

REAR AXLE

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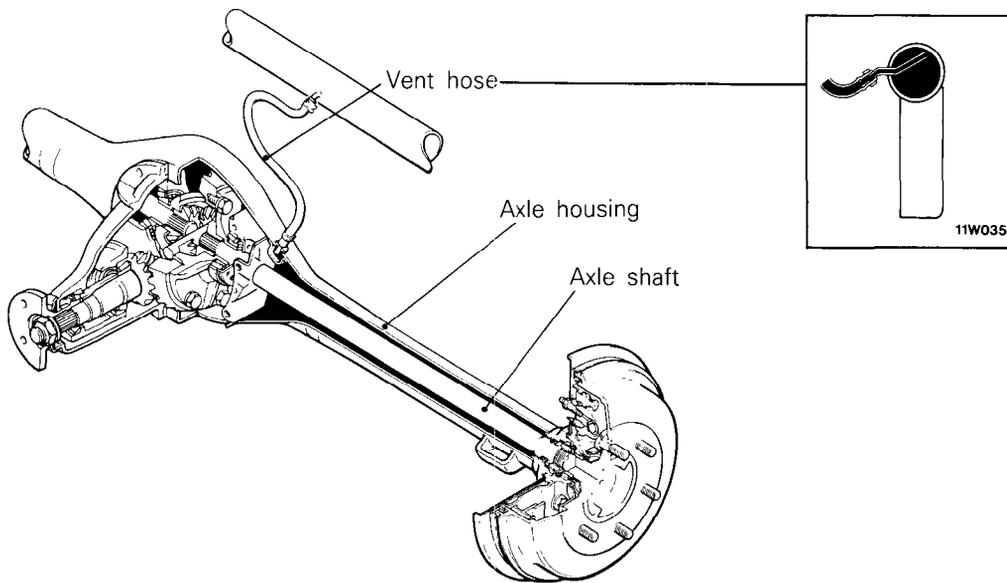
GENERAL INFORMATION

N03BAAB

The banjo-type, semi-floating type of rear axle has been adopted.

In order to improve the river-crossing ability of this model, a vent hose has been installed from the axle housing, and a differential breather (air bleeder) has been used within the frame crossmember.

There are two types of differential; conventional differential and limited slip differential. The limited slip differential is of great help when driving on muddy and other slippery ground.



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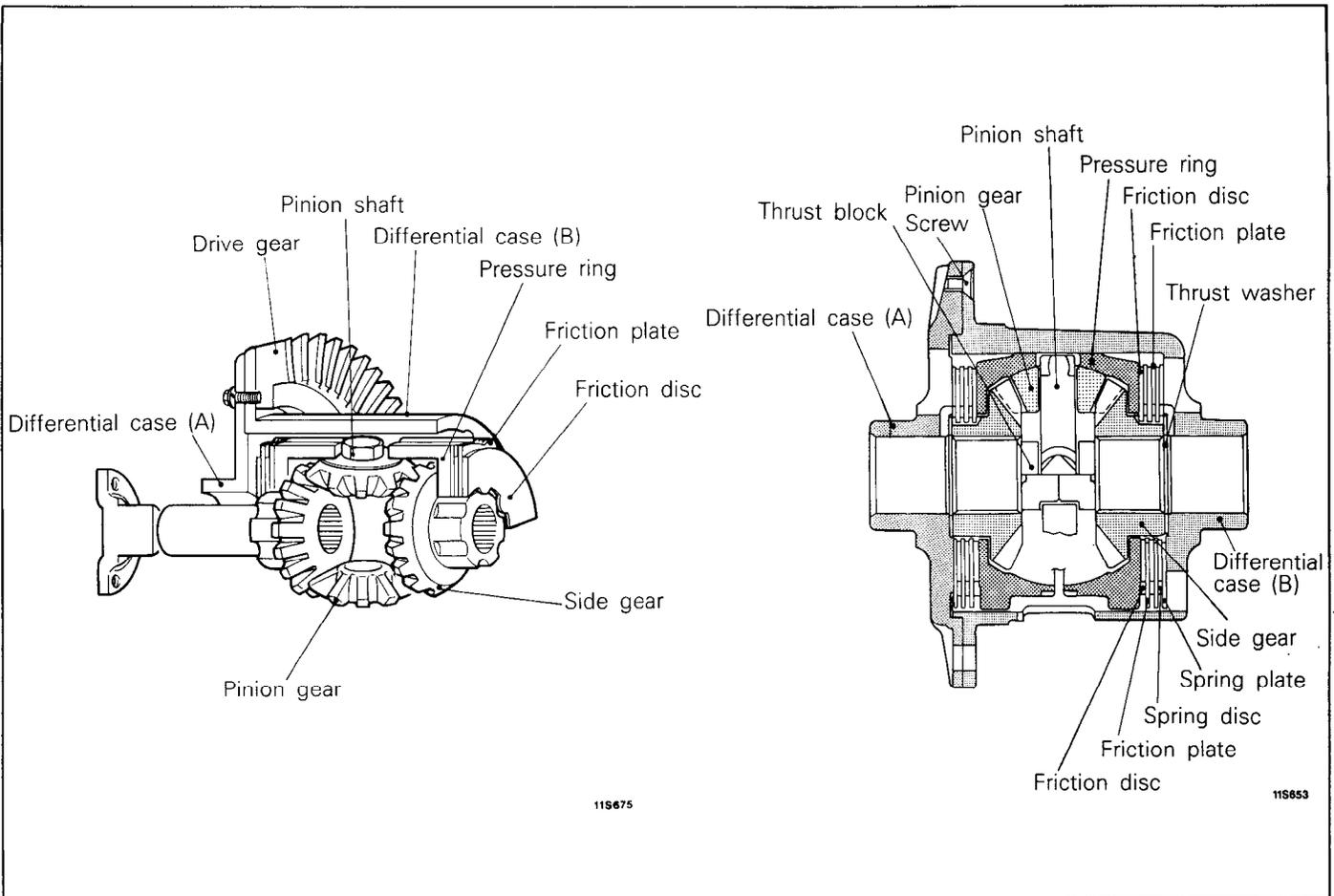
LIMITED SLIP DIFFERENTIAL

N03BBAB

A limited slip differential is an anti-slipping device which functions as a differential during cornering to allow the outer wheel to turn at a faster speed than the inner wheel. In the event that one wheel begins spinning (driving on slippery road surfaces, one wheel leaves the road surface, etc.), it automatically functions to prevent such spinning.

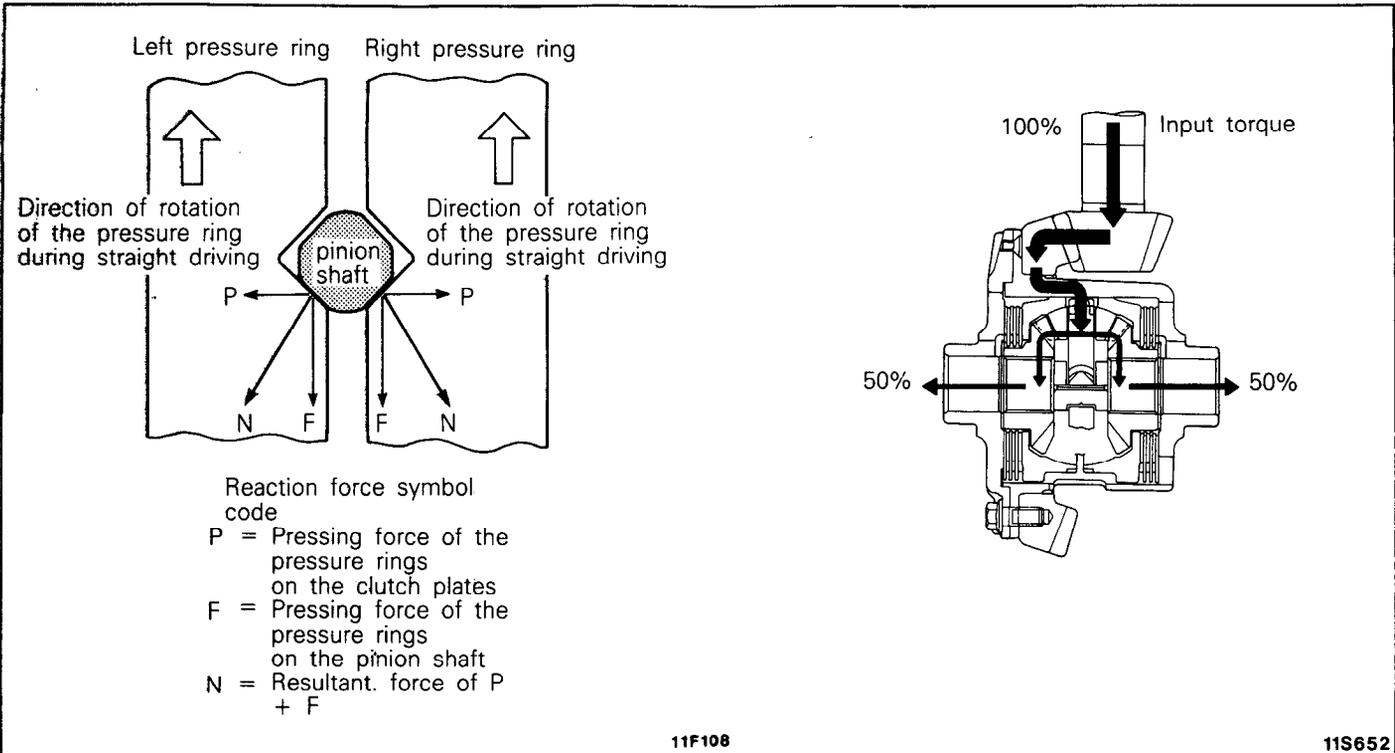
CONSTRUCTION AND FUNCTION

With a conventional differential, in the event that one wheel of the vehicle is on ice, mud, or some other slippery surface, the wheel will spin and the drive force of the vehicle will be greatly reduced. If this happens, the speeds of the differential case and of the side gear (axle shaft) are different because of differential operation. The limited slip function acts to limit this differential operation. The construction is shown in the illustration. The multi-plate clutches engage with the differential case and with each of the side gears. If spinning causes a difference in component speeds, the frictional force between the clutch plates will cause the speed of the side gear to become closer to that of the differential case, and thus the limited slip function will control the spinning. In addition, the purpose of the pressure rings inside the differential case is to transmit the driving force to the pinion gear, and the reason for the separation is to provide an increase in the clutch plate pressing force through the leverage of the pinion shaft.



OPERATION (TORQUE TRANSMISSION) DURING STRAIGHT DRIVING

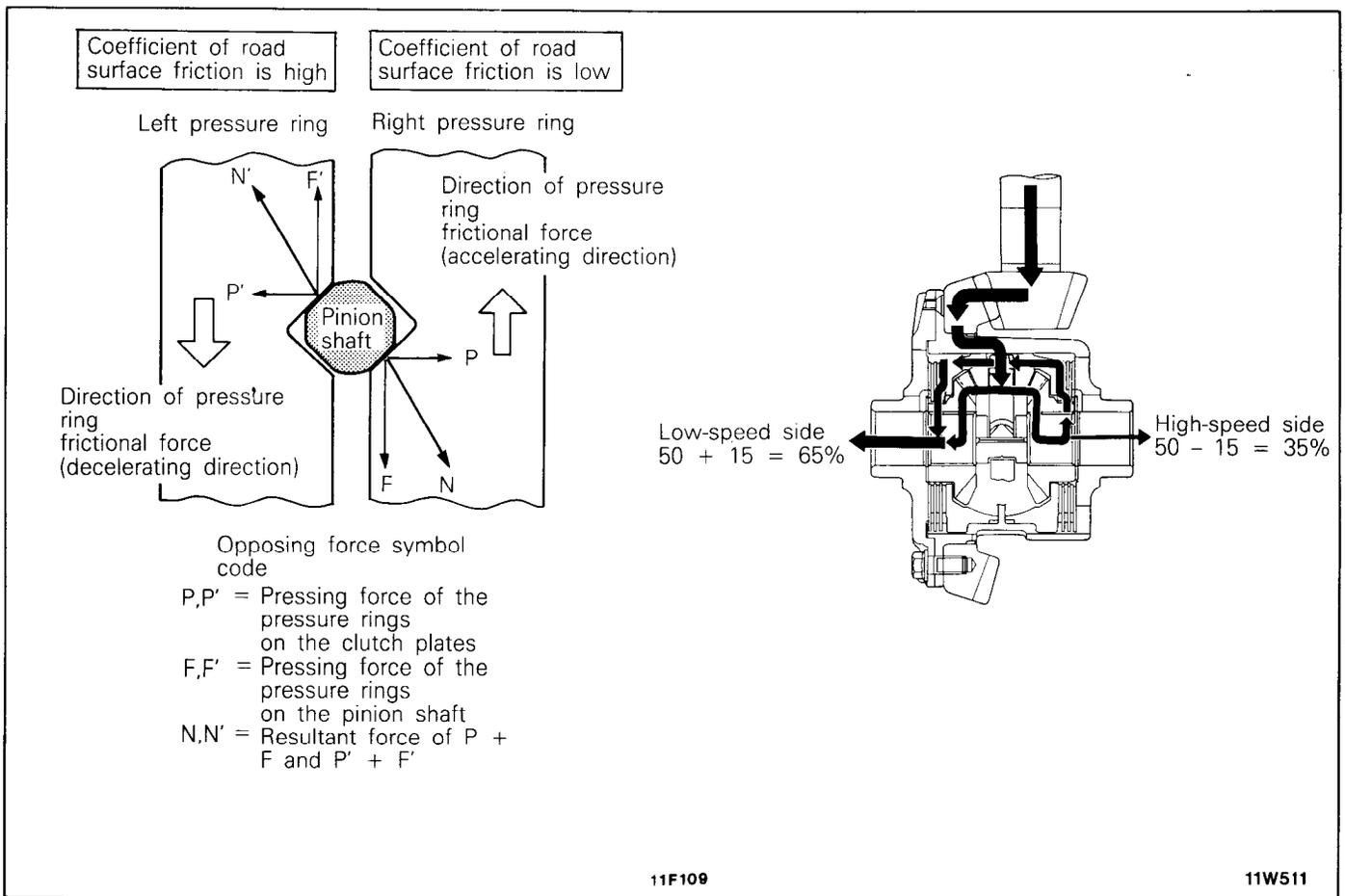
When the differential case is turned the drive pinion via the drive gear, the pressure rings which are interlocked with the differential case will also turn at the same speed. (The projections located on the outside of the pressure rings engage (with some play) the grooves located on the inside of the differential case). When the pressure rings move in the direction of rotation, they contact the tapered portion of the pinion shaft, and thereby receive reaction force in both the lateral direction and the direction of rotation. The reaction force in the lateral direction presses the clutch plates together, and maintains straight driving. During such driving, because the road surface gives equal resistance to both the left and right wheels, equal resistance is applied to the left and right side gears. Therefore, the pinion gear does not revolve, and the drive gear, the differential case, the pinion shaft, the pinion gear, and the left and right side gears all turn as one unit.



OPERATION (TORQUE TRANSMISSION) WHEN THE SPEEDS OF LEFT AND RIGHT WHEELS ARE DIFFERENT

When one wheel is in contact with a concrete road surface (which has high coefficient of friction) and the other wheel is in contact with a muddy or other slippery road surface (which has low coefficient of friction), the differential operation will cause the speed of the wheel in contact with the slippery surface to be faster than the speed of the drive gear, lowering the maximum drive force. If this occurs, the limited slip function will control the differential operation and increase the driving force. The transmission of torque through the limited slip device in this event is as follows:

When the differential case is turned by the drive gear and the drive pinion, the pressure rings which are interlocked with the differential case will turn at the same speed. Also, the difference in the road surface resistances will cause differential operation and the left and right side gears will revolve at speeds different from that of the differential case. Because of the friction produced between the clutch plates in mesh with both the side gear and differential case, one of the pressure rings increases its rotating speed, whereas the other reduces its rotating speed. The pressure rings press the tapered portion of the pinion shaft with which they are in contact, and thereby receive reaction force in both the lateral direction and the direction of rotation. The reaction force in the lateral direction causes the clutch plates to mesh, increasing the frictional and the drive force.



FEATURES OF LIMITED SLIP DIFFERENTIAL

- (1) When one wheel of the vehicle is in contact with a road surface which has poor traction, the limited slip differential, in comparison to a conventional differential, supplies additional torque to the wheel which has the better traction conditions by utilizing clutch plates, thus improving the traction capacity. Moreover, the effect of the limited slip differential is to prevent the vehicle from becoming stuck, even if the traction of one of the wheels becomes radically reduced.
- (2) When one wheel moves from a road surface which has poor traction onto one which has good traction, or when the wheels are constantly leaving the road surface while driving on a rough, bumpy road, the clutch plates of the limited slip differential allow the torque to absorb the differences between the revolution speeds of the right and left wheels. In addition, the sudden changes (jolting) in the drive force are also absorbed, thus preventing skidding.
- (3) Because in the limited slip differential, the differential operation is slightly restricted during normal cornering, the understeer tendency (the tendency for the cornering of the vehicle to exceed the turning of the steering wheel) becomes greater; however, this does not have any detrimental effect on the driving of the vehicle. Moreover, in the event that the inside wheel lifts up (the tire leaves the road surface) during high speed cornering, the clutch plates function to limit differential operation which would simultaneously decrease the drive force of the outside wheel; therefore, the limited slip differential moderates sudden speed reductions during vehicle cornering, and thereby provides greater cornering capability than a conventional differential.

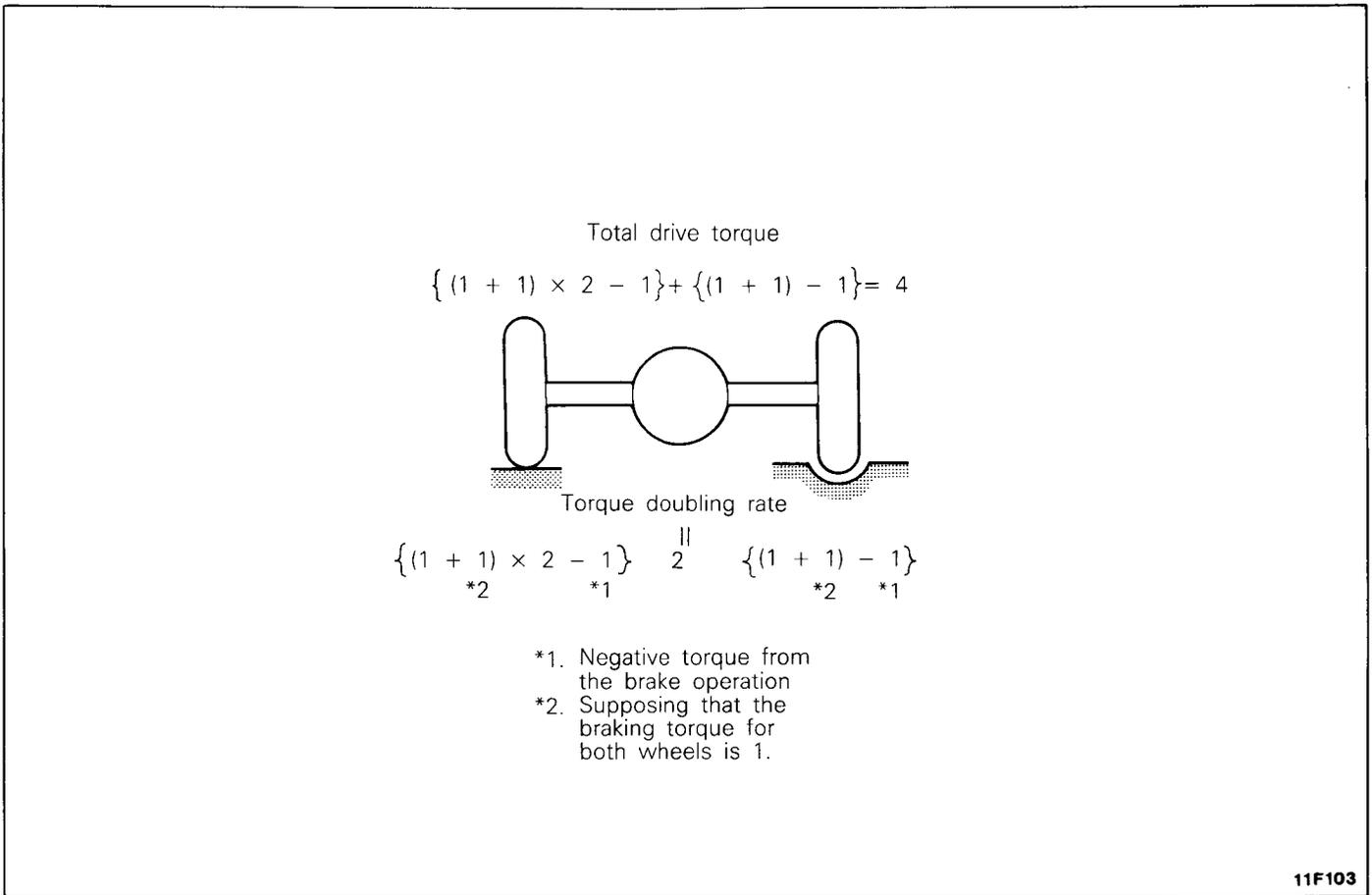
MAKING EFFECTIVE USE OF LIMITED SLIP DIFFERENTIAL

Effective Use in Combination with Brakes

If a wheel is in contact with a slippery road surface and has begun to spin, using the brakes in combination with the limited slip differential will provide even greater traction capability. The resistance caused by the brakes will further increase the drive torque of the engine, and this increased torque will increase the clutch plate pressing force of the pressure ring, thus increasing the traction. Also, the drive force transmitted to the brakes will not function as real drive force. This is shown in the illustration below.

In the illustration, the application rate is $R_t = 2$, and, supposing the torque from the brake operation is 1, a drive torque of $1 + 1 = 2$ will be applied to the spinning wheel (the right wheel), and a drive torque of twice that which is applied to the spinning wheel, or $(1 + 1) \times 2 = 4$, will be applied to the wheel which is not spinning (the left wheel). However, because the brake force of 1 is a negative value with regard to the propulsion torque of each wheel, the propulsion torque actually obtained by the right wheel is $(1 + 1) - 1 = 1$, and that obtained by the left wheel is $[(1 + 1) \times 2 - 1] = 3$.

Therefore, the total drive torque is $1 + 3 = 4$. In the same circumstances, the total drive torque of a conventional differential is $1 + 1 = 2$, and that of a limited slip differential when the brakes are not used in combination is $1 + 2 = 3$. This represents an increase in the traction by a factor of 2 over that of a conventional differential, and by a factor of 1.3 over that of a limited slip differential when the brakes are not used.



NOTES REGARDING SERVICE PROCEDURES FOR LIMITED SLIP DIFFERENTIAL

- (1) The engine must never be operated while only a single wheel is jacked up. Doing so is extremely dangerous; if the differential functions while the engine is operated at high speed, the oil film between the clutch plates will decrease, thus causing the friction coefficient to increase, the prescribed torque ratio will be exceeded, an excessive amount of torque will be applied to the stationary wheel, and the vehicle will move forward. Also, resistance must never be applied to the spinning wheel.
- (2) In the event that one of the wheels comes in contact with a slippery road surface and begins to spin, if the engine continues to be operated at high speed for too long, the clutch plates might become abnormally worn; such action must be avoided.
- (3) As gear oil, use MITSUBISHI Genuine Gear Oil (part number 8149630 EX) or equivalent. MITSUBISHI Genuine Gear Oil was especially developed for limited-slip differential use, and is different from ordinary gear oil. When changing the oil, the oil which is removed will appear considerably blacker than ordinary oil. This, however, is not a change in color due to the deterioration of the oil, but rather the oil has become mixed with worn particles of the special treatment on the clutch plates.

SPECIFICATIONS

GENERAL SPECIFICATIONS

N03CA--

Items	Vehicles with conventional differential	Vehicles with limited slip differential
Axle housing type	Banjo type	Banjo type
Axle shaft		
Supporting type	Semi-floating type	Semi-floating type
Shaft dimensions		
Bearing portion dia. mm (in.)	40 (1.57)	40 (1.57)
Center portion dia. mm (in.)	34.5 (1.358)	34.5 (1.358)
Overall length mm (in.)	703.5 (27.700)	703.5 (27.700)
Bearing		
O.D. × I.D. × width mm (in.)	80 × 40 × 19.75 (3.15 × 1.57 × .7776)	80 × 40 × 19.75 (3.15 × 1.57 × .7776)
Differential		
Reduction gear type	Hypoid gear	Hypoid gear
Reduction ratio	4.625	4.625
Differential lock type	–	Disc type
Differential gear type and configuration		
Side gear	Straight bevel gear × 2	Straight bevel gear × 2
Pinion gear	Straight bevel gear × 2	Straight bevel gear × 4
Number of teeth		
Drive gear	37	37
Drive pinion	8	8
Side gear	14	16
Pinion gear	10	10

SERVICE SPECIFICATIONS

N03CB--

Items	Vehicles with conventional differential	Vehicles with limited slip differential
Standard values		
Axle shaft end play mm (in.)	0.05–0.20 (.0020–.0079)	0.05–0.20 (.0020–.0079)
Limited slip differential preload (on Vehicle) Nm (ft.lbs.)	–	35 (25) or more
Parking brake lever stroke	4–6 clicks	4–6 clicks
Final drive gear backlash mm (in.)	0.11–0.16 (.0043–.0063)	0.11–0.16 (.0043–.0063)
Differential gear back lash mm (in.)	0.10–0.25 (.0004–.0098)	–
Drive pinion turning torque		
without oil seal Nm (in. lbs.)	0.4–0.5 (3.5–4.3)	0.4–0.5 (3.5–4.3)
with oil seal Nm (in. lbs.)	0.65–0.75 (5.6–6.5)	0.65–0.75 (5.6–6.5)
Difference in total thickness between left and right clutch plates mm (in.)	–	0.05 (.0020) or less
Clearance between the clutch plates and the differential case mm (in.)	–	0.06–.20 (.0024–.0079)
Difference in distances from backs of left and right pressure rings to end of thrust washer mm (in.)	–	0.05 (.0020) or less
Clearance of the side gear in the axial direction mm (in.)	–	0.05–0.20 (.0020–.0079)
Limited slip differential preload		
When equipped with new clutch plates Nm (ft. lbs.)	–	65–100 (47–72)
When equipped with old clutch plates Nm (ft. lbs.)	–	35–100 (25–72)
Limits		
Rear axle total backlash mm (in.)	5 (.20)	5 (.20)
Drive gear runout mm (in.)	0.05 (.0020)	0.05 (.0020)
Differential gear backlash mm (in.)	0.2 (.008)	–
Friction plates and friction discs warpping (flatness) mm (in.)	–	0.08 (.0031)
Friction plates and friction discs wear (difference in thicknesses of friction surfaces and projections) mm (in.)	–	0.1 (.004)

TORQUE SPECIFICATION

N03CC--

Items	Nm	ft. lbs.
Shackle assembly attaching nut	45-60	33-43
Shock absorber attaching nut	18-25	13-18
U-bolt attaching nut	85-110	61-80
Brake tube flare nut	13-17	9-12
Propeller shaft attaching nut	50-60	36-43
Bearing case to rear axle housing	50-60	36-43
Rear axle bearing lock nut	180-220	130-159
Filler plug	40-60	29-43
Drain plug	60-70	43-51
Differential carrier to rear axle housing	25-30	18-22
Companion flange	190-250	137-181
Differential case to drive gear	80-90	58-65
Bearing cap	55-65	40-47
Lock plate	15-22	11-16

LUBRICANTS

N03CD--

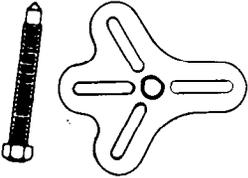
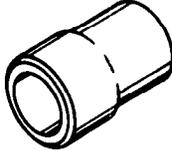
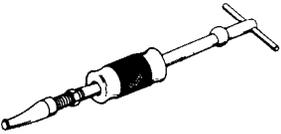
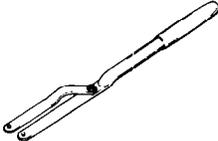
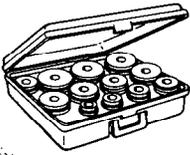
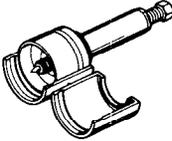
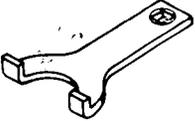
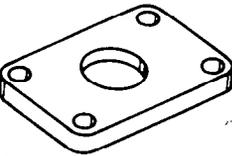
Items	Specified lubricants	Quantity
Rear axle gear oil		
Conventional differential	Hypoid gear oil API classification GL-4 or higher/SAE viscosity No. 90, 80W	1.80 lit. (3.80 U.S.pints., 3.20 Imp.pints.)
Limited slip differential	MITSUBISHI Genuine Gear Oil Part No. 8149630 EX or equivalent	1.80 lit. (3.80 U.S.pints., 3.20 Imp.pints.)
Axle housing oil seal	Multipurpose grease SAE J310, NLGI No. 2	As required
Axle shaft bearing	Multipurpose grease SAE J310, NLGI No. 2	As required
Axle shaft oil seal	Multipurpose grease SAE J310, NLGI No. 2	As required
Axle shaft thread portion	Multipurpose grease SAE J310, NLGI No. 2	As required
Differential carrier oil seal lip	Multipurpose grease SAE J310, NLGI No. 2	As required
Companion flange washer	Multipurpose grease SAE J310, NLGI No. 2	As required

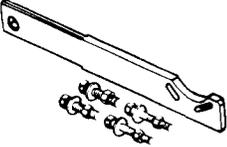
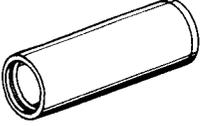
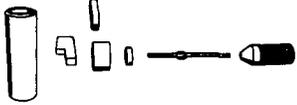
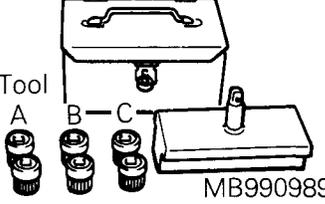
SEALANT AND ADHESIVE

N03CE--

Item	Specified sealant and adhesive	Quantity
Axle shaft shim	3M ART Part No.8663,8661 or equivalent	As required
Differential carrier gasket	3M ART Part No.8663,8661 or equivalent	As required
Drive gear threaded hole	3M Adhesive stud locking 4170 or equivalent	As required

SPECIAL TOOLS

Tool (Number and name)	Use	Tool (Number and name)	Use
MB990241-01 Axle puller 	Measurement of limited slip differential preload Removal of axle shaft	MB990799-01 Axle bearing remover and installer 	Pressing of axle shaft bearing inner race
MB990211-01 Sliding hammer with adapter 	Removal of axle shaft Removal of axle housing oil seal	MB990201-01 Adjustable wrench 	Removal and adjustment of side bearing nut
MB990925-01 Bearing and oil seal installer disc set 	Pressing of axle housing oil seal Pressing of axle shaft bearing outer race Pressing of axle shaft oil seal Pressing of drive pinion rear bearing outer race Pressing of drive pinion front bearing outer race	MB990339-01 Pinion carrier bearing puller 	Removal of side bearing inner race Removal of drive pinion rear bearing inner race
MB990938-01 Handle 	Pressing of axle housing oil seal Pressing of axle shaft bearing outer race Pressing of axle shaft oil seal Pressing of drive pinion rear bearing outer race Pressing of drive pinion front bearing outer race	MIT303173 Insert 	Removal of side bearing inner race Removal of drive pinion rear bearing inner race
MB990785-01 Lock nut spanner wrench 	Removal and installation of lock nut	MIT44801 Collet set 	Removal of side bearing inner race Removal of drive pinion rear bearing inner race
MB990787-01 Rear axle bearing case remover 	Removal of axle shaft bearing and bearing case	MB990811-01 Side bearing cup remover step plate 	Removal of side bearing inner race

Tool (Number and name)	Use	Tool (Number and name)	Use
MB990767-01 End yoke holder 	Holding of companion flange	MIT304180 Handle 	Pressing of drive pinion oil seal
MB990901-01 Pinion height gauge set 	Measurement of pinion height	MB990031-01 Drive pinion oil seal installer 	Pressing of drive pinion oil seal
MB990802-01 Bearing installer 	Pressing of drive pinion rear bearing inner race Pressing of side bearing inner race	MB990988 Side gear holding tool 	Measurement of limited slip differential preload

TROUBLESHOOTING

N03EAAA

Symptom	Probable cause	Remedy	Reference page
AXLE SHAFT, AXLE HOUSING			
Noise while wheels are rotating	Brake drag Bent axle shaft Worn or scarred axle shaft bearing	Replace	3-22
Grease leakage	Worn or damaged oil seal Malfunction of bearing seal	Replace	3-22
DIFFERENTIAL (CONVENTIONAL DIFFERENTIAL)			
Constant noise	Improper final drive gear tooth contact adjustment Loose, worn or damaged side bearing Loose, worn or damaged drive pinion bearing	Correct or replace	3-29 3-32, 35
	Worn drive gear, drive pinion Worn side gear thrust washer or pinion shaft Deformed drive gear or differential case Damaged gear	Replace	3-32, 35
	Foreign material	Eliminate the foreign material and check; replace the parts if necessary	3-32, 35
	No oil	Fill or change	3-17
Gear noise while driving	Poor gear engagement Improper gear adjustment Improper drive pinion preload adjustment	Correct or replace	3-29, 37
	Damaged gear	Replace	3-32, 35
	Foreign material	Eliminate the foreign material and check; replace the parts if necessary	3-32, 35
	Insufficient oil	Fill or change	3-17
Gear noise while coasting	Improper drive pinion preload adjustment	Correct or replace	3-37
	Damaged gear	Replace	3-32, 35
Bearing noise while driving or coasting	Cracked or damaged drive pinion rear bearing	Replace	3-32, 35
Noise while turning	Loose side bearing Damaged side gear, pinion gear or pinion shaft	Replace	3-32, 35
Heat	Improper gear backlash Excessive preload	Adjust	3-29
	Insufficient oil	Fill or change	3-17

Symptom	Probable cause	Remedy	Reference page
Oil leakage	Clogged breather hose	Clean or replace	3-20
	Cover tightened not Seal malfunction	Retighten, apply sealant, or replace the gasket	3-27
	Worn or damaged oil seal	Replace	3-32, 35
	Excessive oil	Adjust the oil level	3-17
DIFFERENTIAL (LIMITED SLIP DIFFERENTIAL) Abnormal noise during driving or gear changing	Excessive final drive gear backlash Insufficient drive pinion preload	Adjust	3-29, 47
	Excessive differential gear backlash	Adjust or replace	3-29
	Worn spline of a side gear	Replace	3-42, 45
	Loose spline coupling self-locking nut	Retighten or replace	3-42, 45

NOTE

In addition to a malfunction of the differential carrier components, abnormal noise can also be caused by the universal joint of the propeller shaft, the axle shafts, the wheel bearings, etc. Before disassembling any parts, take all possibilities into consideration and confirm the source of the noise.

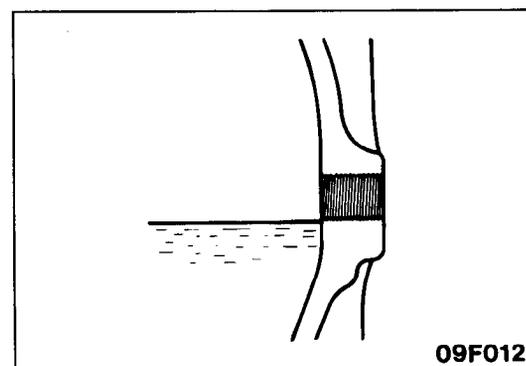
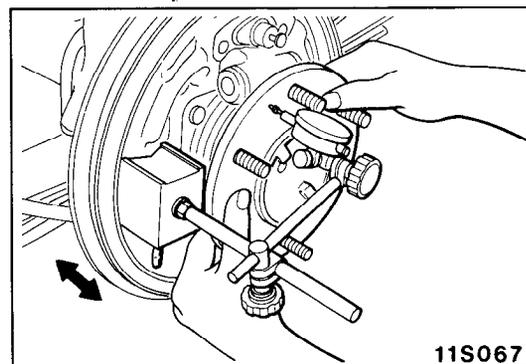
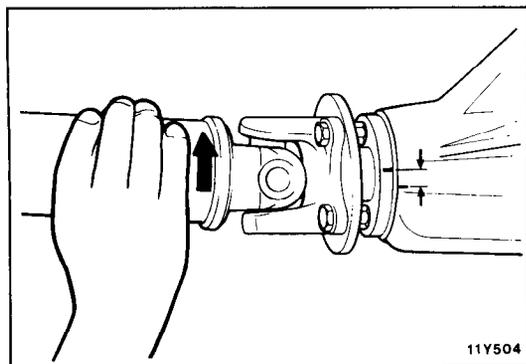
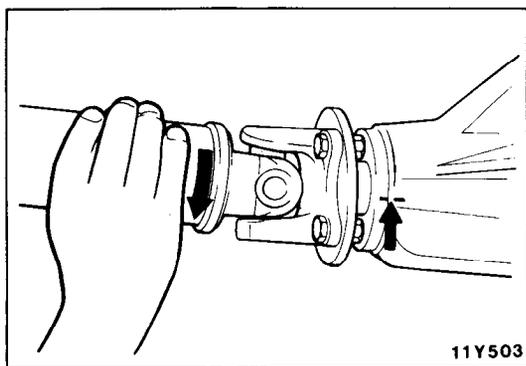
Abnormal noise when cornering	Damaged differential gears Damaged pinion shaft Nicked and/or abnormal wear of inner and outer clutch plates Poor gear oil Abnormally worn or damaged thrust washer	Replace	3-42, 45 3-51
	Improper gear oil quantity	Refill or replace	3-17
Gear noise	Improper final drive gear tooth contact adjustment	Adjust or replace	3-29
	Incorrect final drive gear backlash Improper drive pinion preload adjustment	Adjust	3-29, 47
	Damaged, broken, and/or seized tooth surfaces of the drive gear and drive pinion Damaged, broken, and/or seized drive pinion bearings Damaged broken, and/or seized side bearings Damaged differential case Poor gear oil	Replace	3-42, 45
	Improper gear oil quantity	Refill or replace	3-17

NOTE

Noise from the engine, muffler vibration, transmission, propeller shaft, wheel bearings, tires, body, etc., is easily mistaken as being caused by malfunction in the differential carrier components. Be extremely careful and attentive when performing the driving test, etc.

Test methods to confirm the source of the abnormal noise include: coasting, acceleration, constant speed driving, raising the rear wheels on a jack, etc. Use the method most appropriate to the circumstances.

Symptom	Probable cause	Remedy	Reference page
Gear oil leakage	Worn or damaged front oil seal, or an improperly installed oil seal Damaged gasket	Replace	3-42, 45
	Loose spline coupling self-locking nut	Retighten or replace	3-42, 45
	Loose filler or drain plug	Retighten or apply adhesive	3-27
	Clogged or damaged breather hose	Clean or replace	3-20
Seizure	Improper final drive gear backlash Excessive drive pinion preload Excessive side bearing preload Improper differential gear backlash Excessive clutch plate preload	Adjust	3-29, 47, 51
	Improper gear oil	Replace	3-17
	Improper gear oil quantity	Refill or replace	3-17
<p>NOTE In the event of seizure, disassemble and replace the parts involved, and also be sure to check all components for any irregularities and repair or replace as necessary.</p>			
Breakdown	Incorrect final drive gear backlash Incorrect drive pinion preload Incorrect side bearing preload Excessive differential gear backlash Incorrect clutch plate preload	Adjust	3-29, 47, 51
	Loose drive gear clamping bolts	Retighten	3-42, 45
	Operational malfunction due to overloaded clutch	Avoid excessively rough operation	–
<p>NOTE In addition to disassembling and replacing the failed parts, be sure to check all components for irregularities and repair or replace as necessary.</p>			
Limited slip differential does not function (on snow, mud, ice, etc.).	The limited slip device is damaged	Disassemble, check the functioning, and replace the damaged parts	3-42, 45, 51



SERVICE ADJUSTMENT PROCEDURES N03FAAB

CHECKING REAR AXLE TOTAL BACKLASH

If the vehicle vibrates and produces a booming sound due to the unbalance of the drivetrain, use the following procedure to measure the rear axle total backlash to see if it is necessary to remove the differential carrier assembly.

- (1) Park the vehicle on a flat, level surface.
- (2) Set both the transmission shift lever and the transfer shift lever to neutral.
- (3) Chock the wheels.

NOTE

If the vehicle is to be raised on a lift, engage the parking brake to lock the wheels.

- (4) Manually turn the propeller shaft clockwise as far as it will go and make mating marks on the companion flange dust cover and the gear carrier.
- (5) Manually turn the propeller shaft counterclockwise as far as it will go and measure the movement of the mating marks.

Limit : 5 mm (.20 in.)

- (6) If the backlash exceeds the limit, remove the differential carrier assembly and adjust it.

CHECKING AXLE SHAFT FOR END PLAY N03FBAB

1. Jack up the vehicle and remove the rear wheels.
2. Remove the brake drums.
3. Measure the axle shaft end play with a dial indicator.
4. Pull the axle shaft all the way out and note the end play indication on the dial indicator.

Standard value : 0.05–0.20 mm (.0020–.0079 in.)

5. If the axle shaft end play exceeds the standard value, withdraw the axle shaft, and then adjust to the standard value by changing the shim thickness. (Refer to P.3-26.)

CHECKING GEAR OIL LEVEL N03FCAC

1. Remove the filler plug, and check the oil level.
2. The oil level is sufficient if it reaches the level plug hole.

Specified gear oil:

Conventional differential

Hypoid gear oil API classification GL-4 or higher/SAE viscosity No. 90, 80W
 [1.80 lit. (3.80 U.S.pints., 3.20 Imp.pints.)]

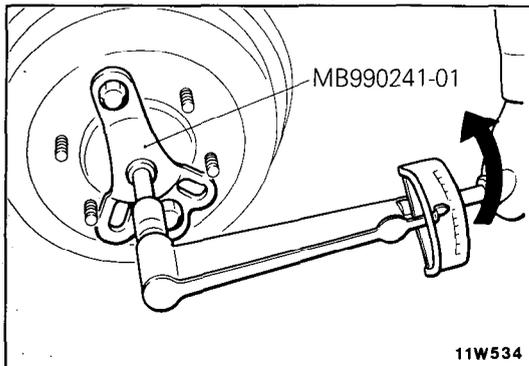
Limited slip differential

MITSUBISHI Genuine Gear Oil Part No. 8149630 EX or equivalent
 [1.80 lit. (3.80 U.S.pints., 3.20 Imp.pints.)]

LIMITED SLIP DIFFERENTIAL PRELOAD MEASUREMENT

N03FDAD

1. To measure the preload of the limited slip differential, set the shift lever of the transmission to the neutral position, lock the front wheels, and fully release the parking brake. One of the rear wheels should be maintained in contact with the ground surface, and the other should be raised up.
2. Measure the axle shaft turning torque at the side on which the wheel is raised position by using the following procedure:
 - (1) Remove the wheel.
 - (2) Mount the special tool to the hub bolts with the hub nuts.
 - (3) Find the limited slip differential preload by measuring the axle shaft turning torque in the forward direction with a torque wrench.



NOTE

Before measuring the turning torque, turn the axle shaft to remove any initial resistance.

Standard value : 35 Nm (25 ft.lbs.) or more

- (4) If the turning torque is less than the standard value, remove the limited slip differential from the vehicle and repair it. (Refer to P.3-45.)

REPLACEMENT OF AXLE HOUSING OIL SEAL

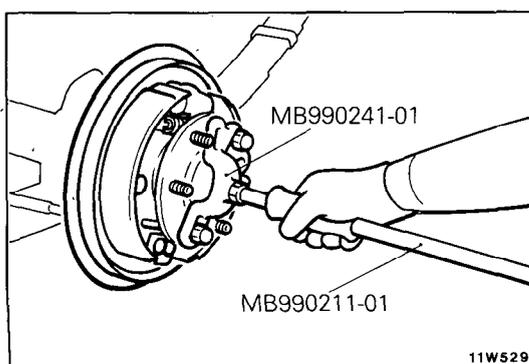
N03FEAC

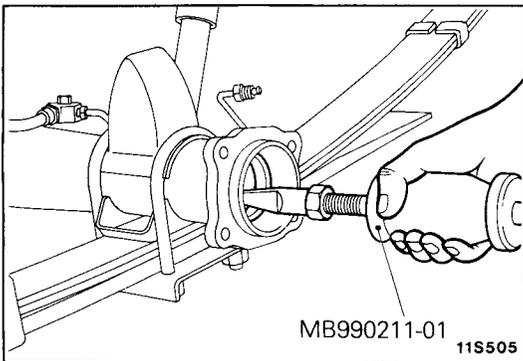
1. Disconnect the parking brake cables from the equalizer and then remove the clamps from the parking brake cables. (Refer to GROUP 5 BRAKES – Parking Brake Cable.)

NOTE

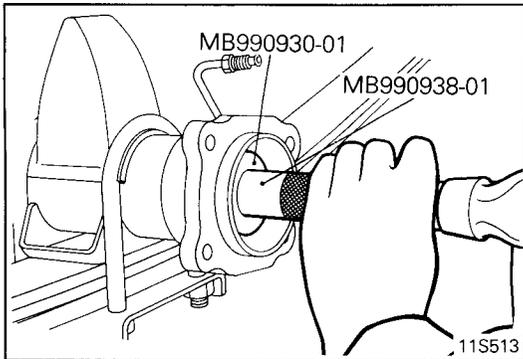
Do not disconnect the parking brake cable and rear brake connection.

2. Before disconnecting the brake tube, drain the brake fluid from the bleeder screw at the left side of the rear brake.
3. Pull the rear axle shaft with rear brake assembly attached. If the rear axle shaft is hard to remove, use the special tools.





4. Use special tool with hook attached to remove the oil seal.



5. Apply the specified grease to the oil seal fitting area of the rear axle housing.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

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

7. Apply the specified grease to the oil seal lip.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

8. Adjust the clearance between the bearing case and rear axle housing end. (Refer to P.3-26.)

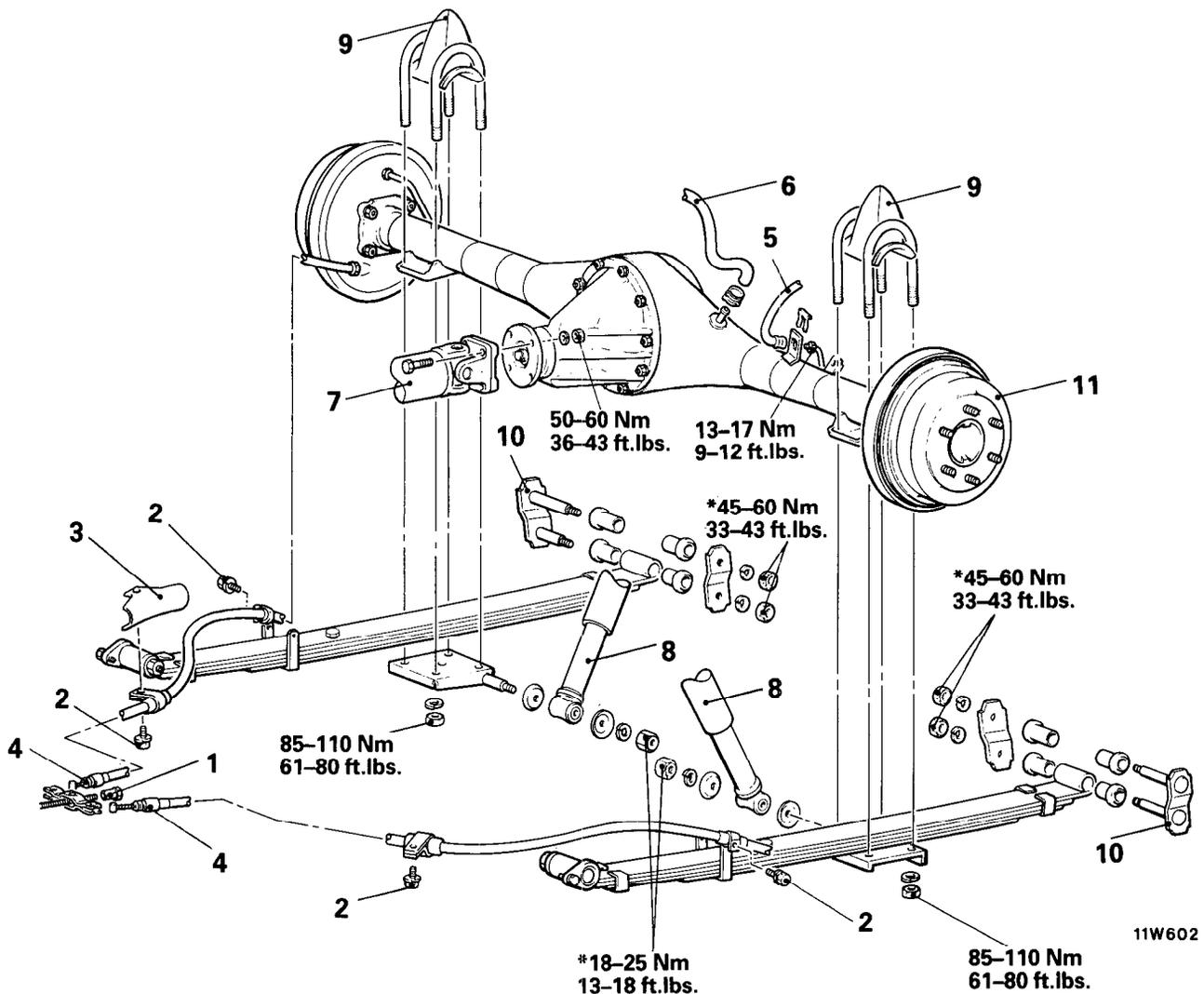
9. Install the rear axle shaft assembly to the rear axle housing.
10. Connect the brake tube and bleed out the air. (Refer to GROUP 5 BRAKES-Service Adjustment Procedures.)

11. Connect the parking brake cable, and adjust the stroke of the parking brake lever.

Standard value : 4-6 clicks

(Refer to GROUP 5 BRAKES-Service Adjustment Procedures.)

**AXLE ASSEMBLY
REMOVAL AND INSTALLATION**



11W602

Post-installation Operation

- Air Bleeding from Brake Lines (Refer to GROUP 5 BRAKES - Service Adjustment Procedures)
- Adjustment of Parking Brake Lever Stroke (Refer to GROUP 5 BRAKES - Service Adjustment Procedures)

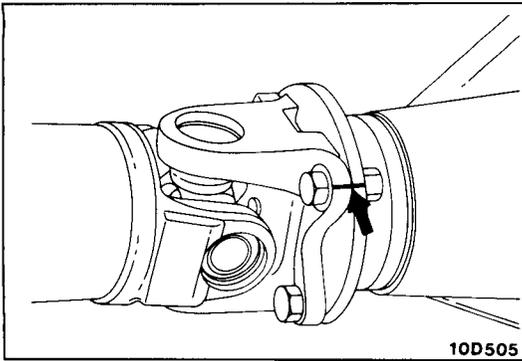
Removal steps

1. Adjuster (Parking brake cable)
2. Parking brake cable attaching bolts
3. Parking brake cable heat protector (right side only)
4. Connection of parking brake cables and equalizer
5. Connection of brake hose
6. Connection of breather hose
7. Rear propeller shaft

8. Connection of shock absorbers (lower part only)
9. U-bolts and bump stopper
10. Shackle assembly
11. Axle assembly

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◀▶ : Refer to "Service Points of Removal".
- (3) ▶▶ : Refer to "Service Points of Installation".
- (4) The part with * must be tightened with the vehicles lowered to the ground.



SERVICE POINTS OF REMOVAL

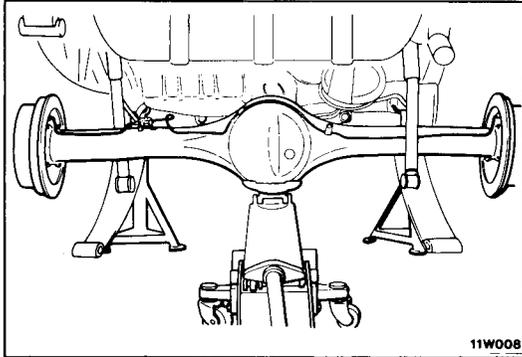
N03GBAB

5. DISCONNECTION OF BRAKE HOSE

Before disconnecting the brake tube, drain the brake fluid from the bleeder screw at the right side of the rear brake.

7. REMOVAL OF REAR PROPELLER SHAFT

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



9. REMOVAL OF U-BOLT AND BUMP STOPPER

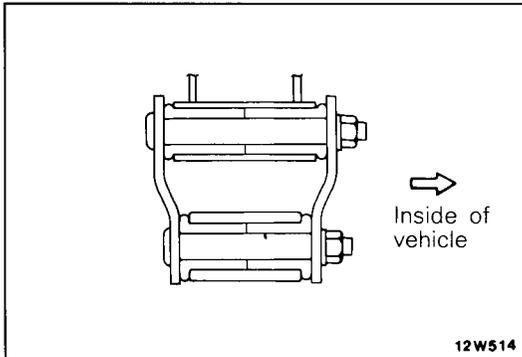
Before removing the U-bolt and the bumper stopper, place the jack underneath the center of the axle assembly to hold it slightly upward.

11. REMOVAL OF AXLE ASSEMBLY

Draw out the axle assembly toward the rear of the vehicle.

Caution

The axle assembly is unstable on the jack; be careful not to allow it to fall.



SERVICE POINTS OF INSTALLATION

N03GDAB

10. INSTALLATION OF SHACKLE ASSEMBLY

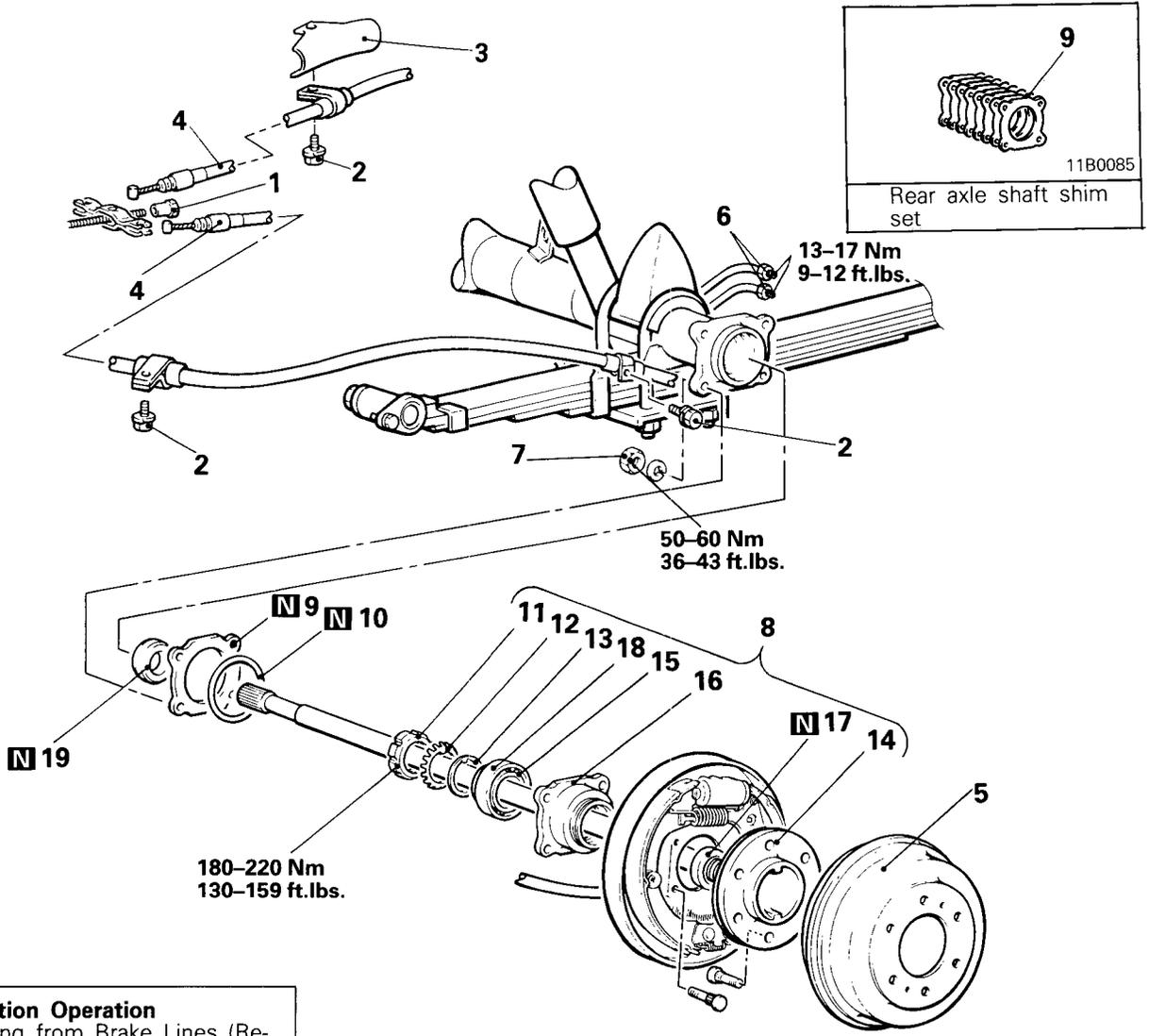
Install the shackle assembly from the outside toward the inside of vehicle.

7. INSTALLATION OF REAR PROPELLER SHAFT

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

**AXLE SHAFT
REMOVAL AND INSTALLATION**

N03HA--



Post-installation Operation

- Air Bleeding from Brake Lines (Refer to GROUP 5 BRAKES - Service Adjustment Procedures)
- Adjustment of Parking Brake Lever Stroke (Refer to GROUP 5 BRAKES - Service Adjustment Procedures)

11W603

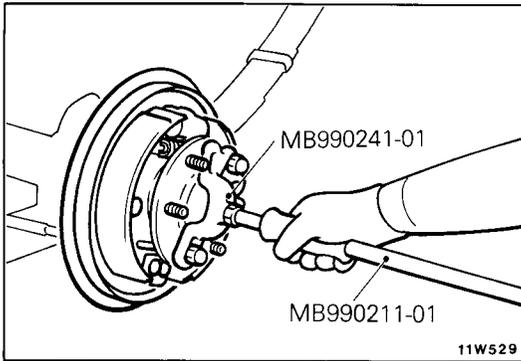
Removal steps

- 1. Adjuster (Parking brake cable)
- 2. Parking brake cable attaching bolts
- 3. Parking brake cable heat protector (right side only)
- 4. Connection of parking brake cable and equalizer
- 5. Brake drum
- ◄◄ 6. Connection of brake tubes
- ◄◄ 7. Nuts
- ◄◄ 8. Rear axle shaft assembly (with parking brake cable)
- 9. Shims
- 10. O-ring
- ◄◄ Adjustment of axle shaft end play

- ◄◄ ◄◄ 11. Lock nut
- ◄◄ 12. Lock washer
- ◄◄ 13. Washer
- ◄◄ ◄◄ 14. Rear axle shaft
- ◄◄ 15. Bearing inner race
- ◄◄ 16. Bearing case
- ◄◄ 17. Oil seal
- ◄◄ ◄◄ 18. Bearing outer race
- ◄◄ ◄◄ 19. Oil seal

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◄◄ : Refer to "Service Points of Removal".
- (3) ◄◄ : Refer to "Service Points of Installation".
- (4) [N] : Non-reusable parts



SERVICE POINTS OF REMOVAL

N03HBAB

6. DISCONNECTION OF BRAKE TUBES

Before disconnecting the brake tube, drain the brake fluid from the bleeder screw at the right side of the rear brake.

8. REMOVAL OF REAR AXLE SHAFT ASSEMBLY

Pull the rear axle shaft with rear brake assembly attached. If the rear axle shaft is hard to remove, use the special tools.

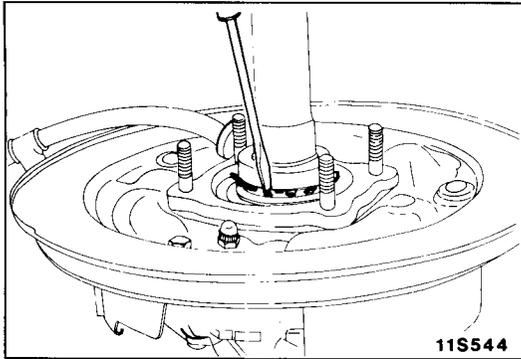
NOTE

Do not damage the oil seal during its removal.

11. REMOVAL OF LOCK NUT

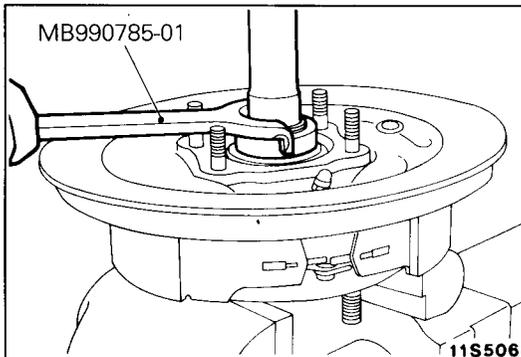
Remove the lock nut by following the steps below.

(1) Straighten the bent tab of the lock washer with the screwdriver.



(2) Remove the lock nut by using the special tool.

(3) Remove the lock washer and the washer.



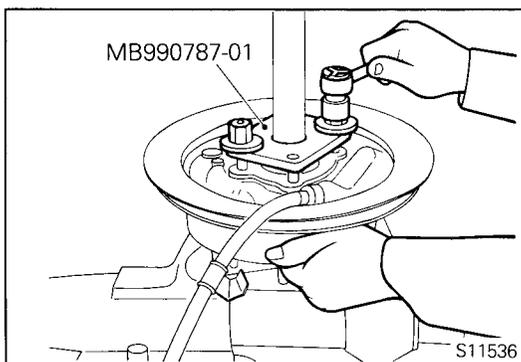
14. REMOVAL OF REAR AXLE SHAFT

(1) Reinsert the lock nut on the axle shaft approximately three turns.

(2) Install the special tool as figure to remove the rear axle shaft from the bearing case.

Be sure to install nuts and washers diagonally.

(3) Turn nuts with equal pressure to ensure smooth removal of the wheel bearing.

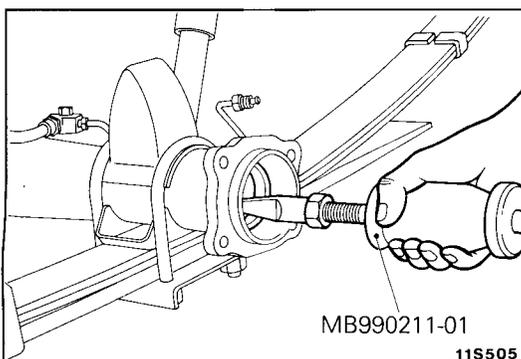


18. REMOVAL OF BEARING OUTER RACE

Using a hammer and drift, remove bearing outer race from bearing case.

19. REMOVAL OF OIL SEAL

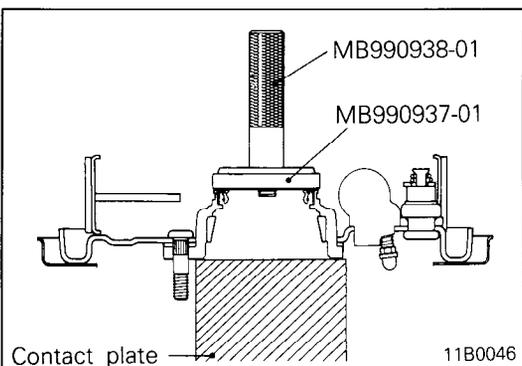
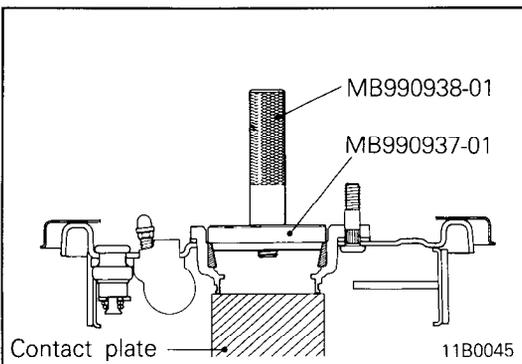
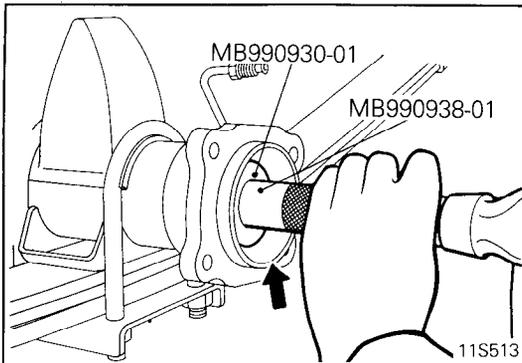
Remove the oil seal from the end of rear axle housing with the special tool, if necessary.



INSPECTION

N03HCAA

- Check the dust cover for deformation and 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.



SERVICE POINTS OF INSTALLATION

N03HDAD

19. INSTALLATION OF OIL SEAL

- (1) Apply the specified grease to the oil seal fitting area of the rear axle housing.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

- (2) Drive the new oil seal into the rear axle housing end by using the special tools.
- (3) Apply the specified grease to the oil seal lip.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

18. INSTALLATION OF BEARING OUTER RACE

- (1) Apply the specified grease to the external periphery of the bearing outer race.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

- (2) Press-fit the bearing outer race into the bearing case by using the special tools.

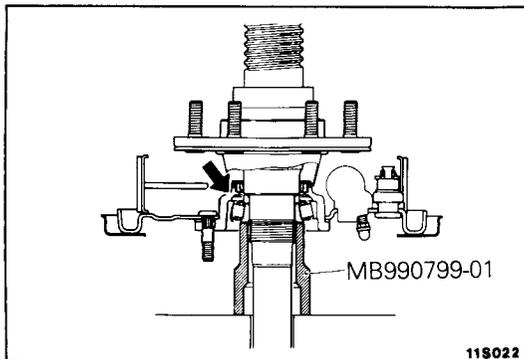
17. INSTALLATION OF OIL SEAL

- (1) Apply the specified grease to the external periphery of the new oil seal.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

- (2) Press-fit the new oil seal into the bearing case until it is flush with the face of the bearing case by using special tools.
- (3) Apply the specified grease to the lips of the oil seal.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2



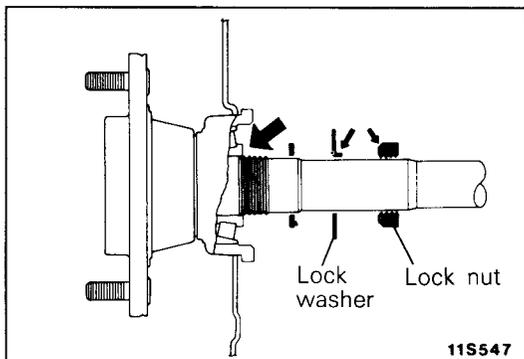
15. INSTALLATION OF BEARING INNER RACE/14. REAR AXLE SHAFT

- (1) Apply the specified grease to the roller surfaces of the bearing inner race.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

- (2) Install the rear brake assembly attached with bearing case and the bearing inner race in that order to the axle shaft.
- (3) Press-fit the bearing inner race into the axle shaft using the special tool.
- (4) Pack the bearing case with the specified grease.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2



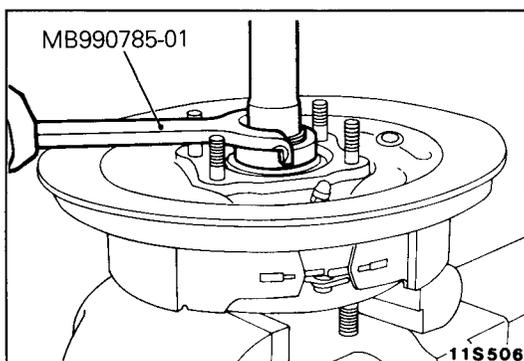
13. INSTALLATION OF WASHER/12. LOCK WASHER/11. LOCK NUT

Install these parts with cares described below.

- (1) Apply the specified grease to the thread portion of the axle shaft, to which the locking nut is installed.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

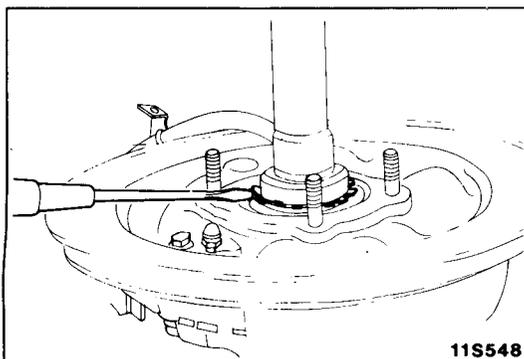
- (2) Align the washer tab with the slot of the axle shaft to install the washer.
- (3) Align the lock washer tab with the slot of the axle shaft to install the lock washer as figure.
- (4) Install the lock nut with its chamfering in the directions shown in the illustration.
- (5) Tighten the lock nut to the specified torque by using the special tool.

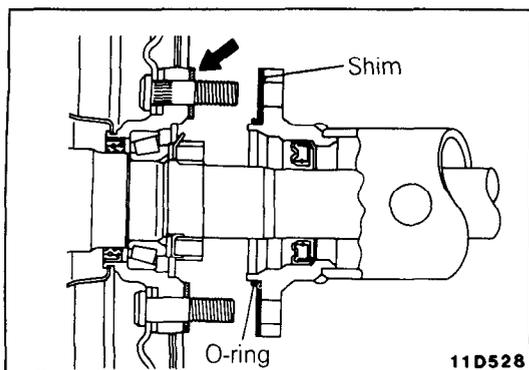


- (6) Bend the tab of the lock washer into the slot of the lock nut.

NOTE

If the slot in the lock nut and the tab of the lock washer are out of alignment, turn the lock nut in until they are in alignment.





- **ADJUSTMENT OF AXLE SHAFT END PLAY**

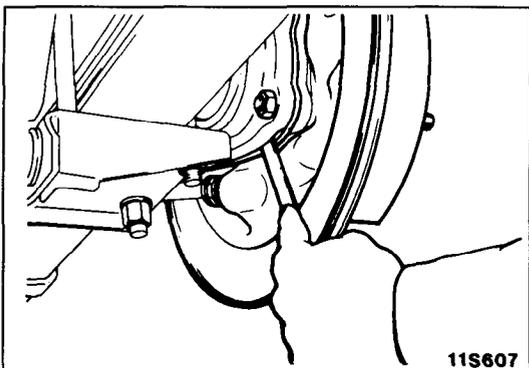
Adjust the clearance between the bearing case and rear axle housing end by the following procedure.

- (1) Insert a 1 mm (.04 in.) thick shim and O-ring into the left side rear axle housing.
- (2) Apply the specified sealant to the mating surface of bearing case, install the left axle shaft into rear axle housing and tighten the nuts.

NOTE

Tighten the nuts in diagonal sequence.

Specified sealant : 3M ART Part No 8663, 8661 or equivalent

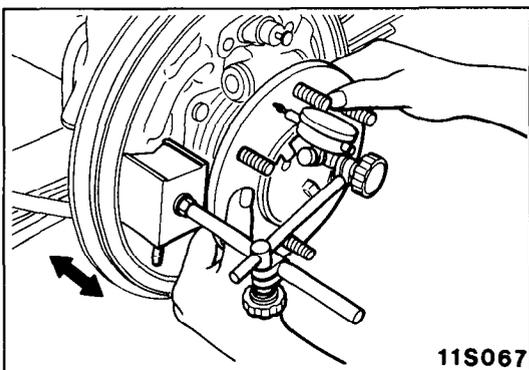


- (3) Install the right axle shaft without a shim (s) and O-ring and temporarily tighten to about 6 Nm (4.3 ft.lbs.).
- (4) Measure the clearance between the bearing case and rear axle housing end with a feeler gage.
- (5) Select shims of the thickness which is equal to the sum of the measured clearance and 0.05–0.20 mm (.0020–.0079 in.)
- (6) Remove the right axle shaft, and install shim (s) and O-ring on the right side rear axle housing end.
- (7) Apply the specified sealant to the mating surface of bearing case, install the right axle shaft into rear axle housing and tighten the nut.

NOTE

Tighten the nuts in diagonal sequence.

Specified sealant : 3M ART Part No. 8663, 8661 or equivalent

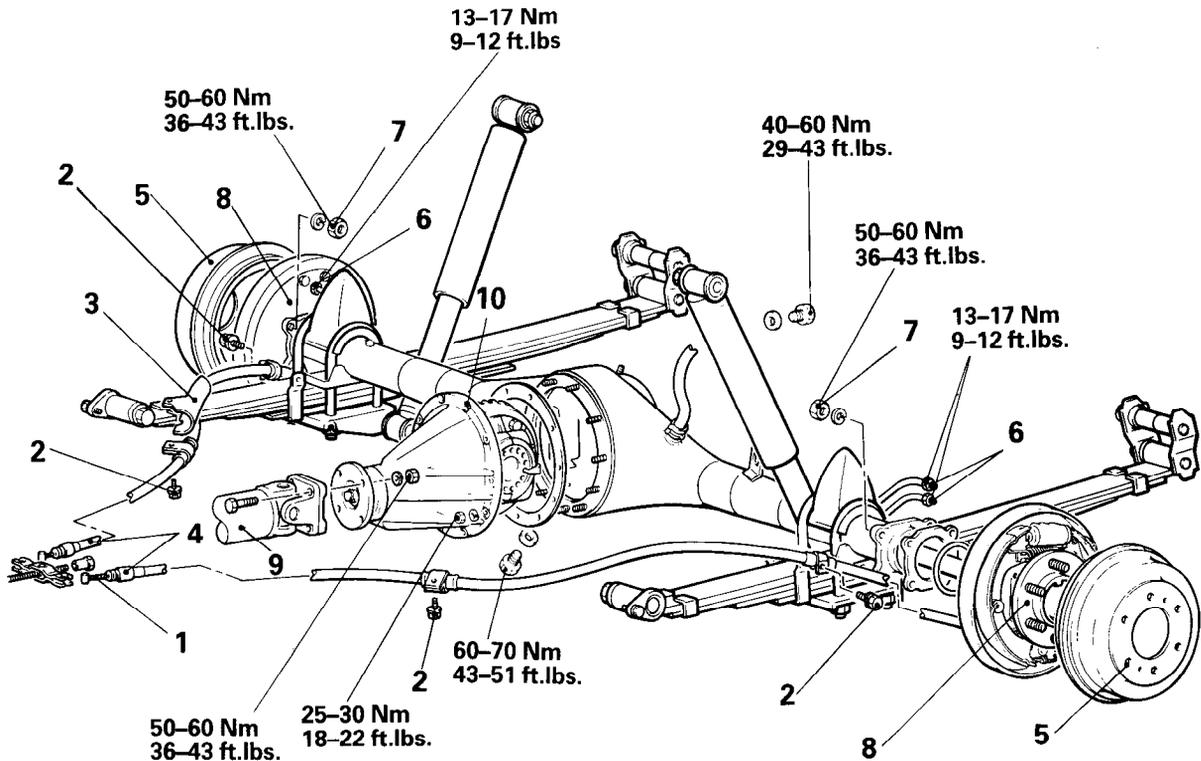


- (8) Check to assure that the axle shaft axial play is within the standard value.

Standard value : 0.05–0.20 mm (.0020–.0079 in.)

**DIFFERENTIAL CARRIER
REMOVAL AND INSTALLATION**

N031A--



11W615

Pre-removal Operation

- Drain of Differential Gear Oil (Refer to P.3-17.)

Post-installation Operation

- Air Bleeding from Brake Lines (Refer to GROUP 5 BRAKES – Service Adjustment Procedures)
- Adjustment of Parking Brake Lever Stroke (Refer to GROUP 5 BRAKES – Service Adjustment Procedures)
- Addition of Differential Gear Oil (Refer to P.3-17.)

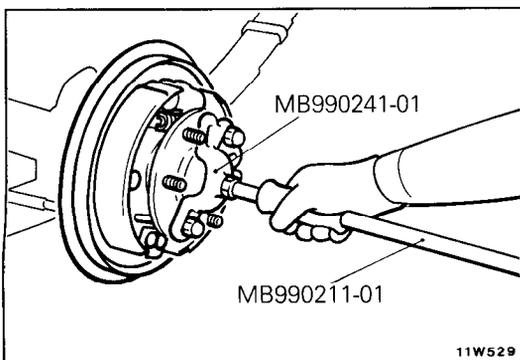
Removal steps

1. Adjuster (Parking brake cable)
2. Parking brake cable attaching nuts
3. Parking brake cable heat protector (right side only)
4. Connection of parking brake cable and equalizer
5. Brake drums
6. Connection of brake tubes

7. Nuts
8. Rear axle shaft assembly
9. Rear propeller shaft
10. Differential carrier

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◄◄ : Refer to "Service Points of Removal".
- (3) ►► : Refer to "Service Points of Installation".



SERVICE POINTS OF REMOVAL

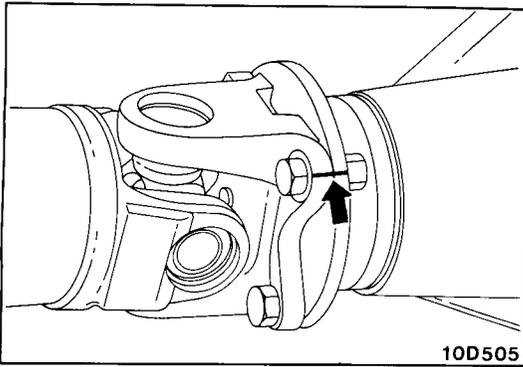
N031BAB

6. DISCONNECTION OF BRAKE TUBES

Before disconnecting the brake tube, drain the brake fluid from the bleeder screw at the right side of the rear brake.

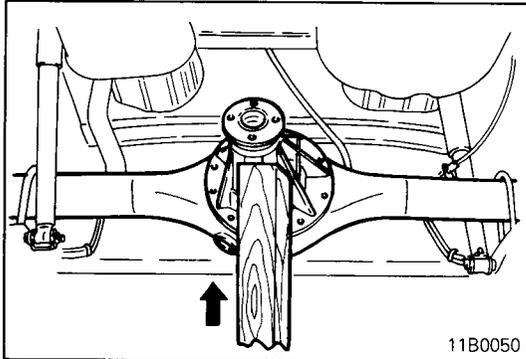
8. REMOVAL OF REAR AXLE SHAFT ASSEMBLY

Pull out the right and left axle shafts by about 70 mm (2.8 in.). If it is hard to pull out, use the special tools.



9. REMOVAL OF REAR PROPELLER SHAFT

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



10. REMOVAL OF DIFFERENTIAL CARRIER

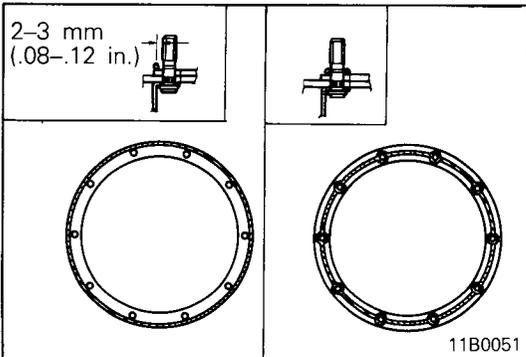
Remove the attaching nuts and strike the lower part of differential carrier assembly with a square lumber several times, to remove the assembly.

NOTE

Do not remove the uppermost nut but keep it loosened all the way to the stud bolt end.

Caution

Use care not to strike the companion flange.



SERVICE POINTS OF INSTALLATION

N03IDAB

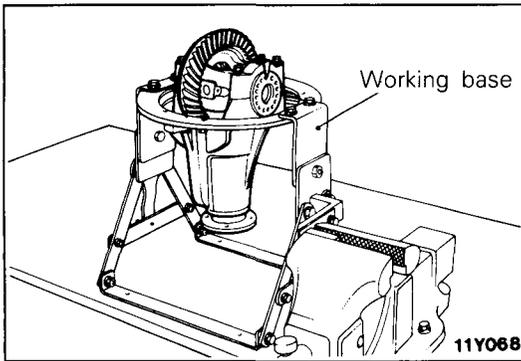
10. APPLICATION OF SEALANT TO DIFFERENTIAL CARRIER

When the differential carrier is installed, apply specified sealant to the differential carrier mounting surface of the axle housing as illustrated in either of the illustrations.

Specified sealant : 3M ART Part No. 8663, 8661 or equivalent

9. INSTALLATION OF REAR PROPELLER SHAFT

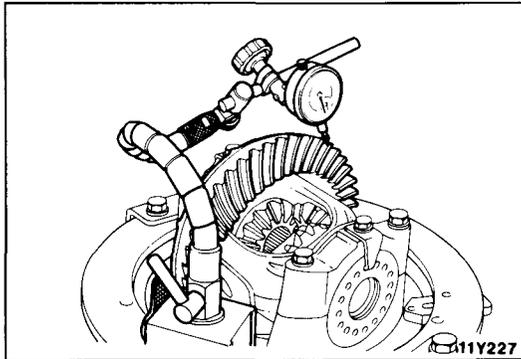
Align the mating marks on the flange yoke and the companion flange to install the rear propeller shaft.



INSPECTION BEFORE DISASSEMBLY

N03IEAA

Secure the working base in a vice and then install the removed differential carrier assembly.



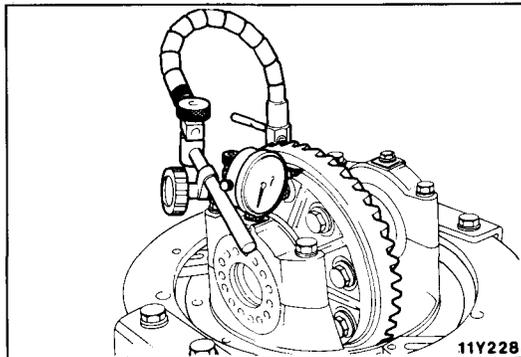
FINAL DRIVE GEAR BACKLASH

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.

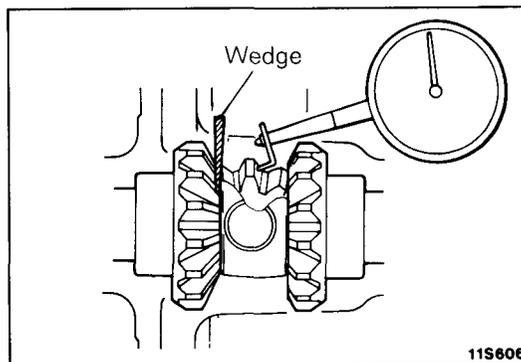
Standard value : 0.11–0.16 mm (.0043–.0063 in.)



DRIVE GEAR RUNOUT

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

Limit : 0.05 mm (.0020 in.)

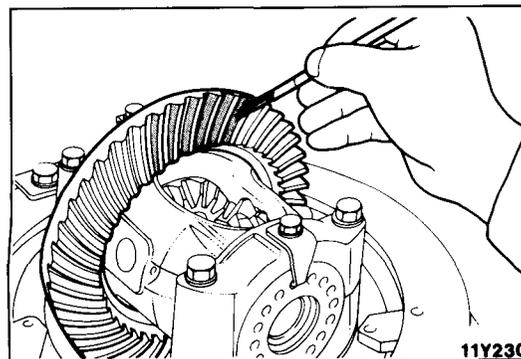


DIFFERENTIAL GEAR BACKLASH (CONVENTIONAL DIFFERENTIAL)

While locking the side gear with the wedge, measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value : 0.01–0.076 mm (.0004–.0030 in.)

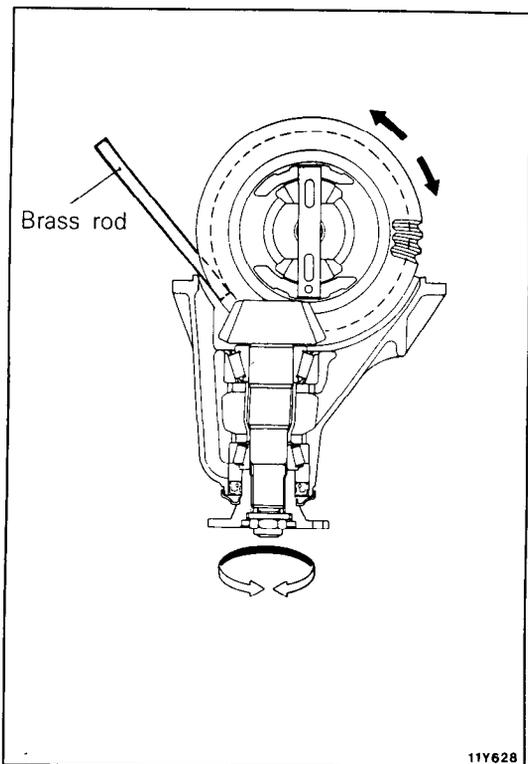
Limit : 0.2 mm (.008 in.)



FINAL DRIVE GEAR TOOTH CONTACT

Check the final drive gear tooth contact by following the steps below.

- (1) Apply a thin, uniform coat of machine blue to both surfaces of the drive gear teeth.



- (2) Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear, so that the revolution torque [approximately 2.5–3.0 Nm (1.8–2.2 ft.lbs.)] is applied to the drive pinion.

Caution

If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

- (3) Check the tooth-contact condition of the drive gear and drive pinion.

NOTE

Checking the tooth contact pattern is the way to confirm that the adjustments of the pinion height and backlash have been done properly. Continue to adjust the pinion height and backlash until the tooth contact pattern resembles the standard pattern.

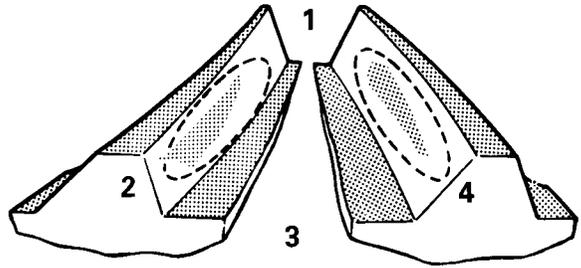
If, after adjustments have been made, the correct tooth contact pattern cannot be obtained, it means that the drive gear and the drive pinion have become worn beyond the allowable limit. Replace the gear set.

Caution

If either the drive gear or the drive pinion is to be replaced, be sure to replace both gears as a set.

Standard tooth contact pattern

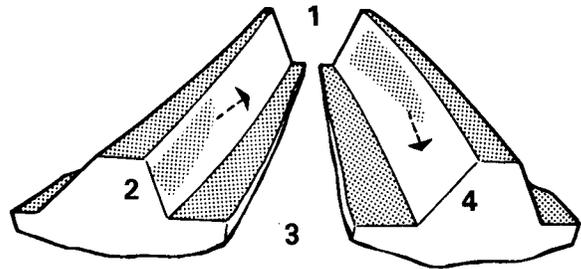
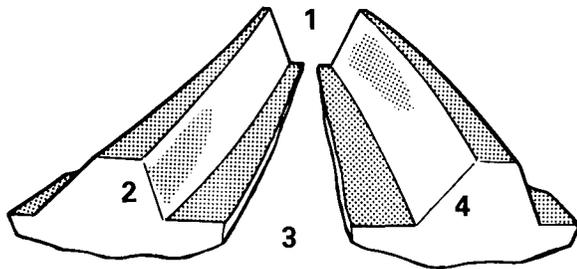
- 1 Toe
- 2 Drive-side
- 3 Heel
- 4 Coast-side



Problem

Solution

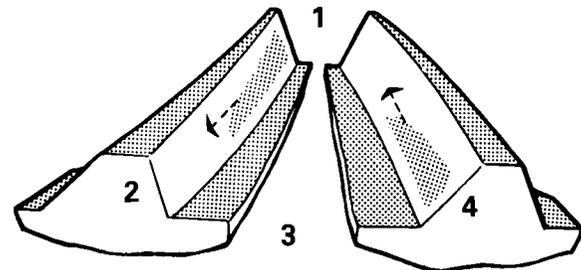
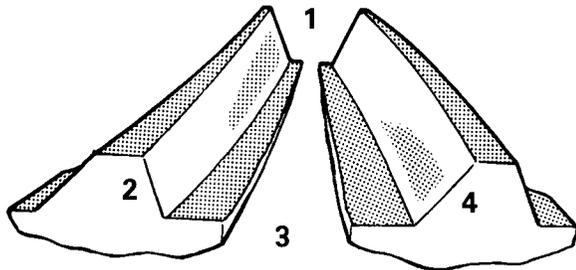
Tooth contact pattern resulting from excessive pinion height



The drive pinion is positioned too far from the center of the drive gear.

Increase the thickness of the pinion height adjusting shim, and position the drive pinion closer to the center of the drive gear. Also, for backlash adjustment, position the drive gear farther from the drive pinion.

Tooth contact pattern resulting from insufficient pinion height



The drive pinion is positioned too close to the center of the drive gear.

Decrease the thickness of the pinion height adjusting shim, and position the drive pinion farther from the center of the drive gear. Also, for backlash adjustment, position the drive gear closer to the drive pinion.

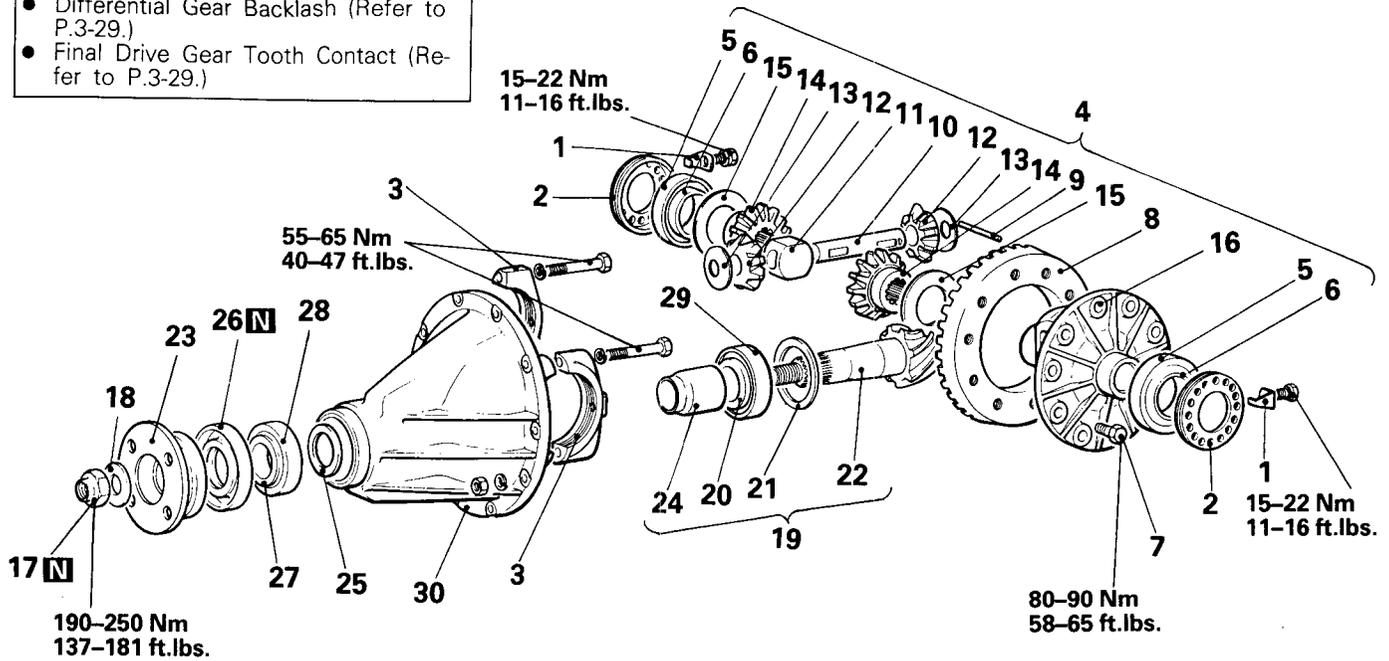
11S642

DISASSEMBLY

N031F--

Inspection Before Disassembly

- Final Drive Gear Backlash (Refer to P.3-29.)
- Drive Gear Runout (Refer to P.3-29.)
- Differential Gear Backlash (Refer to P.3-29.)
- Final Drive Gear Tooth Contact (Refer to P.3-29.)



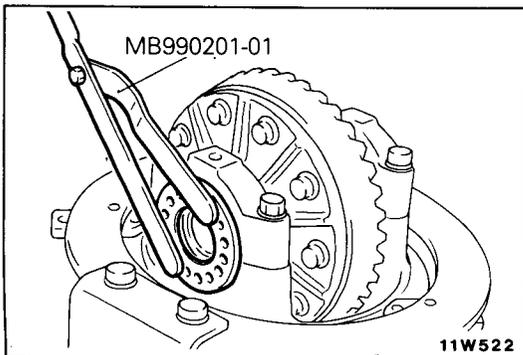
Disassembly steps

11W546

- | | |
|---------------------------------|---|
| 1. Lock plates | |
| ↔ 2. Side bearing nuts | ↔ 19. Drive pinion assembly |
| 3. Bearing caps | ↔ 20. Drive pinion rear bearing inner race |
| ↔ 4. Differential case assembly | ↔ 21. Drive pinion rear shim (for pinion height adjustment) |
| 5. Side bearing outer races | 22. Drive pinion |
| ↔ 6. Side bearing inner races | 23. Companion flange |
| ↔ 7. Bolts (10) | 24. Drive pinion spacer |
| ↔ 8. Drive gear | 25. Drive pinion front shim (for preload adjustment) |
| ↔ 9. Lock pin | 26. Oil seal |
| 10. Pinion shaft | ↔ 27. Drive pinion front bearing inner race |
| 11. Thrust block | ↔ 28. Drive pinion front bearing outer race |
| 12. Pinion gears | ↔ 29. Drive pinion rear bearing outer race |
| 13. Pinion washers | 30. Differential carrier |
| 14. Side gears | |
| 15. Side gear thrust spacers | |
| 16. Differential case | |
| ↔ 17. Self-locking nut | |
| 18. Washer | |

NOTE

- (1) ↔ : Refer to "Service Points of Disassembly".
 (2) **N** : Non-reusable parts

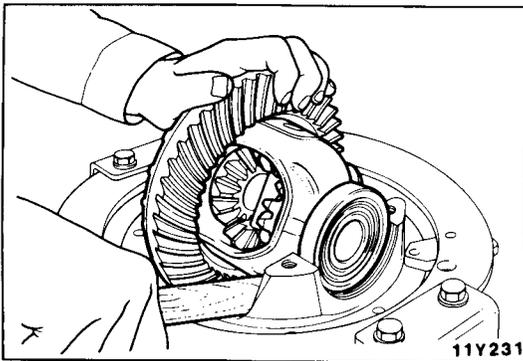


SERVICE POINTS OF DISASSEMBLY

N031GAA

2. REMOVAL OF SIDE BEARING NUT

Using the special tool, remove the side bearing nut.

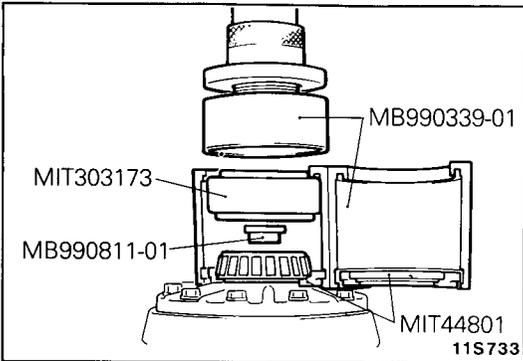


4. REMOVAL OF DIFFERENTIAL CASE ASSEMBLY

Take out the differential case assembly with hammer handles.

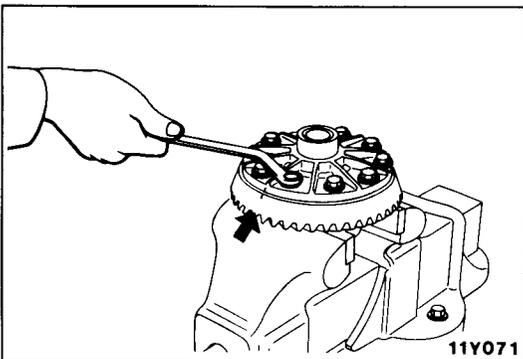
NOTE

Keep the right and left side bearings and side bearing nuts separate, so that they do not become mixed at the time of reassembly.



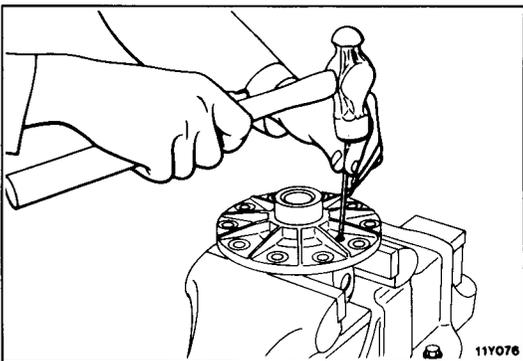
6. REMOVAL OF SIDE BEARING INNER RACE

Pull out the side bearing inner races by using the special tools.



8. REMOVAL OF DRIVE GEAR

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

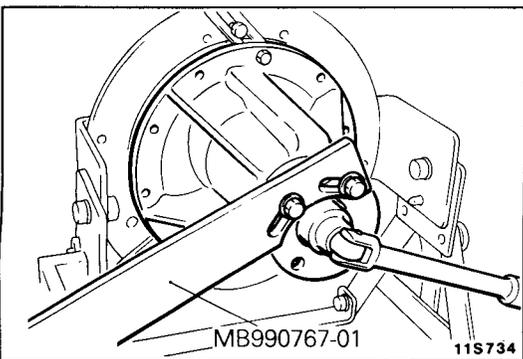


9. DRIVE-OUT OF LOCK PIN

Drive out the lock pin with a punch.

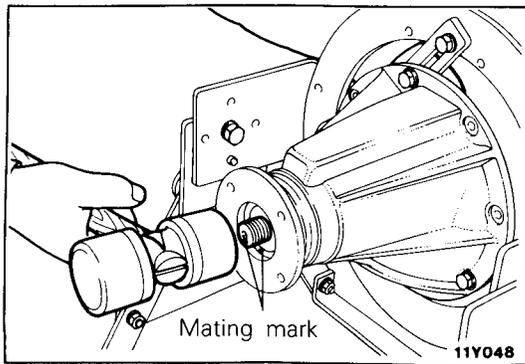
NOTE

The removed side gears and side gear thrust spacers, left and right, should be retained for reassembly.



17. REMOVAL OF SELF-LOCKING NUT

Use the special tools to hold the companion flange and remove the companion flange self-locking nut.

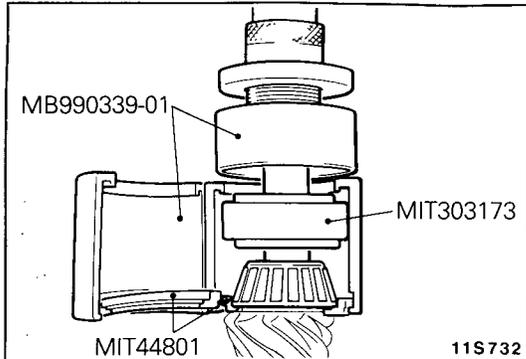
**19. REMOVAL OF DRIVE PINION ASSEMBLY**

- (1) Make the mating marks to the drive pinion and companion flange.

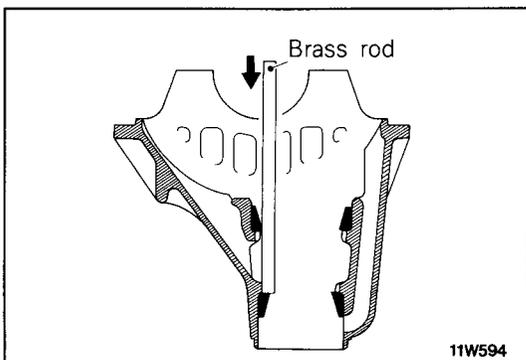
Caution

The mating mark made on the companion flange must not be on the coupling surface of the flange yoke and the rear propeller shaft.

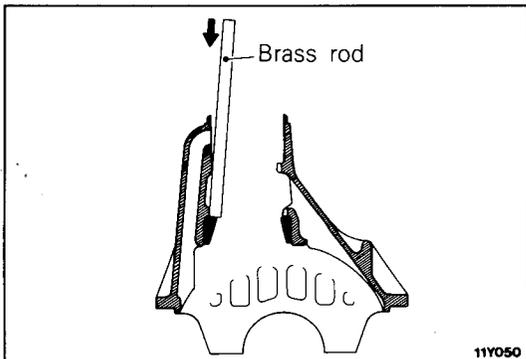
- (2) Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.

**20. REMOVAL OF DRIVE PINION REAR BEARING INNER RACE**

Pull out the drive pinion rear bearing inner race by using the special tools.

**28. REMOVAL OF DRIVE PINION FRONT BEARING OUTER RACE**

Drive out the drive pinion front bearing outer race from the gear carrier.

**29. REMOVAL OF DRIVE PINION REAR BEARING OUTER RACE**

Drive out the drive pinion rear bearing outer race from the gear carrier.

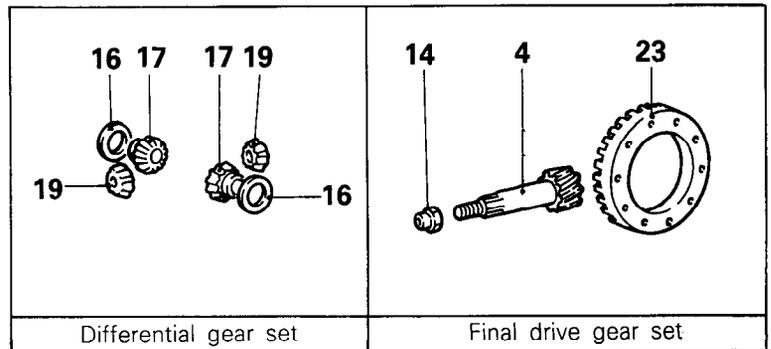
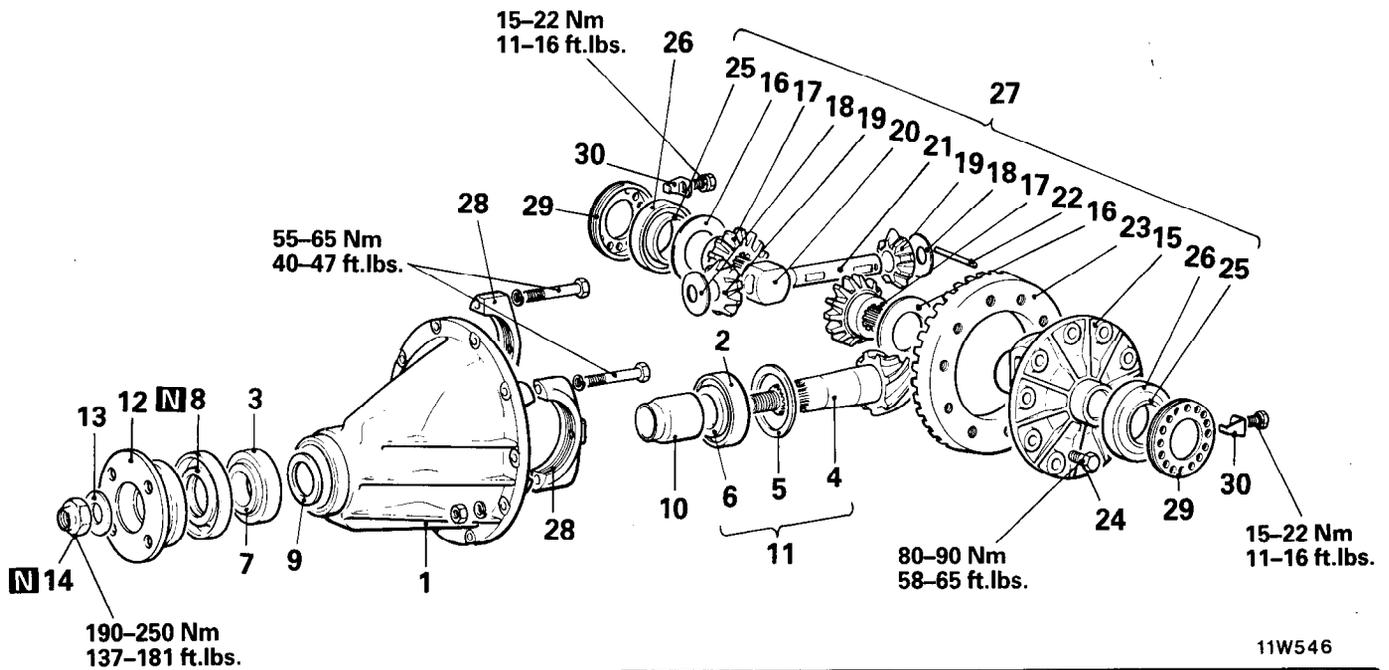
INSPECTION

N03IHAA

- 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 gear carrier for cracks.
- Check the drive pinion and ring gear for wear or cracks.
- Check the side gears, pinion gears and pinion shaft for wear or damage.
- Check the side gear spline for wear or damage.

REASSEMBLY

N0311-

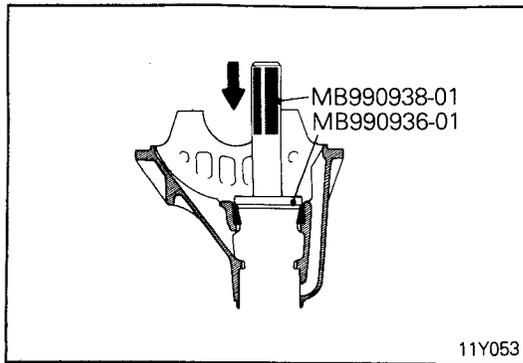


Reassembly steps

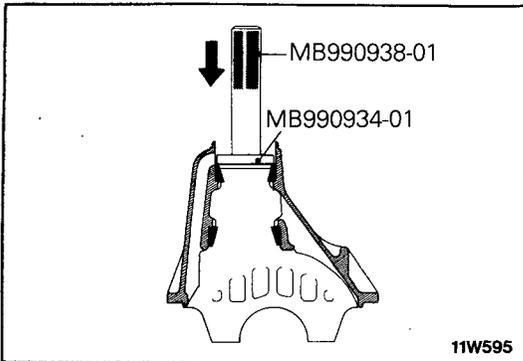
- | | |
|--|---|
| <ul style="list-style-type: none"> 1. Differential carrier ◆◆ 2. Drive pinion rear bearing outer race ◆◆ 3. Drive pinion front bearing outer race ◆◆ Adjustment of pinion height 4. Drive pinion 5. Drive pinion rear shim (for pinion height adjustment) 6. Drive pinion rear bearing inner race ◆◆ Adjustment of drive pinion preload 7. Drive pinion front bearing inner race 8. Oil seal 9. Drive pinion front shim (for preload adjustment) 10. Drive pinion spacer 11. Drive pinion assembly 12. Companion flange 13. Washer 14. Self-locking nut 15. Differential case 16. Side gear thrust spacers | <ul style="list-style-type: none"> 17. Side gears 18. Pinion washers 19. Pinion gears ◆◆ Adjustment of differential gear backlash 20. Thrust block 21. Pinion shaft ◆◆ 22. Lock pin ◆◆ 23. Drive gear 24. Bolts (10) ◆◆ 25. Side bearing inner races 26. Side bearing outer races 27. Differential case assembly ◆◆ 28. Bearing caps ◆◆ Adjustment of final drive gear backlash 29. Side bearing nuts 30. Lock plates |
|--|---|

NOTE

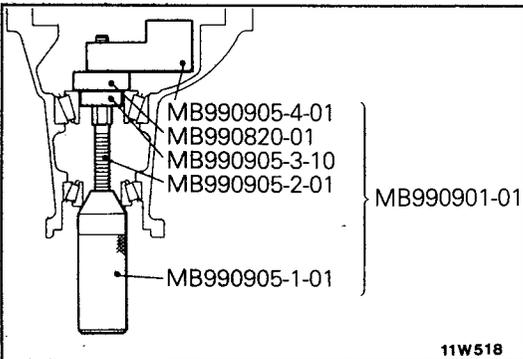
- (1) ◆◆ : Refer to "Service Points of Reassembly".
- (2) N : Non-reusable parts



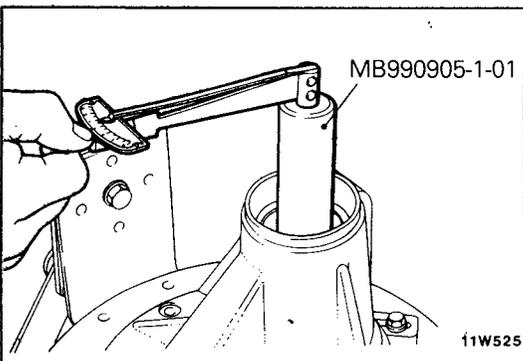
11Y053



11W595



11W518



11W525

SERVICE POINTS OF REASSEMBLY

N03IJAB

2. INSTALLATION OF DRIVE PINION REAR BEARING OUTER RACE

Press-fit the drive pinion rear bearing outer race into the gear carrier by using the special tools.

NOTE

Perform press-fitting carefully so as not to tilt the outer race.

3. INSTALLATION OF DRIVE PINION FRONT BEARING OUTER RACE

Press-fit the drive pinion front bearing outer race into gear carrier by using the special tools.

NOTE

Perform press-fitting carefully so as not to tilt the outer race.

- **ADJUSTMENT OF PINION HEIGHT**

Adjustment 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.

NOTE

Apply a thin coat of the specified grease to the mating face of the washer of the special tool.

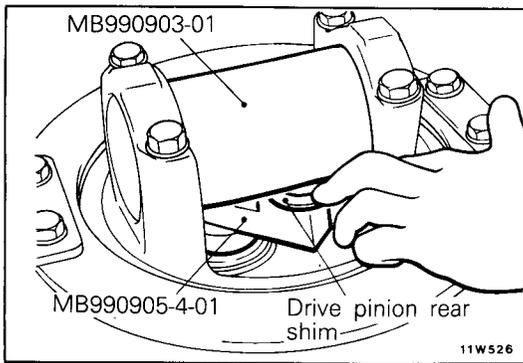
Specified grease : Multipurpose grease SAE J310, NLGI No. 2

- (2) Tighten the handle of the special tool until the standard value of drive pinion turning torque is obtained.
- (3) Measure the drive pinion turning torque (without the oil seal).

Standard value : 0.4–0.5 Nm (3.5–4.3 in.lbs.)

NOTE

Gradually tighten the handle of the special tool while checking the drive pinion turning torque.

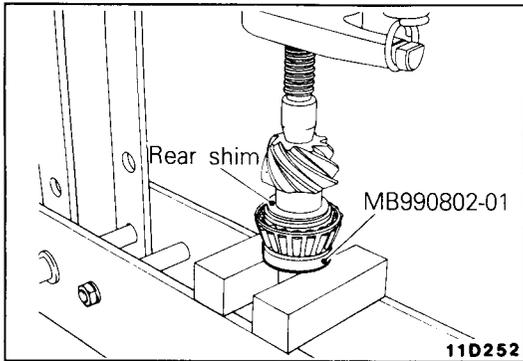


- (4) Position the special tool in the side bearing seat of the gear carrier, and then select a drive pinion rear shim of a thickness which corresponds to the gap between the special tools.

NOTE

Be sure to clean the side bearing seat thoroughly. When positioning the special tool, be sure that the cut-out 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.

● **ADJUSTMENT OF DRIVE PINION PRELOAD**

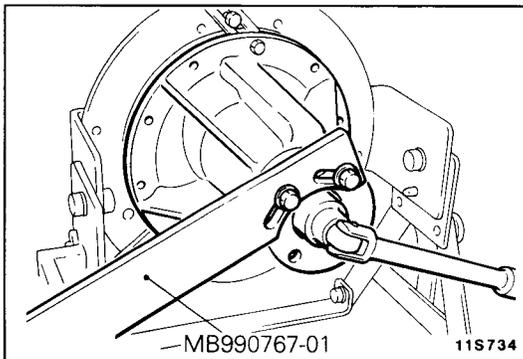
Adjust the drive pinion turning torque by using the following procedure:

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.



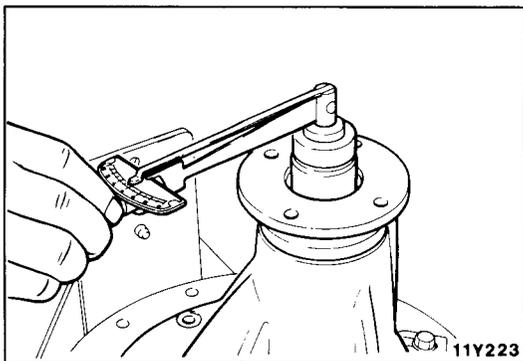
- (3) Measure the drive pinion turning torque (without the oil seal)

Standard value : 0.4–0.5 Nm (3.5–4.3 in.lbs.)

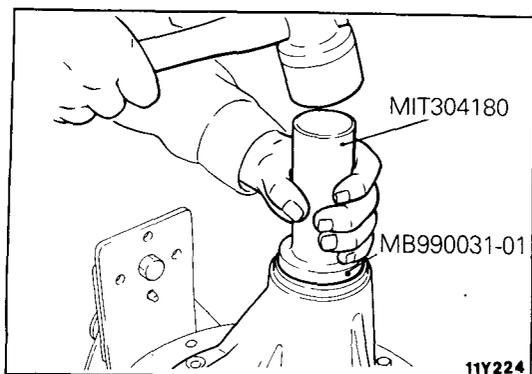
- (4) If the drive pinion turning torque is not within the range of the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

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.

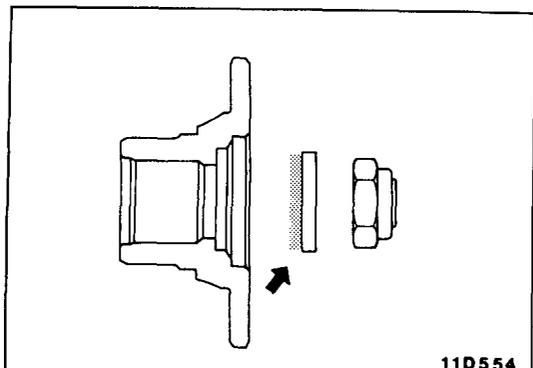


- (5) Remove the companion flange and drive pinion once again.

**With Oil Seal**

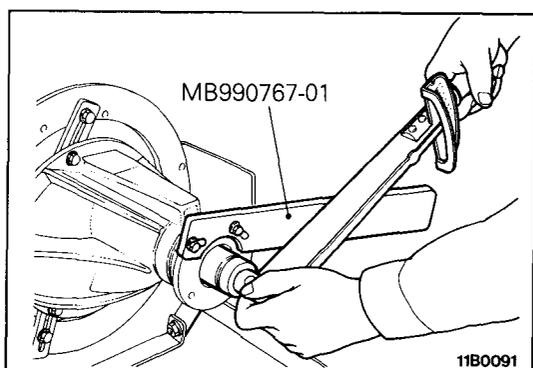
- (1) After setting the drive pinion front bearing inner race, drive the oil seal the gear carrier front lip by using the special tool.
- (2) Apply specified grease to the Oil seal lip.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

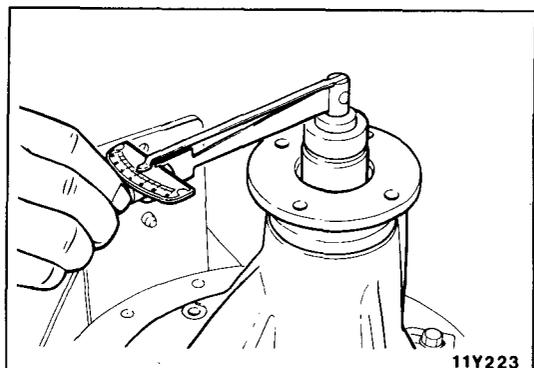


- (3) Apply a thin coat of specified grease to the companion flange contacting surface of the washer before installing drive pinion assembly.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

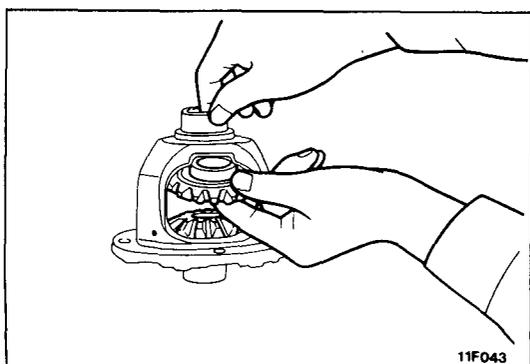


- (4) Install the drive pinion assembly and companion flange with mating marks properly aligned, and tighten the companion flange self-locking nut to the specified torque by using the special tools.



- (5) Measure the drive pinion turning torque (with oil seal) to verify that the drive pinion turning torque complies with the standard value.

Standard value : 0.65–0.75 Nm (5.6–6.5 in.lbs.)

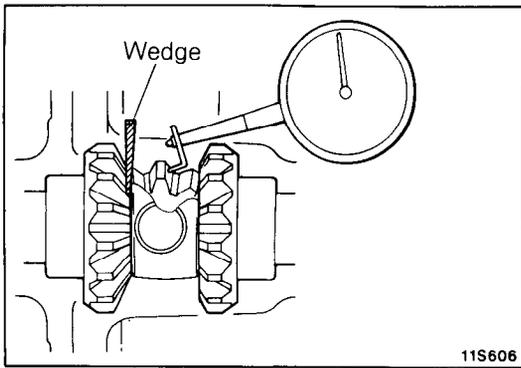


- **ADJUSTMENT OF DIFFERENTIAL GEAR BACKLASH**

- (1) Assemble the side gears, side gear thrust spacers, pinion gears, and pinion washers into the differential case.
- (2) Temporarily install the pinion shaft.

NOTE

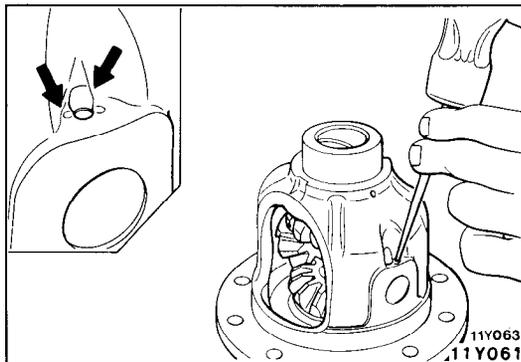
Do not drive in the lock pin yet.



- (3) Insert a wedge between the side gear and the pinion shaft to lock the side gear.
- (4) While locking the side gear with the wedge, measure the differential gear backlash with a dial indicator on the pinion gear.

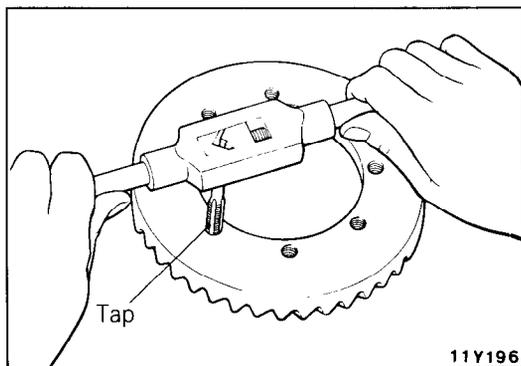
Standard value : 0.01–0.076 mm (.0004–.0030 in.)
Limit : 0.2 mm (.008 in.)

- (5) If the differential gear backlash exceeds the limit, adjust the backlash by installing thicker side gear thrust spacers.
- (6) Measure the differential gear backlash once again, and confirm that it is within the limit.
 If adjustment is not possible, replace the side gears and pinion gears as a set.



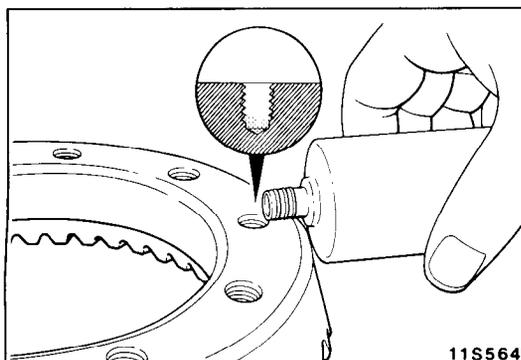
22. INSTALLATION OF LOCK PIN

- (1) Align the pinion shaft lock pin hole with the differential case lock pin hole, and drive in the lock pin.
- (2) Stake the lock pin with a punch at two points.



23. INSTALLATION OF DRIVE GEAR

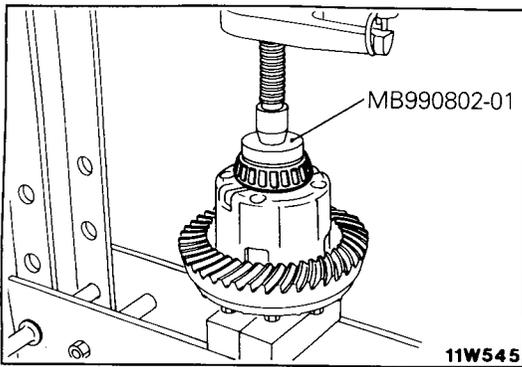
- (1) Clean the drive gear attaching bolts.
- (2) Remove the adhesive adhered to the threaded holes of the drive gear by turning the tap tool (M10 × 1.25); and then clean the threaded holes by applying compressed air.



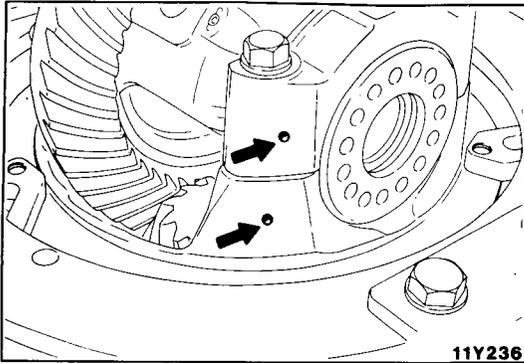
- (3) Apply the specified adhesive to the threaded holes of the drive gear.

Specified adhesive : 3M adhesive stud locking 4170 or equivalent

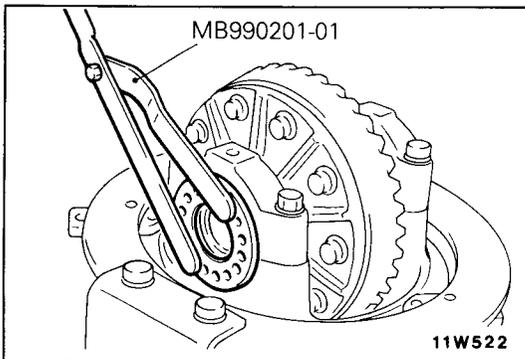
- (4) Install the drive gear onto the differential case with the mating marks properly aligned. Be sure to tighten the bolts to the specified torque in a diagonal sequence.

**25. PRESS-FIT OF SIDE BEARING INNER RACE**

Press-fit the side bearing inner races to the differential case by using the special tool.

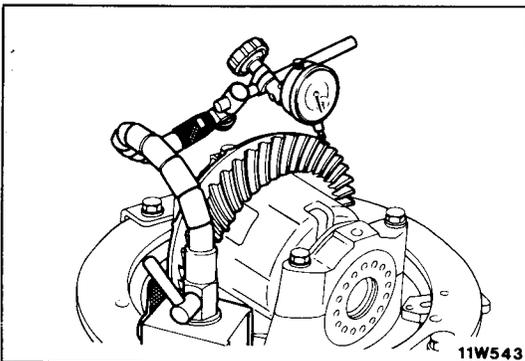
**28. INSTALLATION OF BEARING CAP**

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



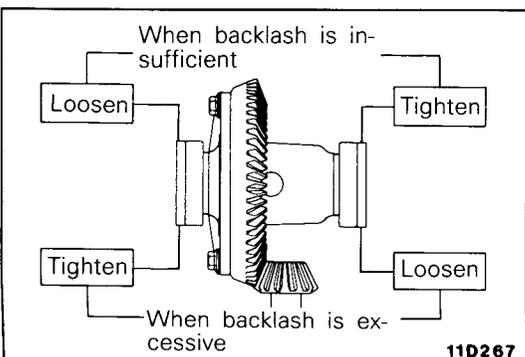
- ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH**

(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.

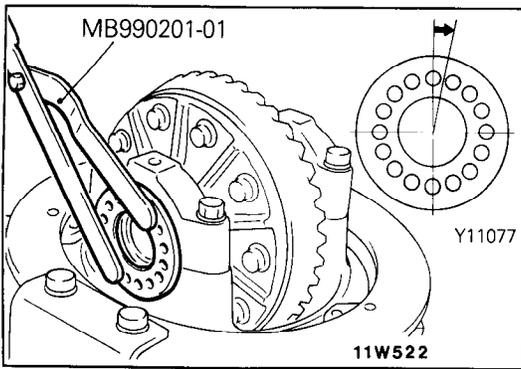
Standard value : 0.11–0.16 mm (.0043–.0063 in.)



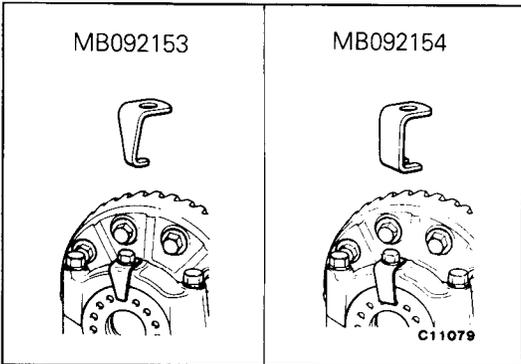
(3) Using the special tool (MB990201-01), adjust the backlash to standard value by moving the side bearing nut as shown.

NOTE

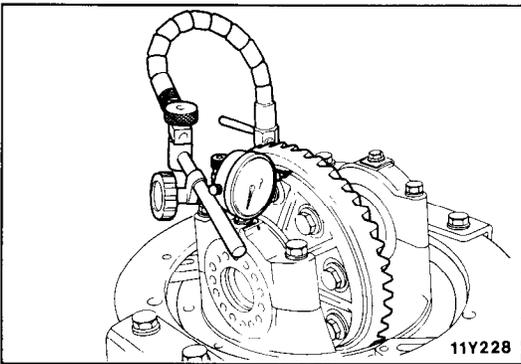
First turn the side bearing nut for loosening, and then turn (by the same amount) the side bearing nut for tightening.



- (4) Using the special tool, to apply the preload, turn down both right and left side bearing nuts on half the distance between centres of two neighbouring holes.



- (5) Choose and install the lock plates (two kinds).



- (6) Check the final tooth contact. If poor contact is evident, make adjustment. (Refer to P.3-29.)
 (7) Measure the drive gear runout.

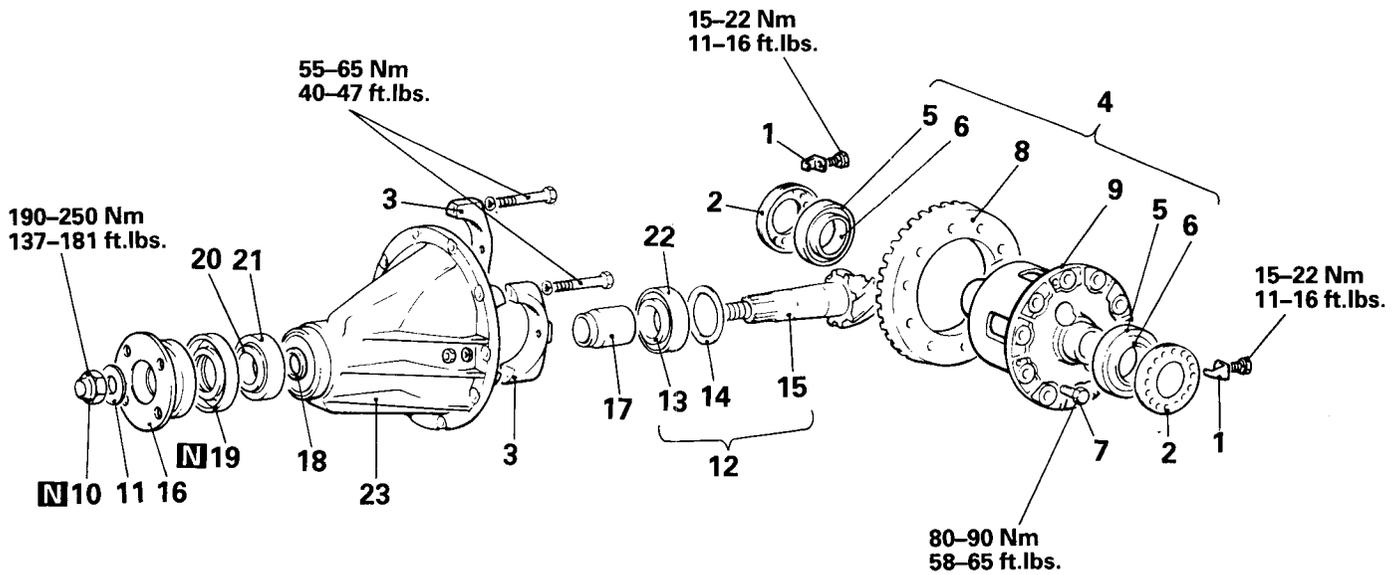
Limit : 0.05 mm (.0020 in.)

If the drive gear runout exceeds the limit, reinstall by changing the phase of the drive gear and differential case, and remeasure

DISASSEMBLY

Inspection Before Disassembly

- Final Drive Gear Backlash (Refer to P.3-29.)
- Drive Gear Runout (Refer to P.3-29.)
- Final Drive Gear Tooth Contact (Refer to P.3-29.)



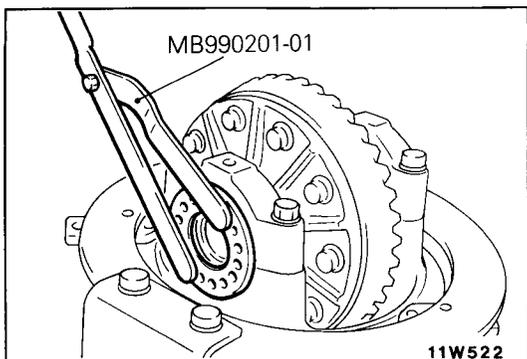
Disassembly steps

- | | | |
|----|---|--|
| ◆◆ | 1. Lock plates | |
| ◆◆ | 2. Side bearing nuts | |
| ◆◆ | 3. Bearing caps | |
| ◆◆ | 4. Differential case assembly | |
| ◆◆ | 5. Side bearing outer races | |
| ◆◆ | 6. Side bearing inner races | |
| ◆◆ | 7. Bolts | |
| ◆◆ | 8. Drive gear | |
| ◆◆ | 9. Limited slip differential case assembly | |
| ◆◆ | 10. Self-locking nut | ◆◆ |
| ◆◆ | 11. Washer | ◆◆ |
| ◆◆ | 12. Drive pinion assembly | |
| ◆◆ | 13. Drive pinion rear bearing inner race | |
| ◆◆ | 14. Drive pinion rear shim (for pinion height adjustment) | |
| | | 15. Drive pinion |
| | | 16. Companion flange |
| | | 17. Drive pinion spacer |
| | | 18. Drive pinion front shim (for preload adjustment) |
| | | 19. Oil seal |
| | | 20. Drive pinion front bearing inner race |
| | | 21. Drive pinion front bearing outer race |
| | | 22. Drive pinion rear bearing outer race |
| | | 23. Differential carrier |
- NOTE
 (1) ◆◆ : Refer to "Service Points of Disassembly".
 (2) N : Non-reusable parts

SERVICE POINTS OF DISASSEMBLY

2. REMOVAL OF SIDE BEARING NUT

Using the special tool, remove the side bearing.

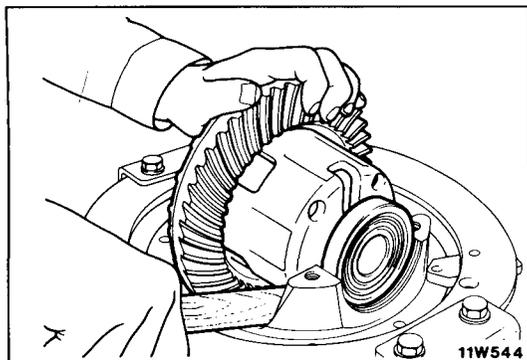


4. REMOVAL OF DIFFERENTIAL CASE ASSEMBLY

Take out the differential case assembly with hammer handles.

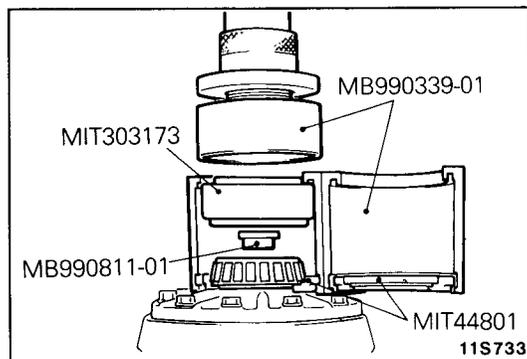
NOTE

Keep the right and left side bearings and side bearing nuts separate, so that they do not become mixed at the time of reassembly.



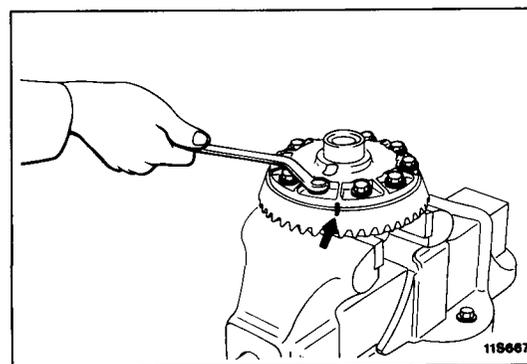
6. REMOVAL OF SIDE BEARING INNER RACE

Pull out the side bearing inner races by using the special tools.



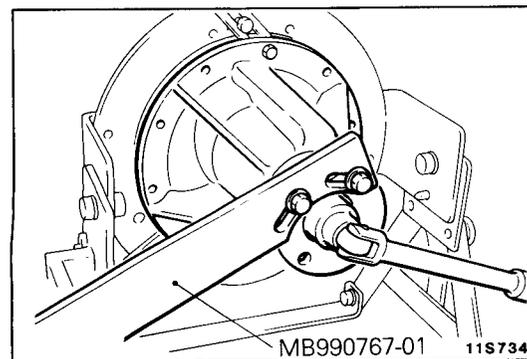
8. REMOVAL OF DRIVE GEAR

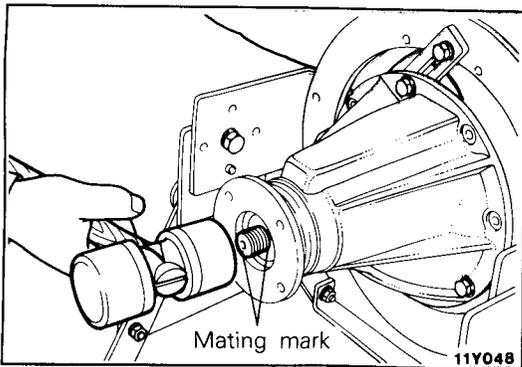
- (1) Make the mating marks to the differential case and the drive gear.
- (2) Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



10. REMOVAL OF SELF-LOCKING NUT

Use the special tools to hold the companion flange and remove the companion flange self-locking nut.



**12. REMOVAL OF DRIVE PINION ASSEMBLY**

- (1) Make the mating marks to the drive pinion and companion flange.

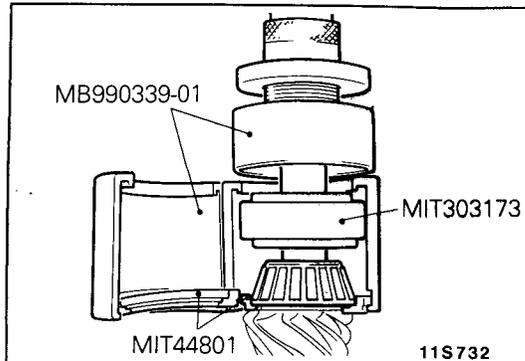
Caution

The mating mark made on the companion flange must not be on the coupling surface of the flange yoke and the rear propeller shaft.

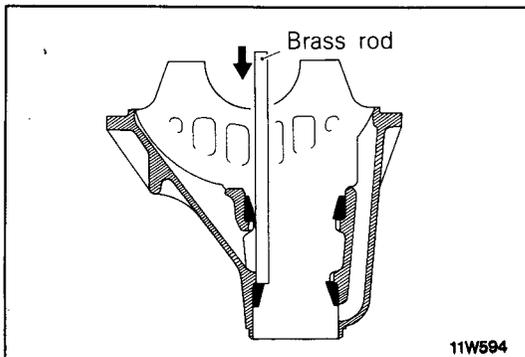
- (2) Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.

13. REMOVAL OF DRIVE PINION REAR BEARING INNER RACE

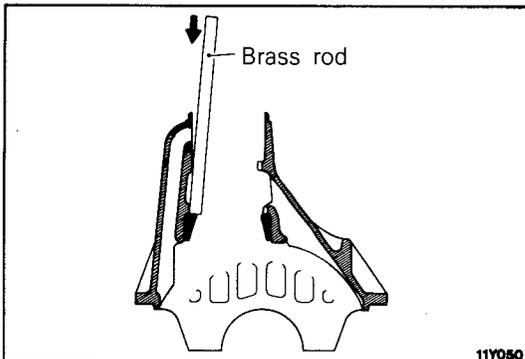
Pull out the drive pinion rear bearing inner race by using the special tools.

**21. REMOVAL OF DRIVE PINION FRONT BEARING OUTER RACE**

Drive out the drive pinion front bearing outer race from the gear carrier.

**22. REMOVAL OF DRIVE PINION REAR BEARING OUTER RACE**

Drive out the drive pinion rear bearing outer race from the gear carrier.

**INSPECITON**

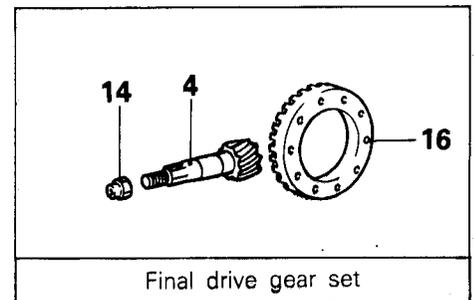
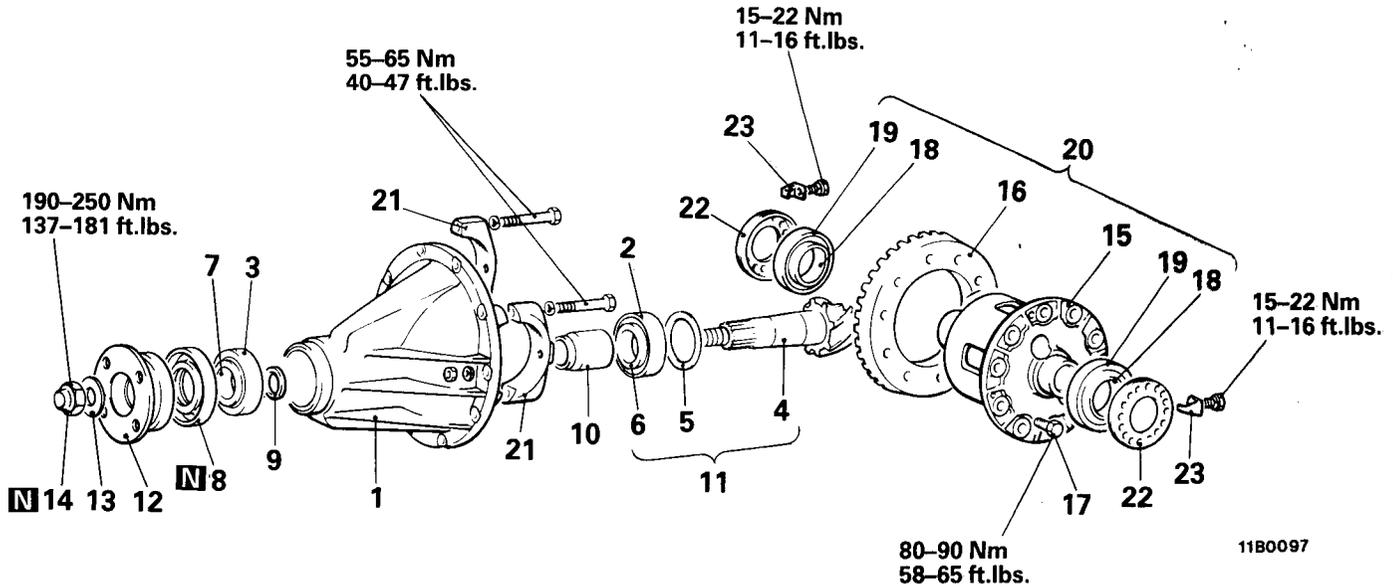
N031MAA

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 gear carrier for cracks.
- Check the drive pinion and ring gear for wear or cracks.

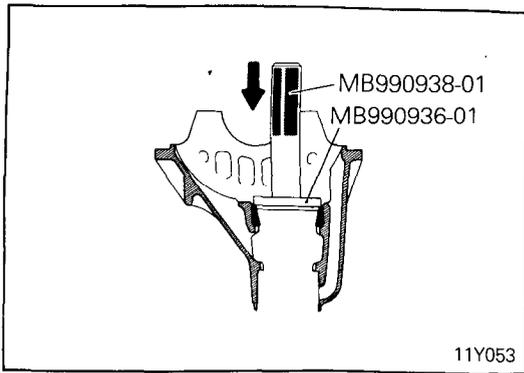
REASSEMBLY

N0317--



Reassembly steps

- 1. Differential carrier
 - ◆◆ 2. Drive pinion rear bearing outer race
 - ◆◆ 3. Drive pinion front bearing outer race
 - ◆◆ Adjustment of pinion height
 - 4. Drive pinion
 - 5. Drive pinion rear shim (for pinion height adjustment)
 - 6. Drive pinion rear bearing inner race
 - ◆◆ Adjustment of drive pinion preload
 - 7. Drive pinion front bearing inner race
 - 8. Oil seal
 - 9. Drive pinion front shim (for preload adjustment)
 - 10. Drive pinion spacer
 - 11. Drive pinion assembly
 - 12. Companion flange
 - 13. Washer
 - 14. Self-locking nut
 - 15. Limited slip differential case assembly
 - ◆◆ 16. Drive gear
 - 17. Bolts
 - ◆◆ 18. Side bearing inner races
 - 19. Side bearing outer races
 - 20. Differential case assembly
 - ◆◆ 21. Bearing caps
 - ◆◆ Adjustment of final drive gear backlash
 - 22. Side bearing nuts
 - 23. Lock plate
- NOTE
- (1) ◆◆ : Refer to "Service Points of Reassembly".
 - (2) **N** : Non-reusable parts



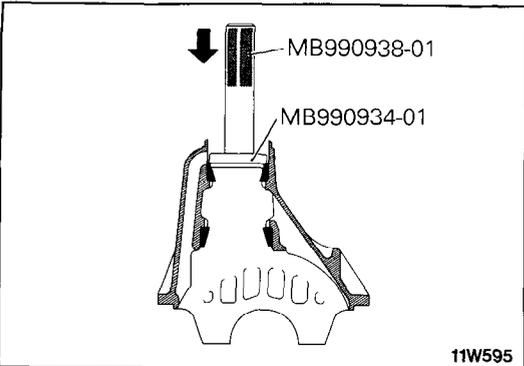
SERVICE POINTS OF REASSEMBLY

2. INSTALLATION OF DRIVE PINION REAR BEARING OUTER RACE

Press-fit the drive pinion rear bearing outer race into the gear carrier by using the special tools.

NOTE

Perform press-fitting carefully so as not to tilt the outer race.

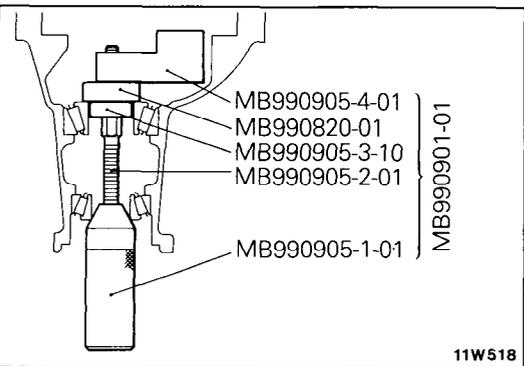


3. INSTALLATION OF DRIVE PINION FRONT BEARING OUTER RACE

Press-fit the drive pinion front bearing outer race into gear carrier by using the special tools.

NOTE

Perform press-fitting carefully so as not to tilt the outer race.



● ADJUSTMENT OF PINION HEIGHT

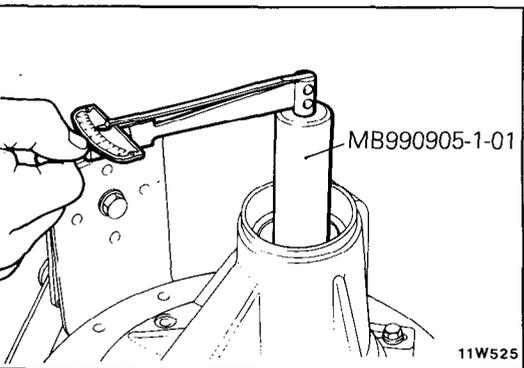
Adjust the drive pinion height by the following procedures:

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

NOTE

Apply a thin coat of the specified grease to the mating face of the washer of the special tool.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2



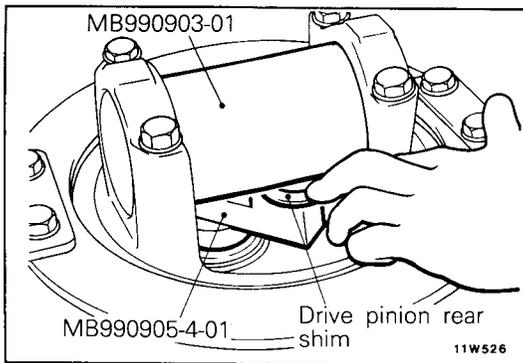
- (2) Tighten the handle of the special tool until the standard value of drive pinion turning torque is obtained.

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

Standard value : 0.4–0.5 Nm (3.5–4.3 in.lbs.)

NOTE

Gradually tighten the handle of the special tool while checking the drive pinion turning torque.

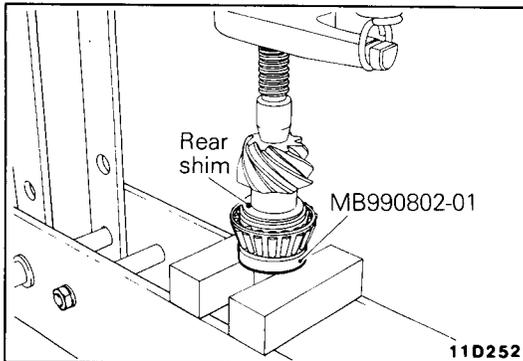


- (4) Position the special tool in the side bearing seat of the gear carrier, and then select a drive pinion rear shim of a thickness which corresponds to the gap between the special tools.

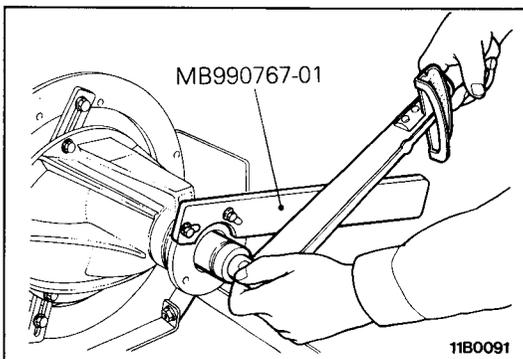
NOTE

Be sure to clean the side bearing seat thoroughly. When positioning the special tool, be sure that the cut-out 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.



● **ADJUSTMENT OF DRIVE PINION PRELOAD**

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).

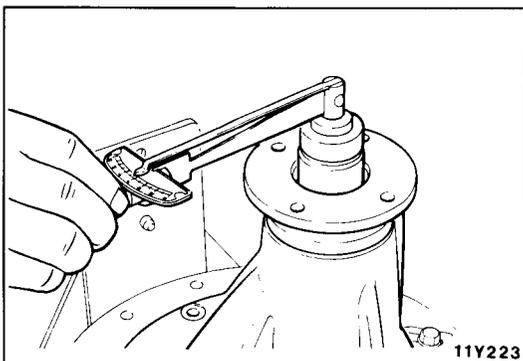
Standard value : 0.4–0.5 Nm (3.5–4.3 in.lbs.)

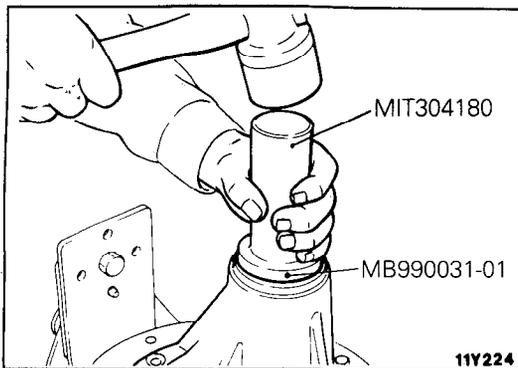
- (4) If the drive pinion turning torque is not within the range of the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

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.

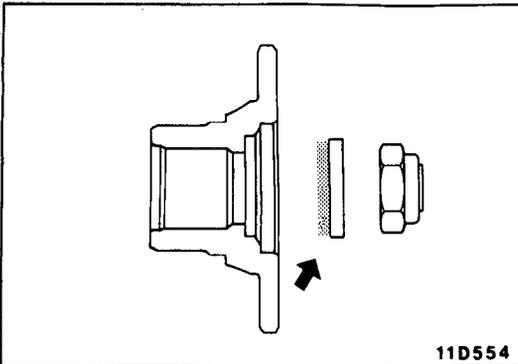
- (5) Remove the companion flange and drive pinion once again.



**With Oil Seal**

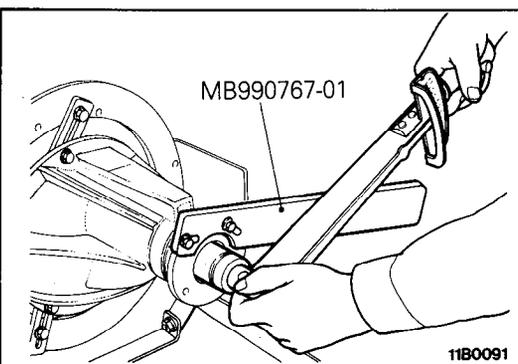
- (1) After setting the drive pinion front bearing inner race, drive the oil seal the gear carrier front lip by using the special tool.
- (2) Apply specified grease to the Oil seal lip.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

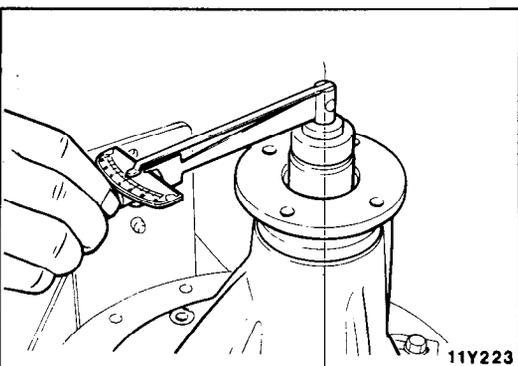


- (3) Apply a thin coat of specified multipurpose grease to the companion flange contacting surface of the washer before installing drive pinion assembly.

Specified grease : Multipurpose grease SAE J310, NLGI No. 2

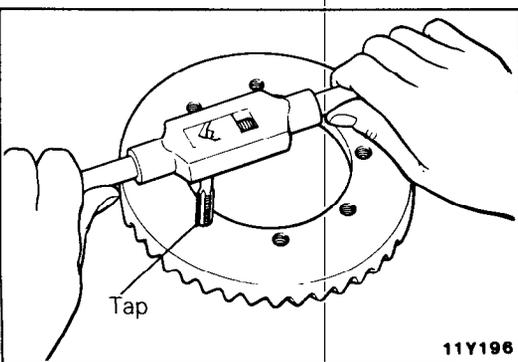


- (4) Install the drive pinion assembly and companion flange with mating marks properly aligned, and tighten the companion flange self-locking nut to the specified torque by using the special tools.

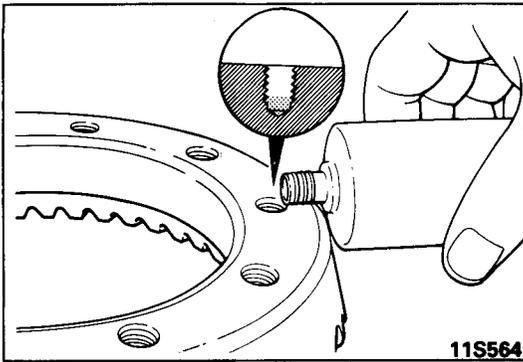


- (5) Measure the drive pinion turning torque (with oil seal) to verify that the drive-pinion turning torque complies with the standard value.

Standard value : 0.65–0.75 Nm (5.6–6.5 in.lbs.)

**16. INSTALLATION OF DRIVE GEAR**

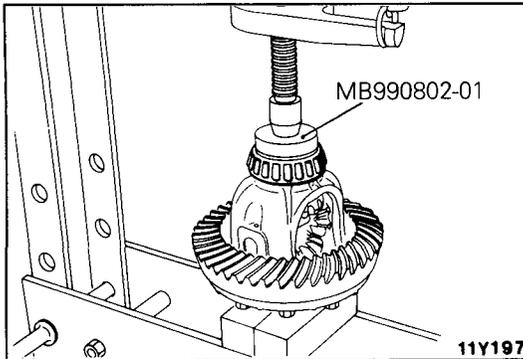
- (1) Clean the drive gear attaching bolts.
- (2) Remove the adhesive adhered to the threaded holes of the drive gear by turning the tap tool (M10 × 1.25), and then clean the threaded holes by applying compressed air.



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

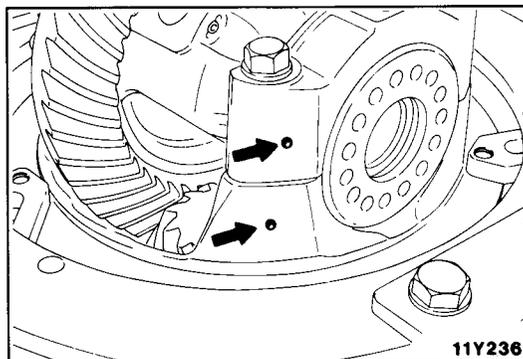
Specified adhesive : 3M Adhesive stud locking 4170 or equivalent

- (4) Install the drive gear onto the differential case with the mating marks properly aligned. Be sure to tighten the bolts to the specified torque in a diagonal sequence.



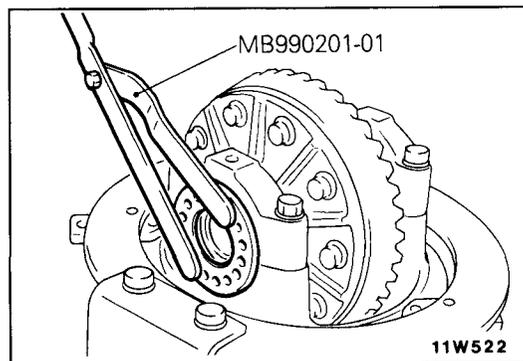
18. PRESS-FIT OF SIDE BEARING INNER RACE

Press-fit the side bearing inner races to the differential case by using the special tool.



21. INSTALLATION OF BEARING CAP

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

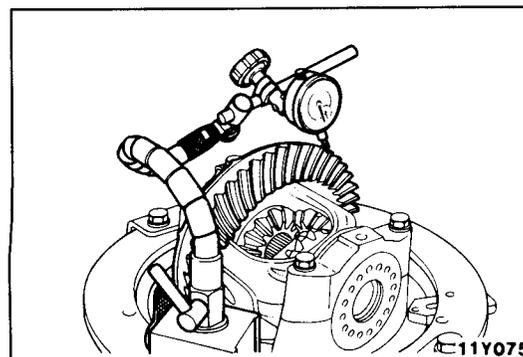


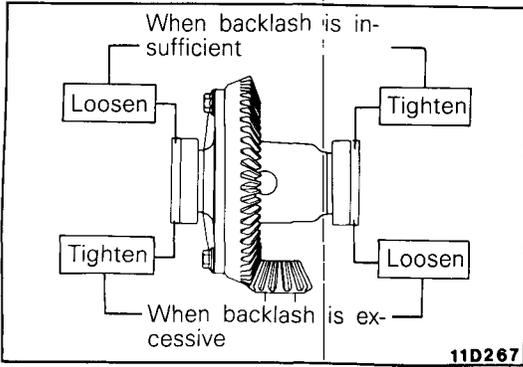
● **ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH**

- (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 : 0.11–0.16 mm (.0043–.0063 in.)

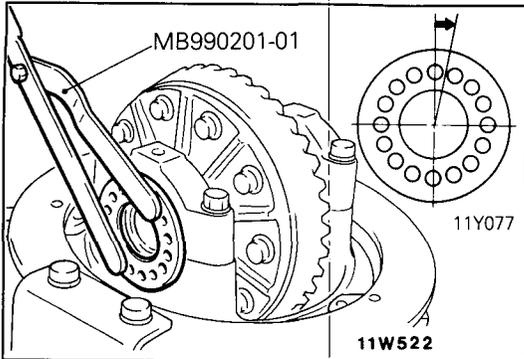




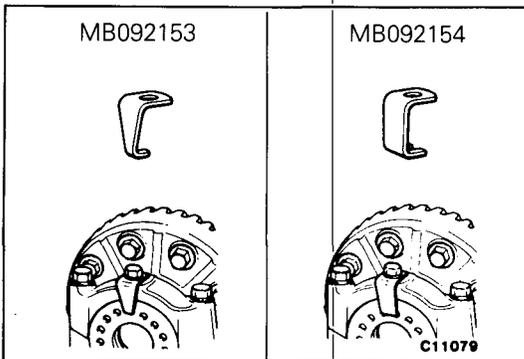
(3) Using the special tool (MB990201-01), adjust the backlash to standard value by moving the side bearing nut as shown.

NOTE

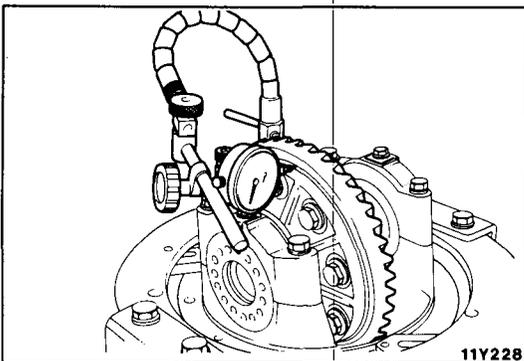
First turn the side bearing nut for loosening, and then turn (by the same amount) the side bearing nut for tightening.



(4) Using the special tool, to apply the preload, turn down both right and left side bearing nuts on half the distance between centres of two neighbouring holes.



(5) Choose and install the lock plates (two kinds).



(6) Check the final tooth contact. If poor contact is evident, make adjustment. (Refer to P.3-29.)

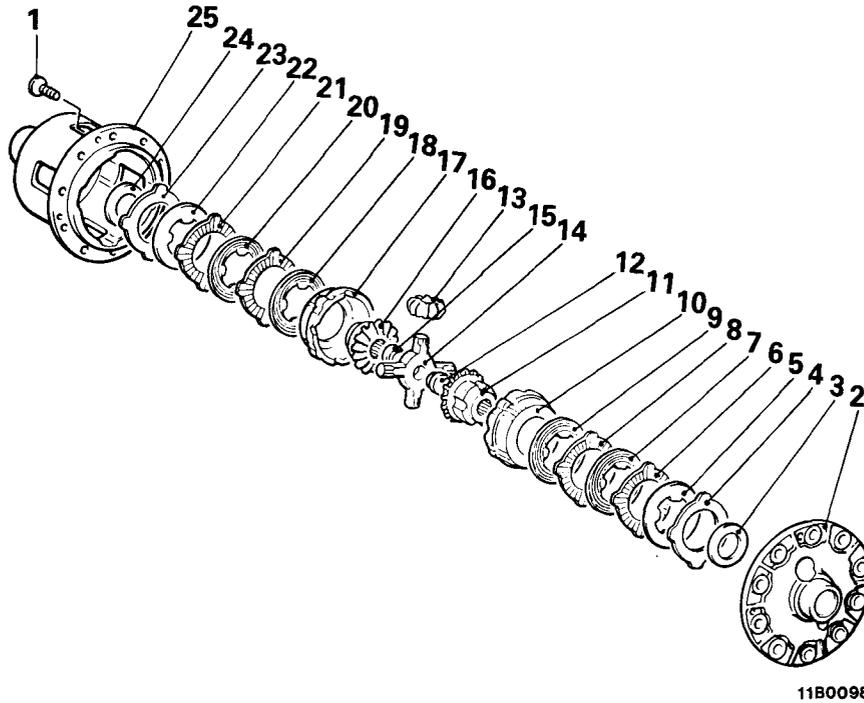
(7) Measure the drive gear runout.

Limit : 0.05 mm (.0020 in.)

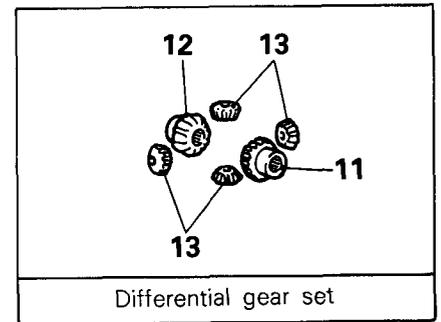
If the drive gear runout exceeds the limit, reinstall by changing the phase of the drive gear and differential case, and remeasure.

OVERHAUL

N0310--



1180098

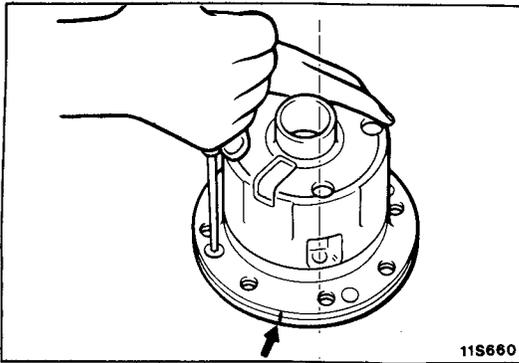


Disassembly steps

- ◄◄ ◄◄ 1. Screw
- 2. Differential case (A)
- 3. Thrust washer
- 4. Spring plate
- 5. Spring disc
- 6. Friction plate
- 7. Friction disc
- 8. Friction plate
- 9. Friction disc
- 10. Pressure ring
- 11. Side gear
- 12. Thrust block
- 13. Differential pinion gear
- 14. Differential pinion shaft
- 15. Thrust block
- 16. Side gear
- 17. Pressure ring
- 18. Friction disc
- 19. Friction plate
- 20. Friction disc
- 21. Friction plate
- 22. Spring disc
- 23. Spring plate
- 24. Thrust washer
- ◄◄ 25. Differential case (B)

NOTE

- (1) Reverse the disassembly procedures to reassembly
- (2) ◄◄ : Refer to "Service Points of Disassembly".
- (3) ◄◄ : Refer to "Service Points of Reassembly".



SERVICE POINTS OF DISASSEMBLY

N031PAA

1. REMOVAL OF SCREW

- (1) Loosen screws of the differential cases (A) and (B) uniformly a little at a time.
- (2) Separate differential case (A) from differential case (B).

NOTE

Before disassembling the differential cases, confirm that the mating marks (numbers) on case A and case B are the same.

- (3) Remove the components from differential case (B).

NOTE

Keep the right and left thrust washers, spring plates, spring discs, friction plates, and friction discs separate in order to be able to distinguish them for reassembly.

INSPECTION

N031QAA

- Check the side gears, pinion gears and pinion shaft for wear or damage.
- Check the side gear spline for wear or damage.

INSPECTION OF CONTACT AND SLIDING SURFACES OF PARTS

- (1) Inspect the friction plate, friction disc, spring plate, spring disc and pressure ring.

- A** The friction surfaces of the friction plate, friction disc, spring plate, and spring disc. If there are any signs of seizure, severe friction, or color change from the heat, it will adversely affect the locking performance; replace the part with a new one.

NOTE

The strong contact on the inner circumference of the friction surfaces is because of the spring plate and the spring disc; this wear is not abnormal.

- B** The six projections on the inner circumference of the friction disc. If there are nicks and dents, it will cause abnormalities in the clutch pressure.

Repair the parts by using an oil stone; if the parts cannot be repaired, replace them.

- C** The four projections on the outer circumference of the friction disc.

If there are nicks and dents, it will cause abnormalities in the clutch pressure.

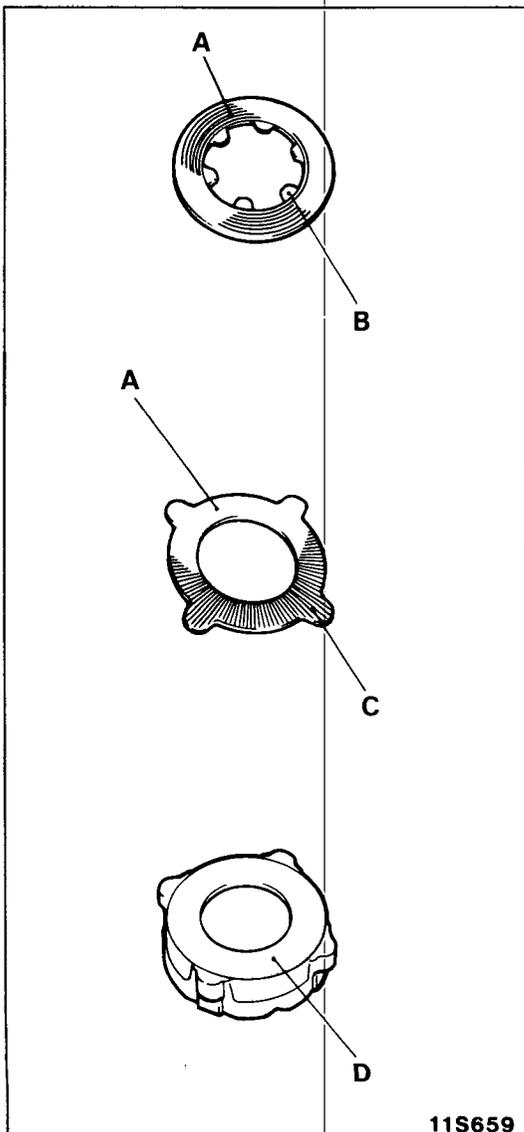
Repair the parts by using an oil stone; if the parts cannot be repaired, replace them.

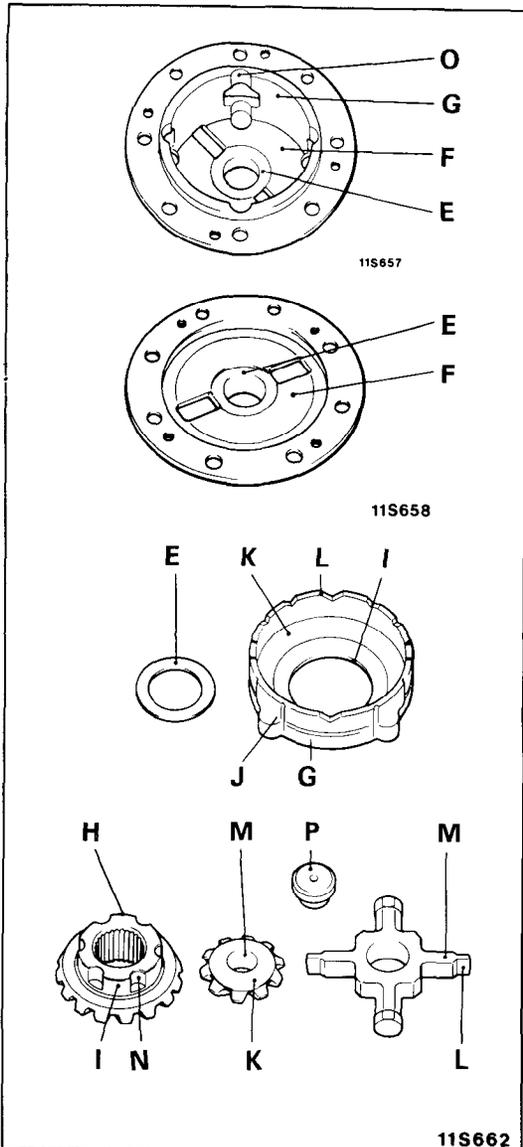
- D** The friction surface of the friction disc of the pressure ring.

If there are nicks or scratches, repair the part by first grinding with an oil stone and then polishing with rubbing compound on a surface plate.

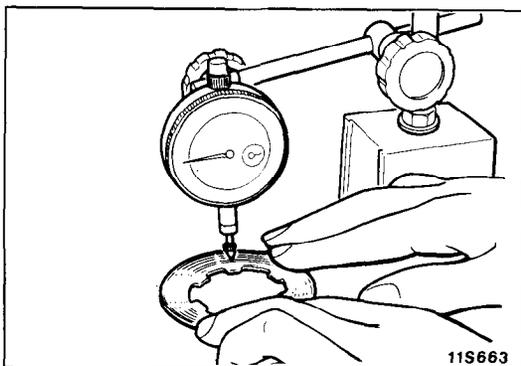
NOTE

The strong contact on the inner circumference of the friction surface is because of the spring plate and the spring disc; this wear is not abnormal.





- (2) Inspect the contact and sliding surfaces listed below, and repair any nicks and burrs by using an oil stone.
- E** The sliding surfaces of the thrust washer and the case.
 - F** The spring contacting surface of the differential case.
 - G** The contact surfaces of the outer circumference of the pressure ring and the inner circumference of the differential case.
 - H** The sliding surface of the thrust washer.
 - I** The sliding surfaces of the hole in the pressure ring and the outer circumference of the side gear.
 - J** The projection on the outer circumference of the pressure ring.
 - K** The spherical surface of the differential pinion gear and the inner diameter of the pressure ring.
 - L** The V-shaped groove in the pressure ring, and the V-shaped part in the pinion shaft.
 - M** The outer diameter of the pinion shaft and the hole of the differential pinion gear.
 - N** The outer circumference groove of the side gear.
 - O** The inner circumference groove of the differential case.
 - P** The sliding surface of the thrust block.



INSPECTION FOR WARPING OF FRICTION PLATE AND FRICTION DISC

Using a dial indicator, measure the amount of warping (the flatness) of the friction plate and the friction disc on a surface plate by turning the friction plate or disc.

Limit : 0.08 mm (.0031 in.)

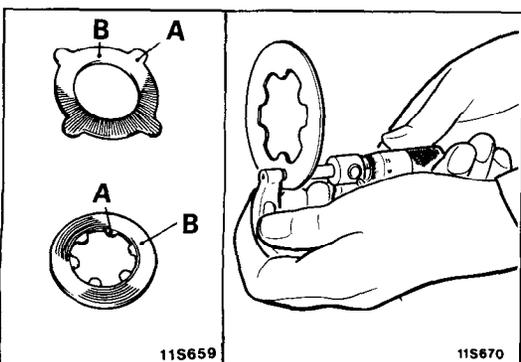
INSPECTION FOR WEAR OF FRICTION PLATE AND FRICTION DISC

- (1) In order to measure the wear, measure the thickness of the friction surfaces and projections of the friction disc and plate, and then find the difference. (The same procedure is used for the spring discs and the spring plates.)

Limit : 0.1 mm (.004 in.)

NOTE

Make the measurement at several different points.



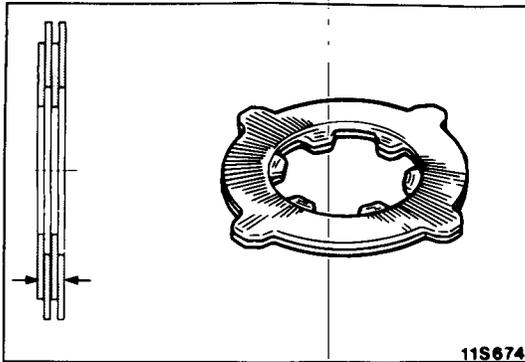
- (2) If the parts are worn beyond the allowable limit, replace them with new parts.

SERVICE POINTS OF REASSEMBLY

N031RAC

25. INSTALLATION OF DIFFERENTIAL CASE (B)

Before assembly, use the following method to adjust the clearance between the spring plates and differential cases (for adjustment of the clutch plate friction force), and to adjust the axial clearance of the side gear when installing the internal components into the differential case.

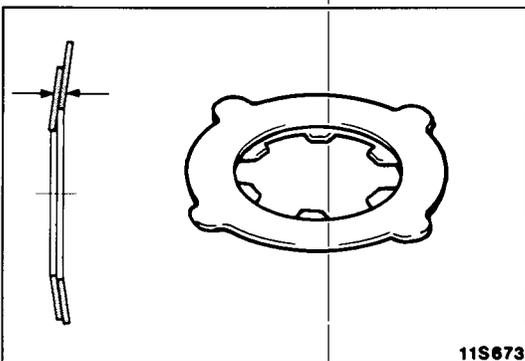


- (1) Arrange the two (each) friction discs and friction plates for each side, one on top of another, as shown in the figure, combining them so that the difference in thickness between the left and the right is the standard value.

Standard value : 0.05 mm (.0020 in.) or less

NOTE

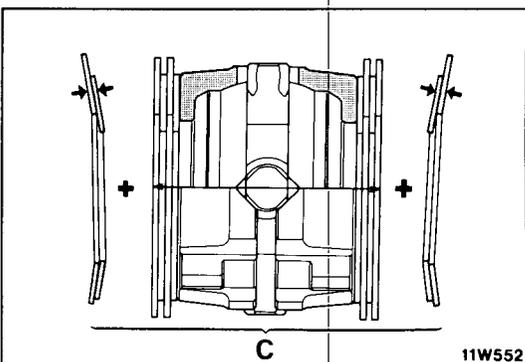
For new ones, there is one type of friction plate: 1.75 mm (.0689 in.); there are two types of friction disc: 1.75 mm (.0689 in.) and 1.85 mm (.0728 in.).



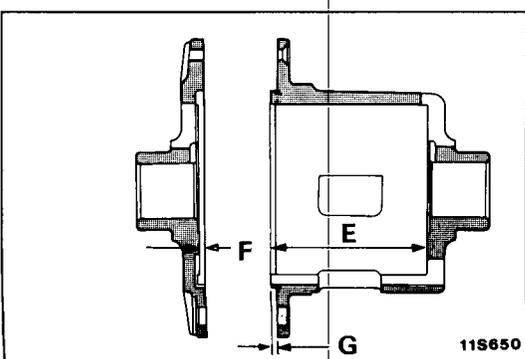
- (2) Arrange one spring disc and one spring plate for each side, one on top of the other, so that the difference between the left and the right thickness is minimized.

NOTE

For new ones, there is one type of spring disc and spring plate: 1.75 mm (.0689 in.).



- (3) Assemble the pressure ring's internal components (differential pinion shaft and pressure ring) and the friction discs and friction plates, and then, as shown in the figure, measure the overall width.
- (4) Calculate the total value (C) of the thickness of the spring discs and spring plates plus the value measured in (3) above.

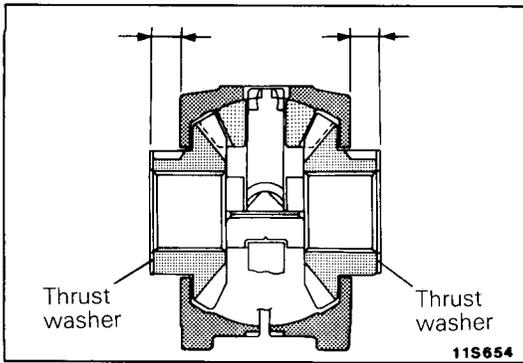


- (5) Obtain the dimension (D) between the spring plate contact surfaces when differential cases (A) and (B) are combined.

$$(D = E + F - G)$$

- (6) Change the thickness of the friction disc so that the clearance (D – C) between the differential case and the spring plate becomes the standard value.

Standard value : 0.06–0.20 mm (.0024–.0079 in.)

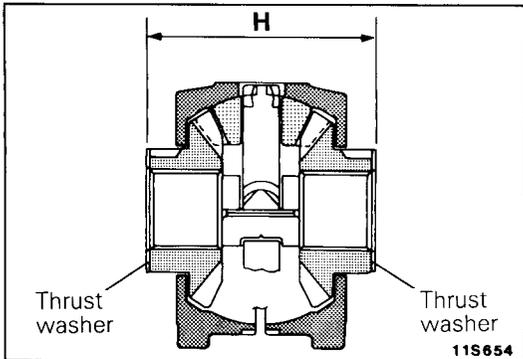


- (7) Remove the spring plates, spring discs, friction plates and friction disc.
- (8) Install the thrust washer as shown in the figure, and then select a thrust washer so that the difference between the left and right dimensions from the pressure ring rear face to the thrust washer end face is the standard value.

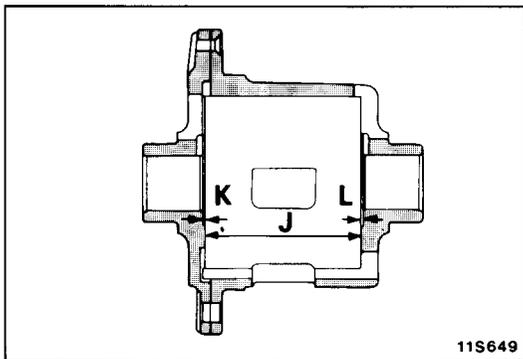
Standard value : 0.05 mm (.0020 in.) or less

NOTE

Measure the distance while squeezing the V-shaped groove manually.



- (9) Measure the dimension (H) from the thrust washer end surface to end surface.



- (10) Obtain the dimension (I) between the thrust washer contact surfaces when differential cases (A) and (B) are combined.
(I = J + K + L)

NOTE

Dimension J is the distance between the spring plate contact surfaces when differential cases (A) and (B) are combined. (Refer to P.3-54.)

- (11) Change the thickness of the thrust washer so that the clearance (I – H) between the thrust washer and the differential case is the standard value.

Standard value : 0.05–0.20 mm (.0020–.0079 in.)

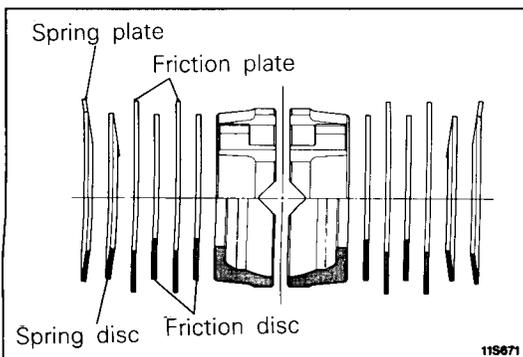
NOTE

1. Select the thrust washer so that the difference between the left and right dimensions from the pressure ring rear face and the thrust washer end surface are the standard value even when the thrust washer is changed.
2. There are three sizes of new thrust washers: 1.50 mm (.0591 in.), 1.60 mm (.0630 in.), and 1.70 mm (.0670 in.)

- (12) Place the each part in the differential case (B) as directions shown in the figure.

NOTE

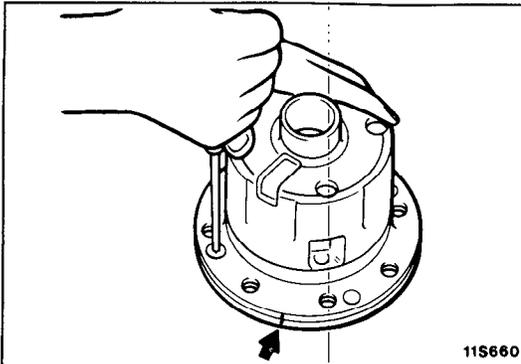
1. Before assembly, apply the specified gear oil to each component especially careful to coat contact surfaces and sliding surfaces.



Specified gear oil:

MITSUBISHI Genuine Gear Oil Part No. 8149630 EX or equivalent

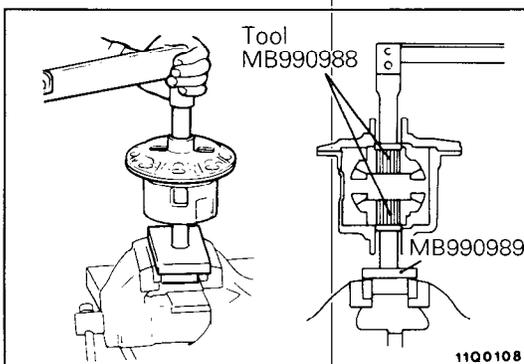
2. Be careful not to insert the friction plates and friction discs in the incorrect order and to install the spring plates and spring disc in incorrect direction.

**1. INSTALLATION OF SCREW**

- (1) Align the mating marks (the same numeral on each case) of differential case (A) and differential case (B).
- (2) Turning the screwdriver slowly several times, tighten the screw so that the cases are in close contact.

NOTE

If, even though the screw is tightened, the end surfaces of case (A) and case (B) do not come into close contact, probably the thrust washer and spring plate are not fit correctly into the groove, so make the assembly again.



- (3) After assembly, in order to check the frictional force of the clutch plate, use the special tools to measure the starting torque.

Standard value:

When a new clutch plate is used

65–100 Nm (47–72 ft.lbs.)

When an old clutch plate is used

35–100 Nm (25–72 ft.lbs.)

NOTE

Measure the starting torque after rotating slightly. When measuring the torque, do so at the beginning of movement.