SUSPENSION

67U13X-501

OUTLINE

OUTLINE OF CONSTRUCTION

1. The front suspension has been changed from a strut type with I-shaped lower arm, tension rod and stabilizer to a strut type with A-shaped lower arm and stabilizer.
2. For the front suspension, control stability and riding comfort have been improved by using optimum wheel alignment, by optimizing forward/rearward bushing compliance, and by maintaining lateral rigidity.
3. The rear suspension has been changed from the rigid axle type to an independent system in which toe and camber changes occur depending on driving conditions to improve vehicle agility and stability.
4. Some models are equipped with an auto-adjusting suspension system which automatically adjusts the damping force of the shock absorbers according to the vehicle speed and driving conditions.

67U13X-502

SPECIFICATIONS

Front Suspension

Item			Specifications
Suspension type			Strut
Springs	Type		Coil
	Wire diameter mm (in)	Passenger's side	11.8 (0.46)
		Driver's side	12.0 (0.47)
	Coil diameter mm (in)	Passenger's side	146.8 (5.78)
		Driver's side	147.0 (5.79)
	Free length mm (in)	Passenger's side	327.0 (12.9)
		Driver's side	336.5 (13.2)
	Coil number mm (in)	Passenger's side	5.31
		Driver's side	5.51
Stabilizer	Type		Torsion bar
	Diameter mm (in)		24.0 (0.94)
Shock absorbers			Cylindrical, double-actings

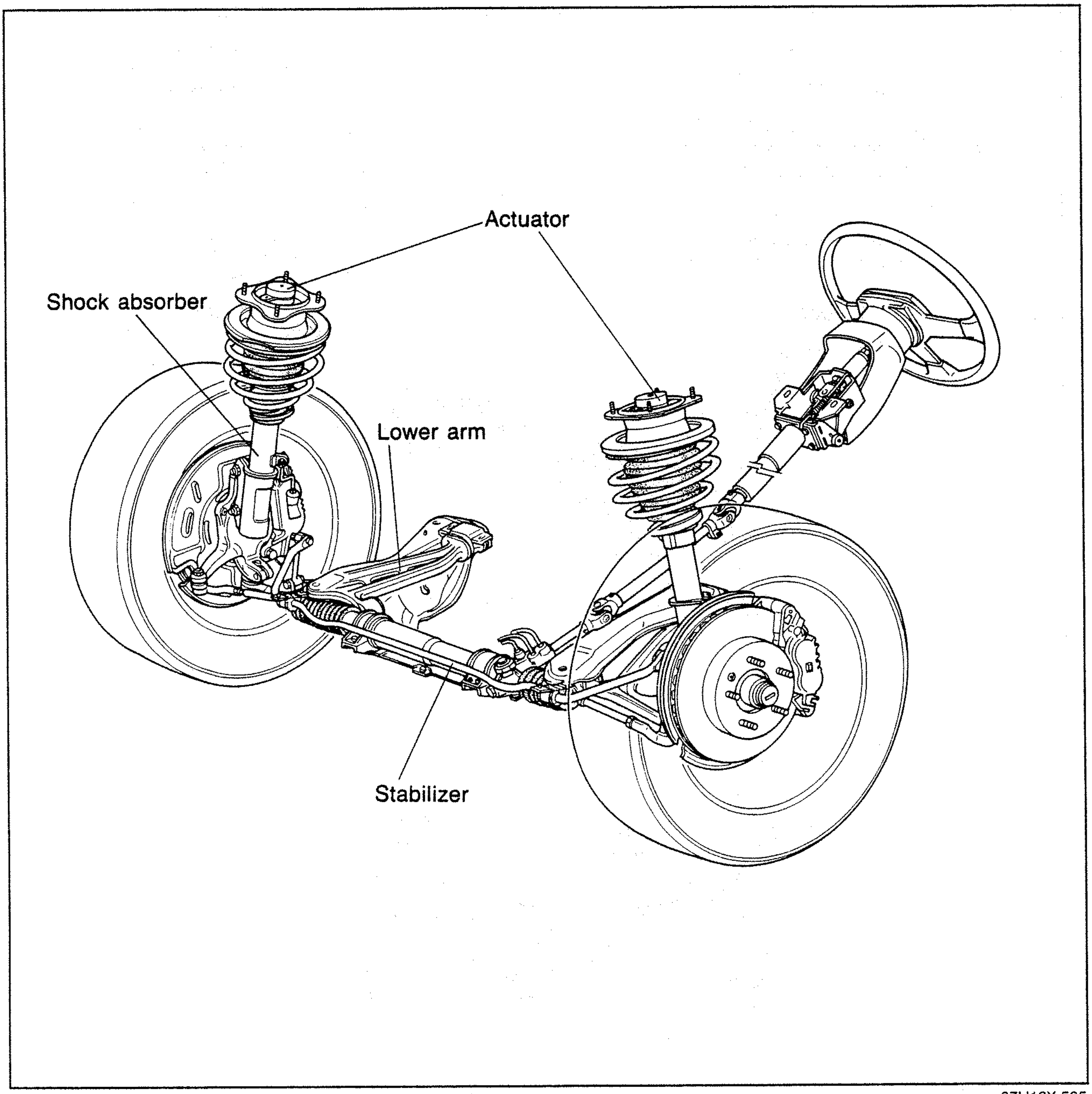
57G13X-501

Rear Suspension

Item			Specifications
Suspension type			Multilink semi-trailing
Springs	Type		Coil
	Wire diameter	mm (in)	10.1 (0.39)
	Coil diameter	mm (in)	84.4 (3.32)
	Free length	mm (in)	355 (14.0)
	Coil number		10.79
Stabilizer	Type		Torsion bar
	Diameter	mm (in)	13 (0.51)
Shock absorbers			Cylindrical, double-acting

57G13X-502

FRONT SUSPENSION

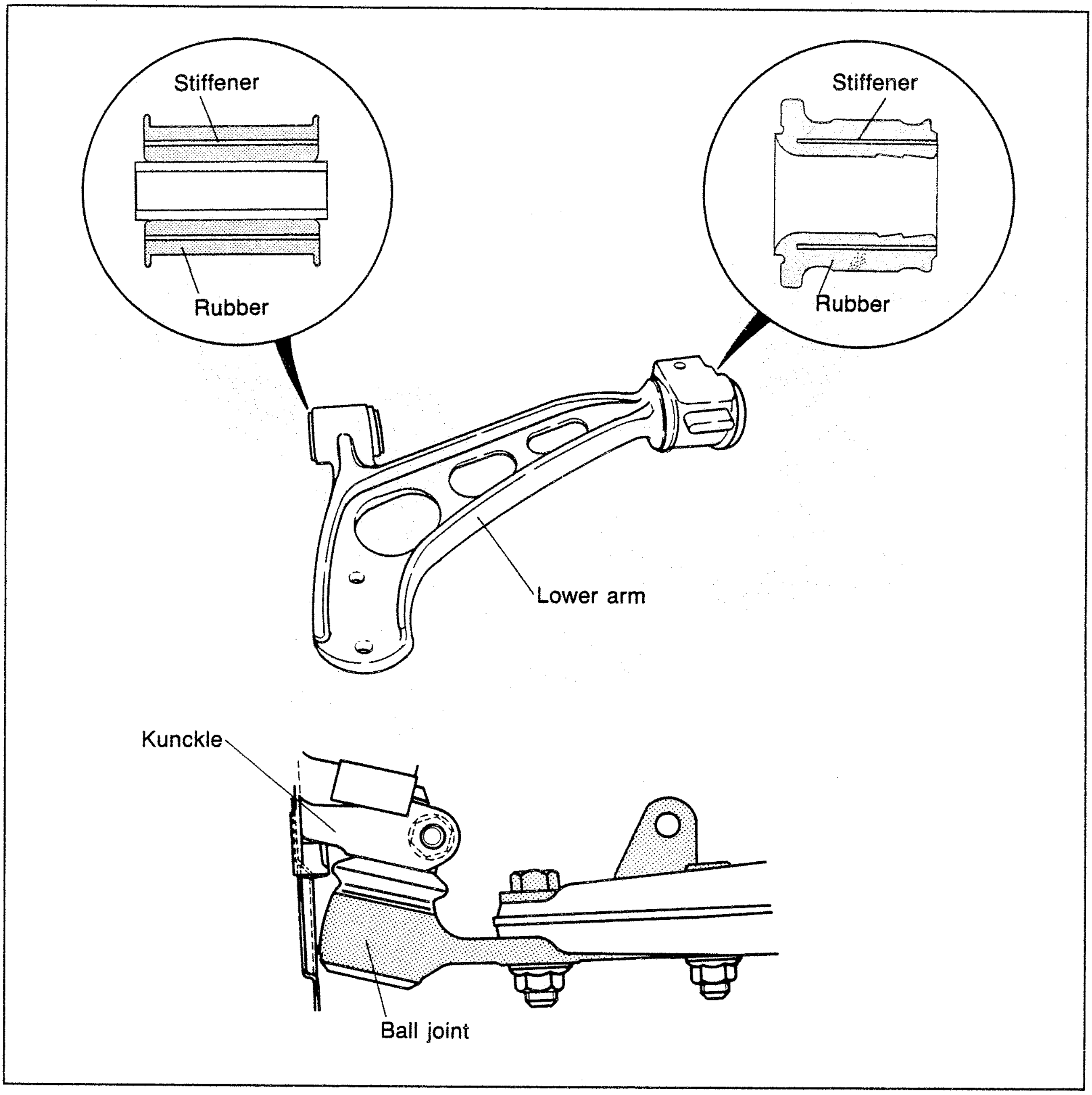


67U13X-505

For the front suspension, riding comfort and control stability have been improved by using a bushing where the lower arm attaches to the body. This bushing has soft characteristics relative to longitudinal movements but has firm characteristics relative to lateral movements.
The shock absorber and knuckle have been changed from the press-in single-piece type of the previous model to separate type which is bolted to the knuckle.
Unlike the previous model, the shock absorber cannot be dismantled for repair. The use of A-shaped lower arms has allowed the front suspension to be simplified and the torsion rods have been deleted.

67U13X-506

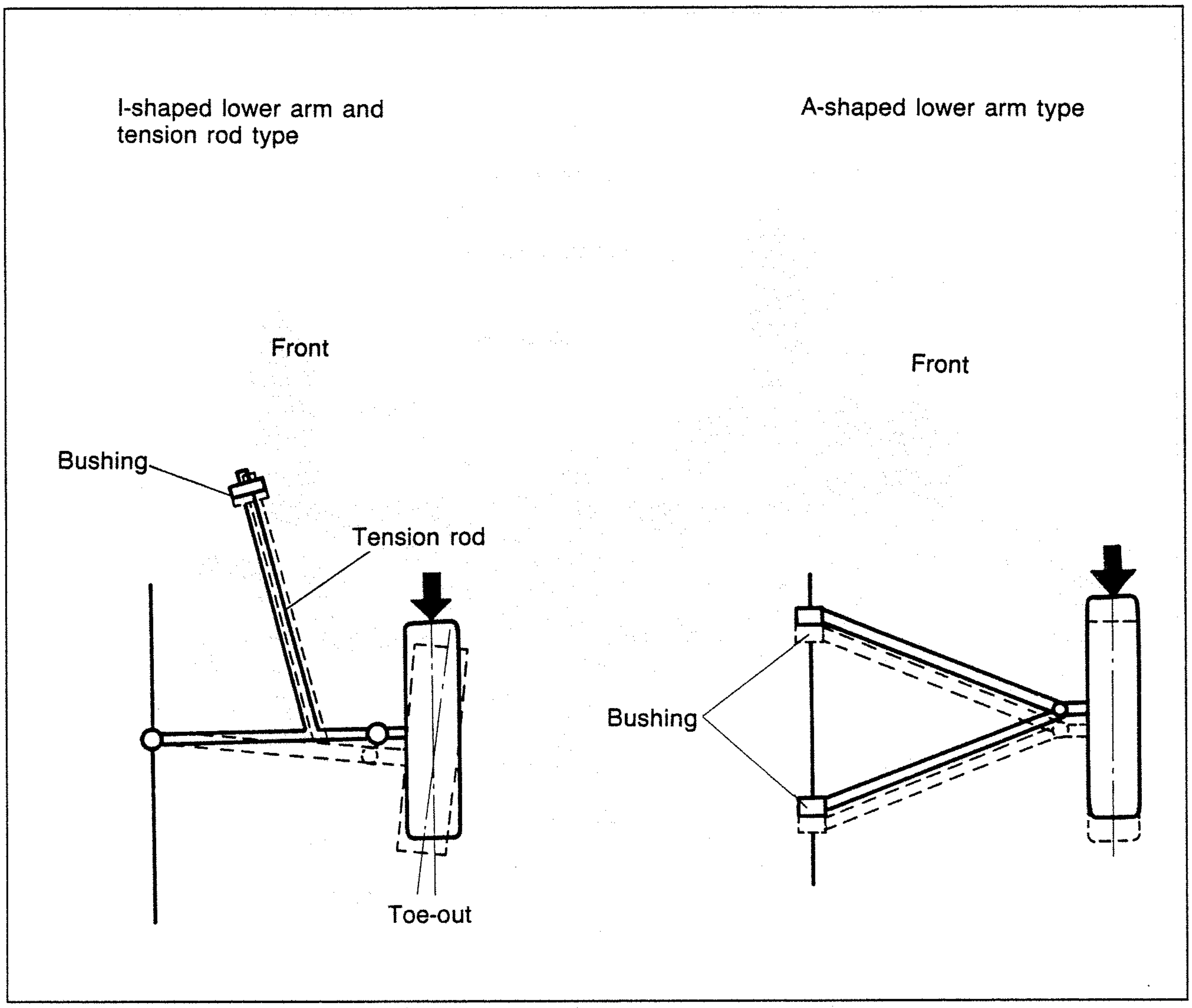
LOWER ARM



67U13X-507

The lower arm is aluminum alloy forged in an A shape. It is installed on the sub-frame at two places via bushings.
To prevent electrolytic corrosion between the lower arm and other metal parts, the surface of the bushing is rubber.
A zinc-chromate coating has also been applied to the shadowed part of the lower arm ball joint.

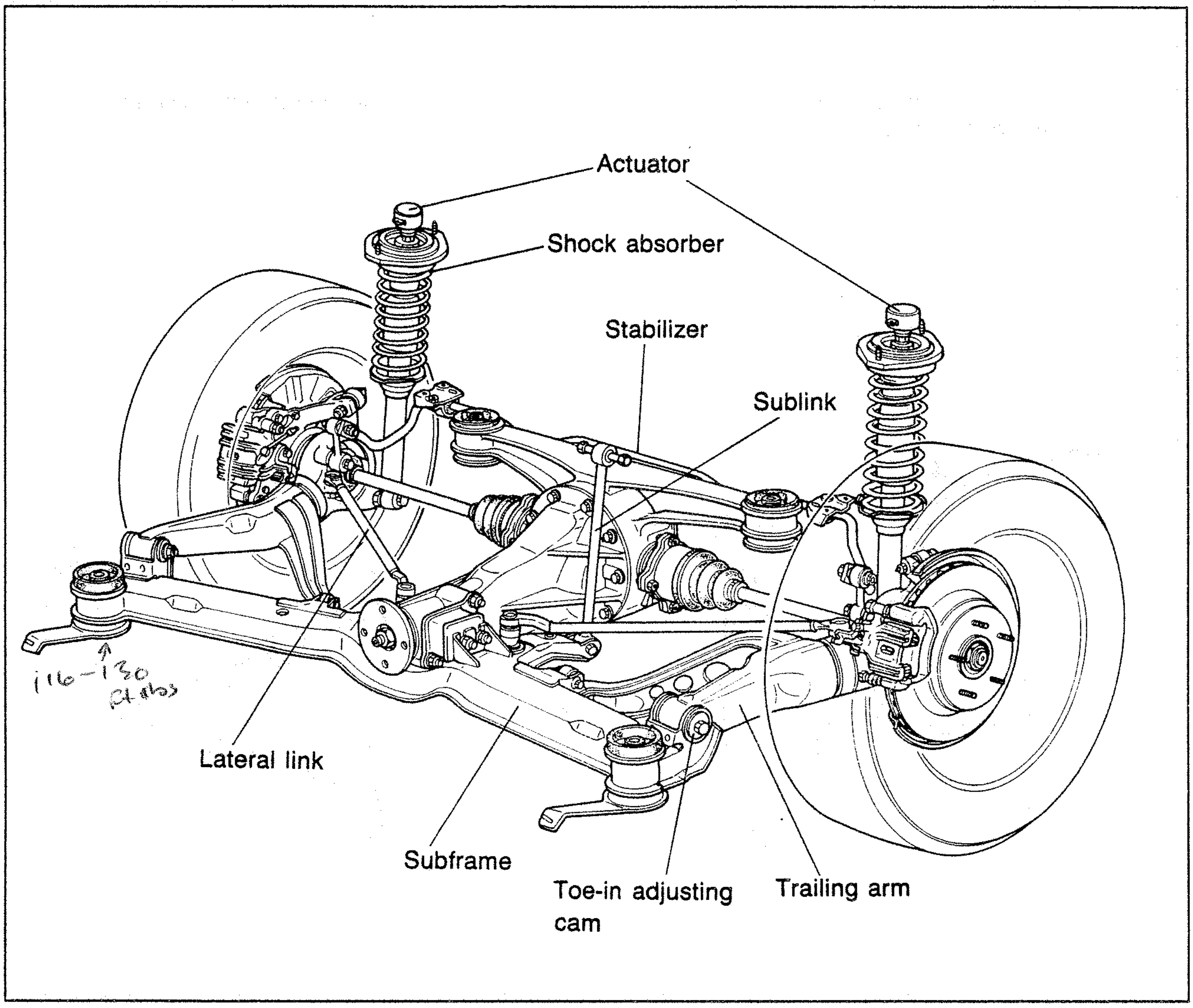
CHARACTERISTICS OF A-SHAPED LOWER ARM



67U13X-508

For the I-shaped lower arm and tension rod type of suspension, the bushing at the front end of the tension rod was compressed when force was applied to the tire from the front.
Then, because the links moved as shown by the broken line in the figure, tire toe-out occurred.
By using an A-shaped lower arm, when force is applied to the tire from the front, the bushings bend to the rear and the lower arm moves toward the rear.
Because the two points at which the lower arm is installed to the body are arranged in parallel relative to a center line of the vehicle, this movement is straight toward the rear. Thus, there is no change of the toe-in of the tires, and excellent control stability can be maintained.

REAR SUSPENSION



67U13X-509

The rear suspension consists of inner and outer triaxial floating hubs connected by three support points, as well as the trailing arm, control link, lateral link, etc.
The rear wheels have a self-compensating toe-in and camber which assures that they will always maintain the best toe-in and camber under any driving conditions.
The toe-in of the rear wheels can also be manually adjusted, by turning the adjusting cam located at the outer side of the front edge of the trailing arm.

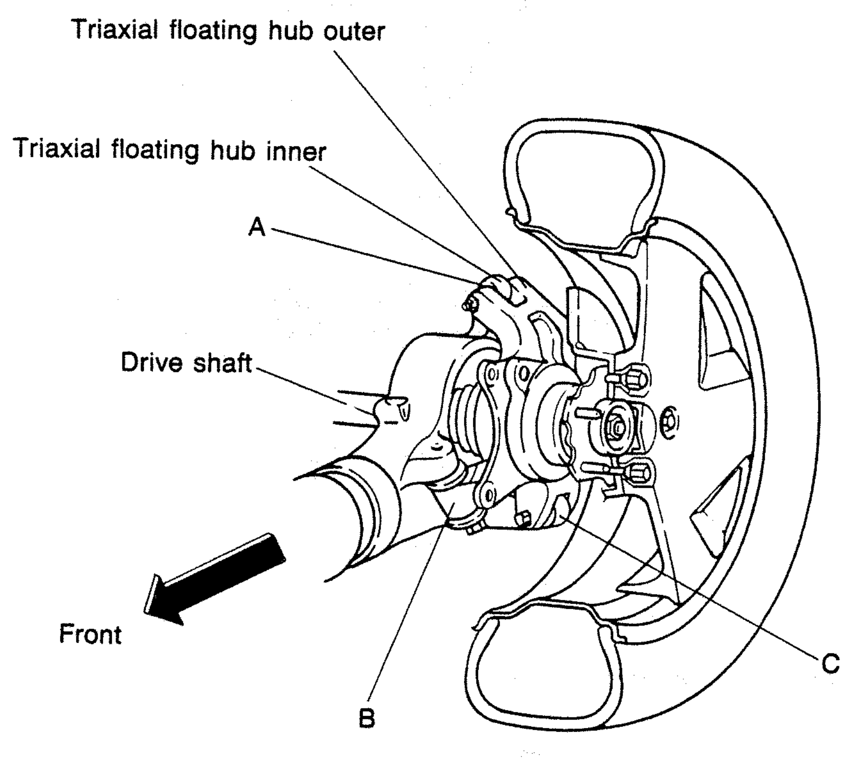
DYNAMIC TRACKING SUSPENSION

Outline

With the dynamic tracking suspension of the new model, the rear wheels become an active part of the steering system.
When lateral force is applied, the rear suspension begins to toe out. As the force increases, the characteristics change to toe-in.
Toe-in stability also increases when the brakes are applied, during engine braking or cornering.
Although a semi-trailing arm suspension inherently provides good camber control, an innovative mounting geometry sets a new standard of control on the new model.
By slightly offsetting the mounting of the control arm and the control link from the vertical axis of the trailing arm, the camber of the wheels is levered to remain static with only a small narrowing of the track.
Camber is thus maintained throughout a bump response cycle.

67U13X-510

Toe Control Mechanism
Construction

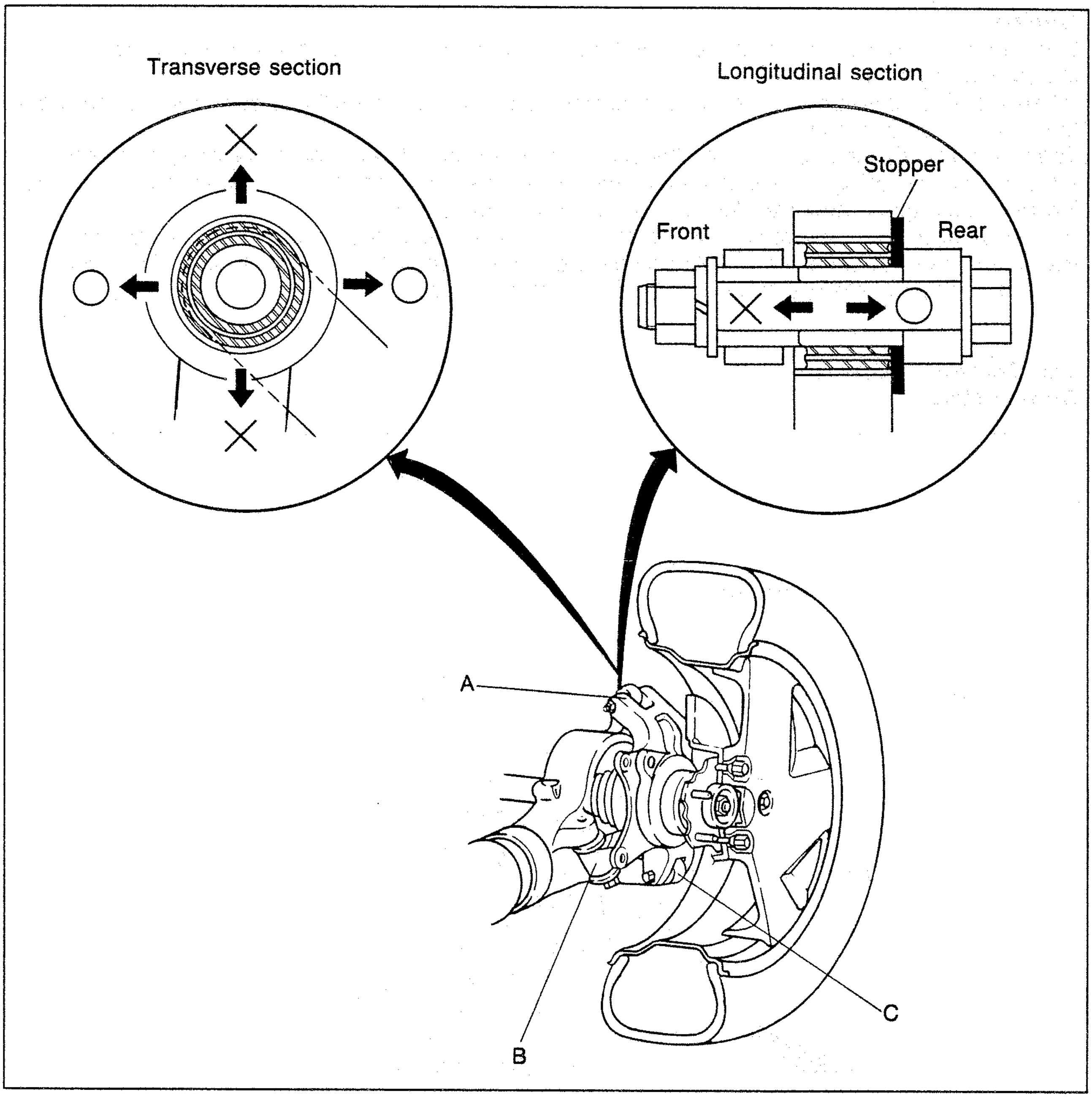


67U13X-511

The toe-control mechanism is composed of the triaxial floating hub (inner) unified with the trailing arm, and the triaxial floating hub (outer) which supports the wheel and drive shaft. The mechanism is also composed of the parts used for coupling the inner and outer hubs: two bushings (A and B) and a pillow ball (C).

A point: Bushing support
B point: Bushing support
C point: Pillow ball support

Movement of triaxial floating hub outer

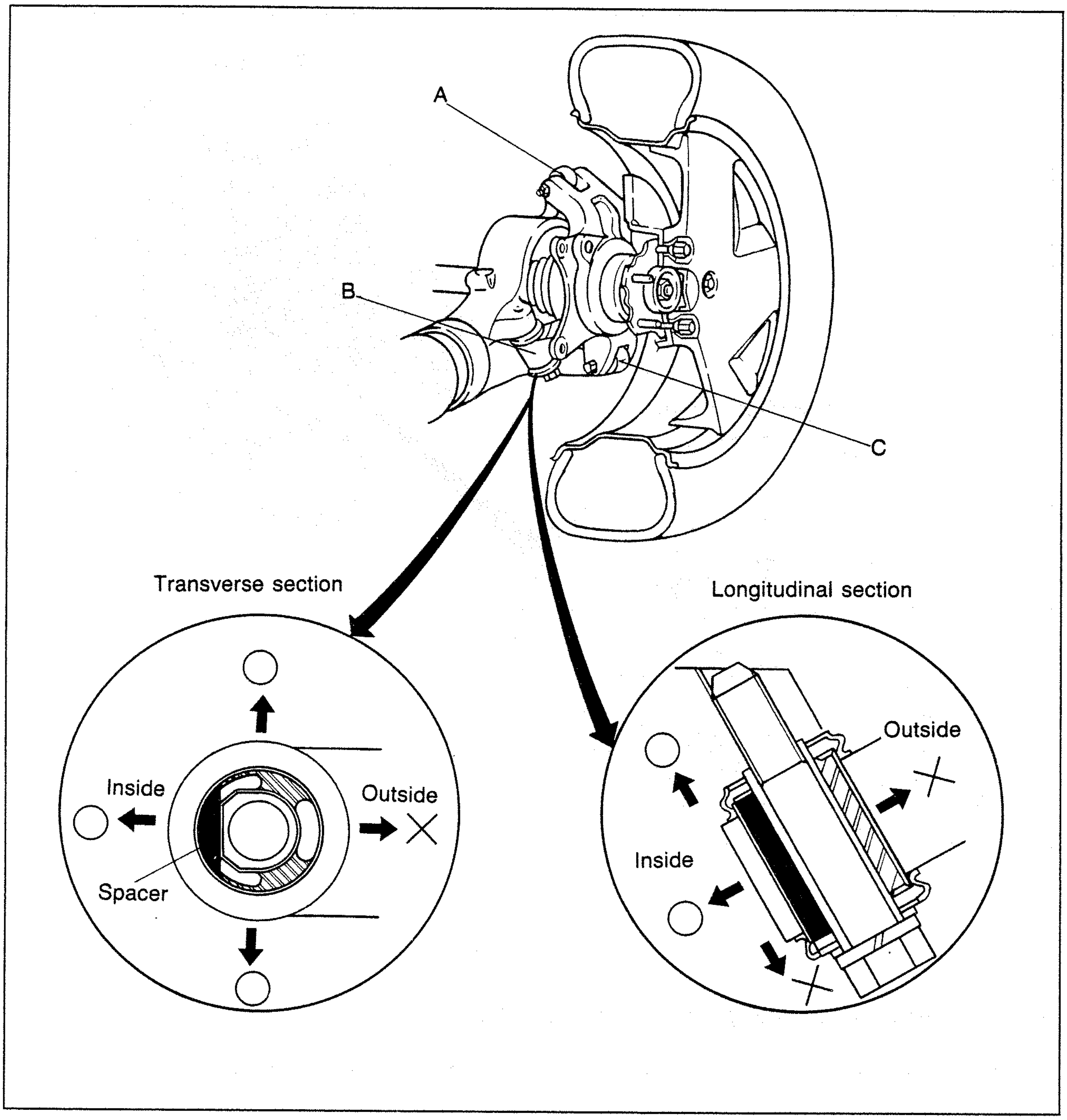


67U13X-512

Triaxial floating hub (outer) movement at point A

Chassis transverse direction . . .
Because the bushing is compressed when force from the triaxial floating hub (outer) is applied, the triaxial floating hub (outer) can move laterally.

Chassis longitudinal direction . . .
Because the bushing is compressed when force from the triaxial floating hub (outer) is applied rearward, the triaxial floating hub (outer) can move rearward.
The stopper prevents force from the triaxial floating hub (outer) from being applied in the forward direction to the bushing, so the bushing will not be compressed, and therefore the triaxial floating hub (outer) cannot move. If such movement were to occur, it would produce unwanted toe-out.

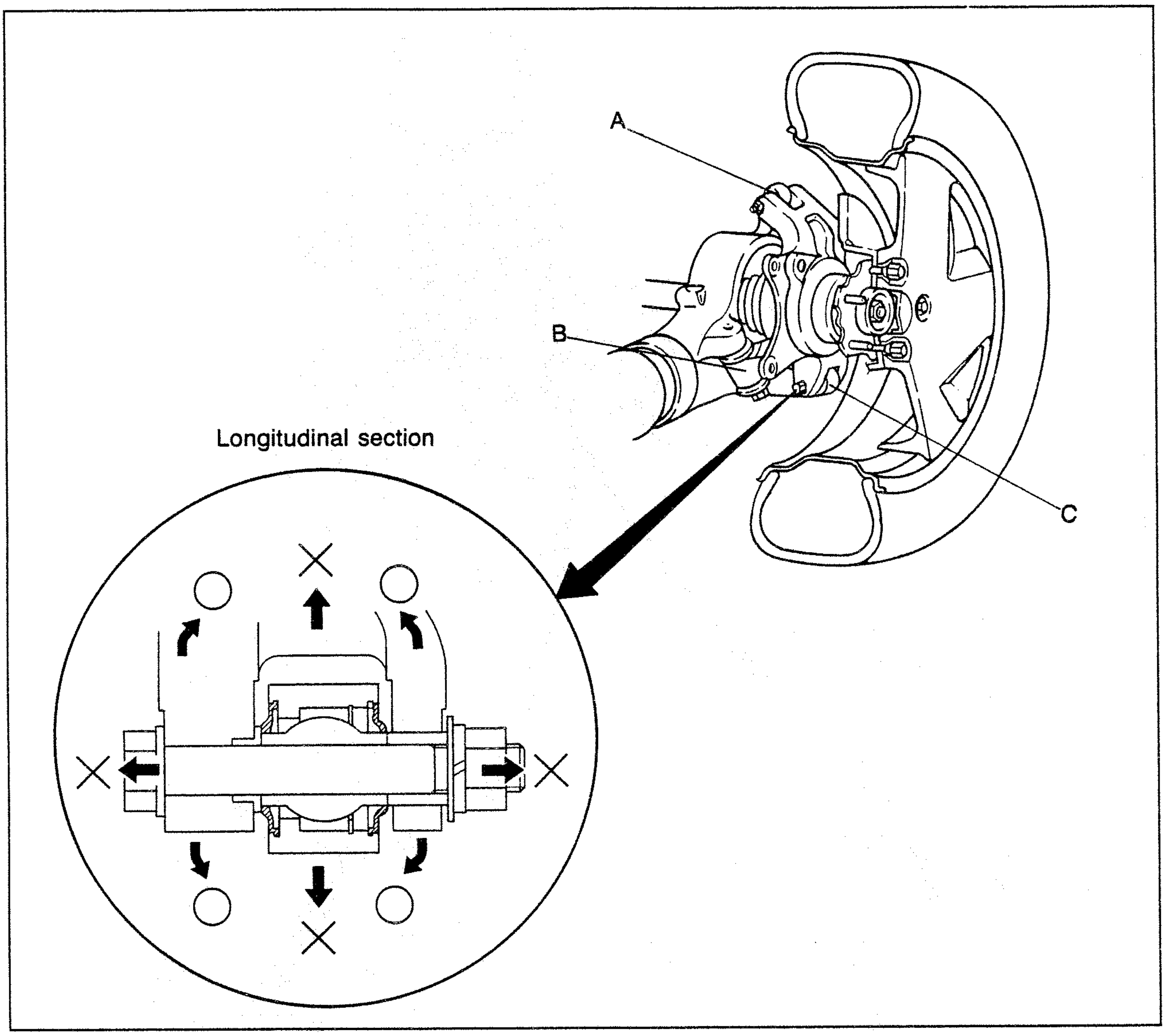


67U13X-513

Triaxial floating hub (outer) movement at point B

Chassis transverse direction
Because the bushing is compressed when force from the triaxial floating hub (outer) is applied rearward, the triaxial floating hub (outer) can move (except toward the outside of the chassis).
Because the spacer prevents force from the triaxial floating hub (outer) from being applied toward the outside of the chassis to the bushing, the bushing will not be compressed, and therefore the triaxial floating hub (outer) cannot move outward.
The purpose for not moving the triaxial floating hub (outer) in the outside direction of the chassis is to prevent the toe-out of the tires.

Chassis vertical direction . . .
Because the bushing is compressed when force from the triaxial floating hub (outer) is applied upward, the triaxial floating hub (outer) can move.

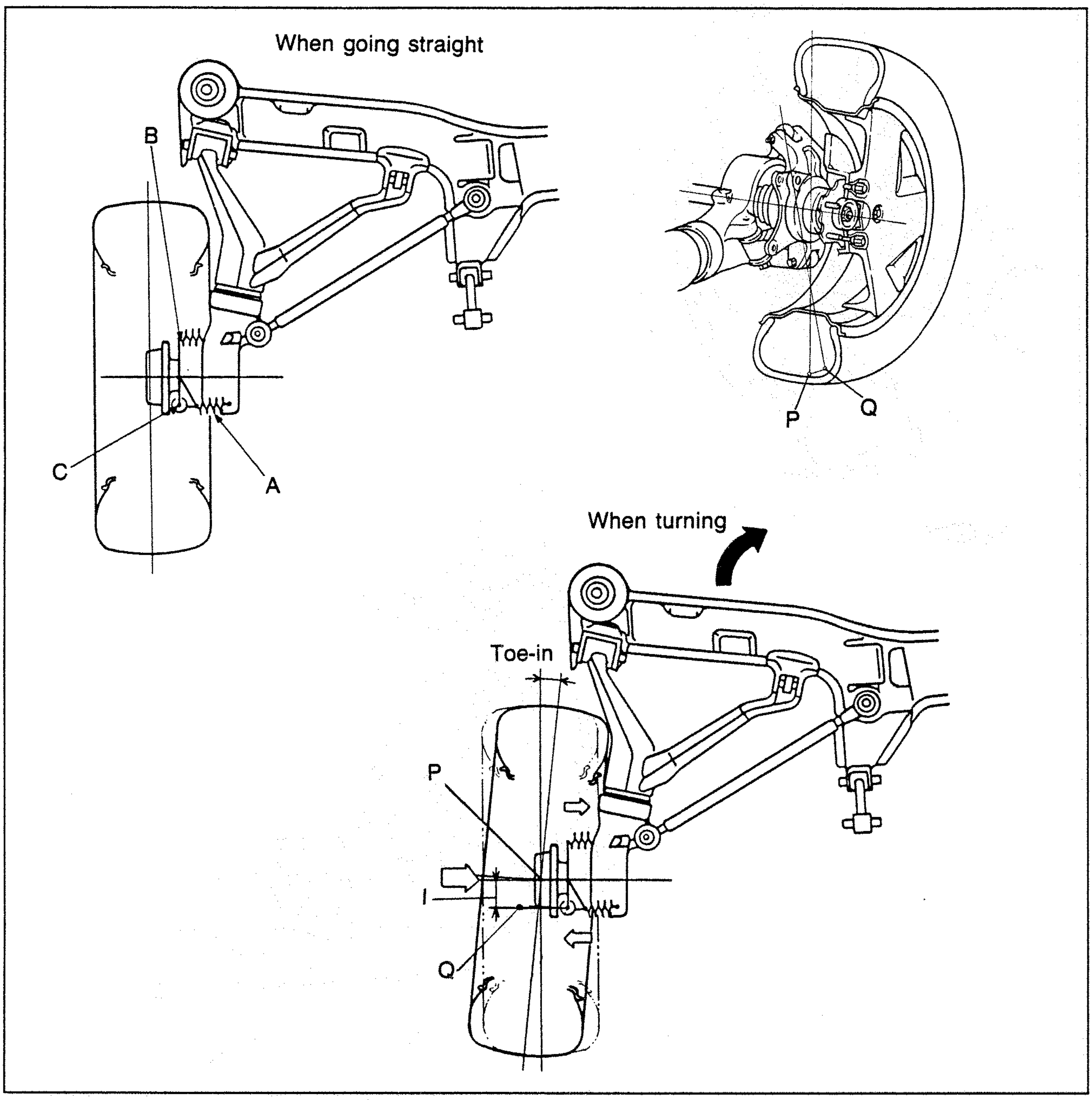


67U13X-514

Triaxial floating hub (outer) movement at point C

Because there is a pillow ball at point C, the triaxial floating hub (outer) can move three-dimensionally around its center.

Function



67U13X-515

1. During turning...

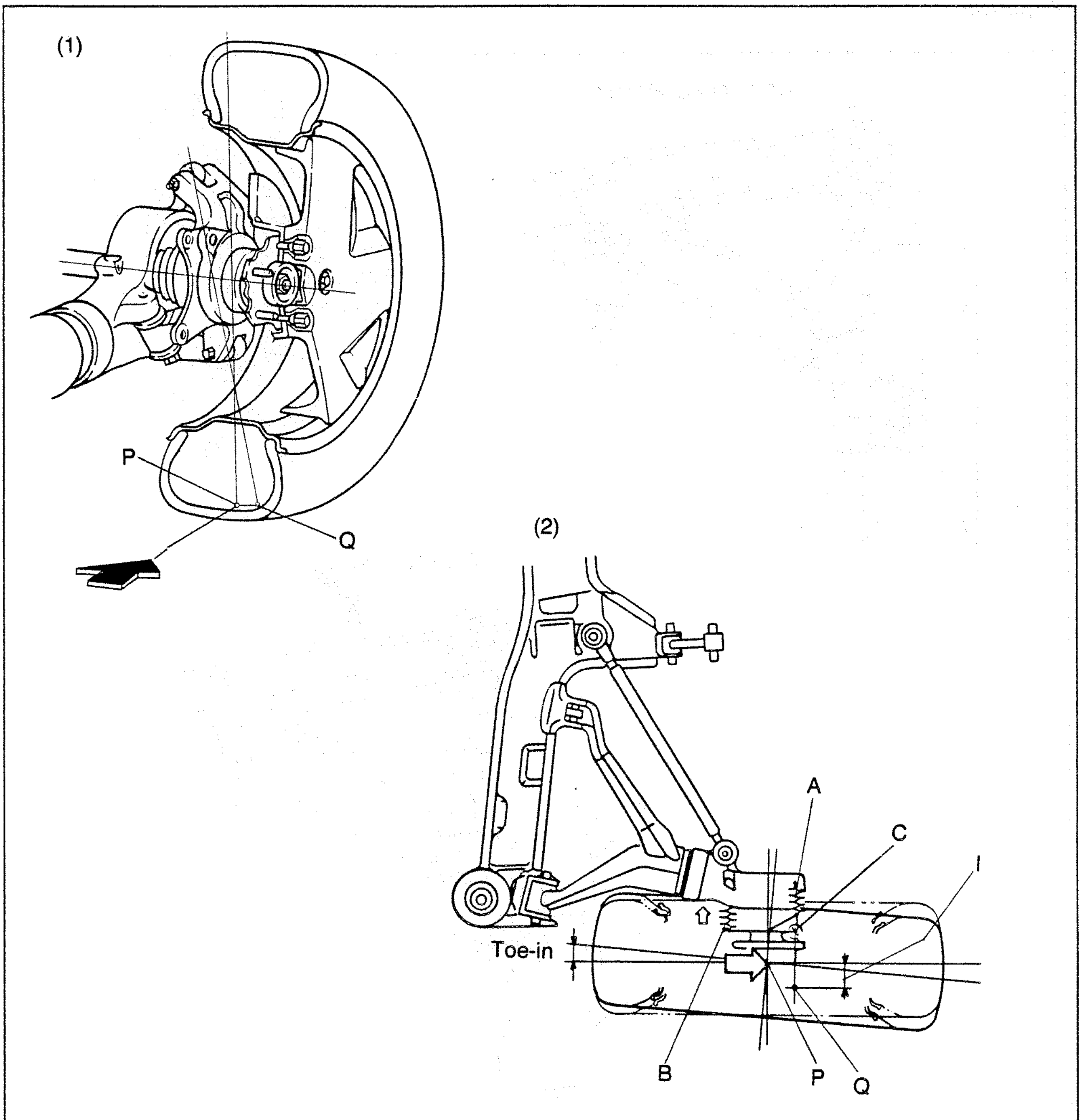
(1) Illustration (1) shows the tire condition during straight-line travel of the chassis, and illustration (3) shows the tire condition during a turn to the right.

(2) During straight-line travel, no cornering force is applied to the tire, so the tire is supported as shown in illustration (1), and bushings A and B are not bent.

(3) As can be seen in illustration (2), the tire can be pivoted around the line (called the imaginary king-pin axis) connecting bushing A and pillow ball C.

(4) Assuming the ground point of the imaginary king-pin axis to be Q and the tire center ground point to be P, there is offset I between Q and P (illustration (3)).

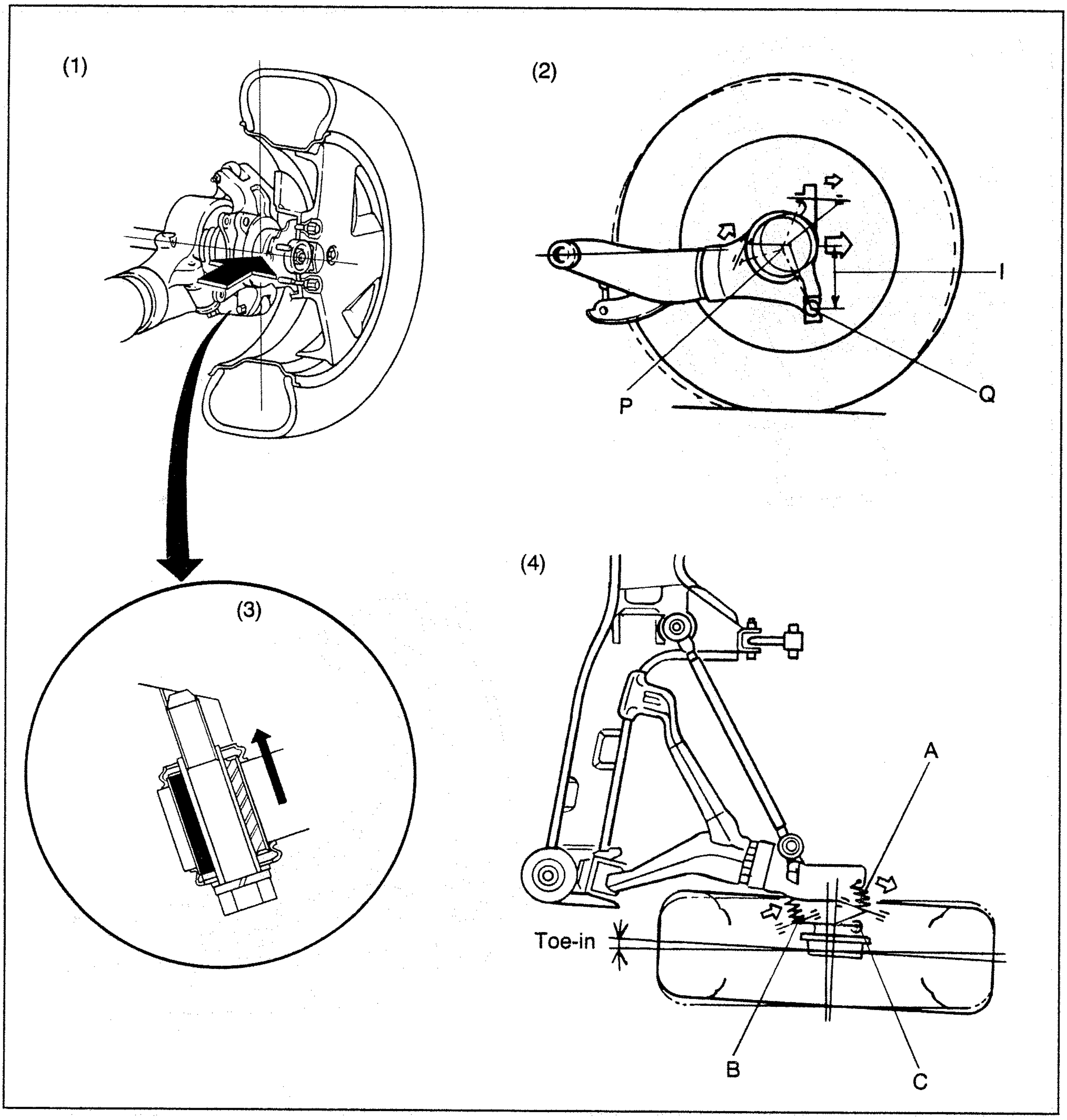
(5) Because cornering force is applied from the tire direction to point P, bushing A is compressed to the outer side and bushing B to the inner side by the cornering force and offset. As a result, the tire rotates in the vicinity of the imaginary king-pin axis (centered on pillow ball C) and the tire develops a tendency toward toe-in.



67U13X-516

2. During braking...

(1) Braking force is applied from the front of the chassis to the ground point of the tire (illustration (1)).
(2) Assuming the ground point of the imaginary king-pin axis to be Q and the ground point of the tire center to be P, there is offset I between P and Q (illustration (2)).
(3) Because braking force is applied to point P, bushing B is compressed to the inner side by the braking force and offset. As a result, the tire pivots in the vicinity of the imaginary king-pin axis (centered on pillow ball C) and the tire develops a tendency toward toe-in.



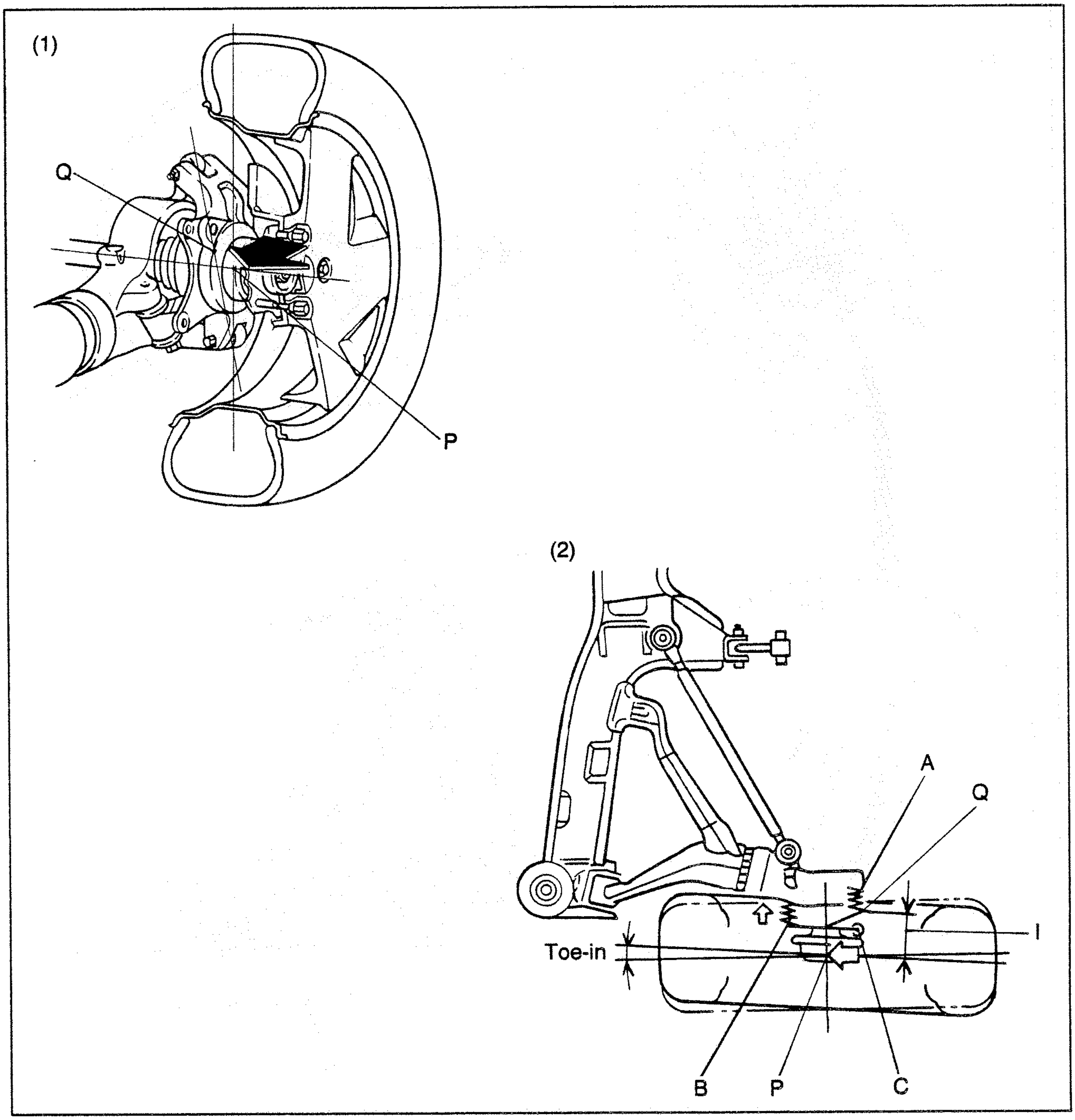
67U13X-517

3. During engine braking...

(1) Engine braking force is applied toward the rear at the center of the tire (illustration (1)).
If here the tire center is assumed to be P and pillow ball C to be Q, there is offset I between P and Q (illustration (2)).

(2) Because engine braking force is applied to point P, bushings A and B are compressed by the engine braking force and offset, and, as a result, the triaxial floating hub (outer) is pivoted rearward centered on pillow ball C (illustration (2)).

(3) Because bushings A and B are inclined at an angle (illustration (3)), the front part faces inward while the triaxial floating hub (outer) rotates rearward.
Because the tire is unified with the triaxial floating hub (outer), it moves in the same way, tending to toe-in.



57G13X-503

4. During application of driving force...

(1) The driving force is applied in a forward direction to the tire center (illustration (1)).

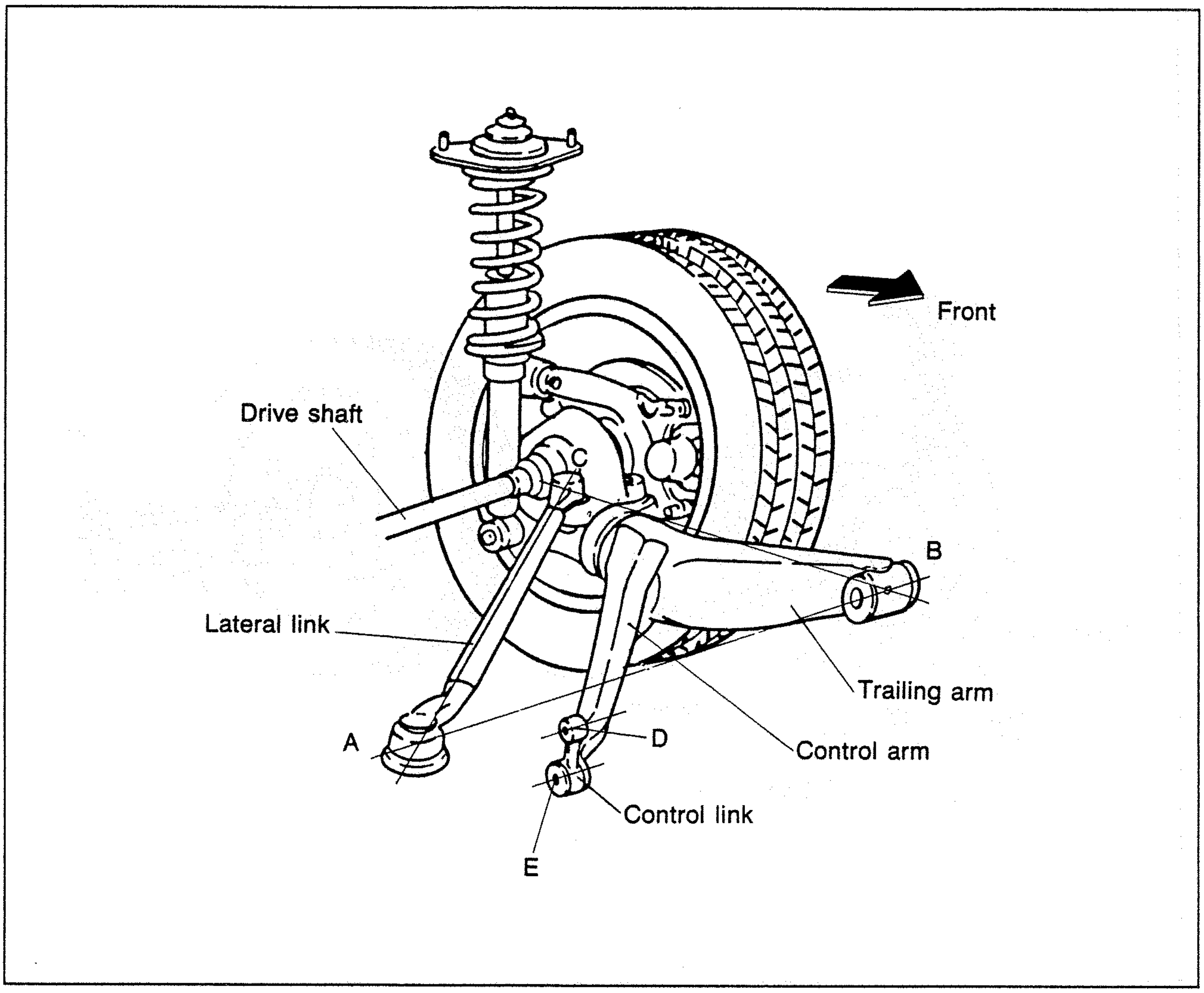
(2) If the intersection of the A-C connecting line (imaginary king-pin axis) and the horizontal extension line of the tire center (P) is assumed to be Q, there is offset I between Q and P.

(3) Because driving force is applied to point P, bushing B is compressed by the driving force and offset, and, as a result, the tire rotates in the vicinity of the imaginary king-pin axis, centered on pillow ball C, and the tire develops a tendency toward toe-in.

Note

During engine braking, engine braking force is applied to the tire center, and the triaxial floating hub (outer) rotates rearward. However, the reason that the triaxial floating hub (outer) does not rotate forward during application of driving force is because there is a stopper at the rear edge of bushing A. This stops the movement of the triaxial floating hub (outer) (See page 13-8.)

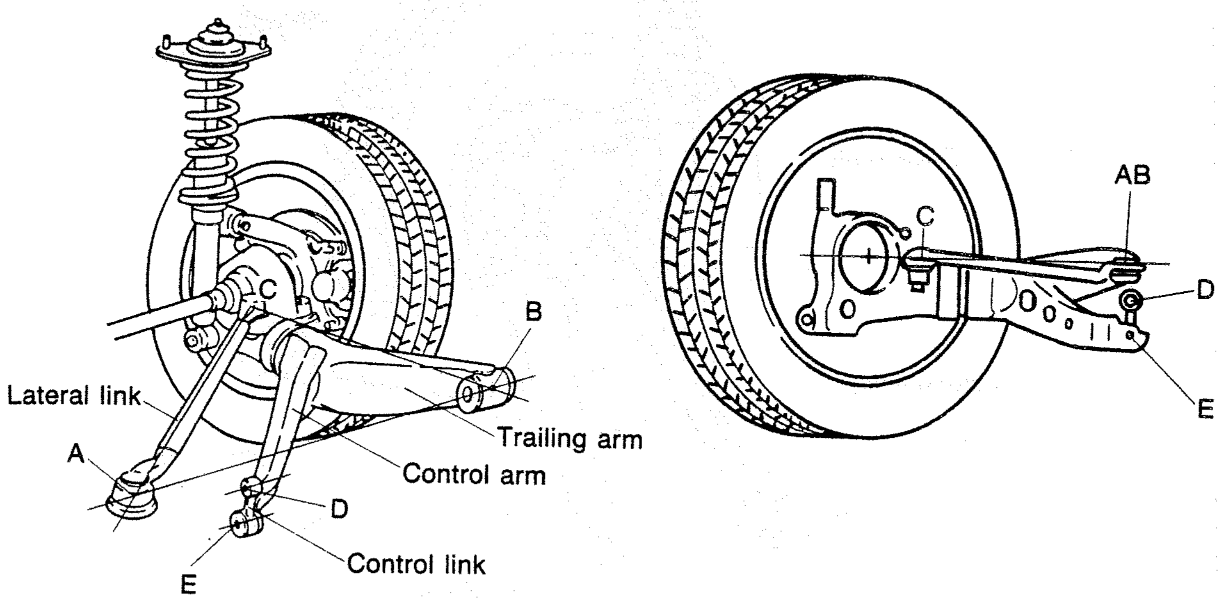
Camber Control Mechanism
Construction



67U13X-519

The camber-control mechanism is composed of the trailing arm, control arm, lateral link and control link; points A, B and D are installed to the body.
The longitudinal and transverse positions of the wheel are determined respectively by the trailing arm and the lateral link. The camber is determined by the control arm and control link.
A point: Ball joint
B point: Bushing
C point: Ball joint
D point: Ball joint
E point: Ball joint

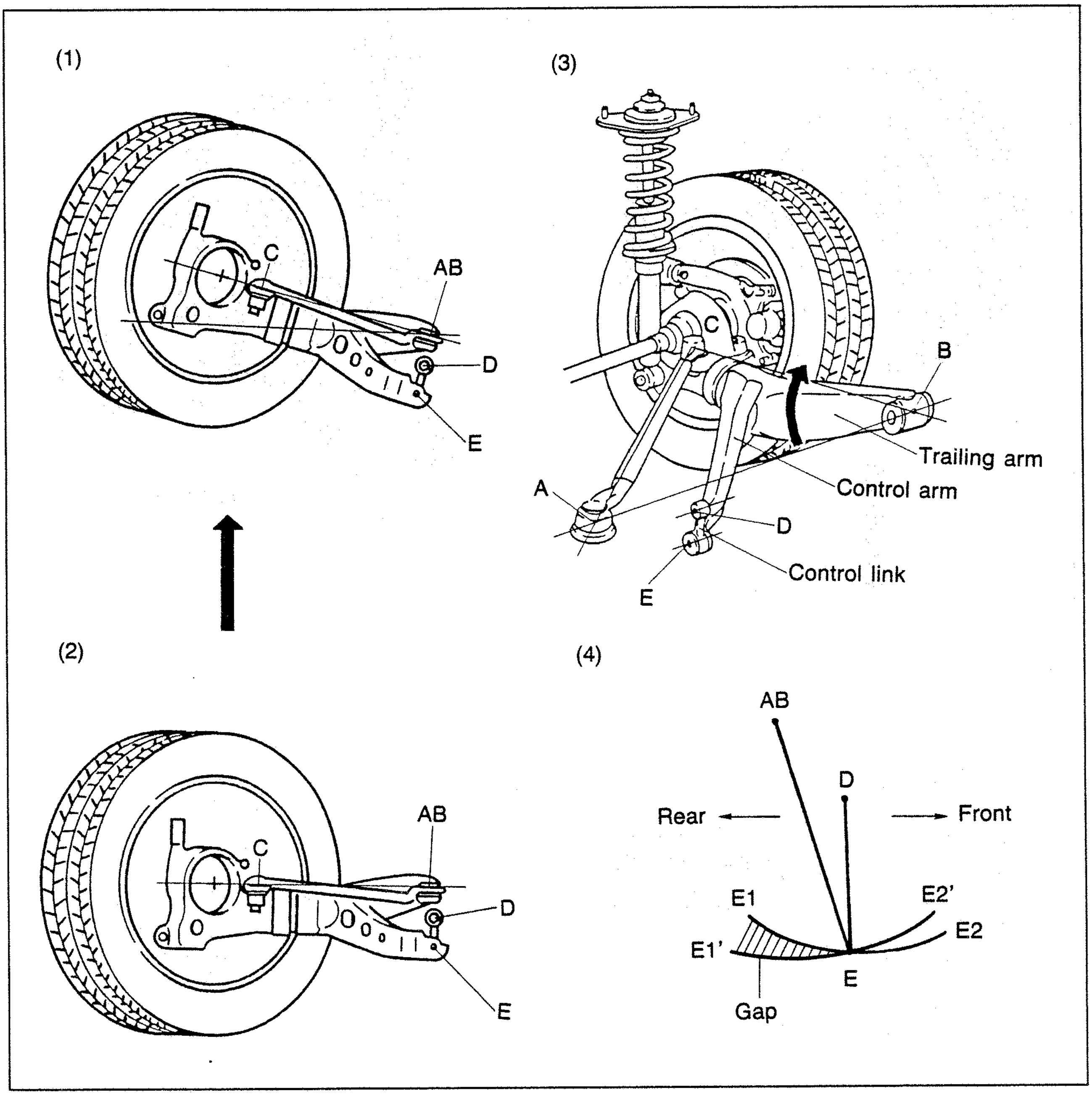
Movement of points



67U13X-520

Points A, B and D are the central points of rotation of the lateral link, trailing arm and control link. Rotation occurs at point C centered on the A and B axis.
Point E can swing centered on point D; in addition, rotation also occurs centered on the C and B axis.

Function



67U13X-521

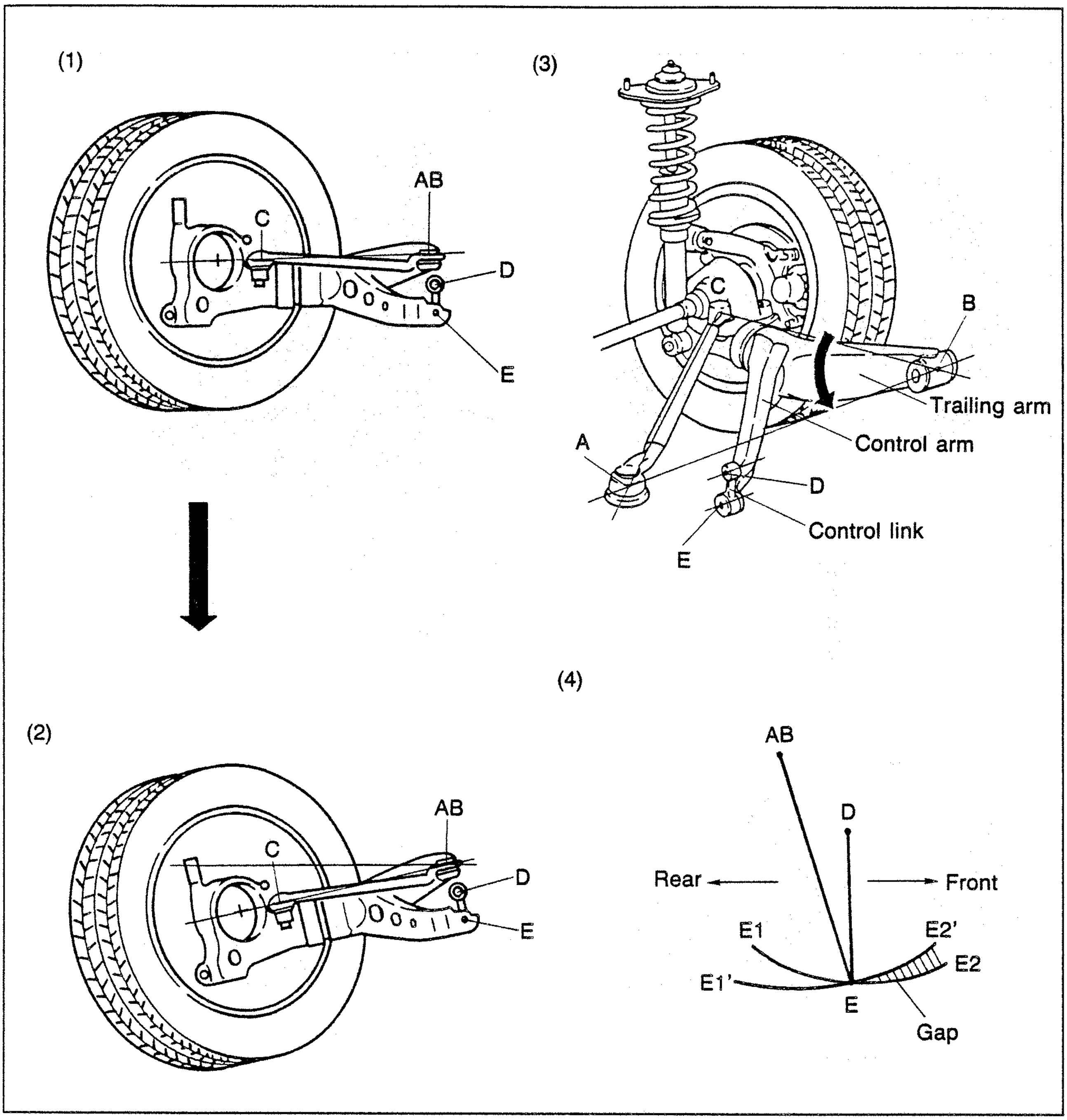
1. During "bounding"...

(1) During "bounding", if it is assumed that the trailing arm and control arm are not constrained by the control link and that E, C and B move as one unit, then point E would have the movement shown by E1' and E2' in illustration (4).

(2) However, point E rotation is centered on point D, resulting in movement of E1 and E2. Therefore, a gap occurs between the locuses of E1 and E2 and of E1' and E2'.

(3) During bounding, because point E of the control arm and the gap between E1 and E1' moves upward, there is a change in the angle of the control arm. This angle change causes the trailing arm to rotate as shown in illustration (3).

(4) As a result, the camber angle of the tire, unified with the trailing arm, is changed to a positive angle. This prevents excessive negative camber of the tire which would otherwise exist.



67U13X-522

2. During "rebound"...

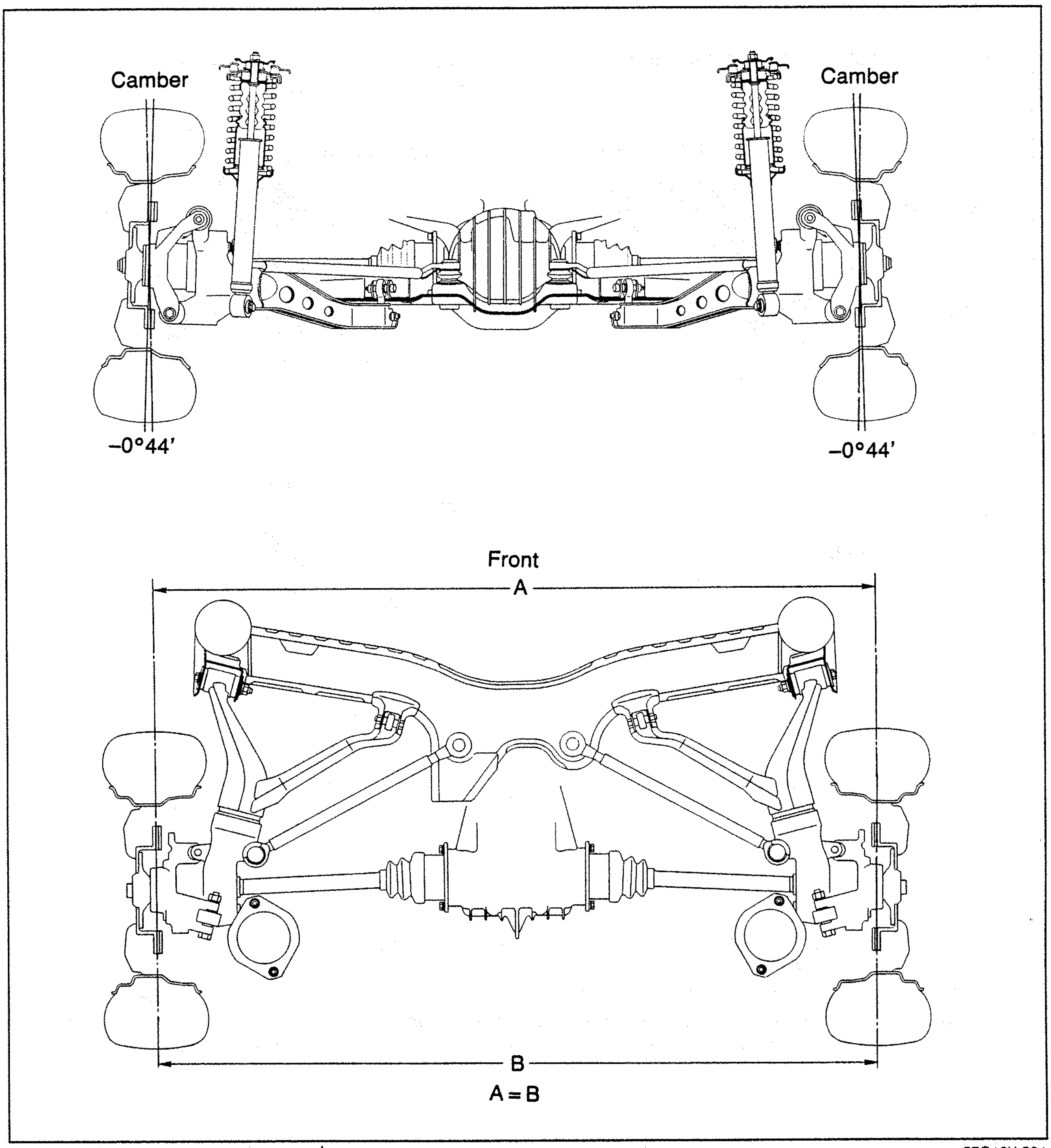
(1) During "rebound", if it is assumed that the trailing arm and control arm are not constrained by the control link and that E, C and B move as one unit, then point E would have the movement shown by E1' and E2' in illustration (4).

(2) However, point E rotation is centered on point D, resulting in movement of E1 and E2; so, for that reason, a gap occurs between the locuses of E1 and E2 and of E1' and E2'.

(3) During rebound, because point E of the control arm and the gap between E2 and E2' moves downward, there is a change of the angle of the control arm. This angle change causes the trailing arm to rotate as shown in illustration (3).

(4) As a result, the camber angle of the tire, unified with the trailing arm, is changed to the negative angle. This prevents excessive positive camber of the tire.

REAR WHEEL ALIGNMENT

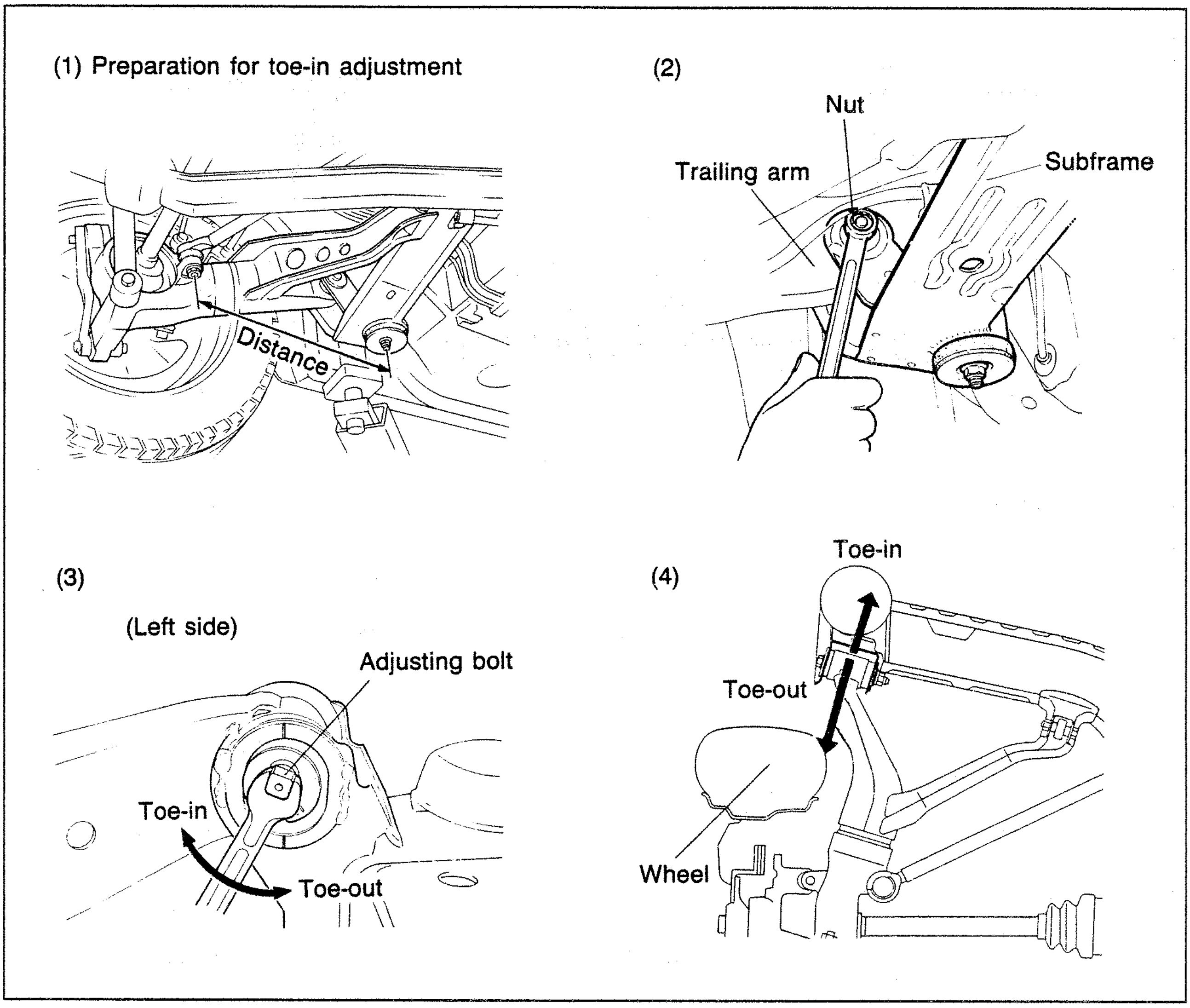


57G13X-504

Negative camber and zero toe-in are provided on the rear wheels to get better steering stability. The camber is preset during production and is not adjustable, but the toe-in is adjustable.

	Toe-in	Camber
New model	0 ± 3 mm (0 ± 0.12 in)	-0°44' ± 30'
Previous model	0 mm (0 in)	0°

Adjustment of Toe-in



67U13X-524

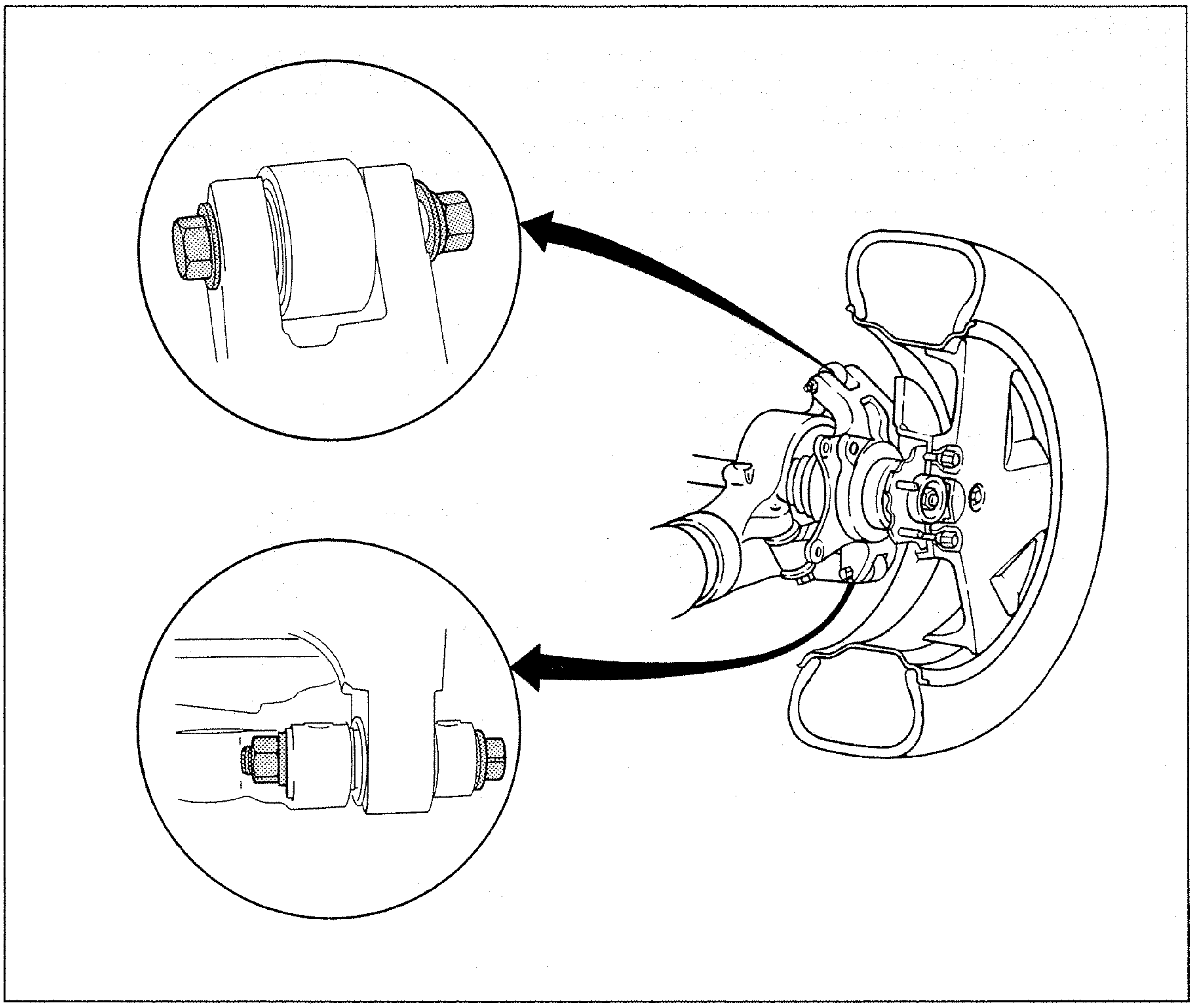
Measure the distance between the subframe rubber mount and the lateral link ball joint for both left and right of the vehicle.
If the measurements are **within 5mm (0.2 in)** of each other, adjust toe-in using alignment equipment. If not, loosen the nut attaching the trailing arm to the subframe and turn the adjusting bolt until both measurements are **witin 5mm (0.2 in)** of each other. Then proceed with final adjustments using alignment equipment.

Note

a) adjustment of one mark on the adjuster scale is equal to 2.3mm (0.90 in) of toe-in for one wheel.

b) When adjusting the toe-in, always turn the both adjusting cams by the same amount.

ZINC-CHROMATE COATED BOLT, WASHER AND NUT



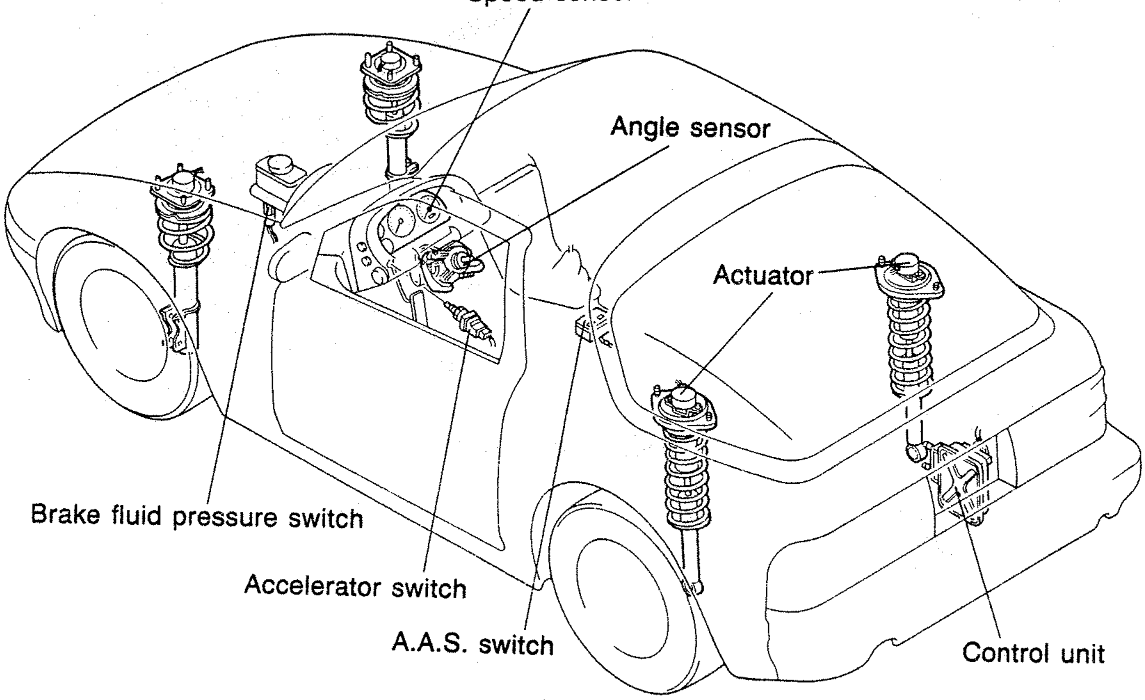
67U13X-525

A zinc-chromate plating is applied to the surface of the parts shadowed in the figure. This is to prevent steel parts and aluminum parts from directly contacting each other. A direct connection causes electrolytic corrosion when exposed to moisture and salt (i.e. salted roads).

AUTO ADJUSTING SUSPENSION (A.A.S.)

OUTLINE

The auto adjusting suspension system functions to select various combinations of soft, firm or very firm damping of the front and rear shock absorbers. This selection is based on driving conditions and the driver's choice of NORMAL or SPORT settings.
The auto adjusting suspension system also functions to also suppress the occurrence of vehicle rolling, diving and squating during, cornering, braking and starting acceleration.



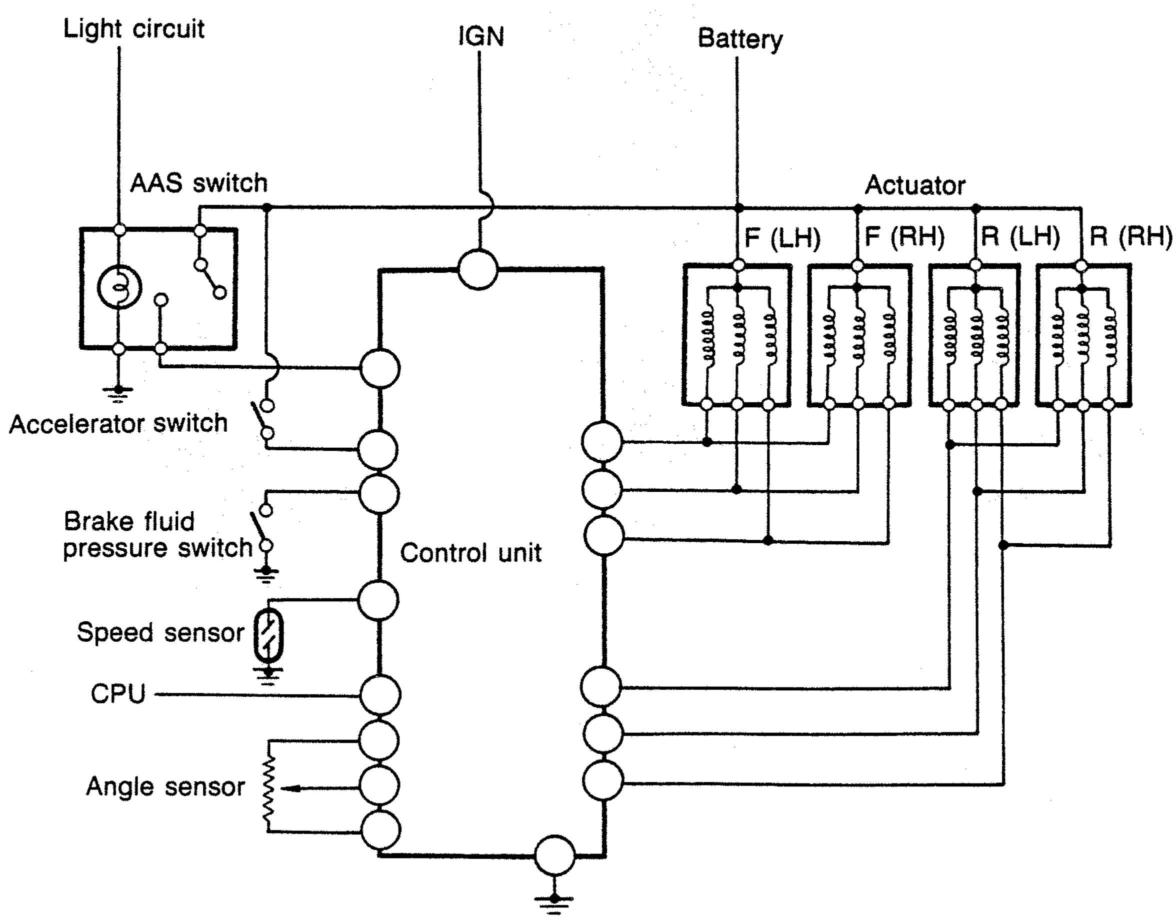
67U13X-526

MAJOR A.A.S. COMPONENTS AND THEIR FUNCTIONS

Parts	Function
A.A.S. switch	"NORMAL" or "SPORT" mode signal is sent to the control unit.
Speed sensor	Four pulses are generated for each rotation of the speedometer cable. These pulses are sent to the control unit.
Angle sensor	Steering wheel turning-angle signals are sent to the control unit.
Accelerator switch	When the accelerator switch has travelled 5/6th of its full stroke, a signal is sent to the control unit.
Brake fluid pressure switch	When the brake fluid pressures becomes 3,434 kPa (35 kg/cm^2, 498 psi), the switch is turned ON and a signal is sent to the control unit.
Actuator	Turns the shock absorbor control rod.
Control unit	Activates the actuator based upon signals from sensors.
Shock absorber	Built-in control rod with rotary valve changes damping force.

67U13X-527

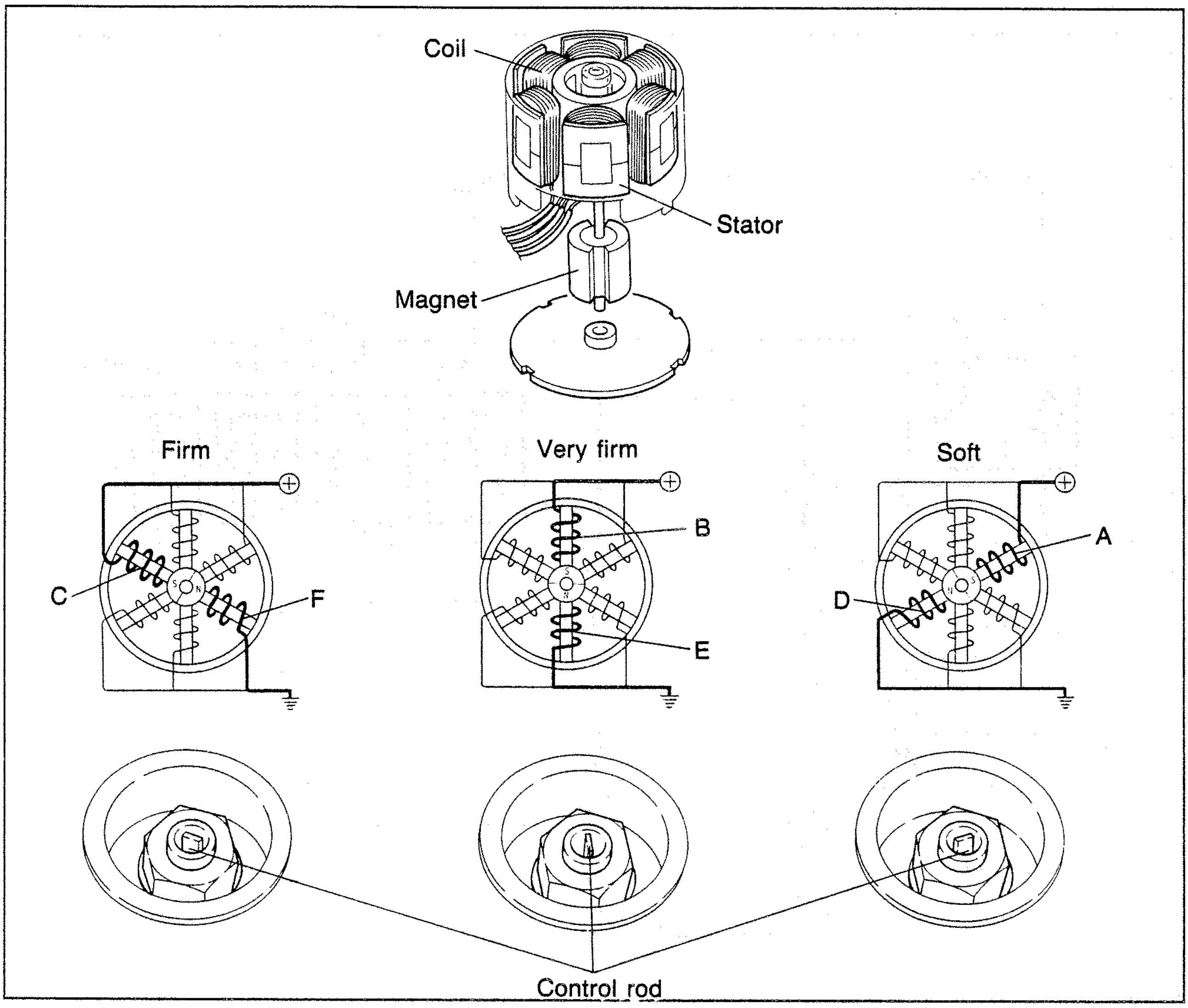
ELECTRICAL SYSTEM
Control unit



67U13X-528

The speed signal, steering-angle signal, acceleration signal and brake-pressure signal, which are determined by driving conditions, are input to the control unit.
The signal resulting from the selection, by the driver, of the "NORMAL" or "SPORT" setting of the A.A.S. switch is input to the control unit.
A soft damping force is provided when the "NORMAL" button is pressed and a firm damping force is provided when the "SPORT" button is pressed.
Output from the control unit is sent to the actuators installed at the top of the front and rear shock absorbers.

Actuator



67U13X-529

Construction

There is a permanent magnet at the center of the actuator. 6 coils are wound around the actuator. The lower edge of the shaft of the permanent magnet is connected to (and turns) the control rod at the center of the shock absorber.

Operation

Firm...

Current flows between coils C and F of the actuator, the stator is magnetized, and the permanent magnet is attracted as shown in the illustration.
The control rod is turned 60° to the left.

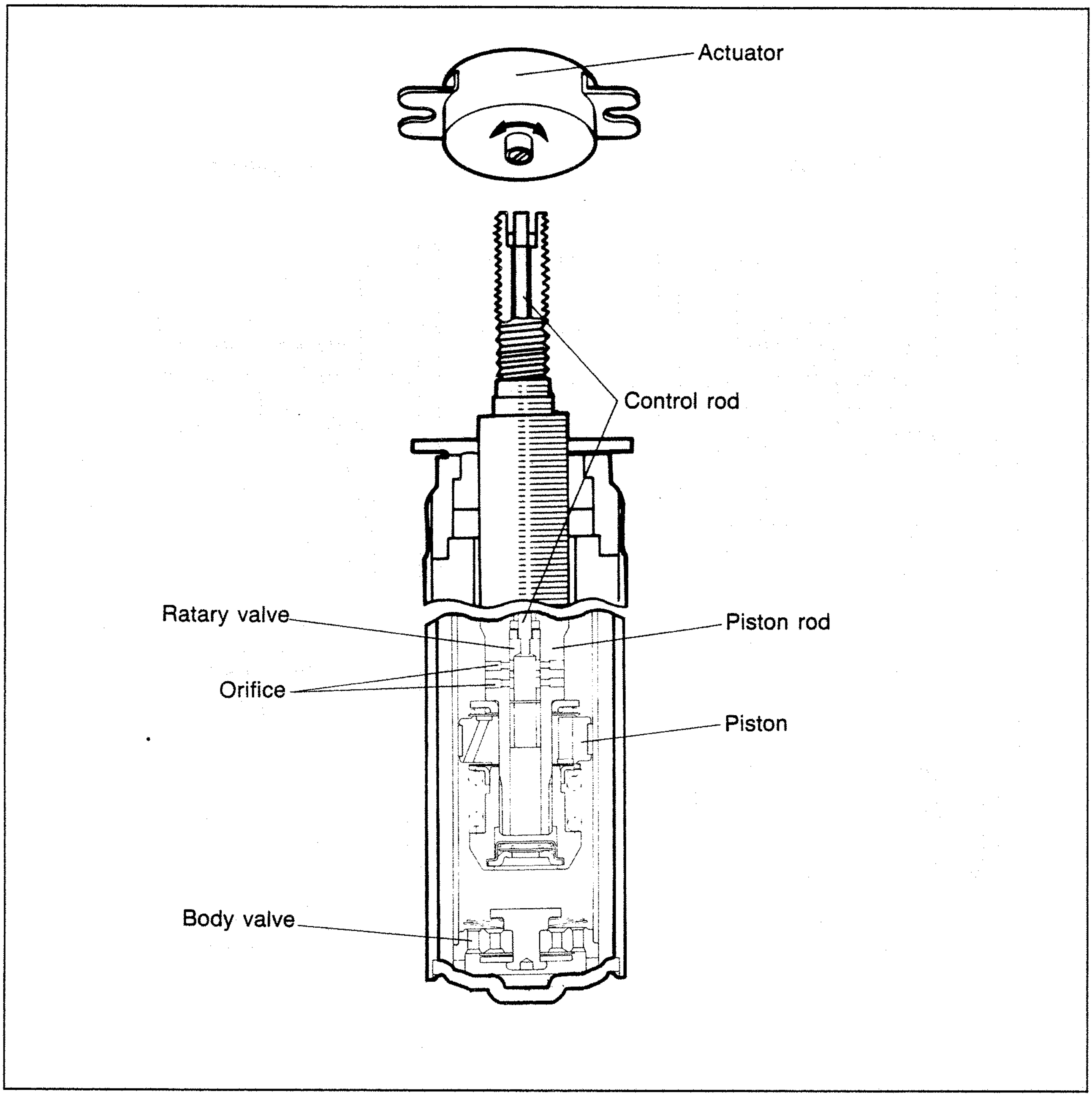
Very firm...

Current flows between coils B and E of the actuator, the permanent magnet is attracted to the stator and is turned 60° to the right from the position for "firm".
The control rod, in the same way as the permanent magnet, is turned 60° to the right.

Soft...

Current flows between coils A and D of the actuator, the permanent magnet is attracted to the stator and is turned 60° to the right from the position for "very firm".
The control rod, in the same way as the permanent magnet, is turned 60° to the right.

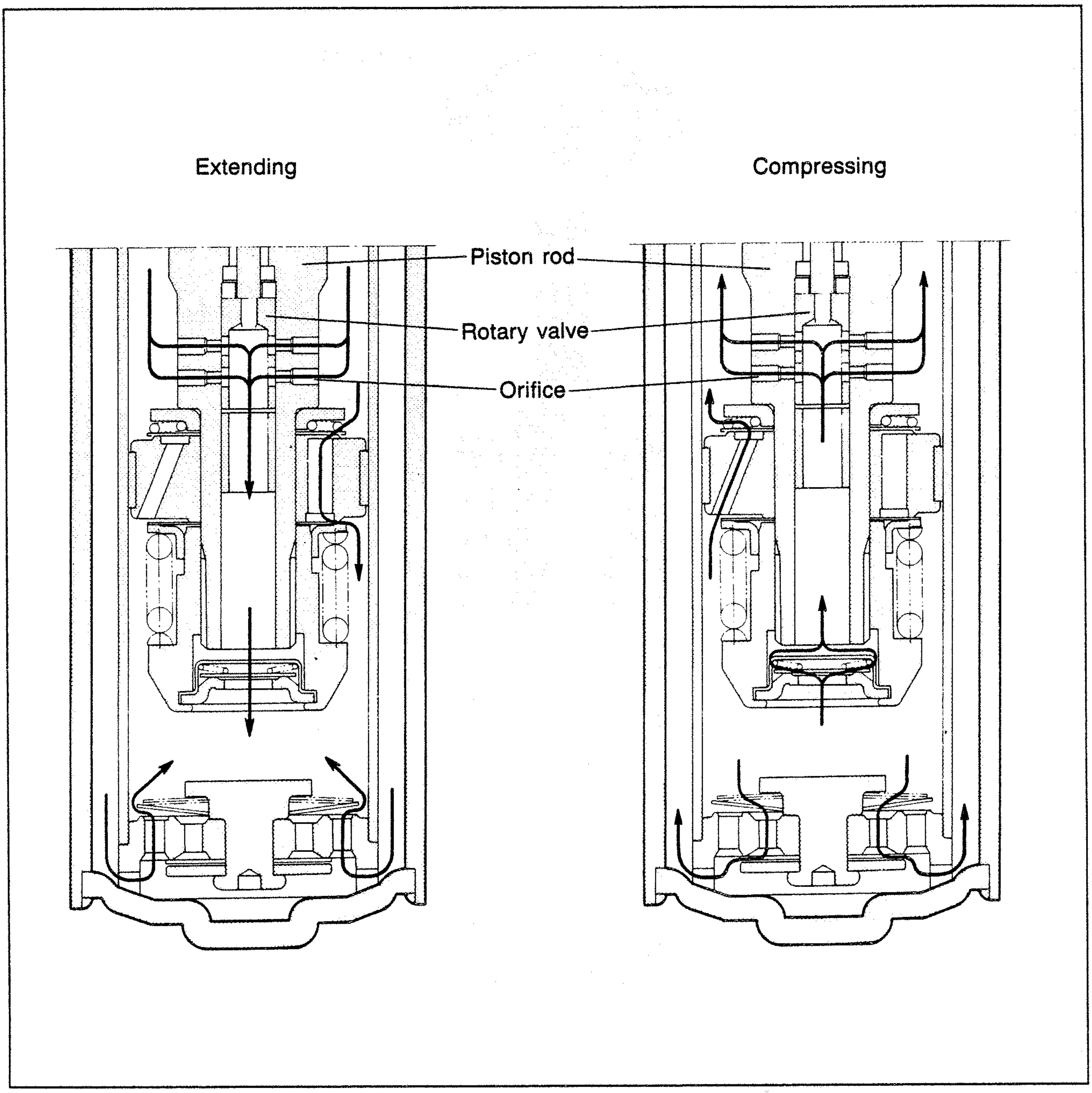
SHOCK ABSORBER



67U13X-530

The damping force of the shock absorbers is switched according to the opening and closing of the orifices in the piston rod and the rotary valve.
Actuators are located at the top of the shock absorbers.
The actuator turns the control rod according to the signal from the control unit, and the rotary valve (unified with the control rod) turns to open or close the orifices.

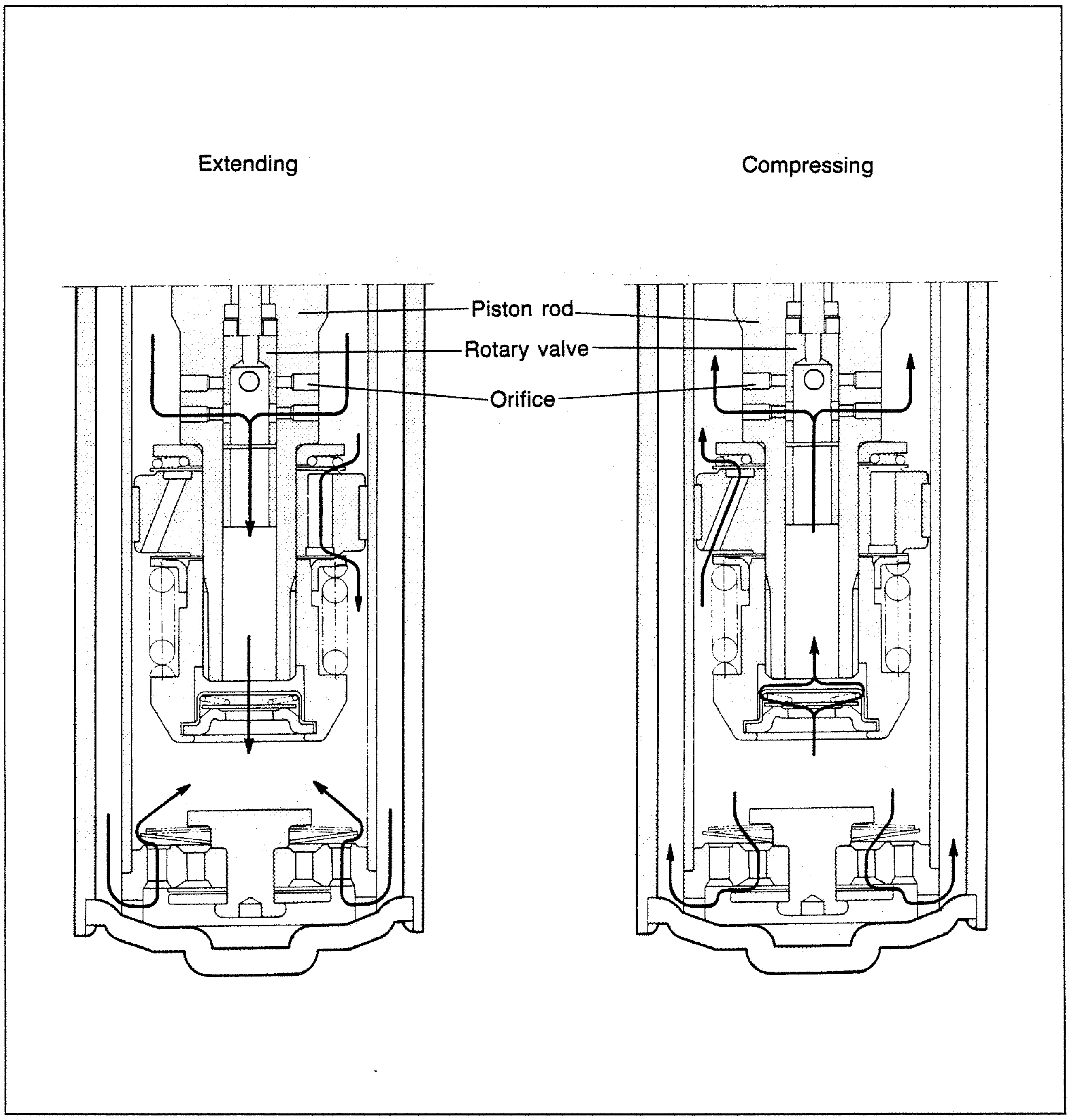
Operation



67U13X-531

"SOFT"...

During both extension and compression, there are four available orifices in both the rotary valve and the piston rod.
Thus, there is no resistance to the oil flow, and the damping force becomes "SOFT".

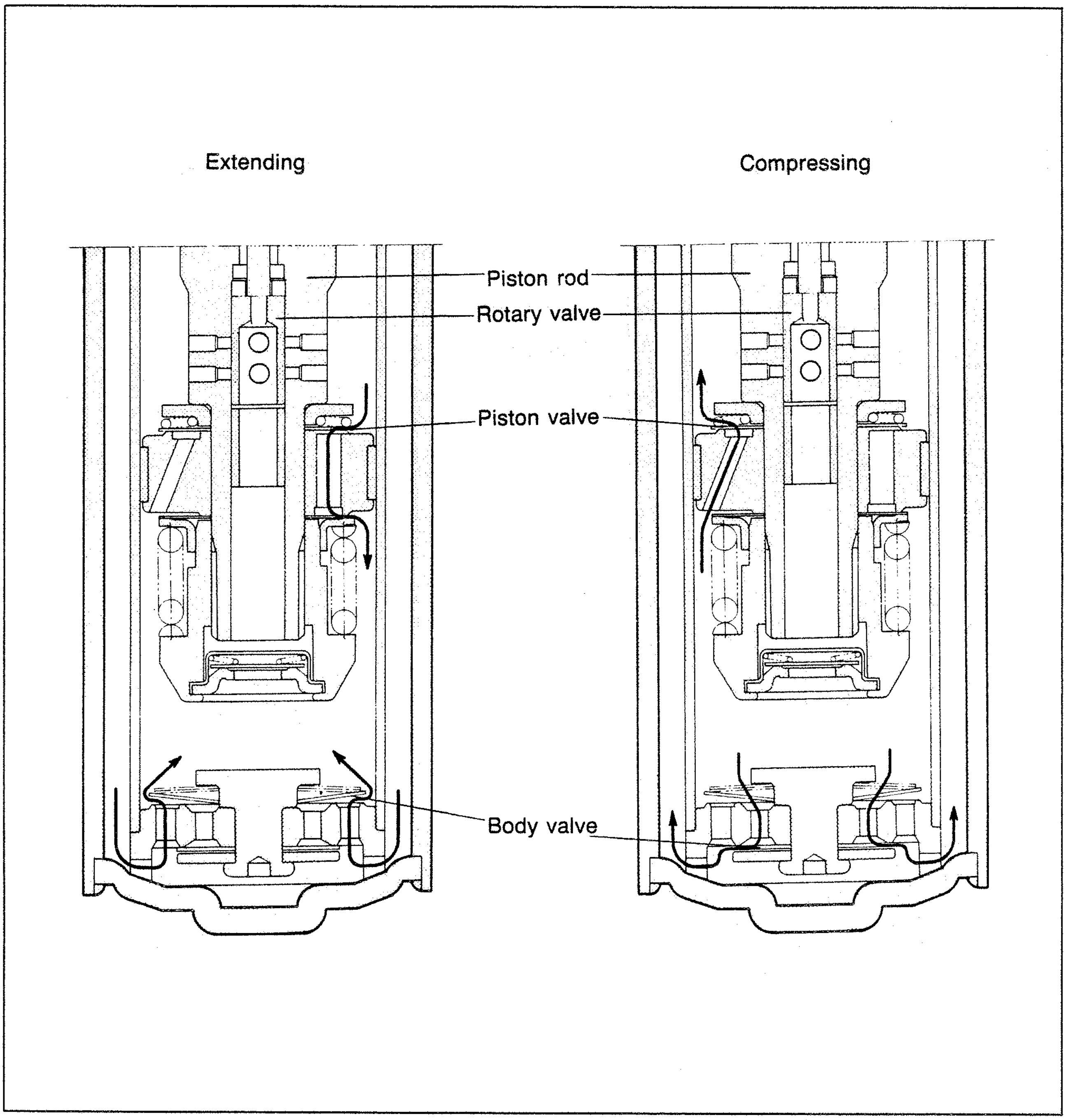


67U13X-532

"FIRM"...

During both extension and compression, there are two available orifices in both the rotary valve and the piston rod.

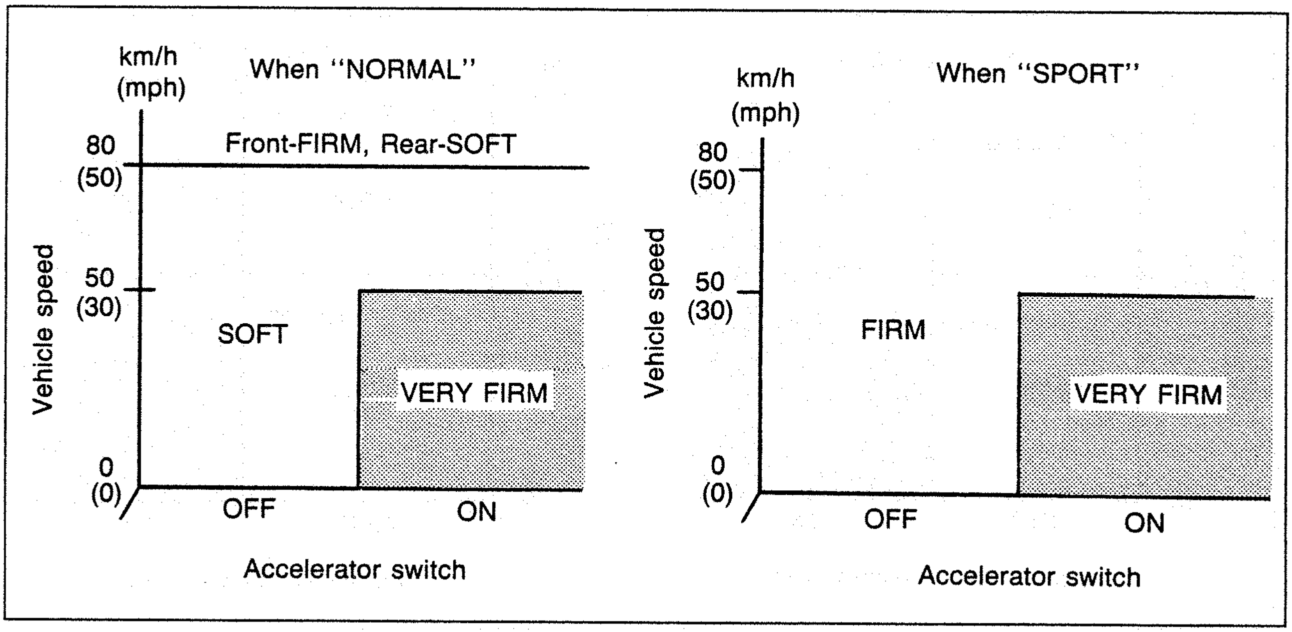
As a result, there is an increase, compared to "SOFT", of the resistance to oil flow, and the damping force becomes "FIRM".



67U13X-533

"VERY FIRM"...
During both extension and compression, the orifices in the piston rod and the rotary valve are blocked so that the oil cannot pass through.
Because the oil passes through only the piston valve and the body valve, the damping force becomes "VERY FIRM".

A.A.S. FUNCTIONS



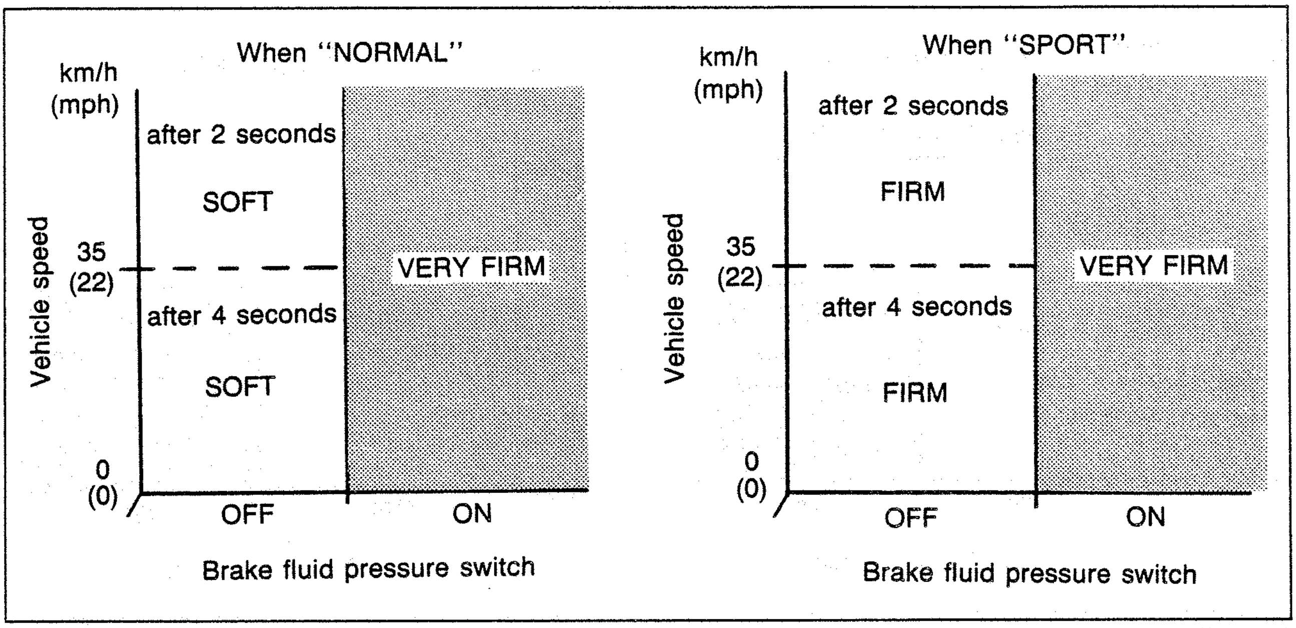
67U13X-534

Anti-squat function...

When sudden starting acceleration occurs, the damping force of all shock absorbers becomes "VERY FIRM" in order to suppress the squat tendency.
This function is regulated by the amount of accelerator depression and the vehicle speed.

A.A.S. switch position	Accelerator switch	Vehicle speed km/h (mph)	Damping force	
			Front	Rear
NORMAL	ON	Below 50 (30)	VERY FIRM	VERY FIRM
	ON	50 (30) - 80 (50)	*SOFT	*SOFT
	ON	80 (50) and above	FIRM	SOFT
	OFF	No speed condition	SOFT	SOFT
SPORT	ON	Below 50 (30)	VERY FIRM	VERY FIRM
	ON	50 (30) and above	*FIRM	*FIRM
	OFF	No speed condition	FIRM	FIRM

* The damping force becomes" SOFT" or "FIRM" about 2 seconds after the vehicle speed reaches 50 km/h (30 mph).



67U13X-535

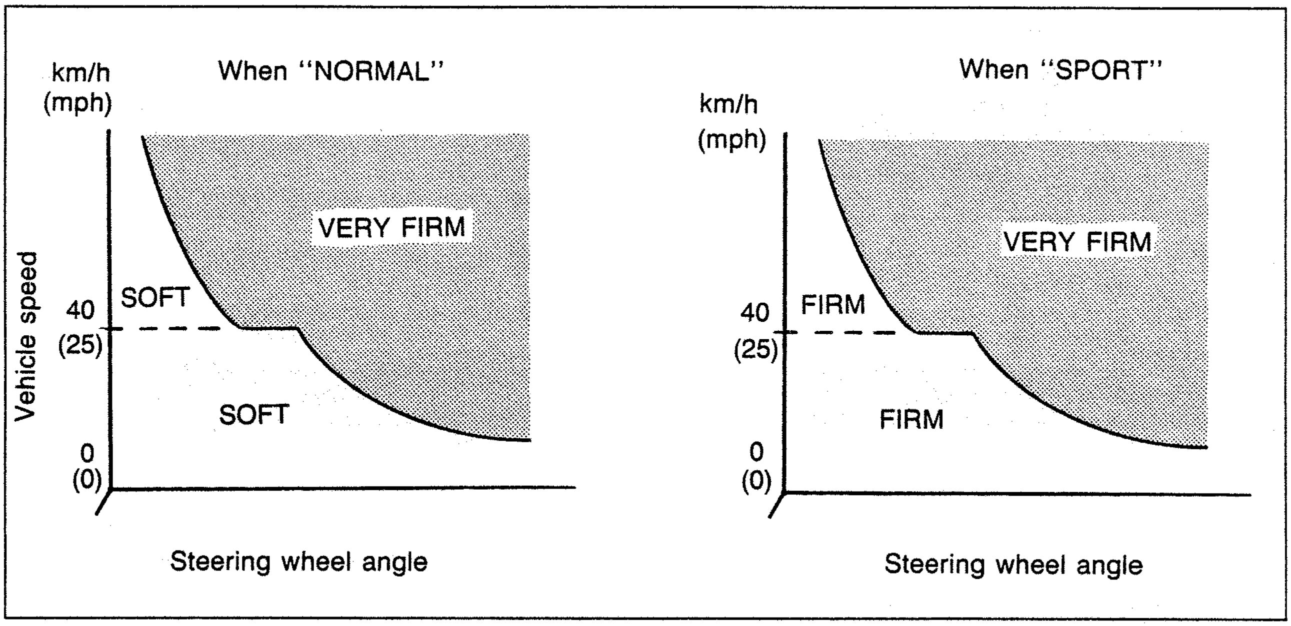
Anti-dive function...

This feature functions to prevent nose-down ("dive") when braking at high speed by changing the damping force of all shock absorbers to "VERY FIRM".

This function is controlled by the brake fluid pressure and the vehicle speed.

A.A.S switch position	Brake fluid pressure switch	Vehicle speed km/h (mph)	Damping force Front and rear
NORMAL	ON	No speed condition	VERY FIRM
	OFF	Below 35 (22)	*1 SOFT
	OFF	35 (22) and above	*2 SOFT
SPORT	ON	No speed condition	VERY FIRM
	OFF	Below 35 (22)	*1 FIRM
	OFF	35 (22) and above	*2 FIRM

*1 The damping force becomes "SOFT" or "FIRM" about 4 seconds after the brake switch is turned OFF.
*2 The damping force becomes "SOFT" or "FIRM" about 2 seconds after the brake switch is turned OFF.



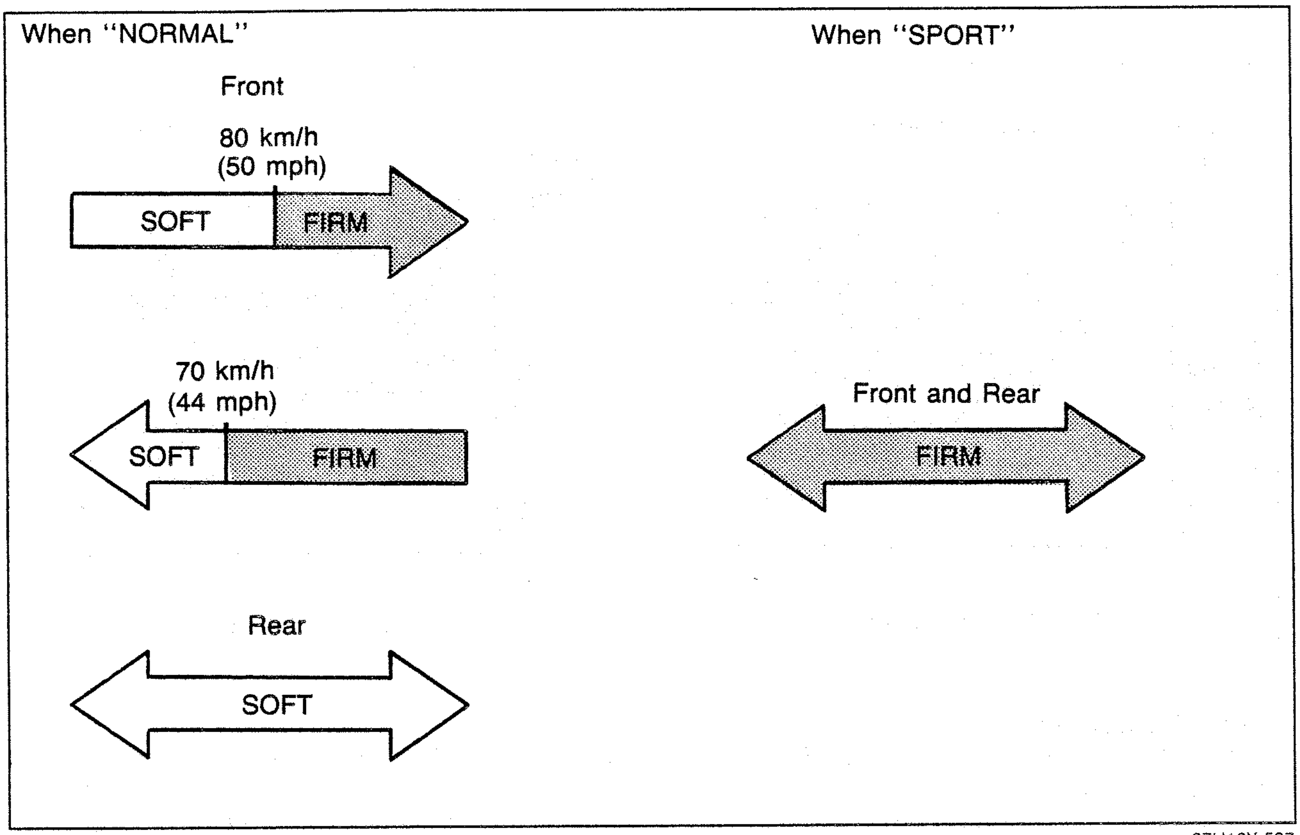
67U13X-536

Anti-roll function

This is a function to activate the "VERY FIRM" damping force of all shock absorbers when cornering in order to reduce the roll caused by centrifugal force.
This function is regulated by the control unit which calculates Lateral-G force based on signals from steering wheel angle and the vehicle speed.

A.A.S. switch position	Vehicle speed km/h (mph)	Lateral G-force	Damping force
			Front and rear
NORMAL	Below 40 (25)	Below 0.11G	*SOFT
	Below 40 (25)	Above 0.11G	VERY FIRM
	Above 40 (25)	Below 0.3G	*SOFT
	Above 40 (25)	Above 0.3G	VERY FIRM
SPORT	Below 40 (25)	Below 0.11G	*FIRM
	Below 40 (25)	Above 0.11G	VERY FIRM
	Above 40 (25)	Below 0.3G	*FIRM
	Above 40 (25)	Above 0.3G	VERY FIRM

* Below the specified Lateral-G force, it takes about 3 seconds for the damping force to change to "SOFT" or "FIRM".



67U12X-537

Speed-response function

This is a function to automatically change all shock absorbers to the "FIRM" damping force (depending on the vehicle speed) to maintain straight-line stability.

A.A.S. switch position	Vehicle speed km/h (mph)	Damping force	
		Front	Rear
NORMAL	When acceleration Above 80 (50)	FIRM	SOFT
	When deceleration Above 70 (44)	FIRM	SOFT
	When deceleration 70 (44) and below	SOFT	SOFT
SPORT	No speed condition	FIRM	FIRM