

Rear Axle Assembly

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Chapter I Introduction of Rear Axle Structure

I. General description of the structure

Types of Rear Axle Structure (Table 1)

Item	Content
Type of axle case	Press-welding integral type
Type of axle shaft support	Full floating type
Type of reduction gear	Single-stage hypoid spiral bevel gear
Number of planetary gears	4 planetary gears
Rated axle load	4 tons
Maximum output torque	8500N·m

This series of rear axle is the drive axle for two-wheel drive vehicle, and the rear suspension is of the rigid-axle type suspension structure. It is composed of the final gear, differential and axle case etc., which is the final reduction and driving mechanism in the automotive power transmission system. The final gear can both change the power transmission direction, and reduce the rotation speed and increase the torque. It is composed of the drive gear and the driven gear. The end with spline of the drive gear is jointed to the propeller shaft universal joint assembly through the drive gear flange, and the middle of it is supported by two conical bearings which are installed in opposite direction, so as to bear the axial force and the tangential force. The small face neck of the drive gear is installed on the conical roller bearing, which only bears the radial force. The driven gear is fixed on the differential left casing by the bolts.

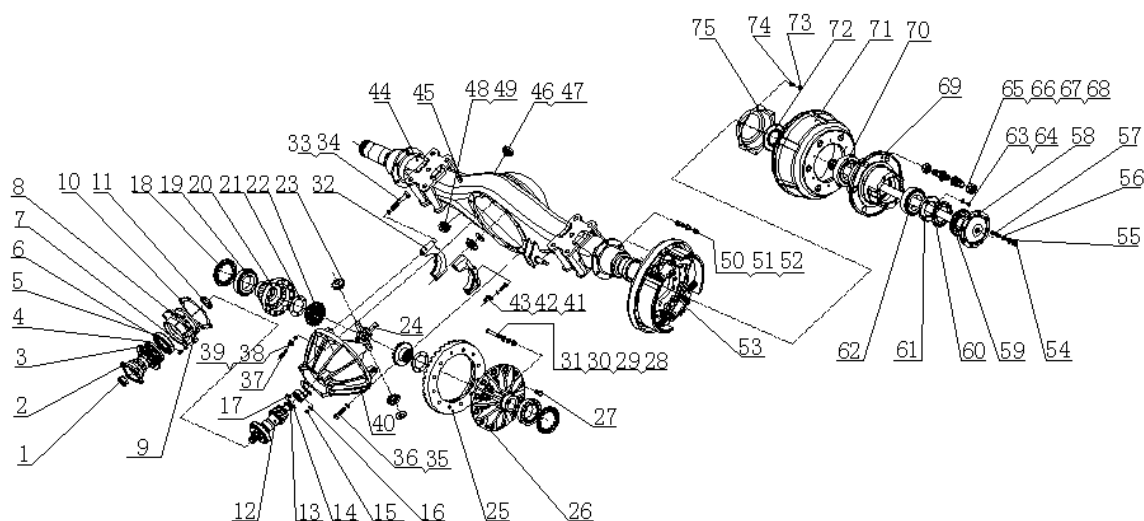
Differential allows the left wheel and the right wheel to generate different rotation speed, it is composed of such components as the differential right casing and left casing, cross shaft, four planetary gears, and two axle shaft gears etc.

One end of the rear-axle shaft is jointed to the axle shaft gear with spline, the flange on other end is connected to the hub and brake drum assembly by the bolts.

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II. Explosion diagram and details of rear axle assembly:

1.	Drive gear flange self-lock nut	2.	Drive gear flange	3.	Dust fender	4.	Oil seal-drive gear
5	Drive gear inner and outer bearing	6	Bearing seat bolt	7	Spring washer	8	Drive gear bearing seat
9	Adjusting washer-bearing seat	10	O-ring	11	Compressible spacer	12	Drive gear
13	Guide bearing spring collar	14	Guide bearing guard assembly	15	Type 1 Hex nut	16	Spring washer
17	Drive gear guide bearing	18	Differential bearing adjusting nut	19	Differential bearing	20	Differential casing (right)
21	Axle shaft gear thrust washer	22	Axle shaft gear	23	Planetary gear	24	Planetary gear shaft
25	Driven gear	26	Differential casing (left)	27	Bolt-driven gear	28	Bolt-differential casing
29	Nut-differential casing	30	Spring washer	31	Flat washer	32	Bearing cap
33	Bearing cap bolt	34	Spring washer	35	Reduction casing bolt	36	Spring washer
37	Reduction casing bolt	38	Reduction casing nut	39	Spring washer	40	Final drive casing
41	Hex bolt	42	Locking plate-adjusting nut	43	Spring washer	44	Rear axle casing assembly
45	Normally open vent plug	46	Filler plug	47	Filler plug sealing ring	48	Drain plug
49	Drain plug sealing ring	50	Find thread hex bolt	51	Type 1 fine thread hex nut	52	Spring washer
53	Rear brake assembly (left and right)	54	Axle shaft nut	55	Taper sleeve	56	Spring washer
57	Axle shaft bolt	58	Axle shaft	59	Axle shaft oil seal	60	Lock washer
61	Bearing nut	62	Rear hub outer bearing	63	Hex bolt	64	Spring washer
65	Tyre bolt	66	Tyre outer nut	67	Tyre inner nut	68	Rear hub inner nut
69	Rear hub	70	Rear hub inner bearing	71	Rear brake drum	72	Rear hub inner oil seal
73	Hex bolt	74	Spring washer	75	Oil catcher		



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III. Sealant and Adhesive Applied on Rear Axle (Table 2)

Item	Specified sealant and adhesive
Installation surfaces of the rear axle casing assembly and final reduction assembly	515 Anaerobic sealant
Driven gear bolt	GY-340 Anaerobic sealant
Differential casing bolt	GY-340 Anaerobic sealant
Reduction casing bolt	Mechanical sealant 605
Hub inner cavity	ZL-2 GB5671-85 Automobile General purpose Lithium Base Grease.
Installation of the final reduction assembly components	No. 10 motor oil

VI. Detailed List of Rear Axle Wearing Parts (Table 3)

Description	Quantity
Drive gear oil seal	1
Rear hub inner oil seal	2
Rear hub inner bearing	2
Rear hub outer bearing	2
Drive gear inner bearing	1
Drive gear outer bearing	1
Axle shaft oil seal	2
Drive gear nut	1
Differential bearing	2
Left and right plate friction lining	2 pieces for each
O-ring	1
Drive gear, bearing seat adjusting washer	According to actual need

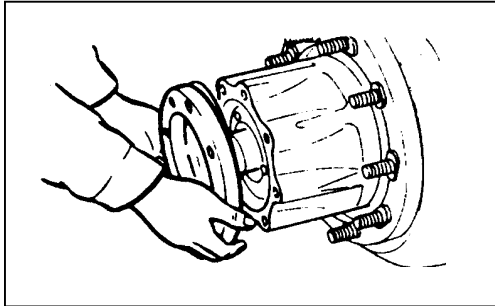
Rear Axle

V. Table of Main Bolts Tightening Torque (Table 4)

Bolt (nut) Name	HF15015 (N.m)
Drive gear nut	250~280
Drive gear bearing seat bolt	75~113
Bolt –driven gear	108~161
Differential casing bolt	45~79
Reduction casing bolt	45~79
Guide bearing guard plate bolt	16~26
Bearing cap bolt	122~185
Adjusting nut locking plate bolt	16~26
Rear brake back plate nut	78~115
Axle shaft bolt	45~79
Hub inner nut	287~346
Lock washer small hex bolt	6~12
Filler plug	44.1~53.9
Drain plug	44.1~53.9

Chapter II Disassembling, Inspection and Reparation of Rear Axle

I. Disassembling

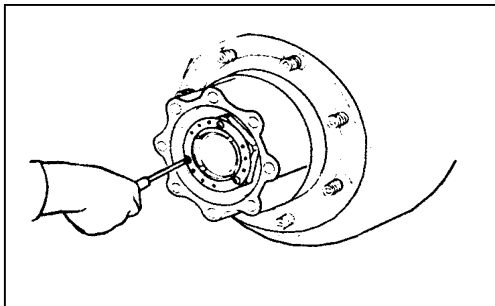


Remove the rear axle

1. Put wooden wedges under the wheel in the front and behind, to hold the wheel in position.
2. Loosen the wheel nuts of the outer side wheel.
3. Jack up the rear axle.

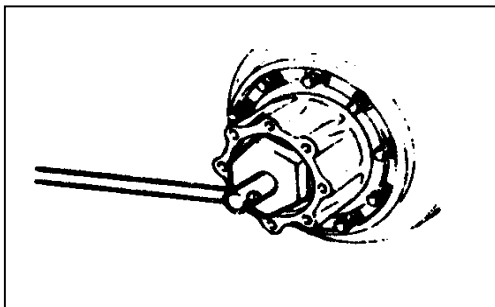
Remove the axle shaft

1. Loosen the axle shaft nuts.
2. Remove the axle shaft. If it is difficult to remove the axle shaft, use copper hammer to slightly knock on the axle shaft flange, until the axle shaft is loosen off.



Disassemble the wheel hub

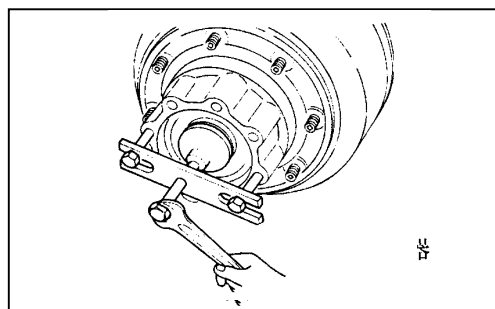
1. Remove the lock washer.



2. Remove the nub bearing lock nut.

Note:

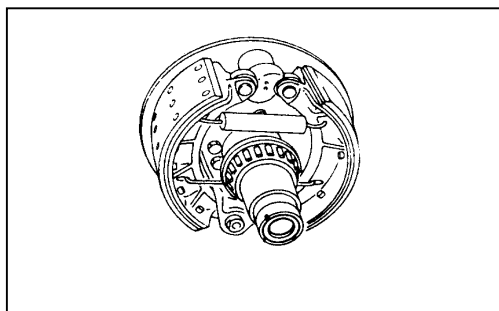
Use the hub bearing adjusting nut spanner to remove the adjusting nut.



3. Remove the wheel hub assembly.

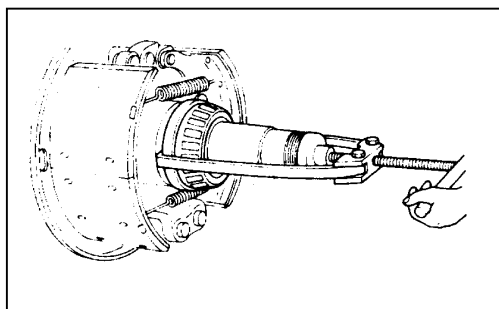
Note: use rear hub extractor, to remove the hub.

Rear Axle

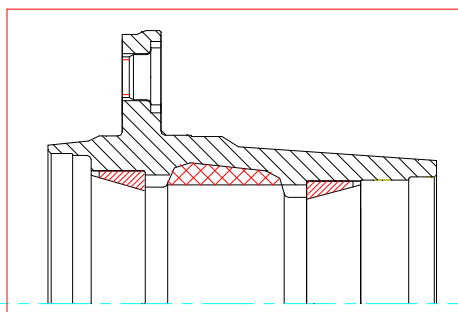


4. Remove the axle shaft oil seal from the end of the axle sleeve.

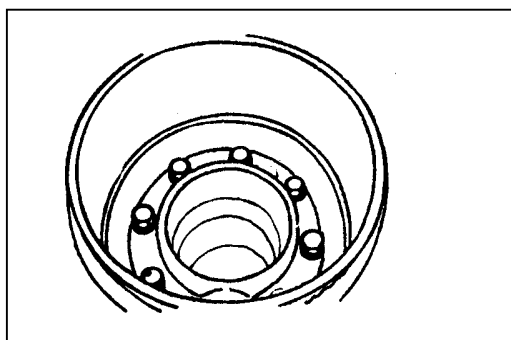
Note: when assembling, the outer ring of the axle shaft oil seal shall be applied with lithium base grease and then pressed into the rear hub.



5. Remove the oil seal from the hub assembly.

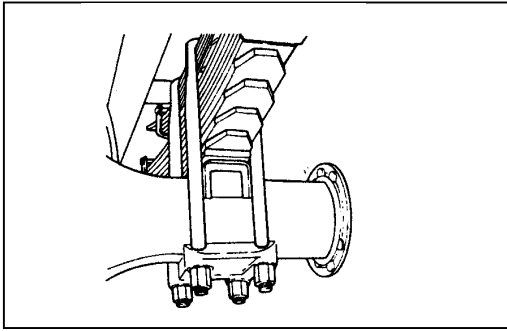


6. Remove the bearing cup of the inner and outer bearing.



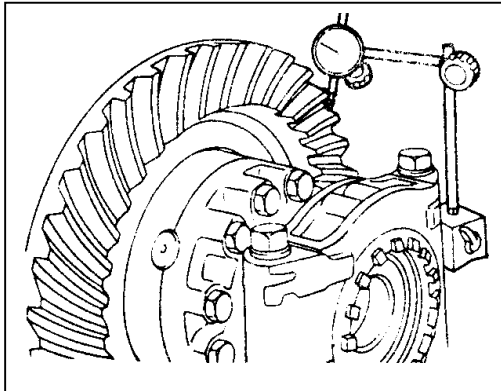
7. Remove the brake drum and oil retainer.

Rear Axle



Disassemble the axle case and the final reduction gear

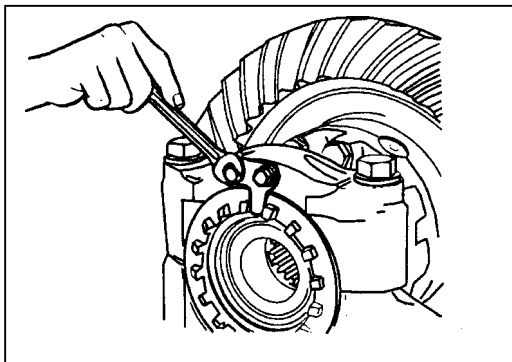
- 1) Bleed out the final reduction gear lubricating oil.
 - 2) Disassemble the connection between the propeller shaft and main reduction gear.
 - 3) Use jack to remove the final reduction gear assembly.
 - 4) Remove the hose, steel pipe, and wire cluster.
 - 5) Remove the brake assembly.
 - 6) Remove the rear axle.
- Jack up the axle casing.
 - Remove the U bolt and upper and lower base plates, lower down the jack, and pull out the axle casing.



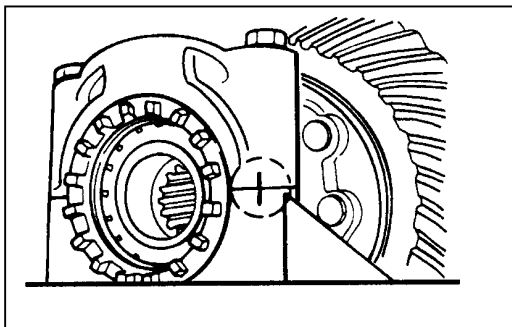
Disassemble the main reduction gear assembly

- 1) Before disassembling, measure and record the tooth clearance of the drive gear and the driven gear.

Note: After adjustment, check the engagement of the gears.



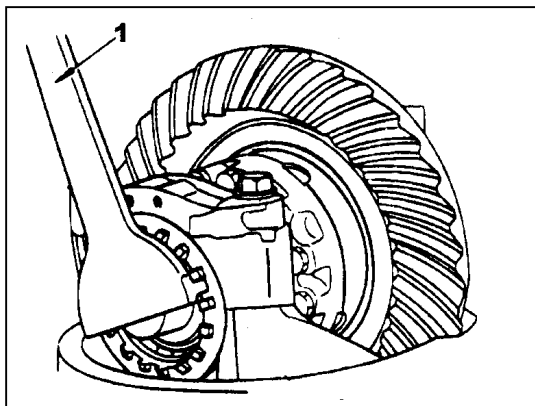
- 2) Remove the locking plate;



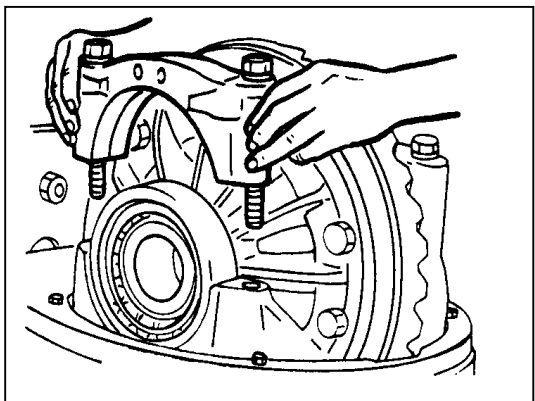
- 3) Make assembly marks on the bearing cap and casing;

The disassembled bearing cap and reduction casing shall be placed separately per left and right according to the matching number, in order to avoid mismatching during re-assembling.

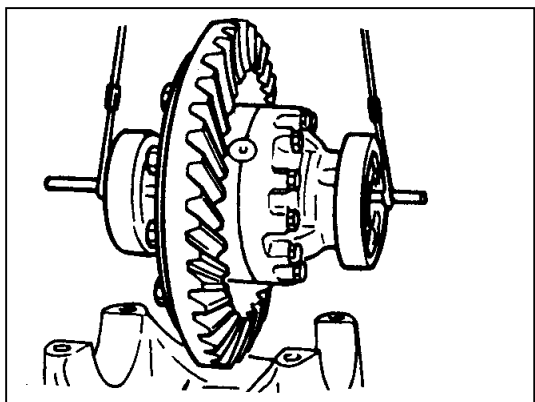
Rear Axle



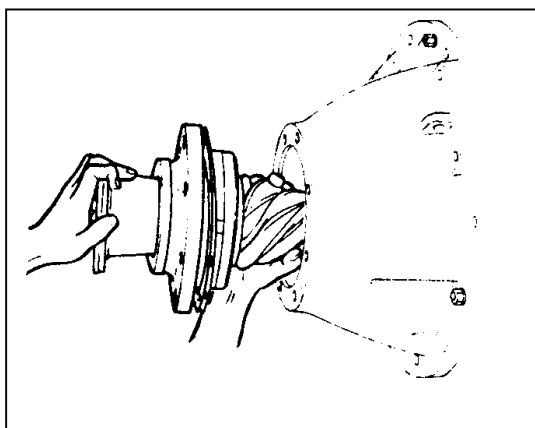
4) Loosen the fixing bolts of the bearing cap, use differential spanner to remove the adjusting nut;



5) Remove bearing cap and bolt;

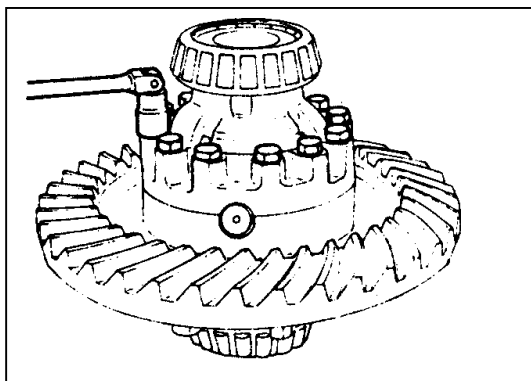


6) Remove the differential assembly;



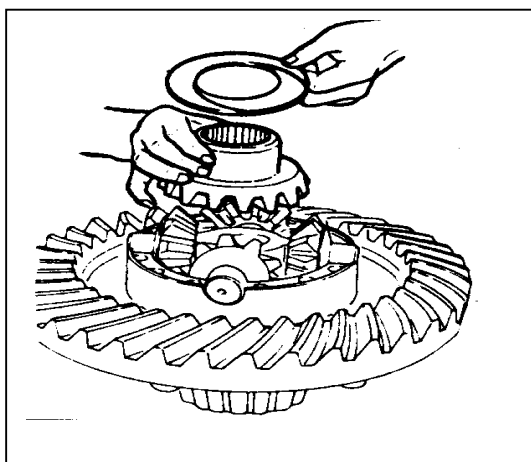
7) Use stripper to remove the drive gear assembly, at the same time remove the adjusting washer;

Rear Axle

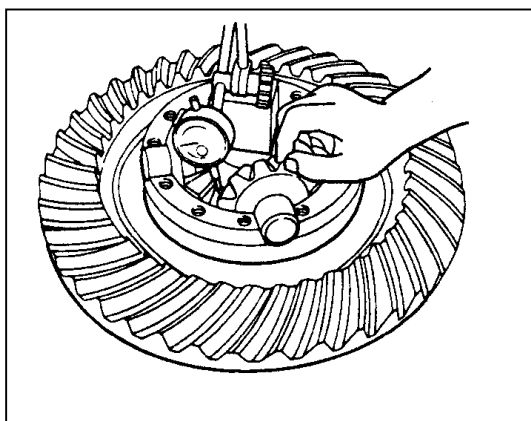


Disassemble the differential assembly

1) Remove the differential right casing;

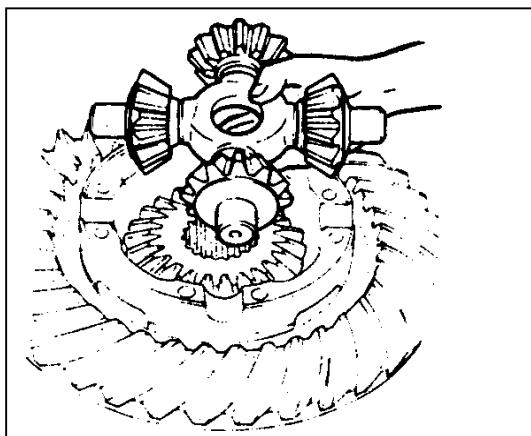


2) Remove the axle shaft gear and washer;



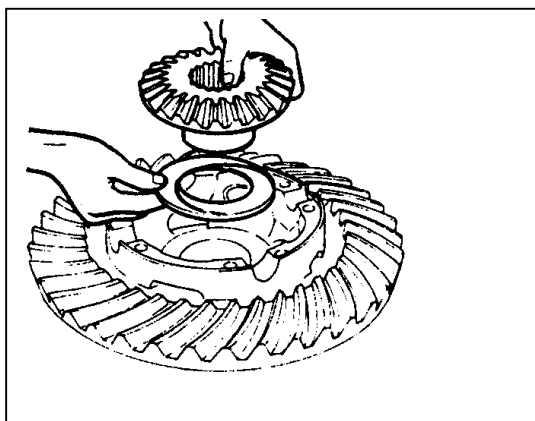
3) Measure and record the tooth clearance of the planetary gear;

Note: when measuring the tooth clearance, make sure to press down the planetary gear cross shaft.



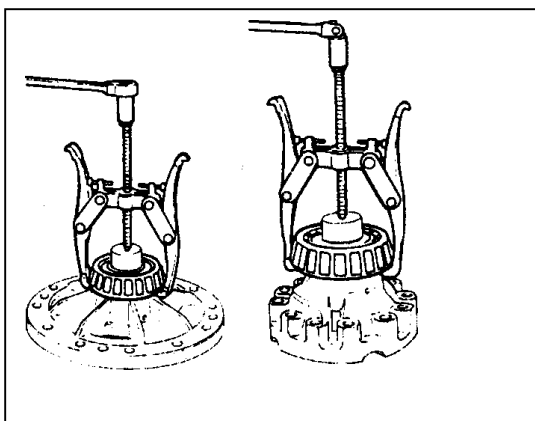
4) Remove the planetary gear cross shaft assembly, and then remove the planetary gear and washer from the cross shaft;

Rear Axle

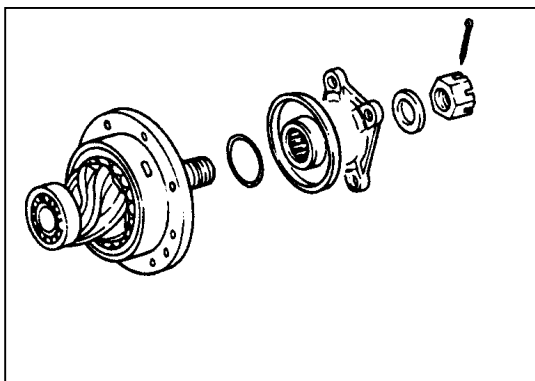


5) Take out the axle shaft gear and the thrust washer on the axle shaft;

6) Remove the driven gear;

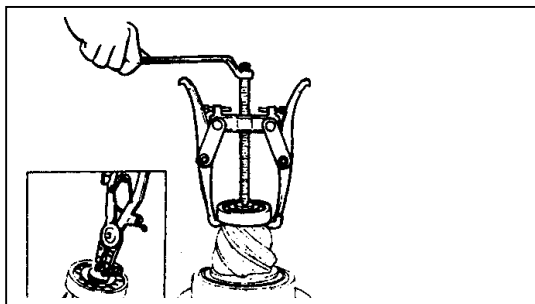


7) Remove the differential bearing from the differential casing;



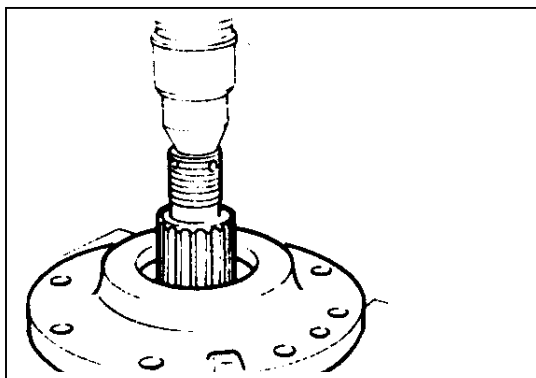
Disassembling of the drive gear

1) Remove the drive gear flange.

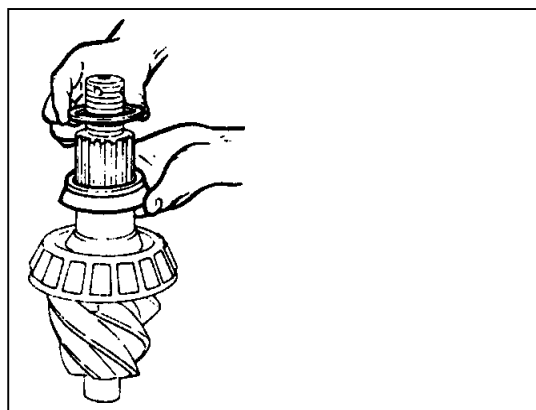


3) Remove the stopper elastic ring for shaft and take off the drive gear guide bearing;

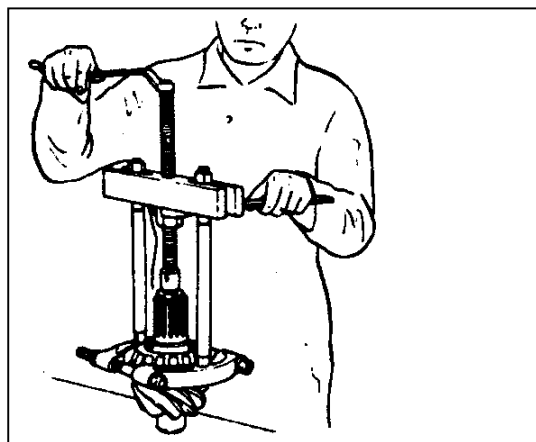
Rear Axle



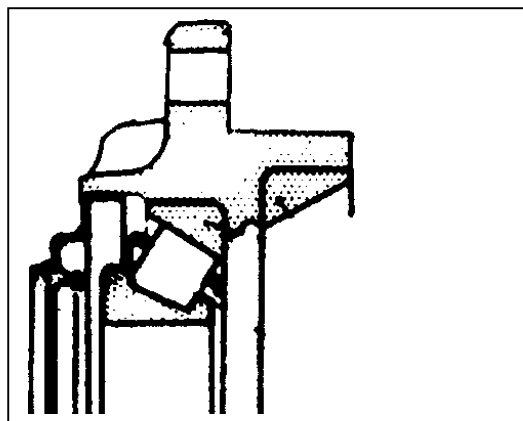
4) Press out the drive gear from the bearing seat;



5) Remove the adjusting washer and the bearing spacer;



6) Remove the bearing from the drive gear;



7) Remove the oil seal from the bearing seat;

8) Remove the bearing cone, remove the bearing cup.

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Key points for check-up during disassembling

1. Check the drive gear flange for any wearing or damage.
2. Check the bearing for any wearing or color change.
3. Check the gears for any crack.
4. Check the drive gear and driven gear for any wearing or crack.
5. Check the axle shaft gear, planetary gear, and planetary gear shaft for any wearing or crack.
6. Check the axle shaft spline for any wearing or damage.

II. Table of Rear Axle Maintenance Parameters (Table V)

Item	Value
Drive and driven gear clearance	0.18~0.23mm
Planetary, axle shaft gear clearance	0-0.15 mm
Drive gear rotational torque	Without oil seal Apply gear oil 10-20 Kgf·cm
Rear axle gear oil	Hyperbolic gear oil: (GL-5) 85W/90 Volume: 3.5 L
Oil applied on the outer rim and lip of the axle shaft oil seal, and drive gear oil seal	ZL-2 GB5671-85 Automobile General Purpose Lithium Base Grease.
Clearance between friction lining and brake drum	0.4-0.7 mm (Hydraulic brake)

III. Rear axle inspection and reparation

1. Special measuring instrument or tools shall be used for the inspection of components.

Judgment on whether a component can continue in service shall be made according to the specified maintenance standard table. The broken parts shall be repaired and replaced according to the requirements. In case one of a pair of matching parts is worn out, which causes the clearance go beyond the specified value, this part and the other matching part shall all be replaced as per the corresponding requirements.

2. From the view of preventive maintenance, some of the parts which are still within the reparation limit or wearing limit shall also be replaced before they exceed the limit.
3. Carefully check the appearance of all the components, through the assigned methods as visual inspection or red pigment penetration etc. If the outside appearance of the component has the following abnormal signs, the said component shall be repaired or replaced as per the

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requirements.

Abnormal signs:

- Uneven wear •Eccentric wear • Scrape
- Crack •Distortion •dead or weaken (refer to spring)
- Bending deflection •Abnormal noise (refer to bearing)
- Loosen •Color change or seize up •Rust
- Deterioration (refer the brake friction lining)

4. All the rubber pieces, such as O-ring, oil seal, and gasket etc. shall be discarded after removal, and they are not allowed to be re-used.

5. In case the transmission system generates abnormal sound or vibrates, first check the total free play of the rear axle, and then determine whether it is necessary to disassemble the final reduction gear assembly.

Place the vehicle on the level ground, put the transmission gear and transfer gearbox on neutral position, pull up the parking brake lever and jack up the vehicle. Turn the flange clockwise to the end, and make matching marks on the flange dust fender and the reduction casing, and then turn the flange counter clockwise to the end, measure the moving distance of the two matching marks, the ultimate free play is 6mm, if the free play exceed that limit, it indicates excessive gear clearance of the rear axle, and the rear axle shall be disassembled to make adjustment.

Abnormal sound is also one type of noise, it mainly appears as the abnormal sounds generated under different service conditions (such as vehicle speed, road conditions), like knocking sound or screeching sound, some of the sounds will gradually disappear through breaking-in, while some of the sounds will get louder and louder. This is mainly because of the improper assembly and adjustment. Under the precondition of good quality components, most of such problems can be solved through adjusting the assembling clearance.

6. Failure of brake return mainly is the problem that the brake seized up after being stepped down and cannot continue the brake operation. This problem mainly can be solved by adjusting the brake assembly clearance.

Item	Reparation Standard	Wearing Limit	Remarks
Wear of rear axle leaf spring location hole		1mm	
Radial jumping of left, right axle shaft sleeve outer bearing journal	—	0.1mm	
Radial jumping of axle shaft middle un-machined surface	—	1.5mm	
End surface jumping of the hub and axle shaft flange coupling surface	—	0.15mm	

Chapter III Assembling and Adjustment of Rear Axle Assembly

I. Assembling and adjustment of rear axle assembly

(1) The assembling of the final reduction gear assembly is following the reverse procedure of the above disassembling procedure, before assembling all the components shall be kept clean, free of such foreign substances as oil dirt, iron dust etc. Apply NO.10 motor oil for lubrication during assembling, and make adjustment as per the following requirements:

1. Drive gear inner and outer bearing preloading

1.1 When assembling the final reduction gear, the conical roller bearing shall have certain assembly preload, that is, to give certain preloading force on the basis of eliminating the bearing clearance. The purpose of it is to reduce the axial replacement caused by the axial force generated during the transmission process of conical gear, so as to increase the supporting rigidity of the shaft, and ensure the normal engagement of the conical gear pair. But it also shall not be too tight, if it is too tight, it will cause low transmission efficiency, and speed up the wearing of the bearing.

1.2 Adjustment of the drive gear bearing preloading force: under the condition of drive gear flange nut tightening torque, install the drive gear oil seal, the drive gear is not engaged with the driven gear, and ensure the drive gear bearing preloading torque (see Table 5). The adjustment of preload is made by increasing and reducing the drive gear bearing adjusting washers in between the drive gear inner and outer bearings (for specifications, see Table 6). Reduce the number of adjusting washers; the preloading torque is increased; while increase the number of adjusting washers, the preloading torque is decreased.

2. Differential bearing preload adjustment

2.1 Adjustment of differential bearing: the differential bearing shall be adjusted to have certain preloading force, so as to obtain 0.01-0.02 interference on both sides of it, apply gear oil to the bearing rotating part under the condition of no engagement between drive gear and driven gear, the start up friction torque is 0.686-1.586N.m. The differential bearing preload adjustment is realized through the tightening of the differential bearing nut. When adjusting, first put on the bearing cap freely, when the adjusting ring can be turned smoothly, then tighten the bearing cap bolt, and after that adjust the preloading force. The locking slot on the adjusting nut after the adjustment shall be aligned with the locking plate. After adjustment, the driven gear shall not have end float misalignment.

2.2 Differential gear clearance adjustment

Use dial gage to measure the differential gear meshing backlash on the planetary gear. Note: take measurement from more than three points, the standard value is: 0~0.15mm; limit value: 0.3mm。

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3. Adjustment of drive and driven gear backlash, and meshing mark

3.1 Adjustment of gear backlash

The normal meshing backlash and the gear backlash variables of the drive and driven gear is shown in table 5. When adjusting the gear backlash, the measurement shall be taken on four positions which are evenly distributed along the circumference of the driven gear, the measuring head of the micrometer shall be perpendicular to the surface of the measured point.

3.2 Adjustment of drive and driven gear meshing mark

First apply red lead to the teeth of drive gear, and then turn the drive and driven gear repeatedly by hand, there will be red marks on the two working sides of the driven gear, if the marks on the standard rotation and reverse rotation working sides of the driven gear are on the middle of the tooth depth and closer to the small end, and occupies 60% of the tooth face, then it is a correct meshing. See attached Figure (I). The position of correct meshing marks is adjusted through the adjustment of the drive gear bearing adjusting washer (for specifications, see Table 6) and the differential bearing adjusting nut.

In order to keep the adjusted differential bearing preload from being changed, the number of circles of the adjusting nut being turned in on one side shall be equal to the number of circles of the adjusting nut being turned out on the other side. Check and confirm the clearance again, and then lock up the locking plate.

(II) The assembling of the rear hub with brake drum assembly is as per the reverse procedure of disassembling, and the adjustment to be made during assembling is as follows:

1. Adjustment of rear hub bearing backlash

Tighten the bearing nut until the brake drum is no possible or difficult to move, and then slightly loosen the bearing nut by 1/6-1/8 circle, turn the brake drum, under the condition of no contact between brake friction disc and the brake drum, the tangent tensile force measured at the tyre bolt shall be (3-5kg) , or the brake drum can be turned freely by hand.

(III) Rear brake braking clearance adjustment:

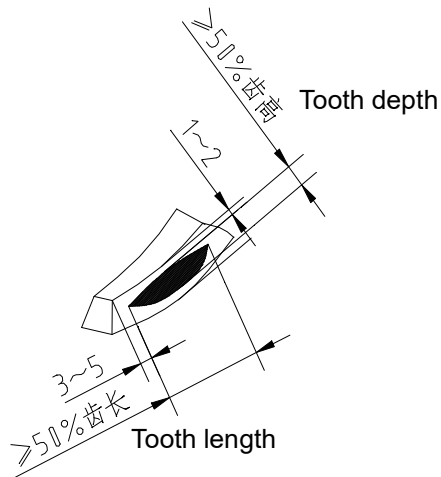
1. Liquid brake: for the two-way balanced type brake, first move the two brake chamber adjusting gears respectively as per the arrow direction indicated at the back plate adjusting hole, so that the brake drum is tightly against the brake lining, and then turn the brake chamber adjusting gear back by 5-9 teeth, to allow the brake drum to move freely.

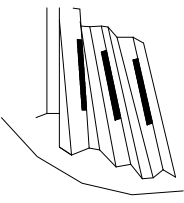
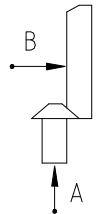
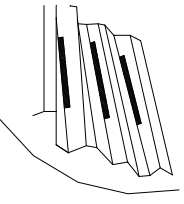
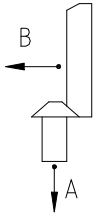
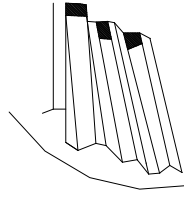
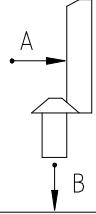
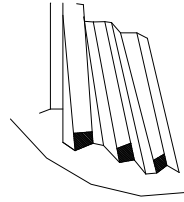
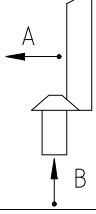
In the actual maintenance process, adjustment shall be made strictly according to the above procedures and requirements.

Table 6 Washer Specifications (mm)

Drive gear bearing seat adjusting washer		Drive gear bearing adjusting washer	
0.10	0.18	0.05	0.20
0.12	0.20	0.08	0.25
0.14	0.35	0.12	0.35
0.16	0.50	0.15	1.00

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Contact status of driven gear working tooth face	Causes	Adjusting method	A-Adjust tooth face contact area
 Deviate to crest	Drive gear too far from the driven gear	 1. Drive gear away from the drive gear 2. Drive gear closer to driven gear to achieve correct backlash (add washer)	
 Deviate to root	Drive gear is too close to the driven gear	 1. Driven gear closer to the drive gear 2. Drive gear away from the driven gear to achieve correct backlash (reduce washer)	
 Deviate to small	Driven gear is too close to the drive gear	 1. Driven gear away from the drive gear 2. Drive gear away from the driven gear to achieve correct backlash (reduce washer)	
 Deviate to big end	Driven gear is too far from the drive gear	 1. Driven gear closer to the drive gear 2. Drive gear closer to driven gear to achieve correct backlash (add washer)	

(Figure 1)

Adjustment Method of Gear Meshing Backlash

Chapter IV Use and Maintenance

I. Hyperbolic gear has strict requirement on the lubricating oil, the axle casing is only allowed to be filled with specified hyperbolic gear oil. It is not allowed to use normal gear oil as substitution or to be mixed with normal gear oil, otherwise it will cause tooth face early wearing, and even the gear is "shaved bald".

II. The conical gear of the rear axle final reduction gear has been selected and adjusted before ex-work, therefore, under normal condition, it is necessary to be disassembled and adjusted. It can be disassembled and adjusted only when the gear is worn out, the gear clearance exceeds the specified value or the bearing axial clearance is too big, and the component is damaged and need to be replaced.

III. The dirt and dust layer on the vent plug of rear axle casing shall be frequently cleaned off. In primary maintenance, it shall be removed and washed clean, to ensure that the vent pipe is unblocked. Blocked vent pipe will cause the pressure in the rear axle casing rising up, and lead to oil leakage at oil seal and joint place of the drive gear, at the same time, and the lubricating oil level inside of the casing shall also be checked.

1. In the first time of secondary maintenance for a new car, the lubricating oil shall be replaced. After a new car has been driven for 40000Km or 24 month, the rear axle lubricating oil shall be replaced. First bleed out the gear oil in the rear axle casing, fill in kerosene, and drain it out after cleaning, and then fill in GL-5 (85W/90) lubricating oil. It is not allowed to substitute with normal gear oil. After the lubricating oil has been replaced when the car has been driven for 80000Km or 48 month, it will be replaced once every 50000Km of driving.

After that, check the lubricating oil quality every four times of the secondary maintenance, if there are deteriorations such as color change or getting thinner, it shall be replaced with new oil.

2. Check the wearing conditions of the brake shoe lining and the brake drum. After a new car is driven for 40000Km or 24 month, check the wearing status of the brake shoe lining and the brake drum, measure the thickness of the place on the brake lining with the severest wearing, the standard value is 4.6mm, and the limit value is 1.0mm. When the thickness of the brake lining is smaller than the limit value, the brake lining shall be replaced.

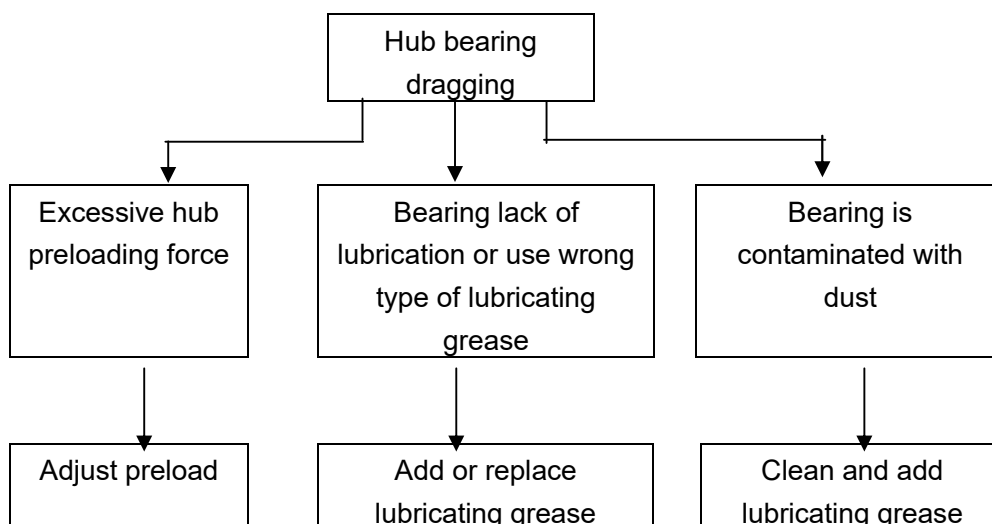
IV. In the third maintenance, the rear axle can be disassembled, and inner cavity and final reduction gear assembly can be cleaned. After that, tighten the bolts and nuts for each part as per the specified torque.

V. Points of attention:

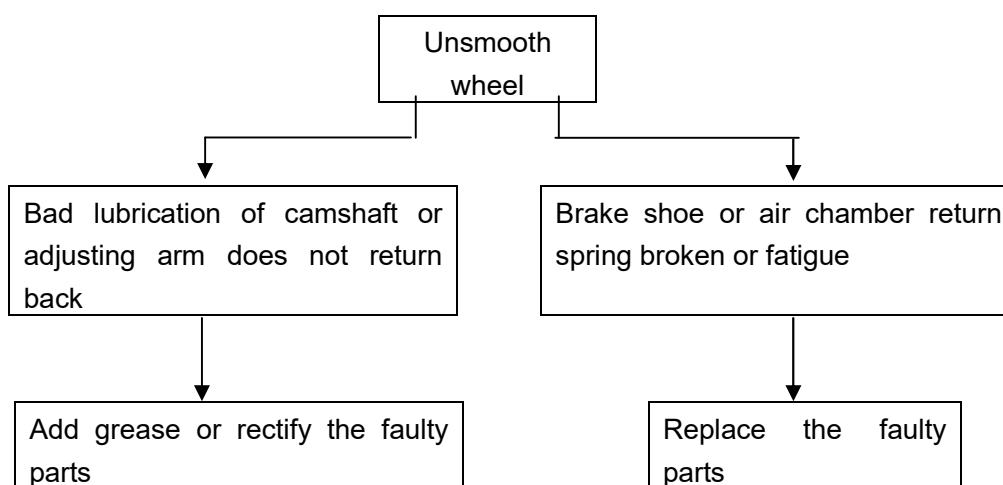
1. The vehicle shall not be loaded with the weight that exceeding its maximum loading capacity.
2. During the driving process of the vehicle, in order to avoid impact damage to the gears, it is not allowed to improve the obstacle crossing capacity of the vehicle by releasing the clutch abruptly.

Chapter V Trouble Shooting

I. Hub bearing dragging

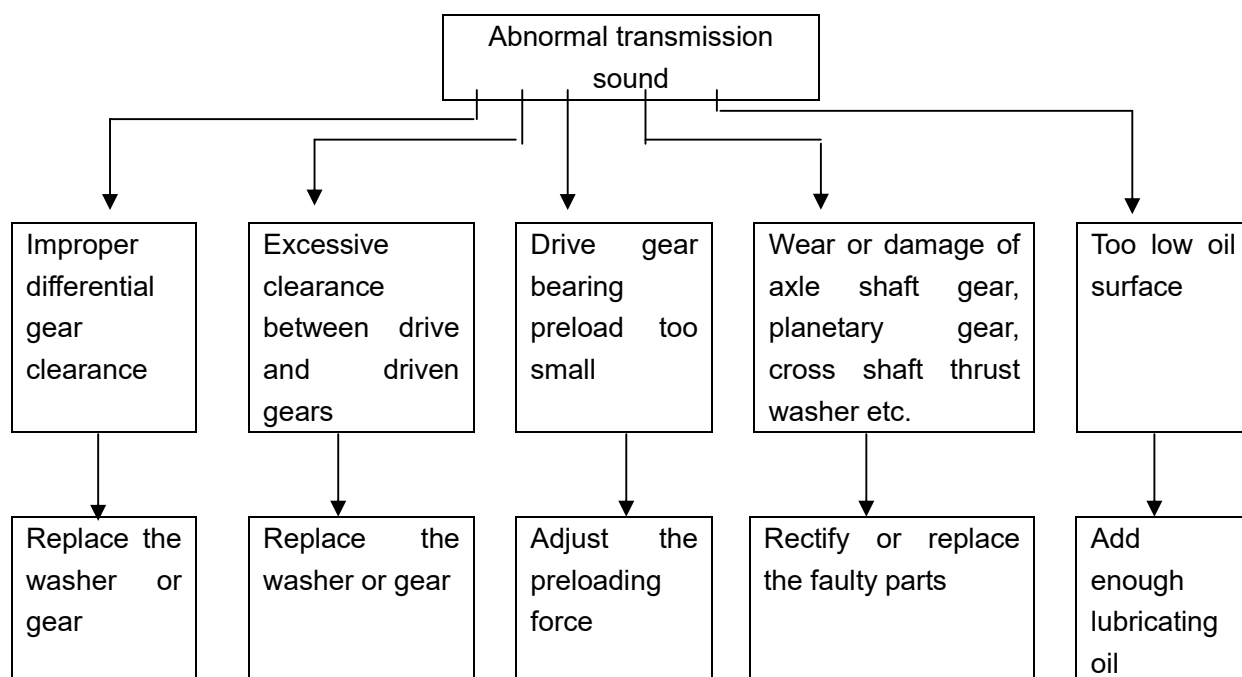


II. Unsmooth wheel

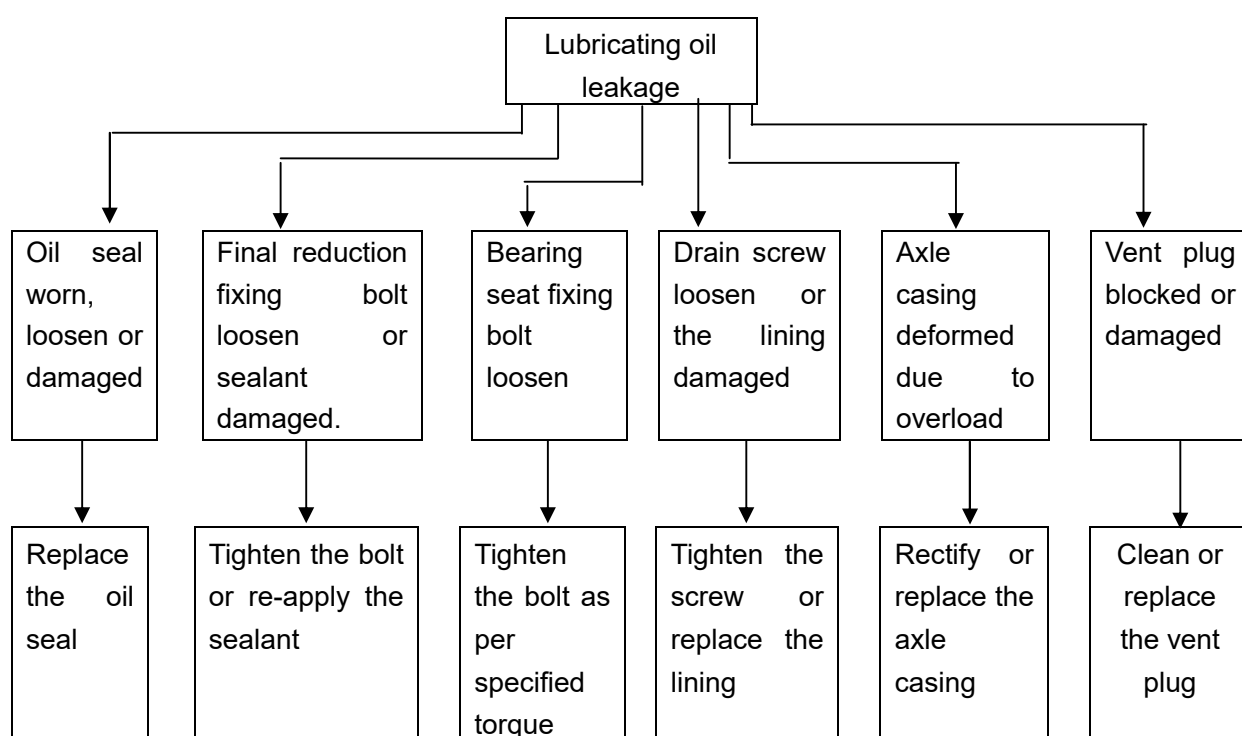


Rear Axle

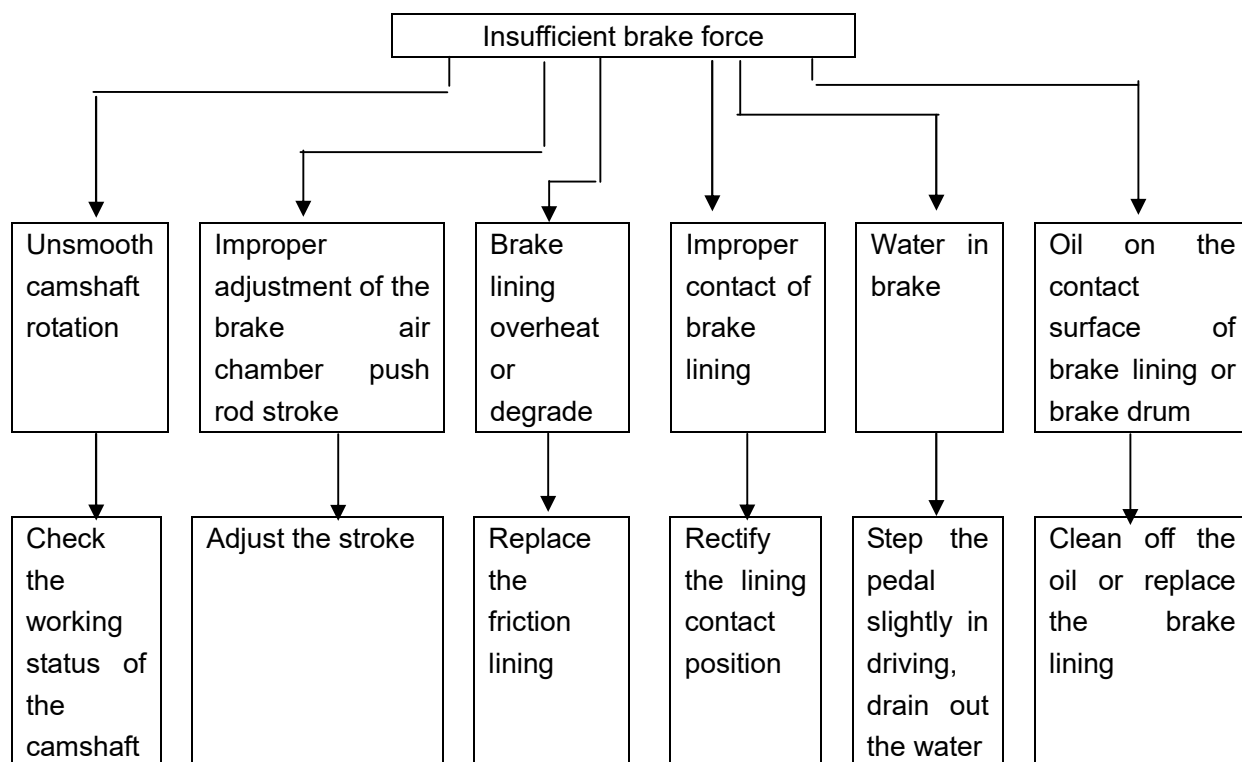
III. Abnormal transmission sound



IV. Lubricating oil leakage



V. Insufficient brake force



VI. Abnormal brake sound

