

Chapter 3 Four-wheel Alignment Test and Adjustment

Section 1 Basic Test

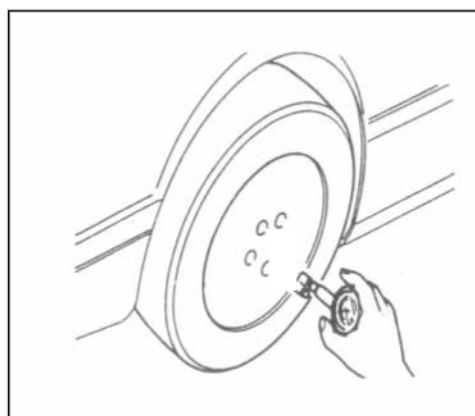
Preparation before adjustment

I. Check before adjustment

1、Check and adjust tyre pressure to assigned pressure.

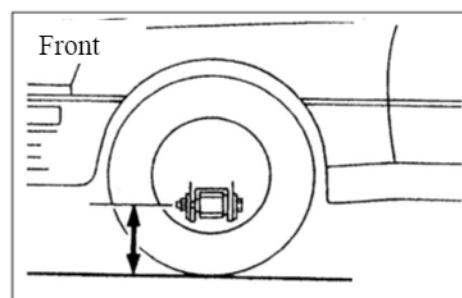
Standard inflation pressure of cold tyre (kPa)

Tyre size	Front wheel	Rear wheel	Spare tyre
205/65R15*94H	220	200	250
205/55R16*91V	220	200	



2、Check body height

Before measuring vehicle height, pressurize the tyre to standard assigned value (pay attention to keeping left tyre pressure in accordance with right tyre pressure.)

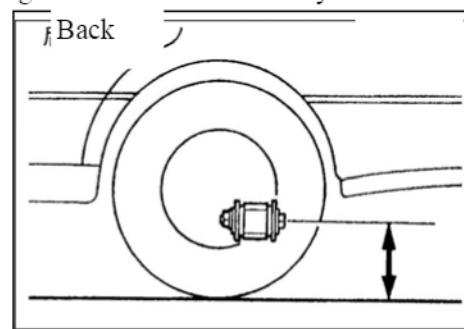


①Front measurement point

Measure the height between lower control arm assy from the ground and pivot of binding bolt of front steering knuckle. Body height of left and right wheel shall be basically the same.

②Rear measurement point

Measure the height between rear axle assy from the ground and pivot of binding screw bolt of shock absorber . Body height of left and right wheel shall be basically the same.



Caution: Before testing wheel alignment, adjust the vehicle to assigned height first.

If vehicle height fails to meet the standard value, check if front suspension and rear suspension have been damaged or deformed.



- 3、Check front-wheel bearing clearance, and replace front-wheel bearing if necessary.
- 4、Check if rims and tyres wobble.
- 5、Check if ball joint of cross connecting rod loosens.
- 6、Park the vehicle without luggage and persons on the level ground.
- 7、Heights from left and right sides of fender apron to vehicle center line can't exceed standard height of checking suspension.
- 8、Wobble wheels to check if shock absorber functions properly.

Note: *1 Make sure fuel tank is full of fuel, radiator coolant and engine oil are in the given height, the tyre jack and basic hand tools are in the specified position.

II. Rims and Tyres

1、Sight Check

Check the rim and tyre, it is needed to replace them, if crack and damage and deformation of the rim and tyre are found .(see the figure)

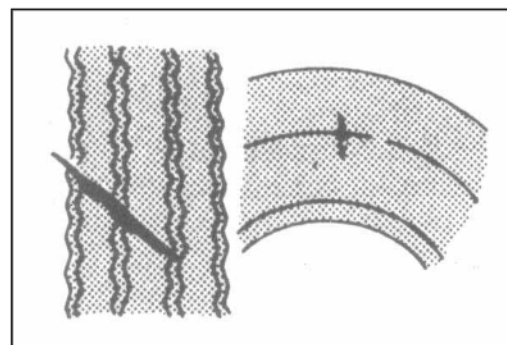


Figure : Tyre Abrasion

2、Tyre Abrasion

(1)Check tread depth left. Standard tyre illustrated in the figure: at least 1.6mm

Snow tyre: 50% of tread.

(2) It is needed to replace the tyre, if abrasion indicating strip unfolds.

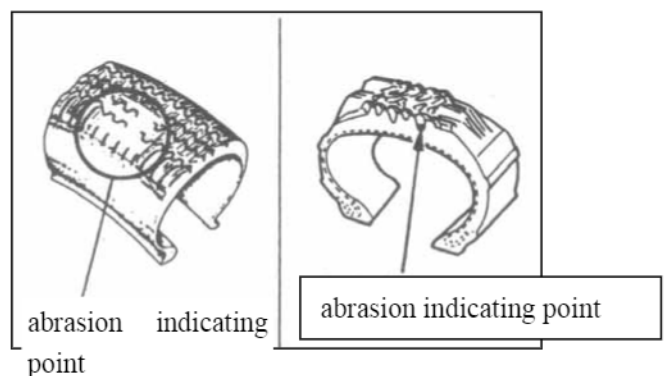


Figure: Tyre Abrasion Indicating Point

3、Abnormal Abrasion of Tyres

Undue abrasion of tyres illustrated in the right figure may occur, consult possible reasons and disposal methods in following table. (See the figure)

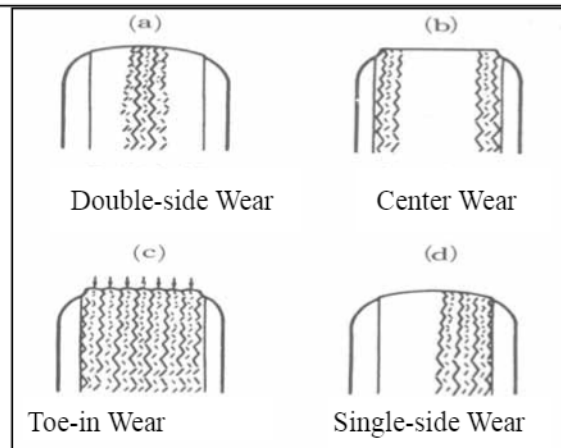


Figure: Tyre Abrasion

	Possible reasons	Disposal methods
(a)	*Lack of tyre pressure (abrasion on both sides) *Turn in high-speed *Location of tyres hasn't been adjusted.	* Measure and adjust tyre pressure *Speed down *Adjust tyre location
(b)	* Tyre pressure is too high. *Location of tyres hasn't been adjusted.	*Measure and adjust tyre pressure *Adjust tyre location
(c)	* Incorrectness of toe-in	*Adjust toe-in
(d)	*Incorrectness of camber or caster * Suspension system failure. *Tyre imbalance *Out-of-round of brake drum or the disk. * Other mechanical problems *Location of tyres hasn't been adjusted.	*Adjust ,fix or replace the axle and suspension system. *Fix or replace *Keep the tyre in dynamic balance or replace it. *Calibrate or replace *Calibrate or replace *Adjust tyre location

4、Precautions related to rims and tyres

(1) Don't use substandard rims and tyres.

(2) Aluminum alloy steel rim is likely to be scraped, so use soft fabric to clean it instead of steel brush. Don't use boiling water to clean it directly if cleaning vehicles with steam.

(3) If toothed compound, such as mud or slurry is attached to aluminum alloy steel rim, it is needed to clean it with neutral cleanser as quickly as possible to avoid damaging.



5、Replacement of tyres

(1) Before equipping inner tube valve, check if valve hole is smooth without a bur. Then apply glycerol onto the rubber surface of inner tube valve or dip inner tube valve into glycerol. It is finished with installation correctly via passing binding ring of inner tube valve through the hole of the vehicle under the pressure of 200-400N with special tools (Suds is allowable for replacement of glycerol.)

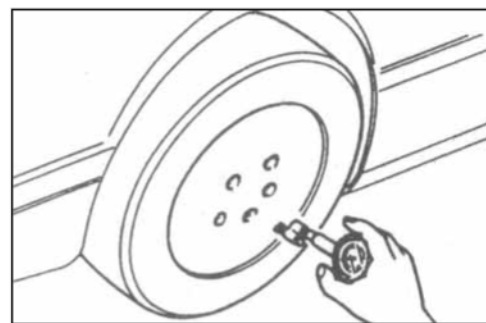
(2) Before equipping tyres, apply glycerol or suds onto the bead and note: when there's a dub mark on wheel rim, align the mark of tyre uniformity test with the dub mark. When there isn't a dub mark on wheel rim, align the mark of dynamic balance test with inner tube valve. When there is neither a dub mark on wheel rim nor the mark of dynamic balance test, but there is a mark of static balance test, align test mark of static balance with inner tube valve.

6、Tyre pressure

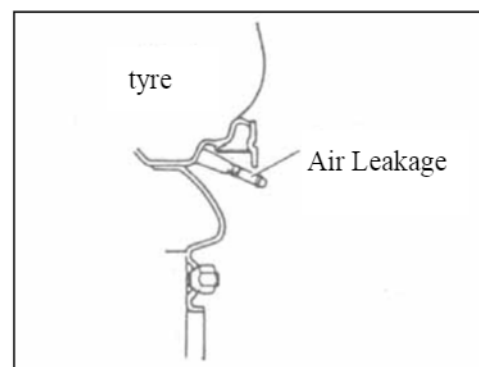
Check pressure of all tyres, including spare tyres and adjust it when needed. Inflate tyres according to given pressure strictly. Air pressure can't exceed 10% of rated air pressure during inflation. When installing spare tyres assy separately, rated inflation pressure shall be 3.5bar and they shall be stocked in isolation from four wheels for equipping the vehicle. Before processing four-wheel alignment, check tyres pressure of 4 wheels and adjust it : front wheel : 2.2bar, rear wheel 2.0bar.(See the figure)

7、Air Leakage

Make sure there's no air leakage of inner tube valve as shown.

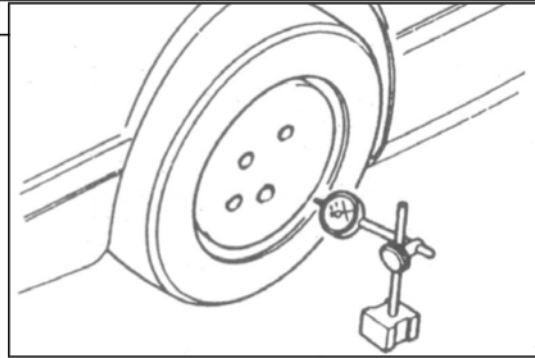


Check tyre pressure



8、Check out-of-flat of rims

- (1) Prop up vehicles high and safely.
- (2) Fix up micrometer indicator equipped with cylindrical finger ($\Phi 10$) on the edge of wheel rim to measure depth of out-of-flat.(see the figure)
- (3)If needed, replace the rim.



Check out-of-flat of rims

Note: allowable deformation in wheel rim:

allowable maximum value of out-of-flat depth average on both edges of wheel rims can't exceed:

steel wheel rim:5mm ,

aluminum alloy wheel rim:3mm

9、Adjust tyre location

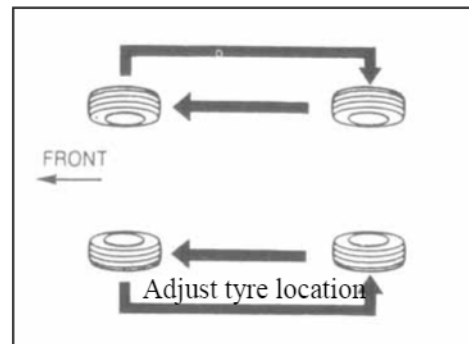
In view of extending tyre life and making sure tyre abrasion situation, adjust tyre location per 6000km (3750miles) .

(See the figure)

Caution:

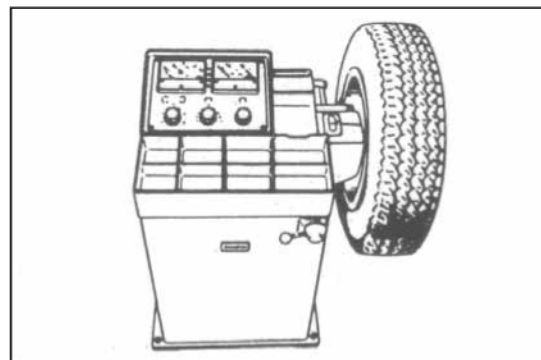
*It is needed to use the highest quality tyre for front wheel.

*After adjusting tyre location, adjust tyre pressure to assigned pressure value.



10、 Wheel balance adjustment

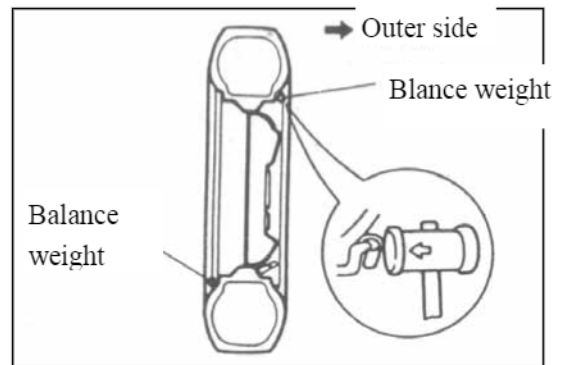
After tyre inflation, screw valve protecting cap to process dynamic balance test and equip suitable balance weight on the inner and outer edges of wheel rim according to the requirement, and require the last unbalance degree assy is less than 100g· cm (about 5g of balance weight on the inner and outer edges of wheel rim)



Note: Allow at least one balance weight per side of per wheel and maximum mass is less than and equals to 70g. In the process of equipping, avoid hitting balance weight too heavily. If so, replace balance weight in time. Balance weight replaced mustn't be used again.

11、Installation

(1) When installing wheel and tyre assembly, screw wheel bolts into wheel rim with hands to be preloading. After preloading, screw it on with special tools in the diagonal to screw the moment of a force ($110 \pm 10 \text{ N.m}$). It's forbidden to use impact wrench to avoid damaging wheels, loosening and tightening. It's forbidden to apply lubricating grease on wheel bolts. (It's needed for wheel and tyre assembly equipped to screw wheel bolts on once and tighten the moment of a force after the first running of 100km. It's one of the content of routine maintenance to check wheel bolts and tighten the moment of a force.)



(2) Tighten nuts by crossing. The degrees of screwing should be close to each other and make sure that wheels can turn freely. After tightening, wheels lie on the ground.



(3) Install **trimming cover** or place trimming cover according to requirements. When installing **ferrule-type trimming cover**, flap it with hands or knock it in with rubber tools.





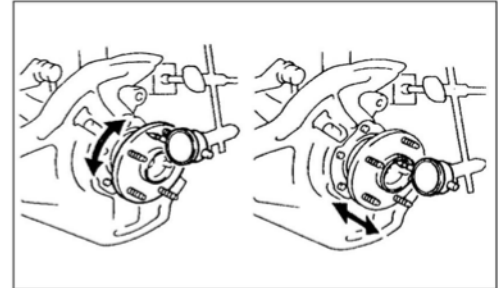
III. Check loosening degree of wheel bearing

- 1、Check bearing axial clearance

Maximum: 0.05mm

- 2、Check deflection of axle rim

Maximum: 0.05mm



IV. Check loosening degree of front suspension

V. Check loosening degree of steering horizontal linkage

VI. Check loosening degree of knuckle joint end

VII. Check if shock absorber can operate properly.

- 1、Check if there's oil leakage.
- 2、Check if there's abrasion of assembly liner.
- 3、Check damping force of shock absorber. If it's disqualification, it's needed to be replaced.

Section 2 Rear Wheel Alignment

It's commended for the chassis of this vehicle type to use four-wheel position indicator by propulsive line positioning methods. Single wheel toe-in of front wheel shall be influenced, if propulsive line positioning adjust rear wheel toe-in .So if carrying out four-wheel alignment test, adjust rear wheel first, then adjust front wheel. And adjust camber of rear wheel first, then toe-in angle. After that, adjust caster, camber and toe-in angle of front wheel.

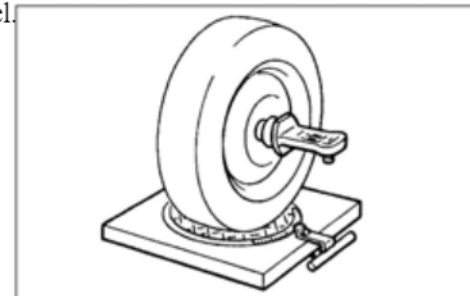
I. Install position indicator or retainer in wheels.

- 1、Install it according specific

instruction of equipment manufacturer.

- 2、Test and adjust vehicles according to equipment requirement, see the following alignment requirements:

Total toe of rear wheels	$18^1 \pm 12^1$
Single wheel toe-in of rear	$9^1 \pm 6^1$





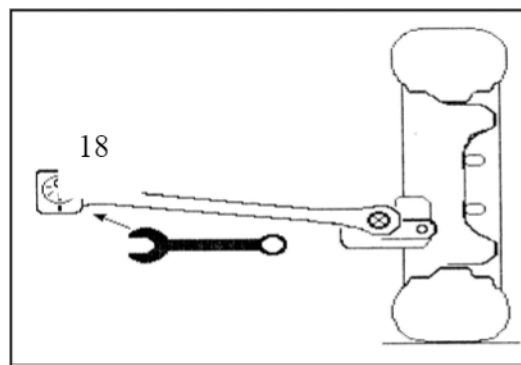
wheels	
Camber of rear wheels	$-35^1 \pm 60^1$
Thrust angle	$-10^1 \sim +15^1$

Note: Camber of rear wheels isn't adjustable. If finding abnormal tyre abrasion of rear wheels, check if there's abrasion and deformation in rear suspension.

II. Adjust rear wheel toe-in

If rear wheel toe-in can't conform to requirements, adjust it.

It's allowable to adjust **offset bolt** 16 of rear suspension swinging arm assembly and change toe-in size (The detailed adjustment procedures are as follows).

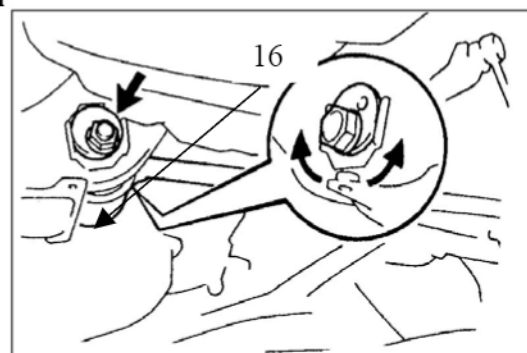


1、 Loosen Nut 18, pay attention not to making nuts drop from the groove.

2、 Rotate offset bolt 16 to change rear wheel toe-in value till conforming to requirements.

3、 Screw Nut 18 on to assigned moment of a force

4、 After screwing nuts on, bounce vehicle body to check toe-in size.



Section 3 Front Wheel Alignment

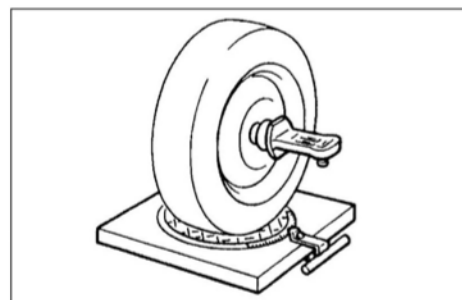
I. Install position indicator or retainer in wheels.

Install it according to specific instruction of equipment manufacturer.

II. Test and adjust negative caster, camber,

toe-in angle of front wheels and steering angle

Specification: follow the requirements of vehicle front wheel alignment:



negative caster	$3^{\circ}.13^1 \pm 60^1$
Camber of front wheels	$-30^{\circ} \pm 60^1$
Single wheel toe-in of front wheels	$1^1 \pm 4^1$
Steering angle	Inner: $39.9^0 \pm 4^0$ Outer: $33.5^0 \pm 4$

Note: First adjust caster, next camber, then toe-in angle.

1、Negative Caster

Negative caster is assured in design structure. There's no need to adjust it.

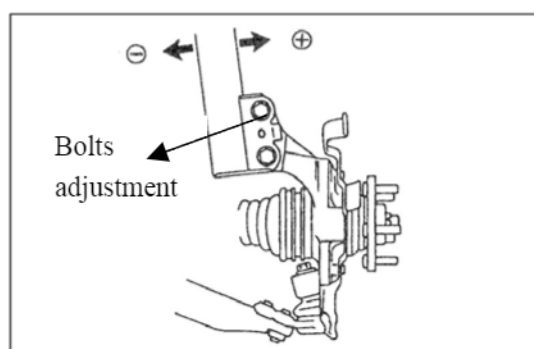
Influence of Caster

Main function of caster is to make vehicles run in the direction of straight front.

If caster is in the right position, the inner of vehicles shall go down when turning front wheels. Its result is to hoist the chassis and add load to steering knuckle. If two front wheels have the same caster, vehicles will turn back to the direction of straight front after turning. To add positive caster angle can increase stability of steering wheel, but it'll increase turning force when turning. To reduce positive caster angle can decrease stability of steering wheel, but it'll decrease turning force when turning. The angle of caster won't influence abrasion of tyres. It's used to stabilize vehicle running direction and make steering wheel turn back by itself when turning. If vehicle equipments are tradition mechanical turning, the angle of caster is small, without so much as tending to minus caster angle, and it's easy to turn. If vehicles are equipped with power-steering, caster is regulated to bigger positive caster and it can make drivers have more feelings of driving .To add positive caster angle can increase turning force, but it'll increase stability when running in the straight direction.

2、Camber

After installing independent suspension and steering knuckle, there's no need to adjust camber normally. If finding camber deviate tolerance for other reasons, use binding bolts of independent suspension and steering knuckle to calibrate.





(1) Before revising, sight check if there's damage in running system components. Replace components damaged. Camber of front wheels designed by the manufacturer isn't adjustable.

(2) If finding camber of front wheels exceeds deviation, loosen binding bolts of front shock absorber and steering knuckle and calibrate it by moving wheels.

3、Front Wheel Toe-in

Use special four-wheel position indicator to test and adjust toe-in.

(1) According to requirements of position indicator, locate wheels to prepare for

alignment. Fasten steering wheel in the

direction of straight front with limiting

device of steering wheel which can be bought

in the market. (Steering wheel must be in the center position of $\pm 5^\circ$ and lower flange clamping bolt of steering shaft must be level.)

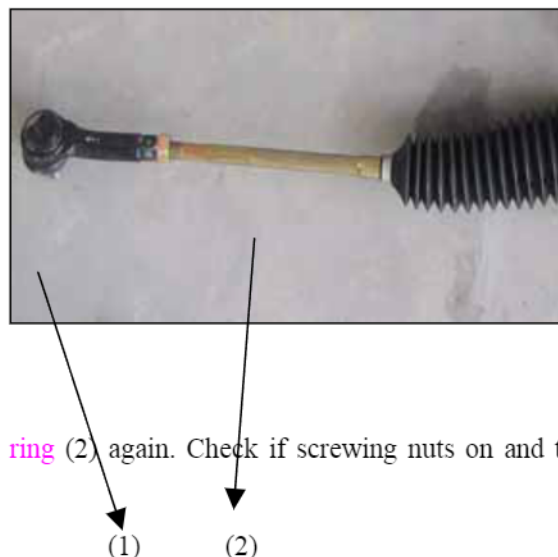
(2) Loosen the lock nut (1) of steering horizontal linkage.

(3) Dismantle **flexible sheath retaining ring** (2) with pinchers.

Caution: If retaining ring is lack of elasticity, It is needed to replace it.

(4) According to requirements, screw toe-in adjusting rod to adjust the length to assigned value.

(5) Screw lock nut (1) on and install **flexible sheath retaining ring** (2) again. Check if screwing nuts on and the sheath is in the right position.



(6) After adjusting front wheel toe-in, check if steering wheel is level. If not, loosen lock nut of steering wheel and adjust steering wheel to level position. And screw lock nut of steering wheel on and adjust steering wheel to requirements of the moment of a force ($30 \pm 3 \text{ Nm}$).

4、Check Front Wheel Steering Angle

After replacing horizontal linkage tie-in or adjusting toe-in, check steering angle. If front wheel steering angle can't conform to the standard, check and adjust the length of left and right horizontal linkages.



Section 4 Diagnostic Troubleshooting Manual

Issues	Possible Reason	Solution
Excessive abrasion and abrasion inequality of tyres	As shown in the following	
Tyre abrasion beforehand	Falseness of tyre pressure Falseness of wheel alignment parameter	Adjust Adjust
Tyre noise	Falseness of tyre pressure Tyre abrasion	Adjust Adjust, check and replace
Road surface noise or vehicle body vibration	Lack of tyre pressure Tyre imbalance Deformation of rims and tyres Abrasion inequality	Adjust Adjust Fix or replace Adjust , check and replace
Steering wheel vibration up and down	Excessive wobbling of rims and tyres Wheel screw cap or axle neck loosen Tyre imbalance Break or abrasion of engine rubber suspension Break or abrasion of rubber of transmission case bracket	Replace Screw on Adjust Replace Replace
Circle vibration of steering wheel	Excessive wobbling of rims and tyres Wheel screw cap or axle neck loosen Tyre imbalance Abrasion inequality Lack of tyre pressure Damage or abrasion of front wheel bearing Steering system failure	Replace Screw on Adjust Check Adjust Replace Check



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Chassis Section

	Suspension system failure	Check
Inclination of steering wheel to one side	Improper tyre pressure	Adjust
	Excessive abrasion and abrasion inequality of tyres	Check
	Steering system failure	Check
	Brake system failure	Check
	Suspension system failure	Check
Instability of running	Difference of tyre pressure of two sides	Adjust
	Deformation of rims and tyres	Fix or replace
	Wheel screw cap loosen	Screw on
	Steering system failure	Check
	Suspension system failure	Check
Inclination of the brake to one side	Inequality tyre pressure of two sides	Adjust
	Brake system failure	Check
方向盘重 Steering wheel is heavy.	Lack of tyre pressure	Adjust
	Steering system failure	Check
	Suspension system failure	Check
	Falseness of wheel alignment parameter	Check



Steering wheel turns back badly.	Lack of tyre pressure	Adjust
	Steering system failure	Check
	Suspension system failure	Check
	Falseness of negative caster of front wheels	Adjust
