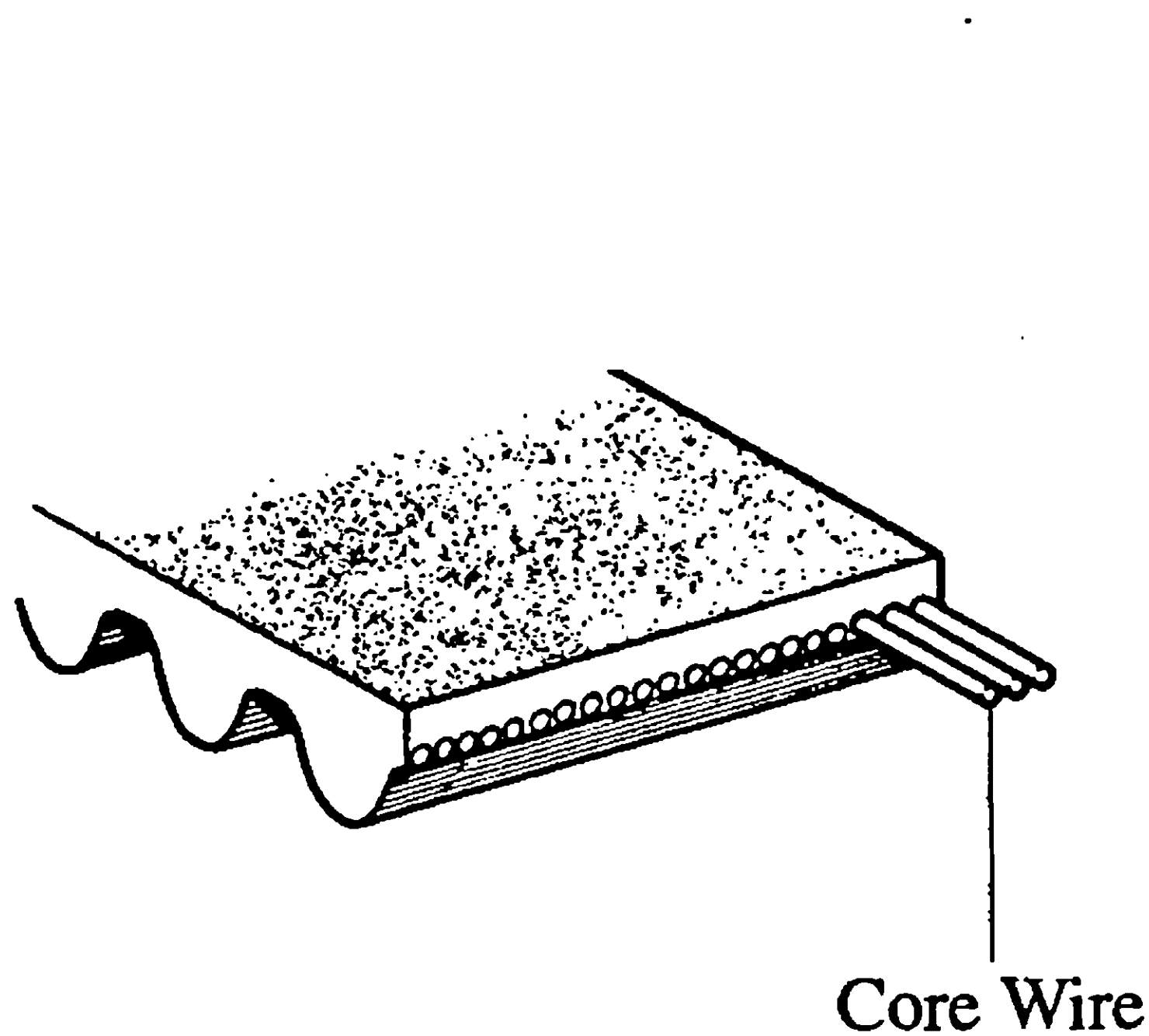
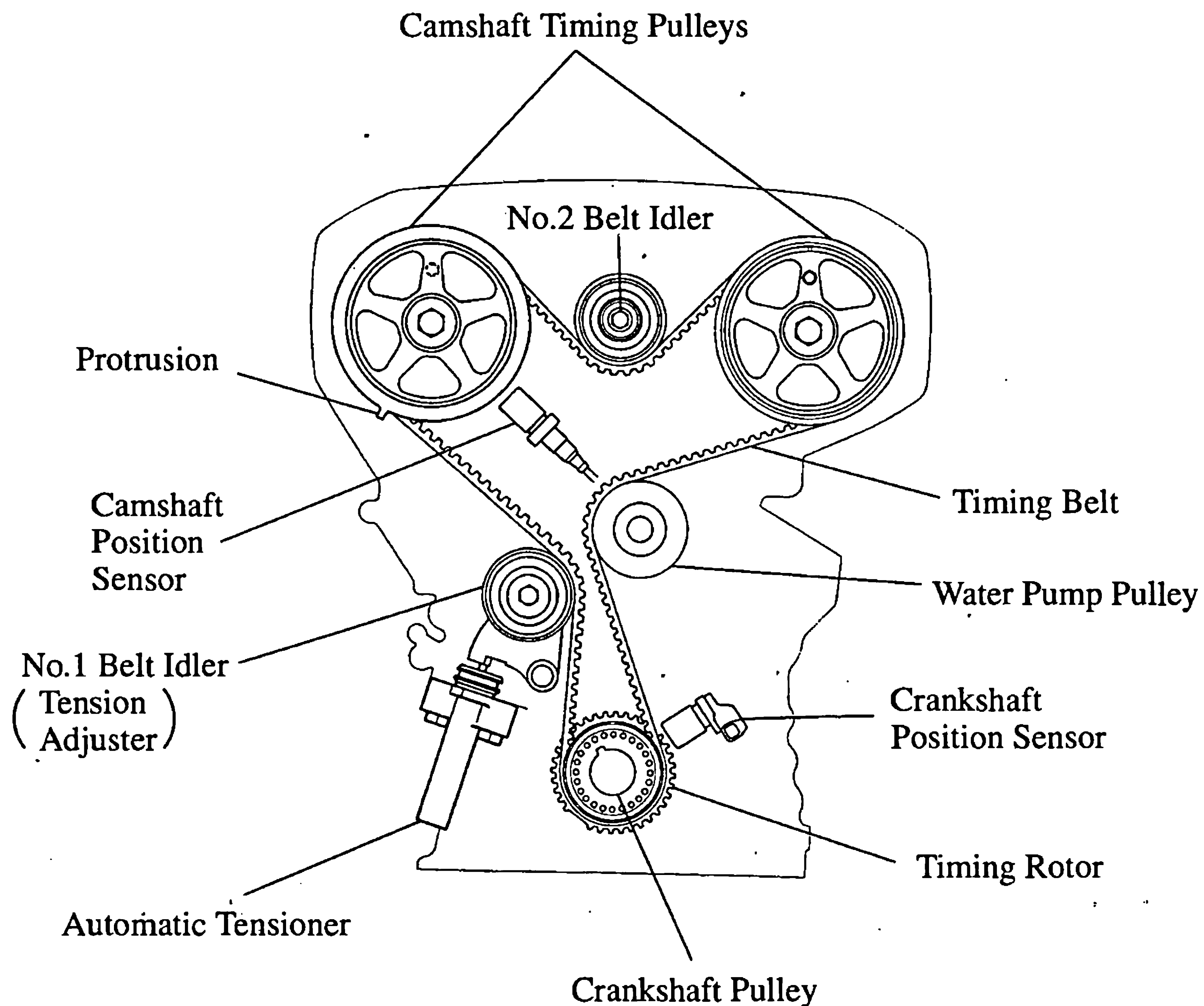
2. Camshaft

The exhaust camshafts are driven by gears on the intake camshafts. The scissors gear mechanism is used on the exhaust camshaft to control backlash and suppress gear noise.

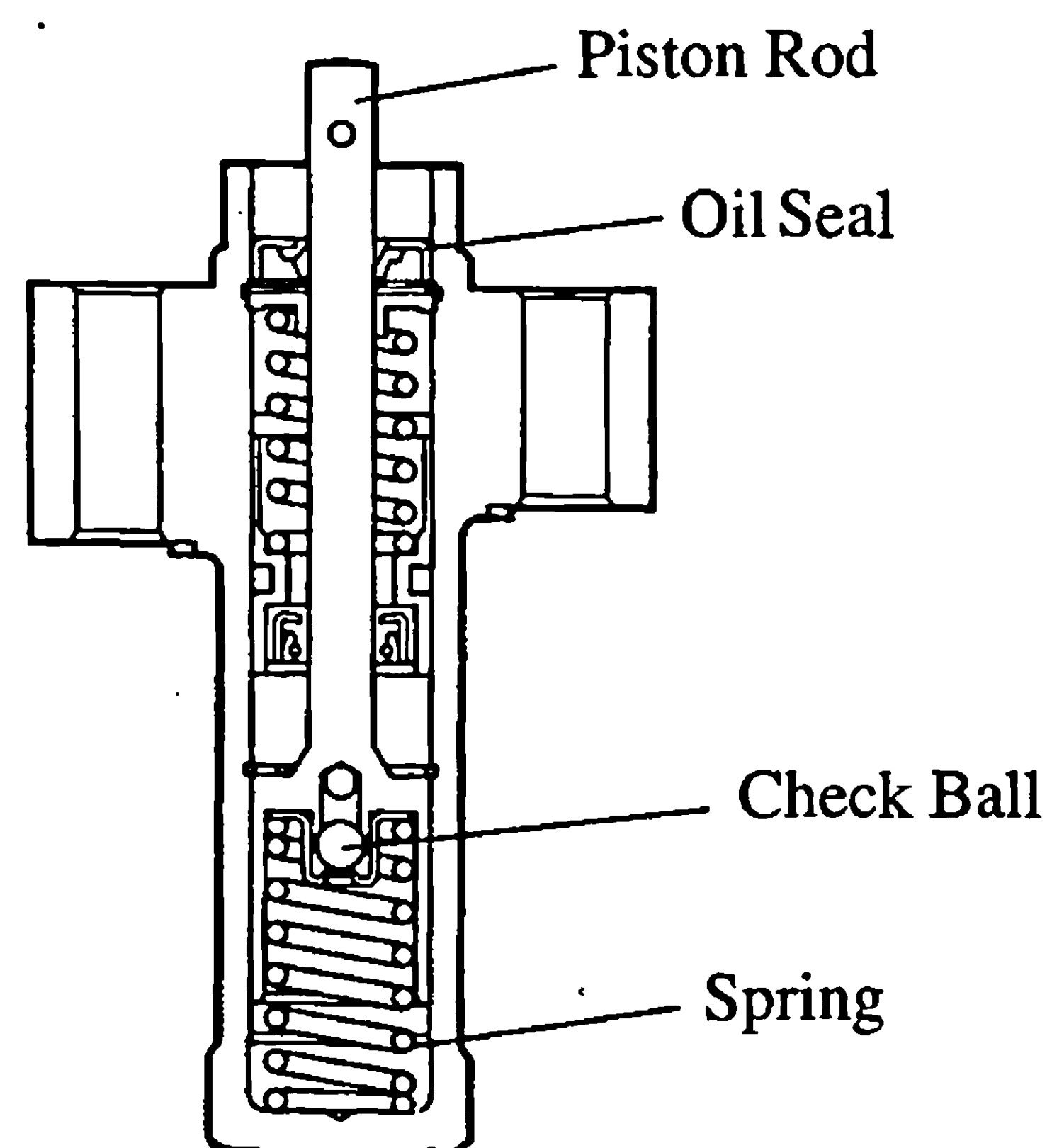


3. Timing Pulleys and Belt

- 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 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.
- The timing rotor for the crankshaft position sensor has been integrated into the crankshaft pulley.
- The protrusion rotor for the camshaft position sensor has been integrated into the right bank camshaft timing pulley.



Timing Belt

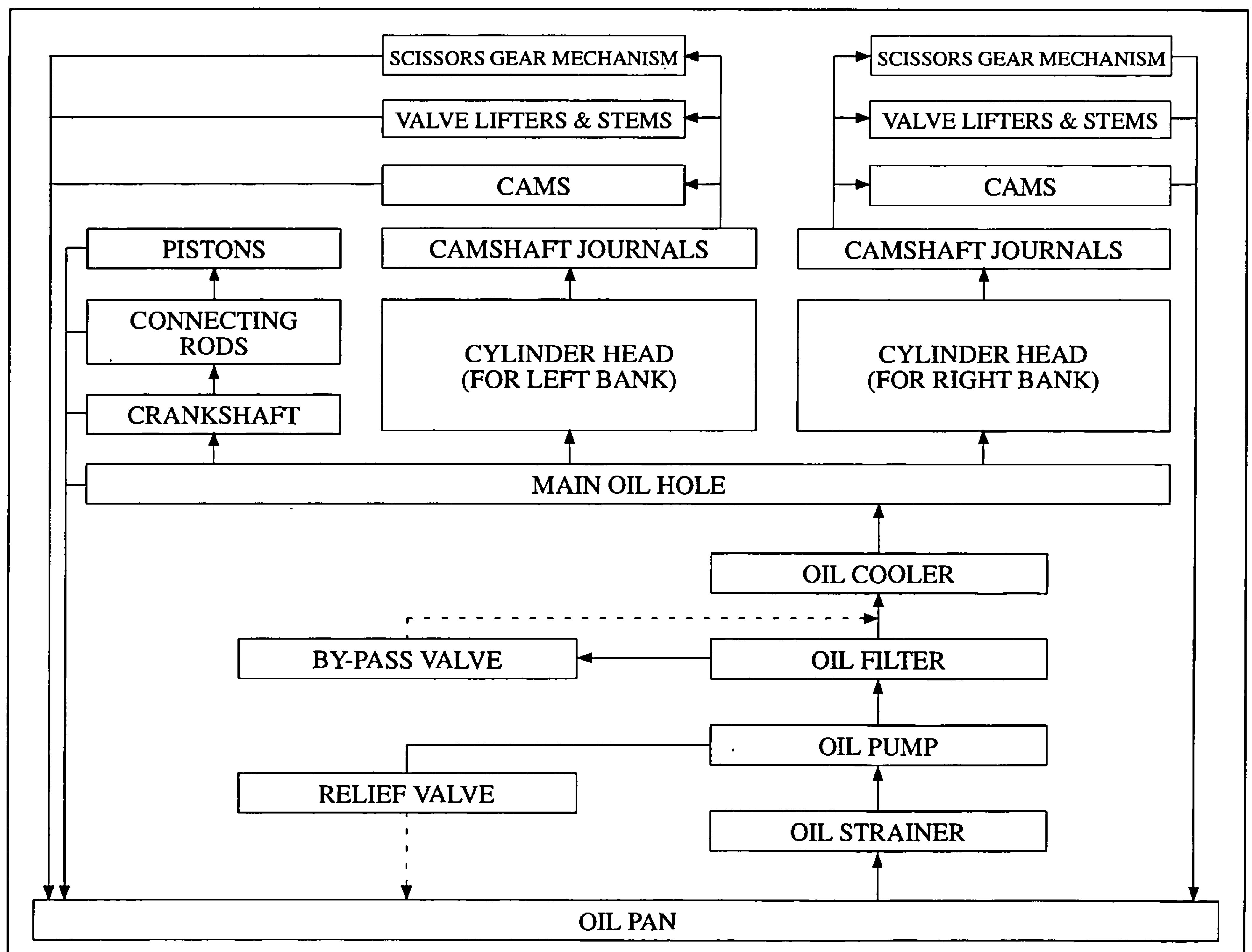
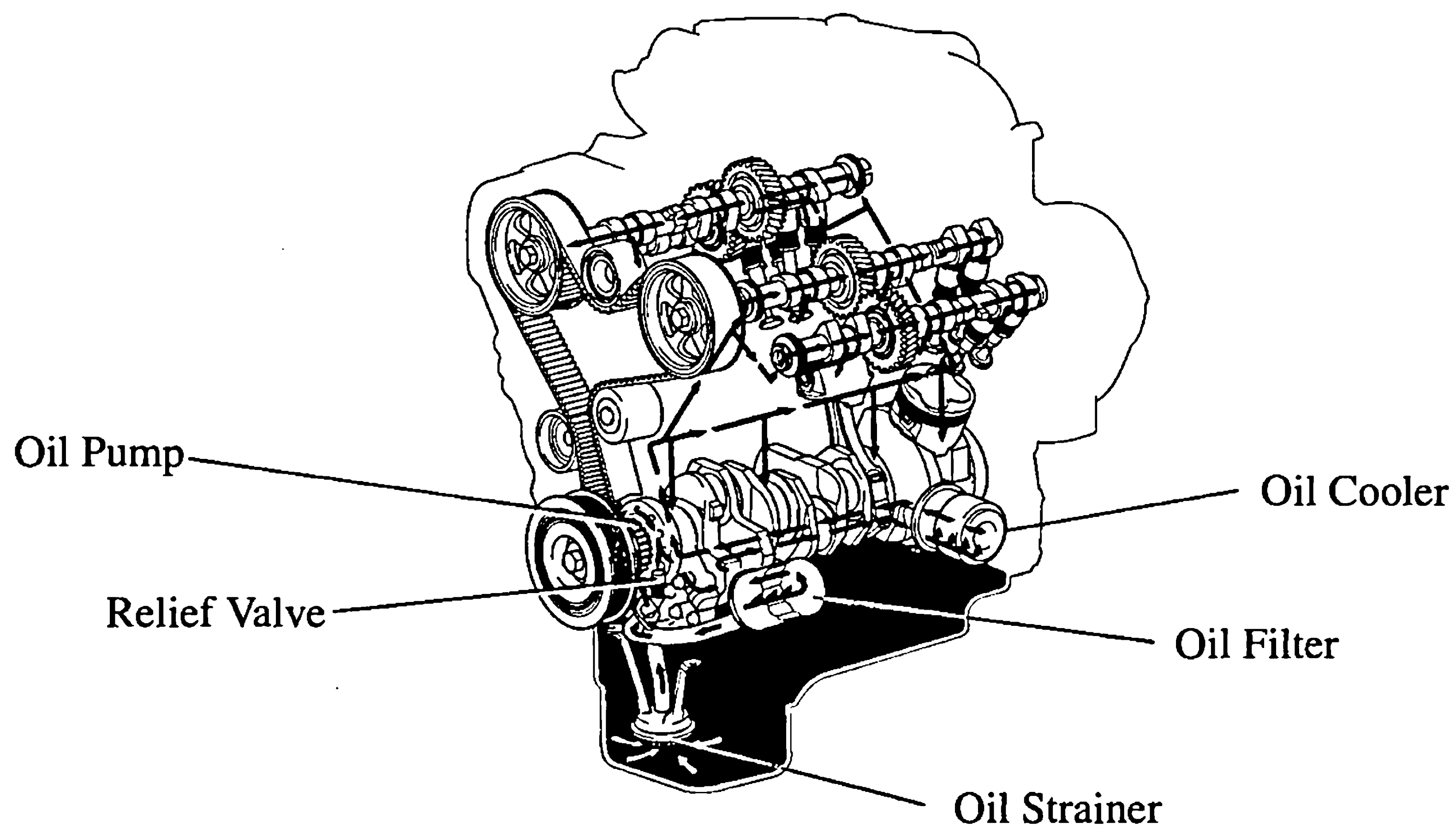


Automatic Tensioner

■ LUBRICATION SYSTEM

1. General

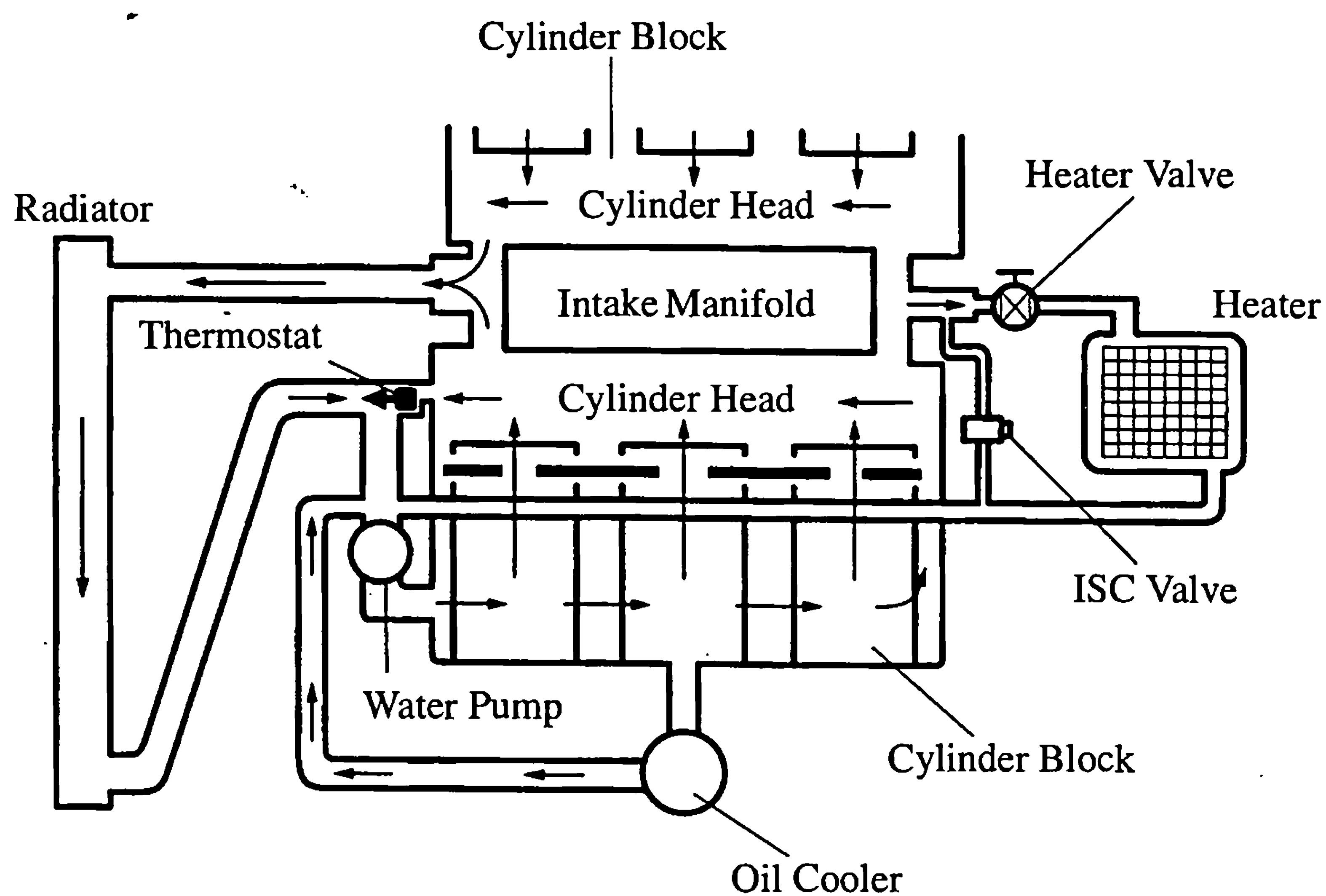
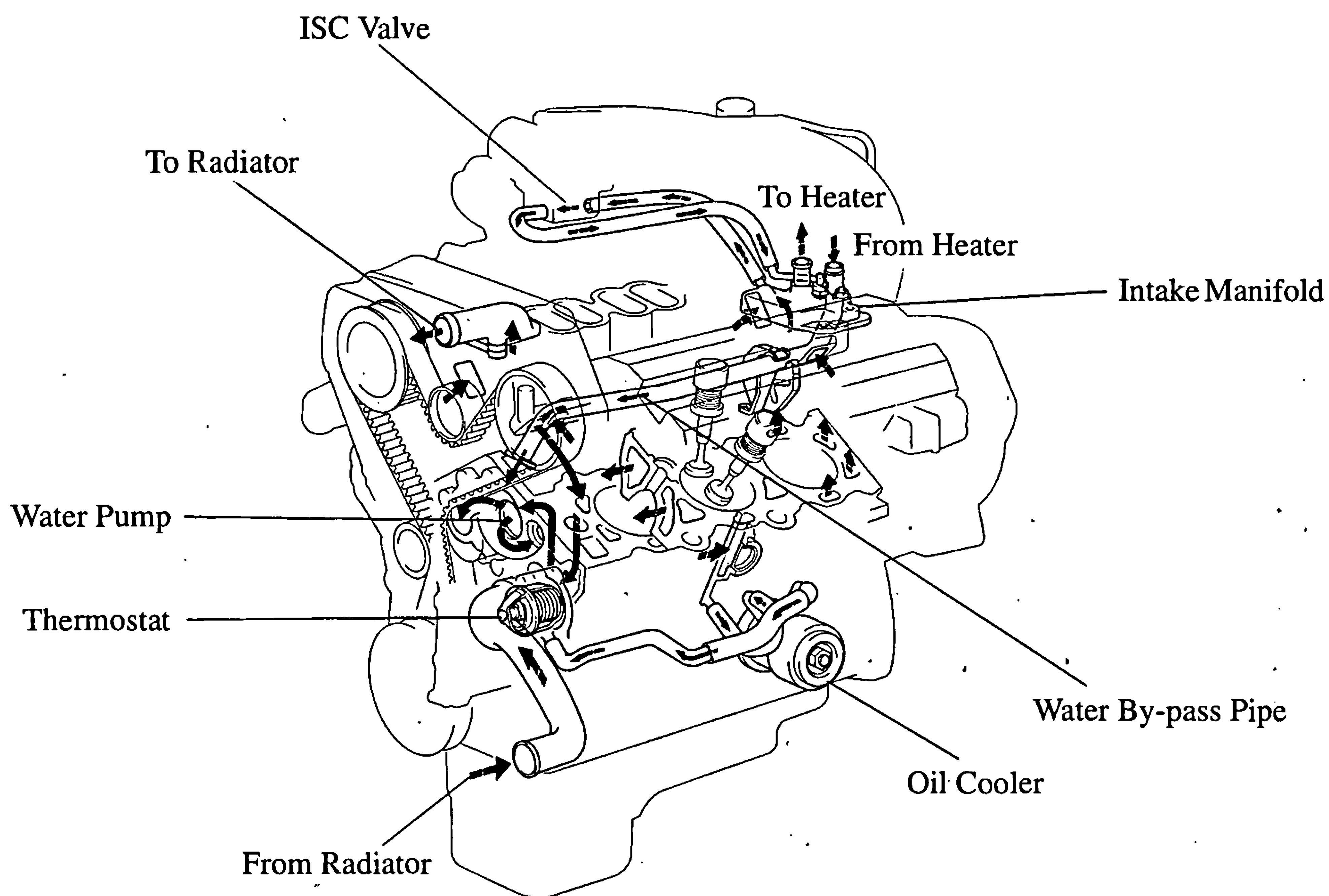
- The lubrication circuit is fully pressurized and all oil passes through an oil filter.
- A trochid gear type oil pump is directly driven by crankshaft.
- The water-cooled type engine oil cooler is used to lower the oil temperature.



■ COOLING SYSTEM

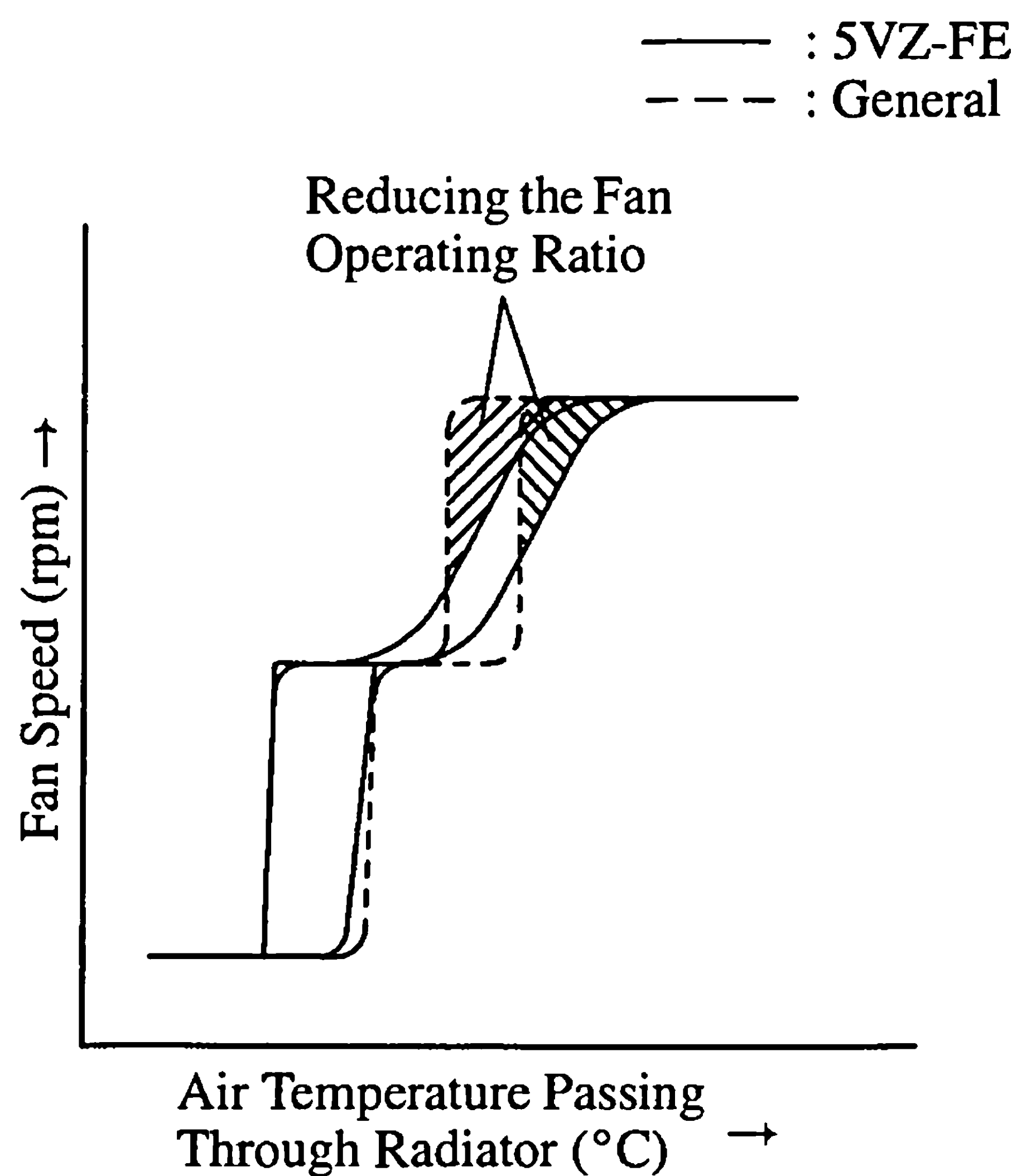
1. General

- The cooling system is a pressurized, forced-circulation type.
- The fan coupling characteristic of the temperature controlled auto-coupling fan has been improved.



2. Coupling Fan

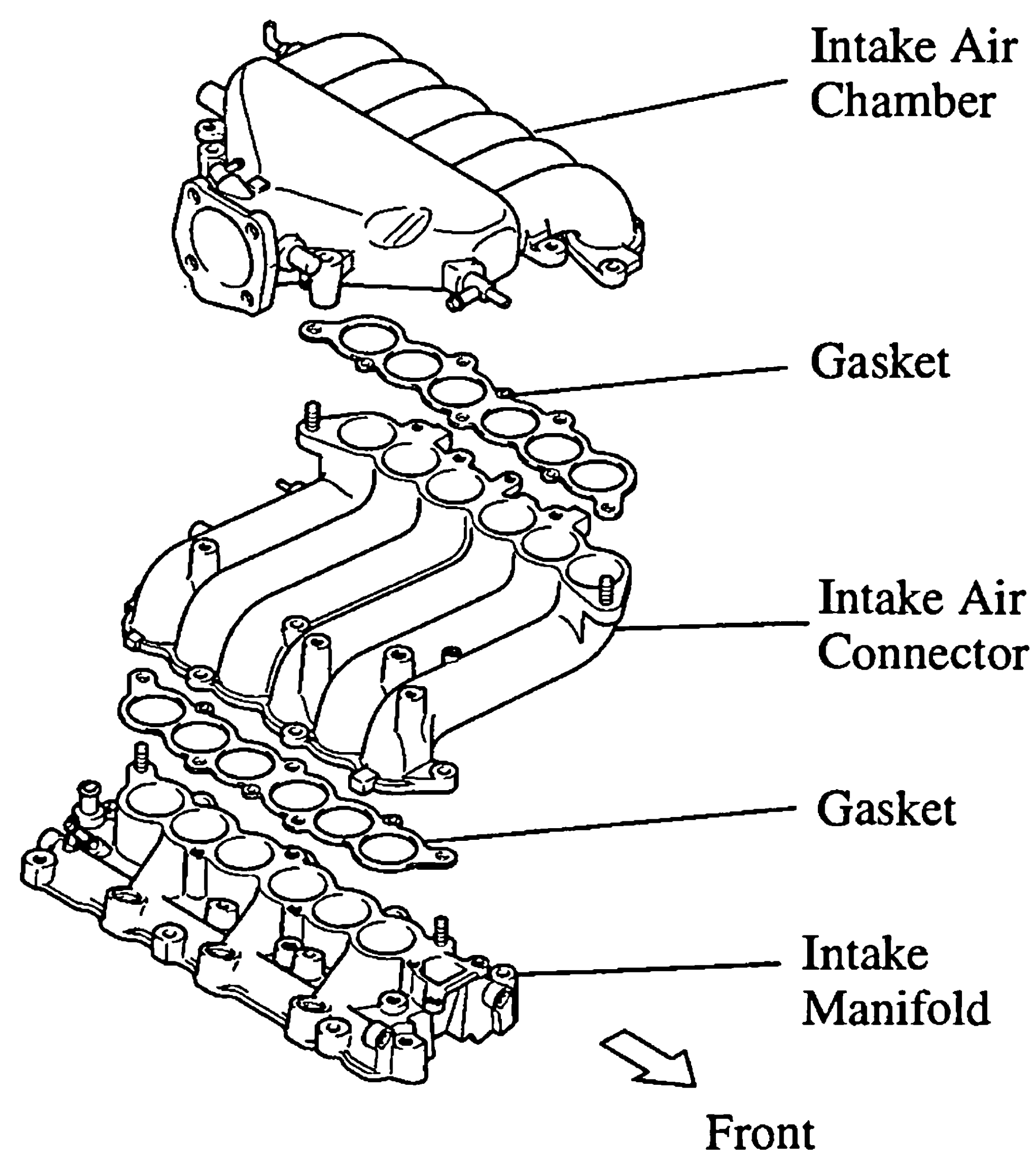
Fan coupling characteristics have been improved in order to realize improved fuel economy and quieter operation by reducing the fan operating (load) ratio.



■ INTAKE AND EXHAUST SYSTEM

1. Intake Air Chamber and Intake Manifold

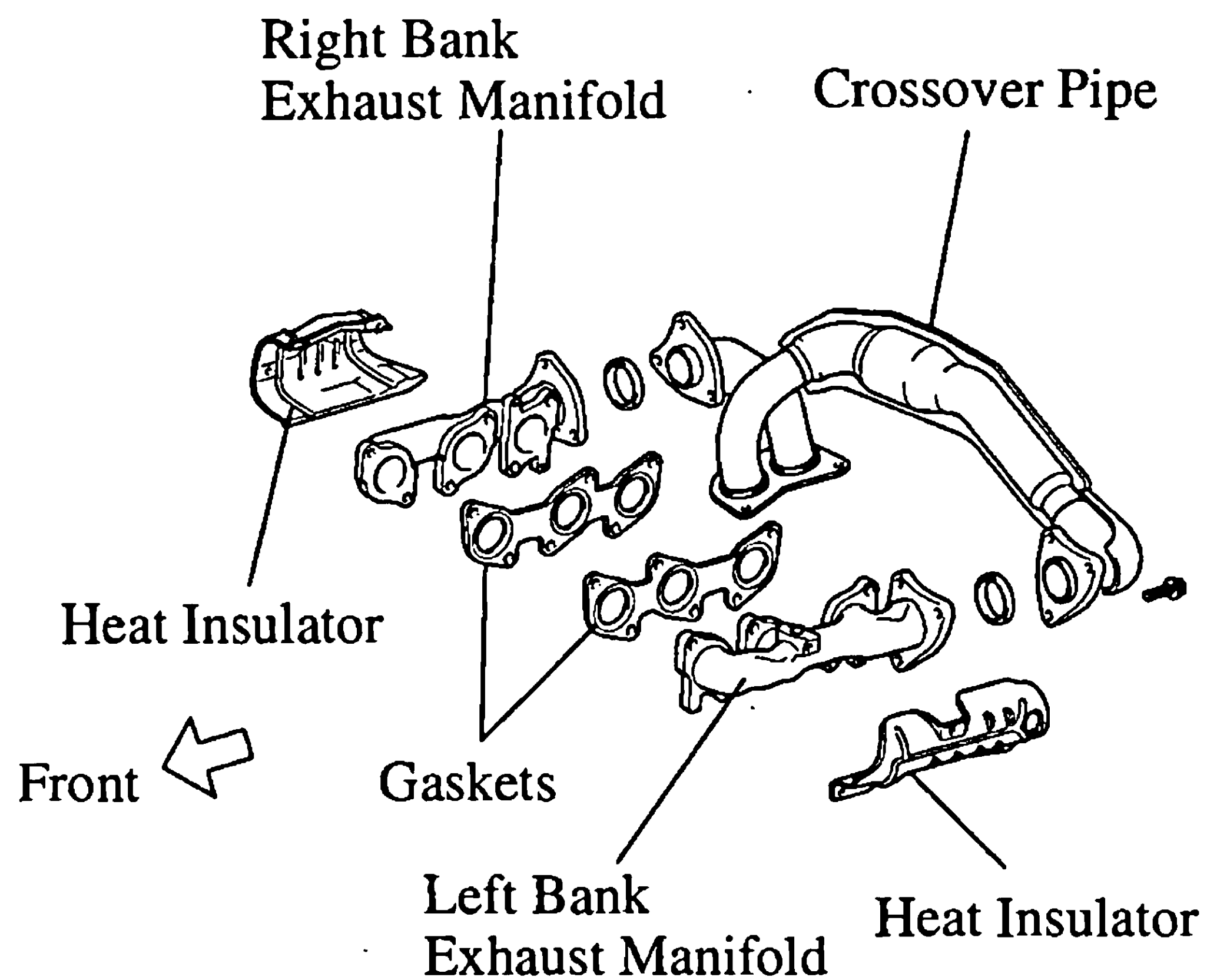
- The length and diameter of the intake manifold and intake air chamber ports have been optimized. Each port has been lengthened and equalized for enhanced intake efficiency.
- The intake manifold gasket and intake air chamber gasket have rubber coating applied onto both surfaces, and provide superior durability.



2. Exhaust Manifold

For LHD Models

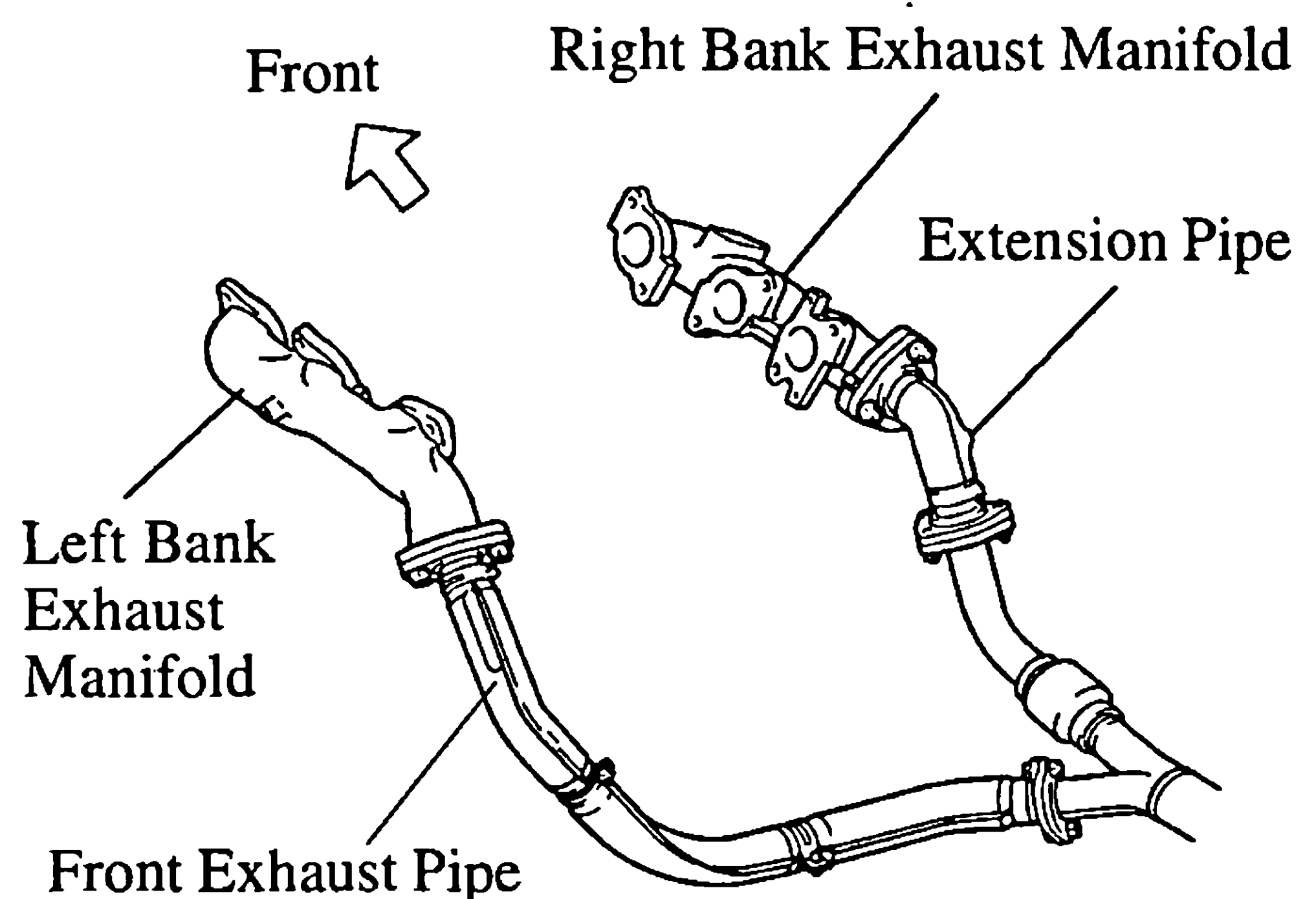
Both exhaust manifolds are connected to the front exhaust pipe via the crossover pipe.



EG

For RHD Models

The left bank exhaust manifold is connected directly to the front exhaust pipe. The right bank exhaust manifold is connected to the front exhaust pipe via the extension pipe.



3. 2-Way Exhaust Control System

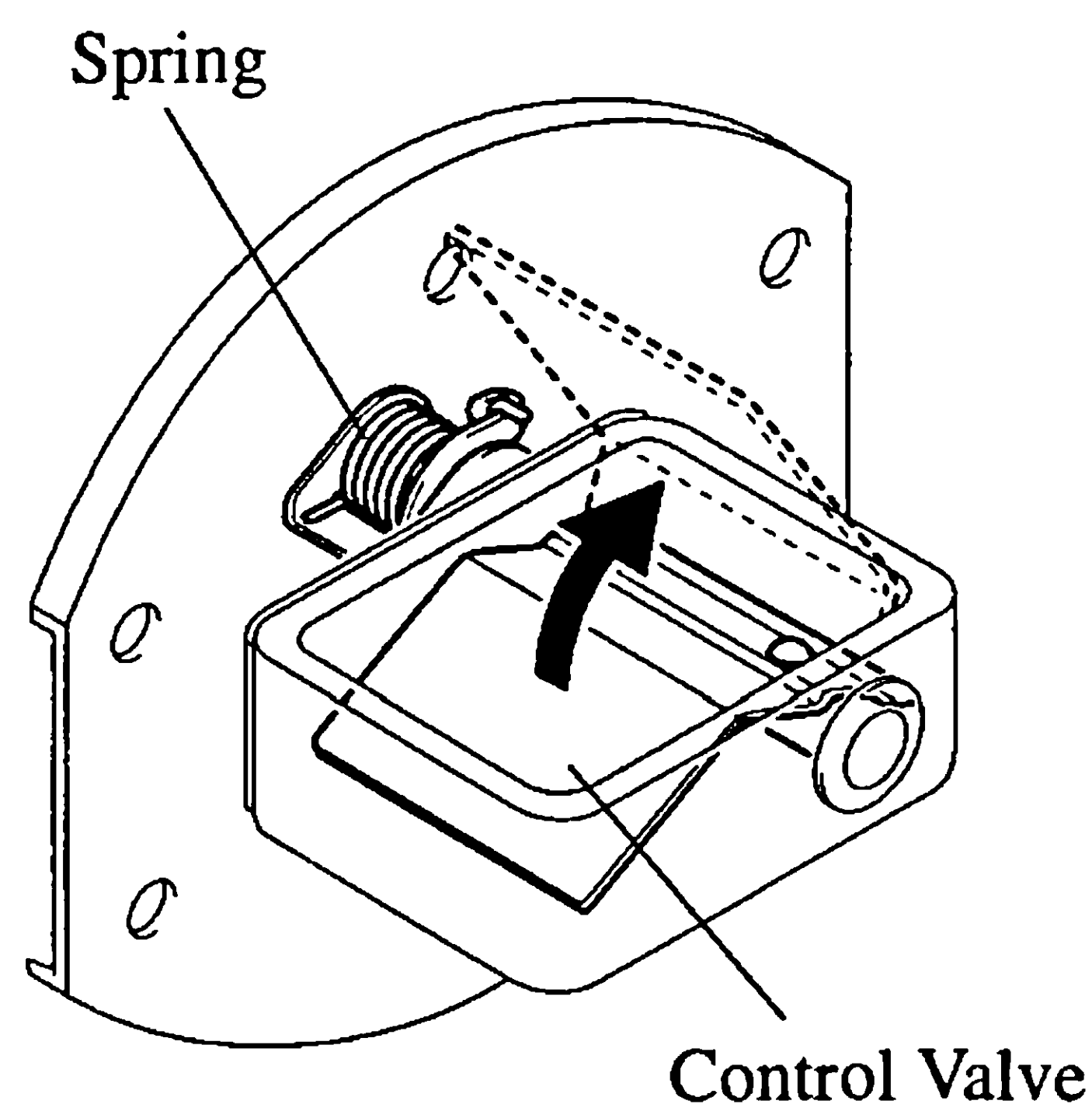
General

- A 2-way exhaust control system is used. This system reduces the back pressure by opening and closing a variable valve that is enclosed in the main muffler, thus varying the exhaust gas passage.
- The valve opens steplessly in accordance with the operating condition of the engine, thus enabling a quieter operation at lower engine speeds, and reduces back pressure at higher engine speeds.

Construction

1) Control Valve

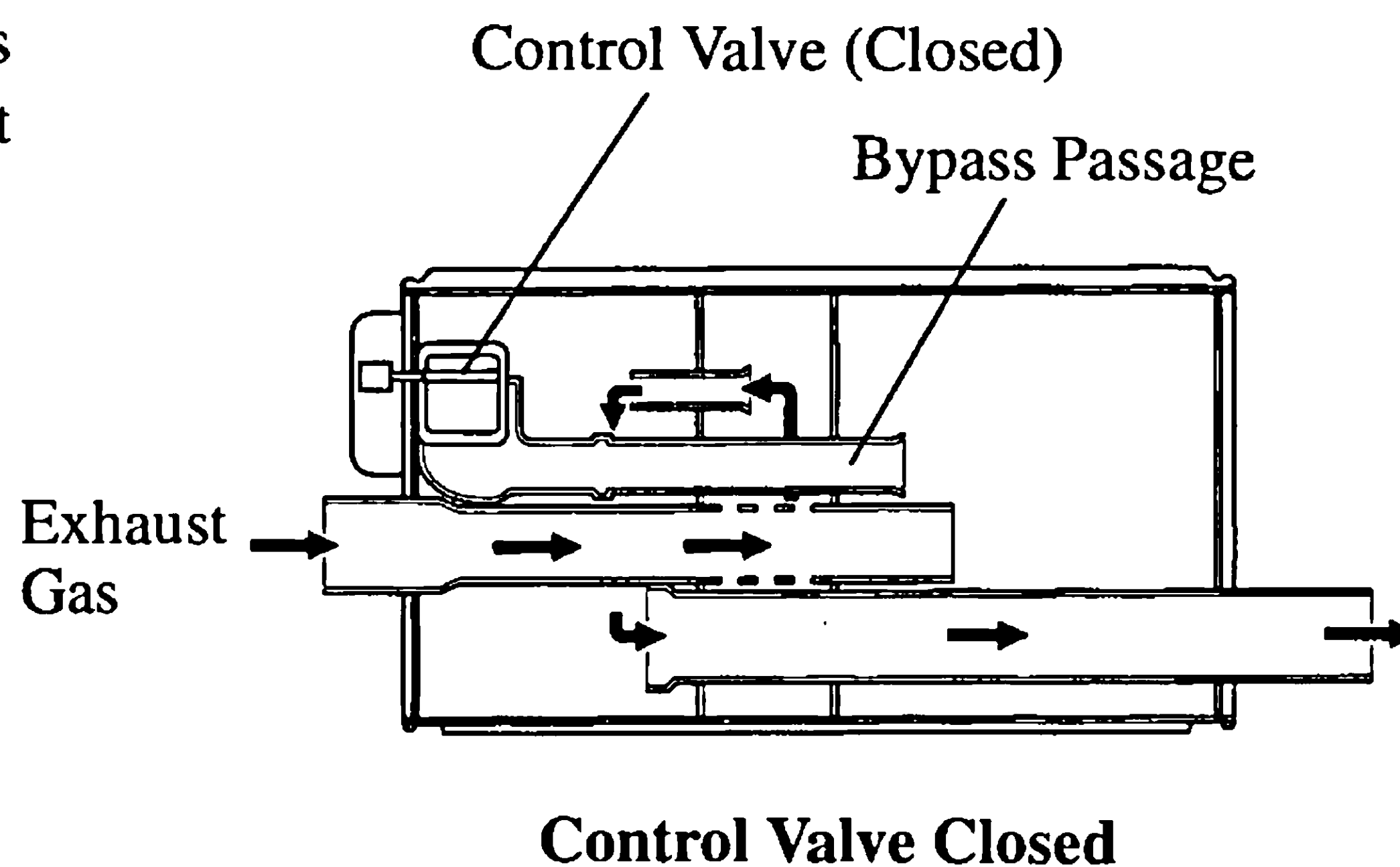
The control valve is enclosed in the main muffler. When the exhaust gas pressure overcomes the spring pressure, the control valve opens steplessly in accordance with the exhaust gas pressure.



Operation

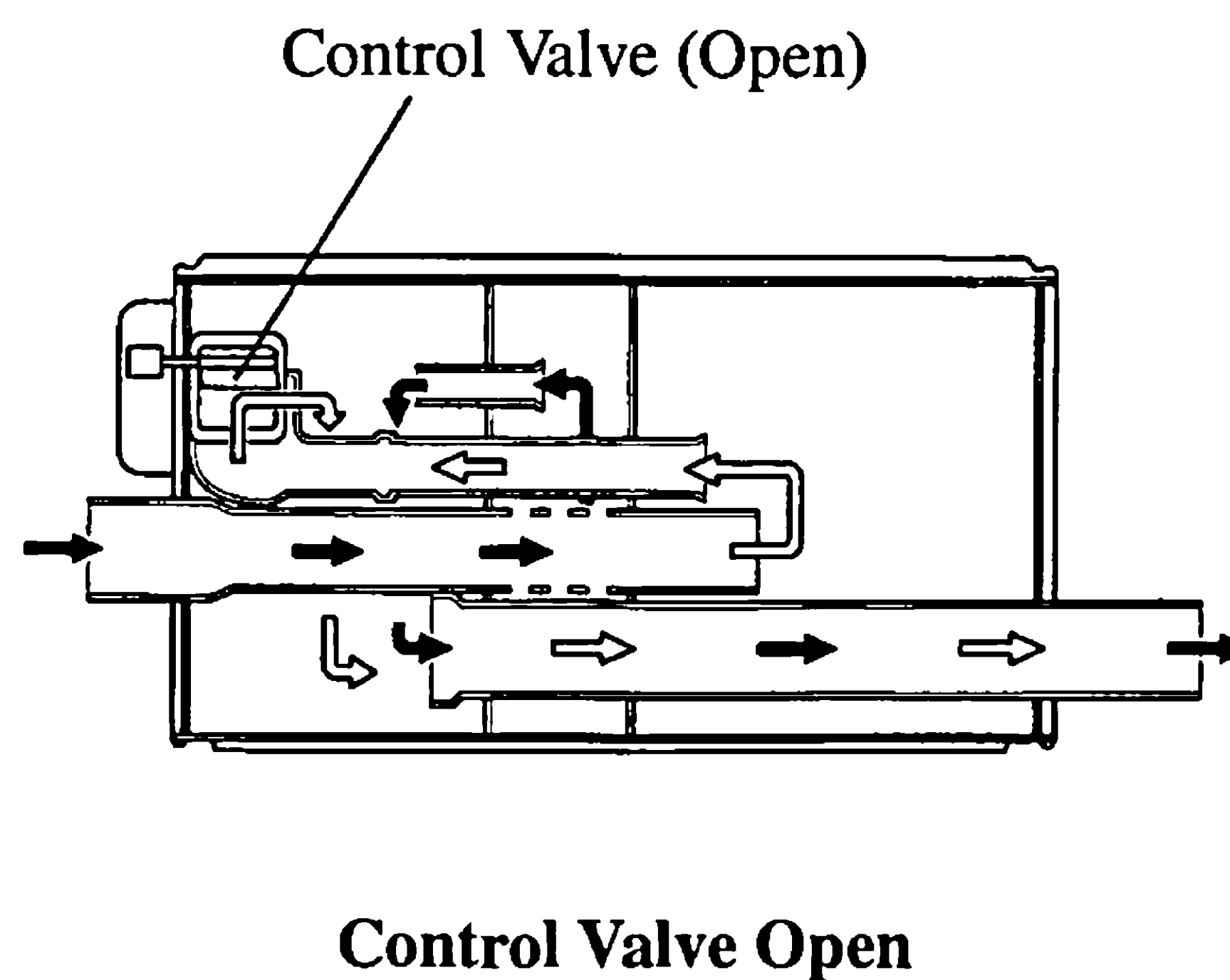
1) When Control Valve is Closed (low engine speed)

Since the pressure in the main muffler is low, the control valve is closed. Hence exhaust gas does not pass the bypass passage, and exhaust noise is decreased by the main muffler.



2) When Control Valve is Open (middle to high engine speed)

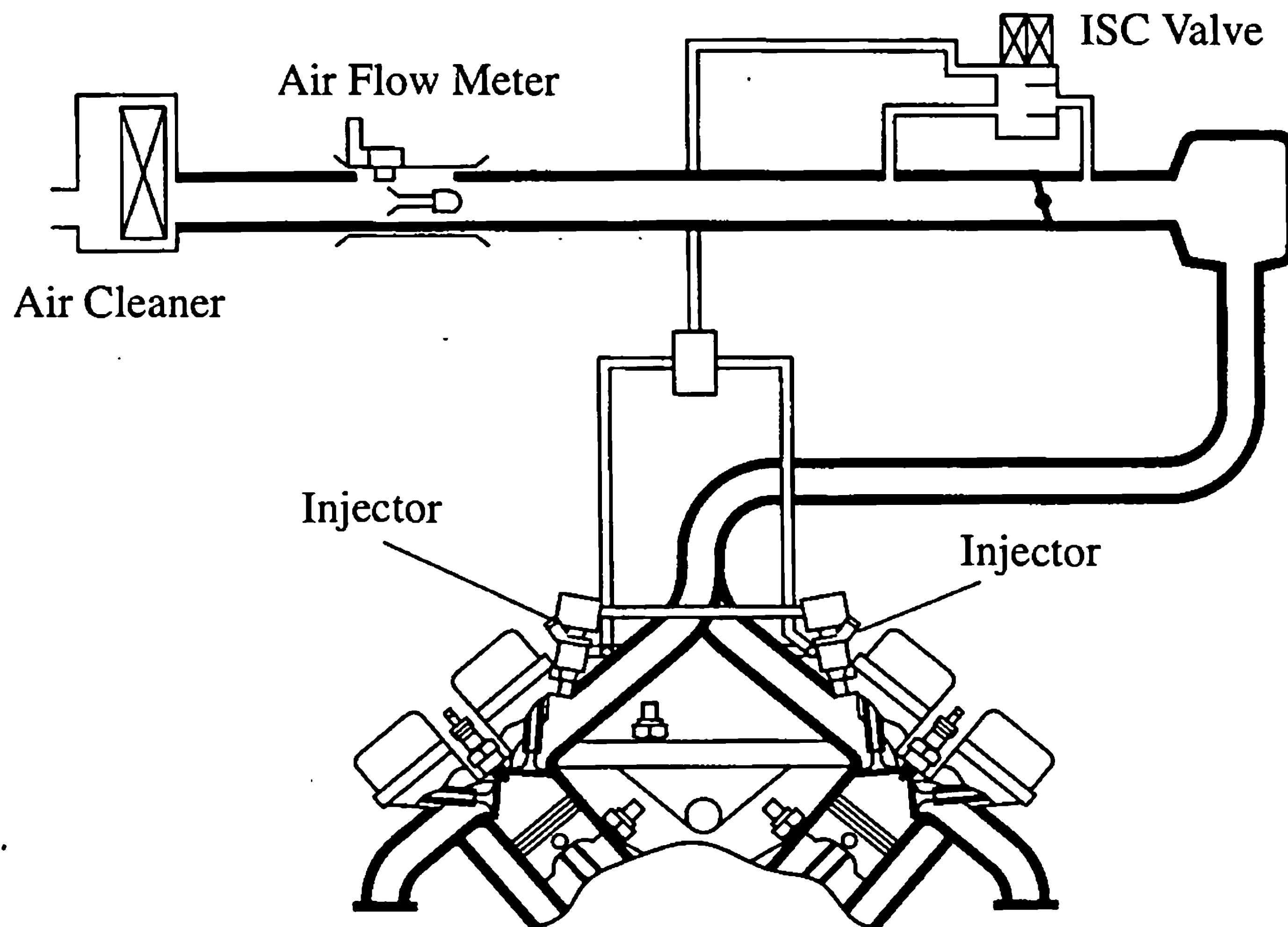
The valve opens more as the engine speed and the back pressure in the muffler increase. This allows a large volume of exhaust gas to pass the bypass passage thereby substantially decreasing the back pressure.



■ FUEL SYSTEM

1. Air Assist System

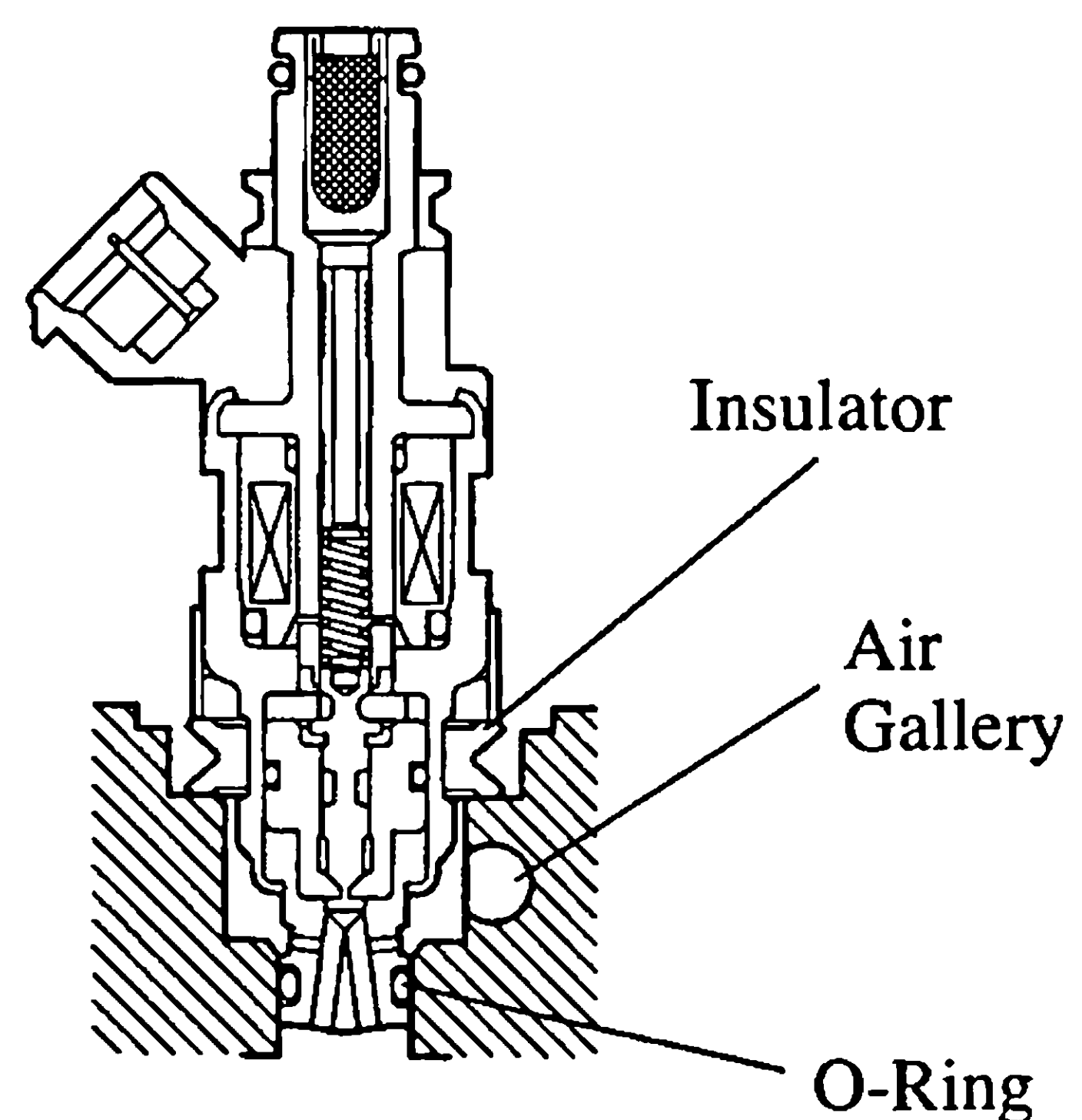
This system is designed to regulate air intake to the upstream (atmospheric side) of the throttle valve using the ISC (Idle Speed Control) valve, and direct it to the nozzle of the fuel injector inside the intake manifold (negative pressure side). This promotes atomization of the fuel while reducing emissions and improving fuel economy and idle stability.



EG

2. Fuel Injector

- The 2-hole type fuel injectors are used.
- Air introduced from the ISC valve, air pipe 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.



3. Pressure Regulator

Previously, the intake manifold vacuum was applied to the diaphragm chamber of the pressure regulator. This method was used to ensure that the fuel pressure applied to the injector was constantly higher than the vacuum in the intake manifold into which the fuel is actually injected.

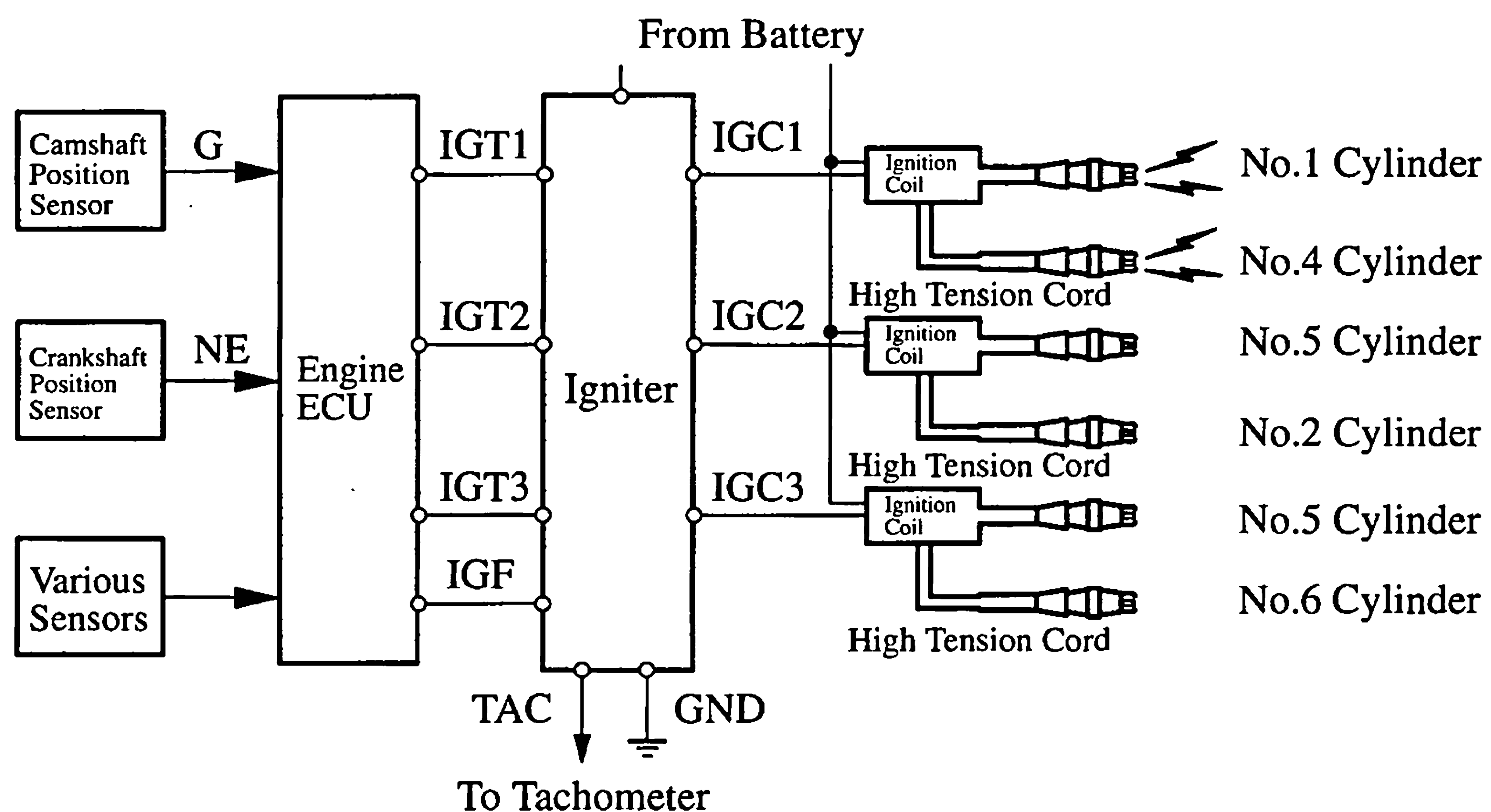
In the 5VZ-FE engine, atmospheric pressure is applied to the diaphragm chamber of the pressure regulator, ensuring a constant fuel pressure. Any injection volume variances owing to fluctuations in the intake manifold pressure are corrected by the engine ECU that increases or decreases the length of fuel injection time.

■ IGNITION SYSTEM

1. General

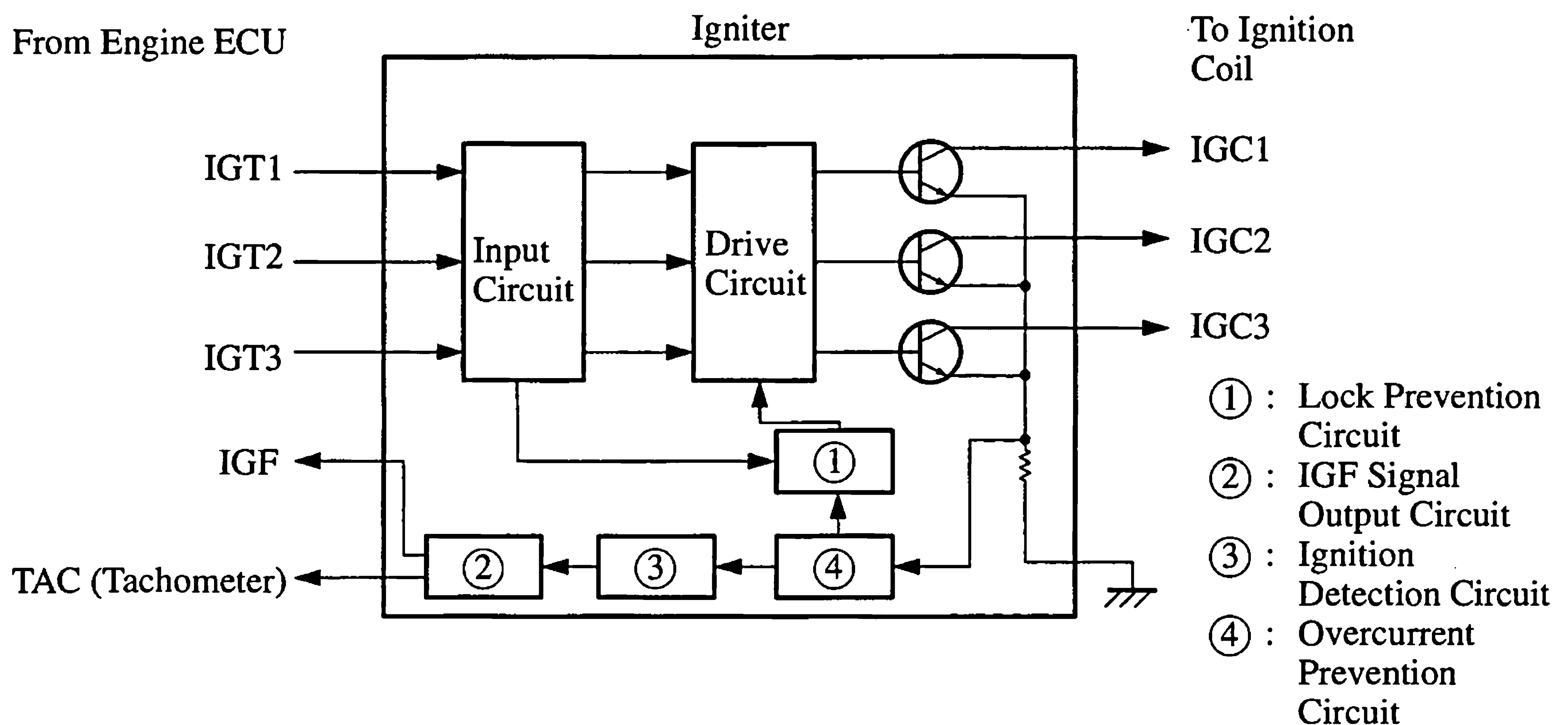
A DIS (Direct Ignition System) has been adopted in the new 5VZ-FE engine. The DIS improves the ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor.

The DIS in new 5VZ-FE engine is a 2-cylinder simultaneous ignition system which ignites 2-cylinders simultaneously with one ignition coil.



2. Igniter

The internal system diagram of the igniter is shown below. A characteristic of this igniter is that it contains the 3 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 current (IGC) for all ignition coils. At the same time, the igniter also sends an ignition confirmation signal (IGF) as a fail-safe function to the engine ECU.

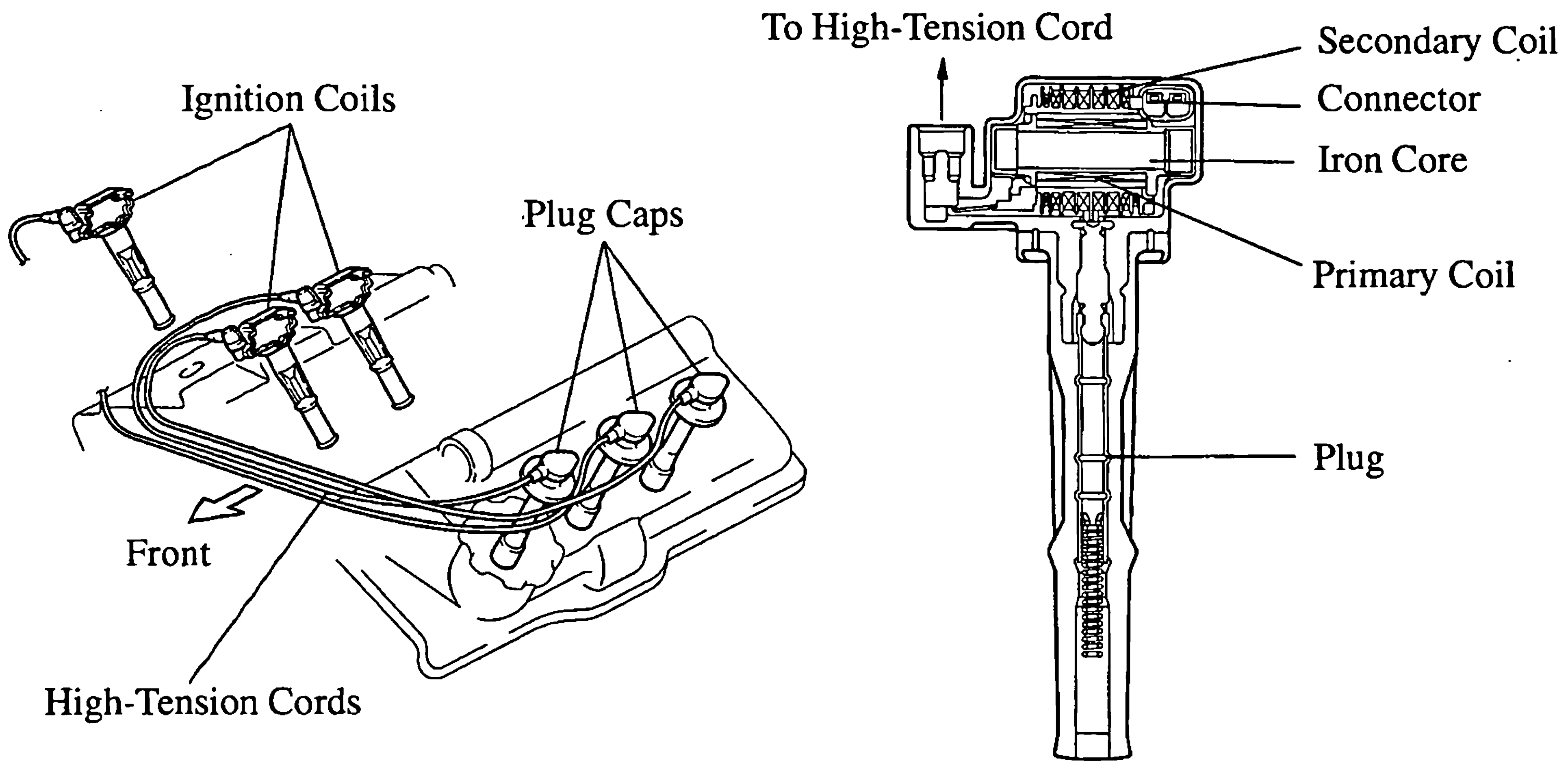


3. Ignition Coil

1) Construction

The DIS system of the 5VZ-FE engine consists of 3 sets of ignition coils integrated with plug caps and with the high-tension cords attached directly onto the ignition coil.

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.

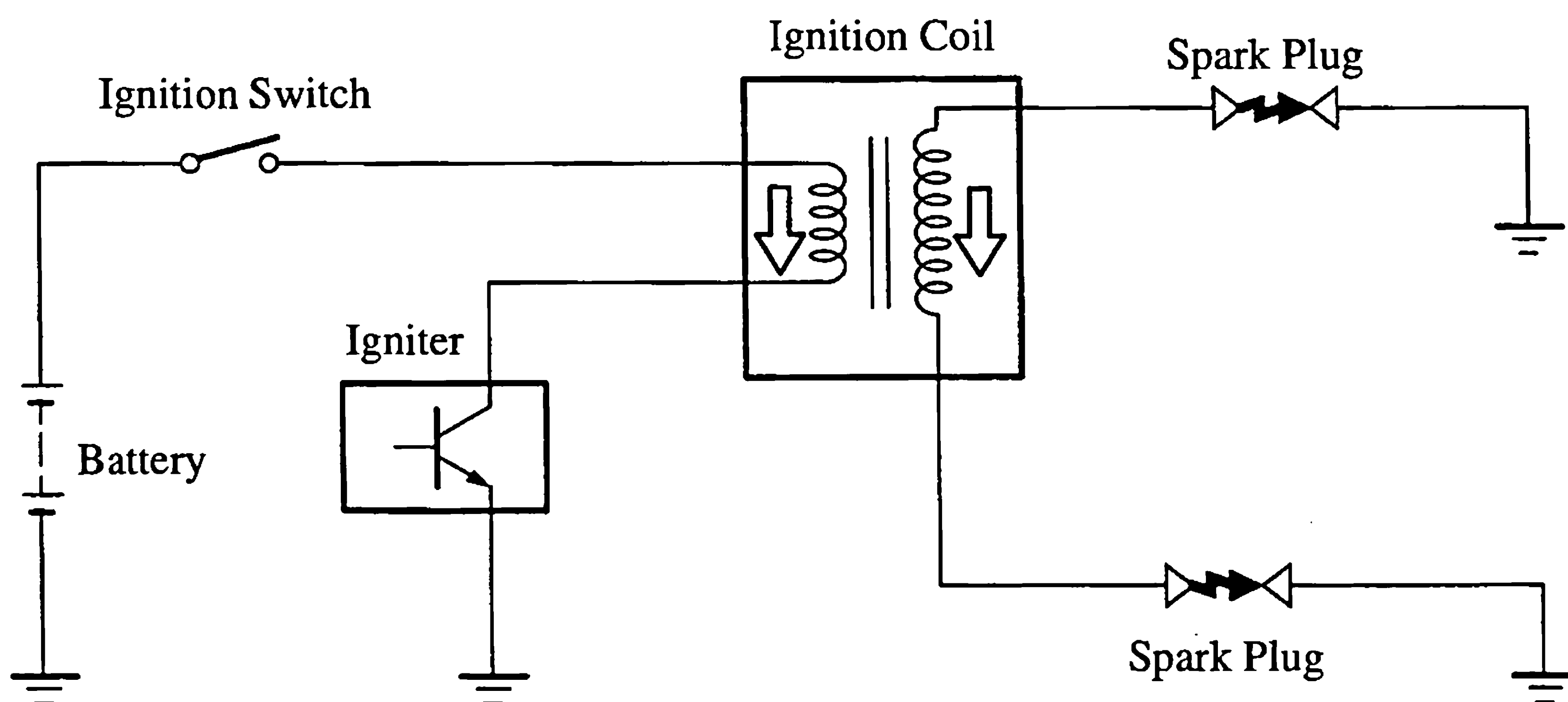


Ignition Coil Cross Section

EG

2) Operation

In the DIS system of the 5VZ-FE engine, each spark plug is connected to the end of the secondary winding. High voltage generated in the secondary winding is applied directly to 2 spark plugs. The sparks of the 2 spark plugs pass simultaneously from the center electrode to the ground electrode.

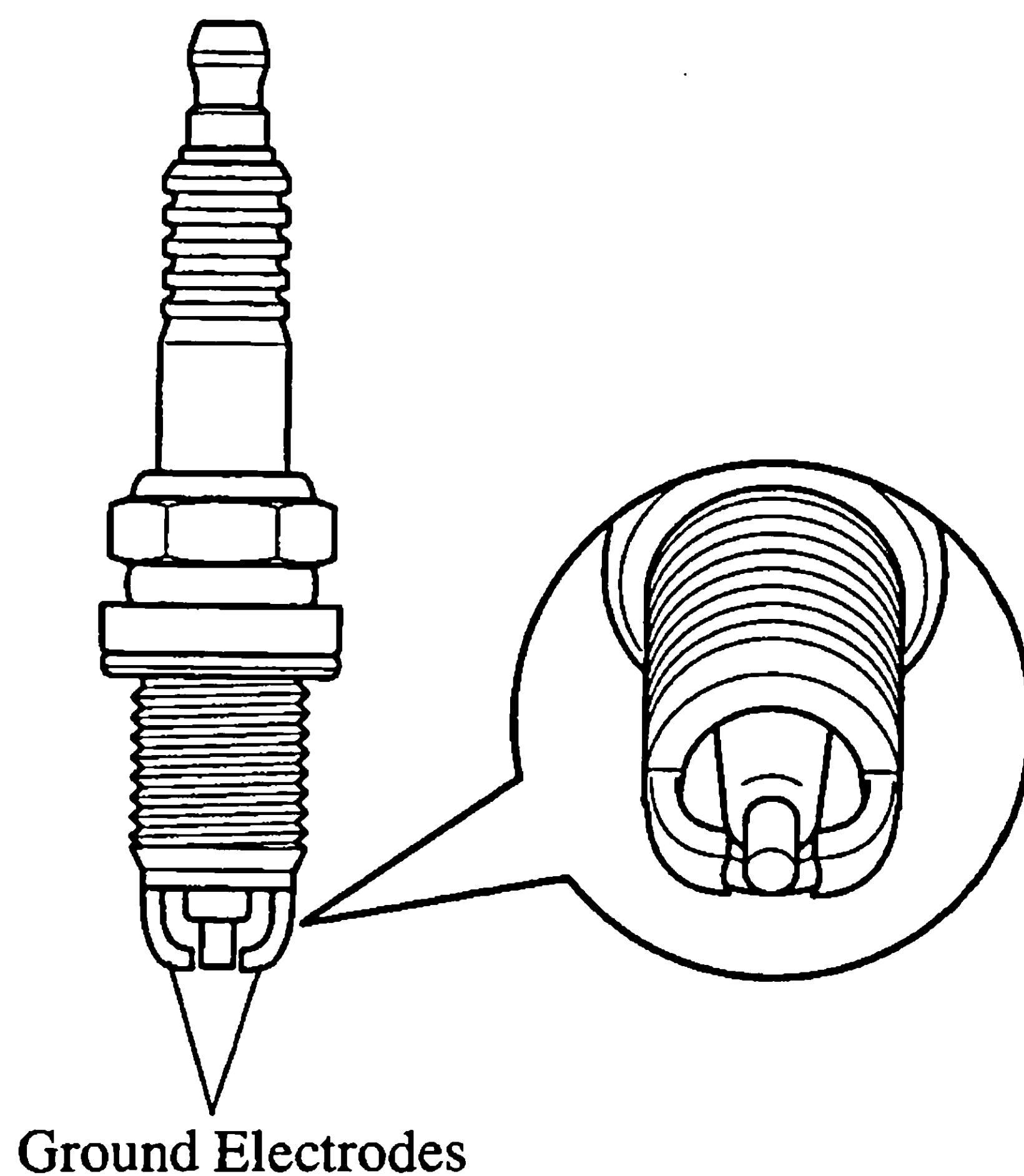


4. Spark Plugs

Twin ground electrode type spark plugs are used on the 5VZ-FE engine. Due to the employment of the DIS system, the number of spark produced is double that produced in the conventional ignition system. To maintain spark plug durability, the ground electrodes have been made bipolar.

► Recommended Spark Plugs ◀

Type	ND-made	K16TR11
	NGK-made	BKR5EKB-11
Plug Gap		1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)



■ ENGINE CONTROL SYSTEM

1. General

The sequential multiport fuel injection system that uses hot-wire type air flow meter and the idle speed control system that uses a rotary solenoid type ISC valve are adopted in the engine control system for the 5VZ-FE engine.

The engine control system for the 5VZ-FE engine has the following system.

System	Outline
EFI (Electronic Fuel Injection)	● An L-type EFI system directly detects the intake air mass with a hot-wire type air flow meter. ● The fuel injection system is a sequential multipoint fuel injection system.
ESA (Electronic Spark Advance)	● Ignition timing is determined by the 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. ● 2 knock sensors are used to further improve knock detection.
ISC (Idle Speed Control)	A rotary solenoid type ISC valve controls the fast idle and idle speeds.
Fuel Pump Control	Fuel pump operation is controlled by signals from the engine ECU based on the engine speed signal (Ne).
Oxygen Sensor Heater Control* ¹	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.
Air Conditioner Control* ²	By turning the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Sub Fuel Tank Control	Drivers use the fuel tank changeover switch to select the fuel tank (main or sub) they wish to use.
Engine Immobiliser* ³	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.
Diagnosis	● When the engine ECU detects a malfunction, the engine ECU diagnoses 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	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in memory.

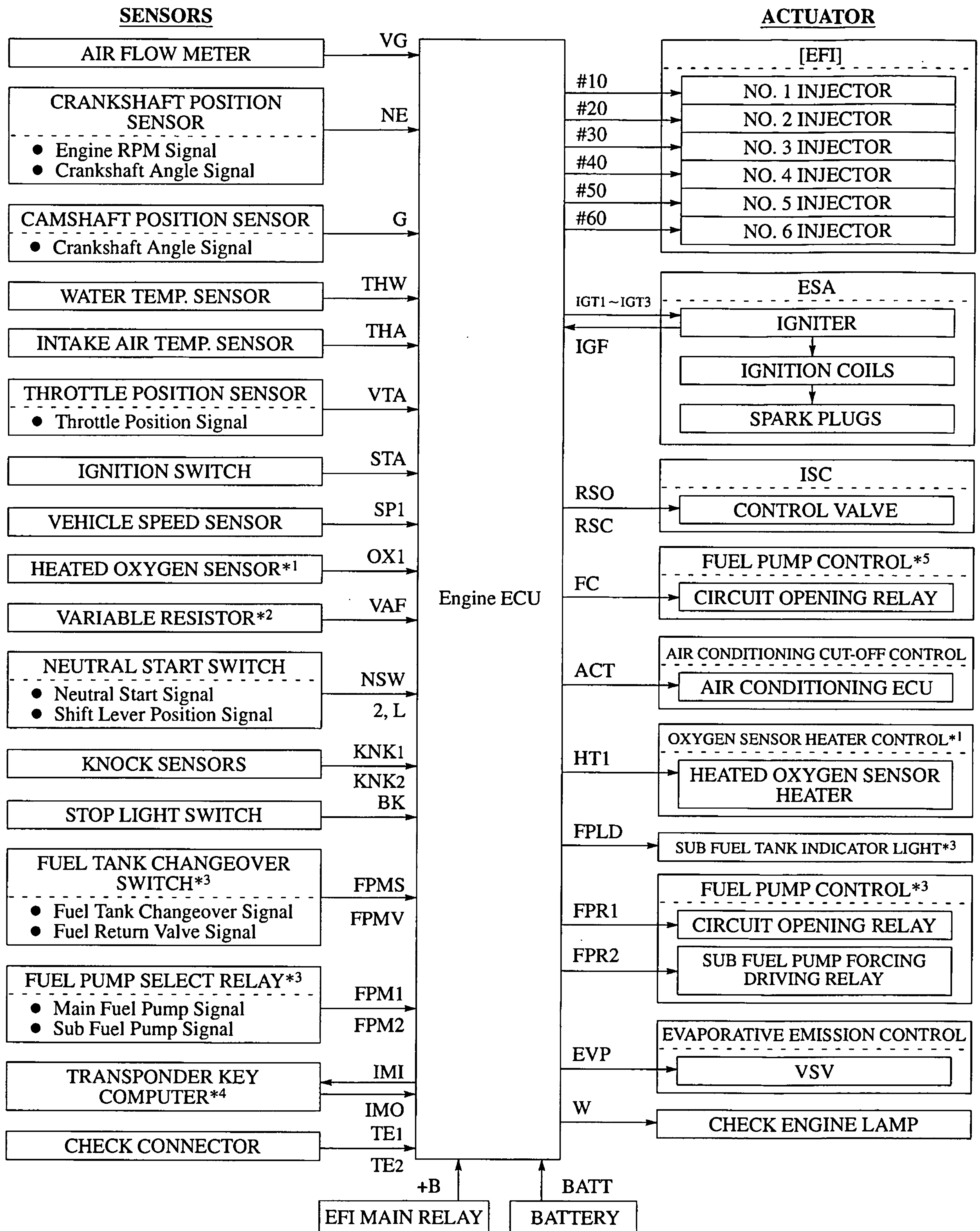
*¹: Models for Europe and Thailand.

*²: Only on models equipped with sub fuel tank system.

*³: Vehicles equipped with the engine immobiliser system.

2. Construction

The configuration of the engine control system of the 5VZ-FE engine is as shown in the following chart.



*1: Models for Europe and Thailand.

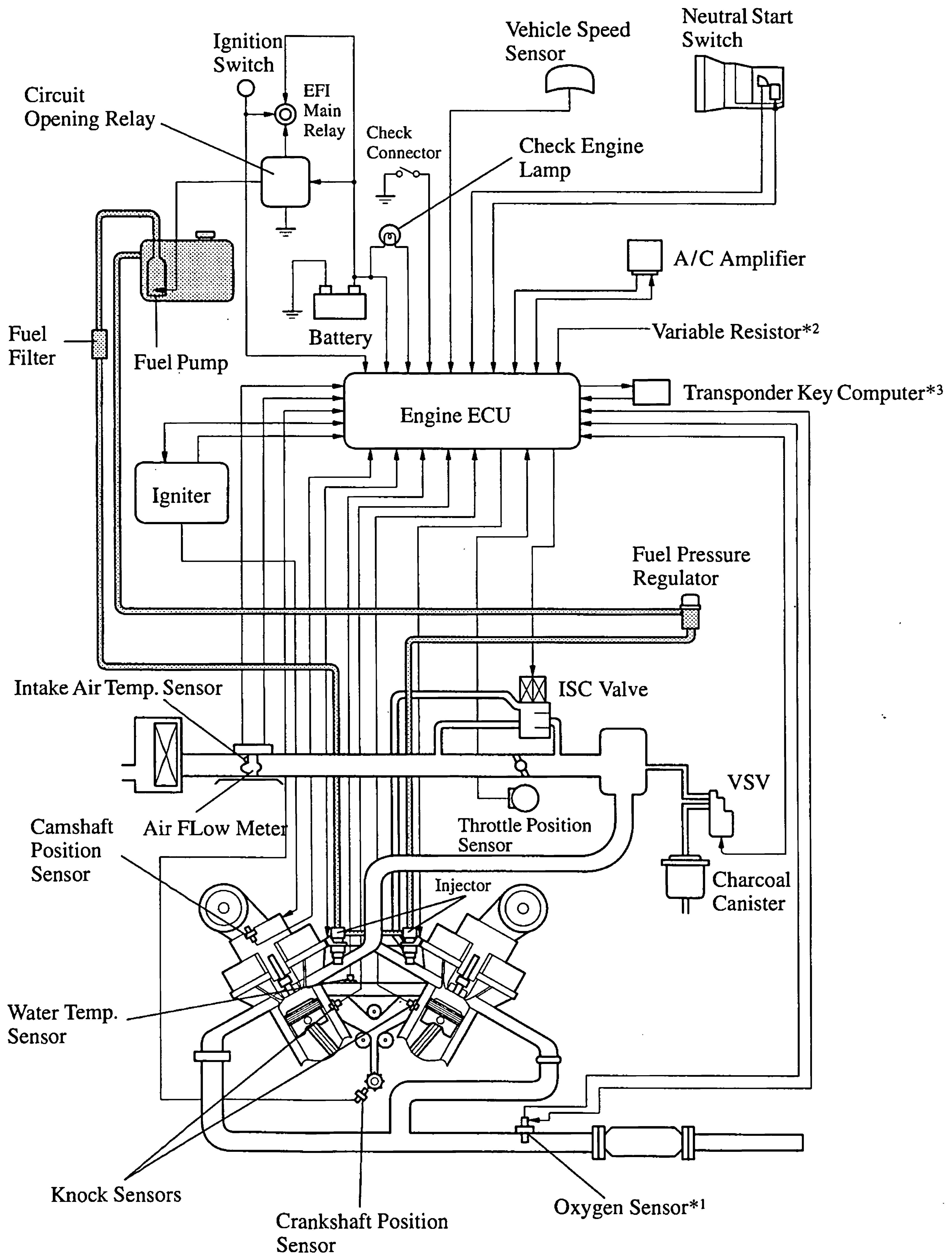
*2: Models for Australia, G.C.C. Countries and Chaina.

*3: Only on models equipped with sub fuel tank system.

*4: Only on models for Europe and Australia equipped with the engine immobiliser system.

*5: Only on models without sub fuel tank system.

3. Engine Control System Diagram



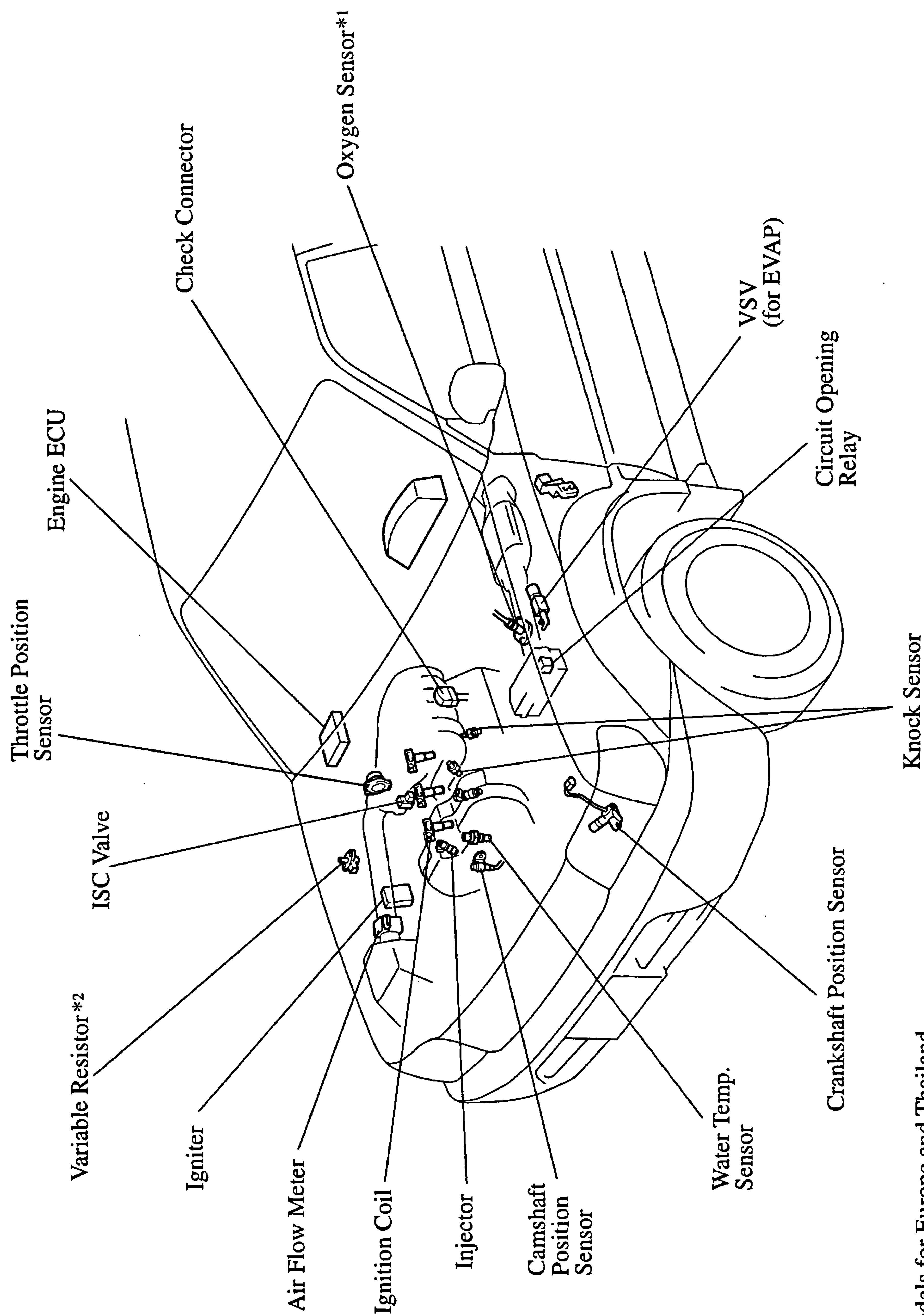
EG

*1: Models for Europe and Thailand.

*2: Models for Australia, G.C.C. Countries and China.

*3: Only on models for Europe and Australia equipped with the engine immobiliser system.

4. Layout of Components



*1 : Models for Europe and Thailand.

*2 : Models for Australia, G.C.C. Countries and China.

5. Main Components of Engine Control System

General

The main components of the 5VZ-FE engine control system are as follows:

Component	Outline
Air Flow Meter	Hot-Wire Type
Crankshaft Position Sensor	Pick-Up Coil Type, 1
Camshaft Position Sensor	Pick-Up Coil Type, 1
Throttle Position Sensor	Linear Type
Oxygen Sensor	With Heater Type
Knock Sensor	Built-In Piezoelectric, 2
Fuel Injector	2-Hole Type with Air Assist
ISC Valve	Rotary Solenoid Type

EG

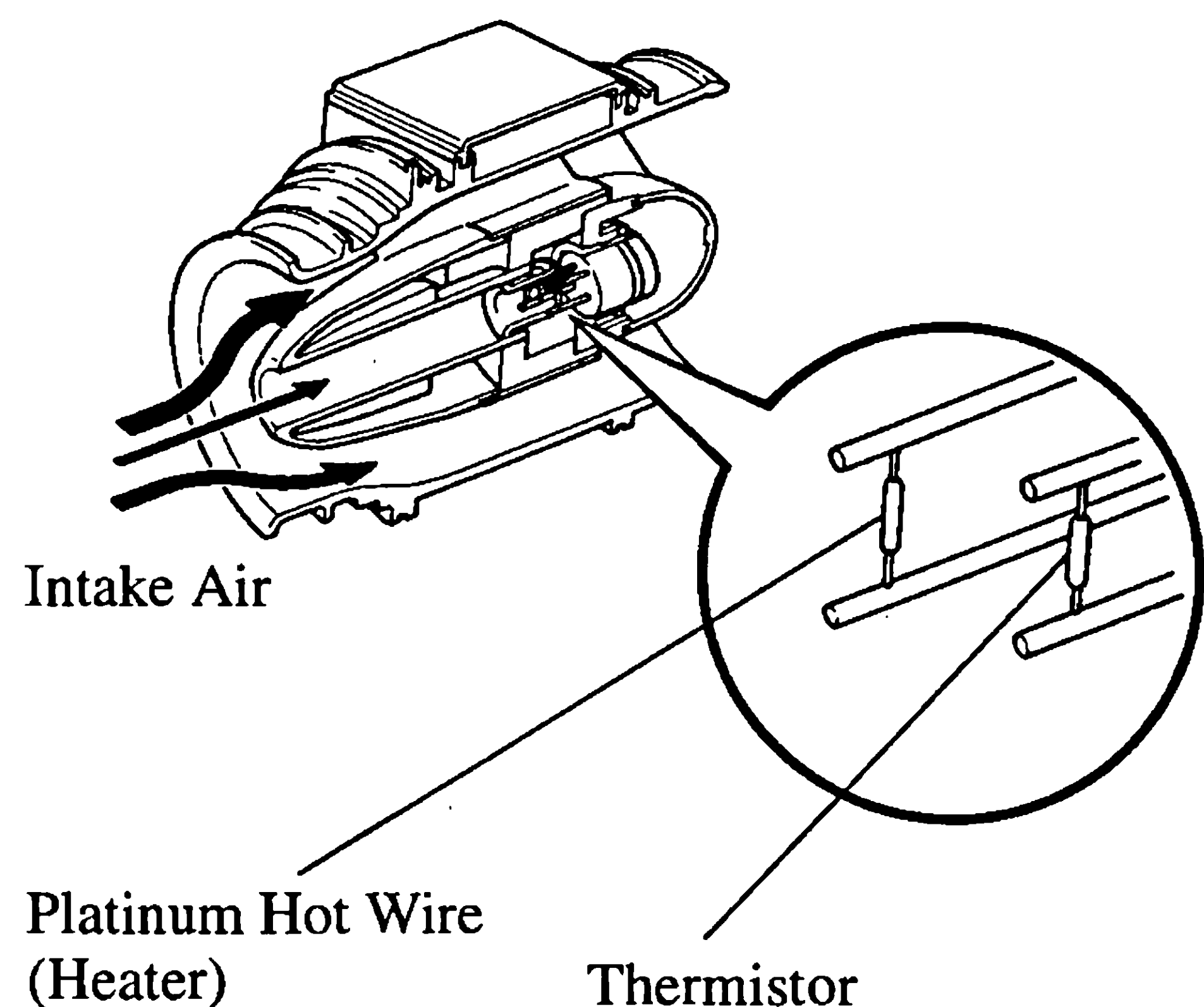
Air Flow Meter

1) Description

The 5VZ-FE engine adopts the hot-wire type air flow meter designed for direct electrical measurement of the intake air mass flow.

This 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:

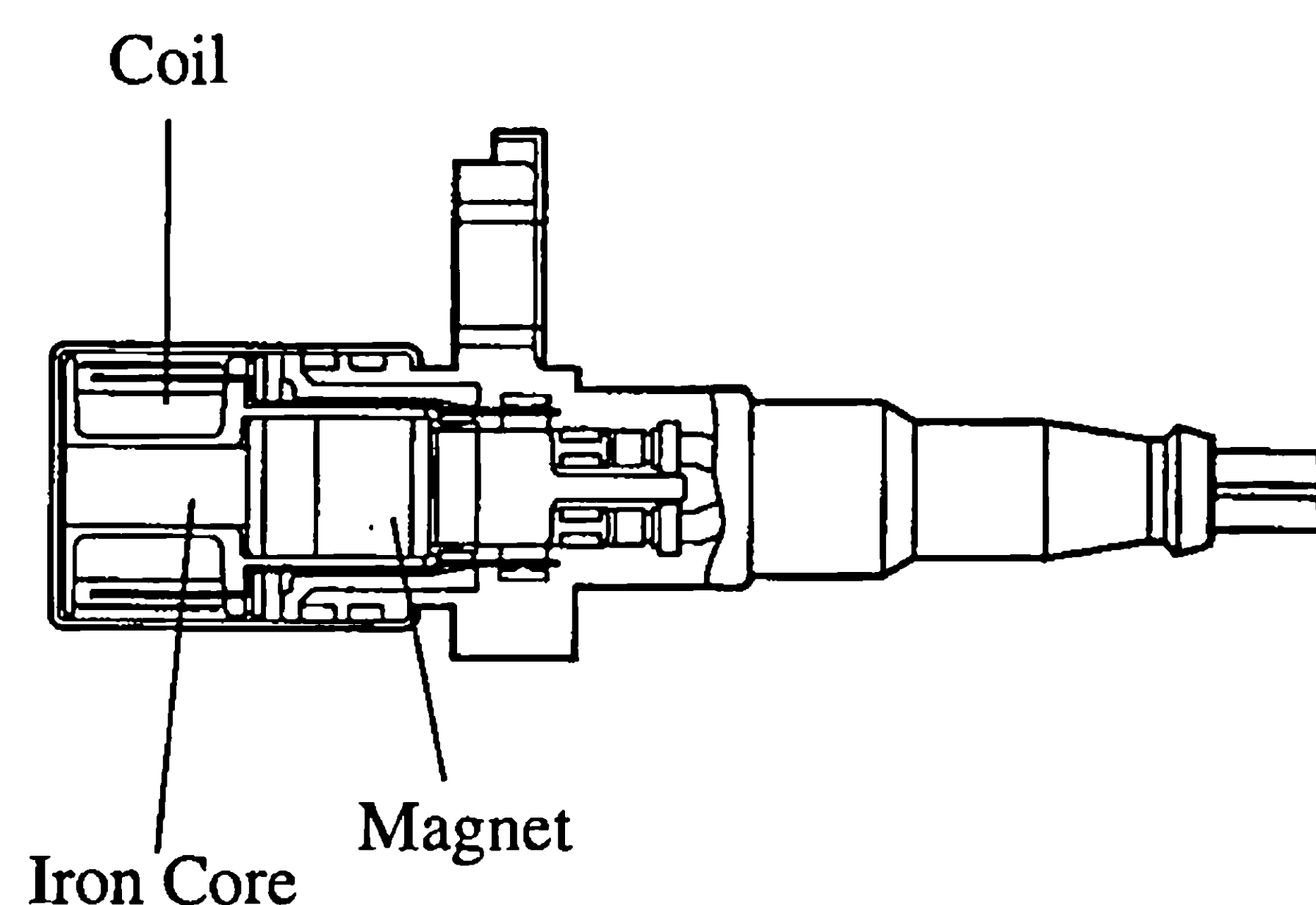
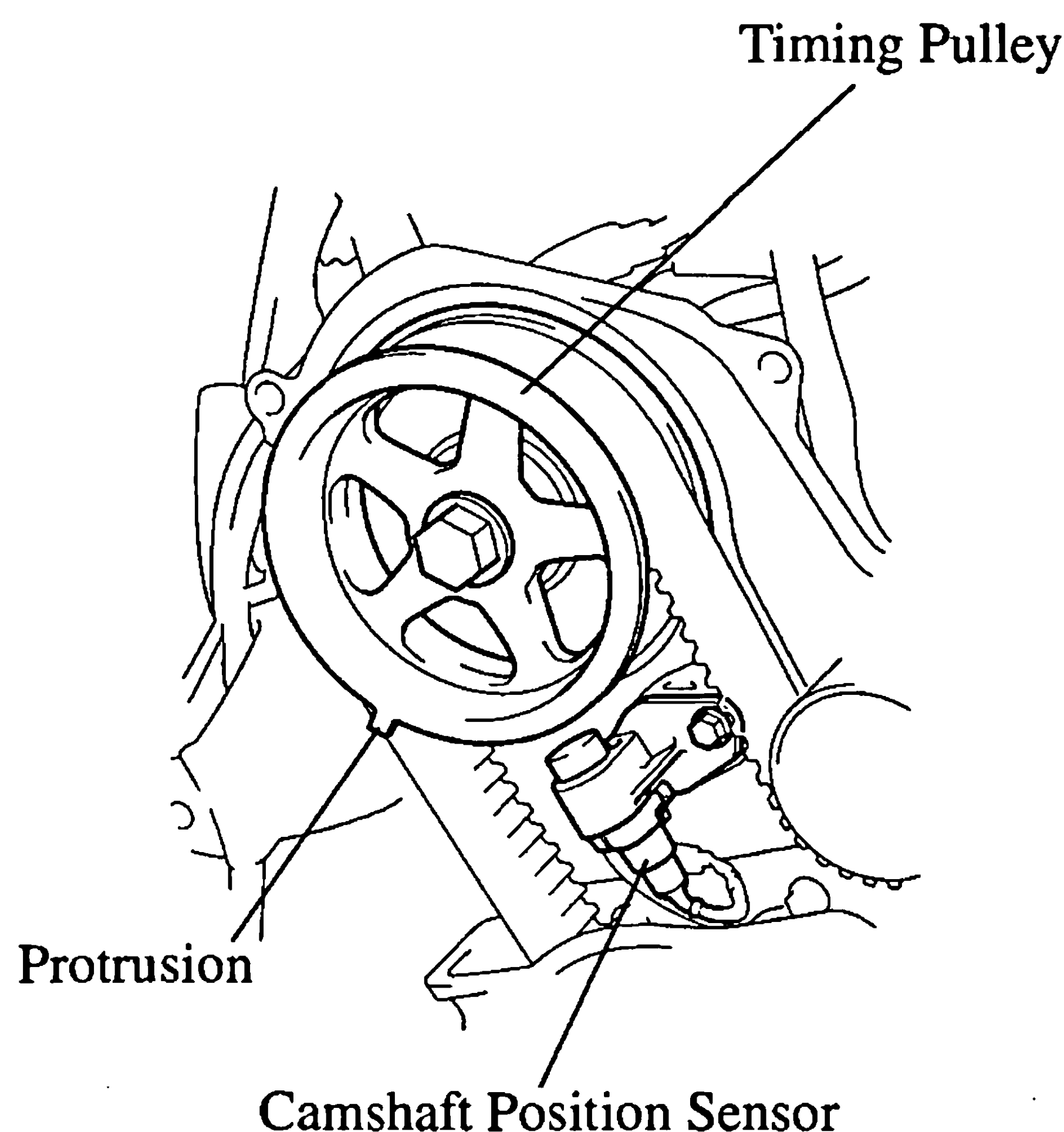
- Compact and lightweight
The pressure loss caused by this sensor is small, and offers only slight intake air flow resistance.
- Superior response and measuring accuracy
- Ability to measure a wide airflow range
- Having no mechanical functions, it offers a superior durability.



Camshaft Position Sensor

The camshaft position sensor consists of a magnet, coil and iron core, and is mounted onto the right bank cylinder head.

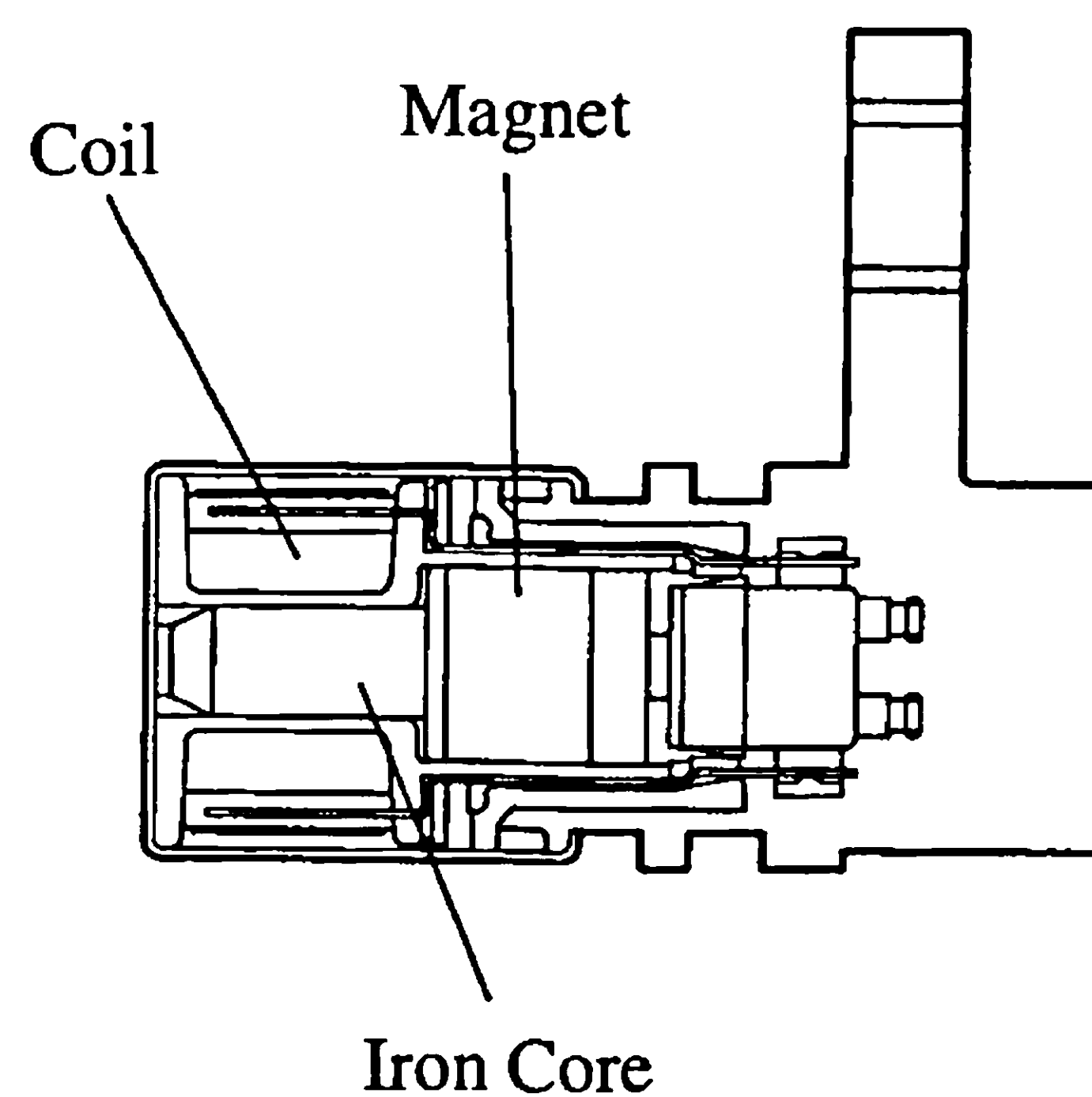
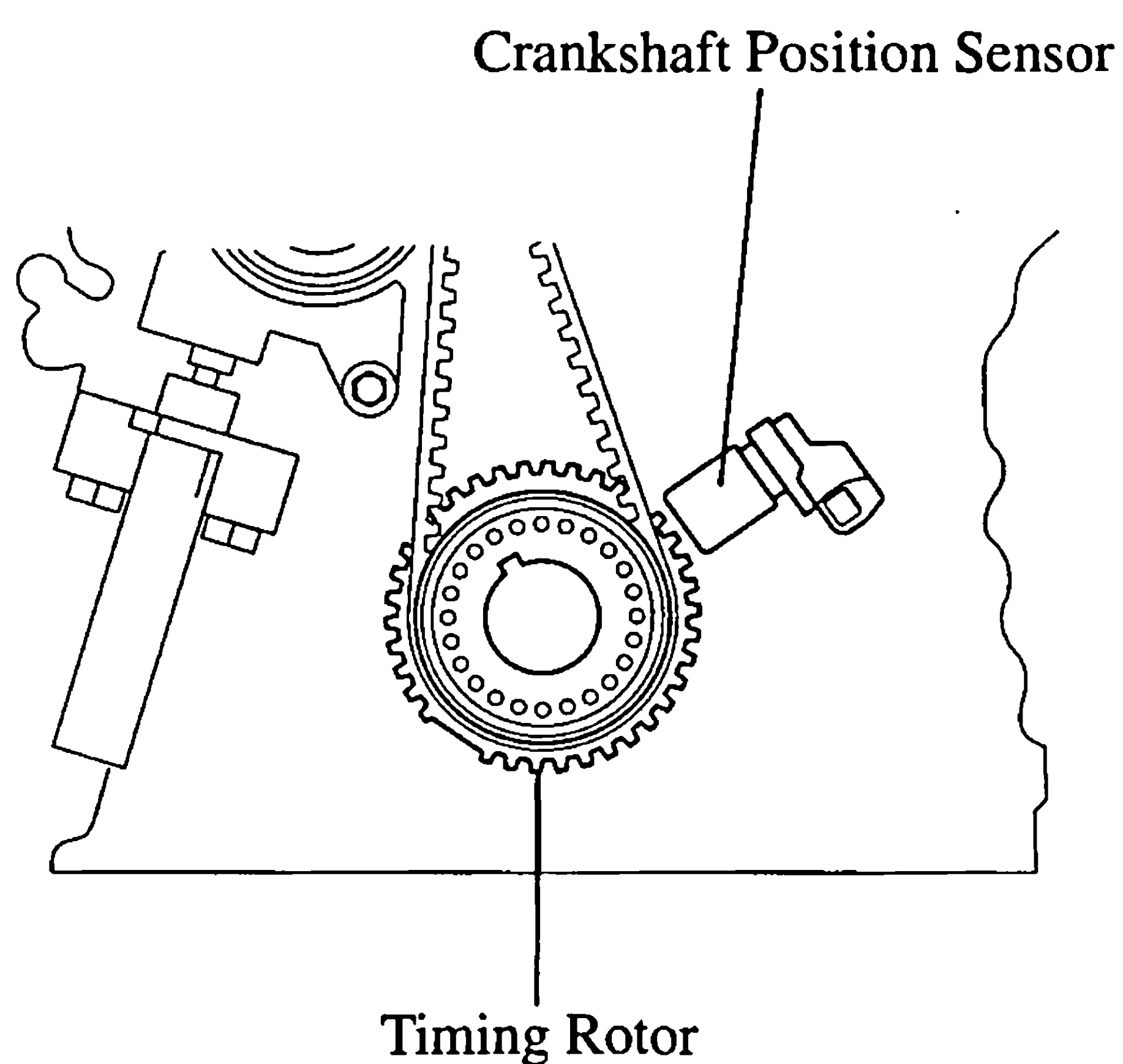
Each time the camshaft rotates, the distance between the camshaft position sensor and the protrusion integrated onto the camshaft timing pulley is varied. This causes the magnetic flux passing through the coil in the camshaft sensor to increase and decrease, generating an electromotive force. Since the voltage generated when the camshaft protrusion approaches the pickup coil is the opposite of when it departs, an alternating electrical current is produced.



Camshaft Position Sensor Cross Section

Crankshaft Position Sensor

The crankshaft position sensor, which detects the engine speed and crankshaft angle signal [NE signal], has been installed on the oil pump body. For basic operation of the crankshaft position sensor is the same as in the 3RZ-FE engine. For detail, see page 62.



Crankshaft Position Sensor Cross Section

6. Evaporative Emission Control

An evaporative emission control system which uses the engine ECU to control the evaporative emissions (HC) from the charcoal canister to the purge port has been adopted.

The construction and operation of the evaporative emission control system is basically the same as the 3RZ-FE engine. For detail, see page 63.

7. Sub Fuel Tank Control

By activating the fuel pump of the fuel tank (main or sub) that was selected by the fuel tank changeover switch, and by changing over the fuel return valve, fuel is supplied to the engine from the fuel tank selected by the driver.

The construction and operation of the sub fuel tank control system is basically the same as the 3RZ-FE engine. For detail, see page 64.

8. Engine Immobiliser System

The engine immobiliser system has been designed to prevent the vehicle from being stolen. This system uses a transponder key computer that stores the ID code of the authorized ignition key. If an attempt is made to start the engine using an unauthorized key, the transponder key computer emits a signal to the engine ECU to prohibit fuel delivery and ignition effectively disabling the engine. For details, see page 212, in the Engine Immobiliser system section.

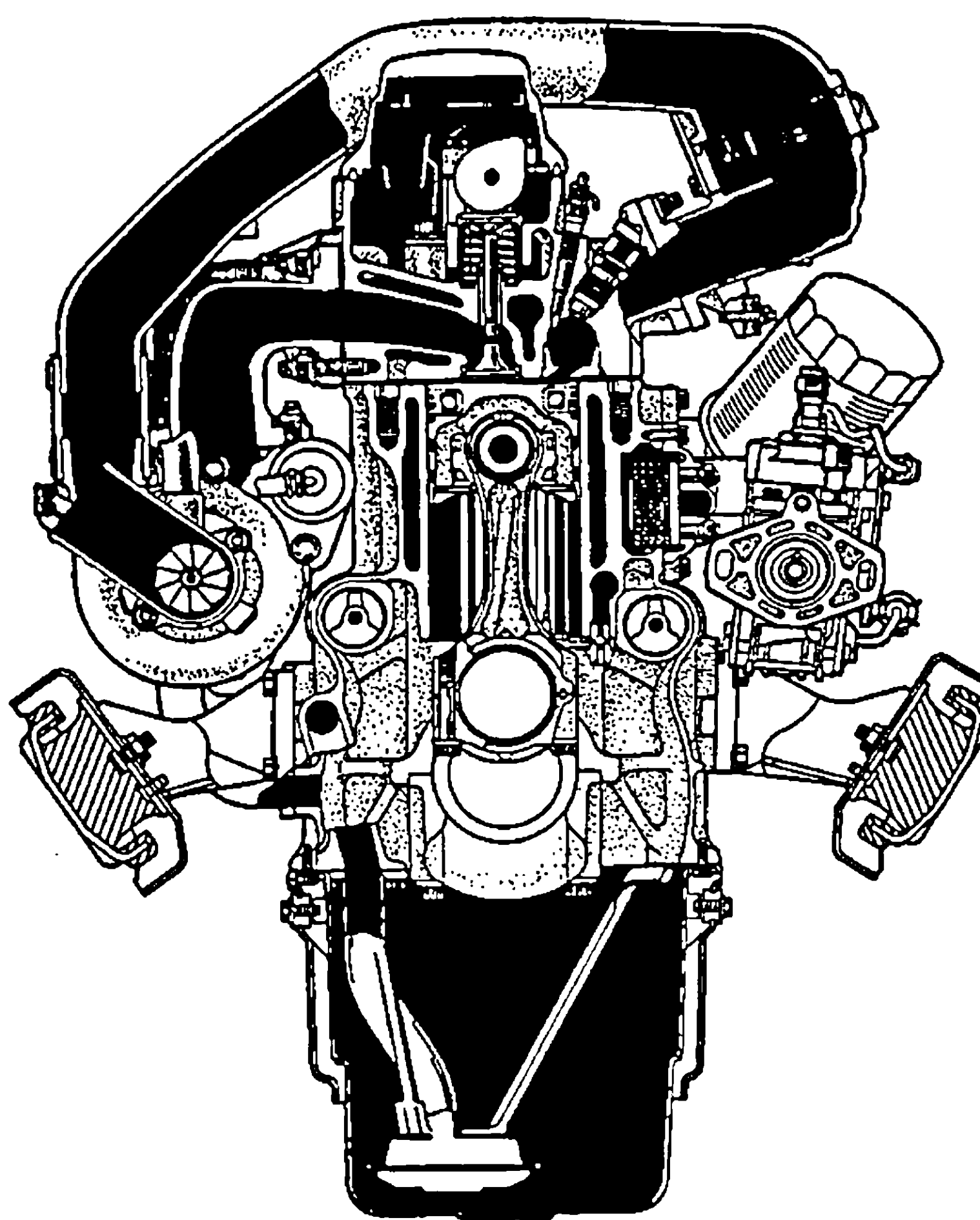
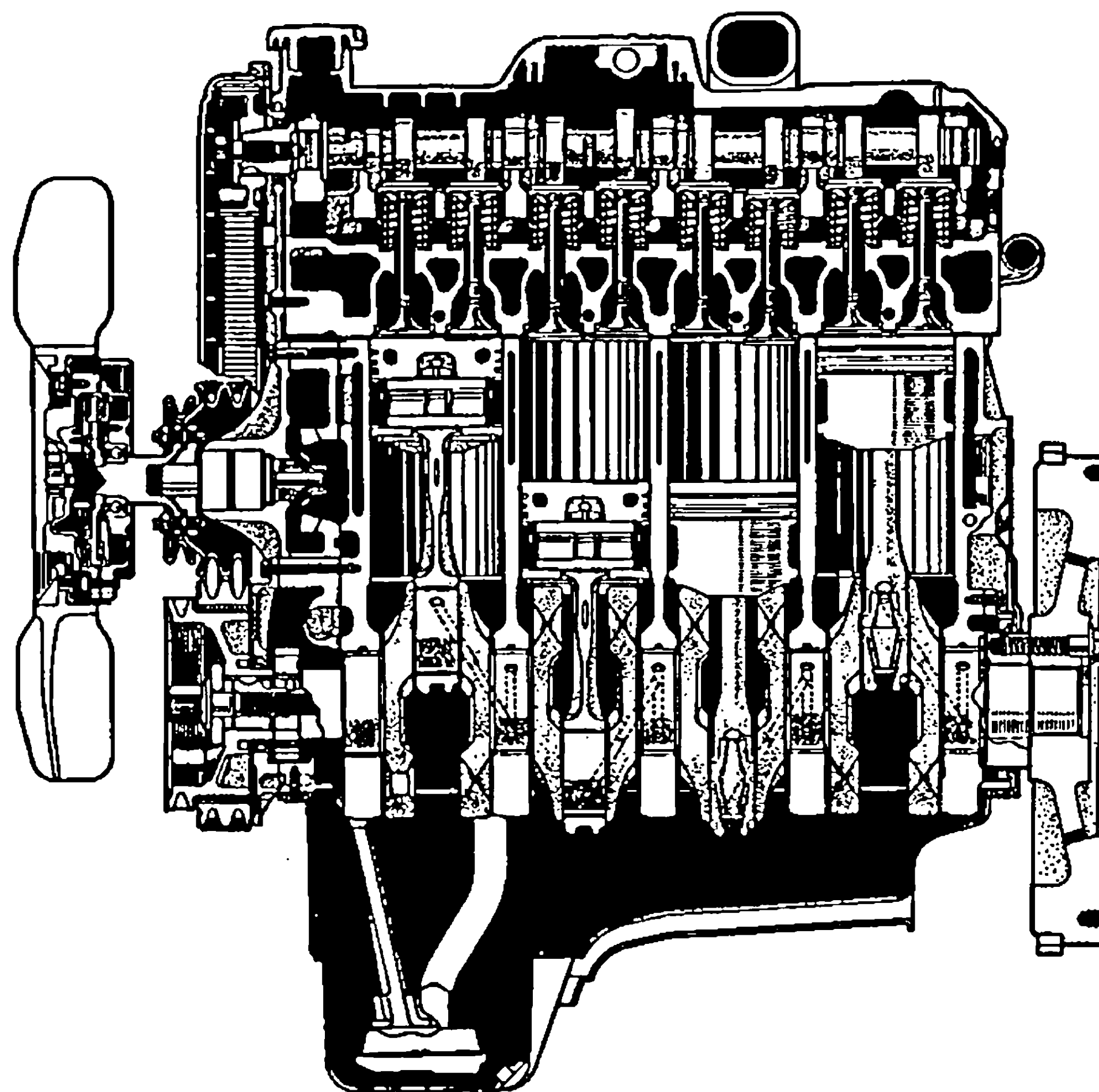
1KZ-T AND 1KZ-TE ENGINES

■ DESCRIPTION

The 1KZ-T and 1KZ-TE are in-line 4-cylinder, 3.0-liter, 8-valve, OHC turbocharged diesel engines. These engines use an aluminum cylinder head and a resin cylinder head cover for weight reduction, and balance shafts for reducing noise and vibration.

In addition, the 1KZ-TE engine uses an electronically controlled injection pump to reduce exhaust emissions while realizing fuel economy and high performance.

► 1KZ-TE Engine ◀

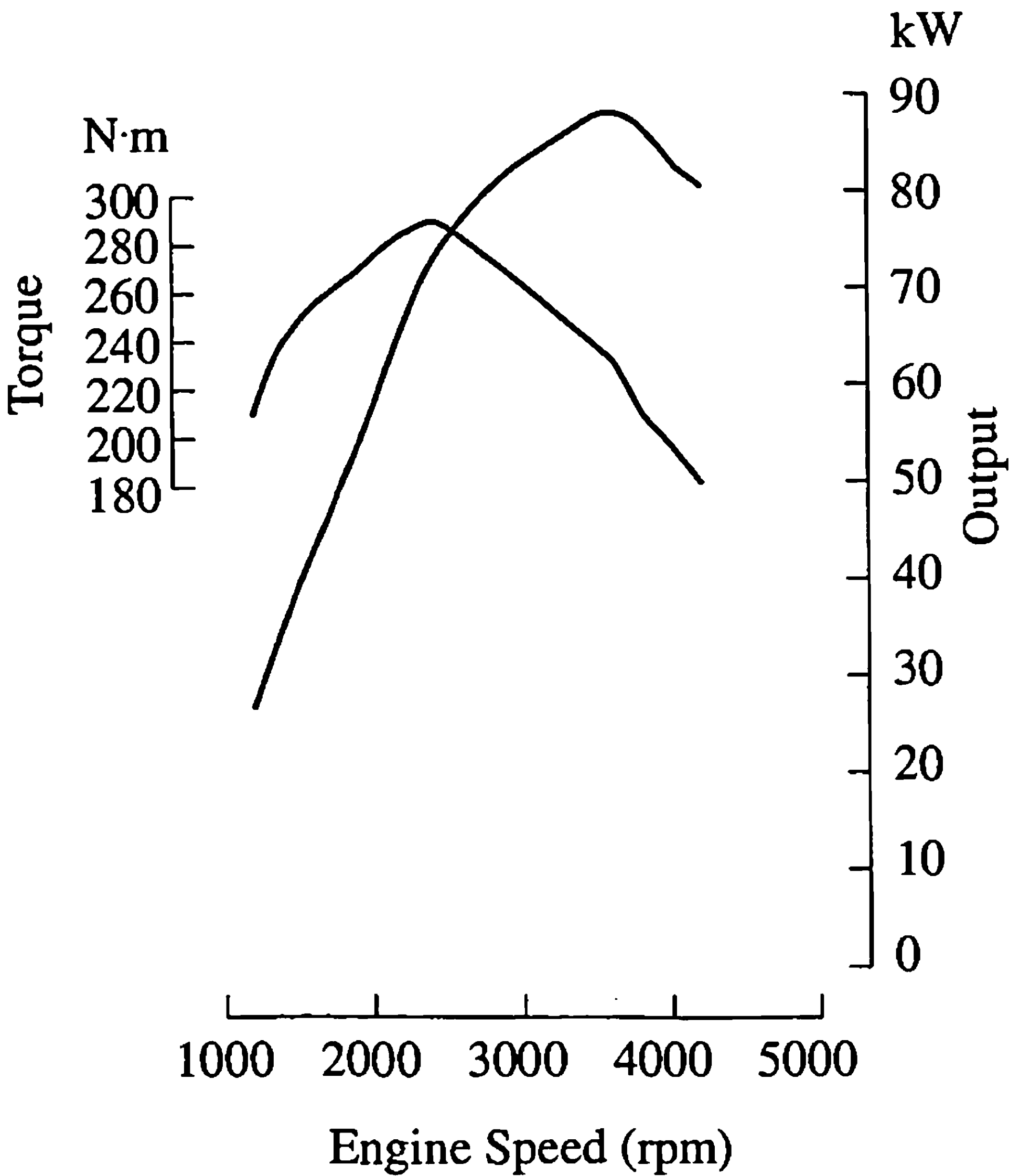


ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

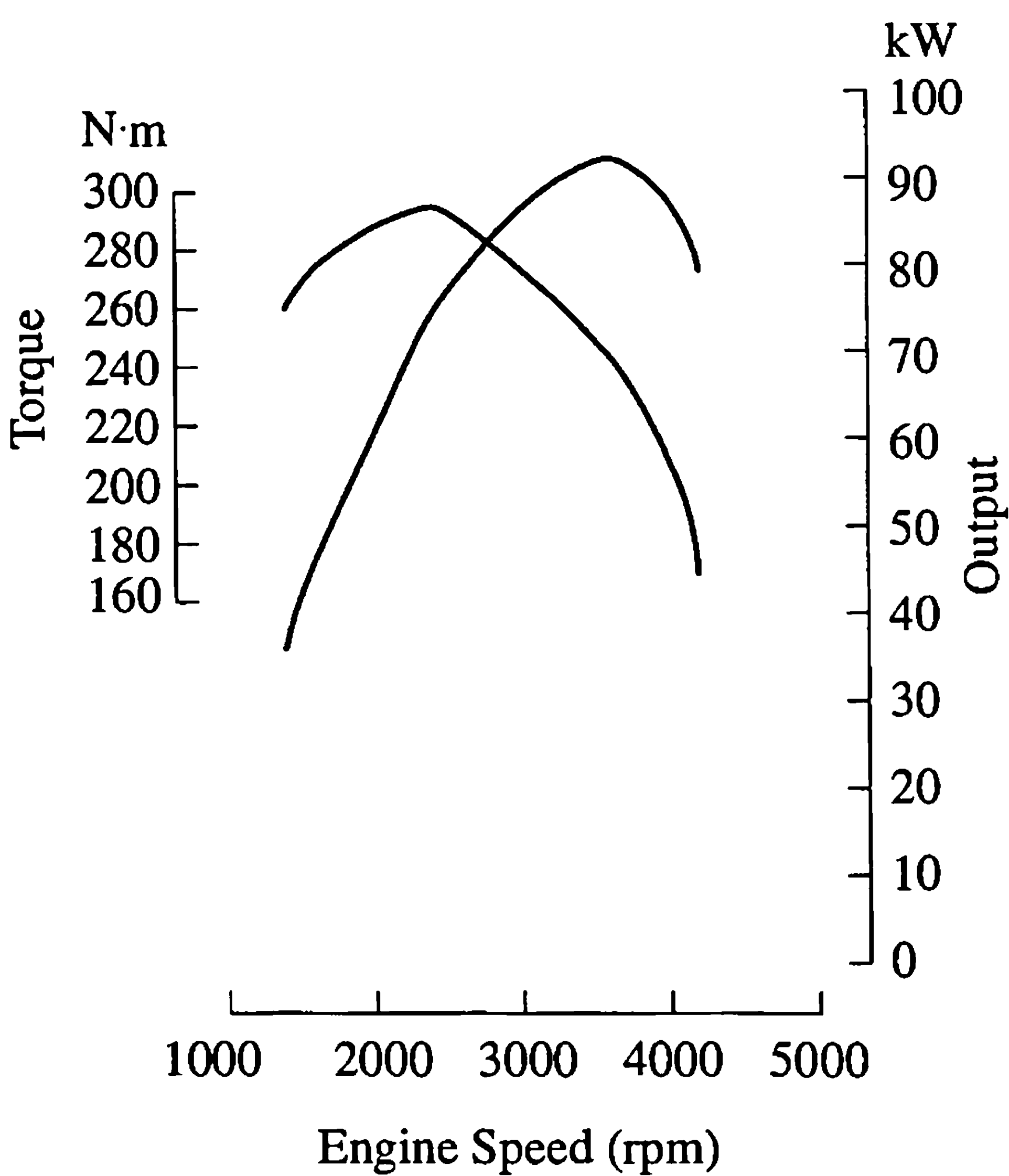
Engine		1KZ-T	1KZ-TE
Item			
No. of Cyls. & Arrangement		4-Cylinder, In-Line	←
Valve Mechanism		8-Valve, OHC, Gear and Belt Drive	←
Combustion Chamber		Swirl Type	←
Manifolds		Cross-Flow	←
Displacement	cm ³ (cu. in.)	2982 (181.9)	←
Bore x Stroke	mm (in.)	96.0 x 103.0 (3.78 x 4.06)	←
Compression Ratio		21.2 : 1	←
Max. Output	EEC	–	92 kW @ 3600 rpm
	SAE-NET	88 kW @ 3600 rpm	–
Max. Torque	EEC	–	295 N·m @ 2400 rpm
	SAE-NET	290 N·m @ 2400 rpm	–
Valve Timing	Intake	Open	6 BTDC
		Close	32 ABDC
	Exhaust	Open	53 BBDC
		Close	3 ATDC
Fuel Cetane Number		50	←
Oil Grade		API CD or Better	←

EG

► 1KZ-T Engine ◀



► 1KZ-TE Engine ◀



■ FEATURES OF 1KZ-T AND 1KZ-TE ENGINES

Features of the 1KZ-T and 1KZ-TE engine are listed below.

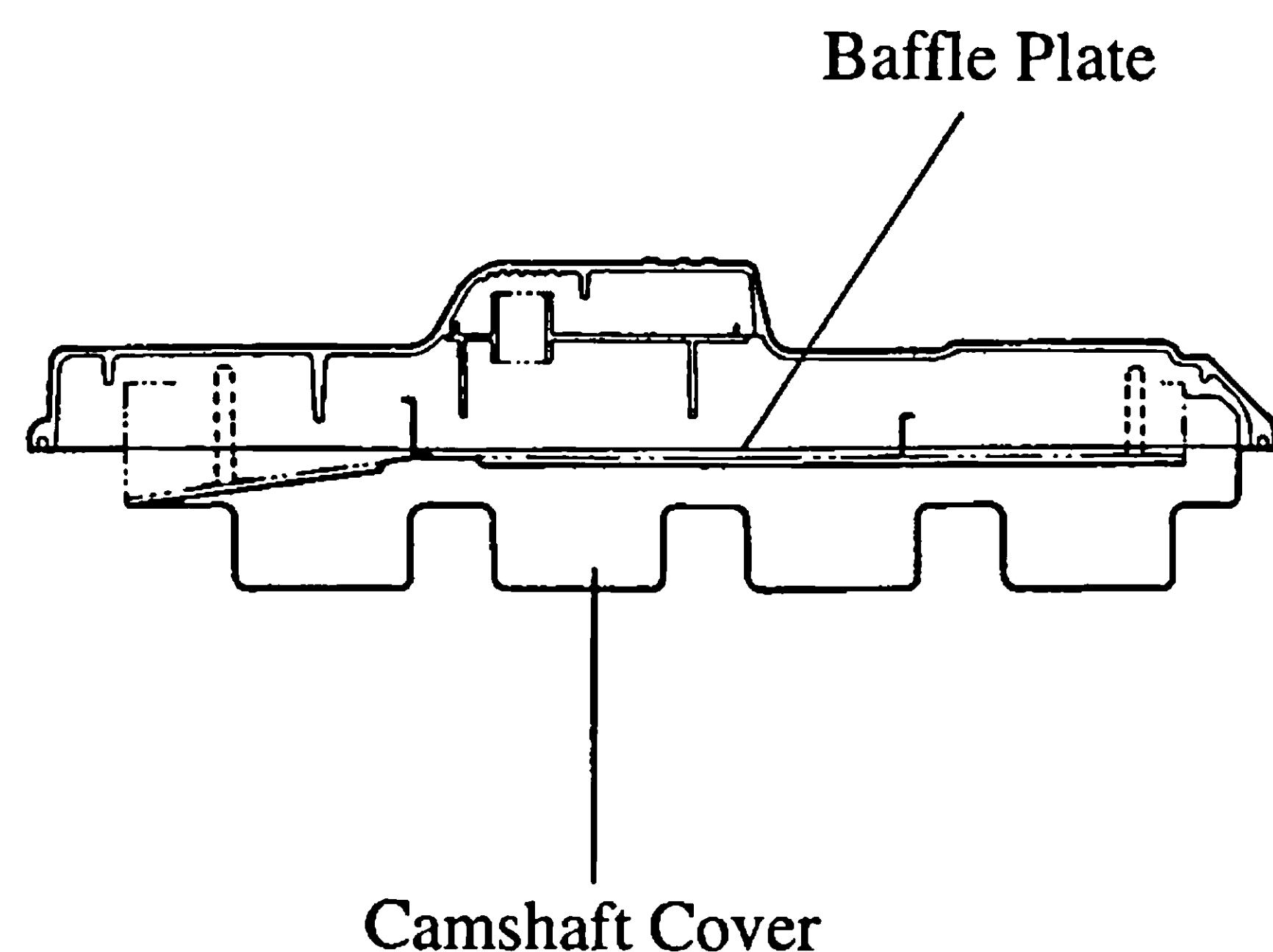
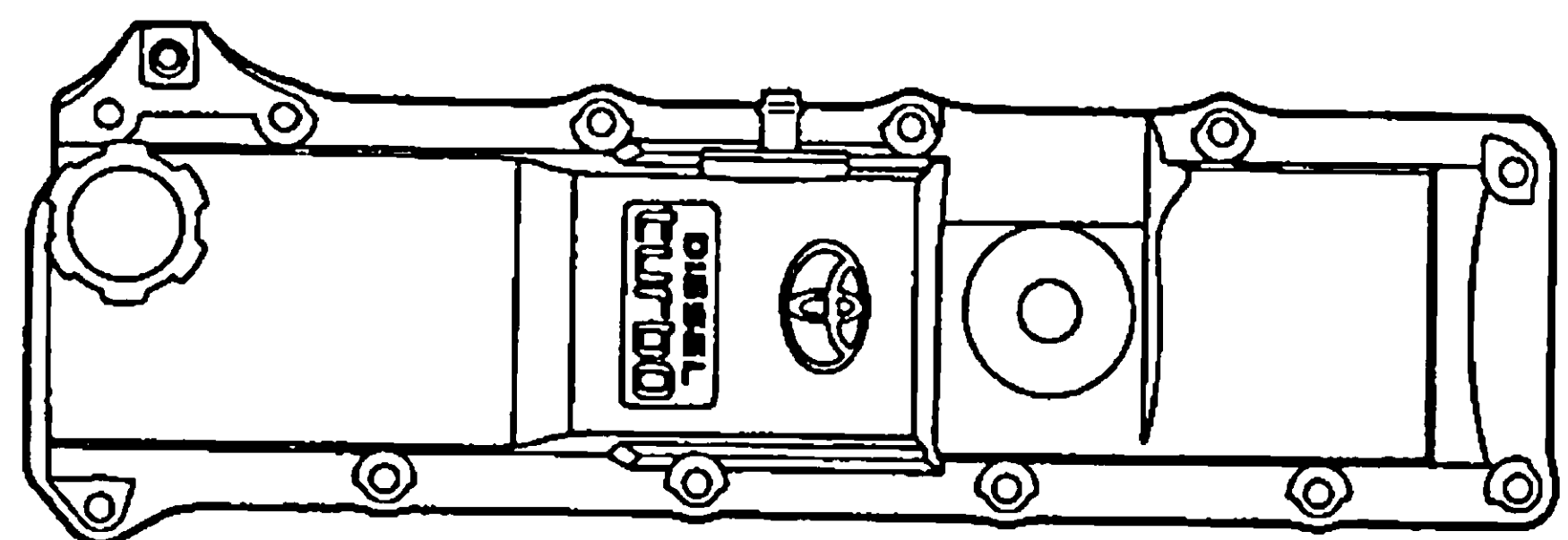
Features	Contents
High Performance and Fuel Economy	● A compact, lightweight turbocharger is used ● An electronically controlled injection pump is used* ● Optimized combustion chamber shape and compression ratio
Low Noise and Low Vibration	● 2 balance shafts built into the cylinder block ● A scissors gear mechanism is used on the idle gear ● A highly rigid cylinder block is used.
Light Weight and Compact Design	● A cylinder head is made of aluminum. ● A cylinder head cover is made of resin. ● A camshaft is driven by a timing belt and gear. ● An aluminum radiator core is used.
Good Serviceability and High Reliability	● An automatic tensioner is provided for the timing belt. ● An oil gallery has been provided in the piston to improve the piston's cooling performance. ● A steel laminate type cylinder head gasket has been adopted to improve the gasket's sealing ability. ● Ceramic glow plugs are used.

*: 1KZ-TE Engine Only

■ ENGINE PROPER

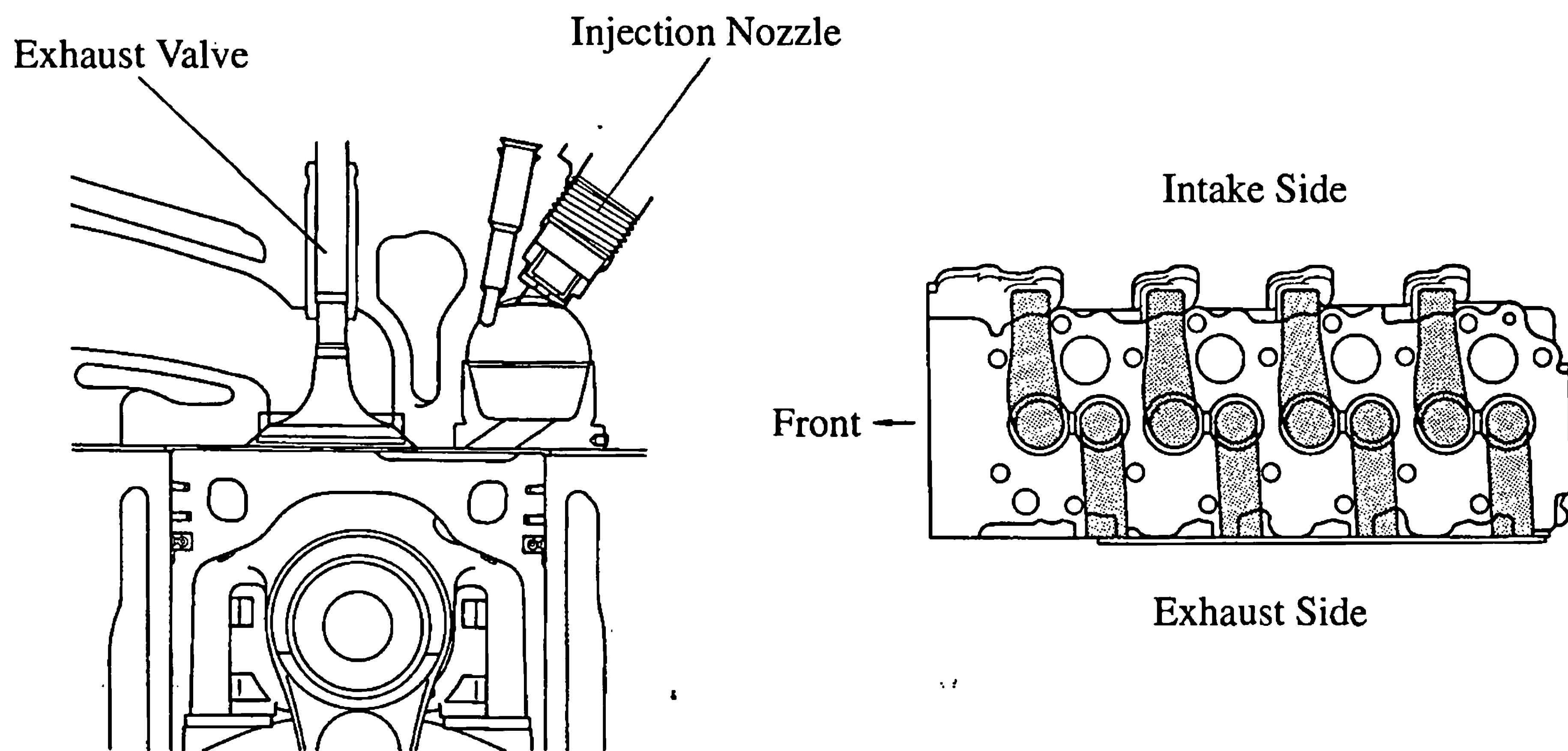
1. Cylinder Head Cover

- The cylinder head cover is made of resin to reduce weight and noise.
- A baffle plate and a camshaft cover are provided on the inside of the cylinder head cover to reduce the consumption of engine oil through blow-by gas.



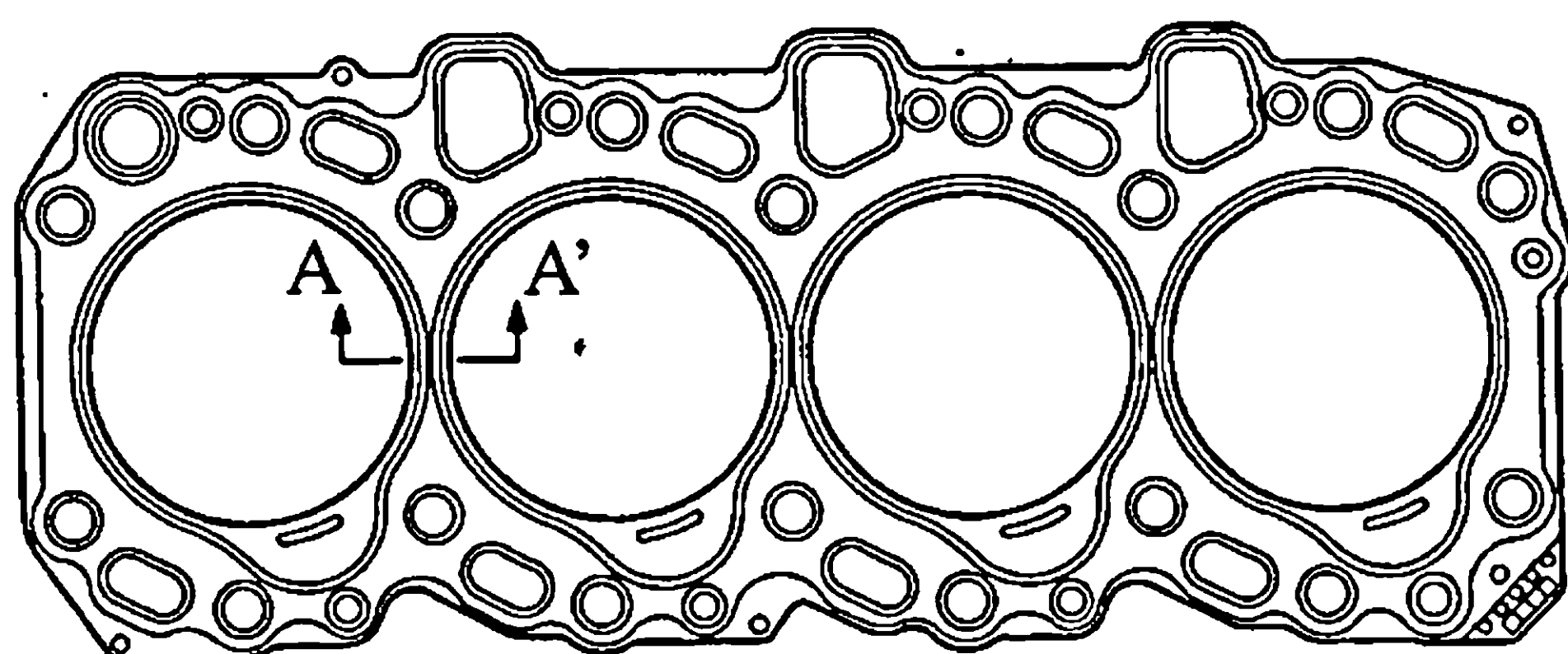
2. Cylinder Head

- The cylinder head is made of lightweight aluminum alloy having good thermal conductivity.
- A cross-flow intake and exhaust layout is used to improve intake and exhaust efficiency.
- Plastic region tightening bolts are used for the cylinder head.
- The combustion chamber shape and the injection nozzle position have been optimized to increase output and reduce exhaust emissions.



3. Cylinder Head Gasket

- A steel laminate type cylinder head gasket which offers superior pressure resistance and sealing performance has been adopted.
- Gaskets of different thicknesses are selected in accordance with the amount of protrusion of the pistons to reduce variations in the compression ratio.

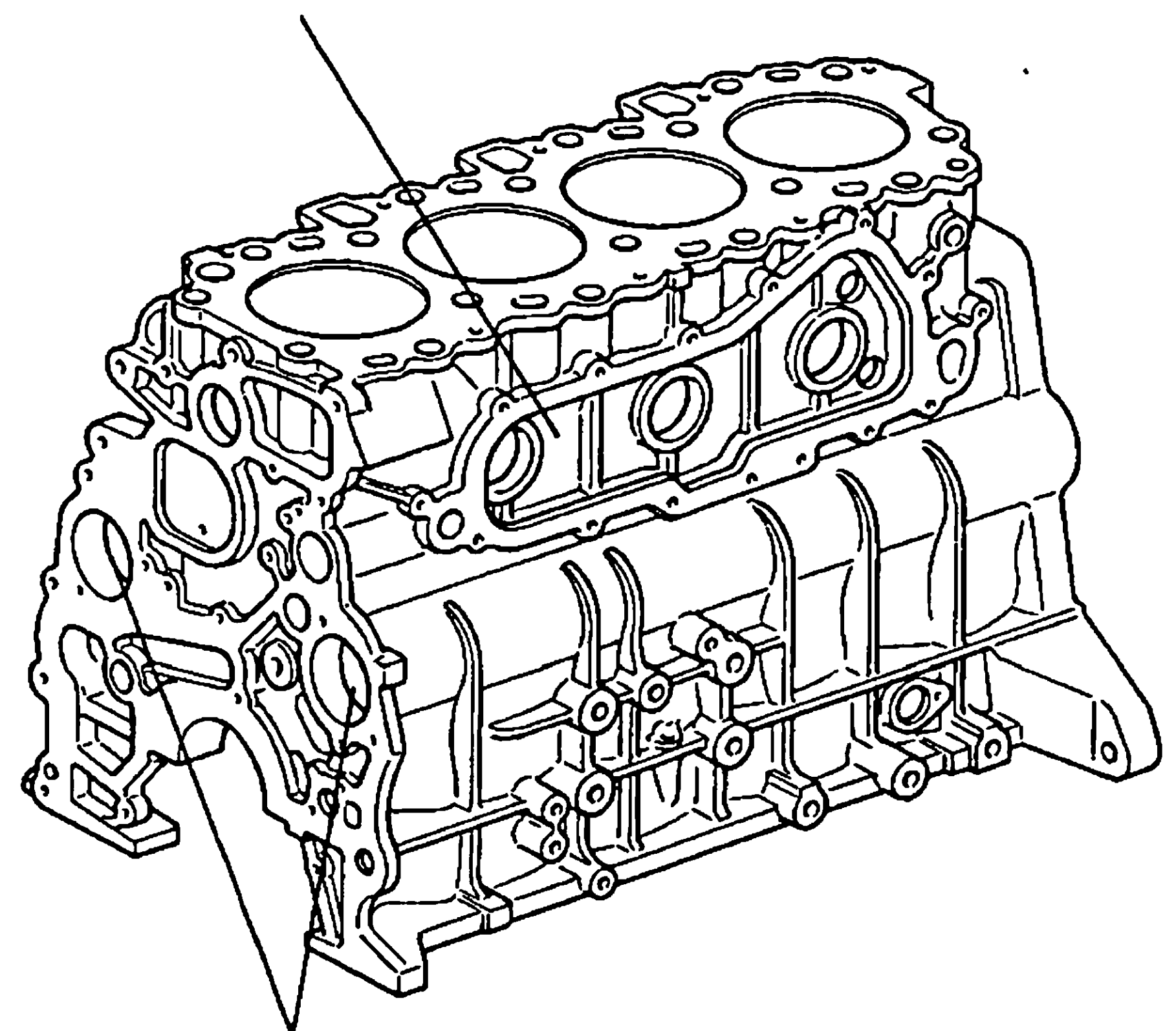


A – A' Cross Section

4. Cylinder Block

- The cylinder block is made of wear resistant alloy cast iron as in the previous model with linerless construction. The bore surfaces have undergone plateau honing.
- The oil cooler is an internal type, and is enclosed in the left-hand side of the cylinder block.
- The cylinder block is constructed to accommodate the balance shafts inside.

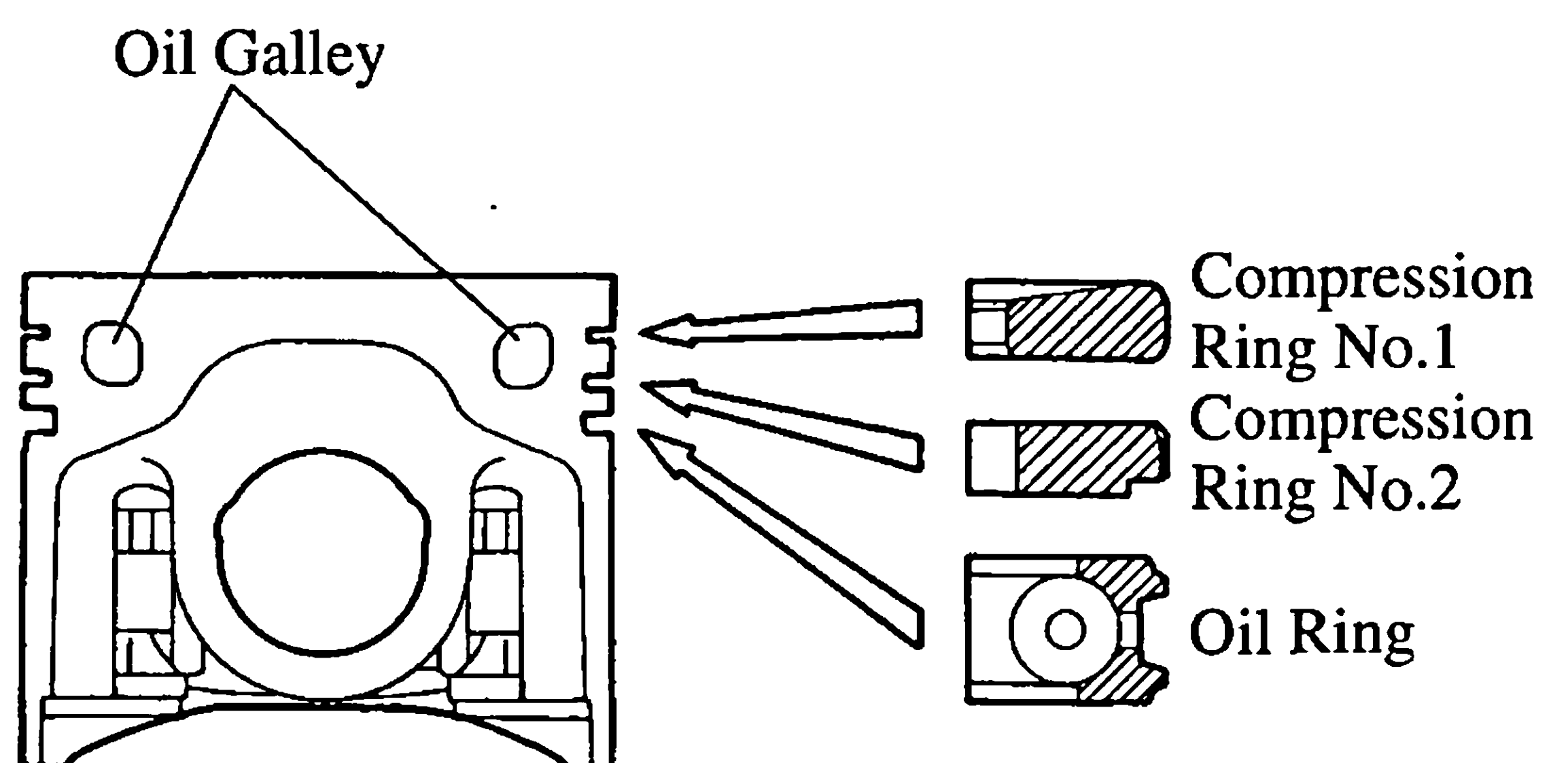
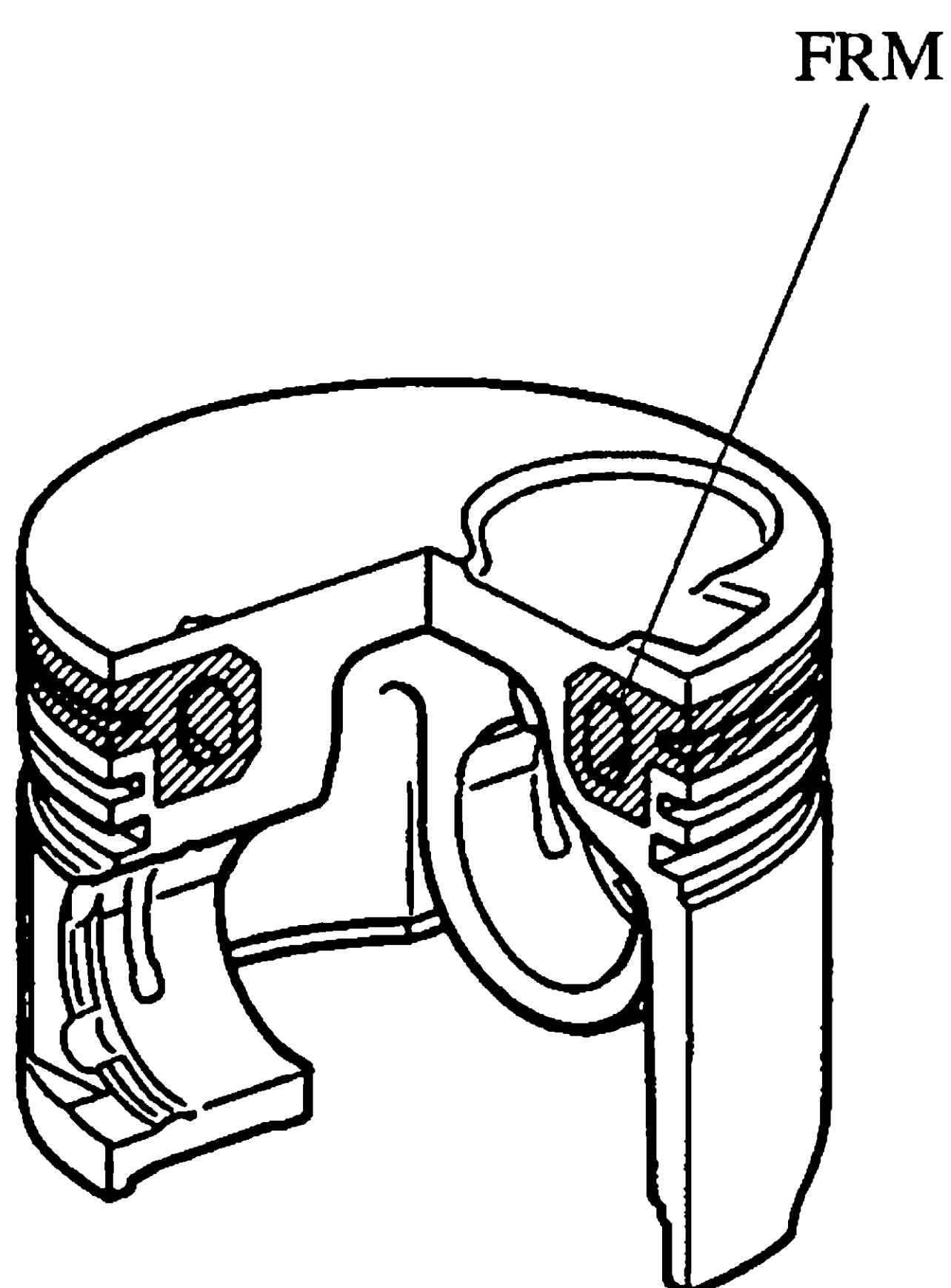
Area for Oil Cooler Installation



Areas for Balance Shaft Installation

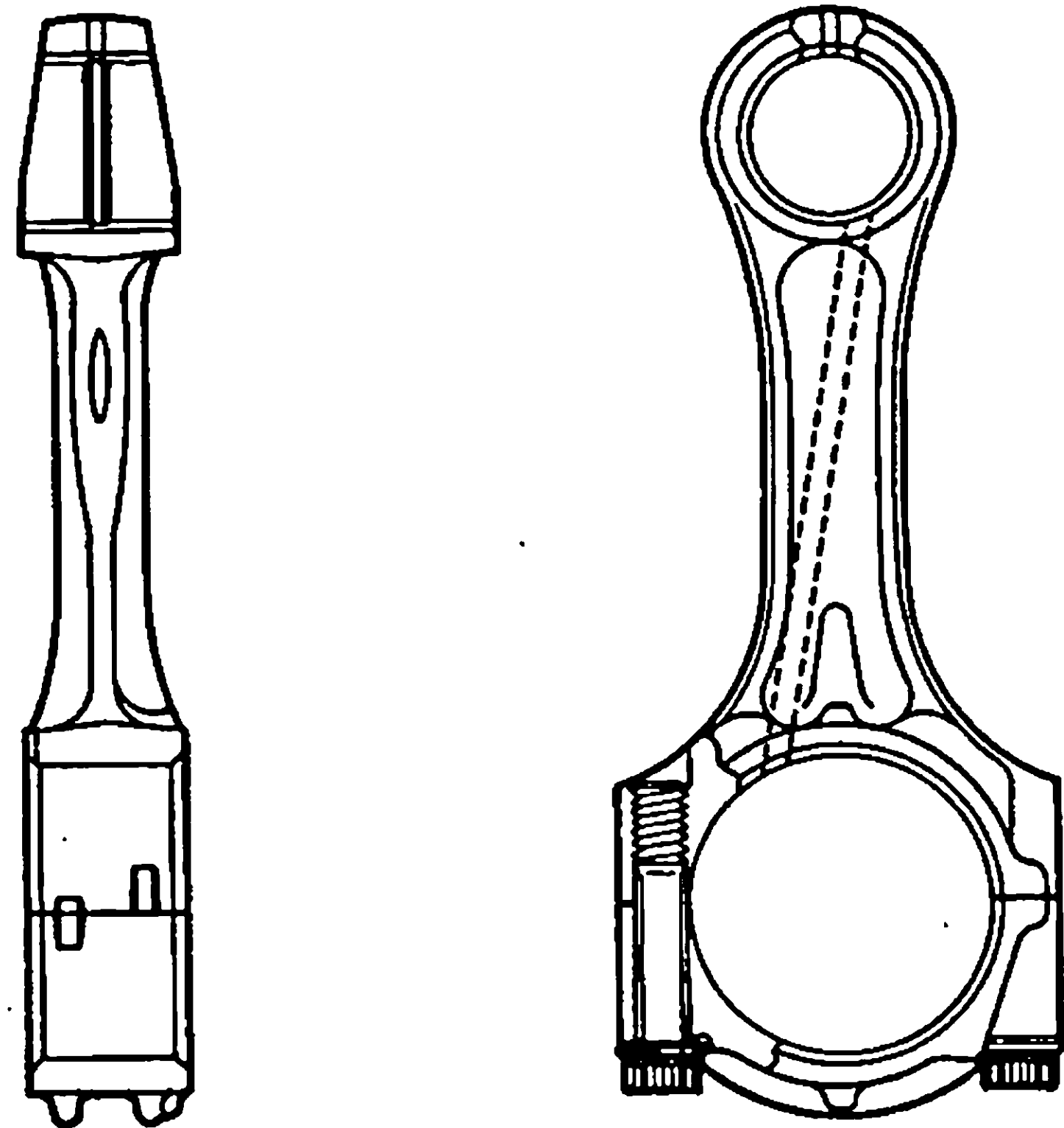
5. Piston

- Pistons are made of aluminum alloy having outstanding high-temperature strength.
- FRM (Fiber Reinforced Metal) is used for the top ring groove of the pistons to provide improved wear resistance.
- Oil galley is provided in the upper part of the piston to improve the cooling performance of piston.



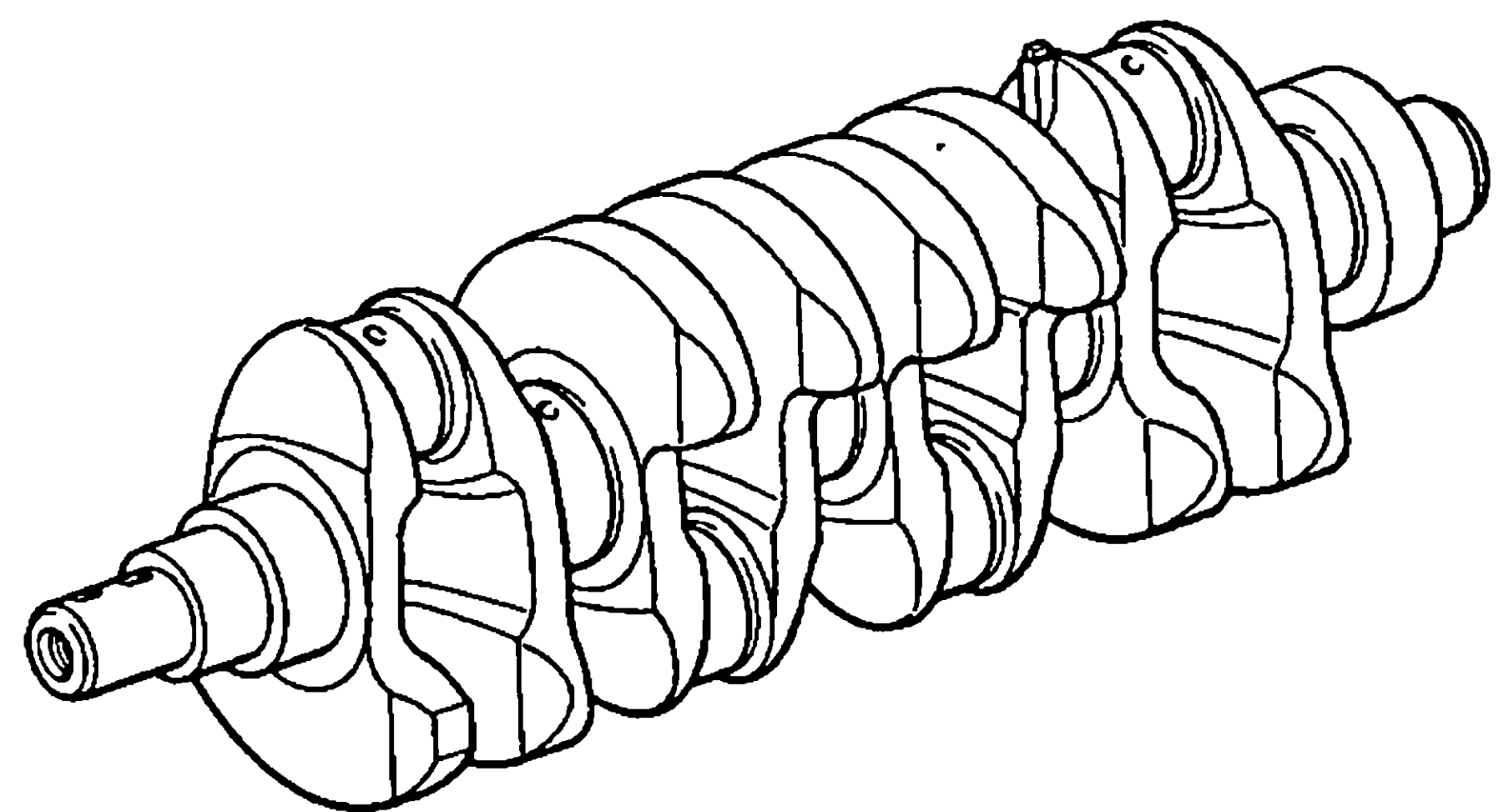
6. Connecting Rod

- The connecting rod is made of a lightweight carbon steel that withstand higher speed and high output operation.
- The small end of the connecting rods has been given a tapered shape to reduce weight.
- Plastic region tightening bolts are used for the connecting rods.



7. Crankshaft

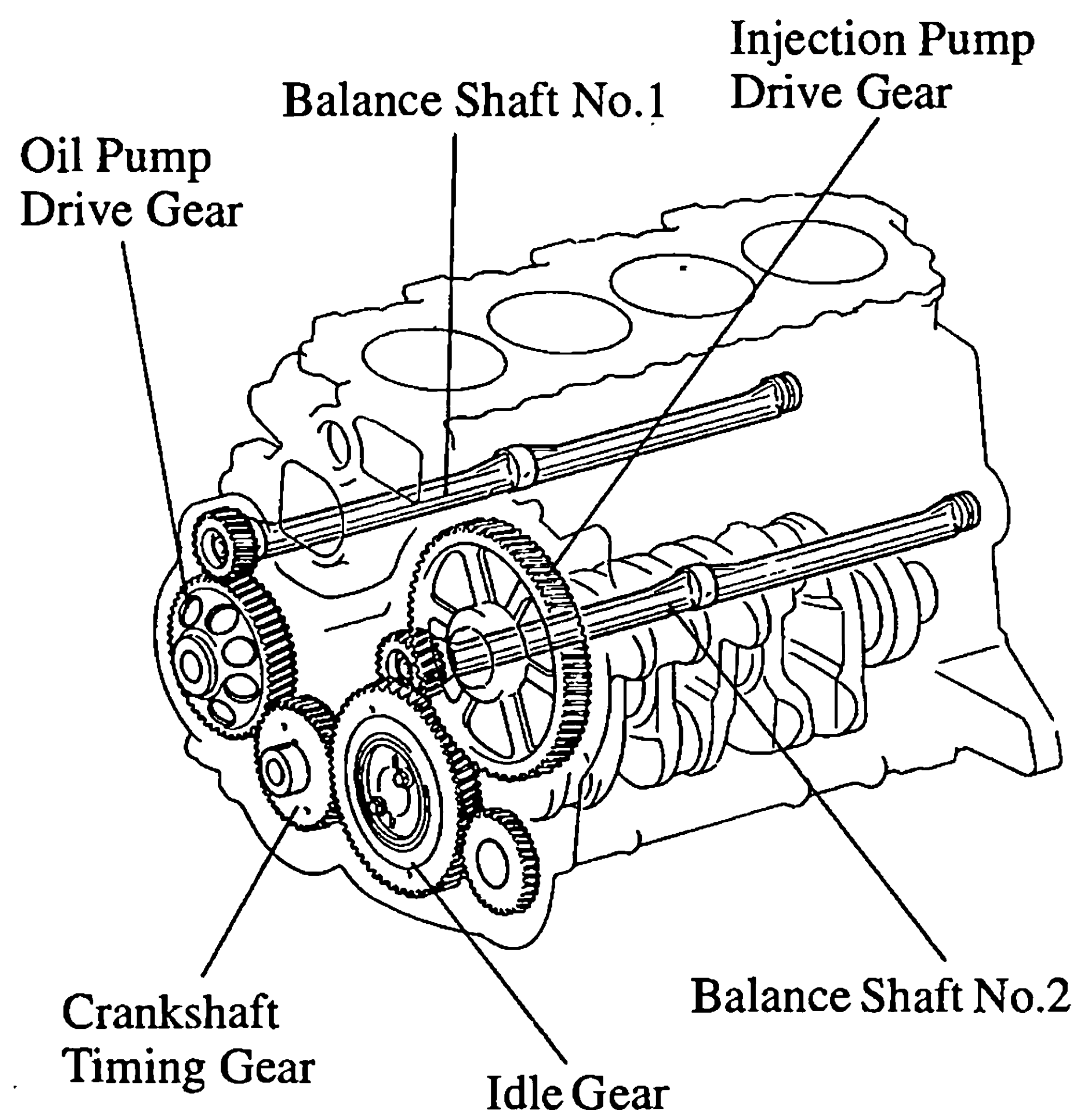
- The crankshaft is made of steel, and has 5 journals and 8 balance weight.
- The crankshaft bearing is made of aluminum alloy.



EG

8. Balance Shaft

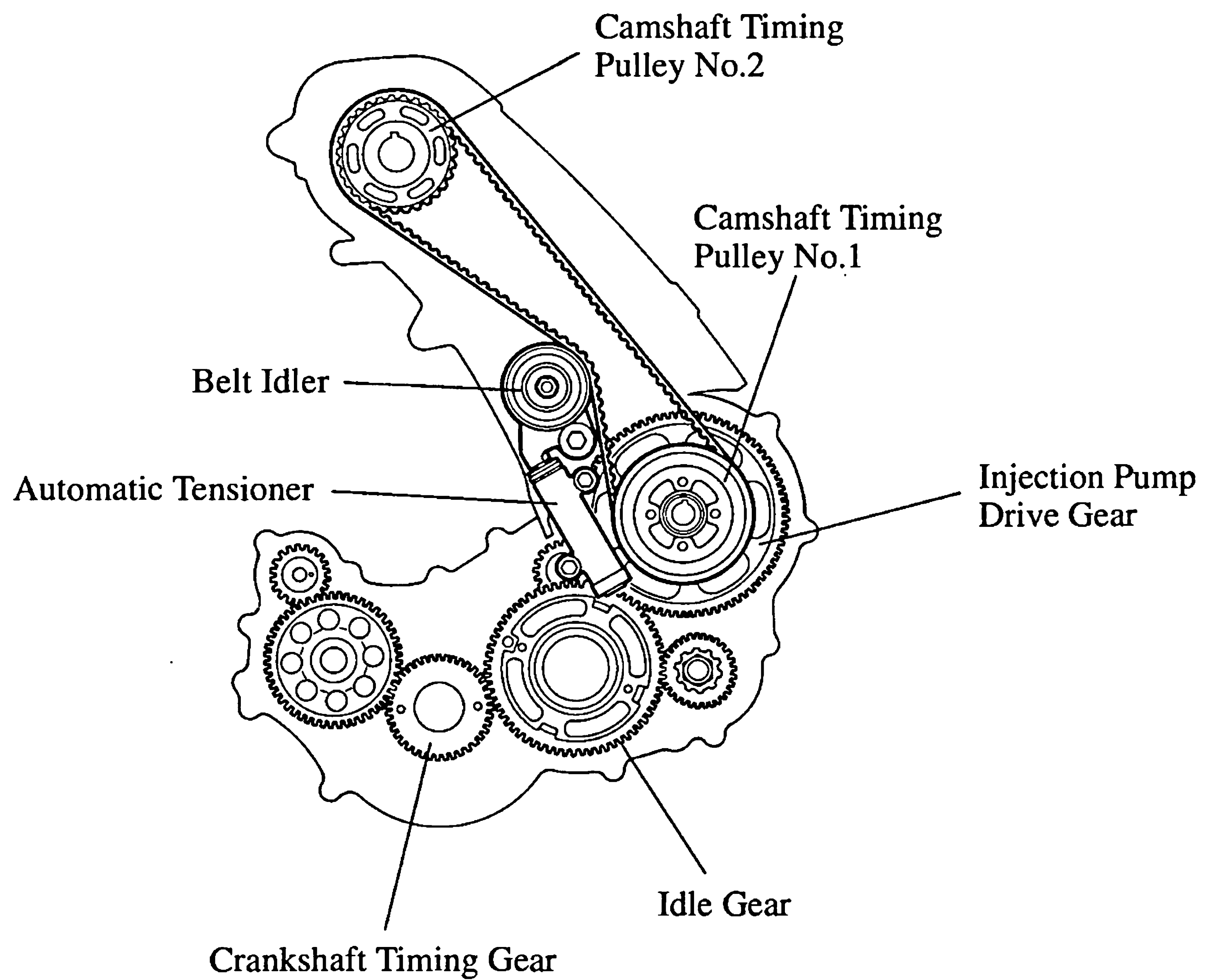
- Balance shafts are used to reduce engine vibration.
- 2 balance shafts are built into the cylinder block. Driven by the timing gear, the balance shafts rotate at twice the speed of the crankshaft and in the opposite direction of each other. The basic operation of the balance shaft is the same as in the 3RZ-F/3RZ-FE engines. For details, see page 41.



■ VALVE MECHANISM

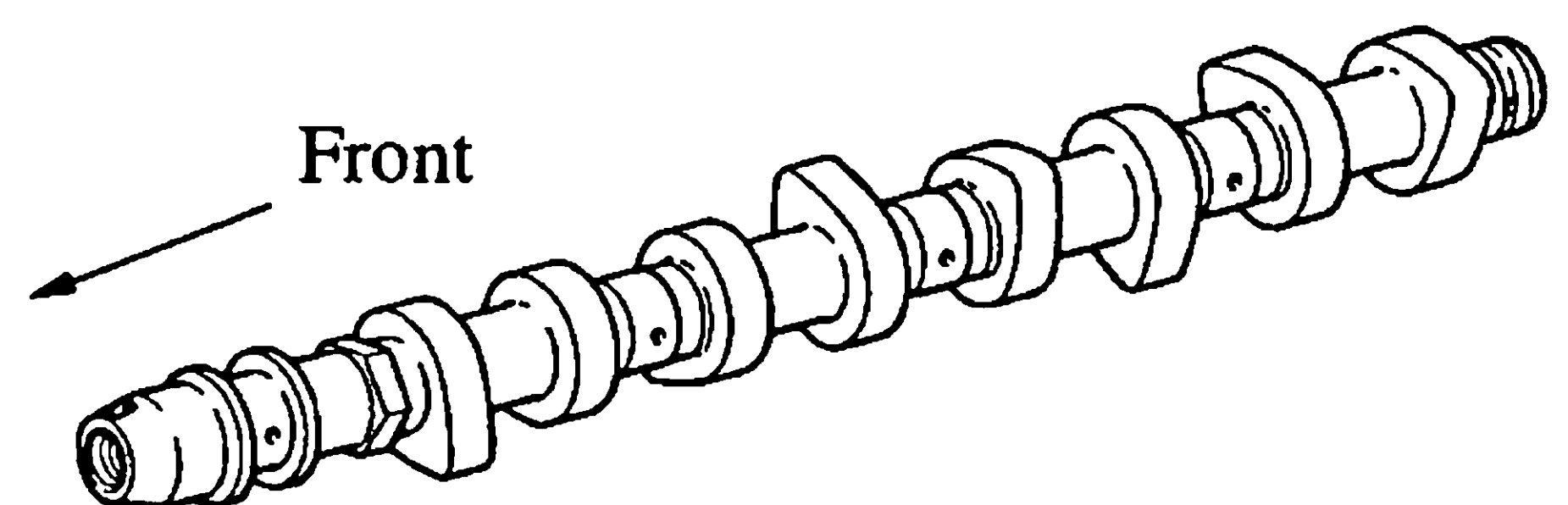
1. General

- A direct drive OHC is used for valve drive mechanism.
- The camshaft is driven by the timing belt via gears.



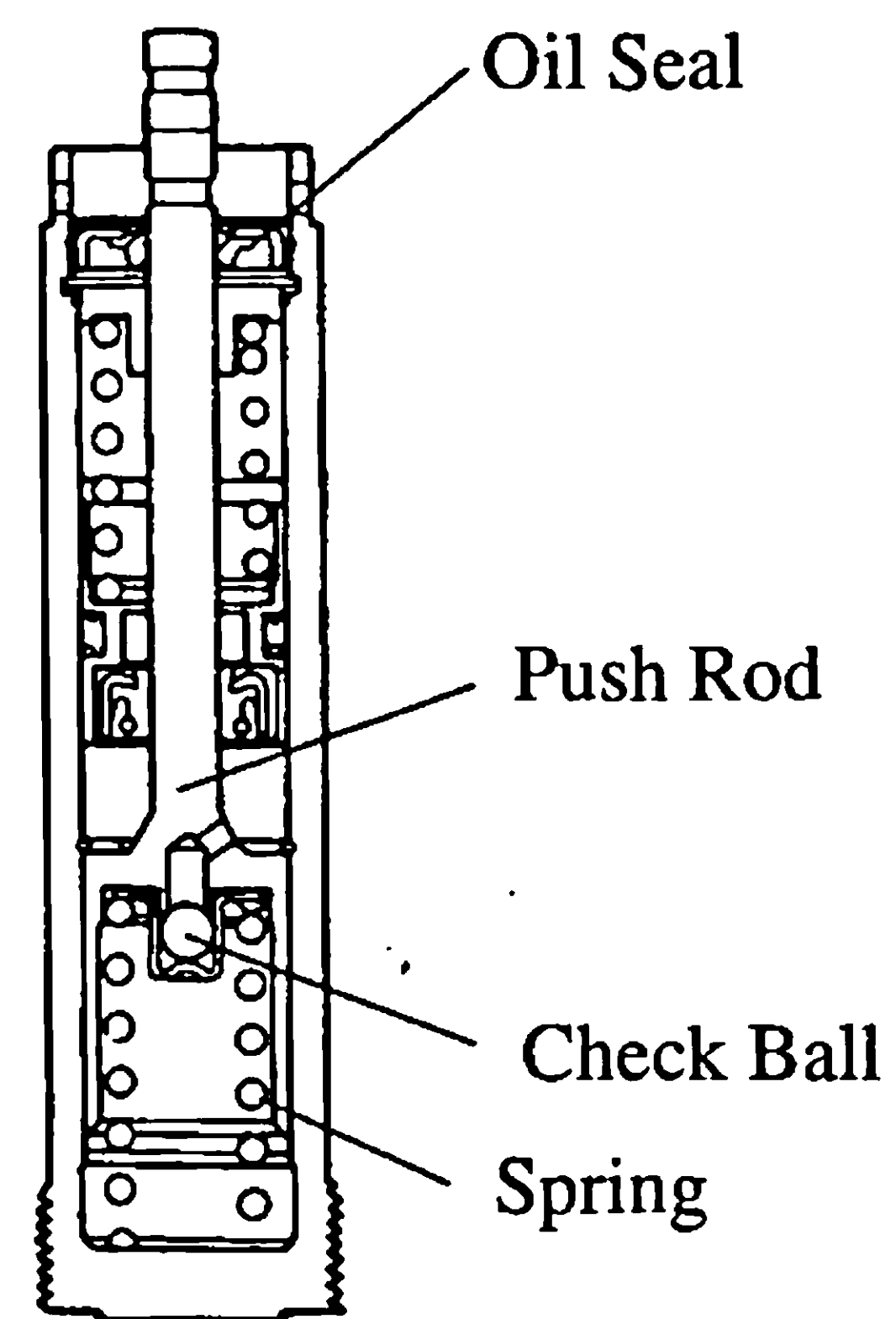
2. Camshaft

- The cam nose has been chill treated to increase its abrasion resistance.
- The camshaft timing pulley fitting portion has been tapered to increase connection strength.



3. Automatic Tensioner

The automatic tensioner is made up of a spring and oil damper, and maintains proper timing belt tension at all time. The automatic tensioner suppresses noise generated by the timing belt.

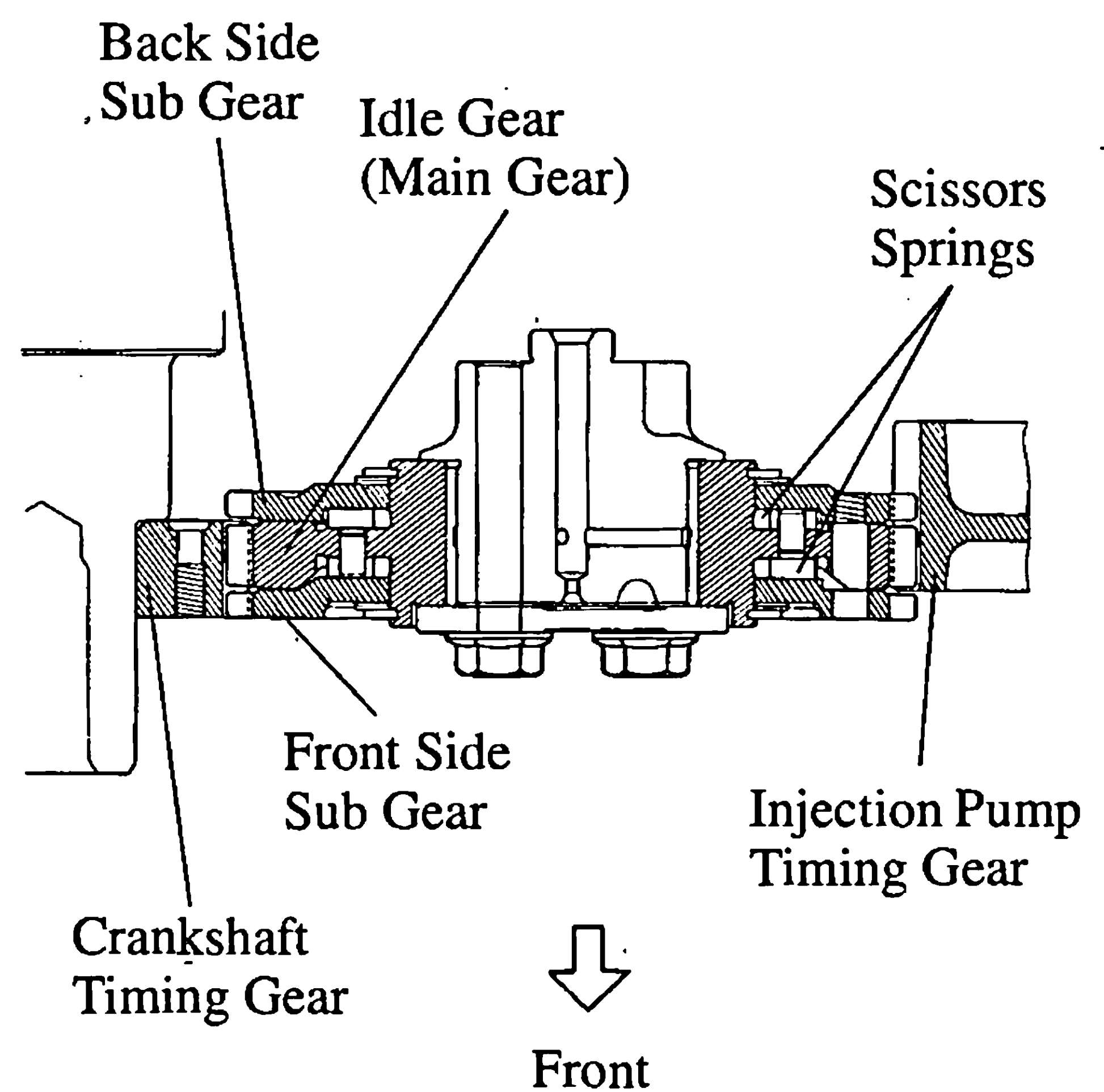
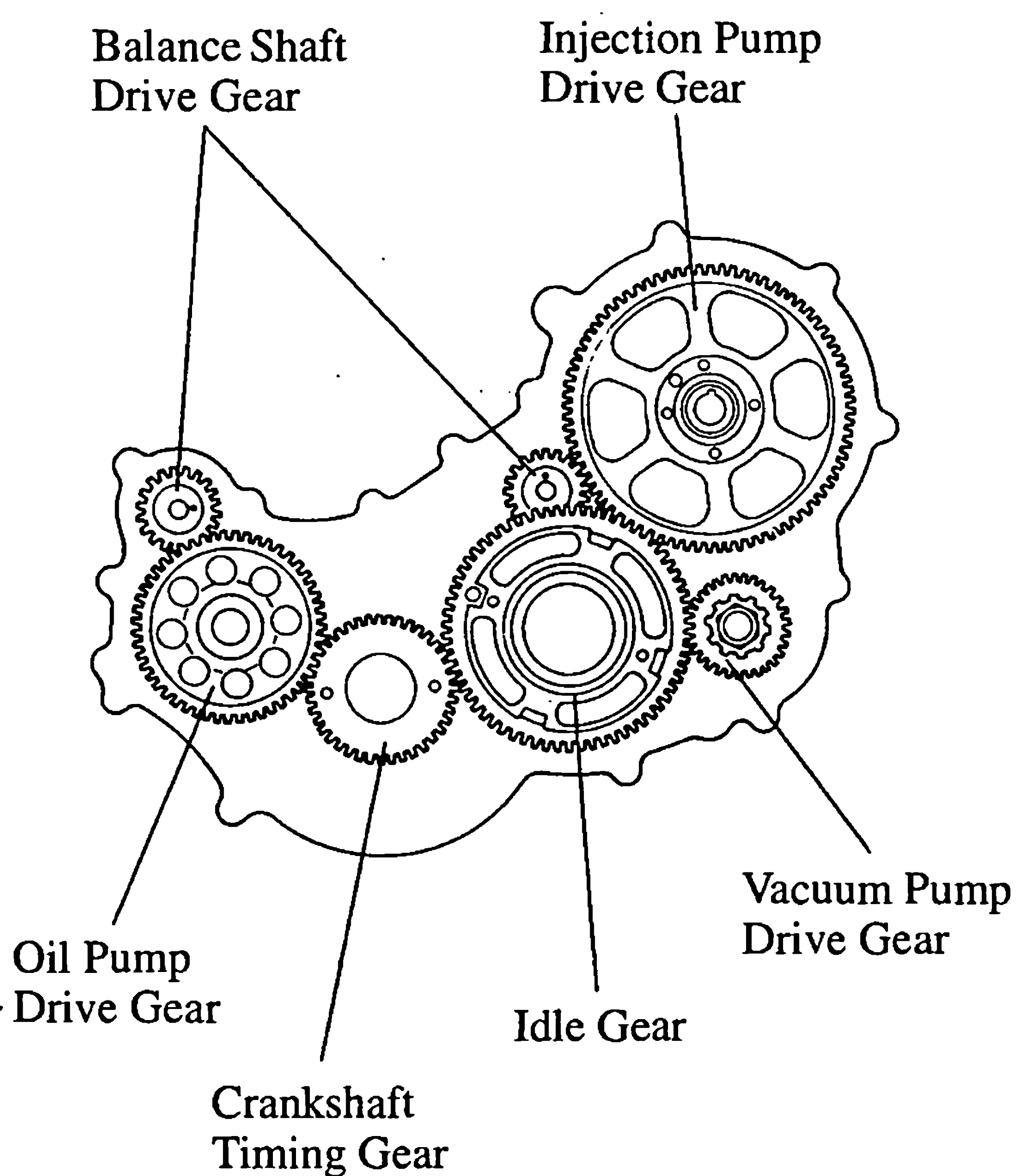


Automatic Tensioner

EG

4. Timing Gear Train

- The injection pump, vacuum pump, oil pump, and balance shafts are driven by the timing gear.
- The idler gear is constructed with a scissors gear on its front and back to reduce noise.

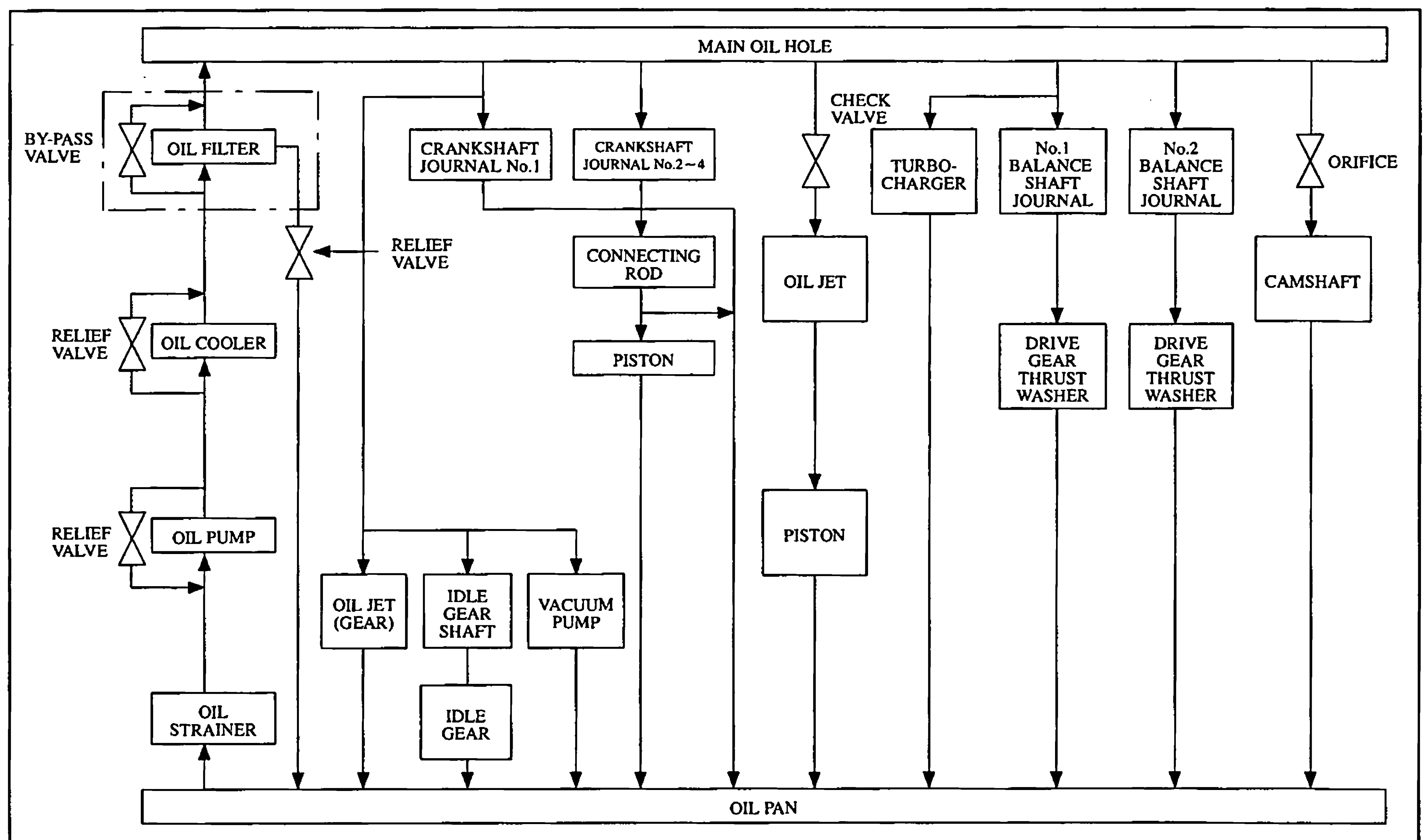
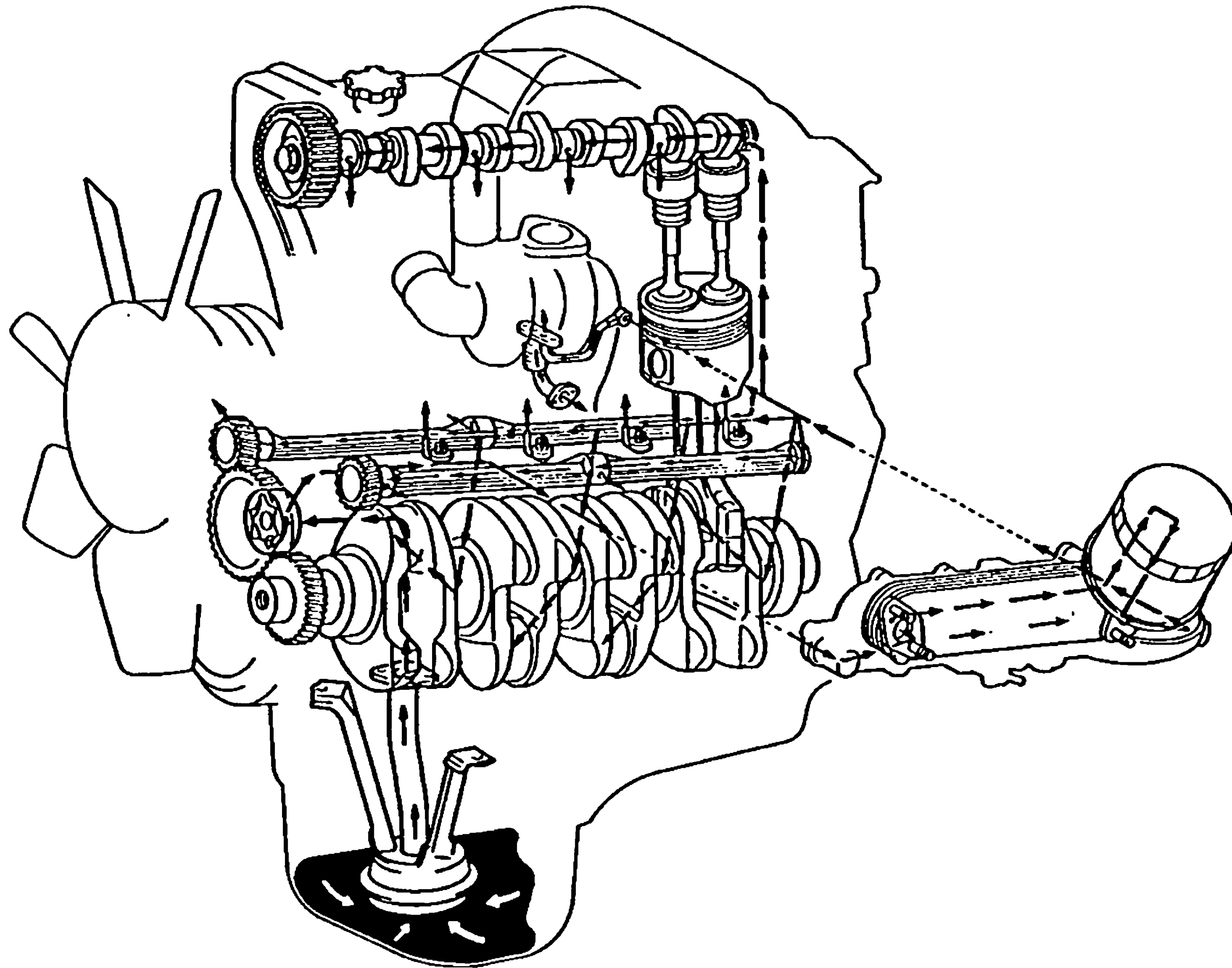


Idle Gear Cross Section

■ LUBRICATION SYSTEM

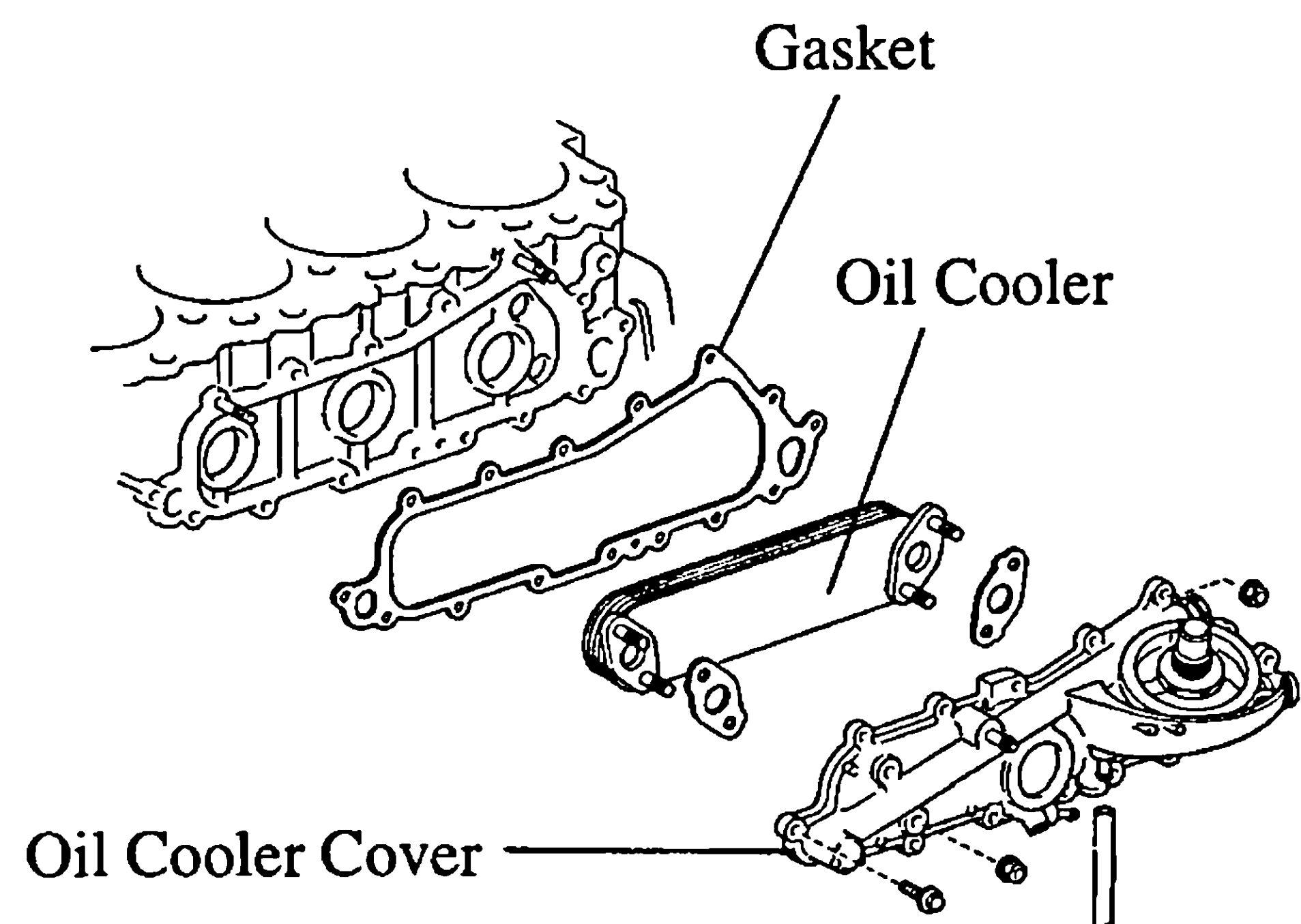
1. General

- The lubrication is fully pressurized and all oil passes through an oil cooler and an oil filter.
- A trochoid oil pump driven by a gear engaged with the crankshaft is used.



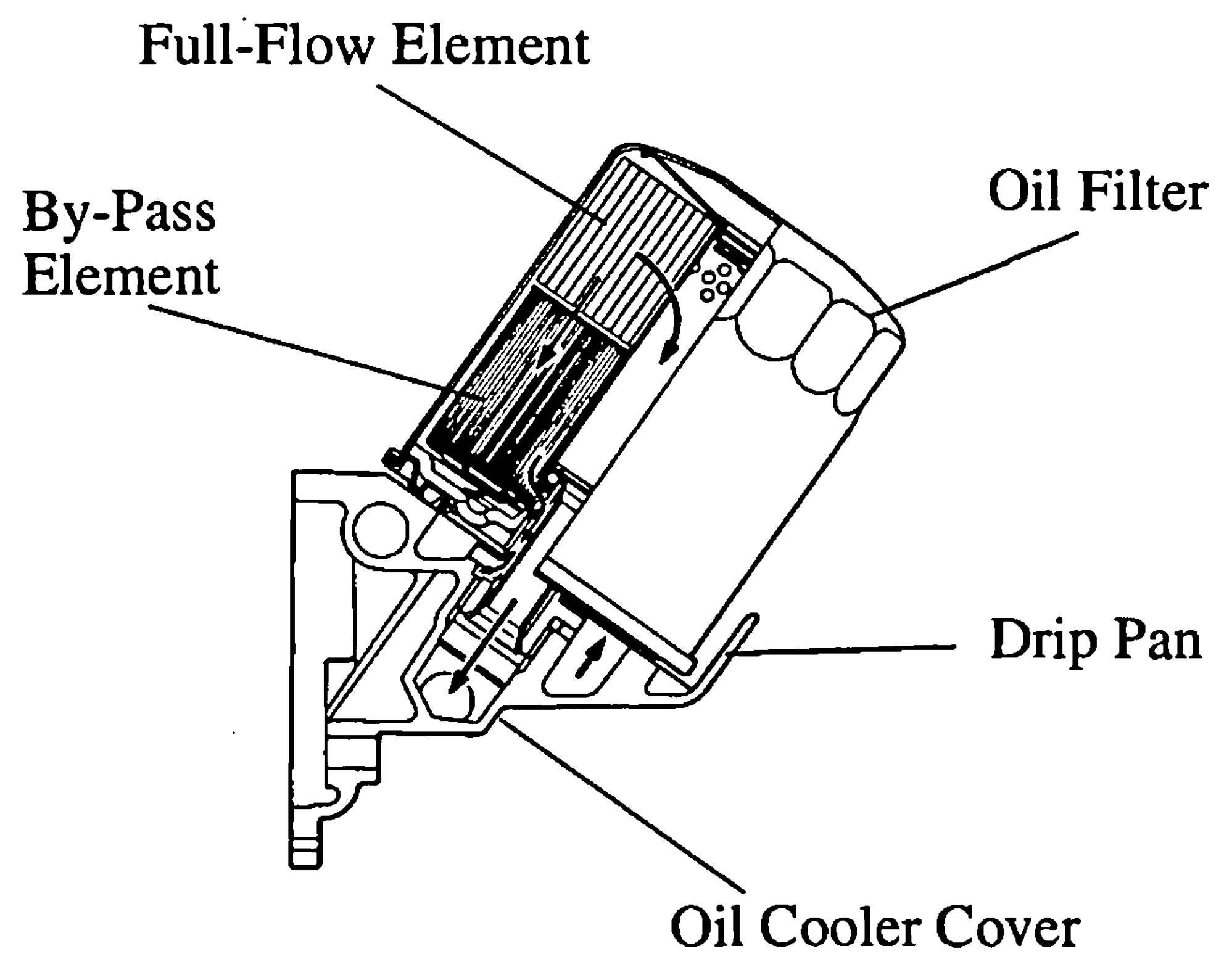
2. Oil Cooler

The water-cooled oil cooler is enclosed in the cylinder block.



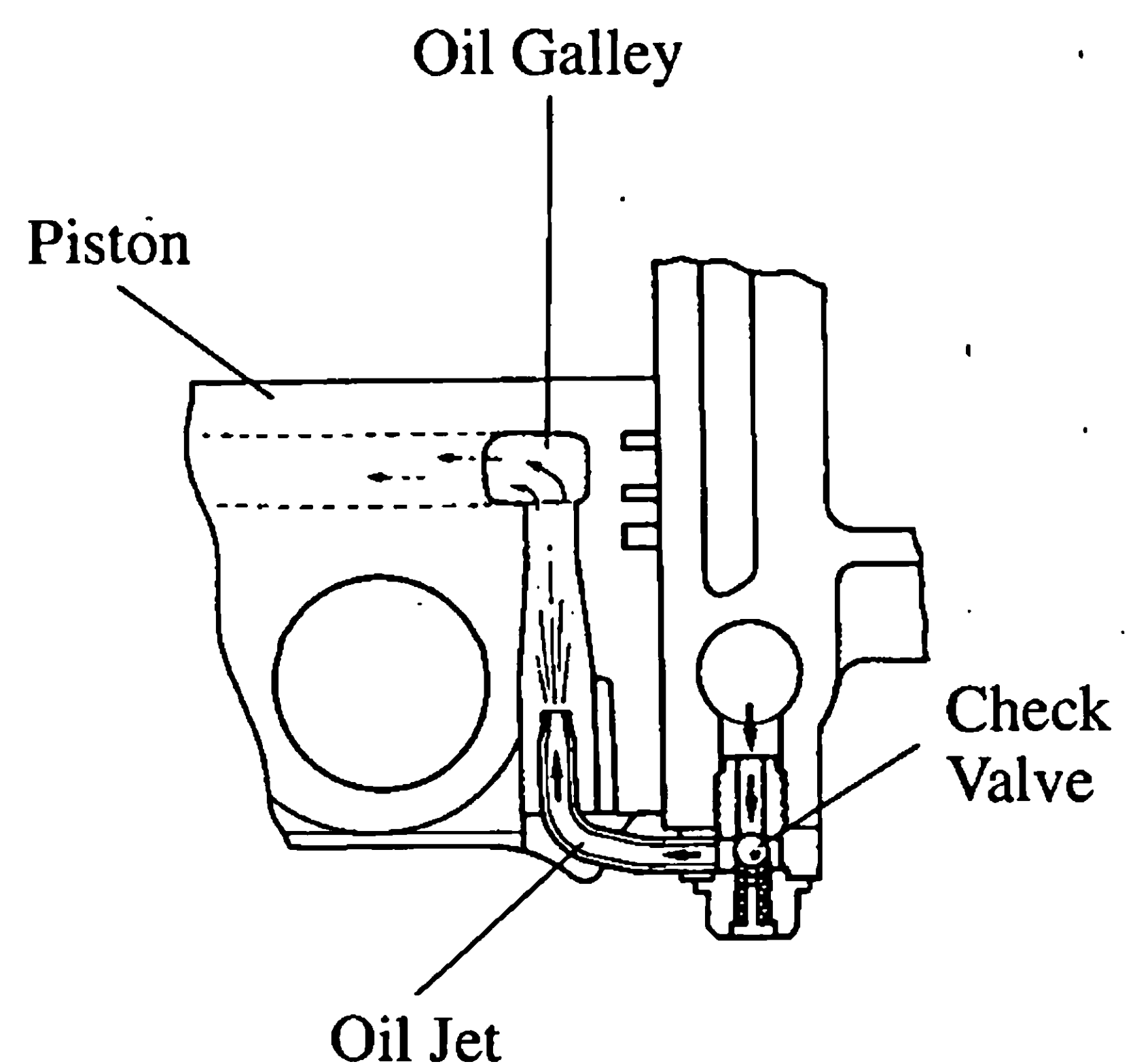
3. Oil Filter

- A twin-element type oil filter, in which a full-flow and bypass elements are combined, is used to increase the cleaning performance of the oil.
- A drip pan is provided in the oil cooler cover to catch the oil that could drip when the oil filter is replaced.



4. Oil Jets

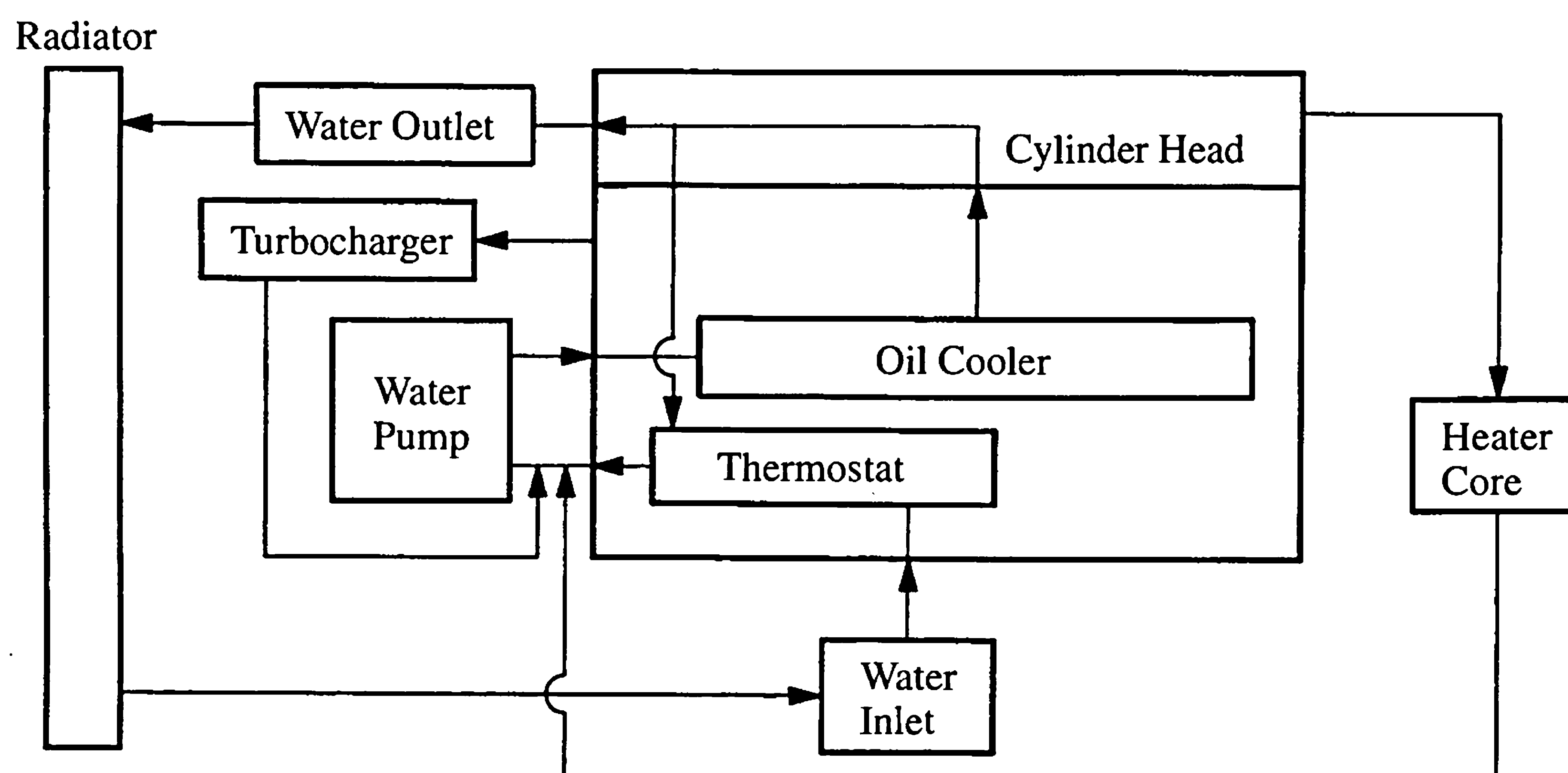
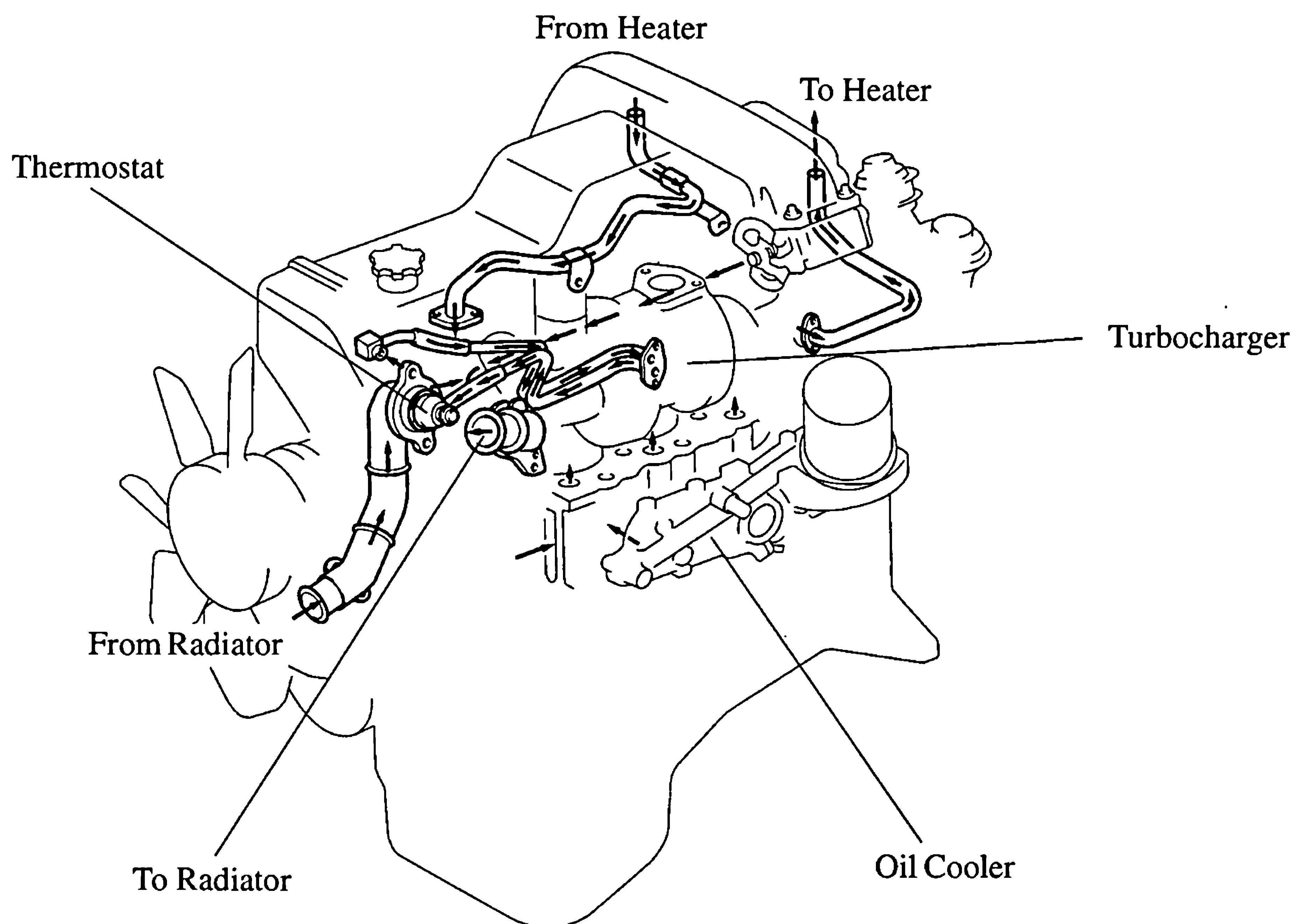
An oil jet is provided at the bottom of the cylinder block to spray oil to the piston's oil galley, thus further cooling and lubricating the piston.



■ COOLING SYSTEM

1. General

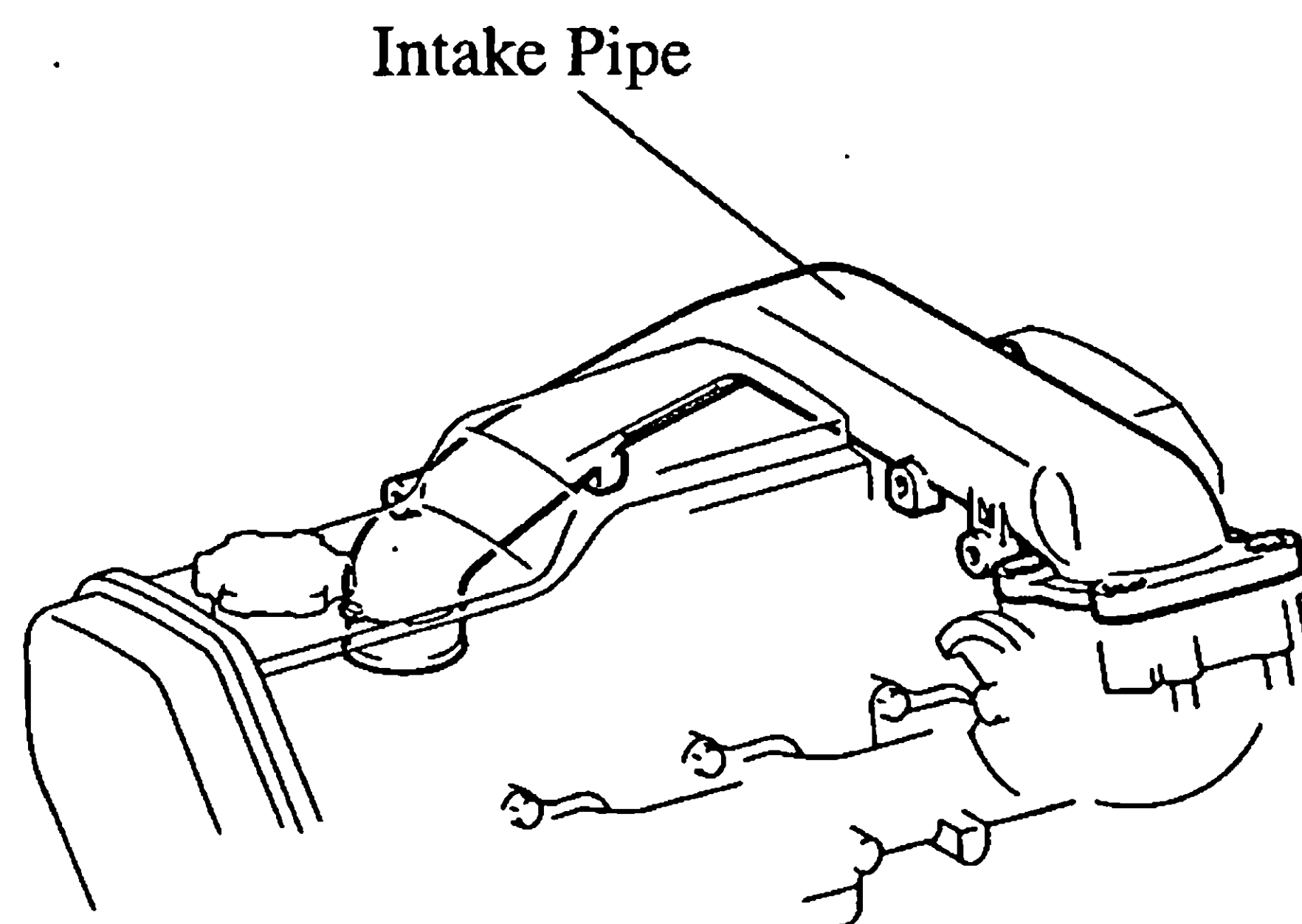
- The cooling system is a pressurized, forced-circulation type.
- An aluminum radiator core is used for weight reduction.



■ INTAKE AND EXHAUST SYSTEM

1. Intake Pipe

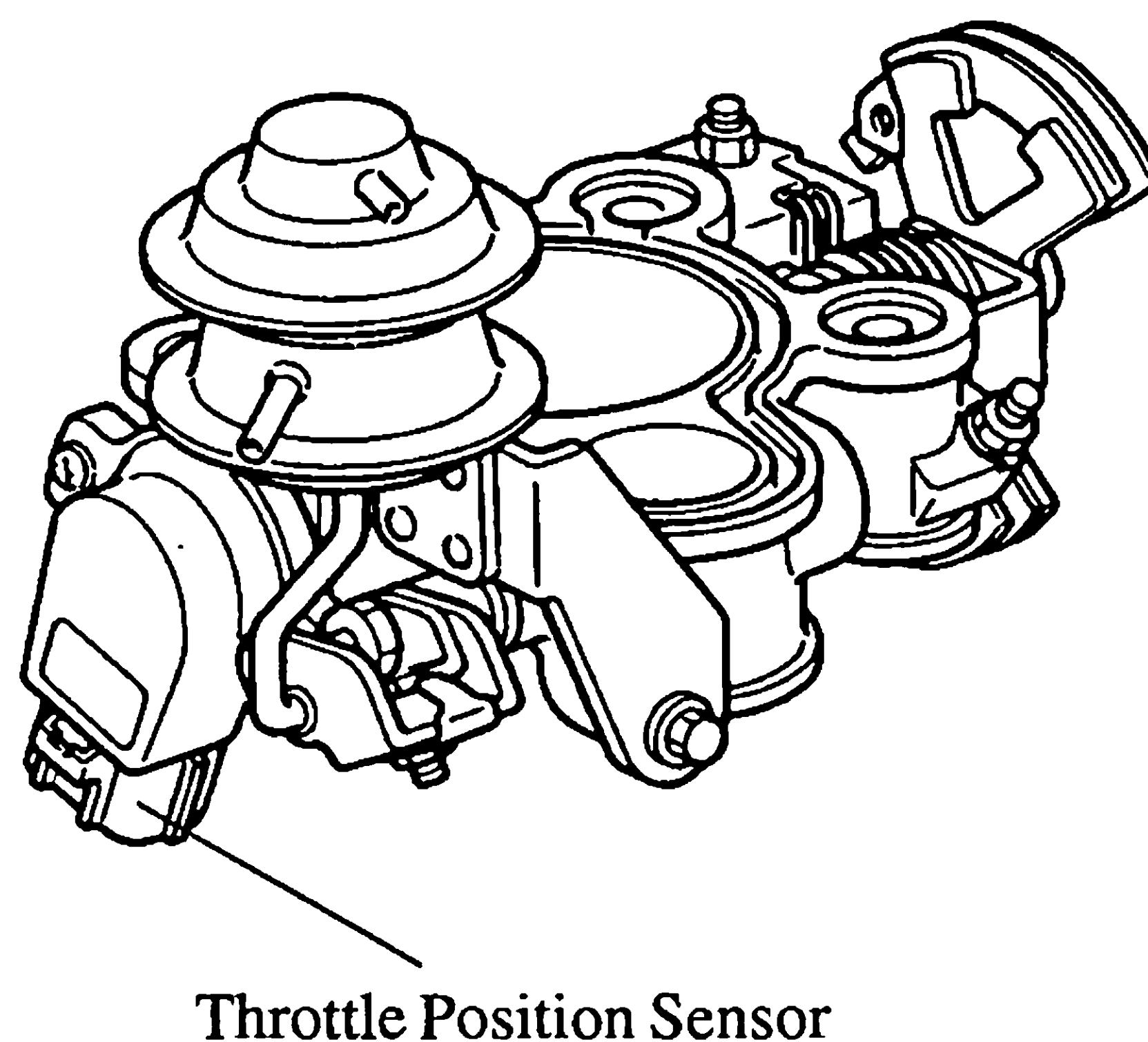
The intake pipe is made of aluminum to reduce weight and noise.



2. Venturi

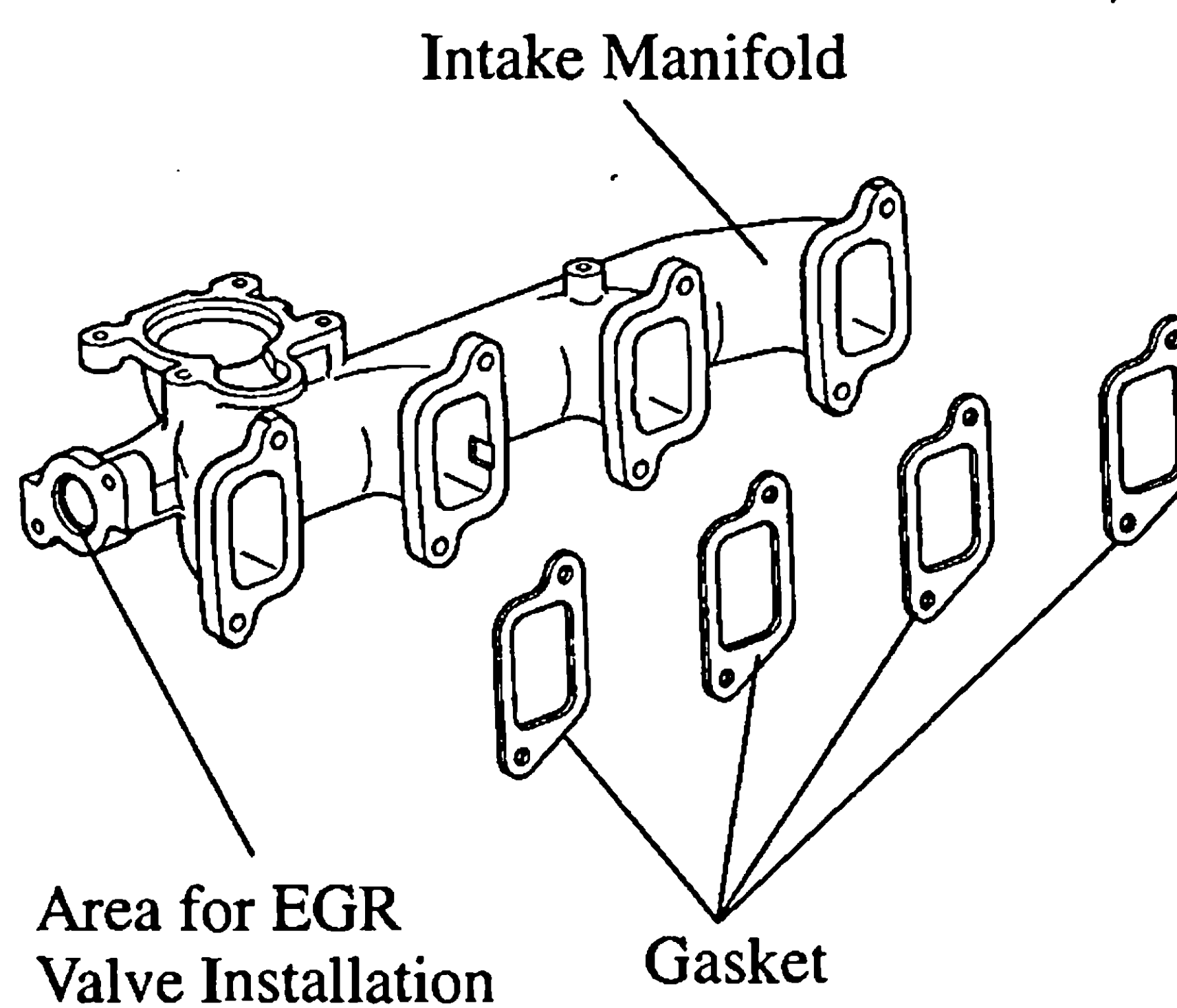
- A 1-valve type venturi on the 1KZ-T engine and a 2-valve type venturi on the 1KZ-TE engine are adopted to reduce vibration when the engine is stopped.
- On the 1KZ-FE engine, a throttle position sensor is provided on the venturi.

► For 1KZ-TE Engine ◀



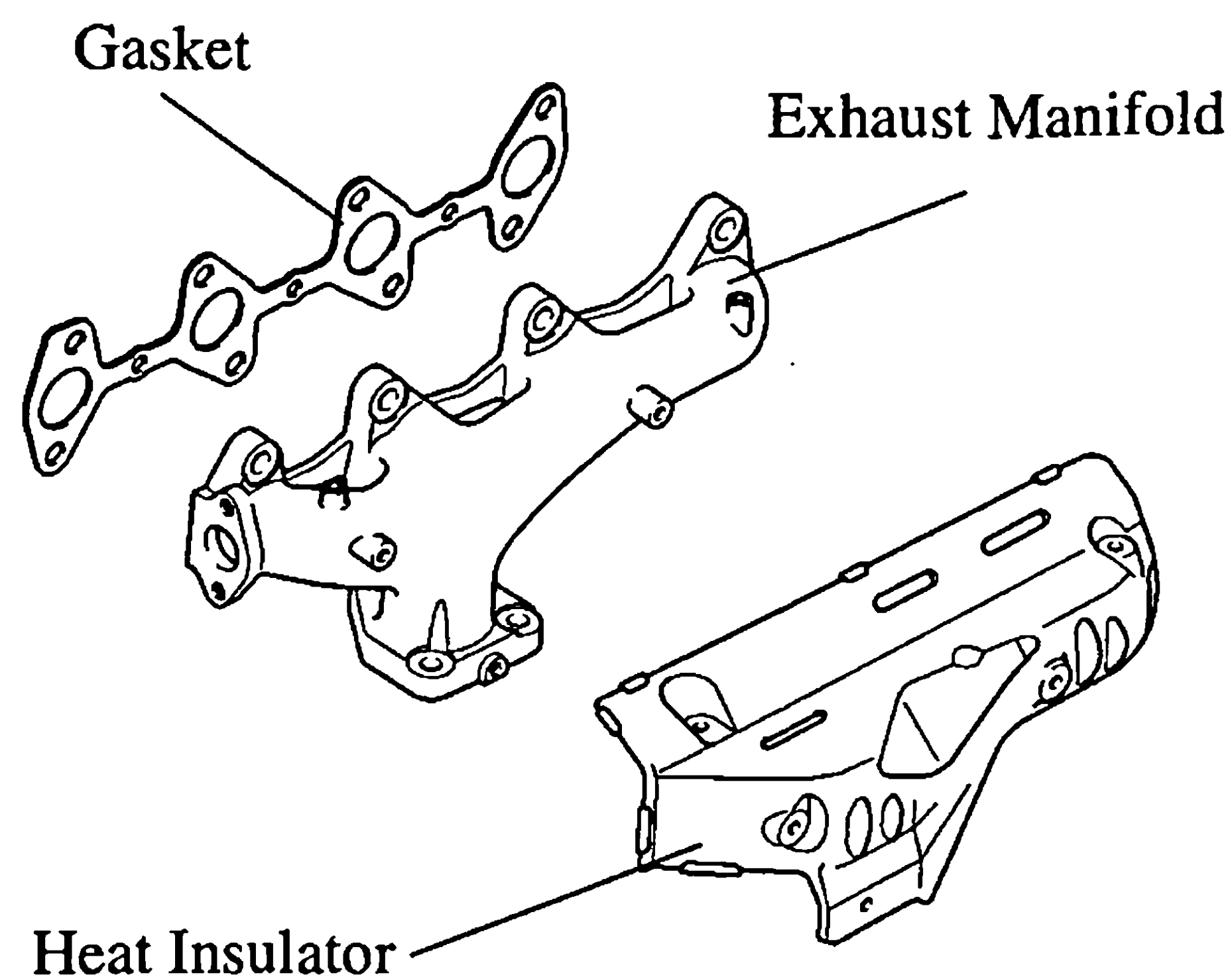
3. Intake Manifold

To accommodate the use of the EGR (exhaust gas recirculation) system, the 1KZ-TE engine provides an area for EGR valve installation.



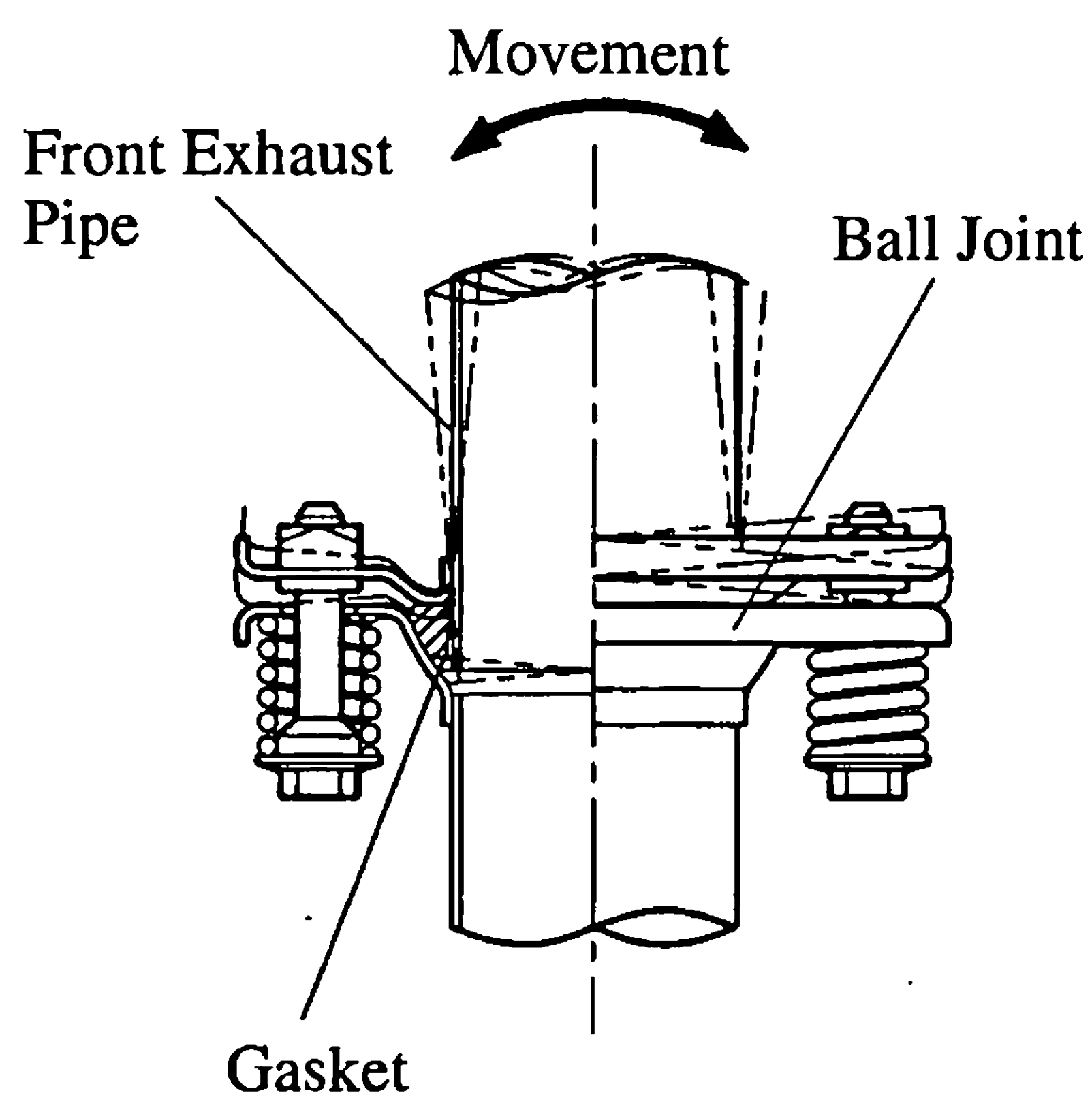
4. Exhaust Manifold

- The exhaust manifold is made of heat-resistant cast steel.
- The stainless laminete type gasket is used for exhaust manifold gasket.



5. Exhaust Pipe

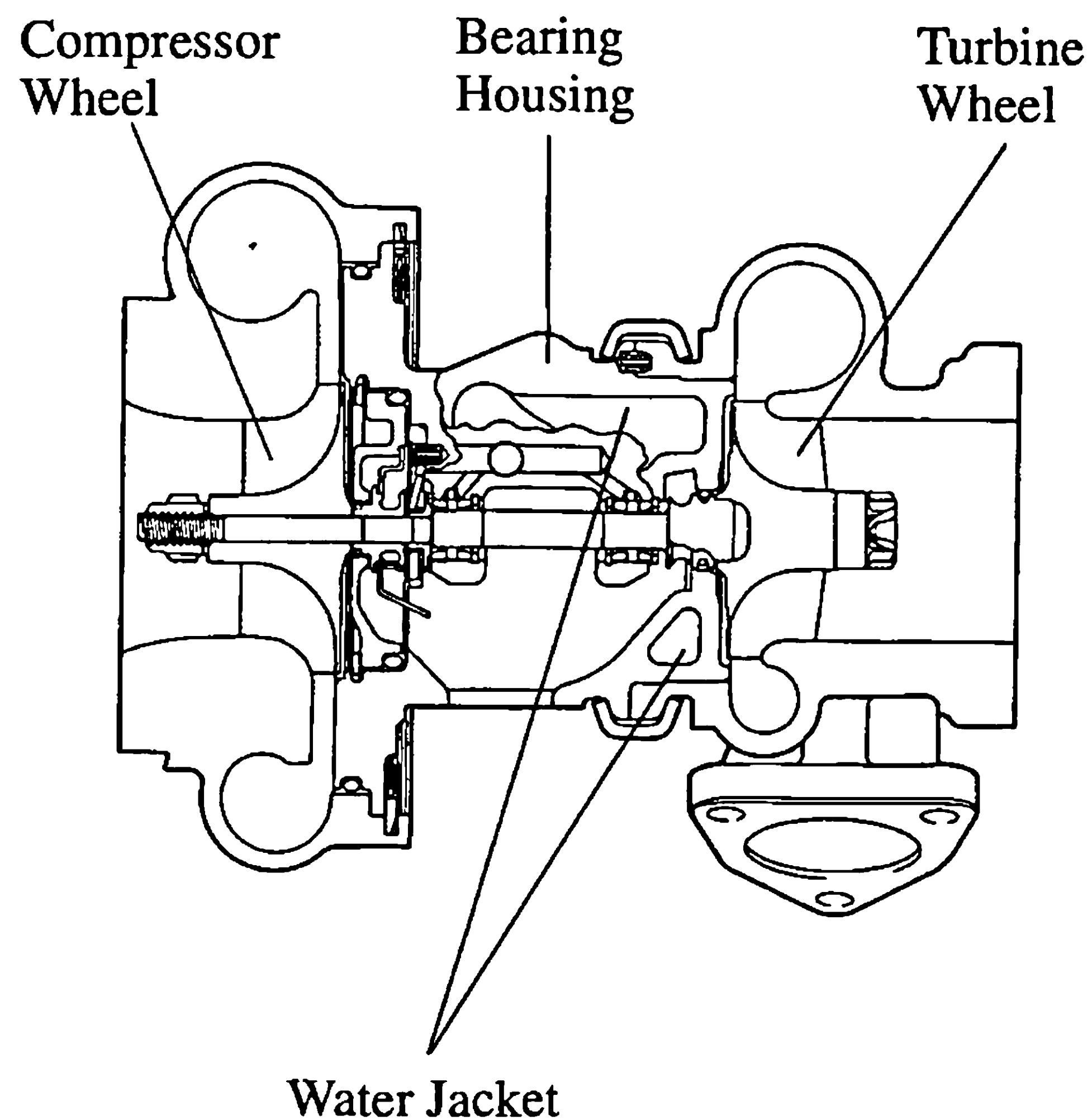
A ball joint has been placed at the front exhaust pipe to reduce noise and vibration.



■ TURBOCHARGER SYSTEM

1. General

- A lightweight and compact turbocharger is used for high performance.
- A water jacket is provided in the bearing housing to improve the cooling performance of the turbocharger.

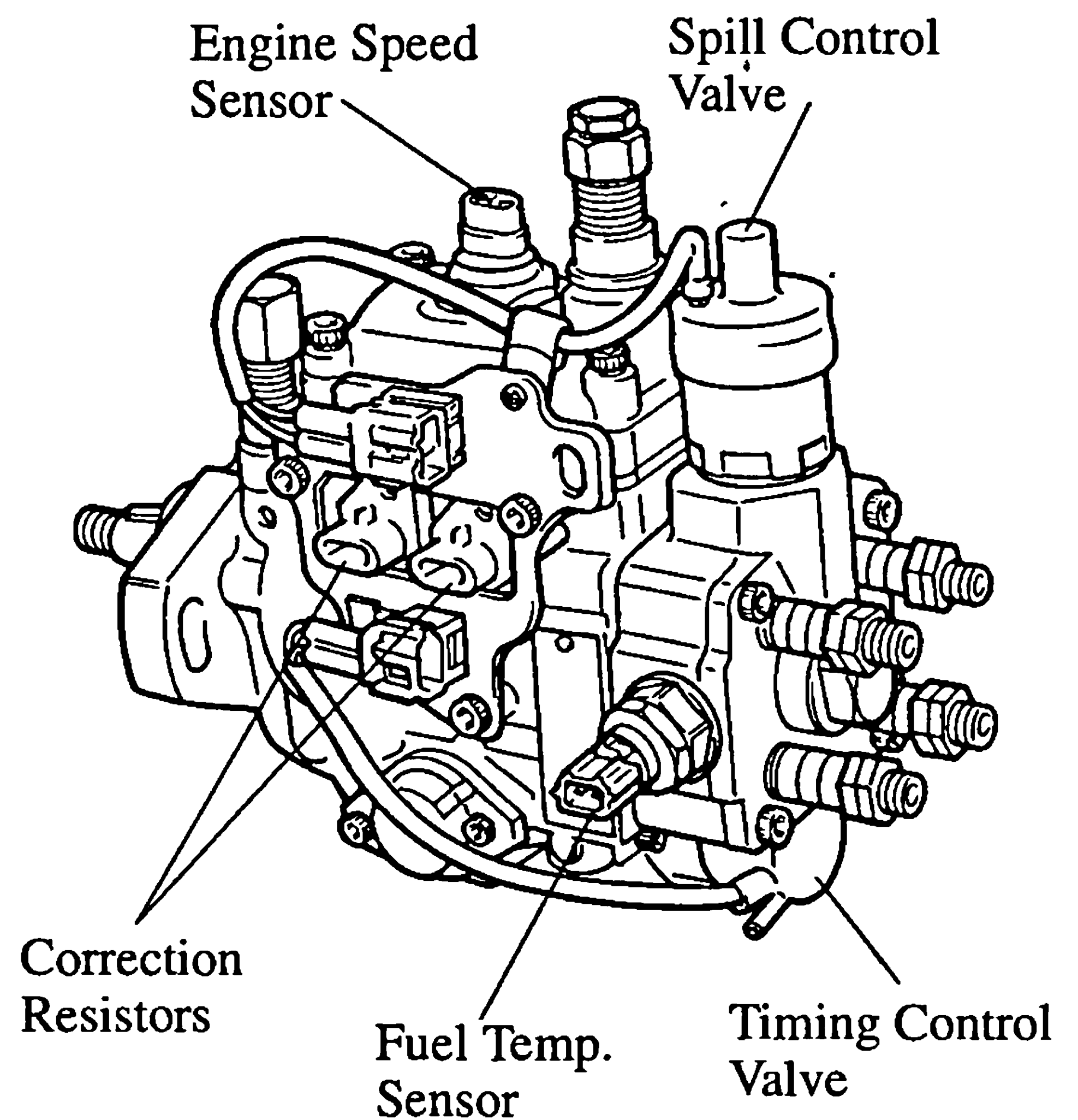


■ FUEL SYSTEM

1. Injection Pump

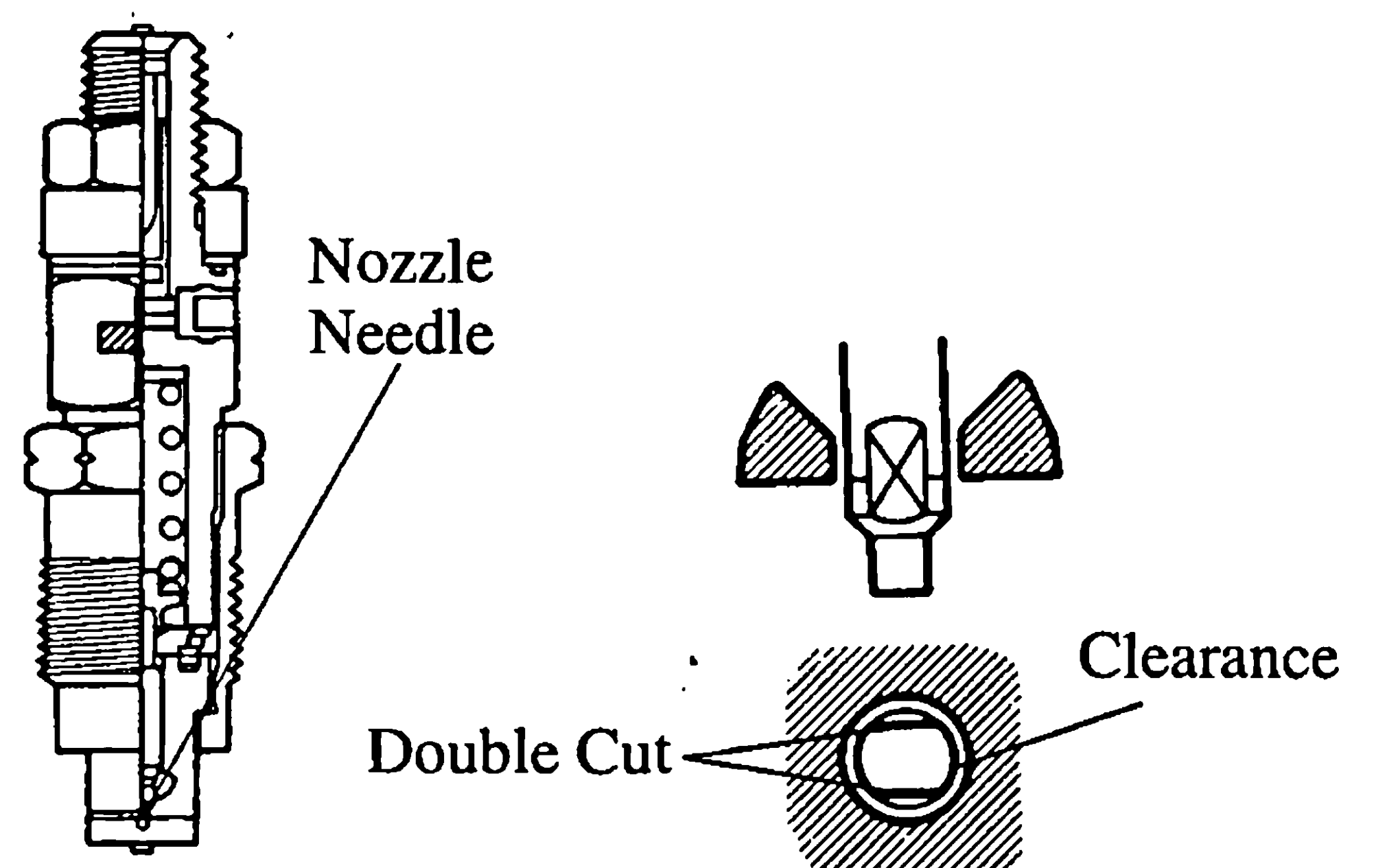
- A VE distribution type injection pump is used.
- The 1KZ-TE engine provides, in conjunction with the adoption of electronic control, a spill control valve, timing control valve, fuel temperature sensor, engine speed sensor, and correction resistors.

► For 1KZ-TE Engine ◀



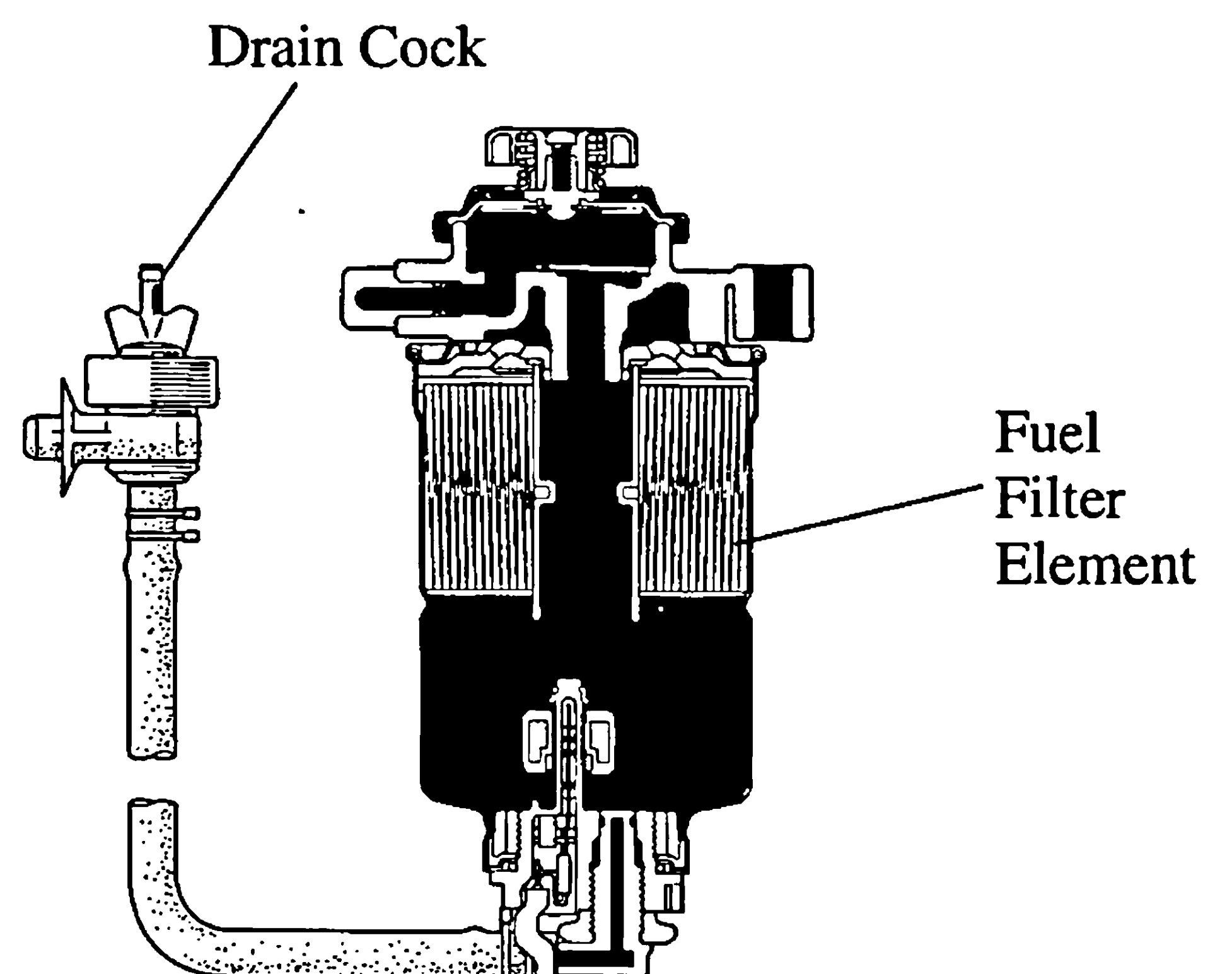
2. Injection Nozzle

- Compact size throttle type injection nozzles are used.
- A double-cut nozzle needle is used and the clearance has been optimized to reduce exhaust emissions and noise during idling.



3. Fuel Filter

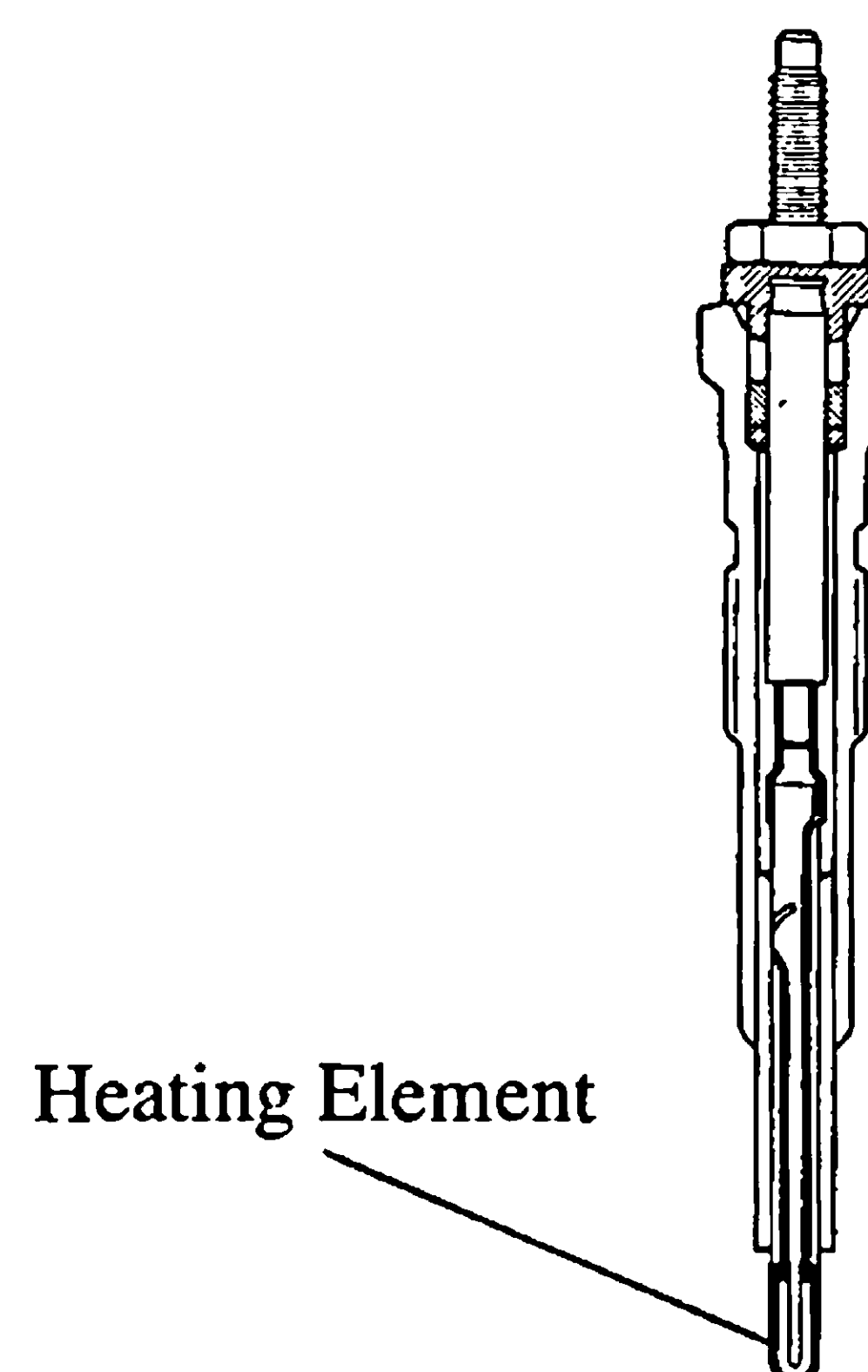
Fuel filter functions to separate water included in the fuel and the drain cock is made separate in order to improve operationability to drain the separated water.



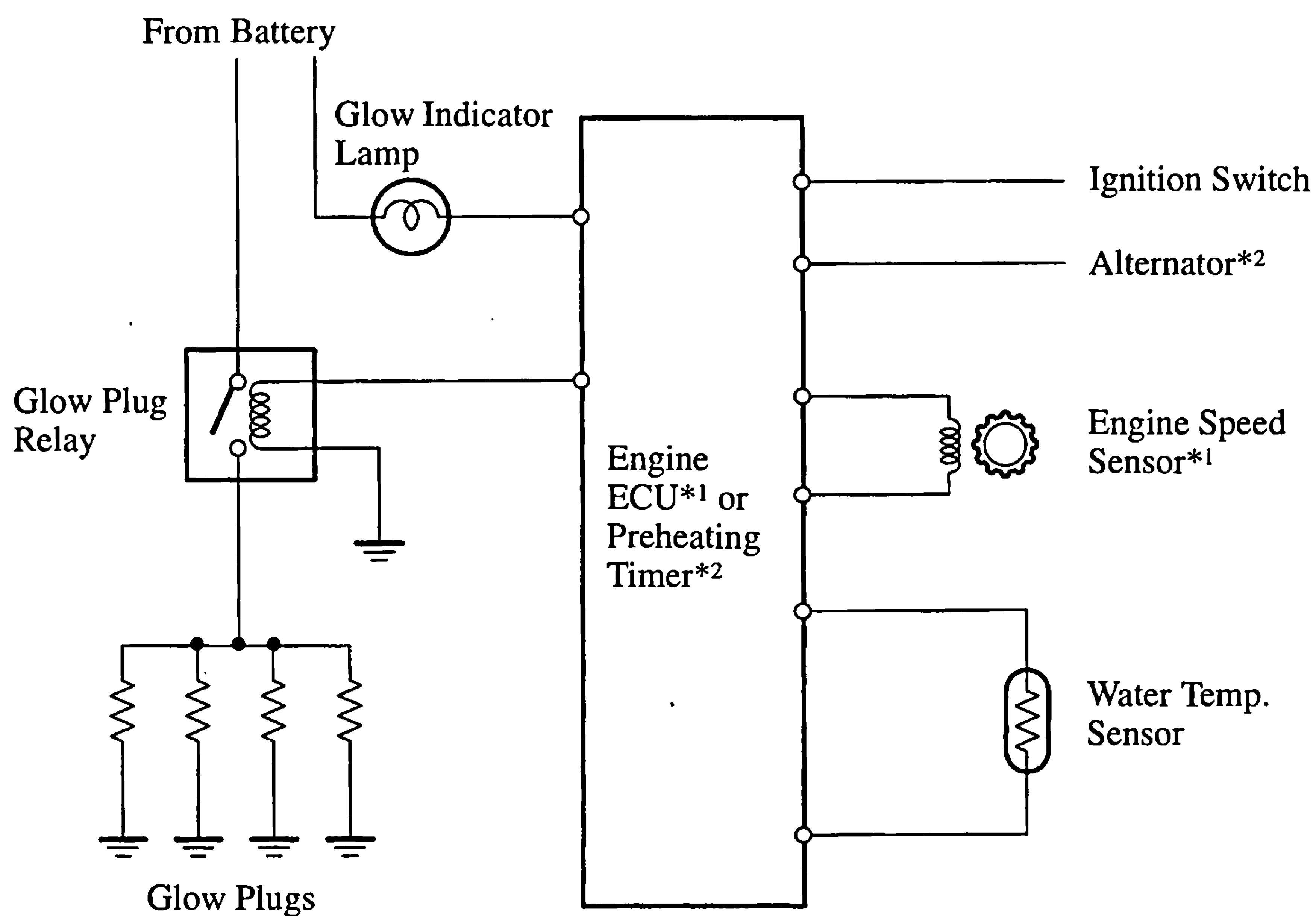
■ GLOW SYSTEM

1. Glow Plug

- Ceramic glow plugs are used to reduce preheating time and to simplify the system configuration.
- The ceramic glow plug's heating element provides the function to regulate its own temperature, thus improving its heating performance and simplifying the system configuration.



► Wiring Diagram ◀



*1: Only for 1KZ-TE Engine

*2: Only for 1KZ-T Engine

■ ENGINE CONTROL SYSTEM (FOR 1KZ-TE ENGINE)

1. General

To operate the engine in an optimal condition. The engine control system of the 1KZ-TE engine takes general control of the following functions: fuel injection volume control, fuel injection timing control, idle speed control, and intake constrictor control. In addition, a diagnosis function has been added to improve the serviceability of the engine.

System	Outline
Fuel Injection Volume Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection volume in accordance with the engine condition.
Fuel Injection Timing Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection timing in accordance with the engine condition.
Idle Speed Control	The engine ECU determines the idle speed in accordance with the engine condition, and controls the fuel injection volume in order to achieve the target idle speed.
Stable Idling Control	Corrects the fuel injection volume that is directed to each cylinder during idling, thus reducing engine vibration.
Intake Constrictor Control	Shuts off the intake air to reduce the vibration when the engine stopped.
Glow Plug Control	Controls the length of time when the current is applied to the glow plugs, in accordance with the coolant temperature.
EGR Control	Controls the EGR volume in accordance with the engine condition.
Air Conditioning Cut-Off Control	By controlling the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Engine Immobiliser	Prohibits fuel delivery if an attempt is made to start the engine with an invalid ignition key.
Diagnosis	● When the ECU detects a malfunction, the ECU diagnoses 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	When the ECU detects a malfunction, the ECU stops or controls the engine according to the data already stored in memory.

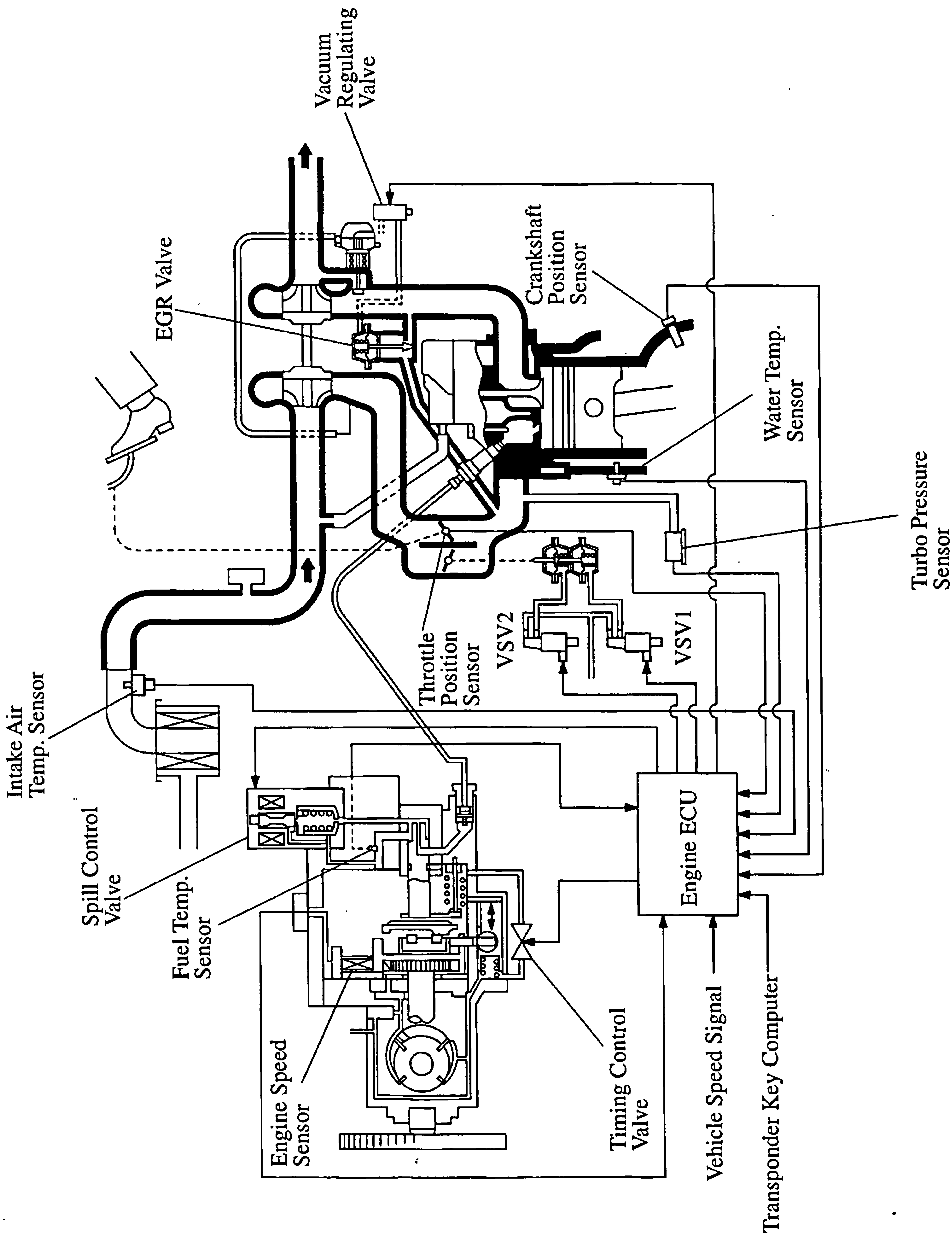
2. Construction

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

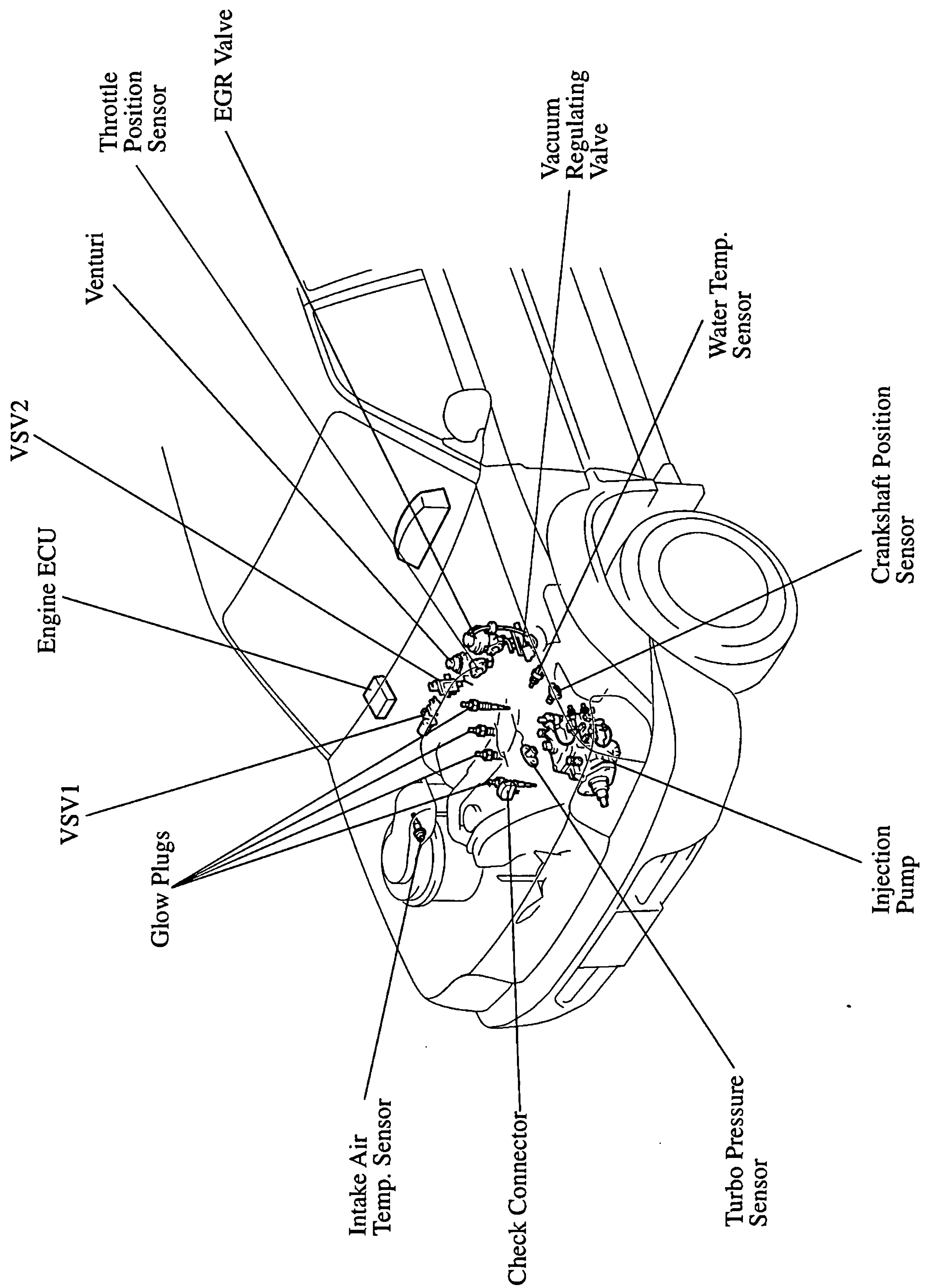


*: Automatic transmission models only

3. Engine Control System Diagram



4. Layout of Components

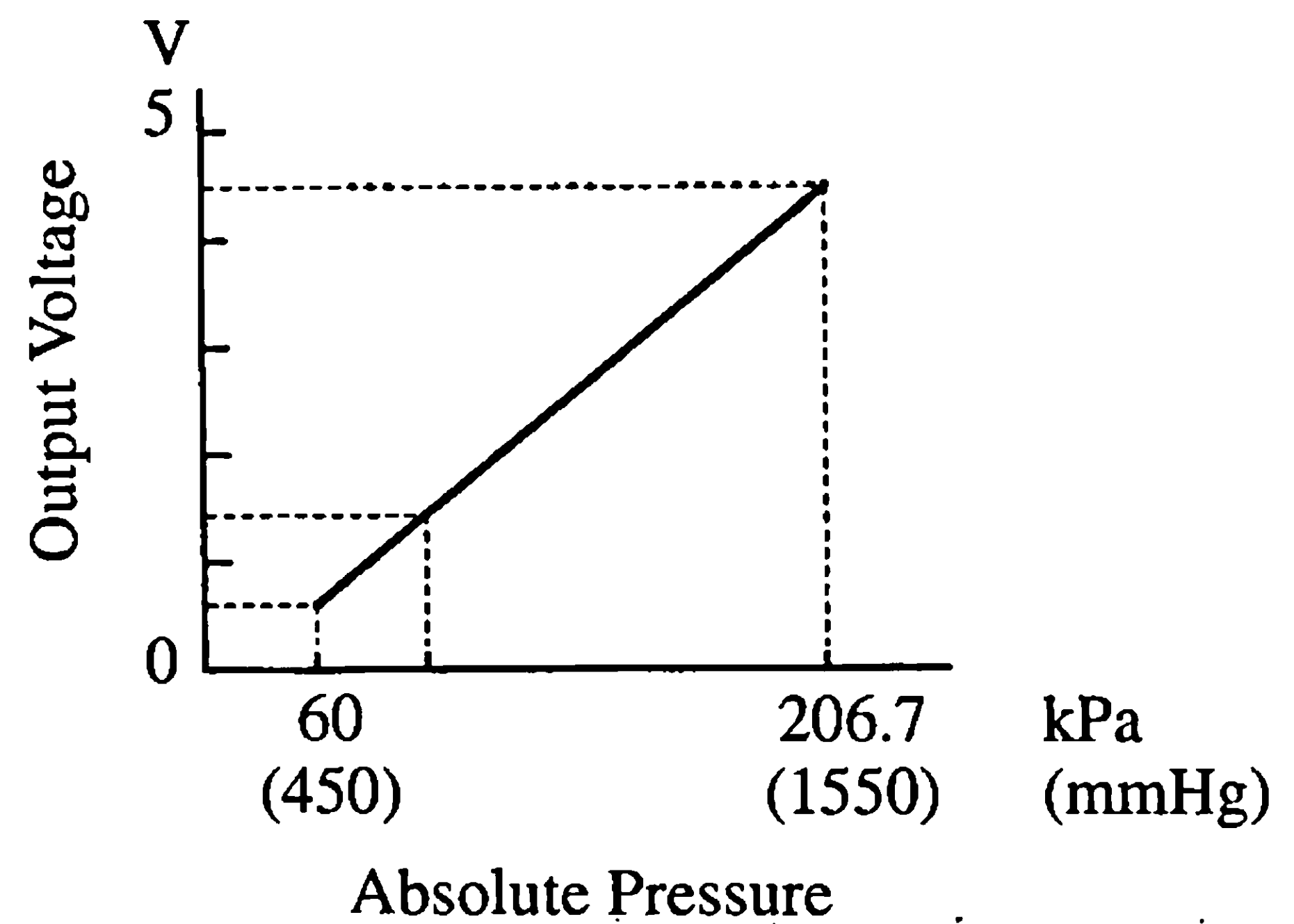
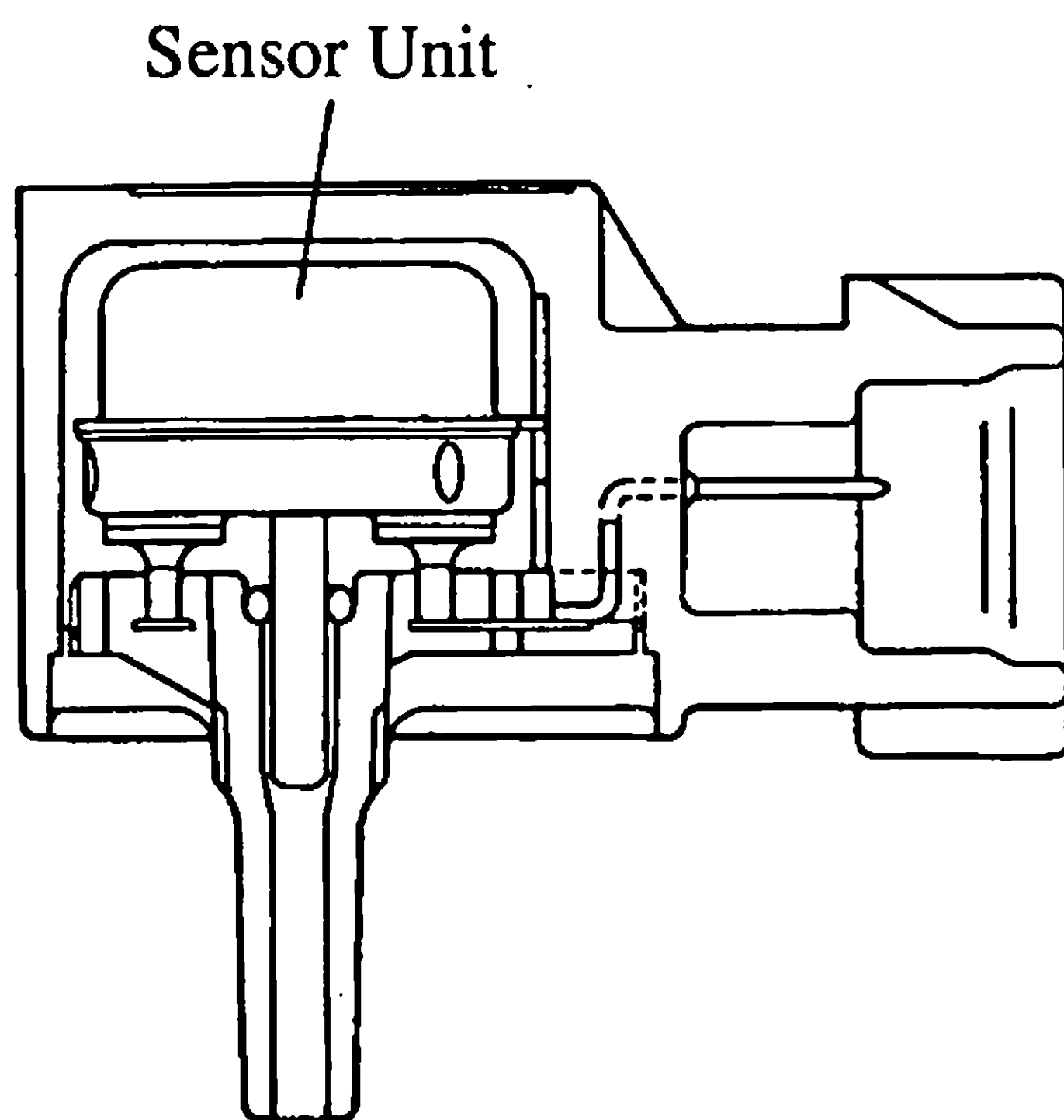


5. Main Components of Engine Control System

Turbo Pressure Sensor

The manifold pressure sensor is mounted on the intake manifold.

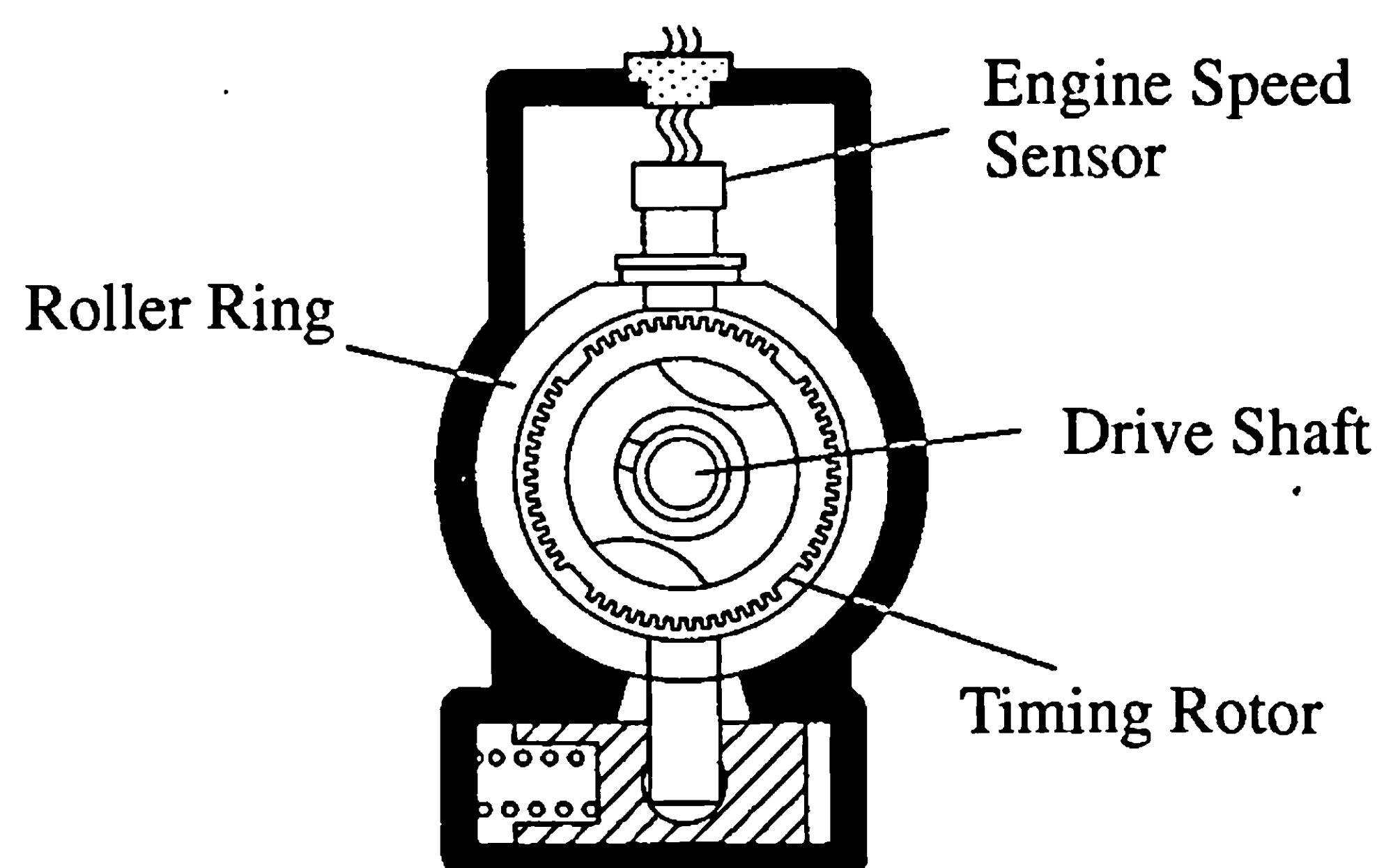
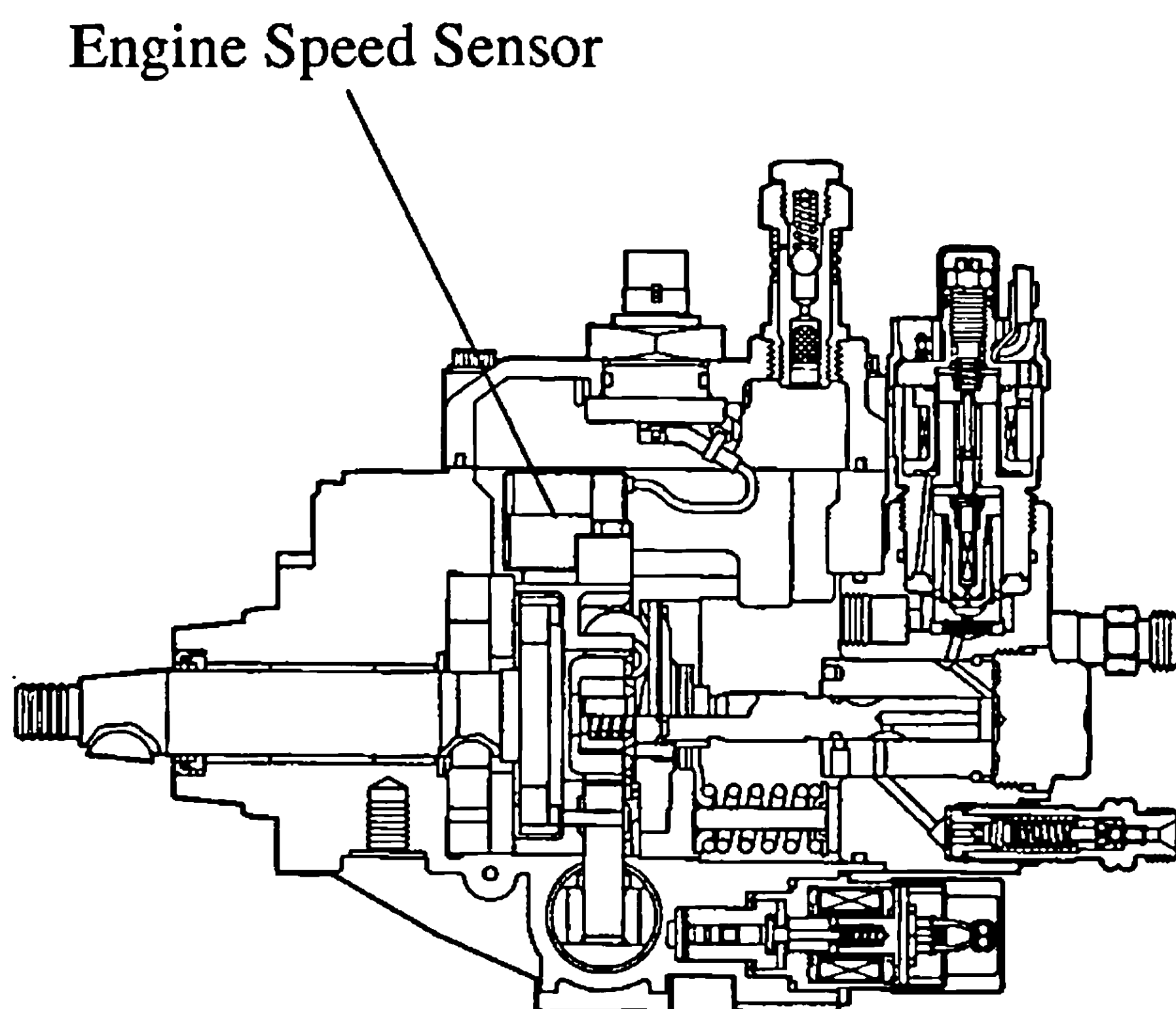
It consists of a semiconductor which utilizes the characteristic of a silicon chip that changes its electrical resistance when pressure is applied to it. The sensor converts the pressure into an electrical signal, and sends it to the engine ECU in an amplified form.



**Turbo Pressure Sensor
Output Characteristics**

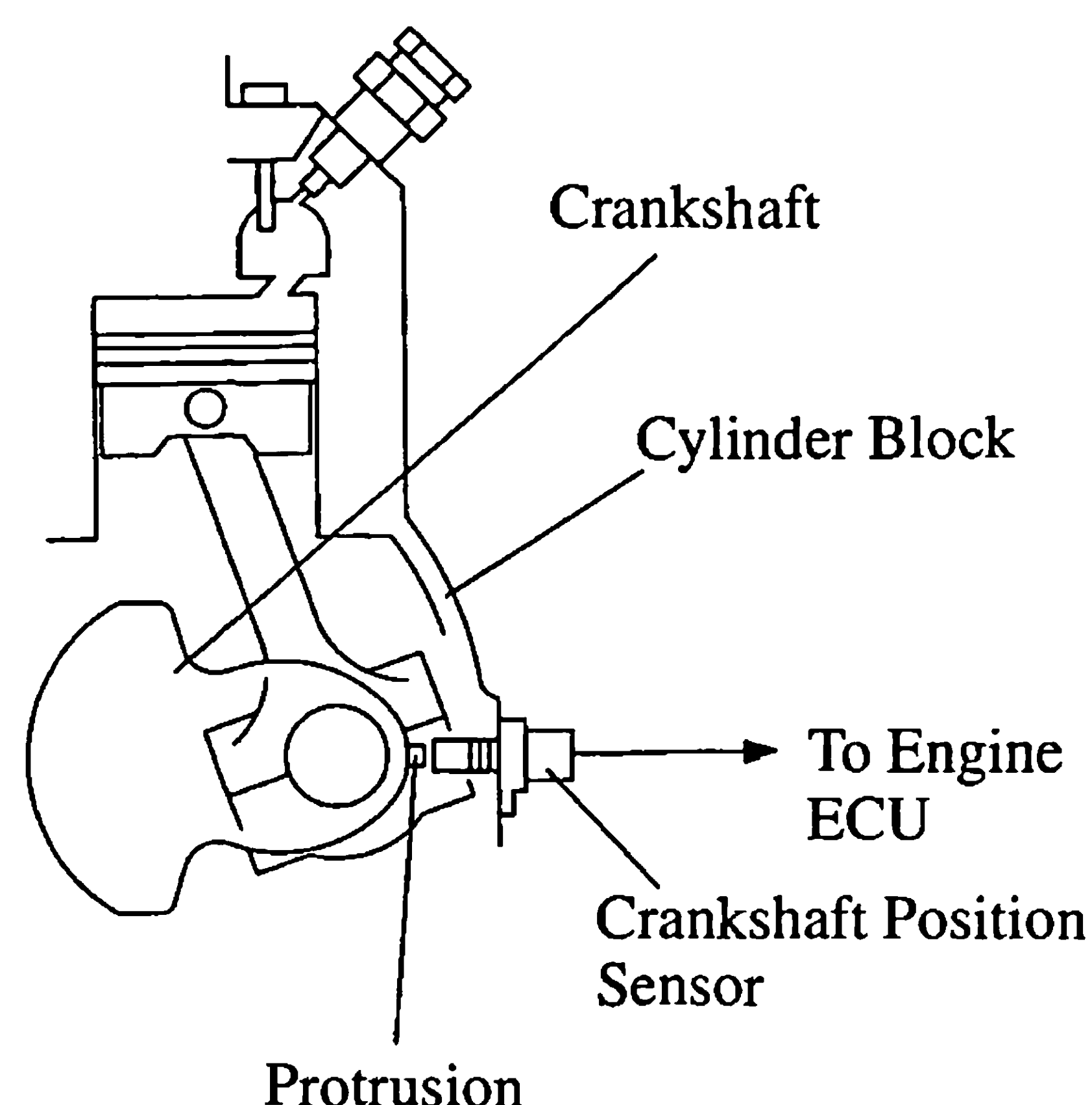
Engine Speed Sensor

The engine speed sensor is attached to the roller ring in the injection pump to detect the engine speed. The timing rotor is attached to the drive shaft. Missing 2 teeth at each of the 4 locations, the timing rotor generates a signal every 11.25° (crankshaft angle) with its 56 teeth.



Crankshaft Position Sensor

The crankshaft position sensor is attached to the cylinder block. Using the protrusion that is provided on the crankshaft, the sensor generates 1 signal for every revolution. This signal is then sent to the engine ECU as a crankshaft position signal.

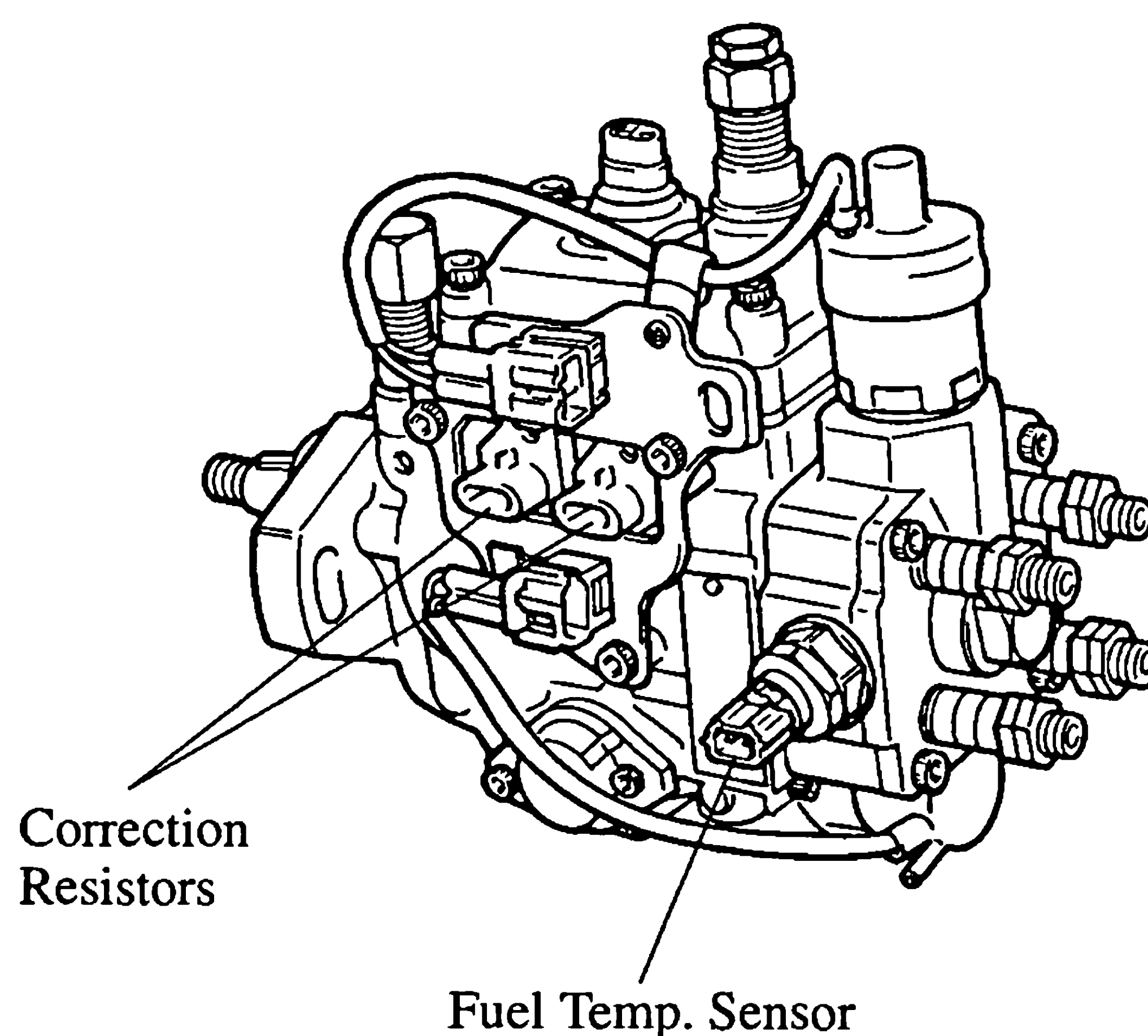


Fuel Temperature Sensor

The fuel temperature sensor is attached to the injection pump, and uses an internal thermistor to detect the fuel temperature.

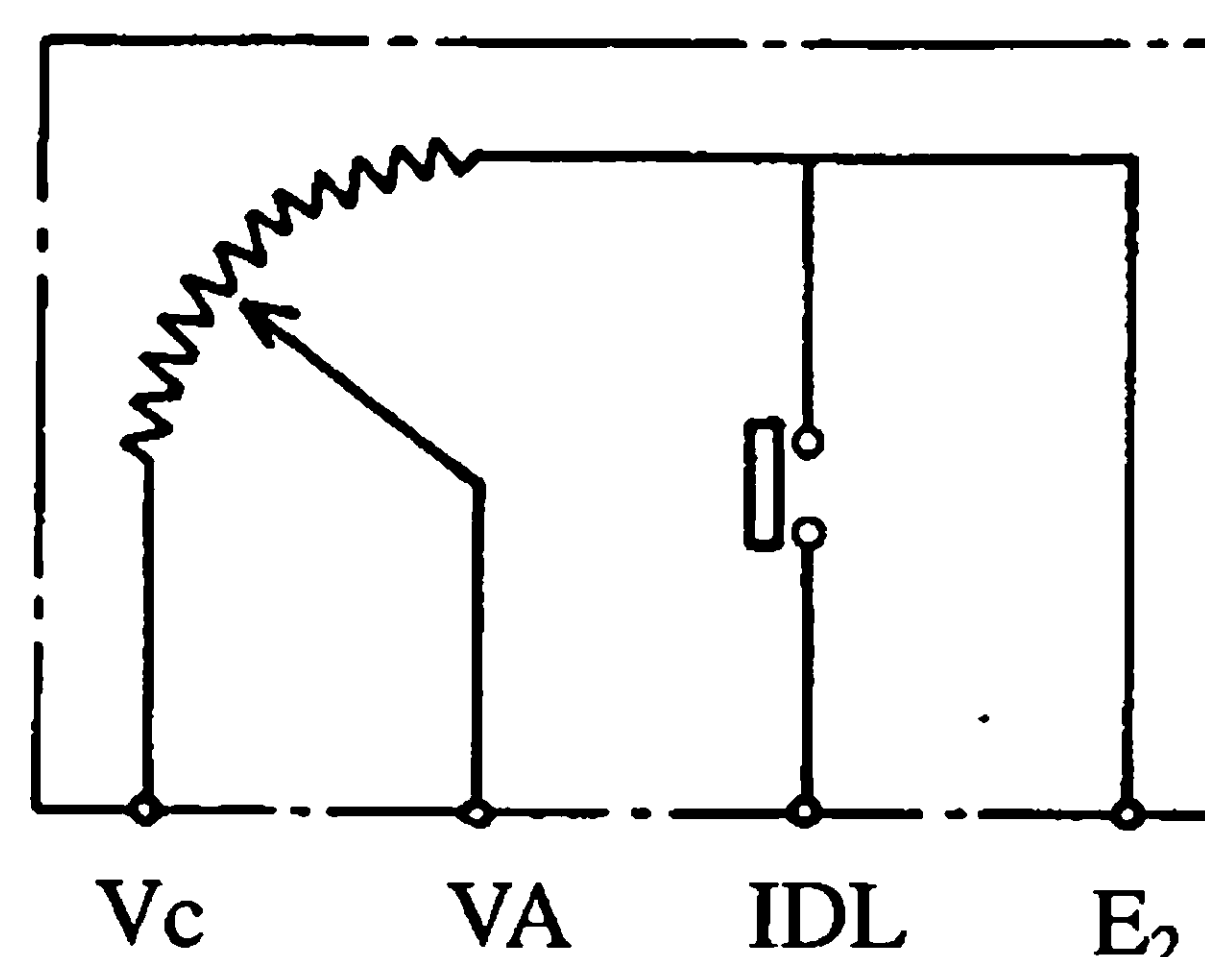
Correction Resistors

To compensate for the shift in injection volume and injection timing caused by the variance in the injection pump itself, an appropriate correction resistor is selected for each injection pump and installed on the pump.



Throttle Position Sensor

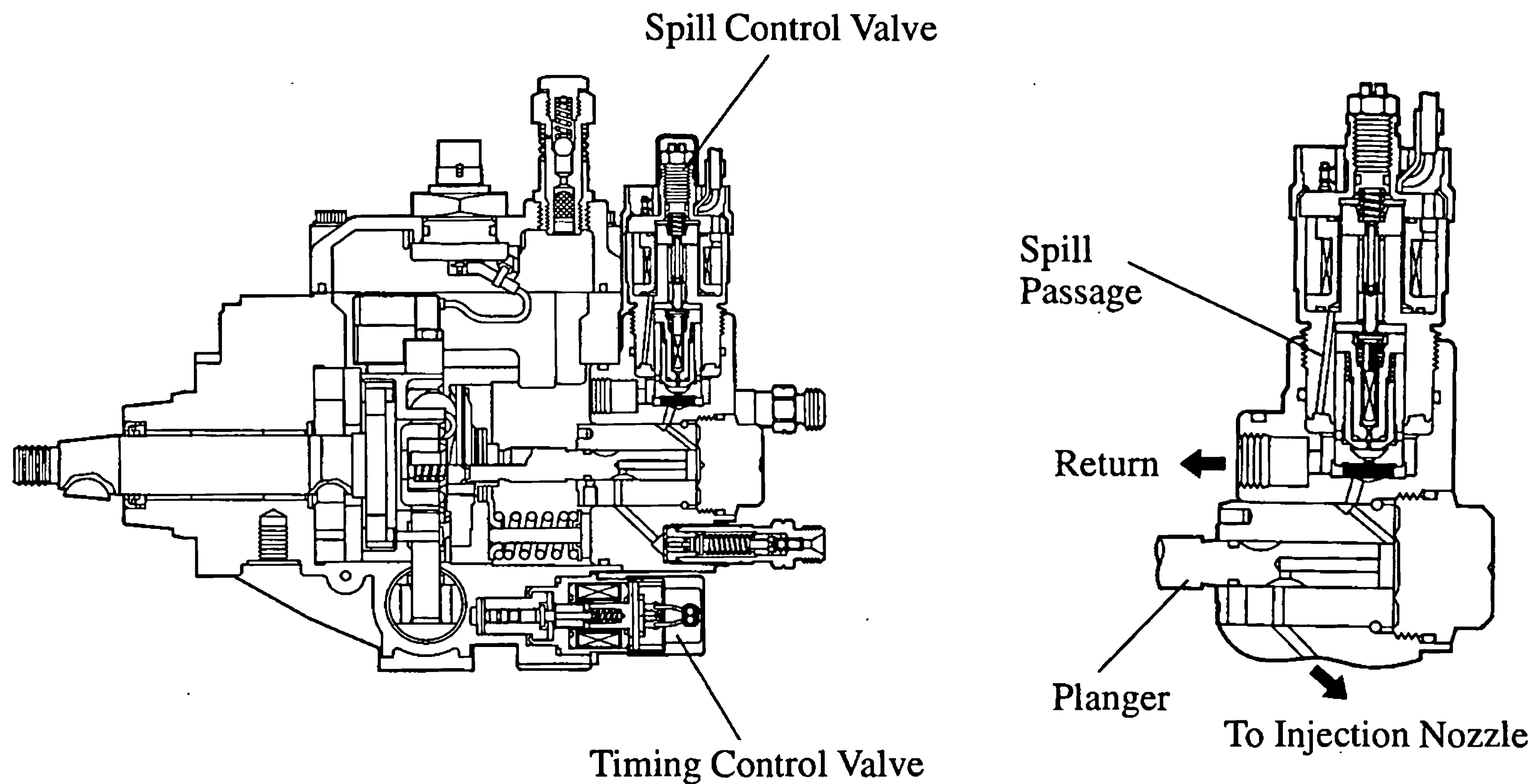
The throttle position sensor is attached to the venturi of the intake manifold to detect the idling signal and the throttle position signal.



Spill Control Valve

The spill control valve is attached to the injection pump to control the fuel injection volume in accordance with the signals received from the engine ECU. When the current applied to the spill control valve is shut off, the valve in the spill control valve opens by the difference in pressures. Thus, the pressure in the plunger decreases causing the injection nozzle to stop injection fuel.

The length of time until the spill control valve is turned OFF becomes the fuel injection time. Thus, the fuel injection volume is controlled by increasing or decreasing the length of time until the spill control valve is turned OFF.

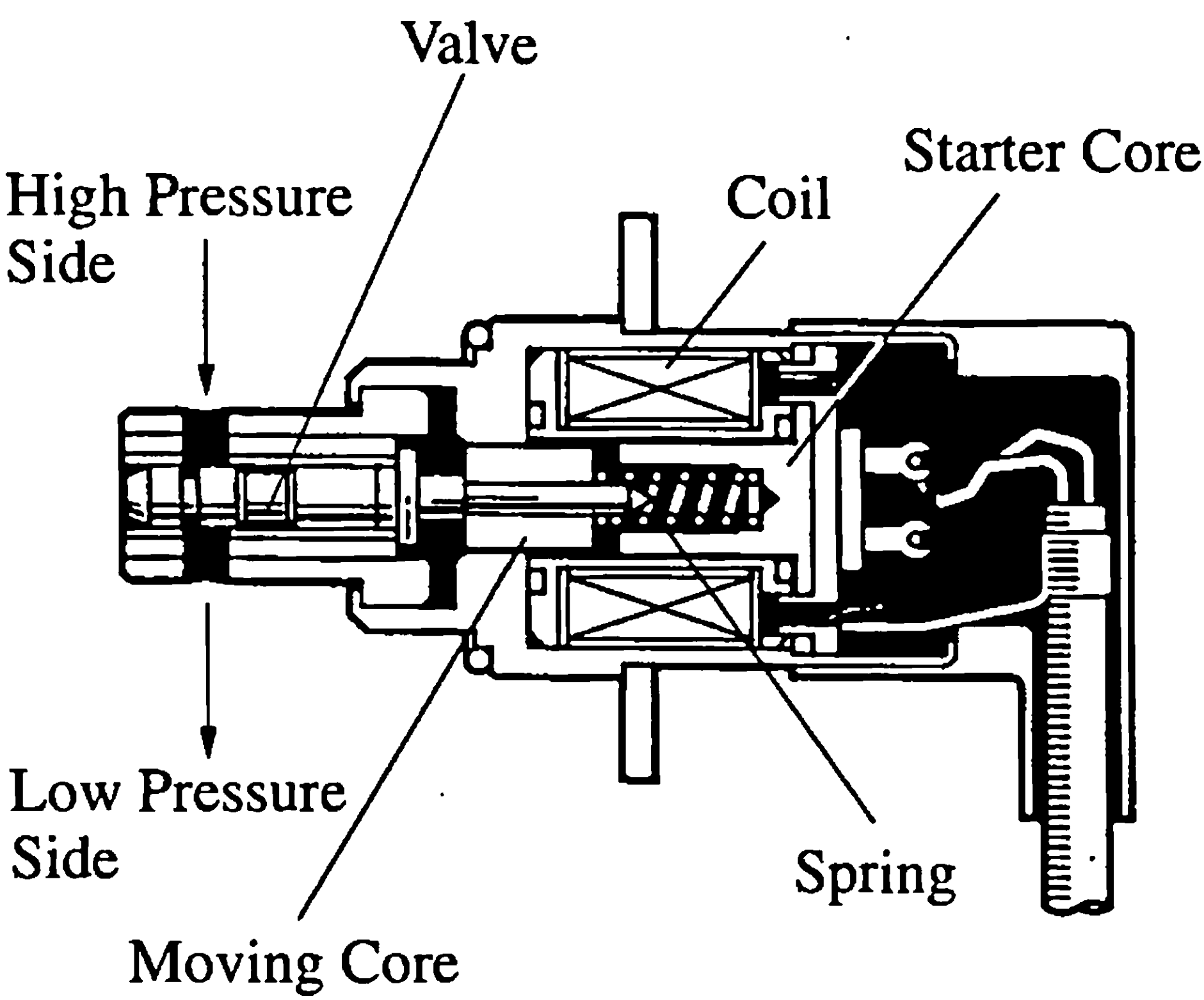


EG

Timing Control Valve

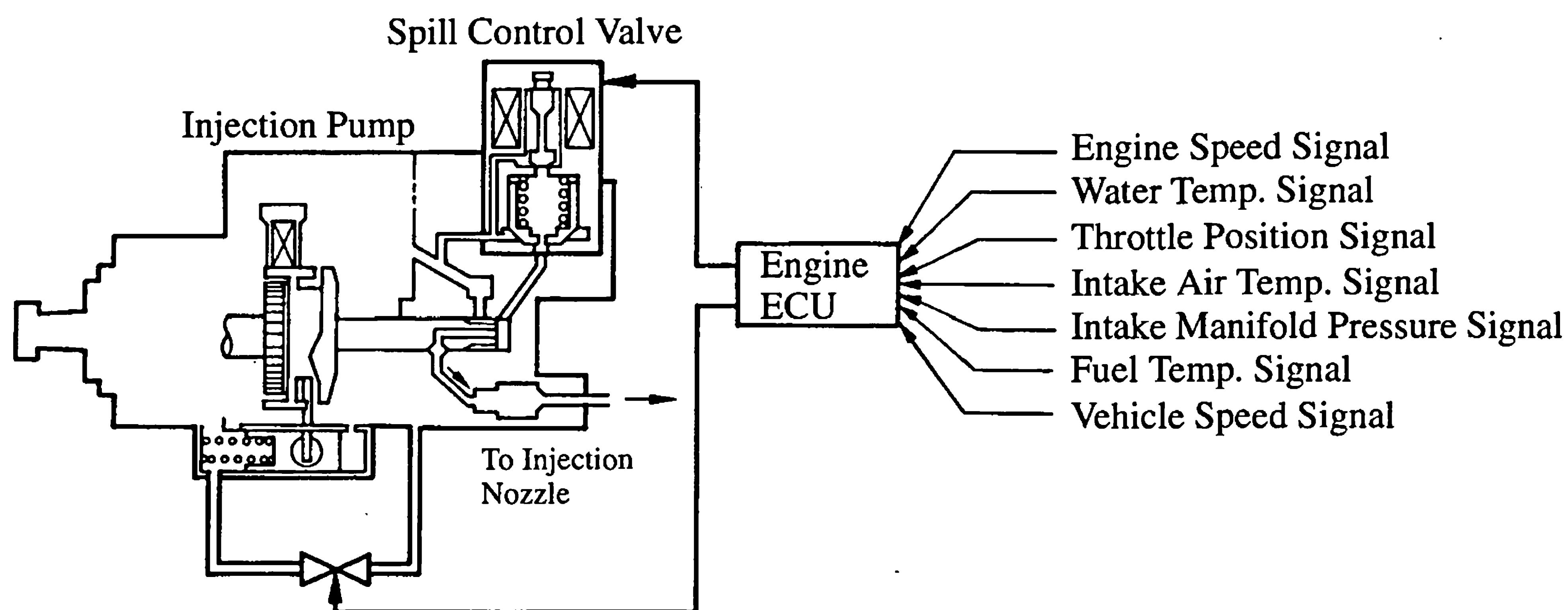
The timing control valve is attached to the injection pump. In accordance with the signals from the engine ECU, it opens the valve in the fuel passage between the high-pressure chamber and the low-pressure chamber, thus controlling the injection timing.

When the current flows to the coil of the timing control valve, the stator core becomes an electromagnet to push and compress the spring. This causes the moving core to retract and open the fuel passage.



6. Fuel Injection Volume Control

Based on sensor signals, the engine ECU controls the fuel injection volume by calculating the fuel injection volume that is appropriate for the engine condition.



Function of Engine ECU

The engine ECU calculates the basic injection volume based on the throttle opening and engine speed, and the maximum injection volume for the engine condition. The two injection volumes are then compared, and the lesser of the two is selected. A correction value, which is obtained via the correction resistors, is added to that injection volume, thus determining the final injection volume.

1) Basic Injection Volume

Determined in accordance with the throttle opening and the engine speed.

2) Maximum Injection Volume

Based on the signals received from the sensors, correction values are added to the theoretically required injection volume (basic maximum injection volume) to determine the maximum injection volume during engine operation.

a. Basic Maximum Injection Volume

Determined in accordance with the engine speed.

b. Intake Manifold Pressure Correction

Corrects the basic maximum injection volume in accordance with the intake manifold pressure. The higher the intake manifold pressure becomes, the larger the injection volume becomes.

c. Intake Air Temperature Correction

Corrects the variance in the air-fuel ratio that is created by the difference in the density of the intake air in accordance with the intake air temperature. The higher the intake air temperature becomes, the smaller the injection volume becomes.

d. Fuel Temperature Correction

Corrects the variance in the injection volume that is created by the difference in the density of the fuel in accordance with the fuel temperature. The higher the fuel temperature becomes, the larger the injection volume becomes.

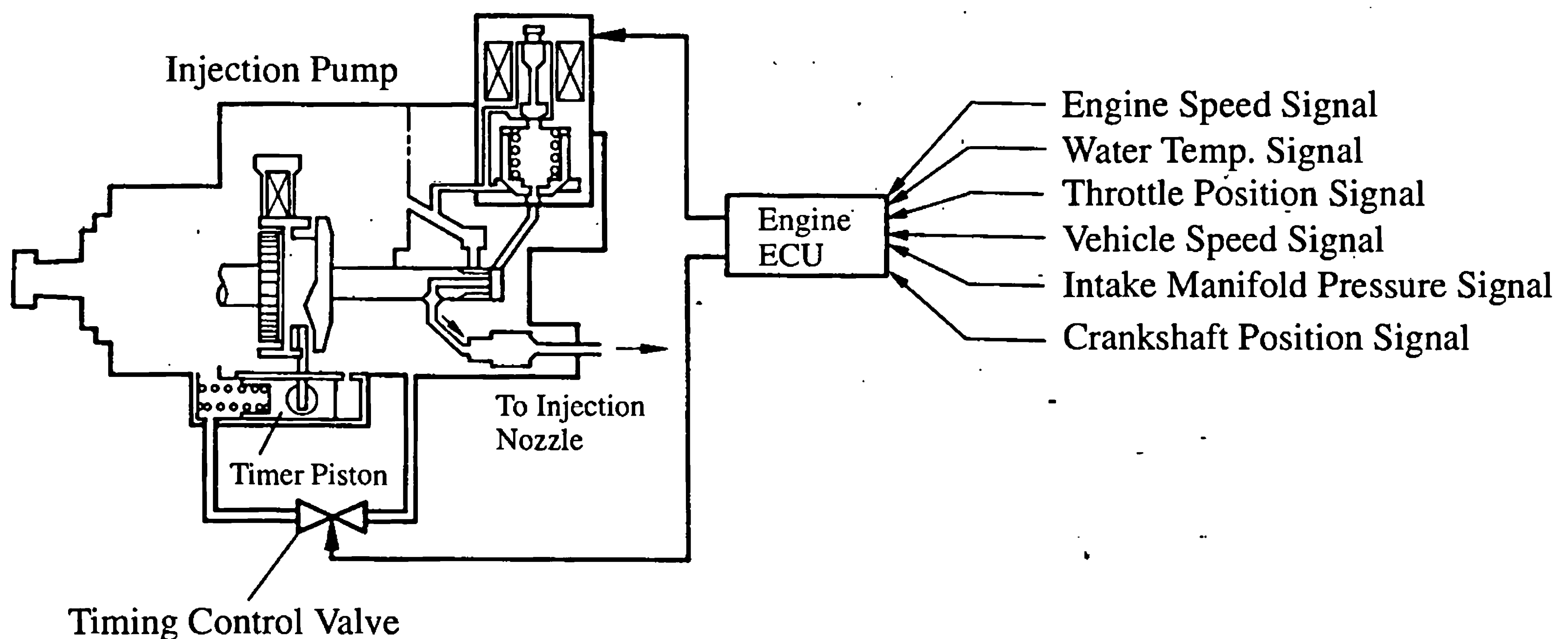
3) Starting Injection Volume Control

Determines the fuel injection volume during starting in accordance with the starting signal and the water temperature signal. When the engine is cold, the lower the coolant temperature becomes, the larger the injection volume becomes.

EG

7. Fuel Injection Timing Control

Based on the signals received from the sensors, the engine ECU calculates and controls the fuel injection timing to be optimal for the engine condition.



Function of Engine ECU

The engine ECU adds the corrections from the sensor signals to the basic fuel injection timing to calculate the fuel injection timing that is optimal for the engine condition.

1) Basic injection timing

The basic injection timing is determined in accordance with the injection volume and the engine speed.

2) Injection timing correction

a. Intake Manifold Pressure Correction

Corrects the basic fuel injection timing in accordance with the intake air pressure. The injection timing is advanced when the intake manifold pressure is low such as in the case of high altitude areas.

b. Water Temperature Correction

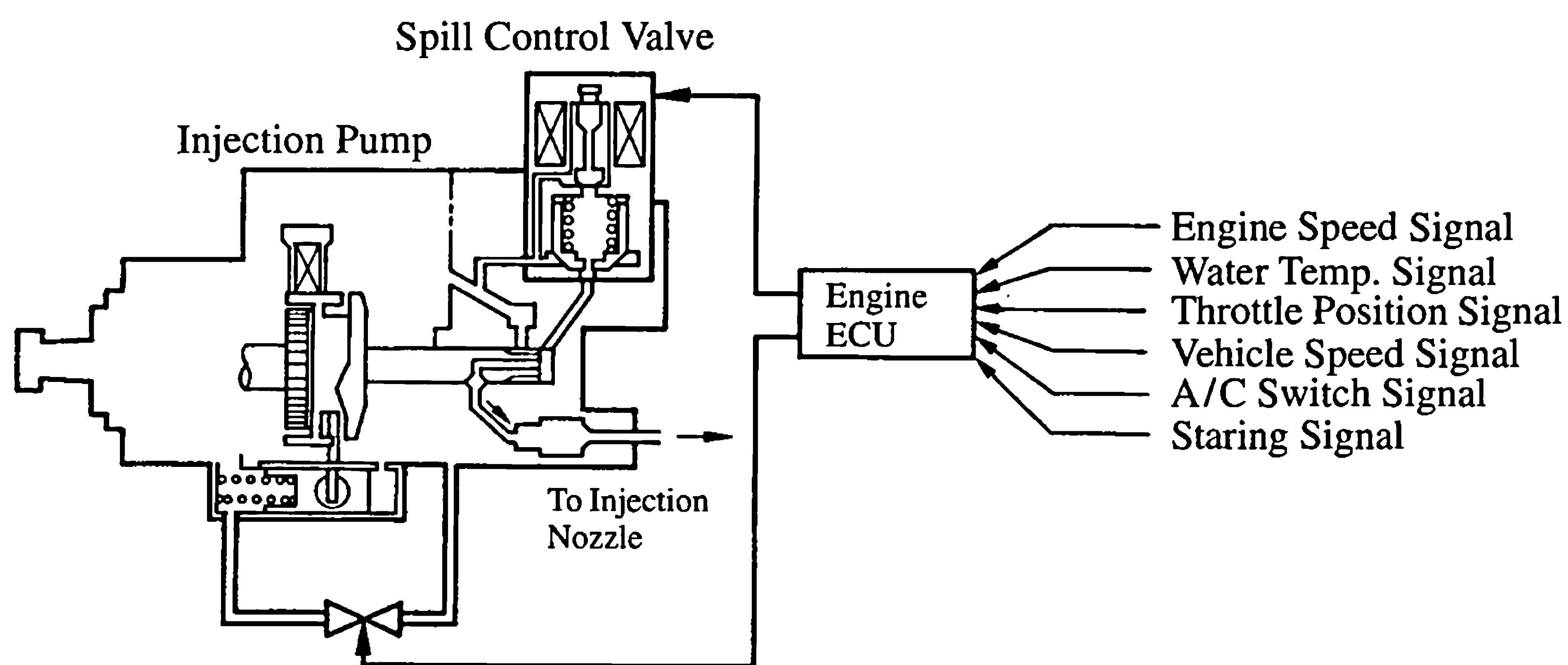
Corrects the basic fuel injection timing in accordance with the water temperature. The injection timing is advanced when the water temperature is low.

3) Starting Injection Timing Control

The starting injection timing is determined in accordance with the starting signal, water temperature signal, and engine speed. The injection timing is advanced when the water temperature is low and engine speed is high.

8. Idle Speed Control

In this system, the engine ECU calculates the target engine speed in accordance with the engine condition, and determines the fuel injection volume, thus controlling the idle speed rpm.



Function of Engine ECU

1) Feedback Control

During idling, the feedback control controls the injection volume to achieve the target idle speed, if there is a difference between the target idle speed calculated by the engine ECU and the actual idle speed.

2) Warm-Up Control

Controls the injection volume during warm-up, in accordance with water temperature, to achieve an optimal fast idle speed.

3) Engine Speed Change Estimate Control

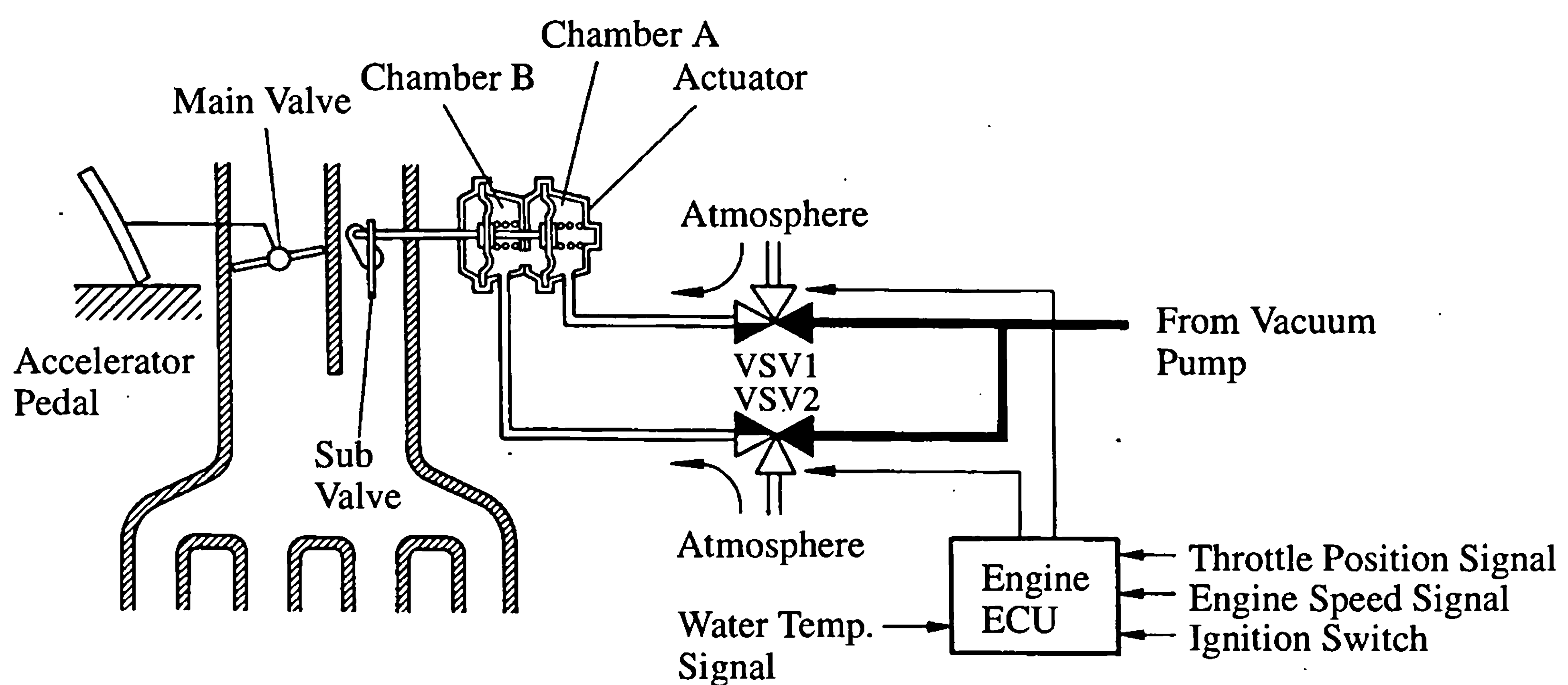
Immediately after the air conditioning switch is engaged, the idle speed can be affected by the change in the load that is applied to the engine. To prevent this symptom, the engine speed-change estimate control increases or decreases the injection volume before the idle speed changes.

9. Intake Constrictor Control

The intake constrictor control is a system in which the venturi sub valve that is installed in the intake manifold is opened and closed, and shuts off the intake air to reduce the vibration when the engine is stopped.

► System Diagram ◀

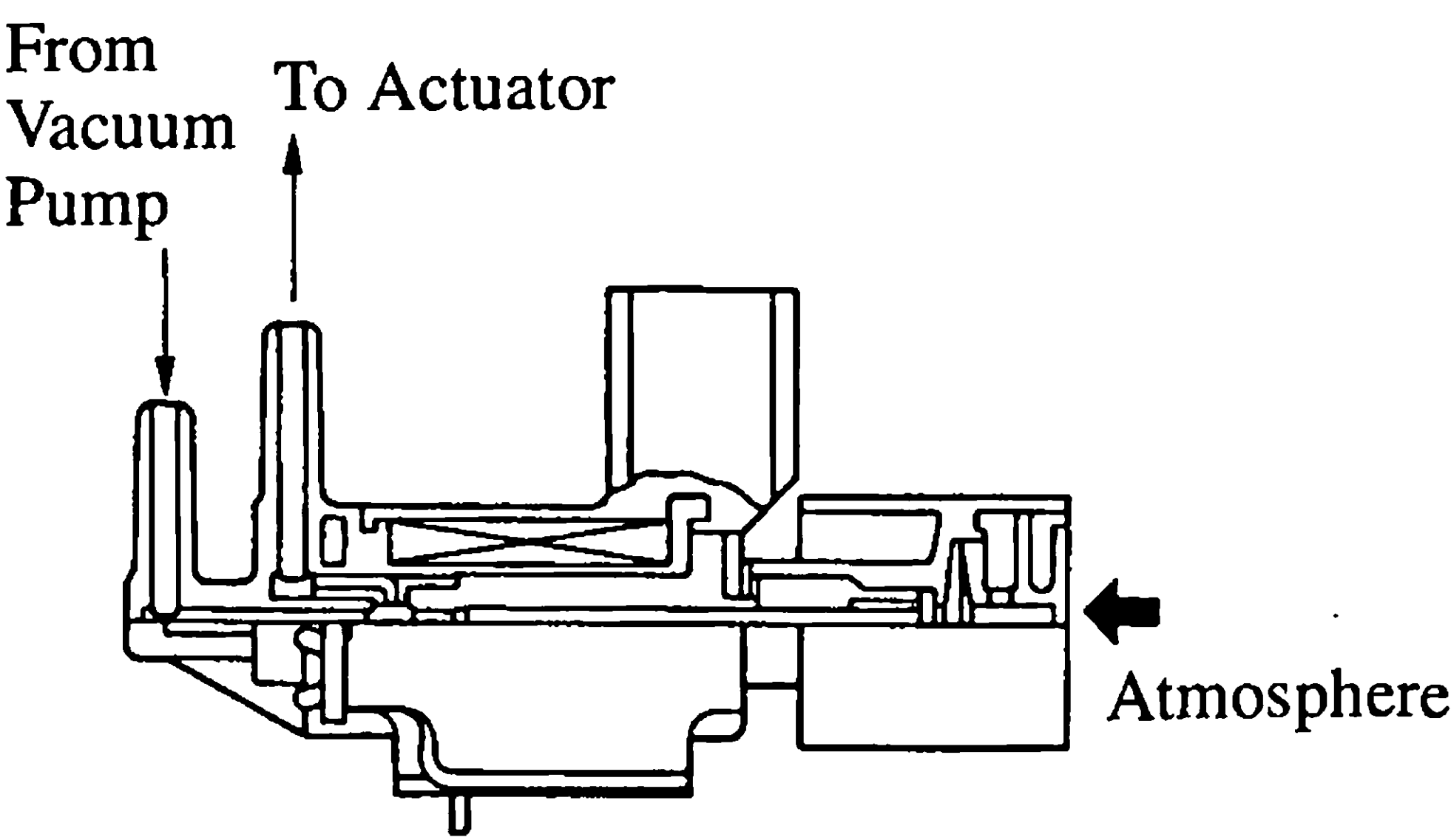
EG



Construction

1) VSV1 and VSV2

Switches between the vacuum and atmosphere that is applied to the actuator in accordance with the signals from the engine ECU.



Operation

Based on the signals received from the sensors, the engine ECU controls the VSV as shown below.

	VSV1	VSV2	Actuator		Sub Valve	Effectiveness
			Chamber A	Chamber B		
During Normal Driving	OFF	OFF	Atmo-sphere	Atmo-sphere	Fully Open	Ensures the engine's intake air volume
When the Engine is Stopped	ON	ON	Vacuum	Vacuum	Fully Closed	Ensures prompt stopping of the engine.

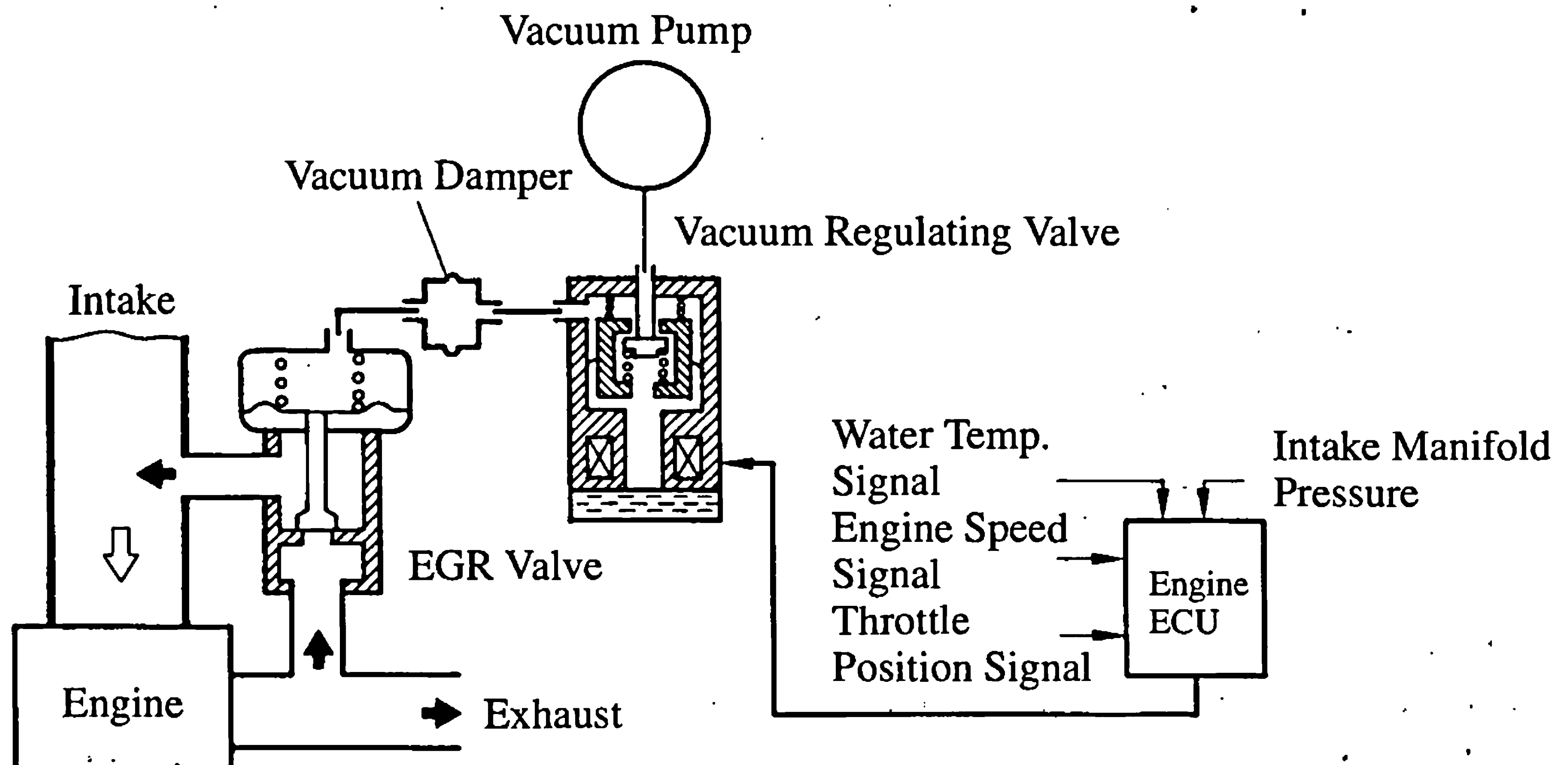
10. Stable Idling Control

During idling, the stable idling control detects the fluctuations in the engine speed of each cylinder and corrects the injection volume that is directed to each cylinder. Accordingly, the variances between the cylinders are reduced, which are caused by the disparity in the operation of the injection pump and the injection nozzle. As a result, vibration during idling is reduced.

11. EGR Control

In the EGR control system, the engine ECU controls the vacuum regulating valve to recirculate an appropriate amount of exhaust gas to the combustion chamber in accordance with the engine condition. This results in slower combustion rate, lower combustion temperature, and reduced NO_x emissions.

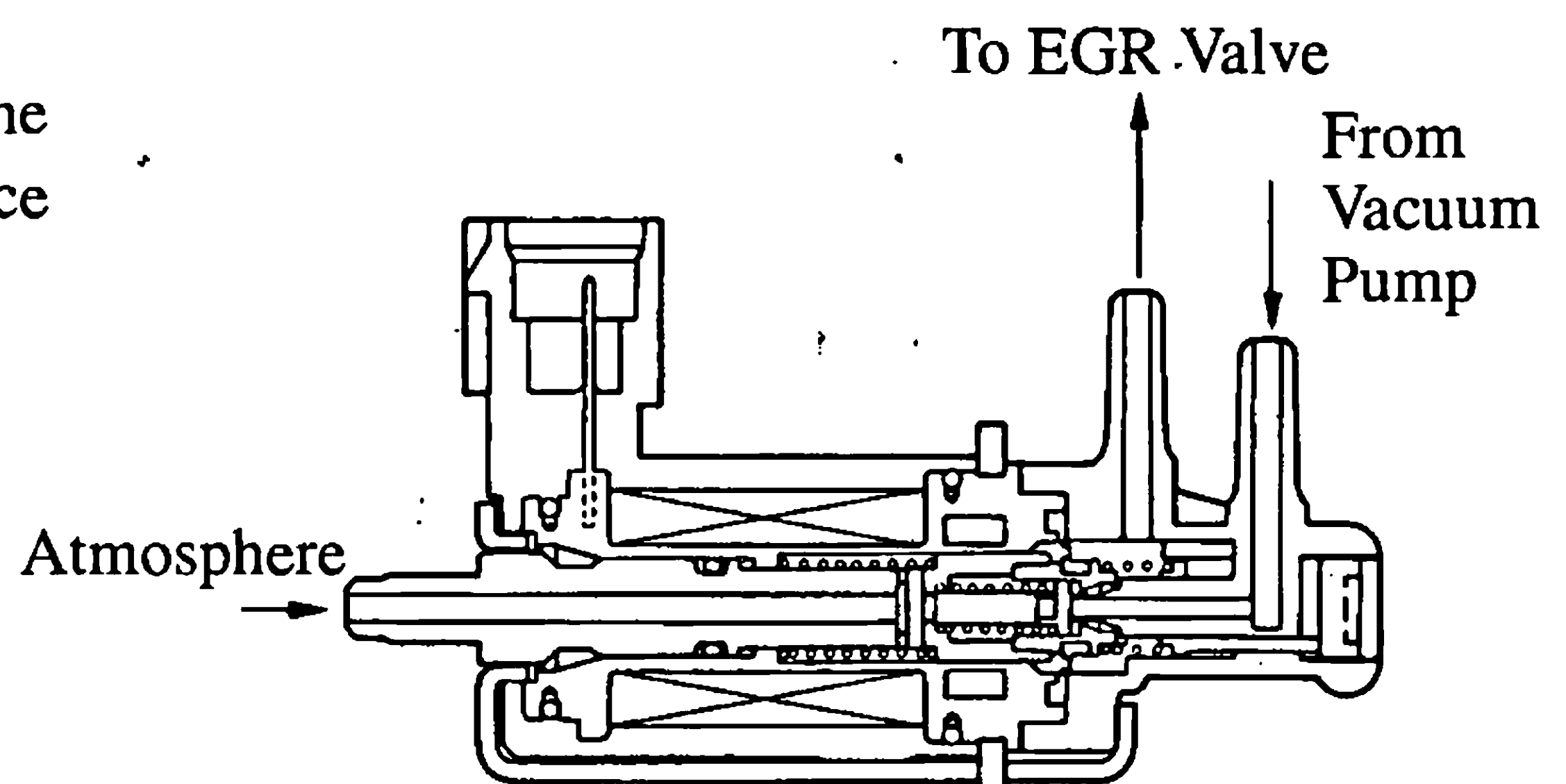
► System Diagram ◀



Construction

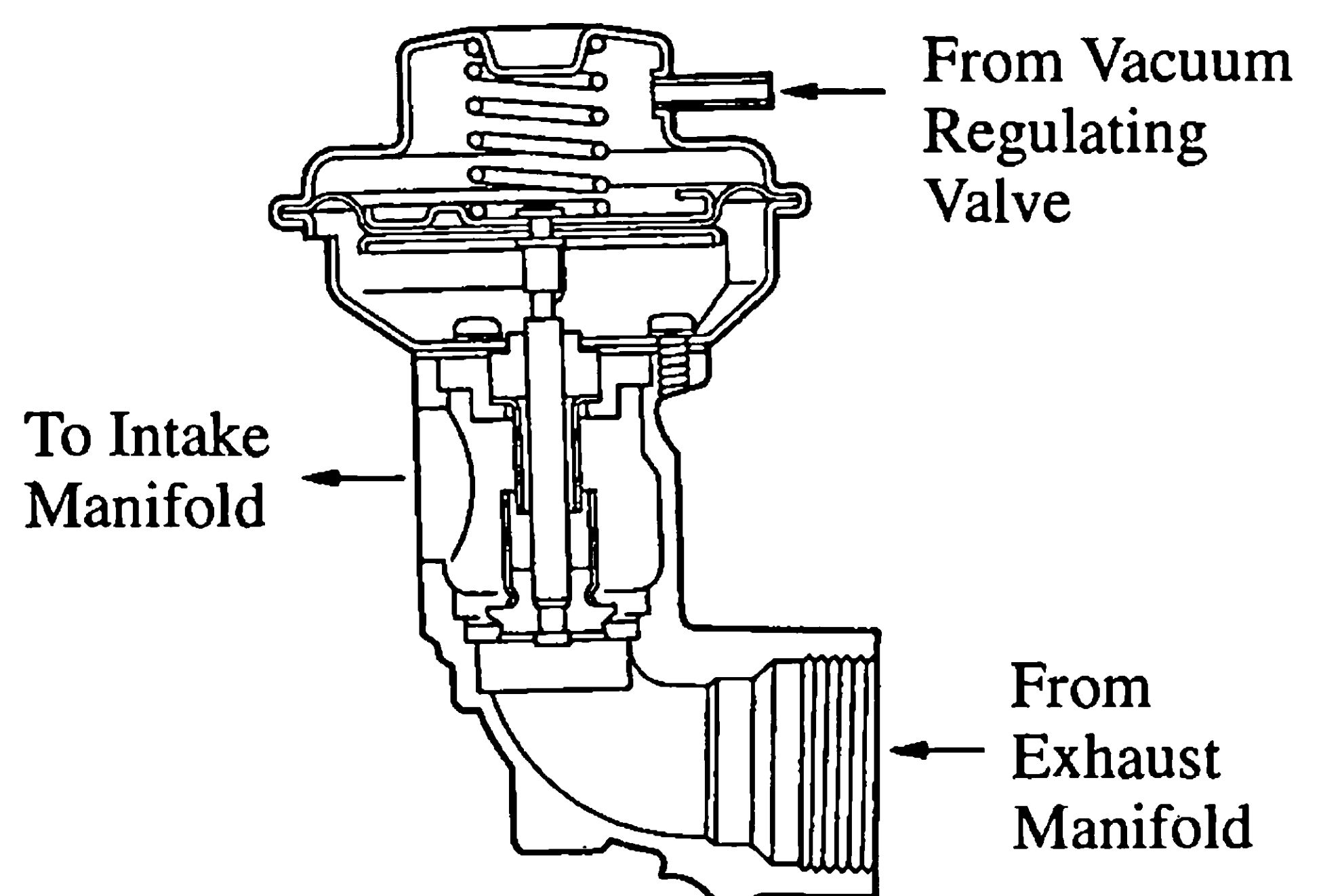
1) Vacuum Regulating Valve

Controls the vacuum that is applied by the vacuum pump to the EGR valve in accordance with the signals from the engine ECU.



2) EGR Valve

Using the vacuum from the vacuum regulating valve, the EGR valve opens and closes the valve to introduce exhaust gas into the intake manifold.



Operation

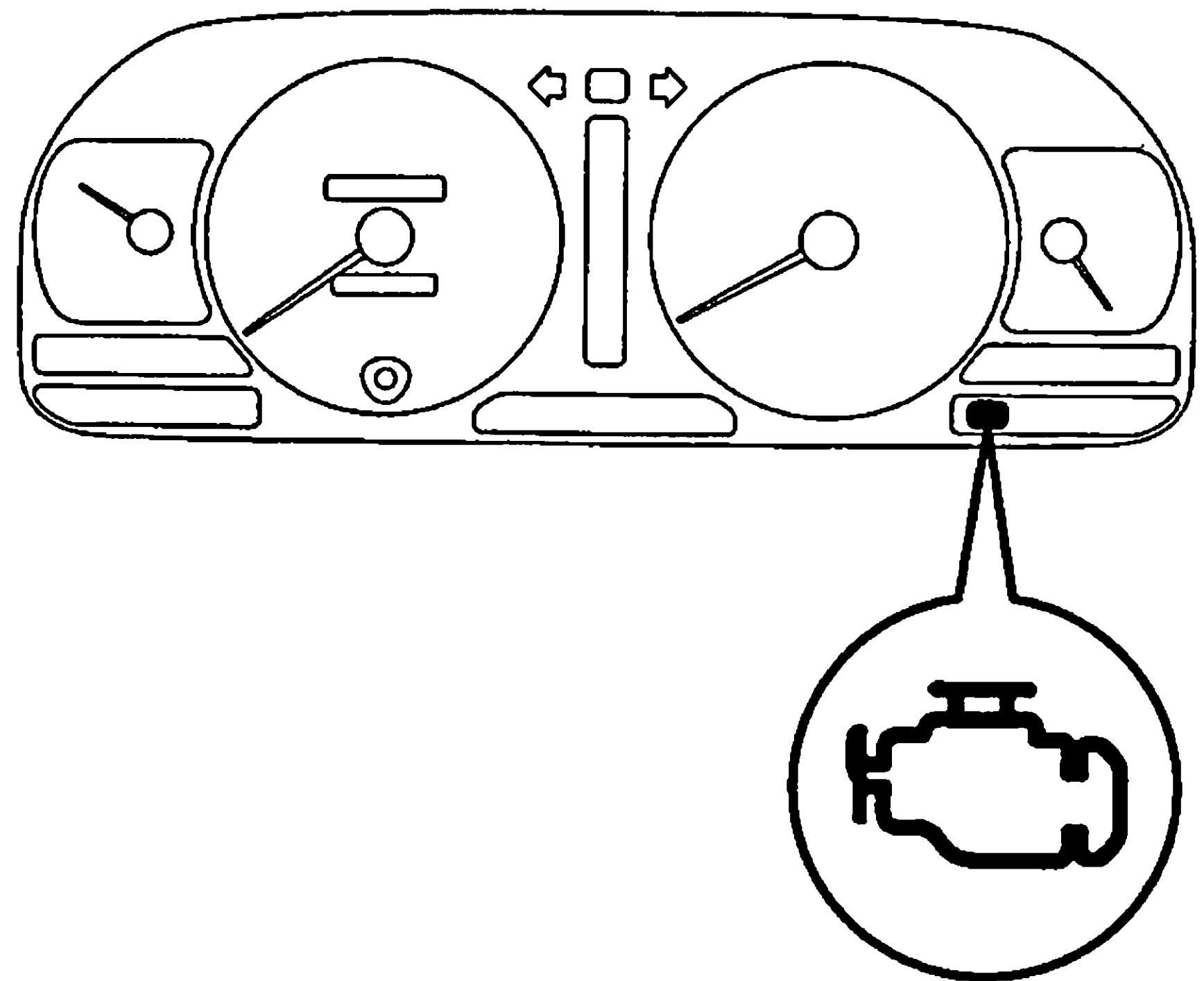
- 1) Based on the signals from the sensors, the engine ECU applies duty control to the current that is applied to the vacuum regulating valve, thus regulating the vacuum that is applied to the EGR valve. Thus, the EGR valve opening is controlled to provide the volume of EGR gas that is appropriate for the engine condition.
- 2) The EGR function is stopped under the conditions given below to ensure drivability and to reduce diesel smoke.
 - The water temperature is below 60°C (140°F).
 - The vehicle is driven under high load conditions (more than 75 % of a fully loaded condition, and operating at the engine speed of 2900 rpm or more).
 - During deceleration (The EGR operates at idle.)
 - When driving high altitude areas.

12. Engine Immobiliser System

The engine immobiliser system has been designed to prevent the vehicle from being stolen. This system uses a transponder key computer that stores the ID code of the authorized ignition key. If an attempt is made to start the engine using an unauthorized key, the transponder key computer emits a signal to the engine ECU to prohibit fuel delivery effectively disabling the engine. For details, see page 212 in the Engine Immobiliser system section.

13. Diagnosis

- If the engine ECU detects any problem with a sensor or an electrical circuit, it turns ON the CHECK ENGINE light in the combination meter to inform the driver. In addition, the malfunction code will be stored in memory.
- A test mode is provided to improve the accuracy of diagnosis.
For the diagnostic code check method, see 1KZ-TE Engine Repair Manual Supplement (Pub. No. RM522E).



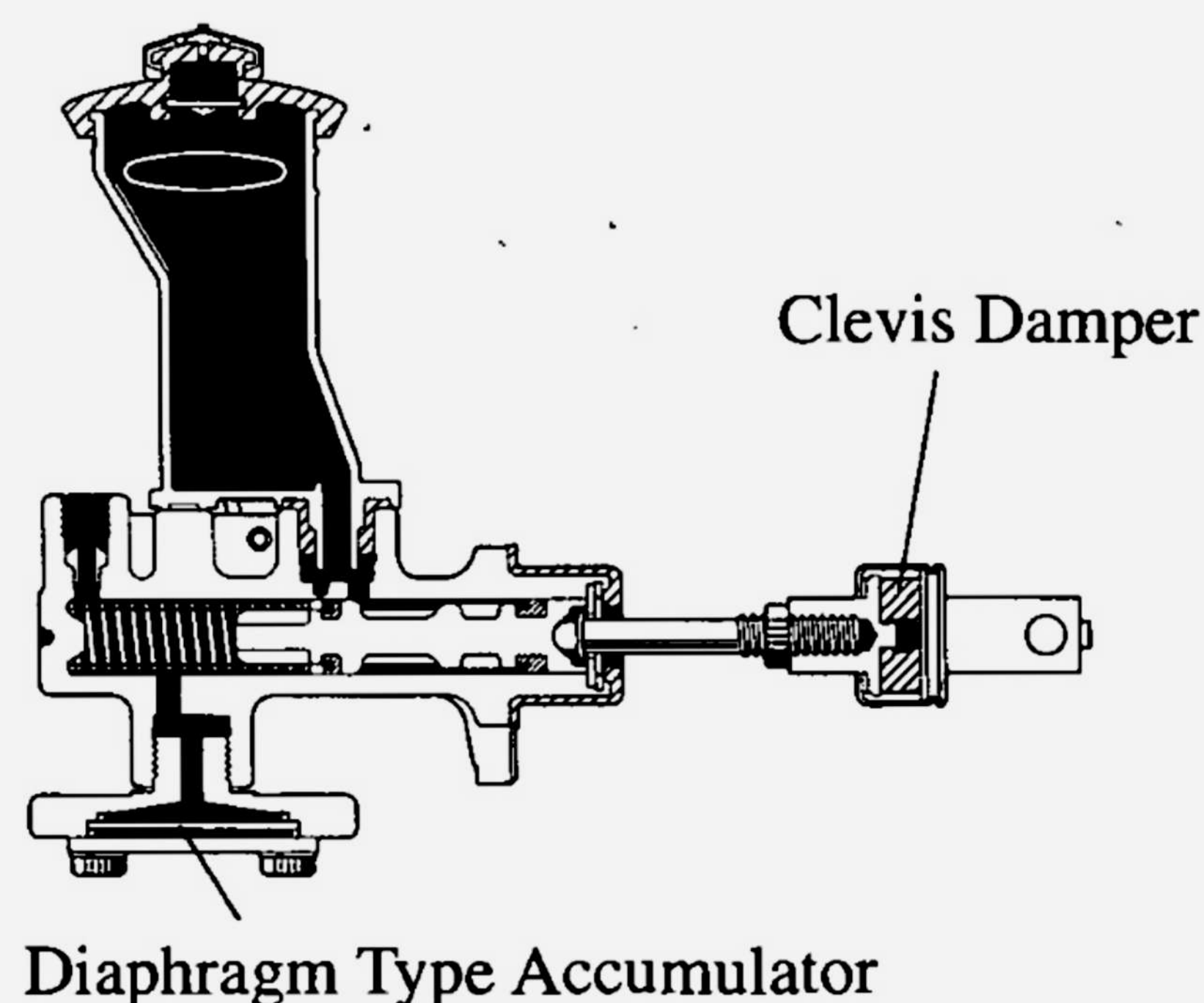
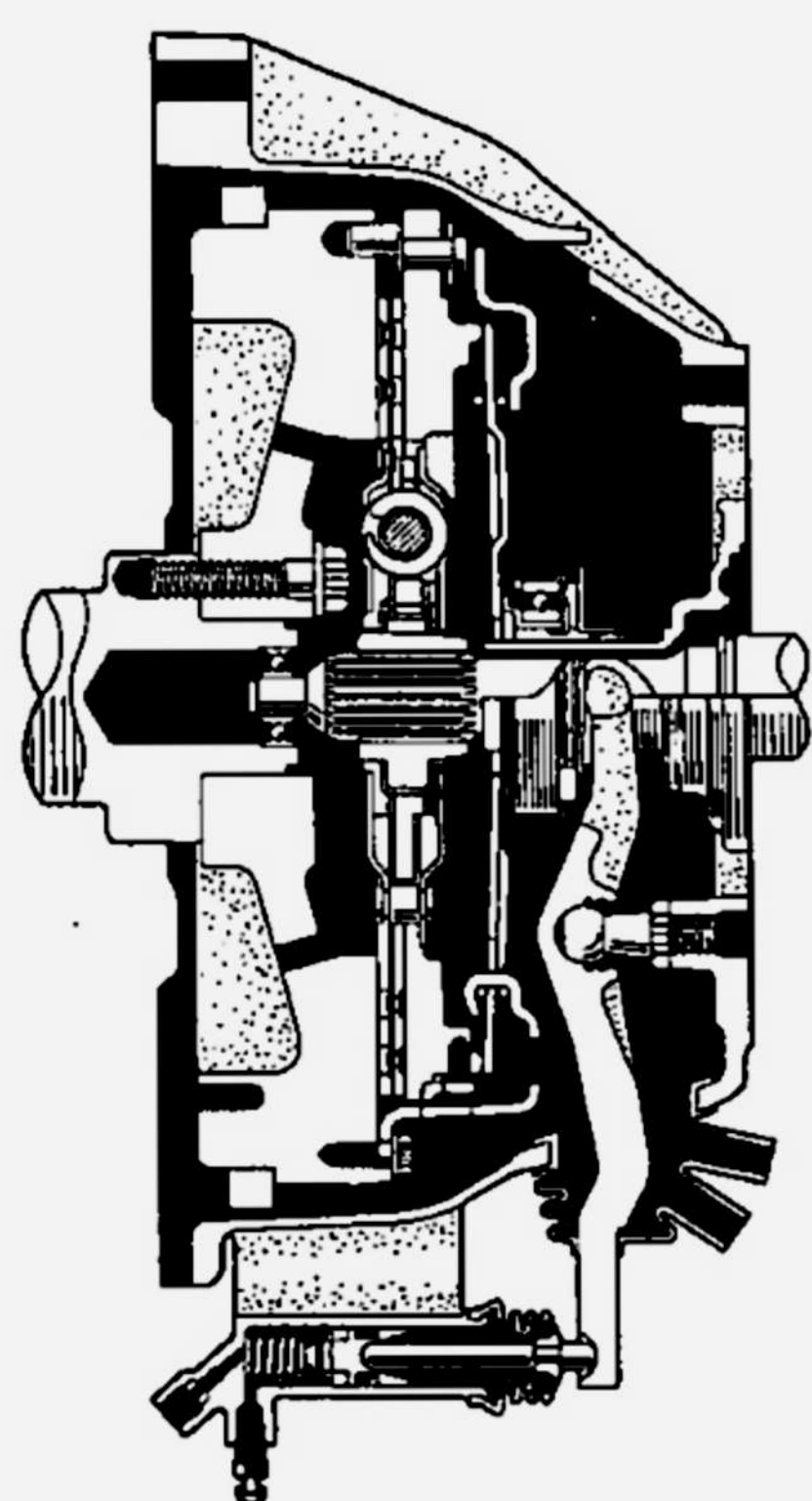
CHECK ENGINE Light

CHASSIS

CLUTCH

DESCRIPTION

- The dry hydraulic single plate clutch used in the previous model is also used in the new model.
- A large torsional angle type clutch disc is used in the 5VZ-FE engine model, resulting in reducing drive line noise and vibration.
- To reduce the vibration and noise that is transmitted to the clutch pedal, a clevis damper that was used in the master cylinder of the previous model is also used in the new models except 5VZ-FE engine model. In addition, all models use a diaphragm type accumulator that is integrated with the master cylinder.
- The clutch pedal of the 5VZ-FE, 1KZ-T and 1KZ-TE engine models uses a turnover mechanism to reduce the pedal effort.
- Cooling holes are provided in the clutch housing to improve the cooling efficiency of the clutch housing.



Diaphragm Type Accumulator

For 1KZ-T and 1KZ-TE Engine Model

Specifications

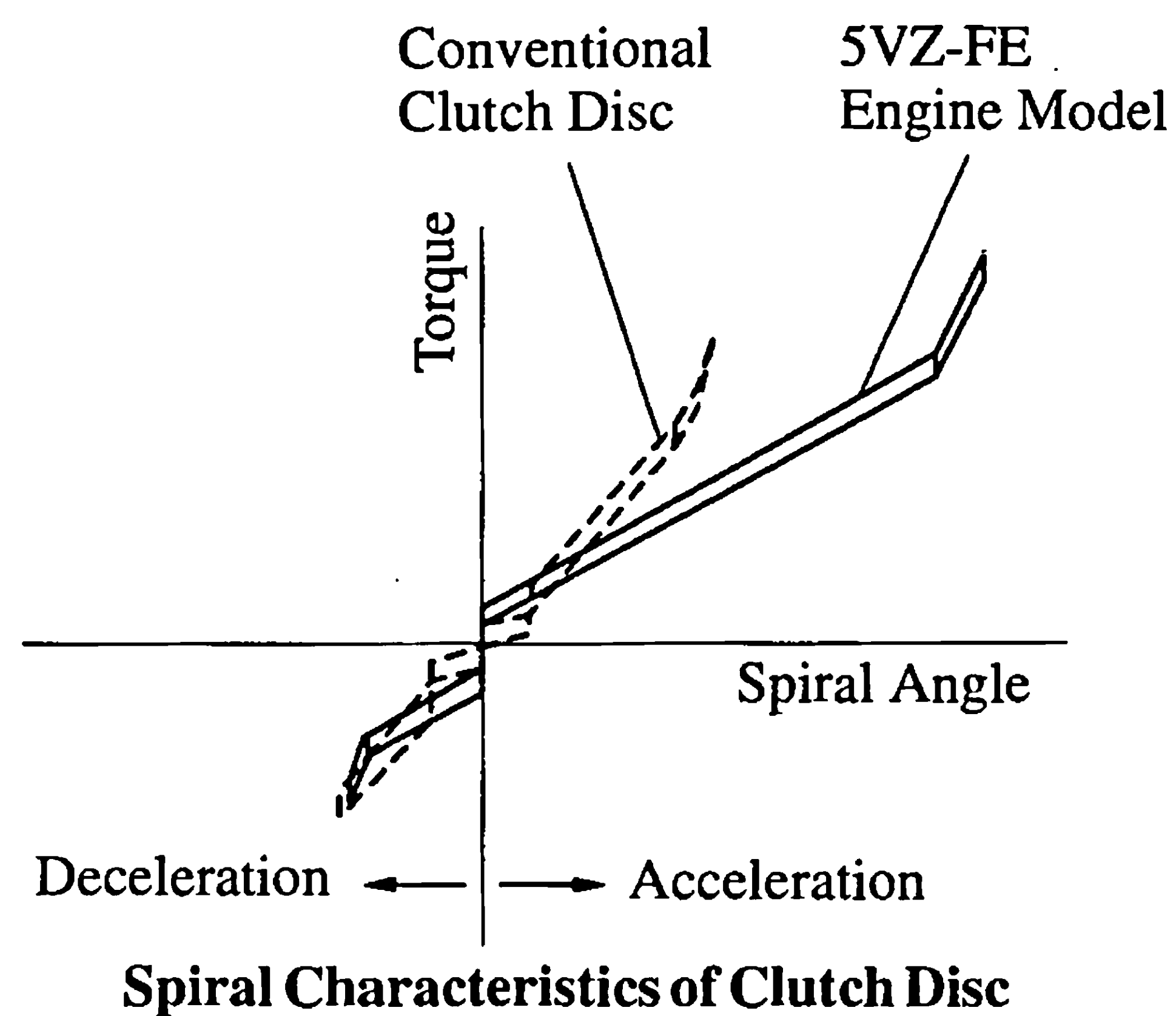
Engine Type Item		3RZ-F 3RZ-FE	5VZ-FE	1KZ-T 1KZ-TE	3L
Clutch	Type	Dry Type Single Plate Clutch, Diaphragm spring	←	←	←
	Operation	Hydraulic	←	←	←
Clutch Cover	Type	DST* ¹	←	←	←
	Size mm (in.)	250 (9.84)	←	260 (10.24)	224 (8.82)
Clutch Disc	Facing Size* ² mm (in.)	250 x 160 x 3.5 (9.84 x 6.30 x 0.14)	←	260 x 170 x 3.5 (10.24 x 6.69 x 0.14)	224 x 150 x 3.5 (8.82 x 5.91 x 0.14)
	Facing Area cm ² (in. ²)	289 (44.80)	←	303 (46.97)	217 (33.64)
Master Cylinder	Type	Conventional	←	←	←
	Cylinder Dia. mm (in.)	15.87 (0.62)	←	←	←
Release Cylinder	Type	Non-Adjustable	←	←	←
	Cylinder Dia. mm (in.)	20.64 (0.81)	←	19.05 (0.75)	20.64 (0.81)

*¹: DST (Diaphragm Spring Turnover)

*²: Outer Diameter x Inner Diameter x Thickness

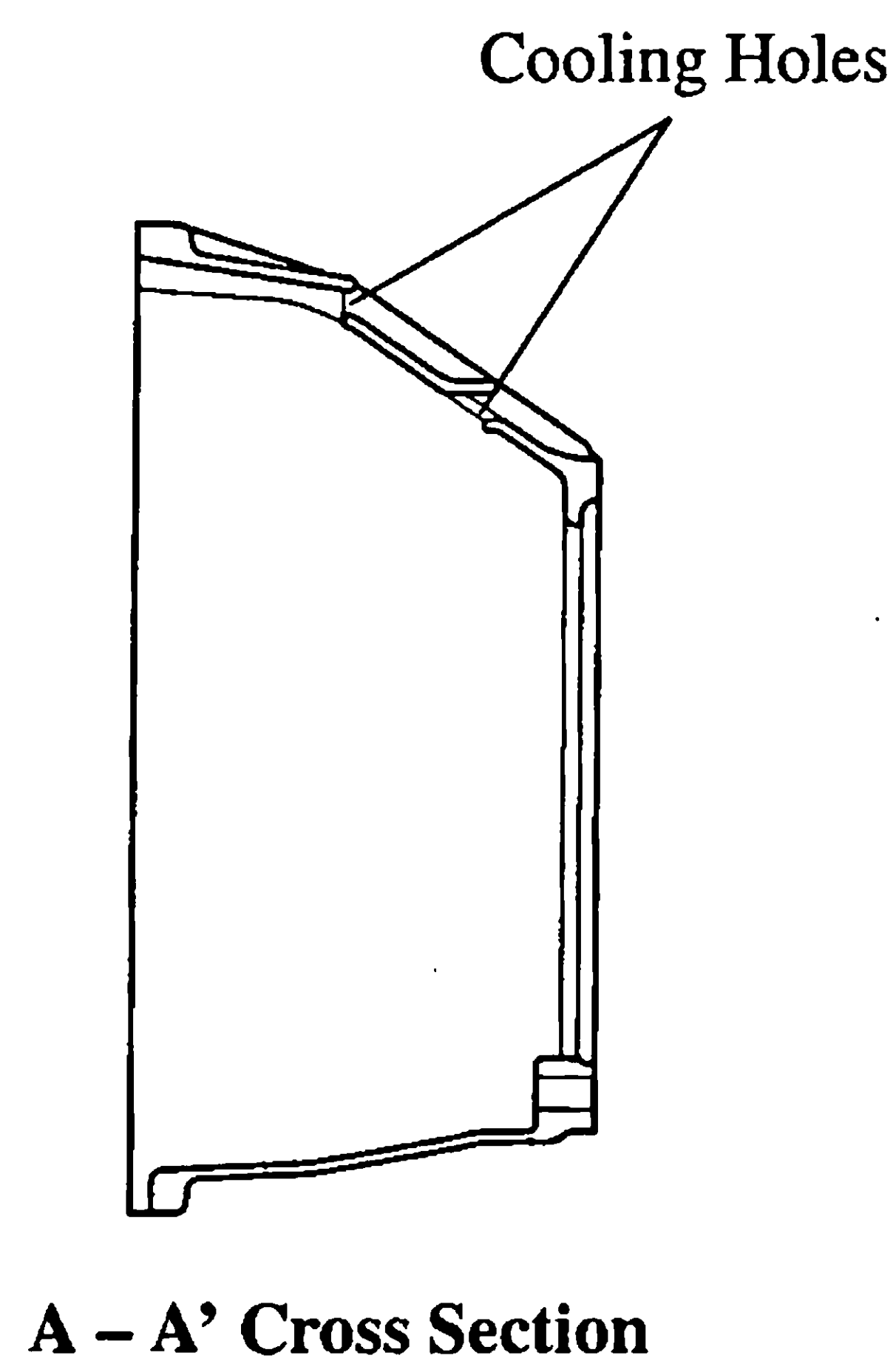
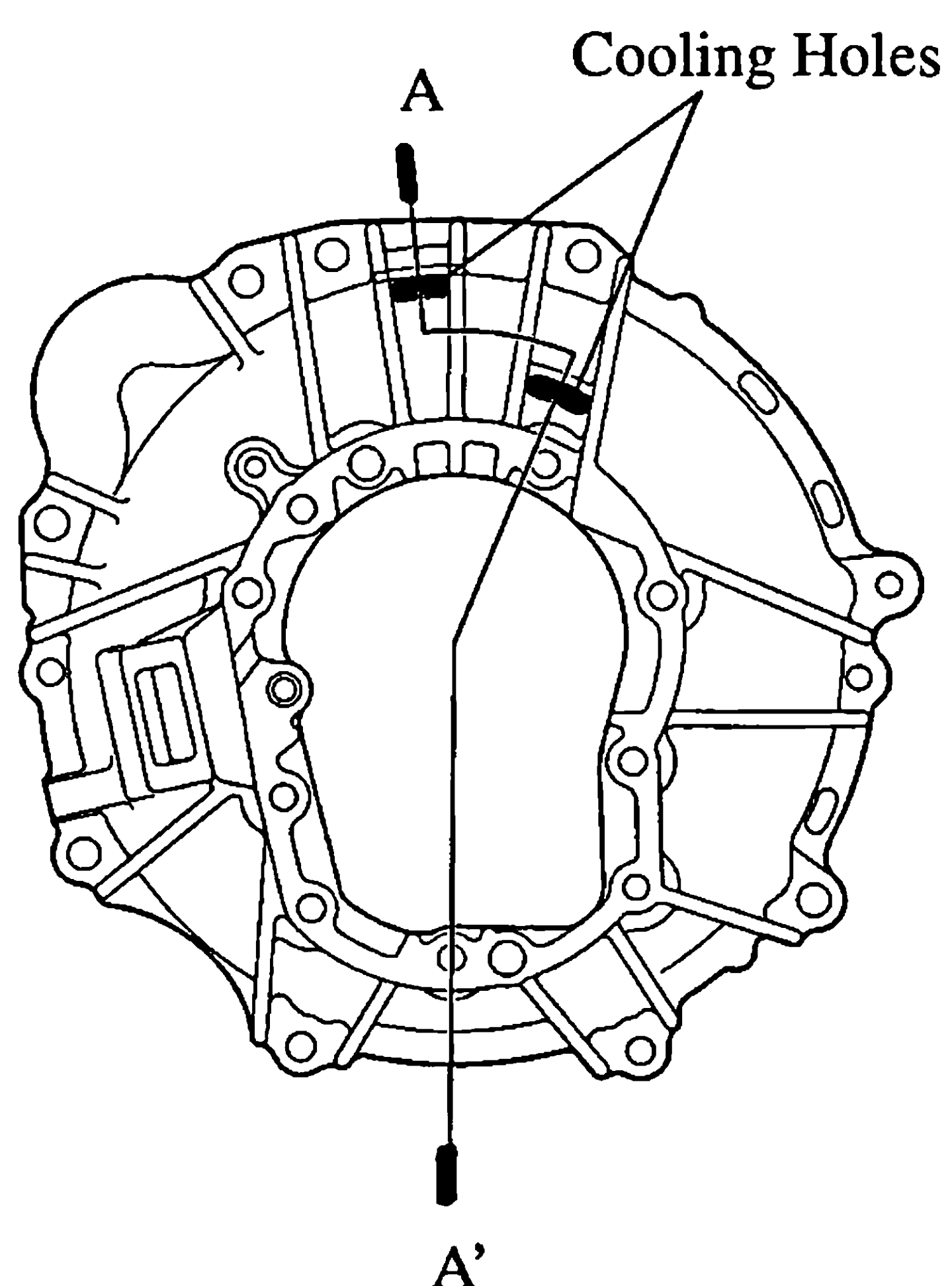
■ CLUTCH DISC

A large torsional angle type clutch disc has been newly adopted in the high-performance, high-torque 5VZ-FE engine model to reduce the noise and vibration of the drive line.



■ CLUTCH HOUSING

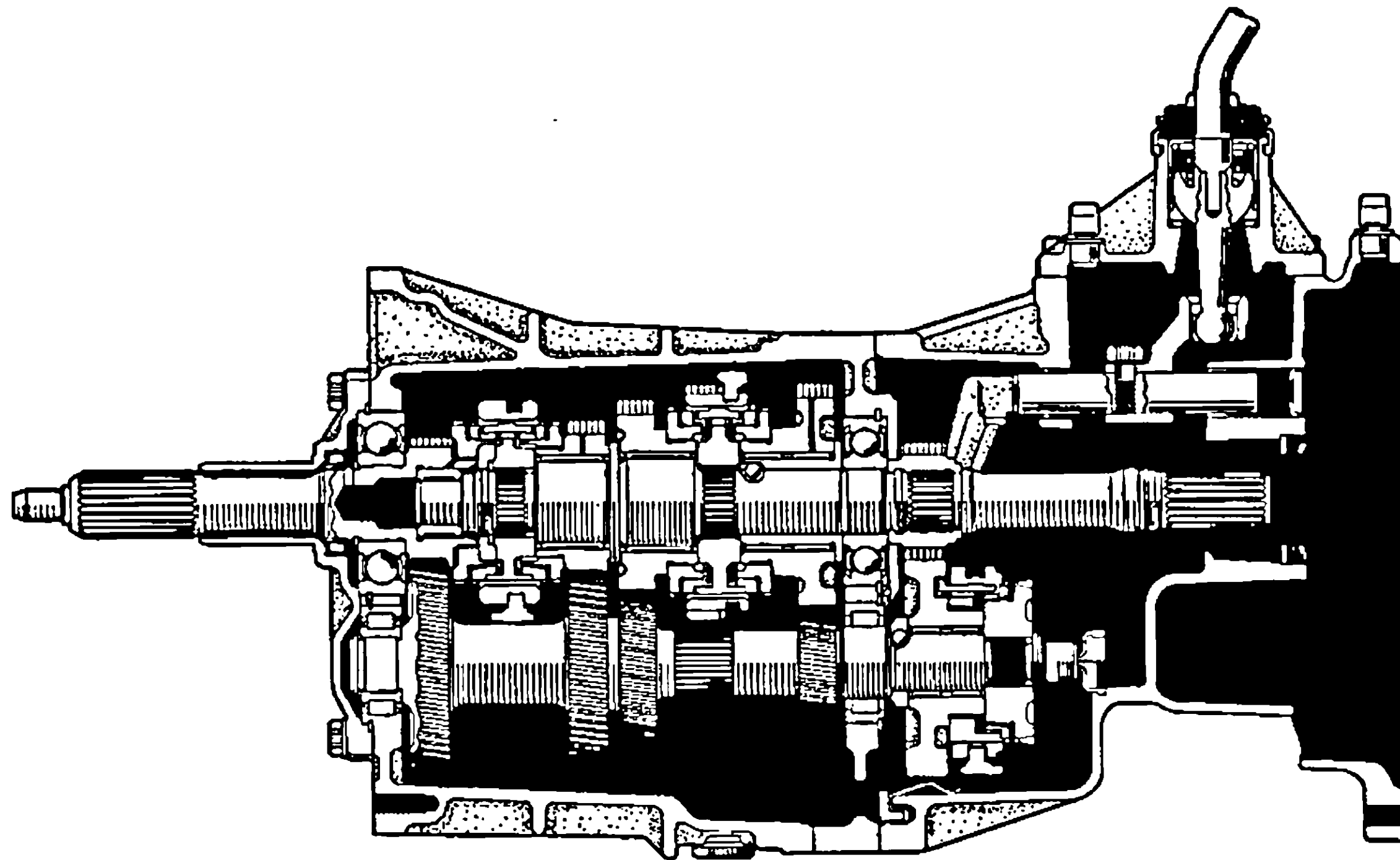
Cooling holes are provided in the clutch housing. The cooling efficiency of the clutch housing is thus improved resulting in a longer clutch disc life time.



MANUAL TRANSMISSION

DESCRIPTION

- The 3L engine model uses the same G52 manual transmission as in the previous model.
- Along with adopting the 3RZ-F and 3RZ-FE engine models, the W56 manual transmission was newly adopted.
- The 1KZ-T, 1KZ-TE, and 5VZ-FE engine models have adopted the R150F manual transmission. The R150F manual transmission uses a triple-cone type synchromesh mechanism in the second gear and a synchromesh mechanism in the reverse gear.



G52 Manual Transmission

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► Specifications ◀

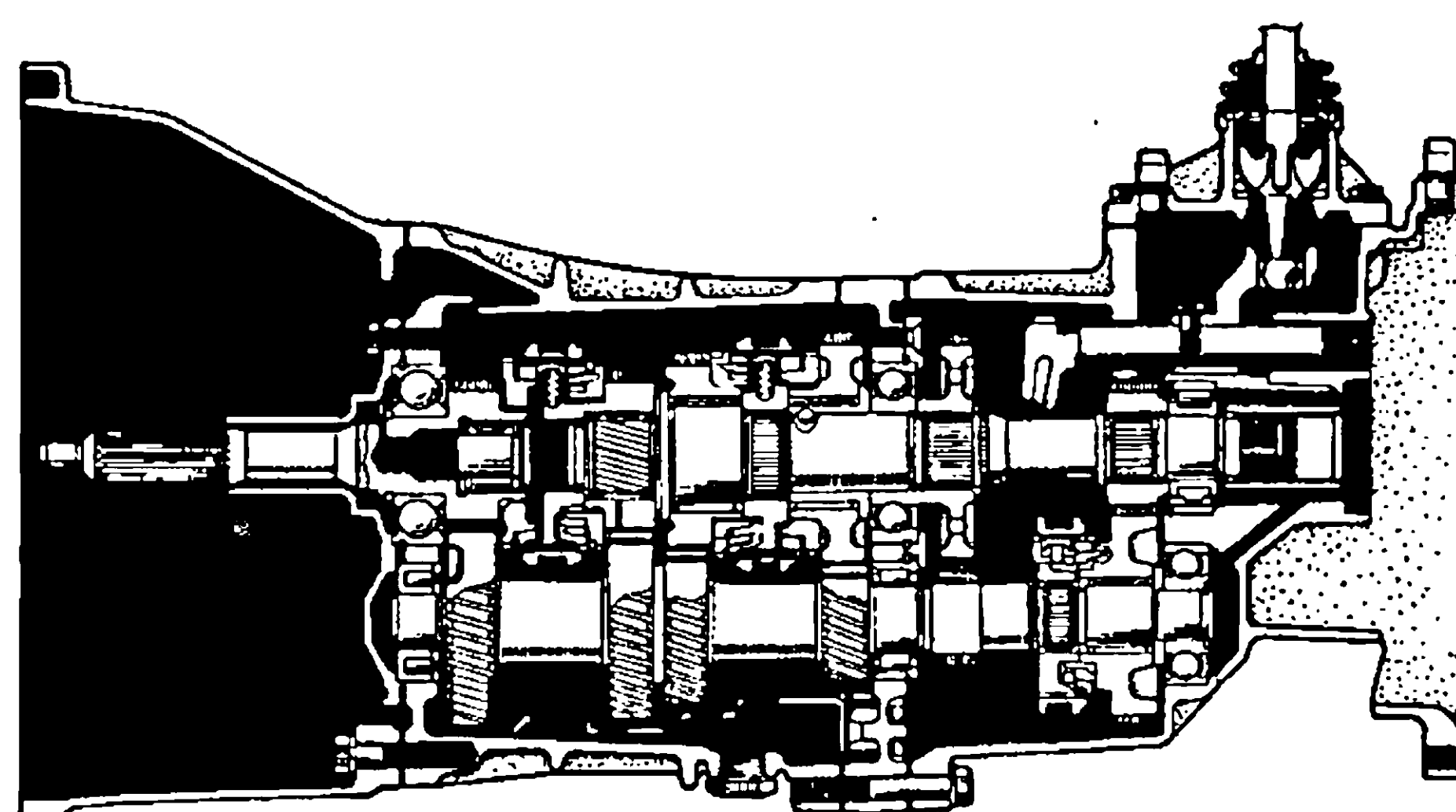
Transmission Type		G52	W56	R150F
Engine Type		3L	3RZ-F, 3RZ-FE	5VZ-FE, 1KZ-T, 1KZ-TE
Item				
Gear Ratio	1st	3.928	3.954	3.830
	2nd	2.333	2.141	2.062
	3rd	1.451	1.384	1.436
	4th	1.000	←	←
	5th	0.851	0.850	0.838
	Reverse	4.743	4.091	4.220
Oil Capacity liters (US qts, Imp. qts)		2.2 (2.3, 1.9)	2.5 (2.6, 2.2)	2.2 (2.3, 1.9)
Oil Viscosity		SAE 75W-90	←	←
Oil Grade		API GL-4 or GL-5	←	←

■ W56 MANUAL TRANSMISSION

1. General

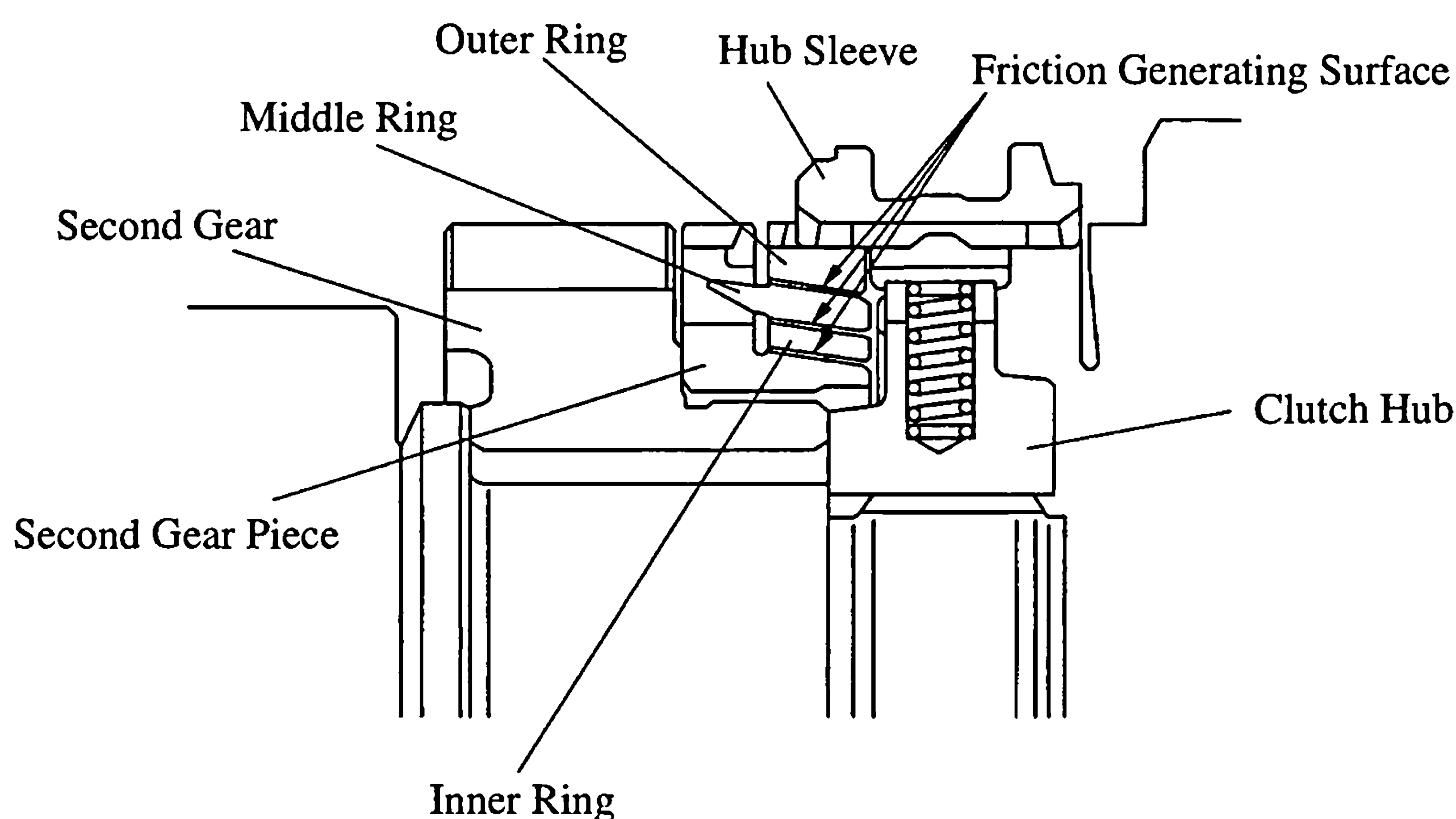
Along with adopting 3RZ-F and 3RZ-FE engine models, the W56 manual transmission was newly adopted. In the W56 manual transmission, a triple-cone type synchronesh mechanism is used in the second gear and a double-cone type synchronesh mechanism is used in the third gear and a synchronesh mechanism is used in the reverse gear.

Accordingly, a smooth shifting performance has been realized.



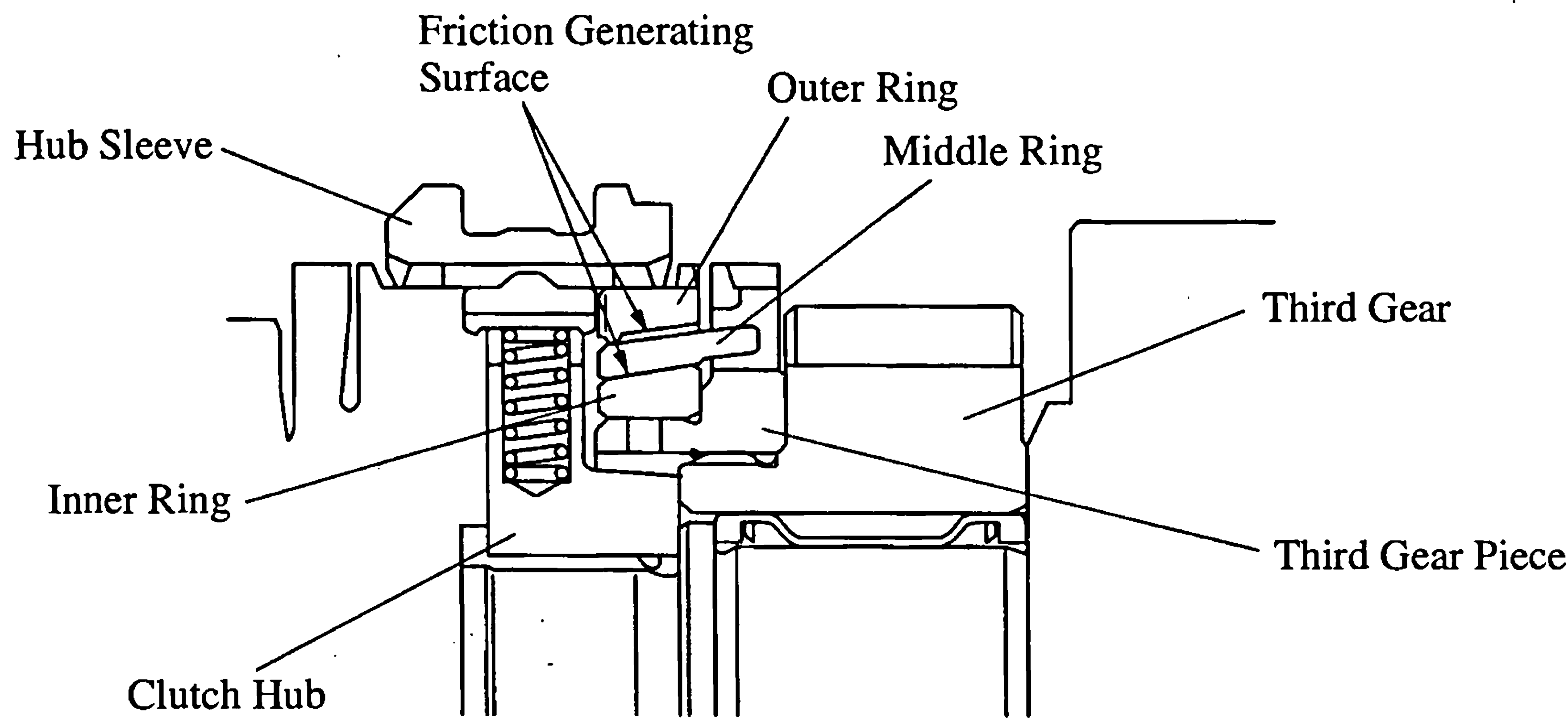
2. Second Gear (Triple-Cone Type Synchronesh Mechanism)

The triple-cone type synchronesh mechanism consists of an outer ring, middle ring, inner ring and gear piece in addition to a clutch hub, shifting keys and a hub sleeve. The outer ring and inner ring together with the clutch hub, shifting keys and a hub sleeve always turn in unison with the transmission output shaft. The middle ring together with the gear piece always turns in unison with the transmission gear. During shifting, the hub sleeve pushes the outer ring. As a result, friction is generated between the three cones comprised of the outer ring and middle ring, the middle ring and inner ring, and the inner ring and gear piece, thus causing a synchronizing action and permitting the gear piece and hub sleeve to engage smoothly.



3. Third Gear (Double-Cone Type Synchromesh Mechanism)

The double-cone type synchromesh mechanism is basically the same in construction and operation as the triple-cone type synchromesh mechanism used in the second gear. But it does not have the synchronizing action between the inner ring and the gear piece.

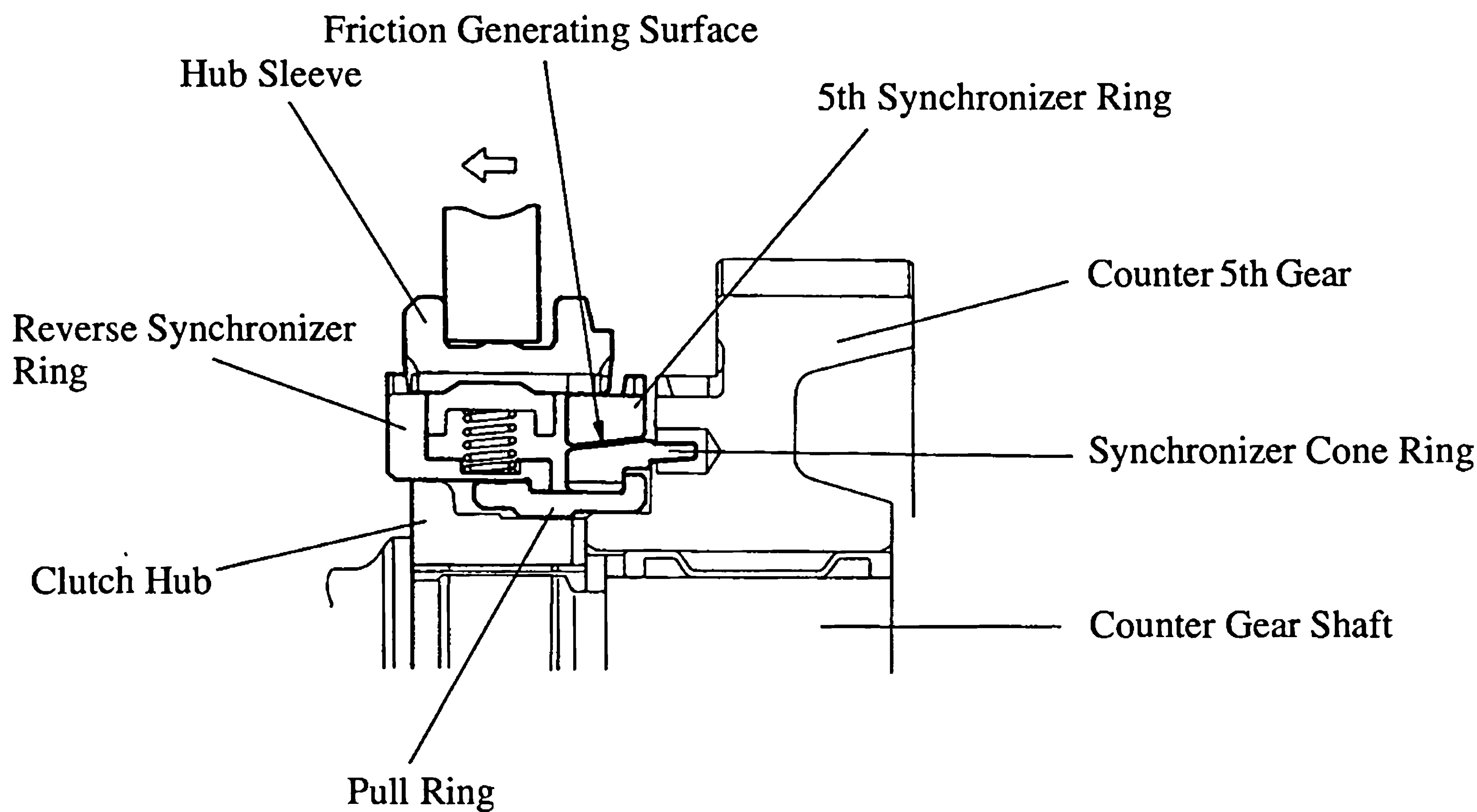


CH

4. Reverse Gear Synchromesh Mechanism

The reverse gear synchromesh mechanism consists of a reverse synchronizer ring, clutch hub, pull ring, synchronizer cone ring, 5th synchronizer ring and hub sleeve. The reverse and 5th synchronizer rings together with the clutch hub and hub sleeve always turn in unison with the counter gear shaft. The synchronizer cone ring remains stopped together with the 5th gear.

When shifted to the reverse position, the hub sleeve is pushed to the left side (See illustration.), thereby pushing the reverse synchronizer ring to the left also. The reverse synchronizer ring pulls the pull ring to the left, thereby pulling the synchronizer cone ring. The synchronizing action stops rotation of the counter shaft and input shaft of the transmission for smooth engagement of the reverse idle gear.

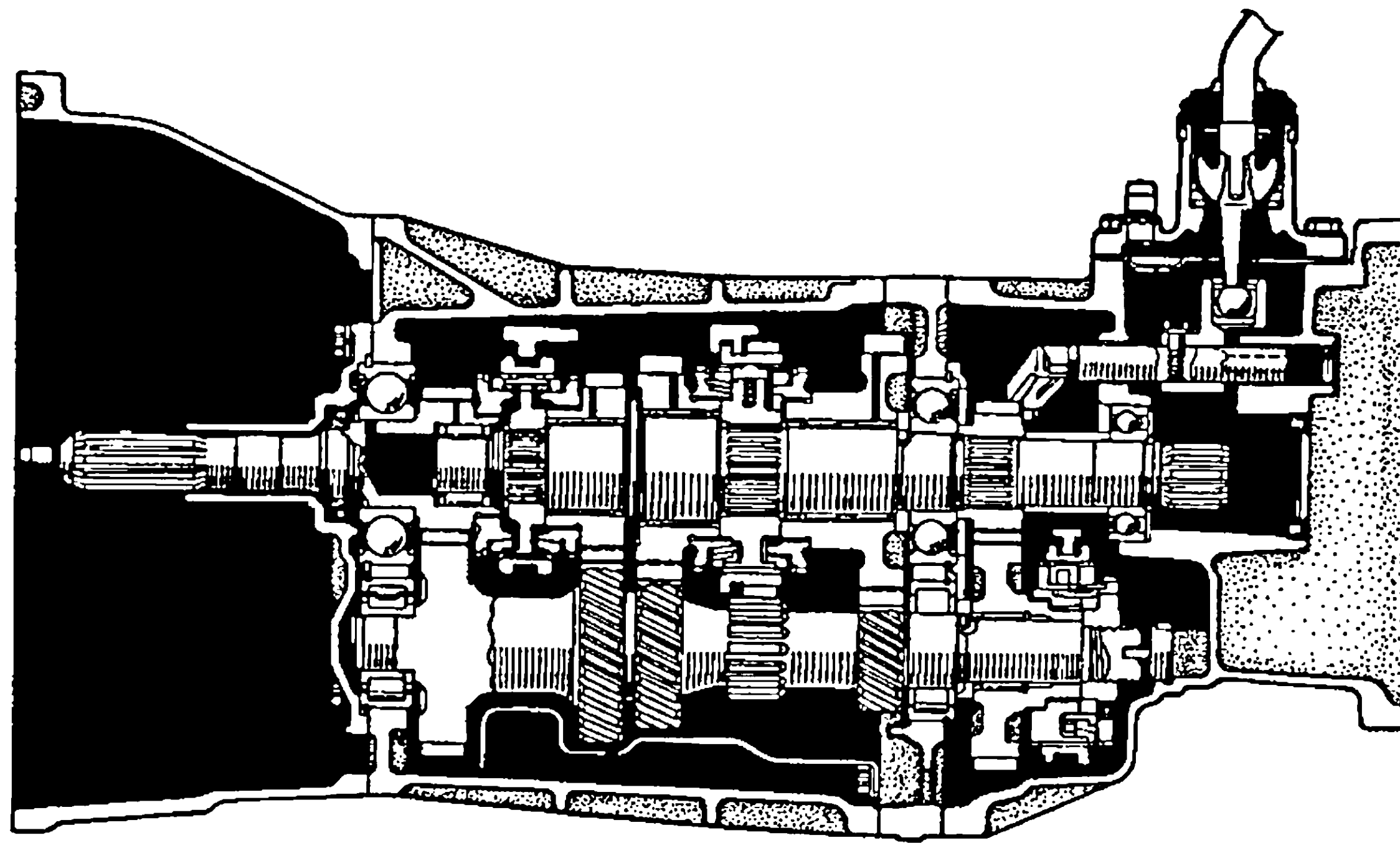


■ R150F MANUAL TRANSMISSION

The R150F manual transmission used in the previous model is also used in the new model.

However, this transmission uses a triple-cone type synchromesh mechanism in the second gear and a synchromesh mechanism in the reverse gear resulting in excellent shifting performance.

The basic construction and operation of the synchromesh mechanisms in the second and reverse gears are the same as those in the W56 manual transmission.

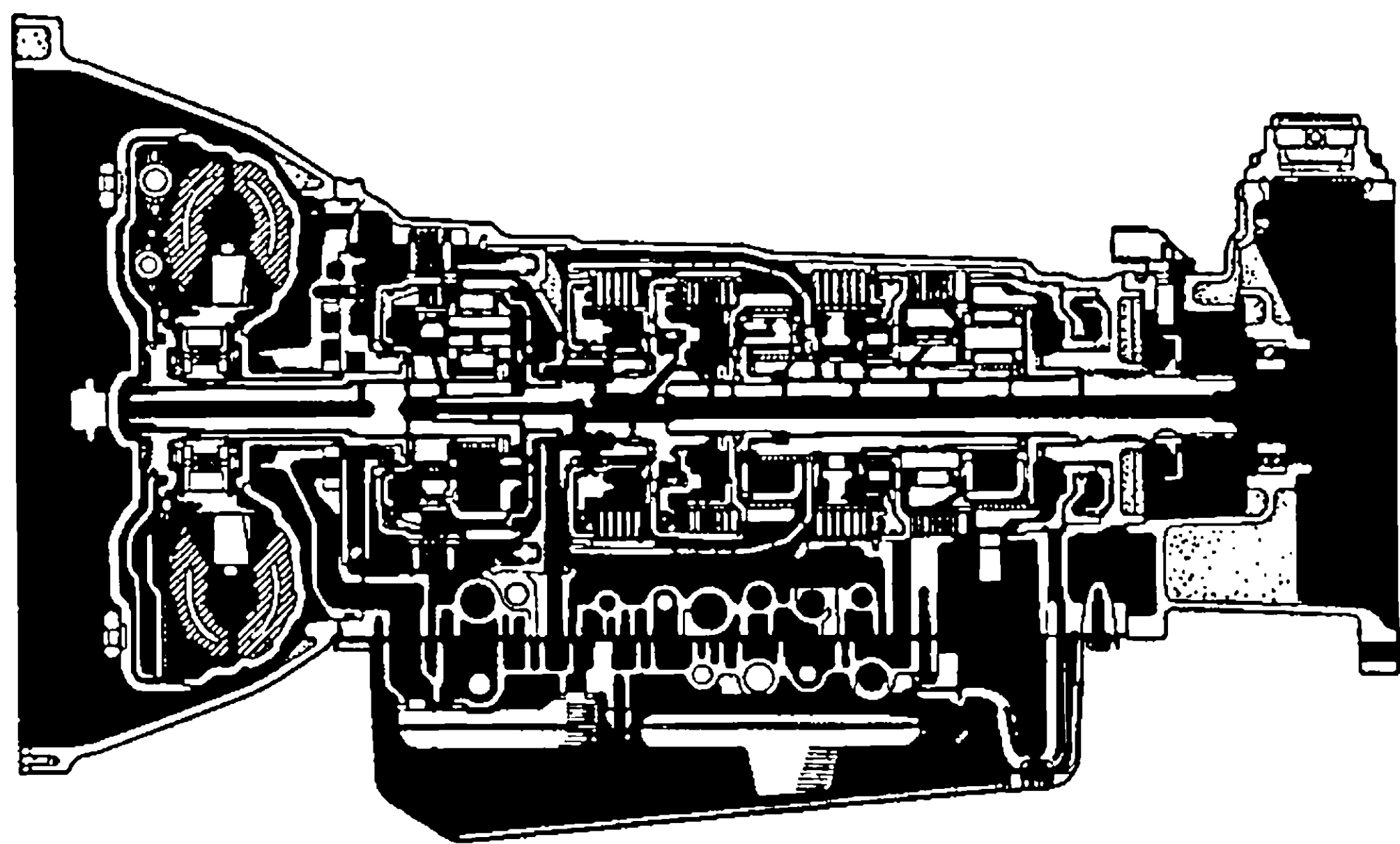


A343F AUTOMATIC TRANSMISSION

DESCRIPTION

The A343F automatic transmission is used on the 3RZ-FE, 5VZ-FE and 1KZ-TE engine models.
The A343F automatic transmission features the following characteristics:

- An engine torque control system is used on the gasoline engine model.
- A 2nd start system is used.
- A high efficiency torque converter is used.



CH

Specifications

Transmission Type		A343F
Item		
Gear Ratio	1st	2.804
	2nd	1.531
	3rd	1.000
	4th (Overdrive)	0.753
	Reverse	2.393
Fluid Capacity	liters (US qts, Imp. qts)	10.1 (10.7, 8.9)
Fluid Type		ATF Type D II or DEXRON®II, DEXRON®III

■ TORQUE CONVERTER AND PLANETARY GEAR UNIT

The torque converter has optimally designed fluid passages and impeller configuration resulting in substantially enhanced torque ratio and transmission efficiency to ensure better starting, acceleration and fuel economy.

The specifications of the torque converter and planetary gear unit have been matched each engine.

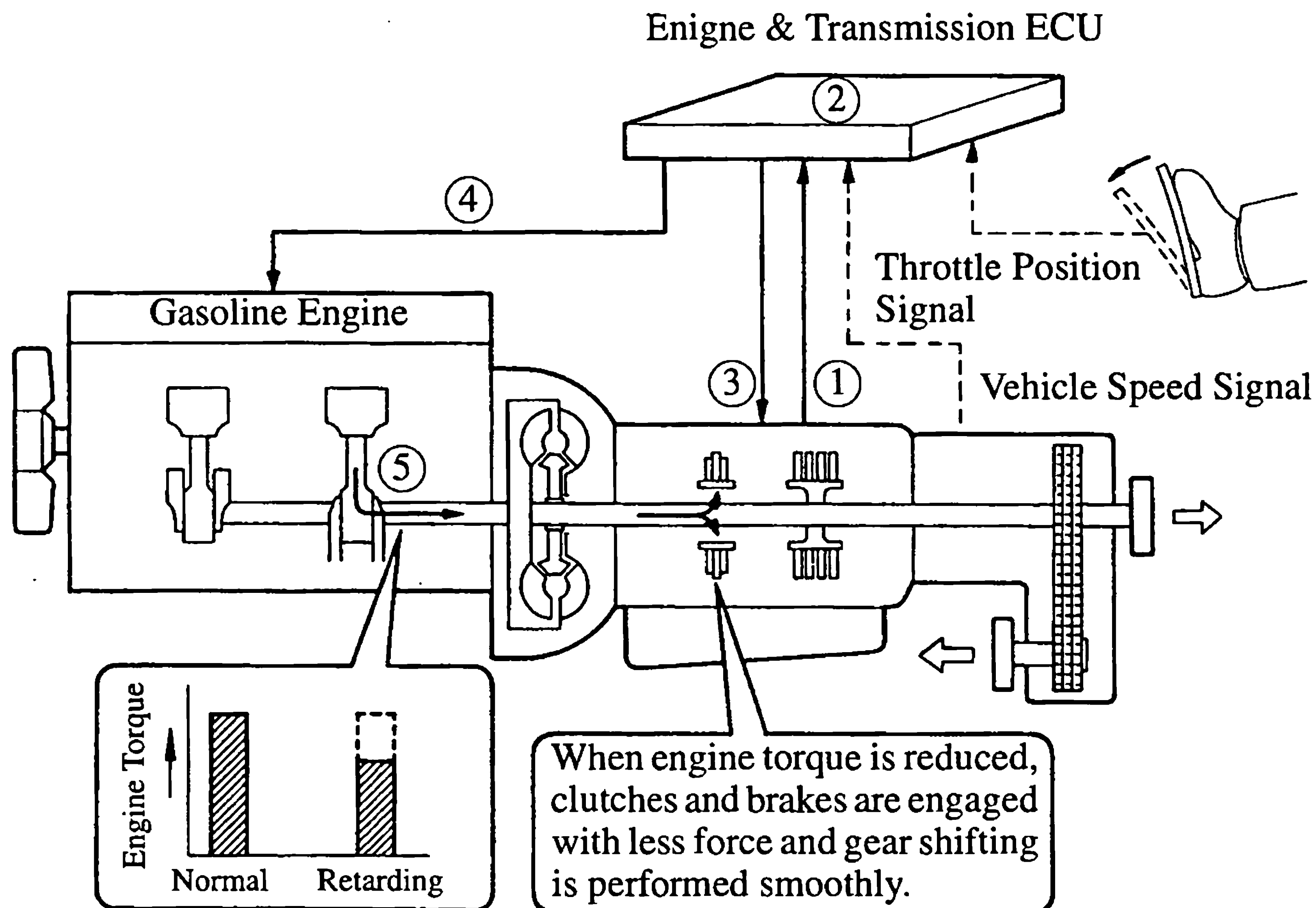
► Specifications ◀

Engine Type				3RZ-FE	5VZ-FE	1KZ-TE
Item						
Torque Converter	Converter Type			3-Element, 1-Step, 2-Phase, with Lock-Up Mechanism		
	Stall Torque Ratio			1.900	←	←
Planetary Gear Unit	C ₀	OD Direct Clutch	No. of Discs	2	←	←
	C ₁	Forward Clutch		5	6	←
	C ₂	Direct Clutch		3	4	←
	B ₀	OD Brake	No. of Discs	4	←	3
	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	←	←
	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	31	←	←
			No. of Pinion Gear Teeth	32	←	←
			No. of Ring Gear Teeth	95	←	←

ENGINE TORQUE CONTROL

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

When the 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 ECU retards the engine ignition timing to reduce 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.



- ① Judgment of Gear Shifting
- ② Determination of Ignition Timing Retard Angle
- ③ Gear Shifting
- ④ Retarding Ignition Timing
- ⑤ Torque Reduction

■ 2ND START SYSTEM

1. General

The 2nd start system enables the driver to use a pattern select switch to select the 2nd start mode which allows the vehicle to start in 2nd gear.
This system has been designed to make it easy for the vehicle to start on sandy or muddy terrain.

2. Operation

- When the 2nd start mode is selected while the shift lever is in the “D” or “2” position, the vehicle can start in the 2nd gear. After a start, if the shift lever is in the “D” position, the transmission will shift up automatically into 3rd and overdrive gears, as usual. If the shift lever is in the “2” position, the transmission will continue to operate in the 2nd gear.
- When a vehicle is allowed to start in 2nd gear under the 2nd start mode, it accelerates more gently and provides better control. This also minimize the fluctuation of the drive force transmitted to the tires realizing a smoother start with minimum slippage.

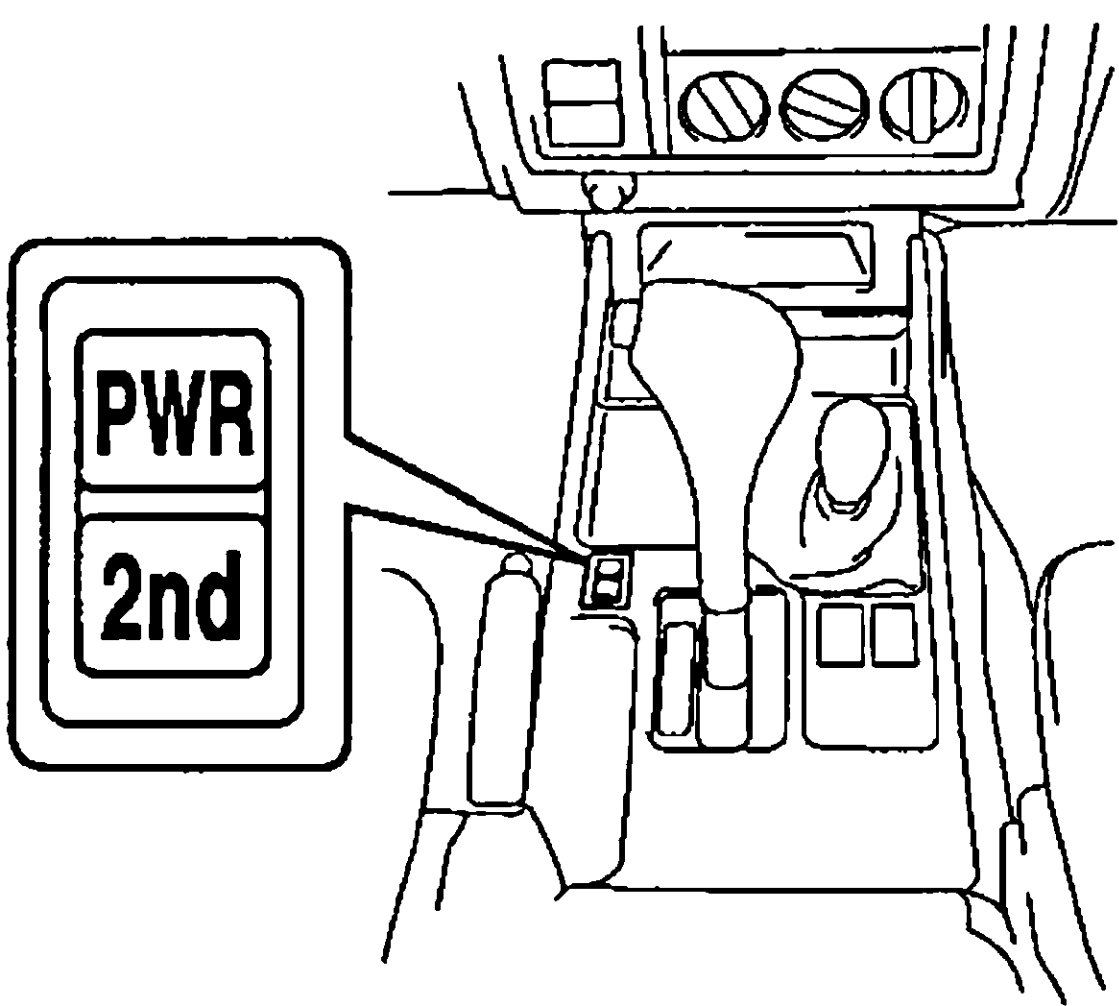
► Shift Program ◀

⇒: Up-shift ⇐: Down-Shit

Mode Shift Lever Position	Normal, Power	2nd Start
D (O/D Switch ON)	1st⇔ 2nd⇔ 3rd⇔ O/D	2nd⇔ 3rd⇔ O/D
2	1st⇔ 2nd⇐ 3rd	2nd⇐ 3rd
L	1st⇐ 2nd	←

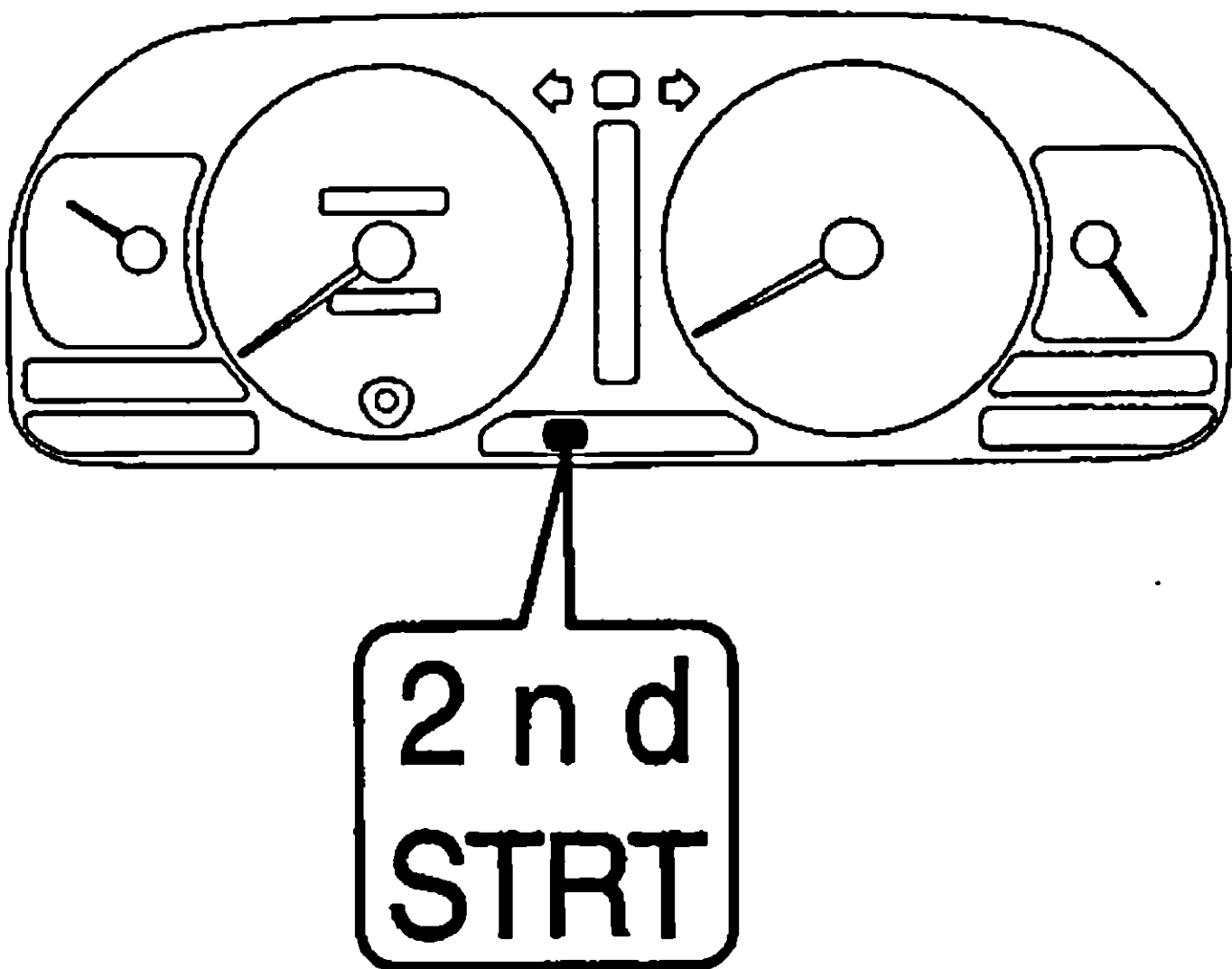
3. Pattern Select Switch

- A 2nd start mode has been provided in the pattern select switch. It is a momentary type switch which turns on upon pressing and turns off upon pressing it again. Also, the 2nd start mode is canceled once the ignition switch is turned off and returns to the normal mode.
- The 2nd start mode is also canceled when the power mode is selected. Likewise, the power mode is canceled when the 2nd start mode is selected.



4. 2nd Start Indicator Light

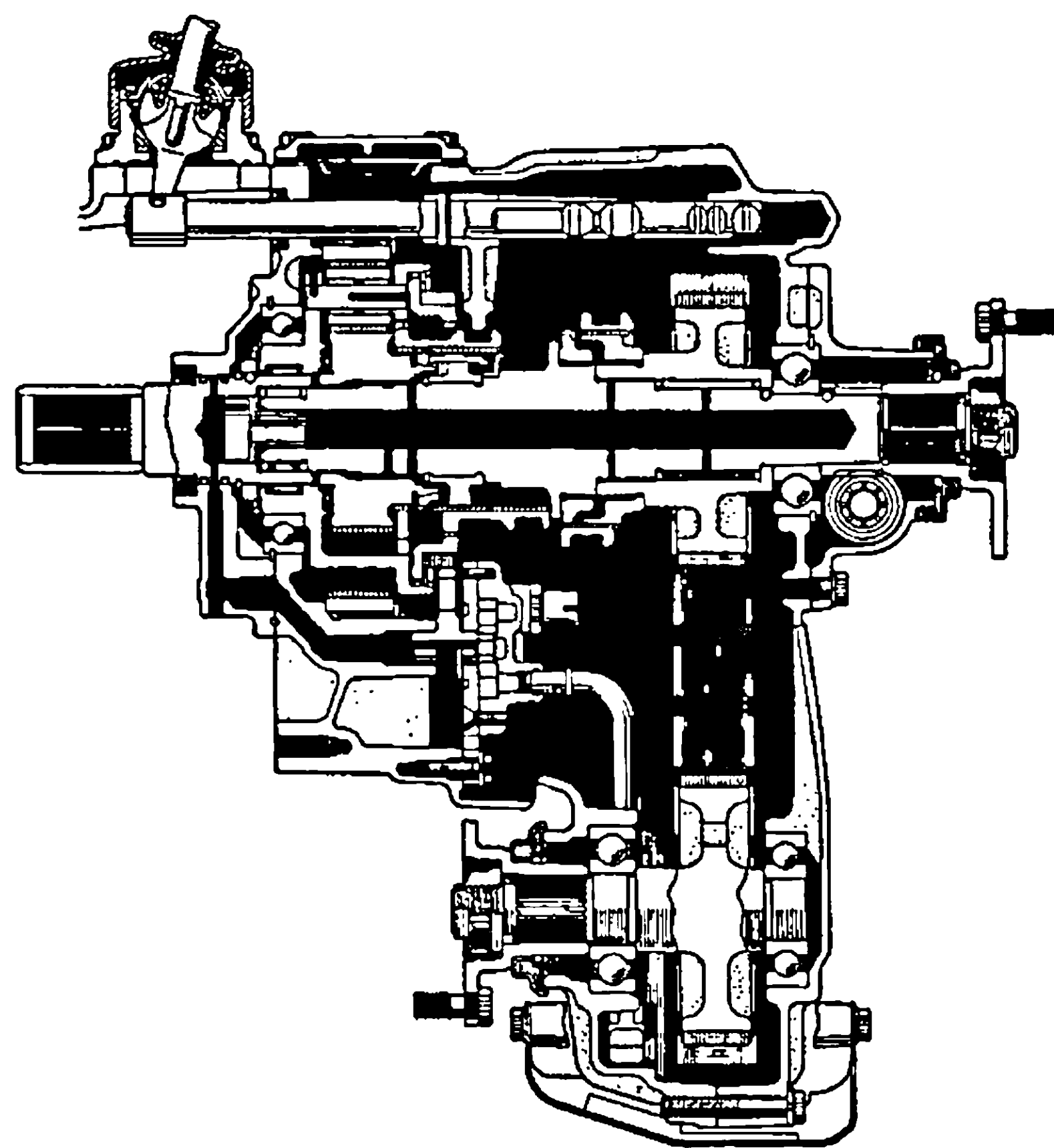
A 2nd start indicator light which turns on when the 2nd start mode is selected is provided in the combination meter.



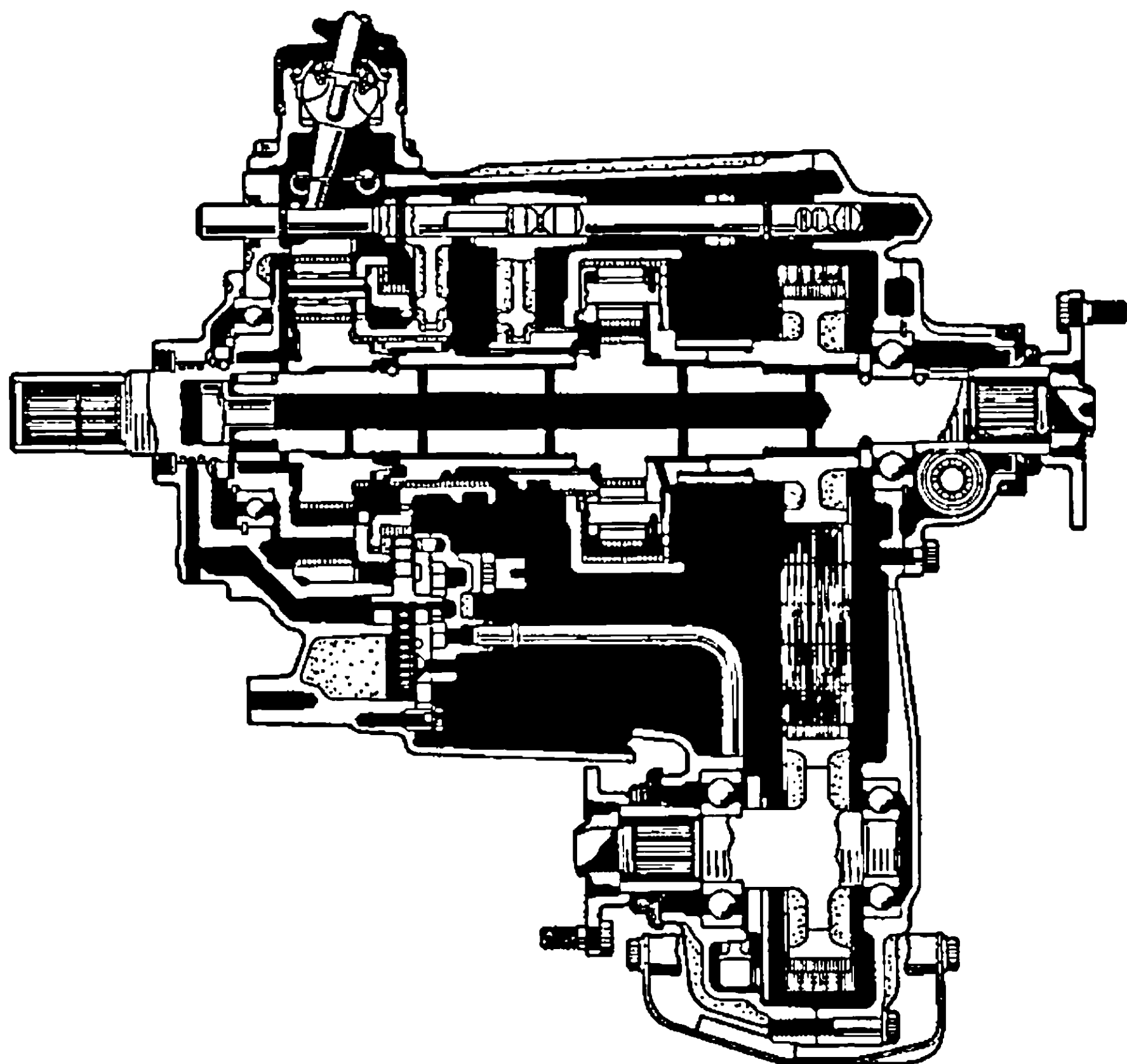
TRANSFER

DESCRIPTION

The new model uses the part-time 2-speed VF2A transfer with a reduction mechanism in its planetary gear unit and the full-time 2-speed VF3B transfer with a center differential mechanism in its double pinion planetary gear unit.



VF2A Transfer



VF3B Transfer

CH

Specifications

Transfer Type		VF2A	VF3B
Engine Type		3RZ-F, 3RZ-FE, 1KZ-T, 3L	3RZ-FE*, 5VZ-FE, 1KZ-TE
Item			
Reduction Gear Type		Single Pinion Planetary Gear	+
Gear Ratio	H2	1.000	–
	H4	1.000	+
	L4	2.566	+
Center Differential Gear Type		–	Double Pinion Planetary Gear
Oil Capacity	liters (US qts, Imp. qts)	1.0 (1.1, 0.9)	1.2 (1.3, 1.1)
Oil Viscosity		SAE 75W-90	+
Oil Grade		API GL-4 or GL-5	+

*: Models for Australia

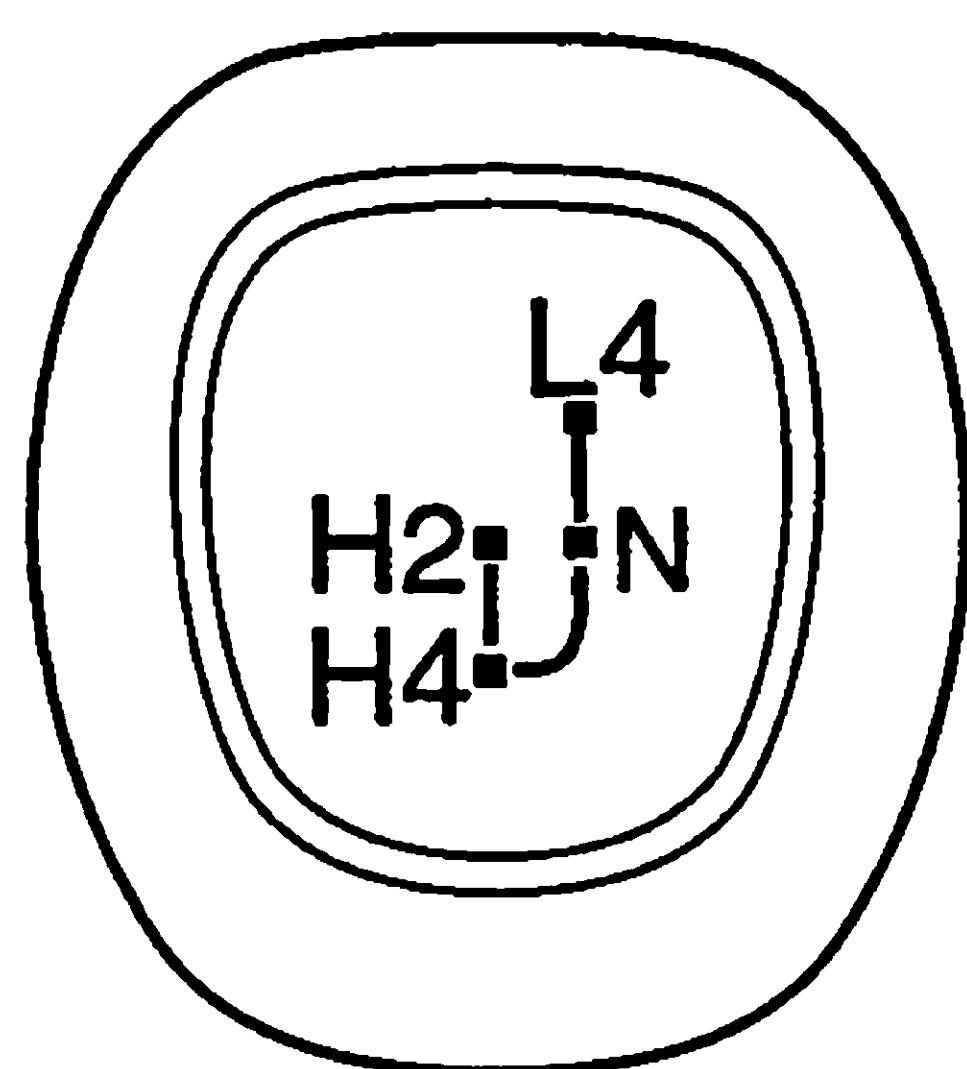
■ VF2A TRANSFER

1. General

The VF2A transfer is a compact and lightweight part-time 2-speed transfer. In this transfer, planetary gear train is adopted in the reduction mechanism and a silent chain is used for the front drive which reduces noise. In addition, a synchromesh mechanism is adopted for smooth shifting from low gear (L4) to high gear (H4).

2. Shift Pattern

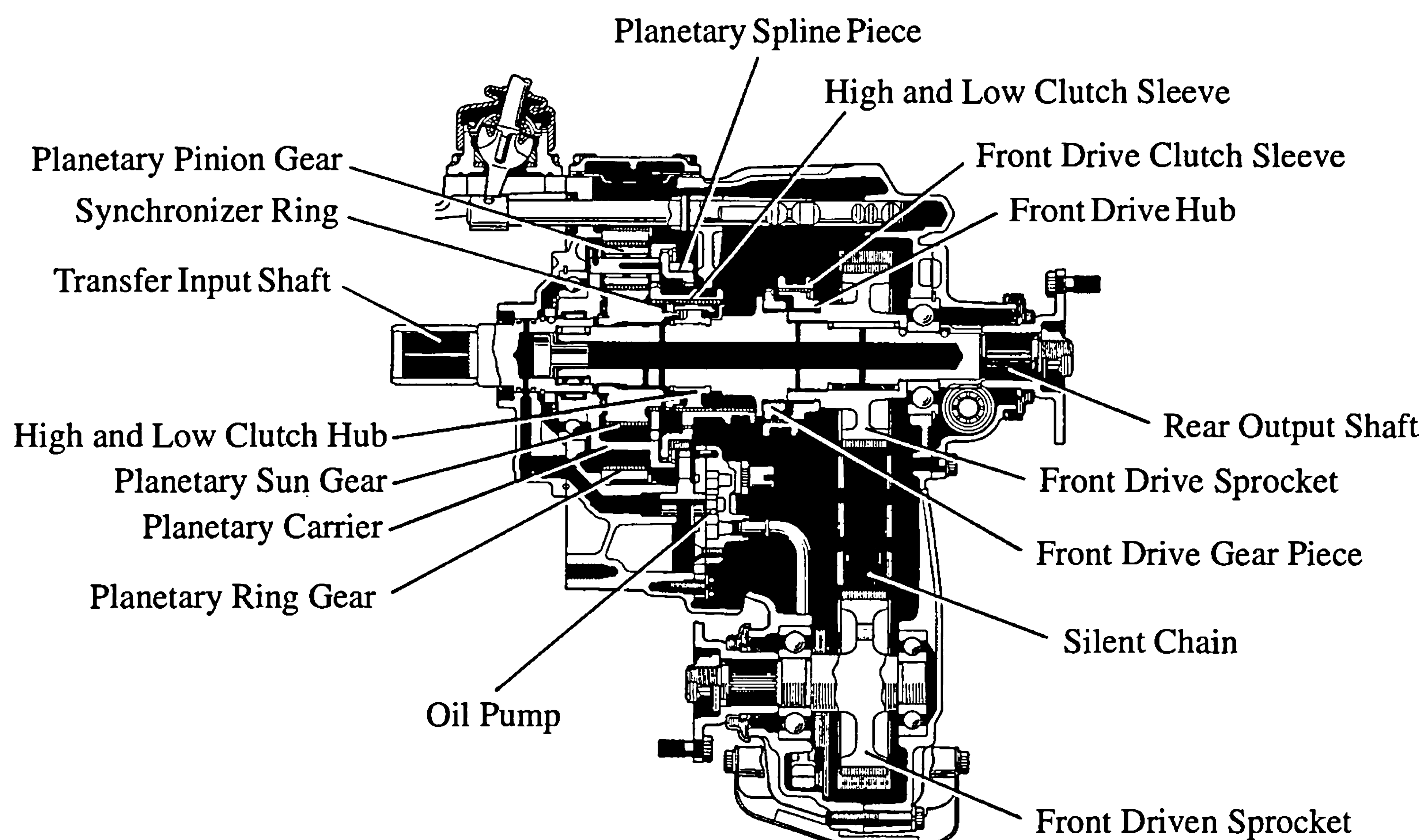
The shift pattern of the transfer is shown below.



H2: High Speed 2WD
H4: High Speed 4WD
N : Neutral
L4: Low Speed 4WD

3. Construction

The construction of the transfer is shown below.

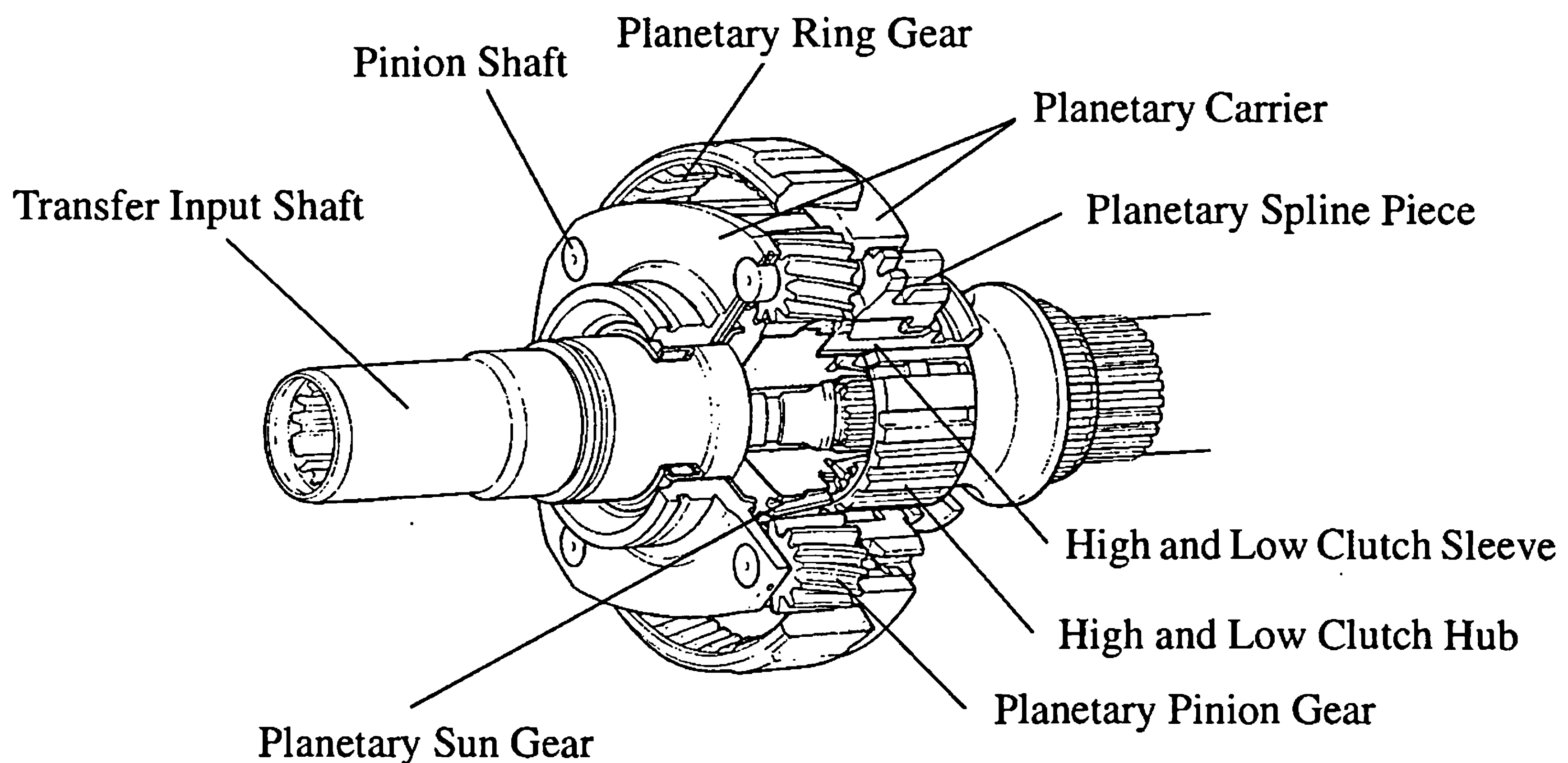


4. Planetary Gear Unit

Construction

The transfer input shaft integrates with the planetary sun gear. At the rear of the input shaft, a high and low clutch sleeve is installed via the synchro mechanism on the output shaft.

4 planetary pinion gears are fitted to the planetary carrier. The shaft of each pinion gear is fixed to the carrier. A planetary spline piece is fitted to the rear of the carrier and internal gear teeth of the spline piece can be engaged with the external teeth of the low and high clutch sleeve. The planetary ring gear is fixed to the transfer case and its internal teeth are meshed with the planetary pinion gear.

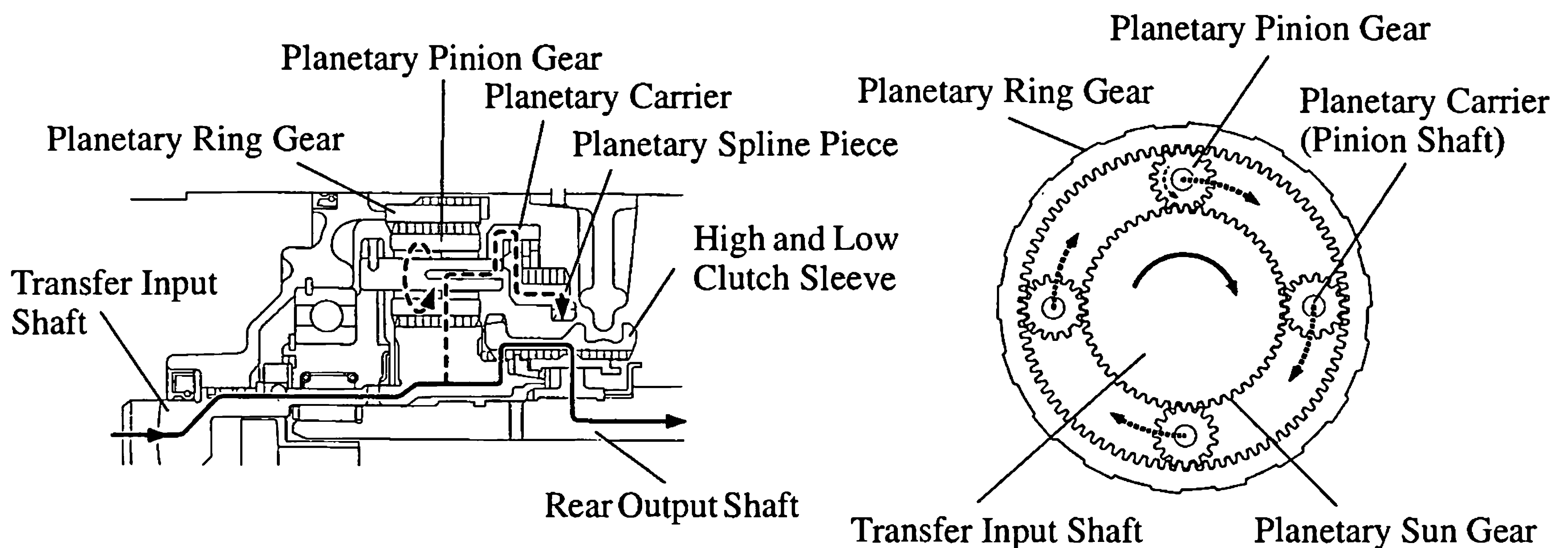


Operation

1) H2 and H4 Position

In the H2 and H4 position, the splines at the rear of the input shaft mesh with the internal gear teeth of the high and low clutch sleeve.

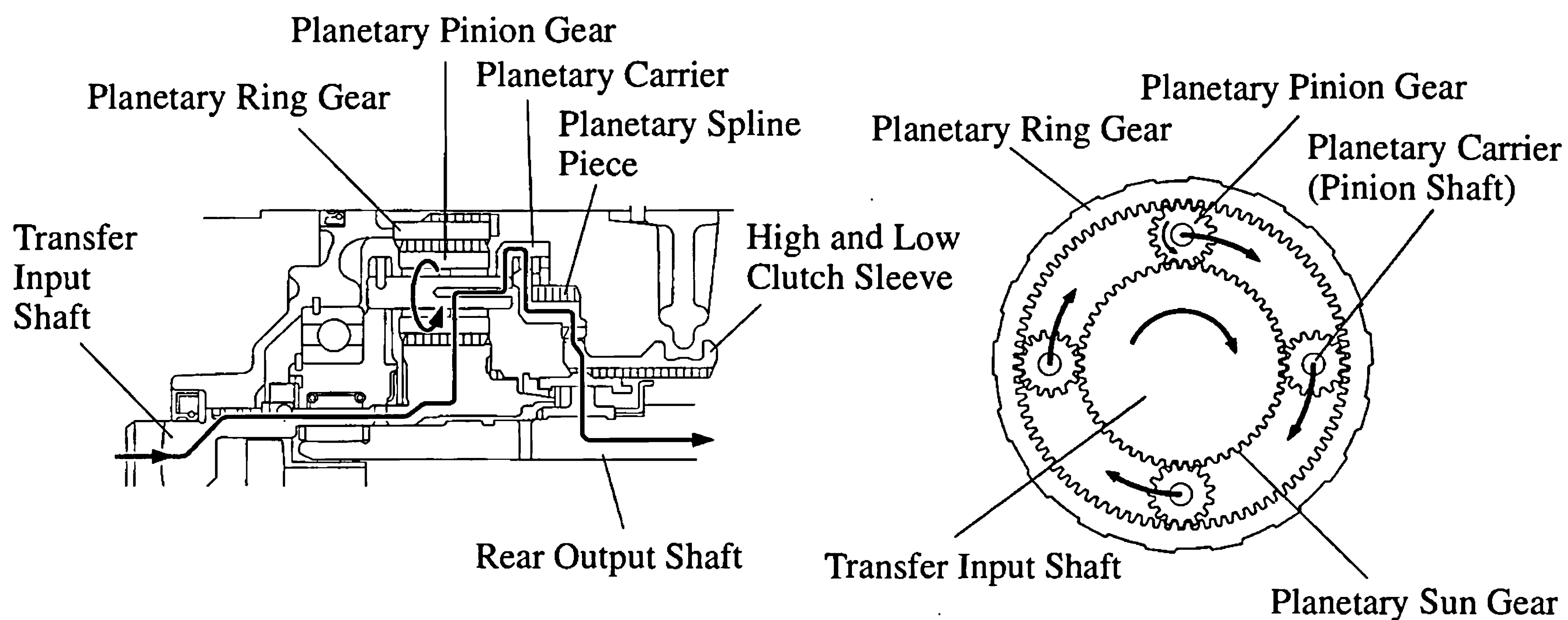
Also, the high and low clutch sleeve is meshed to the rear output shaft via the high and low clutch hub. Thus, the rotation of the input shaft is transmitted to the high and low clutch sleeve, high and low clutch hub, and to the rear output shaft.



2) L4 Position

In the L4 position, the external teeth of the high and low clutch sleeve are meshed with the planetary spline piece.

Thus, the rotation of the input shaft is transmitted in a reduced form to the sun gear, pinion gear, pinion shaft, planetary carrier, planetary spline piece, high and low clutch sleeve, high and low clutch hub, and rear output.



■ VF3B TRANSFER

1. General

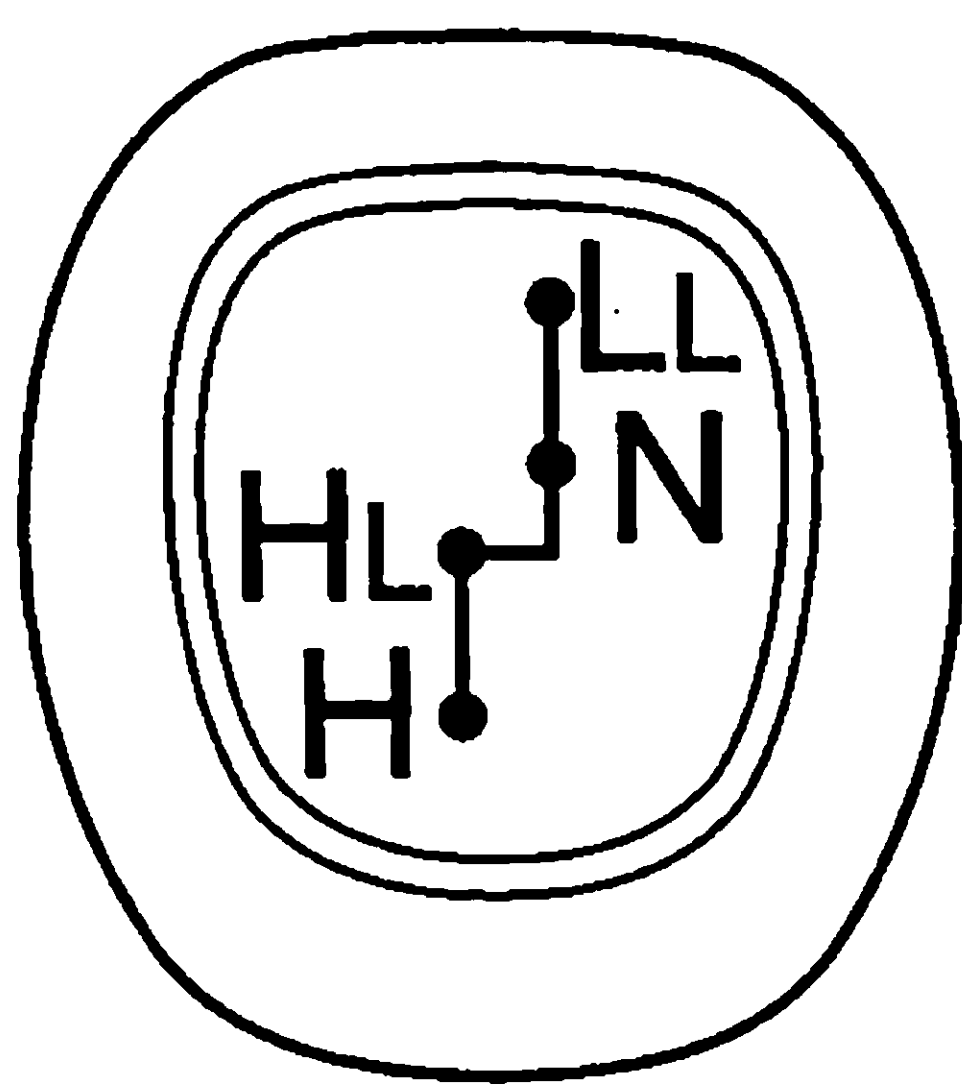
To enable full-time 4WD operation, the VF3B transfer is a full-time 2-speed transfer that is based on the VF2A transfer to which a double-pinion planetary gear type center differential has been added.

This transfer is equipped with a center differential lock mechanism.

Similar to the VF2A, the manual transmission model adopts a synchromesh mechanism to ensure smooth shifting from low gear (LL) to high gear (HL).

2. Shift Pattern

The shift pattern of the transfer is shown below.



H : High Speed

HL : High Speed, Center Differential Lock

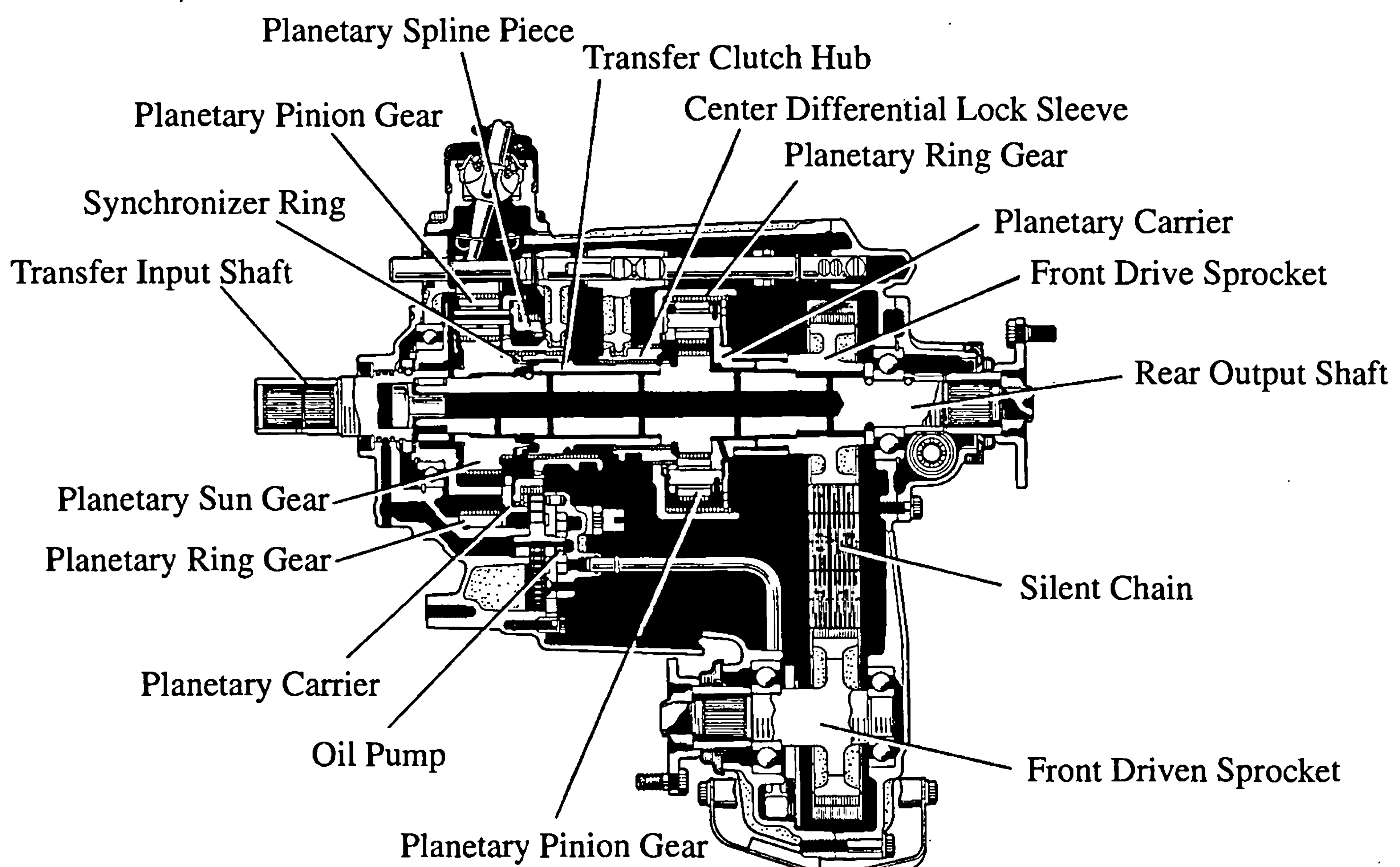
N : Neutral

LL : Low Speed, Center Differential Lock

CH

3. Construction

The construction of the VF3B transfers is show in below.



VF3B Transfer

4. Center Differential

Construction

The double pinion planetary gear type center differential consists of a planetary ring gear, a planetary sun gear, a planetary carrier and 6 planetary pinion gears.

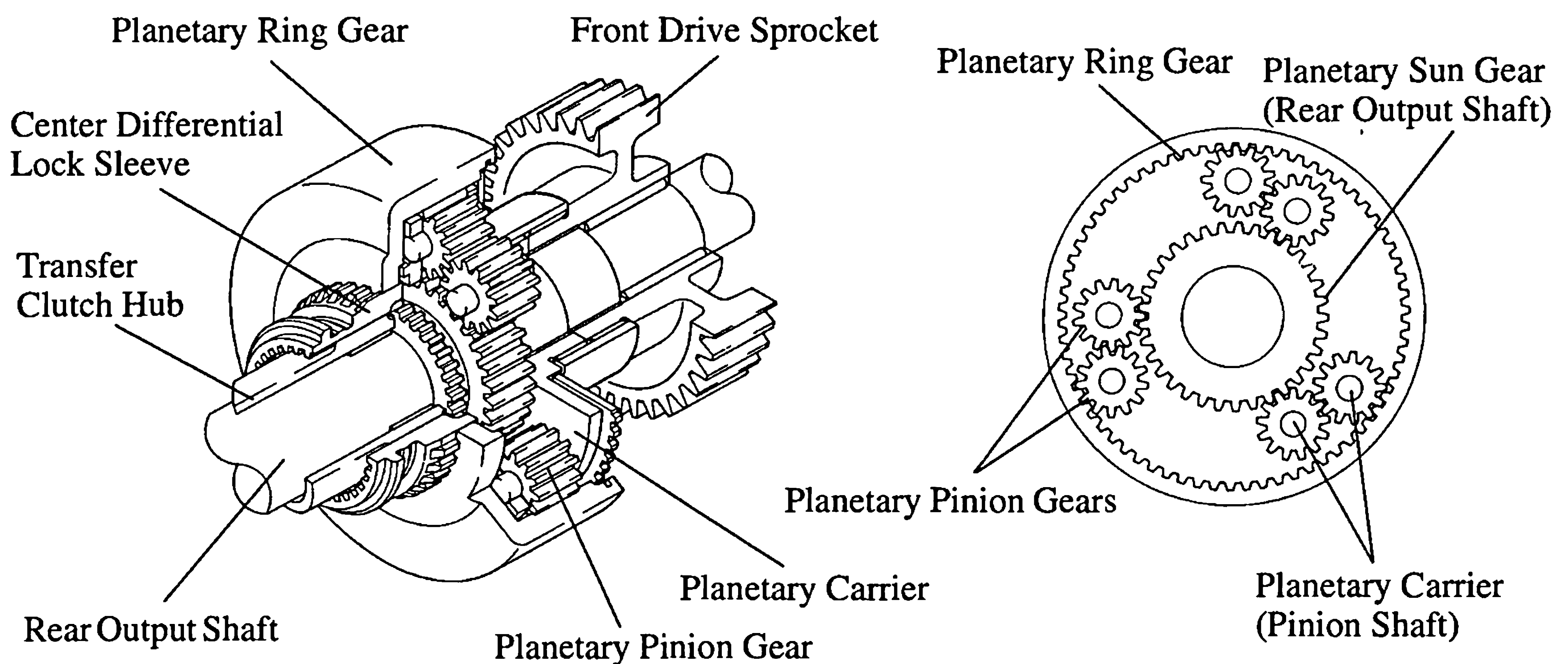
Three sets of planetary pinion gears, which are meshed in pairs, are enclosed in the planetary carrier.

One of the paired planetary pinion gears (the outer gear) is meshed with the planetary ring gear and the other side (the inner gear) is meshed with the planetary sun gear of the rear output shaft.

The drive force from the transfer clutch hub is transmitted to the planetary ring gear via the center differential lock sleeve.

The planetary carrier transmits the drive force to the front wheels and the planetary sun gear transmits the drive force to the rear wheels.

In addition, a center differential lock mechanism is provided in the front of the center differential.

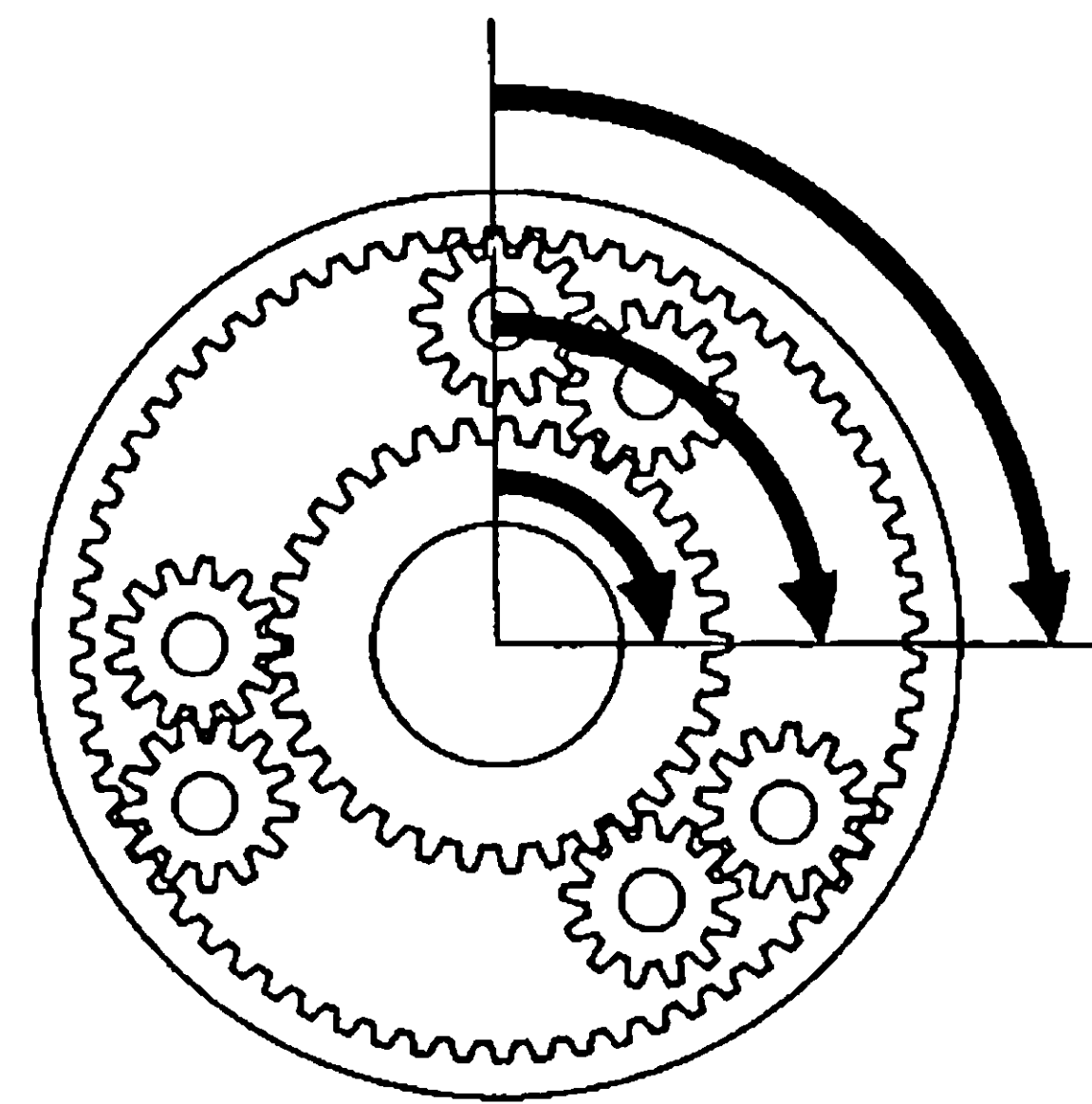
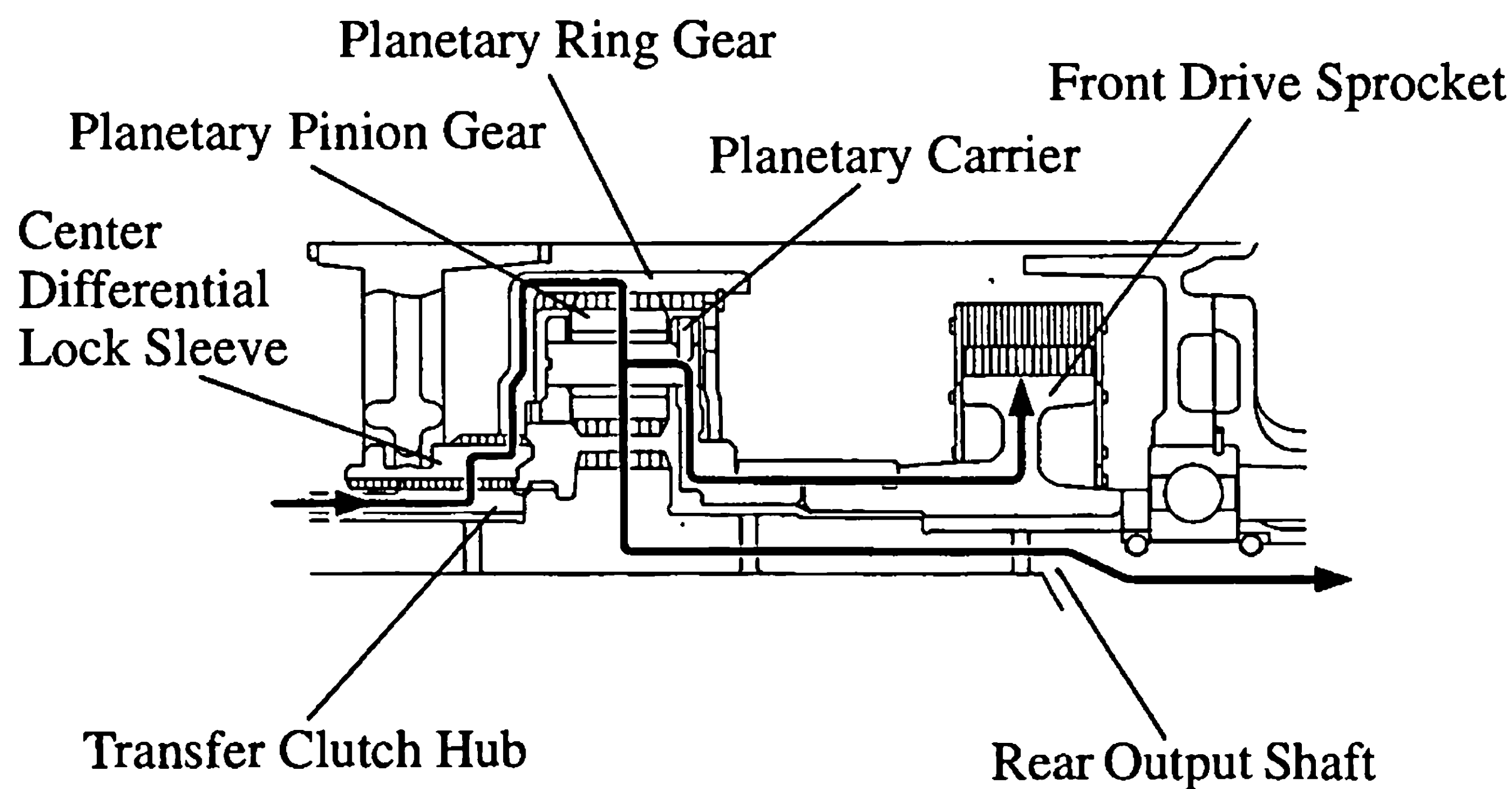


Operation

1) Free Mode

a. When the Vehicle is Travelling Straight

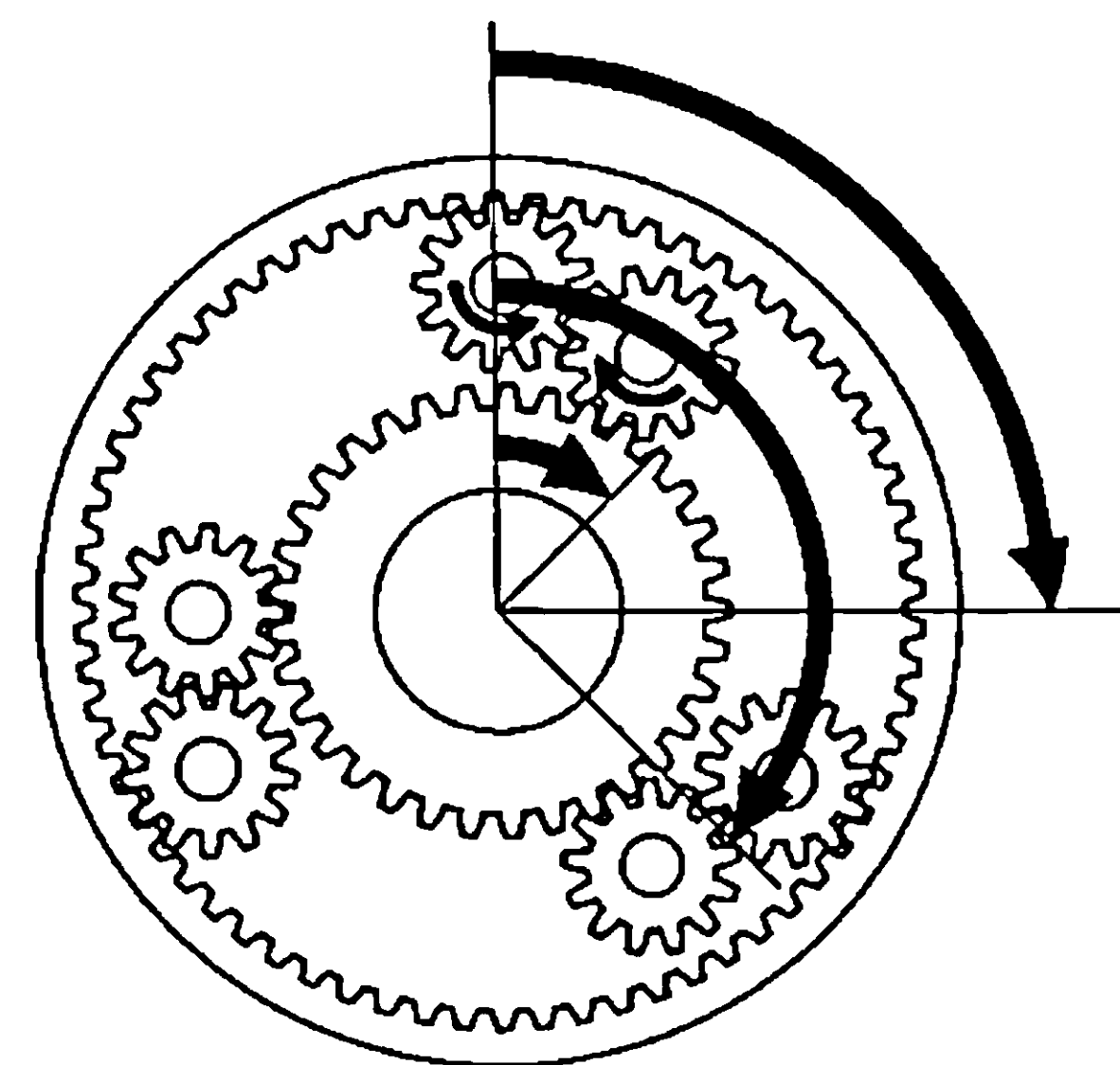
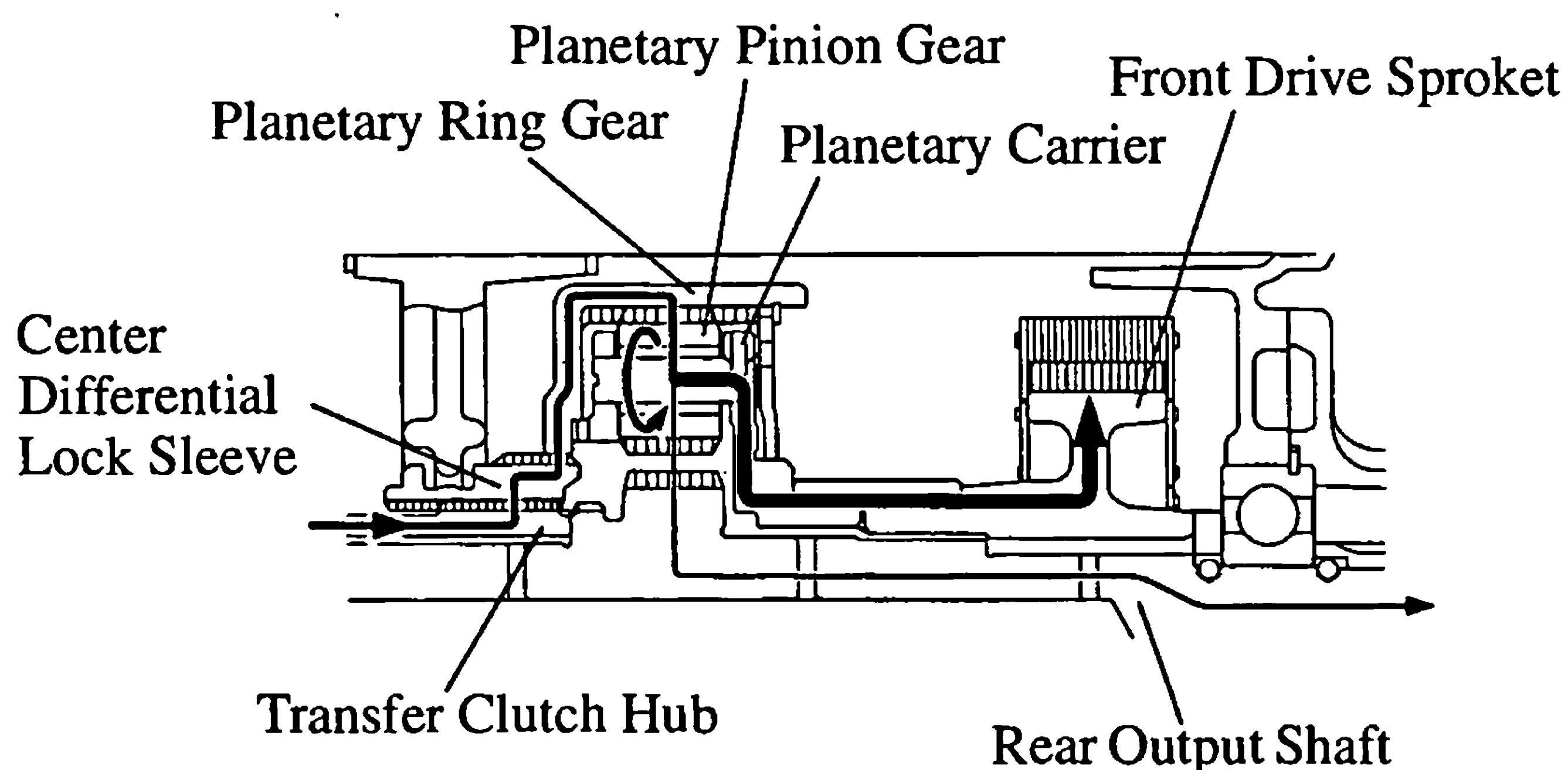
There is practically no speed difference between the front and rear wheels when the vehicle is running straight at a constant speed. In this condition, the transfer clutch hub, drive sprocket and rear output shaft rotate at the same speed. That is, they rotate together with the center differential unit. In this case, the driving force from the transfer clutch hub is distributed uniformly and transmitted to the front and rear wheels from the planetary pinion shaft.



CH

b. When the Vehicle is Cornering

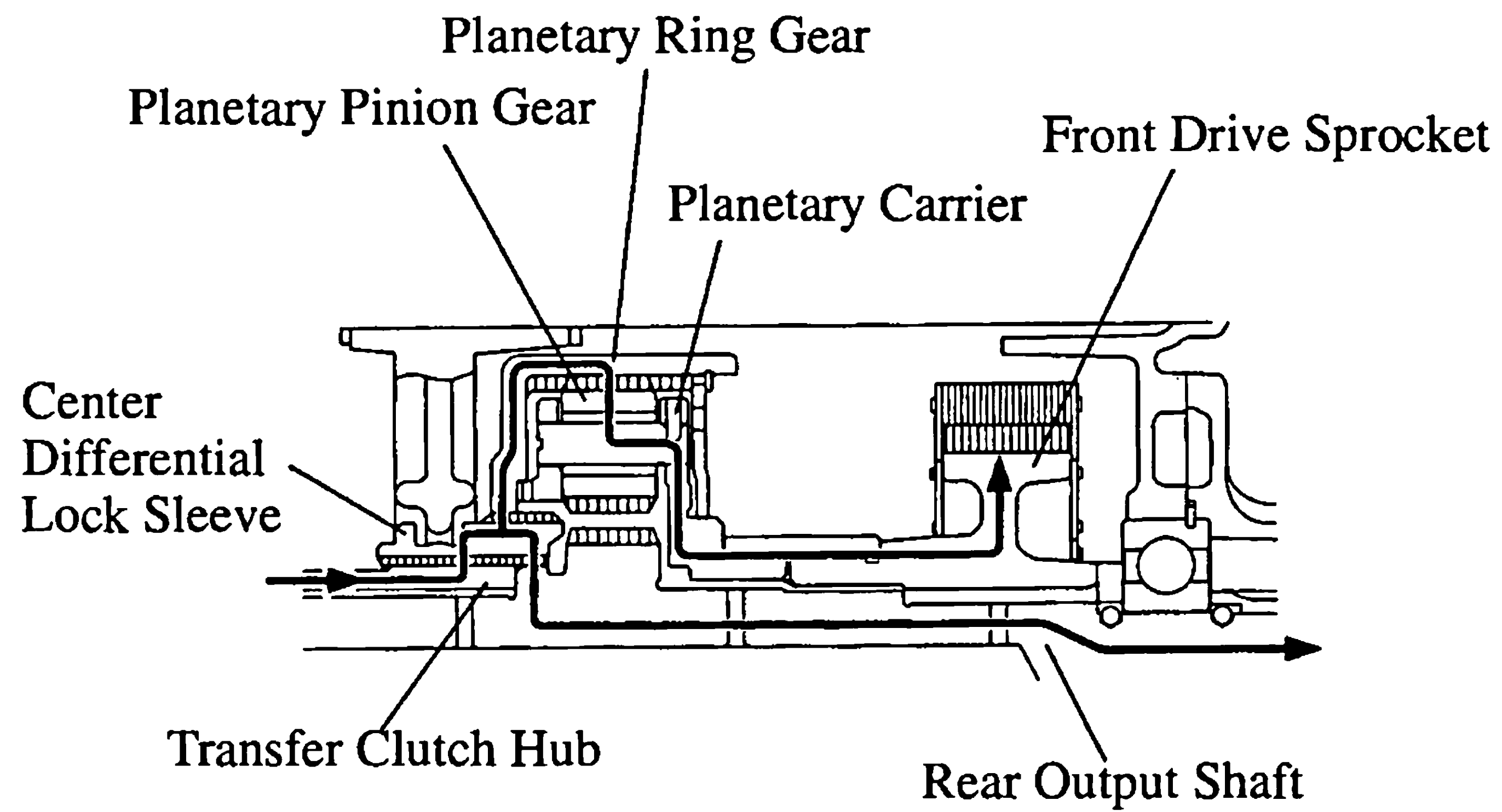
If a speed difference is generated between the front and rear wheels due to a turn, etc., the planetary pinion of the center differential unit rotates and absorbs the speed difference. For example, if the speed of the front wheels becomes greater than the speed of the rear wheels, the front drive sprocket rotates faster than the transfer clutch hub. As a result, the planetary carrier rotates faster, but in the same direction as the planetary ring gear. This causes the pinion gear (outer), which is meshed with the planetary ring gear, to rotate in the opposite direction while orbiting (revolving) the ring gear in the same direction. As a result, the other pinion gear (inner) rotates in the same direction as the ring gear and the rotation of the rear output shaft becomes slower than that of the drive sprocket by the amount of the rotating of the pinion gear.



2) Lock Mode

Shifting the transfer shift lever from “H” to “HL” causes the center differential lock sleeve to move to the right, the inner teeth of the center differential lock sleeve to mesh with the rear output shaft, and the outer teeth to mesh with the planetary carrier.

As a result, the center differential stops operating and assumes a locked state.

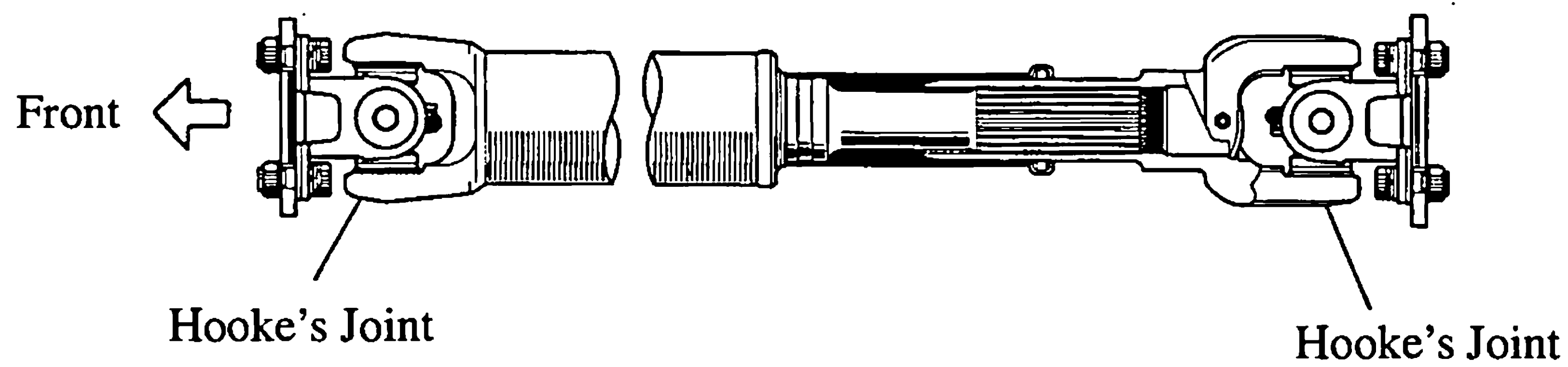


PROPELLER SHAFT

■ DESCRIPTION

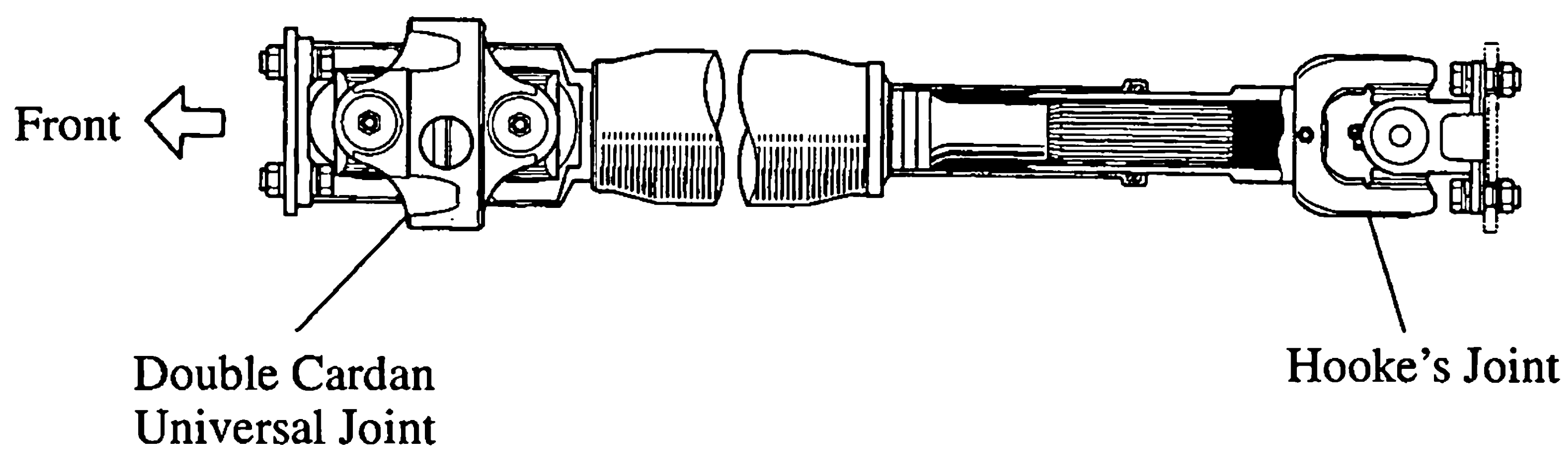
A 2-joint type propeller shaft is used in both front and rear on all model.

A double cardan universal joint is used on a transfer side of the rear propeller shaft.



Front Propeller Shaft

CH

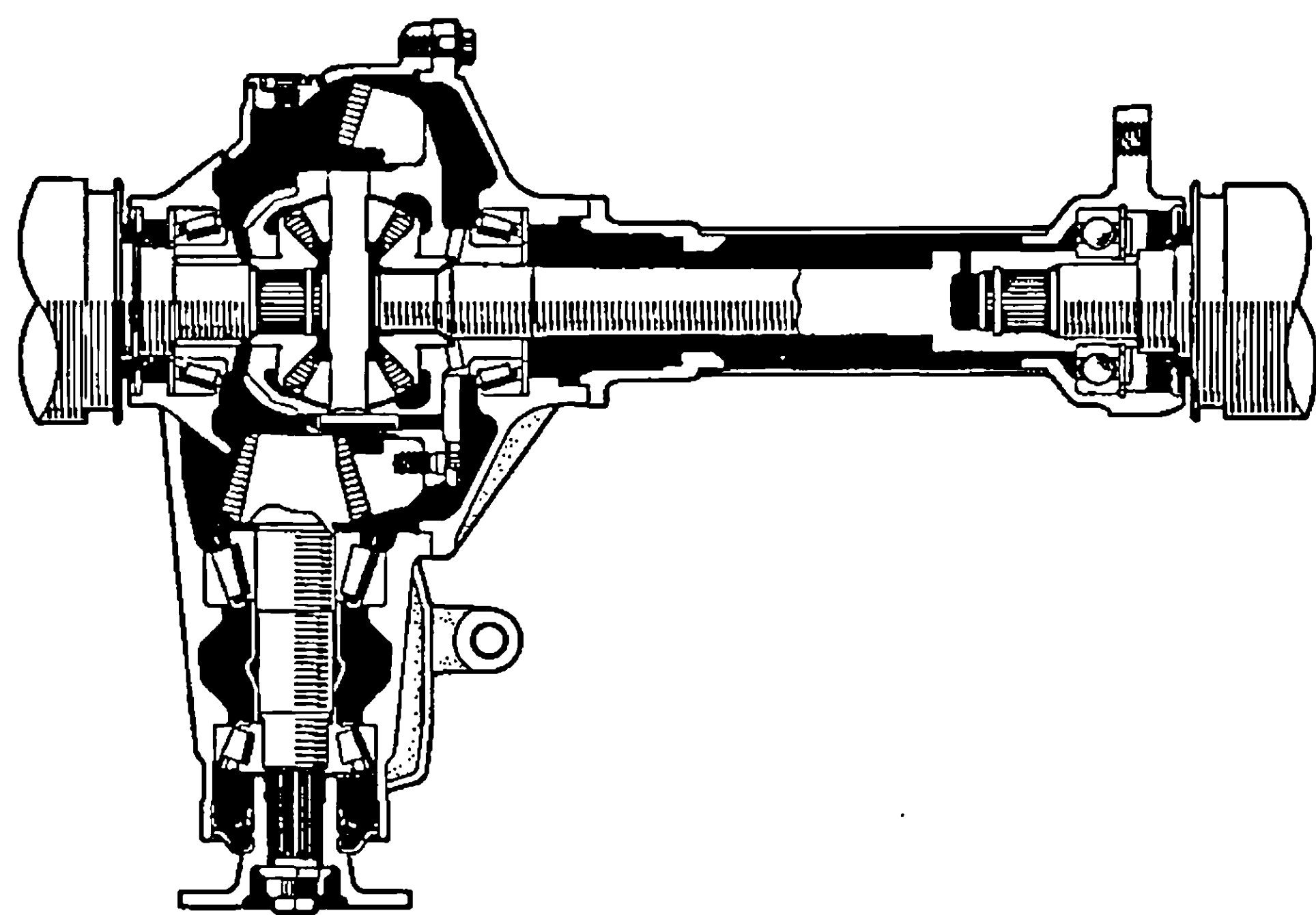


Rear Propeller Shaft

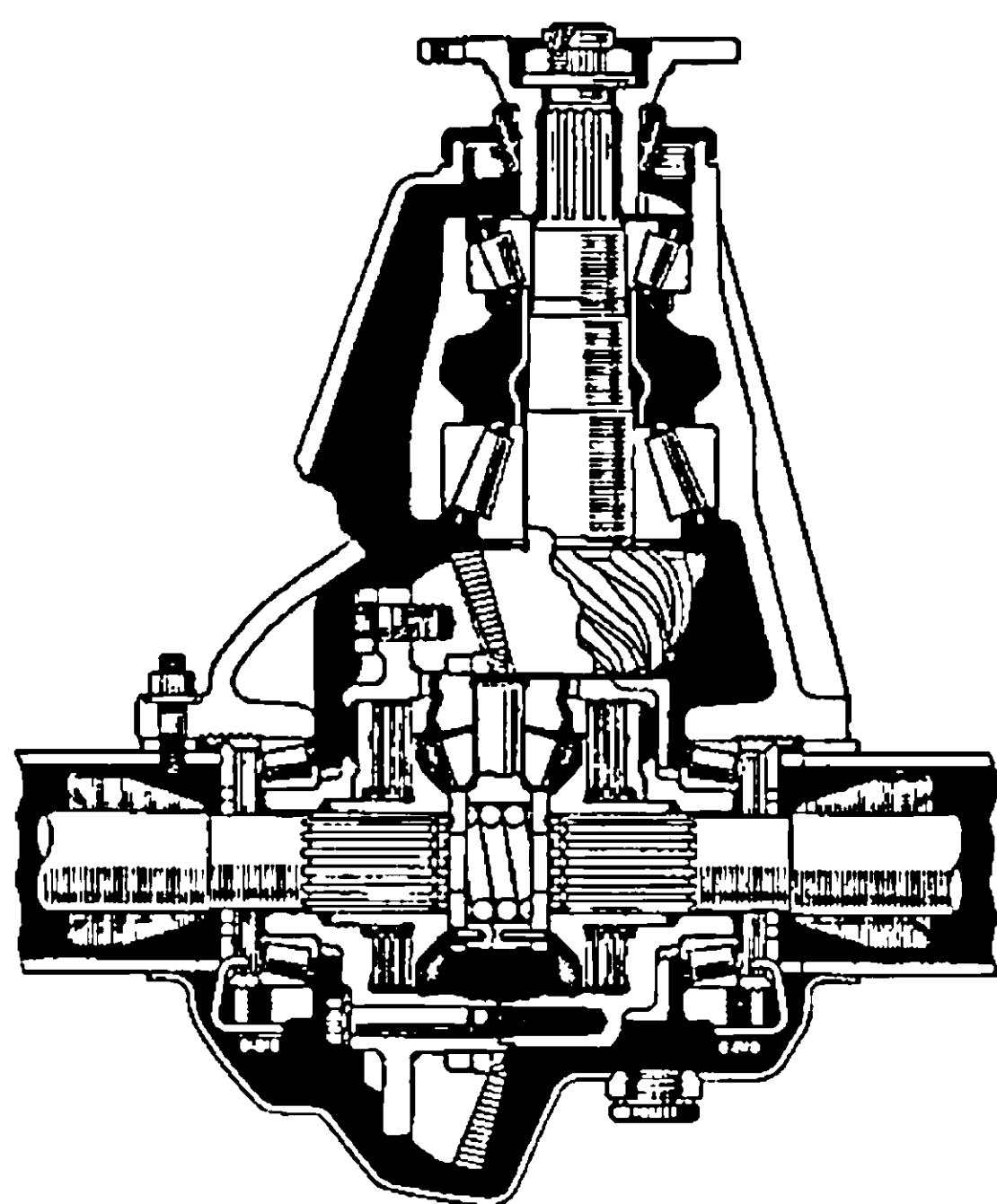
DIFFERENTIAL

DESCRIPTION

- All models use a 7.5-inch ring gear on the front differential and an 8-inch ring gear on the rear differential.
- A multi-disc type LSD (limited slip differential) is available as an option for the rear differential of all models.
- A rear differential lock system is available as an option on the models for Europe, and 3RZ-F and 1KZ-T engine model for General countries.



Front Differential



Rear Differential (LSD Type)

Specifications

Engine Type		3RZ-F, 3RZ-FE	5VZ-FE, 1KZ-T, 1KZ-TE	3L
Item				
Differential Gear Ratio		4.300 4.556*1	4.100 4.300*1	4.875
Ring Gear Size mm (in.)	Front	190 (7.48)	←	←
	Rear	205 (8.07)	←	←
Oil Capacity liters (US qts, Imp. qts)	Front	1.1 (1.2, 1.0)	←	←
	Rear	2.3 (2.4, 2.0)*2 2.6 (2.7, 2.3)*2,4 2.6 (2.7, 2.3)*3 2.9 (3.1, 2.6)*3,4	←	2.3 (2.4, 2.0)*2 2.6 (2.7, 2.3)*3
Oil Viscosity	Front	SAE 80W-90	←	←
	Rear	SAE 80W-90	←	←
Oil Grade		API GL-5	←	←
Oil Type		Hypoid, Hypoid for LSD*5	←	←

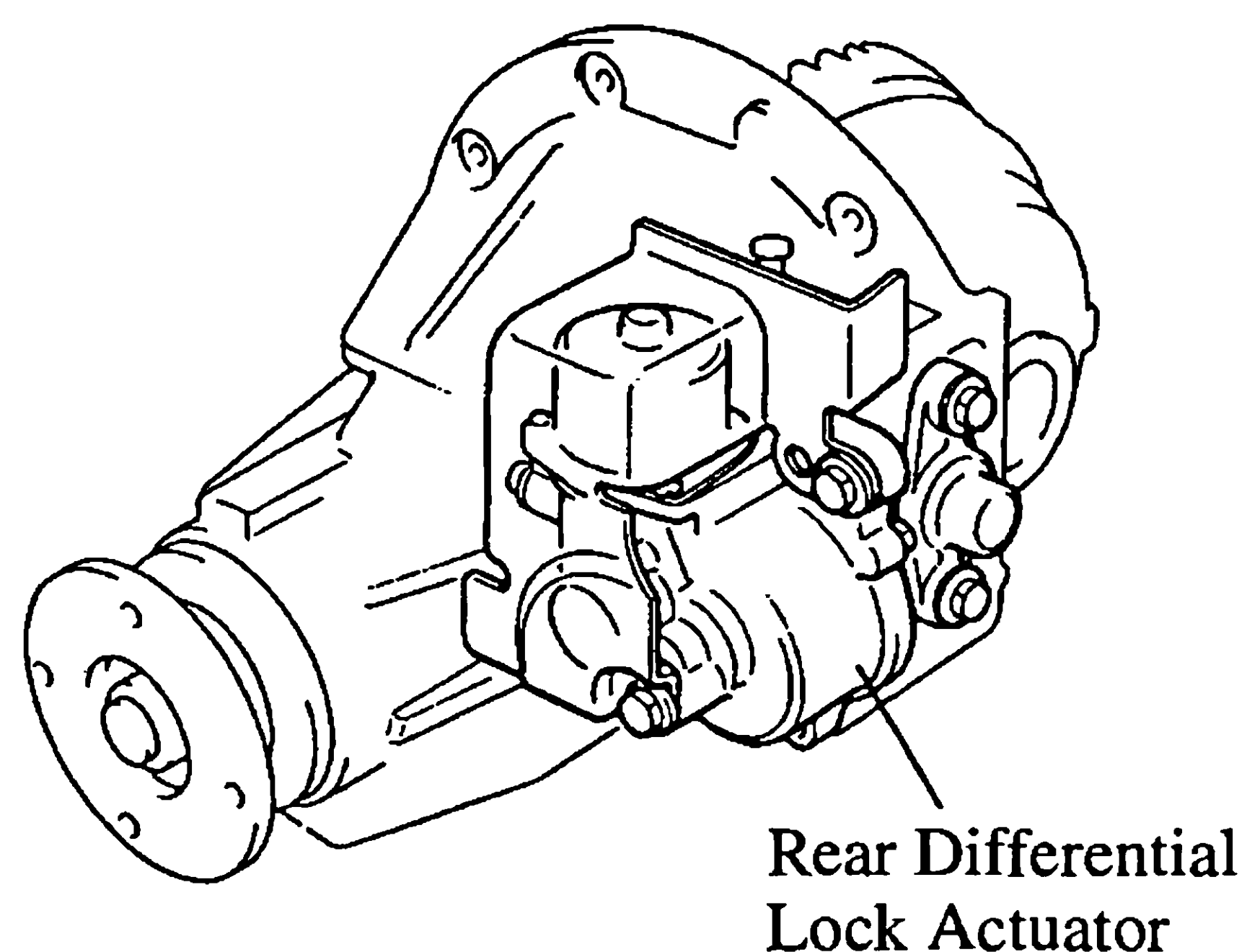
*1: With 265/70R16 Tire
*2: 3-Door Model
*3: 5-Door Model

*4: With Rear Differential Lock System
*5: With LSD

■ REAR DIFFERENTIAL LOCK SYSTEM

1. Construction

The left side differential case boss has been provided with splines which mesh with the sleeve and has both inner and outer splines. The sleeve slides the boss by way of the rear differential lock actuator attached to the outside of the differential carrier. Also, the outer tip area of the side gear boss has been provided with splines which mesh with the inner splines of the sleeve.



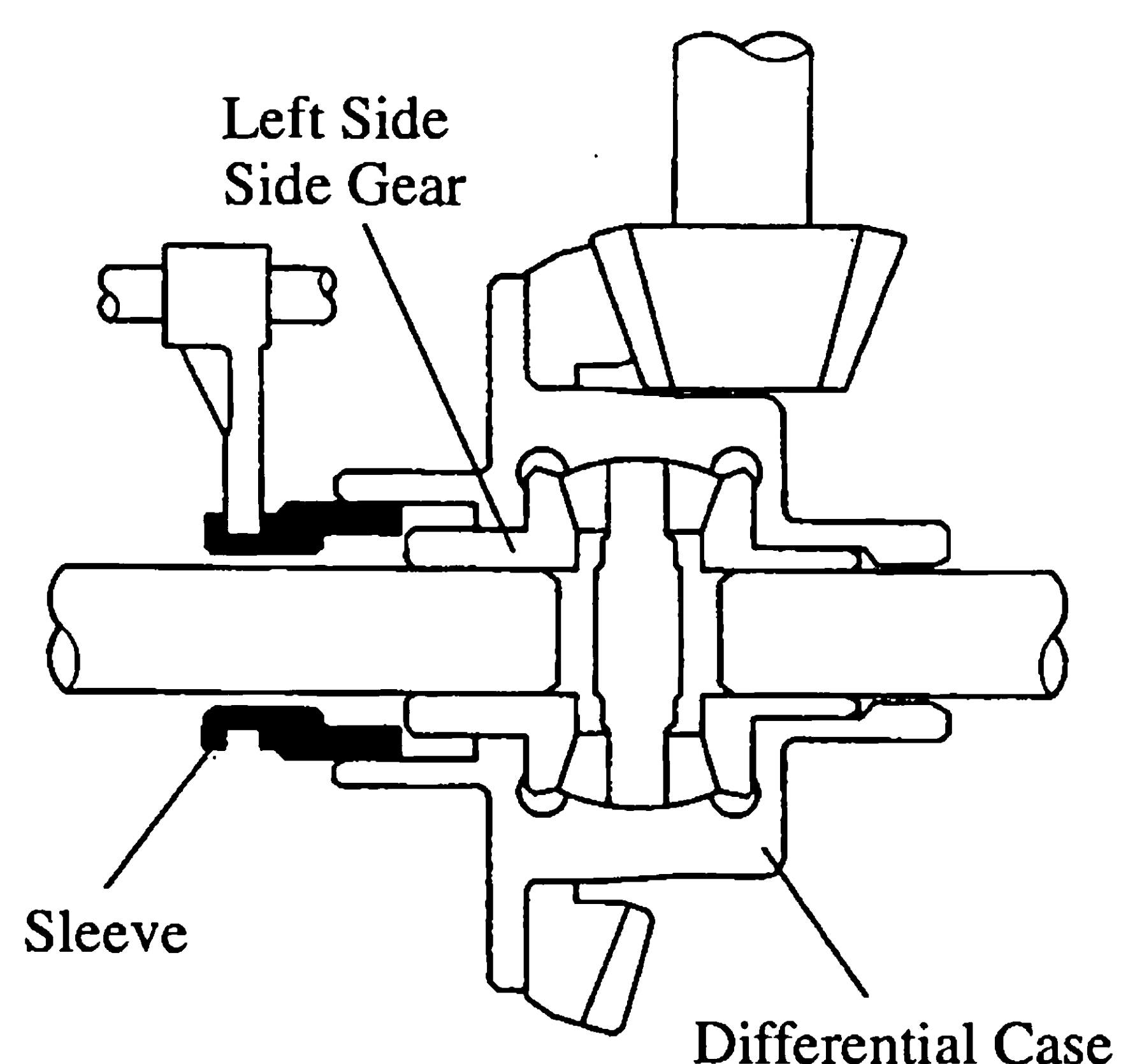
2. Operation

Differential Lock not Engaged ("FREE" Mode)

When the differential lock switch is OFF, the differential lock actuator is not activated.

Hence, the sleeve will remain on the left as illustrated without engaging with the left-side side gear.

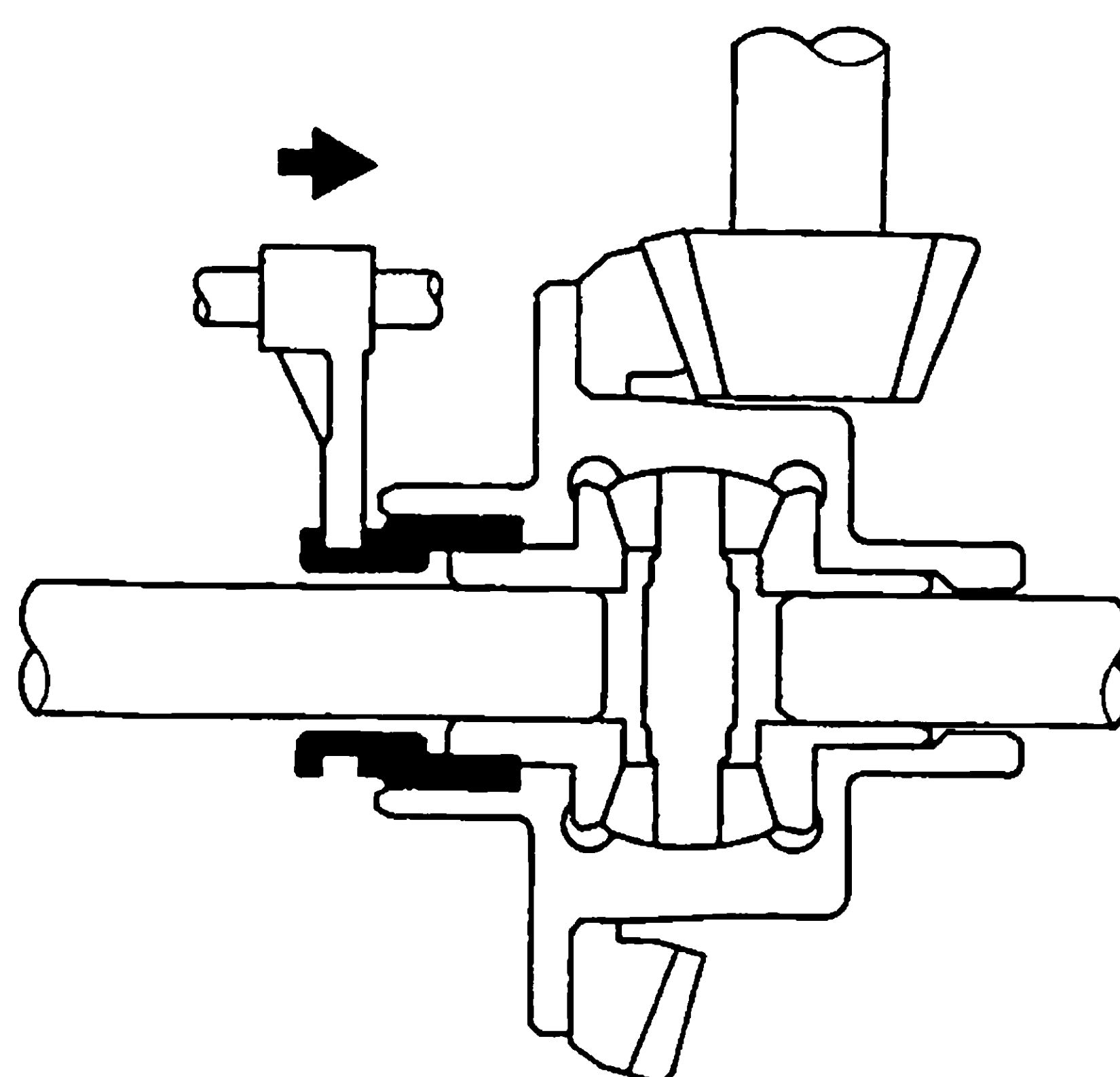
It will thus operate normally as conventional differential gear.



Differential Lock Engaged ("LOCK" Mode)

When the differential lock switch is ON, the differential lock actuator slides the sleeve toward right and meshes with the left-side side gear.

Accordingly, the differential case and side gear are locked by the sleeve to provide differential control.

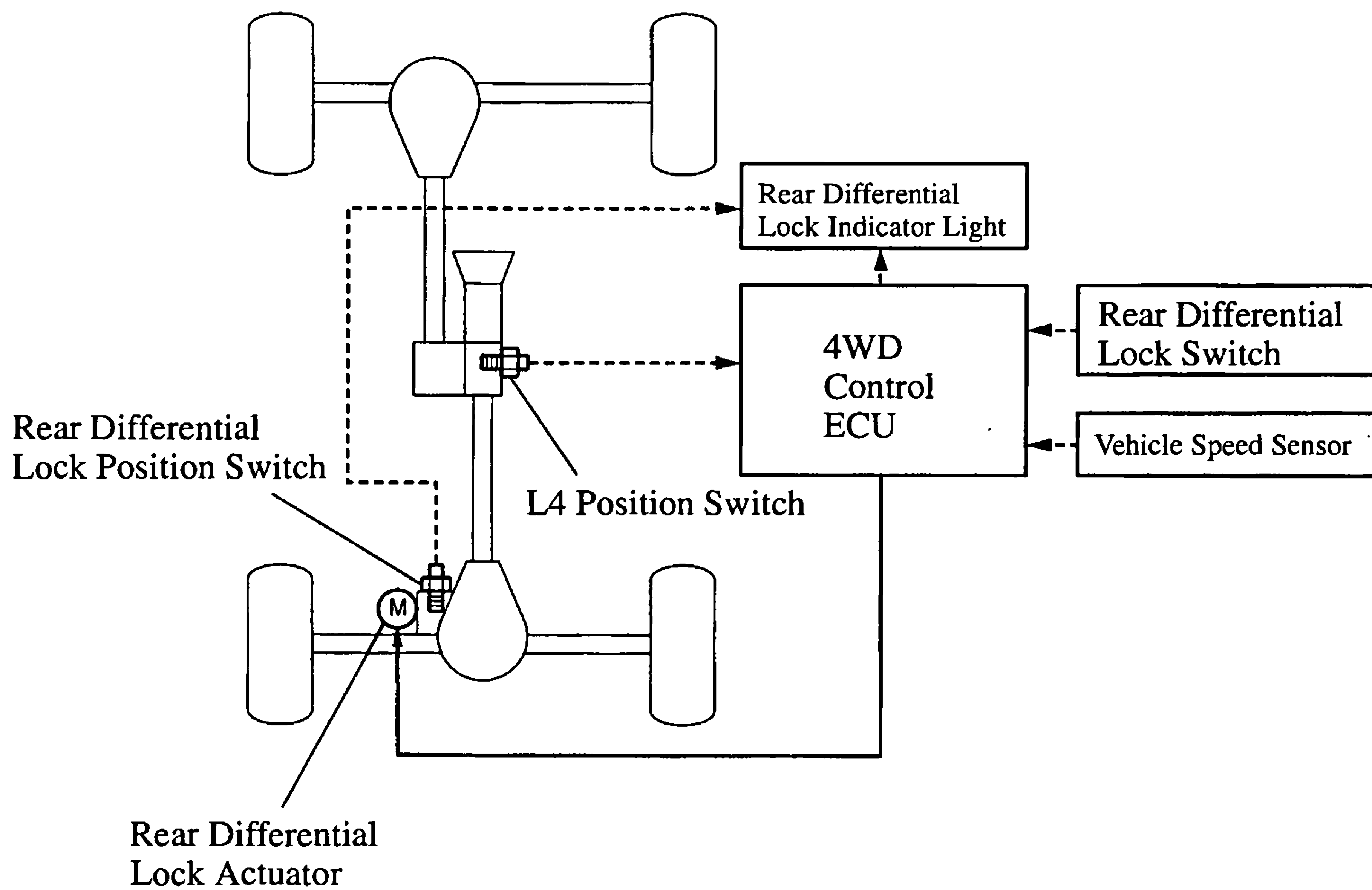


3. Electronic Control System

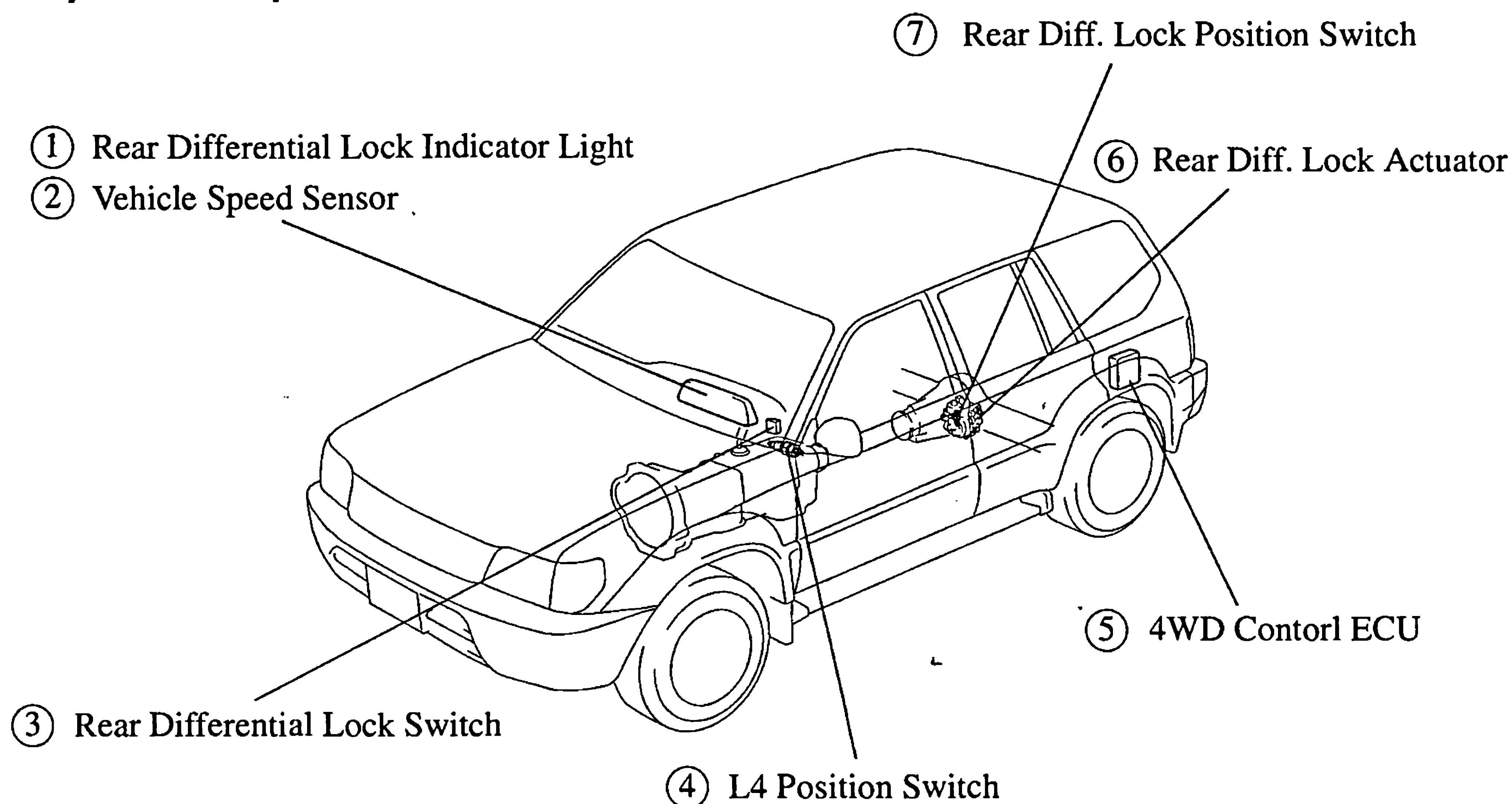
General

The sliding of the differential lock sleeve is accomplished by an electric motor which is controlled by the 4WD control ECU in conformity with the signals from the rear differential lock switch (on the instrument panel) and from other switches and sensors. This motor is built into the rear differential lock actuator.

System Diagram



Layout of Components

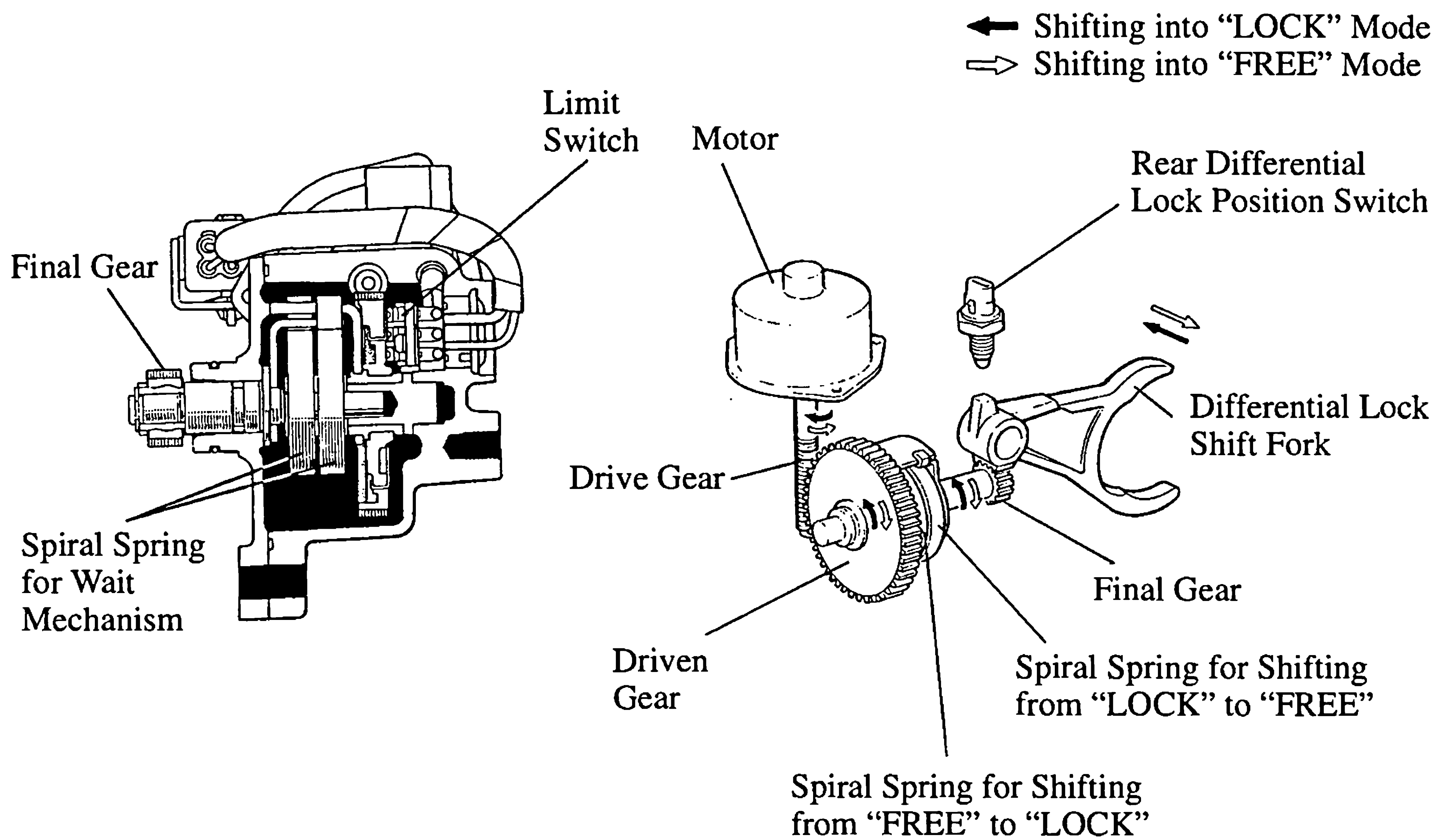


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Function of Components

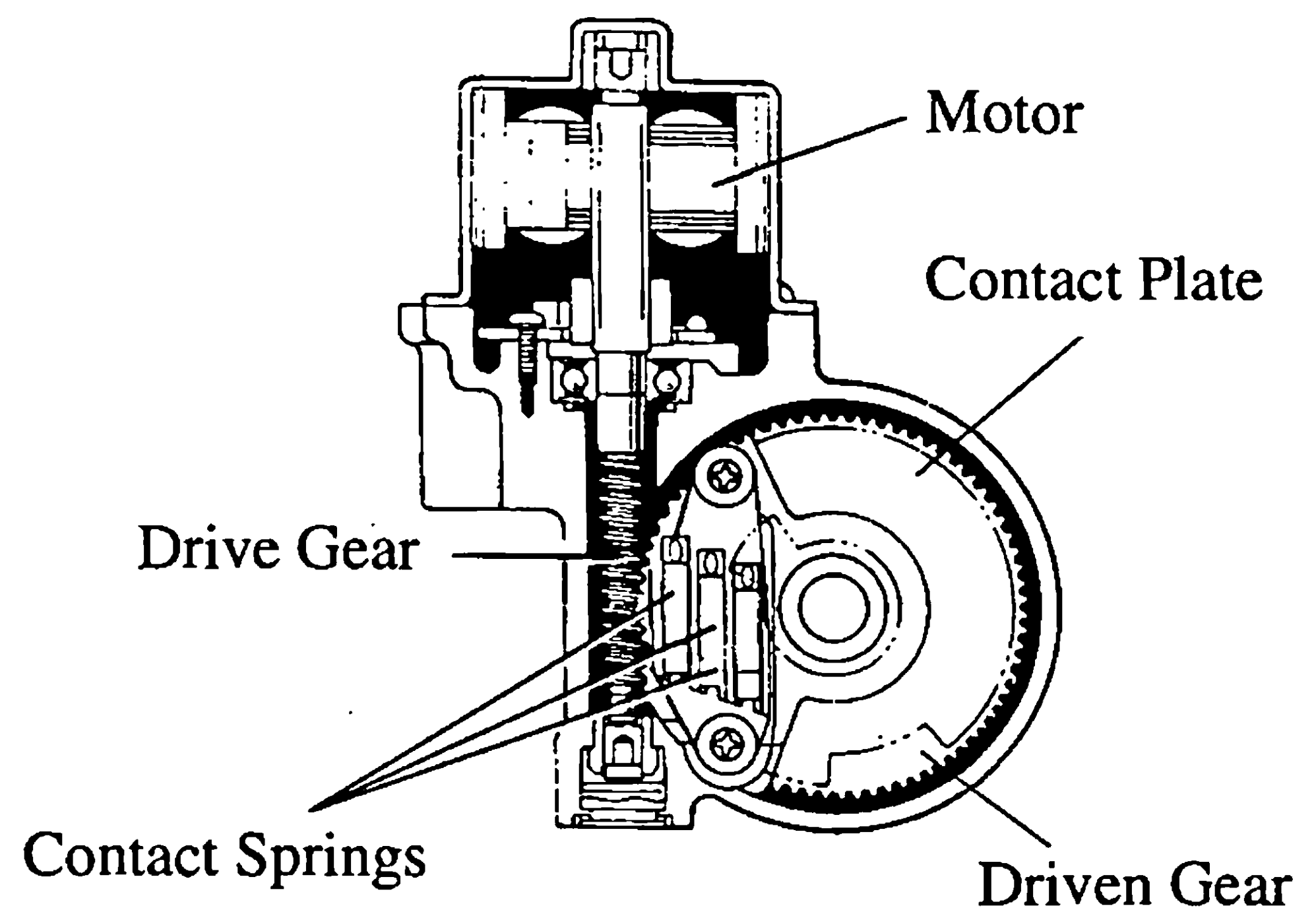
No.	Component	Function
①	Rear Differential Lock Indicator Light	Informs the driver what the operating condition of the differential lock system is by the condition of the light (off, blinking or on).
②	Vehicle Speed Sensor	Detects the vehicle speed.
③	Rear Differential Lock Switch	Changes the differential operation (lock or free) of the rear differential.
④	L4 Position Switch	Detects the driving mode of the transfer (L4 or other range)
⑤	4WD Control ECU	Changes the rear differential operation according to the condition of the rear differential lock switch and other switch and sensor.
⑥	Rear Diff. Lock Actuator	Drives the motor and changes the rear differential operation in accordance with signal from the 4WD control ECU.
⑦	Rear Diff. Lock Position Switch	Detects the rear differential operation (lock or free).

► Rear Differential Lock Actuator ◀



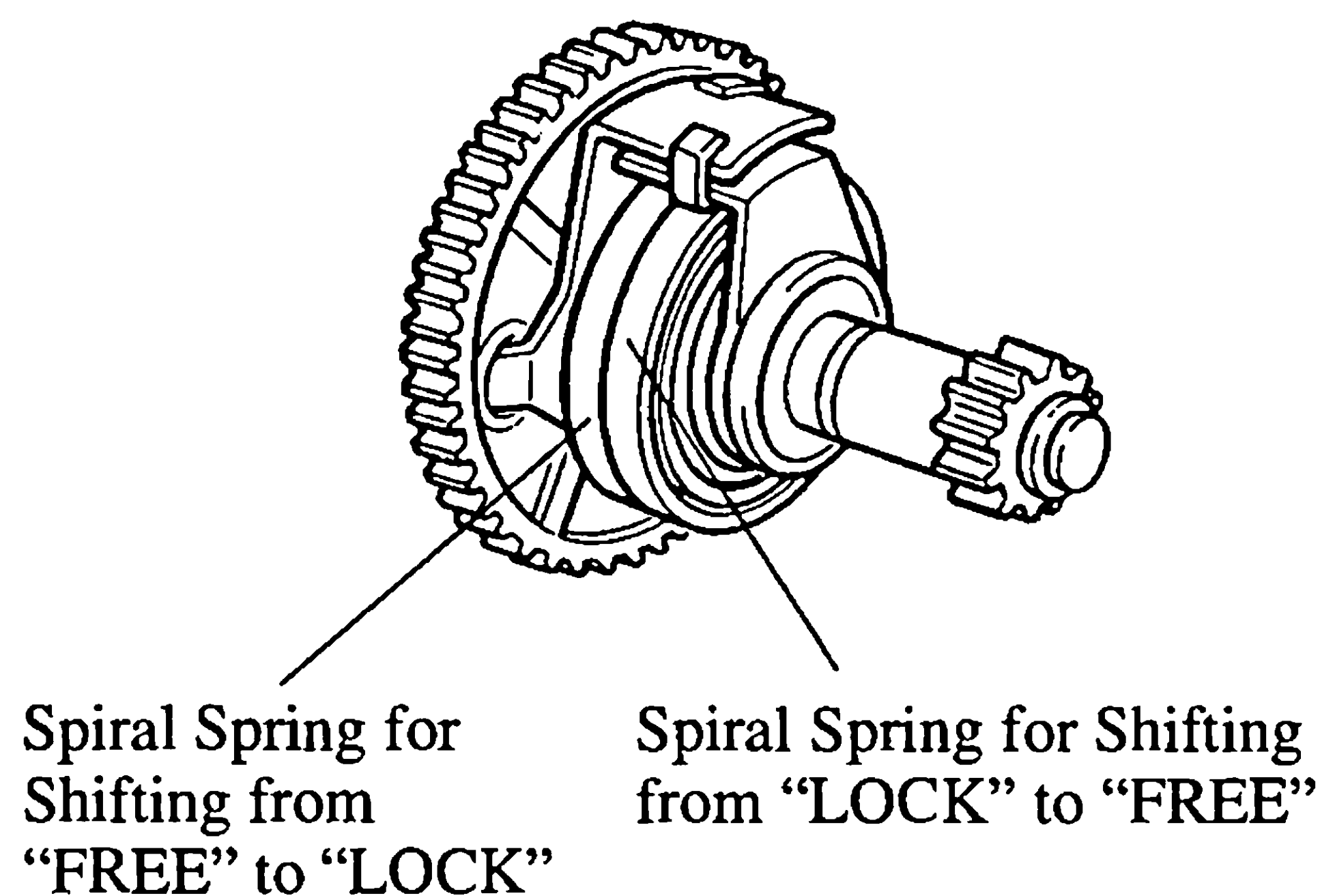
a. Motor Control Limit Switch

This limit switch consists of a contact plate mounted on the side of the driven gear and contact springs mounted in the actuator case. A notch is provided on the contact plate and the contact plate slides on the contact spring together with the rotation of the driven gear. In this way the connection state of the contact springs changes causing the motor to stop always in the optimum position.



b. Wait Mechanism Spiral Springs

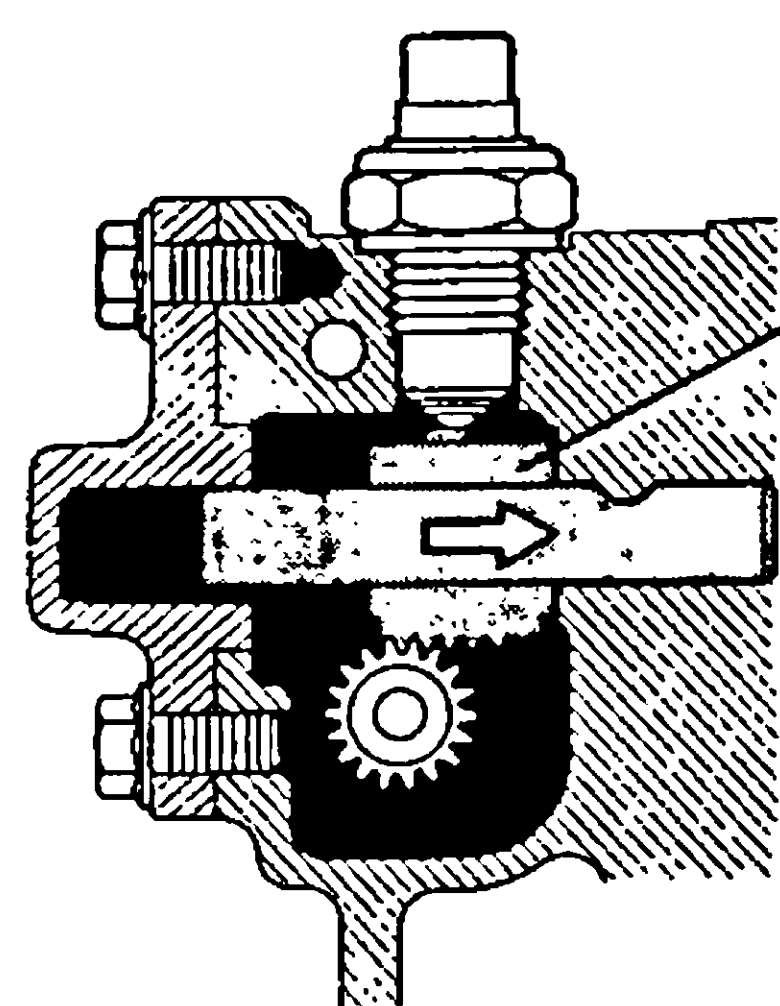
If the operating resistance of the differential lock shift fork is large, the motor force is partially stored in these spiral springs. Afterward, when the operating resistance is reduced, the spring force causes the differential lock shift fork shaft to slide. Two spiral springs are included in the wait mechanism, one for shifting from FREE to LOCK and the other for shifting from LOCK to FREE.



2) Rear Differential Lock Position Switch

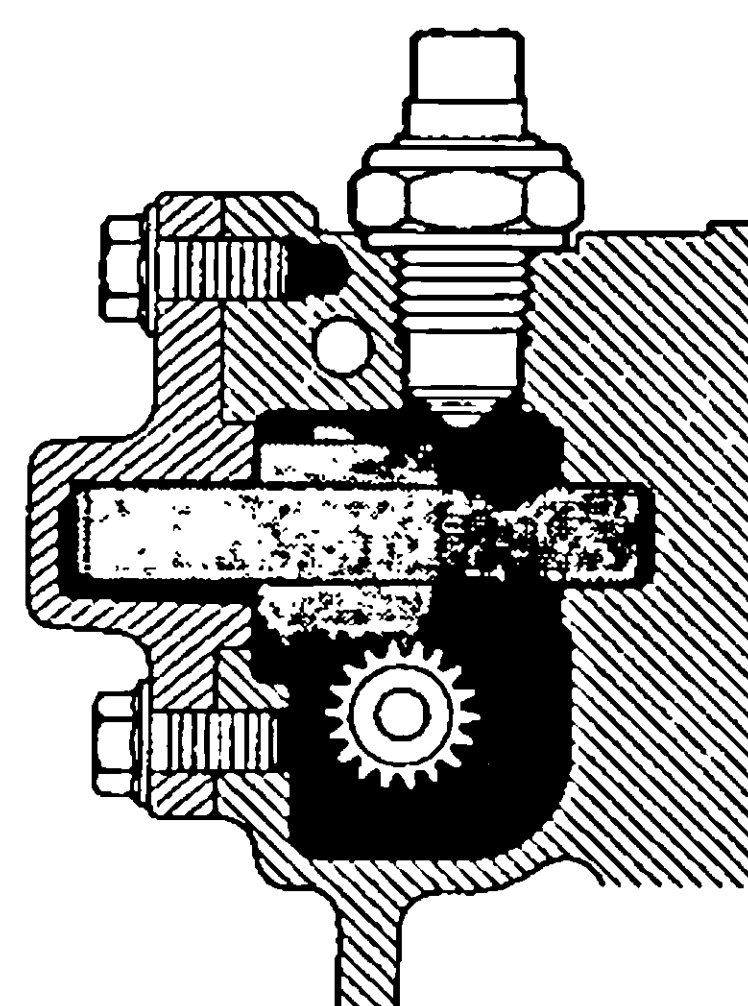
This switch is mounted on the rear differential carrier and detects whether the differential gear is locked or free. If it is locked, the switch turns on the rear differential lock indicator light.

Rear Differential Lock
Position Switch (ON)



“LOCK” Mode

Rear Differential Lock
Position Switch (OFF)



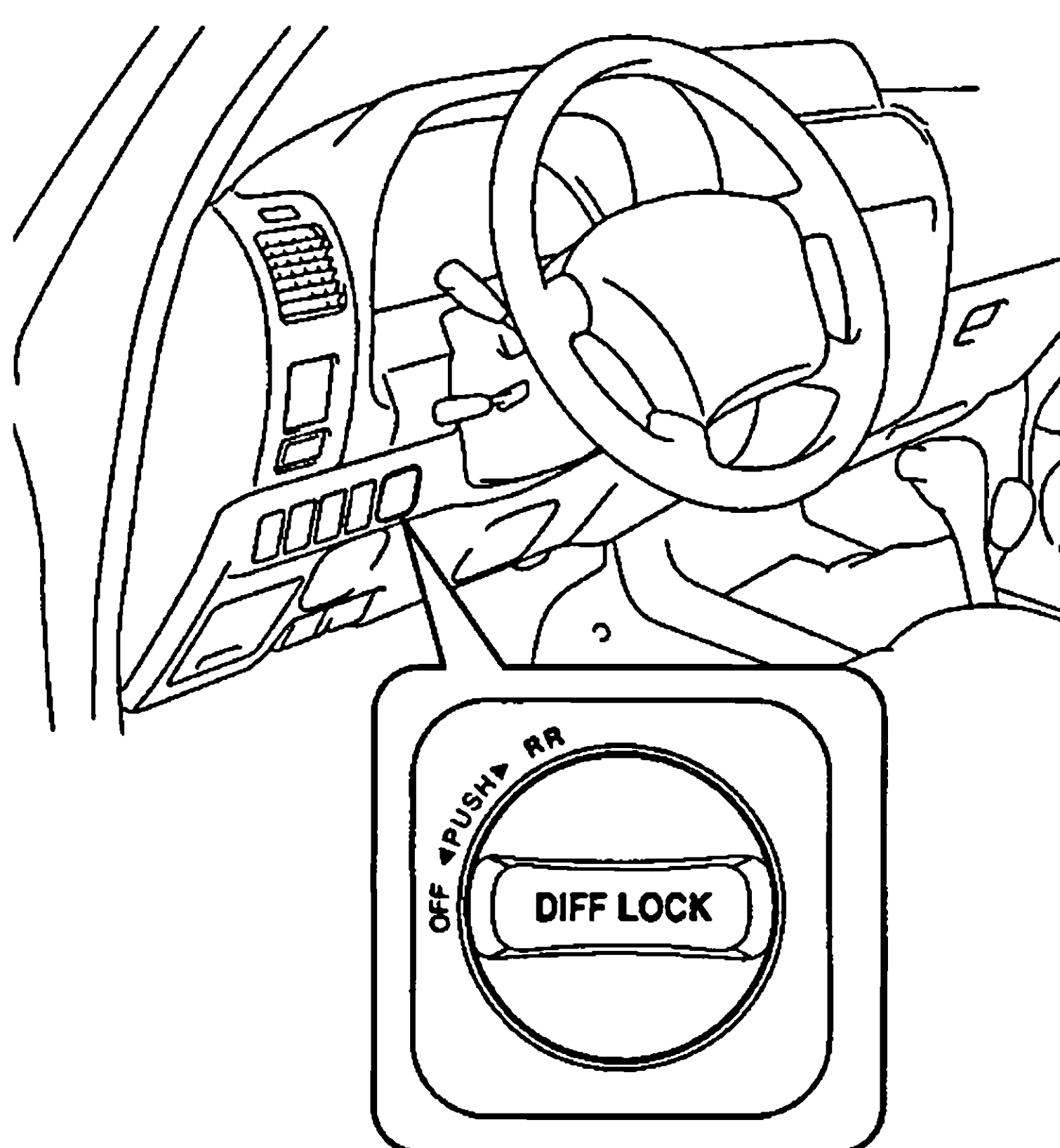
“FREE” Mode

3) L4 Position Switch

The L4 position switch is mounted on the transfer case to detect its driving mode (L4 or other ranges). The basic construction and operation of this switch are the same as those of the rear differential lock position switch.

4) Rear Differential Lock Switch

This switch is a push and turn type switch located on the instrument panel. Operating this switch causes the rear differential lock mechanism to lock or to unlock.



Rear Differential Lock Switch

5) Rear Differential Lock Indicator Light

The rear differential lock indicator light is located on the combination meter.

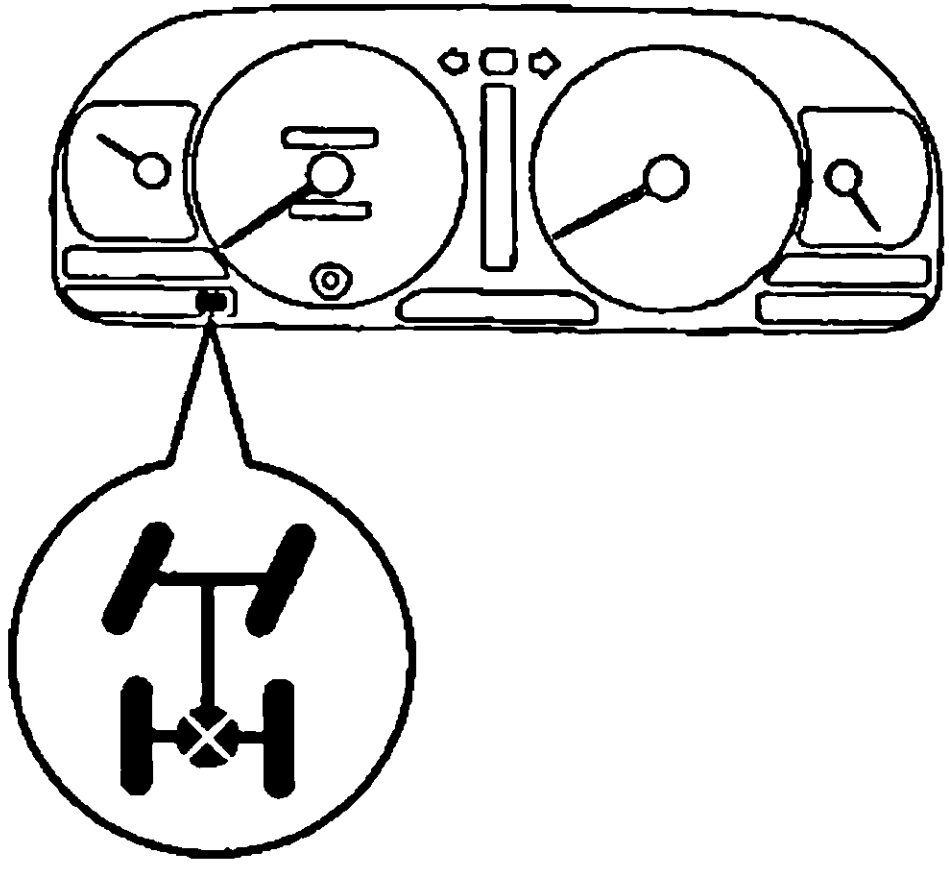
This indicator light informs the driver of the operating condition of the differential lock system by lighting up or blinking.

When the rear differential lock switch is operated to change the operating condition of the differential from free (with the indicator light off) to locked, the indicator immediately starts blinking.

When differential lock is completed, the indicator light remains on.

If the L4 mode is released while the rear differential lock switch remains on, the rear differential lock is freed, and the indicator light blinks to inform the driver that the rear differential lock switch was left on inadvertently.

The indicator light turns on for about 1 second after the ignition switch is turned on to check the circuit.



Rear Differential Lock Indicator Light

6) 4WD Control ECU

The table below shows how the 4WD control ECU controls the differential lock actuator and differential lock indicator light based on the ECU signals received from the switches and sensors depending on the operation of the rear differential lock switch.

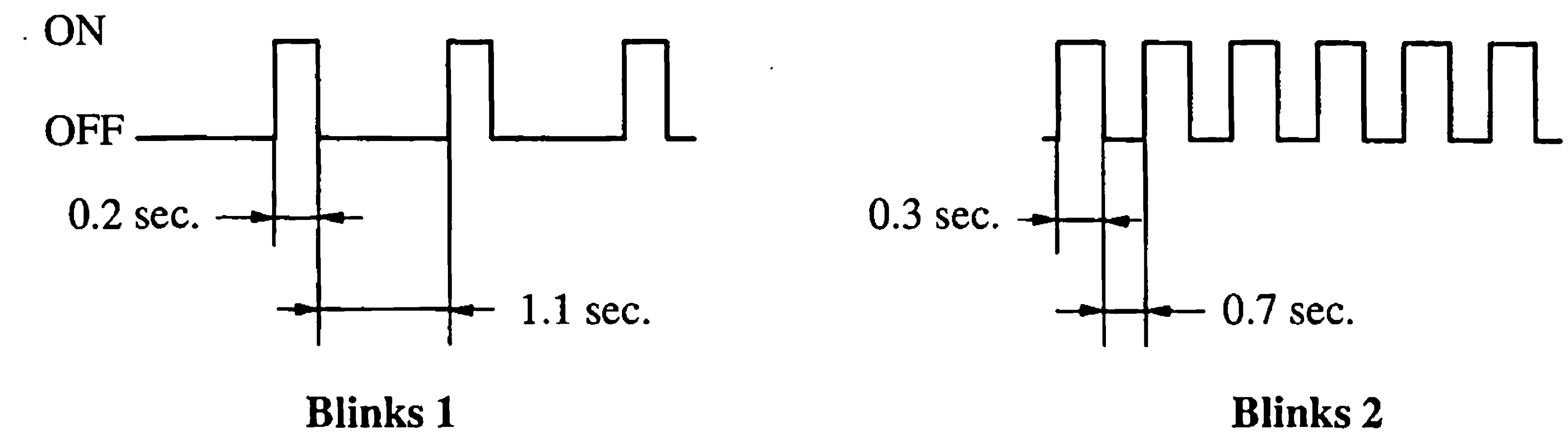
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► Operation Condition ◀

Switches and Sensor Condition				Differential Condition	Rear Differential Lock Indicator Light Condition
Rear Diff. Lock Switch	L4 Position Switch	Vehicle Speed Sensor	Rear Diff. Lock Position Switch		
OFF	OFF	–	OFF	Free	OFF
ON	OFF	–	OFF	Free	BLINKS 1
ON	ON	Over 8 km/h (5 mph)	OFF	Free	BLINKS 1*
ON	ON	8 km/h (5 mph) or Lower	OFF	During shifting into “Lock” mode	BLINKS 2
ON	ON	8 km/h (5 mph) or Lower	ON	Lock	ON

*: When the vehicle speed is higher than 8 km/h (5 mph), the ECU prohibits shifting into the “Lock” mode, and blinks the indicator light.

► Rear Differential Lock Indicator Light Condition ◀



– REFERENCE –

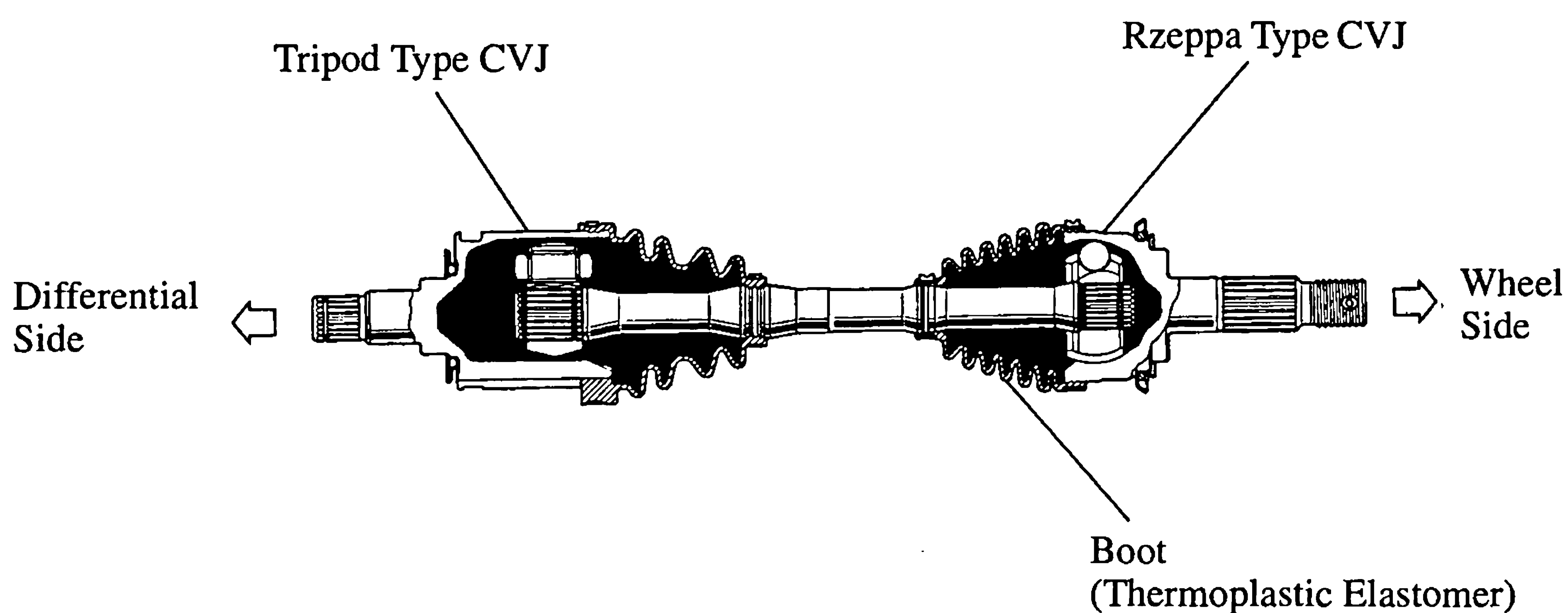
When the rear differential lock is in operation, the ECU stops the operation of the ABS and turns on the ABS warning light.

FRONT DRIVE SHAFT

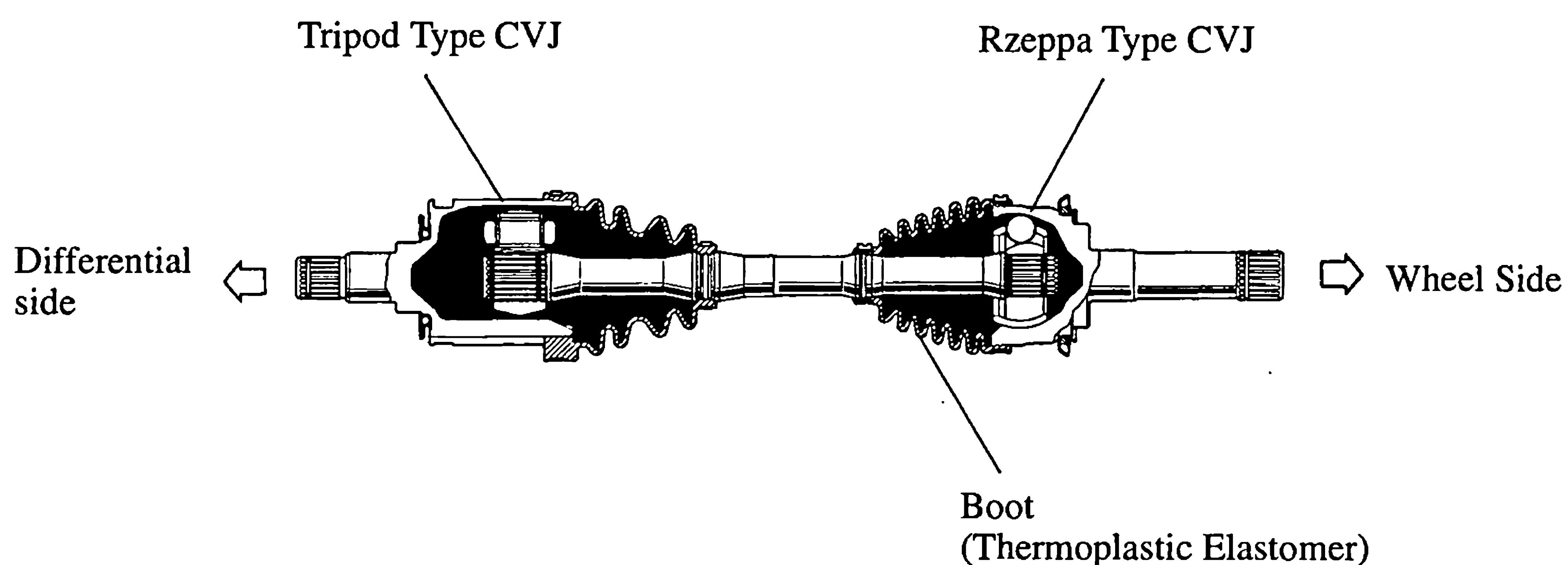
■ DESCRIPTION

Drive shafts are used in conjunction with the adoption of the independent front suspension system. These drive shafts feature the following characteristics:

- Equal length drive shafts are used for both the right and the left sides, thus realizing excellent stability, controllability, and low vibration and noise.
- The drive shafts use the tripod type CVJs (Constant-Velocity Joints) on the differential side and Rzeppa type CVJs on the wheel side.
- The boot of the wheel side joint made of thermoplastic elastomer which is light has a low expansion characteristic in response to centrifugal force and also has superior durability.



Without Free Wheel Hub Model

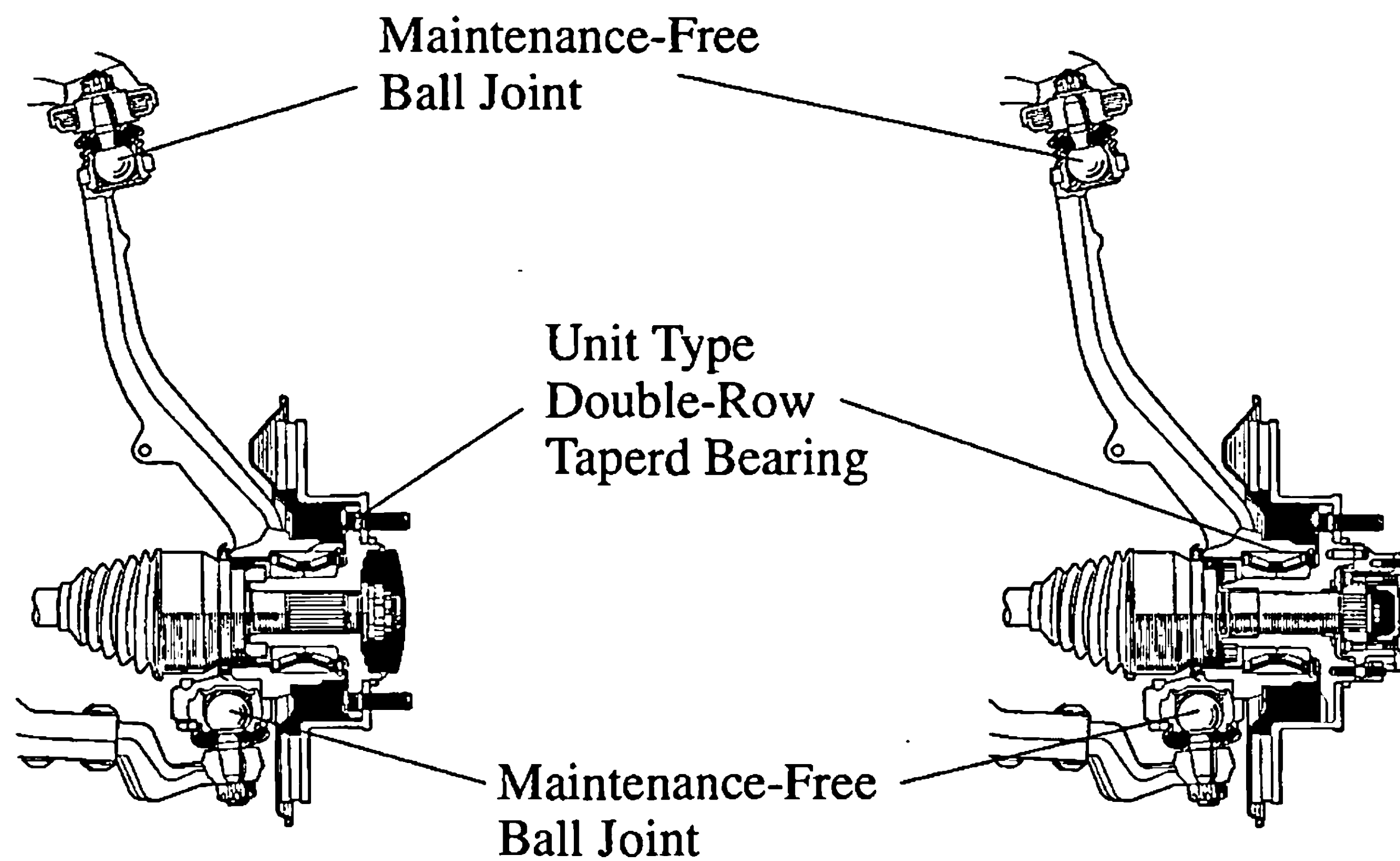


With Free Wheel Hub Model

AXLES

■ FRONT AXLE

- Unit type double-row tapered bearings, which are compact and do not require preload adjustment, are used in the wheel bearings.
- A high-damping grease (which increases the rotational friction torque in proportion to the rise in the frequency of vehicle vibration) is used at the upper and lower ball joint to realize excellent steering response and decrease flutter. Also, maintenance-free ball joints are used for the upper and lower ball joints.
- A free wheel hub is available as an option on the part time 4WD model.



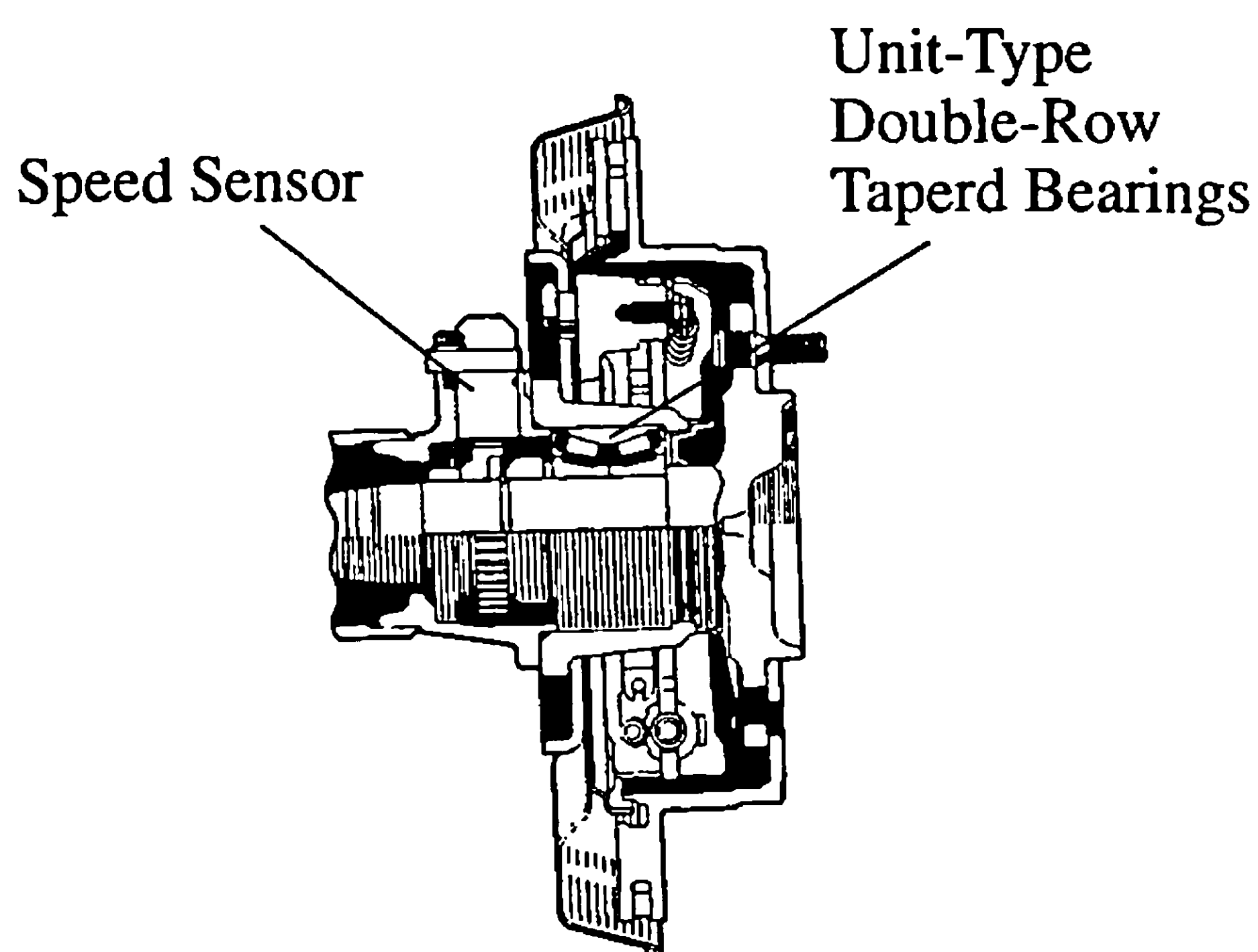
**Full-Time 4WD Model and
Part-Time 4WD Model
without Free Wheel Hub**

**Part-Time 4WD Model
with Free Wheel Hub**

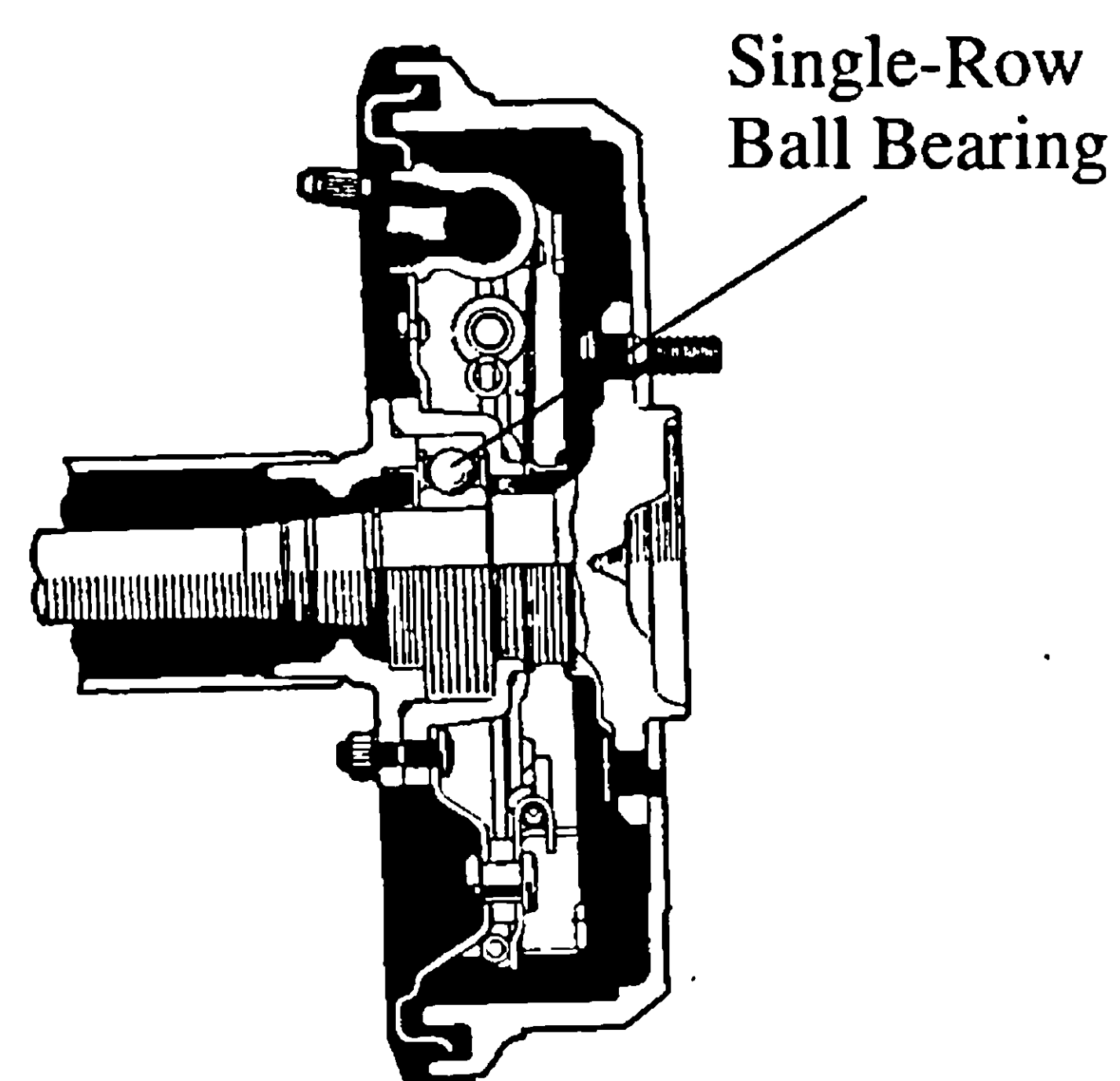
CH

■ REAR AXLE

- A semi-floating axle that uses unit-type double-row tapered bearings is used for the rear axle on the rear disc brake model.
- A semi-floating axle that uses single-row ball bearing is used for the rear axle on the rear drum brake model.



Rear Disc Brake Model with ABS

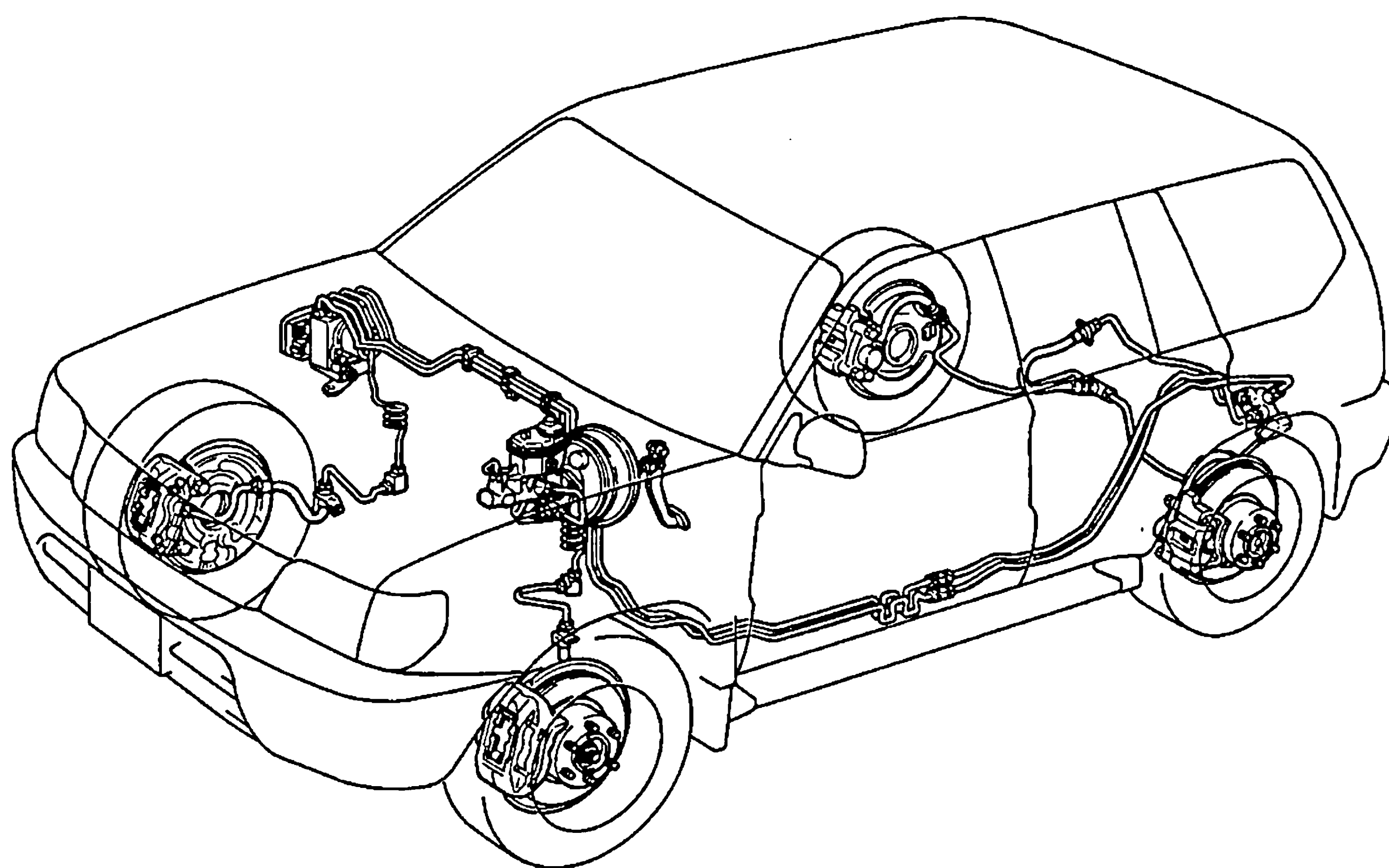


Rear Drum Brake Model

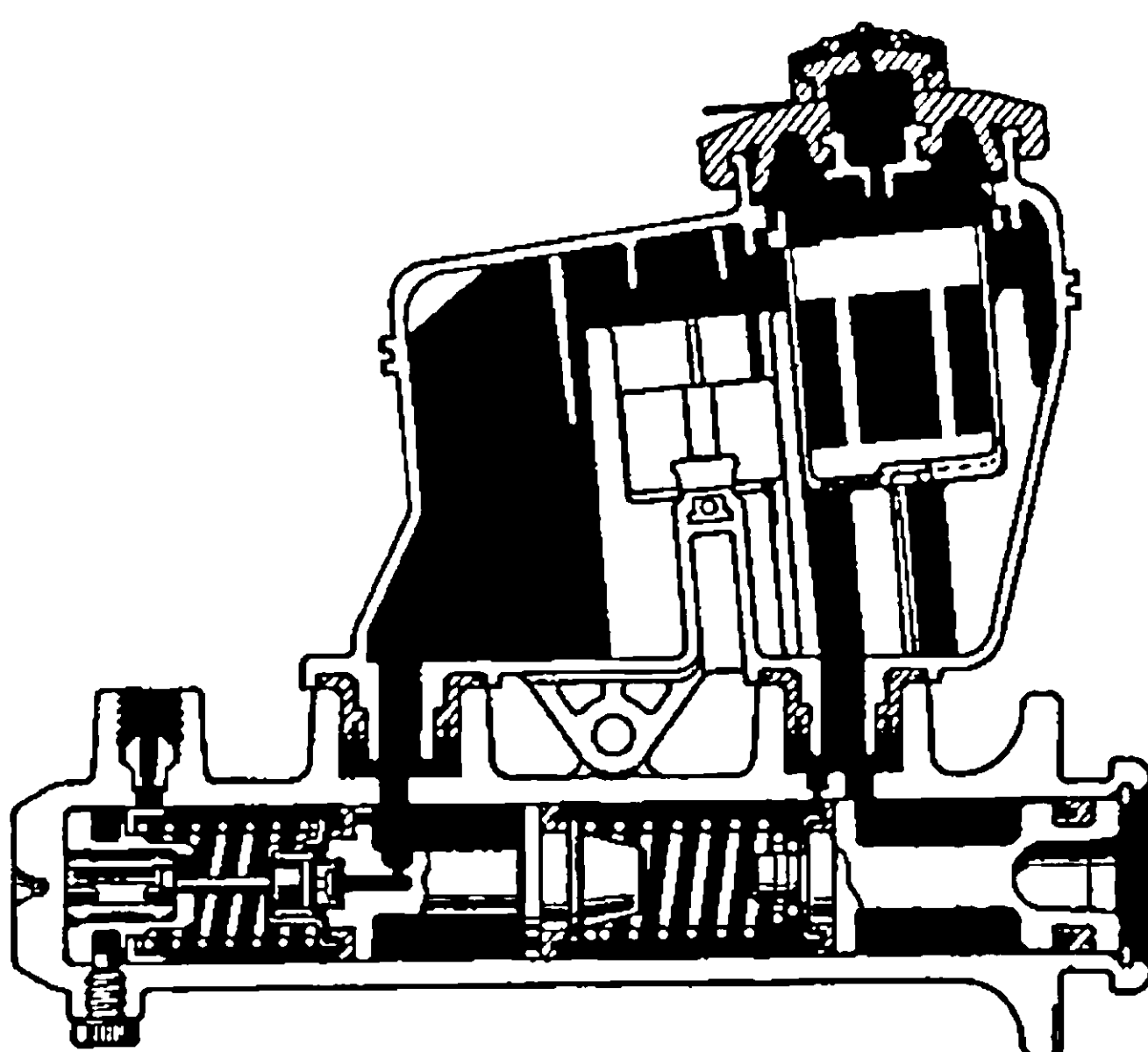
BRAKES

■ DESCRIPTION

- In conjunction with the adoption of the 16-inch wheels on all models, large ventilated disc brakes are used for the front brakes.
- The ABS is available as an option on models except for the 3L engine and STD grade models and those with the front bench seat.
- For the rear brakes, the 5VZ-FE and 1KZ-TE engine models use ventilated disc brakes. Also, models with the ABS use ventilated disc brakes. Other models use leading-trailing drum brakes.
- A portless and lockheed type master cylinder is used on the models with ABS.



Models with ABS



Master Cylinder with ABS Model

► Specifications ◀

Rear Brake Type			Drum	Disc	
Item					
Master Cylinder	Type		Tandem	←	
	Diameter	mm (in.)	23.81 (0.94)* ¹ 25.4 (1.00)	←	
Brake Booster	Type		Tandem	←	
	Size	in.	7" + 8"* ² 8" + 9"* ³	←	
Front Brake	Type		Ventilated Disc	←	
	Pad Area	cm ² (in. ²)	50.0 (7.75)	←	
	Wheel Cylinder Dia.	mm (in.)	45.4 (1.75) × 2	←	
	Rotor Size (D × T)* ⁴	mm (in.)	319 × 22 (12.56 × 0.87)	←	
Rear Brake	Drum	Type	Leading-Trailing		
		Lining Area	cm ² (in. ²)		148 (22.94)
		Wheel Cylinder Dia.	mm (in.)		25.4 (1.00)
		Drum Inner Dia.	mm (in.)		295 (11.61)
	Disc	Type		Ventilated Disc	
		Pad Area		cm ² (in. ²)	37.0 (5.74)
		Wheel Cylinder Dia.		mm (in.)	48.1 (1.89)
		Rotor Size (D × T)* ⁴		mm (in.)	312 × 18 (12.28 × 0.71)
Brake Control Valve	Type		LSP & BV	←	
	Deflection Point of Hydraulic Pressure kPa (kgf/cm ² , psi)		980 (10, 142)* ⁵ 1471 (15, 213)* ⁶	980 (10, 142)* ⁵ 1471 (15, 213)* ⁶ 1471 (15, 213)* ^{5, 7} 1961 (20, 284)* ^{6, 7}	
	Pressure Reduction Gradient		0.25	0.25* ^{5, 6} 0.37* ^{5, 7} 0.53* ^{6, 7}	
Parking Brake	Type		Drum	←	
	Size	mm (in.)	295 (11.61)	210 (8.27)	

*1: For Europe Model

*2: Diesel Engine Model

*3: Gasoline Engine Model

*4: D: Outer Diameter, T: Thickness

*5: 3-Door Model

*6: 5-Door Model

*7: With ABS Model

■ ABS (ANTI-LOCK BRAKE SYSTEM)

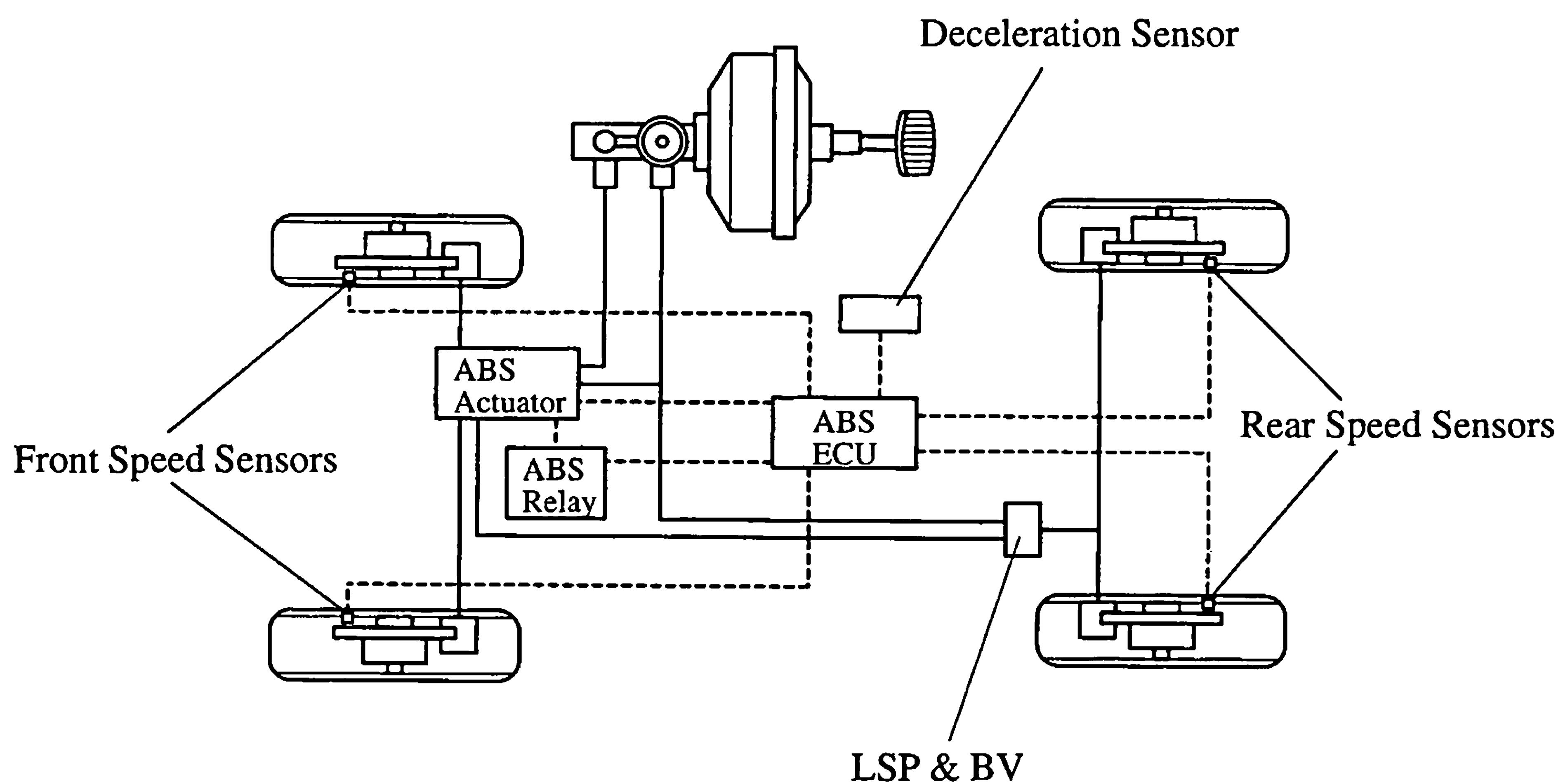
1. General

The ABS controls the brake fluid pressure acting on the wheel cylinders to help preventing the wheels from locking and thus helps to maintain good directional stability and steerability on slippery surfaces and during panic braking, and it is an option.

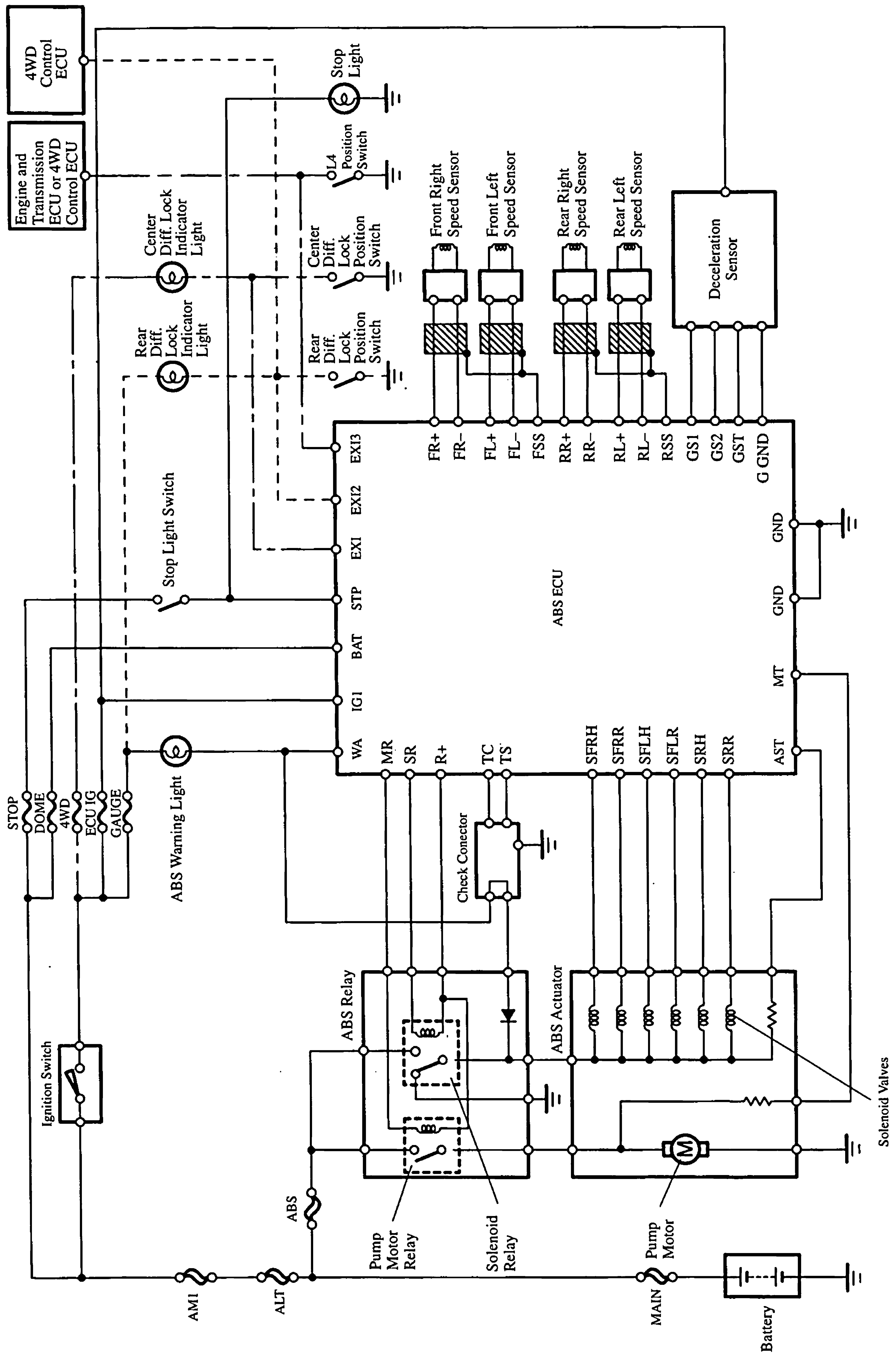
The ABS has the following features;

- It is a 3-channel type ABS with 4 speed sensors and a deceleration sensor.
- The ABS actuator has six 2-position solenoid valves.
- When the rear differential lock is in operation, the ABS ECU stops the operation of the ABS and turns on the ABS warning light.

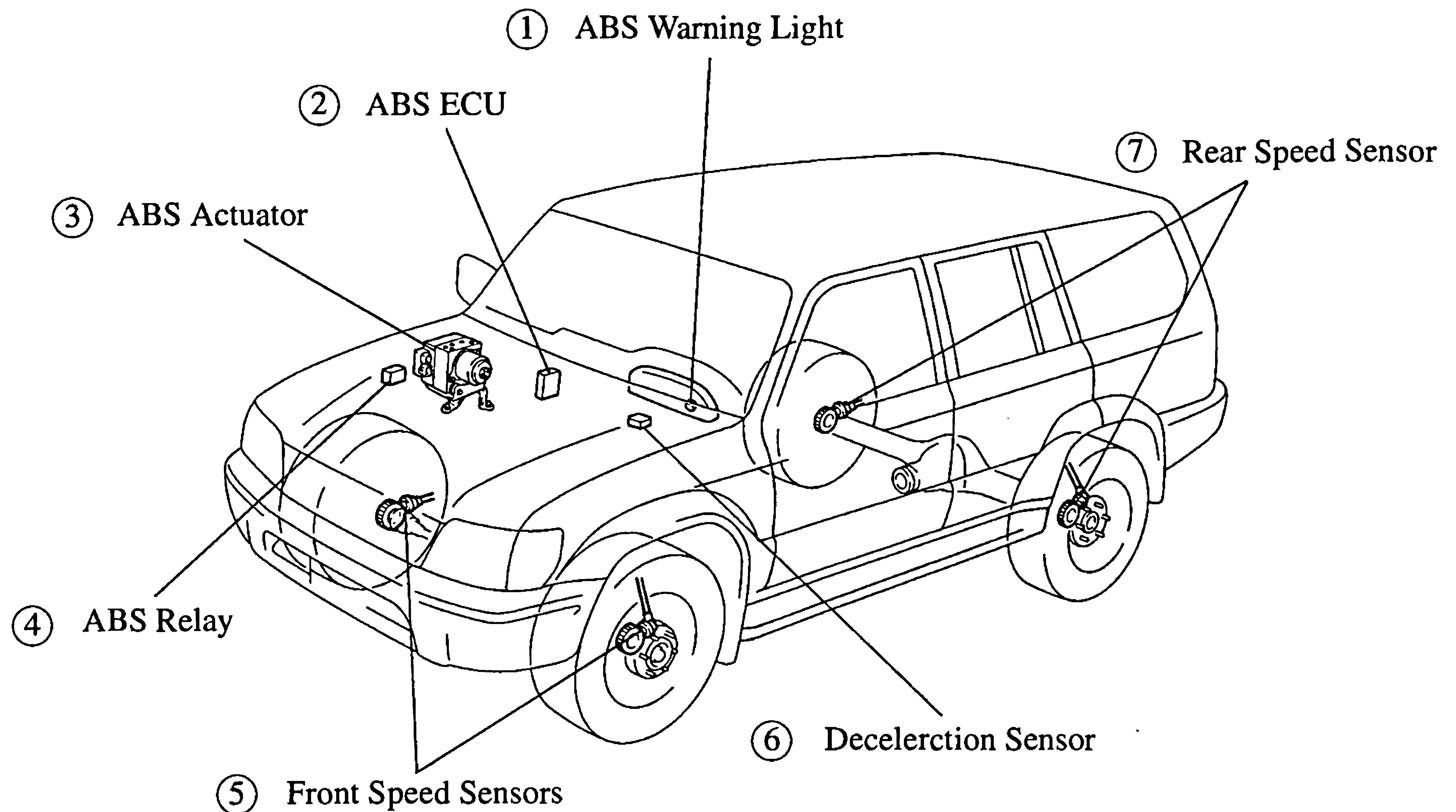
2. System Diagram



3. Wiring Diagram



4. Layout of Components



5. Function of Components

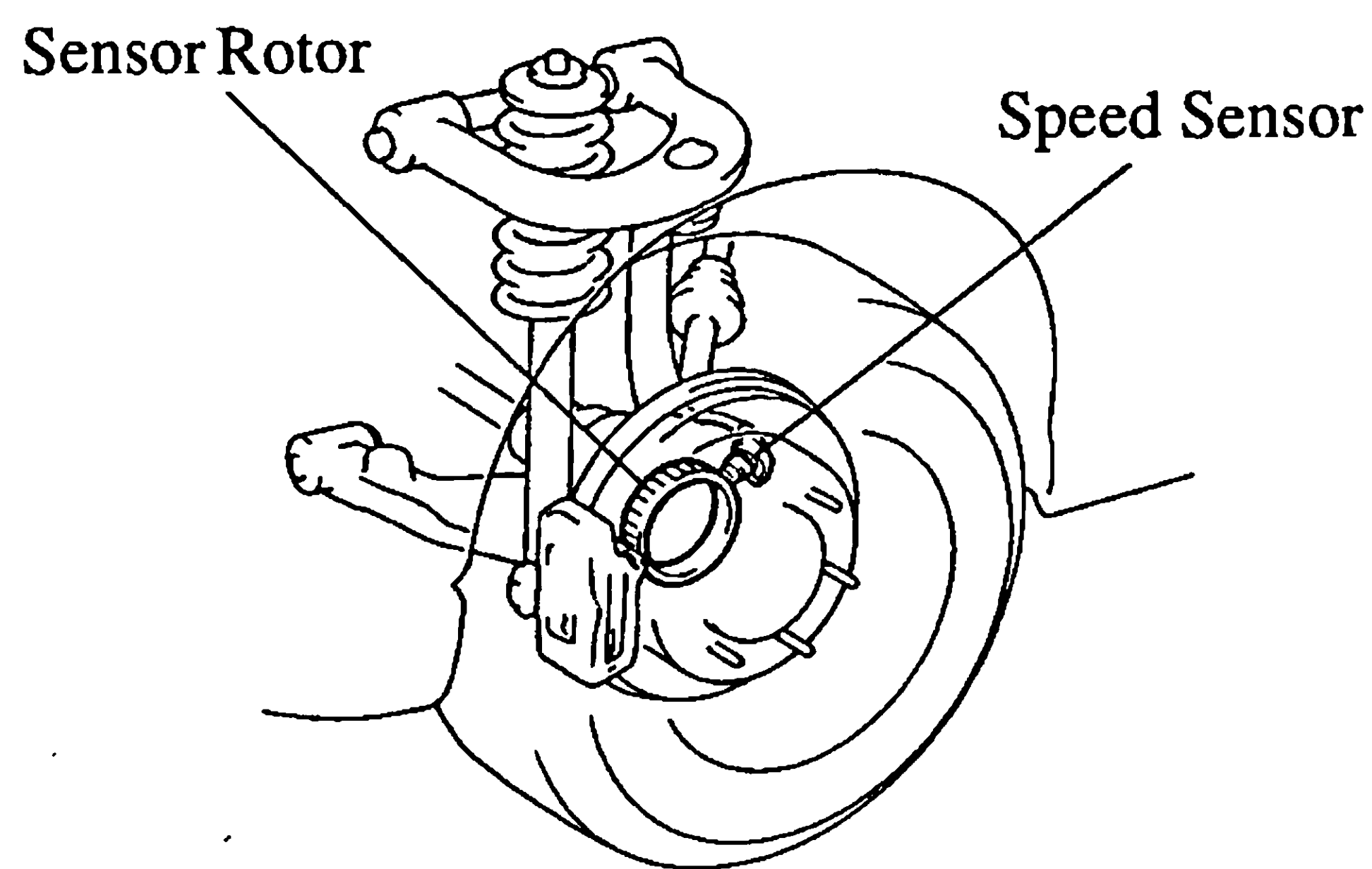
No.	Components		Function
①	ABS Warning Light		Lights up to alert the driver when a malfunction has occurred in the ABS system and when the rear differential lock is engaged.
②	ABS ECU		Based on the signals from each speed sensor and deceleration sensor, it calculates slip values and sends signals to the actuator and relay to control brake fluid pressure.
③	ABS Actuator		Controls the brake fluid pressure to each brake wheel 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	Deceleration Sensor		Detects the vehicle's acceleration.
⑦	Rear Speed Sensors		Detect the wheel speed of each of the left and right rear wheels.

6. Construction and Operation of Components

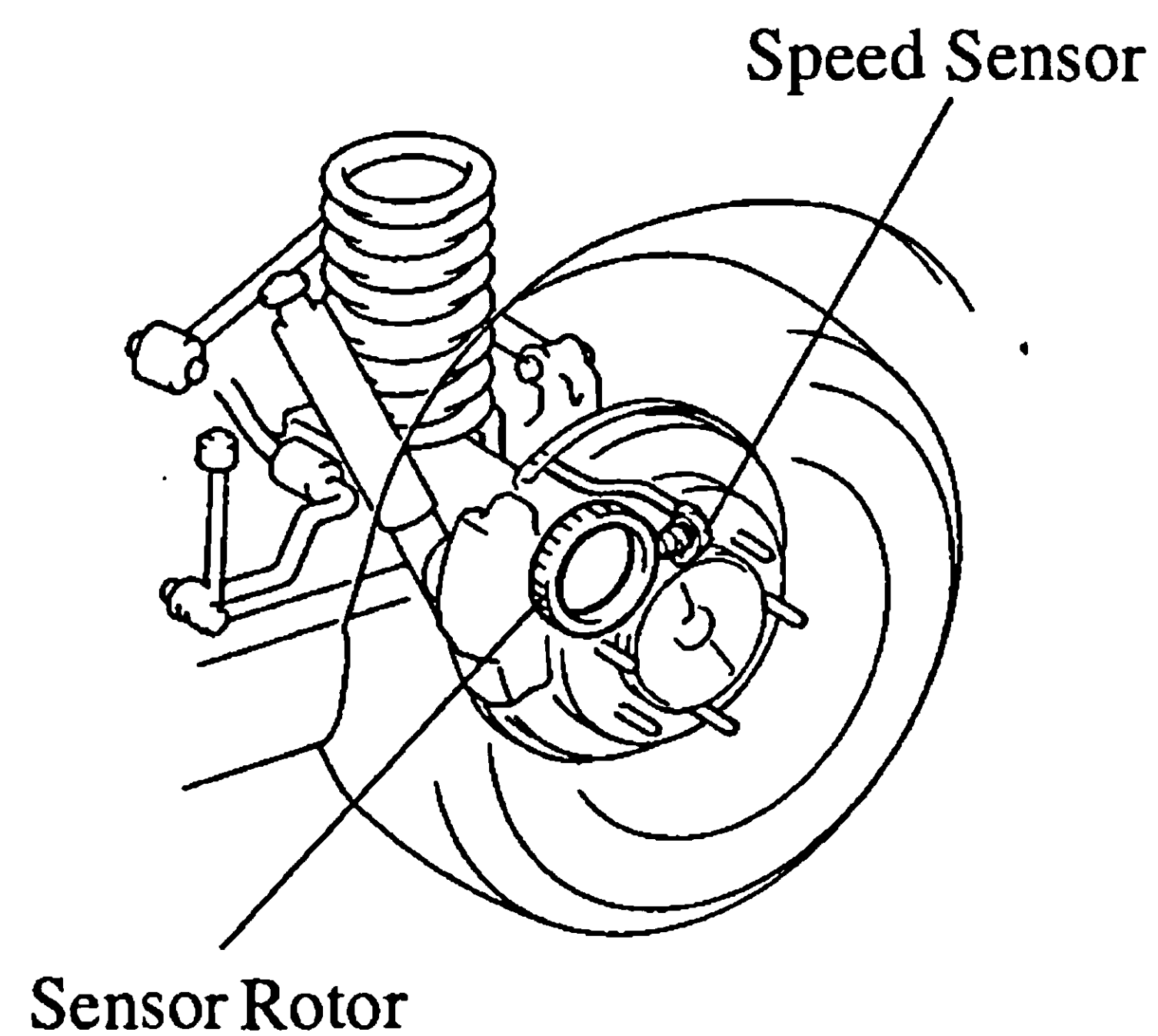
Front and Rear Speed Sensors

The front speed sensors are fitted to the steering knuckle, and the rear speed sensors are fitted to rear axle end. Front sensor rotors are fitted to the wheel side of the drive shaft, and rear sensor rotors are fitted to the rear axle shaft.

The speed sensors detect the speed of each wheel and send this information to the ECU.



Front Speed Sensor



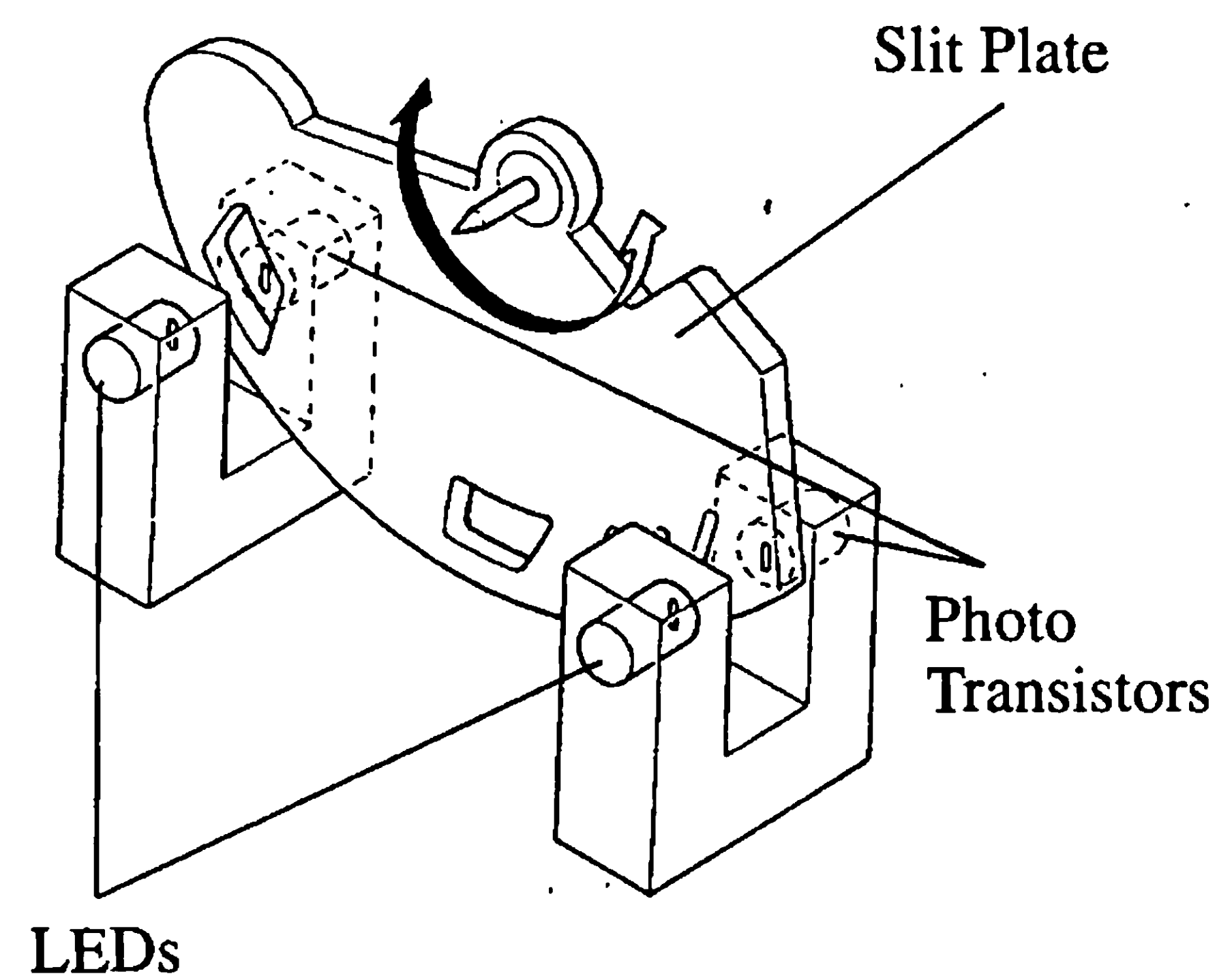
Rear Speed Sensor

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Deceleration Sensor

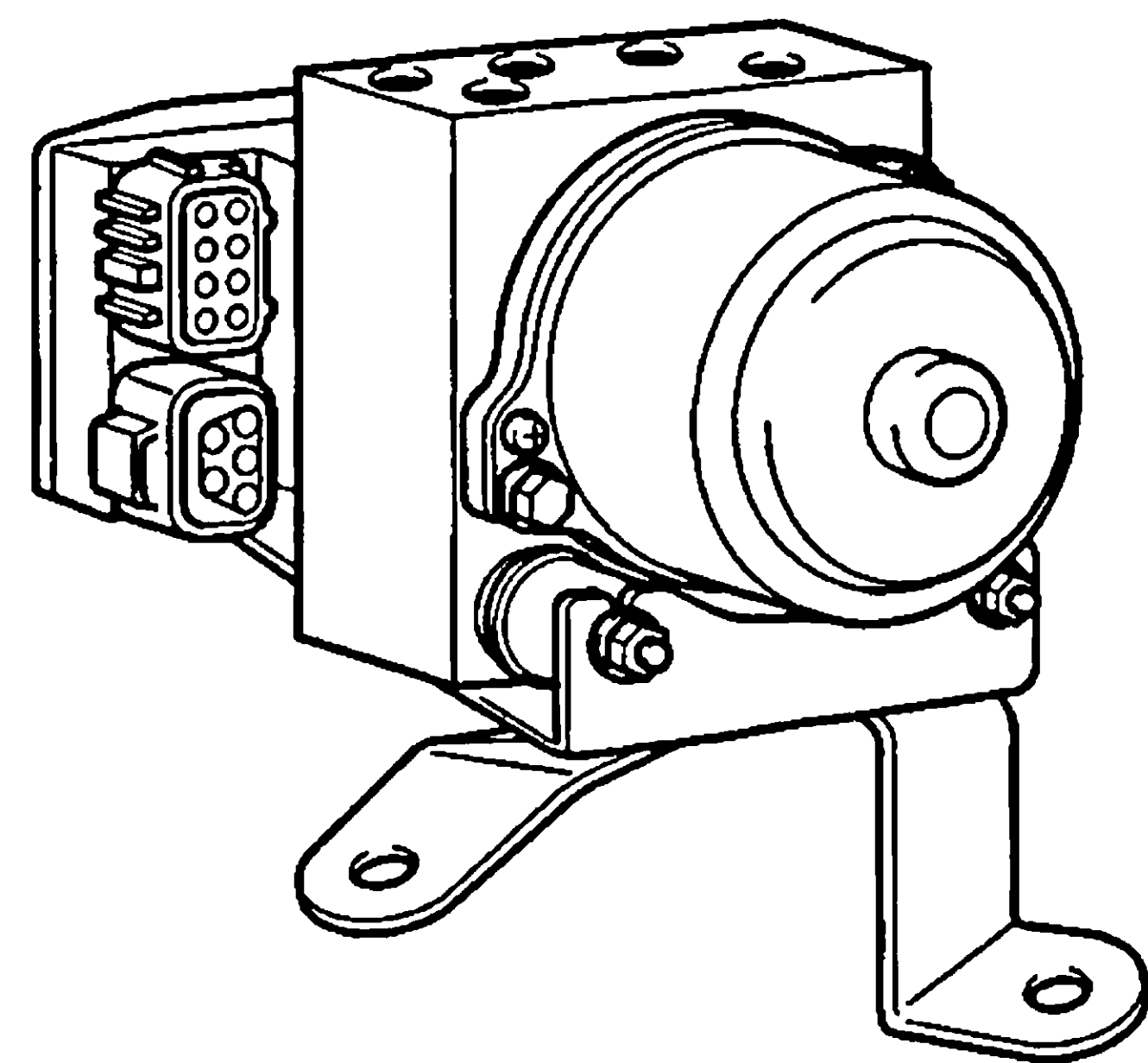
Consisting of two pairs of LEDs (Light Emitting Diodes) and photo transistors, a slit plate, and a signal conversion circuit, the deceleration sensor is mounted in front of the shift lever inside the console.

When the vehicle decelerates, the slit plate rotates in proportion to the deceleration rate. Then, the photo transistors turn ON and OFF, depending on whether the light from the LEDs to the photo transistors is interrupted or not. Using two pairs of LEDs and photo transistors, the extent of deceleration is detected through the combination of the ON and OFF signals output by each photo transistor.



ABS Actuator

Six 2-position solenoid valves control the fluid pressure to each wheel cylinder.



1) Construction

The actuator can be functionally divided into the following two components:

Component	Function
Control Unit (2-Position Solenoid Valve)	During ABS operation, signals from the ECU to the solenoid valves control the brake fluid pressure in the wheel cylinders in 3 modes (pressure increase, holding and pressure reduction) for the front and rear brakes.
Pressure Reduction Unit (Reservoir, Pump)	As the pressure is reduced, the brake fluid returns from the wheel cylinders and is sent to the master cylinder by the pump as well as filling the actuator reservoir. The pump is a motor-driven plunger type pump.

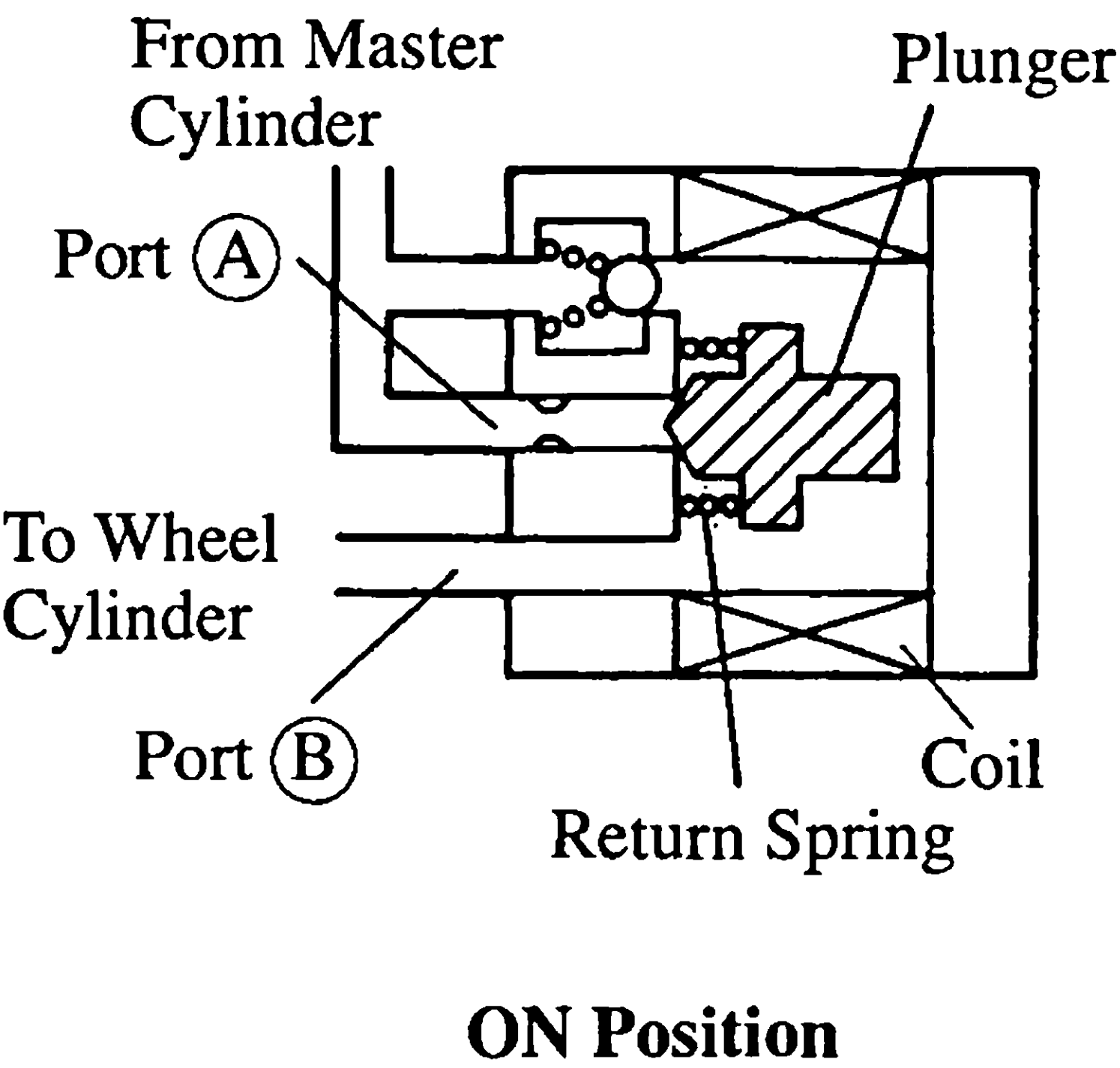
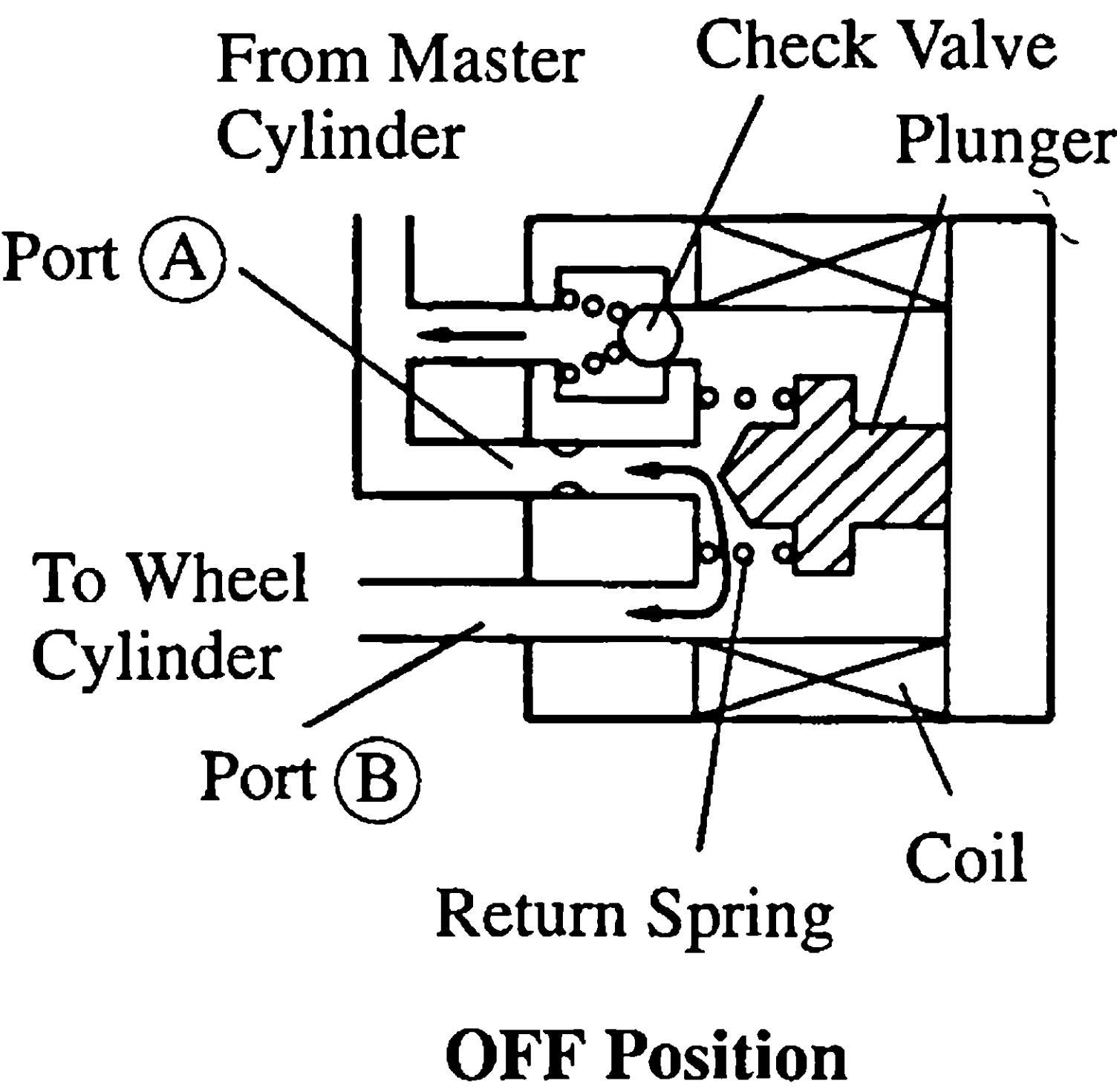
a. 2-Position Solenoid Valves

i) Pressure Holding Valve

The pressure holding valve consists of a plunger, coil and check valve.

When no current is flowing from the ABS ECU to the coil, no magnetic force is generated in the coil. Therefore, the plunger is pushed to the right side by the return spring causing port (A) to be open and opening the circuit from the master cylinder to the wheel cylinder.

When current flows from the ABS ECU to the coil, a magnetic force is generated in the coil. This magnetic force attracts the plunger causing it to push against the return spring and move to the left. This closes port (A) cutting off the circuit from the master cylinder to the wheel cylinder.



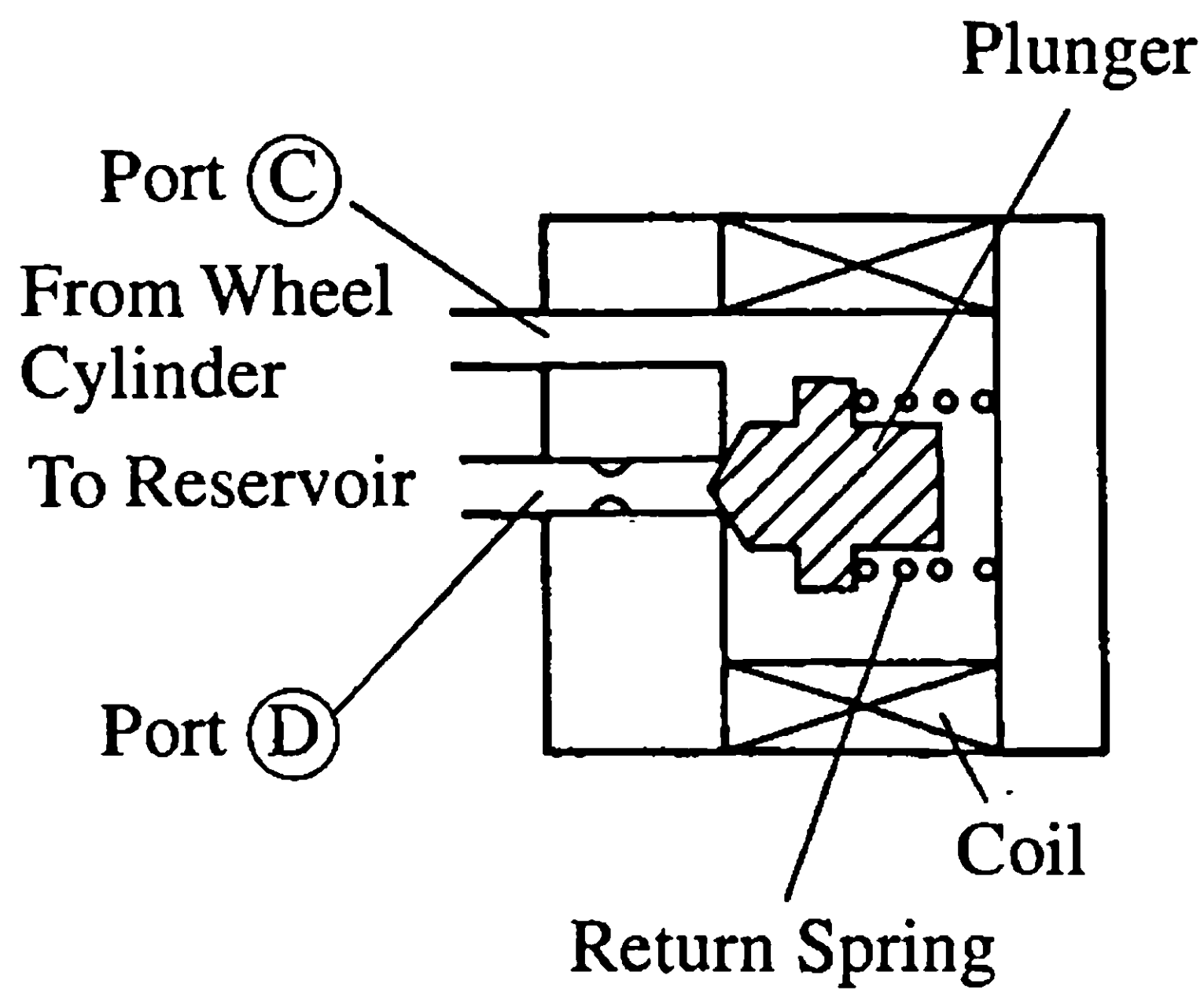
ii) Pressure Reduction Valve

The pressure reduction valve consists of a plunger and coil.

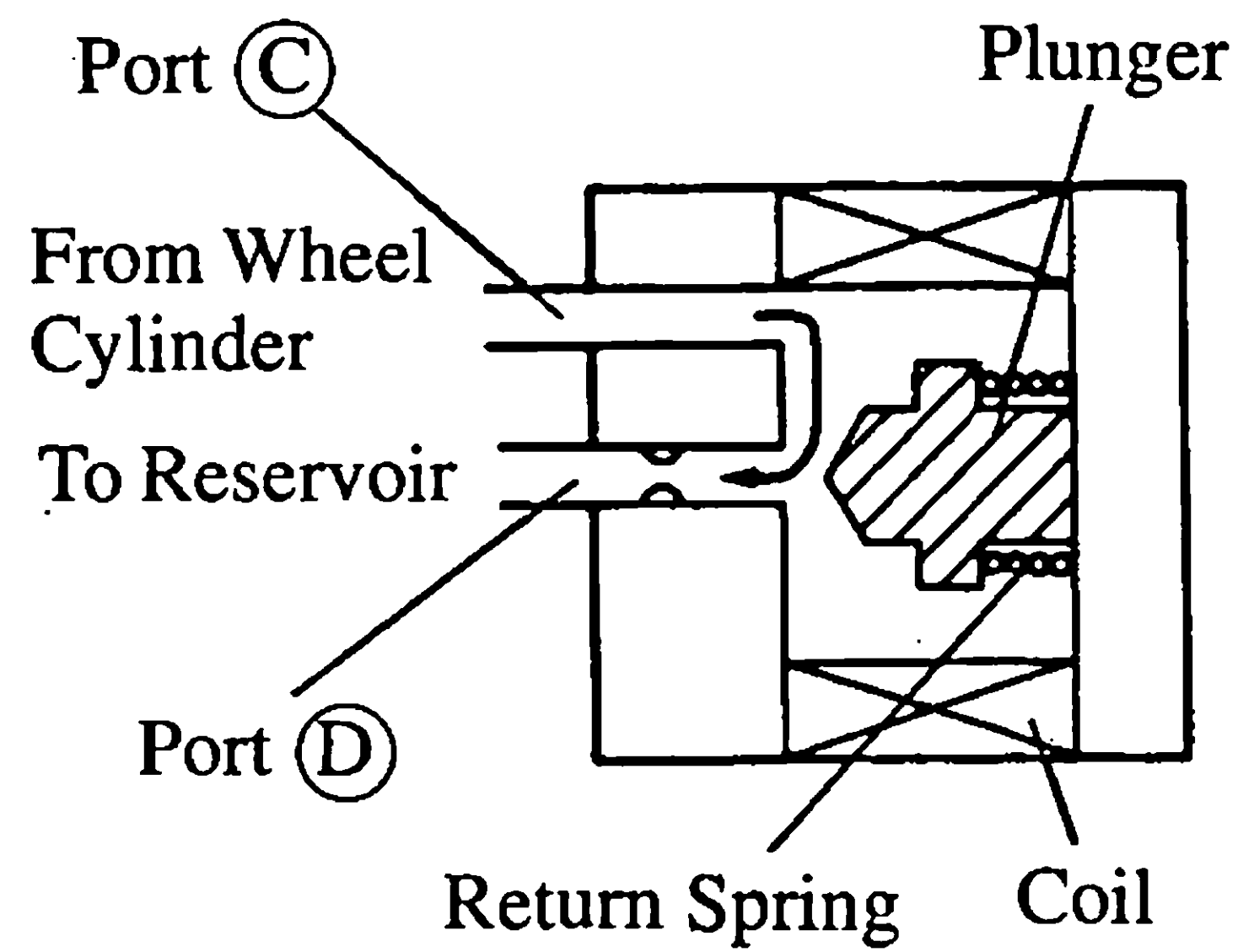
When no current is flowing from the ABS ECU to the coil, no magnetic force is generated.

Therefore, the plunger is pushed to the left by the return spring causing port (D) to be closed and cutting off the circuit from the wheel cylinder to the reservoir.

When current flows from the ABS ECU to the coil, magnetic force is generated in the coil. This magnetic force attracts the plunger, causing it to push against the return spring and move to the right. This opens port (D) and the fluid circuit from the wheel cylinder to the reservoir.



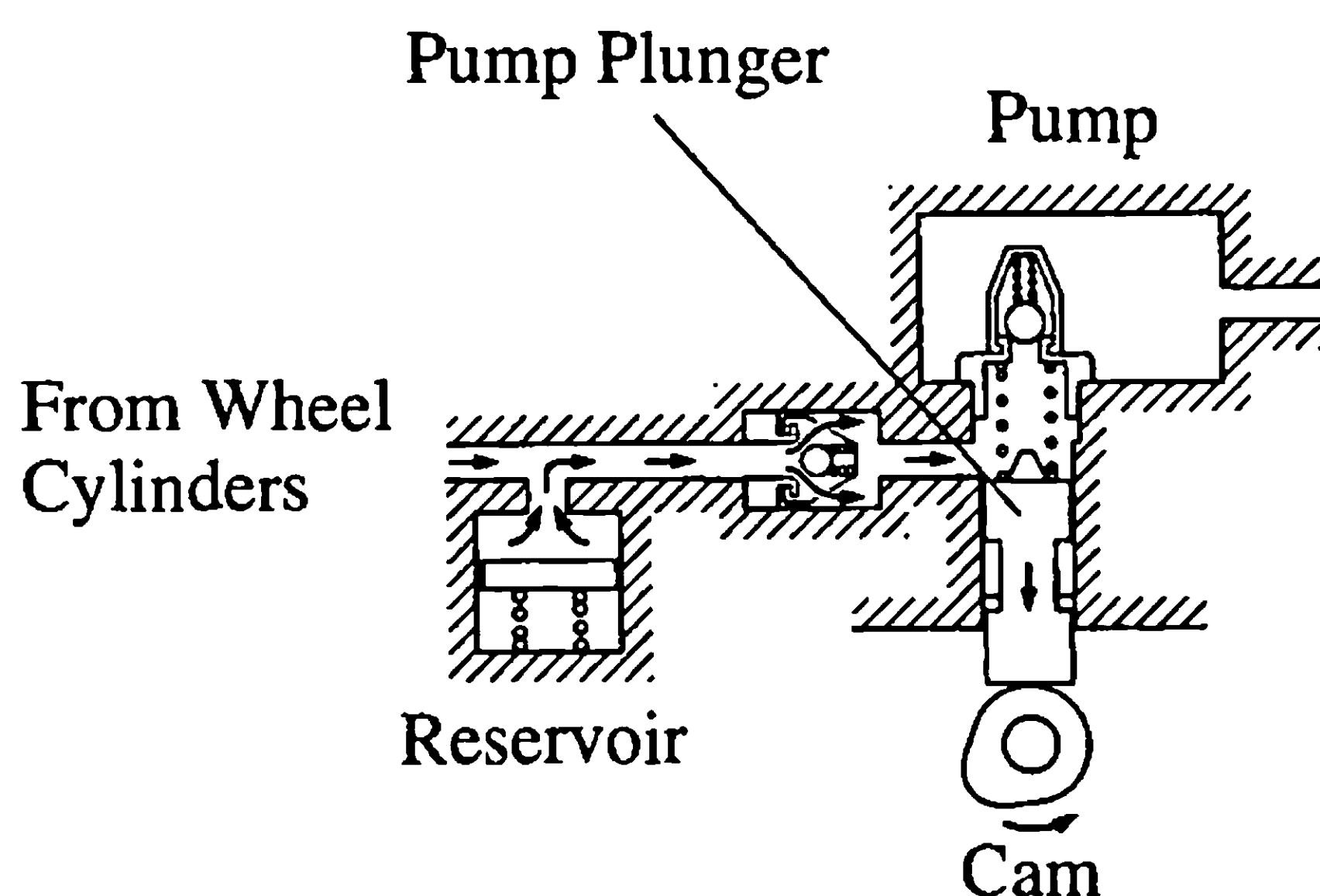
OFF Position



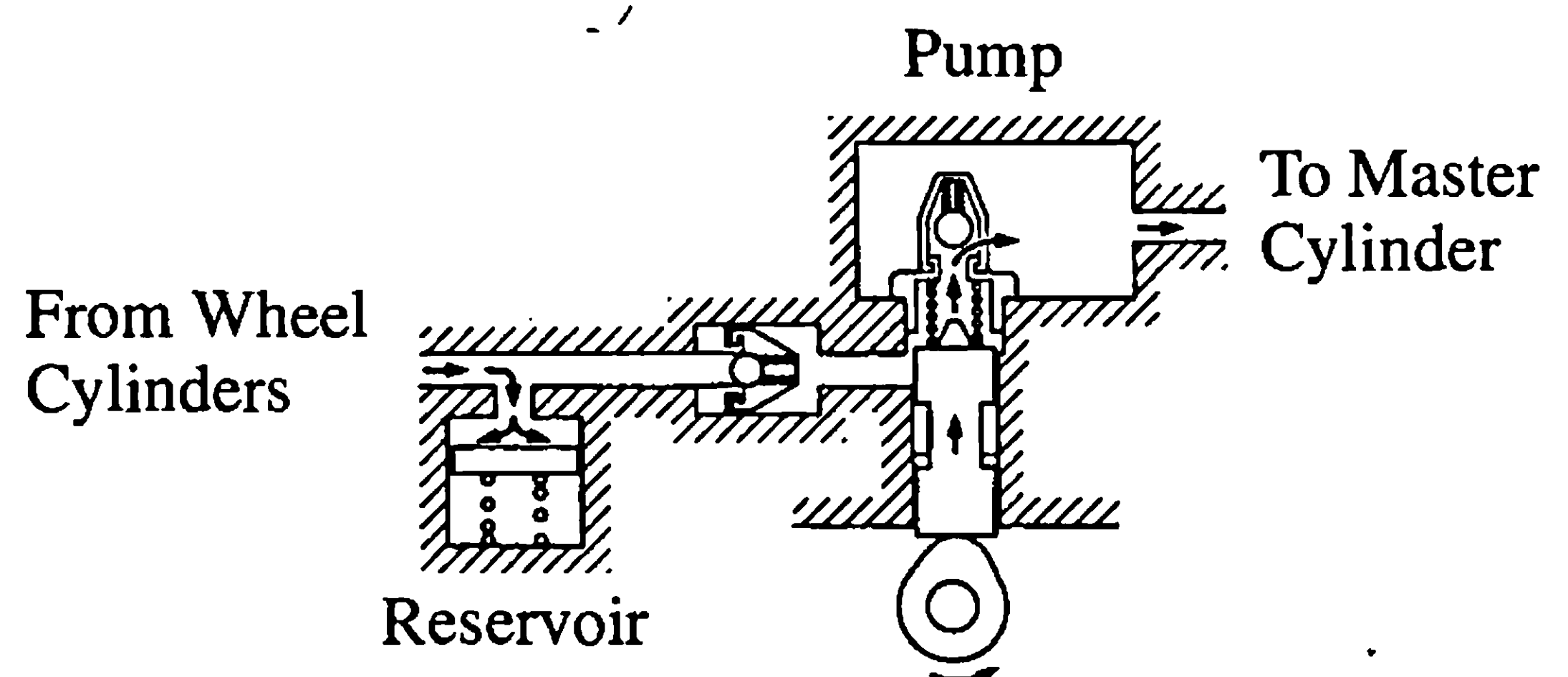
ON Position

b. Reservoir and Pump

The reservoir temporarily stores brake fluid that returns from each wheel cylinder during the pressure reduction mode. The pump sends brake fluid back to the brake master cylinder from the reservoir. The ABS ECU sends signals to the pump motor to turn a cam which is fitted at the end of the pump motor shaft. The cam moves the pump plunger up and down to scoop up brake fluid in the reservoir and return it to the brake master cylinder. The pump is always operating while the ABS is activated.

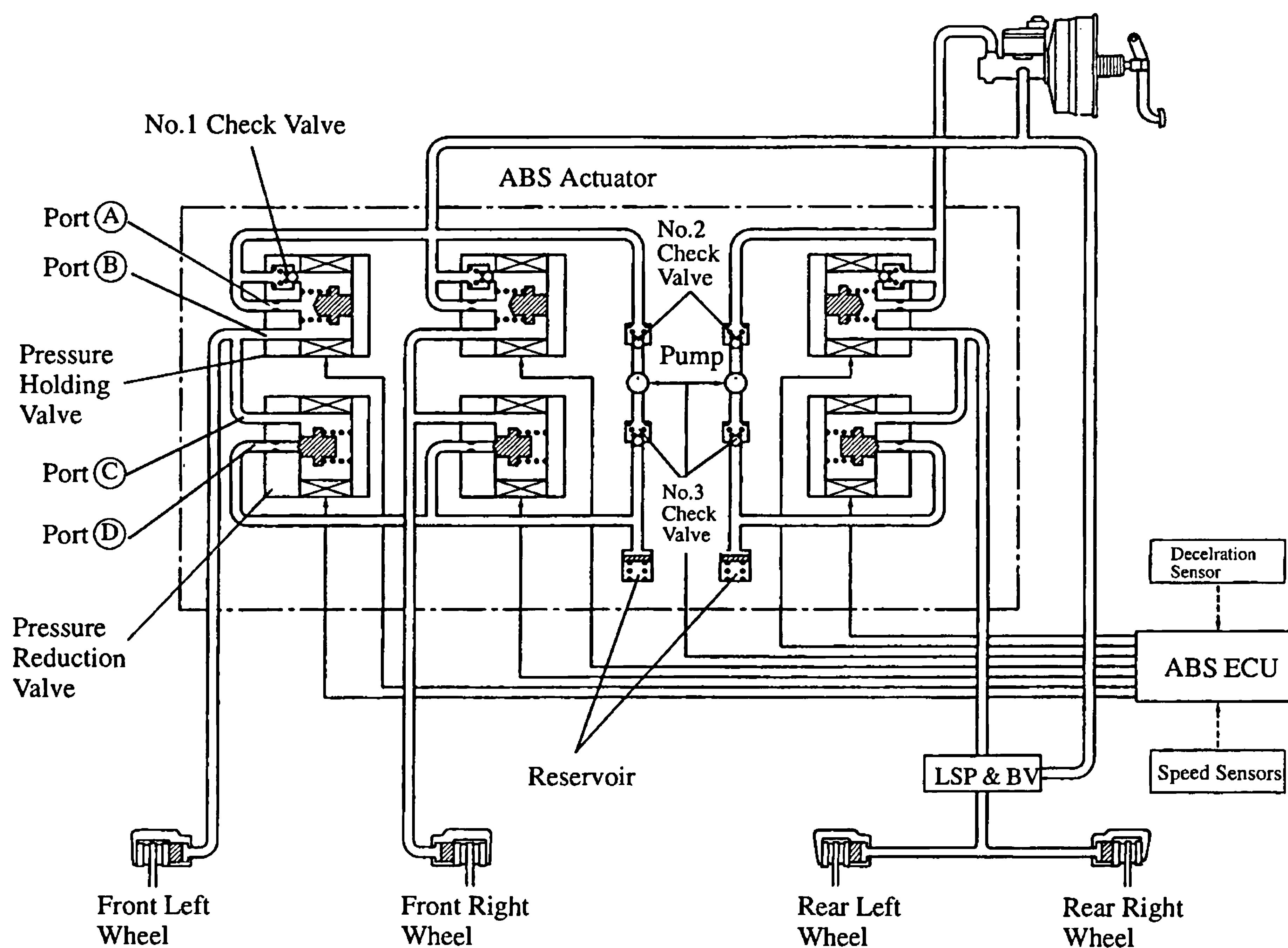


Drawing the Brake Fluid From the Reservoir



Returning the Fluid To the Master Cylinder

2) Hydraulic Circuit



3) Operation

a. During Normal Braking (ABS not activated)

During normal braking, the ABS is not activated and the ECU does not send current to the solenoid coils. As a result, port (A) of the pressure holding valve is open and port (D) of the pressure reduction valve is closed.

When the brake pedal is depressed, the fluid pressure in the master cylinder rises and brake fluid passes from port (A) to port (B) and then flows to the wheel cylinder. The brake fluid is prevented from flowing into the pump by the No.2 check valve located in the pump circuit.

When the brake pedal is released, brake fluid returns from the wheel cylinder to the master cylinder through port (B) to port (A) and the No.1 Check Valve.

► Condition of Each Valve Port and Pump Motor ◀

Part Name	Operation	
Pressure Holding Valve	Port (A)	Open
Pressure Reduction Valve	Port (D)	Closed
Pump Motor	Stop (OFF)	

b. During Emergency Braking (ABS activated)

When any of the four wheels are about to lock during emergency braking, the ABS actuator controls brake fluid pressure acting on that wheel according to a signal sent from the ECU. As a result, the wheel is prevented from locking.

i) Pressure Reduction Mode

When the wheels are about to lock, the ECU sends current to the coil of the pressure holding and pressure reduction valves. This causes port (A) of pressure holding valve to close and port (D) of the pressure reduction valve to open. As a result, brake fluid from the wheel cylinder passes through port (C) to port (D) of the pressure reduction valve and flows into the reservoir.

At the same time, signals from the ECU start the pump motor rotating. It scoops up the brake fluid in the reservoir and increases its pressure higher than the pressure in the master cylinder. The high pressure pushes up the No.2 check valve and returns the fluid back to the master cylinder. Brake fluid coming from master cylinder, on the other hand, is prevented from entering the pressure holding valve by port (A) which is closed and by No.1 and No.2 check valves. As a result, the pressure level inside the wheel cylinder decreases to prevent wheel from locking.

► Condition of Each Valve Port and Pump Motor ◀

Part Name	Operation	
Pressure Holding Valve	Port (A)	Closed
Pressure Reduction Valve	Port (D)	Open
Pump Motor	ON	

ii) Holding Mode

As the pressure inside the front wheel cylinder is reduced or increased and the speed sensor sends a signal indicating the speed is at the controlled braking level, the ECU sends current to the coil of the pressure holding valve. The ECU therefore does not send current to the coil of the pressure reduction valve. This causes port (A) of the pressure holding valve to close and port (D) of pressure reduction valve to close. As a result, the brake fluid holds the pressure in the front wheel cylinder at that level.

► Condition of Each Valve Port and Pump Motor ◀

Part Name	Operation	
Pressure Holding Valve	Port (A)	Closed
Pressure Reduction Valve	Port (D)	Closed
Pump Motor	ON	

iii) Pressure Increase Mode

When the fluid pressure in the front wheel cylinder needs to be increased to apply more braking, the ECU does not send current to the solenoid coils of the pressure holding and pressure reduction valves. As a result, port (A) of the pressure holding valve is open and port (D) of the pressure reduction valve is closed. This allows fluid inside the master cylinder to pass from port (A) to port (B) and be sent to the wheel cylinder increasing pressure inside the cylinder. The fluid pressure increase rate is controlled by repetition of the pressure increase and holding modes.

► Condition of Each Valve Port and Pump Motor ◀

Part Name	Operation	
Pressure Holding Valve	Port (A)	Open
Pressure Reduction Valve	Port (D)	Closed
Pump Motor	ON	

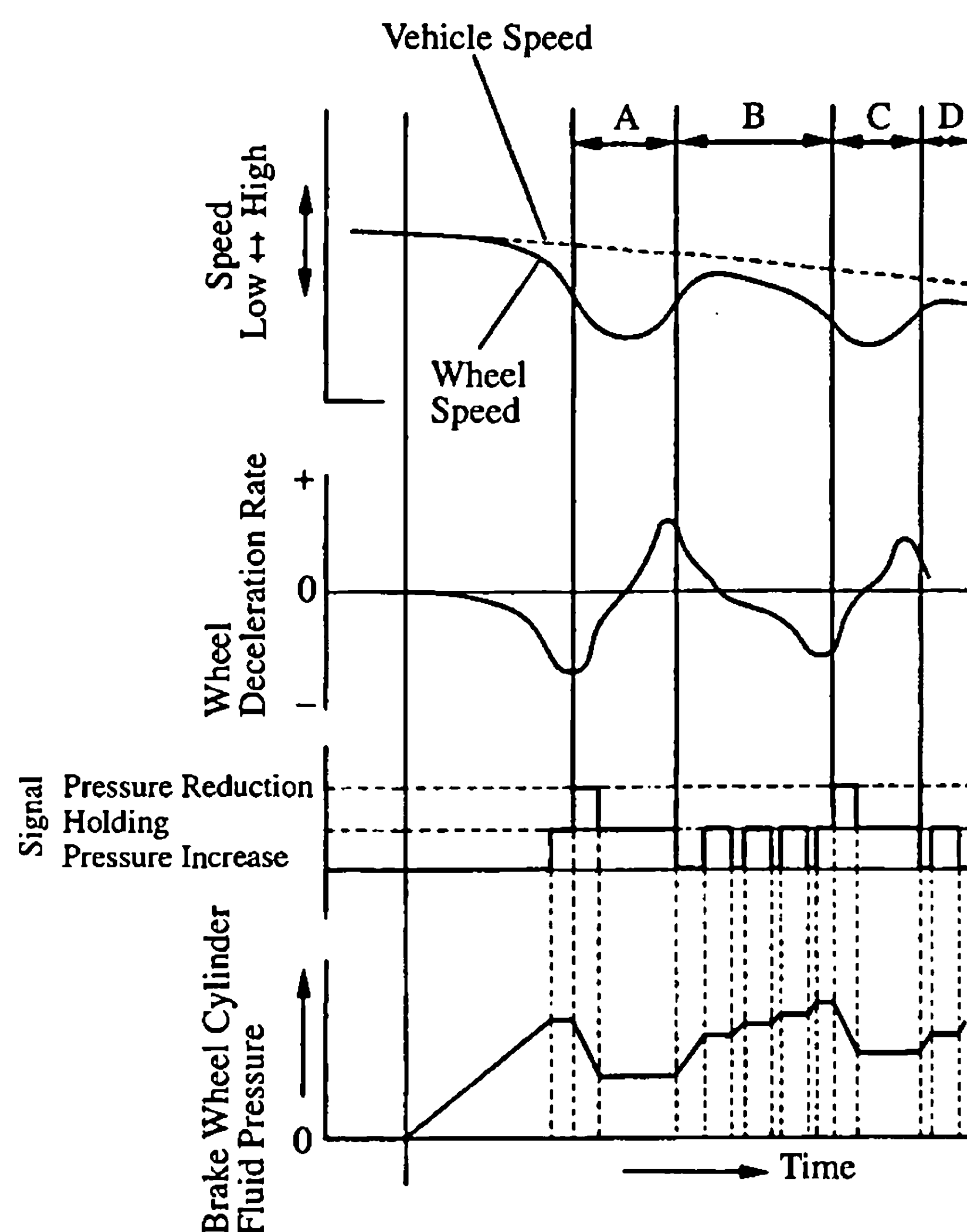
ABS ECU

1) Wheel Speed Control

The ECU constantly receives signals from the 4 speed sensors and deceleration sensor, and estimates the vehicle speed by calculating the speed and deceleration rate of each wheel. When the brake pedal is depressed, the fluid pressure of each brake wheel cylinder starts to increase and the wheel speed starts to decrease.

If any of the wheels is about to lock, the ECU controls the fluid pressure inside the brake wheel cylinder of that wheel according to its wheel speed and the deceleration rates of the other wheels which vary due to the road conditions.

The ECU controls the fluid pressure of each of the front left and right wheels independently while the fluid pressure of the rear left and right wheels is controlled simultaneously for vehicle stability. If one of the rear wheels is about to lock, then the fluid pressure of both rear wheels is controlled to suit the wheel which is about to lock.



a. Control in Section A

The ECU sets each solenoid valve to the pressure reduction mode according to the deceleration rate of the wheel speed, and thus reduces fluid pressure inside the brake wheel cylinder. After the pressure reduces, the ECU switches each solenoid valve to the holding mode to watch the change in wheel speed. If the ECU judges that the fluid pressure needs to be reduced further, it will reduce the pressure again.

b. Control in Section B

When the fluid pressure inside the brake wheel cylinder is reduced in section A, the brake force being applied to the wheel is weakened. This allows the wheel that was just about to lock to pick up more speed.

If the fluid pressure is kept low, the braking force acting on the wheel will become too low.

Therefore, the ECU sets each solenoid valve to the pressure increase mode and holding mode alternately and slowly increases the fluid pressure inside the brake wheel cylinder.

c. Control in Section C

As the fluid pressure is gradually increased inside the brake wheel cylinder in section B, the wheel tends to lock again.

Therefore, the ECU again switches each solenoid valve to the pressure reduction mode to reduce the fluid pressure again inside the brake wheel cylinder.

d. Control in Section D

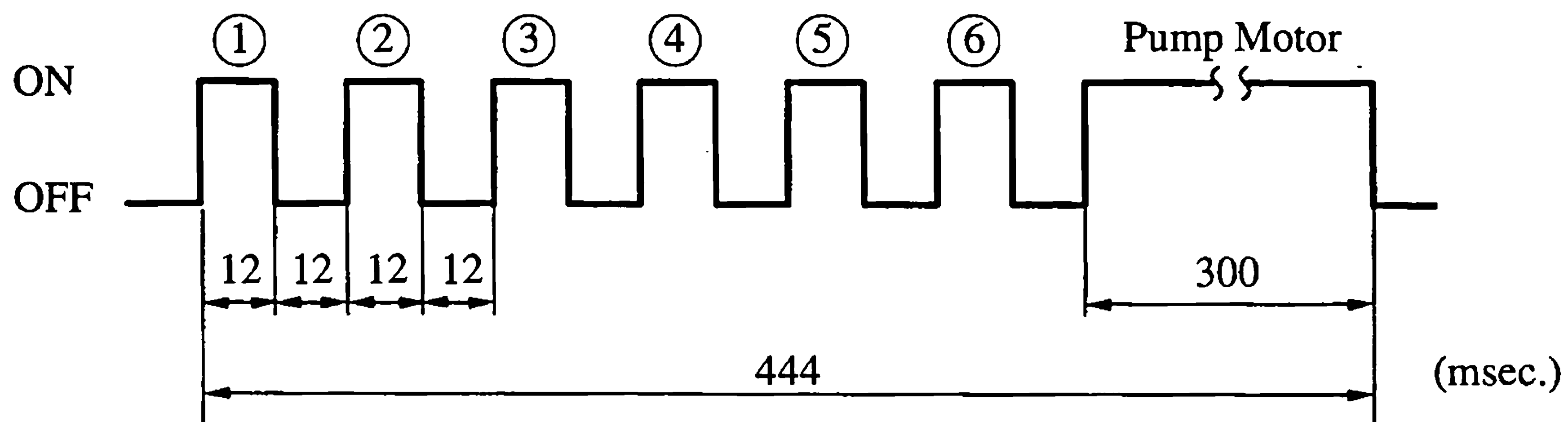
Since the fluid pressure inside the brake wheel cylinder is decreased again in section C, the ECU starts to increase the pressure again as in section B.

2) Initial Check

An initial check is carried out once every about 3 seconds after the ignition was turned on. The functions of each solenoid valve and pump motor in the actuator are checked in order.

If the brake pedal is depressed at this time, the check is not performed. The check is performed only after the brake pedal is released. If the brake pedal is depressed while the check is in progress, the check is discontinued. Then, when the brake pedal is released again, the check is started again (commencing at the front RH pressure holding valve).

If a malfunction is detected during the check, the check is terminated immediately and the ABS warning light lights up.



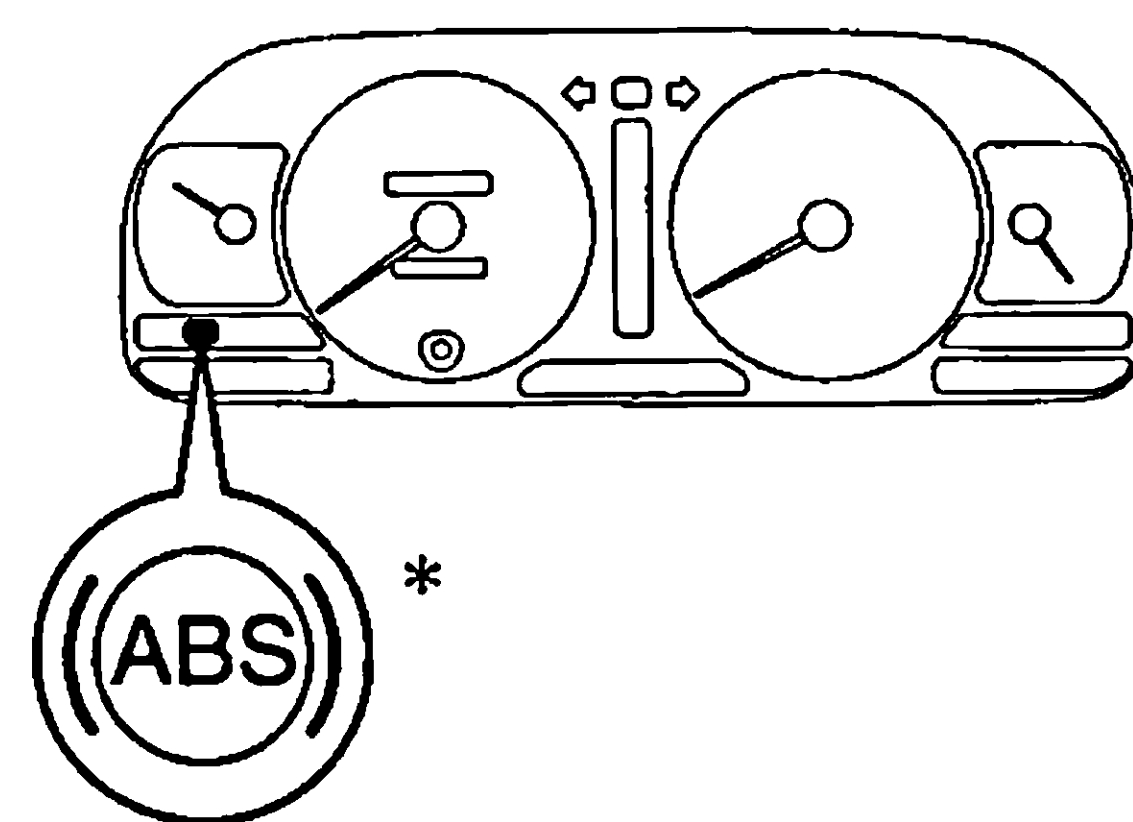
- ① Front RH Pressure Holding Valve
- ② Front RH Pressure Reduction Valve
- ③ Front LH Pressure Holding Valve

- ④ Front LH Pressure Reduction Valve
- ⑤ Rear Pressure Holding Valve
- ⑥ Rear Pressure Reduction Valve

CH

3) Speed Sensor Check Function

The ABS ECU has a speed sensor check function. The output voltage level and output voltage fluctuation of the speed sensor can thus be checked. The results of each check are indicated by the ABS warning light located in the combination meter blinking the appropriate code. For the check procedure and diagnostic code of speed sensor check function, see the Land Cruiser/Land Cruiser Prado Chassis and Body Repair Manual (Pub. No. RM517E).



ABS Warning Light

*: The Australian model indicates "ABS" only.

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

4) Self-Diagnosis

If malfunction occurs in any sensor or actuator, the ABS warning light in the combination meter will light up and alert the driver that a malfunction has occurred. The ECU will also store the codes of the malfunctions. For the diagnostic code check method, diagnostic code and diagnostic code clearance, see the Land Cruiser/Land Cruiser Prado Chassis and Body Repair Manual (Pub. No. RM517E).

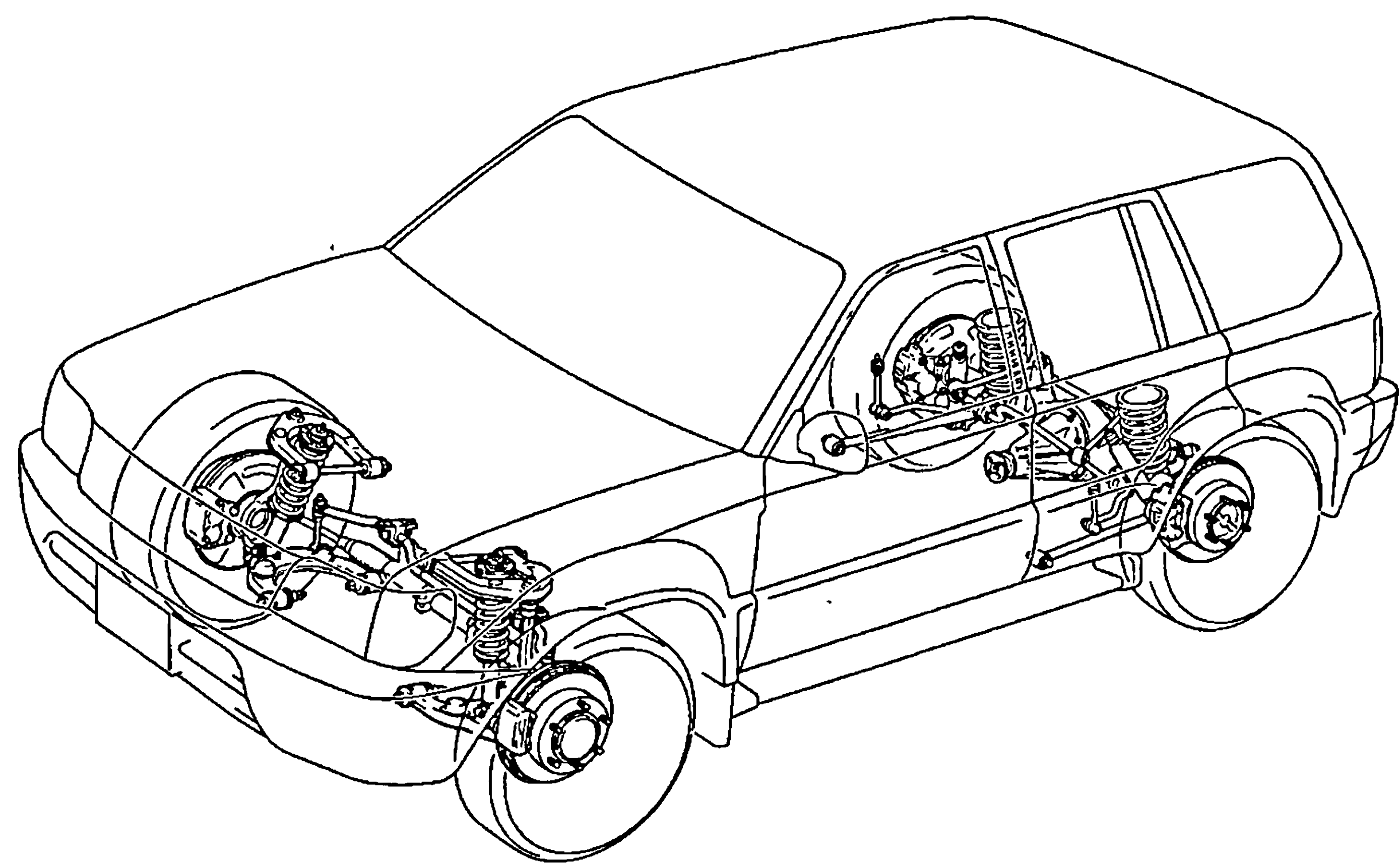
5) Fail-Safe

In the event of a malfunction in an input signal to the ECU, the ECU cuts off its current to the actuator. As a result, the brake system operates in the same way as in a vehicle without ABS and normal braking function is assured.

SUSPENSION

DESCRIPTION

A double-wishbone type independent suspension is used for the front, and a 4-link coil spring with lateral rod type suspension is used for the rear. Thus, an optimal suspension geometry has been achieved to realize excellent riding comfort, stability, and controllability.



Specifications

Model			3-Door	5-Door
Item				
Tread	Front	mm (in.)	1475 (58.07) 1505 (59.25)*1	←
	Rear	mm (in.)	1480 (58.27) 1510 (59.45)*1	←
Front Wheel Alignment*2	Caster	degrees	3°00'	2°50'
	Camber	degrees	−0°10'	−0°05'
	Toe-In	mm (in.)	2 (0.08)	3 (0.12)
	King Pin Inclination	degrees	10°55'	10°50'

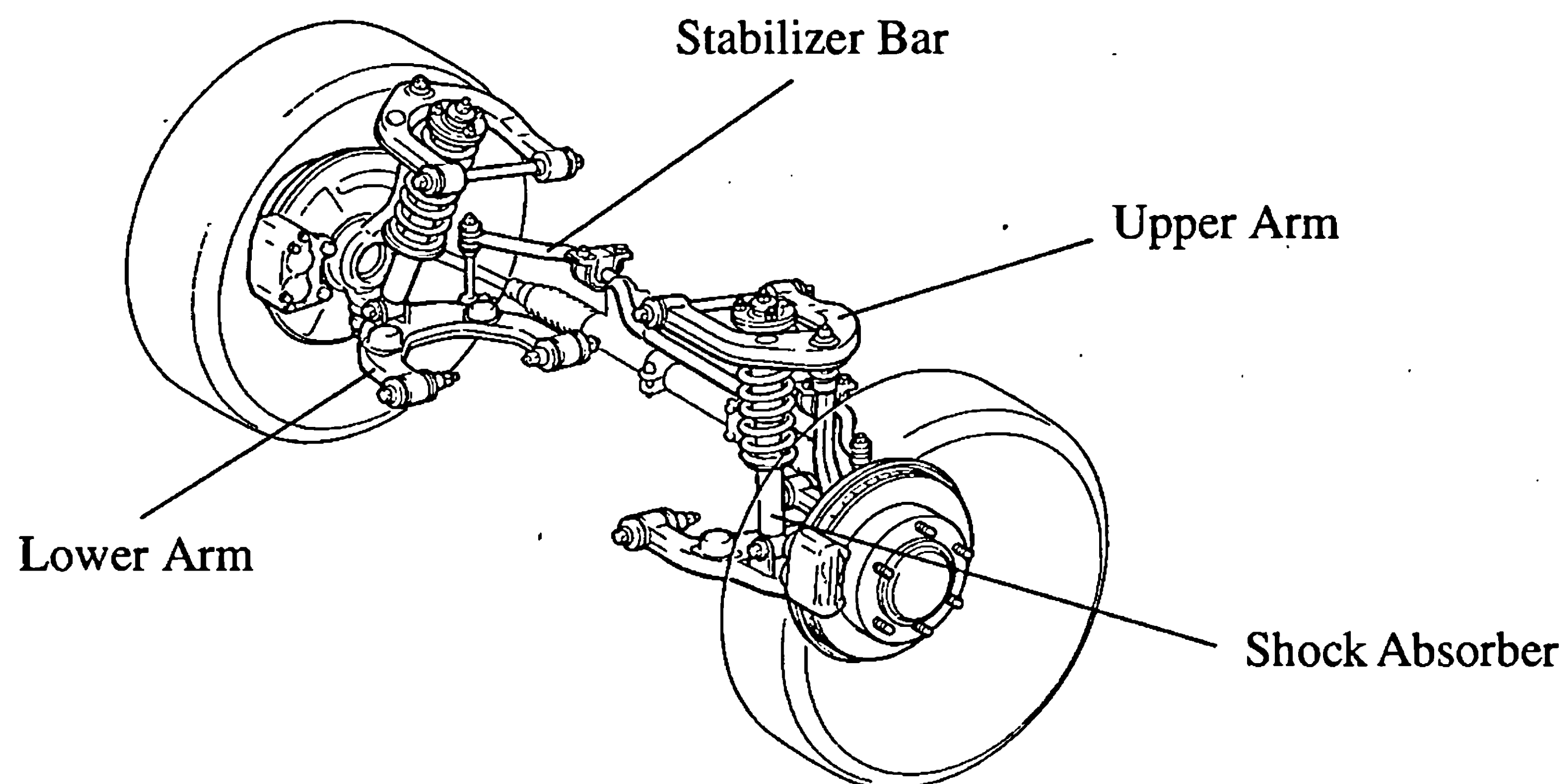
*1: With 265/70 R 16 Tire

*2: Unloaded Condition

■ FRONT SUSPENSION

1. General

A double-wishbone type independent suspension, in which the upper arm is located higher, is used to reduce unsprung weight. As a result, excellent riding comfort, stability, and controllability have been realized. To ensure excellent high-speed straightline stability, a small kingpin inclination and a small spindle offset are used. To ensure braking stability, a small kingpin offset and anti-dive geometry are used.



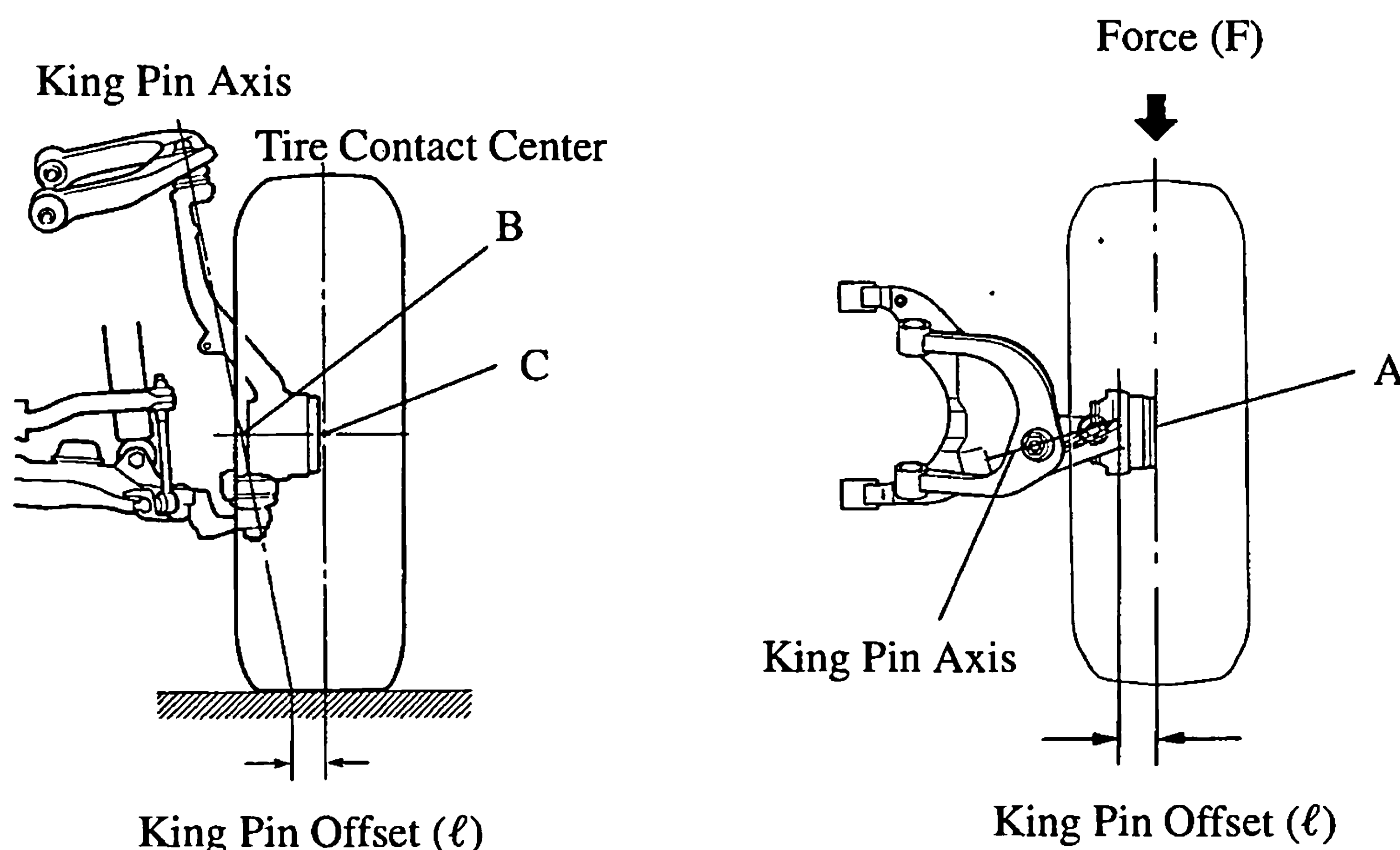
CH

2. Small King Pin Inclination, Spindle Offset and King Pin Offset

A small kingpin offset is used and the moment which occurs around the king pin axis is made small in order to realize excellent vehicle stability when braking.

When force (F) is applied to the wheel during braking etc., the force (F) is applied at the tire center ground contact point (A) and the king pin offset radius (ℓ). The power of F multiplied by ℓ tries to turn the kingpin axis. In this way, making the king pin offset smaller produces smaller moment of the king pin axis to provide excellent vehicle stability.

And a small king pin inclination is used to reduce the spindle offset (the distance between B and C) in order to realize excellent vehicle stability when braking and steering feeling.



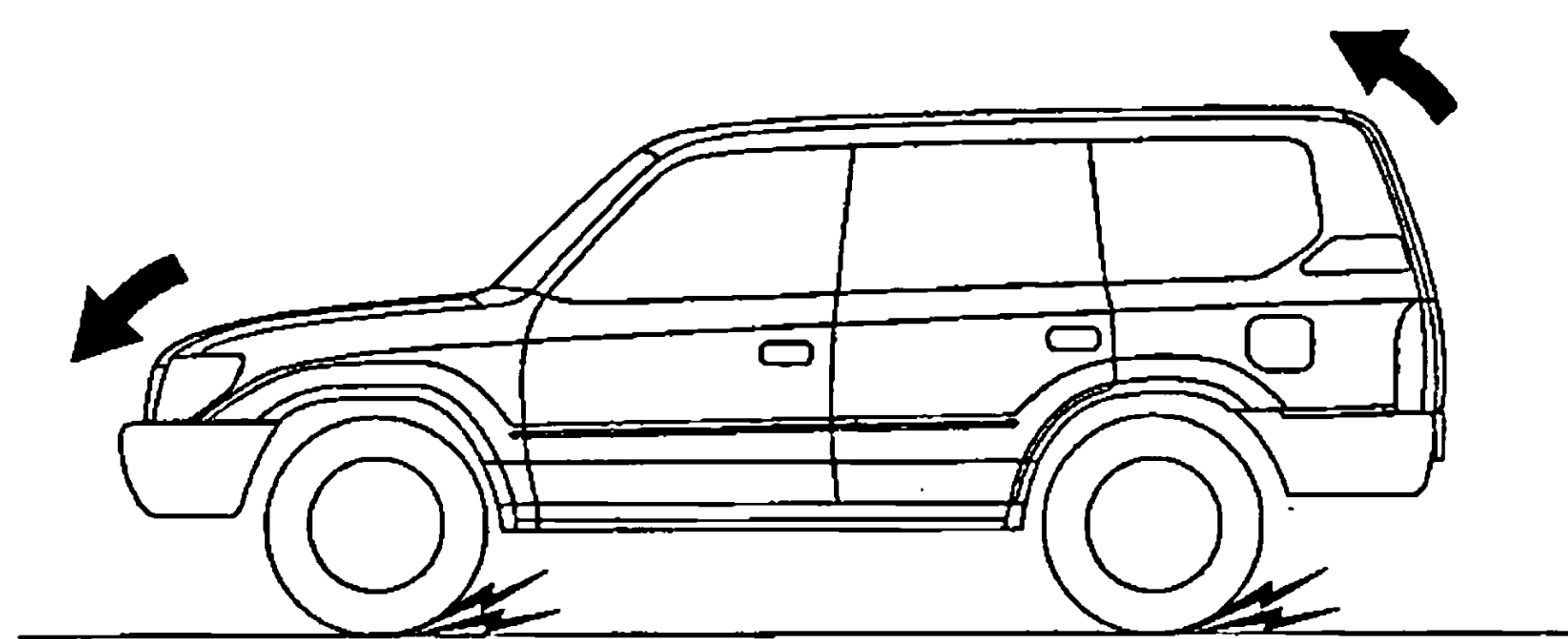
3. Anti-Dive Geometry

By making the rear of upper arm lower, anti-dive geometry was adopted in order to restrain the dive of the front end of the vehicle generated during braking.

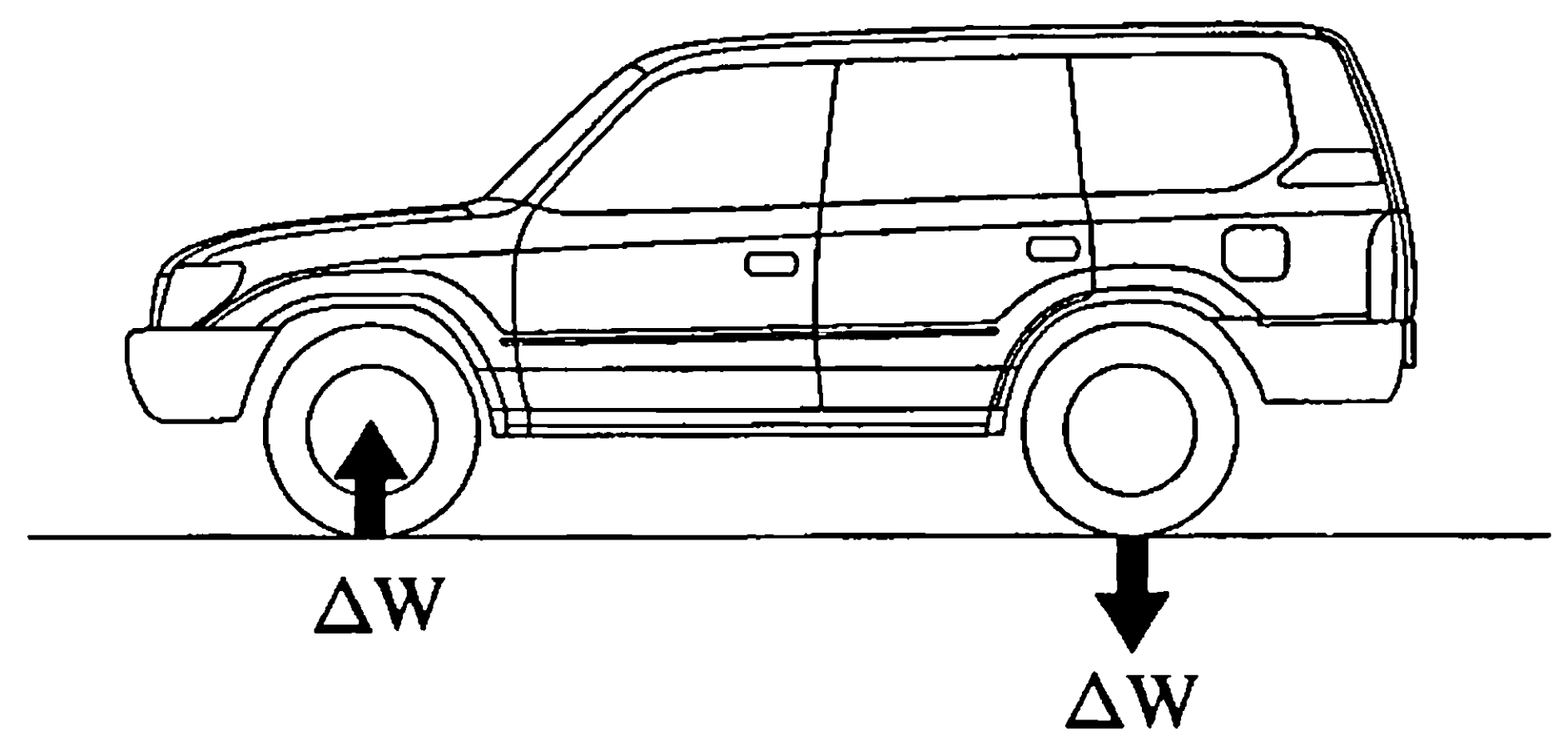
Since suspension movements occur in a stroke which is centered around the virtual center, the position of the virtual instantaneous center becomes very important. The front instantaneous virtual center is the point of intersection between the line which connects the lower arm's front and rear mounting points and the line which connects the upper arm's front and rear mounting points. 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.

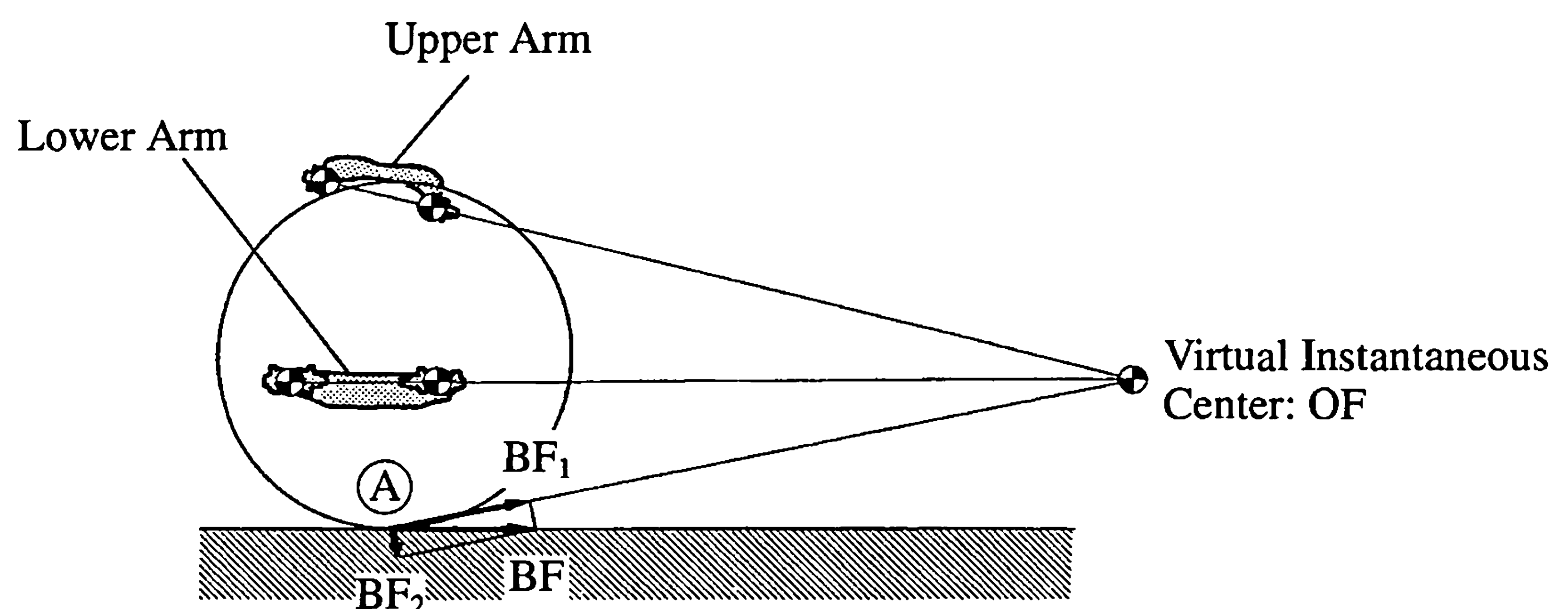
During braking, braking force BF acting on the front tire ground contact point (A) can be resolved into force BF_1 which acts along a line from the virtual center OF and the ground contact point (A), and force BF_2 , which acts perpendicular to the force BF_1 at contact point (A). At this time, the downward force BF_2 combines with the upward force ΔW , reducing the amount of front dive.



During Braking



If the Body's Posture is Constant

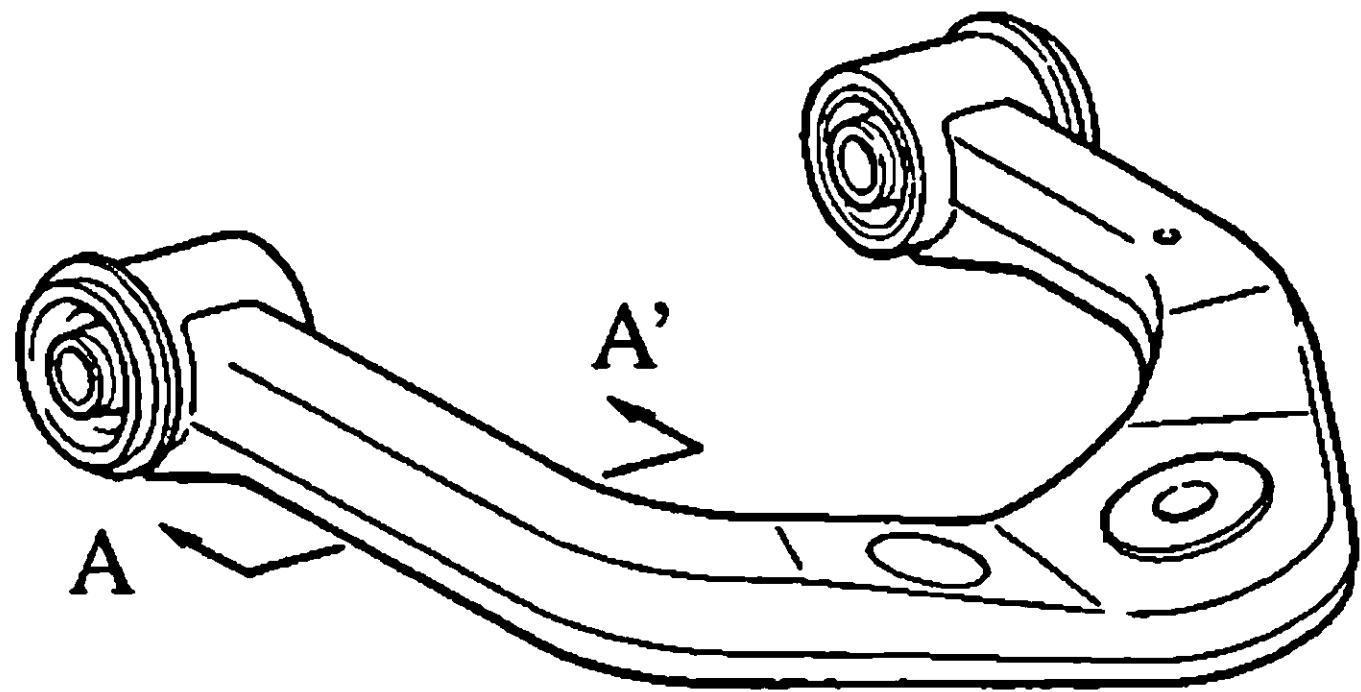


4. Upper Arm and Lower Arm

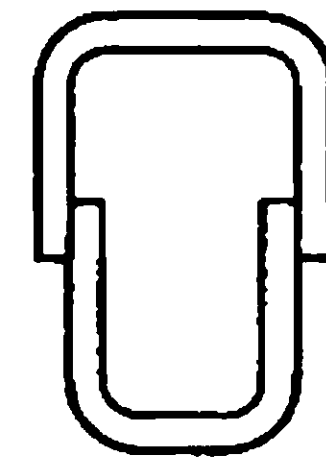
The upper and lower arms are made of highly rigid stamped sheet steel.

The cross section of the arms are closed cross section to reduce weight and to ensure a high level of rigidity.

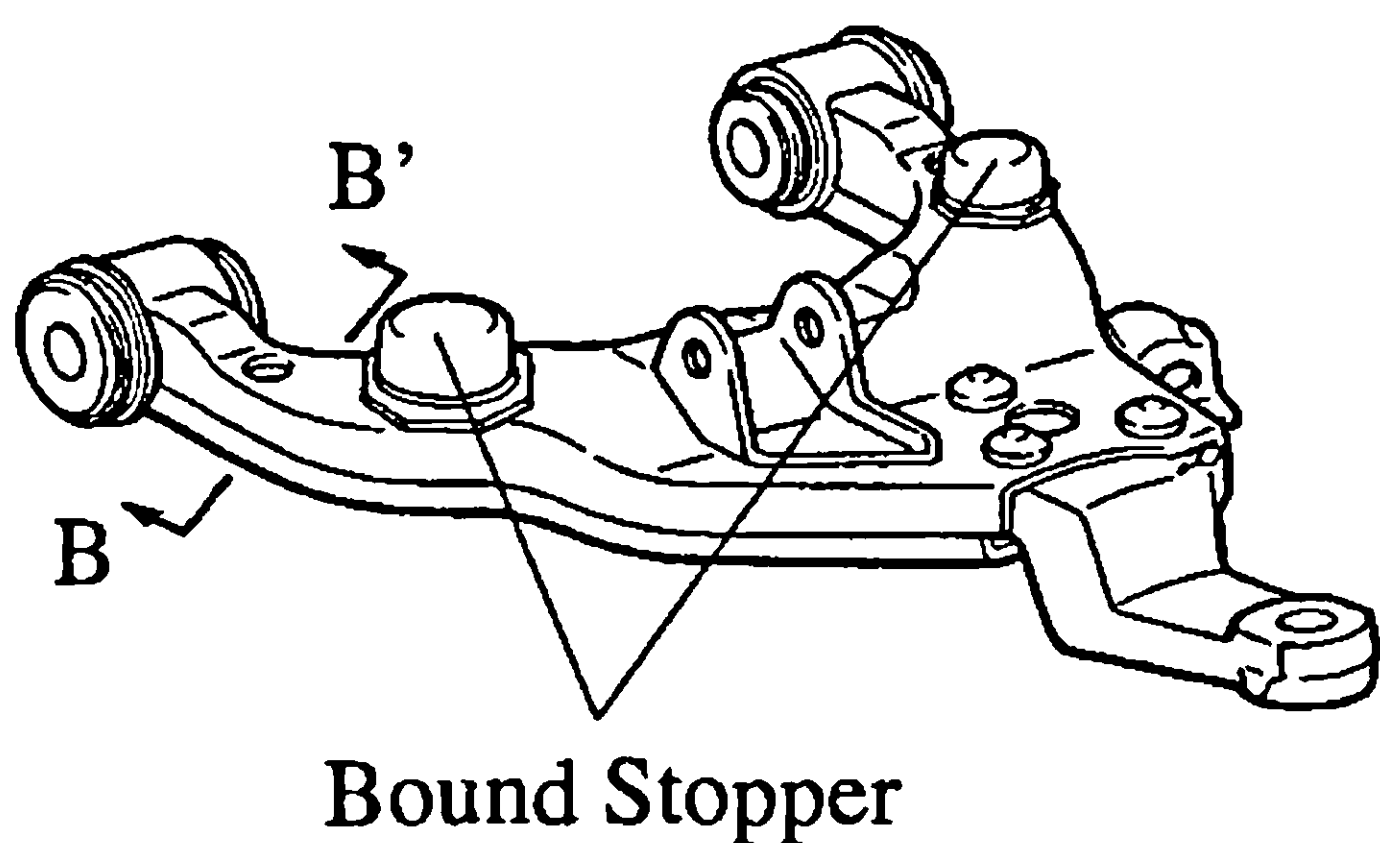
A bound stopper is provided in the front and rear of the top surface of the lower arm.



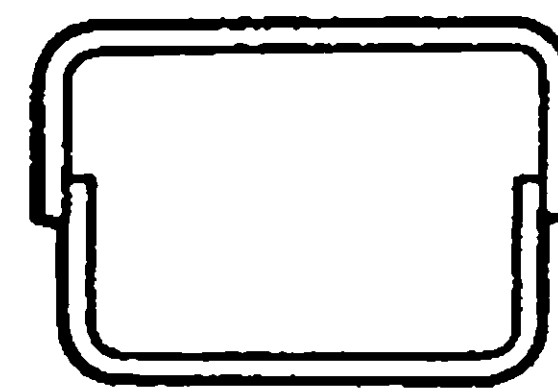
Upper Arm



A – A' Cross Section



Lower Arm



B – B' Cross Section

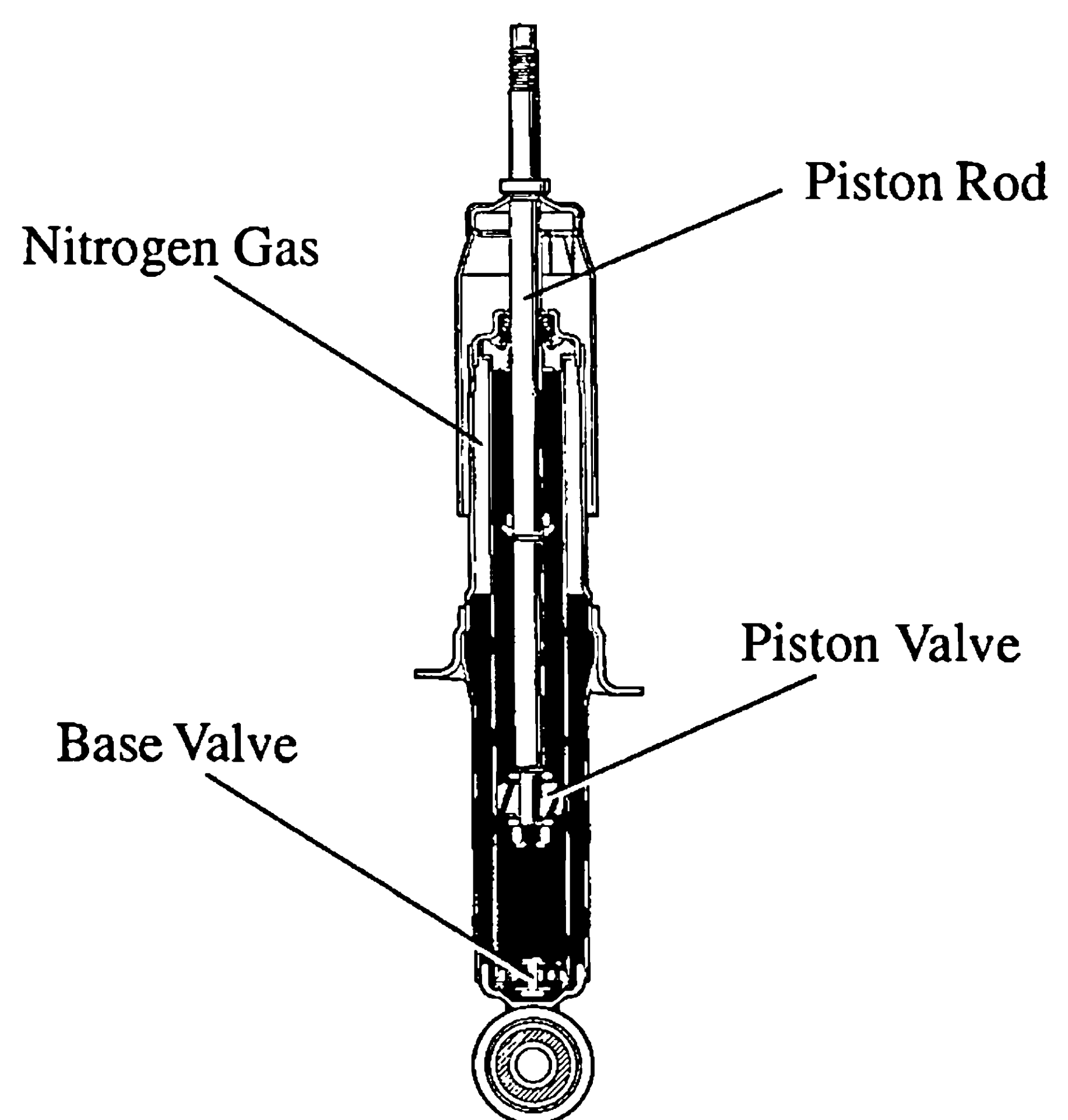
CH

5. Stabilizer Bar

A solid bar is used for the stabilizer bar to realize excellent stability, controllability, and maneuverability.

6. Shock Absorber

The shock absorber inhibits cavitation and offers outstanding damping force characteristics through the use of low-pressure nitrogen gas.

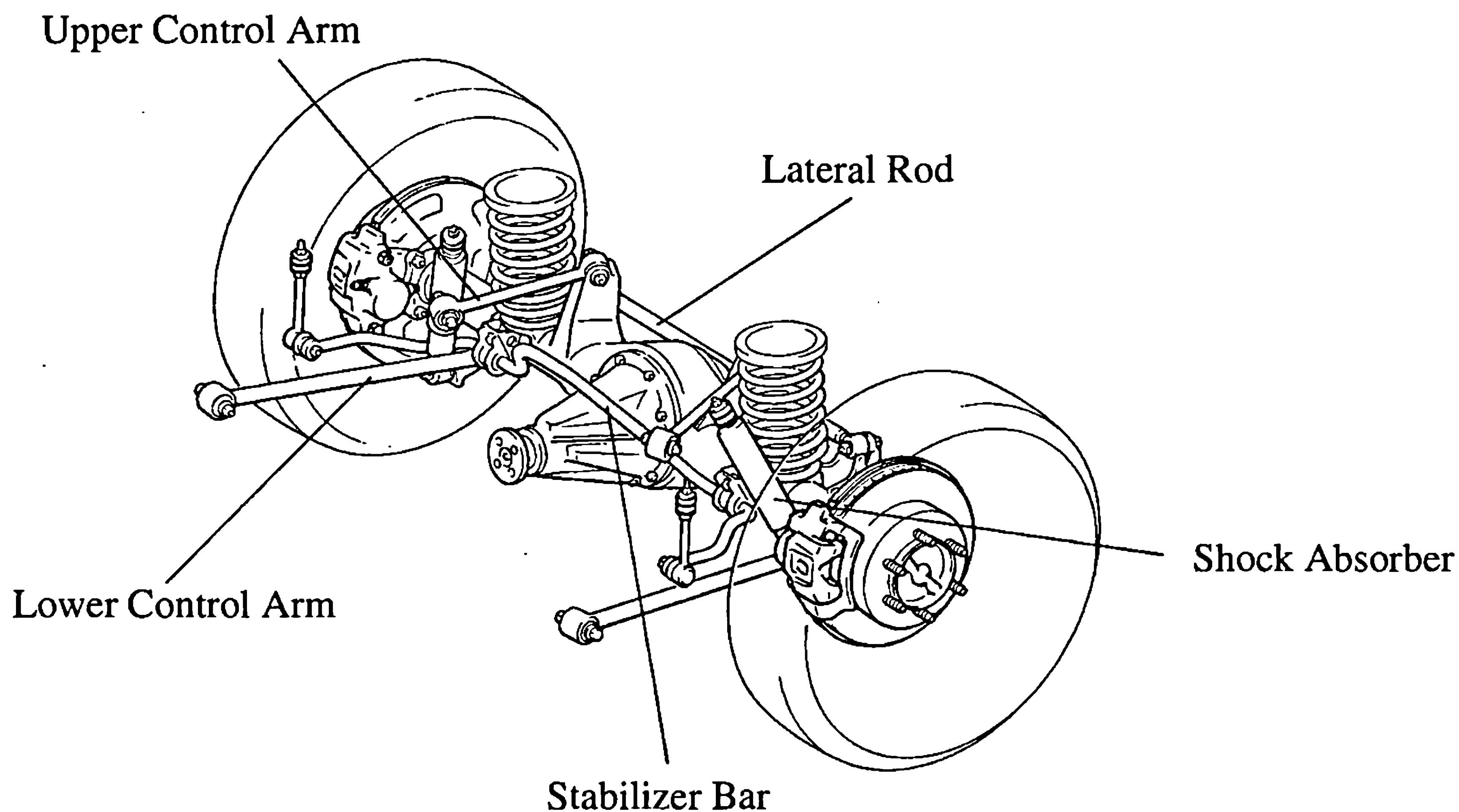


■ REAR SUSPENSION

1. General

A 4-link coil spring with lateral rod type suspension is used to realize excellent riding comfort, stability, controllability, and offroad drivability.

The upper and lower control arms have been optimally located to enable the axle to understeer, thus realizing excellent maneuverability.



2. Axle Steer

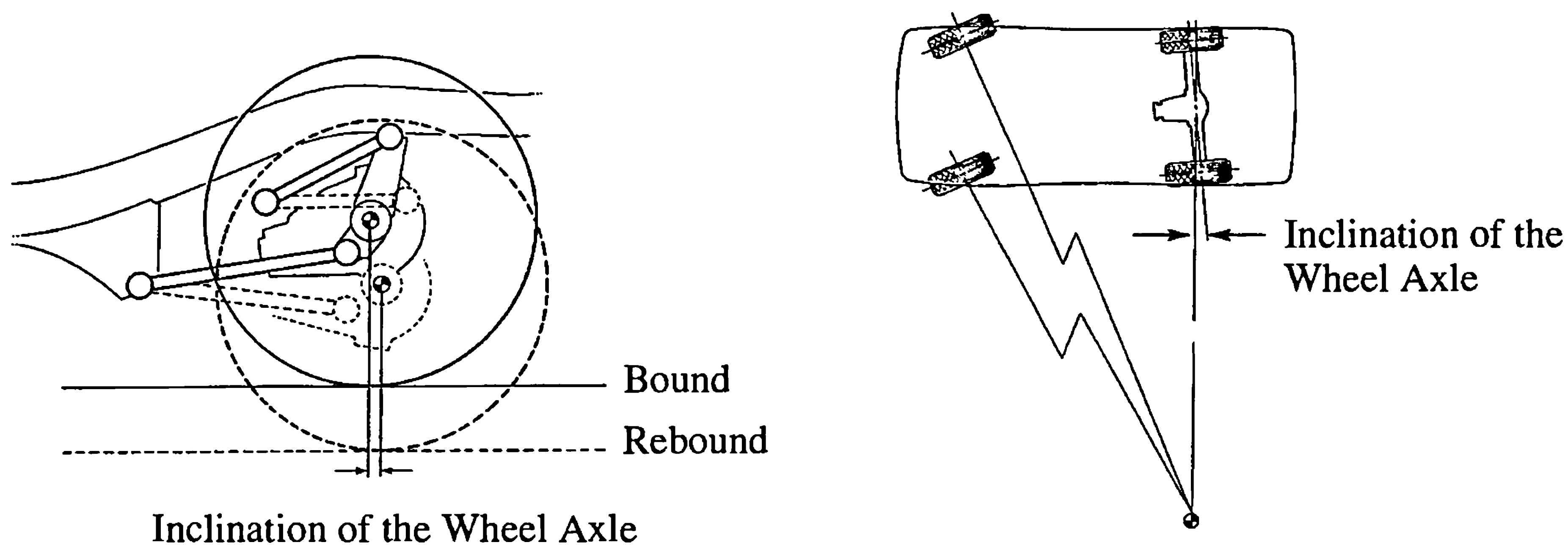
Axle steer is a condition in which the orientation of the rear axle changes when the vehicle body rolls during cornering, creating the same effect as if the vehicle was steered.

The upper control arm has a sharp frontal inclination, and the lower control arm is long and nearly horizontal. Thus, during a bound, the axle housing advances forward due to the curve that is drawn by the axle housing's upper control arm attachment position.

For this reason, when the vehicle body rolls during cornering, the upper control arm of the outer wheel will have a sharper frontal inclination, causing the outer wheel side of the axle housing to greatly advance forward. And the upper control arm becomes nearly horizontal, the inner wheel side of the axle housing will not move very much.

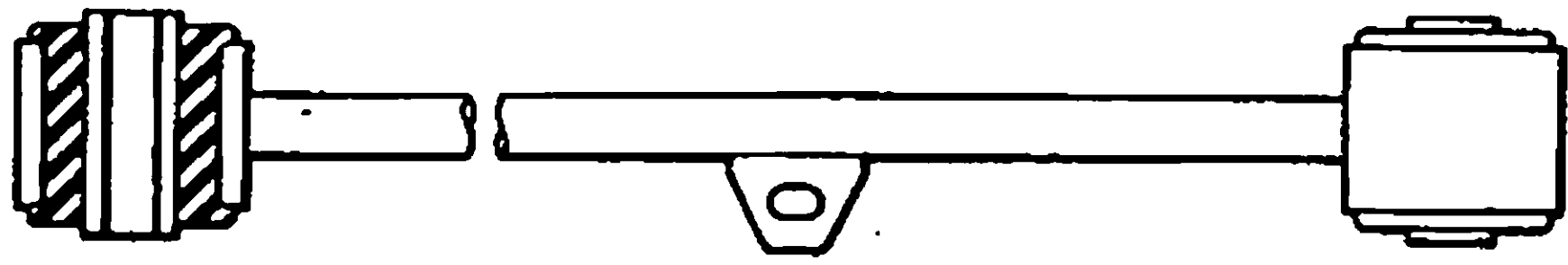
As a result, the axle housing will have steered in the same phase as that of the front tires.

Accordingly, the tires' slip angle increases, and a cornering force is generated in the rear wheels, thus realizing excellent maneuverability.

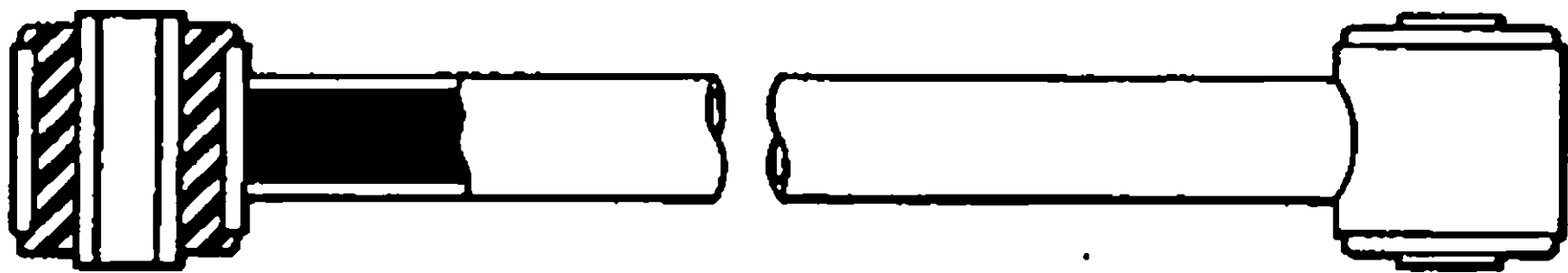


3. Upper Control Arm and Lower Control Arm

The upper control arm uses a solid bar and the lower control arm uses a hollow bar.



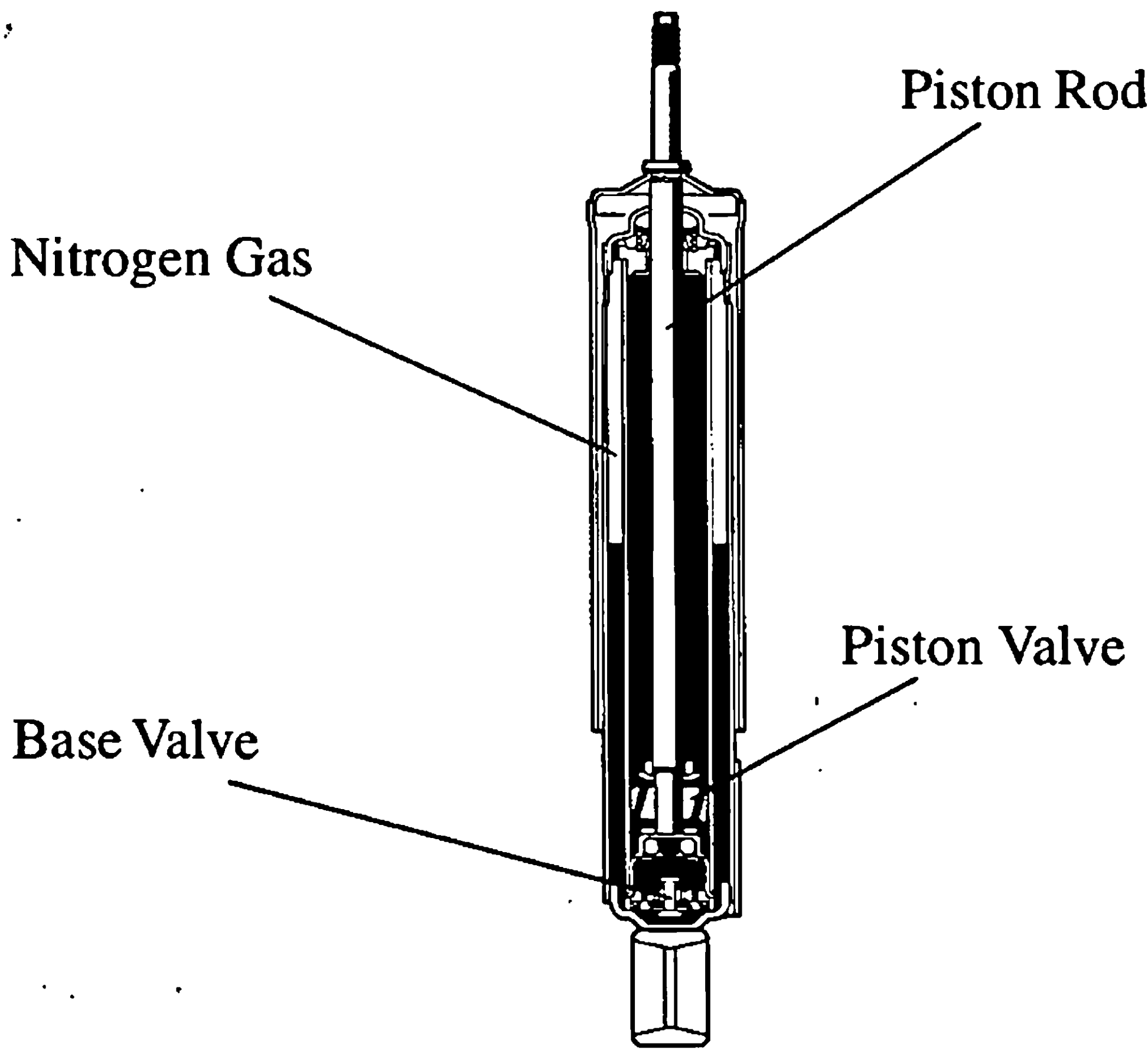
Upper Control Arm



Lower Control Arm

4. Shock Absorber

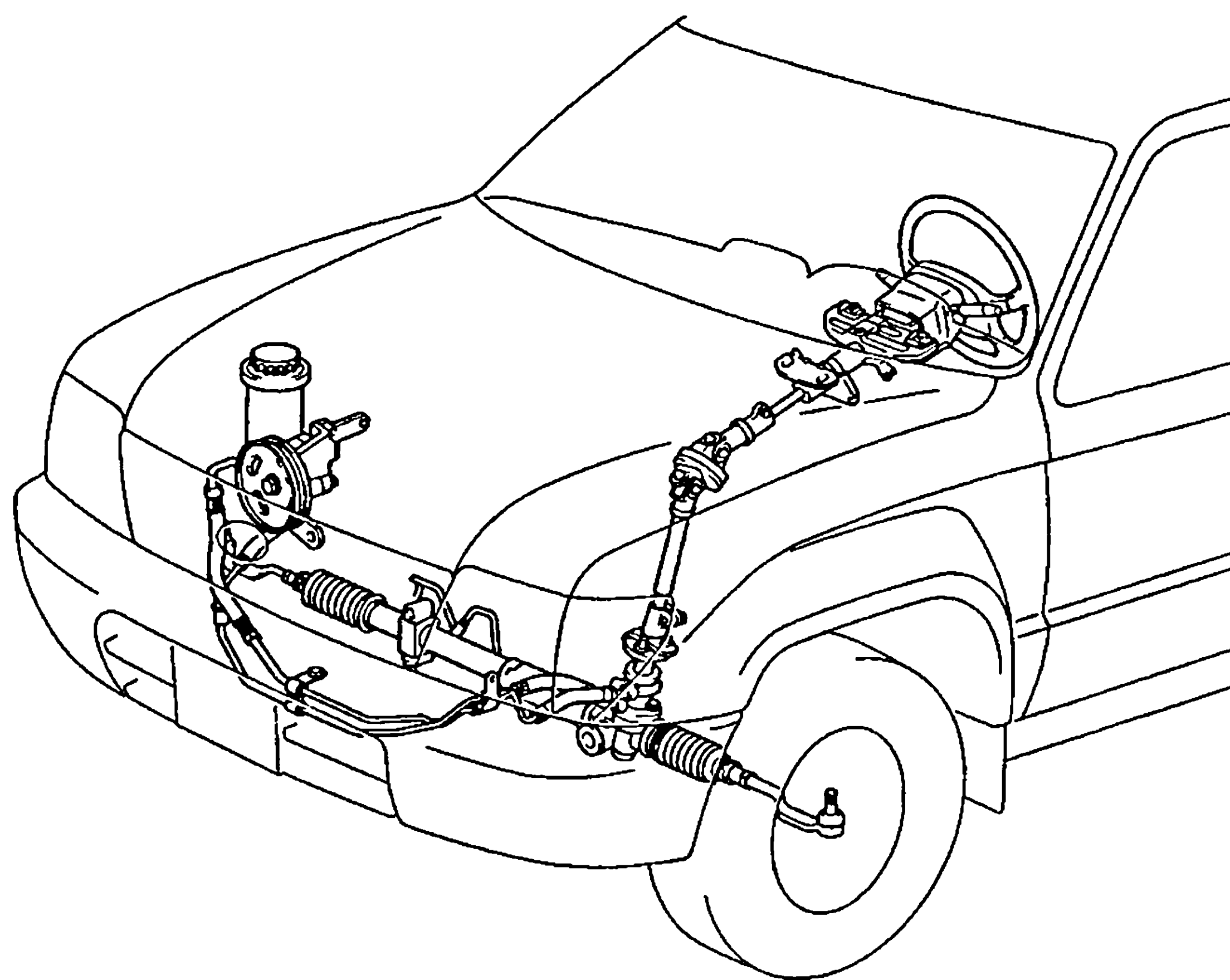
As in the front suspension, the rear shock absorber inhibits cavitation and offers outstanding damping force characteristics through the use of low-pressure nitrogen gas.



STEERING

■ DESCRIPTION

- All models use a compact and lightweight rack-and-pinion type power steering system.
- A compact and lightweight tilt steering mechanism is provided as standard equipment on models for Europe and Australia, and for the VX grade model for G.C.C. Countries. It is also available as an option on the GX grade model for the G.C.C. Countries and General Countries.
- A bending bracket type energy absorbing mechanism is used in the steering column.



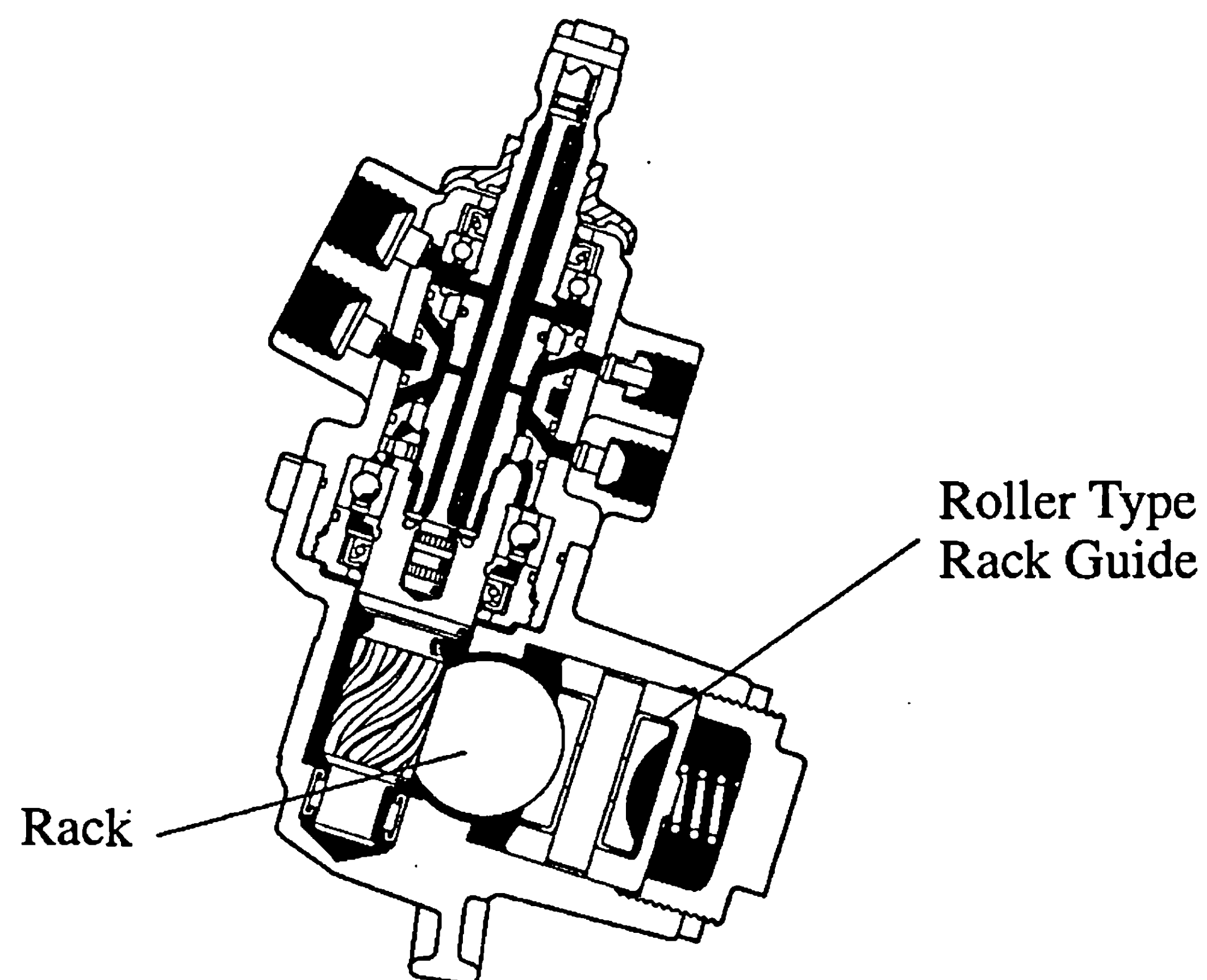
5VZ-FE Engine Model

► Specifications ◀

Gear Ratio (Overall)	20.0 : 1
No. of Turns Lock to Lock	3.5
Rack Stroke	mm (in.)
Fluid Type	ATF Type DEXRON®II or III

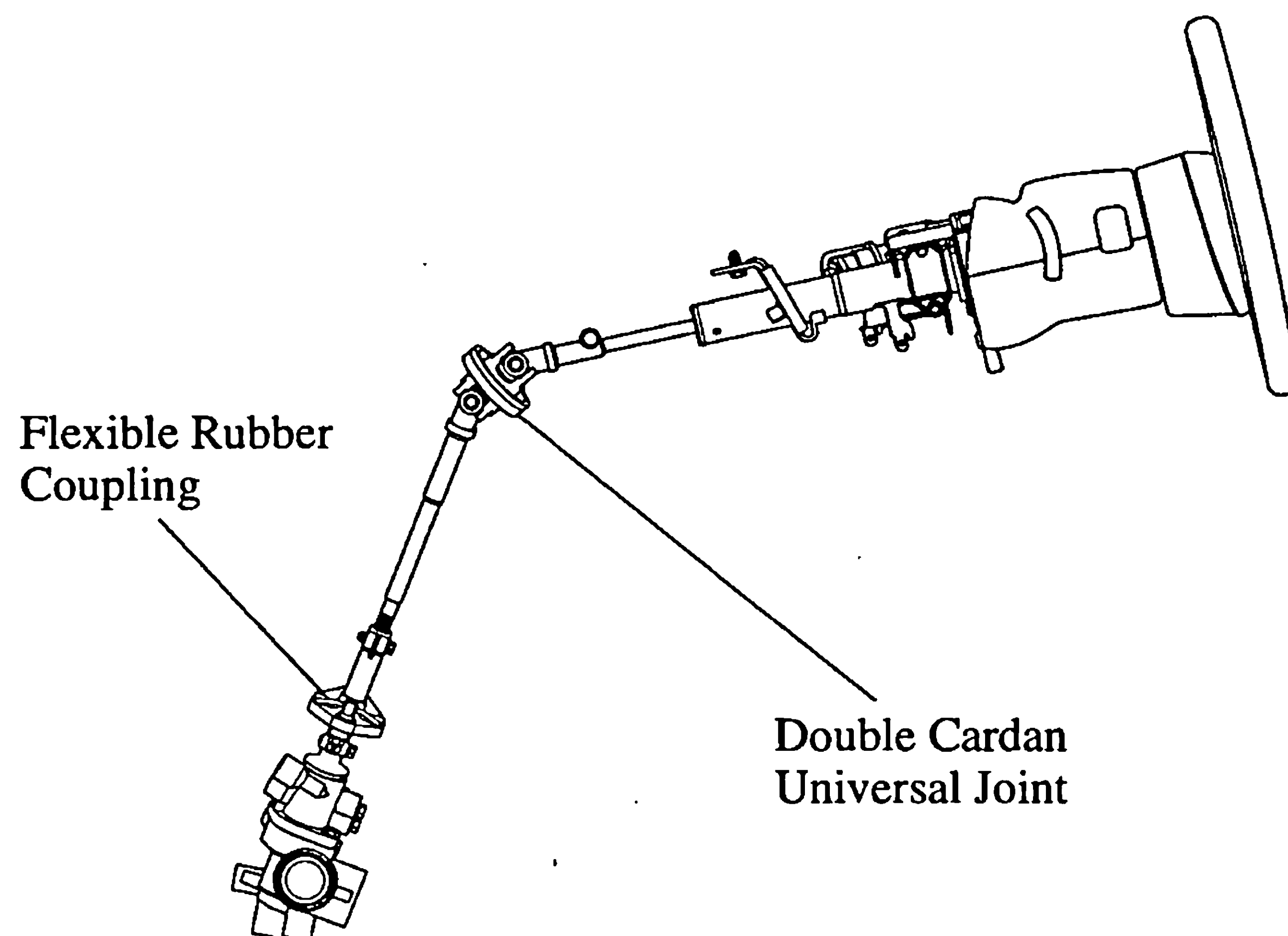
■ STEERING GEAR

A lightweight and compact rack and pinion type steering gear with excellent steering feeling has been adopted. A roller type rack guide is used to realize smoother steering feeling and excellent steering response.

**CH**

■ STEERING SHAFT

A double cardan universal joint and flexible rubber coupling have been adopted to realize the excellent steering feeling.



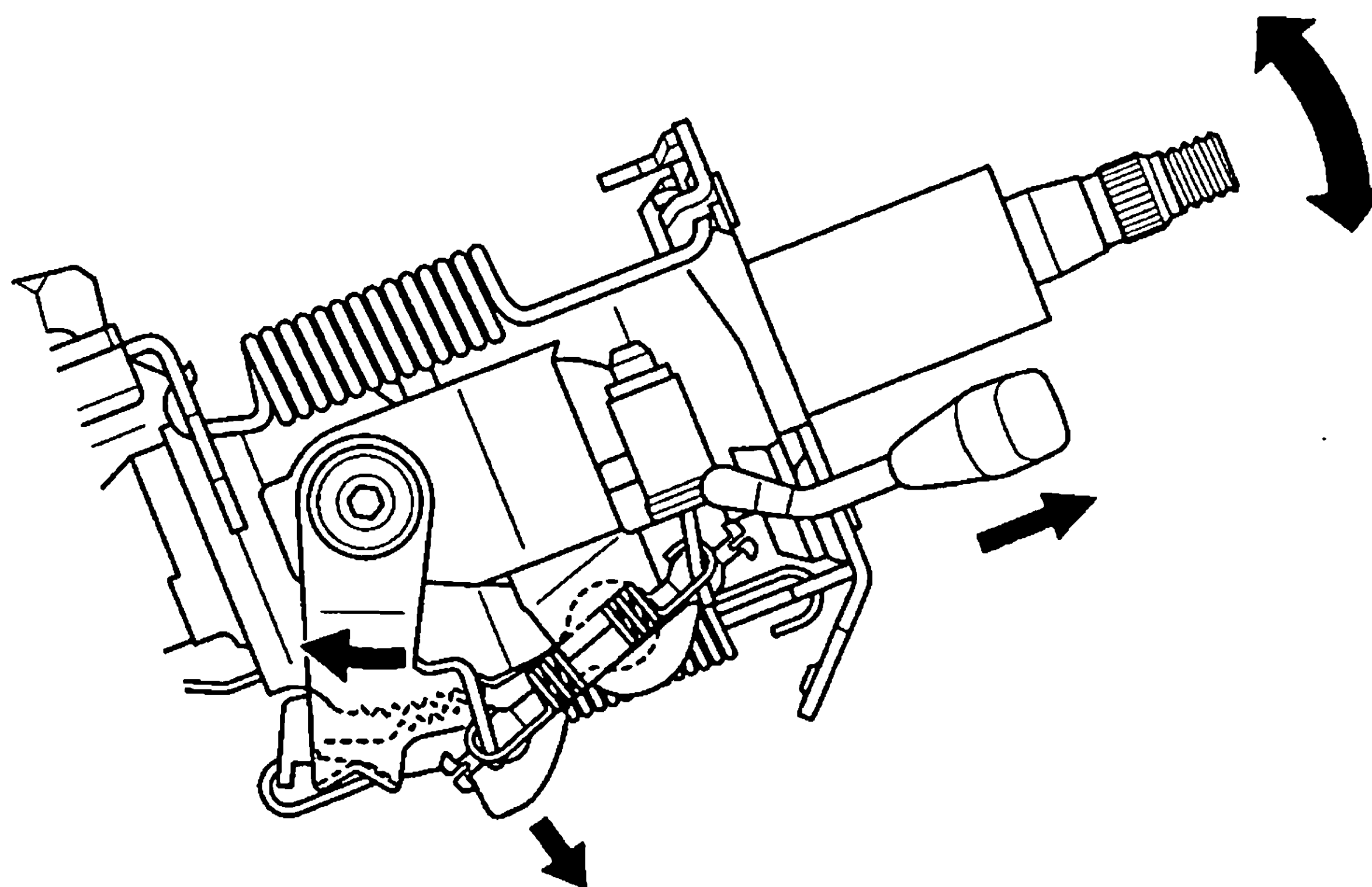
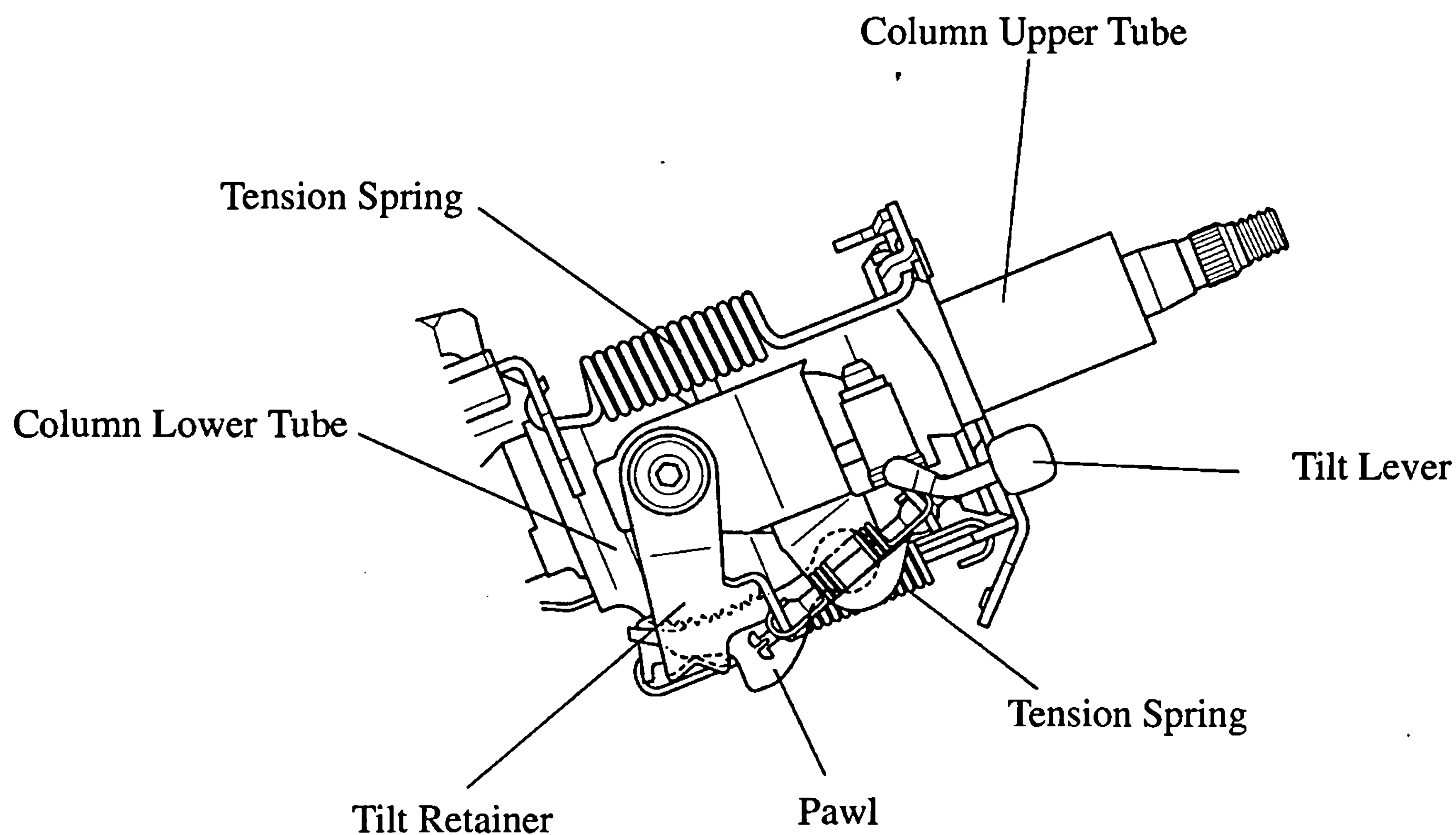
■ TILT STEERING

1. Construction and Operation

A tilt mechanism consists of a column upper tube, lower tube, pawl, tilt retainer, tilt lever and tension springs etc.

The pawl is attached to the column upper tube. Under spring tension, the pawl is pushed by the tilt retainer against the ratchet in the lower tube, thus locking the tilt steering.

By operating the tilt lever, the tilt retainer moves in unison to release the pawl. The pawl disengages from the ratchet in the lower tube, allowing the steering to tilt.

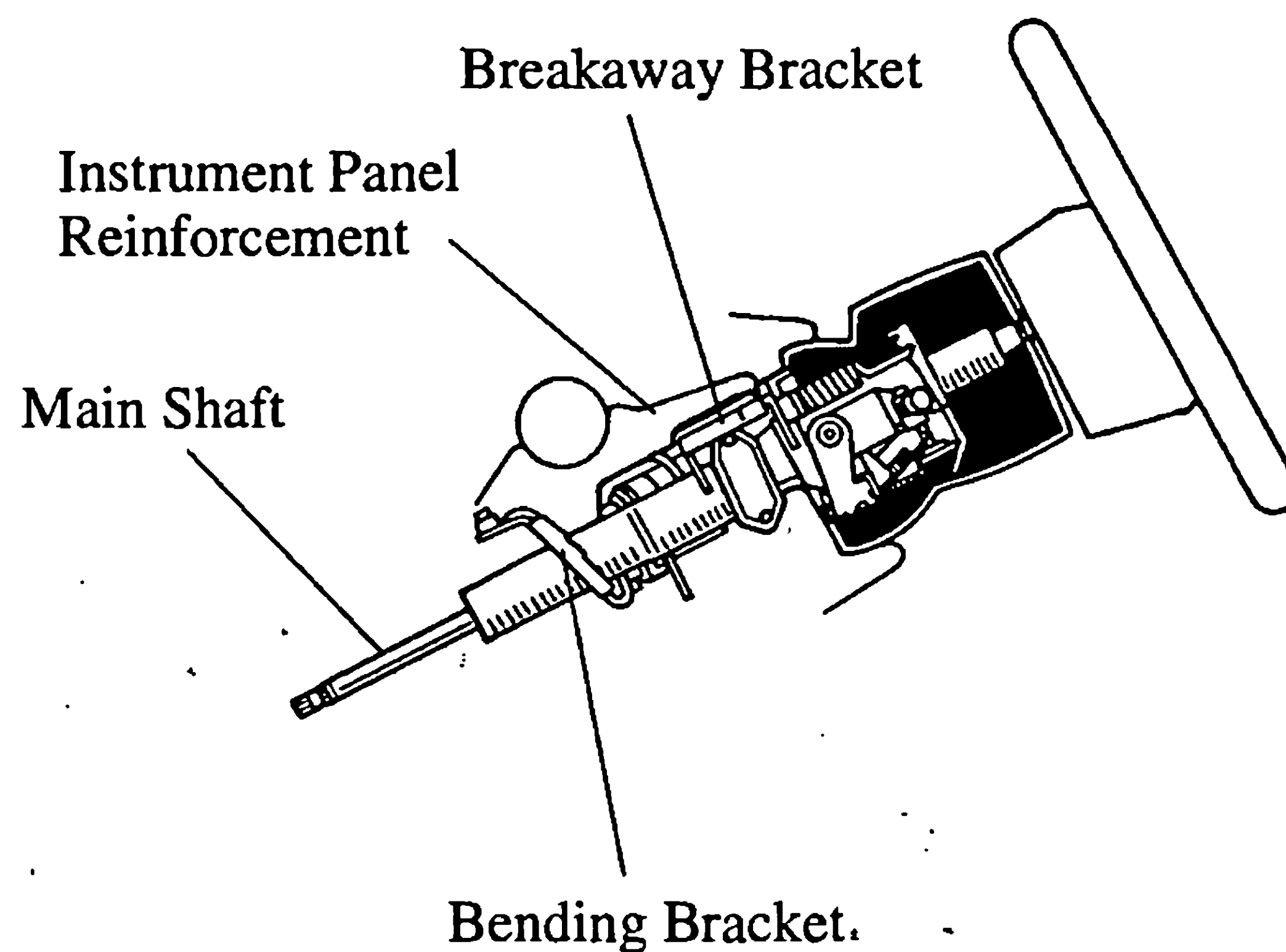


■ ENERGY ABSORBING MECHANISM

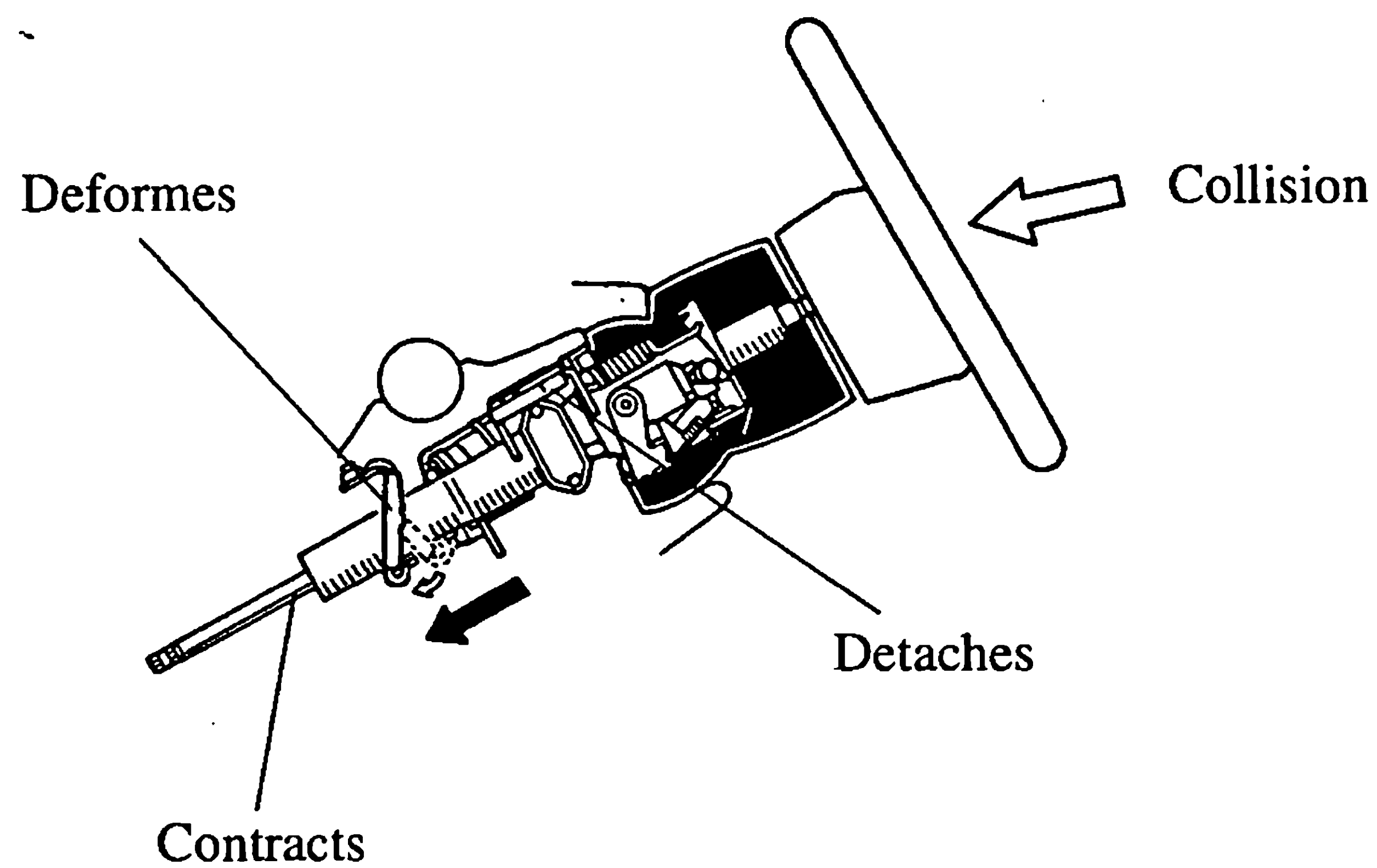
1. Construction and Operation

The energy absorbing mechanism consists of a bending bracket, breakaway bracket and contractile main shaft. The breakaway bracket is attached to the instrument panel reinforcement, via the capsule.

When the impact that is applied by the driver is received by the steering wheel, the energy of the impact is absorbed by the steering wheel and the wheel pad. At the same time, the bending bracket bends to absorb the energy. Simultaneously, the breakaway bracket detaches from the instrument panel reinforcement, and the main shaft contracts.



Before Collision



During Collision

BODY

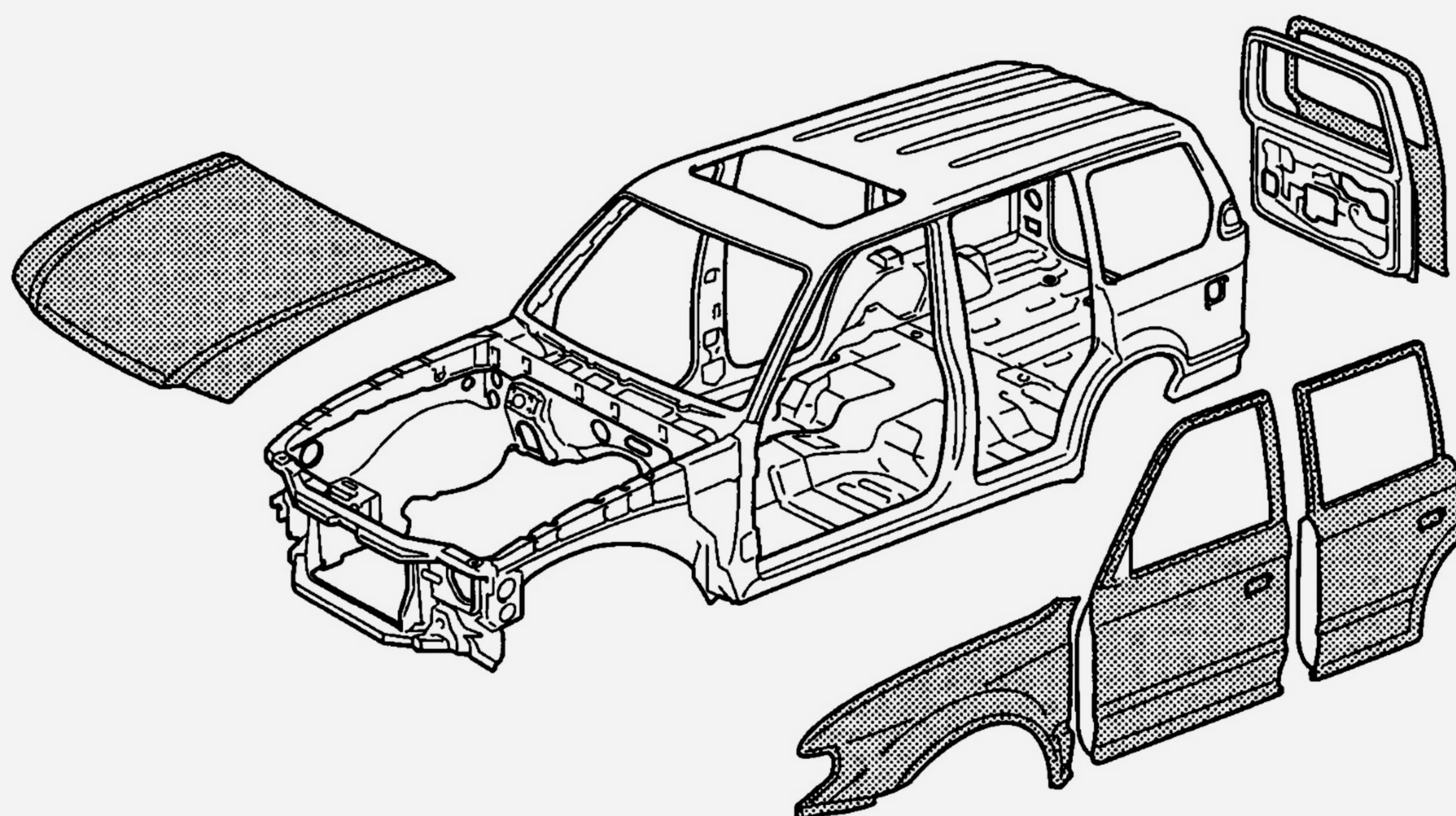
HIGHLY RIGID BODY

The shapes and allocation of the reinforcements and members have been modified and high strength sheet steel has been adopted in order to realize a vehicle body with higher rigidity.

■ HIGH STRENGTH SHEET STEEL

High strength sheet steel is used for the hood, door panels, back door and members.

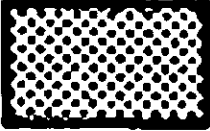
 : High Strength Sheet Steel

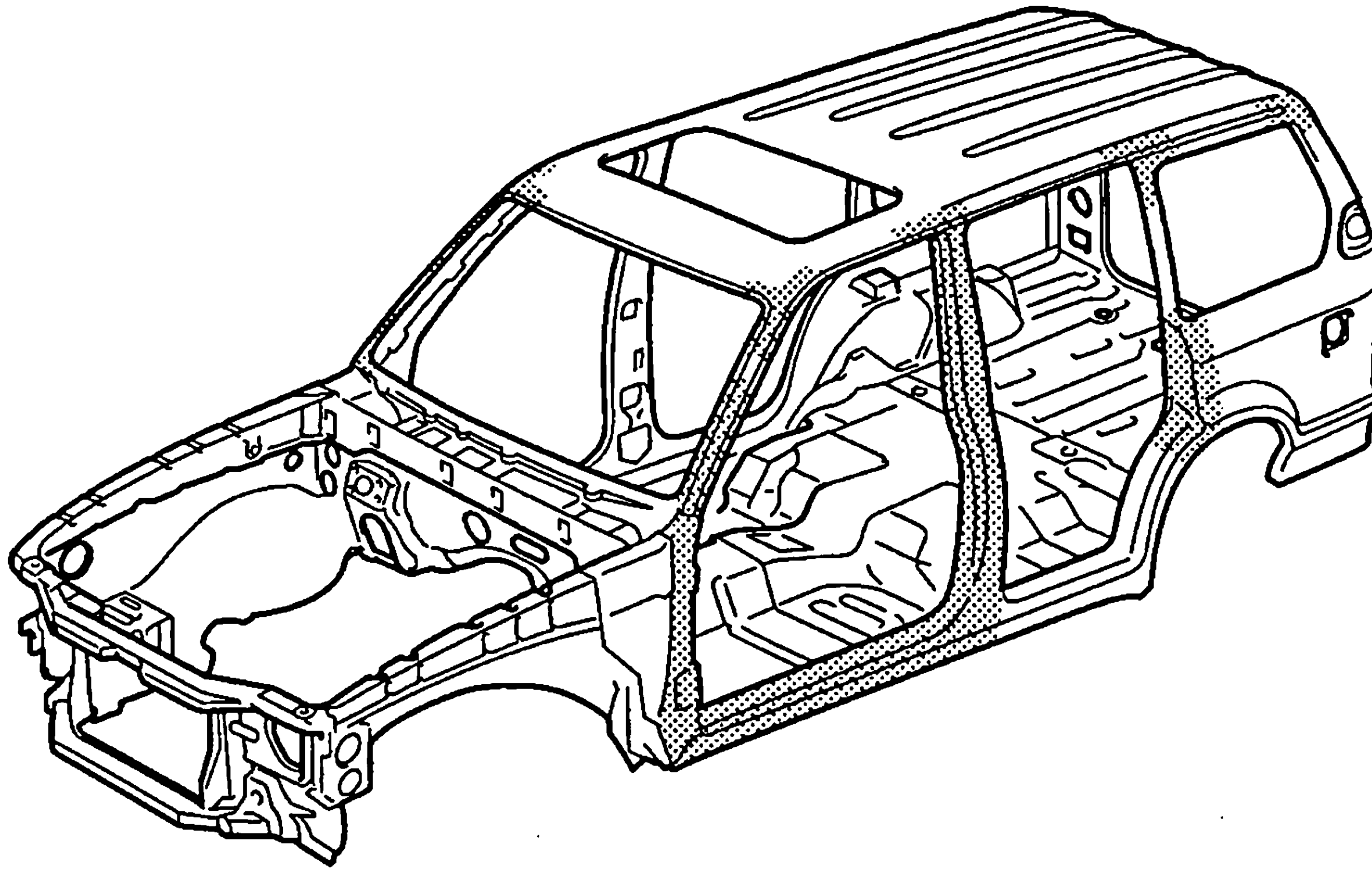


5-Door Model

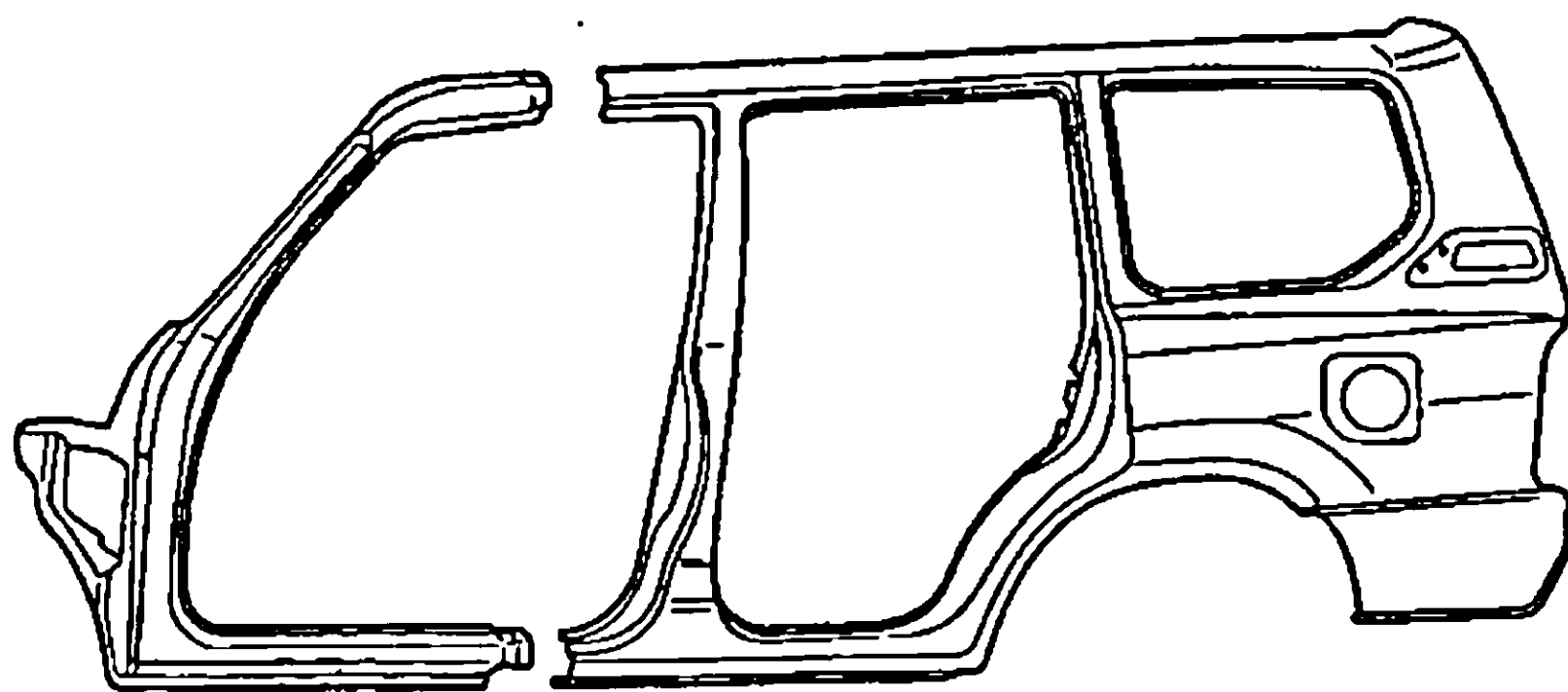
■ BODY SHELL

- The areas that join the pillars to the roof side rail or the rocker are provided with reinforcements to ensure a strong pillar construction. In addition, reinforcements are efficiently located throughout the body to realize excellent body rigidity.

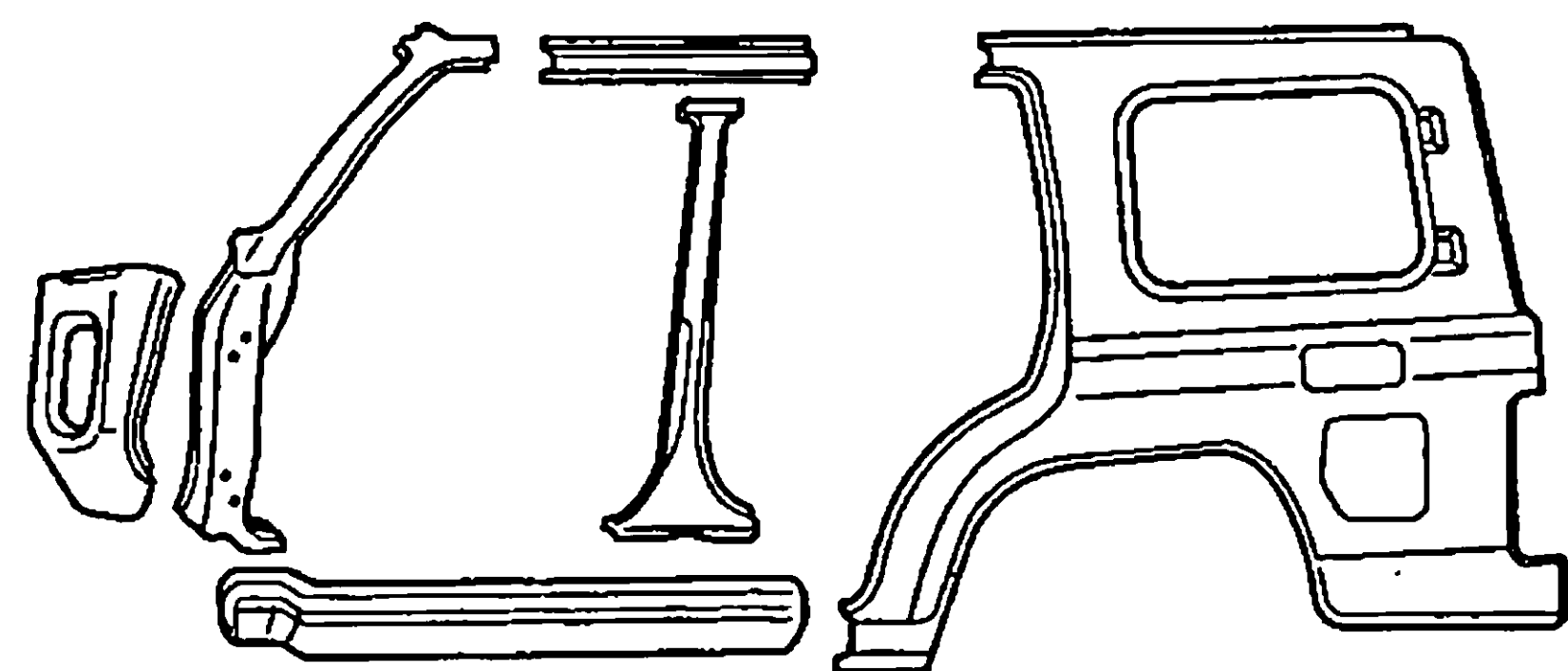
 : Reinforcements

**BO**

- The side member panel has been integrated in order to realize excellent panel precision and joining rigidity.



New

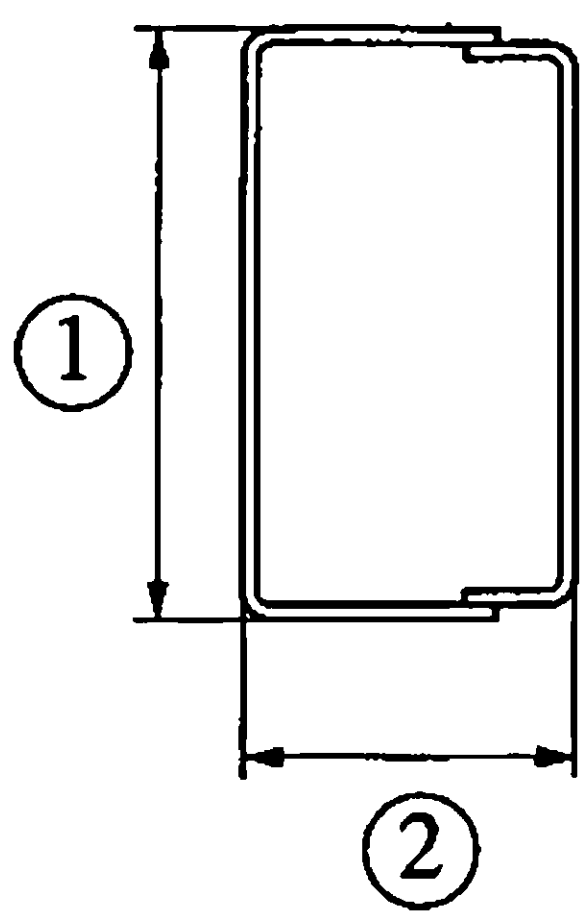
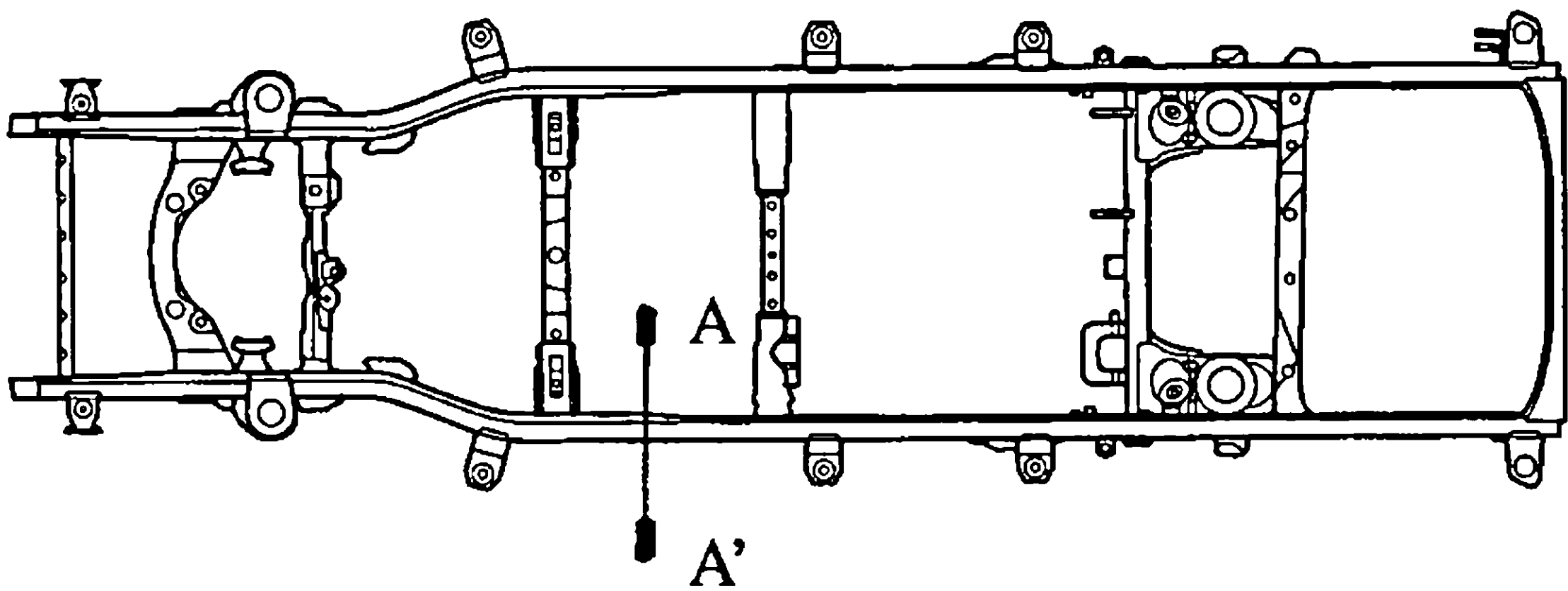


Previous

■FRAME

The frame is basically the same ladder type used in the previous model. The shape of the various areas of the frame has been modified in order to realize excellent collision safety performance, good driving stability and riding comfort.

- The cross section area of the frame side rail has been enlarged in order to realize excellent frame’s rigidity and joining rigidity of the suspension system. As a result, the vehicle’s driving stability and riding comfort has been improved.

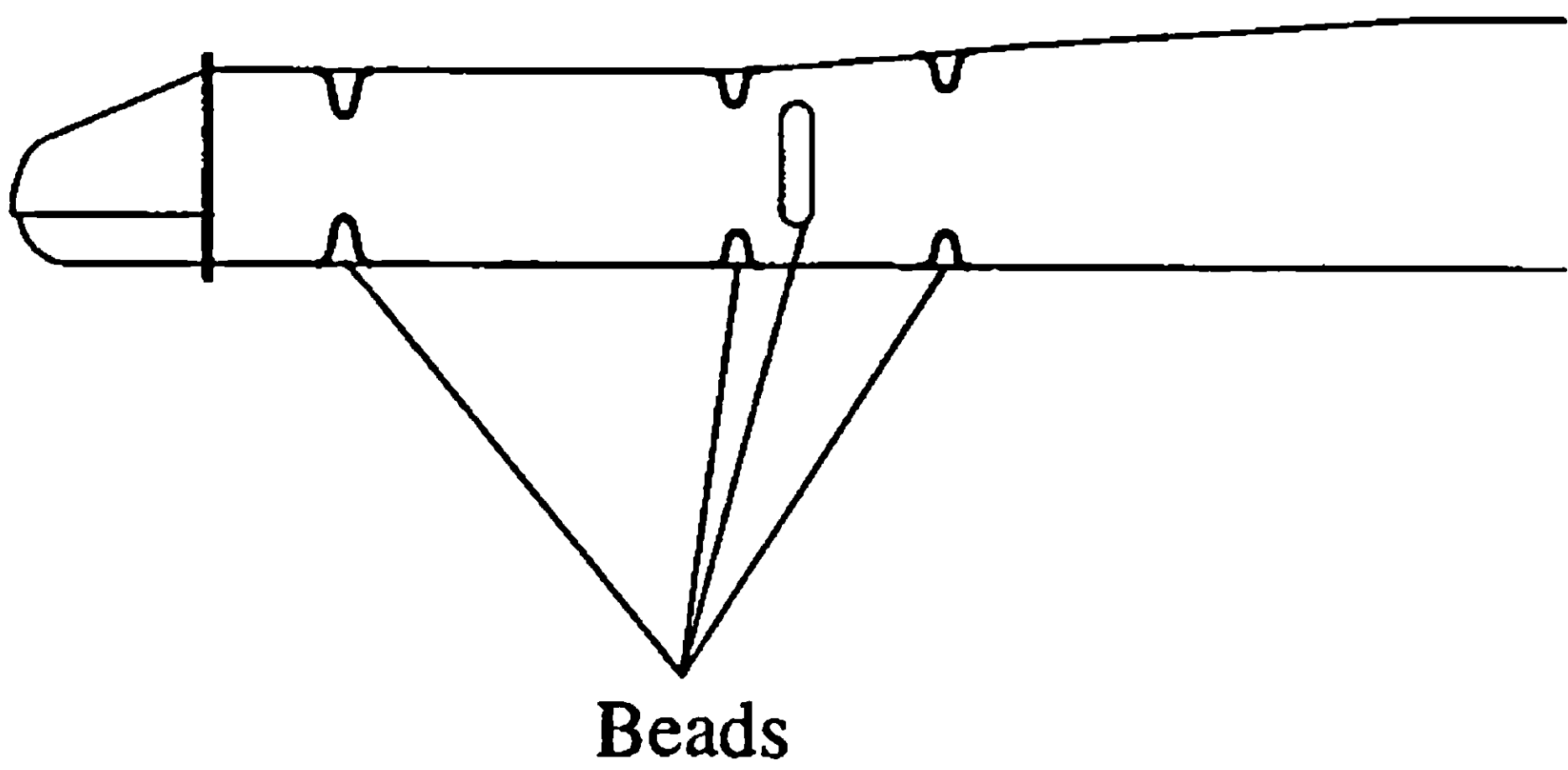


A – A’ Cross Section

► Size of Cross Section ◀

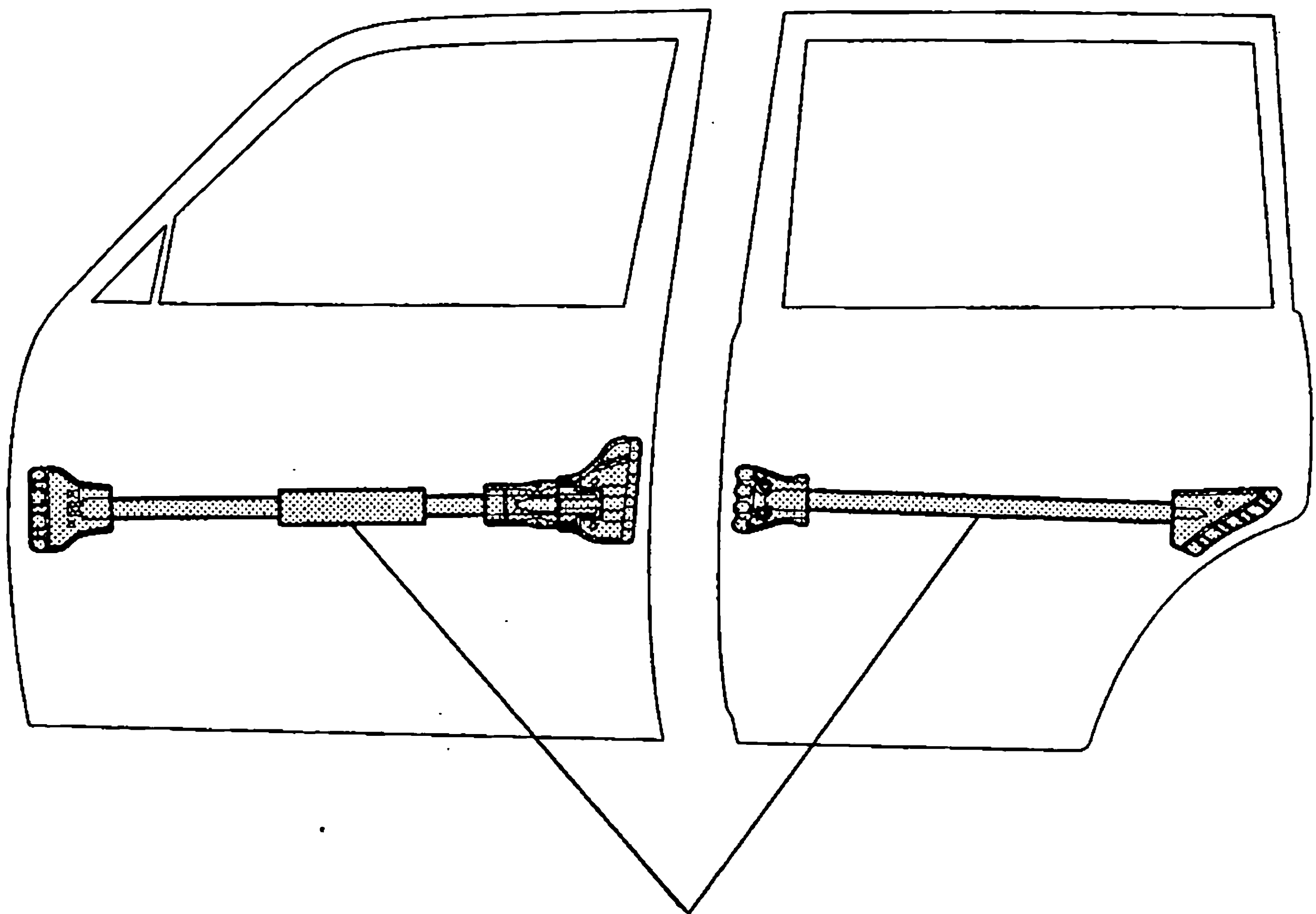
Model		New	Previous
Item			
①	Height mm (in.)	140 (5.5)	145 (5.7)
②	Width mm (in.)	80 (3.1)	55 (2.2)

- Beads have been provided in the front portion of the frame as means to effectively absorb the impact energy that is transmitted to the cabin in the event of a frontal collision.



■ DOORS

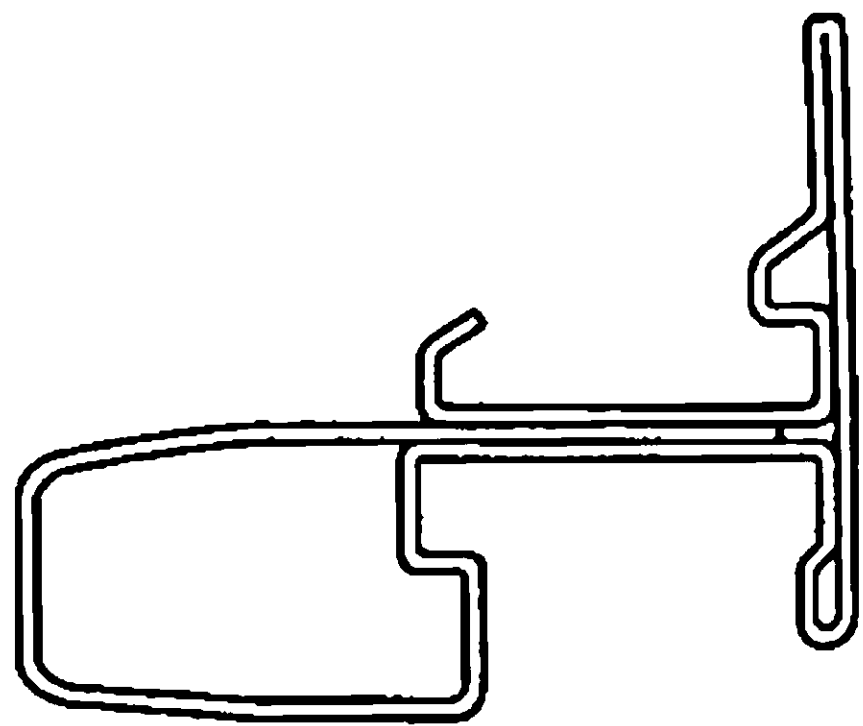
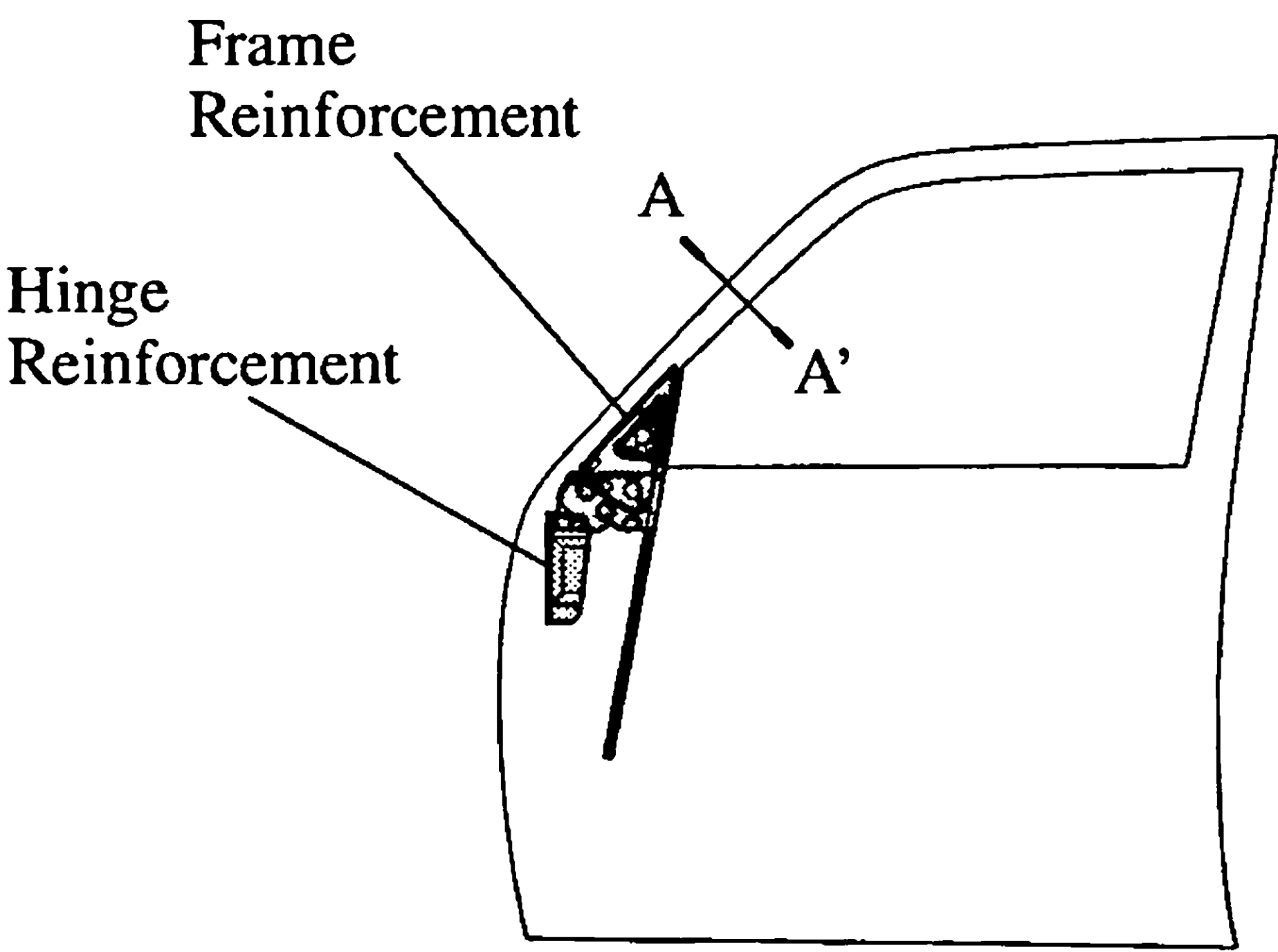
- Pipe type side protection beams are mounted in the center space between the door panels.



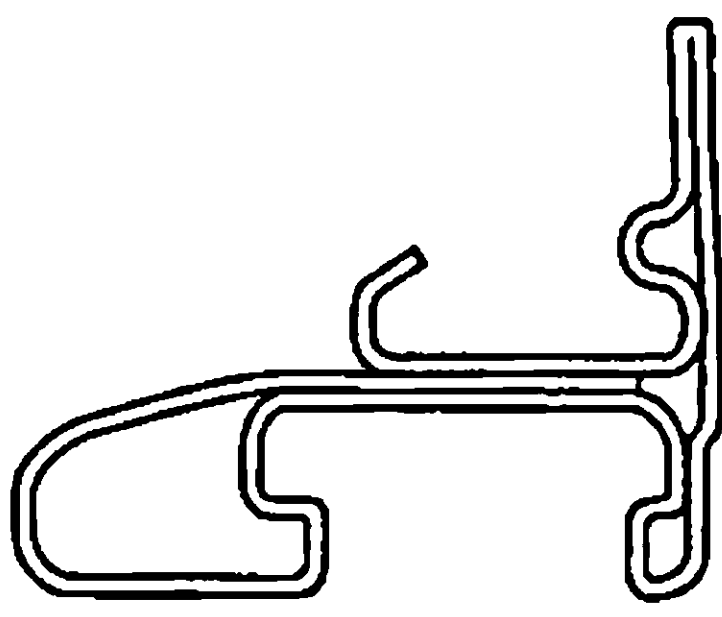
Side Protection Beams

- The cross section of the door frame is made larger, and hinge reinforcements are provided. Thus, the excellent door frame rigidity has been realized.

BO



New



Previous

A – A' Cross Section

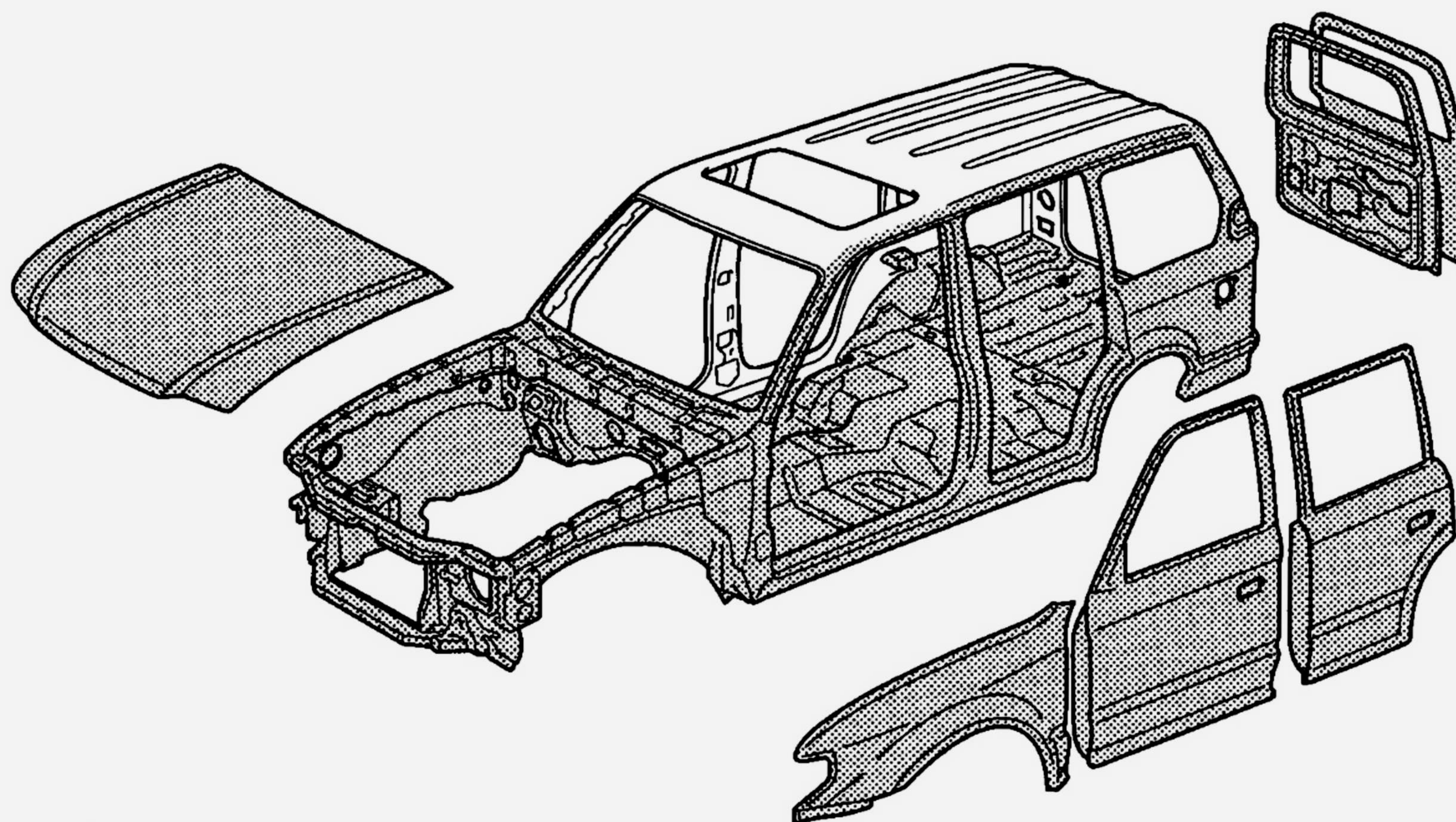
RUST-RESISTANT BODY

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

■ ANTI-CORROSION SHEET STEEL

Anti-corrosion sheet steel is used for many inner and outer panels of the body shell such as the dash panel, floor panels, hood and doors, etc. in order to further improve rust-resistant performance.

 : Anti-Corrosion Sheet Steel



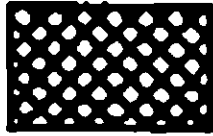
5-Door Model

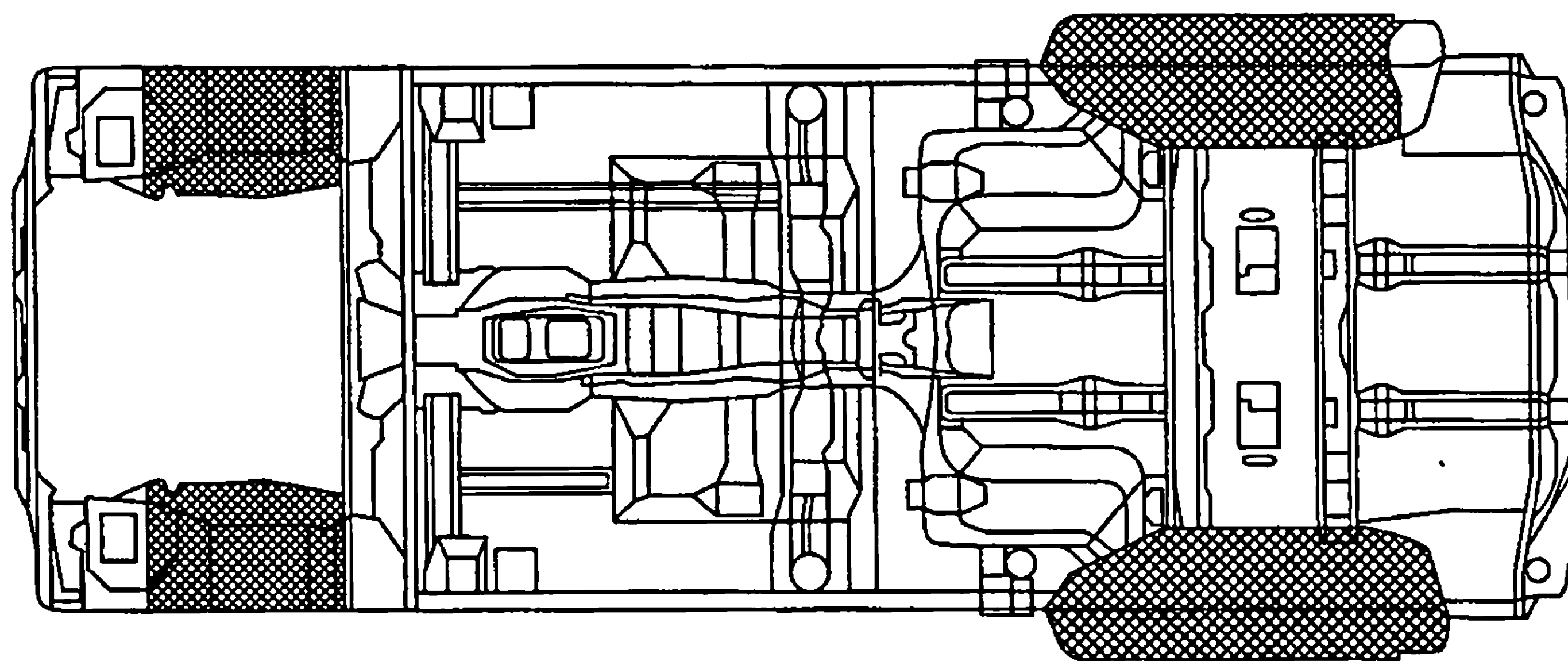
■ WAX AND SEALER

Wax and sealer are applied to the hemmed portions of the hood, door panels, hinge and etc. to improve rust-resistant performance.

■ UNDER COAT

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

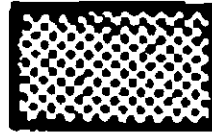
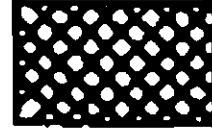
 : PVC Coating Area

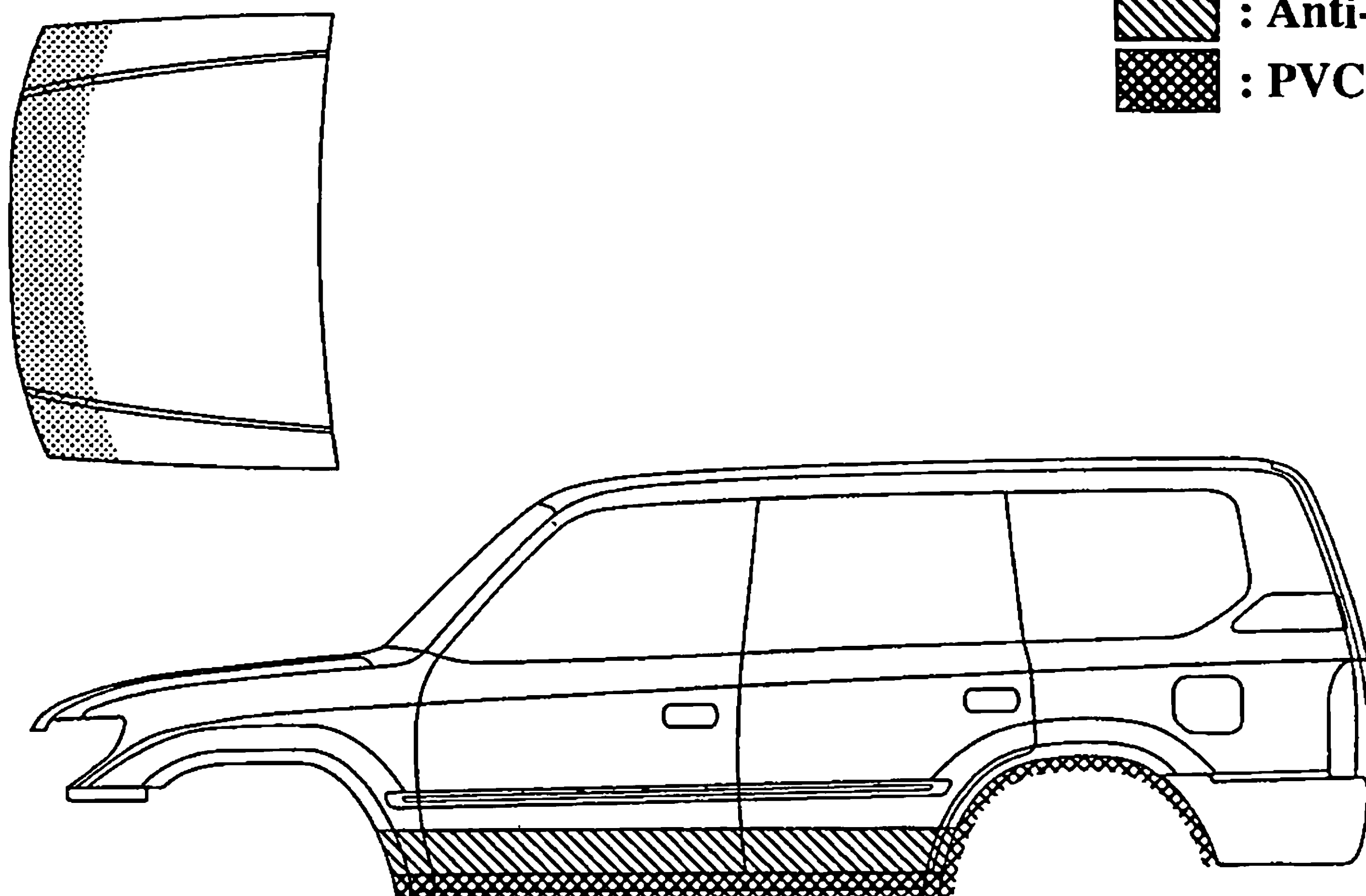


■ ANTI-CHIPPING APPLICATION

PVC chipping primer is applied around the wheel housing of all models. In addition, PVC chipping primer is applied to the rocker panel area of the outside molding and/or side stepless model. Furthermore, on models for Europe, soft-chip primer is applied to the front end of the hood, and anti-chipping paint is applied to the lower door panel area of the outside molding and/or side stepless model.

BO

 : Soft-Chip Primer
 : Anti-Chipping Paint
 : PVC Chipping Primer



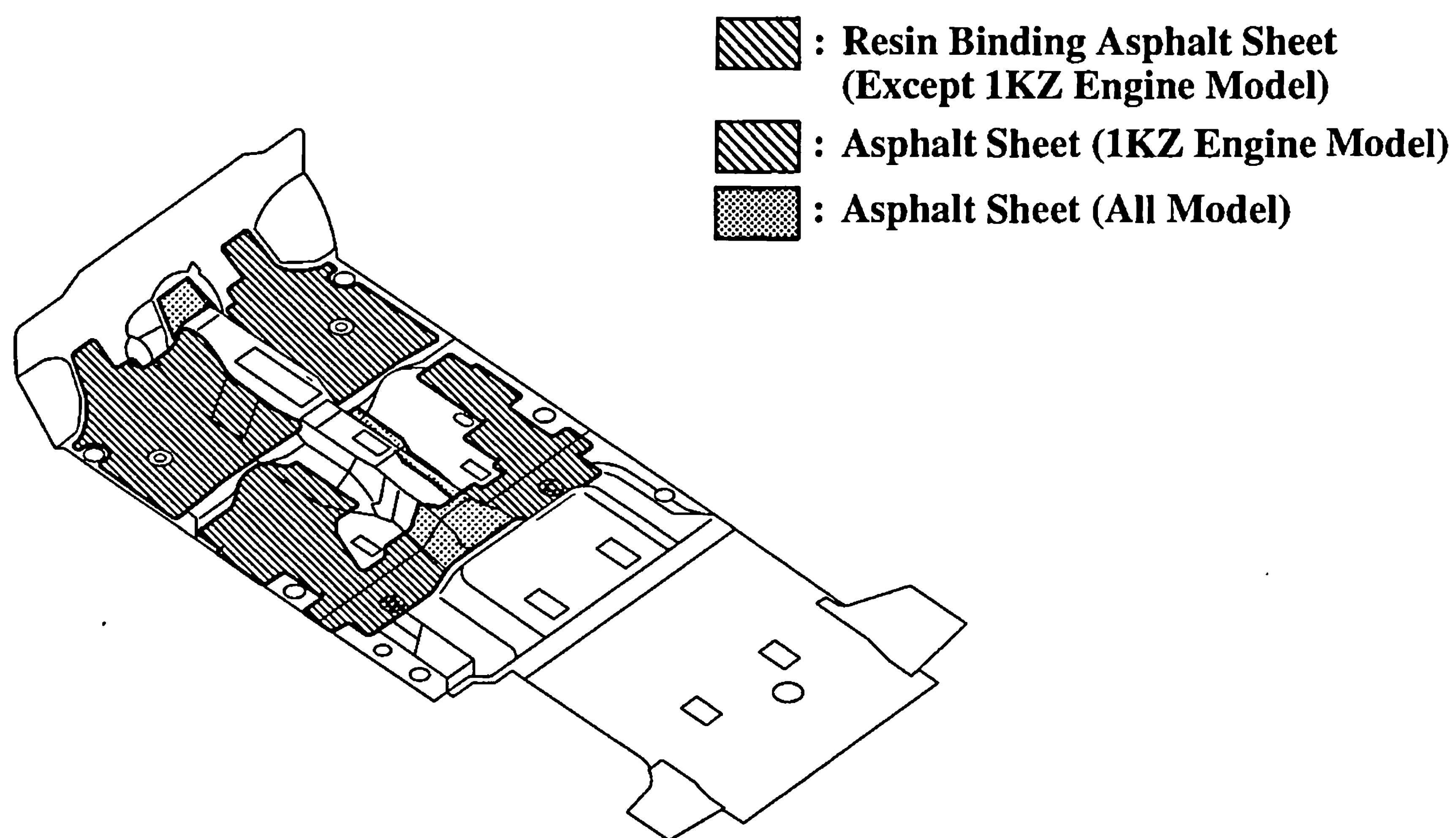
5-Door Model

LOW VIBRATION, LOW NOISE BODY

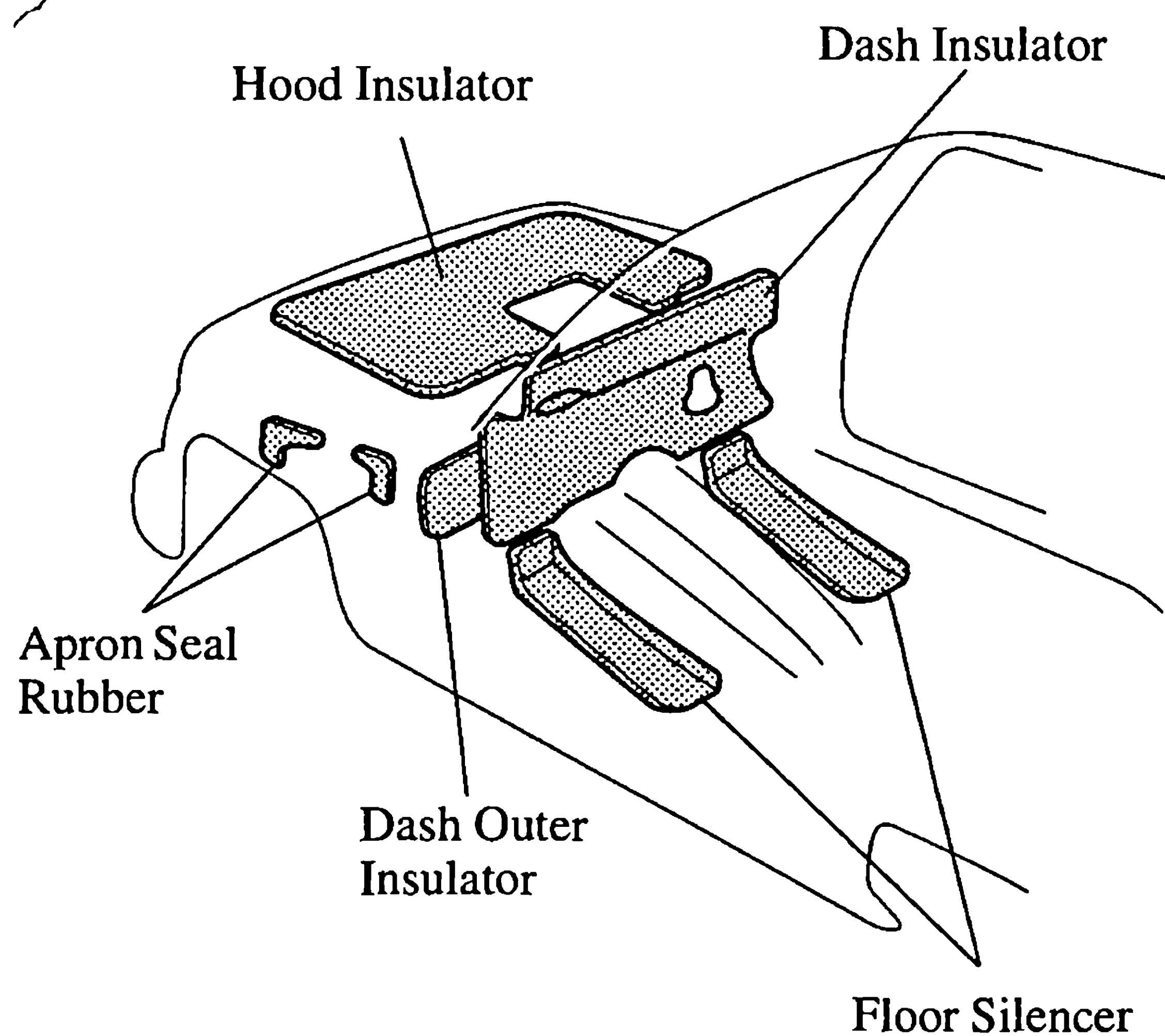
An effective application of vibration damping and noise suppressant materials reduces engine and road noise.

■ SOUND ABSORBING AND VIBRATION DAMPING MATERIALS

- Resin binding asphalt sheets and asphalt sheets are optimally allocated to reduce engine and road noise for quieter vehicle operation.

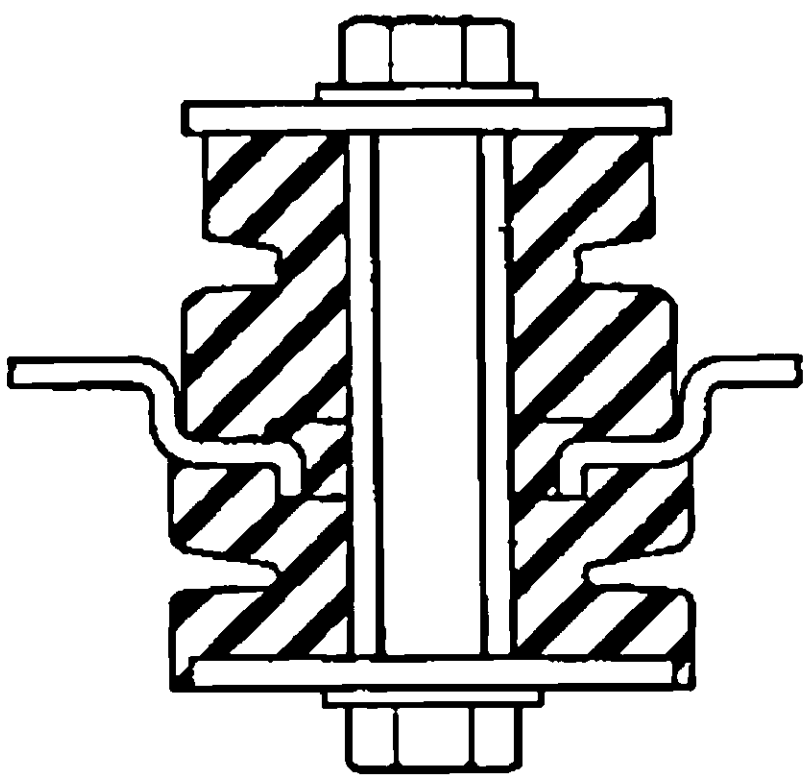
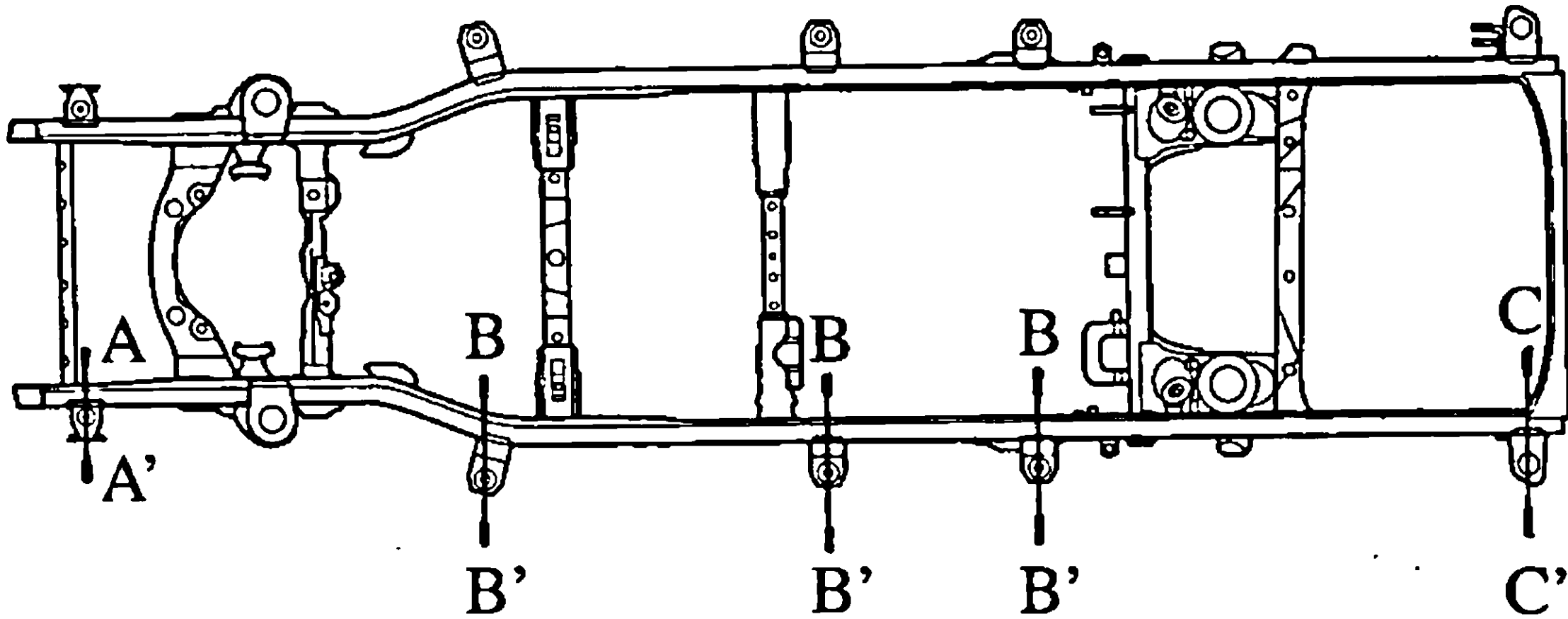


- The hood insulator, dash insulator, and dash outer insulator are provided on all models, thus reducing the engine and road noise during driving. Furthermore, the model for Europe is additionally equipped with the apron seal rubber and the floor silencer.



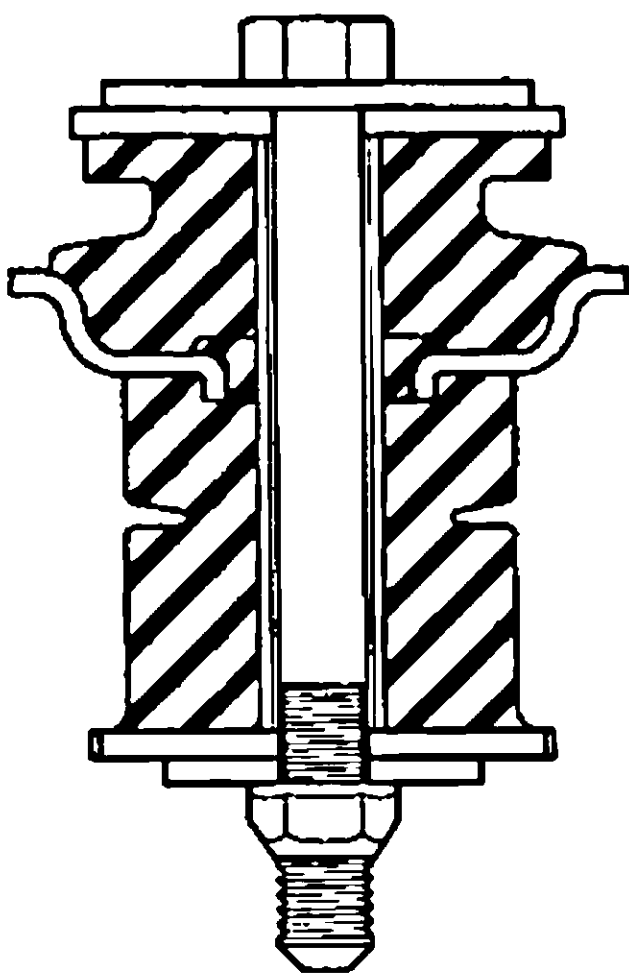
BODY MOUNTING

The spring properties of the rubber cushion of each of the body mounts have been optimized in order to improve the vehicle’s riding comfort and to reduce noise and vibration.



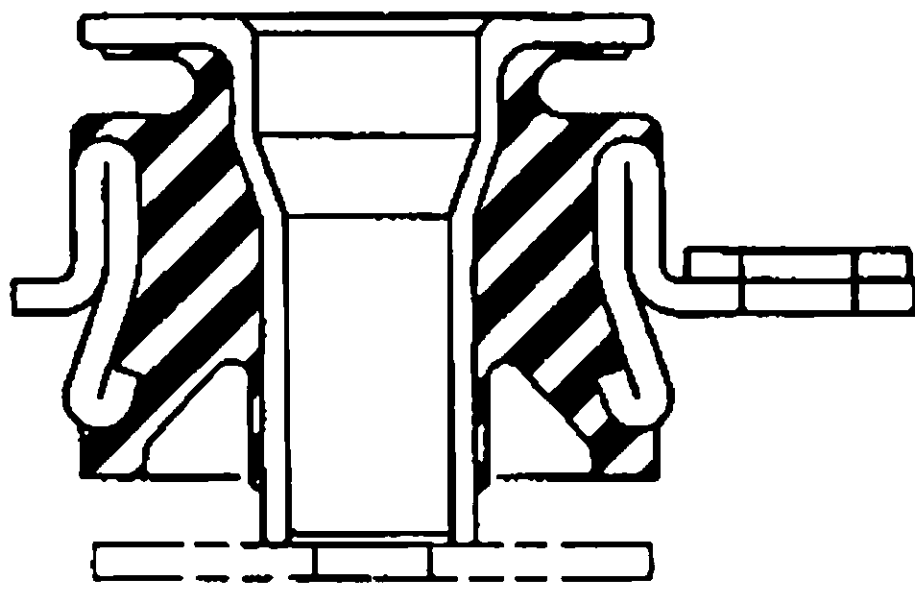
A – A' Cross Section

No.1 Mounting



B – B' Cross Section

No.2, 3 and 4 Mountings



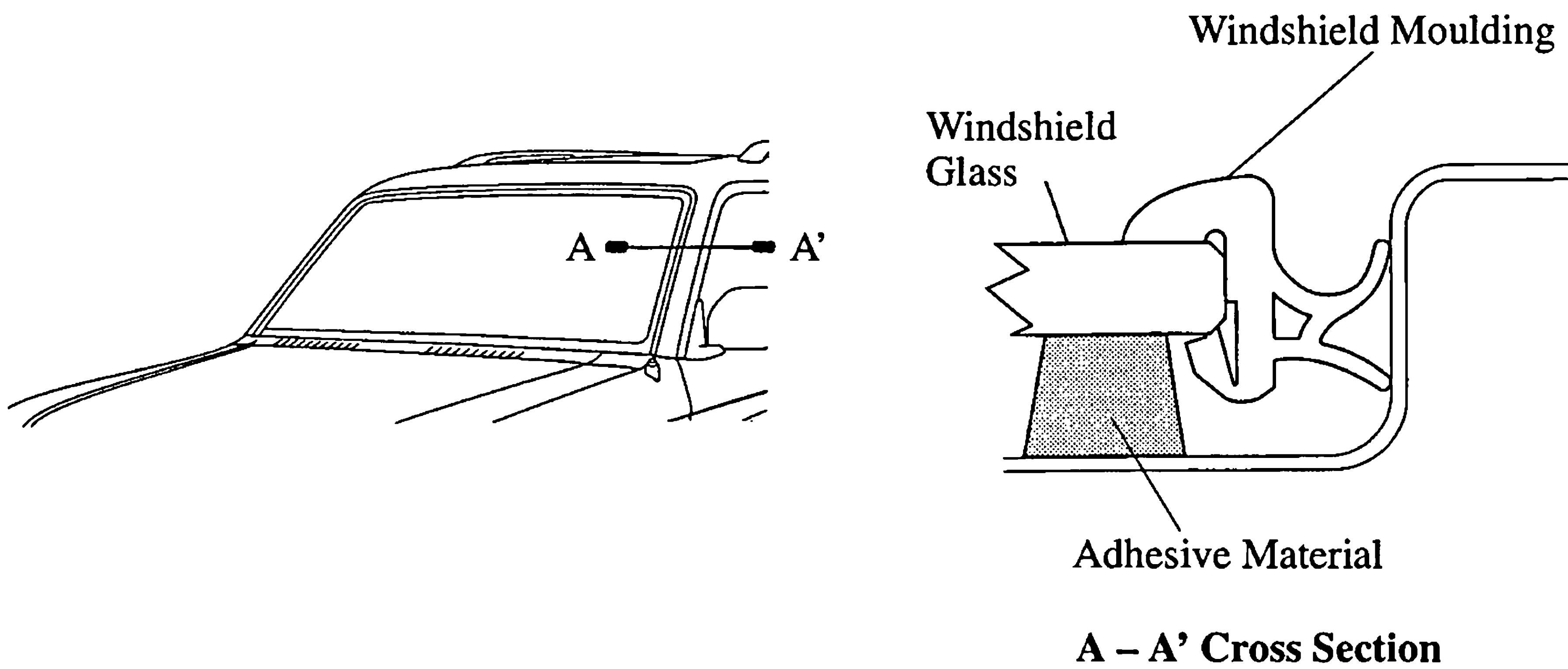
C – C' Cross Section

Rear Mounting

ENHANCEMENT OF PRODUCT APPEAL

■ WINDSHIELD MOULDING

The method used for fitting the windshield glass is the adhesive fixed type. This results in a decreased level difference between the glass and the body and in an improved appearance.



SEAT BELT PRETENSIONER

■ DESCRIPTION

A mechanical sensing type seat belt pretensioner is incorporated with the front outside seat belt on the European and Australian models.

In a collision, the pretensioner sensor detects the shock and if the front-to-rear shock is greater than a specified value, the seat belt pretensioner is activated instantaneously to pull in a predetermined length of the seat belt.

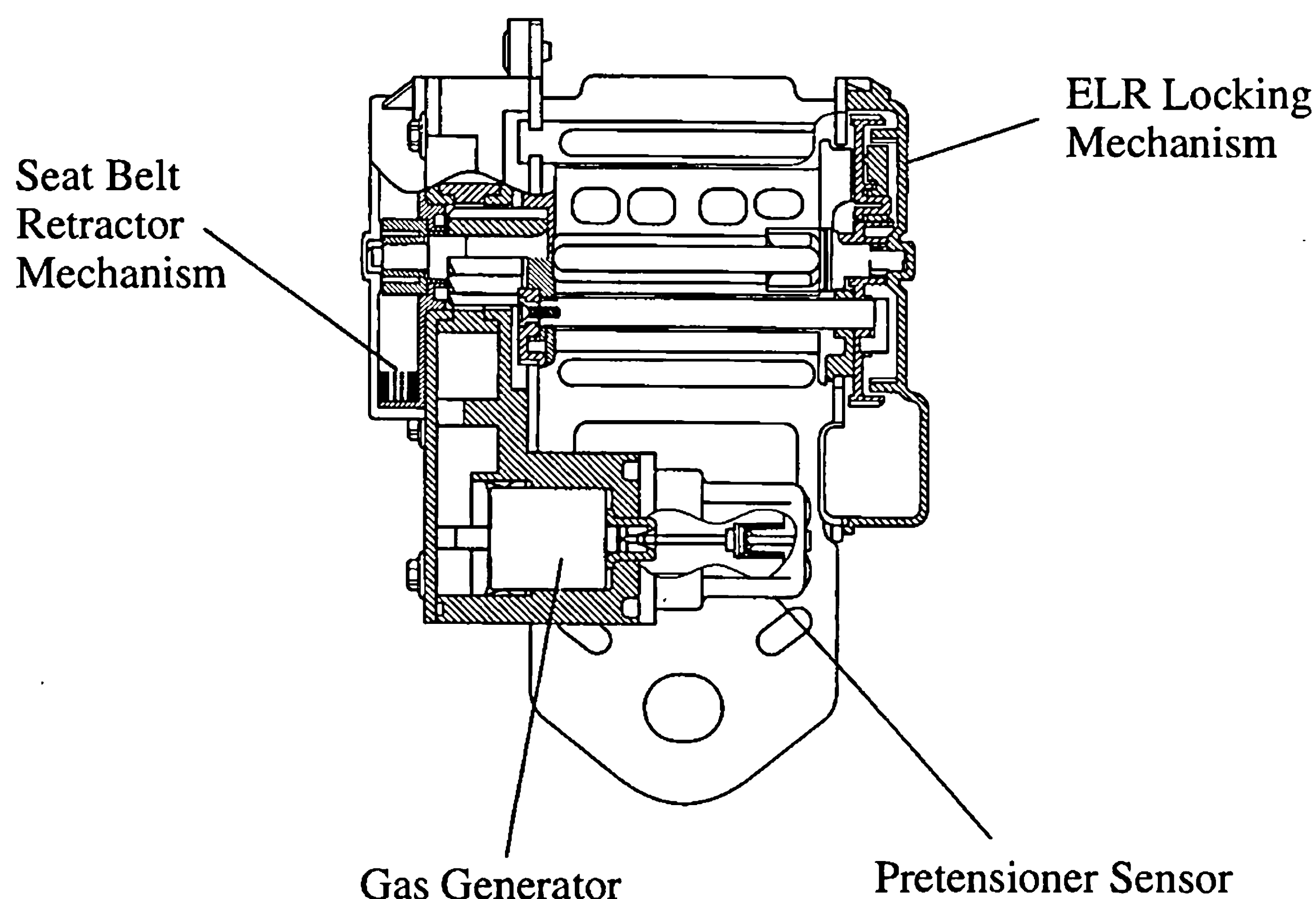
– REFERENCE –

The mechanical sensing type seat belt pretensioner is equipped with an independent pretensioner sensor. For this reason, depending on the circumstances of the collision, the seat belt pretensioner may not operate when the airbag is deployed, and vice versa. The same is applied between the right and left seat belt pretensioners.

■ CONSTRUCTION AND OPERATION

1. General

The seat belt retractor with pretensioner consists of the pretensioner mechanism, retractor mechanism, and ELR locking mechanism. The pretensioner mechanism consists of a pretensioner sensor, gas generator, rotor, gear clutch, key clutch, etc.. When the pretensioner is activated, the key clutch engages the rotor to the gear clutch. Since the rotor and gear clutch are not normally engaged, the gear clutch and the shaft can rotate freely, thus permitting normal seat belt operation.

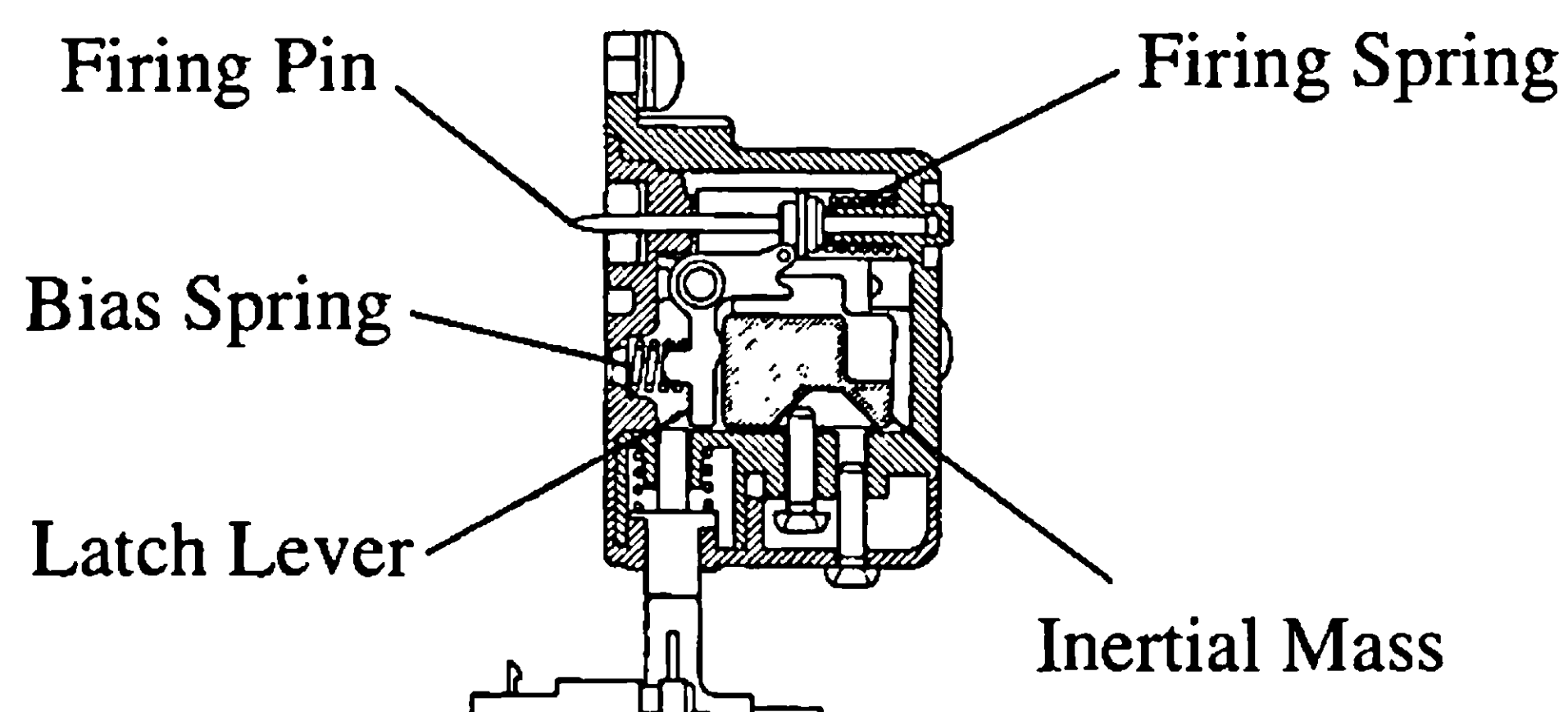


2. Pretensioner Sensor

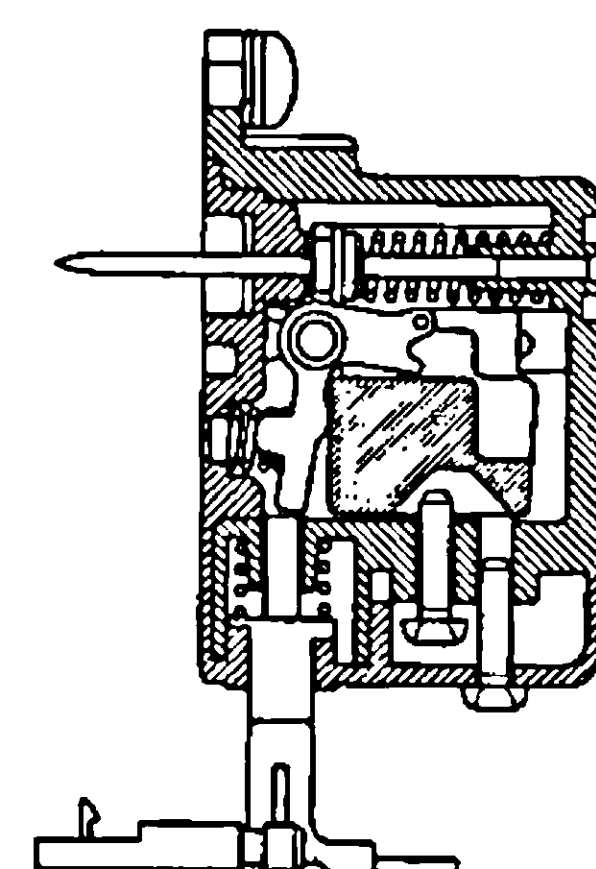
The pretensioner sensor consists of an inertial mass, latch lever, sub-lever, firing pin, firing spring, etc. The latch lever, sub-lever and firing pin are normally engaged with each other so that the firing pin is not ejected. In addition, any unnecessary inertial mass movement is suppressed by the bias spring force so that the seat belt pretensioner is not activated by mistake.

If a severe frontal collision occurs, the vehicle decelerates instantaneously. The inertial mass begins to move despite the bias spring force. If rapid deceleration continues, the spring force of the firing spring disengages the firing pin from the latch lever, ejects the firing pin, and ignites the primer. The flame spreads instantaneously to the gas generator, and a large amount of gas is generated from the gas generator.

▷ Non-Deployed State ◁

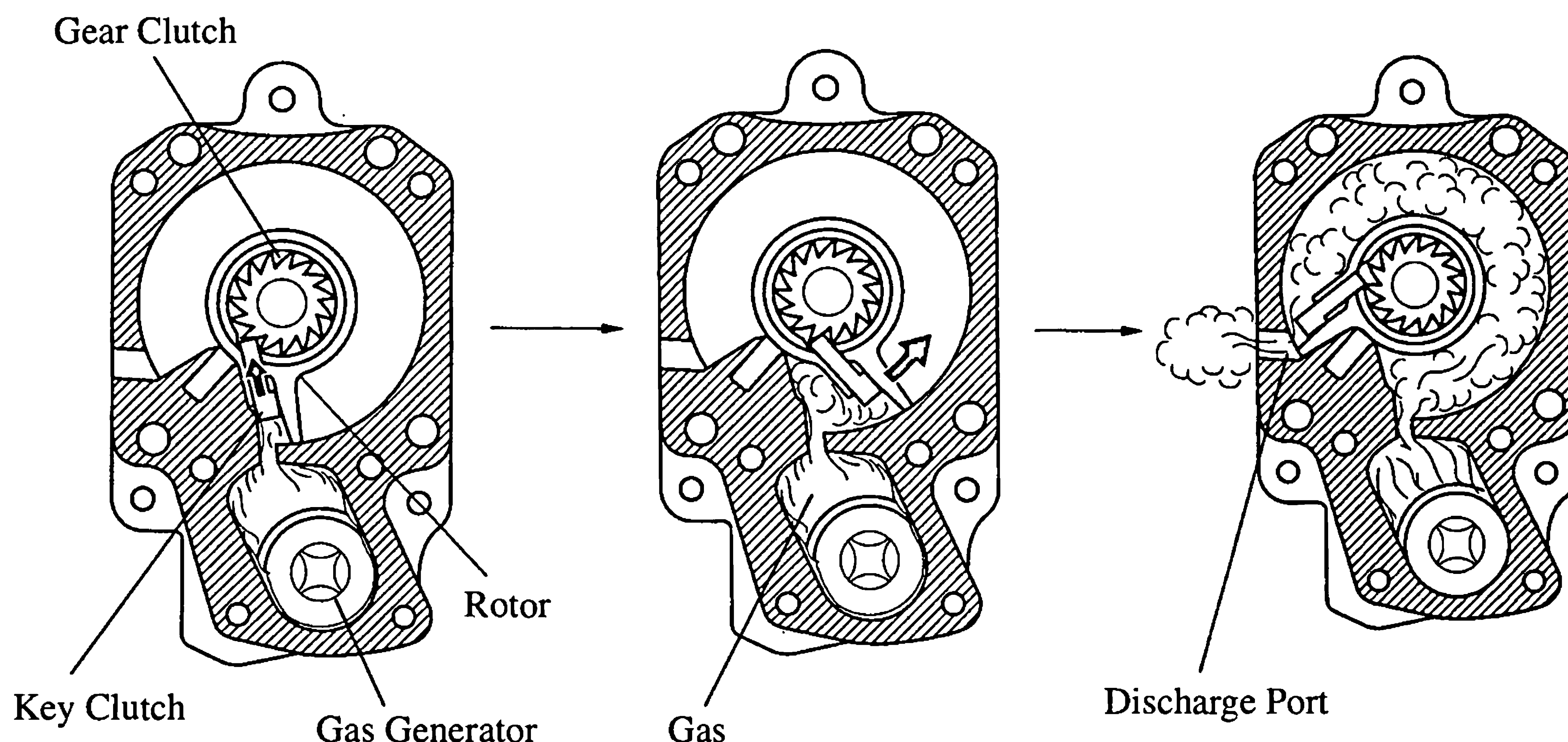


▷ Deployed State ◁



3. Pretensioner Mechanism

The large amount of gas generated by the gas generator flows from the accumulator in the housing to the cylinder. The pressure of the gas introduced into the cylinder pushes the key clutch, which in turn meshes with the teeth of the gear clutch, and causes the rotor and gear clutch to engage. After the internal pressure of the cylinder increases further, the rotor and the gear clutch rotate together. Accordingly, the shaft that is meshed to the teeth of the gear clutch also rotates. According to the rotation of the rotor, the shaft rotates approximately a full turn in the wind-up direction of the seat belt and pulls in a predetermined length of the belt to restrain the occupant. After the rotation of the rotor has been completed, the gas that caused the rotation is discharged from the discharge port, and the internal pressure in the cylinder decreases. After the internal pressure in the cylinder decreases, the key clutch that was engaged with the teeth of the gear clutch disengages. As a result, the shaft can rotate freely, and the seat belt resumes its normal operation.

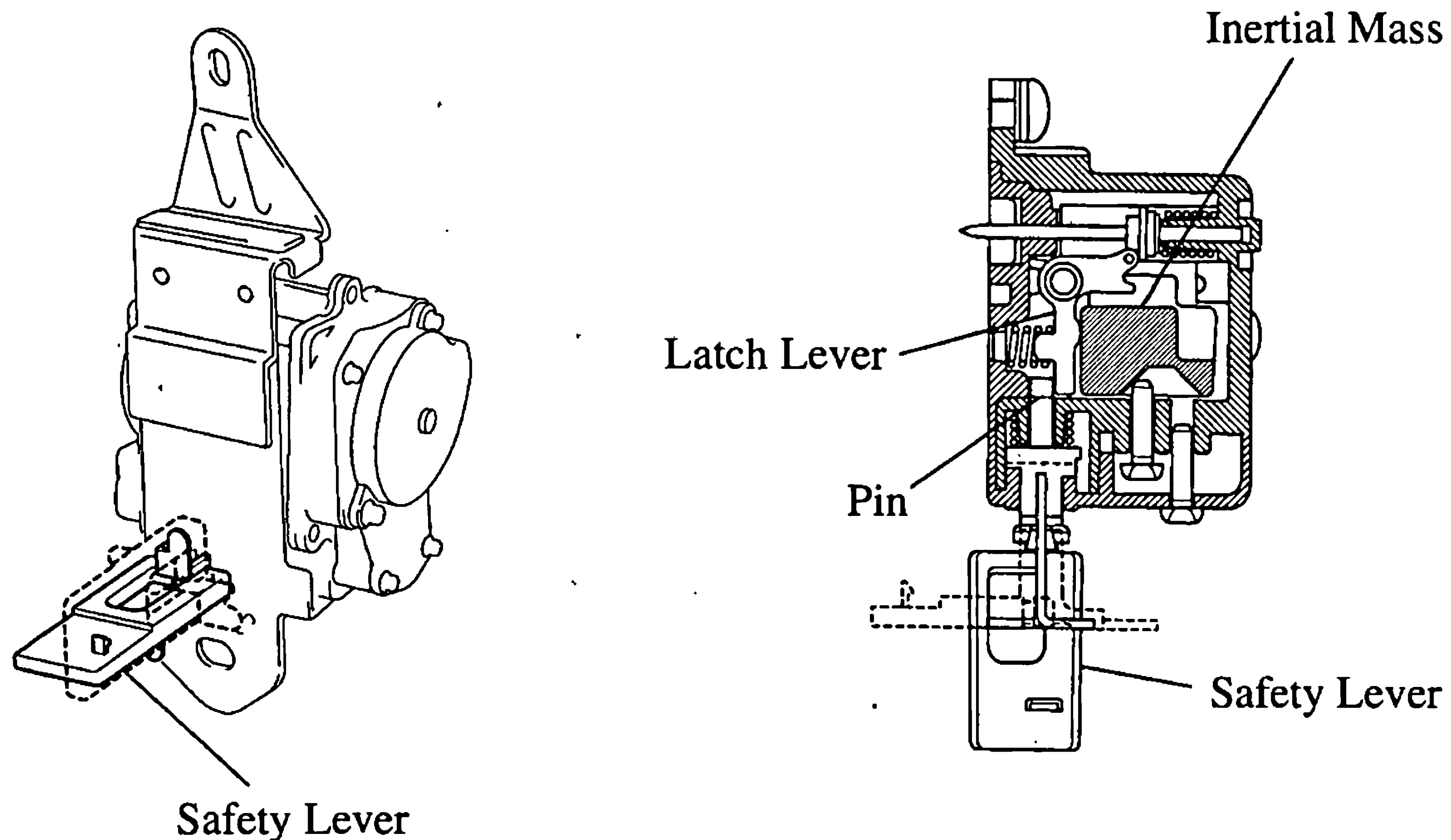


4. Safety Device

In order to prevent unintended deployment when removing the seat belt or when handling the seat belt pretensioner by itself, the seat belt pretensioner is equipped with a safety device that stops the operation of the sensor.

To activate the safety device, the safety lever illustrated below must be pushed, which causes the safety lever to turn 90° clockwise. Accordingly, the pin that is attached to the tip of the safety lever moves to the position to restrain the movement of the latch lever. Therefore, even if a large deceleration is applied to the inertial mass, the latch lever will not move and the pretensioner sensor will not activate.

► Safety Device Activation ◀



BODY ELECTRICAL

LIGHTING

■ DESCRIPTION

The Land Cruiser/Land Cruiser Prado has the following items:

System	Outline
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. The basic construction and operation are the same as in the previous model.
Headlight Beam Level Control System	This system keeps the beam of the headlights adjusted to the appropriate level in accordance with the number (weight) of passengers and volume of luggage. The headlight beam level can be adjusted in 5 steps by operating the headlight beam level control switch. The basic construction and operation are the same as in the previous model.
Rear Fog Light	In bad weather, such as in rain or fog, the rear fog light makes the car highly visible to other vehicles that are driven behind. The basic construction is the same as in the previous model. However, the operating condition of the rear fog light has been modified to prevent it from being unintentionally left on. For details, see the next page.
Light Reminder System	When the ignition key is turned from ON or ACC to LOCK position while the driver's door is open with the taillights or headlights turned on, this system warns the driver that the lights remain on by sounding the buzzer. The basic construction and operation are the same as in the previous model.

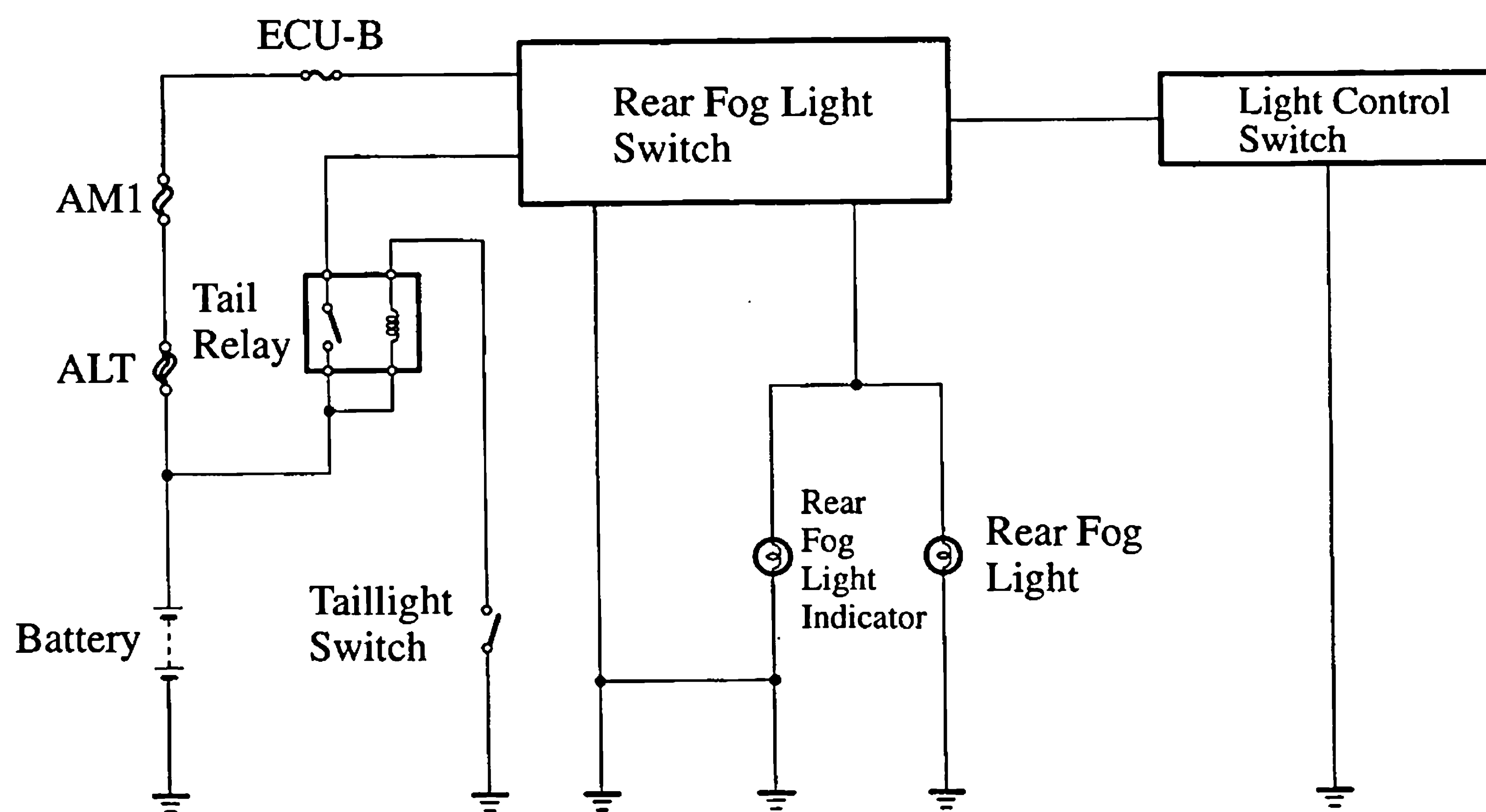
■ REAR FOG LIGHT

1. General

In bad weather, such as in the rain or fog, the rear fog light makes the car highly visible to other vehicles that are driven behind. The basic construction is the same as in the previous model.

However, the operating condition of the rear fog light has been modified to prevent it from being unintentionally left on.

2. Wiring Diagram

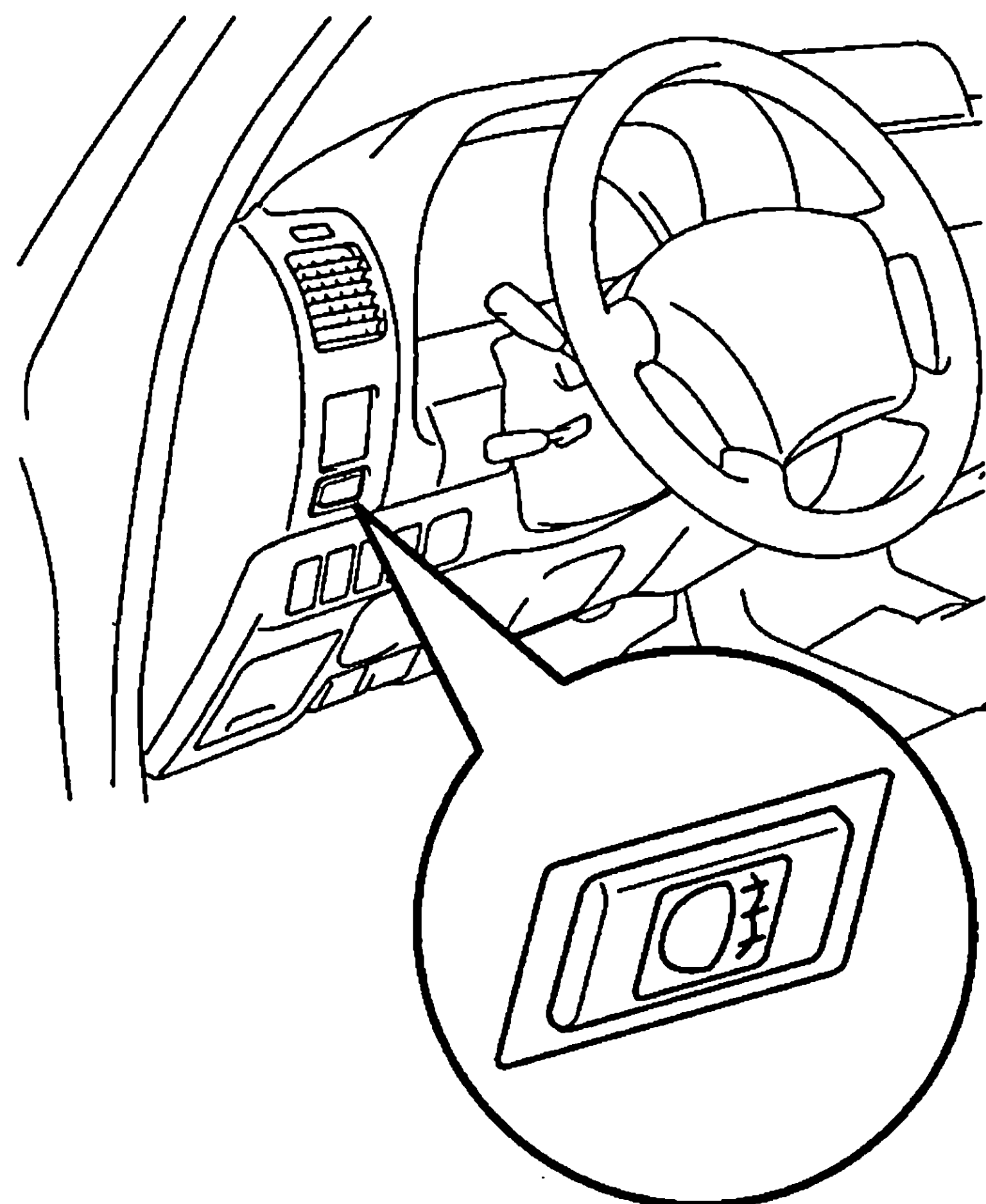


BE

3. Construction and Operation

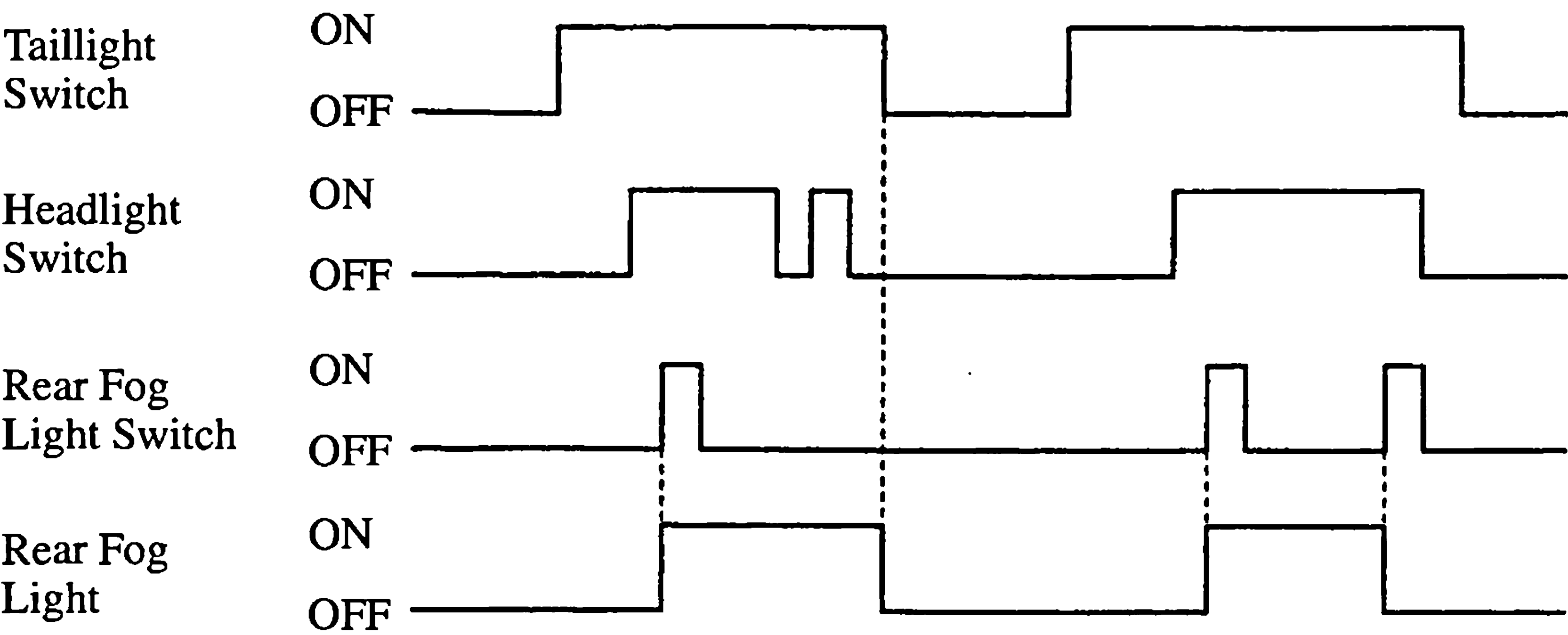
Rear Fog Light Switch

- The rear fog light switch is a momentary type switch. This switch turns on upon pressing and turns off upon pressing it again.
- When the taillight switch is turned off with the rear fog light switch on, the rear fog light switch is turned off also. The rear fog light switch remains off even when the headlight switch is turned on again.



System Operation

The rear fog light turns on when the rear fog light switch is pressed, providing that the tail lights and headlights are on. However, once the rear fog light is turned on, it will remain on even after the headlights are turned off. Once the rear fog light is turned off by turning the tail light switch off, the rear fog light will not turn back on unless the rear fog light switch is pressed again.

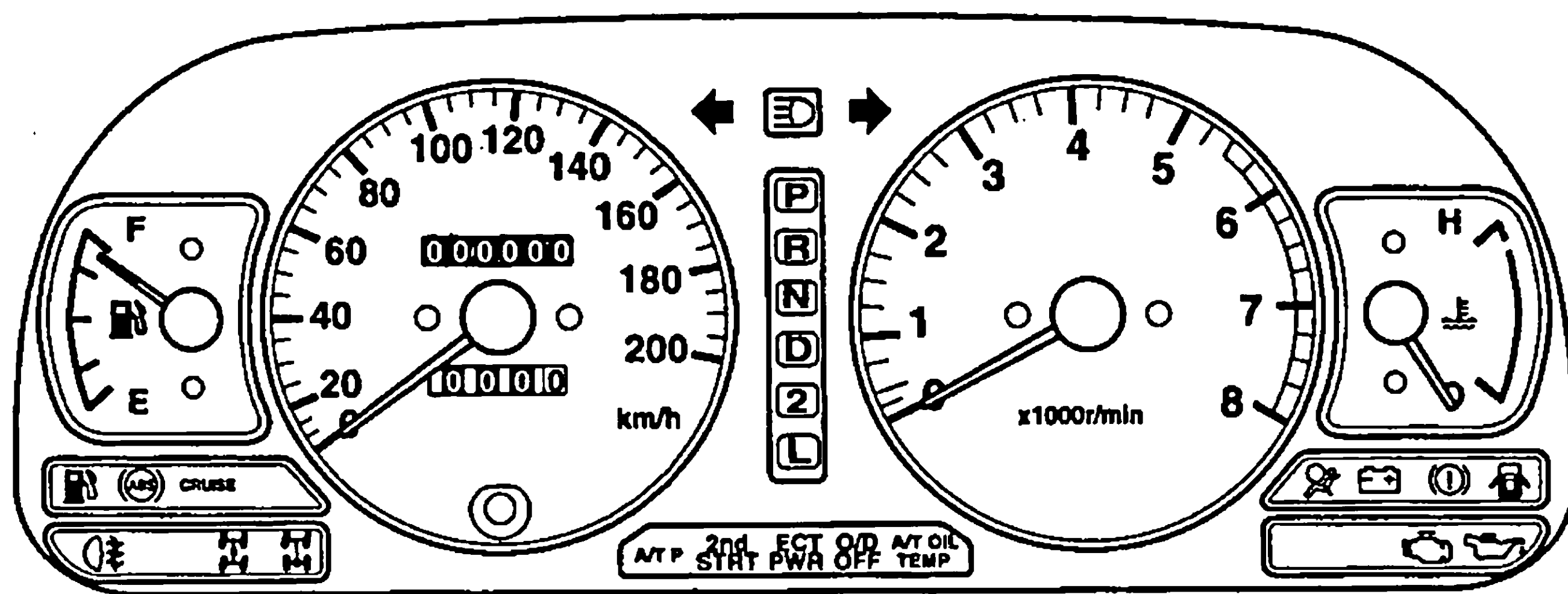


METER

■ COMBINATION METER

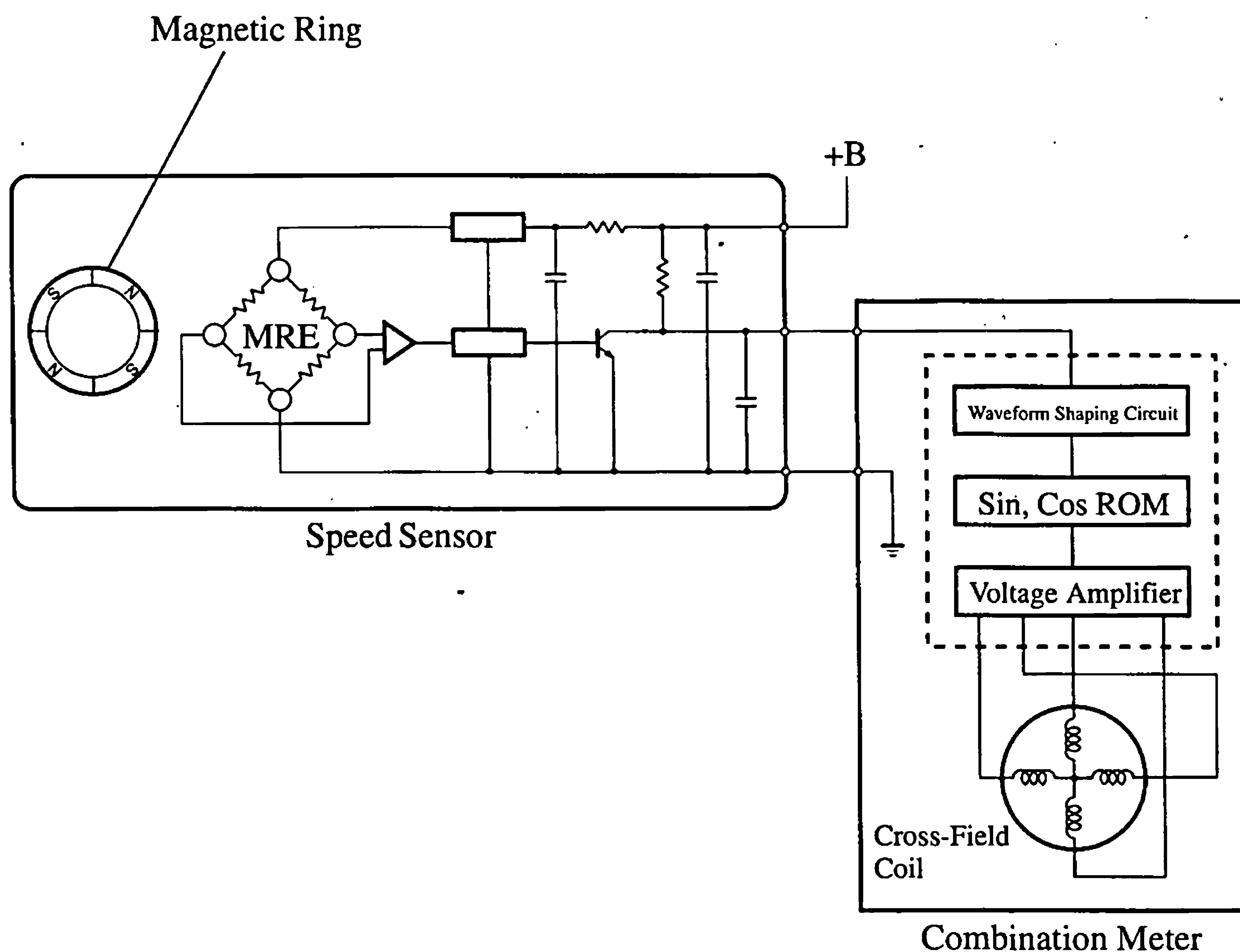
1. Description

- The combination meter is an analog meter with a round shape which is simple and has excellent visibility.
- An electrical analog meter is used in all models, eliminating the need for the speedometer cable.
- The warning and indicator lights are grouped at the bottom of the gauge for better visibility.



2. System Diagram

The driving circuit diagram for the speedometer is as follows.



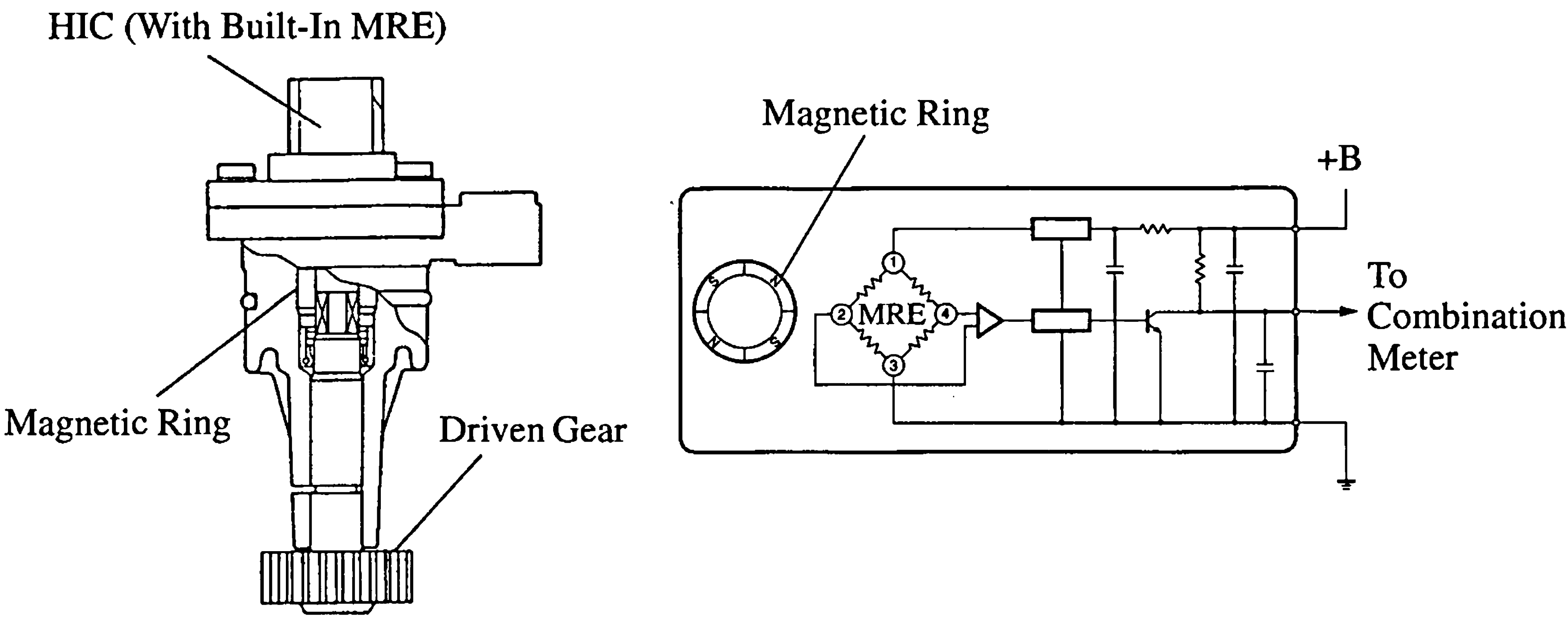
3. Construction and Operation

Speed Sensor

1) Construction

- Speed sensor is fitted to the transfer case.
- The speed sensor consists of an HIC (Hybrid Integrated Circuit) with a built-in MRE (Magnetic Resistance Element) and a magnetic ring. The magnetic ring has four poles (2 N and 2 S poles each).

► Wiring Diagram ◀



2) Operation

When the vehicle starts and the magnetic ring rotates, the MRE sends 4 cycles of alternating current to the comparator per each rotation of the magnetic ring. The comparator changes the AC to a digital wave which is then inverted by transistor before being sent to the combination meter.

Magnetic Ring Rotation	
MRE Output	
Comparator Output	
Speed Sensor Output	

– REFERENCE –

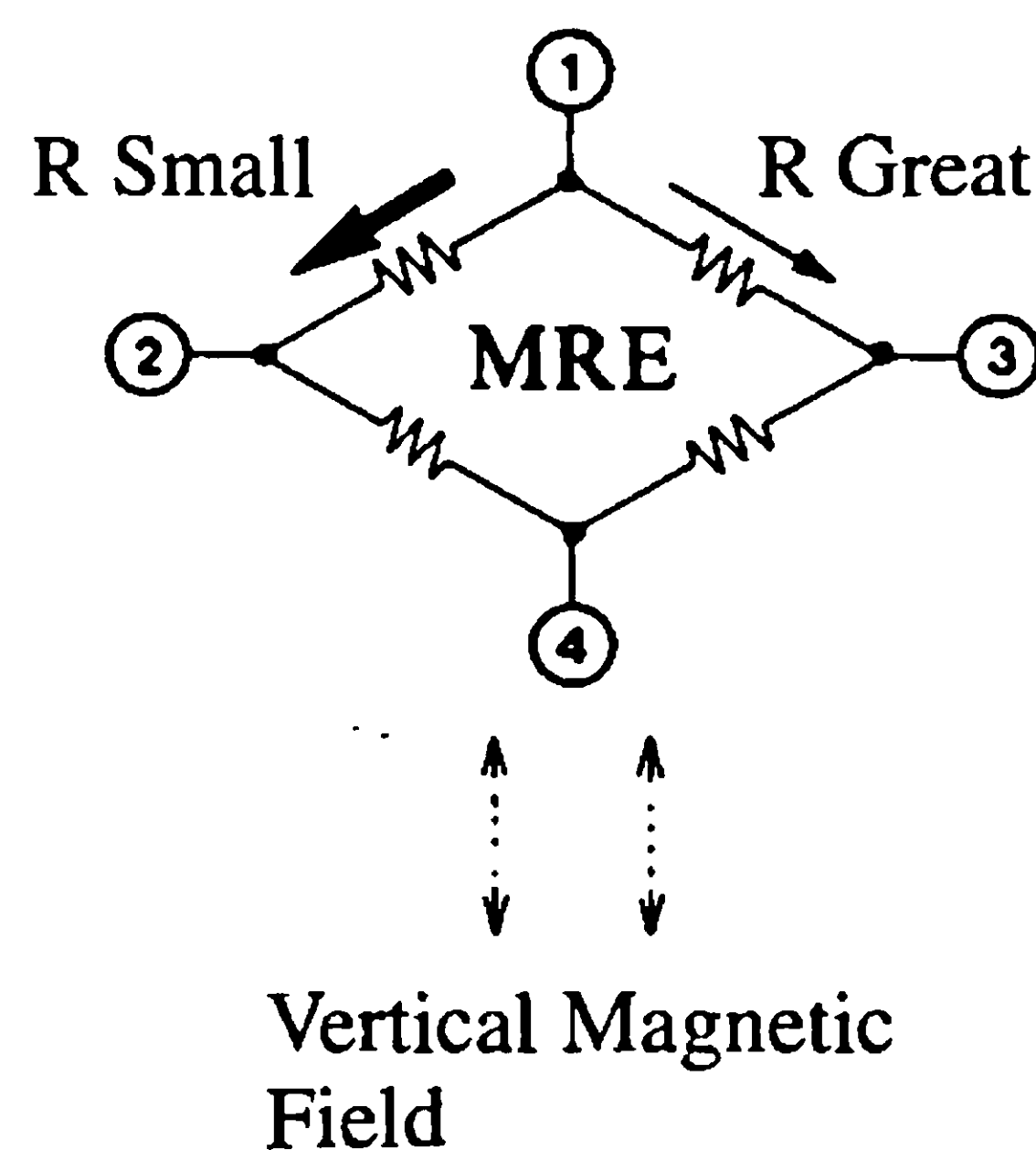
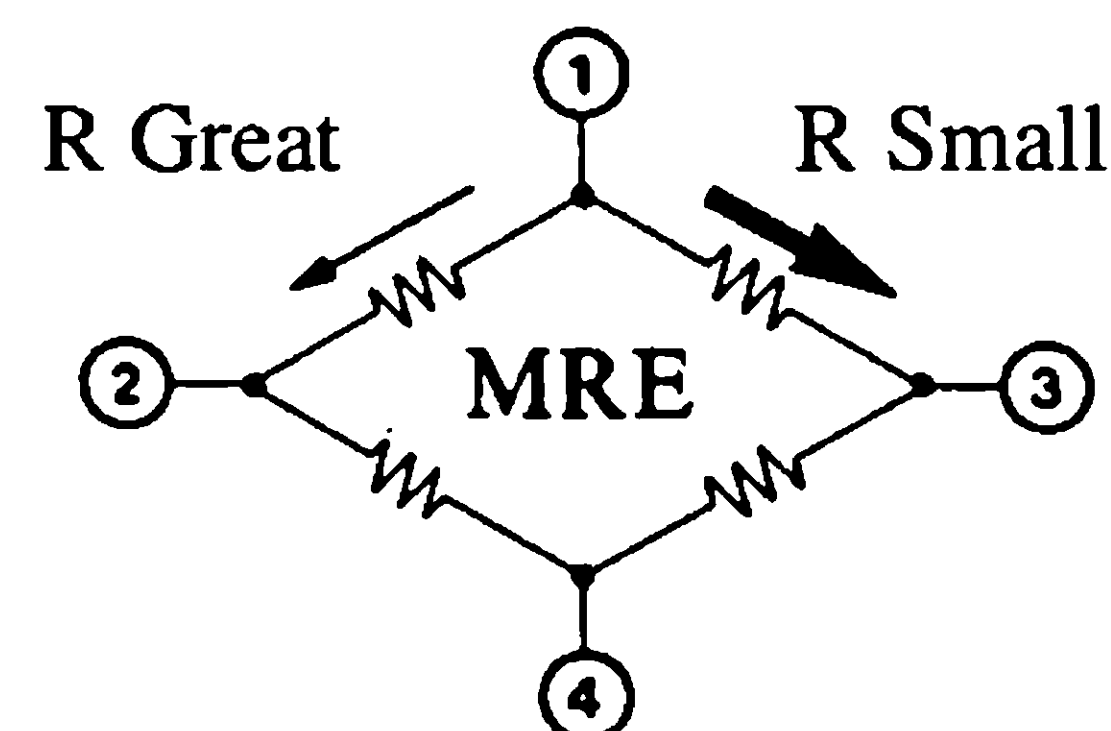
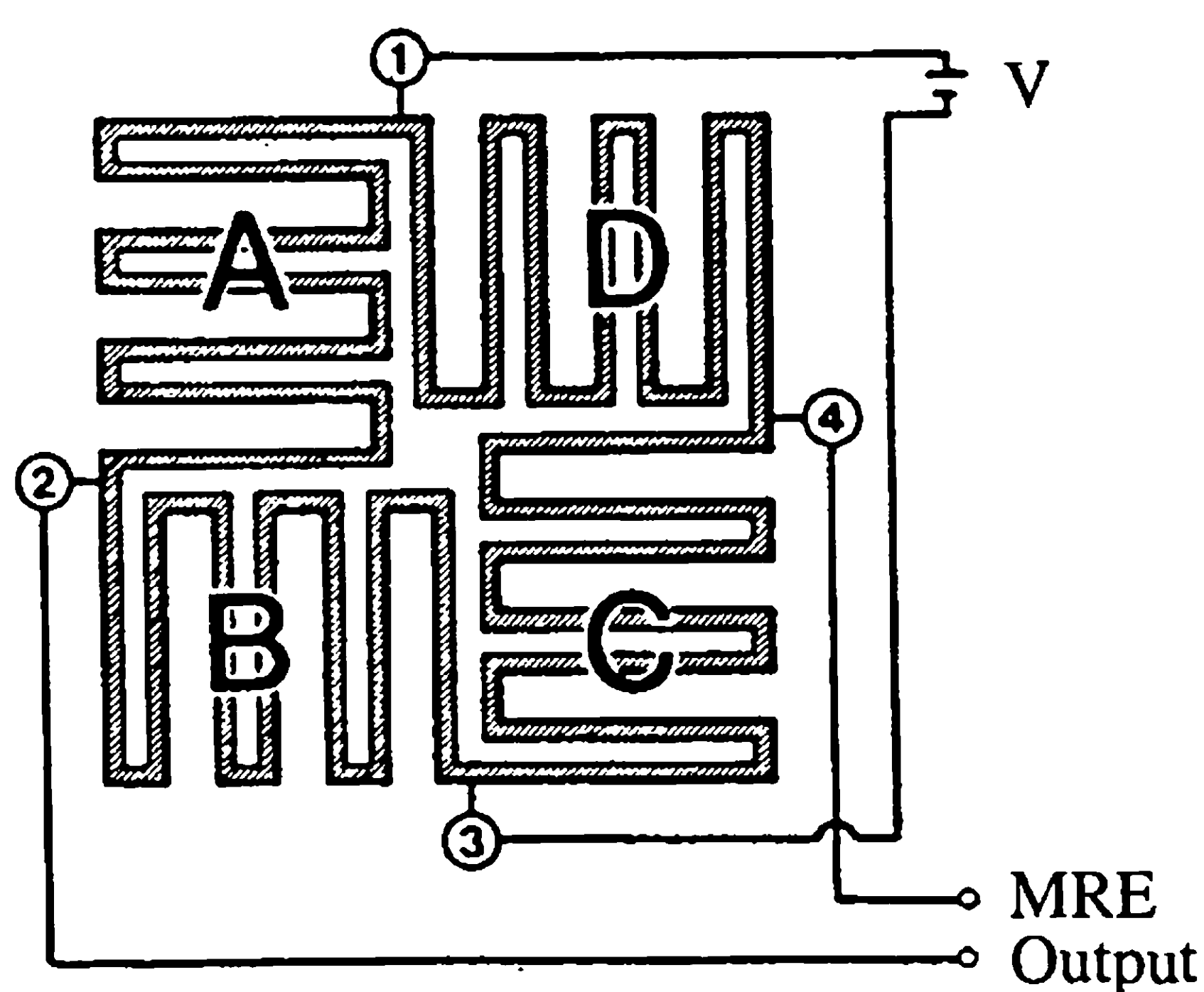
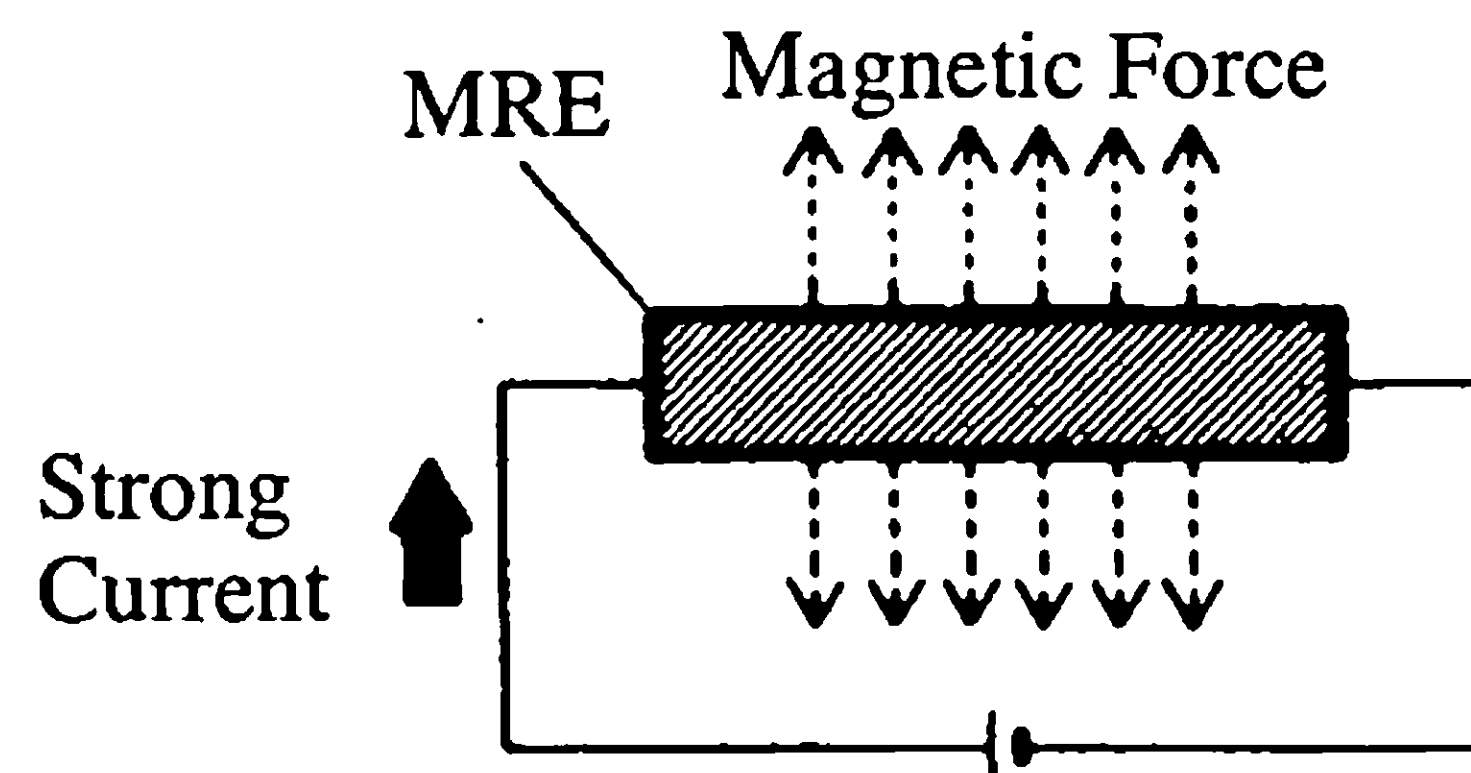
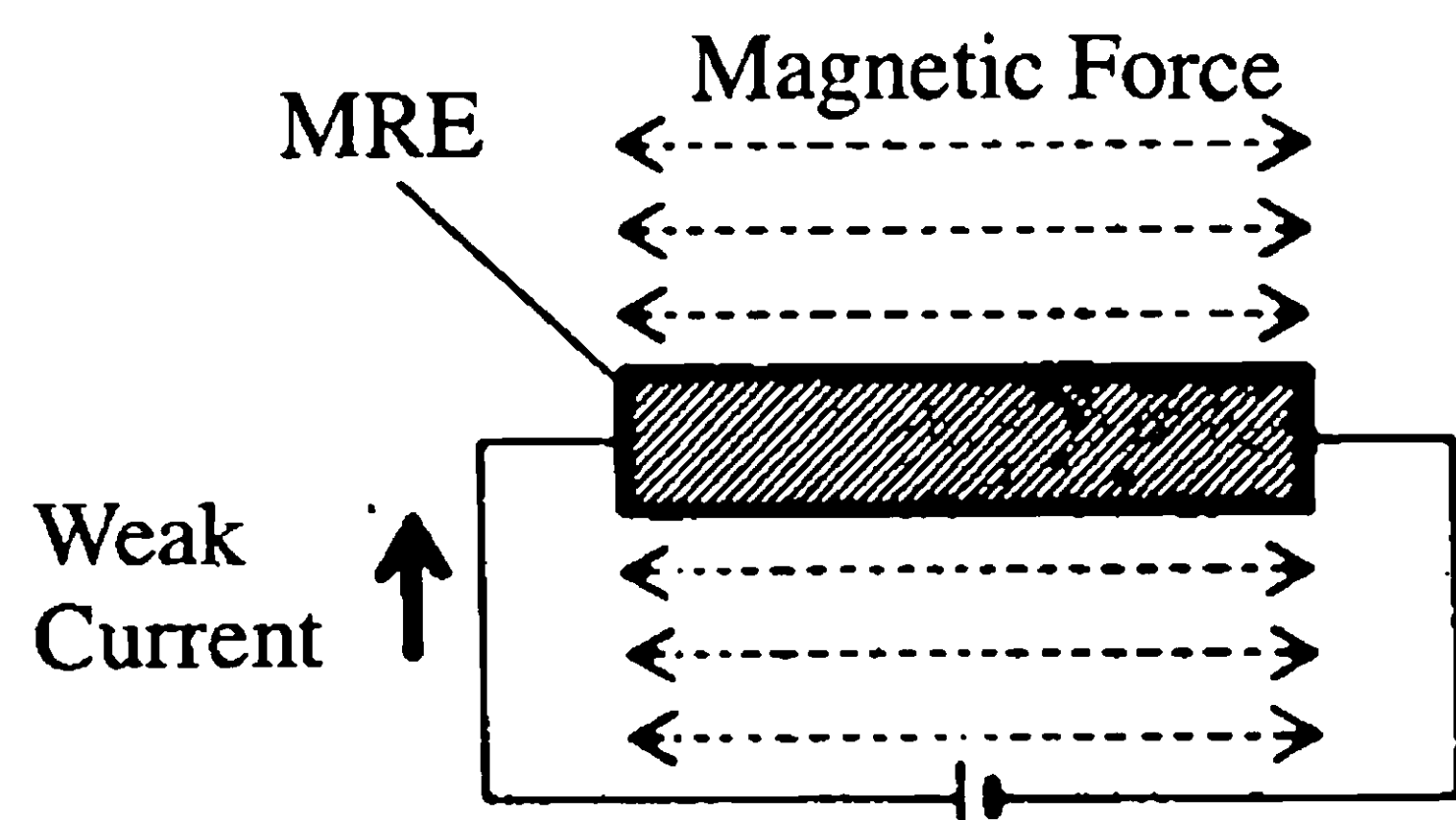
Theory of MRE Operation

In the MRE, when the direction of the current flowing in the element is parallel to the direction of the magnetic lines of force, the resistance becomes great and conversely, when the current direction and the direction of the magnetic lines of force cross each other, the resistance drops to the minimum level.

As shown below, if the power supply is connected to terminals ① and ③ of the element and lines of magnetic force are caused to act in the horizontal direction, the resistance in A and C becomes great and the resistance in B and D becomes small. Therefore, a negative potential difference is generated at terminal ② and a positive potential difference is generated at terminal ④.

Conversely, if the lines of magnetic force are caused to act in the vertical direction, the resistance in B and D becomes great and the resistance in A and C becomes small, and a positive potential difference is generated at terminal ② while a negative potential difference is generated at terminal ④.

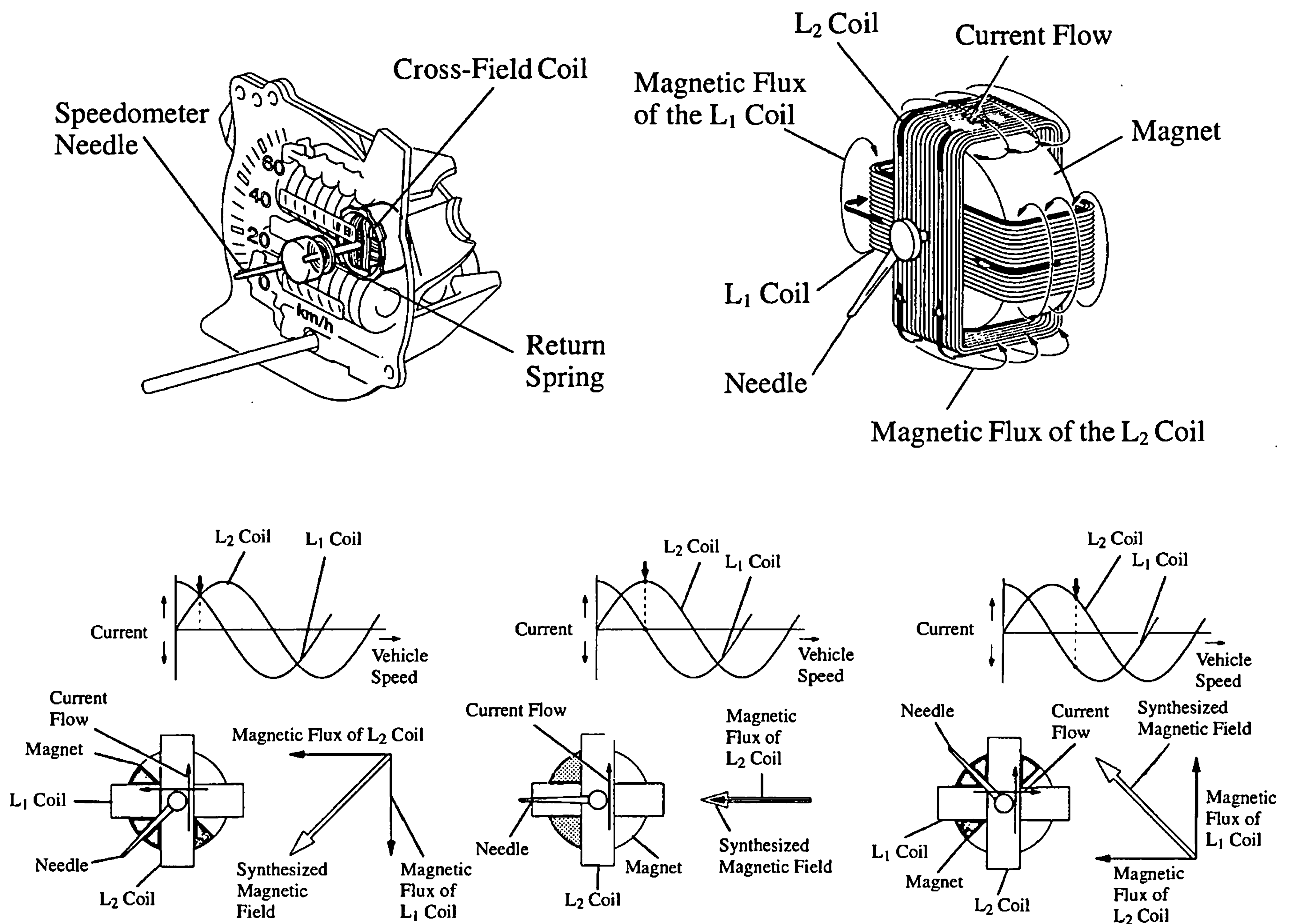
The direction of the lines of magnetic force is determined by magnetizing the magnetic ring and rotating the 4 pole magnet, with the result that the output of the element becomes an AC waveform with 4 cycles per revolution of the magnetic ring.



Speedometer

1) Construction and Theory

The indicator needle is driven by a crossed-field coil. The crossed-field coil meter consists of a magnet with 2 coils wound around it at an angle of 90° to each other. By changing the strength and direction of the current flowing in the coils, the magnetic flux excited in the coils is changed and a combined force which causes the rotor to move can thus be created. The currents flowing in coils L_1 and L_2 are out of phase by 90° . By introducing an alternating current with a logical sine waveform, linear indicator characteristics are obtained around the entire 360° .



2) Operation

The vehicle speed signal from the speed sensor is input at the rate of 4 pulses per revolution into the IC (integrated circuit). By counting these pulses, the driver IC for the crossed-field coil provides appropriate voltage and polarity signals to the coils according to the vehicle speed. These signals cause the coils to produce a combined magnetic field which determines in which direction the needle will point.

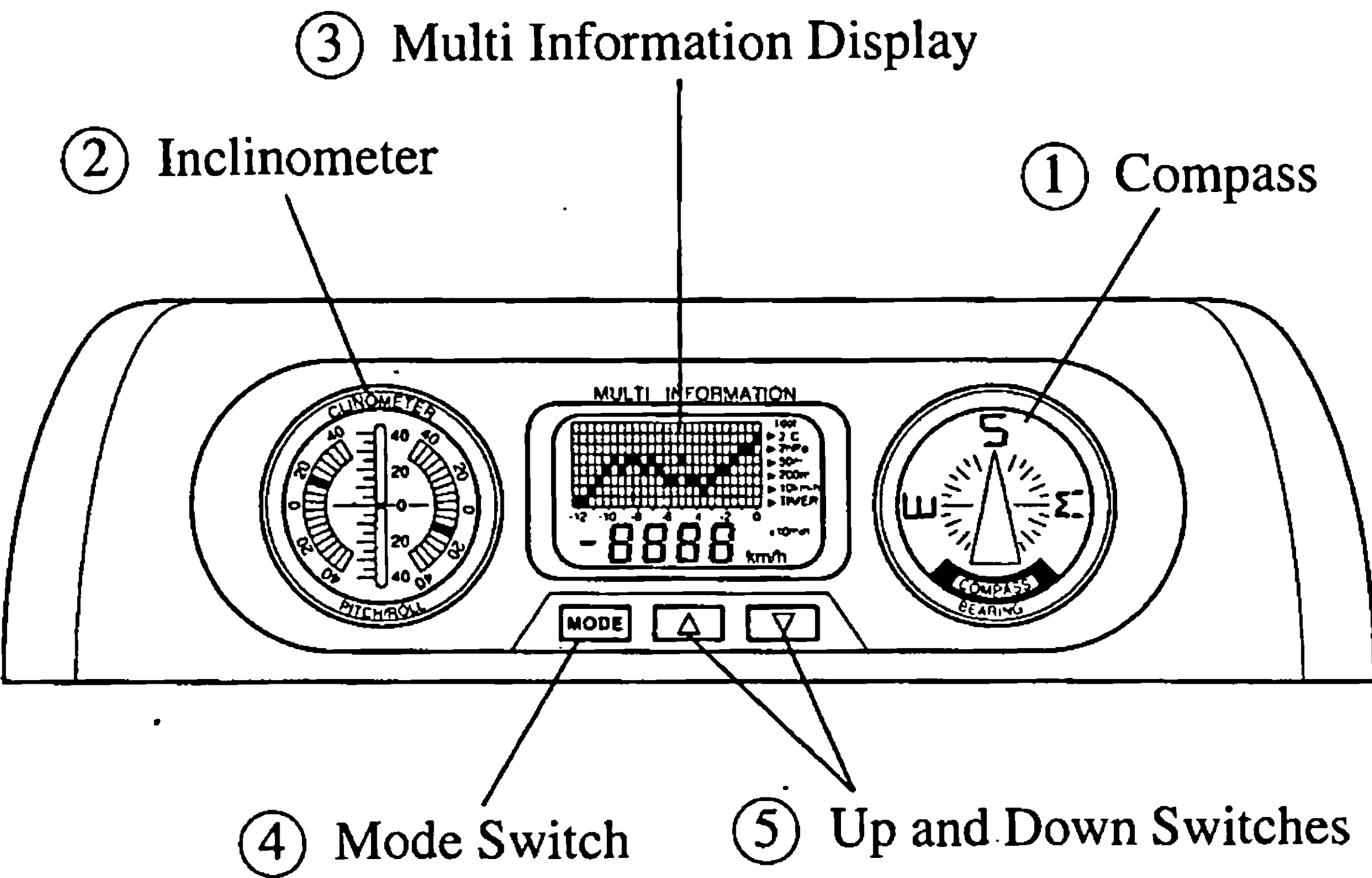
The movement of the indicator needles is nearly the same as that of a mechanical indicator needle.

NOTE: The logic IC inside the combination meter outputs the vehicle speed signal to the engine ECU and other ECUs.

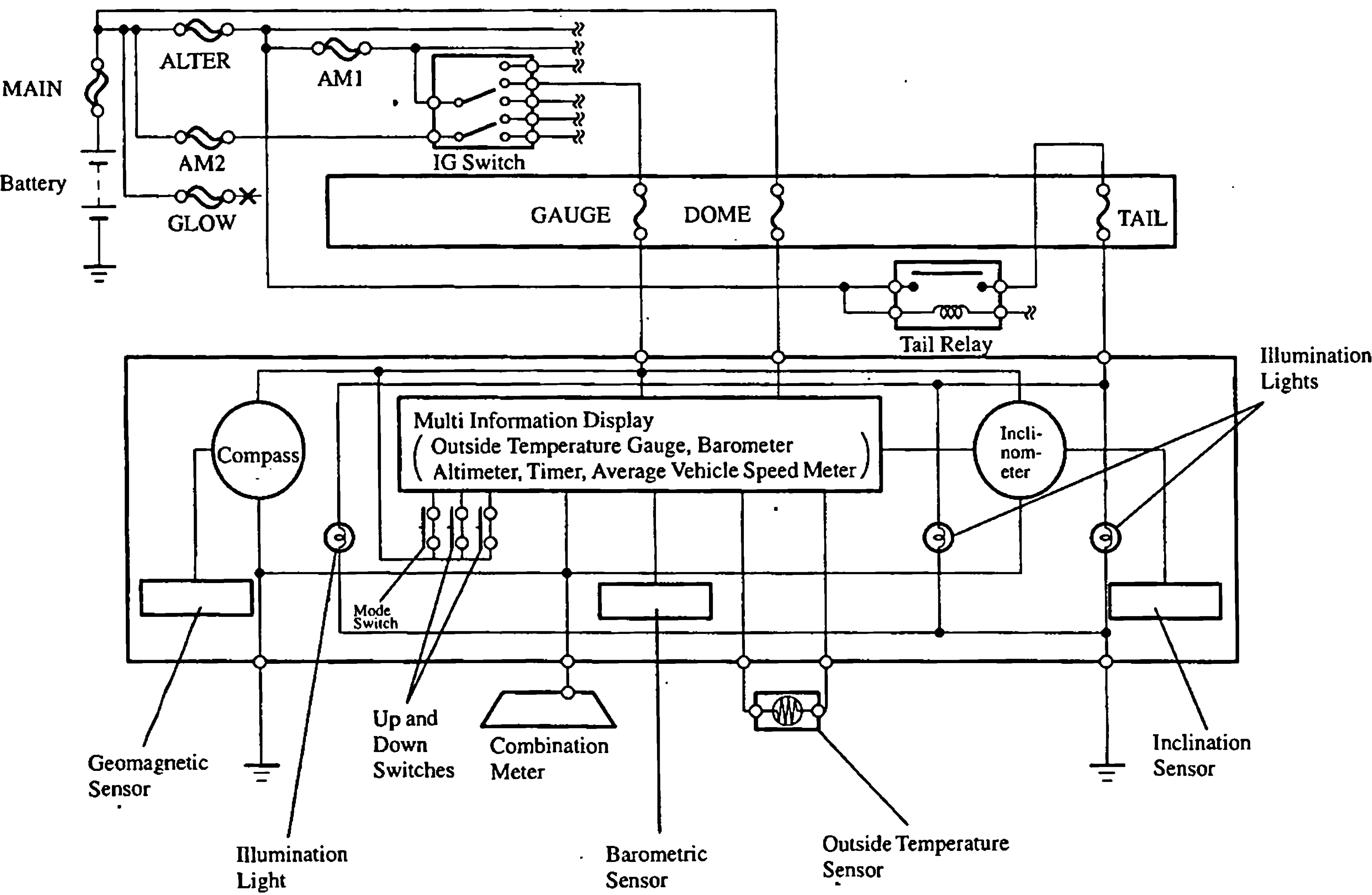
■ ACCESSORY METER

1. Description

An accessory meter equipped with a multi-information display is provided. The accessory meter features the following functions: compass, inclinometer, outside temperature gauge, altimeter, average speed meter, timer, and barometer. Each function is displayed digitally using a large LCD (Liquid Crystal Display) for excellent visibility.



2. Wiring Diagram



3. Function

The accessory meter provides the 7 functions listed below. Excluding the compass and the inclinometer, the remaining 5 functions can be selected and displayed in the multi-information display by operating the switch.

No.	Item		Function
①	Compass		Uses a geomagnetic sensor to detect the azimuth of the vehicle's current direction of travel and displays it in a meter that contains 16 azimuth angles. In addition, this meter has a function to correct the azimuth errors caused by the magnetism of the vehicle.
②	Inclinometer		Uses an inclination sensor to detect the fore-aft and side-to-side inclination angles of the vehicle and display the respective values in the meter.
③	Multi Information Display	Outside Temperature Gauge	When the temperature display mode is selected using the mode switch, the outside temperature that is detected by the thermistor, as well as the temperature readings taken at previous 30-minute intervals, are displayed in the multi-information display.
		Barometer	When the barometer display mode is selected using the mode switch, the barometric pressure that is detected by the barometric sensor, as well as the barometric pressure readings taken at previous 30-minute intervals, are displayed in the multi-information display.
		Altimeter	When the altitude display mode is selected using the mode switch, the multi-information display indicates the current elevation as well as the altitude readings taken at previous 5-minute intervals. (The current elevation is obtained by calculating the difference between the barometric pressure that is detected by the barometric sensor and the hypothetical sea-level barometric pressure [1013.25 hPa].)
		Timer	When the timer display mode is selected using the mode switch, the length of time that is measured by the internal pulse of the CPU is displayed in the multi-information display.
		Average Vehicle Speed Meter	When the average vehicle speed display mode is selected using the mode switch, the multi-information display indicates the average vehicle speed as well as the average vehicle speed readings taken at previous 5-minute intervals. (The average speed is obtained from the driven distance that is calculated by the vehicle speed pulse, and from the length of time that is calculated by the timer.)
④	Mode Switch		The mode switch is used to select the function to be displayed in the multi-information display. Also, by pressing this switch for 1 second or more, the backlighting of the LCD (Liquid Crystal Display) can be turned ON and OFF.
⑤	Up and Down Switches		By operating these switches, the correction mode for the compass and the inclinometer can be started, selected, or stopped. Also, the functions of these switches change according to the display mode that is selected in the multi-information display. ● Altimeter: Corrects the error in the displayed altitude. ● Average Vehicle Speed Meter and Timer: The UP switch starts and stops the measurement of the data that is used for displaying the average vehicle speed and the timer. The DOWN switch resets the display of the average vehicle speed and the timer, and clears the measured data.

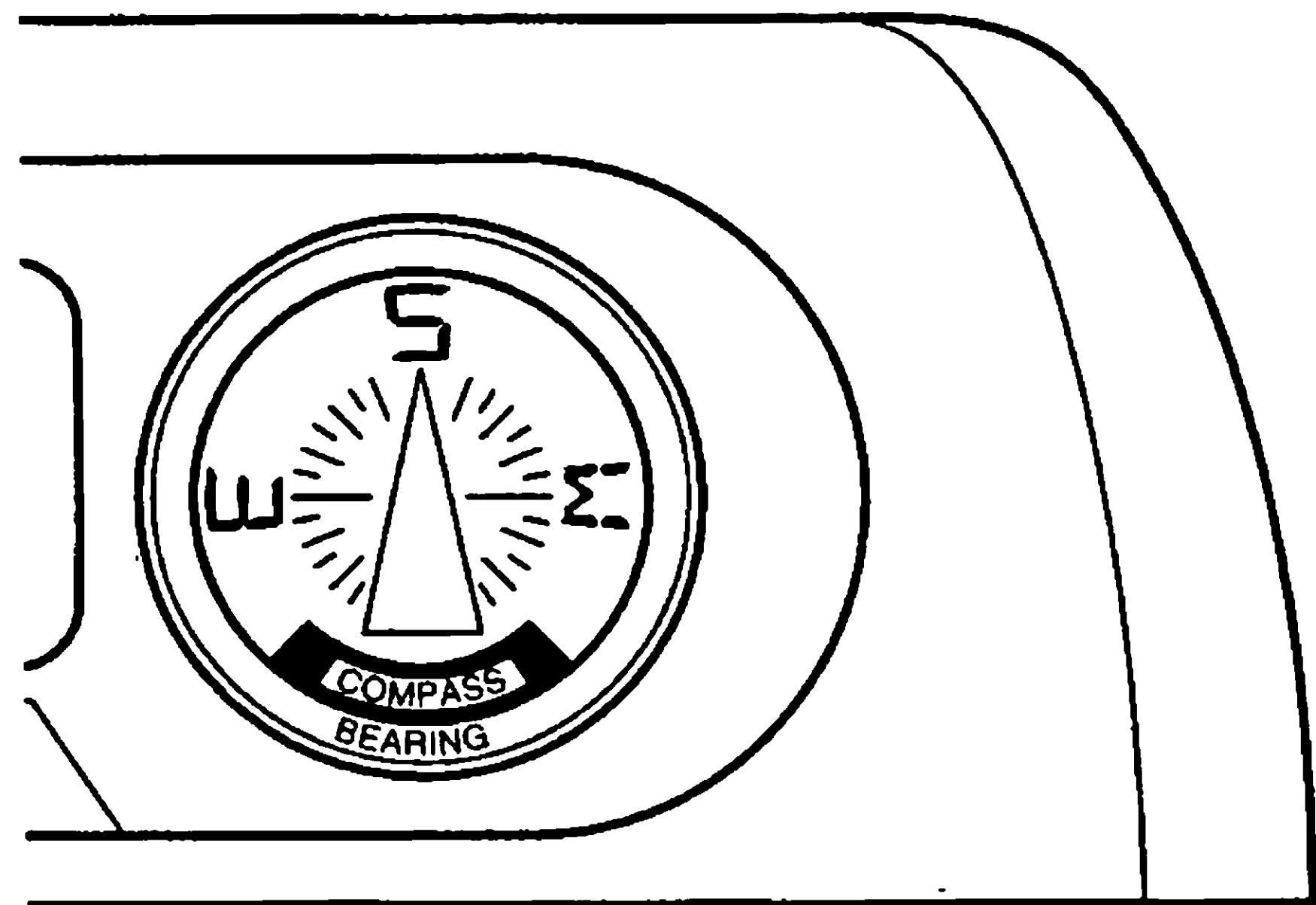
4. Construction

Compass

1) Description

The compass displays the vehicle's current direction of travel in a meter that contains 16 azimuth angles. The CPU that is located in the meter processes the earth's magnetism which is detected by the geomagnetic sensor that is enclosed in the accessory meter and shows it in the display.

As the magnetism of the earth is extremely weak, it can be temporarily affected by climate conditions or by the magnetism of the vehicle itself. This meter has a magnetic correction function to handle such situations.



2) Magnetic Correction Function

As shown in the illustration on the bottom left, when the vehicle becomes magnetized, it affects the detection of the earth's magnetism by geomagnetic sensor, creating an error.

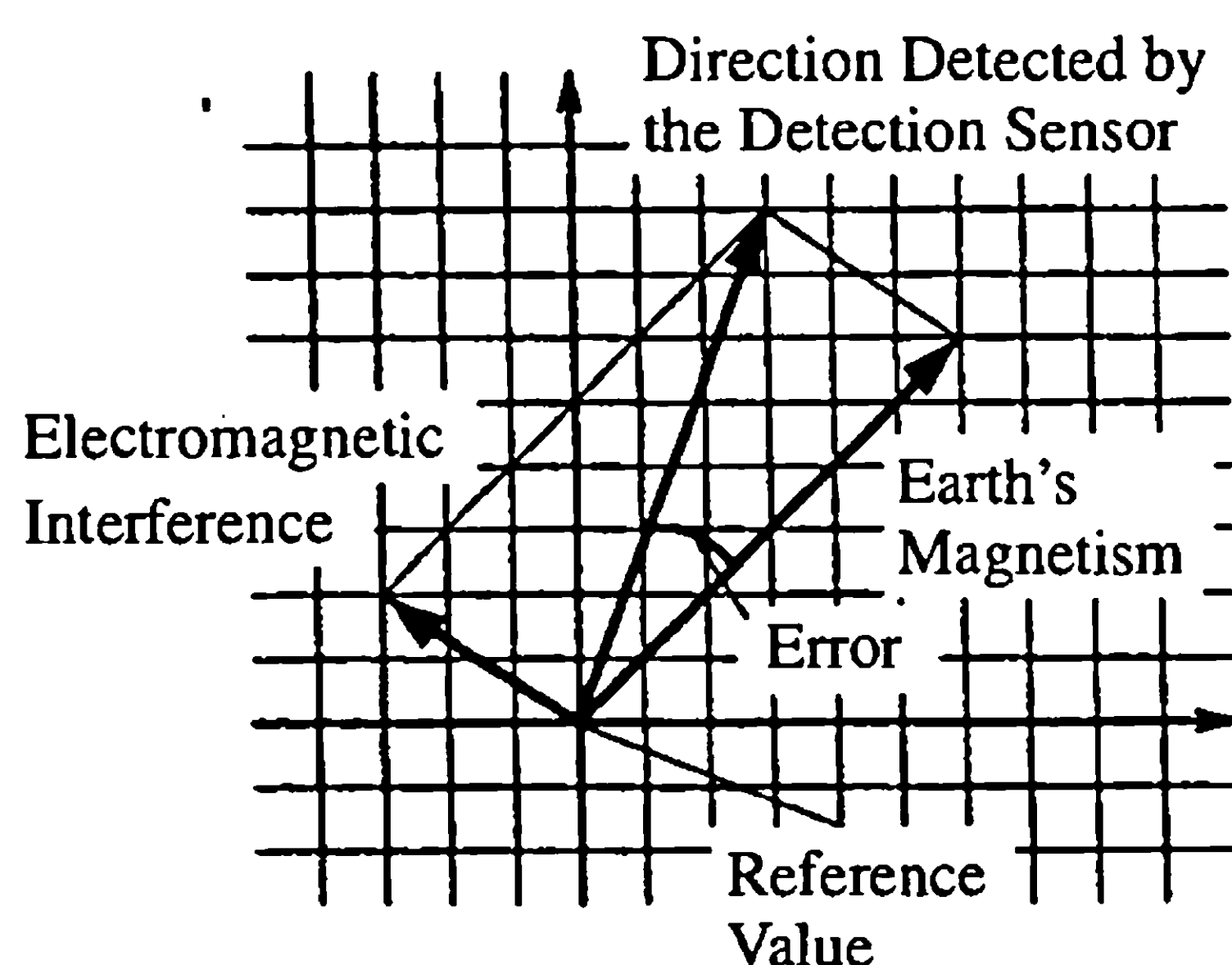
The magnetic correction function alters the reference value, as shown on the bottom right, which is used by the geomagnetic sensor to detect the direction of the earth's magnetism. This cancels out the effects of the vehicle's magnetism, thus correcting the indication error.

The magnetic correction consists of the following functions:

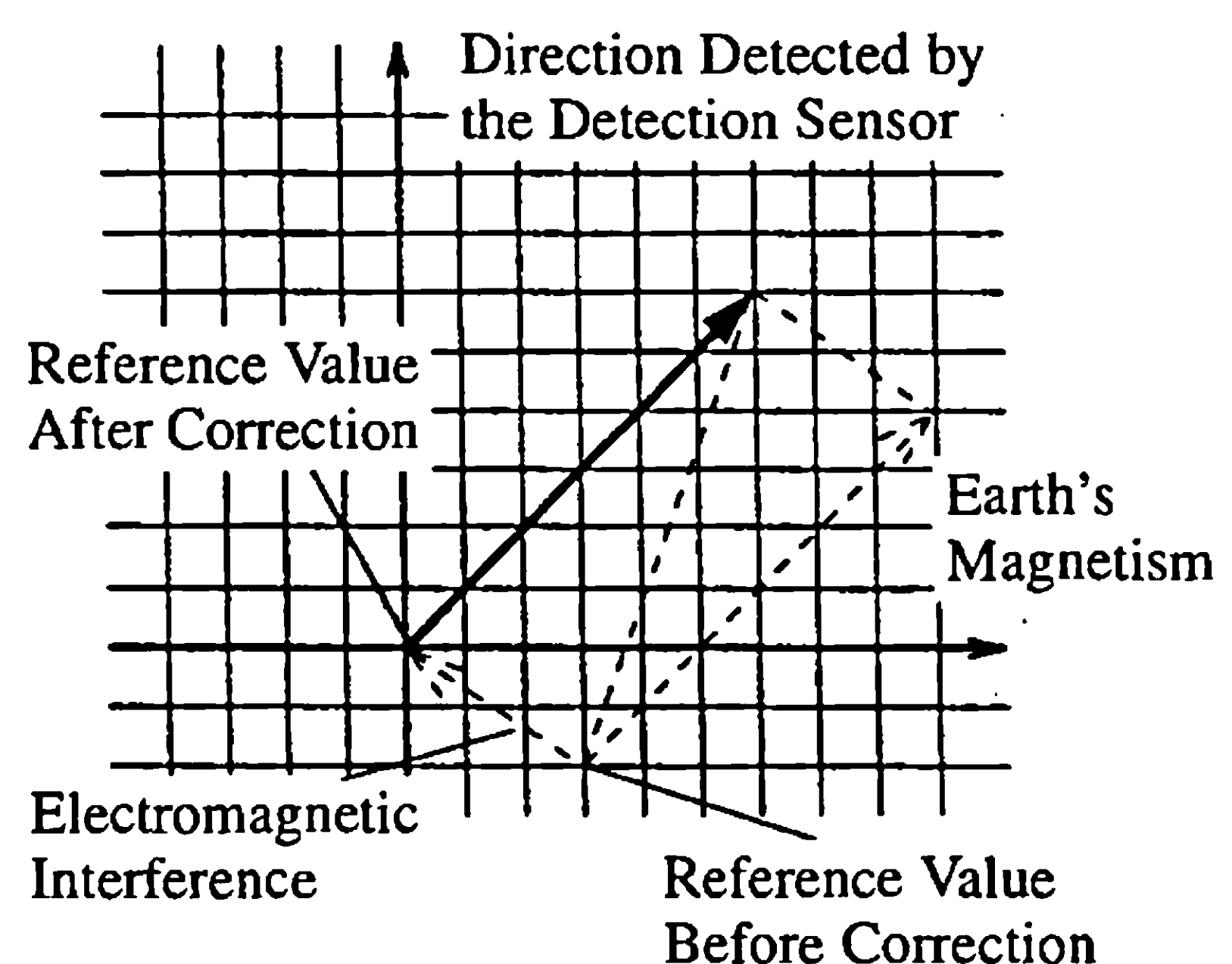
- The turning magnetic correction makes a correction for the magnetism that is present while driving through an area with powerful magnetism, such as near a steel bridge or high-voltage cables.
- The automatic magnetic correction makes an automatic correction for the magnetism that is present by the on-vehicle components such as motors.

The turning correction activates when the turning correction mode is selected and the vehicle is turned 360°. This results in changing the reference value.

The automatic magnetic correction function automatically changes the reference value in accordance with the data detected by the sensor when the vehicle is turned more than 60°.



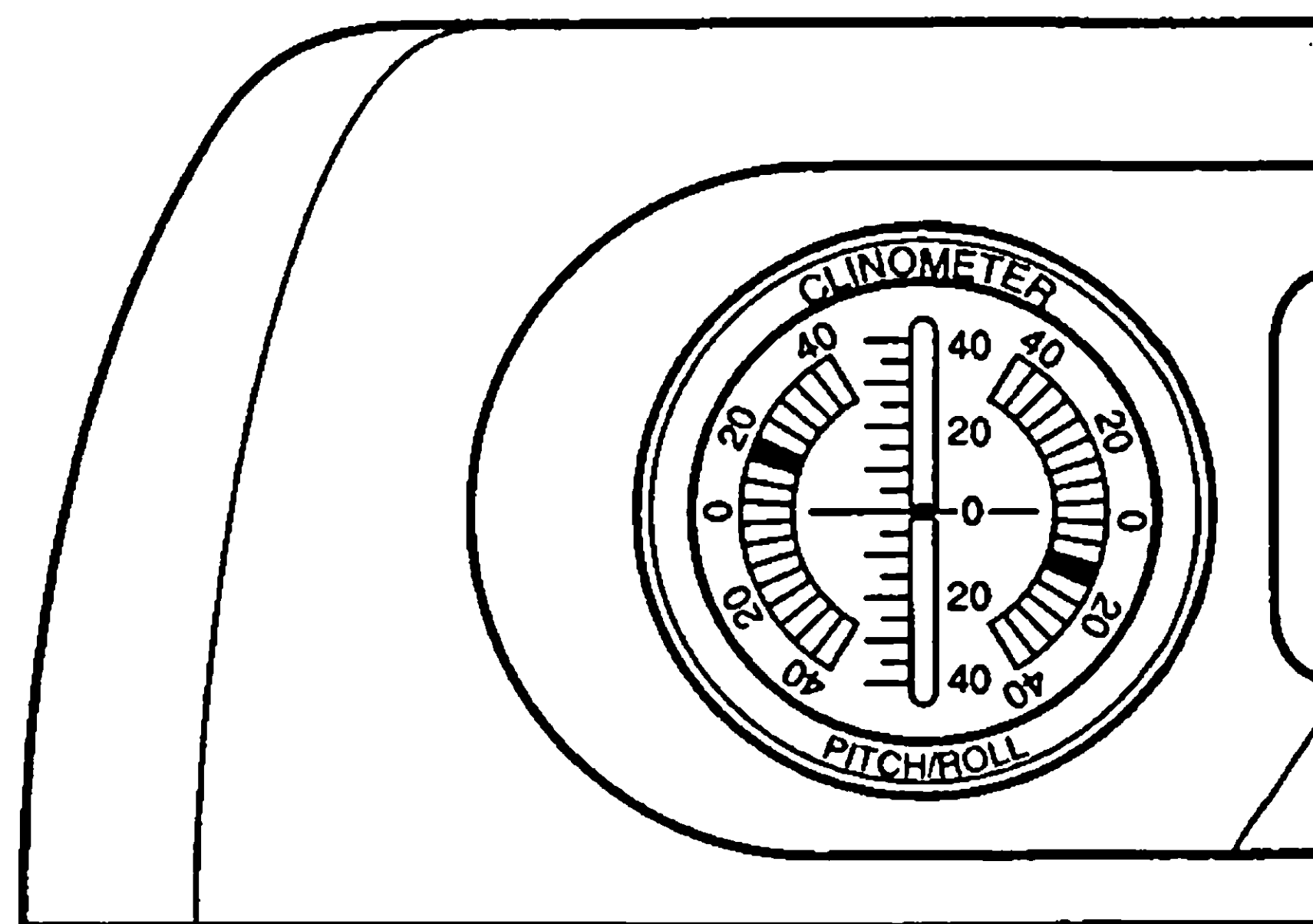
Before Magnetic Correction



After Magnetic Correction

Inclinometer

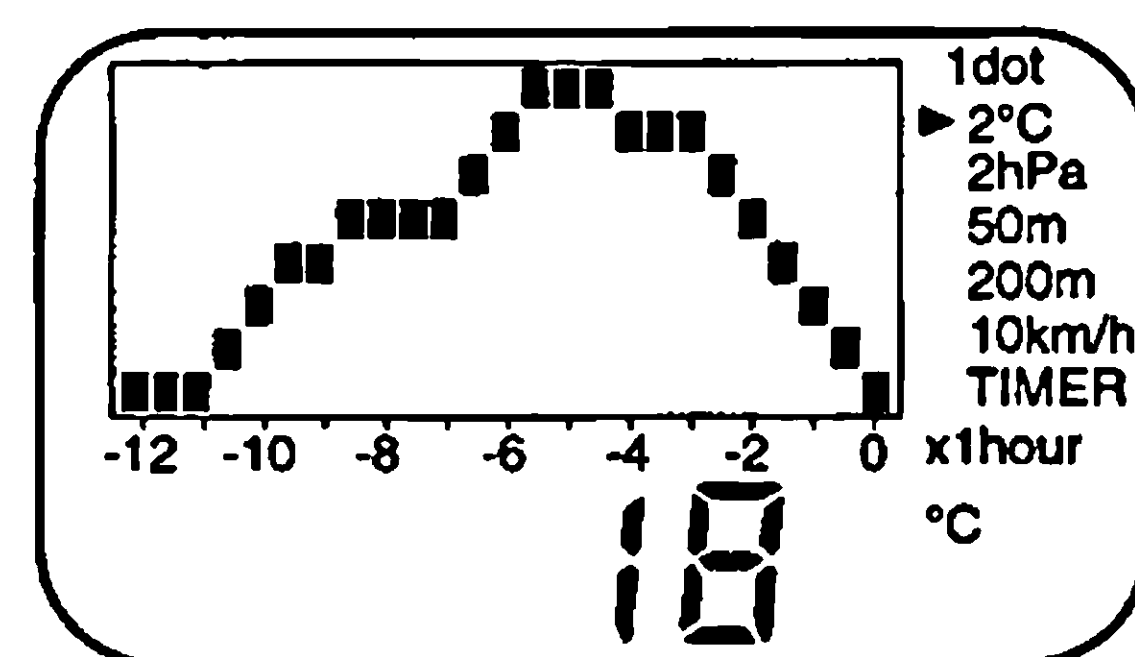
Based on the fore-aft and side-to-side inclination angle of the vehicle as detected by the inclination sensor that is enclosed in the accessory meter, the inclination angle is calculated by the CPU in the meter. As a result of the calculation, the inclinometer displays both the fore-aft and side-to-side inclinations within the range of $\pm 40^\circ$.



Inclinometer

Outside Temperature Gauge

When the mode switch is used to select the outside temperature display mode in the multi-information display, the outside temperature gauge displays the current outside temperature and a broken-line graph indicating the transition of the past temperature readings taken at 30-minute intervals. The display range of the outside temperature gauge is between -30°C and 50°C , and the temperature reading is renewed every 4 seconds. Based on the resistance value that is obtained by the thermistor which functions as the outside temperature sensor, the outside temperature is calculated by the CPU located in the meter and shown in the display.

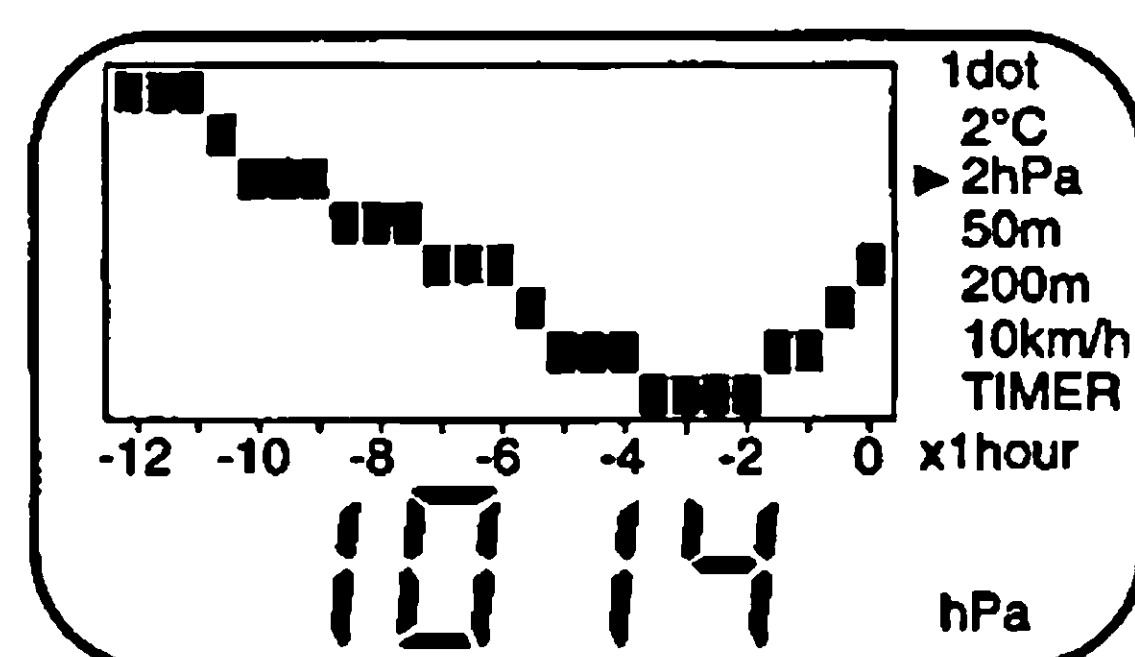


Outside Temperature Gauge

Barometer

When the mode switch is used to select the barometer display mode in the multi-information display, the barometer displays the current barometric pressure and a broken-line graph indicating the transition of the past barometer readings taken at 30-minute intervals. The display range of the barometer is between 584 hPa and 1050 hPa, and the barometer reading is renewed every second.

Based on the barometric data that is detected by the semi-conductor type barometric sensor enclosed in the accessory meter, the barometric pressure is calculated in the CPU in the meter, and shown in the display.



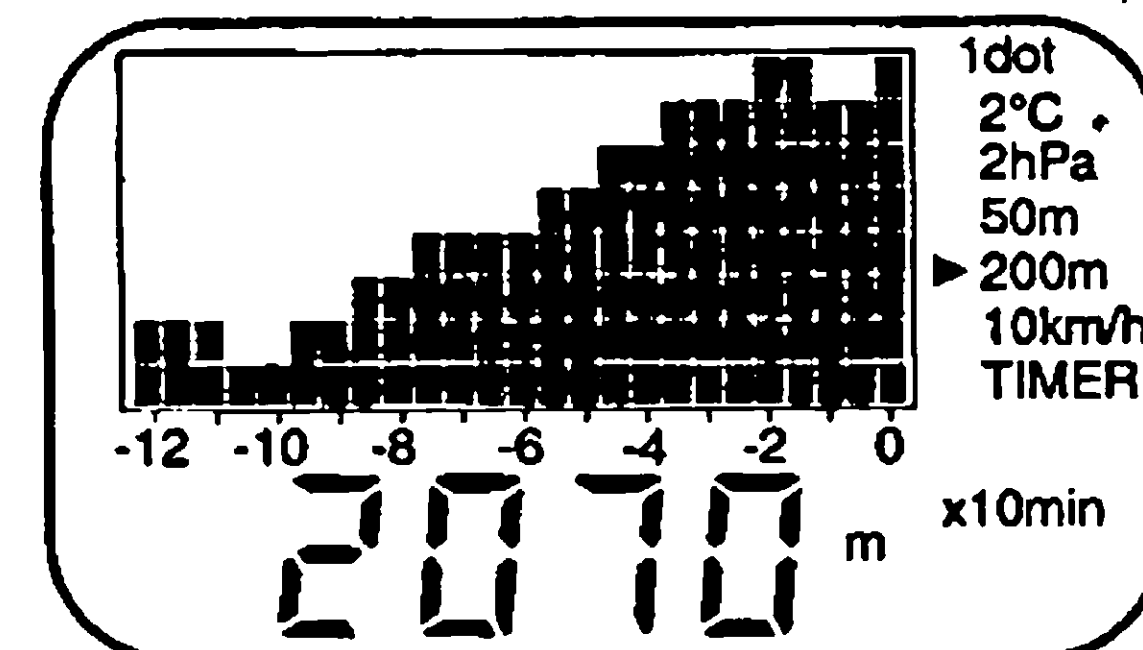
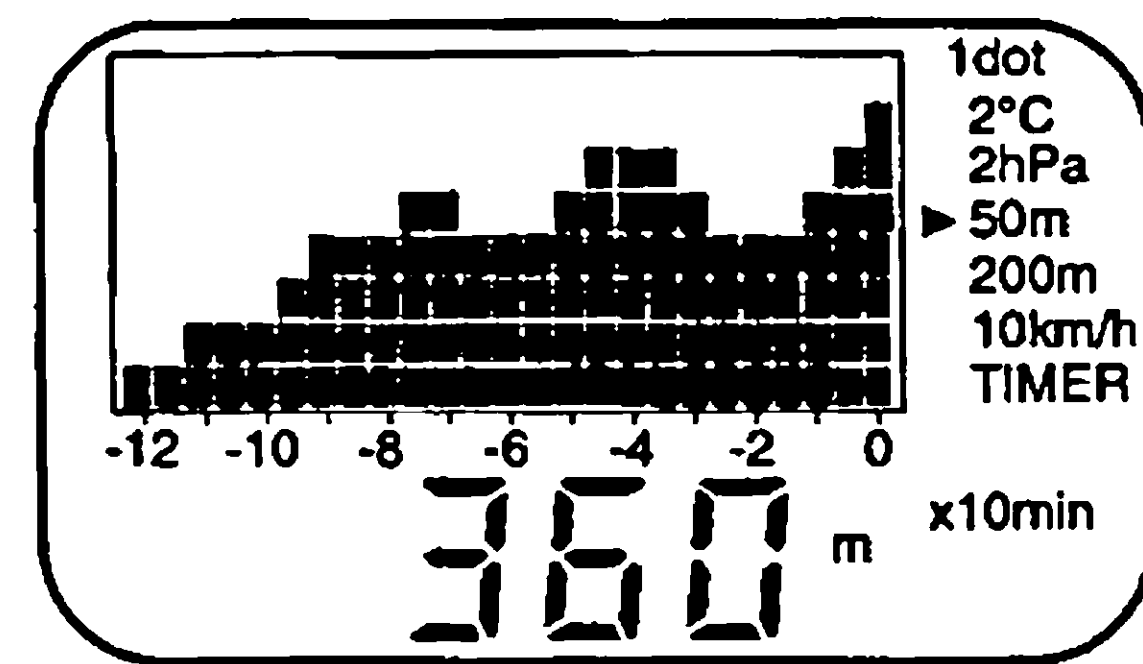
Barometer

Altimeter

When the mode switch is used to select the altimeter display mode in the multi-information display, the altimeter displays the current elevation and a bar graph indicating the transition of the past altimeter readings taken at 5-minute intervals, in the 50 m or 200 m scale.

The display range of the altimeter is between -4000 m and 4000 m, and the altimeter's reading is renewed every second.

Assuming the sea level (0 elevation) barometric value to be 1013.25 hPa, the hypothetical value is compared to the barometric value that is detected by the semi-conductor type barometric sensor. The resultant difference is then calculated into the current elevation.



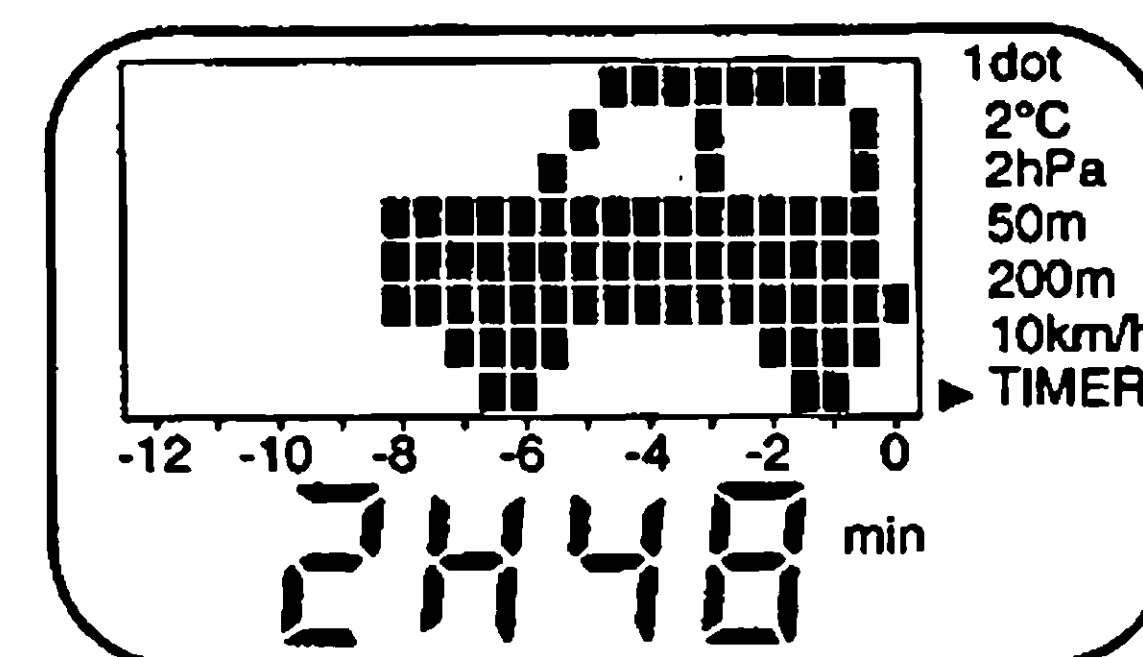
Altimeter

Timer

When the mode switch is used to select the timer display mode in the multi-information display, the timer can be used to measure the elapsed time. The display range of the timer is between 0 and 9 h 59 min, and the time reading is renewed every minute.

After displaying 9 h 59 min, the timer reverts to 0 and continues its count. Also, when the timer is in operation, a character image appears in the information display, and this image moves from the right to the left every second.

The timer uses the clock pulse of the CPU to keep its time.

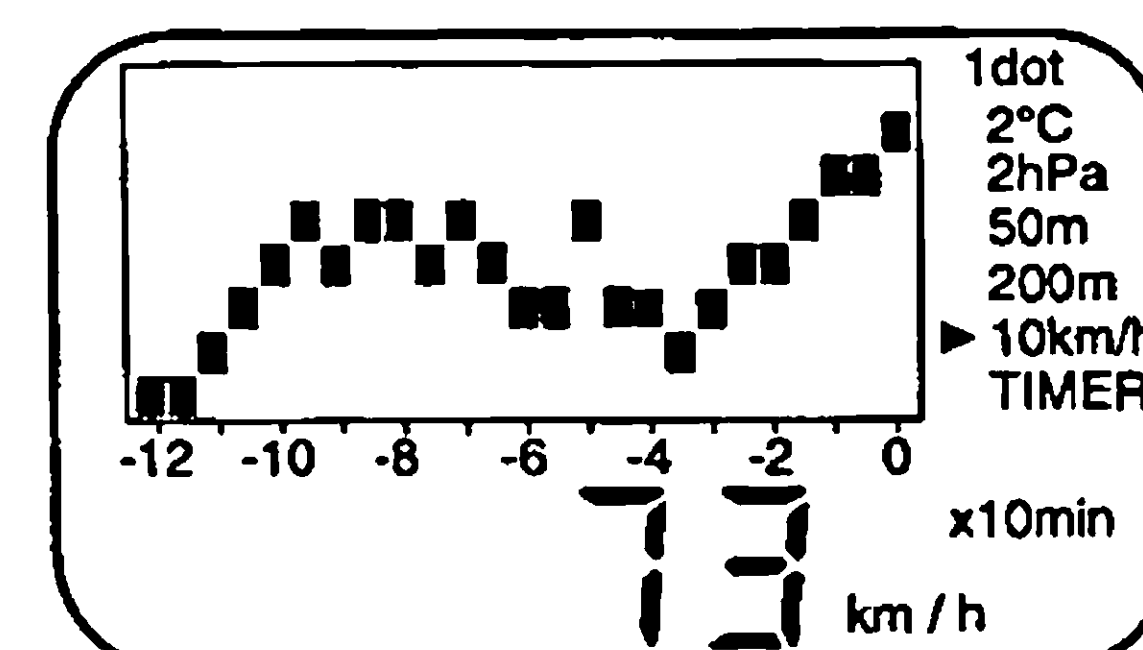


Timer

Average Vehicle Speed Meter

When the mode switch is used to select the average vehicle speed display mode, the multi-information display shows the current average vehicle speed that is calculated by the CPU. In addition, the past average speeds in 5-minute intervals are shown by a broken-line graph. The display of the current average vehicle speed is renewed every second.

The average speed is obtained by calculating the distance obtained from the vehicle sensor pulse and the time obtained from the CPU's internal pulse.



Average Vehicle Speed Meter

AIR CONDITIONING

■ DESCRIPTION

1. General

The air conditioning system in the Land Cruiser/Land Cruiser Prado has the following features:

- The boost ventilator or boost ventilator with heater are standard or optional equipment on all models.
- A rear heater is available as an option on models for Europe and on some models for G.C.C. Countries and General Countries.
- An air conditioner (front only) is available as an option on models for Europe, G.C.C. Countries, and General Countries. Also, a front and rear air conditioner is available as an option on models for Australia and on some models for G.C.C. Countries and General Countries.
- The rotary switch type heater control panel is used on all models.
- A 3-flow level type heater unit which features lower air flow resistance is used on all models. In addition, a max. cool damper has been provided to reduce the ventilation resistance when the temperature control lever is in the max. cool position and to increase the outlet air volume.
- An aluminum heater core has been adopted on all models.
- A drawn cup type evaporator which has a large passage area for refrigerant and high heat exchanging efficiency is used on all models.
- A multi-flow type condenser that provides excellent heat-exchanging efficiency is used.
- A rear heater unit with an air mix type temperature control is used.
- The defroster nozzle inner wall is modified into a radial configuration for smoother air flow.

►Performance of Heater and Air Conditioner ◀

Items			Performance
Heater	Heat Output	W (Kcal/h)	4200 (3610)* ¹ 4500 (3870)* ^{2, 3}
	Air Flow Volume	m ³ /h	260* ¹ , 280* ^{2, 3}
	Power Consumption	W	160* ¹ , 180* ^{2, 3}
Air Conditioner	Heat Output	W (Kcal/h)	5000 (4300) 5500 (4730)* ²
	Air Flow Volume	m ³ /h	410, 525* ²
	Power Consumption	W	180, 250* ²

- *1: LHD Model
*2: Models for G.C.C. Countries
*3: RHD Model

► Specifications of Heater and Air Conditioner ◀

Items			Specifications
Ventilation and Heater	Heater Core	Type	Flat Tube Type
		Size W x H x L mm (in.)	155.7 x 220 x 27 (6.1 x 8.7 x 1.1)
		Fin Pitch mm (in.)	1.6 (0.06)
	Blower	Motor Type	S70F14T* ^{1, 3} , S80F12.5T* ²
		Fan Size Dia. x H mm (in.)	150 x 75 (5.9 x 3.0)
Air Conditioner	Condenser	Type	Multi Flow Type
		Size W x H x L mm (in.)	570 x 463 x 16 (22.4 x 18.2 x 0.6)
		Fin Pitch	3.2 (0.13)
	Evaporator	Type	Drawn Cup Type
		Size W x H x L mm (in.)	264 x 210 x 90 (10.4 x 8.3 x 3.5)
		Fin Pitch mm (in.)	3.5 (0.14)
	Compressor	Type	10PA17
	Refrigerant	Type	HFC134a (R134a)

- *1: LHD Model
*2: Models for G.C.C. Countries
*3: RHD Model
*4: Cold Area Specification Models

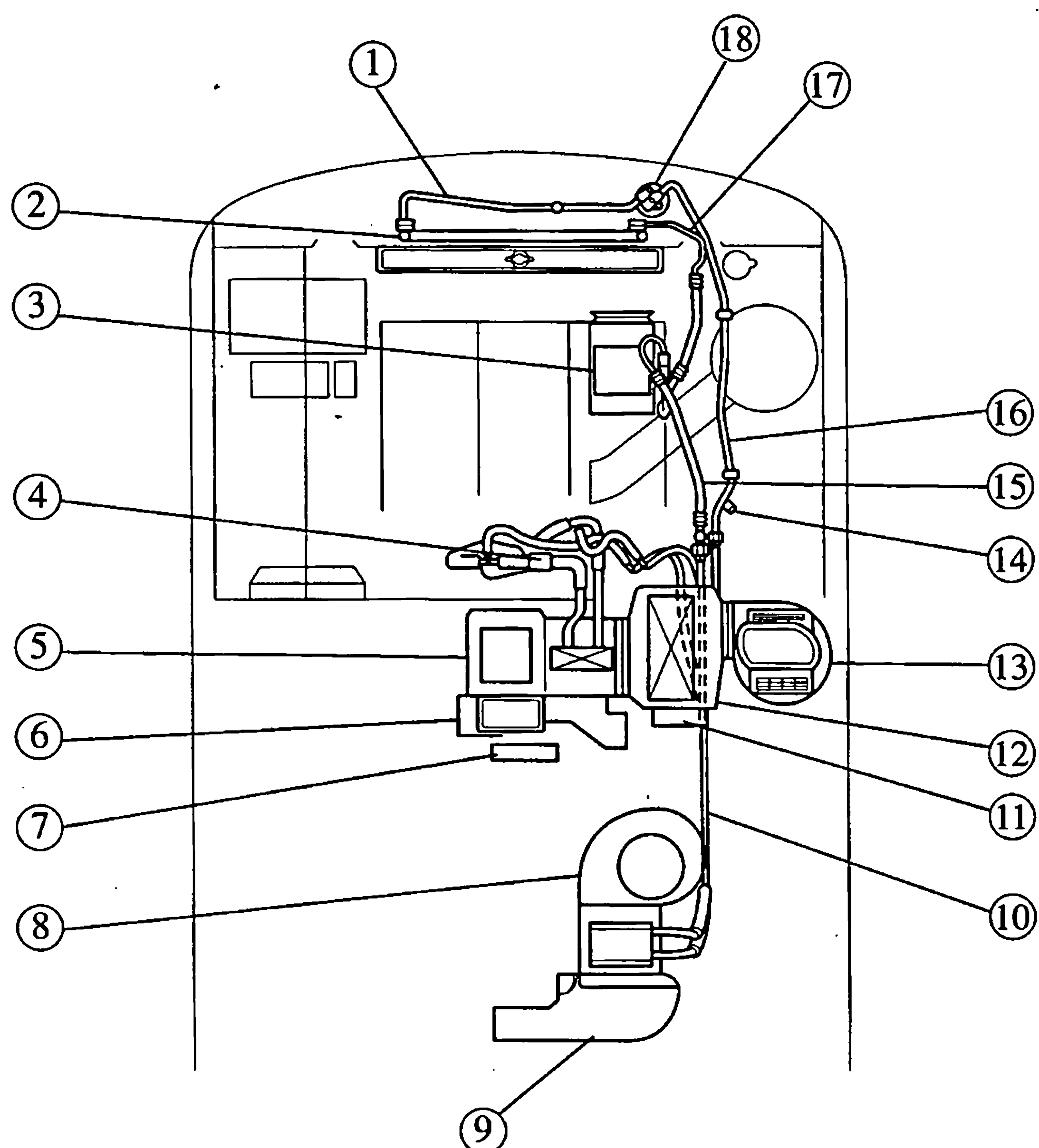
► Performance of Rear Heater and Rear Air Conditioner ◀

Items			Performance
Rear Heater	Heater Output	W (Kcal/h)	1900 (1630)
	Air Flow Volume	m ³ /h	100
	Power Consumption	W	35
Rear Air Conditioner	Heat Output	W (Kcal/h)	2900 (2490)
	Air Flow Volume	m ³ /h	235
	Power Consumption	W	100

► Specifications of Rear Heater and Rear Air Conditioner ◀

Items			Specifications
Rear Heater	Heater Core	Type	Flat Tube Type
		Size W × H × L mm (in.)	105 × 140 × 27 (4.1 × 5.5 × 1.1)
		Fin Pitch mm (in.)	1.8 (0.07)
	Blower	Motor Type	60F22T
		Fan Size Dia. × H mm (in.)	130 × 65 (5.1 × 2.6)
Rear Air Conditioner	Evaporator	Type	Drawn Cup Type
		Size W × H × L mm (in.)	159 × 170 × 90 (6.3 × 6.7 × 3.5)
		Fin Pitch mm (in.)	4.0 (0.16)
	Blower	Motor Type	S70F14T
		Fan Size Dia. × H mm (in.)	130 × 65 (5.1 × 2.6)
	Refrigerant	Type	HFC134a (R134a)

2. Layout of Functional Parts



5VZ-FE Engine Models (LHD)

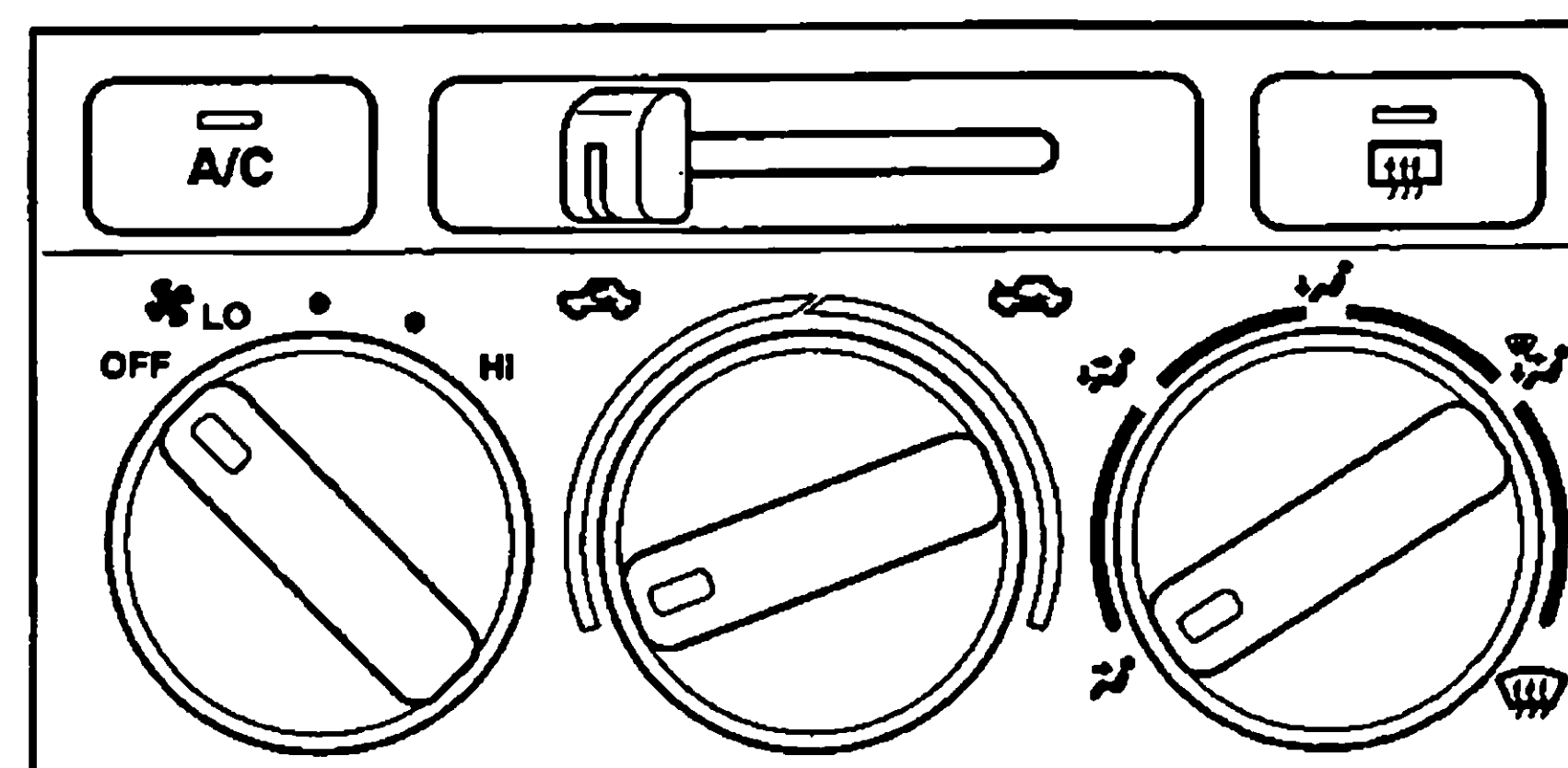
BE

No.	Part Name	No.	Part Name
①	Refrigerant Tube	⑩	Rear Heater Pipe
②	Condenser	⑪	Air Conditioning Amplifier
③	Compressor	⑫	Cooler Unit
④	Water Valve	⑬	Blower Unit
⑤	Heater Unit	⑭	Pressure Switch
⑥	3-Way Duct	⑮	Suction Hose
⑦	Heater Control Panel	⑯	Refrigerant Tube
⑧	Rear Heater Unit	⑰	Discharge Hose
⑨	Rear Heater Duct	⑱	Receiver Tank

■ CONSTRUCTION AND OPERATION

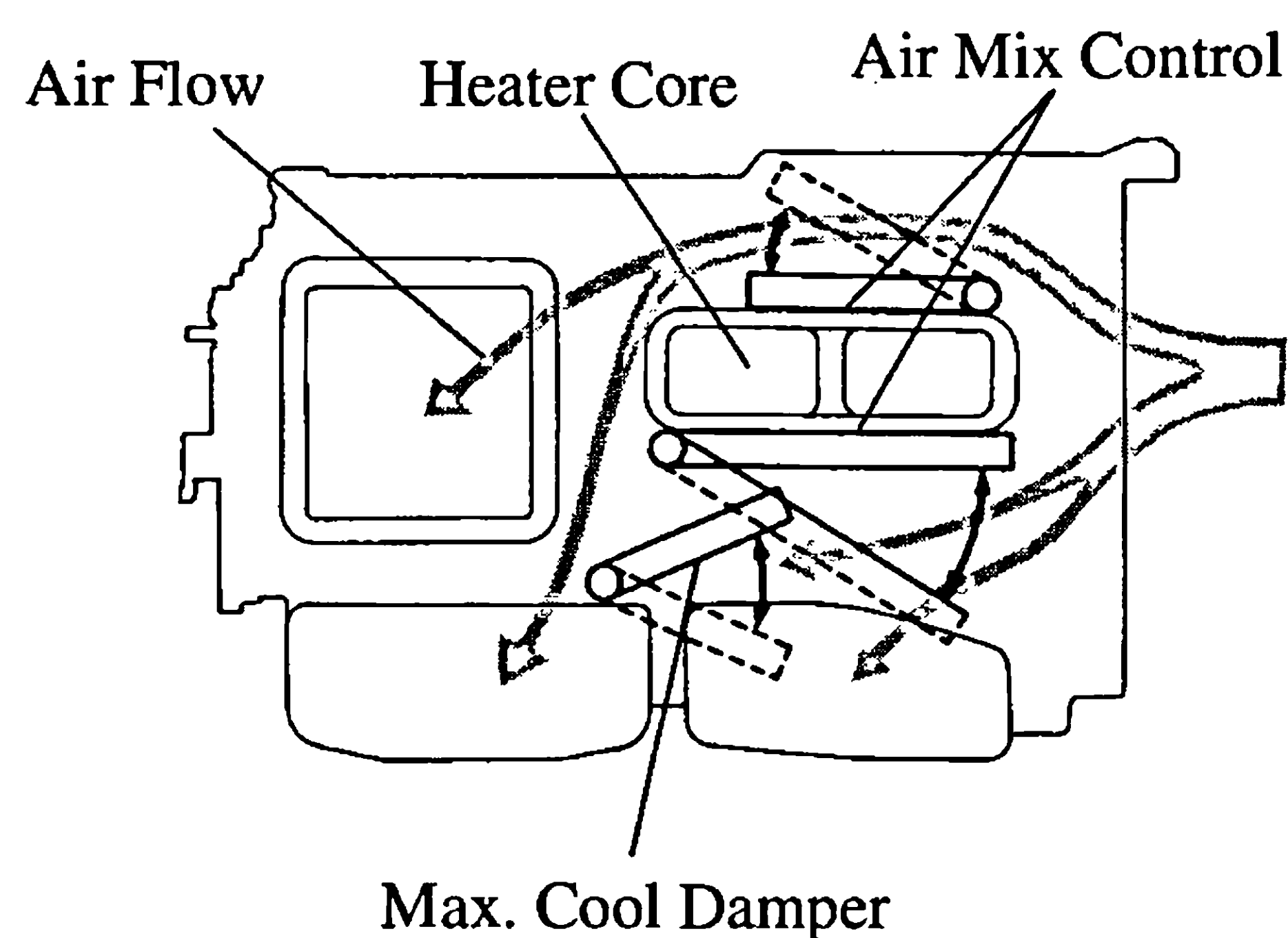
1. Front Heater Control Panel

A rotary switch type heater control panel, which features superior ease of use, is provided on all models.



2. Front Heater Unit

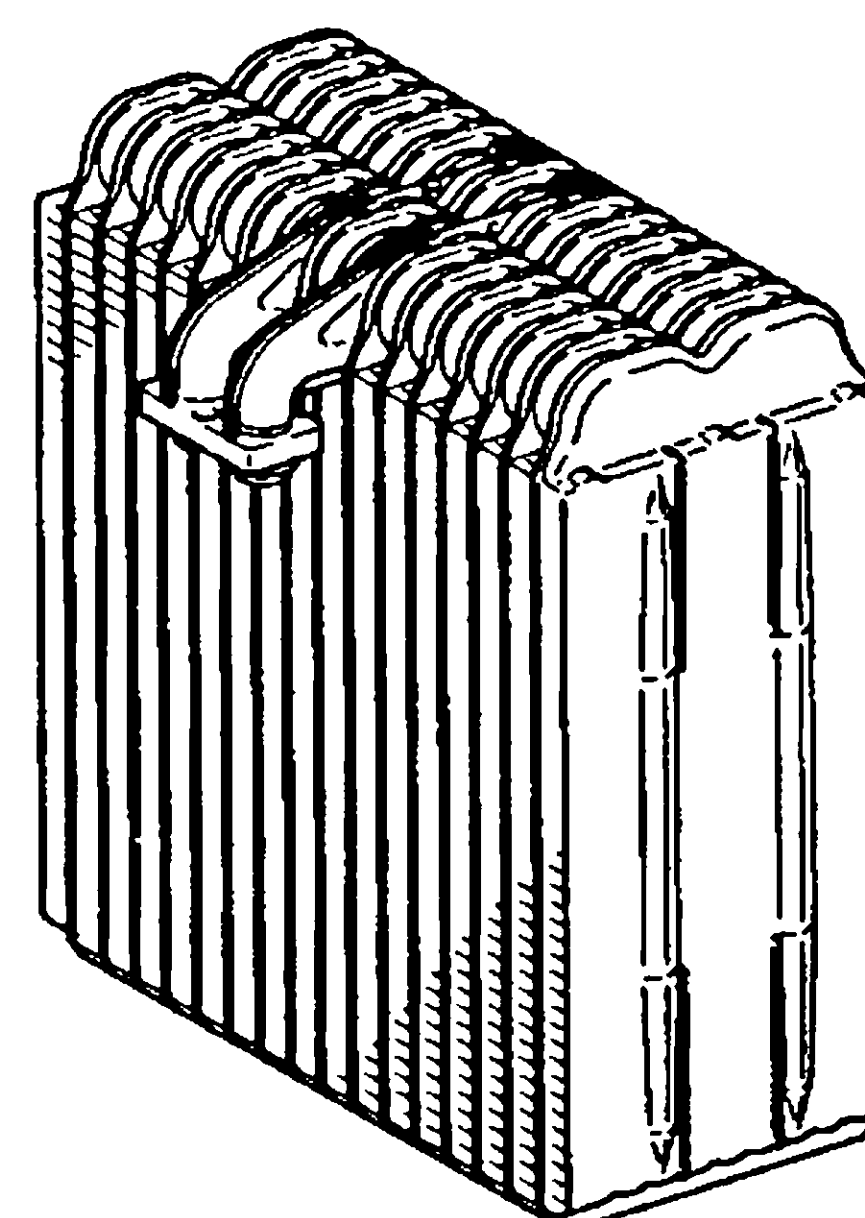
- A 3-flow level, full air mix type heater unit has a pair of air mix control dampers. The heater core is located at the center of the heater unit to minimize ventilation resistance.
- The heater unit is equipped with a max. cool damper to reduce ventilation resistance.
- A lightweight aluminum heater core is used on all models.



3. Cooler Unit

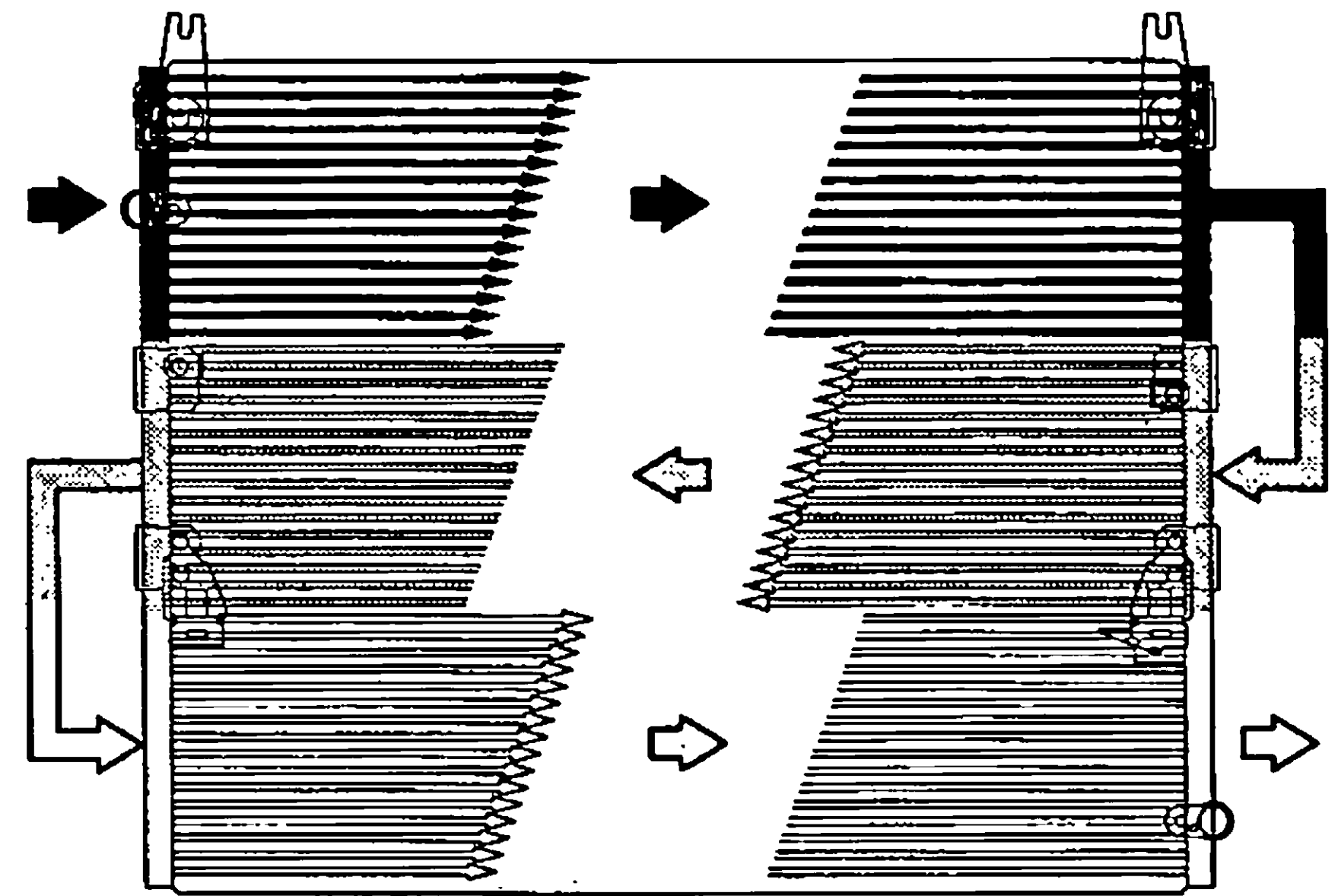
Drawn Cup Type Evaporator

A drawn cup type evaporator is used in the cooler unit. This type of evaporator has superior heat exchange characteristics.



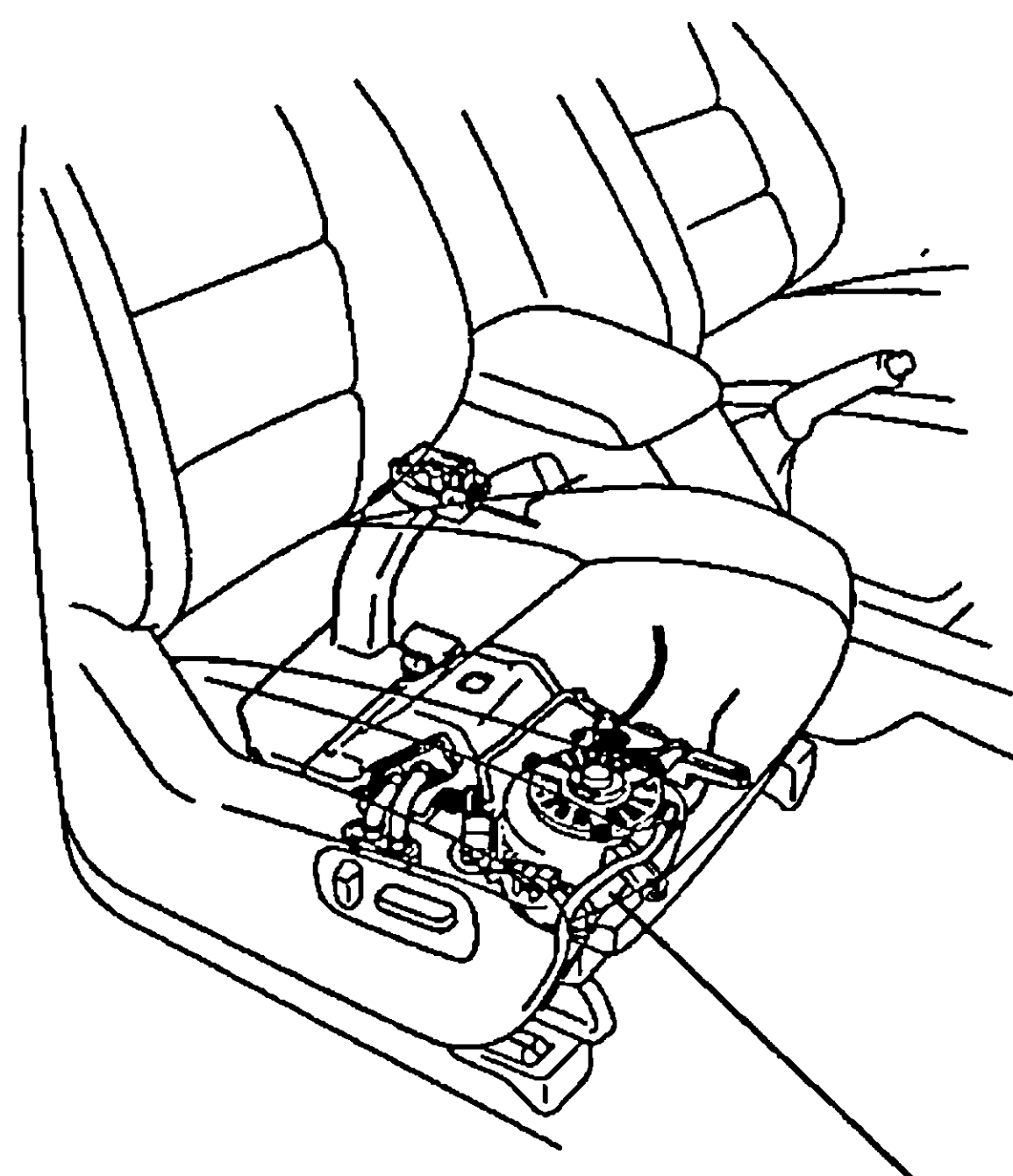
4. Condenser

A multi-flow type condenser that provides a wider heat dissipation area and offers excellent heat-exchanging efficiency has been adopted.



5. Rear Heater Unit

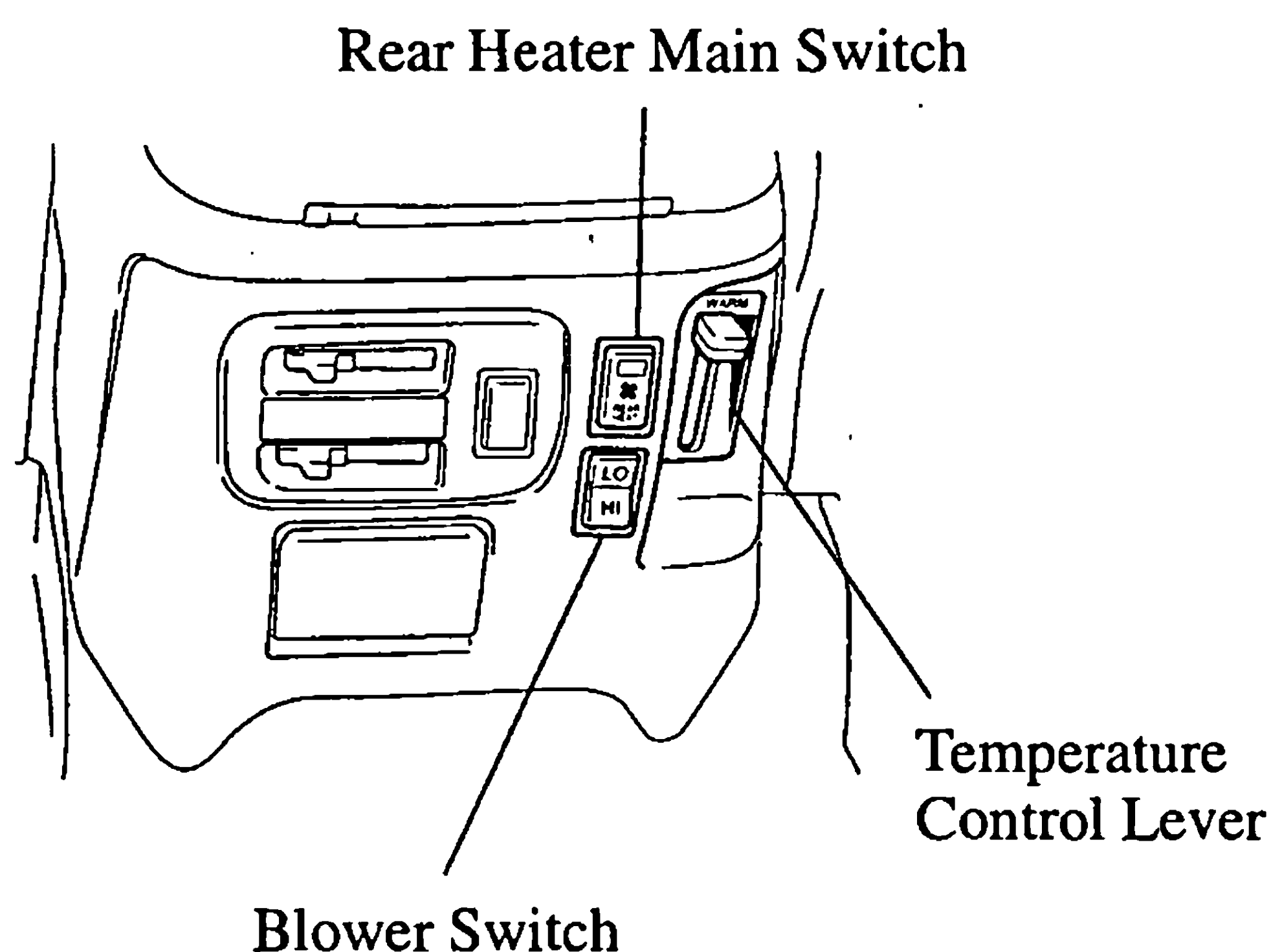
- As in the front heater unit, an aluminum heater core has been adopted for the rear.
- A rear heater unit with an air mix type temperature control is used, thus improving the temperature control performance for the rear seat.
- The rear heater unit is located under the front right seat. As a result, the rear console's storage space has been increased.



Rear Heater Unit

6. Rear Heater Control Panel

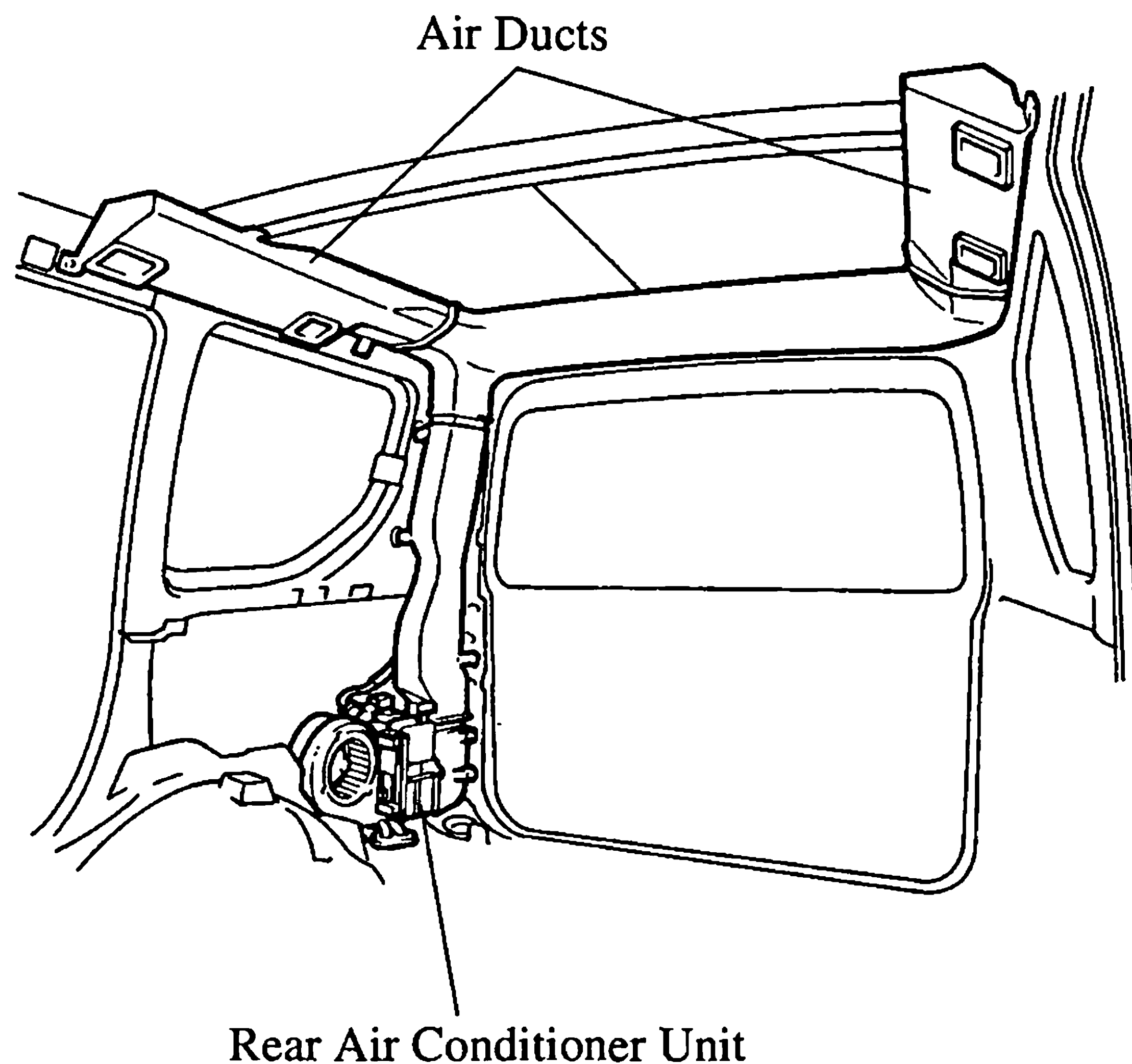
A rear heater main switch to turn the rear heater ON/OFF is provided in the rear console to improve the rear heater's ease of use. Also, a vertical type temperature control lever is used for the rear heater control to increase the storage space of the rear console.



7. Rear Air Conditioner

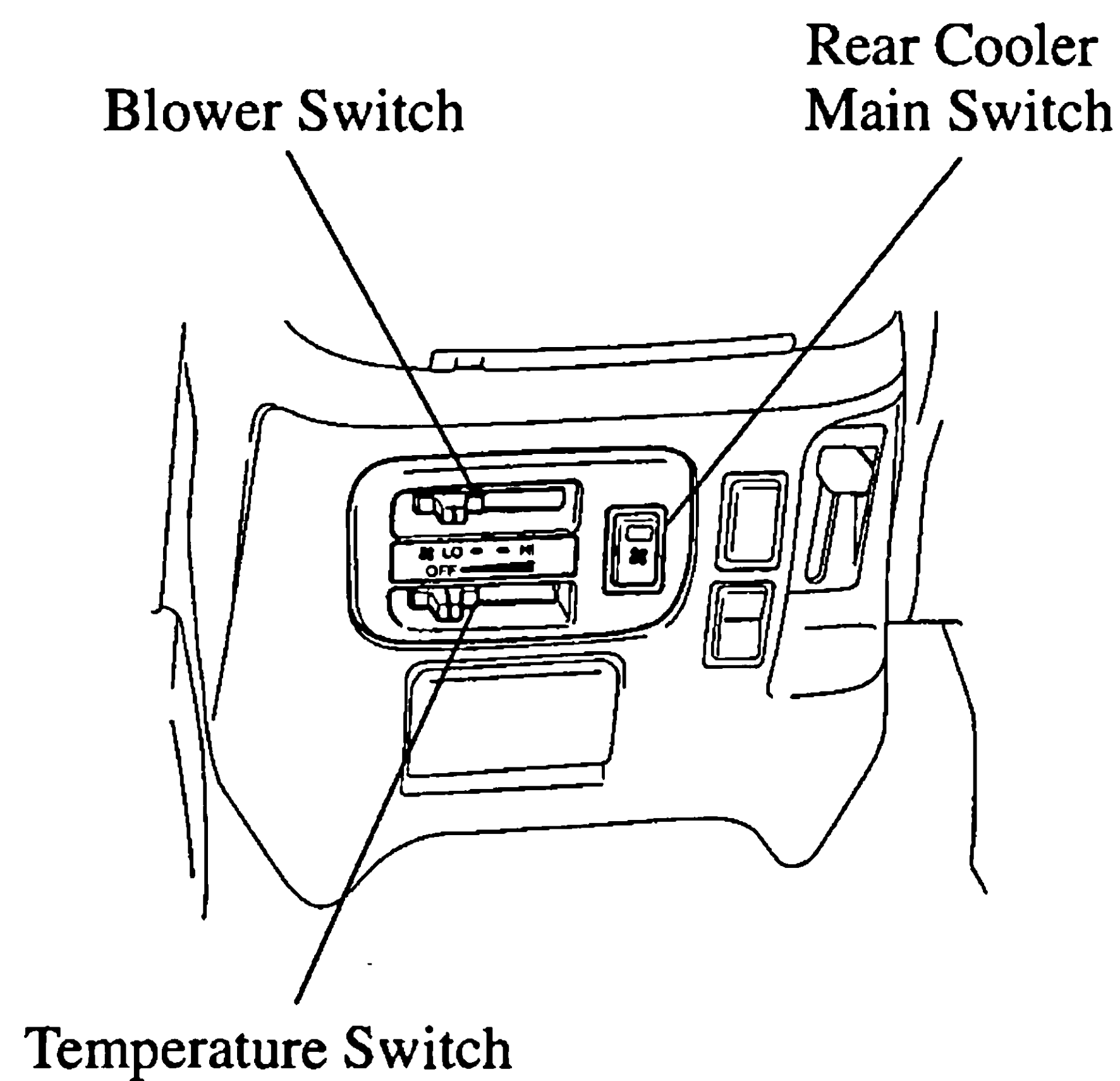
Rear Air Conditioner Unit and Air Duct

The rear air conditioner unit is mounted inside the right rear quarter trim. Also, the air duct is embedded in the pillar and in the ceiling to improve the appearance of the vehicle interior.



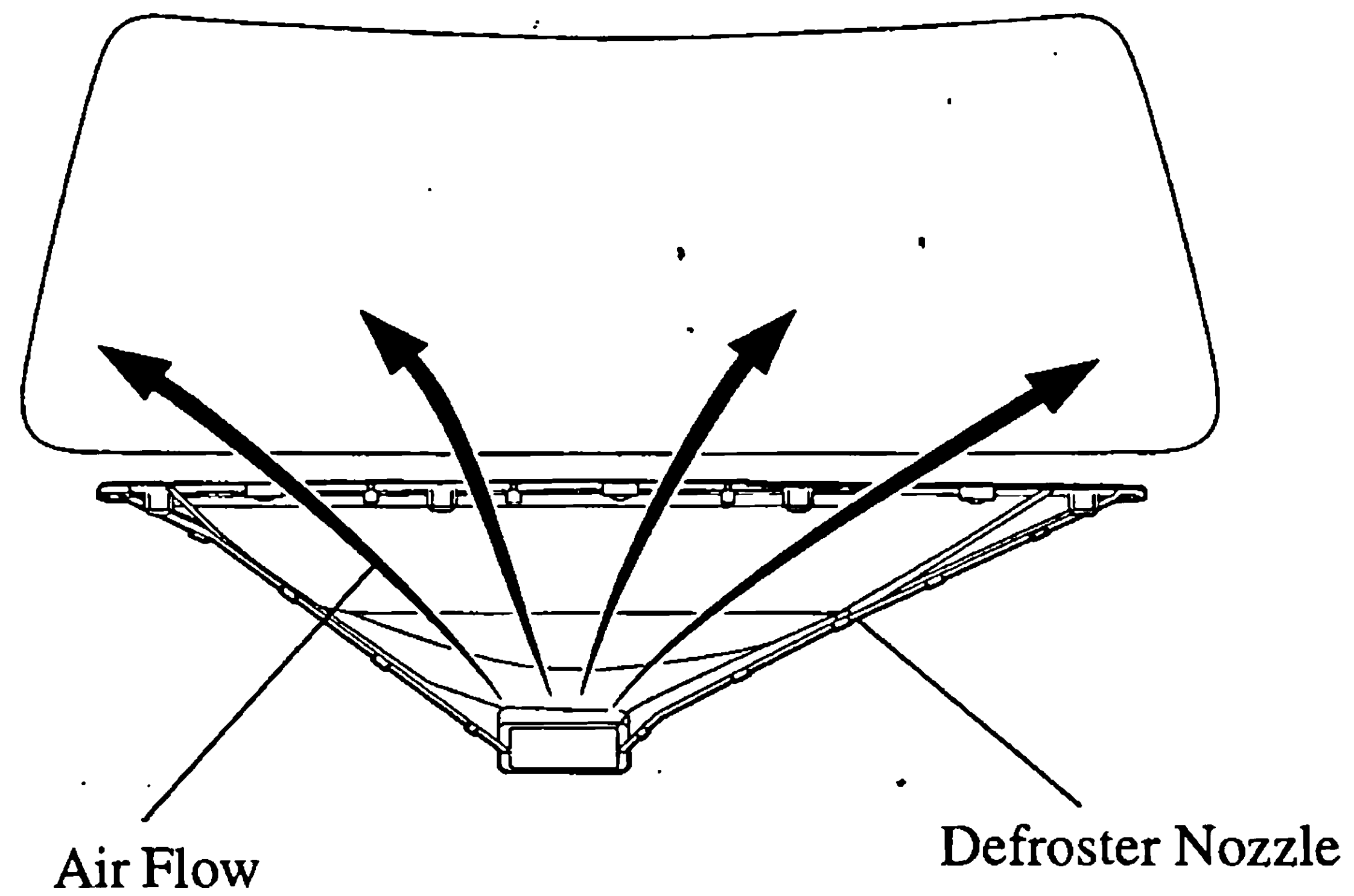
Rear Air Conditioner Control Panel

As in the rear heater control panel, the rear air conditioner panel is also provided in the rear console to improve its ease of use.



8. Defroster Nozzle

The inner wall of the front defroster nozzle has adopted a radial shape in order to provide a smoother air flow out of the vents. As a result, the noise level of the blower during the defroster mode has been reduced.



ACCESSORIES

■ DESCRIPTION

The Land Cruiser/Land Cruiser Prado includes the accessory systems shown in the following table.

System	Outline
Power Window System	This system has a “one-touch” operation which automatically opens the driver’s door window simply by pressing the window switch once. However, the fully open or close function is available on the right-hand drive models in General Countries.
Door Lock Control System	This system has a “key-linked lock and unlock” and “lock and unlock controlled by door lock switch” function. All doors can be locked and unlocked simultaneously by operation of the driver’s door key and door lock switch.
Wireless Door Lock Remote Control System	A remote control system is adopted in which the lock and unlock functions of all doors can be controlled by the signals emitted from a transmitter. For details, see the next page.
Engine Immobiliser System	This is a theft-deterrent system which disables the engine unless the ignition key used to start the engine has an ID code that matches the code that is pre-registered in the vehicle. For details, see page 207.
Power Seat	A power seat is provided to adjust the seat position (fore-and-aft sliding, rear vertical height, and reclining) by a simple switch operation.
Seat Heater	A 2-stage seat heater is used in the front seat. The seat heater switch changes the output of the heating elements located in the seatback and seat cushion, to LO or HI. This is accomplished by changing the heating element to series (LO) or to parallel (HI) connection.
Outside Rear View Mirror	An electrical remote control type outside rear view mirror that enables mirror angle to be adjusted by a switch operation is provided. Also, the model for Europe is provided with a mirror heater to remove any water drops from the mirror surface.
SRS Airbag	The SRS (Supplemental Restraint System) airbag is provided for the driver and front passenger. SRS airbag has been designed to help lessening the shock to the head and chest of driver and front passenger in a frontal impact in the event of a collision as a supplement to the seat belt. 1 sensor type airbag system is used in which the detection of deceleration during a frontal collision, as well as control of the airbag system, is accomplished by the airbag sensor assembly. For details, see page 212.
Cruise Control System	Once it has been set at desired vehicle speed, this system automatically adjusts the engine throttle position to maintain the vehicle speed at the desired speed without operating the acceleration pedal.
Moon Roof	By operating the control switch, this system tilts up or slides the moon roof to provide good ventilation and an open-air feeling.
Headlight Cleaner	The headlight cleaner sprays windshield washer fluid onto the headlights to clean the lens.
Key Reminder System	When the driver’s door is opened with the ignition key in the ACC or LOCK position, this system sounds a buzzer to warn the driver that the ignition key has not been removed.

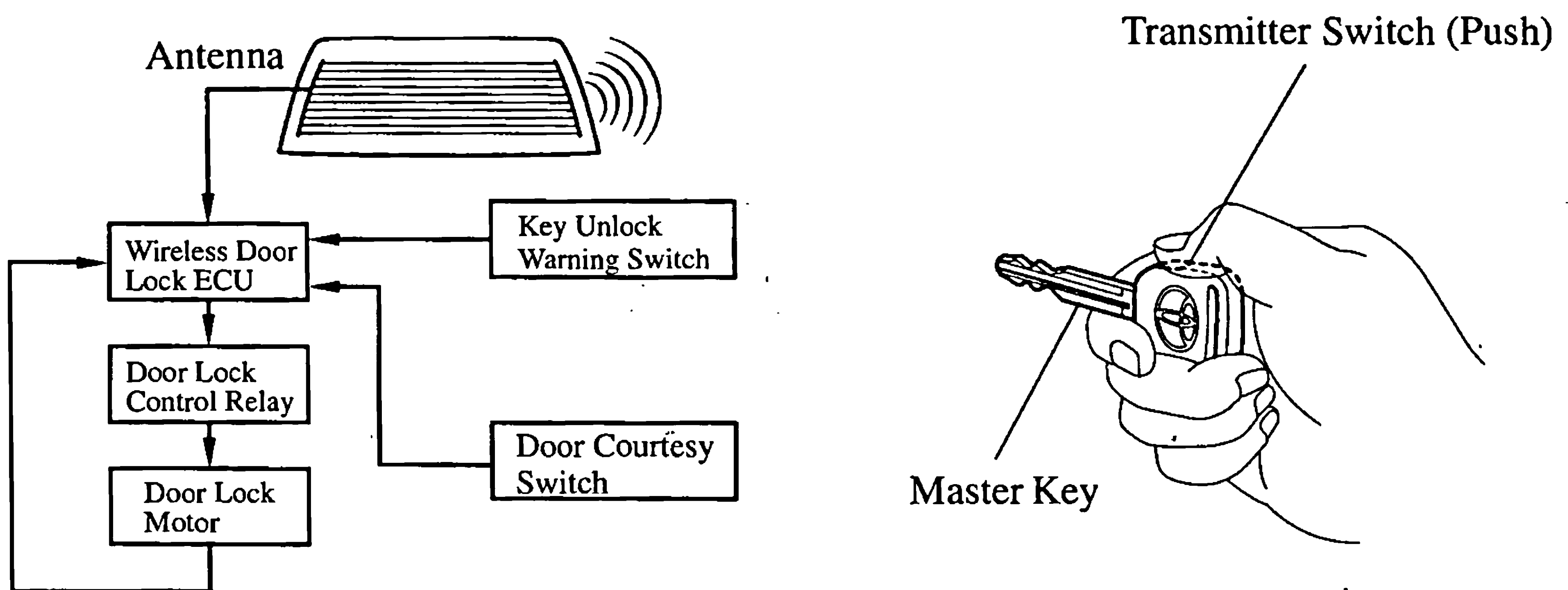
■ WIRELESS DOOR LOCK REMOTE CONTROL SYSTEM

1. General

The wireless door lock remote control system is a convenient system for locking and unlocking all the doors from a distance. A signal (coded differently for each key) is transmitted from a transmitter contained in the master ignition key to the wireless door lock ECU via the rear window defogger wiring.

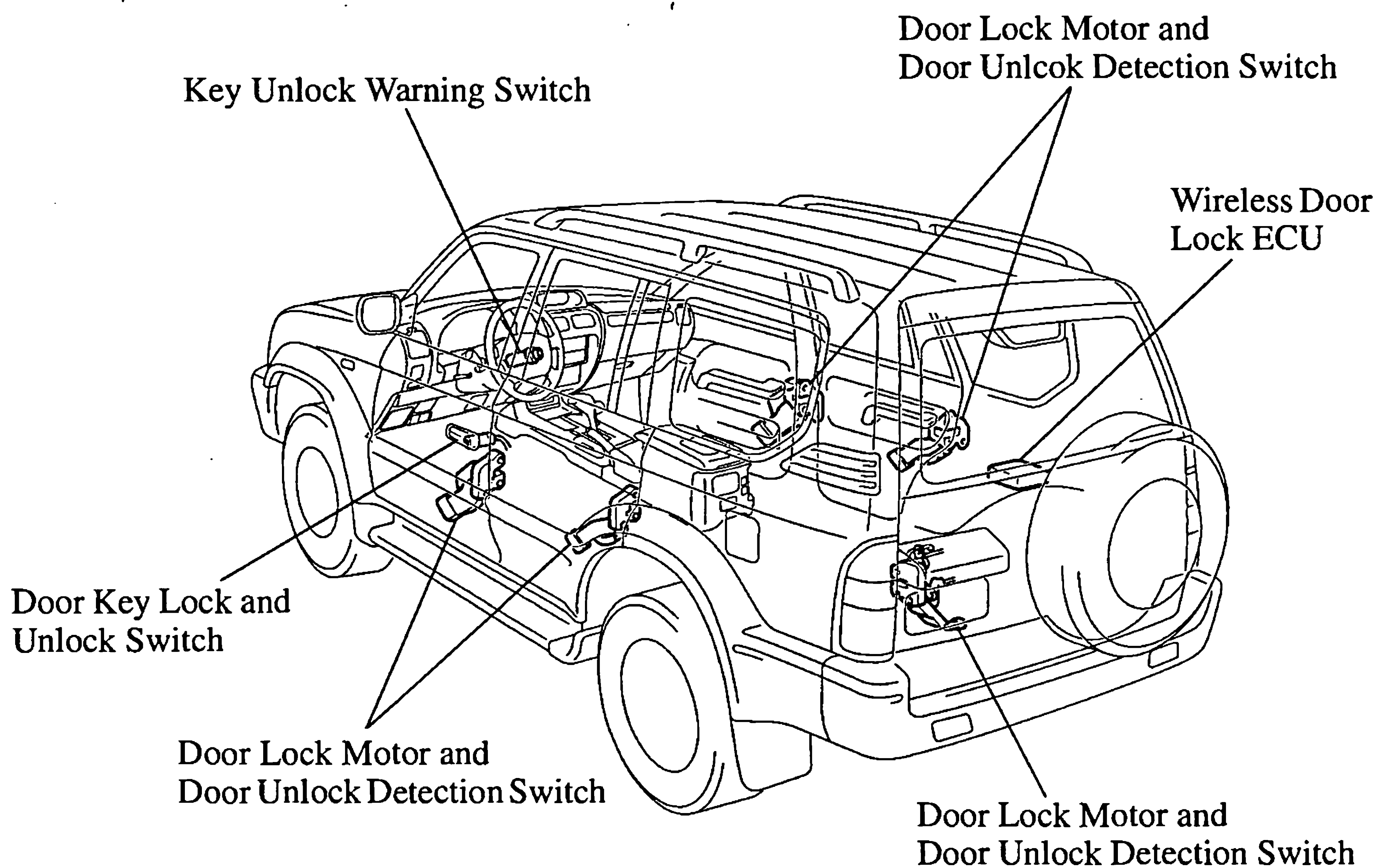
Also, an EEPROM (Electrically Erasable Programmable ROM) is provided in the wireless door lock ECU to enable changing of the transmitter recognition code.

► System Diagram ◀



2. Layout of Components

The major functional parts of the wireless door lock remote control system are shown below. The theft deterrent ECU contains a door lock control relay.

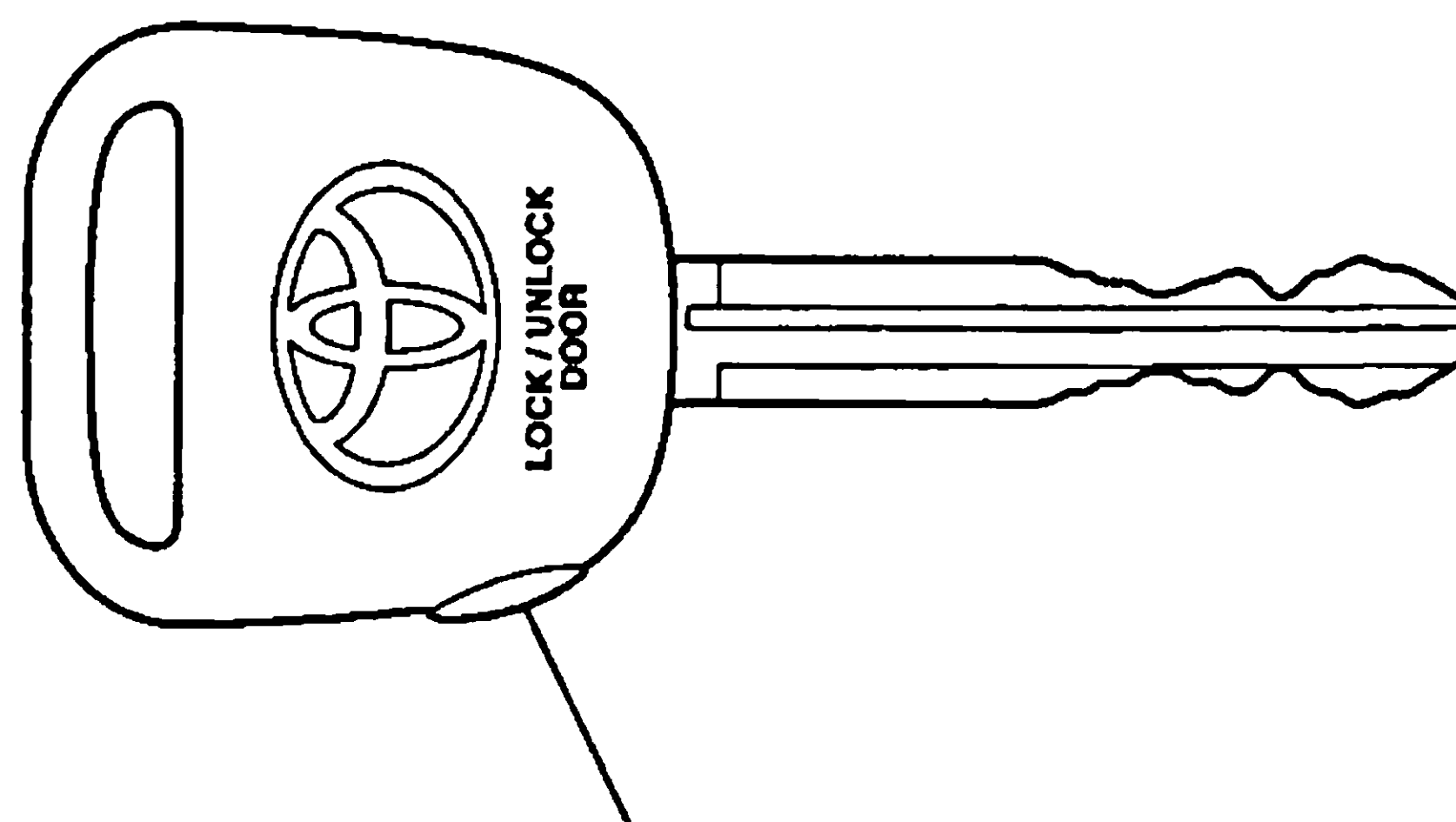


5-Door Models

3. Construction

Transmitter

The transmitter is contained in the grip of the master key. When the transmitter switch is pressed, it transmits a signal having a recognition code from the key plate (used as an antenna). Also, an automatic power-off function is provided, which stops all signal outputs if switch is pressed longer than 0.8 seconds.



Transmitter Switch

Antenna and Wireless Door Lock ECU

The signal from the transmitter is received by the printed wiring of the rear window defogger. The wireless door lock ECU is located inside the right quarter panel and receives the signal via the rear window defogger wiring.

When a signal is received from the transmitter, the ECU outputs an appropriate signal (to lock or unlock the door) to the door lock control relay. The ECU also contains an EEPROM which can store the transmitter recognition codes.

Key Unlock Warning Switch

The key unlock warning switch detects whether the ignition key is inserted into the ignition key cylinder. It goes on when the key is inserted and off when it is removed from the cylinder.

Door Courtesy Switch

The door courtesy switch detects the operation of a door. It goes on when the door is open and off when the door is closed.

4. Function

Normal Operation

Pressing the transmitter switch unlocks all the doors if they have been locked and locks all the doors if any of the doors has been unlocked.

Auto Lock Function

If none of the doors are opened within 30 seconds after they are unlocked by the wireless door lock remote control, all the doors are locked again automatically.

Door-Ajar Lock Prevention Function

Prohibits the locking and unlocking of the door by transmitter if any of the doors is open or ajar and the courtesy switch is turned ON.

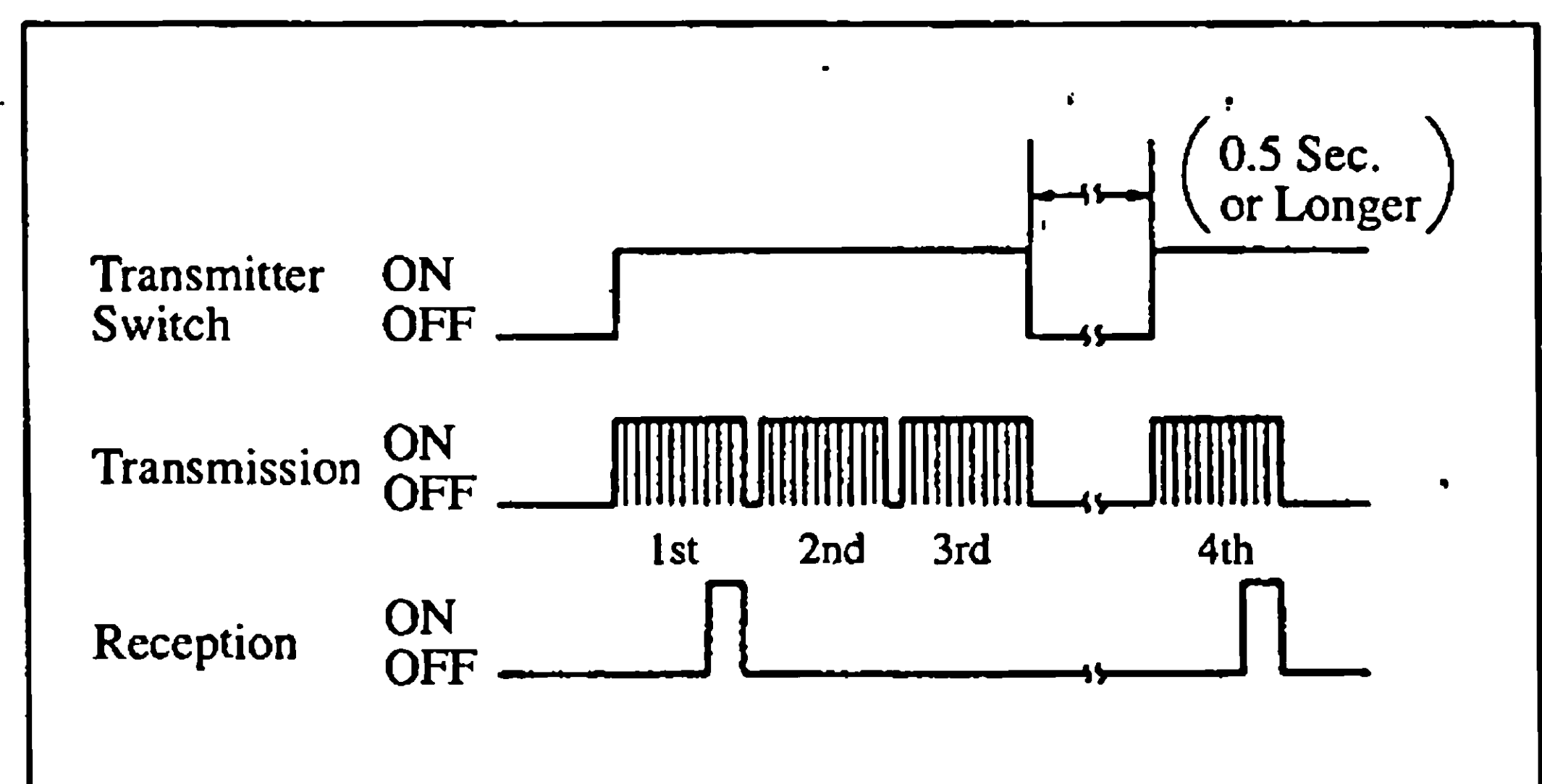
Transmitter Switch Misoperation Prevention Function

When an ignition key is in the ignition key cylinder, the wireless door lock remote control is temporarily cancelled to prevent misoperation.

Anti-Chattering Function

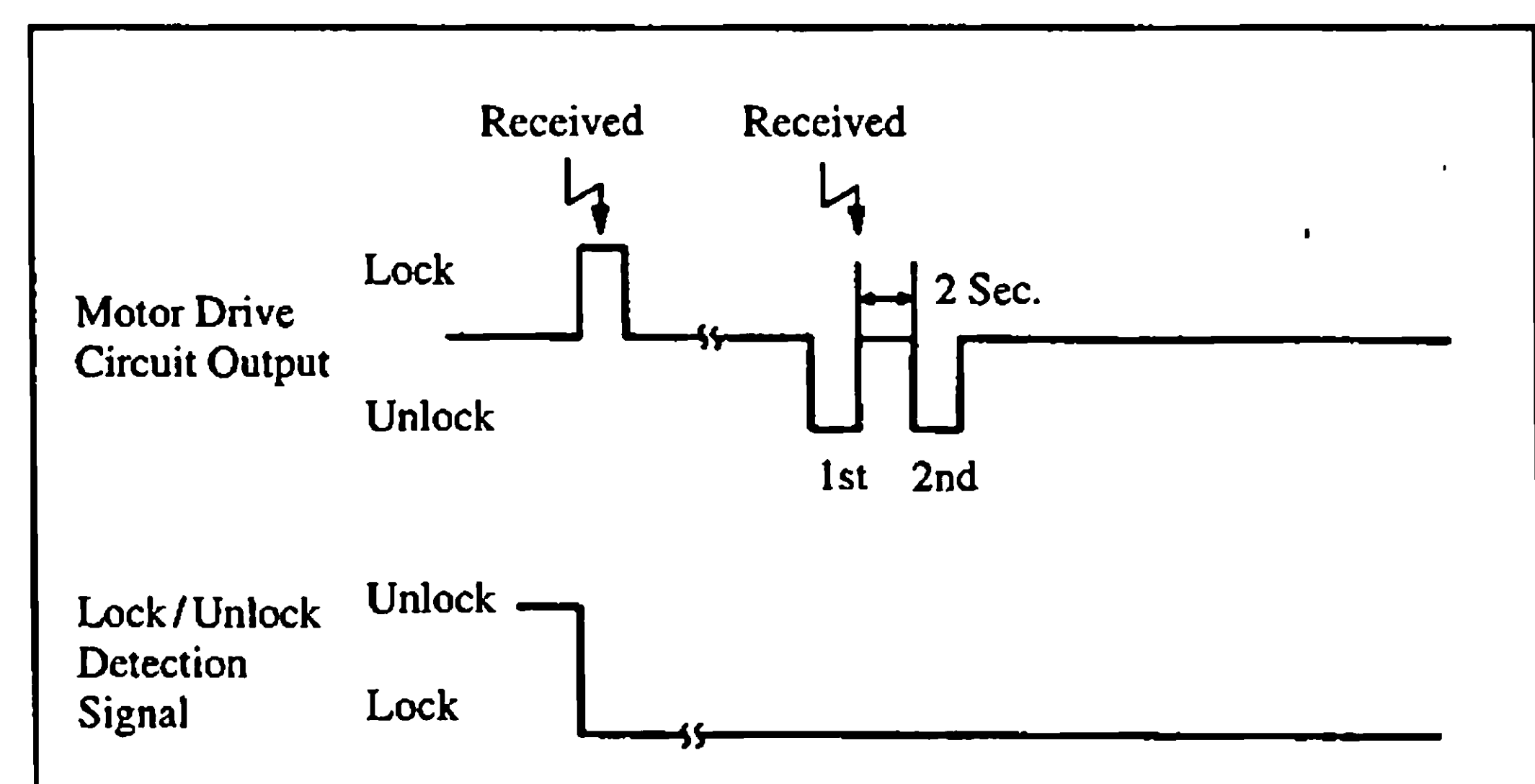
When the wireless door lock ECU receives the correct specified code the first time, it rejects subsequent code signals. It stops reception until transmission is suspended for 0.5 seconds or longer to prevent chattering.

In the example on the right, the first and fourth codes are received but the second and third codes are not received.



Motor Protection Function

When doors are not locked or unlocked after the wireless door lock ECU supplies a lock or unlock signal to the door lock control relay, it continues to send the signal repeatedly about every 2 seconds. It stops sending the signal after repeating 2 times in order to protect the motors.



Security Function

When the receiver receives ten or more incorrect codes within ten minutes, it judges this as a theft attempt and reception is suspended immediately. When this occurs, the receiver rejects all codes including the correct code.

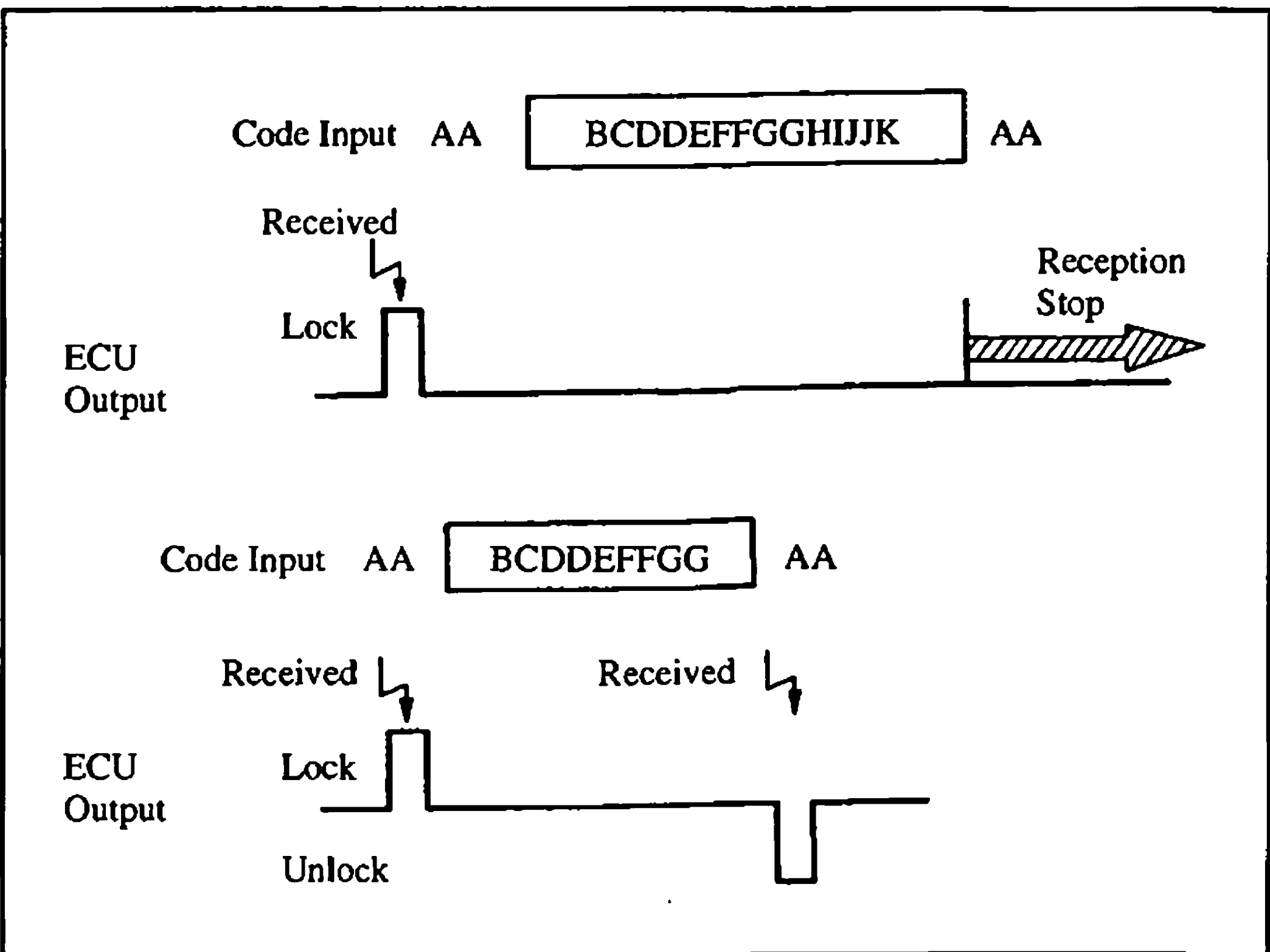
In an example on the right, code A is the correct code and all other codes (B through K) are incorrect (belonging to other vehicles).

When code K (10th different code in this case) is received, the system stops reception.

If a correct code (code A) is received after less than ten different codes are received (six codes from B through G in this case), the code count is cancelled and the system continues receiving codes.

When reception is stopped, it can be resumed as follows:

- Operate a door key and unlock the door.
- Open and close the door.
- Insert an ignition key into the key cylinder.



Transmitter Recognition Code Registration Function

The table below shows the 4 special coded ID registration function modes through which up to 4 different codes can be registered. The codes are electronically registered (written to and stored) in the EEPROM. For details of the recognition code registration procedure, refer to the Land Cruiser/Land Cruiser Prado Chassis and Body Repair Manual (Pub. No. RM517E) to register the codes correctly.

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

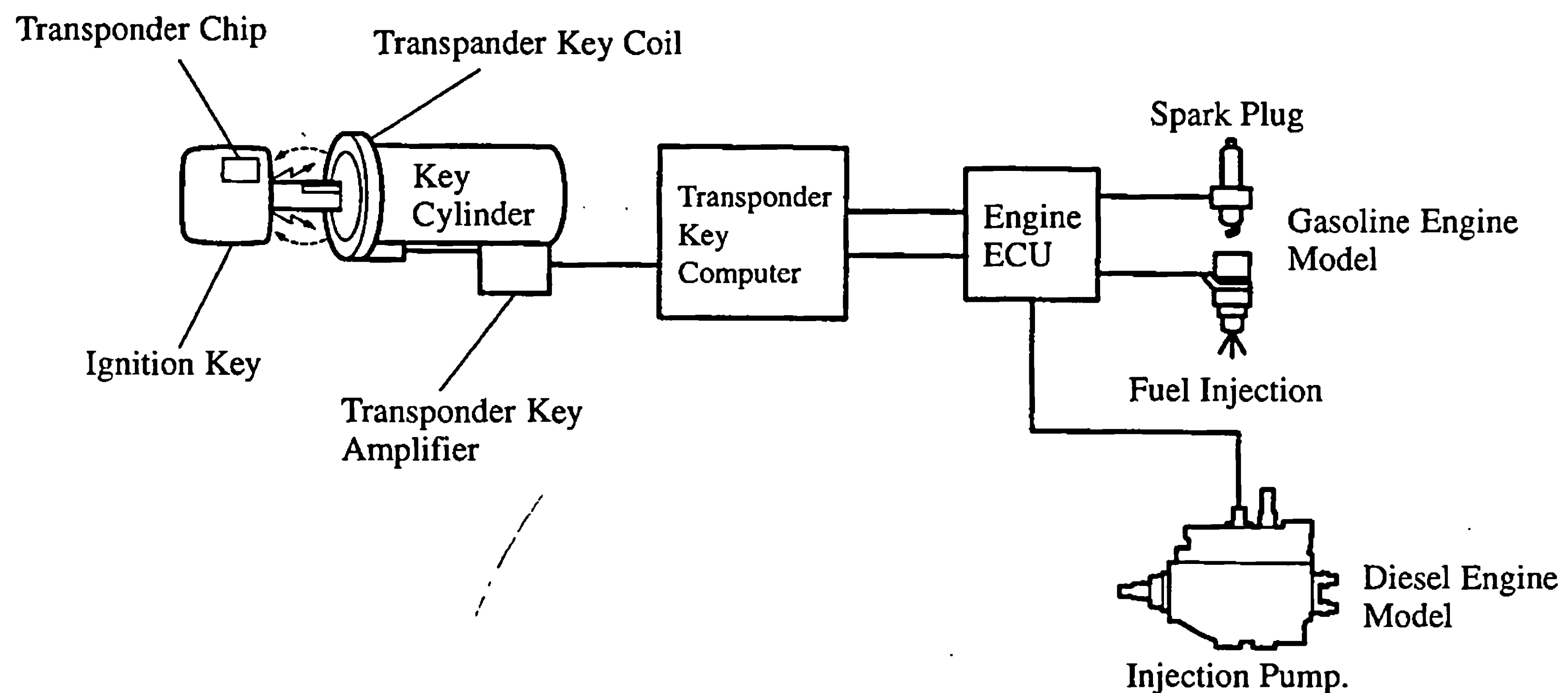
■ ENGINE IMMOBILISER SYSTEM

1. General

The engine immobiliser system is a theft-deterrent system which disables the engine unless it is started by an ignition key with an ID code that matches the code pre-registered in the vehicle.

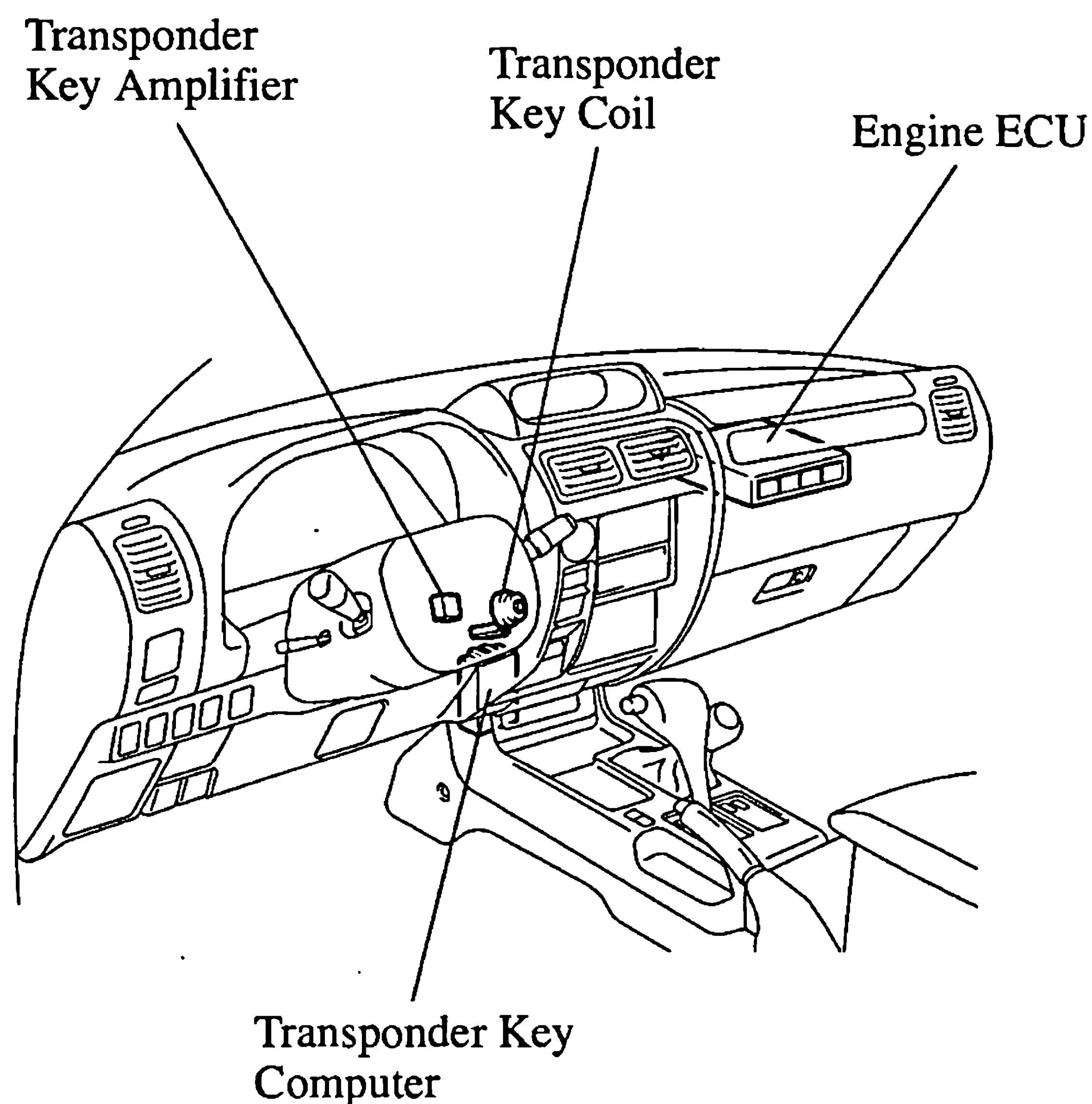
This system adopts a transponder system which uses a transponder chip embedded in the grip of the ignition key. When the coil located around the ignition key cylinder receives the ID code signal transmitted by the transponder chip, the computer determines whether or not the ID code matches the code stored in the computer.

► System Diagram ◀

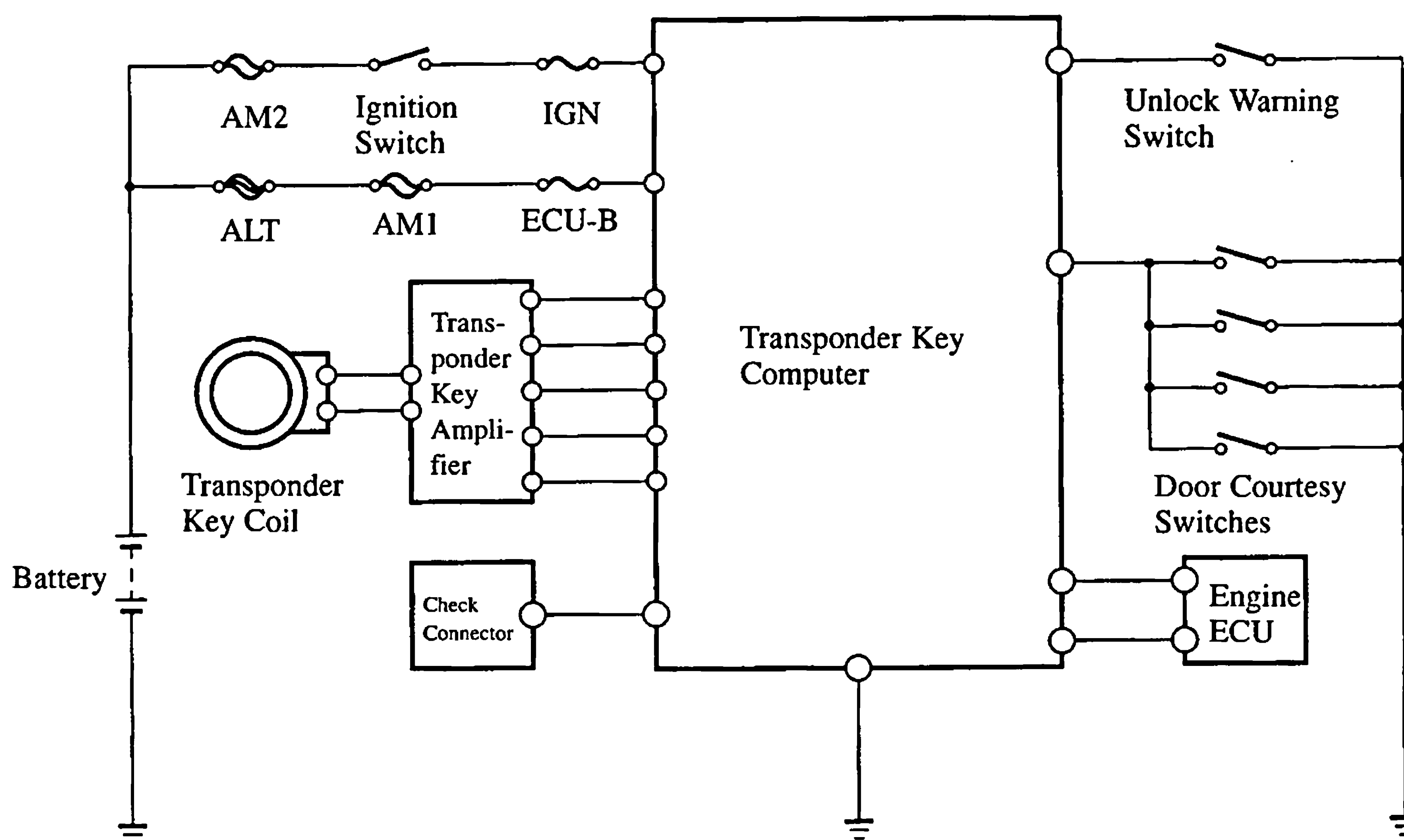


2. Layout of Components

The major parts of the engine immobiliser system are shown below.



3. Wiring Diagram

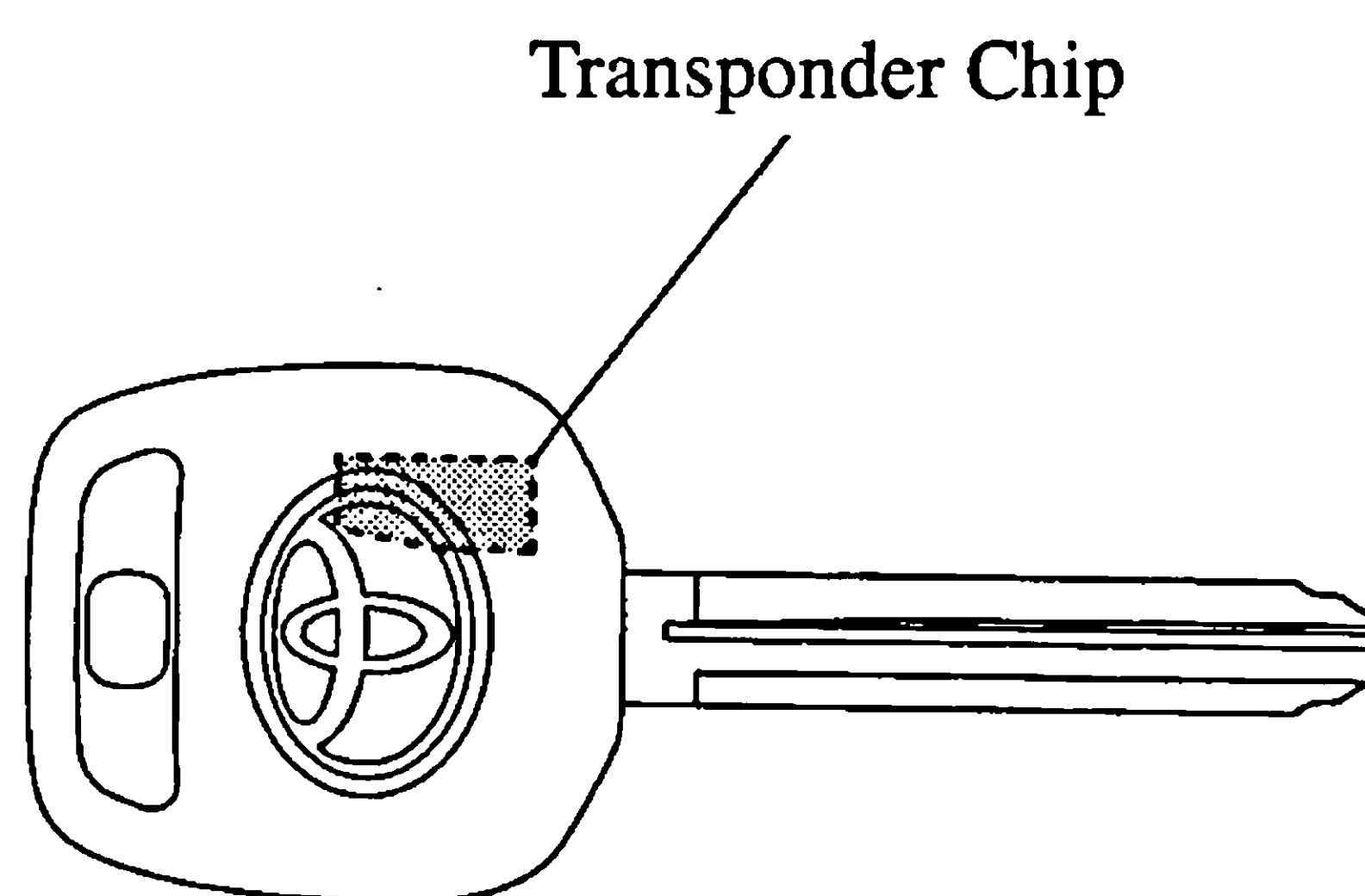


4. Construction

The engine immobiliser system consists of the transponder key (ignition key), transponder key coil, transponder key amplifier, and transponder key computer.

Transponder Key (Ignition Key)

A transponder chip is embedded in the grip of the ignition key. Each transponder chip contains an individual transponder key code (ID code). The key does not need an internal battery to transmit a key code.



Transponder Key Coil and Transponder Key Amplifier

The transponder key coil is a ring-shaped coil installed around the ignition key cylinder. The transponder key amplifier is installed in the back of the ignition cylinder.

Transponder Key Computer

The transponder key computer is located in the back of the center console. A maximum of 6 different transponder key codes (master key: 4 types, sub key: 2 types) can be registered in the key computer.

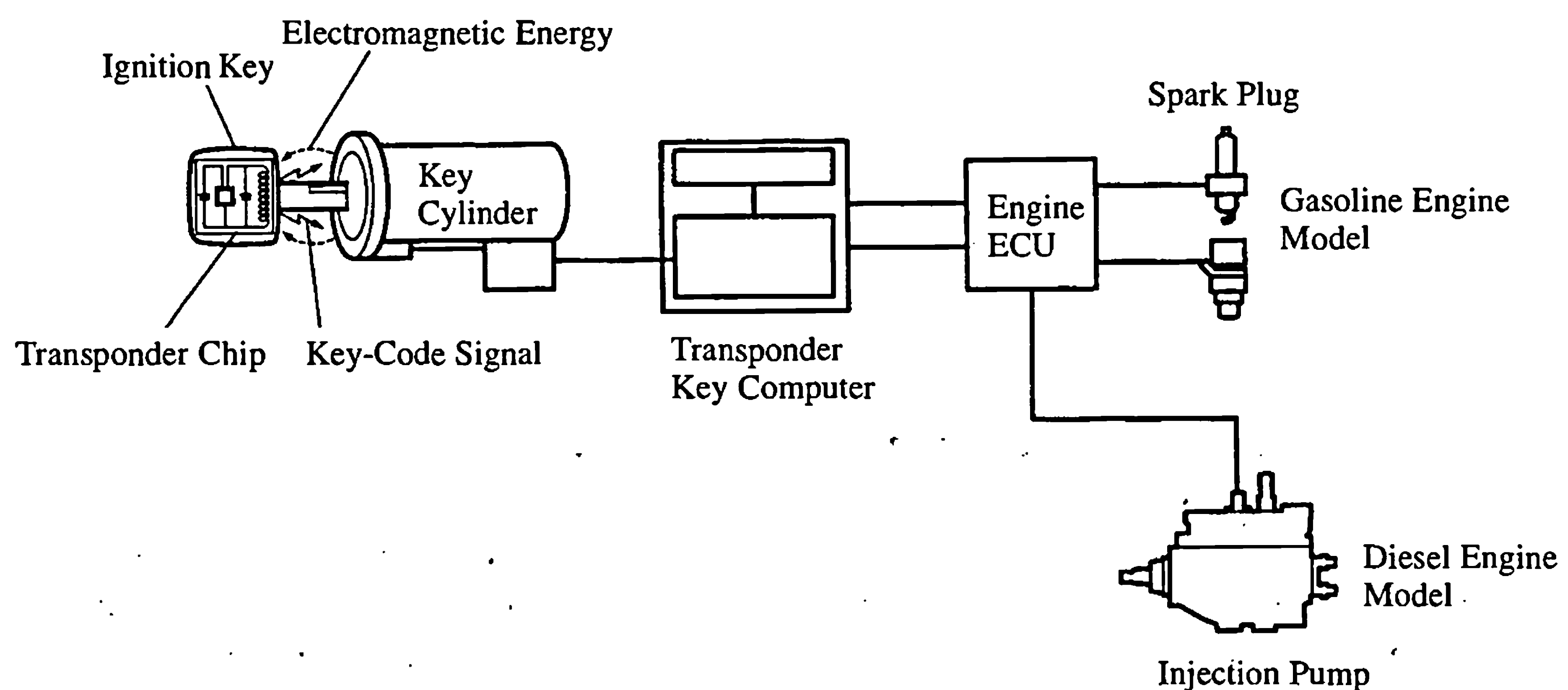
5. Operation

Setting the Engine Immobiliser System

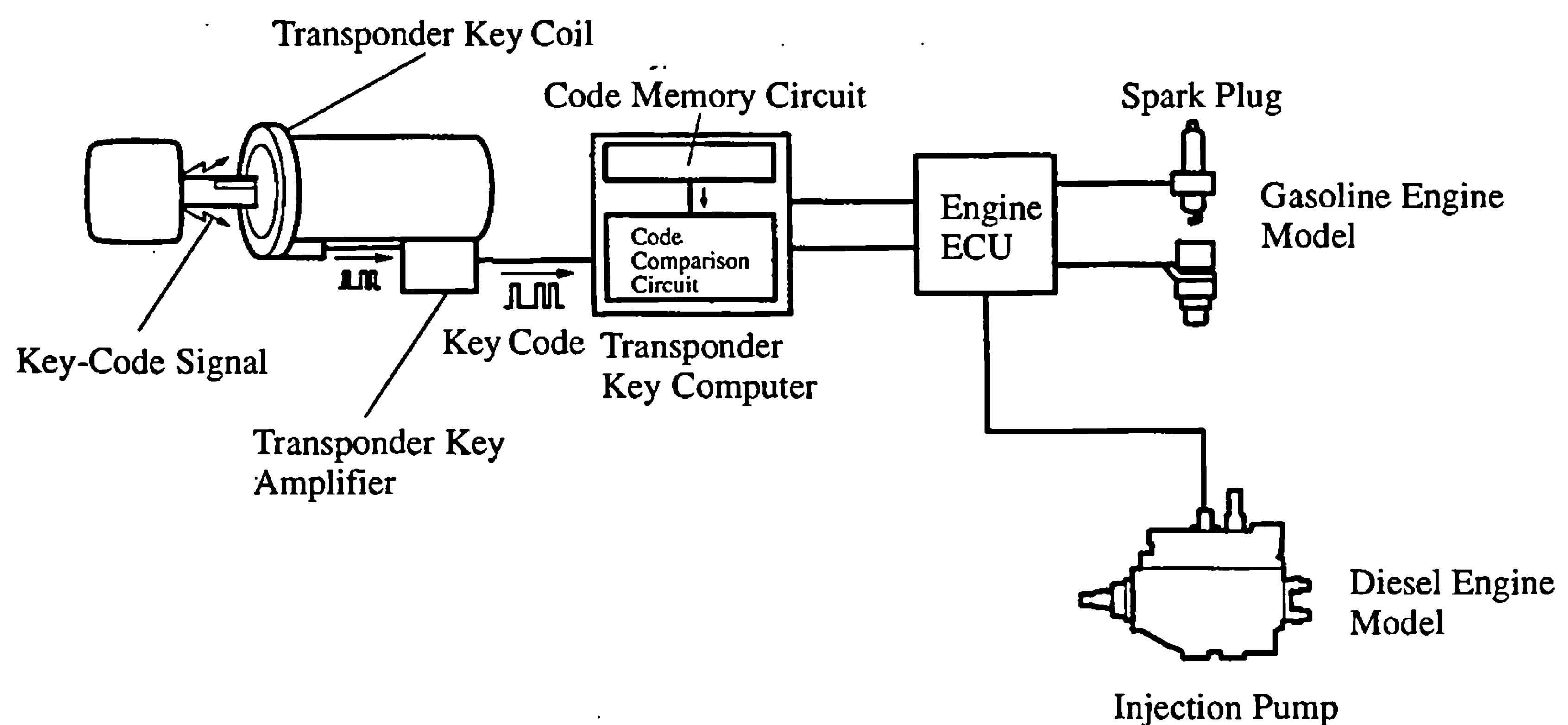
When the ignition key is removed from the key cylinder, the engine immobiliser system will be set.

Unsetting the Engine Immobiliser System

- ① When the ignition key is inserted in the key cylinder, the transponder key computer instructs the transponder key coil to supply the electromagnetic energy that enables the transponder chip to transmit a key-code signal. The condenser in the transponder chip converts and stores this energy as electrical energy. The transponder chip then uses this electrical energy to transmit a key-code signal.

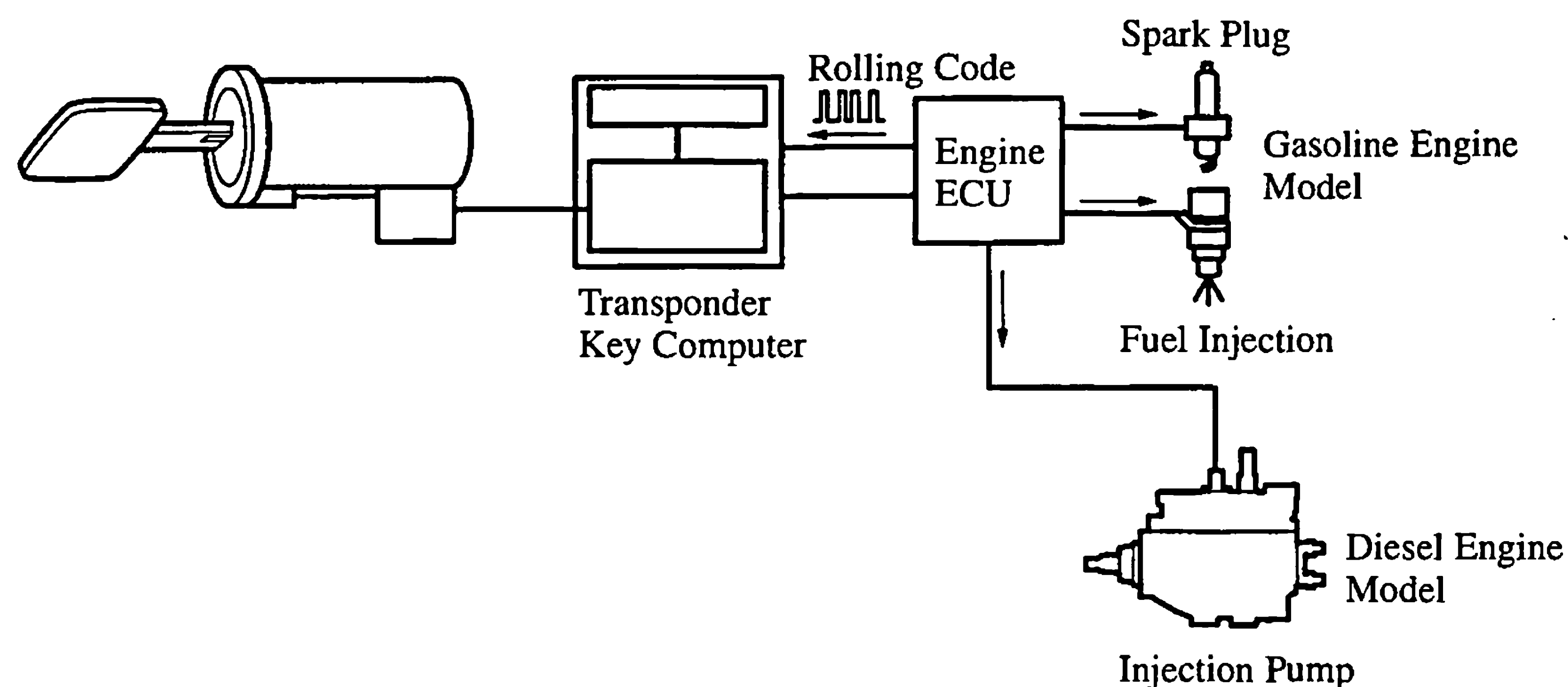


- ② The key code signal that has been received at the coil is amplified by the transponder key amplifier and sent to the computer. The key code that has been received by the computer is then compared to the key code that is stored in the computer. The code comparison process takes place twice, and if the codes match twice in a row, the computer unsets the immobiliser system.

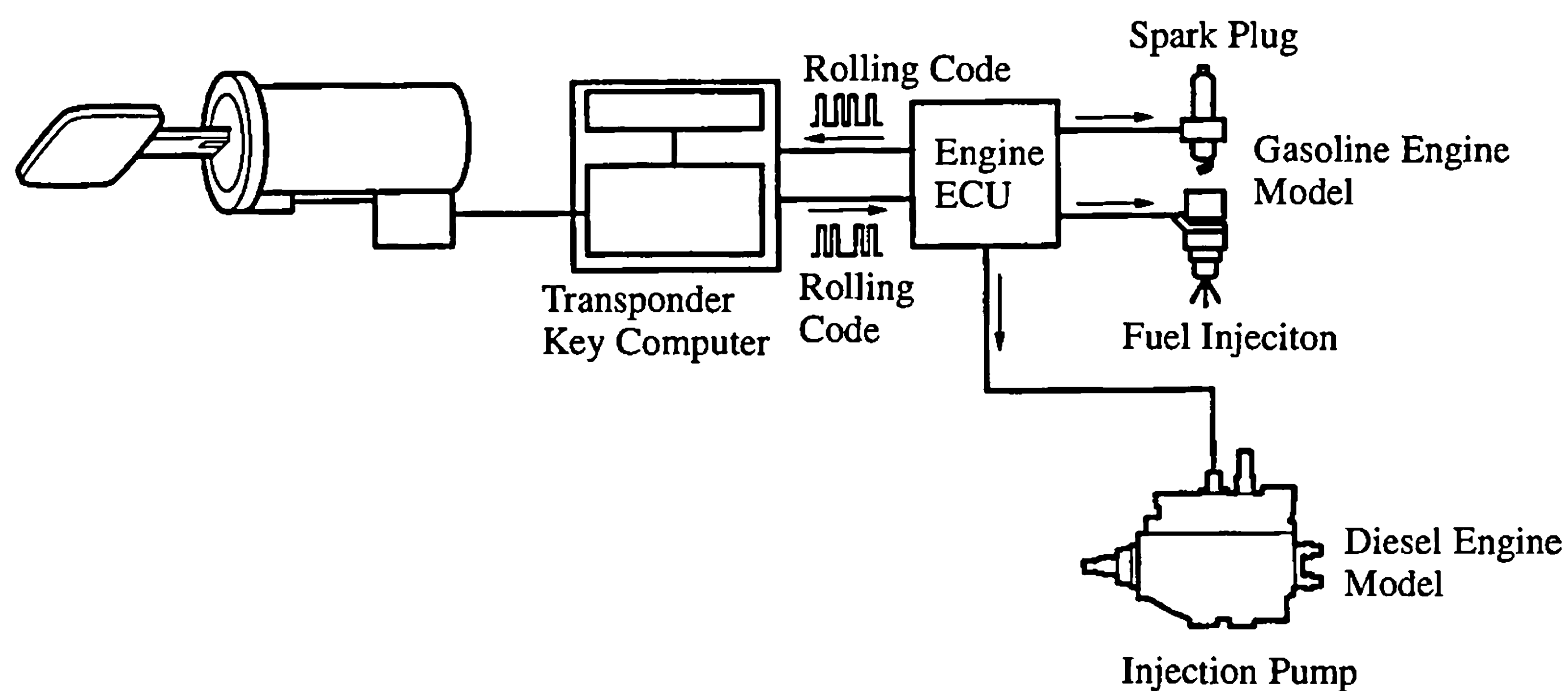


- ③ If the immobilizer system is unset, on the gasoline engine model, the engine ECU allows the current to flow to the injectors and to the spark plugs to enable fuel delivery and ignition. On the diesel engine model, the ECU allows the current to flow to the electromagnetic spill valve, thus enabling the injection pump to inject fuel. As a result, the engine can be started.

Then the engine ECU generates a rolling code based on certain parameters and sends it to the computer.



- ④ Upon receiving the rolling code from the engine ECU, the computer converts the rolling code according to certain parameters and sends it to the engine ECU. This communication between the computer and the engine ECU will take place for a few seconds until the correct signal is sent by the computer to the engine ECU. Within this time, if the correct signal is sent from the computer to the engine ECU, the engine will continue to operate. However, if the correct signal is not sent by the computer within this period, the engine ECU will prohibit fuel delivery and ignition (gasoline engine model only), thus disabling the engine.



6. Function

The engine immobiliser system provides the following functions:

New Transponder Key Code Registration Function

This function allows the registration of the key code of a new master or sub key to the transponder key computer. A maximum of 6 different transponder key codes (4 for master keys and 2 for sub keys) can be registered in the transponder key computer. This function is used if the transponder key computer is replaced with a new one.

Additional Transponder Key Code Registration Function

This function enables the registration of the key code for a new master key or sub key, while retaining the key codes that are already registered. This function is used for the purpose of adding a new master or sub key.

Transponder Key Code Deletion Function

This function deletes all the transponder key codes that are registered in the transponder key computer, except for the key code of the master key that was used to execute the deletion.

For further details on transponder key code registration, addition, and deletion, see the Land Cruiser/Land Cruiser Prado Chassis and Body Repair Manual (Pub. No. RM517E).

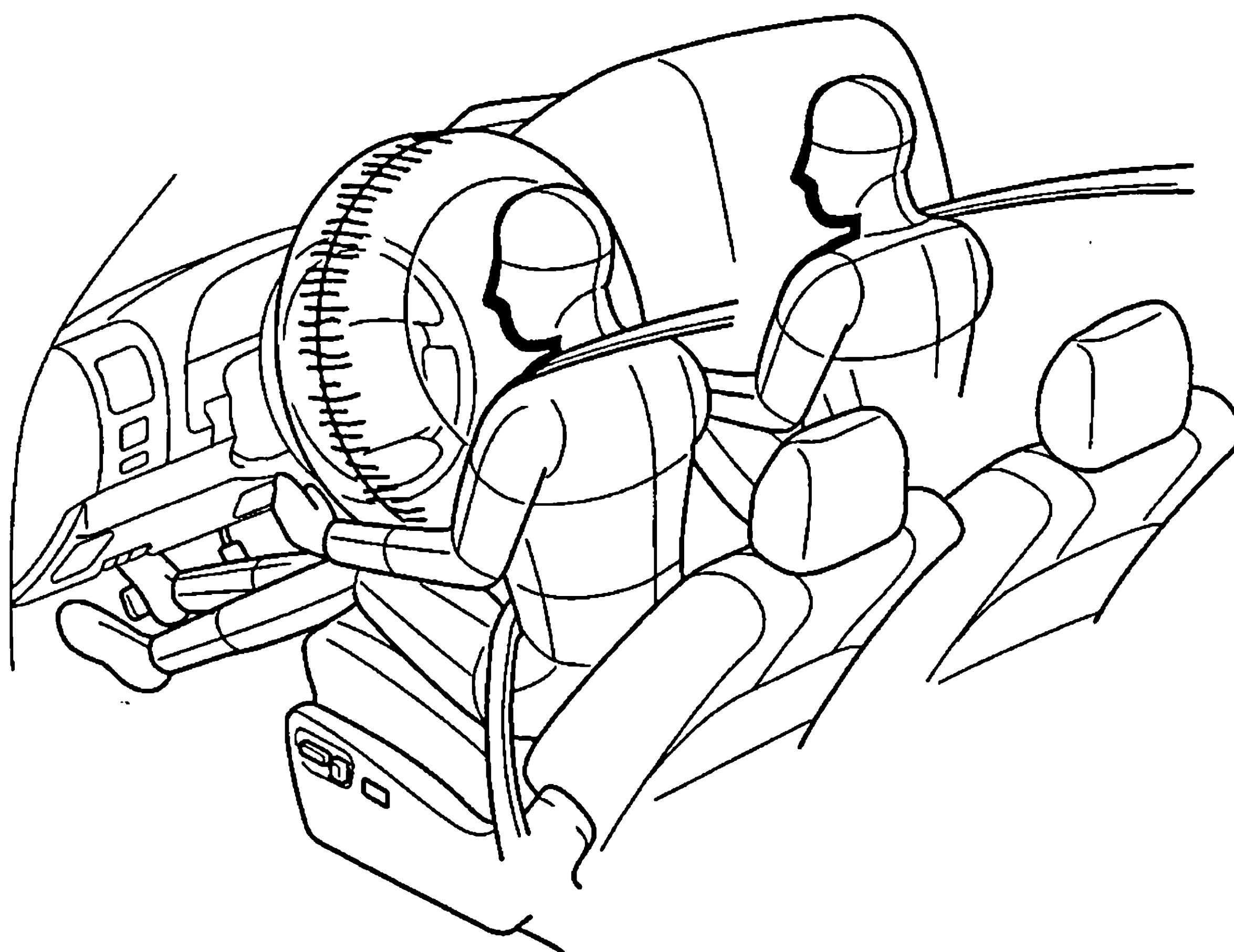
■ SRS AIRBAG

1. General

- The SRS airbag is designed to help lessening the shock to the driver and front passenger as a supplement to the seat belt.

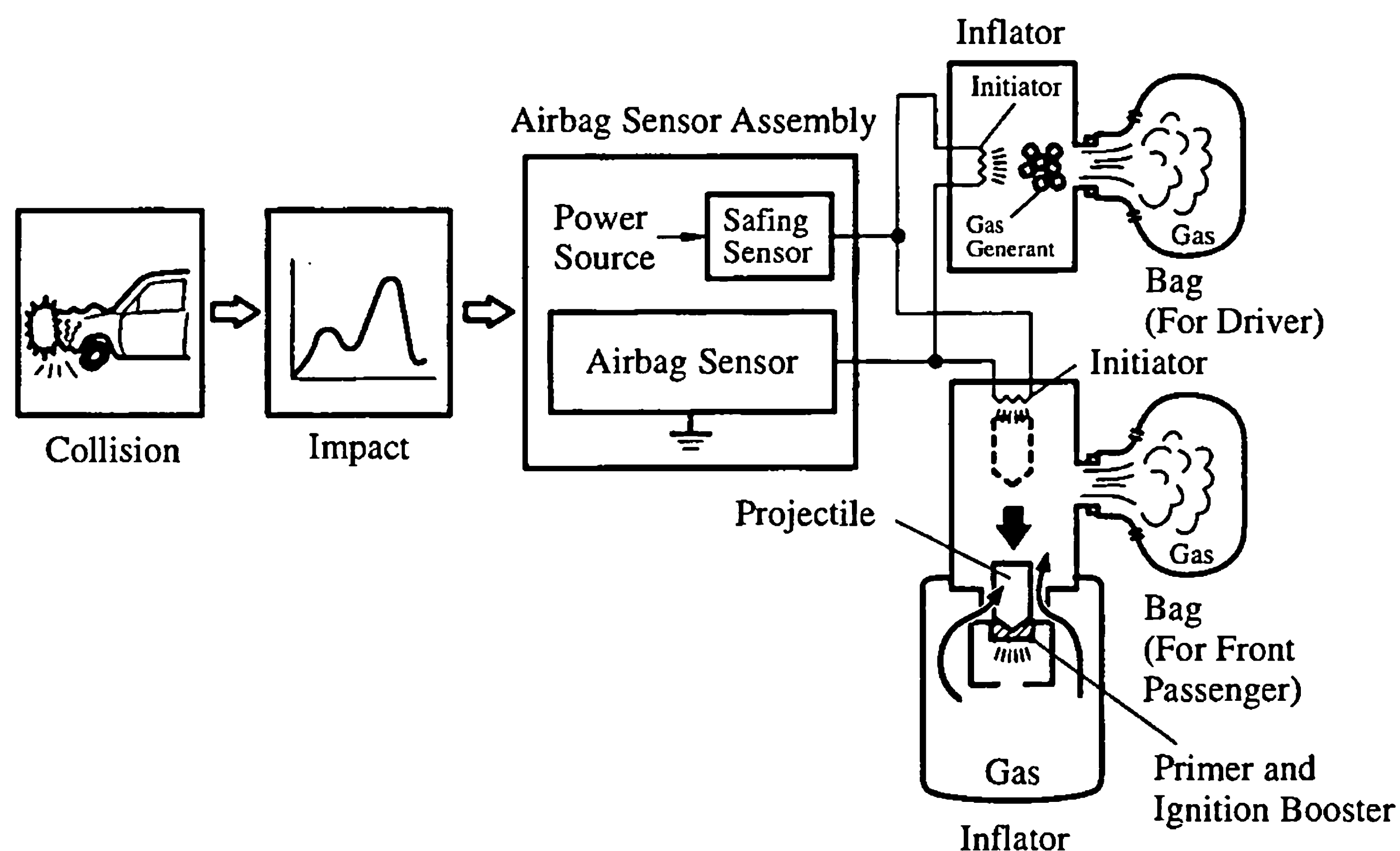
In a collision, the airbag sensor detects the shock and if the front-to-rear shock is greater than a specified value, the airbags stored in the steering wheel pad for the driver and above the glove box for the front passenger inflate instantly to help reducing the likelihood of the driver's or front passenger's head and chest directly hitting the steering wheel or instrument panel.

- A 1-sensor type airbag system is used, in which the detection of deceleration during a frontal collision is accomplished by the airbag sensor enclosed in the airbag sensor assembly.
- The airbag system is controlled by the airbag sensor assembly. It has a self-diagnosis function. When it detects a system malfunction, it lights up the SRS warning light on the combination meter to alert the driver.



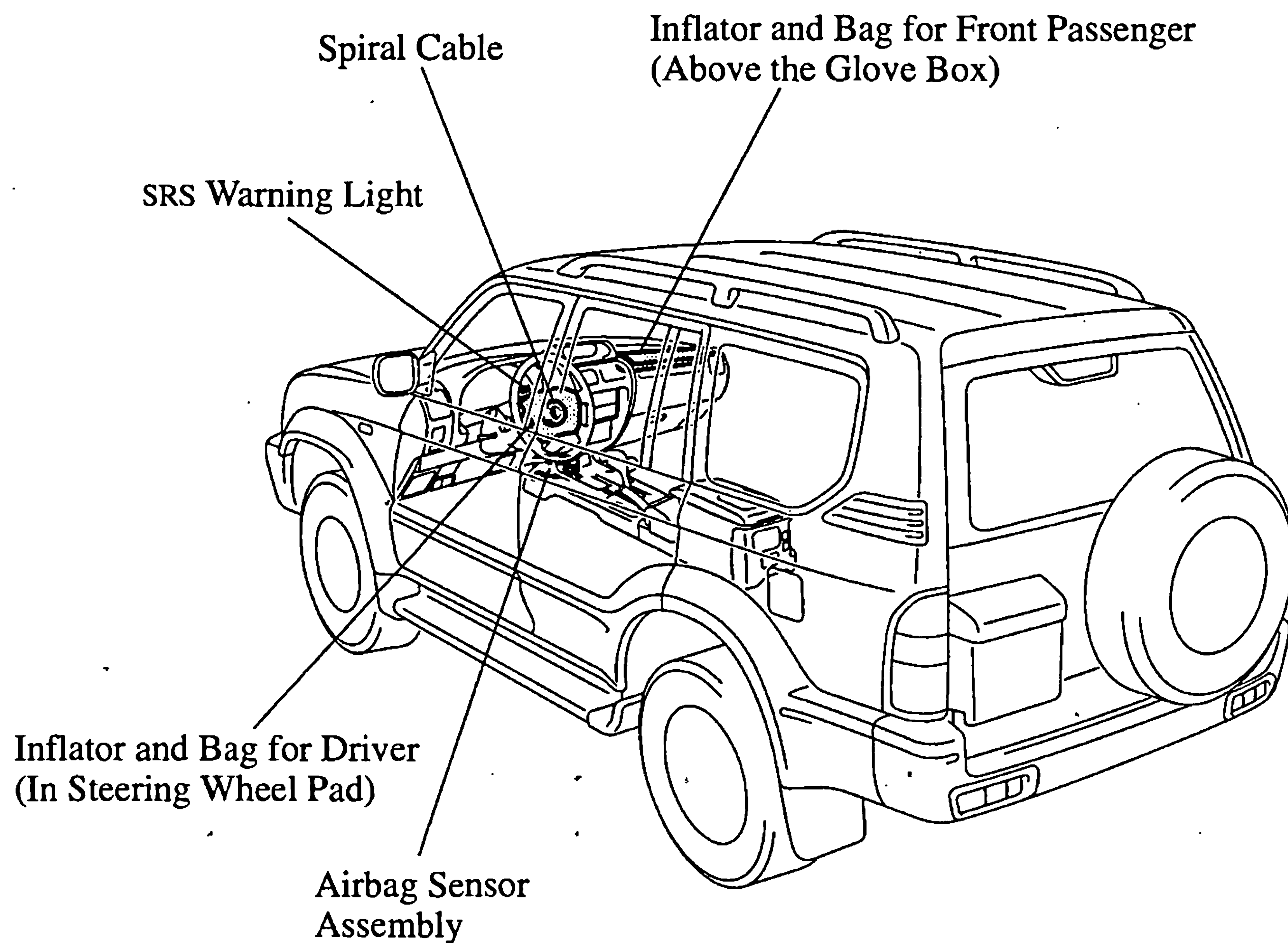
► System Diagram ◀

The activation processes of the SRS airbag is as illustrated below.

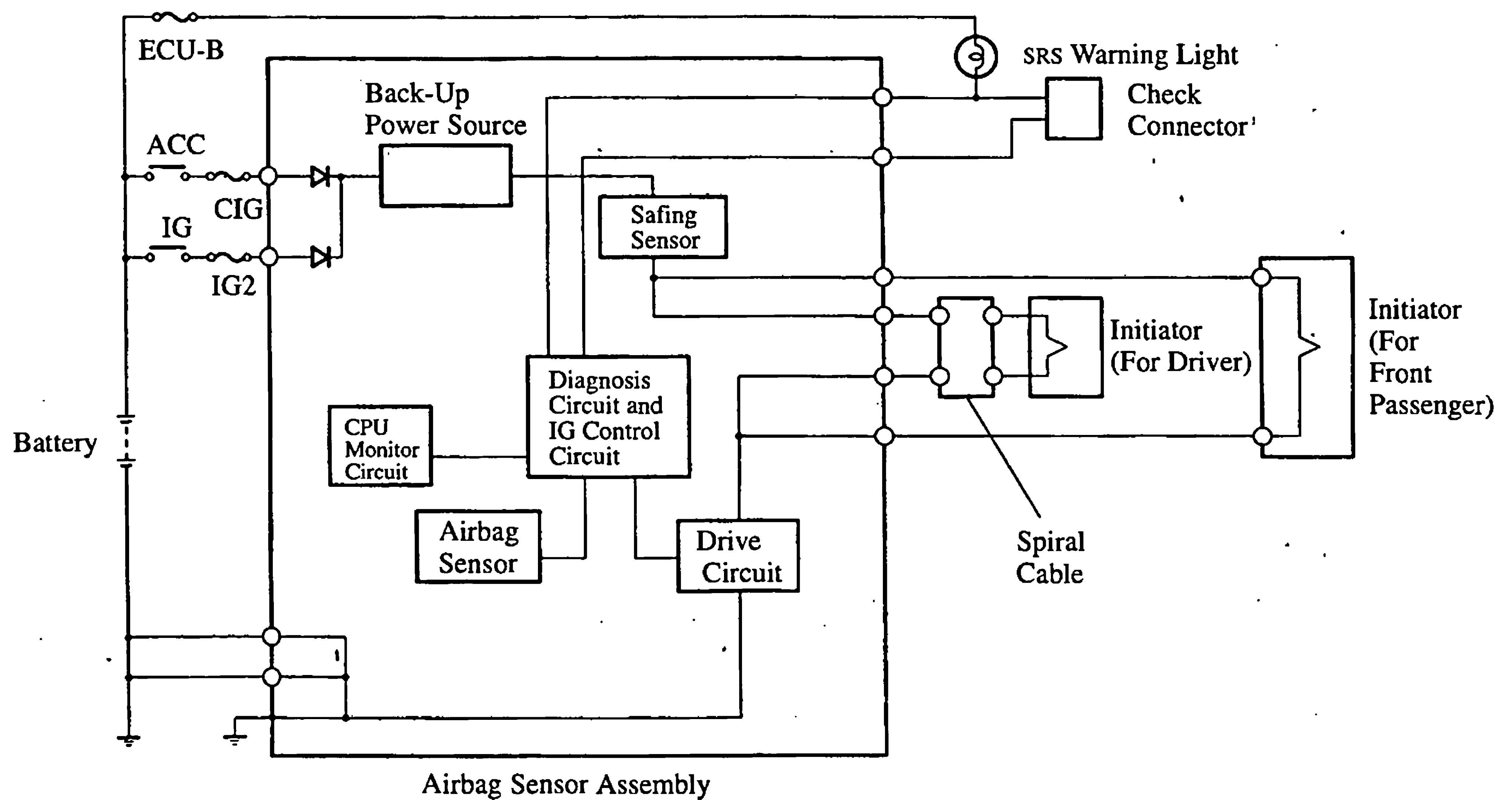


2. Layout of Components

The major function parts of the airbag system are shown below.



3. Wiring Diagram



4. Construction and Operation

Airbag Sensor Assembly

1) Description

The airbag sensor assembly is mounted on the center floor under the instrument panel. It receives signals from the airbag sensor enclosed in the airbag sensor assembly and judges whether or not the airbag must be activated and diagnoses system malfunctions.

2) Construction and Operation

The airbag sensor assembly consists of airbag sensor, safing sensor, ignition control and drive circuit, diagnosis circuit, etc.

a. Airbag Sensor, Ignition Control and Drive Circuit

- The airbag sensor is enclosed in the airbag sensor assembly. Based on the deceleration of the vehicle that occurs during a collision, the distortion created in the sensor is converted into an electric signal. This signal is a linear representation of the deceleration rate.
- The ignition control and drive circuit calculates signals from the airbag sensor. If the calculated value is larger than a predetermined value, it activates the ignition operation.

b. Safing Sensor

The safing sensor is enclosed in the airbag sensor assembly. The sensor turns On and outputs an ON signal to the airbag sensor assembly if a deceleration force that is higher than a predetermined value is applied to the safing sensor as a result of a frontal collision.

c. Backup Power Source

The backup power source consists of a backup capacitor and a DC-DC converter. In case of a power system failure during a collision, the backup capacitor discharges and supplies electric power to the system. The DC-DC converter is a boosting transformer when the battery voltage drops below a certain level.

d. Diagnosis Circuit

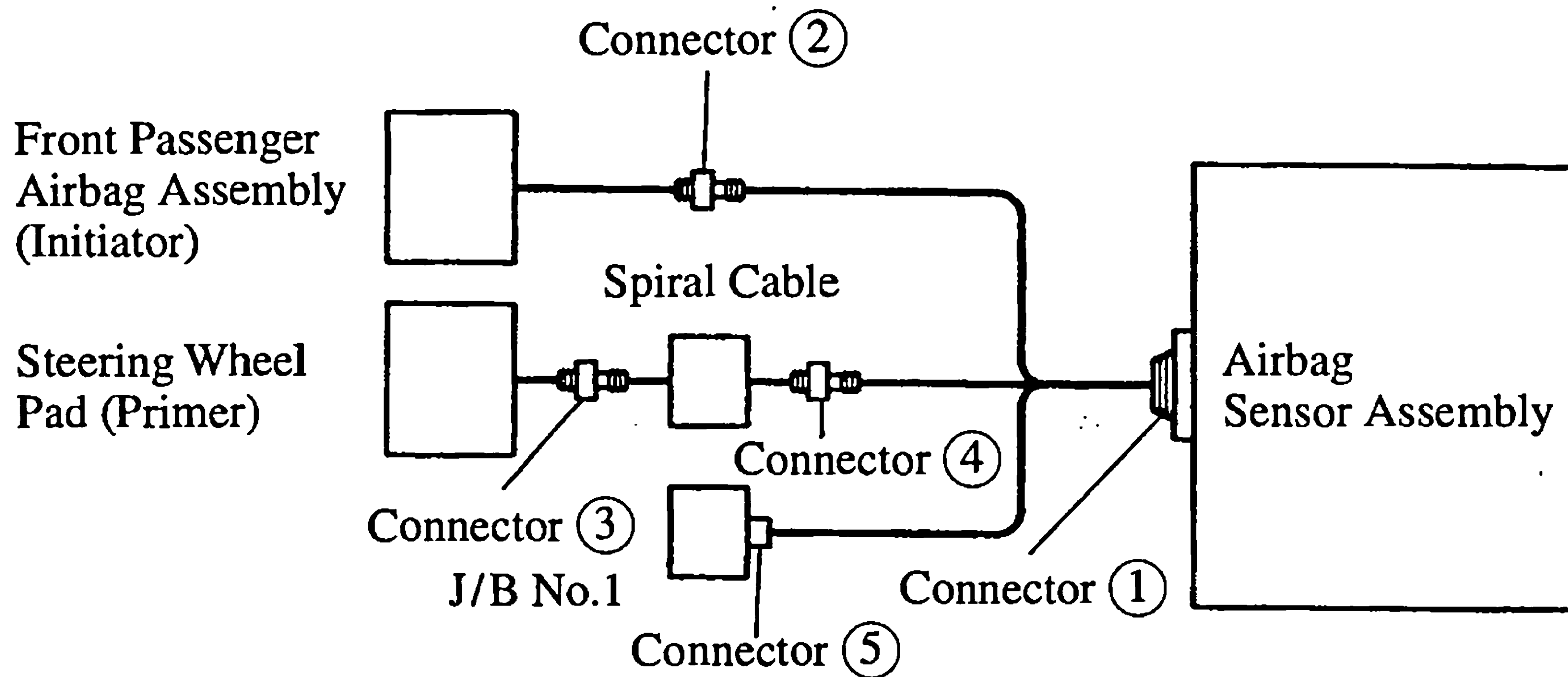
This circuit constantly diagnoses the system for any malfunction. When a malfunction is detected, it lights up the SRS warning light on the combination meter to alert the driver.

e. Memory Circuit

When a malfunction is detected by the diagnosis circuit, it is coded and stored in this memory circuit. However, if the power supply is cut off by turning the ignition switch OFF or by disconnecting the battery terminal, the diagnosis code will be deleted from the memory circuit.

Airbag Connetors

All connectors in the airbag system are colored yellow to distinguish them from other connectors. Connectors having special functions and specifically designed for airbag are used in locations shown below to secure high reliability. These connectors use durable gold-plated terminals.



No.	Items	Application
1	Terminal Twin-Lock Mechanism	Connectors ①, ②, ③, ④, ⑤
2	Airbag Activation Prevention Mechanism	Connectors ①, ②, ③, ④
3	Electrical Connection Check Mechanism	Connector ①
4	Connector Twin-Lock Mechanism	Connectors ②, ③, ④

For details on the mechanisms of the above items (No.1 through 4), see Land Cruiser/Land Cruiser Prado Chassis and Body Repair Manual (Pub. No. RM517E).

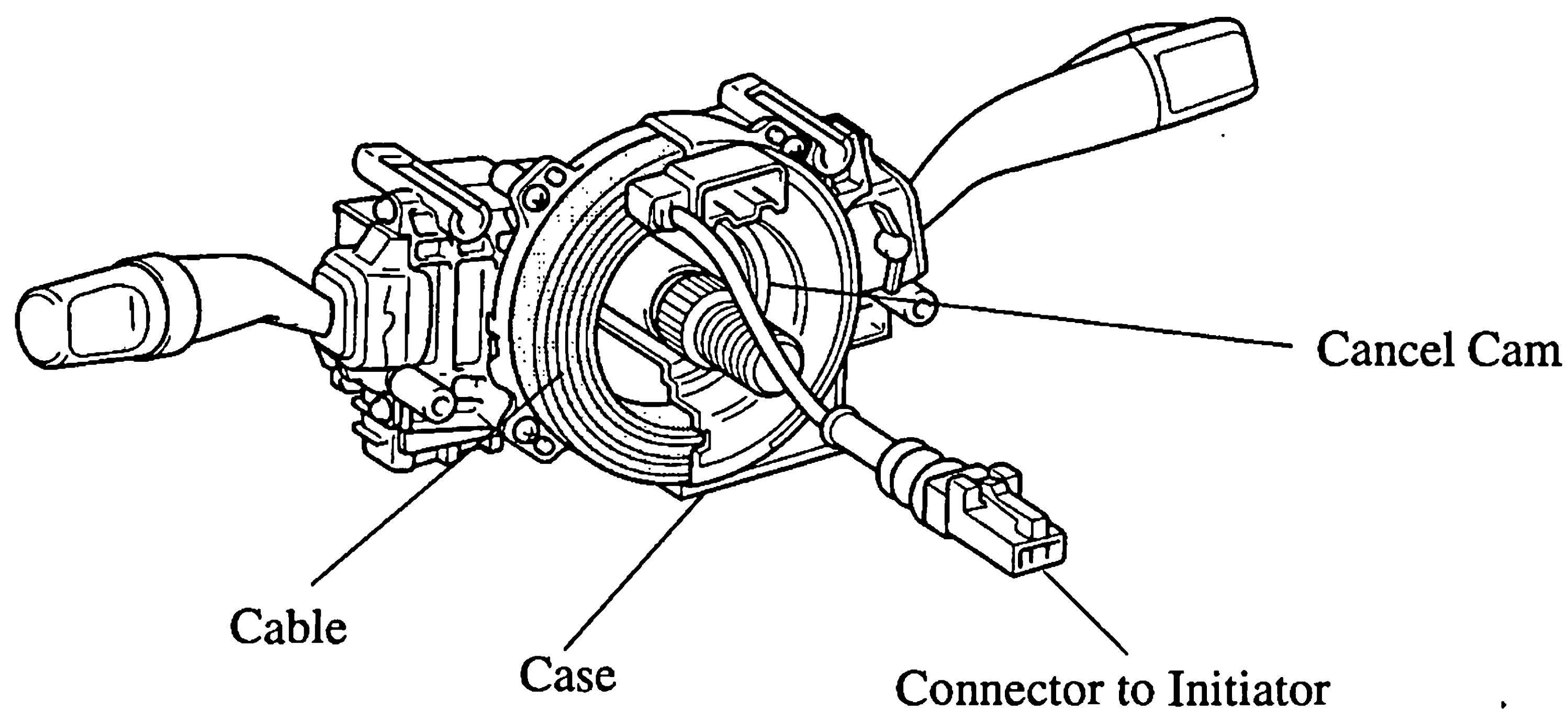
Spiral Cable

1) Description

The spiral cable is an electrical joint that connects the airbag sensor assembly with the inflator in the steering wheel pad.

2) Construction

- The spiral cable is made up of a rotator, case cable, cancel cam, etc.
- The cancel cam and the rotator are meshed to one another by their respective protrusion and groove. These components move in unison when the steering wheel is rotated.
- The cable is placed in a case spirally so that the rotator can be turned 2.5 turns in either direction from the neutral position without pulling the cable.



NOTICE

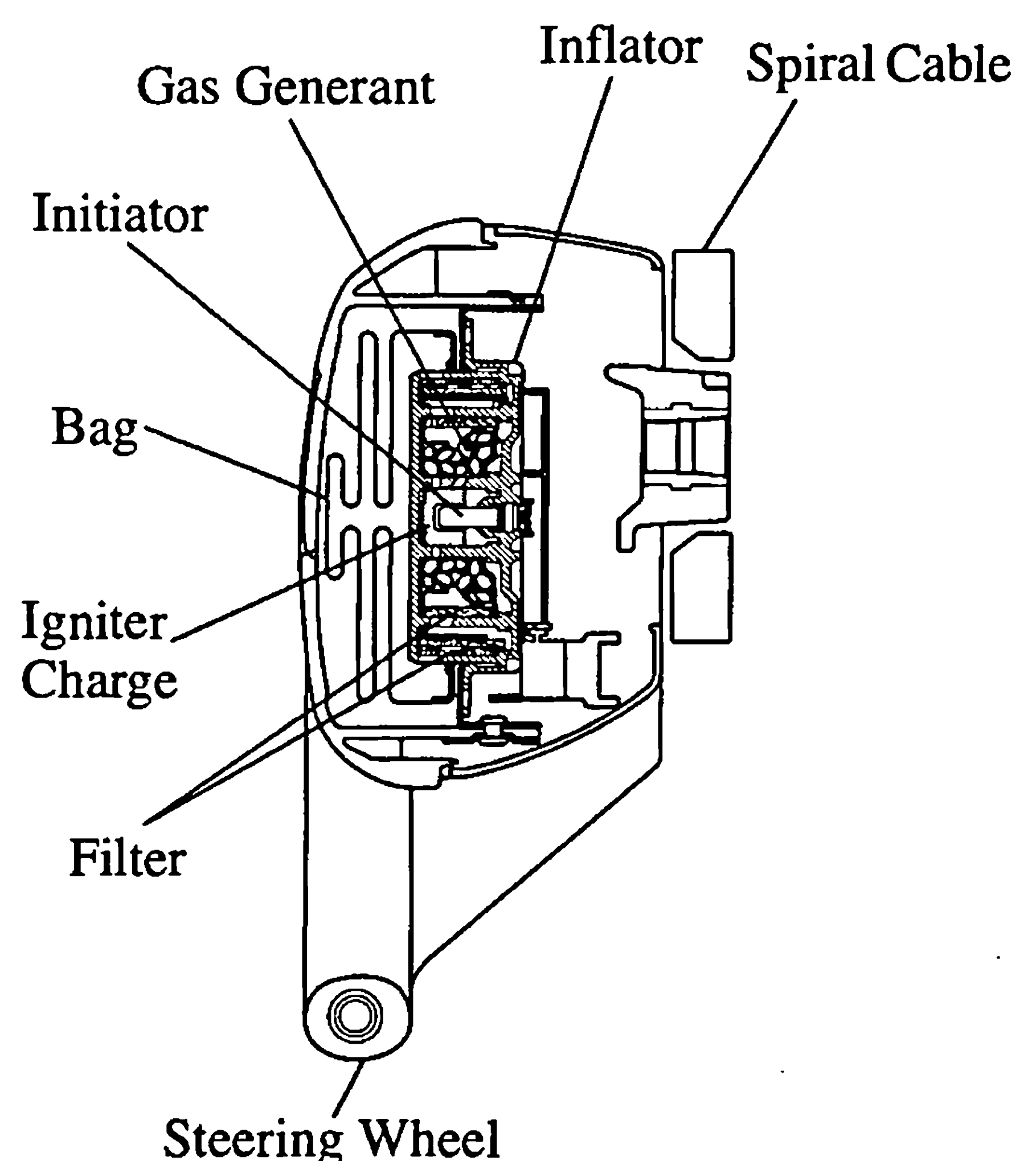
The steering wheel must be fitted correctly to the column at the neutral position during vehicle servicing; otherwise, cable disconnection and other trouble may result. Refer to the repair manual about correct steering wheel installation.

Inflator and Bag

1) Construction

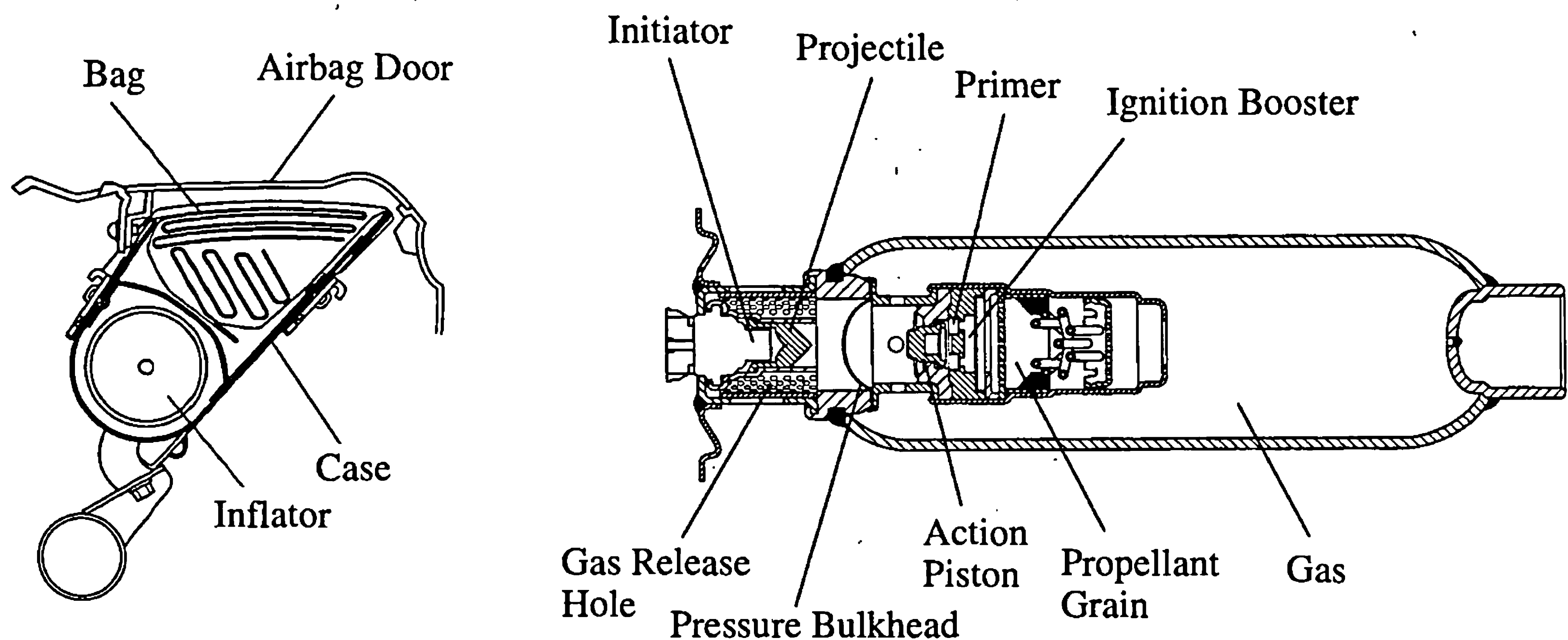
a. For Driver (In Steering Wheel Pad)

The inflator and bag are stored in the steering wheel pad and cannot be disassembled. The inflator contains an initiator, gas generant, etc., and inflates the bag in case of collision. The bag is made of strong nylon cloth. Also, there are 2 gas exhaust ports provided at the back of the airbag to quickly release the nitrogen gas after the airbag has been inflated.



b. For Front Passenger (Above the Glove Box)

The inflator is comprised of a initiator, projectile, pressure bulkhead, propellant grain, gas and etc.. The bag is made of strong nylon cloth, and becomes inflated by the argon gas generated by the inflator. The inflator and bag are integrated inside the case, and located in the passenger side instrument panel.

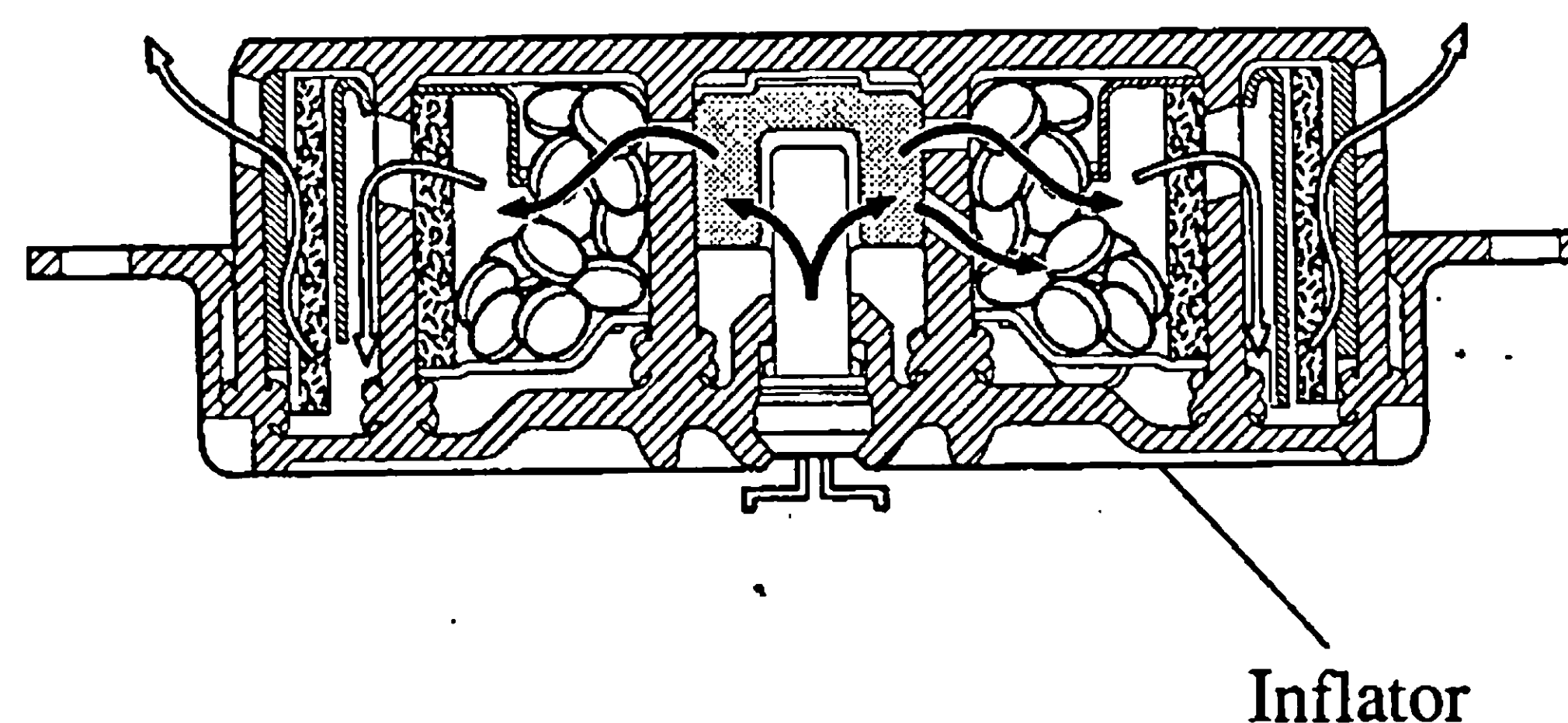


2) Operation

a. For Driver (In Steering Wheel Pad)

The airbag sensor is activated by deceleration due to frontal collision. Electric current then ignites the initiator located in the inflator. The flame spreads instantaneously to the gas generant and a large amount of nitrogen gas is generated from the gas generant. The gas flows through the filter where cinders are removed and the gas is cooled before filling the bag. Then, as it expands, the driver's bag tears open the wheel pad outer layer to further expand and to help restraining the impact applied to the head and chest of the driver.

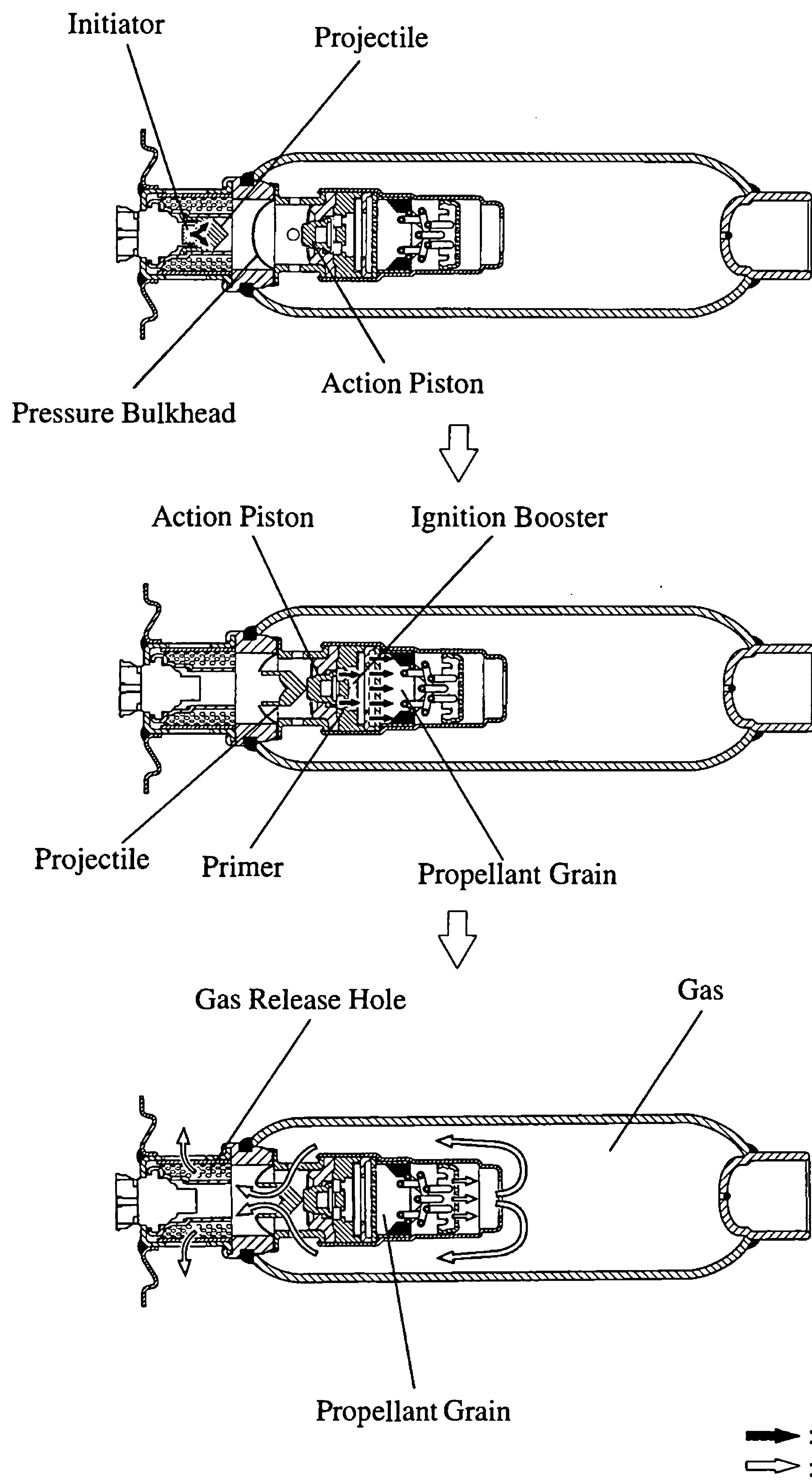
BE



→ : Propagation of Fire
 ⇨ : Flow of Argon Gas

b. For Front Passenger (Above the Glove Box)

The airbag sensor is activated by deceleration due to frontal collision. The electric current then ignites the initiator located in the inflator. The projectile which fired by the ignition of the initiator pierces through the pressure bulkhead and collides with the action piston, which causes the primer to ignite. The flame of the primer spreads instantaneously to the ignition booster and to the propellant grain. The gas which expanded by the heat of the ignition of the propellant grain flows into the airbag via the gas release hole, thus inflating the airbag. The airbag pushes the airbag door open to further expand and to help restrain the impact applied to the head and chest of the front passenger.

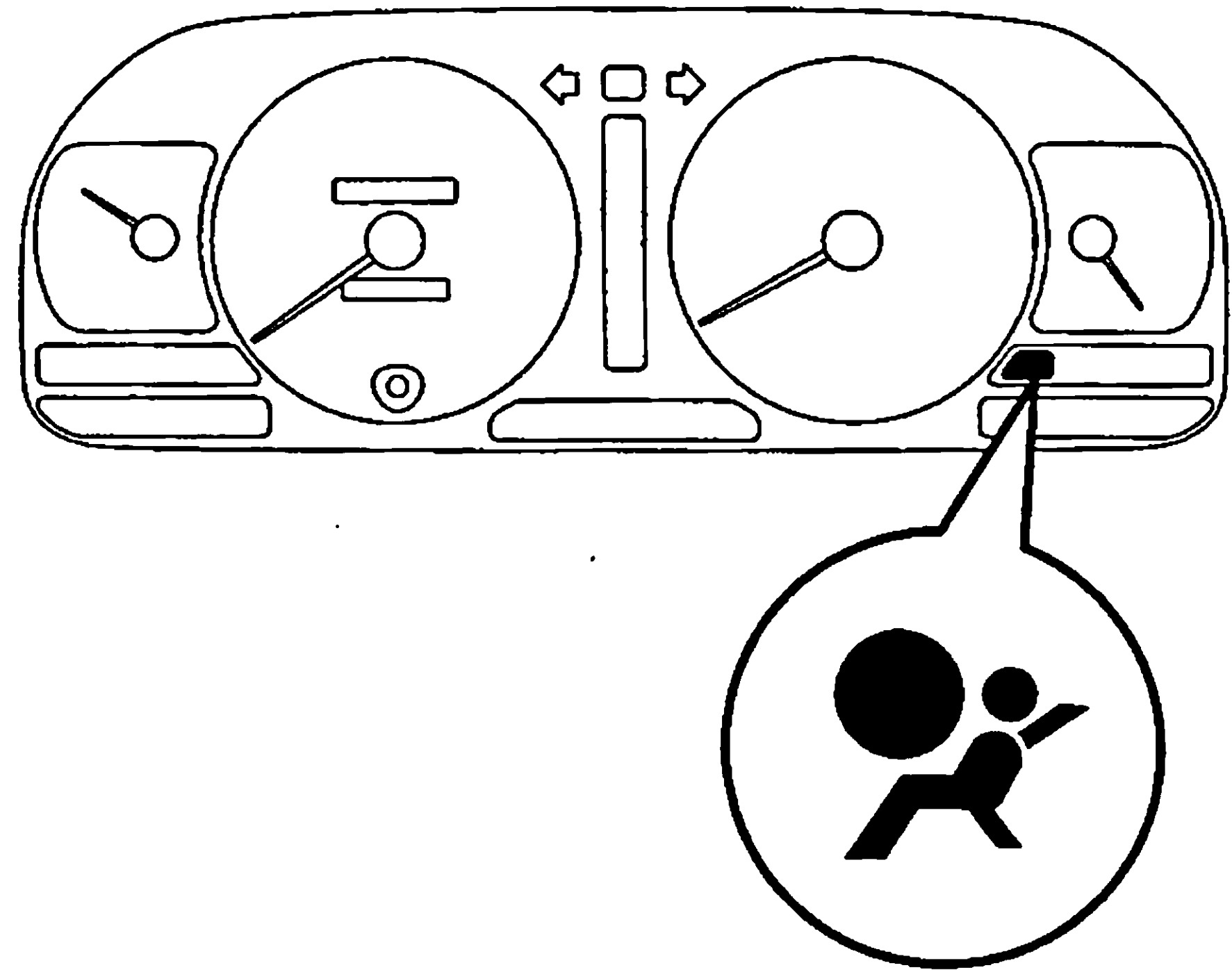


SRS Warning Light

The SRS warning light is located on the combination meter.

It comes on to alert the driver to the system trouble when a malfunction is detected in self-diagnosis of the airbag sensor assembly.

In normal operating conditions when the ignition switch is turned to the ACC or ON position, the light comes on for about 6 seconds and then goes off.



SRS Warning Light

5. System Operation

Ignition Judgement and Conditions

- When the vehicle collides in the hatched area (Fig. 1) and the shock is larger than a predetermined level, the airbag is activated automatically. The airbag sensor is characteristically turned in such a way that it can judge the need for ignition in collisions within the hatched area.
- The safing sensor is designed to be activated by a smaller deceleration rate than the airbag sensor. As illustrated in Fig. 2 below, ignition is caused when current flows to the primer, which happens when a safing sensor and the airbag sensor go on simultaneously.

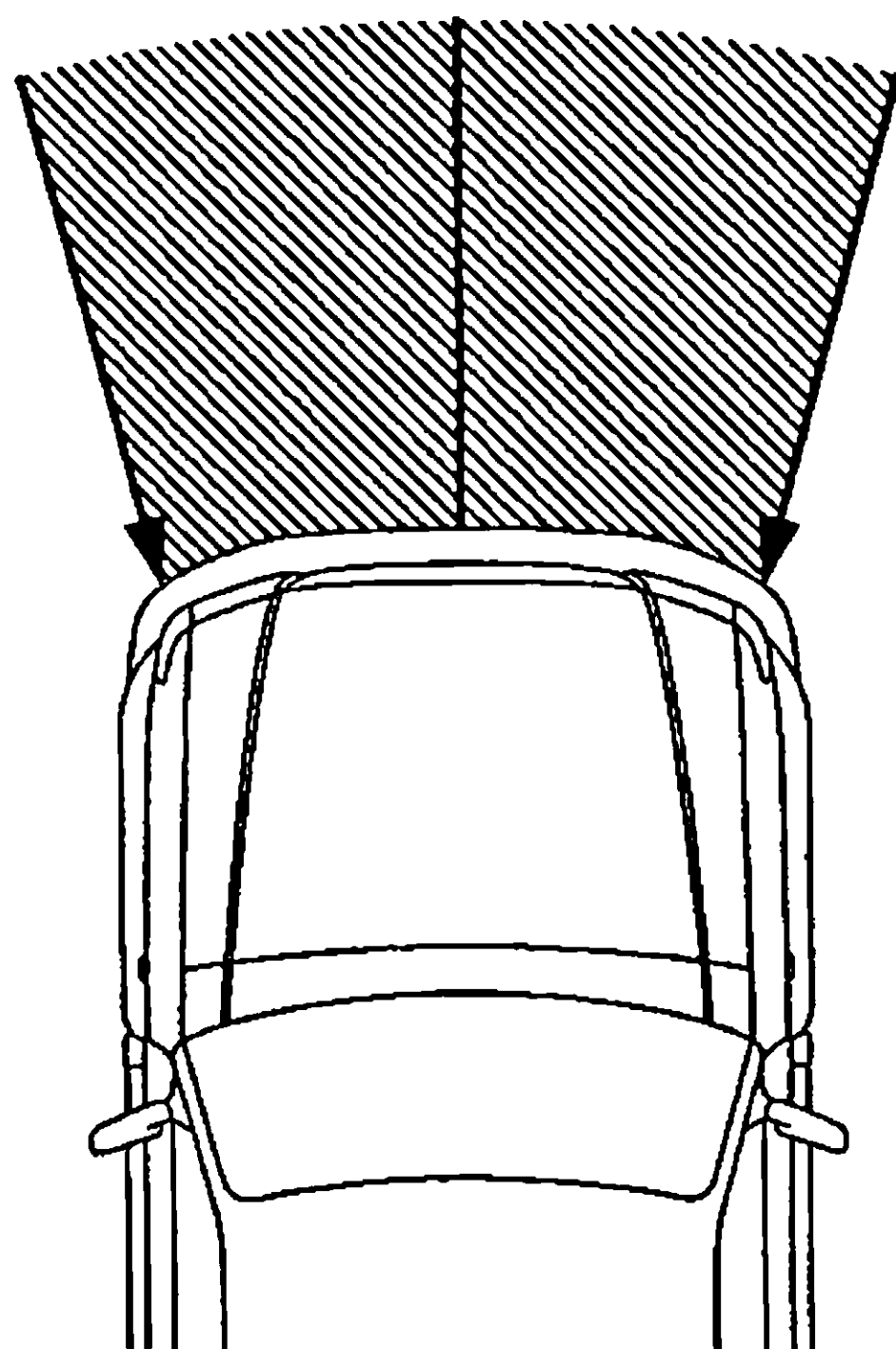


Fig. 1

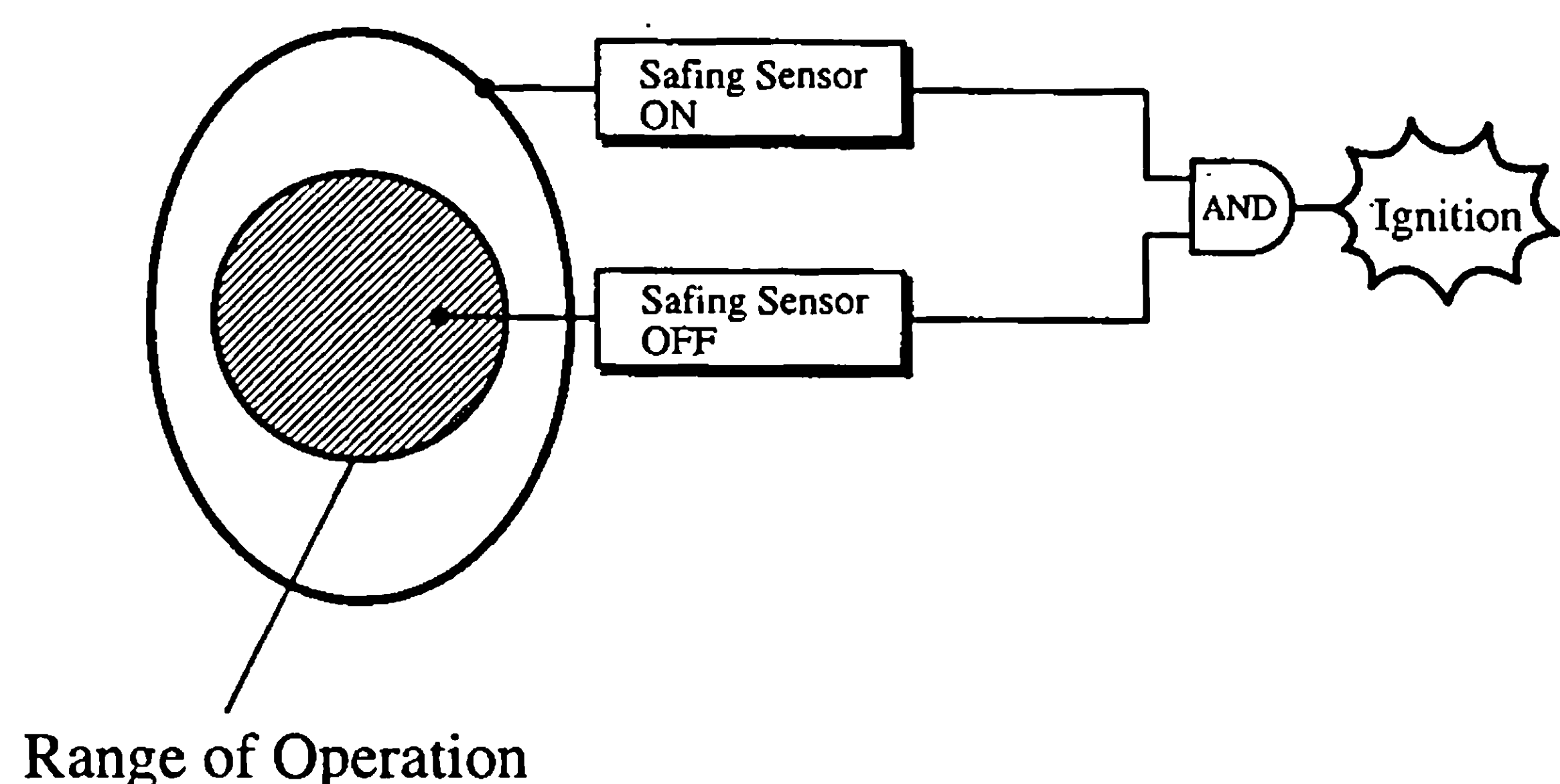


Fig. 2

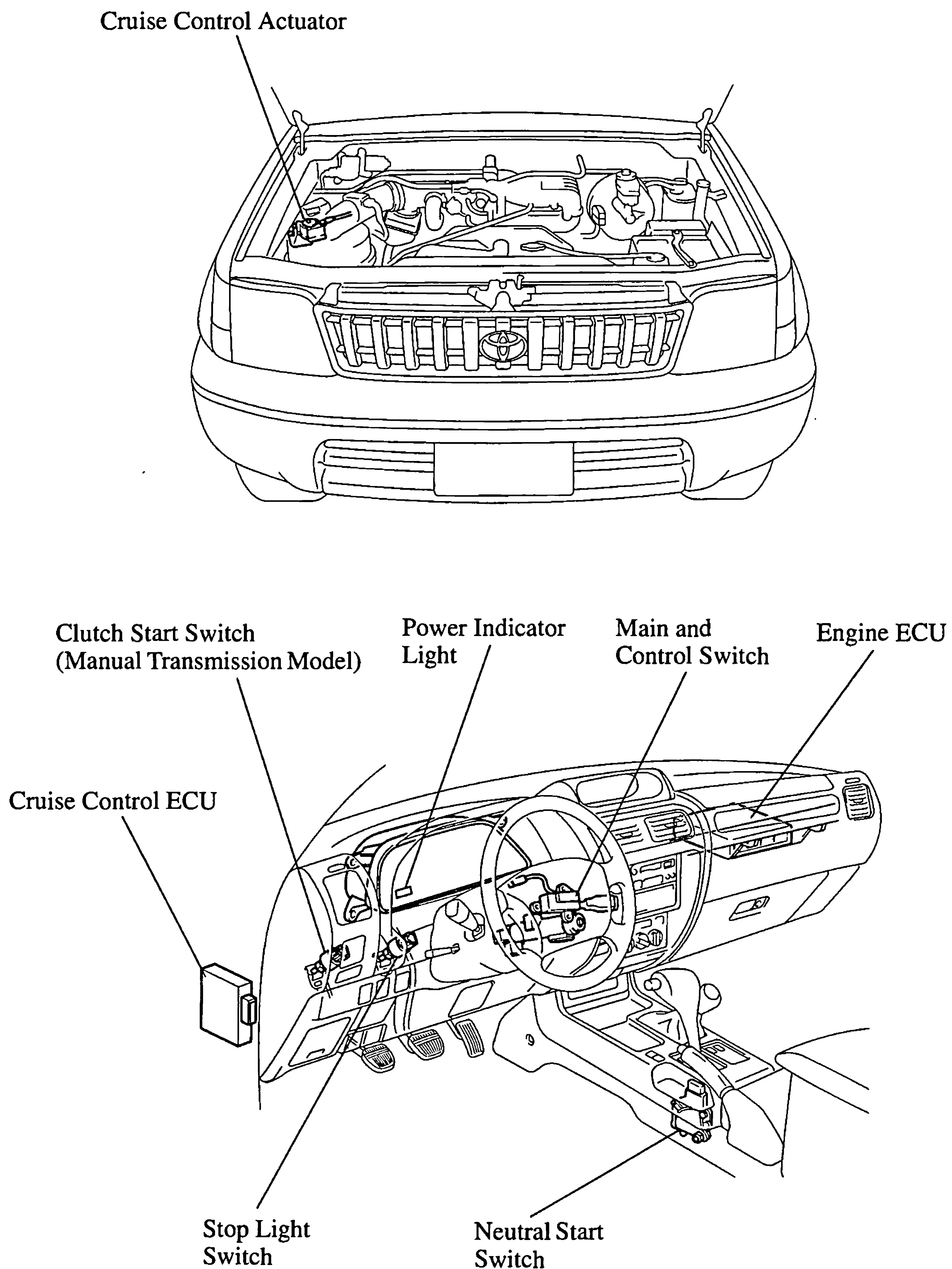
■ CRUISE CONTROL SYSTEM

1. General

Once the system is set to a desired vehicle speed, the engine throttle position is adjusted automatically to maintain the vehicle speed at that speed without depressing the accelerator pedal.

2. Layout of Components

The major function parts of the cruise control system are shown below.



3. Construction and Operation

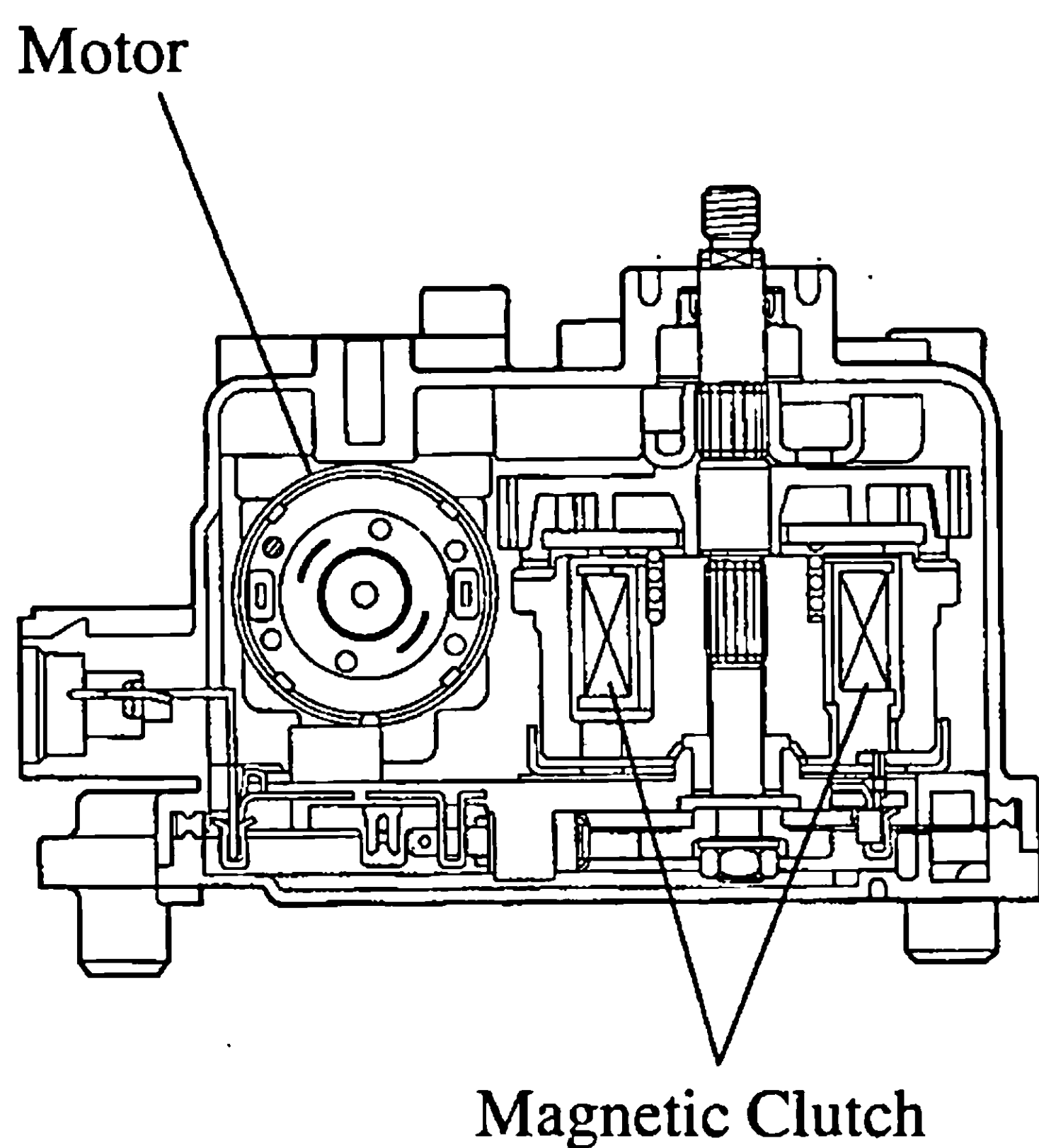
Actuator

1) Description

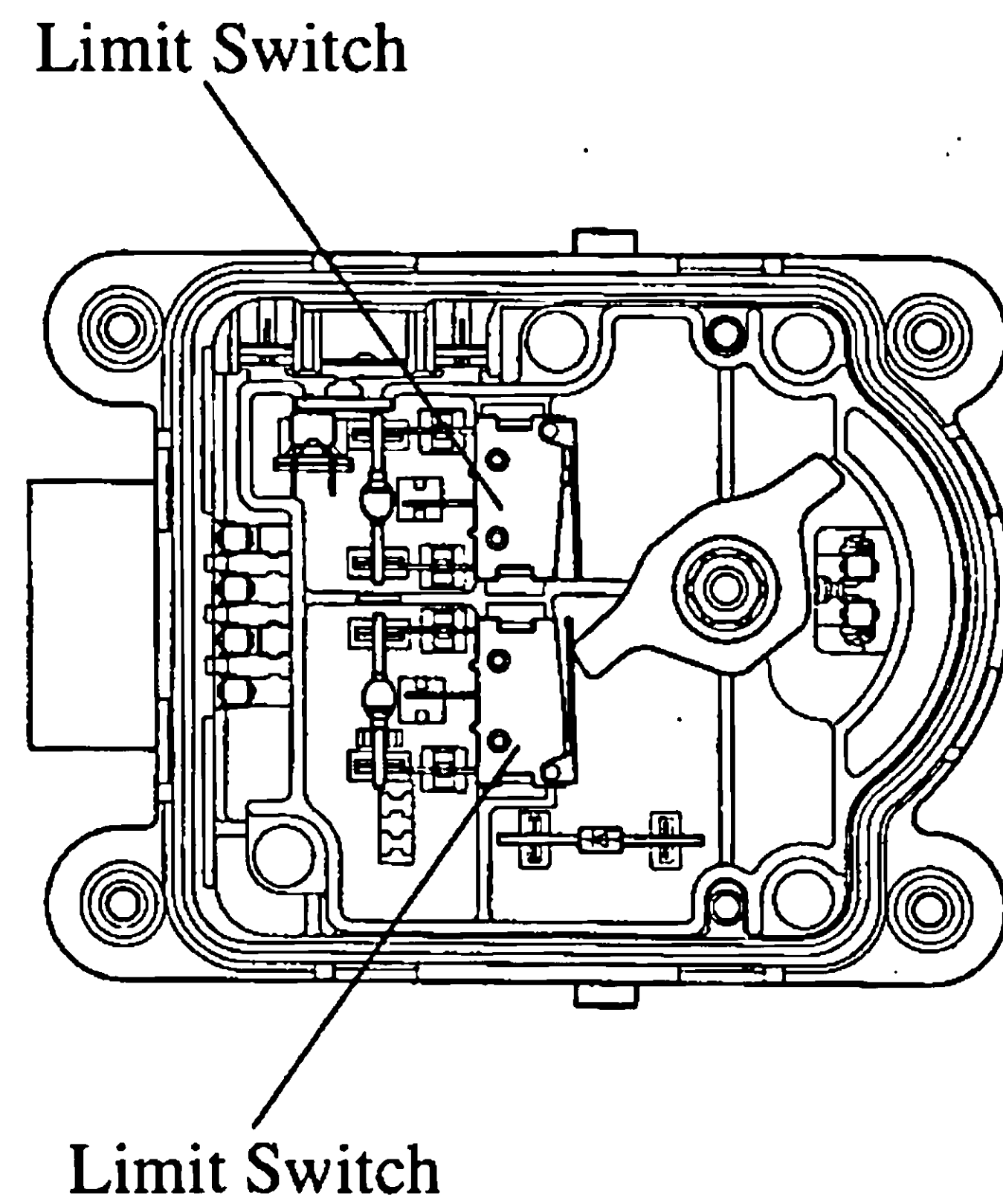
The cruise control system of the Land Cruiser/Land Cruiser Prado uses a motor type actuator. 2 types of motor type actuators are provided, with or without a potentiometer. The actuator without a potentiometer is used on the LHD model, and with a potentiometer is used on the RHD model.

2) Construction

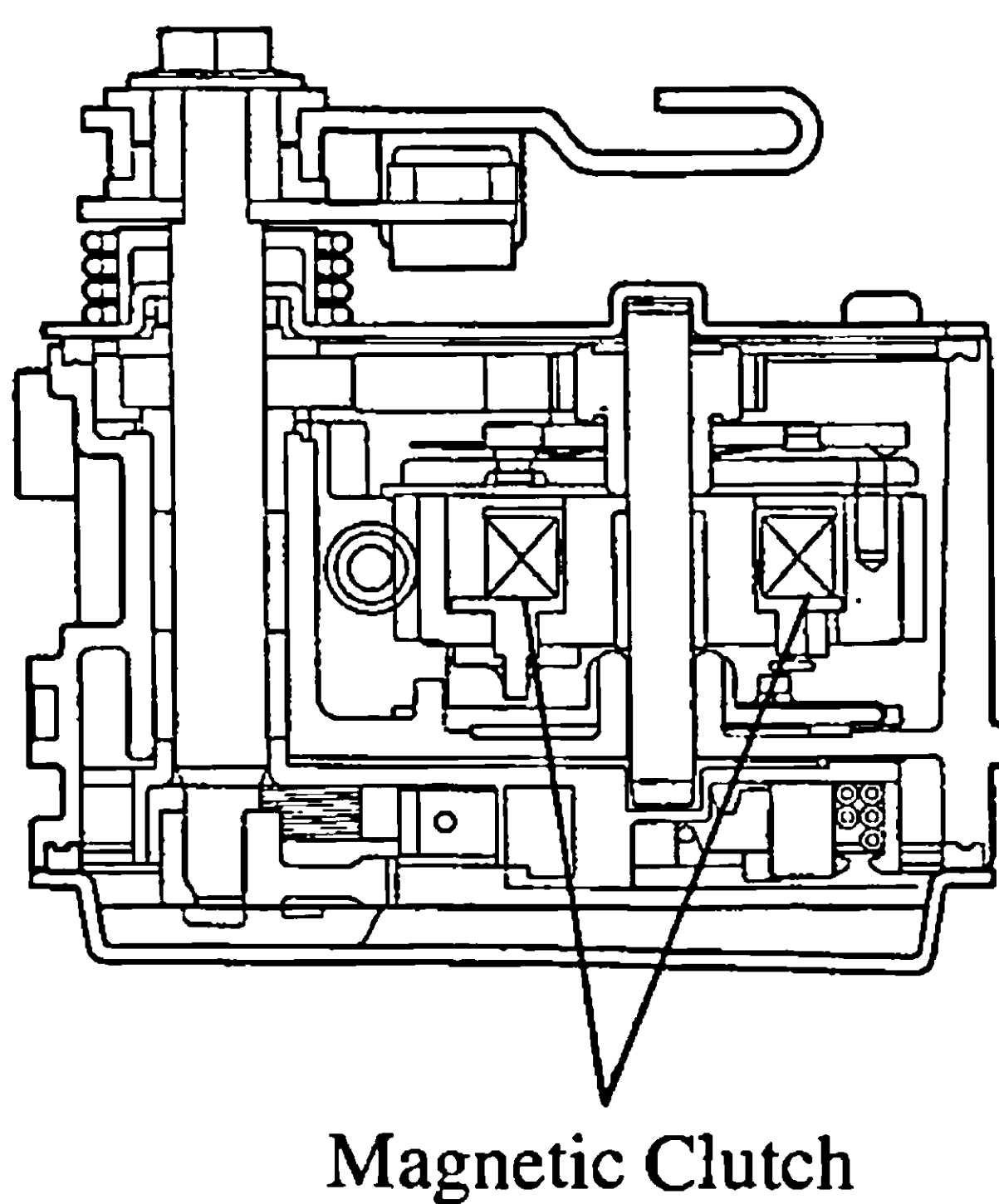
The actuator consists of a motor, magnetic clutch, limit switch, potentiometer (RHD models only), etc., as shown below.



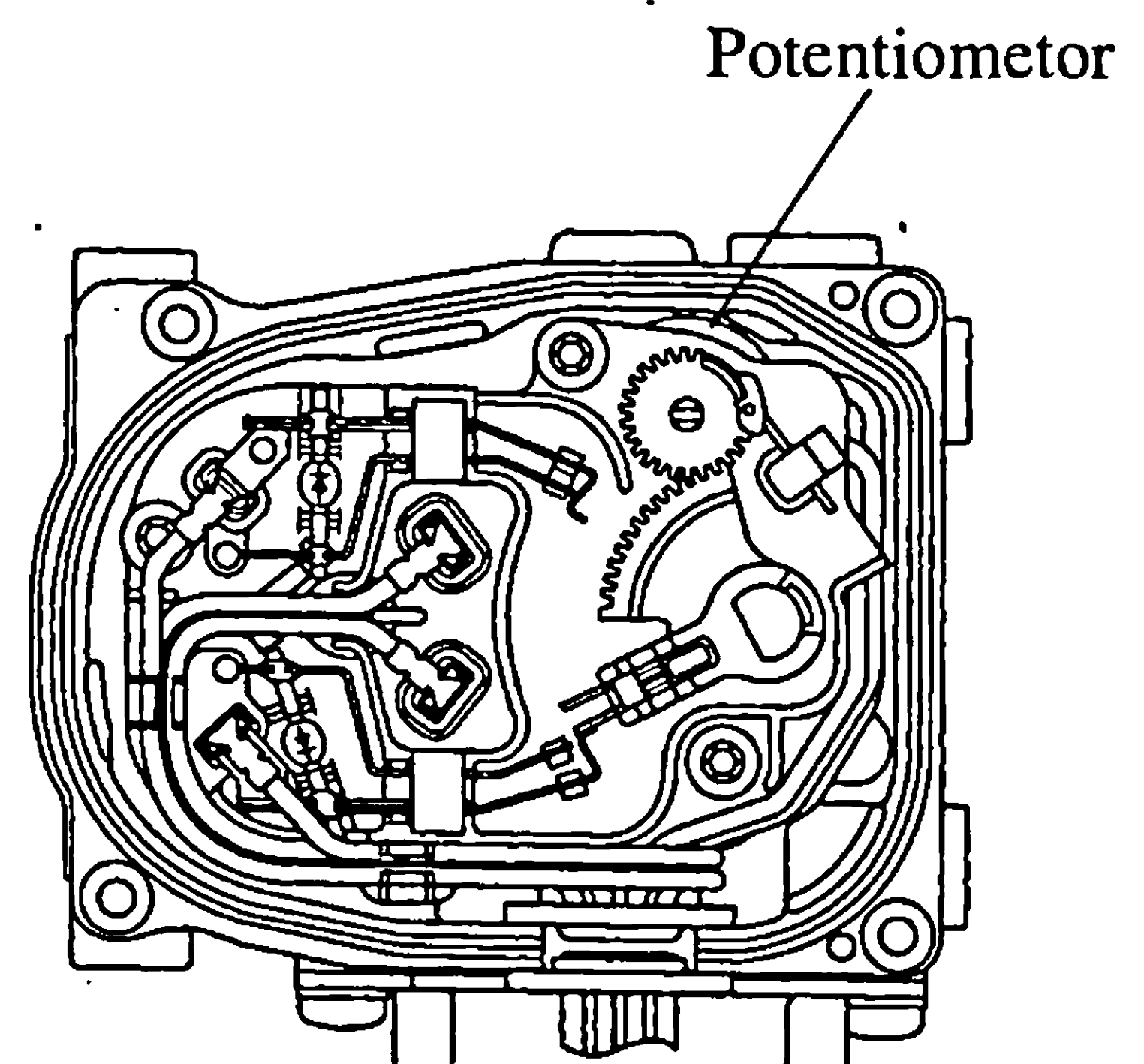
LHD Model



View A



RHD Model



View B

3) Operation

- When the actuator receives a signal from the cruise control ECU, it engages the magnetic clutch and activates the motor. The motor moves the control arm or the control link to control the opening of the engine throttle valve.
- The potentiometer converts the rotational angle of the control arm into a variable voltage signal, which is sent to the cruise control ECU at all times (RHD Model).
- The magnetic clutch functions as a safety valve in the event that the motor fails to turn due to a malfunction. When such a problem occurs, the ECU de-energizes the magnetic clutch to separate the control arm from the motor. The throttle valve is closed as a result.
- As a fail-safe measure, a stop light switch is located between the cruise control ECU and the magnetic clutch. When the brake pedal is depressed, the magnetic clutch is de-energized automatically and the cruise control is cancelled.

Main Switch and Control Switch

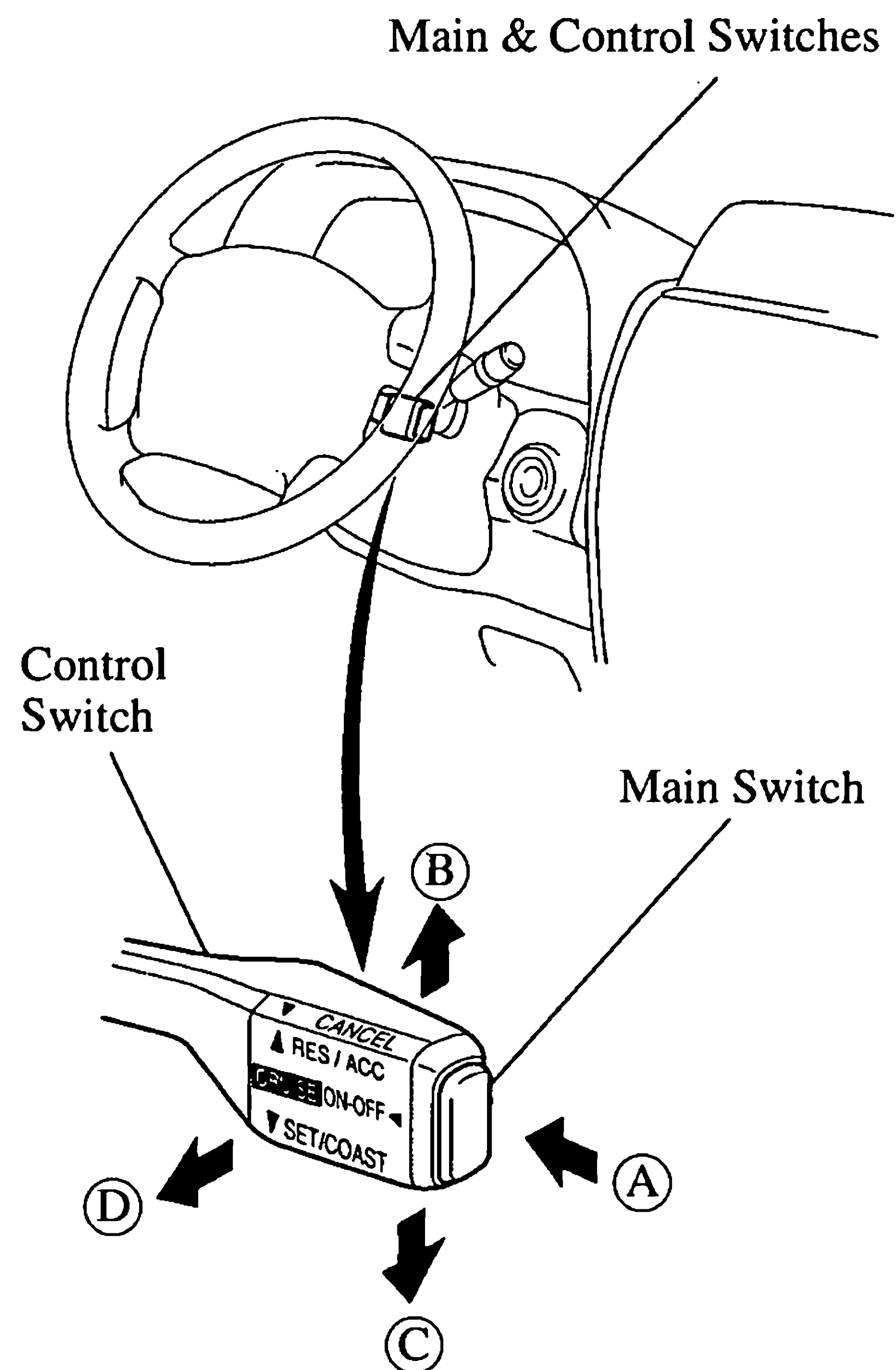
The main switch and control switch have been integrated on a single lever and located on the steering wheel.

1) Main Switch

- The main switch is the main power switch to the cruise control system. It is an alternating switch and the system is powered on and off each time when the switch is pushed in the direction (A) (MAIN ◀).
- When the ignition switch is turned off with the main switch on, the main switch is turned off also. The main switch remains off even when the ignition switch is turned on again.

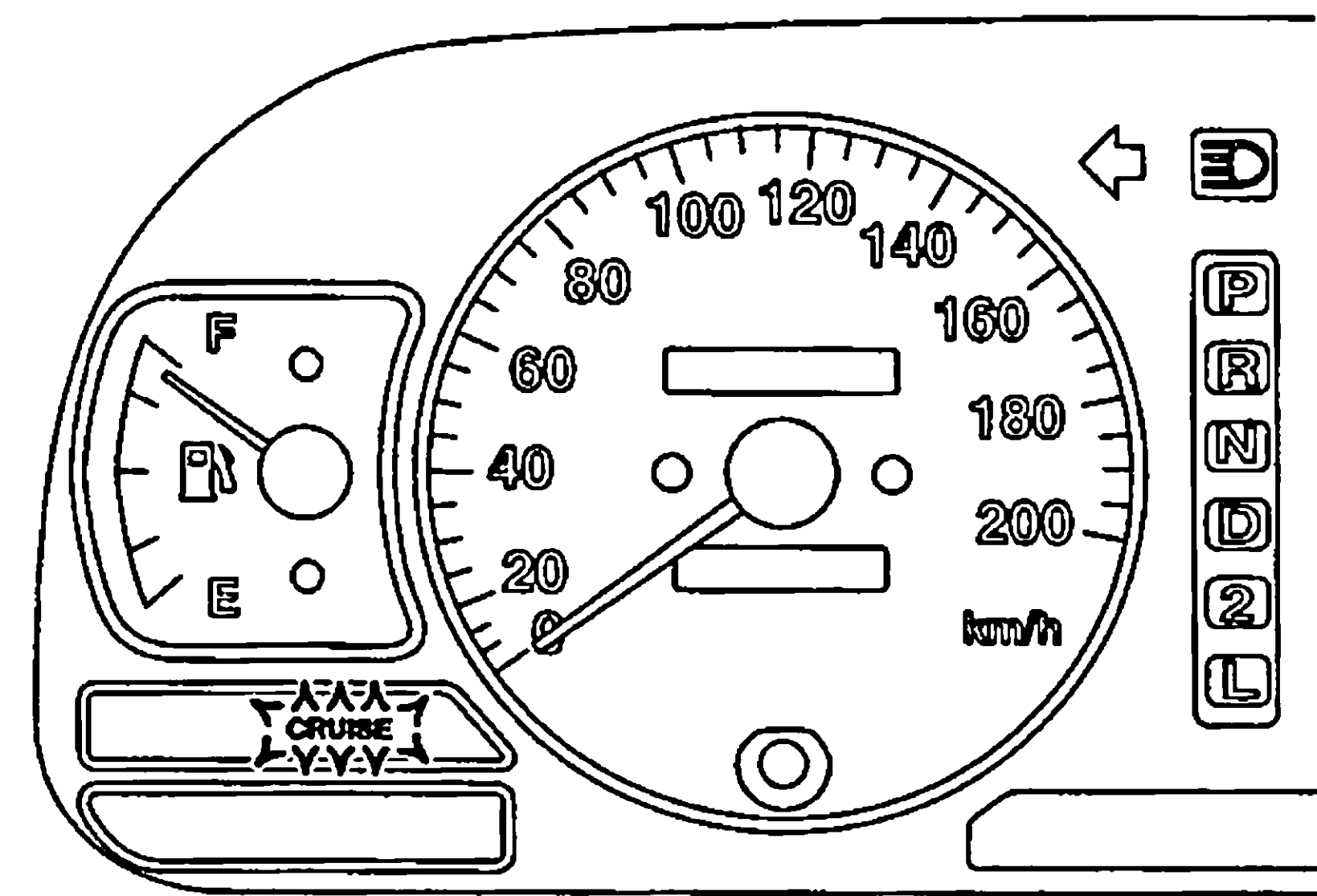
2) Control Switch

- The control switch is a stalk lever type switch and controls five different functions (SET, COAST, RESUME, ACCEL, CANCEL) when the vehicle is running in the cruise control mode. The SET and COAST modes share a switch and the RESUME and ACCEL modes share another switch.
- The switch goes on only when operated in the direction indicated by the “▲” (B), (C) and (D), and goes off when released. It is an auto return type switch.



Power Indicator Light

The power indicator light is located on the combination meter and goes on when the main switch is turned on. In an event of a system malfunction, it starts to blink by the selfdiagnosis function.



Cruise Control ECU

1) Description

- The cruise control ECU is fitted inside the passenger side instrument panel. It controls all functions of the cruise control system according to signals from switches and sensors.
- The cruise control ECU has the following main functions:

► Functions ◀

Functions of the Cruise Control ECU					
a	Constant Speed Control	f	Tap-Up Control	k	Automatic Transmission Control
b	Set	g	Low Speed Limit Control	l	Manual Cancel
c	Coast	h	High Speed Limit Control	m	Auto Cancel
d	Tap-Down Control	i	Magnetic Clutch Control	n	Diagnosis
e	Accel	j	Resume	–	–

2) Operation

BE

a. Constant Speed Control Function

The ECU compares the actual vehicle speed and the set vehicle speed and if the vehicle speed is higher than the set speed, it activates the actuator motor in the throttle closing direction. If the vehicle speed is lower than the set speed, it activates the actuator motor in the throttle opening direction. These control signals are sent to the actuator early enough to compensate for an operational delay of the actuator or the vehicle itself.

b. Set Function

When the control switch is pressed to the SET/COAST side and released while the vehicle is running within a cruising speed control range [approx. 40 km/h (25 mph) to 200 km/h (124 mph)] with the main switch turned on, the cruise control ECU stores the vehicle speed and control it at that speed constantly.

c. Coast Function

When the control switch is kept pushed to the SET/COAST side while running in the cruise control mode, the actuator motor is energized in the throttle closing direction. The vehicle keeps decelerating and the ECU stores the vehicle speed when the hand is released from the switch.

From then on, the ECU control the vehicle speed at that speed constantly.

d. 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 1.5 km/h (1 mph) each time by operating the SET/COAST switch quickly within 0.5 seconds.

e. Accel Function

When the control switch is kept pushed to the RES/ACC side while running in the cruise control mode, the actuator motor is energized in the throttle opening direction. The vehicle keeps accelerating and the ECU stores the vehicle speed when hand is released from the switch.

From then on, the ECU controls the vehilce speed at that speed constantly.

f. Tap-Up 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 increased 1.5 km/h (1 mph) each time by operating the RES/ACC swtich quickly within 0.5 seconds.

g. Low Speed Limit Control Function

The low speed limit is the lowest speed that cruise control can be set and is designed at approximately 40 km/h (25 mph). The cruise control cannot be set below that speed. If the vehicle speed drops below that speed while running in the cruise control mode, the cruise control is cancelled automatically and the set speed in the memory is cleared.

h. High Speed Limit Control Function

The high speed limit is the highest speed that cruise control can be set and is designed at approximately 200 km/h (124 mph). The cruise control cannot be set above that speed. The vehicle speed cannot be increase over that speed by ACCEL operation of the control switch.

i. Magnetic Clutch Control Function

If the vehicle speed increases more than 16 km/h (10 mph) above the set speed in downhill driving, etc., the ECU disengages the magnetic clutch to decelerate the vehicle. When the vehicle speed drops to within 10 km/h (6 mph) above the set speed, the magnetic clutch is turned on again to resume cruising.

j. Resume Function

After the cruise control mode is cancelled by any of the cancel switches, the mode can be resumed and controlled at the set speed by operating the control switch in the RES/ACC direction providing that the vehicle speed has not dropped below the low speed limit [approx. 40 km/h (25 mph)].

The mode cannot be resumed if the vehicle speed once drops below the low speed limit, because the speed in the memory is cleared. It can only be set again by step b. of the page 223.

k. Automatic Transmission Control Function

- When the vehicle is cruising uphill, etc., in the overdrive gear and the speed drops below the overdrive cut speed [the set speed minus 4 km/h (2.5 mph)], the ECU cancels overdrive and increases the driving power to prevent further reduction of vehicle speed. [The overdrive cut speed is set at the set speed minus 8 km/h (5 mph for 7 seconds after the SET/COAST or ACCEL operation.)]
- Once overdrive is cancelled but the vehicle speed rises over the overdrive resume speed [the set speed minus 2 km/h (1.2 mph)] and the ECU judges that the vehicle has completed a uphill climb from a signal from the actuator potentiometer, the ECU resumes overdrive after about 6 seconds.
- When the vehicle is running in the cruise control mode, the cruise control ECU sends a signal to the engine and transmission ECU. Upon receiving the signal, the engine and transmission ECU switches to the normal shifting patterns. It also prohibits lock-up cancellation of the transmission when the idling point of the throttle position sensor goes on (as in downhill driving, etc.). This ensures a smooth cruise control driving.

l. Manual Cancel Function

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)
- Main switch OFF signal
- Cancel switch ON signal of the control switch (Control switch pulled on)
- Neutral Start switch ON → OFF signal (Transmission shifted to positions other than “D”)

m. 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.

Condition	Malfunction Category	How to Reactivate
- Continuous current applied to the motor's acceleration output. - The motor did not move.	A	Turn off the ignition switch, and turn it back on. Then turn on the main switch.
- Excessive current flowed to the motor or magnetic clutch drive transistor. - Open circuit in magnetic clutch. - An open or short circuit in the potentiometer system. - The vehicle speed signal is not sent for a predetermined period of time (approx. 140 msec.) - Short circuit in the control switch.	B	Turn the main switch back on.

n. Diagnosis Function

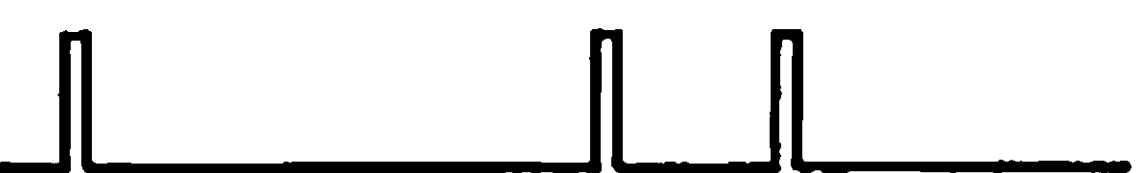
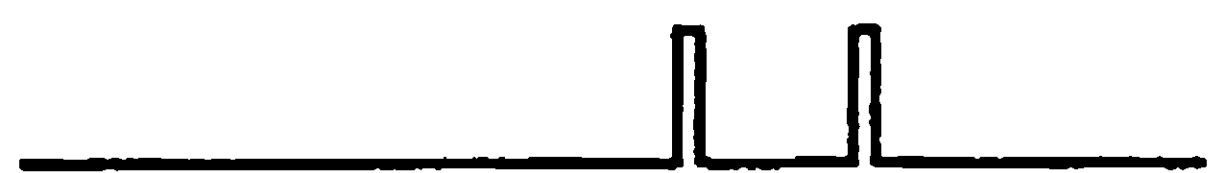
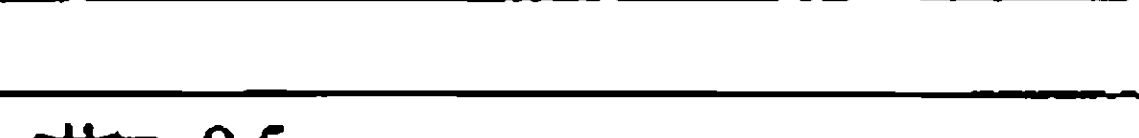
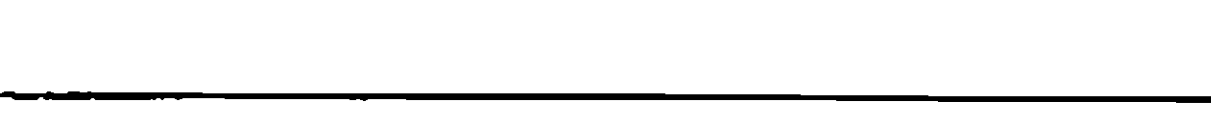
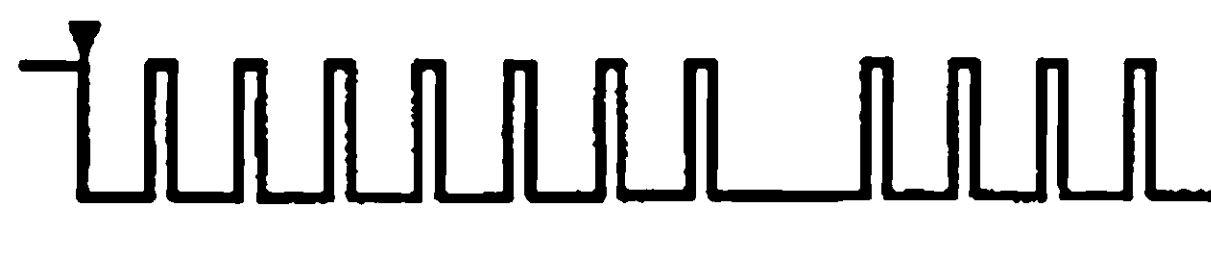
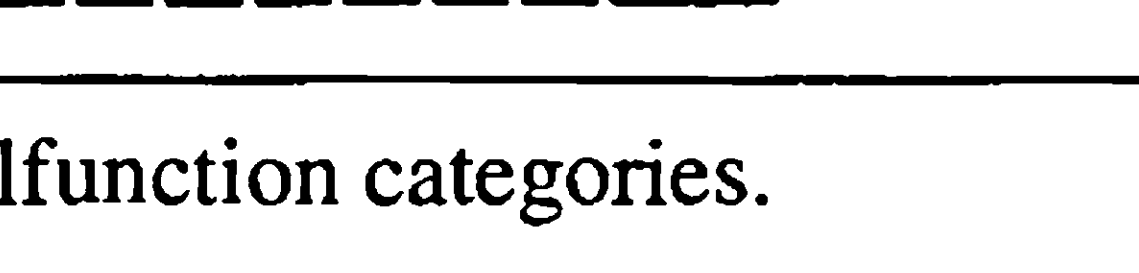
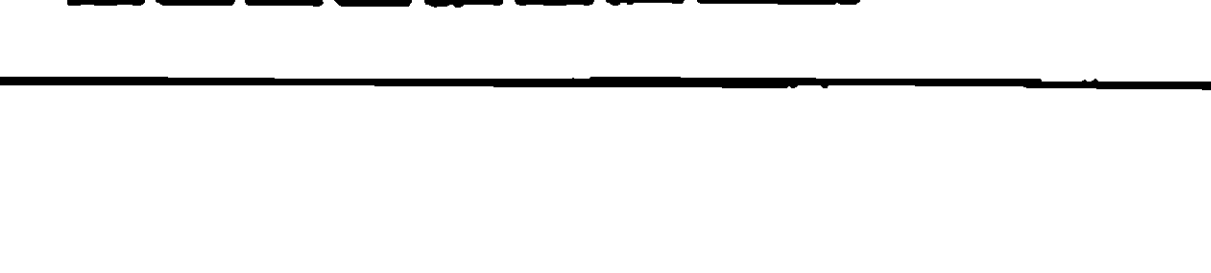
i) Warning Indication

The cruise control ECU immediately blinks the power indicator light in the combination meter on and off repeatedly to alert the driver to a system malfunction.

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 cruise control driving is resumed, the power indicator light output pattern, as shown below, differs according to the malfunction categories A or B. When a category A malfunction is occurring, the power indicator light will flash again, but if it is a category B malfunction, the indicator light will remain on, indicating that the system is operating.

► Power Indicator Light Blinking Pattern ◀

▼: Malfunction Occurred

Condition Operation Method			Actuator Current is Off.	Actuator Current is On.
Main Switch		ON		
		OFF		
Power Indicator Light	A*	ON		
		OFF		
	B*	ON		
		OFF		

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

ii) Diagnostic Trouble Code Indication and Input Signal Check Function

The cruise control ECU has "self-diagnosis" and "input signal check" functions. For details of inspection, diagnostic trouble codes and repair procedures, refer to the Land Cruiser/Land Cruiser Prado Chassis and Body Repair Manual (Pub. No. RM517E).

4. Appendix

MAJOR TECHNICAL SPECIFICATIONS

Item				Area	Europe			
Body Type				3-Door		5-Door		
Vehicle Grade				—				
Model Code				VZJ90L-GJMNKW	VZJ90L-GJPNKW	VZJ95R-GKPNKW	VZJ95L-GKMNKW	
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4290 (168.9), 4315 (199.9)*1	←	4730 (186.2), 4755 (187.2)*1	←	
		Width	mm (in.)	1730 (68.1), 1820 (71.7)*1	←	←	←	
		Height*	mm (in.)	1855 (73.0), 1870 (73.6)*1	←	1860 (73.2), 1875 (73.8)*1	←	
	Wheel Base		mm (in.)	2370 (93.3)	←	2675 (105.3)	←	
	Tread	Front	mm (in.)	1475 (58.1), 1505 (59.3)*1	←	←	←	
		Rear	mm (in.)	1480 (58.3), 1510 (59.4)*1	←	←	←	
	Room	Length	mm (in.)	1285 (50.6)	←	1725 (67.9)	←	
		Width	mm (in.)	1385 (54.5)	←	1450 (57.1)	←	
		Height	mm (in.)	1260 (49.6)	←	←	←	
	Cargo Space	Length	mm (in.)	540 (21.3)	←	975 (38.4)	←	
		Width	mm (in.)	1405 (55.3)	←	1425 (56.1)	←	
		Height	mm (in.)	1110 (43.7)	←	1115 (43.9)	←	
	Overhang	Front	mm (in.)	855 (33.7)	←	←	←	
		Rear	mm (in.)	1060 (41.7), 1085 (42.7)*1	←	1200 (47.2), 1225 (48.2)*1	←	
	Min. Running Ground Clearance		mm (in.)	230 (9.1), 245 (9.6)*1	←	←	←	
	Angle of Approach		degrees	36°	←	←	←	
	Angle of Departure		degrees	34°	←	30°	←	
	Curb Weight	Front	kg (lb)	870 (1918)	880 (1940)	910 (2006)	900 (1984)	
		Rear	kg (lb)	810 (1786)	←	860 (1896)	←	
		Total	kg (lb)	1680 (3704)	1690 (3726)	1770 (3902)	1760 (3880)	
Gross Vehicle Weight	Front	kg (lb)	935 (2061)	945 (2083)	1040 (2293)	1025 (2260)		
	Rear	kg (lb)	1575 (3472)	1565 (3450)	1640 (3615)	1655 (3648)		
	Total	kg (lb)	2510 (5533)	←	2680 (5908)	←		
Fuel Tank Capacity		ℓ (Imp.gal.)	90 (19.8)	←	←	←		
Luggage Compartment Capacity		m³ (cu.ft.)	—	—	—	—		
Performance	Max. Speed		km / h (mph)	—	—	—	—	
	Max. Cruising Speed		km / h (mph)	—	—	—	—	
	Max. Permissible Speed	1st Gear	km / h (mph)	47 (29)	64 (29)	←	47 (29)	
		2nd Gear	km / h (mph)	87 (54)	118 (74)	←	87 (54)	
		3rd Gear	km / h (mph)	125 (78)	—	—	125 (78)	
		4th Gear	km / h (mph)	—	—	—	—	
	Min. Turning Radius	Tire	m (ft.)	5.1 (16.7)	←	57 (18.7)	←	
Body		m (ft.)	5.5 (18.0)	←	6.1 (20.1)	←		
Engine	Engine Type		5VZ-FE	←	←	←		
	Valve Mechanism		24 Valves, DOHC	←	←	←		
	Bore x Stroke		mm (in.) 93.5 x 82.0 (3.68 x 3.23)	←	←	←		
	Displacement		cm³ (cu.in.) 3378 (206.1)	←	←	←		
	Compression Ratio		9.6 : 1	←	←	←		
	Carburetor Type or Injection Pump Type (Diesel)		EFI	←	←	←		
	Research Octane No. or Cetane No. (Diesel)		95	←	←	←		
	Max. Output		kw / rpm 131 / 4600 (EEC)	←	←	←		
	Max. Torque		N·m / rpm 303 / 3600 (EEC)	←	←	←		
Engine Electrical	Battery Capacity (5HR) Voltage & Amp. hr.		12-48	←	←	←		
	Alternator Output		Watts 840	←	←	←		
	Starter Output		kW 1.2	1.2, 1.4*2	←	1.2		
Chassis	Clutch Type		Dry, Single Plate	—	—	Dry, Single Plate		
	Transmission Type		R150F	A343F	←	R150F		
	Transmission Gear Ratio	In First	3.830	2.804	←	3.830		
		In Second	2.062	1.531	←	2.062		
		In Third	1.436	1.000	←	1.436		
		In Fourth	1.000	0.753	←	1.000		
		In Fifth	0.838	—	—	0.838		
		In Reverse	4.220	2.393	←	4.220		
	Transfer Gear Ratio H4 / L4		1.000 / 2.566	←	←	←		
	Differential Gear Ratio (Front / Rear)		4.100 / 4.100, 4.300 / 4.300*1	←	←	←		
	Differential Gear Size (Front / Rear)		in. 7.5 / 8.0	←	←	←		
	Brake Type	Front	Ventilated Disc	←	←	←		
		Rear	Ventilated Disc	←	←	←		
	Parking Brake Type		Duo-Servo	←	←	←		
	Brake Booster Type and Size		in. Tandem 8" + 9"	←	←	←		
	Proportioning Valve Type		LSP & BV	←	←	←		
Suspension Type	Front	Double Wishbone	←	←	←			
	Rear	4-Link with Lateral Rod	←	←	←			
Stabilizer Bar	Front	STD	←	←	←			
	Rear	STD	←	←	←			
Steering Gear Type		Rack & Pinion	←	←	←			
Steering Gear Ratio (Overall)		20.0 : 1	←	←	←			
Power Steering Type		Integral Type	←	←	←			

*: Unladen Vehicle
*¹: With 265/70R16 Tire
*²: Option

Europe					
5-Door		3-Door		5-Door	
—					
VZJ95L-GKPNKW	KZJ90R-GJMNTW	KZJ90L-GJMNTW	KZJ90L-GJPNTW	KZJ95R-GKMNTW	KZJ95R-GKPNTW
5	←	4290 (168.9), 4315 (199.9)*1	←	4730 (186.2), 4755 (187.2)*1	←
	←	←	←	←	←
	←	1855 (73.0), 1870 (73.6)*1	←	1860 (73.2), 1875 (73.8)*1	←
	←	2370 (93.3)	←	2675 (105.3)	←
10	←	←	←	←	←
	←	←	←	←	←
	←	1285 (50.6)	←	1725 (67.9)	←
	←	1385 (54.5)	←	1450 (57.1)	←
15	←	←	←	←	←
	←	540 (21.3)	←	975 (38.4)	←
	←	1405 (55.3)	←	1425 (56.1)	←
	←	1110 (43.7)	←	1115 (43.9)	←
20	←	←	←	←	←
	←	1060 (41.7), 1085 (42.7)*1	←	1200 (47.2), 1225 (48.2)*1	←
	←	←	←	←	←
	←	←	←	←	←
25	←	34°	←	30°	←
	910 (2006)	900 (1984)	←	920 (2028)	950 (2094)
	←	820 (1808)	←	←	860 (1896)
	1770 (3902)	1720 (3792)	←	1740 (3836)	1810 (3990)
30	1040 (2293)	995 (2194)	←	1020 (2249)	1105 (2436)
	1640 (3615)	1515 (3340)	←	1490 (3285)	1575 (3472)
	←	2510 (5534)	←	←	2680 (5908)
	←	←	←	←	←
35	—	—	—	—	—
	—	—	—	—	—
	64 (29)	38 (24)	←	51 (32)	38 (24)
	118 (74)	70 (44)	←	94 (59)	70 (44)
40	—	100 (63)	←	—	100 (63)
	—	—	—	—	—
	←	5.1 (16.7)	←	←	5.7 (18.7)
	←	5.5 (18.0)	←	←	6.1 (20.1)
45	←	1KZ-TE	←	←	←
	←	8 Valves, OHC	←	←	←
	←	96.0 x 103.0 (3.78 x 4.06)	←	←	←
	←	2982 (181.9)	←	←	←
50	←	21.2 : 1	←	←	←
	←	Distributor Type	←	←	←
	←	50	←	←	←
	←	92 / 3600 (EEC)	←	←	←
55	←	295 / 2400 (EEC)	←	←	←
	←	12-64, 52 x 2*2	12-64, 64 x 2*2	←	12-64, 52 x 2*2
	←	←	←	←	←
	1.2, 1.4*2	2.2, 2.7*2	←	2.7, 3.0*2	2.2, 2.7*2
60	—	Dry, Single Plate	←	—	Dry, Single Plate
	A343F	R150F	←	A343F	R150F
	2.804	3.830	←	2.804	3.830
	1.531	2.062	←	1.531	2.062
65	1.000	1.436	←	1.000	1.436
	0.753	1.000	←	0.753	1.000
	—	0.838	←	—	0.838
	2.393	4.220	←	2.393	4.220
70	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
75	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
80	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←

Item				Area	Europe			Australia				
Body Type					5-Door							
Vehicle Grade					—							
Model Code					KZJ95L-GKMNTW		KZJ95L-GKPNTW		RZJ95R-GKMNKQ		RZJ95R-GKPNKQ	
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4730 (186.2), 4755 (187.2)* ¹	←		←		←			
		Width	mm (in.)	1730 (68.1), 1820 (71.7)* ¹	←		←		←			
		Height*	mm (in.)	1860 (73.2), 1875 (73.8)* ¹	←		1865 (68.1), 1880 (74.0)* ¹		←			
	Wheel Base		mm (in.)	2675 (105.3)	←		←		←			
	Tread	Front	mm (in.)	1475 (58.1), 1505 (59.3)* ¹	←		←		←			
		Rear	mm (in.)	1480 (58.3), 1510 (59.4)* ¹	←		←		←			
	Room	Length	mm (in.)	1725 (67.9)	←		1700 (66.9)		←			
		Width	mm (in.)	1450 (57.1)	←		←		←			
		Height	mm (in.)	1260 (49.6)	←		←		←			
	Cargo Space	Length	mm (in.)	975 (38.4)	←		270 (10.6)		←			
		Width	mm (in.)	1425 (56.1)	←		1250 (49.2)		←			
		Height	mm (in.)	1115 (43.9)	←		1020 (40.2)		←			
	Overhang	Front	mm (in.)	855 (33.7)	←		←		←			
		Rear	mm (in.)	1200 (47.2), 1225 (48.2)* ¹	←		←		←			
	Min. Running Ground Clearance			mm (in.)	230 (9.1), 245 (9.6)* ¹	←		←		←		
	Angle of Approach			degrees	36°	←		←		←		
	Angle of Departure			degrees	30°	←		←		←		
	Curb Weight	Front	kg (lb)	950 (2094)	970 (2138)		850 (1874)		860 (1896)			
		Rear	kg (lb)	860 (1896)	←		850 (1874)		←			
		Total	kg (lb)	1810 (3990)	1830 (4034)		1700 (3748)		1710 (3770)			
Gross Vehicle Weight	Front	kg (lb)	1105 (2436)	1130 (2491)		1035 (2282)		1045 (2304)				
	Rear	kg (lb)	1575 (3472)	1550 (3417)		1675 (3693)		1665 (3671)				
	Total	kg (lb)	2680 (5908)	←		2710 (5975)		←				
Fuel Tank Capacity			ℓ (Imp.gal.)	90 (19.8)	←		90 (19.8), 90 + 70 (19.8 + 15.4)* ³		←			
Luggage Compartment Capacity			m ³ (cu.ft.)	—	—		—		—			
Performance	Max. Speed			km / h (mph)	—	—		—		—		
	Max. Cruising Speed			km / h (mph)	—	—		—		—		
	Max. Permissible Speed	1st Gear	km / h (mph)	38 (24)	51 (32)		43 (27)		61 (38)			
		2nd Gear	km / h (mph)	70 (44)	94 (59)		79 (49)		111 (69)			
		3rd Gear	km / h (mph)	100 (63)	—		123 (77)		—			
		4th Gear	km / h (mph)	—	—		—		—			
	Min. Turning Radius	Tire	m (ft.)	5.7 (18.7)	←		←		←			
Body		m (ft.)	6.1 (20.1)	←		←		←				
Engine	Engine Type			1KZ-TE	←		3RZ-FE		←			
	Valve Mechanism			8 Valves, OHC	←		16 Valves, DOHC		←			
	Bore x Stroke			mm (in.)	96.0 x 103.0 (3.78 x 4.06)		95.0 x 95.0 (3.74 x 3.74)		←			
	Displacement			cm ³ (cu.in.)	2982 (181.9)		2694 (164.4)		←			
	Compression Ratio			21.2 : 1	←		9.5 : 1		←			
	Carburetor Type or Injection Pump Type (Diesel)			Distributor Type	←		EFI		←			
	Research Octane No. or Cetane No. (Diesel)			50	←		91		←			
	Max. Output			kw / rpm	92 / 3600 (EEC)		112 / 4800 (EEC)		←			
	Max. Torque			N·m / rpm	295 / 2400 (EEC)		240 / 4000 (EEC)		←			
Engine Electrical	Battery Capacity (5HR)			Voltage & Amp. hr.	12-64, 64 x 2* ²		12-48		←			
	Alternator Output			Watts	840		←		960			
	Starter Output			kW	2.2, 2.7* ²		1.2		←			
Chassis	Clutch Type			Dry, Single Plate	—		Dry, Single Plate		—			
	Transmission Type			R150F	A343F		W56		A343F			
	Transmission Gear Ratio	In First		3.830	2.804		3.954		2.804			
		In Second		2.062	1.531		2.141		1.531			
		In Third		1.436	1.000		1.384		1.000			
		In Fourth		1.000	0.753		1.000		0.753			
		In Fifth		0.838	—		0.850		—			
		In Reverse		4.220	2.393		4.091		2.393			
	Transfer Gear Ratio H4 / L4			1.000 / 2.566	←		←		←			
	Differential Gear Ratio (Front / Rear)			4.100 / 4.100, 4.300 / 4.300* ¹	←		4.300 / 4.300, 4.556 / 4.556* ¹		←			
	Differential Gear Size (Front / Rear)			in.	7.5 / 8.0		←		←			
	Brake Type	Front		Ventilated Disc	←		←		←			
		Rear		←	←		L.T. Drum, Ventilated Disc* ^{2,3,4}		←			
	Parking Brake Type			←	←		L.T. Drum, Duo-Servo* ⁵		←			
	Brake Booster Type and Size			in.	Tandem 7" + 8"		Tandem 8" + 9"		←			
	Proportioning Valve Type				LSP & BV		←		←			
	Suspension Type	Front		Double Wishbone	←		←		←			
		Rear		4-Link with Lateral Rod	←		←		←			
	Stabilizer Bar	Front		STD	←		←		←			
Rear			STD	←		←		←				
Steering Gear Type			Rack & Pinion	←		←		←				
Steering Gear Ratio (Overall)			20.0 : 1	←		←		←				
Power Steering Type			Integral Type	←		←		←				

*: Unladen Vehicle
*¹: With 265 / 70R16 Tire
*²: Option
*³: With ABS
*⁴: With Rear LSD
*⁵: With Rear Ventilated Disc Brake

Australia				G.C.C. Countries	
5-Door				3-Door	5-Door
—		VX	GX	VX	
VZJ95R-GKMNKQ	VZJ95R-GKPNKQ	VZJ95R-GKPEKQ	RZJ95L-GKMNUV	VZJ90L-GJMEKV	VZJ95L-GKMEKV
5	←	←	←	4290 (168.9), 4315 (169.9)* ¹	4730 (186.2), 4755 (187.2)* ¹
	←	←	←	←	←
	←	←	←	1860 (73.2), 1875 (73.8)* ¹	1865 (68.1), 1880 (74.0)* ¹
	←	←	←	2370 (93.3)	2675 (105.3)
	←	←	←	←	←
10	←	←	←	←	←
	1725 (67.9)	←	←	1285 (50.6)	1700 (66.9)
	←	←	←	1385 (54.5)	1450 (57.1)
	←	←	←	←	←
	975 (38.4)	←	←	540 (21.3)	270 (10.6)
15	1425 (56.1)	←	←	1405 (55.3)	1250 (49.2)
	1115 (43.9)	←	←	1110 (43.7)	1020 (40.2)
	←	←	←	←	←
	←	←	←	1060 (41.7), 1085 (42.7)* ¹	1200 (47.2), 1225 (48.2)* ¹
	←	←	←	←	←
20	←	←	←	←	←
	←	←	←	34°	30°
	890 (1962)	900 (1984)	910 (2006)	890 (1962)	920 (2028)
	860 (1896)	←	870 (1918)	830 (1830)	920 (2028)
	1750 (3858)	1760 (3880)	1780 (3924)	1720 (3792)	1840 (4056)
25	1080 (2381)	1095 (2414)	1105 (2436)	1030 (2271)	1125 (2480)
	1630 (3594)	1615 (3561)	1605 (3539)	1480 (3263)	1695 (3737)
	←	←	←	2750 (6063)	2820 (6217)
	←	←	←	90 (19.8)	90 (19.8), 90 + 70 (19.8 + 15.4)* ³
	—	—	—	—	—
30	—	—	—	—	—
	—	—	—	—	—
	47 (29)	64 (40)	←	47 (29)	←
	87 (54)	118 (74)	←	87 (54)	←
	125 (78)	—	—	125 (78)	←
35	—	—	—	—	—
	←	←	←	5.1 (16.7)	5.7 (18.7)
	←	←	←	5.5 (18.0)	6.1 (20.1)
	5VZ-FE	←	←	5VZ-FE	←
	24 Valves, DOHC	←	←	16 Valves, DOHC	←
40	93.5 x 82.0 (3.68 x 3.23)	←	←	95.0 x 95.0 (3.74 x 3.74)	←
	3378 (206.1)	←	←	2694 (164.4)	←
	9.6 : 1	←	←	8.5 : 1	←
	EFI	←	←	Down Draft 2 Barrel	←
	91	←	←	90	←
45	132/4800 (SAE-NET)	←	←	104/5200 (SAE-GROSS)	←
	290/3600 (SAE-NET)	←	←	226/3200 (SAE-GROSS)	←
	←	←	←	←	←
	←	←	←	840	←
	←	←	←	1.4, 2.0* ²	←
50	Dry, Single Plate	—	—	Dry, Single Plate	←
	R150F	A343F	A343F	W56	←
	3.830	2.804	←	3.954	←
	2.062	1.531	←	2.141	←
	1.436	1.000	←	1.384	←
55	1.000	0.753	←	1.000	←
	0.838	—	—	0.850	←
	4.220	2.393	←	4.091	←
	←	←	←	←	←
	4.100/4.100, 4.300/4.300* ¹	←	←	4.300/4.300, 4.556/4.556* ¹	←
60	←	←	←	←	←
	←	←	←	←	←
	Ventilated Disc	←	←	L.T. Drum, Ventilated Disc* ³	←
	Duo-Servo	←	←	L.T. Drum, Duo-Servo* ⁵	←
	←	←	←	←	←
65	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
70	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←

Item			Area	G.C.C. Countries	General Countries			
Body Type				5-Door	3-Door	5-Door		
Vehicle Grade				VX	STD		GX	
Model Code				VZJ95L-GKPEKV	RZJ90L-GJMRU	RZJ95R-GKMRU	RZJ95R-GKMNU	
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4730 (186.2), 4755 (187.2)* ¹	4290 (168.9)	4730 (186.2)	4730 (186.2), 4755 (187.2)* ¹	5
		Width	mm (in.)	1730 (68.1), 1820 (71.7)* ¹	1730 (68.1)	←	1730 (68.1), 1820 (71.7)* ¹	
		Height*	mm (in.)	1865 (73.4), 1880 (74.0)* ¹	1860 (73.2)	1865 (73.4)	1865 (73.4), 1880 (74.0)* ¹	
	Wheel Base		mm (in.)	2675 (105.3)	2730 (93.3)	2675 (105.3)	←	
	Tread	Front	mm (in.)	1475 (58.1), 1505 (59.3)* ¹	1475 (58.1)	←	1475 (58.1), 1505 (59.3)* ¹	10
		Rear	mm (in.)	1480 (58.3), 1510 (59.4)* ¹	1480 (58.3)	←	1480 (58.3), 1510 (59.4)* ¹	
	Room	Length	mm (in.)	1700 (66.9)	1285 (50.6)	1725 (67.9)	←	
		Width	mm (in.)	1450 (57.1)	1385 (54.5)	1465 (57.7)	1450 (57.1)	
		Height	mm (in.)	1260 (49.6)	←	←	←	
	Cargo Space	Length	mm (in.)	270 (10.6)	540 (21.3)	975 (38.4)	←	
		Width	mm (in.)	1250 (49.2)	1405 (55.3)	1425 (56.1)	←	
		Height	mm (in.)	1020 (40.2)	1110 (43.7)	1115 (43.9)	←	15
	Overhang	Front	mm (in.)	855 (33.7)	←	←	←	
		Rear	mm (in.)	1200 (47.2), 1225 (48.2)* ¹	1060 (41.7), 1085 (42.7)* ¹	1200 (47.2), 1225 (48.2)* ¹	←	
	Min. Running Ground Clearance		mm (in.)	230 (9.1), 245 (9.6)* ¹	←	←	←	
	Angle of Approach		degrees	36°	←	←	←	20
	Angle of Departure		degrees	30°	34°	30°	←	
	Curb Weight	Front	kg (lb)	930 (2050)	850 (1874)	←	←	
		Rear	kg (lb)	920 (2028)	790 (1742)	840 (1852)	←	
		Total	kg (lb)	1850 (4078)	1640 (3616)	1690 (3726)	←	
	Gross Vehicle Weight	Front	kg (lb)	1140 (2513)	975 (2150)	1075 (2370)	←	25
		Rear	kg (lb)	1680 (3704)	1535 (3384)	1675 (3693)	1695 (3737)	
		Total	kg (lb)	2820 (6217)	2510 (5534)	2750 (6063)	2770 (6107)	
Fuel Tank Capacity		ℓ (Imp.gal.)	90 (19.8), 90 + 70 (19.8 + 15.4)* ³	90 (19.8)	90 (19.8), 90 + 70 (19.8 + 15.4)* ³	←		
Luggage Compartment Capacity		m ³ (cu.ft.)	—	—	—	—		
Performance	Max. Speed		km/h (mph)	—	—	—	—	30
	Max. Cruising Speed		km/h (mph)	—	—	—	—	
	Max. Permissible Speed	1st Gear	km/h (mph)	64 (40)	43 (27)	←	←	
		2nd Gear	km/h (mph)	118 (74)	79 (49)	←	←	
		3rd Gear	km/h (mph)	—	123 (77)	←	←	
		4th Gear	km/h (mph)	—	—	—	—	35
	Min. Turning Radius	Tire	m (ft.)	5.7 (18.7)	5.1 (16.7)	5.7 (18.7)	←	
Body		m (ft.)	6.1 (20.1)	5.5 (18.0)	6.1 (20.1)	←		
Engine	Engine Type			5VZ-FE	3RZ-F	←	←	
	Valve Mechanism			24 Valves, DOHC	16 Valves, DOHC	←	←	
	Bore x Stroke		mm (in.)	93.0 x 82.0 (3.68 x 3.23)	95.0 x 95.0 (3.74 x 3.74)	←	←	40
	Displacement		cm ³ (cu.in.)	3378 (206.1)	2694 (164.4)	←	←	
	Compression Ratio			9.6 : 1	8.5 : 1	←	←	
	Carburetor Type or Injection Pump Type (Diesel)			EFI	Down Draft 2 Barrel	←	←	
	Research Octane No. or Cetane No. (Diesel)			91	90	←	←	
	Max. Output		kw / rpm	149/4800 (SAE-GROSS)	97/5200 (SAE-NET)	←	←	45
	Max. Torque		N·m / rpm	312/3600 (SAE-GROSS)	217/3200 (SAE-NET)	←	←	
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-48	←	←	←	
	Alternator Output		Watts	960	840	←	←	
	Starter Output		kW	1.2, 1.4* ⁴	1.4	←	←	
Chassis	Clutch Type			—	Dry, Single Plate	←	←	50
	Transmission Type			A343F	W56	←	←	
	Transmission Gear Ratio	In First		2.804	3.954	←	←	
		In Second		1.531	2.141	←	←	
		In Third		1.000	1.384	←	←	
		In Fourth		0.753	1.000	←	←	55
		In Fifth		—	0.850	←	←	
		In Reverse		2.393	4.091	←	←	
	Transfer Gear Ratio H4/L4			1.000/2.566	←	←	←	
	Differential Gear Ratio (Front / Rear)			4.100/4.100, 4.300/4.300* ¹	4.300/4.300	←	4.300/4.300, 4.556/4.556* ¹	
	Differential Gear Size (Front / Rear)		in.	7.5/8.0	←	←	←	60
	Brake Type	Front		Ventilated Disc	←	←	←	
		Rear		Ventilated Disc	L.T. Drum	←	L.T. Drum, Ventilated Disc* ⁵	
	Parking Brake Type			Due-Servo	L.T. Drum	←	L.T. Drum, Duo-Servo* ⁶	
	Brake Booster Type and Size		in.	Tandem 8" + 9"	←	←	←	
	Proportioning Valve Type			LSP & BV	←	←	←	65
	Suspension Type	Front		Double Wishbone	←	←	←	
		Rear		4-Link with Lateral Rod	←	←	←	
	Stabilizer Bar	Front		STD	←	←	←	
		Rear		STD	←	←	←	
	Steering Gear Type			Rack & Pinion	←	←	←	70
	Steering Gear Ratio (Overall)			20.0 : 1	←	←	←	
	Power Steering Type			Integral Type	←	←	←	

*: Unladen Vehicle
*¹: With 265/70R16 Tire
*²: Only for Malaysia
*³: Only for Thailand and Malaysia
*⁴: Option
*⁵: With ABS
*⁶: With Rear Ventilated Disc Brake

General Countries						
5-Door		3-Door	5-Door	3-Door		
STD	GX			STD		
RZJ95L-GKMRU	RZJ95L-GKMNU	RZJ90L-GJMNK	RZJ95R-GKMNK	LJ90R-GJMRS	LJ90L-GJMRS	
5	4730 (186.2)	4730 (186.2), 4755 (187.2)* ¹	4290 (168.9), 4315 (169.9)* ¹	4730 (186.2), 4755 (187.2)* ¹	4290 (168.9)	←
	1730 (68.1)	1730 (68.1), 1820 (71.7)* ¹	←	←	1730 (68.1)	←
	1865 (73.4)	1865 (73.4), 1880 (74.0)* ¹	1860 (73.2), 1915 (75.4)* ¹	1860 (73.2)	←	
	←	←	2370 (93.3)	2675 (105.3)	2370 (93.3)	←
	1475 (58.1)	1475 (58.1), 1505 (59.3)* ¹	←	←	1475 (58.1)	←
10	1480 (58.3)	1480 (58.3), 1510 (59.4)* ¹	←	←	1480 (58.3)	←
	←	←	1285 (50.6)	1725 (67.9)	1285 (50.6)	←
	1465 (57.7)	1450 (57.1)	1385 (54.5)	1450 (57.1)	1385 (54.5)	←
	←	←	←	←	←	←
	←	←	540 (21.3)	975 (38.4)	540 (21.3)	←
15	←	←	1405 (55.3)	1425 (56.1)	1405 (55.3)	←
	←	←	1110 (43.7)	1115 (43.9)	1110 (43.7)	←
	←	←	←	←	←	←
	←	←	1060 (41.7), 1085 (42.7)* ¹	1200 (47.2), 1225 (48.2)* ¹	1060 (41.7), 1085 (42.7)* ¹	←
	←	←	←	←	←	←
20	←	←	←	←	←	←
	←	←	34°	30°	34°	←
	←	←	←	←	860 (1896)	←
	←	←	780 (1720)	840 (1852)	810 (2006)	←
	←	←	1630 (3594)	1690 (3726)	1670 (3682)	←
25	←	←	990 (2183)	1070 (2359)	985 (2172)	←
	1675 (3693)	1695 (3737)	1520 (3351)	1420 (3131)	1565 (3450)	←
	2750 (6063)	2770 (6107)	2510 (5534)	2490 (5490)	2550 (5622)	←
	←	←	90 (19.8)	←	←	←
	—	—	—	—	←	←
30	—	—	—	—	—	—
	—	—	—	—	—	—
	←	←	←	←	32 (20)	←
	←	←	←	←	54 (34), 52 (33)* ²	←
	←	←	←	←	87 (54), 83 (52)* ²	←
35	—	—	—	—	—	—
	←	←	5.1 (16.7)	5.7 (18.7)	5.1 (16.7)	←
	←	←	5.5 (18.0)	6.1 (20.1)	5.5 (18.0)	←
	←	←	3RZ-FE	←	3L	←
	←	←	←	←	8 Valves, OHC	←
40	←	←	←	←	96.0 x 96.0 (3.78 x 3.78)	←
	←	←	←	←	2779 (169.6)	←
	←	←	9.5 : 1	←	22.2 : 1	←
	←	←	EFI	←	Distributor Type	←
	←	←	91	←	50	←
45	←	←	112 / 4800 (EEC)	←	65 / 4000, 60 / 3800* ³ (SAE-NET)	←
	←	←	240 / 4000 (EEC)	←	185 / 2400, 174 / 2400* ³ (SAE-NET)	←
	←	←	←	←	12-52	←
	←	←	←	←	720	←
	←	←	1.2	←	2.0	←
50	←	←	←	←	←	←
	←	←	←	←	G52	←
	←	←	←	←	3.928	←
	←	←	←	←	2.333	←
	←	←	←	←	1.451	←
55	←	←	←	←	←	←
	←	←	←	←	0.851	←
	←	←	←	←	4.743	←
	←	←	←	←	←	←
	4.300 / 4.300	4.300 / 4.300, 4.556 / 4.556* ¹	←	←	4.875 / 4.875	←
60	←	←	←	←	←	←
	←	←	←	←	←	←
	L.T. Drum	L.T. Drum, Ventilated Disc* ⁵	←	←	L.T. Drum	←
	L.T. Drum	L.T. Drum, Duo-Servo* ⁶	←	←	L.T. Drum	←
	←	←	←	←	Tandem 7" + 8"	←
65	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
70	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←

Item				Area	General Countries			
Body Type				5-Door				
Vehicle Grade				STD	GX	STD	GX	
Model Code				LJ95R-GKMRS	LJ95R-GKMNS	LJ95L-GKMRS	LJ95L-GKMNS	
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4730 (186.2)	4730 (186.2), 4755 (187.2)* ¹	4730 (186.2)	4730 (186.2), 4755 (187.2)* ¹	5
		Width	mm (in.)	1730 (68.1)	1730 (68.1), 1820 (71.7)* ¹	1730 (68.1)	1730 (68.1), 1820 (71.7)* ¹	
		Height*	mm (in.)	1865 (73.4)	1865 (73.4), 1880 (74.0)* ¹	1865 (73.4)	1865 (73.4), 1880 (74.0)* ¹	
	Wheel Base		mm (in.)	2675 (105.3)	←	←	←	
	Tread	Front	mm (in.)	1475 (58.1)	1475 (58.1), 1505 (59.3)* ¹	1475 (58.1)	1475 (58.1), 1505 (59.3)* ¹	10
		Rear	mm (in.)	1480 (58.3)	1480 (58.3), 1510 (59.4)* ¹	1480 (58.3)	1480 (58.3), 1510 (59.4)* ¹	
	Room	Length	mm (in.)	1725 (67.9)	←	←	←	
		Width	mm (in.)	1465 (57.7)	1450 (57.1)	1465 (57.7)	1450 (57.1)	
		Height	mm (in.)	1260 (49.6)	←	←	←	
	Cargo Space	Length	mm (in.)	975 (38.4)	←	←	←	15
		Width	mm (in.)	1425 (56.1)	←	←	←	
		Height	mm (in.)	1115 (43.9)	←	←	←	
	Overhang	Front	mm (in.)	855 (33.7)	←	←	←	
		Rear	mm (in.)	1200 (47.2), 1225 (48.2)* ¹	←	←	←	
	Min. Running Ground Clearance		mm (in.)	230 (9.1), 245 (9.6)* ¹	←	←	←	
	Angle of Approach		degrees	36°	←	←	←	20
	Angle of Departure		degrees	30°	←	←	←	
	Curb Weight	Front	kg (lb)	910 (2006)	←	←	←	
		Rear	kg (lb)	850 (1874)	←	←	←	
		Total	kg (lb)	1760 (3880)	←	←	←	
	Gross Vehicle Weight	Front	kg (lb)	1140 (2513)	←	←	←	25
		Rear	kg (lb)	1660 (3660)	←	←	←	
		Total	kg (lb)	2800 (6173)	←	←	←	
Fuel Tank Capacity		ℓ (Imp.gal.)	90 (19.8), 90 + 70 (19.8 + 15.4)* ³	←	←	←		
Luggage Compartment Capacity		m ³ (cu.ft.)	—	—	—	—		
Performance	Max. Speed		km/h (mph)	—	—	—	—	30
	Max. Cruising Speed		km/h (mph)	—	—	—	—	
	Max. Permissible Speed	1st Gear	km/h (mph)	32 (20)	←	←	←	
		2nd Gear	km/h (mph)	54 (34), 52 (33)* ²	←	←	←	
		3rd Gear	km/h (mph)	87 (54), 83 (52)* ²	←	←	←	
		4th Gear	km/h (mph)	—	—	—	—	35
	Min. Turning Radius	Tire	m (ft.)	5.7 (18.7)	←	←	←	
Body		m (ft.)	6.1 (20.1)	←	←	←		
Engine	Engine Type			3L	←	←	←	
	Valve Mechanism			8 Valves, OHC	←	←	←	
	Bore x Stroke		mm (in.)	96.0 x 96.0 (3.78 x 3.78)	←	←	←	40
	Displacement		cm ³ (cu.in.)	2779 (169.6)	←	←	←	
	Compression Ratio			22.2 : 1	←	←	←	
	Carburetor Type or Injection Pump Type (Diesel)			Distributor Type	←	←	←	
	Research Octane No. or Cetane No. (Diesel)			50	←	←	←	
	Max. Output		kw / rpm	65 / 4000,60 / 3800* ³ (SAE-NET)	←	←	←	45
	Max. Torque		N·m / rpm	185 / 2400,174 / 2400* ³ (SAE-NET)	←	←	←	
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-52	←	12-52, 52 x 2* ⁴	←	
	Alternator Output		Watts	720	←	←	←	
	Starter Output		kW	2.0	←	2.0, 2.7* ⁴	←	
Chassis	Clutch Type			Dry, Single Plate	←	←	←	50
	Transmission Type			G52	←	←	←	
	Transmission Gear Ratio	In First		3.928	←	←	←	
		In Second		2.333	←	←	←	
		In Third		1.451	←	←	←	
		In Fourth		1.000	←	←	←	55
		In Fifth		0.851	←	←	←	
		In Reverse		4.743	←	←	←	
	Transfer Gear Ratio H4 / L4			1.000 / 2.566	←	←	←	
	Differential Gear Ratio (Front / Rear)			4.875 / 4.875	←	←	←	
	Differential Gear Size (Front / Rear)		in.	7.5 / 8.0	←	←	←	60
	Brake Type	Front		Ventilated Disc	←	←	←	
		Rear		L.T. Drum	←	←	←	
	Parking Brake Type			L.T. Drum	←	←	←	
	Brake Booster Type and Size		in.	Tandem 7" + 8"	←	←	←	
	Proportioning Valve Type			LSP & BV	←	←	←	65
	Suspension Type	Front		Double Wishbone	←	←	←	
		Rear		4-Link with Lateral Rod	←	←	←	
	Stabilizer Bar	Front		STD	←	←	←	
Rear			STD	←	←	←		
Steering Gear Type			Rack & Pinion	←	←	←	70	
Steering Gear Ratio (Overall)			20.0 : 1	←	←	←		
Power Steering Type			Integral Type	←	←	←		

*: Unladen Vehicle
*¹: With 265 / 70R16 Tire
*²: Only for Malaysia
*³: Only for Thailand and Malaysia
*⁴: Option
*⁵: With ABS
*⁶: With Rear Ventilated Disc Brake

General Countries		
	3-Door	5-Door
	GX	
	KZJ90L-GJMNX	KZJ95L-GKMNX
5	4290 (168.9), 4315 (169.9)* ¹	4730 (186.2), 4755 (187.2)* ¹
	←	←
	1860 (73.2), 1875 (73.8)* ¹	1865 (73.4), 1880 (74.0)* ¹
	2370 (93.3)	2675 (105.3)
	←	←
10	←	←
	1285 (50.6)	1725 (67.9)
	1385 (54.5)	1450 (57.1)
	←	←
	540 (21.3)	975 (38.4)
15	1405 (55.3)	1425 (56.1)
	1110 (43.7)	1115 (43.9)
	←	←
	1060 (41.7), 1085 (42.7)* ¹	1200 (47.2), 1225 (48.2)* ¹
	←	←
20	←	←
	34°	30°
	900 (1984)	950 (2094)
	830 (1830)	860 (1896)
	1730 (3814)	1810 (3990)
25	1050 (2315)	1190 (2624)
	1500 (3307)	1610 (2549)
	2550 (5627)	2800 (6173)
	90 (19.8)	90 (19.8), 90 + 70 (19.8 + 15.4)* ³
	—	—
30	—	—
	—	—
	38 (24)	←
	70 (44)	←
	100 (63)	←
35	—	—
	←	5.7 (18.7)
	←	6.1 (20.1)
	1KZ-T	←
	←	←
40	96.0 x 103.0 (3.78 x 4.06)	←
	2982 (181.9)	←
	21.2 : 1	←
	←	←
	←	←
45	88 / 3600 (SAE-NET)	←
	290 / 2400 (SAE-NET)	←
	12-64	←
	←	←
	2.2	←
50	←	←
	R150F	←
	3.830	←
	2.062	←
	1.436	←
55	←	←
	0.838	←
	4.220	←
	←	←
	4.100 / 4.100, 4.300 / 4.300* ³	←
60	←	←
	←	←
	L.T. Drum, Ventilated Disc* ⁵	←
	L.T. Drum, Duo-Servo* ⁶	←
	←	←
65	←	←
	←	←
	←	←
	←	←
70	←	←
	←	←
	←	←