

MAINTENANCE OF STEERING SYSTEM

Specification and Repair Data of Steering System	VII-2
On-Board Inspection of Steering System	VII-3
Removal and Installation of Steering System	VII-5
Troubleshooting of Steering System	VII-8

Specification and Repair Data of Steering System

Composition of Steering System

Steering system is composed of steering wheel, steering column, steering shaft lower body assembly, steering gear, track rod and power steering mechanism.

Specification of Steering System:

Description	Specification
Steering gear	Integral, recirculating ball and power steering gear
Oil	ATF fluid
Power Steering pump	FP4 blade pump
Steering oil bowl	0.445L
Steering column	Adjustable energy absorption

Inspection and Repair Data of Steering System

Description	Specification
Steering angle - inner wheel	32.2°
Steering angle - outer wheel	28.2°
Steering gear fluid level	25mm
90N acting force of belt tension	New belt 7.0mm; Old belt 9.0mm
Tightening torque of steering gear and frame girder	64±6 N.m
Follow-up arm fixing bolt	64±5 N.m
Steering oil pipe and steering gear joint seal bolt	25±3 N.m
Hose and steel pipe joint seal bolt	34±2 N.m
Drag rod and rocker arm connecting nut	70~78 N.m
Drag rod and follow-up arm connecting nut	7
Drag rod and knuckle arm	7
Toe-in regulating nut	80±5 N.m
Steering wheel lock nut	40±2 N.m
Steering lower shaft connecting nut	25±2 N.m

Lubricant Specification

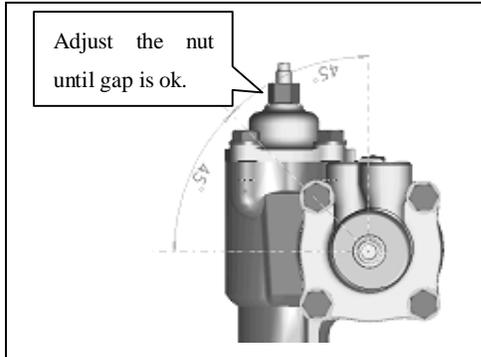
Description	Stipulated Lubricant	Quantity
Steering fluid	ATF	1.5L
Universal joint and spline shaft grease	Lithium grease	a bit

On-Board Inspection of Steering System

Inspection of Steering Wheel Backlash

Inspection of Steering Wheel Backlash in Power Steering System:

Standard value of steering wheel is 30mm. The method is as follows: Keep the engine running at a fixed speed and the steering wheel facing right forward position, and apply a force 4.9N to the steering wheel along the its circumference.



Inspection of Steering Pinion Backlash

The standard value of steering pinion backlash is 0.5mm. Make regulation as shown in the Fig. if the value exceeds the

Measurement of Axial Backlash of Ball and Trunion Joint

Use as special tool to hold the ball and trunion joint, adjust the scale on the special tool to the upper limit, press the ball protrusion and check the axial backlash is within the upper and lower limit graduations. Its limited value is 1.5mm. Replace the ball head if the measured value exceeds the limit value.

Inspection of Steering Angle

The inner wheel steering angle is 32.2 degree max, and the outer wheel steering angle is 28.2 degree. Check the toe-in and adjust the steering limiting screw if measured value is not in the stipulated range.

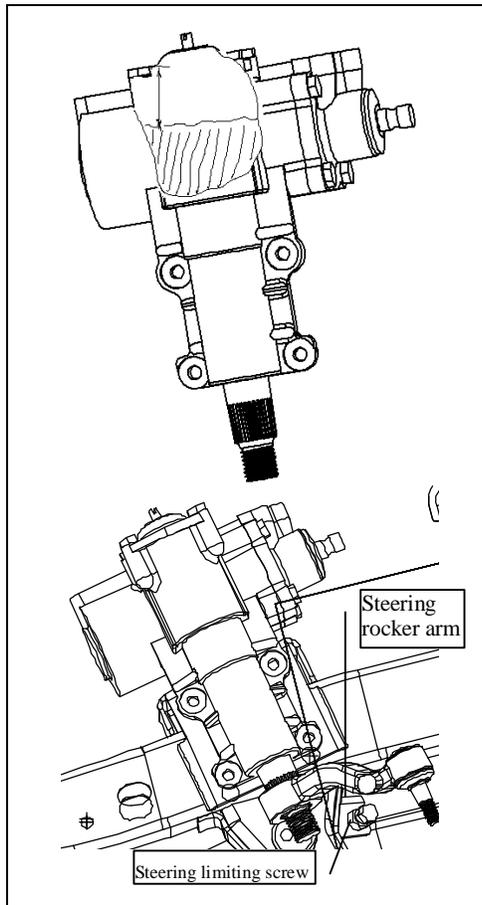
Inspection of Standstill Steering Force (Power Steering)

Park the vehicle correctly, adjust engine speed to 1000r/min, and take care to check that the engine speed returns to standard idle. Clockwise and counterclockwise rotate the steering wheel for 1.5 turns, and measure with a spring balance and in the tangent direction. The standard value is below 37N. Or check the steering belt for looseness and pipeline for oil shortage, mixed air and blocked passage.

Inspection of Steering Wheel Return Center (Power Steering)

(1) Conduct light turn and sharp turn, and check there is no obvious difference in all the used leftward and rightward steering force and steering wheel return center.

(2) Drive the vehicle at a speed of 35km/h, clockwise or counterclockwise turn the steering wheel for 90°, and then release the steering wheel for 1~2s. If the steering wheel return for above 70°, it is OK. When the steering wheel is turned suddenly, there may be a feeling of heavy drive for a short time. This is not a trouble, but the oil pressure is too low during idling of oil pump.



Inspection of Steering Gear Fluid Level (Power Steering)

Inspect the fluid level of power steering system. Park the vehicle on a level ground, start the engine, turn the steering wheel several times to increase the oil temperature to 50-60 edging case of engine running, turn the steering wheel to left and right fully, and repeat this operation for several times, check the oil bowl for foamed or emulsion-like fluid. Check the hydraulic difference when the engine stops running. If the fluid level difference is very big, expel the inside air. During air bleeding, jack up the front wheel, and support it firmly with a rack, turn the steering pump belt for several times, and manually turn the steering wheel to left and to right fully, and repeat this operation for 5-6 times. Check that the fluid level is within the range of 5mm during stop and running of the engine. If the variation is excessive, it means that the air is not expelled completely from the system. (as shown in the Fig.)

Replacement of Fluid (Power Steering)

When adding oil to the steering gear, select the power steering fluid according to the requirement and fill it into the oil bowl.

Air Bleeding of Steering System

Jack up the front axle, turn steering wheel to left and to right for several times, and then add oil. Start the engine and run it at idle speed, turn the steering wheel to left and to right fully for several times (full travel), and then add oil to the oil reservoir. Rotate the steering wheel until there is no bubble in the fluid and the fluid level does not drop.

Inspection of Belt Tension

Vehicle Type	During Inspection (mm)	With New Belt Installed (mm)	With Old Belt Installed (mm)
6473G	98N	5.5~7.5	7.5~8.5
6473Y2	98N	5.0~7.0	7.0~8.0
6473Y3	98N	5.0~7.0	7.0~8.0

Inspection of Oil Pump Pressure

Check the oil pump safety pressure. Disconnect the pressure hose, and then connect the special tool. Expel the air, and then in standstill status of the vehicle, turn the steering wheel for several times to increase the oil temperature to about 50~ 60°C. Start the engine, and run it at idle speed of 900~1100r/min, fully close the cut-off valve of oil pressure gauge, measure the oil pressure safety pressure, and make sure that it is within the standard range which is 7.5~8.2Mpa. Attention should be paid to that the cut-off valve of oil pressure gauge should not be closed continuously for more than 10s. If the measured value is not within the stipulated range, overhaul the oil pump. Remove special tool, tighten the pressure hose to stipulated torque, and expel the air from the system.

Inspection of oil pressure at idles. Disconnect the pressure pipe from the oil pump oil pump, then connect the special tool, expel the air, and then in standstill status of the vehicle, turn the steering wheel for several times to increase the oil temperature to 50~ 60°C. Start the engine, and run it at idle speed of 900~1100r/min, check that oil pressure, with no load and with the cut-off valve of oil pressure gauge not fully opened, is within the range of 0.8~1.0MPa standard value. If the measured value is not within the stipulated range, the oil line or the steering gear case is abnormal and it is necessary to check and repair these parts. Remove special tool, tighten the pressure hose to stipulated torque, and expel the air from the system.

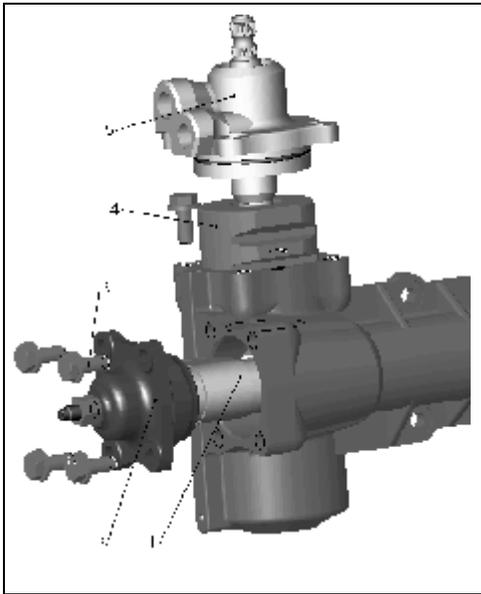
Check pressure maintaining of steering gear by following the above method, full close and open the cut-off valve of oil pressure gauge, turn the steering wheel to left and to right fully, and check that the maintained pressure is with the range of standard value. The standard value is 7.5~8.2MPa. If the measured value is not within the stipulated range, inspect and repair the steering gear case.

Removal and Assembly of Steering System

1. Disassembly and Removal of Recirculating Ball Steering Gear

Caution:

- (1) The steps and methods of disassembly, inspection, return for repair and assembly of the main parts and assemblies in power steering gear are described in the following: Before disassembly, refer to the trouble diagnosis to determine the trouble location. Do not disassemble the part or unit which is not related to the trouble as possible to prevent them from any new damage. Do not disassemble the parts and assemblies which are not allowed to be disassembled in this manual.
- (2) During inspection and repair of power steering gear, it is very important to keep the rack, tool and parts and assemblies clean at any time.
- (3) When power steering gear is assembled or removed on the vice, the vice mouth must be protected at any time. During assembly, unless otherwise specified, all the units are lubricated with power steering fluid.



Disassembly and Removal Steps

- (1) Remove the steering gear as per the Section "Removal of Steering Gear"
- (2) Exhaust the power steering fluid, install the steering gear to the vice with rocker arm shaft spline end downward. Clamp the unprocessed portion on the power steering gear case on the vice, and turn the steering shaft until the rocker arm shaft is located at the middle position of steering.
- (3) Remove four fixing bolts (3) from side cover (2), lightly tap end rocker arm shaft (1) with a sharp-tipped plastic hammer and pull out the rocker arm shaft and side cover assembly from the case.

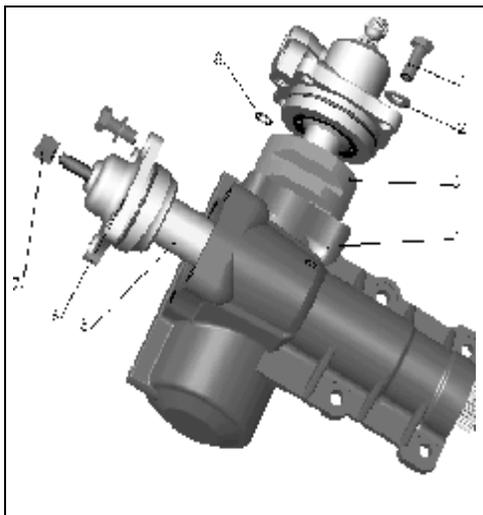
Caution:

- Usually do not disassemble the gear shaft-side cover assembly. If necessary, clamp the assembly on a vice, use a screwdriver to hold the adjustment screw, and then use a box-head spanner to turn the lock nut of Type I non-metal imbedded part until the side cover is separated from the adjustment screw. (Clamp the nonoperating face of the side cover.)
- (4) Remove the four fixing bolts from case assembly (5), and take off the case-bolt and nut assembly from the case.
 - (5) Counterclockwise turn the case assembly and screw it off the steering nut (4). Pour out the steel ball from the steering nut, and check the steering nut for any remaining steel ball. Count the number of steel balls and ensure that 24 steel balls in total are placed on the paper.

Repair of Steering Gear

- (1) When oiling of steering gear is necessary due to repair or other reason, add stipulated power steering fluid. Do not use any other power steering fluid or the fluid mixed with others.
- (2) Oil change in steering gear is conducted after the vehicle travels for the first 3,000km, and every 20,000km thereafter.
- (3) During repair of steering gear, tighten all the connecting parts to the stipulated tightening torques respectively.
- (4) Periodically check the steering system once every 5,000km at least:
 - All the connecting parts are not loose with the stipulated torque range, and all the ball studs are free from looseness.
 - Steering function is normal.

- (5) Periodically check the oil level in oil reservoir once every 5,000km at least. If the oil fluid fails to reach the stipulated level, add oil to the oil reservoir by using the above method of oil filling and air expelling.
- (6) The steering wheel can not stay at its steering limit position more than 5s to prevent the steering pump from damage.
- (7) When replacing steering gear, take care to the following:
 - Do not damage the installation face;
 - Do not damage any of the connecting parts.
- (8) It is not allowed to disassemble the steering gear personally, the disassembly of steering gear should be carried out by the person trained in repair station.



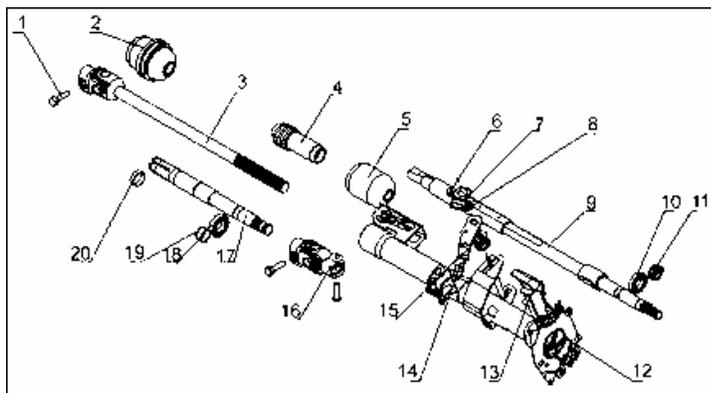
Assembly of Steering Gear

Caution: Strictly conduct the following adjustment according to stipulated procedure and order to prevent the parts and units of steering gear from damage and the steering gear from bad sensitivity.

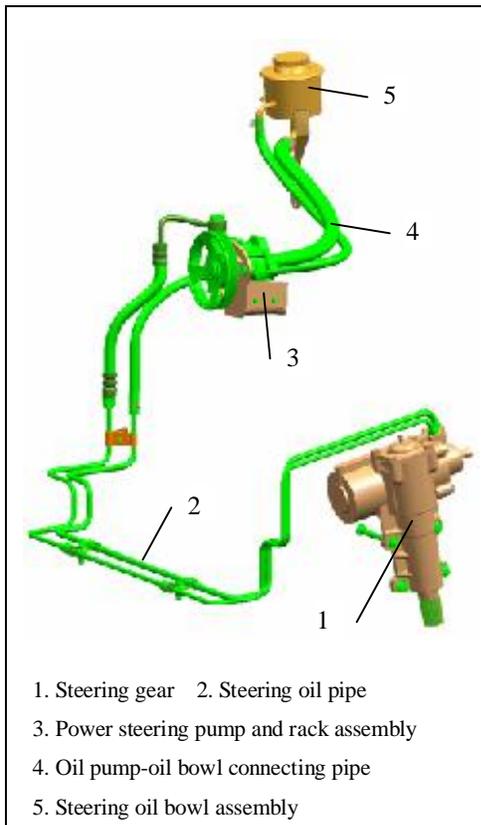
- (1) Lubricate all the mating faces with power steering fluid.
- (2) Check the small seal ring ⑧ in the ring groove on the filler of upper case for existence, and use a bit of grease to stick the seal ring to the groove wall firmly.
- (3) Align the steering nut intermediate rack to the rocker arm shaft bearing hole center, align the oil hole in the upper casing to that in the lower casing, then install the casing-bolt-nut assembly ③ into lower case assembly ④, and secure them by tightening four screws ① (GB/T5783-1986 M10×1.25×25) and four washer ② (GB/T93-1987 10) to the torque 45 N·m~53.9N·m. Locate the rack center toothed groove of steering nut at the center of casing output shaft.
- (4) Check the O ring on side cover of side cover assembly ⑥, and replace if seriously worn. Lubricate this O ring with steering fluid, assembly the side cover assembly and toothed sector shaft assembly ⑤ together, then insert them into the well assembled lower case assembly, align the toothed sector center tooth to mesh with rack center groove. Then fix the side cover onto the lower casing firmly by tightening four screws ① (GB/T5783-1986 M10×1.25×25) and four washers ② (GB/T93-1987 10) to the torque 45 N·m~53.9N·m. Install the lock nut ⑦ of Type I non-metal embedded part, and do not tighten it at this time.

2 Repair of Steering Linkage

Disassembly of steering linkage is as shown in the Fig.:



- | | |
|-------------------------------------|-----------------------------------|
| 1 Assembly bolt | 11 shaft elastic retaining ring |
| 2 Universal joint sleeve 1 | 12 shaft elastic retaining ring |
| 3 Spline shaft and fork welded part | 13 Mount assembly |
| 4 Shrinkage sleeve | 14 Lock handle assembly |
| 5 Universal joint sleeve | 15 lock block |
| 6 Assembly bolt | 16 Universal joint assembly |
| 7 Limiting plate | 17 Intermediate mounting assembly |
| 8 Hexagon flange nut | 18 Deeply grooved ball bearing |
| 9 Steering shaft assembly | 19 Shaft elastic retaining ring |
| 10 Upper bearing | 20 Spring clip |



3 Repair of Steering Gear System

Caution for Assembly of Power Steering Pump

- (1) Remove and install the power steering pump as shown in the Fig. Before removal, expel the power steering fluid. And after installation, add power steering fluid, adjust belt tension, and expel the air from the power steering oil line.
- (2) Expel the steering oil from the steering hose before removal, and add steering fluid and expel the air after installation.

Troubleshooting of Steering System

Trouble Diagnosis of Power Steering Gear

S/N	Trouble	Cause	Remedy
1	Steering gear generates hissing sound.	The hissing sound from the power steering system is normal. It is obvious during stopping. This noise is not related with the steering performance. This hissing sound occurs when the steering wheel is at limit position or when the steering wheel is turned slowly.	Lightly hissing sound is normal and does not affect the steering performance.
2	Steering gear generates cricking and cracking sound.	(1) Steering gear and rack are loose. (2) Steering linkage is loose. (3) Pressure hose is collided with other parts on vehicle. (4) Toothed sector shaft of steering rocker arm is too loose. Note: It is normal that light creaking sound is generated during steering. Do not adjust the gap to beyond the stipulated range to eliminate the light creaking sound. (5) Steering rocker arm is loose.	(1) Check steering gear fixing bolts, and tighten them to the torque of $64\pm 6\text{N}\cdot\text{m}$. (2) Check the drag rod joint for wear, and replace when necessary. (3) Adjust hose position. (4) Adjust toothed sector shaft. (5) Tighten rocker arm nut as per stipulation.
3	During steering or aligning, steering gear generates shrilling sound, and steering wheel aligning performance is poor.	(1) Damping O ring on valve is broken. (2) Lubrication of leverage ball stud is not sufficient. (3) End faces of lower connecting flange and steering gear are worn. (4) During straight running, the steering gear and steering wheel are at central position. (5) Front wheel alignment is incorrect. (6) Steering leverage is seized. (7) Kingpin ball joint is stagnated. (8) Steering wheel and housing is in friction. (9) Steering shaft bearing is overtightened or stagnated. (10) Valve body is seized or blocked. (11) Steering gear is overadjusted. (12) Oil return hose is torsioned or blocked.	(1) Replace valve body assembly. (2) Lubricate leverage joint. (3) Loosen clamping bolt, and install correctly. (4) Adjust to the center position. (5) Check and adjust when necessary. Place the front wheel on the front wheel aligner, and disconnect the toothed sector shaft. Manually turn the front wheel. If the wheel does not rotate or is turned with much force, check steering leverage joint for seize. (6) Replace joint. (7) Replace kingpin ball joint. (8) Center the housing. (9) Replace the bearing. (10) Remove, cleaning or replace valve body. (11) Take off steering gear from vehicle and check and adjust according to the requirement. (12) Replace hose.
4	Off-set drive (In consideration of road condition and wind factor, conduct trial running on flat road and from two directions).	(1) Front wheel alignment is corrected. (2) Valve is imbalanced. Note: If it is caused by this reason, the steering force used in the off-set direction is very light, but the force used in the opposite direction is normal or too great.	(1) Adjust as per stipulation. (2) Replace rotary valve assembly.
5	Steering force increases instantaneously when steering wheel is quickly turned to left or to right.	(1) Oil level is low. (2) Pump belt is slipped. (3) Oil pump leaks excessively. (4) Steering gear leaks excessively.	(1) Add power steering fluid according to the requirement. (2) Tension or replace belt. (3) Check pump pressure (pressure test needed). (4) Repair steering gear.

S/N	Trouble	Cause	Remedy
6	When engine is running, steering wheel is quivering or vibrating during steering, especially during steering in original place.	(1) Oil level is low. (2) Pump belt is loose. (3) Steering leverage is collided with engine. bottom casing at limit position. (4) Pump pressure is not sufficient. (5) Pump flow control valve is seized.	(1) Add oil according to the requirement. (2) Adjust tension as per stipulation. (3) Correct gap. (4) Check pump pressure (pressure test needed). Replace the pressure valve if damaged. (5) Check for gluing and damage, and replace flow control valve when necessary.
8	Steering gear leaks.	(1) Oil pressure is too high. (2) Steering gear leaks.	(1) Replace oil pump. (2) Repair steering gear.
9	Steering gear output pressure is low.	(1) Pressure drops due to worn steering nut seal ring or severely worn casing inner cavity. (2) Seal ring between valve sleeve and valve body is damaged.	(1) Take off steering gear from vehicle, and remove and check nut seal ring and casing inner cavity. (2) Take off steering gear from vehicle, and remove and replace seal ring.
10	Power steering fluid generates emulsified foam.	Oil is mixed with air.	Expel air.