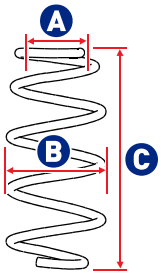
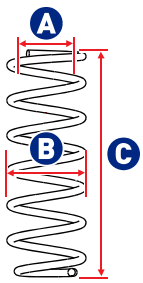
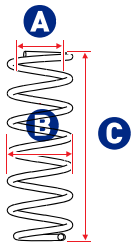
SUSPENSION SYSTEM

4411-00

GENERAL INFORMATION

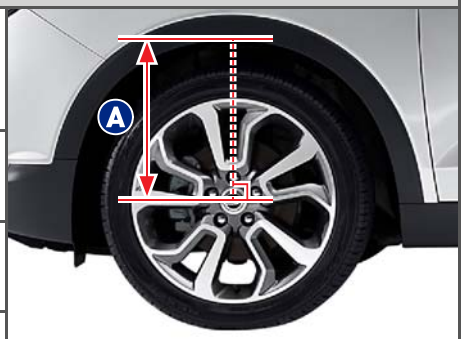
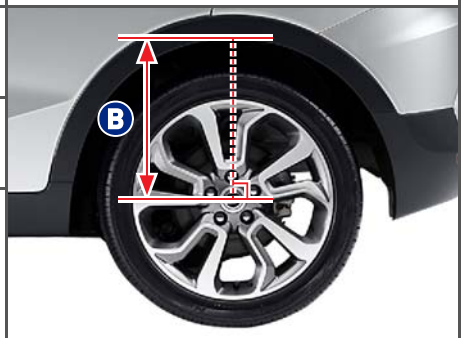
1. SPECIFICATIONS

Item			Specifications
Front suspension	Suspension type		Macpherson Strut
	Spring type		Coil spring
	Stabilizer bar type		Torsion bar
	Shock absorber	Maximum length when extended	Approx. 526 mm
		Minimum length when compressed	Approx. 358 mm
	Coil spring 	Inner diameter (A)	Upper: Approx. 90.5 mm Lower: Approx. 96.0 mm
		Outer diameter (B)	Approx. 146 mm
		Free height (C)	Approx. 295 mm
		Number of windings (effective windings)	4.75(3.6)
		Winding direction	Rightward
Rear suspension (2WD)	Suspension type		Torsion beam
	Spring type		Coil spring
	Shock absorber	Maximum length when extended	Approx. 409 mm
		Minimum length when compressed	Approx. 284 mm
	Coil spring 	Inner diameter (A)	Upper: Approx. 97.5 mm Lower: Approx. 70.6 mm
		Outer diameter (B)	Approx. 119.5 mm
		Free height (C)	Approx. 308.5 mm
		Number of windings (effective windings)	6.01(4.87)
		Winding direction	Rightward

Item			Specifications
Rear suspension (AWD)	Suspension type		Multi-link
	Spring type		Coil spring
	Shock absorber	Maximum length when extended	Approx. 237.2 mm
		Minimum length when compressed	Approx. 117.0 mm
	Coil spring 	Inner diameter (A)	Approx. 88.0 mm
		Outer diameter (B)	Approx. 112.2 mm
		Free height (C)	Approx. 260.0 mm
		Number of windings (effective windings)	6.2 (4.7)
		Winding direction	Rightward

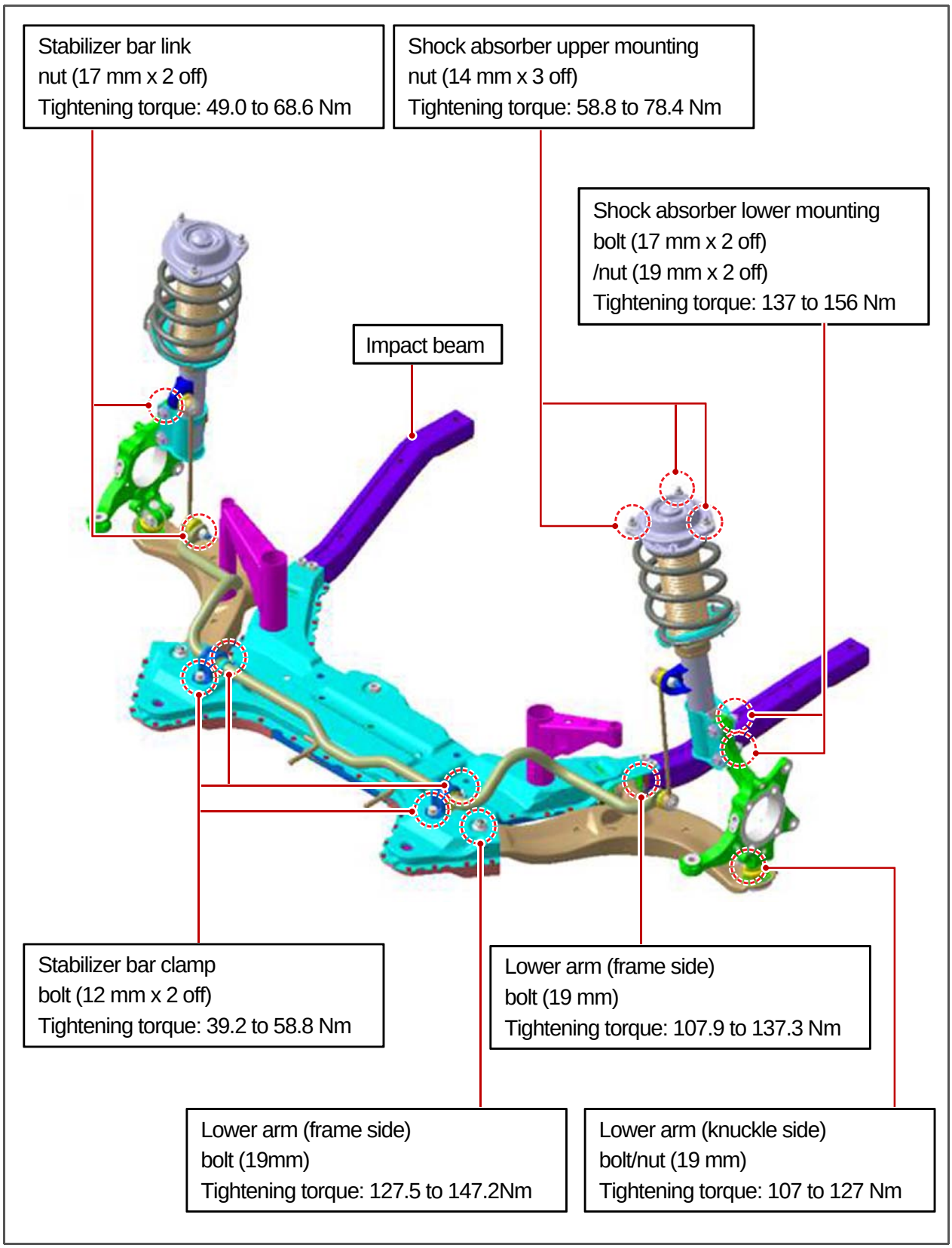
Modification basis	
Application basis	
Affected VIN	

2. WHEEL ALIGNMENT SPECIFICATIONS

Item		Specifications	
Front Suspension	Trim Height (A)	412 mm (from wheel center to bottom of wheel arch)	
	Camber (adjustment-free)	−0.42° ± 0.5°	
	Caster (adjustment-free)	2.96° ± 0.5°	
	Toe (Tie rod adjustment)	0° ± 0.1° (0 mm ± 1.2 mm) Sum of left and right: 0° ± 0.2° (0 mm ± 2.4 mm)	
Rear suspension (2WD)	Trim Height (B)	404mm	
	Camber (adjustment-free)	−1.25° ± 0.5°	
	Toe (adjustment-free)	0.23° ± 0.1° (2.8 mm ± 1.2 mm) Sum of left and right: 0.46° ± 0.2° (5.5 mm ± 2.4 mm)	
Rear suspension (AWD)	Trim Height (B)	409mm	
	Camber (adjustment-free)	−1.25° ± 0.5°	
	Toe (adjustment)	0.15° ± 0.1° (1.8 mm ± 1.2 mm) Left/right total: 0.30° ± 0.2° 3.6 mm ± 2.4 mm	

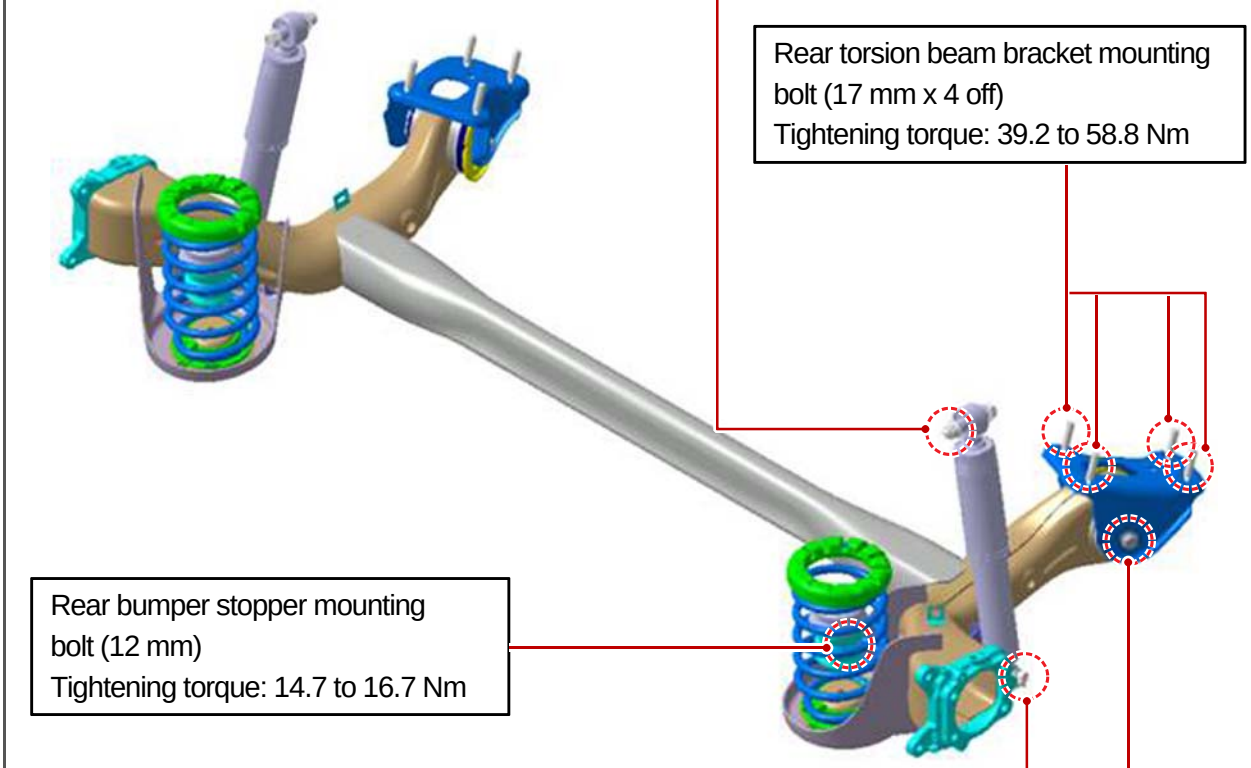
3. SUSPENSION COMPONENTS AND TIGHTENING TORQUE

▶ **Front suspension assembly**

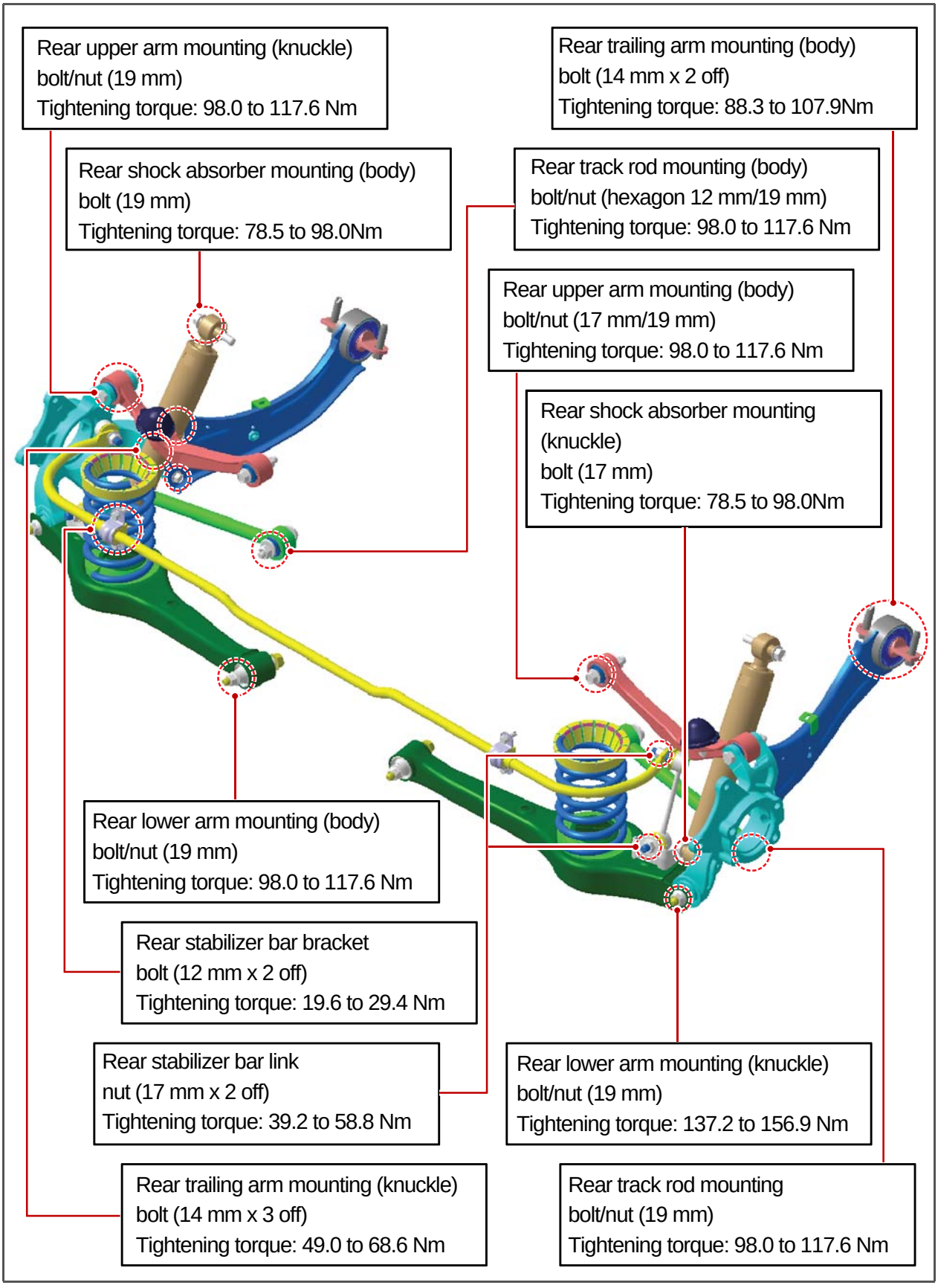


Modification basis	
Application basis	
Affected VIN	

▶ Rear suspension assembly (2WD)



▶ Rear suspension assembly (AWD)



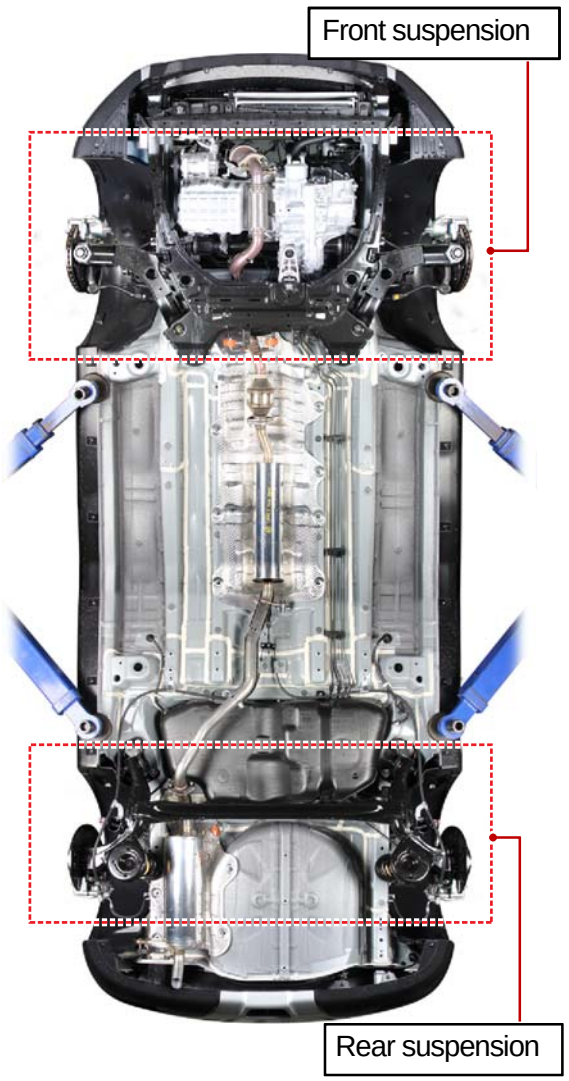
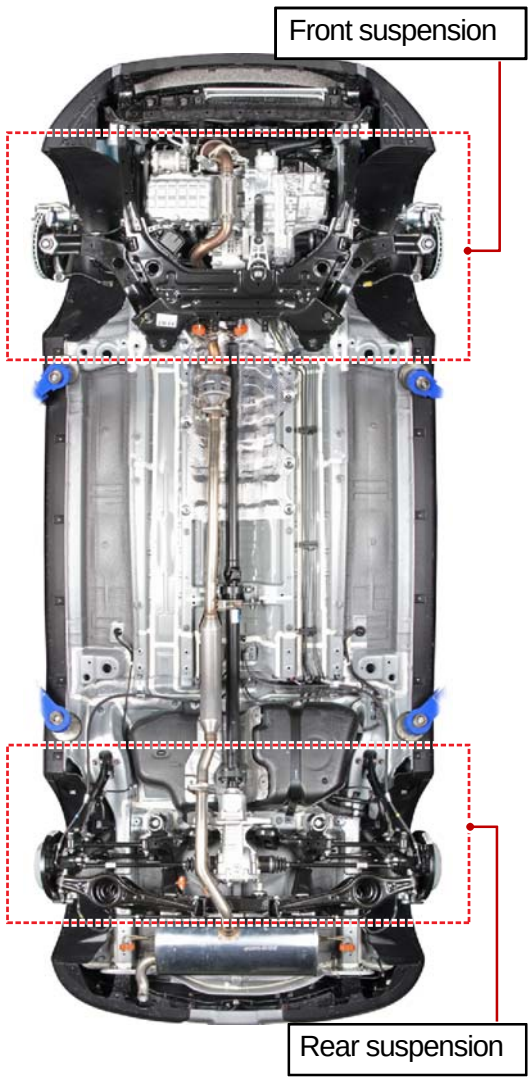
Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

The suspension system connects the axles to the body to: (a) support the vehicle weight; (b) relieve the impact from the road while driving; (c) prevent the vehicle from swaying from side to side while driving; and (d) maximize the ride comfort by utilizing the good handling. The driving stability refers to a well-balanced driveability and stability. The driving stability and ride comfort are significantly affected by the components of the suspension system, along with the vehicle weight, vehicle speed, road conditions, tire and the wheel alignment. It is called "front suspension" or "rear suspension" depending on the mounting position.

2. MOUNTING LOCATION

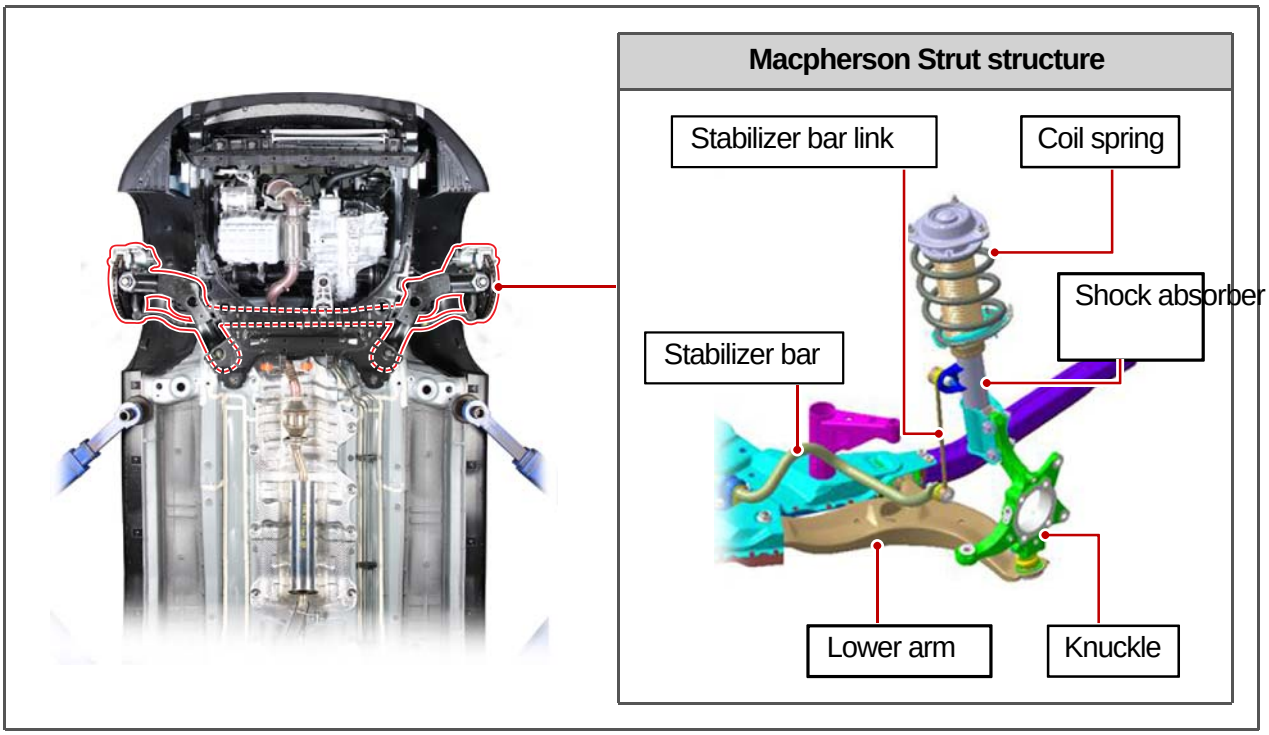
2WD	AWD
	

Modification basis	
Application basis	
Affected VIN	

3. FRONT SUSPENSION ASSEMBLY

1) MacPherson Strut Type

The Macpherson Strut suspension is an independent suspension which has a spring on the strut with a built-in shock absorber. The lower arm is installed on the sub frame and large strut damper is installed on the knuckle to support the wheel.
This suspension is mostly used for the monocoque (unitary) light weight body construction, especially for the FWD models. The upper part with a spring is fitted to the body mounting and the strut with integrated shock absorber is mounted on top of the knuckle.



▶ **Advantages**

1. Because the spring and the shock absorber are integrated,
2. this suspension provides major advantage in package space,
3. and its whole assembly is very simple with fewer parts than other systems. This suspension is widely used for the FWD models with constant velocity joint.
4. In addition to its simple structure, the vibration of the vehicle can be controlled directly with no need for the vibration to travel through initial members.
5. This leads to better ride comfort.

▶ **Disadvantages**

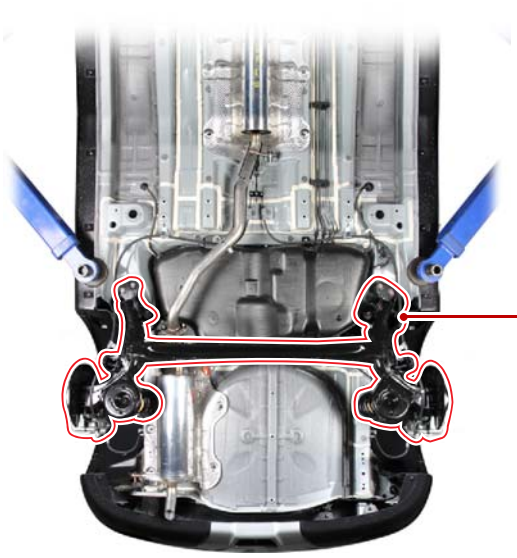
1. The macpherson strut suspension is an independent suspension which has a spring on the strut with a built-in shock absorber. But it needs higher hood because the vertical length of the strut is long, and is very susceptible to external impact because there is only one swing arm which holds the wheel axle.

Modification basis	
Application basis	
Affected VIN	

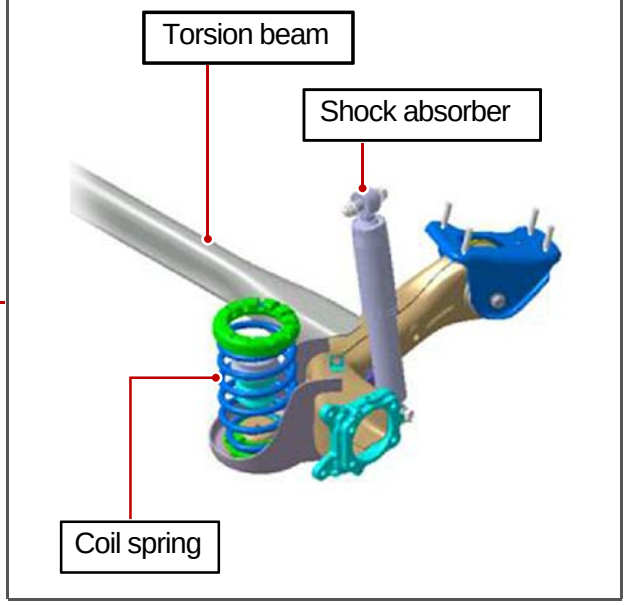
4. REAR SUSPENSION ASSEMBLY

1) Torsion Beam Type (2WD)

The rear suspension maintains the ride comfort and the safety of the vehicle with the front suspension. The rear suspension installed to this vehicle is a torsion beam type with an integrated axle, and consists of torsion beam, shock absorber, and coil spring.

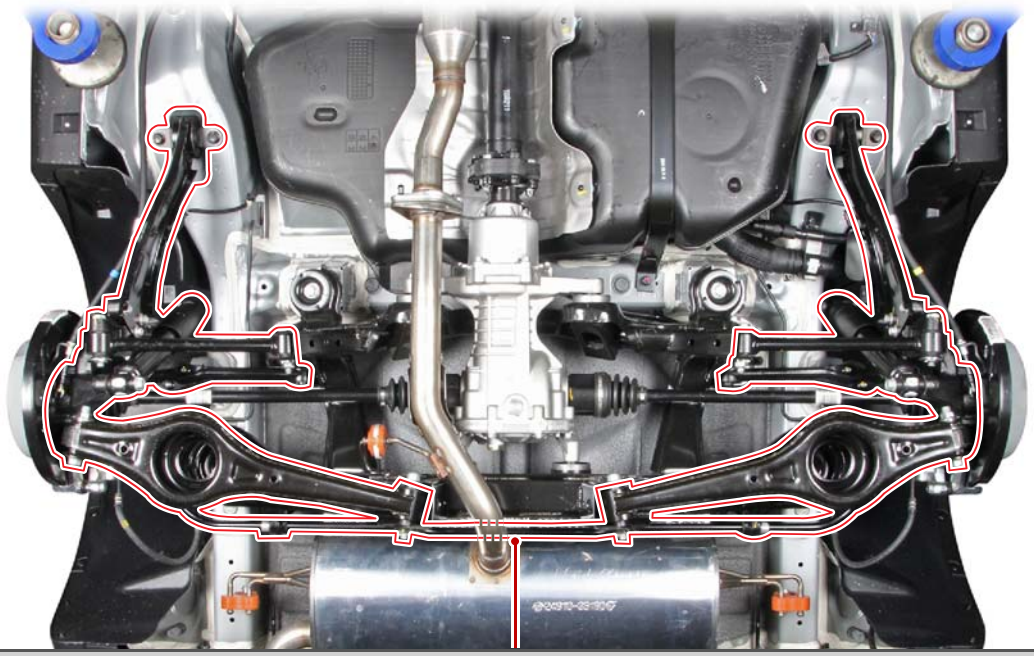


Torsion beam structure

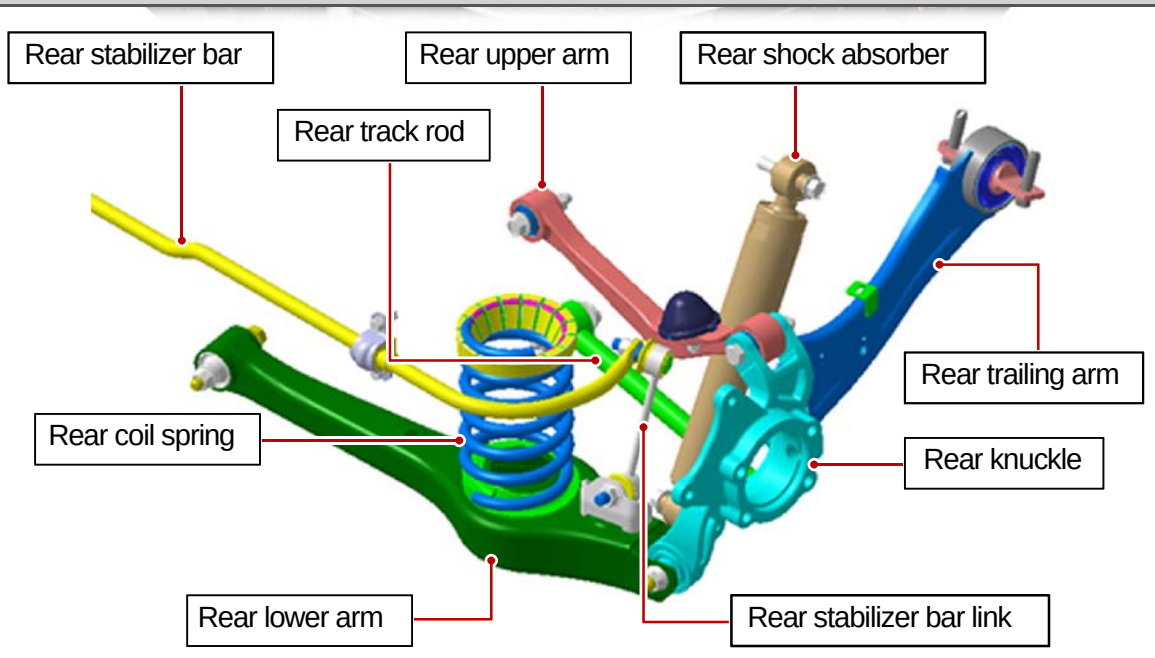


2) Multi-link Type (AWD)

Multi-link type suspension is equipped with several arms which are controlled independently of each other. This type of suspension allows precise design and flexible layout, and is mostly used for rear suspension. Internal force applied to the links are distributed and the optimal layout of the links allows flexible adaptation to camber and toe changes and has the effect of a good road surface adherence. The multi-link rear suspension of this vehicle consists of knuckle, upper arm, track rod, trailing arm, stabilizer bar, stabilizer bar link, coil spring, shock absorber, and lower arm.



Configuration



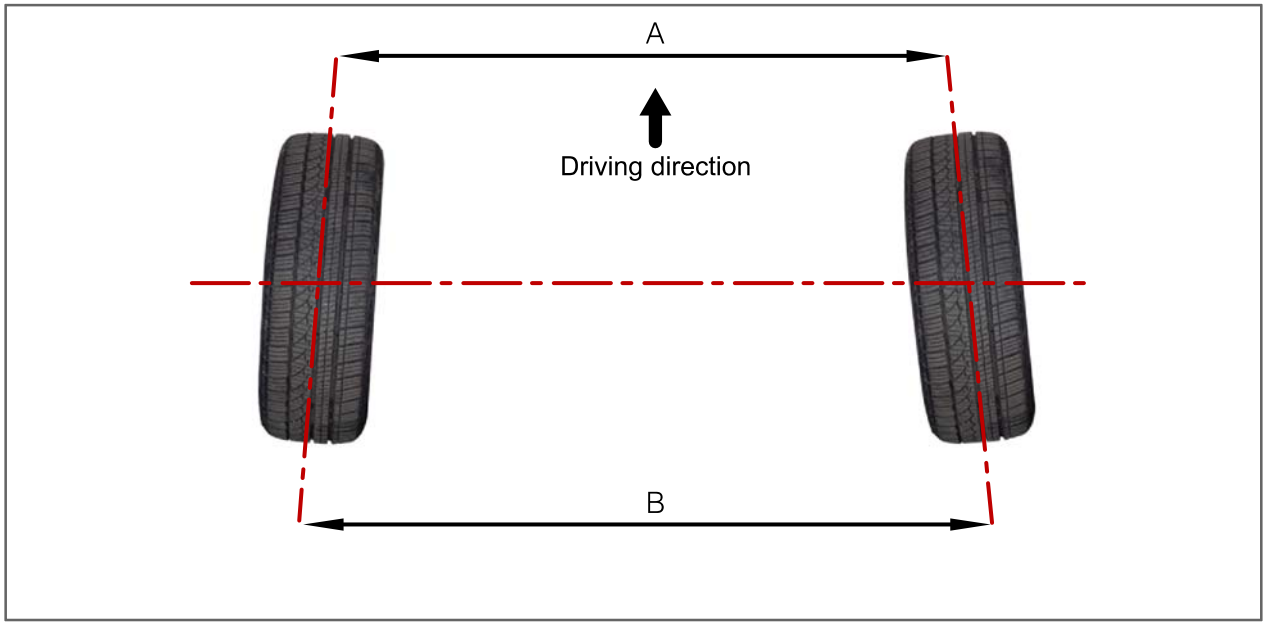
Modification basis	
Application basis	
Affected VIN	

5. WHEEL ALIGNMENT

The wheel alignment deals with geometric angles and basic measurements (camber, caster, and toe) to achieve steering stability and improved ride comfort.

1) Toe-In

Toe-in refers to the front portion of the tires pointing in toward the centerline from a straight ahead position, while the term toe-out refers to the front portion of the tires pointing outward. In the figure shown below, the toe value is "B-A". Toe keeps the front wheels running parallel and reduces the reaction force when the vehicle moves forward.
Incorrect toe causes tire wear and excessive fuel consumption. Any changes due to worn steering components and suspension components because of excessive driving distance need to be compensated by adjusting toe. Adjusting toe should be carried out at the last step.



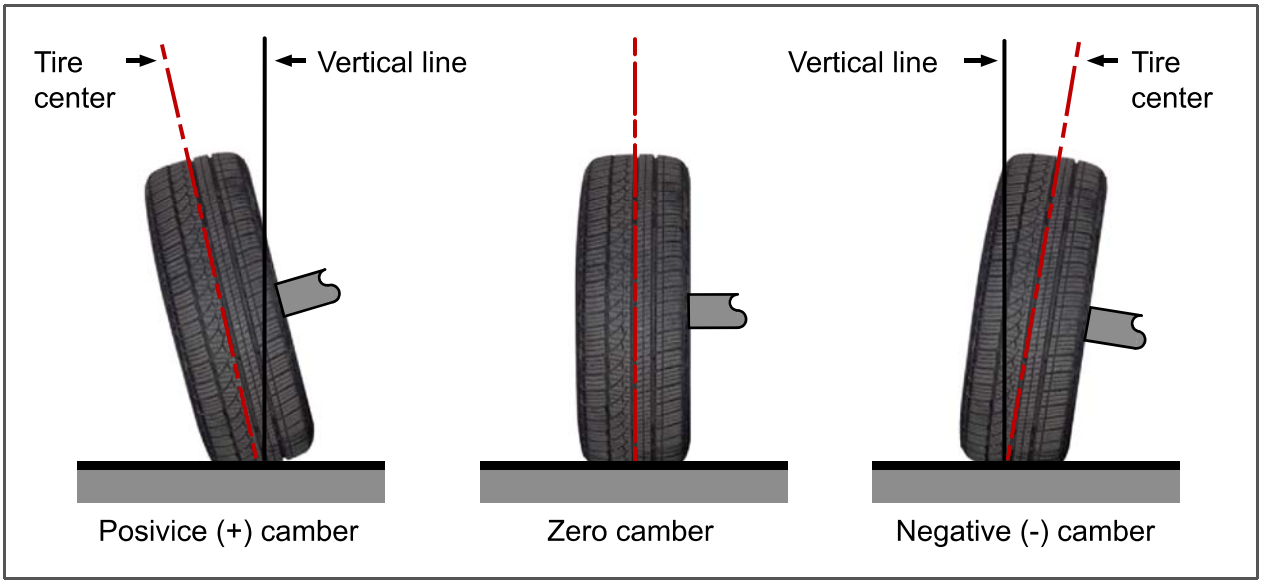
Item		LH/RH	Total	Adjustment
Wheel alignment specification (Toe-in)	Front	0° ± 0.1° (0 mm ± 1.2 mm)	0° ± 0.2° (0 mm ± 2.4 mm)	Adjustment (Tie rod end)
	Rear (2WD)	0.23° ± 0.1° (2.8 mm ± 1.2 mm)	0.46° ± 0.2° (5.5 mm ± 2.4 mm)	Adjustment-free
	Rear (AWD	0.15° ± 0.1° (1.8 mm ± 1.2 mm)	0.30° ± 0.2° (3.6 mm ± 2.4 mm)	Adjustment

▶ Function

1. Prevents uneven tire wear
2. Compensates side slip due to camber
3. Compensates for steering linkage wear or free play

2) Camber

Camber is the angle made by the wheels of a vehicle; specifically, it is the angle between the centerlines of the wheel used for steering and a true vertical axis when viewed from the front of the vehicle. In general, positive camber is required to counteract the force, which causes negative camber, due to curved roads, occupant load, road surfaces, or certain alignment condition.



Item		LH/RH	Cross camber	Adjustment
Wheel alignment specification (Camber)	Front	−0.42° ± 0.5°	0° ± 0.5°	Adjustment-free
	Rear	−1.25° ± 0.5°	0° ± 0.5°	Adjustment-free

▶ **Positive camber: Top of the tire points outward**

Advantages:
- The axle is not bent when it is loaded.
- The force required to operate the steering wheel is reduced because of smaller contact area (or load area) of the tire.
- Restoring force of the steering wheel is gained (when turning the steering wheel, the circular movement of the tire generates the force to lift the frame rather than the force to pull down the tire to the ground. In this case, the shock absorber contracts and the restoring force is applied to the steering wheel.)

Disadvantages:
- Cornering force decreases as the positive camber increases when the vehicle makes turn.
- The hub bearing is worn unevenly if camber is excessive.

▶ **Zero camber: Centerline of tire is perpendicular to road surface**

Modification basis	
Application basis	
Affected VIN	

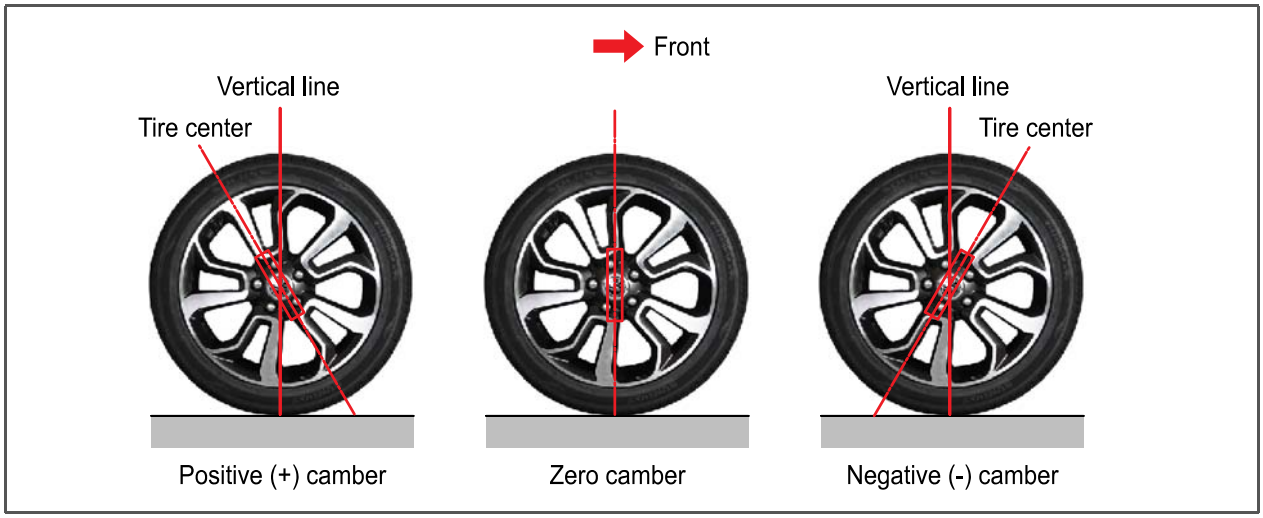
▶ **Negative camber: Top of the tire points inward**

Advantages:
- Better traction force due to wide load area (applicable for off-road vehicle)
- Better corner driving when the vehicle makes turn since the cornering force increases (applicable for high-speed F1 vehicle)

Disadvantages:
- The axle is easier to be bent and deviated in the negative camber than it is in the positive camber when load is applied on the axle.
- Difficult to control due to wide load area.

3) Caster

Caster is the angle between the steering axis tilted forward and a true vertical axis, when viewed from the side of the vehicle. Caster improves stability (straight ahead run) of the vehicle at high speed and does not affect the tire wear. Factors including reduced stiffness of the springs and excessive load influence caster. If the difference between the left and right caster values is great, drag of the steering wheel or vehicle can occur.



Item		LH/RH	Total	Adjustment
Wheel alignment specification (Caster)	Front	2.96° ± 0.5°	0° ± 0.5°	Adjustment-free
	Rear	-	-	-

▶ **Positive caster:**

Advantages:
- Directional force to go straight (following control)
- Restoring force of the wheel (restored to the straight ahead direction)
- Prevention of wheel shimmy (wheels sway from side to side)

▶ **Negative caster:**

Advantages:
- Smaller turning radius

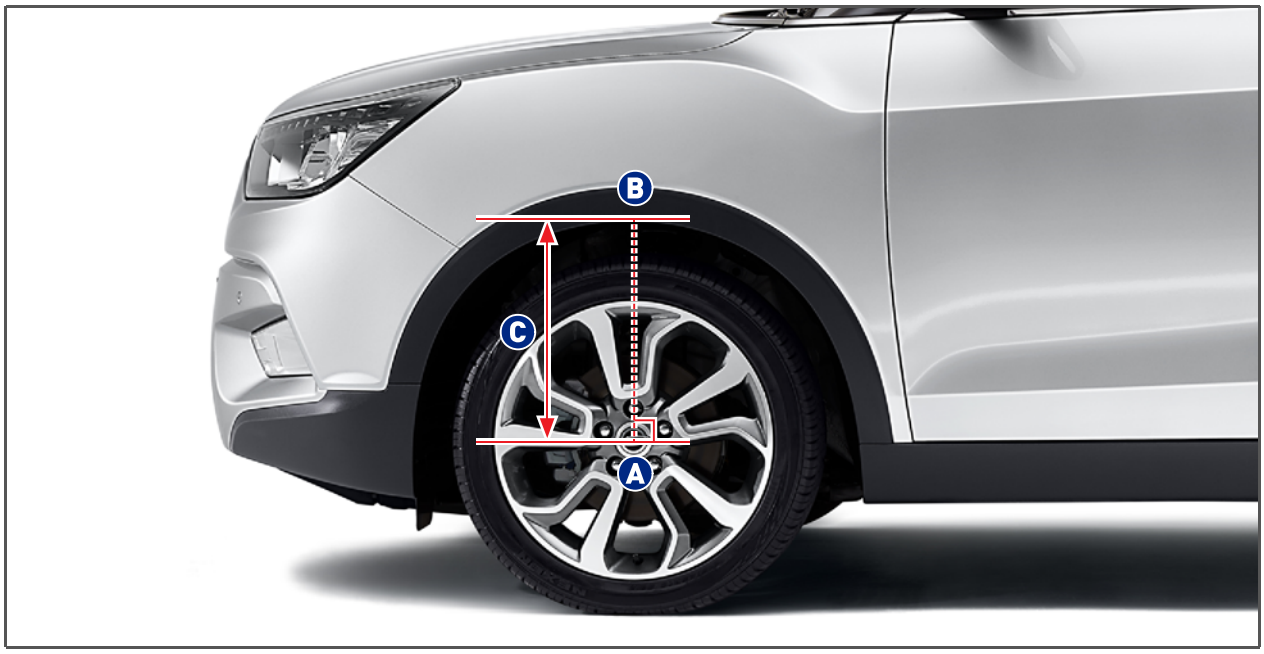
Disadvantages:
- Impact from the road is transferred to the steering wheel (steering wheel turns)
- Poor straight ahead run

4) Trim Height

Incorrect trim height may damage the suspension components or cause problems related to wheel alignment. Therefore, check the trim height before checking wheel alignment when troubleshooting the suspension.

NOTE

Trim height: Distance (C) from the wheel center (A) to the point where an imaginary vertical line from the wheel center meets the bottom of the wheel arch (B) with the vehicle unladen.



Position	2WD	AWD
Front	412 mm	
Rear	404 mm	409 mm

Modification basis	
Application basis	
Affected VIN	