

STEERING SYSTEM

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INTRODUCTION OF STEERING SYSTEM

INTRODUCTION OF STRUCTURE

The structure of the Power Steering System is shown as Figure 1:

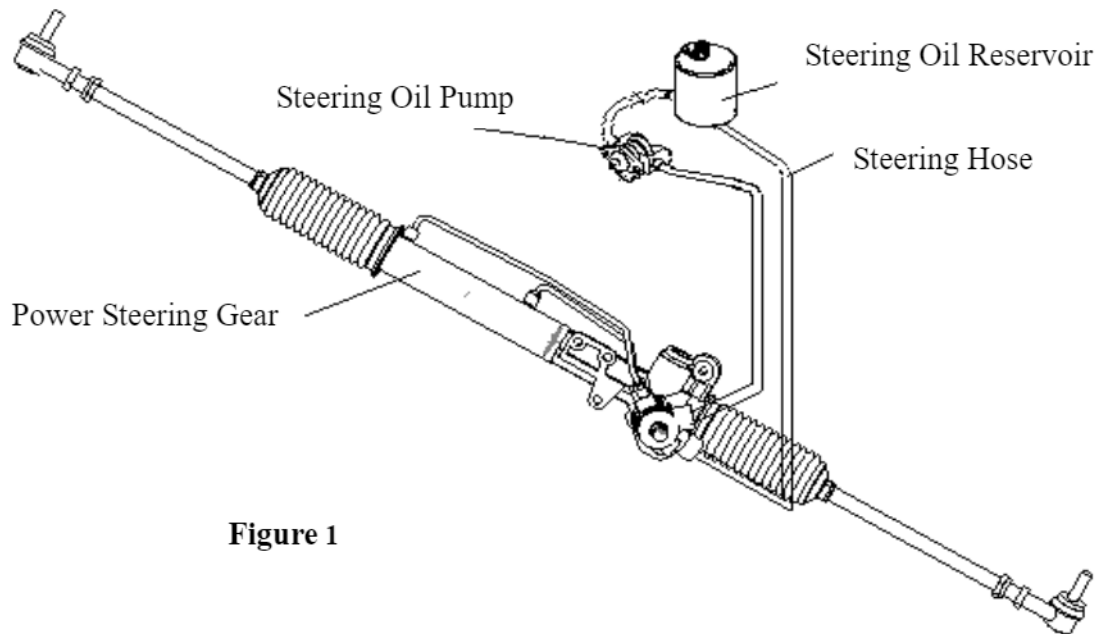


Figure 1

The rack & pinion power steering gear is composed of three sections: control valve, mechanical steering gear and servo cylinder. The control valve is widely utilized overseas due to its advanced structure and high sensitivity. The mechanical steering gear is rack & pinion pattern.

※ Control Valve

- The control valve is a normally open rotary valve and consisted of: torsion bar1, input shaft 2, valve bush 3 and other components. The hydraulic oil flows into the left and right oil chambers through the pre-opened clearance of the input shaft 2 and the valve bush 3. The structure is shown as Figure 2.

※ Mechanical Steering Mechanism

- The mechanical steering mechanism is rack & pinion pattern and composed of three sections: pinion shaft, steering rack piston assy and steering link.

※ Servo Cylinder

- The servo cylinder has metallic hull, which is divided into right and left oil chambers by the inner rack piston and connected with the two oil inlets of control valve.

1. Torsion Bar
2. Input Shaft
3. Valve Bush

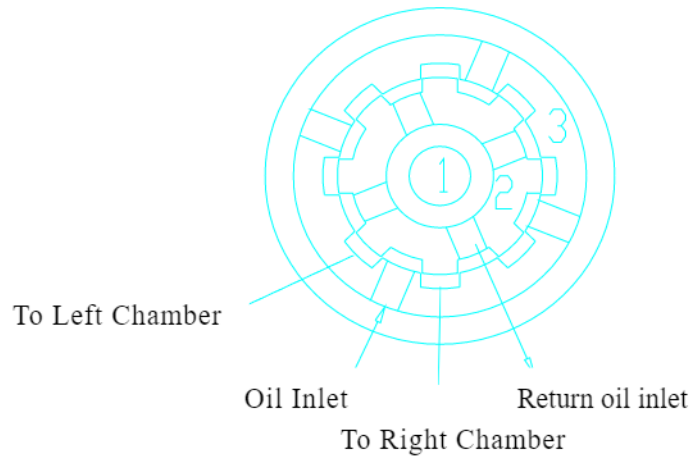


Figure 2

WORKING PRINCIPLE

Middle Position

- When the vehicle moves straight (the steering wheel does not turn), the hydraulic oil which is supplied by the oil pump enters the oil inlet through the pre-opened clearance of the rotary valve. As the rotary valve keeps immovable, the hydraulic oil flows back to the oil reservoir from the return oil inlet. No power is produced because the oil pressures of the two chambers of the steering gear are same.

Steering Process

- When the steering wheel turns, the clearance of the valve spool between the valve bush and the input shaft will be changed, so the hydraulic oil which flows to the two oil chambers forms the oil pressure difference. This difference acts on the piston and pushes it to overcome the steering resistance and make movements. Therefore, the steering link assy is moved to realize power steering.

Return Process

- Once the steering is completed, the force on the steering wheel will disappear. As the effect of the torsion bar elasticity, the input shaft returns to the relative balance position of the valve bush and the oil pressure difference between the two oil chambers of the steering gear follows to disappear. And then the vehicle will convert to straight-line motion by the effect of the vehicle self aligning torque of the front wheels until it enters the straight-line position.

Road Sense Effect

- The road sense effect is also called the ability of feeling steering. The driver applies the force on the steering wheel, which also act on the torsion bar of the steering gear and makes it deform. The amount of deformation which increases as the steering resistance grows, depends on the wheel steering resistance. Therefore, the driver can judge the variation of the steering resistance by the force applied on the steering wheel to obtain the road sense effect.

INTRODUCTION OF PERFORMANCE

- ※The steering force of the steering wheel can be decreased. Power can be felt obviously, especially when the vehicle turns on spot or turns with great corner at low-speed.
- ※The steering sensitivity is enhanced.
- ※The impact of kickback from ground on the steering wheel is reduced.
- ※In the case of tire burst, the sudden turning of the wheels can be effectively avoided. So the security of driving can be improved.
- ※The load on the steering wheel is permitted to increase, which can improve the freedom motion of the general arrangement.

The power steering gear of the steering system of A15LHD is a standard feature, and the mechanical steering gear is optional.

In fact, the power steering gear of A15LHD is based on the mechanical rack & pinion steering gear and enhanced with a set of power mechanism which is composed of the engine used as energy sources, the steering oil pump, the steering control valve, the power oil cylinder and other components. Under the working condition, the power of the engine drives the steering oil pump through the ribbed belt. The power steering fluid (ATF oil) is suck out from the oil reservoir by the steering oil pump and formed pressure oil to get into the control valve. After distributed by the control valve, the pressure oil enters the power cylinder to push the working piston which is connected with one end of the steering rack. So the steering power can be formed by the pressure oil through the working piston.

If the power steering system is in failure, the steering of the vehicle can be also completed by the driver.

The optional mechanical steering gear is a rack & pinion steering gear which the power source is the physical force (strength of the hand) of the driver. All the dynamic components are mechanical.

REMOVAL/INSTALLATION OF STEERING COLUMN

Removal and Installation of the Steering Column

- Remove the nuts on the steering wheel
- Remove the upper and lower protector of the instrument cluster and the switch
- Remove the instrument panel assy. (Please refer to the removal of the instrument panel)
- Remove the joint bolt of the upper steering column bracket and the car body upper bracket.
- Grind away the safety screw and replace with a new one when installing.
- Remove the joint bolt between the steering gear and the steering column (tightening torque: 30N·m)
- Install the steering column inversely according to the removal steps.

The inner spline of the steering gear is shown as the picture below:



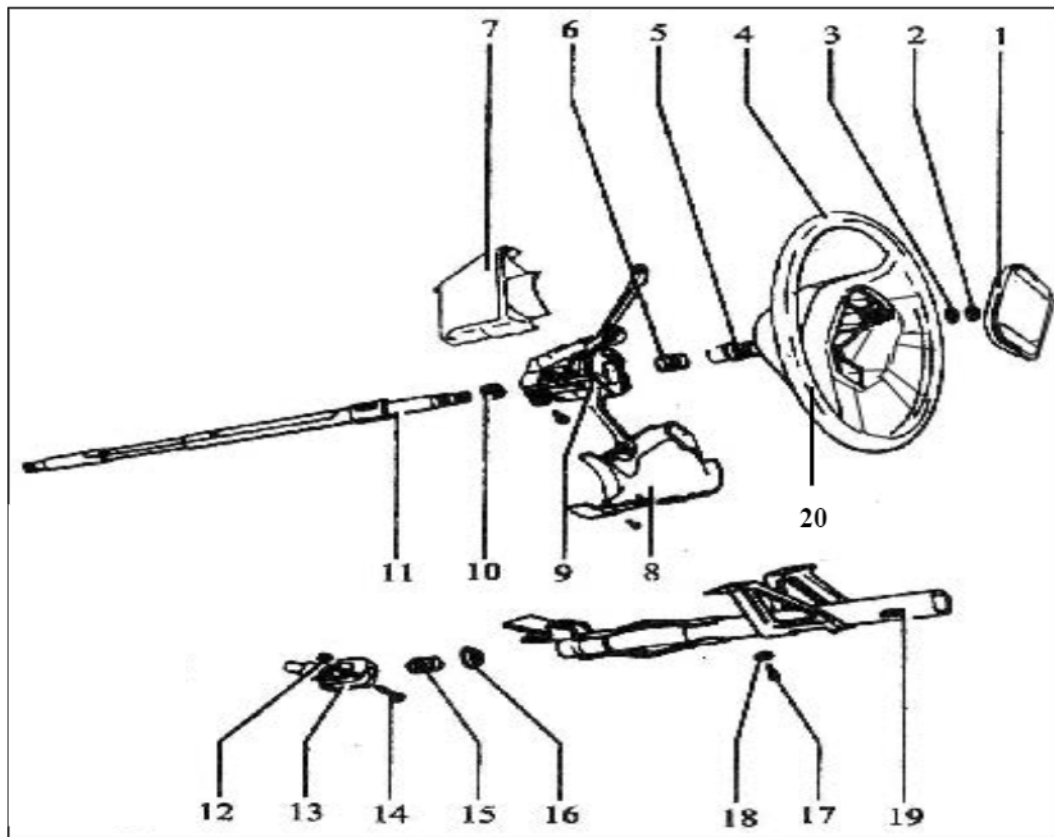
Removal and Installation of Steering Shaft and Steering Tube

- Remove the clip.
- Take off the serrated set bush and the steering gear lock housing from the steering column
- Draw out the steering shaft and press the lower bearing of the steering column out with a presser.
- Disassemble the lock housing spring of the bracket ring steering shaft with a presser.
- Assemble the steering column inversely according to the removal steps.

Precaution:

- Apply a little grease around the lower bearing and the inner wall of the steering hose column lower end, press the lower bearing into the steering hose column using a presser. (Do not move the upper and lower universal joint of the guard column)
- Adjust the relative height of the lock housing and the hose column according to the height of the pre-installed ignition lock cylinder and the combined switch cover.
- Apply lithium base grease evenly around the contact ring.

Disassembling Illustration of the Steering Column



- | | | | |
|---|-------------------|-----------------------------------|---------------------|
| 1- Horn Button Cap; | 2-Nut (40N · m); | 3- Spring Washer; | 4-Steering Wheel; |
| 5- Serrated Set Bush; | 6-Spring; | 7-Lower Trim Cover | 8- Upper Trim Cover |
| 9- Steering Gear Lock Housing and Steering Column Switch; | 10- Support ring; | | |
| 11-Steering Shaft; | 12-Nut (30N · m); | 13- Steering Universal Joint | |
| 14- Hex Bolt | 15-Spring; | 16- Steering Column Lower Bearing | |
| 17-Safety Screw; | 18-Washer; | 19-Steering Tube; | 20- Clip |

REMOVAL/INSTALLATION AND CHECK OF STEERING GEAR

Lift the whole vehicle at a designated safe place with a lifter

- Remove the high and low pressure oil tube of the steering gear with torques of $45 \pm 3 \text{ N} \cdot \text{m}$ and $30 \pm 3 \text{ N} \cdot \text{m}$ respectively.
- Remove the joint piece of the steering link
- Remove the shift shaft bracket
- Remove the front tube and the three way catalytic converter with torques of $60 \pm 3 \text{ N} \cdot \text{m}$

Two bolts on one side of the steering gear are shown as the picture below. Tightening torque: $30 \pm 3 \text{ N} \cdot \text{m}$.



and $25 \pm 3 \text{ N} \cdot \text{m}$ respectively.

- Remove the four bolts of the steering gear.
- Remove the fixing bracket of the steering gear and the rubber hose.
- Install the steering column in the reverse order of the removal.



Note: The right picture shows the status of the power steering oil tube of the steering gear removed.

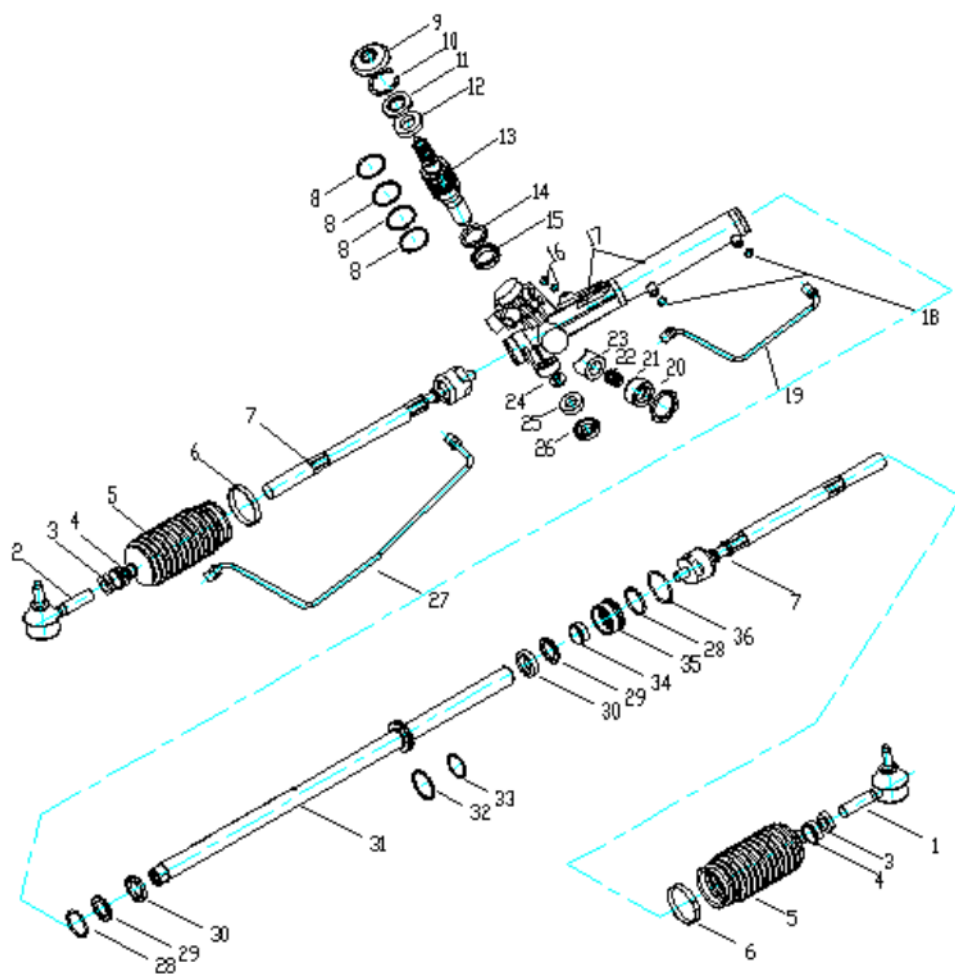
The tightening torque for the hollow bolt which connects the high pressure oil tube and the power steering pump is $45 \pm 3 \text{ N} \cdot \text{m}$.

REMOVAL/INSTALLATION AND REPAIR OF MAIN BODY OF STEERING GEAR

Exploded view of the rack & pinion power steering gear

Code	Description	Quantity
1.	Left pull rod outboard joint assy	1
2.	Right pull rod outboard joint assy	1
3.	Hexagon nut	2
4.	Clamp	2
5.	Rack shield	2
6.	Single ear no-level clamp	2
7.	Inner ball joint	2
8.	Seal ring	4
9.	Dust cover	1
10.	Snap ring for hole	1
11.	Oil seal	1
12.	Bearing	1
13.	Valve core assy	1
14.	Bearing	1
15.	Oil seal	1
16.	Conical connector	2
17.	Hull oil cylinder assy	1

18.	Conical connector	2
19.	Left oil tube assy	1
20.	Lock nut	1
21.	Adjusting plug	1
22.	Spring	1
23.	Rack holder	1
24.	Hexagon flange bolt	1
25.	Bearing	1
26.	Plug cap	1
27.	Right oil tube assy	1
28.	O rubber ring	2
29.	Washer	2
30.	Oil seal	2
31.	Steering rack piston assy	1
32.	Piston ring	1
33.	O rubber ring	1
34.	Housing	1
35.	Stop collar	1
36.	Wire stopper	1



Removal and Dismantling of Steering Gear

Repair and adjust after the removal of the steering gear

Tightening Torque for the Fastener Set Components (Shown as the table below)

Description	Specification	Quantity	Tightening Torque (N.m)
Hexagon flange bolt	Q1840812	1	20~30
Plug cap	M30X1.5	1	35~45
Lock nut	M32X1.5	1	40~50
Oil tube connector bolt	M12X1	2	15~25
Inner ball joint-rack	M12X1	2	70~90
Hexagon nut - outboard joint	M14X1.5	2	4.9~9.8

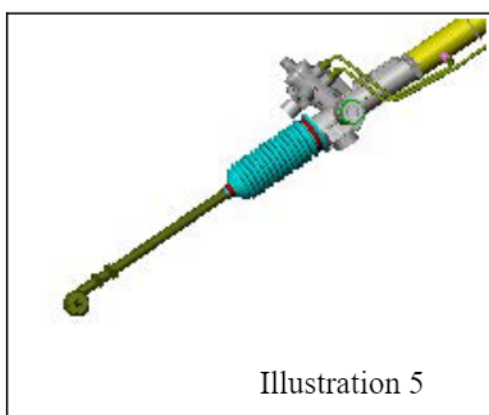


Illustration 5

Fix the steering Gear(Refer to Illustration 5)

- Fix the steering gear on the vises and keep the input shaft flatly. Take off plug cap of the oil inlet and the outlet to discharge the oil. Rotate the input shaft for several times to discharge the oil from the steering gear.



Illustration 6

Remove the left and right steering link assy (Refer to Illustration 6)

- Loosen the lock nut 3 of the left and right steering link assy, and then remove the outboard joint assy 1 and 2

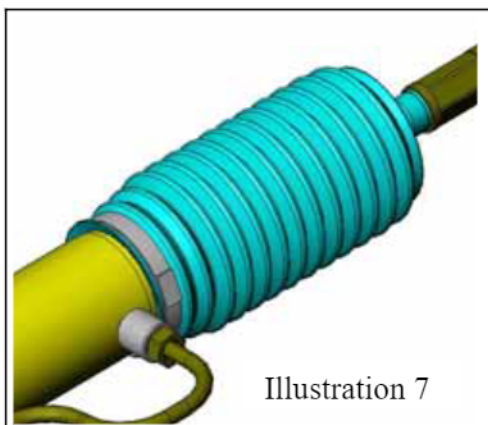


Illustration 7

Remove the left and right protector (Refer to Illustration 7)

- Remove the single ear no-level clip 6, then the clamp 4 and take off the protector 5.

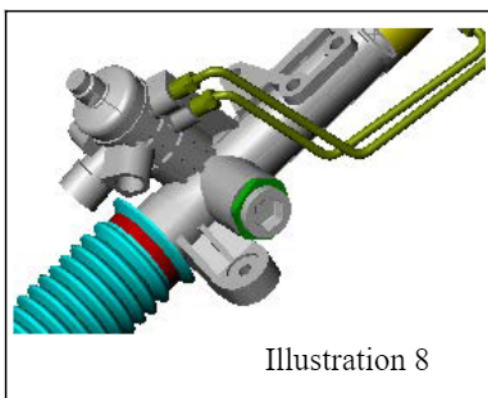


Illustration 8

Remove the left and right oil tube assy (Refer to Illustration 8)

- Loosen the joint nuts of the left oil tube assy 19 and right oil tube assy 27, and then remove the left and the right oil tube assy.

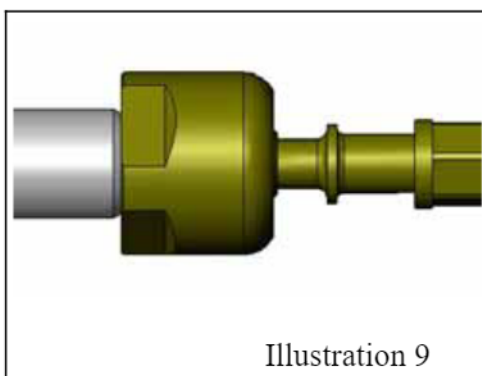
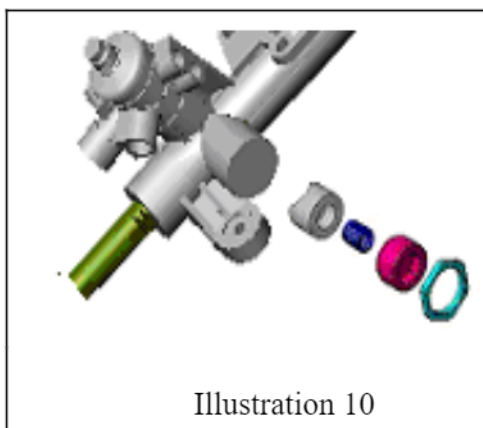


Illustration 9

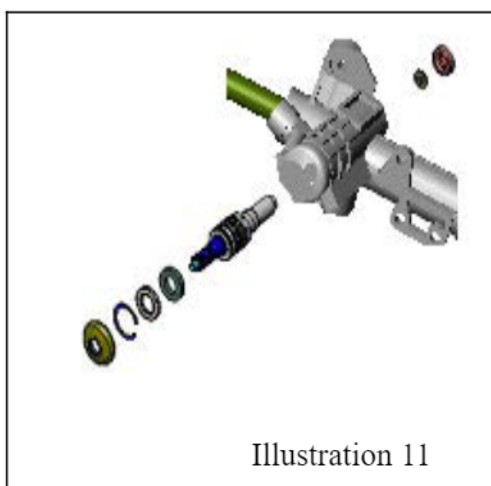
Remove the inner ball joint (Refer to Illustration 9)

- Lock the rack with an open-end assistant, and screw up the inner ball joint assy 7 with another assistant.



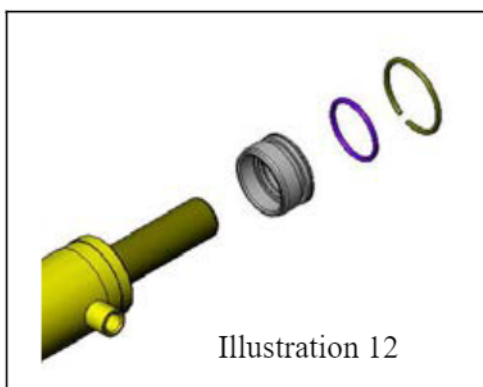
**Remove the support device of the rack
(Refer to Illustration 10)**

- Screw down the lock nut 20 with an special purpose spanner first, then the adjusting plug 21, and remove the spring 22 and the rack holder 23 in sequence..



**Remove the valve core assy (Refer to
Illustration 11)**

- Clamp the hull oil cylinder assy 17 which is used to fix the valve core assy on the bench vises and the upper limiting plug of the rack end. Remove the hexagon flange bolt 23 and the plug cap 26 of the valve core tail with a special purpose tool. Then remove the valve core assy 13. Cover the protector on the pinion shaft spline, and take off the oil seal 11 and the bearing 12(Do not damage the lip of the oil seal)



**Remove the stop collar assy (Refer to
Illustration 12)**

- Remove the round wire snap ring 36 with a wire caliper, then the stop collar 35 and the O rubber ring 28

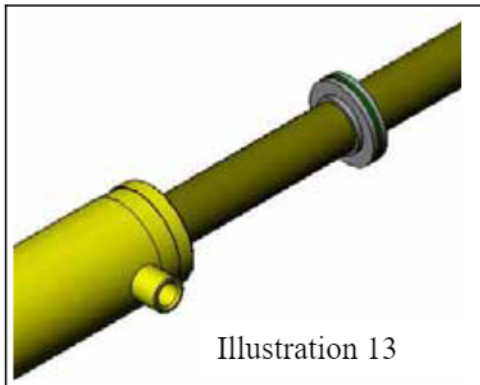


Illustration 13

Remove the rack assy (Refer to Illustration 13)

- Press the rack assy 31 out with a special purpose tool.

Check and Replacement of the Components of the Steering Mechanism



Illustration 14

Check the steering rack piston assy (Refer to Illustration 14)

Check(1): Inspect the stagger of the rack 31 of the rack piston assy, which the maximum value is 0.15mm. Examine if there is flake or indentation on the rack surface and crack or damage on the working surface. Check if there is wear or damage on the back surface. Replace the rack piston assy, if necessary. Check the damage of the piston ring 32 and the O rubber ring 33 of the piston. Replace both, if necessary. Remove the piston ring 32 and O rubber ring 33 with a screwdriver.

Precaution: Do not damage the rack 31. Apply the power steering oil on the new O rubber ring 33, and then install it. Enlarge the piston 30 with finger.

Precaution: Do not enlarge the piston ring excessively. Install the new piston ring 32 on the piston of the rack piston, apply power steering oil on it, press it tightly with finger.

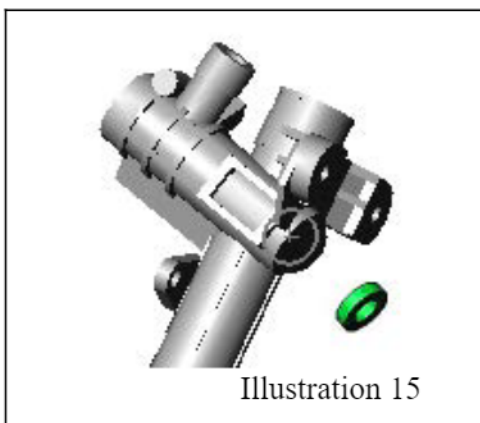
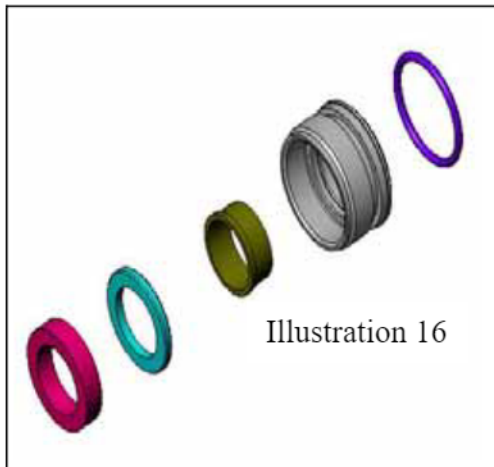


Illustration 15

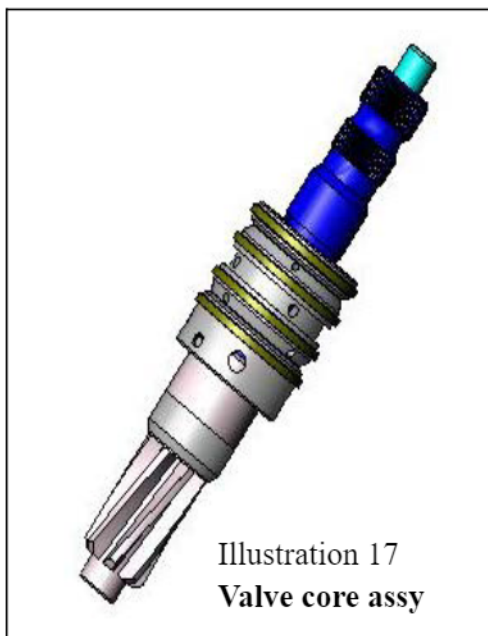
Check the bearing of the rack hull assy (Refer to Illustration 15)

Check (2): Examine if there is indentation or damage on the lower bearing 25 of the hull oil reservoir assy 17 and if it can rotate freely. Replace it, if necessary. Apply the white special grease on the installation position of the bearing when install a new one.



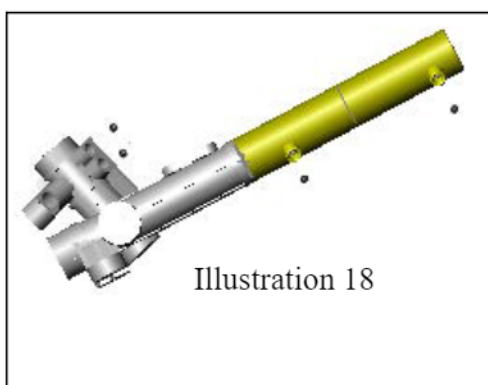
**Check the oil seal of the stop collar assy.
(Refer to Illustration 16)**

Check (3): Inspect if there is flake or indentation on the working surface of the oil seal 30 of the stop collar assy and damage on the lip. Examine if there is scratch on the inner surface of the housing 34 and damage on the O rubber ring 28. Replace the oil seal, housing or O rubber ring, if necessary. Apply the white special grease on the inner and outer surface when install a new one.



Check (4): Inspect if there is crack, damage, flake or deformation on the rack surface of the pinion shaft of the valve core assy 13. Replace the valve core, if necessary. Examine if there is damage on the seal ring 8 of the valve core assy. Replace with a new one, if necessary. Remove the seal ring with a screwdriver when replace.

Precaution: Do not damage the valve bush. Enlarge the new seal ring with a special purpose tool and install the enlarged one on the valve bush of the valve core assy and then shape it with a set sleeve.



Check the conical connectors which are connected with the hull assy (Refer to Illustration 18)

Check (5): Inspect if there is scratch or damage on the surface of the conical connectors 16 and 18 which are connected with the hull and the oil reservoir connectors. Replace with a new one, if necessary. When replace, remove the conical connector with a special purpose tool and beat lightly a new one with a plastic hammer.

Assemblage of the Steering Mechanism

Preparation:

- Clean all components in clean organic solvents before assemblage, then dry them with a blower

Precaution: Be careful during operation. The organic solvent is flammable and explosive, keep it away from any tiny sparks. Otherwise, it may lead hurt or even death.

Precaution: Make sure to wear the goggles while using the compressed air.

- Lay the clean components separately and avoid the collision or scratch.

Replace all the oil seal, seal loop and seal ring. Apply the white special grease on the O-ring and oil seal of the seal sections.

- Get the replacing components ready every component must be qualified before assemblage.

Precaution: When replace, all the set bolt, adjusting screw, seal component, lock nut and the other components must be conformed to the technical specification of Chery and can not be substituted arbitrarily.

- Get the clean MoS₂Lithium lubricating grease or the same performance grease ready during assembling.

Precaution: If the unclean grease is used, the seal components would be damaged or scratched, which will impact the steering power and result in accidents.

Assemblage

Precaution: Do not twist any seal components during assembling.

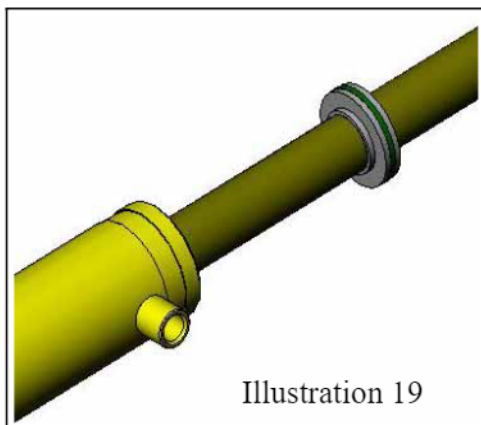


Illustration 19

Install the rack (Refer to Illustration 19)

- Apply MoS₂Lithium lubricating grease on the rack of the rack assy 31
- Protect the rack with the vinyl tape. Fix the rack piston assy in the oil cylinder hull, then pull out the vinyl tape and check if it is complete.

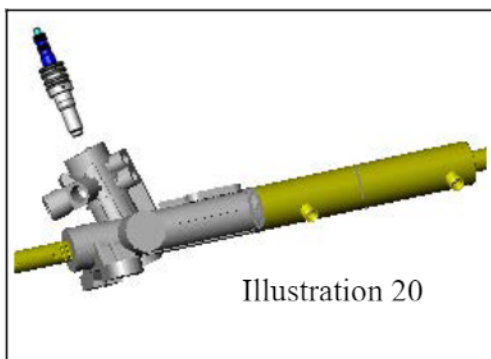


Illustration 20

Install the valve core assy (Refer to Illustration 20)

- Install the valve core assy 31 as the direction of the skew gear tooth into the hull oil reservoir

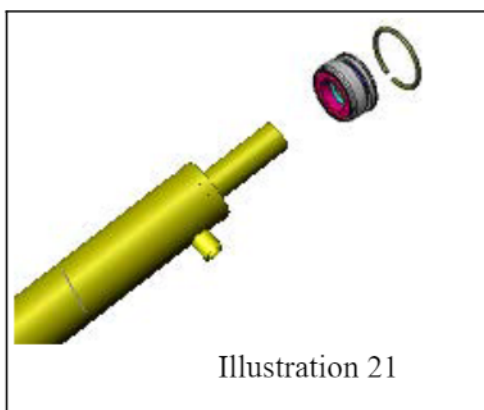


Illustration 21

Install the stop collar assy (Refer to Illustration 21)

- Coat the cylinder side rack 31 with vinyl tape.
- Apply the white special grease on the inner surface of the oil seal 30
- Press the stop collar assy into the oil reservoir body 17
- Install the wire stopper 36 with a wire caliper and position the stop collar assy.

- Install the bearing 12, the upper oil seal 11 and the snap ring for hole 10.

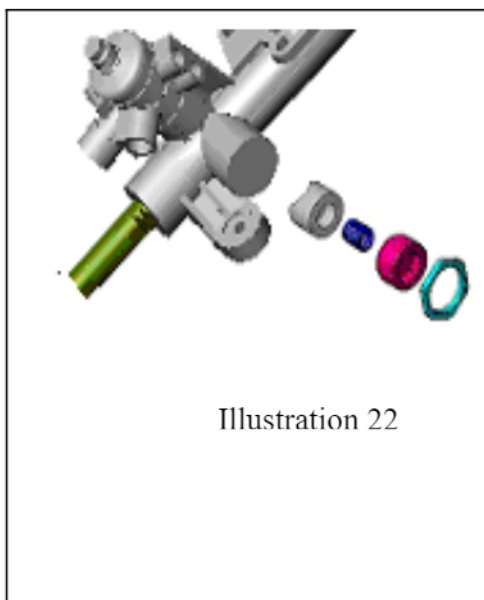


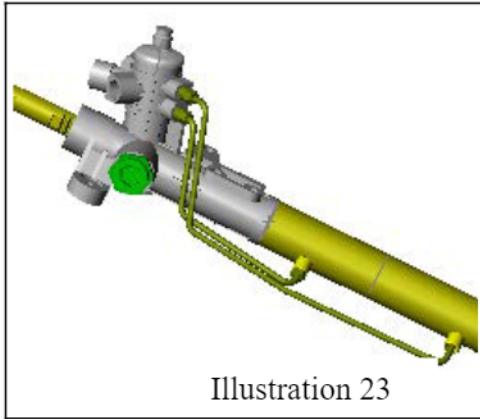
Illustration 22

Install the support device of the rack (Refer to Illustration 22)

- Apply the MoS₂Lithium lubricating grease on the slot area of the rack holder 23
- Install the rack holder 23 into the hull oil reservoir assy 17.
- Install the spring 22.
- Screw the adjusting plug 21 into the hull oil cylinder assy with a special purpose tool and screw back 30°-40 °.
- Screw the lock nut 20 on the adjusting plug.
- Install the limiting plug of the rack end.

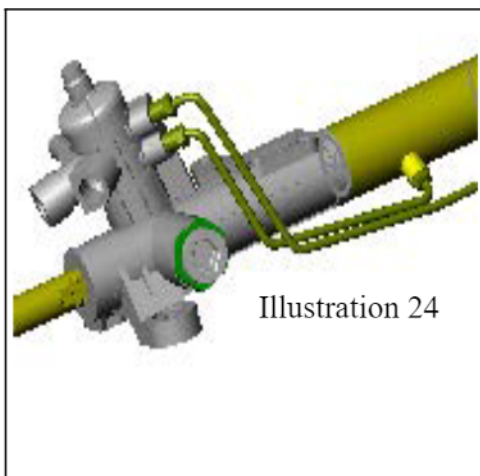
- Apply the 5242 sealant on 1/4 circle thread of the hexagon flange bolt 24 and screw it to the specified position of the pinion shaft. The tightening torque is 20~30N.m

- Screw the plug cap 26 1-2 threads, then apply proper quantities 5242 sealant onto the thread of the plug cap and fix it into the hull. The torque is 35~45N.m.



Install the left and right oil tube assy (Refer to Illustration 23)

- Install the new conical connectors 18 and 16 on the ends of the left oil tube assy 19 and right oil tube assy 27.
- Tighten the left and right oil tube assy with the tightening torque of 15~25N.m



Assembling and adjustment (Refer to Illustration 24)

- Adjust the adjusting plug 21 with a special purpose tool.
- Cover the input shaft with the crank handle and rotate it to feel if it turns smoothly.
- Apply the 5242 sealant on the 1/4 circle thread of the adjusting plug 21 which is close to the hull, fix the adjusting plug and screw the lock nut 20 with the tightening torque of 40~50N.m

★If it is easy to adjust the lock nut of the rack holder, it is not required to remove the steering gear from the vehicle. Therefore the adjustment can be completed on vehicle.

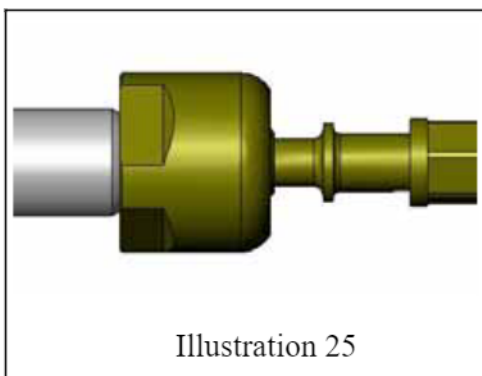
a) Check the clearance

Pull the steering tie rod to make it swing back and forth by hand to ensure that there is no clearance between the rack and the pinion shaft.

Hint: It is not needed to adjust it if it is normal during the check.

b) Adjust the lock nut of the rack holder to eliminate the clearance

If there is the clearance, loosen the lock nut 18 and screw the adjusting plug 19 clockwise until the clearance can not be felt between the rack 29 and the pinion shaft. Screw the adjusting plug 19 back about 30°~40°, and then apply the 5242 sealant on the lock nut 18 and screw it with the tightening torque of 40~50N.m.



Install the rack lock-plate and the inner ball joint assy (Refer to Illustration 25)

- Apply Kerui 5242 sealant on the thread of the inner ball pin.
- Install and screw the inner ball joint assy with a special purpose tool. The tightening torque is 70~90N.m.



Install the protector, outboard joint assy and single ear no-level clip (Refer to Illustration 26)

- Apply the grease on the lip of the protector 5, and then install the hull oil cylinder assy and the inner ball joint assy 7 in it.
- Clip the big end of the protector with the single ear no-level clip 6.
- Clip the small end of the protector with the clamp 4.

- Install the rod lock nut 3.
- Screw the outboard joint assy into the inner ball joint assy.

CHECK OF STEERING SYSTEM

REGULAR INSPECTION

Initial Check

- The maintaining staff should pay attention to the steering system troubles reflected by the user first. In this way, it could save a lot of repairing time. For example, as the user complains that the steering is heavy, it is necessary to clear that it is heavy on left or right; or on spot; or discontinuous heaviness or even no steering power at all.
- If possible, try to drive the vehicle under the available condition in order to get the direct sense about the troubles complained by the user. After the trouble confirmation, do not hurry to remove the steering gear or the fuel pump as the other components of the steering system may cause the troubles in fact. Please check these components first and then the steering gear.
- First, check if there are proper, equal and conform to the standard.
- Second, check the front wheel alignment (caster, king pin inclination, camber and toe-in) and the tightness of the steering tie rod, joint and king pin.
- If the oil tubes have been replaced by consumers, the following cases must be taken into consideration: installation in a wrong way; too small diameter of the tube; clogging; twisting or overbending which would cause the unsmooth flowing or insufficient flux. The unqualified oil tubes must be replaced.
- Next, check the power steering oil reservoir and make sure that the oil level reaches the specified point.
- Check if there is bending on the steering column; Wear or damage on the safety coupling; invalidation of the spring elasticity. Repair or replace, if necessary.

Basic Check

- Check if the set bolt of the steering system is loose.
- Check if the free play of the steering wheel is appropriate. If necessary, check, adjust or replace the components of the steering system.

Overhaul of the steering tie rod

- Check if the steering tie rod ball joint is loose inside. Replace it, if necessary.
- Check if the steering tie rod dust cover is damaged. Repair or replace it, if necessary.

Overhaul of the steering gear

- Check if the dust cover of the steering gear is broken. Replace it, if necessary. Otherwise the water and dust will enter the cover easily which would result the initial damage of the components. Check if the clamp of the dust cover is fixed firmly.
- Check if the clearance of the steering gear is appropriate. Adjust it, if necessary.

Overhaul of the hydraulic power pump

- Check if the hydraulic power pump is clogged. Replace it, if necessary.
- Check if there is abnormal noise in the hydraulic power pump. Replace it, if necessary.
- Check if there is leakage in the hydraulic system. Replace it, if necessary.

CHECK OF THE SEAL OF POWER STEERING SYSTEM

Please follow the below steps:

- Turn the steering wheel quickly to the left and right limit position and keep it immovable, which can make the internal system pressure reach the maximum. Please pay attention to the stay time.
- Visual inspect if the steering flux control valve, rack seal, vane pump(power steering pump) or oil tube connectors leakage. Replace the seal components, if necessary.
- Check if the ATF oil of the oil reservoir is enough. If it is shortage, inspect if the seal of the power steering system is available.
- If all the rack & pinion in seal components of the power steering gear housing are not available, the ATF oil may flows into the bellow housing. Therefore, disassemble the steering gear and replace all the seal rings.
- Check if there is leakage in the oil tube connector. If necessary, find out the cause and reconnect it.

Oil pump flow test

- During inspection, turn the steering wheel to the limit position and apply enough force on the wheel to ensure that the control valve of the steering gear can function normally.
- When the engine is idling and the oil temperature range is $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$, measure the flux of the fuel pump and compare the reading of the flow meter with the specified value.
- Next, adjust the rotating speed of the engine to three times as much as the idling speed and repeat the test mentioned above. If the flux of the fuel pump can not return to the original position immediately, it also shows that the oil pump works abnormally which could lead to the instant failure or the discontinuity of the power. If the value of the internal leakage is larger than 1.2L/min, the steering gear should be repaired.

Precaution: All the tests should be carried out when the engine is hot.

CHECK AND REPLACEMENT OF THE HYDRAULIC POWER OIL

Check the hydraulic power oil

- Repeat turning the steering wheel from one limit position to another when the engine is idling in order to increase the temperature of the power steering oil to 40~80℃
- Check the oil volume left in the oil reservoir, the oil surface should reach “max” mark of the reservoir. When the oil is not enough, please check there is no leakage of all the parts, otherwise fill with the oil to the “max”.



Precaution: It is recommended to use the special machine for vacuumizing the injection when filling with the power steering oil. Otherwise (for example, when the vehicle is repaired). The specifications for filling the power steering oil and exhausting are shown below: fill the oil reservoir with the power steering oil to the maximal position first, and then start the engine at low speed (idling) to drive the steering pump so as the steering system is full of the hydraulic oil. The engine must be kept in idling status to drive the vane pump during refueling and meanwhile refueling continuously to avoid inhaling the air of by the vane due to the fall of the oil level.

Replace the hydraulic power oil

- Lift the vehicle to discharge the oil left in the oil reservoir and backflow hose.
- Keep the engine idling, discharge the oil and meanwhile turn the steering wheel to the end position until there is no hydraulic oil left.

Precaution: All these steps should be finished as soon as possible to avoid damaging the hydraulic power pump.

- Add the power steering oil.
- Discharge the air completely in the hydraulic system.

EXHUAUST OF THE STEERING HYDRALIC SYSTEM

- Check the oil level. Fill with the oil, if necessary.

It should be exhausted as the hydraulic oil in the oil reservoir is emulsionized or the noise of the pump is extremely loud (generally the maximal is 80 dbs) .The steps are shown below:

Lift the vehicle, start the engine and turn the steering wheel left and right to the limit position (Precaution: Do not keep stay on the limit position. If necessary, keep it less than

10 seconds). Repeat this step for several times to discharge all the air of the system from the oil reservoir. Add the hydraulic oil as the oil level descends.

- Keep the engine idling, repeat turning the steering wheel from the left limit position to the right until there is no air bubble and foam in the oil reservoir. If the oil level descends, fill with the oil to the specified value (max).
- The exhaust of this type of vehicle is not easy. Please completely discharge the air bubble left in the system. Otherwise, it would make the abnormal noise in the hydraulic power pump.

CHECK OF THE OUTPUT PRESSURE OF POWER STEERING PUMP

The main purpose of checking the output pressure of the power steering pump is to determine whether there is malfunction in the power steering pump or the steering pinion mechanism. Before checking, in order to measure the output oil pressure of the power steering pump accurately, the oil level of the oil reservoir should reach the normal position and the tension of the drive belt of the power steering pump should conform to the standard.

Measure the output oil pressure of the power steering pump with the pressure gauge which is connected in series with a manual valve in the system. When the engine stopped, remove the pressure pipeline from the power steering pump, connect an end of the pressure gauge with the connector of the pump outlet, join another end of the manual valve with the inlet nozzle of the steering control valve, so the pressure gauge and the manual valve are connected in series in the pressure pipeline of the power steering pump and steering control valve.

Steps for measuring the output oil pressure of the power steering pump are shown below:

- Open the manual valve completely.
- Start the engine and keep it idling.
- Repeat turning the steering wheel from the left limit position to the right for several times until the steering oil temperature reaches 80℃ and ensure that the oil level normal.
- Measure the static oil pressure at the rotating speed is 800r/min. The reading of the pressure gauge is at least 300kPa if the power steering pump functions properly.
- Close the manual valve gradually until the pointer of the pressure gauge keeps stable and get the reading. At that time, the output standard pressure of the power steering pump should be at least 6.2~6.9MPa; The small reading of the pressure gauge shows that pressure of the steering pump is too low which can not effectively complete the steering. That means there are malfunctions in the steering power pump and therefore it should be repaired or replaced.

CHECK OF THE TENSION OF THE BELT

If there is wear, crack or flake on the belt, please replace it in time. For checking the tension, moderate pressure should be applied in the middle of the pulley by thumb and the displacement of the belt should be about 10mm. If the belt is too slack, please go to the nearby service station of Chery to adjust and repair it.

DIAGNOSIS AND TROUBLESHOOTING OF POWER STEERING SYSTEM

The frequent malfunctions of the hydraulic power steering system are the oil leakage, infiltration of air, failure of the power steering pump, and damage of the steering control valve and mechanical transmission mechanism of the hydraulic transmission mechanism. All these malfunctions show in different forms, such as steering heavily, noise, unsmoothness, vibration and so on. When the power steering system is in trouble, please diagnose the failure and eliminate it at once.

Steering heavily

※Malfunction symptom

In general, the steering should be easy for a vehicle with power steering system. If it fails, the steering would be heavy and the steering wheel would be hard to turn.

※Malfunction reason

Generally, it is caused by the invalidation or the insufficient power of the hydraulic power steering system; Damage or improper adjustment of the mechanical transmission mechanism. The specific reasons are shown below:

- The oil reservoir leakage or oil level is lower than the specified value.
- The oil tube connectors is not well sealed, leakage always happens.
- The air enters the steering hydraulic loop.
- The oil tube is deformed; Oil pipeline is blocked; oil pressure or flux of the oil pump is insufficient.
- The tension of the power steering pump driving-belt is insufficient and the belt slides.
- The wear and leakage in the steering pump are serious, which makes the output pressure of the oil pump lower than the standard.
- The pressure regulator oil pump fails, and the output pressure is too low.
- There is internal leakage in the steering control valve and power hydraulic cylinder
- The steering pinion mechanism is damaged or adjusted improperly, steering link system components are bended, and friction force on every ball pin is too large.
- The tire pressure is too low.
- Front wheel alignment is not accurate.
- The vehicle is overloaded seriously.

※Diagnosis and Troubleshooting

- Measure if the tire pressure is normal. If necessary, inflate it according to the specified pressure.
- Check if there is leakage in the oil tube connectors of the steering hydraulic steering system. If there is leakage, screw them tightly. Inspect if there is damage, deformation or crack on the oil tube. If one of the above-mentioned failures is detected, the oil tube should be replaced.
- Check the rotation movement of the steering rack & pinion mechanism at the wheel return position and the other position, if the rotating torque is too large, check the bending of the rack and the adjustment of the rack jacking block. If necessary, adjust the pressure of the rack jacking block or replace the steering rack & pinion mechanism.
- Check if the steering control valve is blocked or returned improperly. Replace it, if necessary.
- Remove and inspect the hydraulic cylinder and replace the damaged components.
- Adjust the ball pins which locate in the connection of the steering transmission mechanism to ensure them run smoothly.

Vibration of the steering wheel as turning

※Malfunction symptom

As the engine works, turn the steering wheel. It vibrates, especially at the limit position.

※Malfunction reason

- The steering oil pump driving-belt slides.
- The oil level is too low in the oil reservoir.
- The air enters the steering hydraulic loop
- The output pressure of the steering oil pump is insufficient.
- The piston of the pressure regulator in the steering oil pump is blocked.

※Diagnosis and Troubleshooting

- Check if the steering oil pump driving-belt is sliding or damaged. If necessary, tighten the tension of the belt or replace it.
- Check if the oil level of the oil reservoir reaches the specified value. If necessary, fill with steering oil.
- Check all the connectors of the steering hydraulic system to see if there is leakage of the steering oil, and discharge the air penetrated into the oil tube.
- Check the output pressure of the steering oil pump. Disassemble the pump when the pressure is insufficient to determine if there is wear or serious internal leakage of the oil pump; the badly leakage or clog of the pressure—limited valve and pressure regulator

piston; Weakening of the pressure regulator spring, damage on the seal components. Find out the malfunctions and eliminate them. If necessary, replace the oil pump.

Steering wheel floating or deflecting when the Vehicle runs straight

※Malfunction symptom

It is difficult to keep the vehicle running straight.

※Malfunction reason

- The steering control valve torque rod is damaged or too gentle to overcome the transmission resistance of the steering gear, which does not enable the valve bush return in time.
- The movement of the valve bush and valve core is clogged due to the unclean oil.
- The steering core of the steering control valve is deviated from the center position.
- The relief piston of the steering pump pressure regulator is clamped which makes the flux of the pump and the pressure difference between the left and right power cylinders too large.
- Clearance of the steering transmission mechanism connectors are too large, the connectors are loose or overworn.

※Diagnosis and Troubleshooting

- First, check if the connectors of the steering transmission mechanism are loose, the clearances of the components are too large, the transmission is slack, in order to eliminate the trouble in the steering transmission mechanism.
- Check if the oil is polluted. If the vehicle is new or repaired or the maintenance and oil-change regulars are not carried out, the oil may be polluted. The polluted oil should be replaced.
- Check the steering control valve. Turn the steering wheel without starting the engine to judge that whether the control valve can open and close smoothly. If there is abnormal, disassemble and check it.
- Finally, check if the pressure regulator of the steering pump works normally and the relief piston is clogged. If necessary, measure the output pressure of the steering pump and then judge it.

Steering noise

※Malfunction symptoms

There is abnormal noise when the vehicle turns.

※Malfunction reason

The noise in the steering system when the vehicle turns is normal; the noise in the early

2~3min, which appears in the steering pump is normal when the engine is started in cold weather (20°C or even colder). But when the noise is abnormal and the turning performance is affected, the noise can be considered as malfunction. The reasons are shown below:

- The looseness of the steering transmission mechanism causes the abnormal turning noise.
- The power steering pump is damaged or overworn or air is mixed into the liquid which causes the loud noise.
- The power steering pump driving belt pulley is loose or the belt sliding which causes the loud noise.
- The performance of the steering control valve is poor.
- The oil tube connector is loose or the oil tube is broken.
- The oil-filter strainer is blocked or there are too much sediments in the hydraulic circuit.

※Diagnosis and Troubleshooting

- If there is sound of “click” when the vehicle turns, maybe the steering column connector, tie rod or ball joint loose. These components should be checked. If necessary, tighten them or replace the damaged one; if the vibration of the steering column shaft is obvious, replace the steering column assy; if the steering gear is installed too loose, tighten it; lubricate the connecting sections where are necessary. In addition, if the steering pump driving belt is loose it will also make a sound of “click”. Therefore, the steering pump belt wheel should be checked if it is loose. If necessary, screw tightly or replace it to clear up the noise failure.
- If there is sound of “quack-quack” when the vehicle turns, especially when the steering wheel is turned from one limit position to another which may be caused by the sliding of the power steering pump. Check the tension and the wear status of the driving belt, then tighten or replace it depending on practical situation.
- If there is sound of “cluck” from the steering pump when the vehicle turns, the reason maybe the air bubbles in the oil which cause the pneumatic noise as the oil flows. First, check the oil level. If it is too low, fill the oil reservoir with oil to the proper position to check and eliminate the leakage failure. Then, check if the hose is broken, or the clamp is loose which the air would enter the system. Replace the broken hose or the clamp, if necessary. After confirming that the air entered the liquid of the power steering system, discharge the air from the power steering system to eliminate the pneumatic noise. If there is sound of “hiss” or scream from the steering pump, and there is no air leakage in the hydraulic system, the tension of the driving belt is normal, it shows there is block in the oil pipeline or the oil pump is overworn and damaged. Repair or replace it.
- There is sound of “hiss” when the steering wheel is in limit position or turning slow in spot. If the noise is extremely abnormal, the performance of the steering control valve may be incompetent. The control valve should be replaced and compared to eliminate the failure.

PRECAUTION OF STEERING SYSTEM MAINTENANCE

Caution: The steering gear is an important danger-proof component which can affect the driving security. If failure appears during use, the vehicle should be sent to the service station designated by Chery; the company is not responsible for the accidents due to self-disassembling, self-maintenance and improper operation.

- The peak rate of flow in the system could not exceed 10L/min, maximal working oil pressure could not exceed 8Mpa at any time.
- After the new steering gear has run for about 2500km, it is required to change the hydraulic oil and clean the strainer in the oil reservoir. Thereforth, change the oil and do the clean of every year or 50000km.
- Check the tire regularly and keep the tire pressure meets the specification.
- If the improper clearance , block or yawing appears, find out and analyze where the failure locates in the steering transmission system, power steering system or steering link system and then resolve it.
- Check regularly if the components of the steering system bear the improper impact. Replace the damaged ones in time.
- Do not weld the components of the steering gear and system rod in any means.
- Be sure not to touch, knock or wear the tube during use. Each segment should be smooth, and no knots.
- Check the hydraulic oil every month to determine whether it is decreasing, deteriorating or polluted. The oil should be changed at once when the problem is detected. The No. of the new added hydraulic oil should be as same as the origin. Mixture is forbidden.

Adding oil of the steering system

- Hydraulic oil for the steering system

Working oil: ATF DEXRON II

Substitute oil: No.8 hydraulic transmission oil.

Caution: One steering gear can be refueled with only one kind of oil mentioned above. It will lead to oil seal damage and leakage if unauthorized oil is used. Consequently, the steering power will fail.

- Adding oil of the steering system
- Fill the steering oil reservoir with the specified hydraulic oil. Keep the engine idling, turn the steering wheel to the left and right limit position (Do not keep the steering wheel stay at the limit position more than 5 seconds), and continue to refuel the oil reservoir with the hydraulic oil until the oil level do not decline and no air bubbles appear. The oil level should reach the half height of the filter core.

- After refueling, check if there is leakage in every component.

Precaution: Keep the impurities away from the system when refueling.

Caution: Dead steering (i.e. turning the steering wheel to the limit position) is forbidden during use. Even if necessary, do not keep the steering wheel stay at the limit position more than 10 seconds. If the minimum turning radius tests in the general assay test drive ground to detect the interference, it is also forbidden to do so. When the steering wheel is turned to the limit position and the louder noise comes from the power steering pump, you can turn the steering wheel back a little until the noise disappears. It is forbidden to run the power steering pump without oil. If the steering is suddenly heavy during use, park the vehicle to check and repair.