REAR AXLE

CONTENTS

GENERAL

OUTLINE OF CHANGES

- The dust cover of the rear axle shaft and the ABS wheel-speed sensor rotor have been redesigned. With this change, the service procedure for the axle shaft has been added.
- Vehicles with 3500 petrol engine and 2800D Diesel engine has used a hybrid type LSD. With this change, the service procedure has been added.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Items	Standard wheelbase 2800D, 3500	Long wheelbase 2800D
Differential		
Differential size	No. 7.5	No. 7.5
Reduction gear type	Hypoid gear (fine pitch type)	Hypoid gear (fine pitch type)
Reduction ratio	4.636	4.900
LSD type	Hybrid type (Helical gear + VCU*)	Hybrid type (Helical gear + VCU*)

NOTE
* : Viscous Coupling Unit

SERVICE SPECIFICATIONS

Items	Specifications
Standard value	
Press-fitting force of retainer N	
Initial press-fitting force	49,000
Final press-fitting force	98,000 – 108,000
Clearance of snap ring and retainer mm	0 – 0,166
Final drive gear backlash mm	0.13 – 0.18
Drive pinion turning torque	
Without oil seal Nm	
With anti-rust agent (new)	0.6 – 0.9
With gear oil applied (new or used)	0.4 – 0.5
With oil seal Nm	
With anti-rust agent (new)	0.85 – 1.15
With gear oil applied (new or used)	0.65 – 0.75
Limit	
Drive gear runout mm	0.05

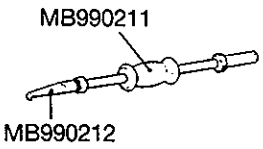
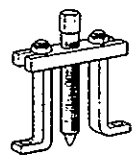
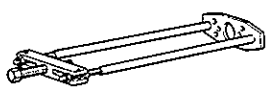
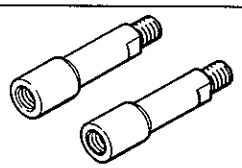
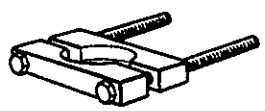
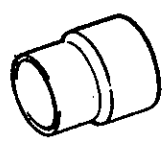
LUBRICANTS

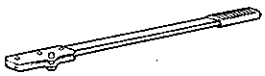
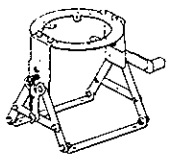
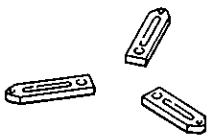
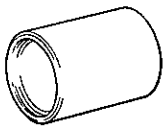
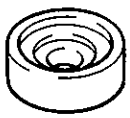
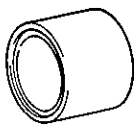
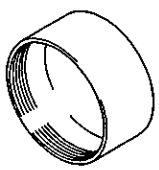
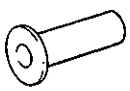
Items	Specified lubricant	Quantity ℓ
Rear axle gear oil Hybrid type LSD	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	3.2

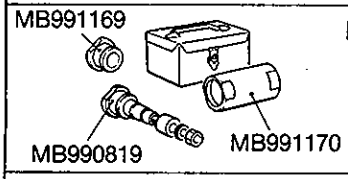
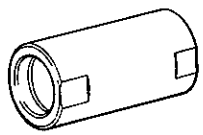
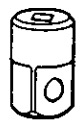
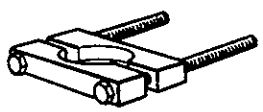
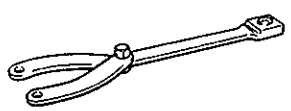
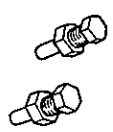
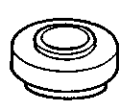
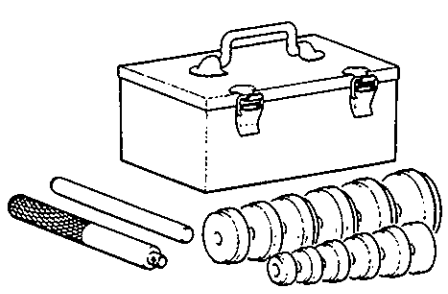
SEALANT AND ADHESIVES

Items	Specified sealants and adhesives	Remarks
Bearing case Differential carrier mounting surface of axle housing	3M ATD Part No. 8663 or equivalent	Semi-drying sealant
Drive gear threaded hole	3M Stud Locking 4170 or equivalent	Anaerobic sealant

SPECIAL TOOLS

Tool	Number	Name	Use
	MB990590	Sliding hammer	Removal of axle shaft (Use together with MB990241) Removal of axle housing oil seal
	MB990241	Rear axle shaft puller	Removal of axle shaft (Use together with MB990590)
	MB991552	Axle shaft bearing and case remover	Removal of the axle shaft bearing and bearing case
	MB991601	Extension bar	
	MB990560	Axle shaft bearing remover	Removal of the axle shaft bearing inner race
	MB990799	Bearing inner race installer	Press-fitting of the axle shaft bearing inner race Press-fitting of the axle shaft retainer

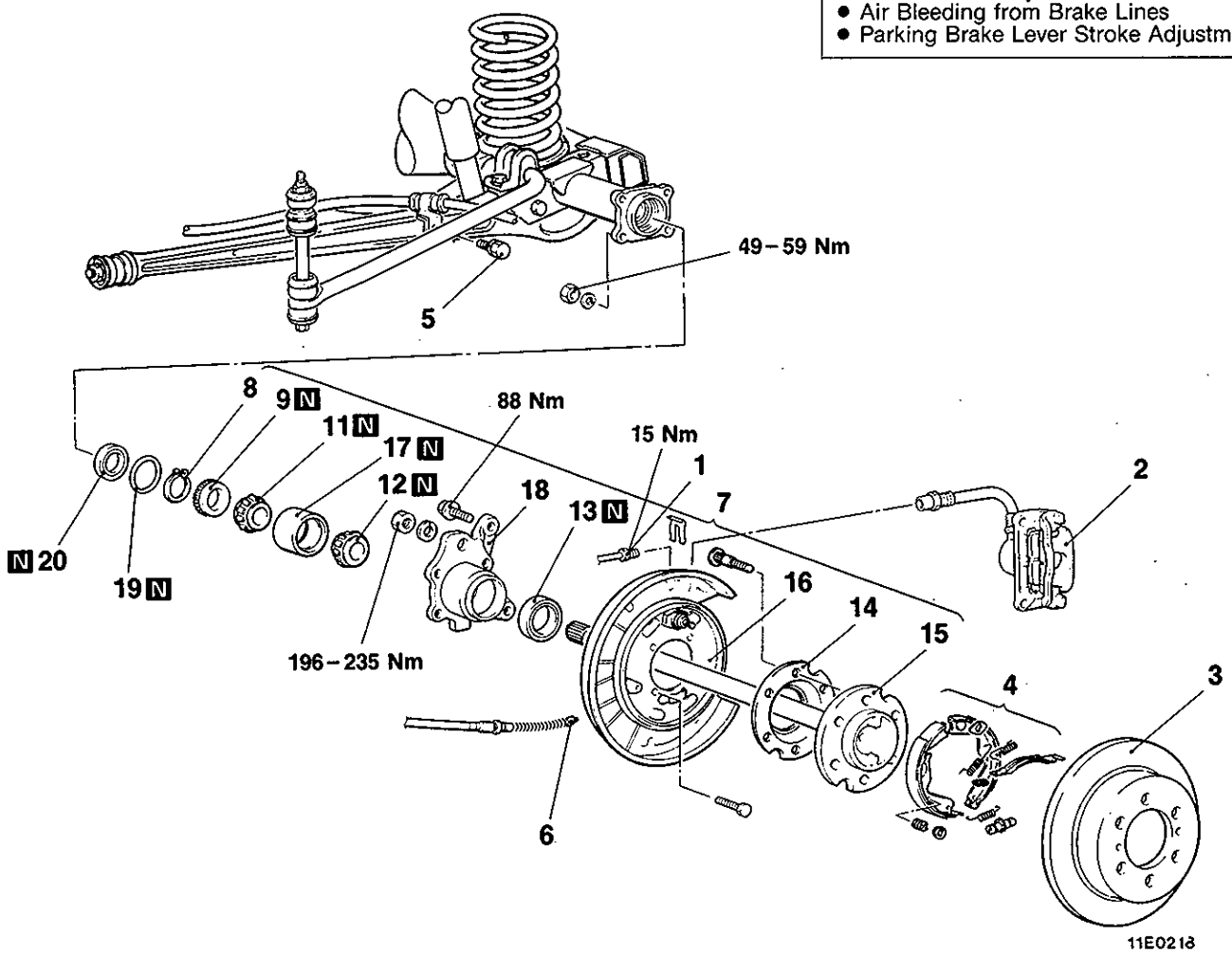
Tool	Number	Name	Use
	MB990810	Side bearing puller	Removal of the side bearing inner race
	MB990850	End yoke holder	Removal of the companion flange
	MB990909	Working base	Support of rear differential carrier assembly
	MB991116	Adapter	
	MB990890 or MB990891	Rear suspension bushing base	Installation of bearing outer race
	MB991407	Differential rear support arbor	Removal of side bearing inner race
	MB991445	Bush remover and installer base	Pressing of drive pinion rear bearing outer race
	MD998812	Installer cap	Pressing of side bearing inner race
	MD998829	Installer adaptor	
	MB991168	Drive pinion oil seal installer	Press-fitting of the drive pinion oil seal

Tool	Number	Name	Use
	MB991171	Pinion height gauge set	Measurement of the pinion height
	MB991534	Cylinder cage	
	MB991151 or MB990685	Torque wrench	Measurement of the starting torque of drive pinion
	MB990326	Preload socket	
	MD998801	Bearing remover	Removal of drive pinion rear bearing inner race
	MB991367	Special spanner	Removal and installation of side bearing nut
	MB991385	Pin	
	MB990802	Bearing installer	Press-fitting of the drive pinion rear bearing inner race Press-fitting of the side bearing inner race
	MB990925	Bearing and oil seal installer set	Press-fitting of the axle housing oil seal MB990938, MB990930 Press-fitting of the axle shaft bearing case oil seal MB990938, MB990936 Driving-out of the drive pinion front bearing, drive pinion rear bearing, outer race and oil seal MB990939 Press-fitting of the drive pinion rear bearing outer race MB990938 use together with MB991445 Press-fitting of the drive pinion front bearing outer race MB990938, MB990934

AXLE SHAFT

REMOVAL AND INSTALLATION

Post-installation Operation
- Air Bleeding from Brake Lines
- Parking Brake Lever Stroke Adjustment



Removal steps

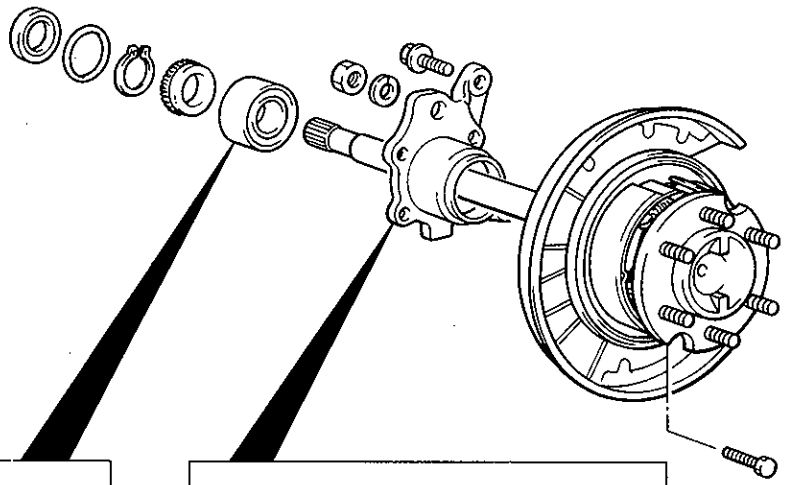
1. Brake tube connection
2. Rear brake assembly
3. Brake disc
4. Parking brake assembly
5. Parking brake cable attaching bolt
6. Parking brake cable end
◀A▶ 7. Axle shaft assembly
8. Snap ring
◀B▶ 9. Retainer*
◀C▶ 10. Axle shaft sub assembly (Parts from step 12 to step 15)
11. Bearing inner race (inner)
◀D▶ 12. Bearing inner race (outer)
13. Oil seal
14. Dust cover
15. Axle shaft
16. Backing plate
◀E▶ 17. Bearing outer race
18. Bearing case
19. O-ring
◀F▶ 20. Oil seal

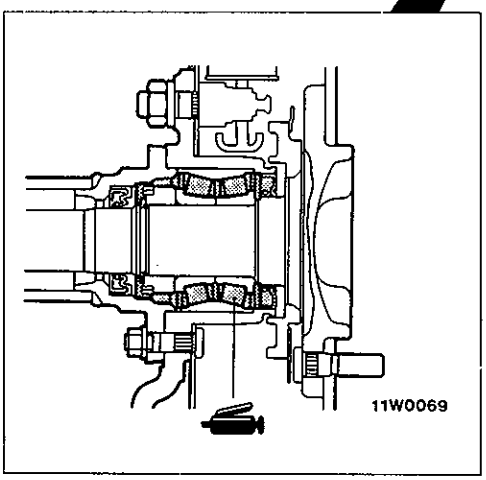
Installation steps

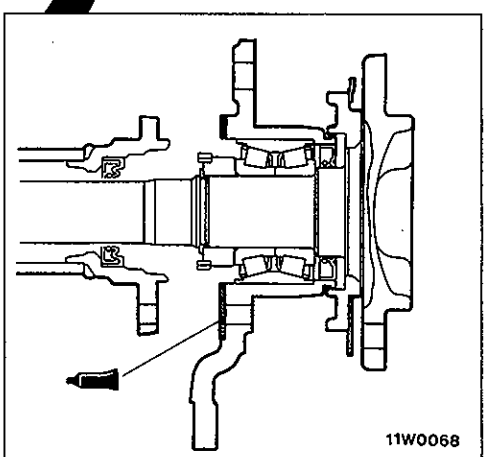
▶A◀ 20. Oil seal
19. O-ring
18. Bearing case
▶B◀ 17. Bearing outer race
16. Backing plate
15. Axle shaft
14. Dust cover
12. Bearing inner race (outer)
▶C◀ 13. Oil seal
▶D◀ 11. Bearing inner race (inner)
▶E◀ 9. Retainer
▶F◀ 8. Snap ring
7. Axle shaft assembly
6. Parking brake cable end
5. Parking brake cable attaching bolt
4. Parking brake assembly
3. Brake disc
2. Rear brake assembly
1. Brake tube connection

NOTE
* : For vehicles with ABS, the sensor rotor has been integrated.

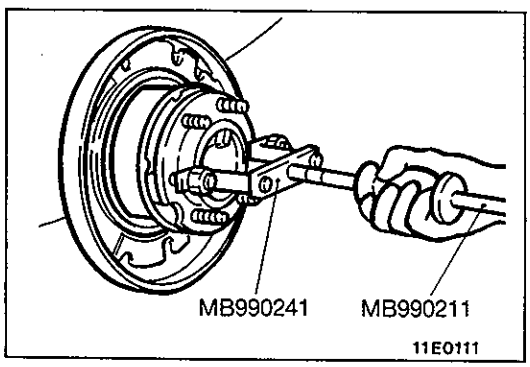
LUBRICATION AND SEALING POINTS







Sealant:
3M ATD Part. No. 8663 or equivalent

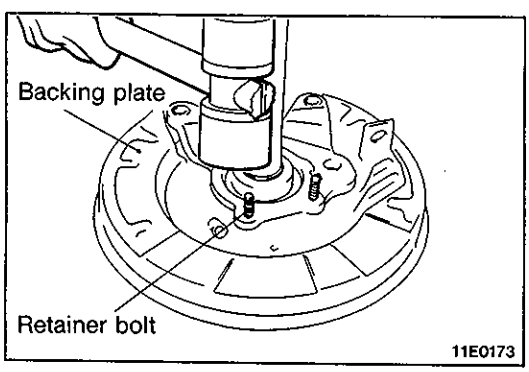


REMOVAL SERVICE POINTS

◀A▶ AXLE SHAFT ASSEMBLY REMOVAL

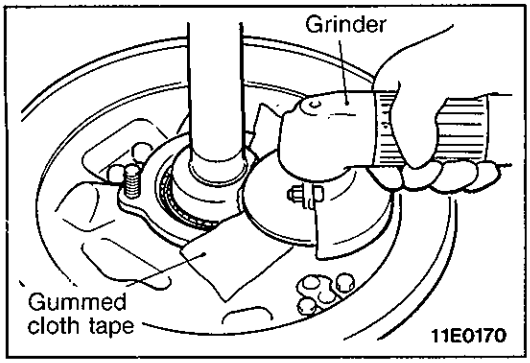
Pull the rear axle shaft. If the rear axle shaft is difficult to remove, use the special tools.

NOTE
Do not damage the oil seal during removal.



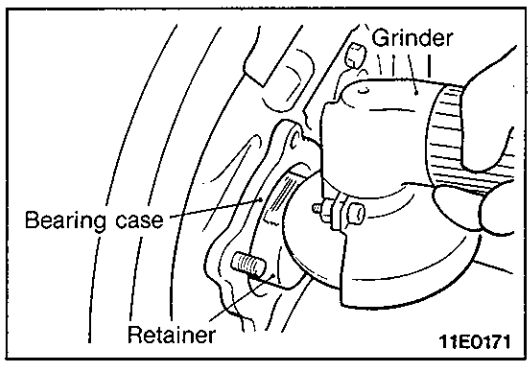
◀B▶ RETAINER REMOVAL

(1) Remove one retainer bolt from the backing plate.



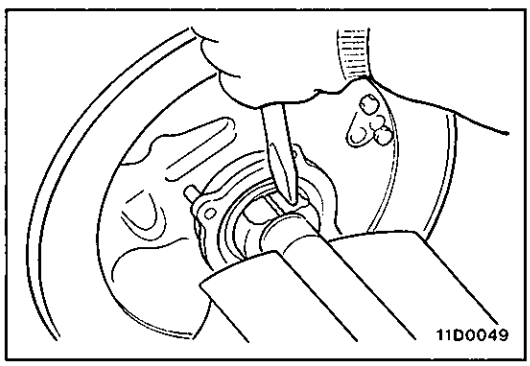
(2) Apply gummed cloth tape around the edge of the bearing case for protection.
(3) As shown in the figure, fix the axle shaft and shave off with grinder a point of its circumference locally until the wall thickness on the side of axle shaft of retainer ring and the side of bearing become approximately 1.0 – 2.0 mm and 2.0 mm respectively.

Caution
Be careful not to damage the bearing case and the axle shaft.



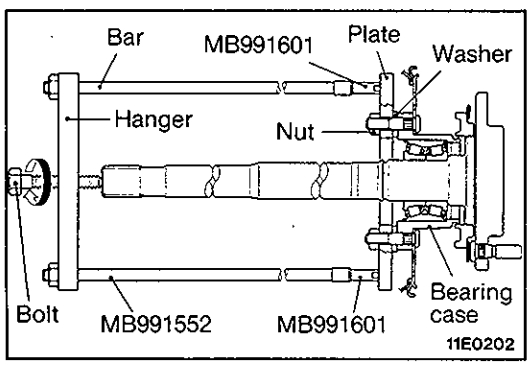
(4) Fix the axle shaft and shave off the remaining 2.0 mm on the side of the bearing of the retainer.

Caution
Be careful not to damage the bearing case and the axle shaft.



(5) Cut in with a chisel the place where the retainer ring has been shaven and remove the retainer.

Caution
Be careful not to damage the axle shaft.



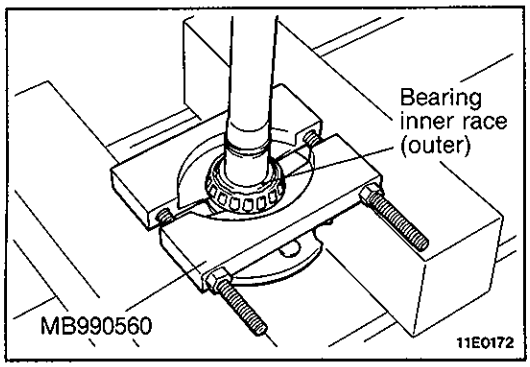
◀C▶ AXLE SHAFT SUB ASSEMBLY REMOVAL

(1) Adjust the height of the hanger, and install the plate, washer, nut in the shown order.

NOTE
If the bar of the special tool (MB991552) is too short, install the extension bar (MB991601).

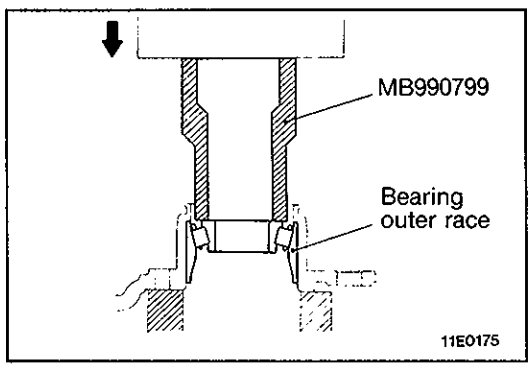
(2) Place the end of the bolt against the centre of the axle shaft, and then tighten the nut to remove the axle shaft from the bearing case assembly.

Caution
The hanger and plate should be placed so that they are parallel.



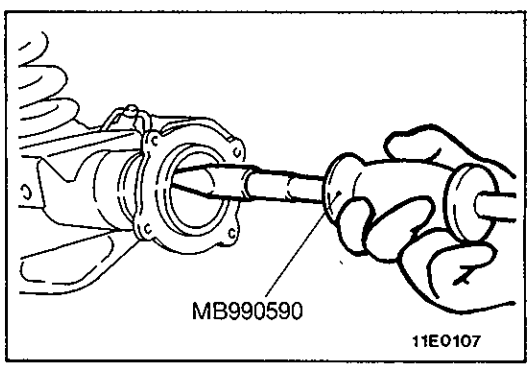
◀D▶ BEARING INNER RACE (OUTER) REMOVAL

Install the special tool as shown in the illustration, and then use a press to remove the bearing inner race (outer) from the axle shaft.



◀E▶ BEARING OUTER RACE REMOVAL

Reinstall the bearing inner race that was removed previously, and then use the special tool and press to remove the bearing outer race.

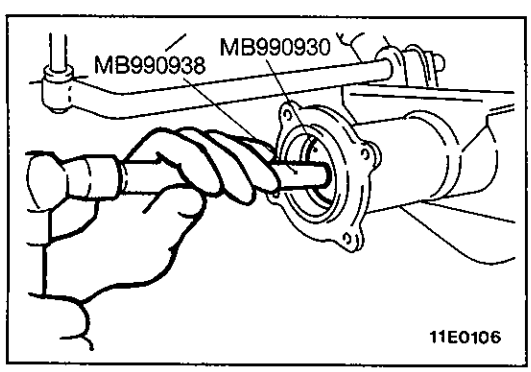


◀F▶ OIL SEAL REMOVAL

Remove the oil seal from the end of rear axle housing using the special tool, if necessary.

INSPECTION

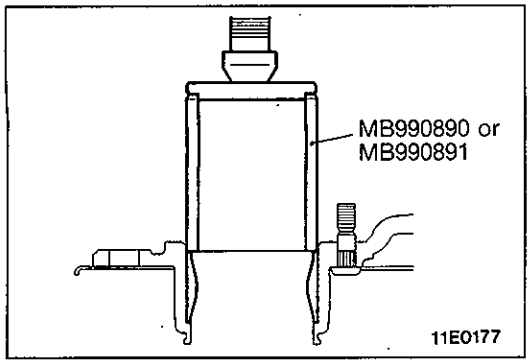
- Check the dust cover for deformation or damage.
- Check the oil seal for damage.
- Check the inner and outer bearings for seizure, discoloration and rough raceway surface.
- Check the axle shaft for cracks, wear and damage.



INSTALLATION SERVICE POINTS

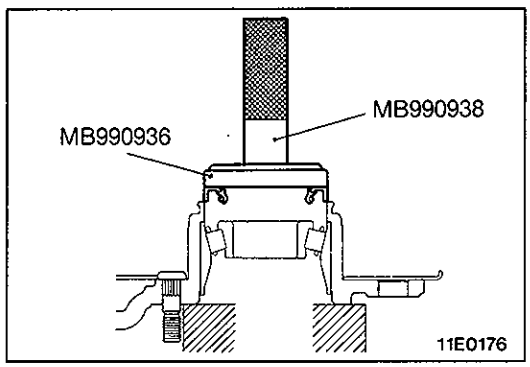
▶A◀ OIL SEAL INSTALLATION

Drive the new oil seal into the rear axle housing end by using the special tools.



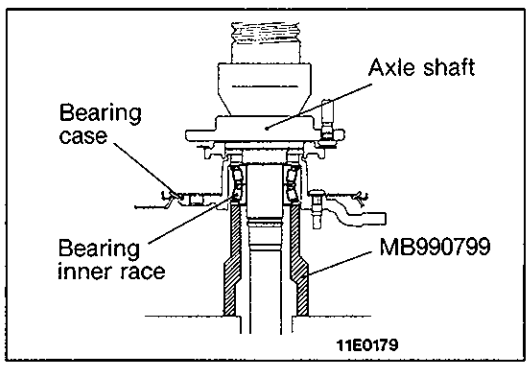
▶B◀ BEARING OUTER RACE INSTALLATION

(1) Apply the multi-purpose grease to the external surface of the bearing outer race.
(2) Press-fit the bearing outer race into the bearing case by using special tools.



▶C◀ OIL SEAL INSTALLATION

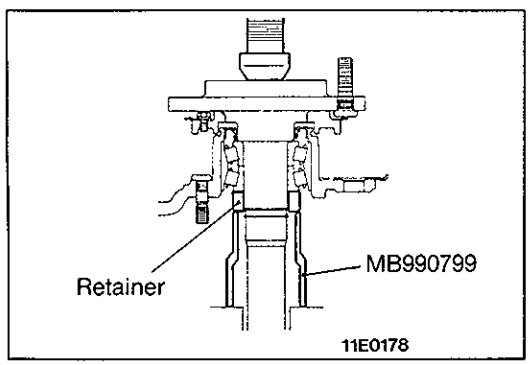
(1) Apply multi-purpose grease to the outside of the oil seal.
(2) Use the special tools to press-fit the oil seal until it is flush with the end of the bearing case.
(3) Apply multi-purpose grease to the lip of the oil seal.



▶D◀ BEARING INNER RACE (INNER) INSTALLATION

(1) Pass the axle shaft through the bearing inner race, the bearing case and the second bearing inner race in that order.
(2) Use the special tool to press-fit the bearing inner race to the axle shaft.

Caution
Both bearing inner race sets should be press-fitted together.

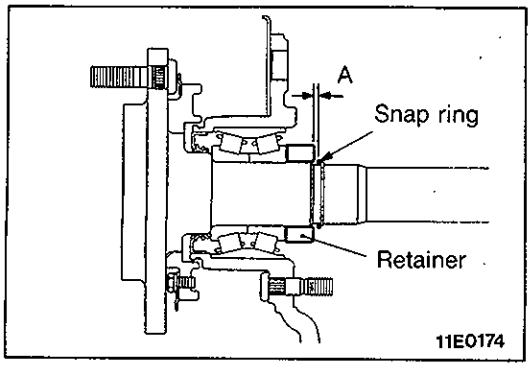


▶E◀ RETAINER PRESS-FITTING

Use the special tool to press-fit the retainer onto the axle shaft, while checking that the press-fitting force is at the standard value.
If the initial press-fitting force is less that the standard value, replace the axle shaft.

Standard value:

Initial press-fitting force N	49,000 or more
Final press-fitting force N	98,000 – 108,000



▶F◀ SNAP RING INSTALLATION

(1) After installing the snap ring, measure the clearance (A) between the snap ring and the retainer with a thickness gauge, and check that it is within the standard values.

Standard value (A): 0 – 0.166 mm

(2) If the clearance exceeds the standard value, change the snap ring so that the clearance is at the standard value.

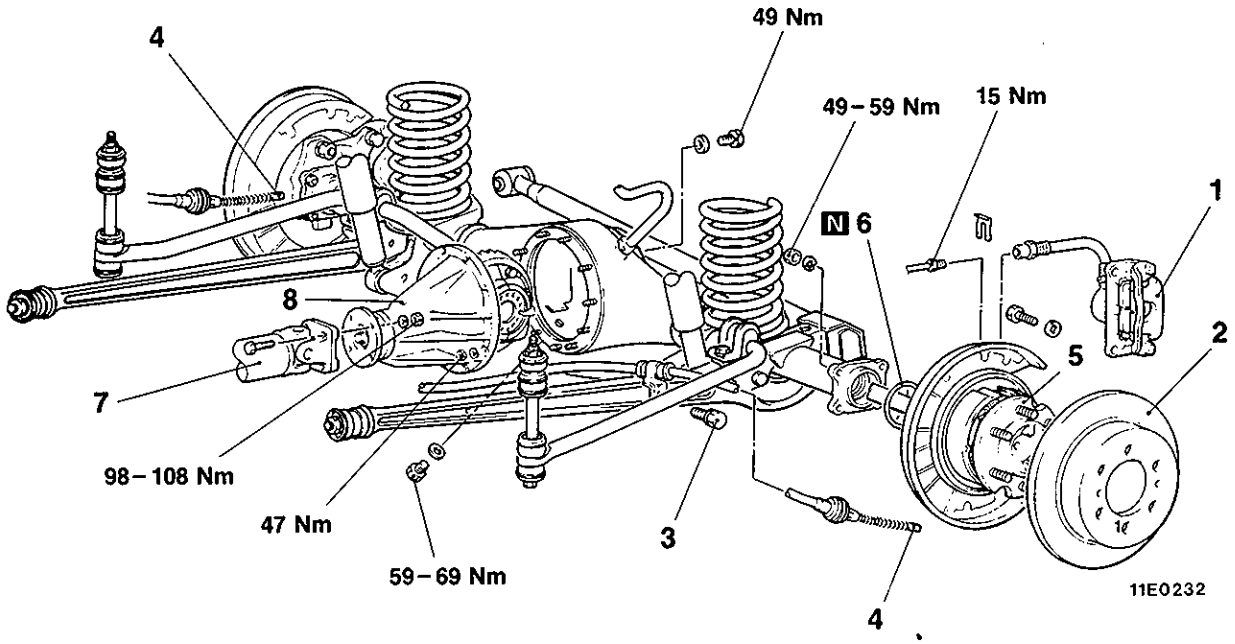
Thickness of snap ring mm	Identification colour
2.17	—
2.01	Yellow
1.85	Blue
1.69	Purple
1.53	Red

DIFFERENTIAL CARRIER <HYBRID TYPE LSD>

REMOVAL AND INSTALLATION

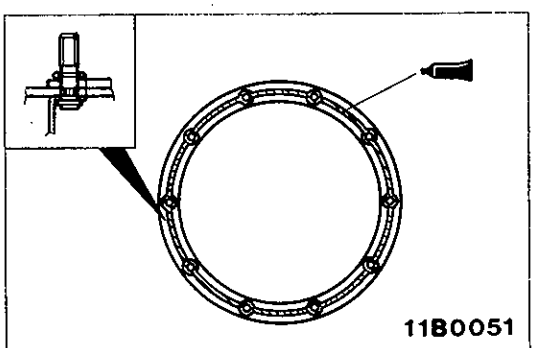
Pre-removal Operation
- Differential Gear Oil Draining

Post-installation Operation
- Air Bleeding from Brake Lines
- Parking Brake Lever Stroke Adjustment
- Differential Gear Oil Filling

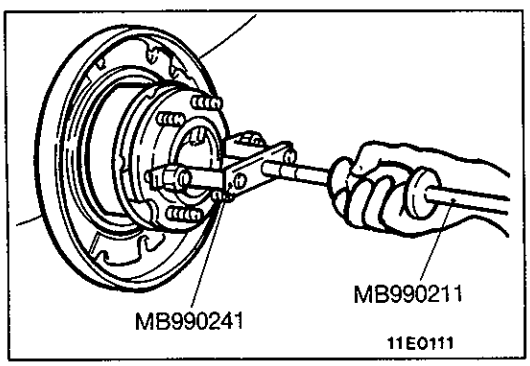


Removal steps

1. Rear brake assembly
2. Brake disc
3. Parking brake cable attaching bolt
4. Parking brake cable end
◀A▶ 5. Rear axle shaft assembly
6. O-ring
◀B▶ ▶A◀ 7. Rear propeller shaft
◀C▶ 8. Differential carrier



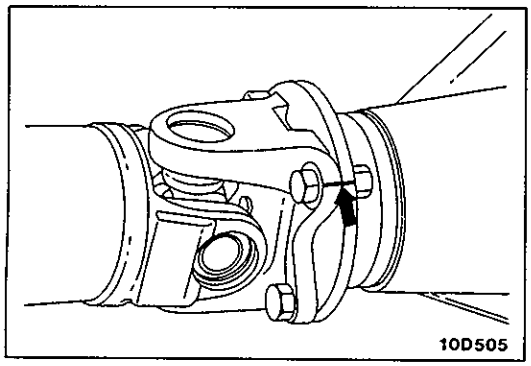
Sealant:
3M ATD Part No. 8663 or equivalent



REMOVAL SERVICE POINTS

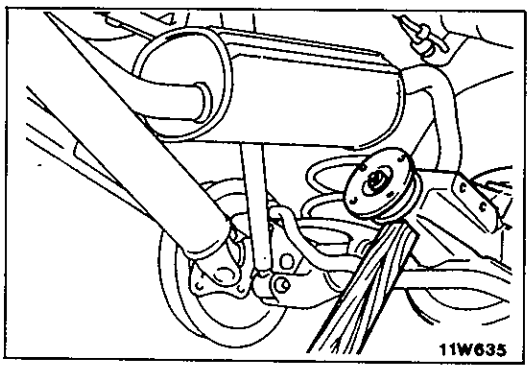
◀A▶ REAR AXLE SHAFT ASSEMBLY REMOVAL

Pull out the right and left axle shafts by about 70 mm. If it is difficult to pull out, use the special tools.



◀B▶ REAR PROPELLER SHAFT REMOVAL

Make the mating marks on the flange yoke of the rear propeller shaft and the companion flange of the differential case.



◀C▶ DIFFERENTIAL CARRIER REMOVAL

Remove the mounting nuts and strike the lower part of differential carrier assembly with a piece of timber several times to loosen it, and then remove the assembly.

Caution

1. **Do not remove the uppermost nut but keep it loosened all the way to the stud bolt end.**
2. **Use care not to strike the companion flange.**

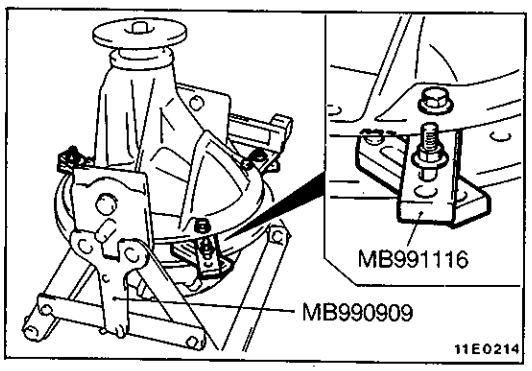
INSTALLATION SERVICE POINT

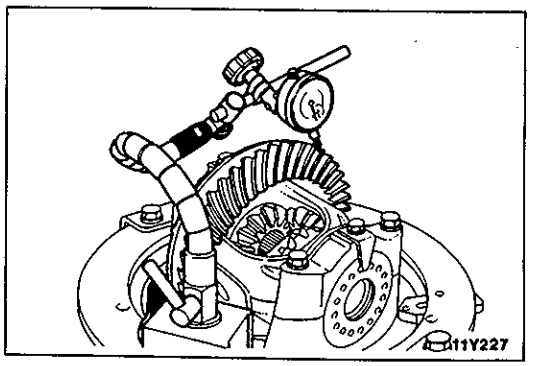
▶A◀ REAR PROPELLER SHAFT INSTALLATION

Align the mating marks on the flange yoke and the companion flange to install the rear propeller shaft.

INSPECTION BEFORE DISASSEMBLY

Hold the special tool (MB990909) in a vise. Use the two special tools (two sets of MB991116) as shown to hold the differential carrier.



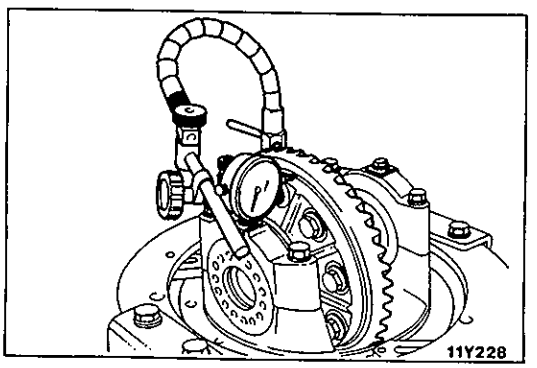


FINAL DRIVE GEAR BACKLASH

With the drive pinion locked in place, measure the final drive gear backlash with a dial indicator on the drive gear.

NOTE
Measure at four points or more on the circumference of the drive gear.

Standard value: 0.13 – 0.18 mm



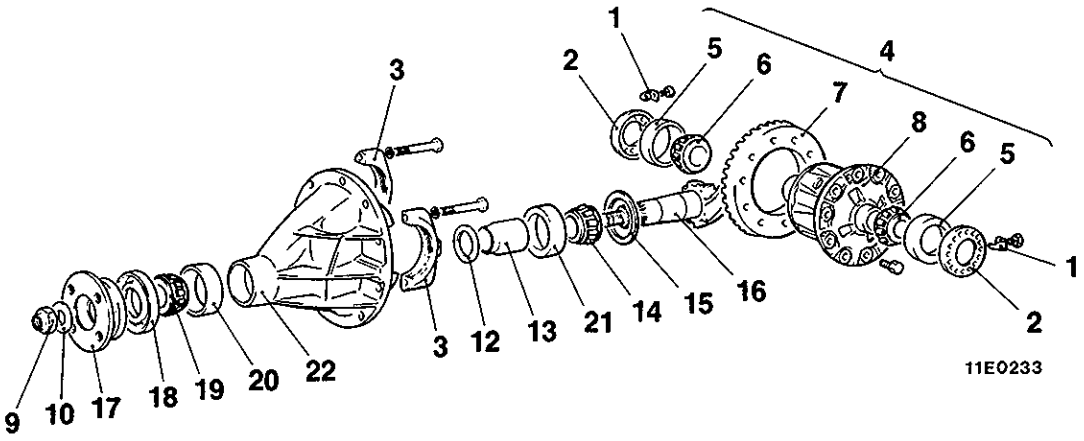
DRIVE GEAR RUNOUT

Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

Limit: 0.05 mm

DISASSEMBLY

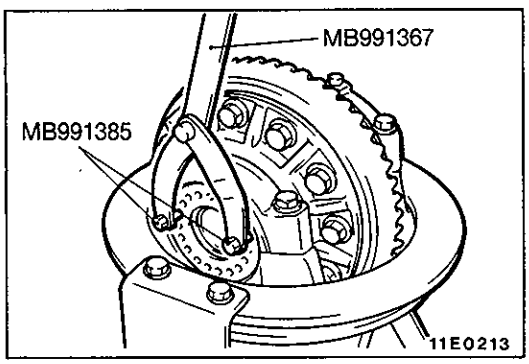
Inspection Before Disassembly
(1) Final Drive Gear Inspection (Refer to P.27-13.)
(2) Drive Gear Run-out Inspection (Refer to P.27-13.)



Disassembly steps

1. Lock plate
◀A▶ 2. Side bearing nut
3. Bearing cap
◀B▶ 4. Differential case assembly
5. Side bearing outer race
◀C▶ 6. Side bearing inner race
◀D▶ 7. Drive gear
8. Differential case*
◀E▶ 9. Self-locking nut
10. Washer
◀F▶ 11. Drive pinion assembly
12. Drive pinion front shim
(For adjusting of drive pinion bearing preload)
◀G▶ 13. Drive pinion spacer
14. Drive pinion rear bearing inner race
15. Drive pinion rear shim
(For adjusting drive pinion height)
16. Drive pinion
◀H▶ 17. Companion flange
◀H▶ 18. Oil seal
◀H▶ 19. Drive pinion front bearing inner race
◀H▶ 20. Drive pinion front bearing outer race
21. Drive pinion rear bearing outer race
22. Differential carrier

Caution
*** : Never disassemble the hybrid type LSD.**



DISASSEMBLY SERVICE POINTS

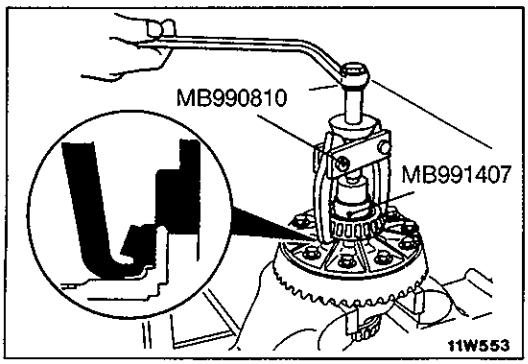
◀A▶ SIDE BEARING NUT REMOVAL

Use the special tool to remove the side bearing nut.

◀B▶ DIFFERENTIAL CASE ASSEMBLY REMOVAL

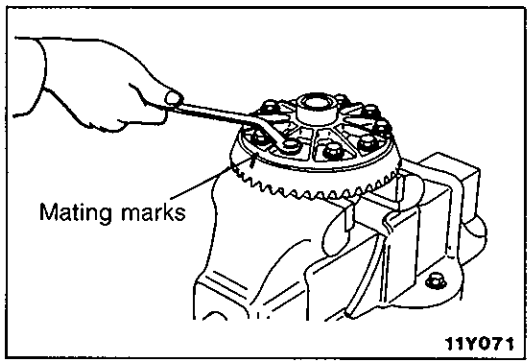
Use hammer handles to take out the differential case assembly.

NOTE
Make mating marks on the bearings.
Keep the right and left side bearings and side bearing nuts separate in order to be able to distinguish them for reassembly.



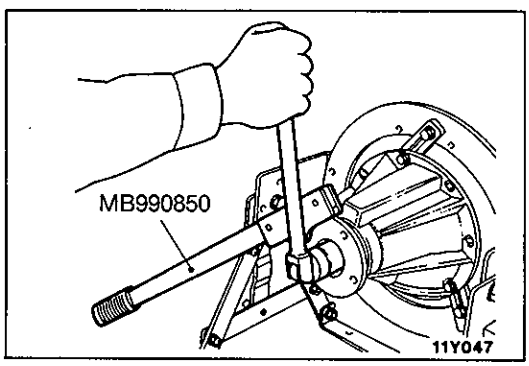
◀C▶ SIDE BEARING INNER RACE REMOVAL

Use the special tools to pull out the side bearing inner races.



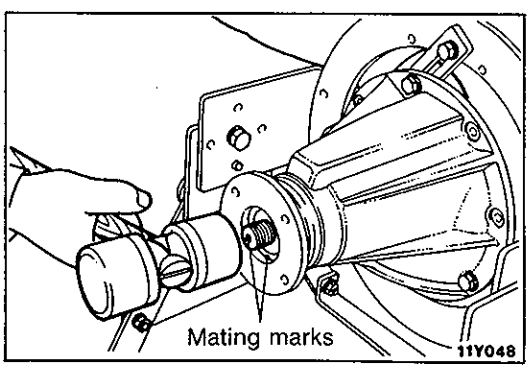
◀D▶ DRIVE GEAR REMOVAL

(1) Make mating marks on the differential case and drive gear.
(2) Loosen the drive gear mounting bolts in diagonal sequence to remove the drive gear.



◀E▶ SELF-LOCKING NUT REMOVAL

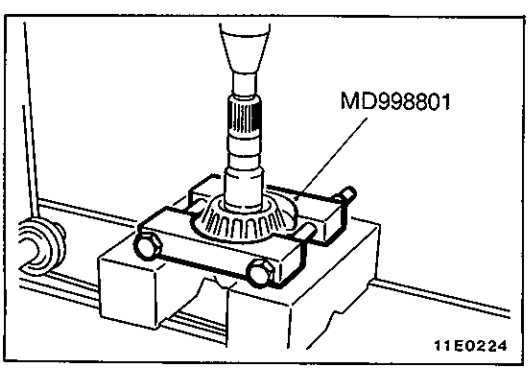
Use the special tool to hold the companion flange, and then remove the companion flange self-locking nut.



◀F▶ DRIVE PINION ASSEMBLY REMOVAL

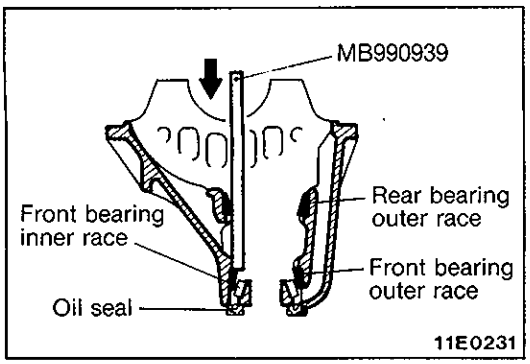
(1) Make mating marks on the drive pinion and companion flange.
(2) Drive out the drive pinion together with the drive pinion spacer and the drive pinion front shims.

Caution
Do not make mating marks on the contact surfaces of the companion flange and propeller shaft.



◀G▶ DRIVE PINION REAR BEARING INNER RACE REMOVAL

Use the special tools to pull out the drive pinion rear bearing inner race.



◀H▶ OIL SEAL, DRIVE PINION FRONT BEARING INNER RACE, DRIVE PINION FRONT BEARING OUTER RACE AND DRIVE PINION REAR BEARING OUTER RACE REMOVAL

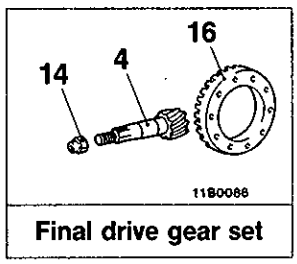
(1) Using the special tool, drive out the drive pinion front bearing outer race with drive pinion front bearing inner race and oil seal from the gear carrier.
(2) Drive out the drive pinion rear bearing outer race in the same manner.

INSPECTION

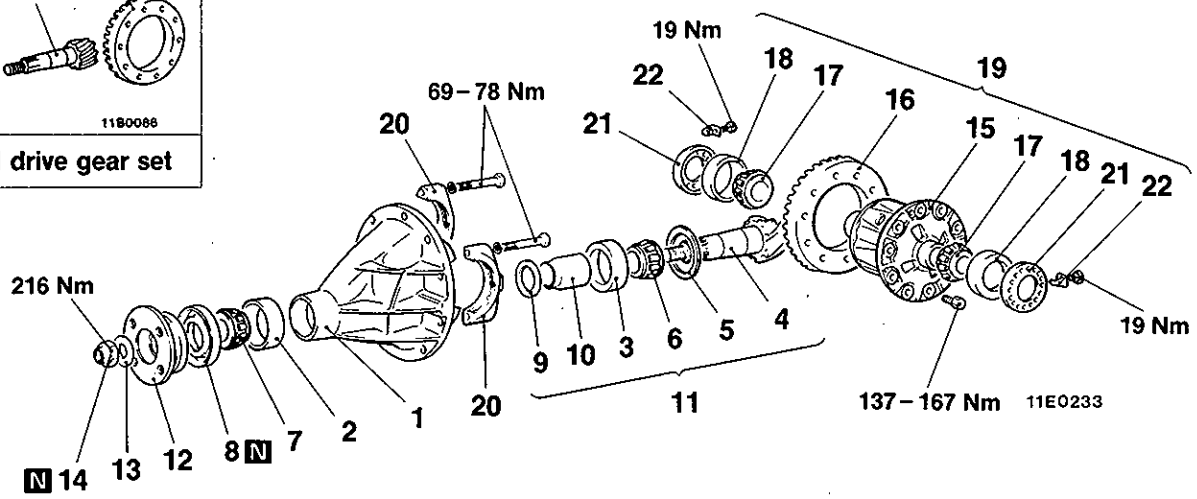
Wash the disassembled parts in cleaning solvent, dry them using compressed air, and then check the following areas.

- Check the companion flange for wear or damage.
- Check the oil seal for wear or deterioration.
- Check the bearings for wear or discoloration.
- Check the differential case for cracks.
- Check the drive pinion and drive gear for wear or cracks.

REASSEMBLY



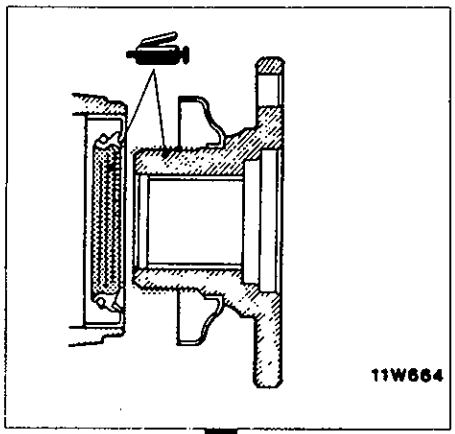
Final drive gear set

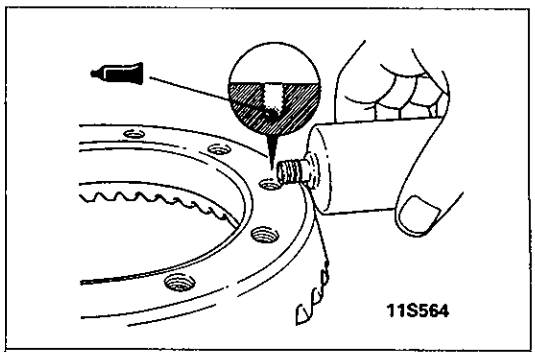


Reassembly steps

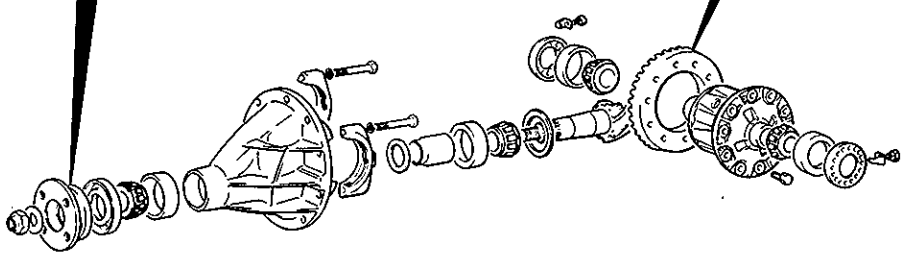
1. Differential carrier
▶A◀ 2. Drive pinion front bearing outer race
▶B◀ 3. Drive pinion rear bearing outer race
▶C◀ • Drive pinion height adjustment
4. Drive pinion
5. Drive pinion rear shim (For adjusting drive pinion height)
6. Drive pinion rear bearing inner race
7. Drive pinion front bearing inner race
8. Oil seal
9. Drive pinion front shim (For adjusting drive pinion bearing preload)
10. Drive pinion spacer
▶D◀ • Drive pinion bearing preload adjustment
11. Drive pinion assembly
12. Companion flange
13. Washer
14. Self-locking nut
15. Differential case
▶E◀ 16. Drive gear
▶F◀ 17. Side bearing inner race
18. Side bearing outer race
19. Differential case assembly
▶G◀ 20. Bearing cap
▶H◀ • Final drive gear backlash adjustment
21. Side bearing nut
22. Lock plate

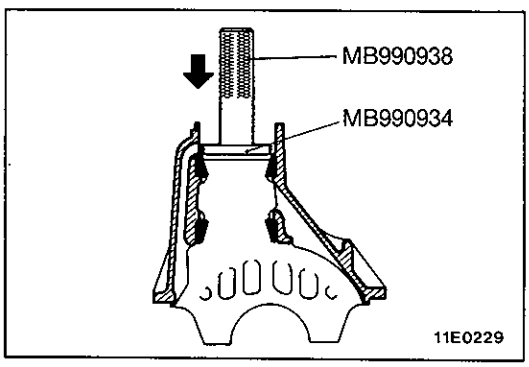
LUBRICATION SEALING AND ADHESION POINTS

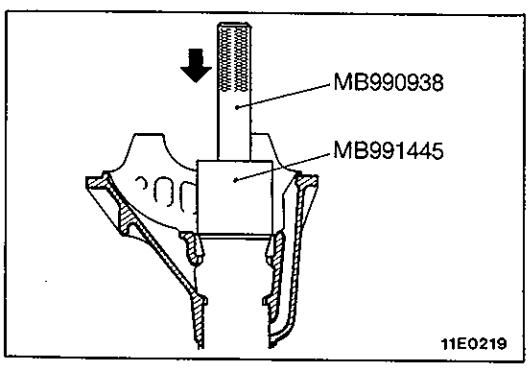




Adhesive:
3M Stud Locking 4170 or equivalent







REASSEMBLY SERVICE POINTS

▶A◀ DRIVE PINION FRONT BEARING OUTER RACE INSTALLATION

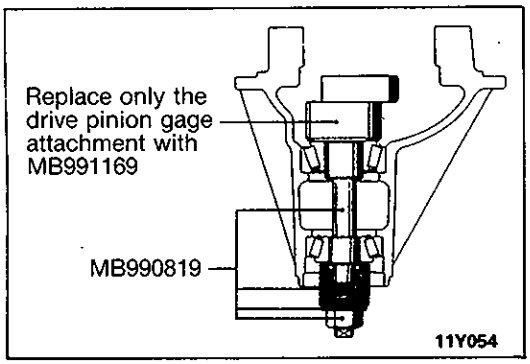
Use the special tools to press-fit the drive pinion front bearing outer race into the gear carrier.

Caution
The bearing outer race must be fitted using a press to avoid tilt and distortion.

▶B◀ DRIVE PINION REAR BEARING OUTER RACE INSTALLATION

Use the special tools to press-fit the drive pinion rear bearing outer race into the gear carrier.

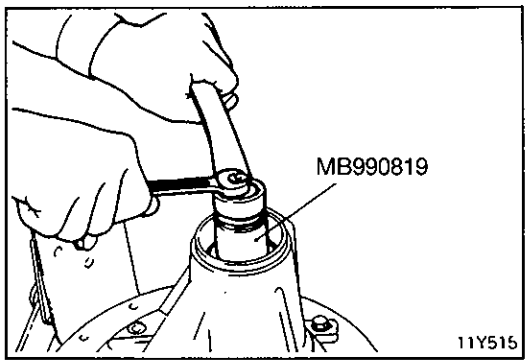
Caution
The bearing outer race must be fitted using a press to avoid tilt and distortion.



▶C◀ DRIVE PINION HEIGHT ADJUSTMENT

Adjust the drive pinion height by the following procedures:

(1) Install special tools and drive pinion front and rear bearing inner races to the gear carrier in the sequence shown in the illustration.

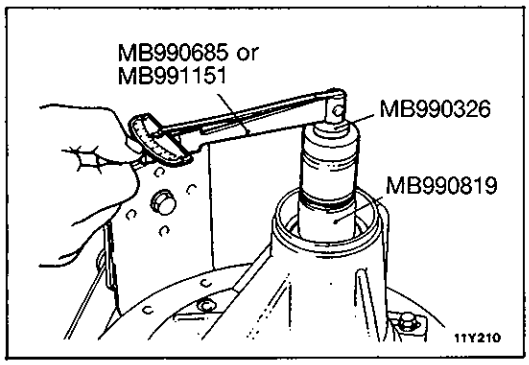


(2) Tighten the nut on the special tool until standard value of drive pinion turning torque is obtained.

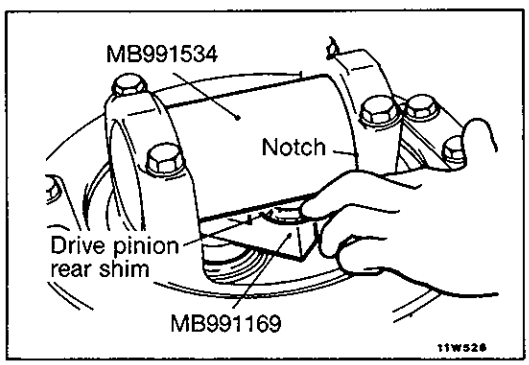
(3) Measure the drive pinion turning torque (without the oil seal).

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.6 – 0.9 Nm
New/reusing	Gear oil applied	0.4 – 0.5 Nm

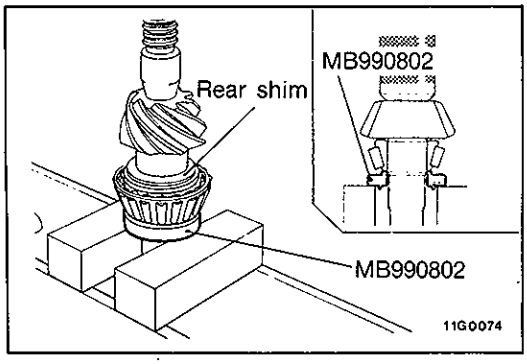


NOTE
1. Gradually tighten the nut of the special tool while checking the drive pinion turning torque.
2. With small type differentials, one complete rotation cannot be given to the special tool. Rotate tool several times within the possible range to run in the bearing, and then measure the torque.

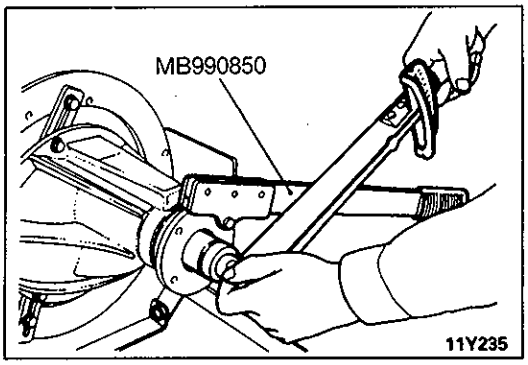


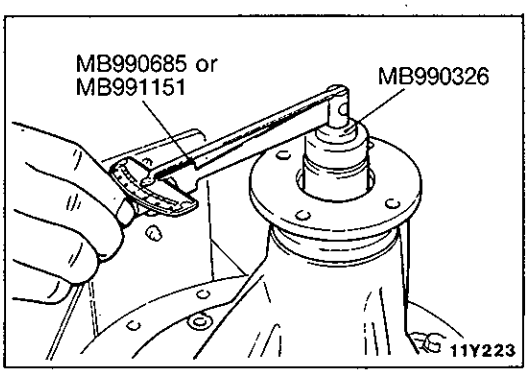
(4) Position the special tool in the side bearing seat of the gear carrier, then select a drive pinion rear shim of a thickness which corresponds to the gap between the special tools.

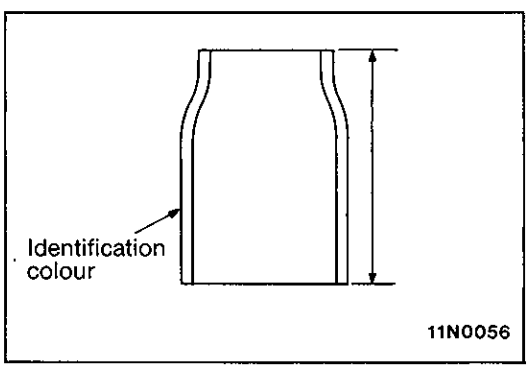
NOTE
Thoroughly clean the side bearing seat.
When positioning the special tool, be sure that the cutout sections of the special tool are in the position shown in the illustration, and also confirm that the special tool is in close contact with the side bearing seat.
When selecting the drive pinion rear shims, keep the number of shims to a minimum.

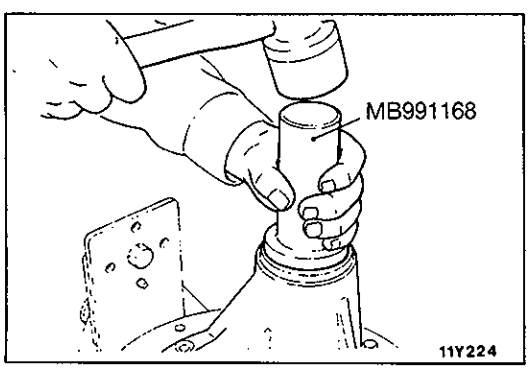


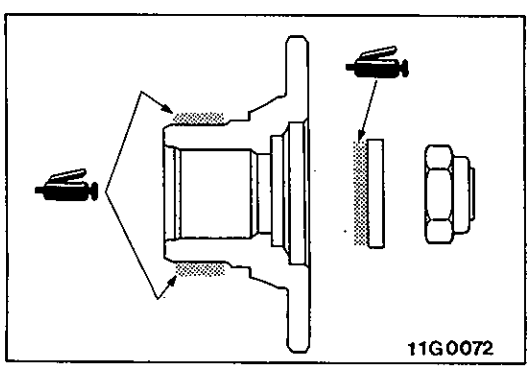
(5) Fit the selected drive pinion rear shim(s) to the drive pinion, and press-fit the drive pinion rear bearing inner race by using the special tool.











▶D◀ DRIVE PINION PRELOAD ADJUSTMENT

Adjust the drive pinion turning torque by using the following procedure:

Without oil seal

(1) Fit the drive pinion front shim(s) between the drive pinion spacer and the drive pinion front bearing inner race.

(2) Tighten the companion flange to the specified torque by using the special tools.

NOTE
Do not install the oil seal.

(3) Measure the drive pinion turning torque. (without the oil seal)

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.6 – 0.9 Nm
New/reusing	Gear oil applied	0.4 – 0.5 Nm

(4) If the drive pinion turning torque is not within the range of the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

NOTE
When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers.
Also, select the drive pinion spacer from the following two types.

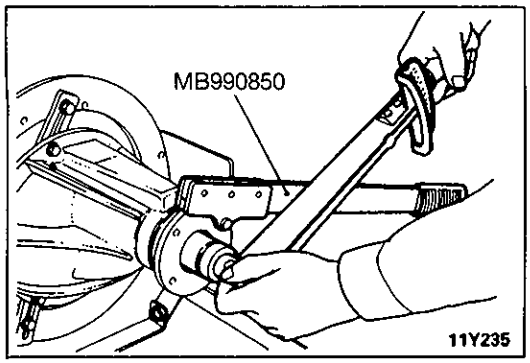
Height of drive pinion spacer mm	Identification colour
52.50	Yellow
52.84	Red

(5) Remove the companion flange and drive pinion once again.

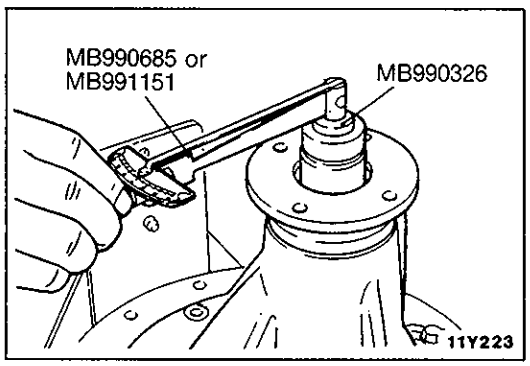
With oil seal

(1) After setting the drive pinion front bearing inner race, use the special tool to drive the oil seal into the front lip of the gear carrier.

(2) Apply a thin coat of clean multi-purpose grease to the companion flange contact surfaces of the washer and the oil seal contacting surface before installing the drive pinion assembly.



(3) Install the drive pinion assembly and companion flange with the mating marks properly aligned, and then use the special tools to tighten the companion flange self-locking nut to the specified torque.

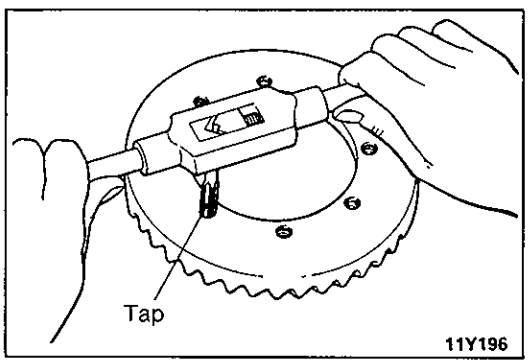


(4) If the drive pinion rotation torque is not within the rage of the standard value, adjust the rotation torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

Standard value:

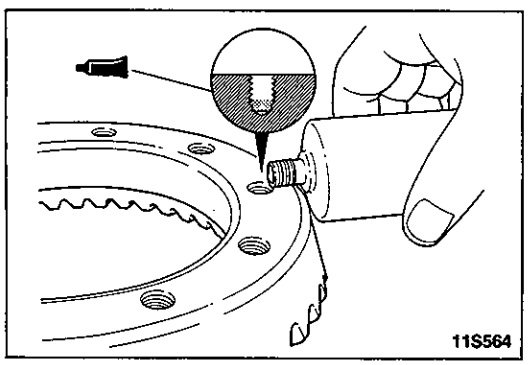
Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.85 – 1.15 Nm
New/reusing	Gear oil applied	0.65 – 0.75 Nm

(5) If the turning torque is outside the standard value, check that the tightening torque of the companion flange self-locking nuts or the installation of the oil seal are correct.



▶E◀ DRIVE GEAR INSTALLATION

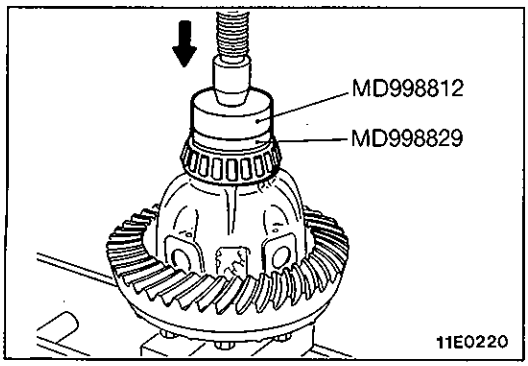
(1) Clean the drive gear mounting bolts.
(2) Remove the adhesive which is adhering to the threaded holes of the drive gear by turning the tap tool (M12 x 1.25), and then clean the threaded holes by applying compressed air.



(3) Apply specified adhesive to the threaded holes of the drive gear.

Specified adhesive:
3M Stud Locking Part No.4170 or equivalent

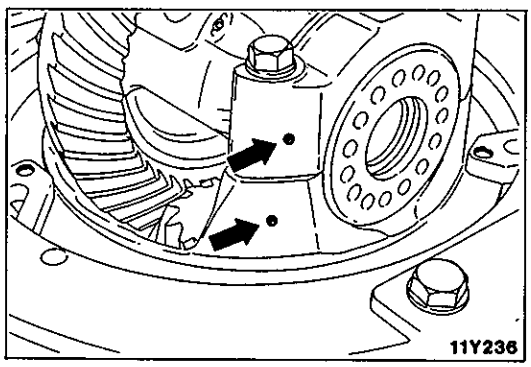
(4) Install the drive gear to the differential case so that the mating marks are properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.



▶F◀ SIDE BEARING INNER RACE INSTALLATION

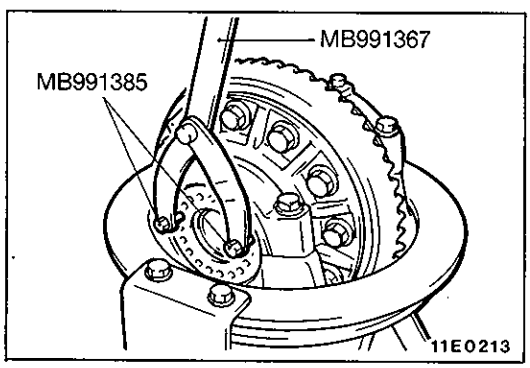
Use the special tool to press-fit the side bearing inner races into the differential case.

Caution
When only one side bearing inner race is installed, place a load on the differential case only.



▶G◀ BEARING CAP INSTALLATION

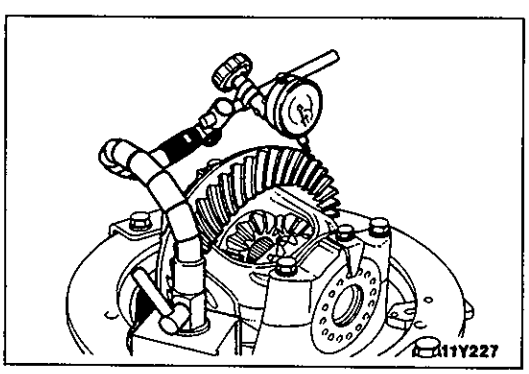
Align the mating marks on the gear carrier and the bearing cap, and then tighten the bearing cap.



▶H◀ FINAL DRIVE GEAR BACKLASH ADJUSTMENT

Adjust final drive gear backlash as follows:

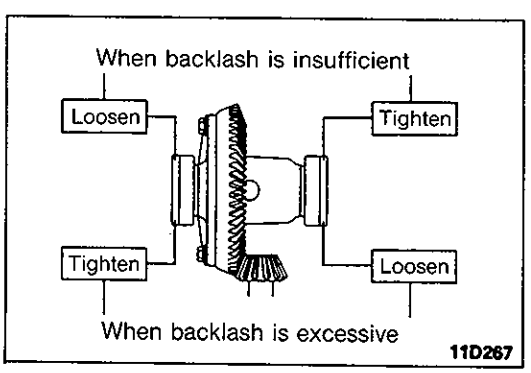
(1) Using the special tool, temporarily tighten the side bearing nut until it is in the state just before preloading of the side bearing.



(2) Measure the final drive gear backlash.

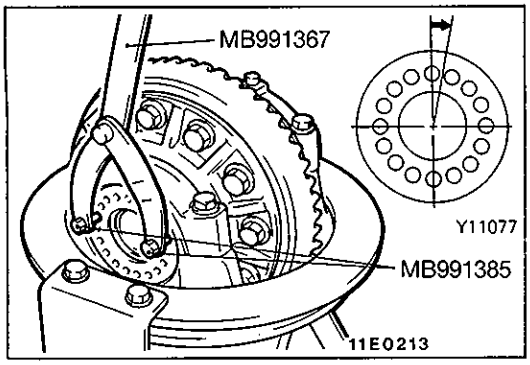
Standard value: 0.13 – 0.18 mm

NOTE
Measure at four points or more on the circumference of the drive gear.

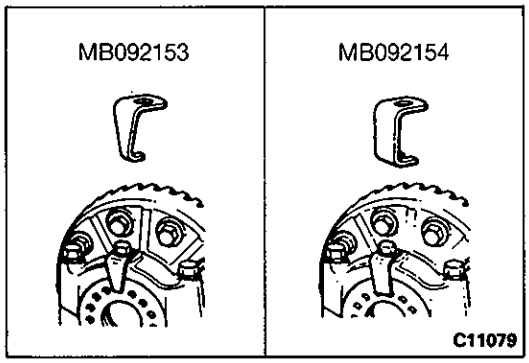


(3) Use the special tool (MB991367 and MB991385) to adjust the backlash to the standard value by moving the side bearing nut as shown.

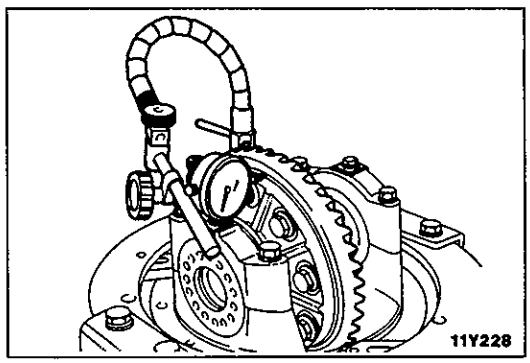
NOTE
First turn the side bearing nut for loosening, and then turn the side bearing nut for tightening by the same amount.



(4) Use the special tool to turn both right and left side bearing nuts one half the distance between the centres of two neighboring holes to apply the preload.



(5) Choose and install the lock plates (two types).
(6) Check the final drive gear tooth contact. If poor contact is evident, carry out adjustment.



(7) Measure the drive gear runout.
Limit: 0.05 mm
(8) If the drive gear runout exceeds the limit, remove the differential case and the drive gears, move them to different positions and then reinstall them.