GROUP 3 — REAR AXLE

SECTION 0 — INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
REAR WHEEL NOISE	(a) Wheel loose.	(a) Tighten loose nuts.
	(b) Faulty, brinelled wheel bearing.	(b) Faulty or brinelled bearings must be replaced. Check rear axle shaft end play.
	(c) Excessive axle shaft end play.	(c) Reduce axle shaft end play.
REAR AXLE DRIVE SHAFT NOISE	(a) Misaligned axle housing.	(a) Inspect rear axle housing, alignment. Correct as necessary.
	(b) Bent or sprung axle shaft.	(b) Replace bent or sprung axle shaft.
	(c) End play in drive pinion bearings.	(c) Refer to Pinion Bearing Pre-load.
	(d) Excessive gear lash between drive gear and pinion.	(d) Check adjustment of drive gear and pinion. Correct as necessary.
	(e) Improper adjustment of drive pinion shaft bearings.	(e) Adjust pinion bearings.
	(f) Loose drive pinion companion flange nut.	(f) Tighten drive pinion flange nut to torque specified under "Torque Specifications".
	(g) Improper wheel bearing adjustment.	(g) Check axle shaft end play. Readjust as necessary.
	(h) Scuffed gear tooth contact surfaces.	(h) If necessary, replace scuffed gears.
REAR AXLE DRIVE SHAFT BREAKAGE	(a) Improperly adjusted wheel bearings.	(a) Replace broken shaft and readjust end play.
	(b) Misaligned axle housing.	(b) Replace broken shaft after correcting rear axle housing alignment.
	(c) Vehicle overloaded.	(c) Replace broken shaft. Avoid excessive weight on vehicle.
	(d) Abnormal clutch operation.	(d) Replace broken shaft, after checking for other possible causes. Avoid erratic use of clutch.
	(e) Grabbing clutch.	(e) Replace broken shaft. Inspect clutch and make necessary repairs or adjustments.
	(f) Normal fatigue.	(f) Replace broken shaft. Inspect to determine causes or damage.
DIFFERENTIAL CASE BREAKAGE	(a) Improper adjustment of differential bearings.	(a) Replace broken case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings.
	(b) Excessive drive gear clearance.	(b) Replace broken case; examine gears and bearings for possible damage. At reassembly, adjust drive gear and pinion backlash.
	(c) Vehicle overloaded.	(c) Replace broken case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle.
	(d) Erratic clutch operation.	(d) Replace broken case. After checking for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.

At reassembly, adjust differential bearings.

Condition	Possible Cause	Correction
DIFFERENTIAL SIDE GEAR BROKEN AT HUB	(a) Excessive axle housing deflection.	(a) Replace damaged gears. Examine other gears and bearings for possible damage. Check rear axle housing alignment.
	(b) Misaligned or bent axle shaft.	(b) Replace damaged gears. Check axle shafts or alignment. Examine other gears and bearings for possible damage.
	(c) Worn thrust washers.	(c) Replace damaged gears. Examine other gears and bearings for possible damage. Replace thrust washers that are badly worn.
SCORING OF DIFFERENTIAL GEARS	(a) Insufficient lubrication.	(a) Replace scored gears. Scoring marks on the pressure face of gear teeth or in the bore are caused by instantaneous fusing of the mating surfaces. Scored gears should be replaced. Fill rear axle to required capacity with proper lubricant. See "Lubrication and Maintenance Group 1".
	(b) Improper grade of lubricant.	(b) Replace scored gears. Inspect all gears and bearings for possible damage. Clean out and refill axle to required capacity with proper lubricant. See "Lubrication and Maintenance Group 1".
	(c) Excessive spinning of one wheel.	(c) Replace scored gears. Inspect all gears, pinion bores and shaft for scoring, or bearings for possible damage. Service as necessary.
TOOTH BREAKAGE (DRIVE GEAR AND PINION)	(a) Overloading.	(a) Replace gears. Examine other gears and bearings for possible damage. Replace parts as needed. Avoid overloading of vehicle.
	(b) Erratic clutch operation.	(b) Replace gears, and examine remaining parts for possible damage. Avoid erratic clutch operation.
	(c) Ice-spotted pavements.	(c) Replace gears. Examine remaining parts for possible damage. Replace as required.
	(d) Normal fatigue.	(d) Replace gears. Examine broken parts to determine cause of normal fatigue.
	(e) Improper adjustment.	(e) Replace gears. Examine other parts for possible damage. Make sure drive gear and pinion backlash is correct.
REAR AXLE NOISE	(a) Insufficient lubricant.	(a) Refill rear axle with correct amount of the proper lubricant. See "Lubrication and Maintenance Group 1". Also check for leaks and correct as necessary.
	(b) Improper drive gear and pinion adjustment.	(b) Check drive gear and pinion tooth contact.
	(c) Unmatched drive gear and pinion.	(c) Remove unmatched drive gear and pinion. Replace with a new matched gear and pinion set.
	(d) Worn teeth on drive gear or pinion.	(d) Check teeth on drive gear and pinion for contact. If necessary, replace with new matched set.
	(e) Loose drive pinion bearings.	(e) Adjust drive pinion bearings.
	(f) Loose differential gear bearings.	(f) Adjust differential gear bearings.

Condition	Possible Cause	Correction
	(g) Misaligned or sprung drive gear.	(g) Check drive gear for runout.
	(h) Loose carrier housing bolts.	(h) Tighten to specifications.
LOSS OF LUBRICANT	(a) Lubricant level too high.	(a) Drain excess lubricant by removing filler plug and allow lubricant to level at lower edge of filler plug hole.
	(b) Water in lubricant causing foaming.	(b) Drain lubricant. Refill with correct grade — See Lubrication (Group 1).
	(c) Worn axle shaft oil seals.	(c) Replace worn oil seals with new ones. Prepare new seals before replacement.
	(d) Cracked rear axle housing.	(d) Repair or replace housing as required.
	(e) Worn drive pinion oil seal.	(e) Replace worn drive pinion oil seal with a new one.
	(f) Scored and worn companion flange.	(f) Replace worn or scored companion flange and oil seal.
OVERHEATING OF UNIT	(a) Lubricant level too low.	(a) Refill rear axle.
	(b) Incorrect grade of lubricant.	(b) Drain, flush and refill rear axle with correct amount of the proper lubricant. (See Lubrication Group 1.)
	(c) Bearings adjusted too tightly.	(c) Readjust bearings.
	(d) Excessive wear in gears.	(d) Check gears for excessive wear or scoring. Replace as necessary.
	(e) Insufficient drive gear to pinion clearance.	(e) Readjust drive gear and pinion backlash and check gears for possible scoring.

REAR AXLE NOISE DIAGNOSIS

Most rear axle failures are relatively simple to locate and correct, although rear axle noise is a little more difficult to diagnose and make the necessary repairs. The most essential part of rear axle service is proper diagnosis of the problem.

All rear axles are noisy to a certain degree. Axles can be noisy if they are not properly adjusted or lack lubrication. Usually when new improperly set gears are noisy, the disturbing noise can be "adjusted out".

If the axle noise complaint is made within the first 8 000 km and the gears are not scored due to lack of lubrication, the gear adjustment should be checked and corrected if necessary. Poor tooth pattern, incorrect drive gear backlash and loose pinion nuts are the primary causes of gear noise in new vehicles. Regardless of what you've heard to the contrary, noisy gears will not get quieter with added use . . . they will stay the same or get worse.

Slight axle noise heard only at certain speeds or under remote conditions must be considered normal. Axle noise tends to "peak" at varying speeds and the noise is **NOT ALWAYS** indicative of trouble in the axle.

If noise is present in an objectionable form, loud or at all speeds, an effort should be made to isolate the noise as being in one particular unit of the vehicle. Many noises, reported as coming from the rear axle actually originate from other sources such as tyres, road surfaces, wheel bearings, engine, transmission, exhaust, propeller shaft vibration, universal joint noise, body drumming, or wind through a roof rack. A thorough and careful check should be made to determine the source of the noise before any disassembly and teardown of the rear axle is attempted.

Axle noises normally fall into two categories; gear noise and bearing noise. The complete isolation of noise in any one unit requires considerable skill and previous experience. Eliminating certain type noises often baffle even the most experienced personnel. Often such practices as raising tyre pressures to eliminate tyre noise, listening for the noise at varying speeds under different load conditions such as; drive, float and coast, and under certain highway conditions, swerving the car from left to right to detect wheel bearing noise, will aid even the beginner in detecting axle shaft bearing noise in axles that use the tapered roller bearing axle shaft.

To make a good diagnostic check for rear axle noise **a thorough road test is necessary.** Select a level smooth asphalt road. This will reduce tyre noise and body drumming. Drive the vehicle far enough to thoroughly warm up the axle to normal operating temperature.

Drive the vehicle and note speed at which noise occurs. Then stop and, with clutch disengaged or automatic transmission in neutral, run engine slowly up and down through engine speeds, corresponding to vehicle speed at which noise was most pronounced, to determine if it is caused by exhaust roar, or other engine conditions. Repeat, while engaging and disengaging clutch (transmission in neutral), to determine if noise can only be isolated by removing propeller shaft and operating transmission in high.

TYRE NOISE

Tyre noise is often mistaken for rear axle noise even though the noisy tyres may be located on the front wheels. Tyres that are unbalanced or worn unevenly or have surfaces of non-skid type design, or worn in a saw tooth fashion are usually noisy and often produce noises that seem to originate in the rear axle.

Tyre noise changes with different road surfaces, but rear axle noise does not. Inflate all tyres to approximately 350 kPa (50 p.s.i.) **for test purposes only.** This will materially alter noise caused by tyres, but will not affect noise caused by rear axle. Rear axle noise usually ceases when coasting at speeds under 50 km/h; however, tyre noise continues, but with lower tone, as car speed is reduced. Rear axle noise usually changes when comparing drive and coast, but tyre noise remains about the same.

Distinguish between tyre noise and differential noise by noting if noise varies with various speeds or sudden acceleration and deceleration; exhaust and axle noise show variations under these conditions while tyre noise remains constant and is more pronounced at speeds of 30 to 50 km/h. Further check for tyre noise by driving vehicle over smooth pavements or dirt roads (not gravel) with tyres at normal pressure. If noise is caused by tyres, it will noticeably change or disappear and reappear with changes in road surface.

FRONT WHEEL BEARING NOISE

Loose or rough front wheel bearings will cause noise which may be confused with rear axle noises; however, front wheel bearing noise does not change when comparing drive and coast. Light application of brake while holding car speed steady will often cause wheel bearing noise to diminish, as this takes some weight off the bearing. Front wheel bearings may be easily checked for noise by jacking up the wheels and spinning them, also by shaking wheels to determine if bearings are loose.

Rear suspension rubber bushings and spring insulators help to dampen out rear axle noise when properly and correctly installed. Metal to metal contact at those points may result in telegraphing road noise and normal axle noise which would not be objectionable if properly installed and tightened to specifications.

GEAR NOISE

The differential side gears and pinions are not a source of noise during normal driving, since the mesh condition changes too slowly to be heard. They will however, emit an audible howl during high rate differential action, as when one rear wheel spins while the other is stationary. This audible howl is not abnormal, but should be regarded as a warning since prolonged high rate differential action can result in extensive damage from seizure of differential components.

Abnormal gear noise can be recognized easily because it produces a cycling tone and will be very pronounced through the speed range in which it occurs. Gear noise may be developed under one or more of the following conditions. "drive", "road load", "float" or "coast". Gear noise usually tends to peak in a narrow speed range or ranges. Gear noise is more prominent between 50 to 65 km/h and 80 to 95 km/h. Abnormal gear noise is quite rare and if present it usually originates from scoring of the drive gear and drive pinion as a result of insufficient or improper lubrication of the axle assembly. If the gear noise is on coast at all speeds, check for a loose pinion nut and readjust per this manual if necessary.

When objectionable axle noise is heard, note the driving condition and speed range. Remove the housing cover or the differential and carrier assembly (depending on axle design). Perform a tooth contact pattern check to determine if the best possible pattern has been obtained. If pattern is found to be unacceptable, reshim and adjust to obtain the best possible tooth pattern. If after readjustment noise still persists, replace with new gear set.

ROOF RACK WIND NOISE

Under certain weather conditions a moaning noise can be created by wind passing across a roofrack (if fitted). This possible source of noise should be removed from the vehicle before attempting further rear axle noise diagnosis.

PRE-DISASSEMBLY INVESTIGATION

A close examination of the rear axle assembly prior to disassembly can often reveal valuable information as to the extent and type of repairs or adjustments necessary. This information coupled with the road test results will provide a basis for determining the degree of disassembly required. Since the most frequent causes of axle noise are improper backlash or differential bearing preload, or both, a few simple adjustments may be all that is necessary to correct the complaint.

Therefore, before disassembly the following check should be made; drive gear and pinion backlash, pinion bearing preload, and tooth contact pattern and these results recorded and analyzed. It is felt that these measurements and their results will aid you in making the necessary repairs to the axle assembly.

BEARING NOISE (DRIVE PINION AND DIFFERENTIAL)

Defective or damaged bearings generally produce a rough growl or grating sound, that is constant in pitch and varies with the speed of the vehicle. This fact will allow you to diagnose between bearing noise and gear noise.

Drive pinion bearing noise resulting from defective or damaged bearings can usually be identified by a constant rough sound. Front pinion bearing noise is usually most pronounced on "coast", whereby rear pinion bearing is loudest on "drive". Pinion bearings are rotating at a higher rate of speed than the differential side bearings or the axle shaft bearings. These particular noises can be picked up best by road testing the vehicle in question on a smooth road. However, extreme caution should be taken not to confuse tyre noise with bearing or gear noise. If doubt should exist tyre treads should be examined for irregularities that will often produce such noise.

Differential bearing noise will usually produce a constant rough tone which is much slower than the noise caused by the pinion bearings.

REAR WHEEL BEARING NOISE

Defective or damaged rear wheel bearings produce a vibration or growl which continues with vehicle coasting and transmission in neutral. A brinneled rear wheel bearing causes a whirring noise. Spalled rear wheel bearings normally produce a noise similar to a growl, created from either flaked or pitted rollers or bearings races. Unless the damage is severe, rear axle bearing noise is seldom heard above 50 km/h.

To differentiate between wheel bearings and gear noise, road test the vehicle on a smooth road at medium and low speed. With traffic permitting, swerve the vehicle sharply right to left. If the noise in question is caused by wheel bearings, it will usually increase when the vehicle is swerved and will probably be coming from the bearing on the loaded side, (tapered roller bearing axle shaft only).

If the noise in question cannot be isolated an inspection of bearings will be necessary.

KNOCK AT LOW SPEEDS

Low speed knock is usually caused by brinneled universal joints or differential side gear hub to counterbore clearance being too great. Inspect and replace universal joint or differential case and side gear as required.

BACKLASH CLUNK

Excessive clunk on acceleration and deceleration can be caused by any one of the following items or a combination; (excessive clearance between) (1) Differential pinion shaft to differential case, (2) Axle shaft to differential side gear splines, (3) Differential side gear hub to differential case counterbore, (4) Differential side gear to pinion, (5) Worn thrust washers, (6) Drive gear backlash. Measure and inspect components and replace as required and/or adjust to proper specifications.

ENGINE AND TRANSMISSION NOISE

Sometimes noises which seem to originate in the rear axle are actually that of the engine or transmission. To diagnose which unit is actually causing the noise, observe the approximate vehicle speed and conditions under which the noise is most pronounced; stop the vehicle in a quiet place to avoid any interfering noises. With engine running and transmission in neutral, run engine slowly up and down through engine speeds corresponding to approximate car speed at which the noise was most pronounced. If a noise similar is produced in this manner it usually can be assumed that the noise was caused by the engine or transmission and not that of the rear axle.

PROPELLER SHAFT VIBRATION

Objectional vibrations at high speed (100 km/h or higher) may be caused by a propeller shaft that is out of balance or worn universal joints. Out of balance may be due to a damaged or bent shaft.

To determine whether propeller shaft is causing the vibration in question; connect a tachometer and road test the vehicle through speed range and note speed at which vibration is most pronounced. Shift transmission into lower gear range and drive vehicle at same engine speed as when vibration was most pronounced in direct drive and note any effect on vibration.

If the vibration is still present at the same engine speed, whether in direct drive or in the lower gear, since the propeller shaft speed varies, this cannot be the fault. If the vibration decreases or is eliminated in the lower gear, then propeller shaft is at fault and should be rebalanced or replaced.

SECTION 1A — BORG WARNER REAR AXLE ASSEMBLY

SPECIFICATIONS

Type	Semi-floating Hypoid	
Models	Ratio	No. Pinions
Automatic Transmission	3.42:1	2
Manual Transmission	3.89:1	2
Side Bearing Preload — (torque measured without axles or pinion) — New Bearings	1,7 to 2,8 Nm (15 to 25 in.-lbs.)	
— Spring Balance Load	2,27 to 3,63 kg (5 to 8 lbs.)	
— Used Bearings	0,55 to 1,35 Nm (5 to 12 in.-lbs.)	
— Spring Balance Load	0,91 to 1,81 kg (2 to 4 lbs.)	
Pinion Bearing Preload		
New Bearings — With oil seal	1,7 to 3,4 Nm (15 to 30 in.-lbs.)	
— Without oil seal	1,7 to 2,8 Nm (15 to 25 in.-lbs.)	
Used Bearings — With oil seal	0,9 to 1,7 Nm (7.5 to 15 in.-lbs.)	
— Without oil seal	0,9 to 1,4 Nm (7.5 to 12.5 in.-lbs.)	
Drive Gear Runout	0,08 mm (0.003")	
Drive Gear Backlash — (at point of minimum backlash)	0,13 to 0,18 mm (0.005 to 0.007")	
Housing Spread — (when removing/replacing differential assembly)	0,102 to 0,203 mm (0.004 to 0.008")	
Axle Shaft Length — (drum mounting surface to splined end)		
3.42 Ratio — L.H. and R.H.	683,5 mm (26.91")	
3.89 Ratio — L.H.	668 mm (26.30")	
— R.H.	700 mm (27.56")	
Wheel Bearing Type	Single Row Roller "Unit Bearing"	
Bearing End-float (built in) Installed Condition		
New Bearing	0,03 to 0,38 mm (0.001 to 0.015")	
Used Bearing	Up to 0,76 mm (0.030")	
Axle Shaft Bearing Fit (on shaft)		
Interference	0,03 to 0,06 mm (0.001 to 0.002")	
Cup to Housing Fit — Clearance	0,01 to 0,08 mm (0.0005 to 0.003")	
Bearing Lock-Collar (on shaft)		
Interference	0,13 mm (0.005")	
Press Fit (minimum)	1135 kg (2 500 lbs.)	
Lubricant — Type	Multi-purpose Gear Oil S.A.E. 90 A.P.I. GL-5/Mil-L-2105B	
— Quantity	1,10 litres (1.9 pts)	

SPECIAL TOOLS

	High and Low Range Torque Wrench
	Dial Indicator Set
E6663	Adaptor — Rear Axle Shaft Puller
E6666	Slide Hammer
E3C20C	Remover — Axle Bearing (complete)
E3C20D	Remover — Axle Bearing (plates only)
E3R10E	Holder — Pinion Flange
E3C10	Remover — Pinion Flange
E3C10J	Installer — Pinion Oil Seal
E3C15A	Spreader — Rear Axle Carrier
E3M15	Spreader — Adaptor Plates
E1673	Puller — Differential Bearing (main tool)
E1673A15	Adaptors — Rear Pinion Bearing Remover
E1673C15	Adaptors — Side Bearing Remover
E3C10AE	Installer — Rear Pinion Bearing
E3C10BZ	Installer — Pinion Bearing Cup (main tool)
E3C10BQ	Installer — Adaptor Pinion Bearing Cup
E3C10BR	Installer — Adaptor Pinion Bearing Cup
E3M10T	Gauge — Pinion Setting

TORQUE SPECIFICATIONS

	Nm	lb./ft.
Axle Shaft Retainer Bolts	47-61	35-45
Drive Gear to Differential Housing Bolts	80-90	60-67
Side Bearing Cap Bolts	47-61	35-45
Pinion Nut	Tighten to Maintain Pinion Bearing Preload	
Rear Cover Bolts	23-30	17-22
Oil Filler Plug	41-47	30-35
Propeller Shaft Bolts — 10T bolts	30-35	22-26
— 8T bolts	24-30	18-22
Assist Link Bolts	49-58	36-43
Lower Control Arm Bolts	127-167	94-123
Shock Absorber — Lower Mounting	16-19	12-14
Upper Control Arm Bolts	127-167	94-123

DIFFERENTIAL SPACER CHARTS

DRIVE PINION HEIGHT ADJUSTING SPACER

3.42:1 AXLE RATIO (Auto. Transmission)		3.89:1 AXLE RATIO (Manual Transmission)	
Spacer Thickness	**Part No.**	**Spacer Thickness**	**Part No.**
0,203 mm (0.008")	4151591	4,456 mm (0.179")	4151614
0,228 mm (0.009")	4151592	4,572 mm (0.180")	4151615
0,254 mm (0.010")	4151593	4,597 mm (0.181")	4151616
0,279 mm (0.011")	4151594	4,622 mm (0.182")	4151617
0,304 mm (0.012")	4151595	4,648 mm (0.183")	4151618
0,330 mm (0.013")	4151596	4,673 mm (0.184")	4151619
0,355 mm (0.014")	4151597	4,699 mm (0.185")	4151620
0,381 mm (0.015")	4151598	4,724 mm (0.186")	4141621
0,406 mm (0.016")	4151599	4,749 mm (0.187")	4151622
0,431 mm (0.017")	4151600	4,775 mm (0.188")	4151623
0,457 mm (0.018")	4151601	4,800 mm (0.189")	4151624
0,482 mm (0.019")	4151602	4,826 mm (0.190")	4151625
0,508 mm (0.020")	4151603	4,851 mm (0.191")	4151626
0,533 mm (0.021")	4151604	4,876 mm (0.192")	4151627
0,558 mm (0.022")	4151605	4,902 mm (0.193")	4151628
0,584 mm (0.023")	4151606	4,927 mm (0.194")	4151629
0,609 mm (0.024")	4151607	4,953 mm (0.195")	4151630
0,635 mm (0.025")	4151608	4,978 mm (0.196")	4151631
0,660 mm (0.026")	4151609	5,003 mm (0.197")	4151632
0,685 mm (0.027")	4151610	5,029 mm (0.198")	4151633
0,711 mm (0.028")	4151611	5,054 mm (0.199")	4151634
0,736 mm (0.029")	4151612	5,080 mm (0.200")	4151635
0,762 mm (0.030")	4151613	5,105 mm (0.201")	4151636

DIFFERENTIAL SIDE BEARING PRELOAD ADJUSTING SPACER

Spacer Thickness	**Part No.**	**Spacer Thickness**	**Part No.**
5,956 mm (0.2345")	4151567	6,565 mm (0.2585")	4151579
6,007 mm (0.2365")	4151568	6,616 mm (0.2605")	4151580
6,057 mm (0.2385")	4151569	6,675 mm (0.2625")	4151581
6,108 mm (0.2405")	4151570	6,718 mm (0.2645")	4151582
6,159 mm (0.2425")	4151571	6,769 mm (0.2665")	4151583
6,210 mm (0.2445")	4151572	6.819 mm (0.2685")	4151584
6,261 mm (0.2465")	4151573	6,870 mm (0.2705")	4151585
6,311 mm (0.2485")	4151574		
6,362 mm (0.2505")	4151575		
6,413 mm (0.2525")	4151576		
6,464 mm (0.2545")	4151577		
6.515 mm (0.2565")	4151578		

COLLAPSIBLE SPACER SHIM

Spacer Thickness	**Part No.**
0,762 mm (0.030")	4151659

SERVICE INFORMATION — PROCEDURES

GENERAL INFORMATION

The rear axle housing (see Fig. 11) is a one piece assembly. The drive pinion and the differential housing with drive gear are mounted directly to the centre (carrier) section of the housing assembly. Access to the differential, drive gears and carrier bearing is obtained by removal of the carrier cover. Axle shafts and the pinion oil seal can be removed without removing the assembly from the vehicle, but the unit should be removed for any additional operations. Axle shaft end play is pre-set and is not adjustable.

REAR AXLE ASSEMBLY

Removal

(1) Loosen the rear wheel nuts, raise the rear of the vehicle and position jack stands under the body. The jack must be left supporting the axle housing.

(2) Remove the rear wheels, mark the pinion and propeller shaft flanges and remove the propeller shaft.

(3) Disconnect the hydraulic brake hose at the rear axle union.

(4) Disconnect the parking brake cable at each braking plate lever and remove the parking brake cable rubber hanger assembly from the rear axle housing.

(5) Disconnect the shock absorber lower mountings, lower the jack and remove the coil springs.

(6) Remove the lower control arm, assist link and upper control arm axle housing mountings and then remove the axle assembly.

NOTE: When removing the axle assembly do not allow it to fall from the jack.

Installation

(1) Position the axle assembly on a jack and locate the axle in position under the vehicle.

(2) Loosely fit the lower control arms, assist links and upper control arms to the axle housing.

(3) Fit the coil springs to their seats and raise the axle assembly. Install the shock absorber lower mounting and tighten the retaining nut to specification.

(4) Connect the parking brake rubber hanger assembly to the axle housing and connect the cable to each backing plate lever.

(5) Connect the hydraulic brake hose and bleed the brake system as described in Group 5, Brake Bleeding.

(6) Align mating marks on pinion and propeller shaft flanges, connect propeller shaft and install the wheels.

(7) Lower the vehicle to the ground and in an unladen condition tighten all control arm and assist link mountings to the specified torque.

(8) Top up the axle lubricant level if necessary.

AXLE DRIVE SHAFT

Removal

(1) Raise the rear of the vehicle and position a jack stand under the body.

(2) Remove the rear wheel and brake drum.

(3) Remove the axle shaft retaining bolts, refer Fig. 1.

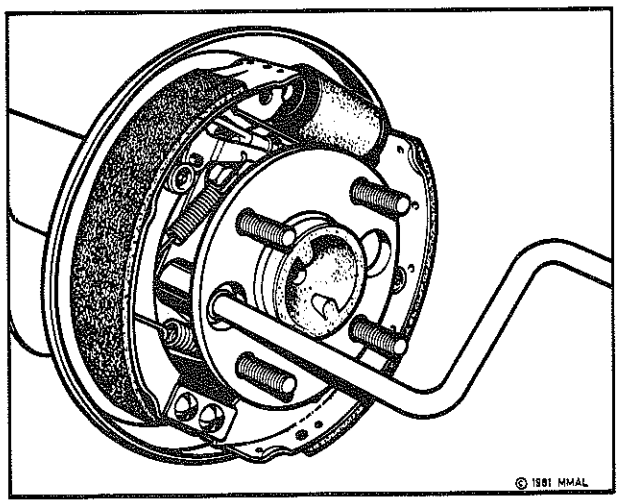


Fig. 1—Removing retaining bolts

(4) Using tool E6663A and slide hammer E6666, remove the axle shaft, refer Fig. 2.

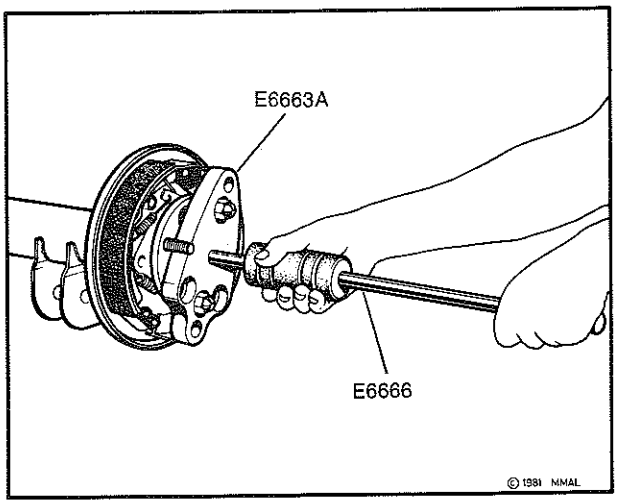


Fig. 2—Removing axle shaft

NOTE: The oil seal is outboard of the bearing cone and will be removed with the axle shaft — The bearing cup may become detached from the bearing and remain in the housing — refer Fig. 3 .

(5) Remove the bearing cup, where necessary using a suitable tool.

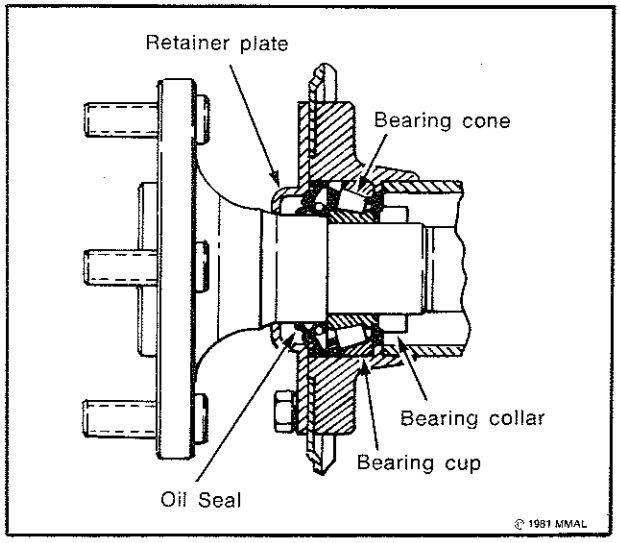


Fig. 3—Axle shaft components

Cleaning and Inspection

NOTE: Do not remove the bearing cone unless bearing or seal replacement is necessary or where the retainer plate is damaged — refer to Axle Shaft Bearing removal.

(1) Clean the bearing using only a solvent which will not affect the oil seal material.

(2) Blow the bearing dry but **do not spin** the cone as scoring may occur, inspect cone and cup for damage.

(3) Clean out the cup and seal recess area in the axle housing and examine for damage.

(4) Inspect the seal "fit" on shaft and seal condition — if unsatisfactory the seal must be replaced — refer to Axle Shaft Bearing Replacement.

Installation

(1) Re-lubricate the bearing cup and cone assembly, the sealing surface on the shaft and the oil seal, using the recommended rear axle lubricant, see specification.

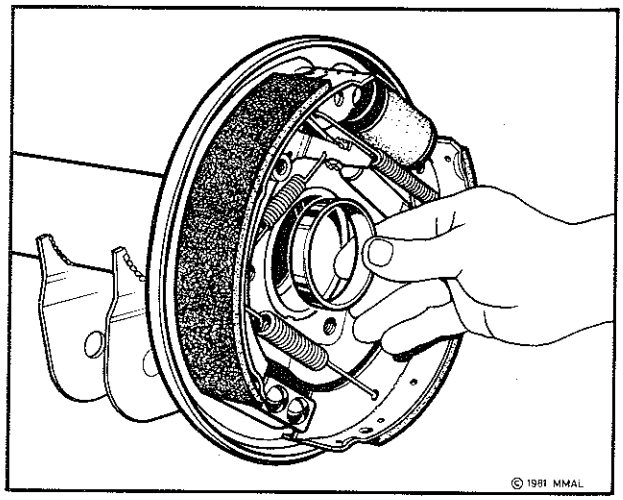


Fig. 4—Installing bearing cup

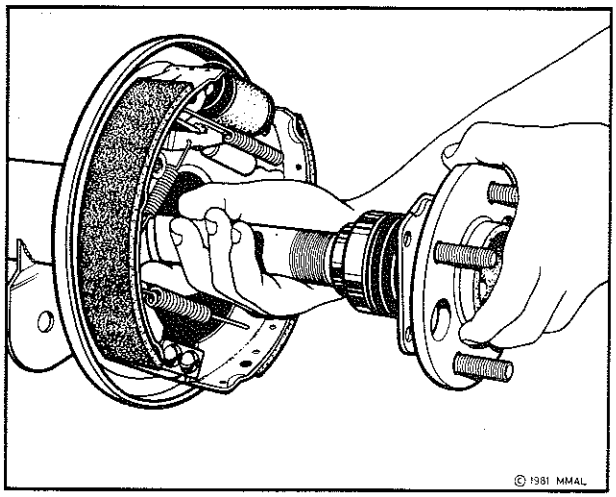


Fig. 5—Replacing axle shaft

(2) Install the bearing cup into the housing ensuring that it seats against the back face of bearing cup recess area in the axle housing, refer Fig. 4.

(3) Carefully insert the axle shaft into the housing and engage the drive shaft splines, refer Fig. 5.

(4) Wipe off any surplus lubricant to prevent brake contamination then commence to start the bearing and seal into the housing.

(5) Correctly install the bearing retainer plate and push the axle, bearing and seal into its seated position.

(6) Install the retaining bolts (refer Fig. 6) and using a tension wrench, tighten evenly to 20 Nm (15 lbs. ft.). Finally tighten evenly to 47 Nm (35 lbs. ft.), this will prevent distortion of the plate and seal.

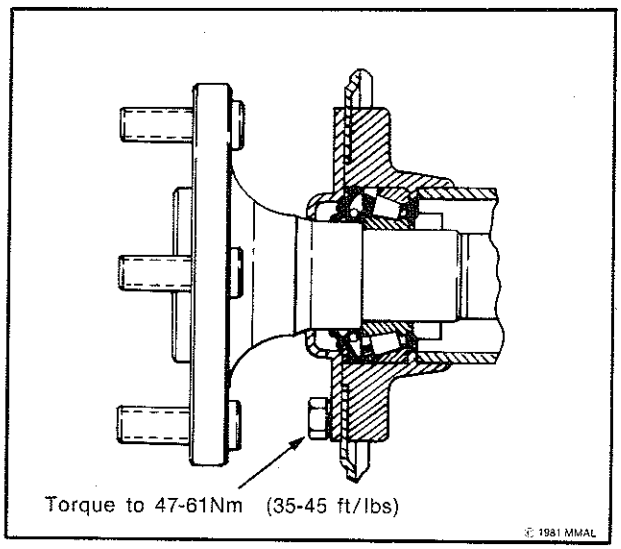


Fig. 6—Axle shaft in assembled condition

NOTE: The shaft end play clearance should be as specified in the specifications.

(7) Install the brake drums and retainer clips (if fitted).

(8) Install wheels and covers then top up rear axle lubricant if necessary (refer to specifications for correct lubricant).

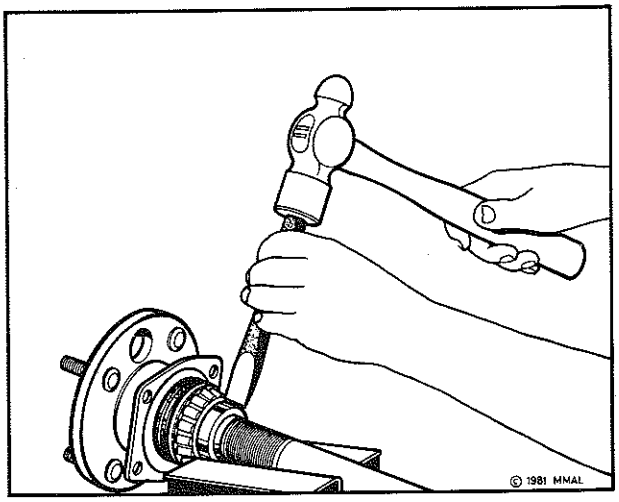


Fig. 7—Loosening bearing retainer collar

AXLE SHAFT BEARING REPLACEMENT

NOTE: Axle bearing and retainer removal must be accomplished using special tools — do not subject the axle shaft to heat.

(1) Loosen the bearing retainer collar with 4 deep chisel cuts, refer to Fig. 7.

(2) Assemble the bearing remover (Special Tool) with the jaws of the puller between the seal and the bearing cone, **ensuring** that the pressure of the tool is applied to the **shoulder** of the cone **not** upon the rollers or the sealing surface, refer Fig. 8.

(3) Install the tool base to the axle flange nuts to direct the screw pressure upon the two pads of the jaws.

(4) **Lubricate** the tool pusher screw **threads** and tighten sufficiently and evenly to force the bearing and retainer from shaft.

NOTE: The retainer must be discarded. The bearing cone assembly may be reinstalled, where necessary, if not damaged by removal.

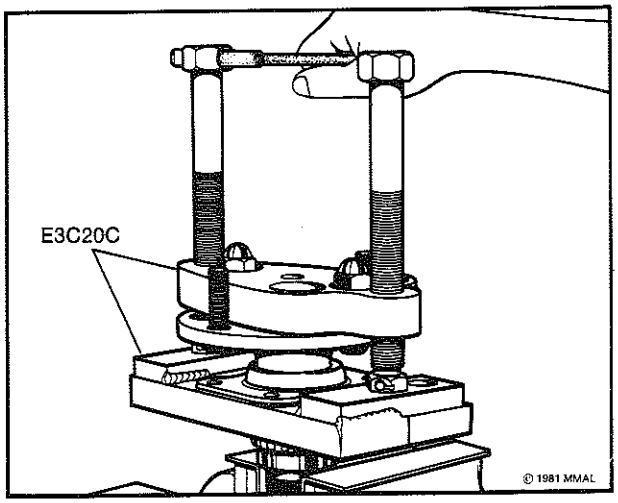


Fig. 8—Dismantling axle shaft

Axle Bearing Installation

It is recommended that when replacement bearings are used, that the seal is also replaced.

Inspection

(1) Prior to replacing the bearings and seals, first check that the bearing retainer plate is not damaged or distorted.

(2) Ensure that any damage such as bruises, nicks or burrs are removed from the seal or bearing surfaces of the axle shaft, to prevent installation damage.

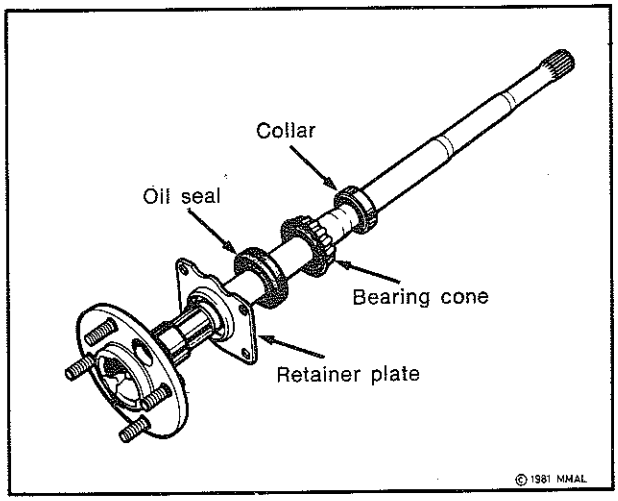


Fig. 9—Axle shaft disassembled

Assembly

(1) Place the retainer plate on the axle shaft with the flat side toward the splined end .

(2) Apply a small volume of bearing lubricant to the cavity between the seal lips and carefully position the seal on the shaft seal surface with the **flat side** of the seal **toward** the retainer plate.

NOTE: Don't force the seal on to the unground surface of the shaft. Install the axle bearing without removing the protective grease — where dry, lubricate using rear axle lubricant of the type required. New bearings have the cup bonded to the cup rib-ring for installation.

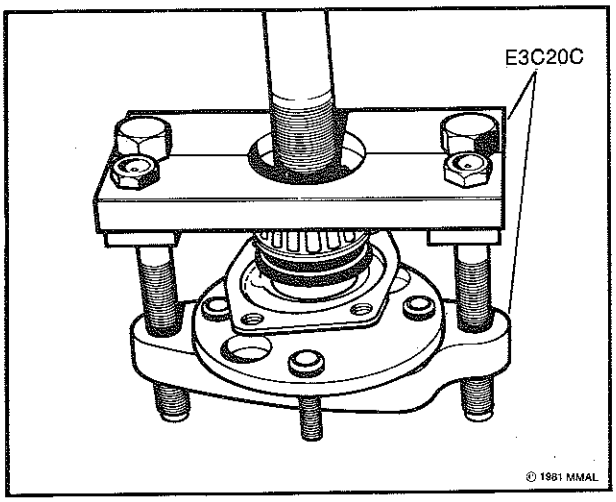


Fig. 10—Installing axle shaft components

(3) Place the lubricated bearing on the axle shaft ensuring that the cup **rib-ring** is **toward the retainer plate.**

CAUTION: Do not omit the cup rib-ring or reverse the bearing direction.

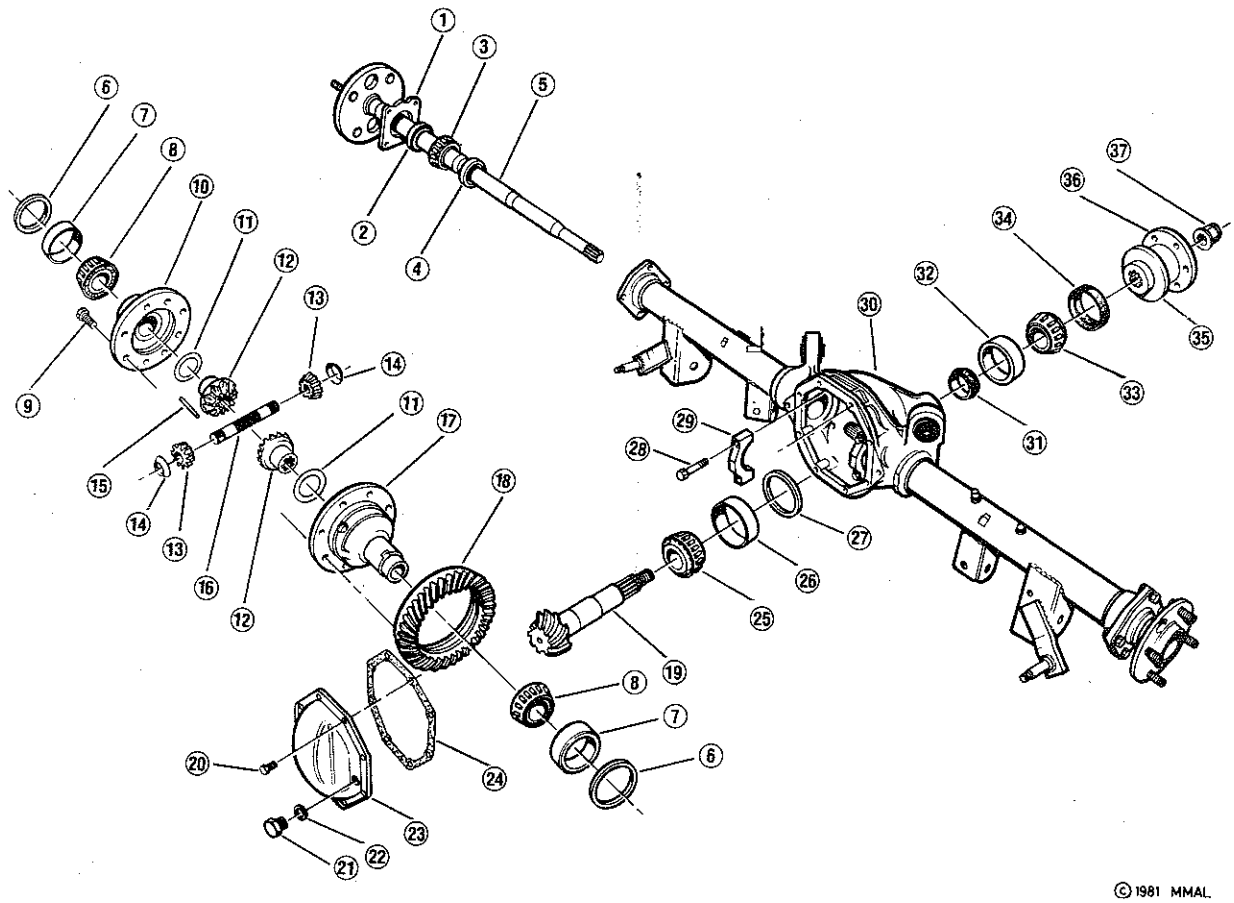
(4) Position the bearing squarely onto the axle shaft using Special Axle Shaft and Bearing Installing Tool. When pressing the bearing onto the axle shaft, ensure that the bearing to shaft fit is such that the bearing inner race will not turn on the axle shaft refer Fig. 10.

(5) Force the bearing cone to seat against the shaft shoulder — check using feeler gauges.

NOTE: An incorrectly installed collar may lose half the retaining interference "grip".

(6) Place a new collar (chamfer towards bearing) onto the axle shaft and press it on until it contacts the bearing cone. When pressing the collar onto the axle shaft a minimum force of 1135 kg (2 500 lbs.) should be used.

(7) Install the assembly as described in Installation.



1 Retainer plate
2 Axle seal
3 Axle bearing cone
4 Collar
5 Axle shaft
6 Spacer
7 Side bearing cup
8 Side bearing cone
9 Bolt
10 Differential housing L.H.
11 Thrust washer
12 Side gear
13 Pinion gear
14 Thrust washer
15 Pin
16 Pinion shaft
17 Differential housing R.H.
18 Drive gear
19 Pinion gear
20 Bolt
21 Plug
22 Washer
23 Cover
24 Gasket
25 Pinion bearing — rear
26. Pinion bearing cup
27 Spacer
28 Bolt
29 Cap
30 Carrier
31 Collapsible spacer
32 Pinion bearing cup
33 Pinion bearing — front
34 Pinion oil seal
35 Dust cover
36 Pinion flange
37 Self locking nut

Fig. 11—Rear axle assembly

PINION OIL SEAL REPLACEMENT

Removal

(1) Raise rear of vehicle and place stands under axle housing.

(2) Disconnect propeller shaft.

NOTE: Prior to removal of the propeller shaft, the rear universal joint yoke and pinion flange should be marked with a punch to ensure correct matching alignment of the propeller shaft with the pinion flange during installation. Failure to carry out this operation may result in propeller shaft vibration.

(3) Mark pinion, pinion nut and pinion flange to assist in re-assembly, refer Fig. 12.

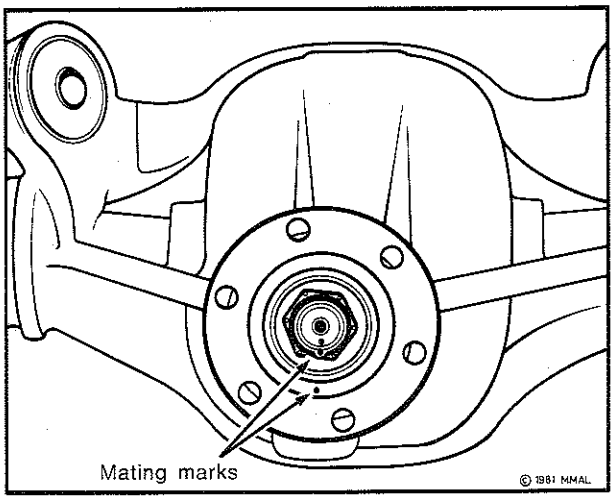


Fig. 12—Marking pinion, flange and nut

(4) Hold pinion flange with tool E3R10E and remove pinion nut, refer Fig. 13.

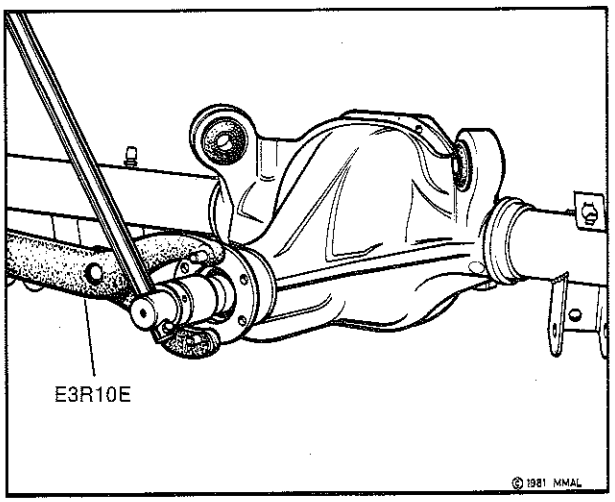


Fig. 13—Removing pinion nut

(5) Remove pinion flange with tool E3C10, refer Fig. 14.

(6) Remove pinion oil seal with tool E3C10C, refer Fig. 15. Examine seal surface of pinion flange for grooving and housing bore for nicks or burrs.

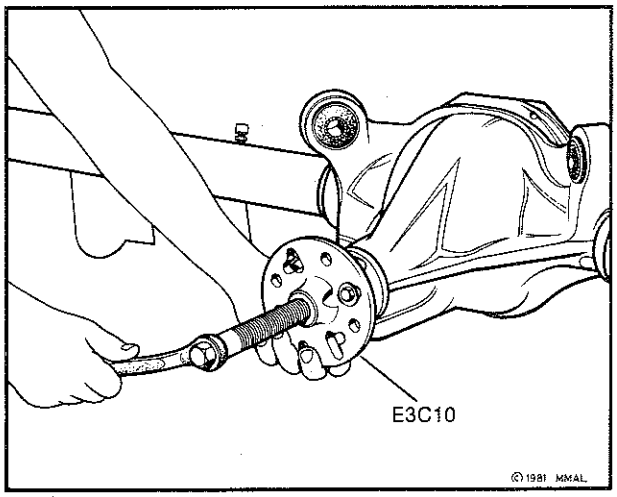


Fig. 14—Removing pinion flange

(7) Install a new pinion oil seal with tool E3C10J (refer Fig. 16) flush to 0,25 mm (0.010") below surface of carrier.

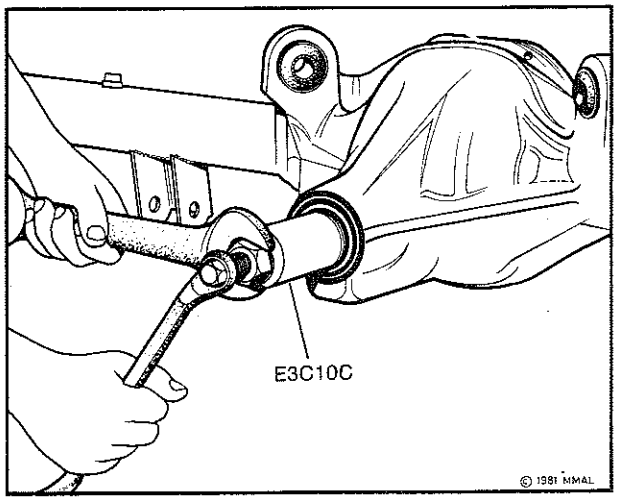


Fig. 15—Removing pinion oil seal

NOTE: Do not use gasket cements or sealants on oil seal outside diameter during installation.

(8) Lubricate sealing lips of seal prior to fitting pinion flange.

(9) Align mating marks of pinion and pinion flange. Install pinion flange and pinion nut.

(10) Tighten pinion nut until mating marks align, to re-establish pinion bearing preload.

NOTE: The pinion nut may be tightened a further 5° maximum past the mating marks. However, if the nut is over-tightened a new collapsible pinion spacer must be fitted.

(11) Align mating marks of propeller shaft and install attaching bolts .

(12) Lower vehicle and top up rear axle oil level if necessary .

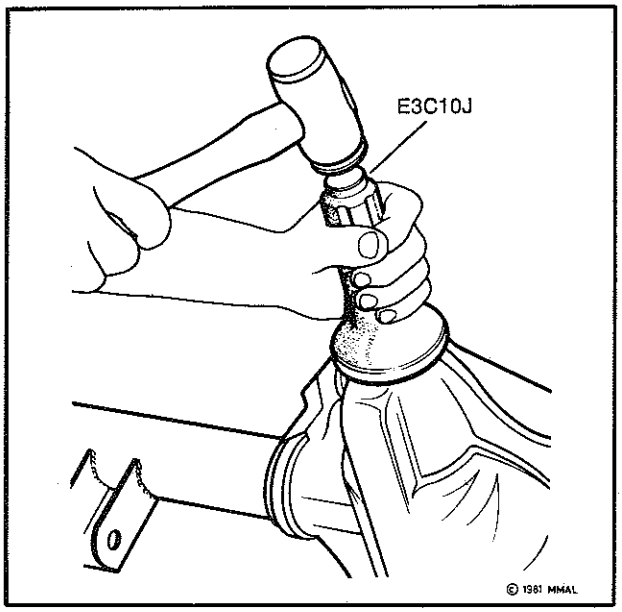


Fig. 16—Installing pinion oil seal

DIFFERENTIAL DIS-ASSEMBLY

Assembly Removed from Vehicle and Axle Shafts Removed

(1) Loosen carrier housing cover and drain lubricant from housing. Rotate assembly to have cover facing upward.

(2) Remove cover and clean carrier housing and differential assembly with kerosene, mineral spirits or other similar cleaning fluid.

(3) Visually inspect moving components for wear and chipped surfaces.

(4) Check torque of ring gear and side bearing cap bolts.

(5) Mount a dial indicator and magnetic base on the carrier housing and load the indicator slightly when the plunger is at right angle to the back face of the drive gear, refer Fig. 17.

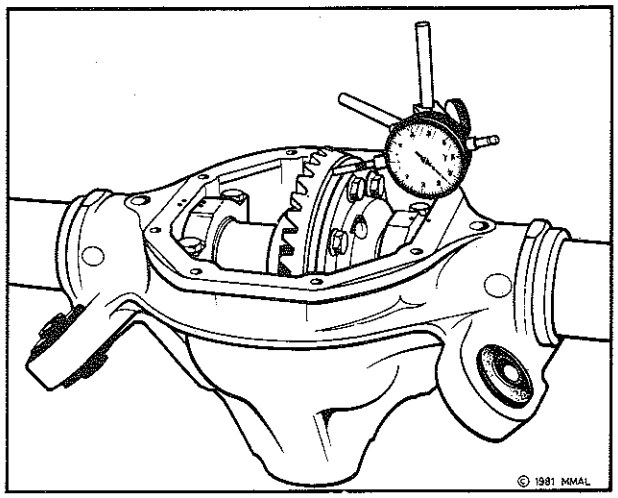


Fig. 17—Checking drive gear runout

(6) Push the differential assembly hard to one side and then to the opposite side to measure side play. There should be no side play.

(7) Check drive gear runout by reading dial indicator whilst turning the drive gear several complete turns. Mark the drive gear and the differential housing at the point of maximum runout for use later in checking the differential housing. Total indicator reading should be no more than 0,08 mm (0.003"). If the runout is over 0,08 mm (0.003") the differential housing assembly may have been sprung. A test of the housing assembly will be described later.

Remove magnetic base and dial indicator.

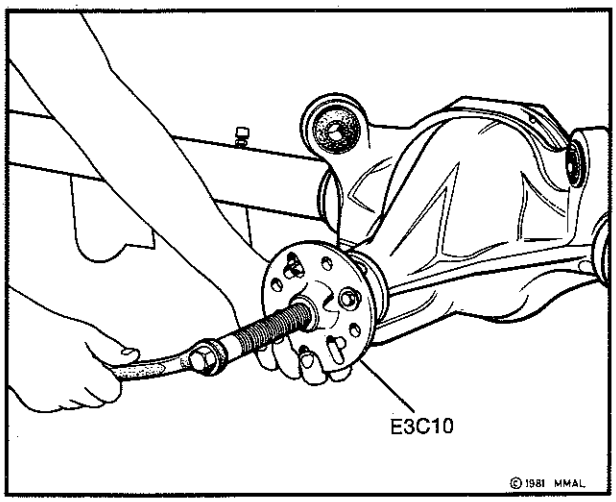


Fig. 18—Removing pinion flange

(8) Remove pinion nut and remove pinion flange with tool E3C10, refer Fig 18.

(9) Remove pinion oil seal with tool E3C10C, refer Fig. 19. Remove pinion front bearing and collapsible spacer.

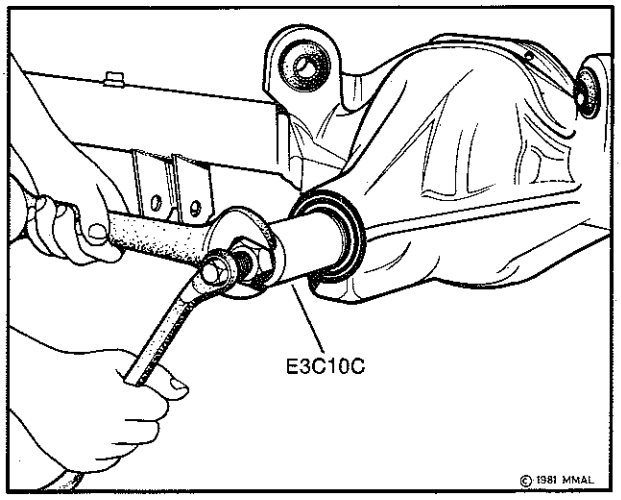


Fig. 19—Removing pinion oil seal

(10) Mark carrier and differential side bearing caps for location in assembly, refer Fig. 20.

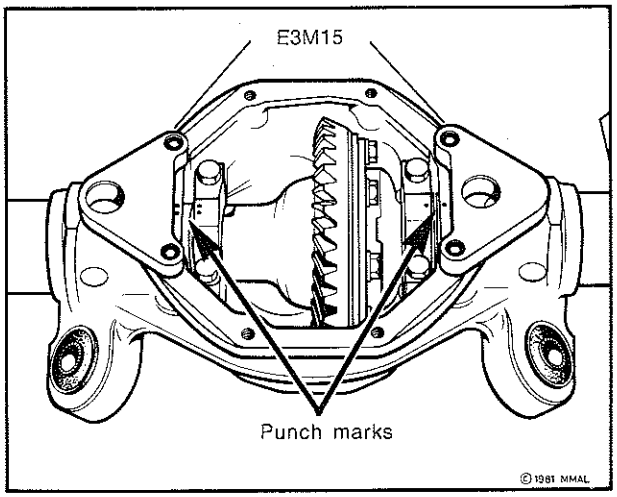


Fig. 20—Bearing cap identification

(11) Remove bearing caps and locate Special Carrier Spreader Tool Adaptor Plates on carrier, making sure that the plates fit flat on the carrier flange when the mounting screws are tightened. If any projections from the axle tube weld points interfere with the correct seating of the adaptor plates, dress down with a file to form a flat surface. At this time the spreader tool should be fitted and adjustment screw tightened finger tight only.

(12) Mount dial indicator magnetic base over a side bearing cap stud hole (refer Fig. 21) or screw a suitable pilot stud into the side bearing cap stud hole. Attach a dial indicator and load the indicator slightly against the opposite side of the carrier, refer Fig. 21.

NOTE: A suitable pilot stud can be made by cutting a 3/8" Whitworth thread 12 mm (½") long on one end of a 165 mm (6½") length of 9,5 mm (3/8") steel rod.

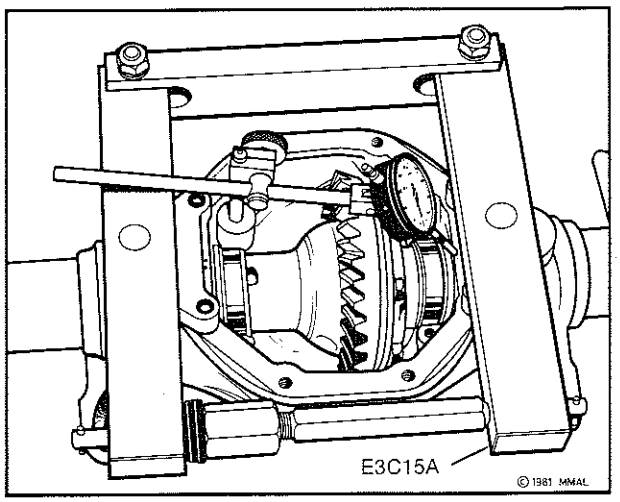


Fig. 21—Spreading carrier

(13) Spread the carrier 0,10-0,20 mm (0.004"-0.008") to permit removal of the differential.

NOTE: Never spread the carrier more than 0,38 mm (0.015").

(14) Remove dial indicator and remove differential assembly from carrier. A light prying action can be useful to unseat the differential from the carrier, refer Fig. 22. Identify bearing cups and preload spacers for location in reassembly. Do not remove spreader tool.

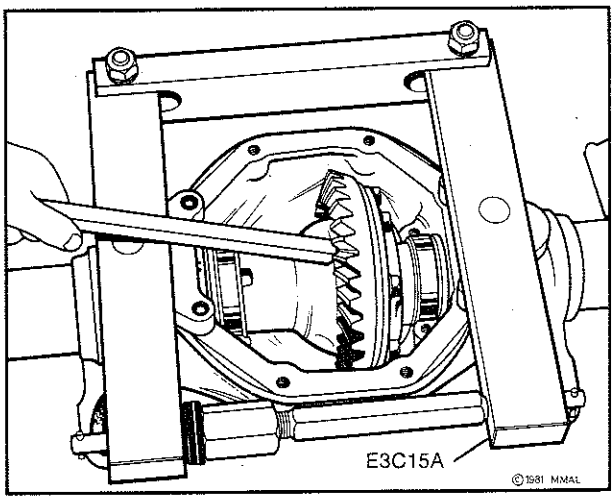


Fig. 22—Loosening differential assembly

(15) Remove pinion from carrier.

(16) Mount differential housing assembly in a vice equipped with soft jaws.

(17) Remove drive gear bolts.

Remove drive gear and inspect for burrs or other reasons likely to cause a runout condition.

(18) If drive gear runout exceeded 0,08 mm (0.003") in step 7, the differential housing assembly flange runout should be checked.

Temporarily install substitute bolts and nuts to hold housing halves together when the drive gear is removed.

Install the differential housing assembly and preload spacers in the carrier and loosen the spreader tool.

Mount the dial indicator in contact with the drive gear side of the flange to take a reading as in step 7. Total allowable runout should not exceed 0,025 mm (0.001"). In a case of slight runout, it may be possible during assembly to relocate the high runout section of the drive gear, opposite (180°) the runout section of the differential housing flange, to reduce the runout tolerance of the assembly.

(19) Spread carrier with spreader tool. Remove differential and remove spreader tool.

Drive differential pinion shaft lock pin out of housing from drive gear end of housing.

(20) Remove differential pinion shaft with a brass drift.

(21) Remove substitute bolts and nuts from differential halves and separate to remove pinion gears and thrust washers.

(22) Remove axle side gears and thrust washers.

(23) Remove differential side bearings with Special Adaptor Plates and Puller, refer Fig. 23.

(24) Remove pinion rear bearing with Special Adaptor Plates and Puller, refer Fig. 24.

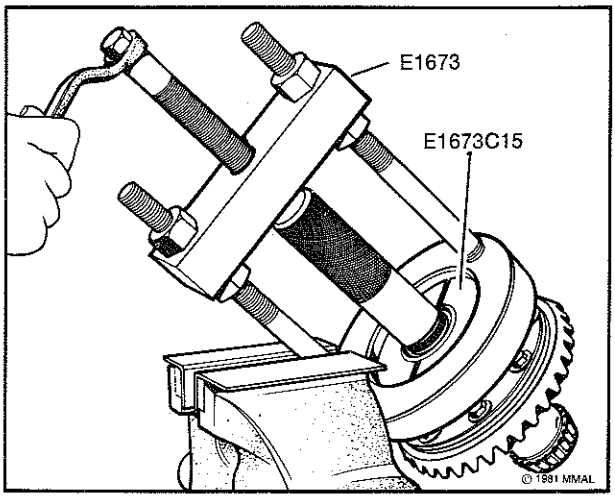


Fig. 23—Removing differential side bearing with special tools

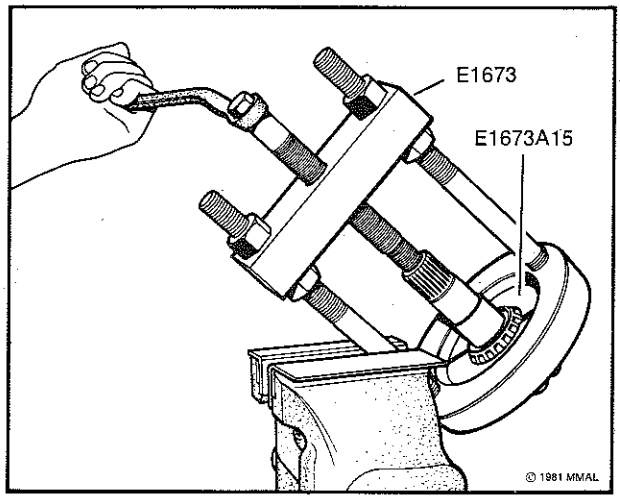


Fig. 24—Removing pinion rear bearing with special tools

CLEANING AND INSPECTION

(1) Clean all parts except the wheel bearings with kerosene, mineral spirits, or other similar cleaning fluids. Clean housing tubes with a cleaning cloth by inserting a stiff wire from ends of tubes into carrier section, and withdraw cleaning cloth from the centre outward. Wipe wheel bearings with a clean, lint free cloth.

(2) The two differential bearing cup contact areas in the carrier should be smooth and flat, without raised metal either in the contact areas or the edges of the machined surfaces. The bearing cups should also have undamaged machined surfaces, and be free from raised metal edges along both sides and also around the bolt holes. In the drive pinion section of the carrier, the bearing cup bores should be smooth and flat. Raised metal on shoulders of the bores incurred in removing the cups, should be flattened by use of a flat nose punch.

(3) The axle drive shaft bearing and oil seal bores at both ends of the housing should be smooth and free from rust or damage.

(4) Axle drive shaft splines should be straight and free from excessive wear. The shaft bearing and retainer area must be smooth and free from raised metal. When necessary to clean this portion remove only the raised metal and use crocus cloth to **polish the area without reducing the diameter of the shaft.**

(5) If the axle shaft bearings were removed from the shaft, install bearings using new retaining collars as these parts are unfit for further use after removal (refer Axle Drive Shaft Assemblies).

(6) Taper roller bearing cone assemblies should have a smooth, unbroken surface on the cone and both shoulders. The rollers should also have smooth unbroken surfaces. The roller retainer should be free from damage and cracks. Bearing cups should have a smooth unbroken surface.

(7) Differential pinion gears and side gears should have smooth teeth with a uniform contact pattern, without excessive wear or broken surfaces. The hub surfaces of side gears should be smooth and the splines should be straight and without excessive wear. The outer surfaces of the pinion gears should be smooth and bright. Thrust washers should be smooth and unbroken.

(8) Inside the differential housing the machined areas should be polished, without surface imperfections. The pinion shaft bore in the case should be round and smooth. Both ends of the pinion shaft should also be round and without excessive wear.

(9) Drive gear teeth should have a uniform contact pattern and have smooth unbroken surfaces without excessive wear. The pinion teeth should have a similar appearance. The machined surface of the pinion shaft and back face of the head should be undamaged and without wear.

(10) Use new gaskets and oil seals in assembly, replace bearings where necessary.

ASSEMBLING THE DIFFERENTIAL

If new differential side gears are to be installed use new thrust washers also.

NOTE: Lubricate all parts when assembling and adjusting.

(1) Install thrust washers on the differential side gears and position gears in each housing half.

(2) Place thrust washers on both pinion gears and mesh the pinion gears with the side gear, having the pinion gears exactly 180° apart, positioned in the drive gear housing half.

(3) Align the pinion gears and washers with the shaft holes in the housing.

(4) Install pinion gear shaft with care, not to damage thrust washers and to have hole in shaft aligned with lock pin hole in housing.

(5) Install a new lock pin in drive gear side of housing half, carefully positioning the housing on to the smaller housing, engage the lock pin in the pin bore, then carefully press halves together.

(6) Position the drive gear on the housing to separate the points of maximum runout 180° and start all bolts through the housing into the drive gear, finger tight.

(7) Tighten the bolts to the specified torque in two stages and in a criss-cross fashion.

(8) Install differential side bearings, refer Fig. 25.

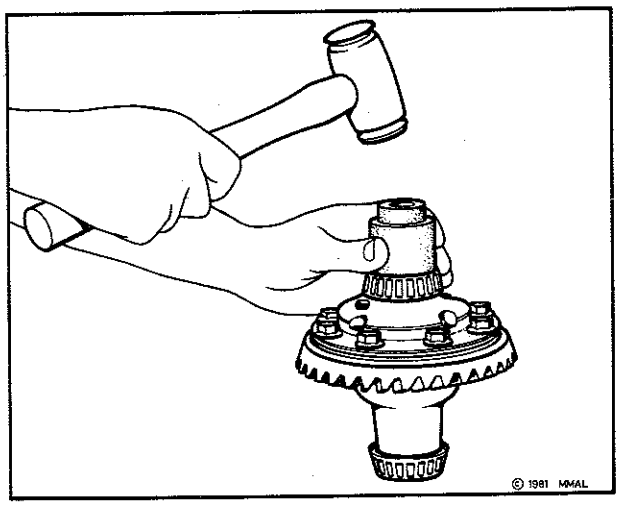


Fig. 25—Installing differential side bearings

DIFFERENTIAL SIDE BEARING PRE-LOAD SPACER SELECTION

(1) Select two differential side bearing spacers that allow positioning of the differential assembly in the carrier without having to spread the carrier.

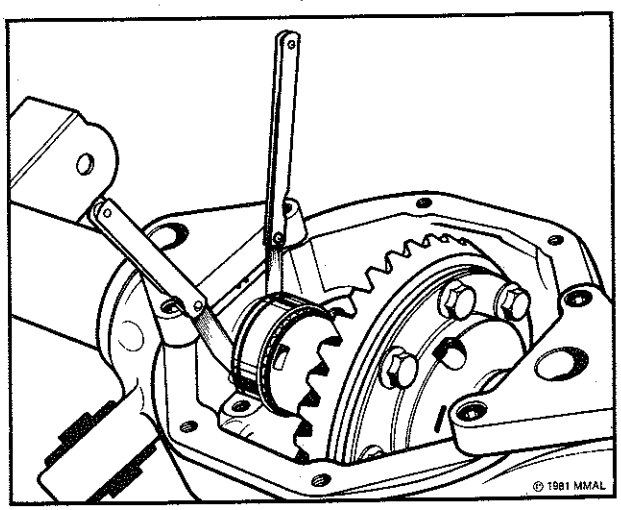


Fig. 26—Measuring side bearing spacers

(2) Push the assembly hard to one side of the carrier and with two feeler gauge sets, measure the gap between the spacer and the carrier at the opposite end, refer Fig. 26.

(3) Remove the assembly and measure the total spacer thickness.

(4) Initial spacer thickness is determined as follows:—

Total spacer thickness selected in step (1) plus gap measured in step (2) plus 0,15 mm (0.006") for used bearings or 0,25 mm (0.010") for new bearings.

(5) Select two spacers, each half the thickness of the value determined in step (4).

NOTE: Refer to Spacer Thickness Chart — page 3 - 1A - 2 for spacer selection.

(6) Attach carrier spreading tool and mount dial indicator on carrier. Spread carrier approximately 0,20 mm (0.008") and install differential assembly and selected spacers in carrier.

NOTE: Never spread carrier more than 0,38 mm (0.015").

(7) Install bearing caps and tighten bolts to specified torque.

NOTE: Ensure bearing caps are fitted to original positions.

(8) Remove carrier spreading tool.

CHECKING DIFFERENTIAL SIDE BEARING PRE-LOAD

(1) Rotate differential several turns to seat side bearings.

(2) Wrap a cord around the outside diameter of the differential housing flange and check preload by pulling the end of the cord with a spring balance, refer Fig. 27.

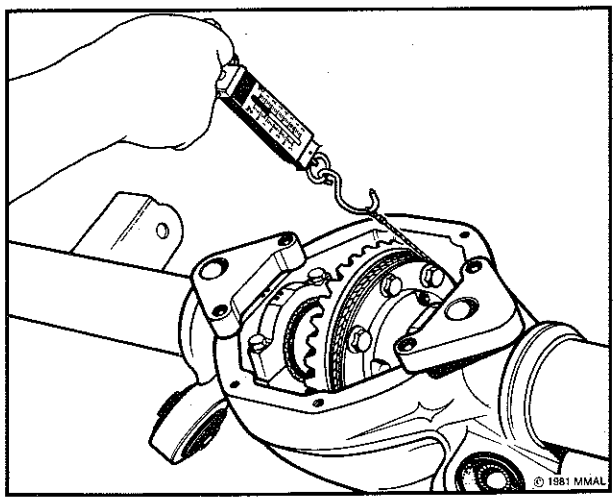


Fig. 27—Measuring side bearing preload

(3) Should the preload not comply to specification, adjustment can be made by decreasing the spacer thickness to reduce the preload and by increasing the spacer thickness to increase the preload.

NOTE: A 0,05 mm (0.002") alteration to total spacer thickness will usually bring the preload within specifications.

(4) When the correct preload is obtained, remove the differential assembly from the carrier and set it aside together with the selected spacers ready for final assembly.

NOTE: Take care not to mix the spacers.

DRIVE GEAR AND PINION DEPTH OF MESH SPACER SELECTION

(1) With the differential assembly and pinion removed from the carrier, remove the rear pinion bearing from the pinion and remove the rear bearing cup and height adjustment spacer from the carrier.

(2) Install the dummy rear pinion bearing (part of tool E3M10T) into the carrier.

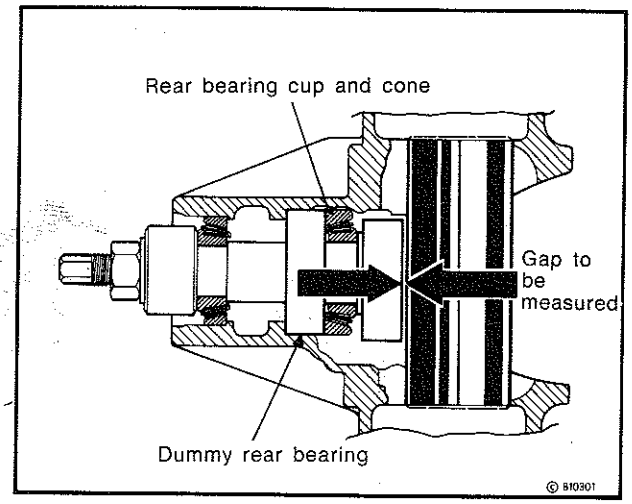


Fig. 28—Pinion setting tools in situ

(3) Install the 4,32 mm (0.170") spacer (part of tool E3M10T) onto the dummy pinion.

NOTE: The 4,32 mm (0.170") spacer is only used with the 3.42:1 ratio rear axle assembly.

(4) Install the pinion rear bearing cup and cone onto the dummy pinion and install the dummy pinion assembly into the carrier housing.

(5) Install the pinion front bearing cone onto the dummy pinion.

(6) Install the spacer, washer and nut (part of tool E3M10T) and tighten nut to obtain the specified pinion bearing preload.

(7) Install the arbor in the carrier and lightly clamp with side bearing caps and bolts.

(8) Measure the gap between the arbor and the dummy pinion head with a feeler gauge, refer Fig. 29.

(9) Note the pinion correction figure etched on the pinion head, refer Fig. 30. Add to, or subtract the etched figure from the previously measured dimension.

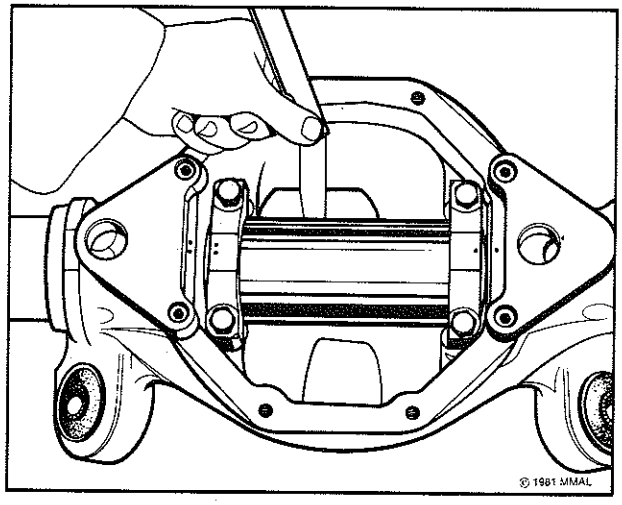


Fig. 29—Pinion shim selection

NOTE: The pinion correction marking represents thousands of an inch and if marked + should be subtracted from the figure, and if marked — should be added. If the correction figure is 0, the gap measured is the correct spacer thickness to be used.

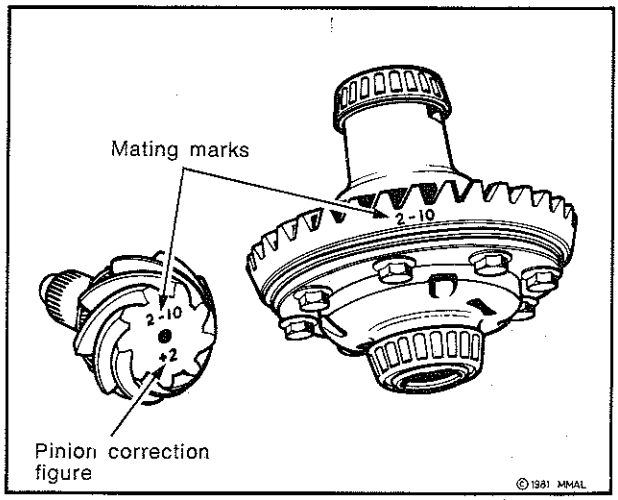


Fig. 30—Pinion and drive gear markings

The Drive Pinion Height Adjusting Spacer Chart on page 3 - 1A - 2 details the selection of spacers available.

(10) Remove tools from carrier and install the selected spacer in the rear pinion bearing cup bore of the carrier.

(11) Install the rear pinion bearing cup in the carrier.

(12) Install rear pinion bearing cone to the pinion, refer Fig. 31.

(13) Install front bearing cone to carrier.

(14) Lubricate sealing lips of pinion oil seal and install seal, refer Fig. 32.

NOTE: Do not use gasket cements or sealants on oil seal outside diameter during installation.

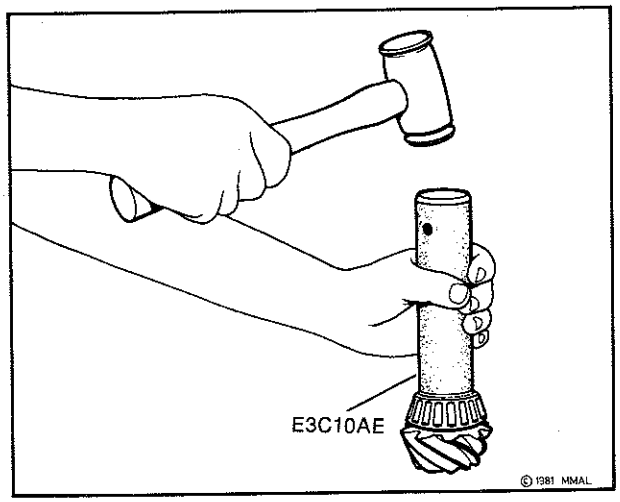


Fig. 31—Installing rear pinion bearing cone

(15) Assemble collapsible spacer onto pinion and install pinion assembly, pinion flange and nut to carrier.

(16) Tighten pinion nut to achieve pinion bearing preload (refer specifications).
Use a torque wrench to test preload.

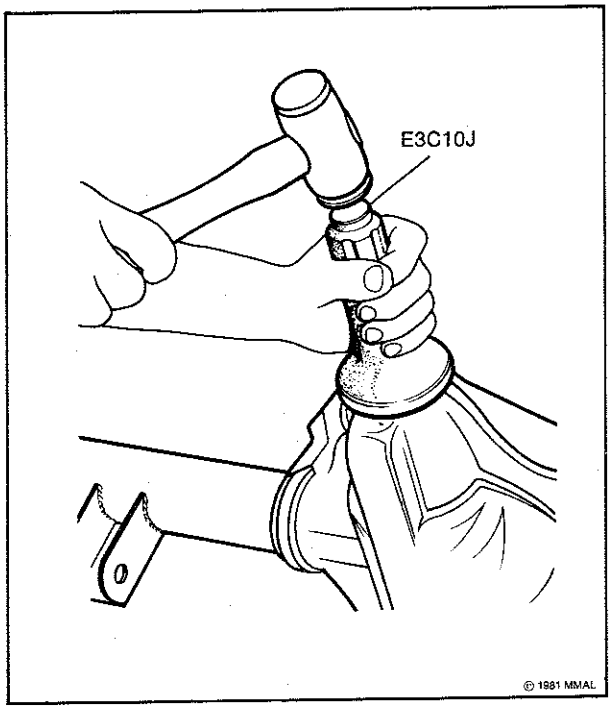


Fig. 32—Installing pinion oil seal

Accurate reading can be obtained only with the nose of the carrier up. With the handle of the wrench "floating", take readings when wrench is moving through several full turns. A reading which varies during rotation indicates a binding condition which should be corrected. Gradually increase torque on the pinion nut until the specified torque is obtained. If the pinion nut is overtightened the collapsible spacer will be crushed and will require replacement.

NOTE: Once used collapsible spacers may be re-used if an additional shim 0,75 mm (0.030") thick is used between the spacer and bearing. It is important that a collapsible spacer be re-used once only.

(17) Attach carrier spreading tool and dial indicator. Spread carrier sufficiently to allow fitment of differential assembly.

Usually a spread of 0,20 mm (0.008") is sufficient.

NOTE: Never spread the carrier more than 0,38 mm (0.015").

(18) Remove dial indicator and install the differential assembly with pre-selected side bearing preload spacers. Remove spreader tool and adaptor plates.

(19) Install side bearing caps and tighten bolts to specified torque.

DRIVE GEAR AND PINION BACKLASH

(1) Attach a dial indicator to the carrier, bringing the indicator parallel with the drive gear rotation and into contact with one tooth, refer Fig. 33.

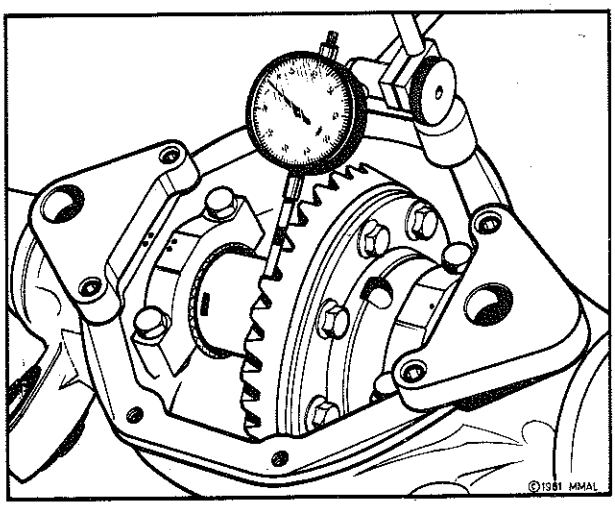


Fig. 33—Measuring minimum backlash

(2) Measure drive gear backlash at three equi-spaced positions, (120° apart) to find the point of minimum backlash.

(3) If the reading is not within tolerance, it will be necessary to adjust the backlash by moving the drive gear closer, or away from the pinion by decreasing the side bearing spacer thickness on one side and increasing the spacer thickness on the other side by the same amount.

NOTE: Total spacer thickness must be the same to maintain the pre-set preload.

CHECKING TOOTH CONTACT PATTERN

(1) Apply a thin film of marking compound on both the drive and coast side of the drive gear teeth. Rotate the drive gear one complete revolution in both directions while levering with a round bar or screwdriver between the carrier and differential housing flange. This action creates a load and produces a distinct tooth contact pattern on the drive gear teeth.

(2) Observe the contact pattern on the drive gear teeth and compare with those in Fig. 34 to determine if the pattern is properly located. If pinion depth of mesh and drive gear backlash are correct, the heaviest most distinct part of the contact pattern should be centred on both drive and coast sides of the drive gear teeth .

(3) If the tooth contact pattern resembles Face contact or Heel contact (refer Fig. 34), the thickness of the spacer between the pinion rear bearing cup and carrier should be increased to move the pinion towards the drive gear centre line. The drive gear must be moved to maintain the specified backlash.

(4) If the tooth contact pattern resembles Flank contact or Toe contact, the thickness of the spacer between the pinion rear bearing cup and carrier should be decreased to move the pinion away from the drive gear centre line. The drive gear must be moved to maintain the specified backlash.

(5) If the correct tooth contact pattern cannot be obtained with the described adjustments, the gear teeth are extensively worn and both drive gear and pinion must be replaced.

(6) When correct tooth contact pattern is obtained, clean marking compound from tooth surfaces.

(7) Clean carrier and cover gasket surfaces, install the cover with a new gasket and tighten cover bolts to the specified torque.

(8) Install rear axle assembly as previously described.

(9) Install axle drive shafts as previously described.

(10) Fill rear axle assembly with correct grade and quantity of lubricant.

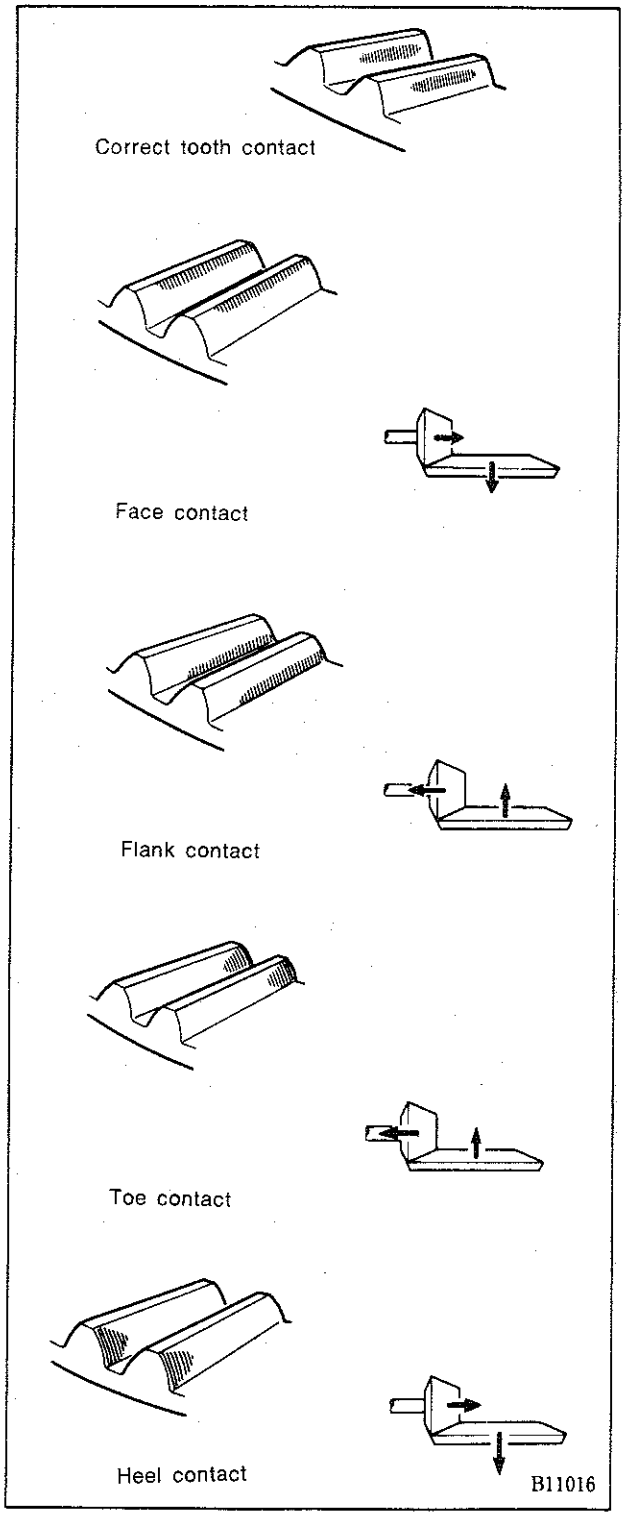


Fig. 34—Gear tooth contact pattern

SECTION 1D — MITSUBISHI REAR AXLE ASSEMBLY

SPECIFICATIONS

Type	Semi-floating Hypoid
Models	Ratio / No. Pinions: 3.545:1 — 2; 3.909:1 — 2
Axle Shaft Flange Squareness	0,04 mm (0.0016") or less
Axle Shaft Concentricity at B	0,025 mm (0.001") or less
Axle Shaft Concentricity at C	1,00 mm (0.040") or less
Axle Shaft Bearing Radial Play	0,026 to 0,040 mm (0.0010" to 0.0016")
Axle Shaft Bearing Axial Play	0,35 to 0,40 mm (0.014" to 0.016")
Axle Shaft Bearing to Outer Bearing Retainer Clearance	0 to 0,25 mm (0 to 0.010")
Axle Shaft Spline to Side Gear Free Play	0,054 to 0,171 mm (0.0021" to 0.0067") standard dimension 0,2 mm (0.008") max. wear limit
Differential Pinion to Pinion Shaft Clearance	0,016 to 0,061 mm (0.0006" to 0.0024")
Pinion and Side Gear Back Lash	0, to 0,076 mm (0 to 0.003")
Pinion Bearing Preload — With oil seal	1,0 to 1,3 Nm (9 to 11 in.-lbs.)
— Without oil seal	0,8 to 1,1 Nm (6 to 9 in.-lbs.)
Crown Wheel Run Out	0,05 mm (0.002") or less
Crown Wheel Back Lash	0,13 to 0,18 mm (0.005" to 0.007")
Differential Bearing Pre-load	0,05 mm (0.002")
Lubricant — Type	Multi-purpose Gear Oil S.A.E. 90 A.P.I. GL-5/Mil-L-2105B.
— Quantity	1,10 litres (1.9 pts.)

SPECIAL TOOLS

	Low Range Torque Wrench
	High Range Torque Wrench
	Dial Indicator Set
E3M10A	Installer Pinion Bearing
E3M10B	Installer Differential Side Bearings
E3M10C	Remover Front Pinion Bearing Cup
E3M10E	Pinion Setting Gauge
E3M10J	Puller Pinion and Differential Side Bearing Cones
E1673-D15	Remover Adaptor Pinion and Differential Side Bearings
E3M10K	Remover Rear Pinion Bearing Cup
E3M20	Installer Rear Axle Shaft Oil Seal
E3R10E	Holder Pinion Yoke
E6663	Remover Rear Axle Shaft Adaptor
E6663A	Remover Rear Axle Shaft Slide Hammer

TORQUE SPECIFICATIONS

	Nm	lb./ft.	lb./in.
Assist Link Bolts	49-58	36-43	
Axle Shaft Nuts	34-39	25-29	
Crown Wheel to Differential Housing Bolts	64-73	47-54	
Differential Bearing Cap Bolts	34-39	25-29	
Drain Plug	69	51	
Gear Carrier to Axle Housing Nuts	24-30	18-22	
Hydraulic Pipes	12-16	9-12	108-144
Level Plug	39	29	
Lower Control Arm Bolts	127-168	94-123	
Pinion Nut	157-217	116-160	
Shock Absorber Lower Mounting Nut	16-19	12-14	144-168
Upper Control Arm Bolt	127-168	94-123	
Wheel Nuts	69-79	51-58	

GENERAL INFORMATION

The rear axle housing is a Banjo type assembly. The drive pinion and the differential case with the crown wheel are mounted to the nose cone which is bolted to the steel axle housing. Access to the differential, drive pinion, crown wheel and bearings is obtained by first removing the axle shafts and then removing the nose cone assembly. All operations except for axle housing removal can be achieved with the axle assembly in the vehicle.

REAR AXLE ASSEMBLY

Removal

(1) Loosen the rear wheel nuts, raise the rear of the vehicle and position jack stands under the body. The jack must be left supporting the axle housing.

(2) Remove the rear wheels and the propeller shaft.

(3) Disconnect the hydraulic brake hose at the rear axle union.

(4) Disconnect the parking brake cable at each braking plate lever and remove the parking brake cable lever assembly from the rear axle housing.

(5) Disconnect the shock absorber lower mountings, lower the jack and remove the coil springs.

(6) Remove the lower control arm, assist link and upper control arm axle housing mountings and then remove the axle assembly.

NOTE: When removing the axle assembly do not allow it to fall from the jack.

Installation

(1) Position the axle assembly on a jack and locate the axle in position under the vehicle.

(2) Loosely fit the lower control arm, assist link and upper control arm to the axle housing.

(3) Fit the coil springs to their seats and raise the axle assembly. Install the shock absorber lower mounting and tighten the retaining nut to specification.

(4) Connect the parking brake lever assembly to the axle housing and connect the cable to each backing plate lever.

(5) Connect the hydraulic brake hose and bleed the brake system as described in Group 5, Brake Bleeding.

(6) Connect the propeller shaft and install the wheels to the axle.

(7) Lower the vehicle to the ground and in an unladen condition tighten all control arm and assist link mountings to the specified torque.

(8) Top up the axle lubricant level if necessary.

AXLE DRIVE SHAFT

Removal

(1) Raise the rear of the vehicle and position a jack stand under the body.

(2) Remove the rear wheel and brake drum.

(3) Remove the axle shaft retaining nuts and remove the axle shaft. If the axle shaft is difficult to remove, use a slide hammer type puller to remove the axle shaft.

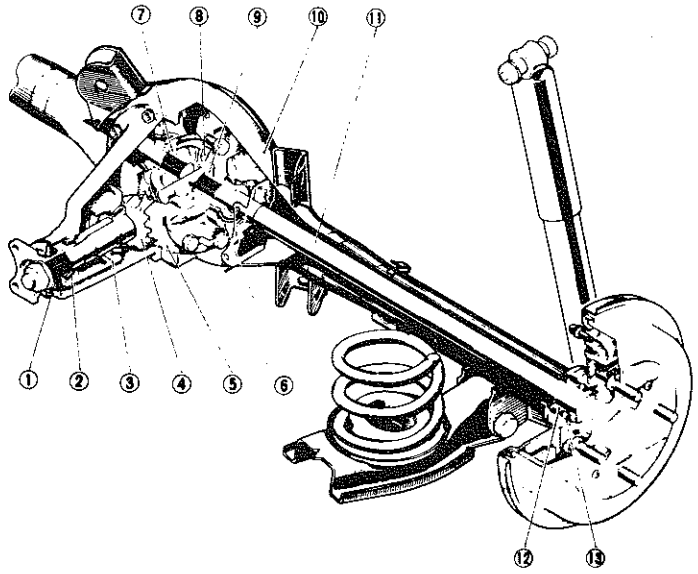


Fig. 1—Rear axle assembly

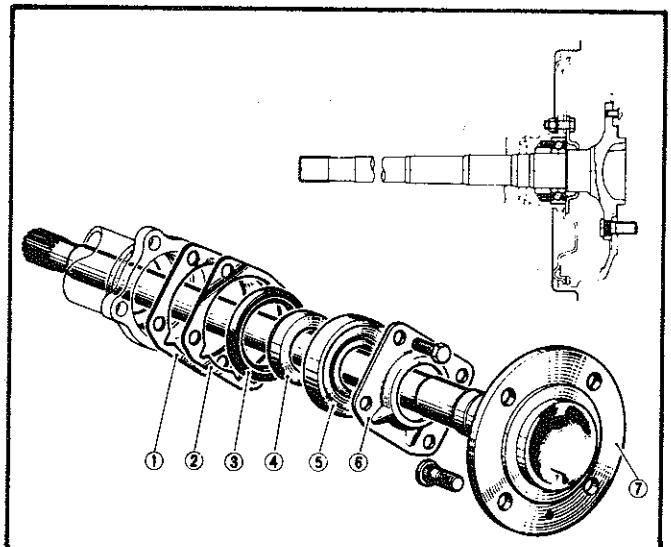


Fig. 2—Axle drive shaft (exploded view)

(4) If the seal is to be reused do not remove it from the axle housing. If replacement is necessary, remove the seal by either using a slide hammer type puller, or collapsing the seal with a suitable drift.

Inspection

(1) Check the axle shaft for bend, the splines and seal lip sliding area for wear and cracks. Replace the shaft if defective.

(2) To check the axle shaft for bend, support the shaft between centres and measure the axle shaft flange squareness at A, axle shaft concentricity at B, and axle shaft concentricity at C, refer Fig. 4.

(3) Check the axle shaft bearing for noise and axial or radial play, if the play exceeds the specified amount, the bearing must be replaced.

(4) Check the wheel hub bolts for looseness and the outer bearing retainer for deformation. Check the gaskets and shims for damage, replace any defective parts.

Installation

(1) Clean the section of the rear axle housing where the oil seal is positioned and lightly smear it with grease.

(2) Install the axle shaft oil seal into the axle housing ensuring that it is correctly seated.

(3) Lightly smear the oil seal lip and axle shaft oil seal contact area with grease.

(4) Install the axle shaft and measure the bearing to outer bearing retainer clearance as shown in Fig. 5. From the result of adding dimensions A and B and subtracting them from dimension C i.e. C — (A + B), the number of shims and gaskets required can be determined from the following table.

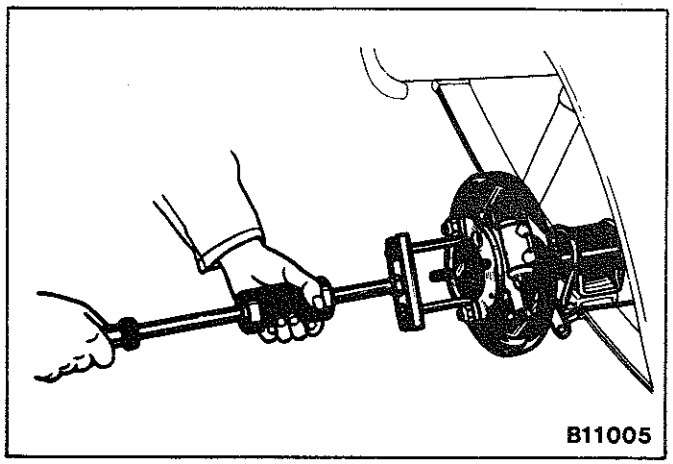


Fig. 3—Removing axle shaft

Formula	Clearance	No. of Gaskets	No. of Shims
C — (A + B) =	Less than 0,25 mm (0.0098")	0	0
	0,25 to 0,50 mm (0.0098 to 0.0197")	1	0
	0,50 to 0,75 mm (0.0197 to 0.0295")	2	0
	0,75 to 1,00 mm (0.0295 to 0.0349")	2	1
	1,00 to 1,25 mm (0.0394 to 0.0492")	2	2

(5) Install the gasket(s) and shim(s) required after performing step 4 and install the axle shaft assembly being careful not to damage the oil seal.

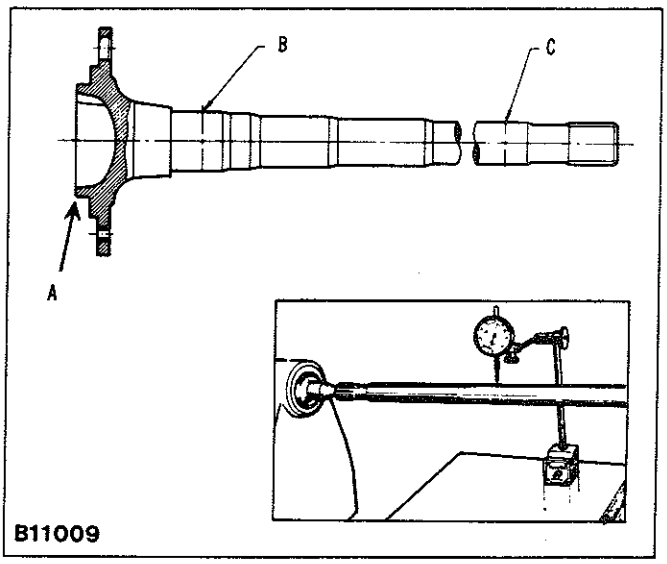


Fig. 4—Checking axle shaft for bend

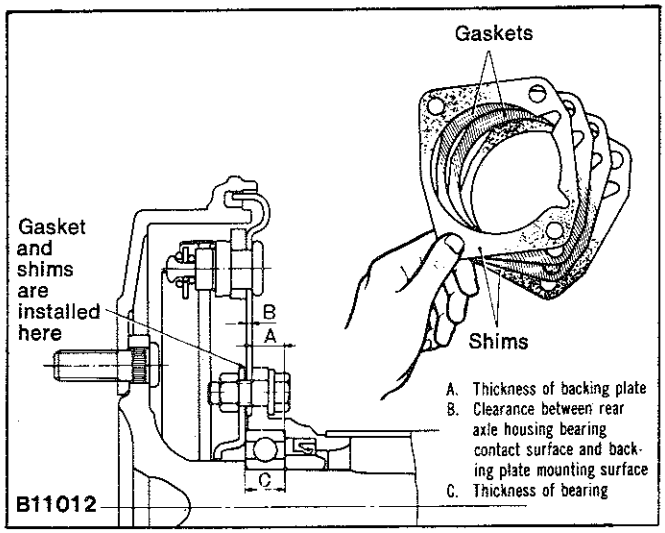


Fig. 5—Determining bearing to outer bearing retainer clearance

NOTE: Ensure that the gasket, shim and outer bearing retainer oil escape holes are aligned with the axle housing holes.

(6) Install the axle shaft retaining bolts and nuts and tighten them to the specified torque in a criss-cross sequence.

(7) Install the brake drum and wheel.

(8) Lower the vehicle and top up the rear axle lubricant level if necessary.

AXLE SHAFT BEARING REPLACEMENT

(1) Remove the axle shaft as previously described.

(2) Grind a point of the bearing retaining collar to within 1,0 to 1,5 mm (0.040 to 0.060") of the axle shaft.

(3) Using a chisel, cut the ground section of the retaining collar and remove the collar.

(4) Using a suitable puller or press adaptor plate remove the bearing from the axle shaft.

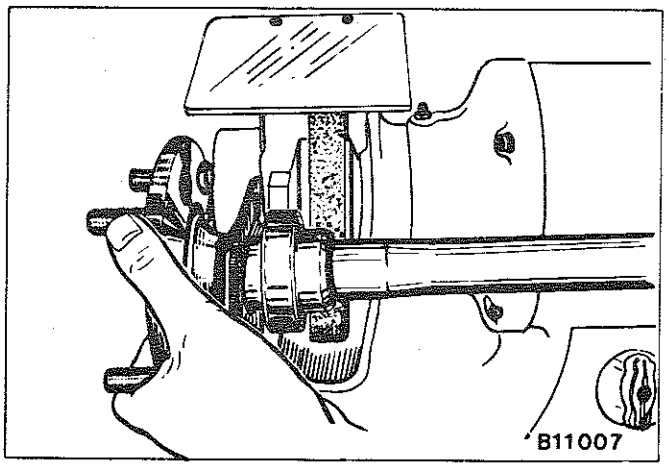


Fig. 6—Removing bearing retaining collar

(5) Prior to installing the bearing ensure the bearing retaining plate is not damaged or distorted and that any nicks, bruises or burrs are removed from the axle shaft bearing surface.

(6) Place the retainer plate on the axle shaft with the flat side towards the splined end.

(7) Install the bearing and retaining collar onto the axle shaft.

NOTE: The retaining collar is fitted with the smaller chamfer facing the bearing.

(8) Press on the retaining collar ensuring the edge completely touches the bearing.

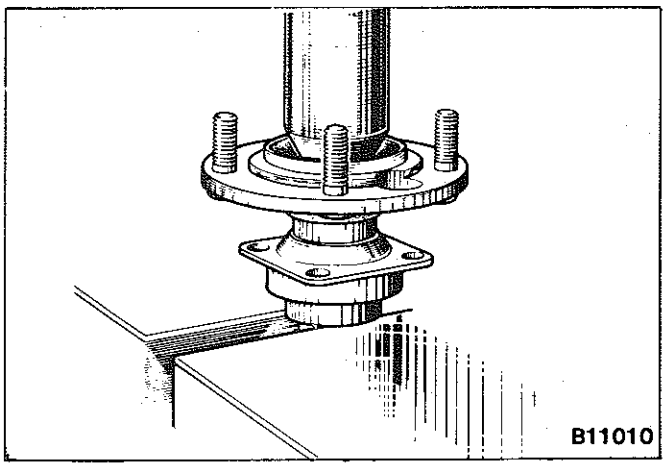


Fig. 7—Installing bearing retaining collar

DIFFERENTIAL

Removal

(1) Drain the lubricant from the housing.

(2) Raise the rear of the vehicle and support on safety jacks.

(3) Disconnect the propeller shaft.

(4) Disengage both axle shafts from the differential as previously described.

(5) Remove the gear carrier (nose cone) mounting nuts.

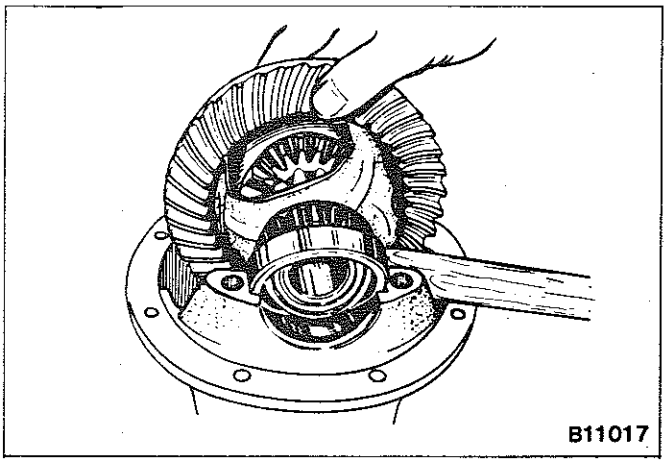


Fig. 8—Removing differential and crown wheel assembly

(6) Remove the gear carrier by lightly striking it with a wooden mallet.

Inspection Prior to Disassembly

(1) Prior to disassembly of the differential, thoroughly clean all components and note the gear tooth contact pattern on each gear and measure the gear back lash and bearing preload.

Disassembly

(1) Remove the bearing cap bolts and remove the caps.
(2) Using a wooden hammer handle or similar, remove the differential and drive gear assembly from the case.
(3) Using bearing puller Tool E3M10J remove the differential side bearings.

NOTE: To assist in reassembly separate and identify the left and right bearings and shims.

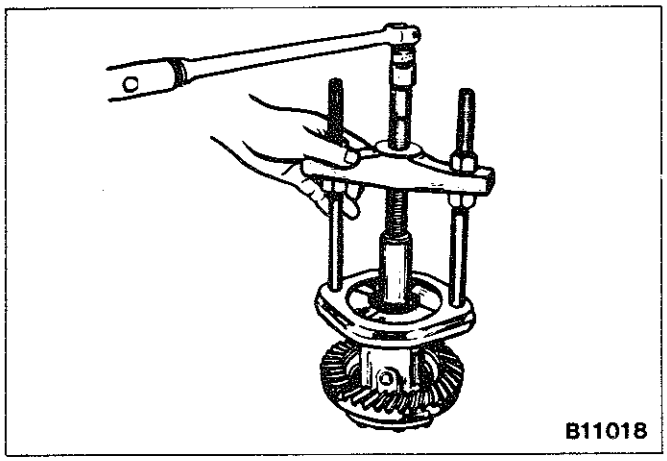


Fig. 9—Removing side bearings

(4) Pry up the drive gear bolt locking tabs and loosen the bolts in a diagonal sequence, remove the bolts and drive gear from the differential.

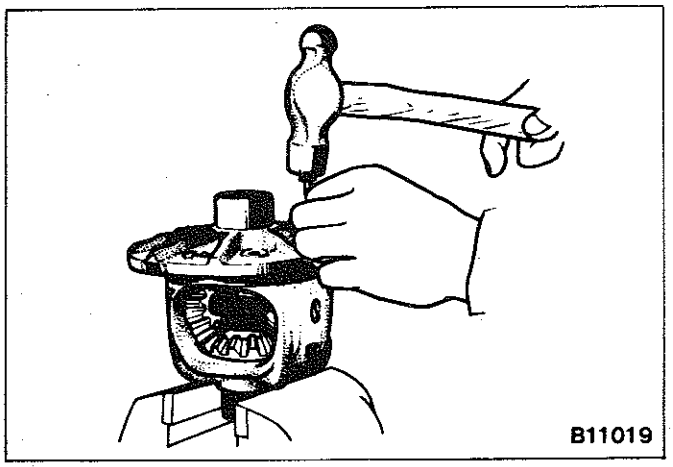


Fig. 10—Removing pinion shaft dowel pin

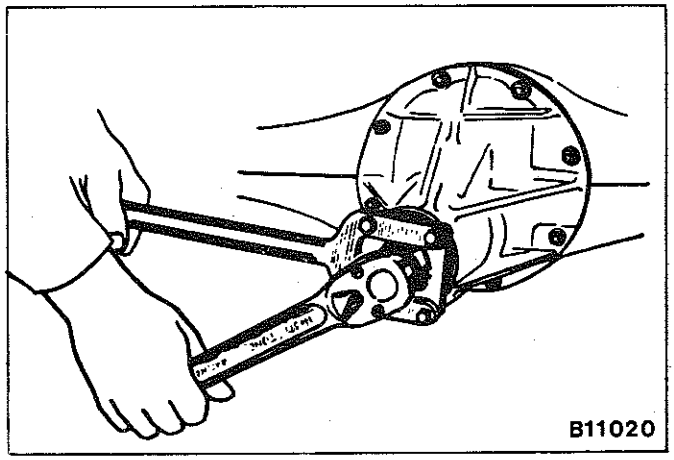


Fig. 11—Removing drive flange nut

(5) Remove the pinion shaft dowel pin using a suitable punch and then remove the pinion shaft, pinions, side gears and washers.

NOTE: To assist in reassembly separate and identify the left and right hand thrust washers.

(6) Holding the drive flange with Tool E3R10E, remove the nut and drive flange.
(7) Tap the drive pinion shaft with a soft hammer and remove the drive pinion, height adjusting shims, drive pinion rear (inner) race, drive pinion spacer and the pre-load adjusting shim as one assembly.
(8) Using bearing puller Tool E3M10J remove the rear bearing inner race from the drive pinion shaft and remove the height adjusting shims.
(9) Remove the drive pinion front bearing outer race and oil seal using remover Tool E3M10C.

NOTE: The drive pinion seal should not be reused, a new seal should be installed.

(10) Remove the drive pinion rear bearing outer race using remover Tool E3M10K.

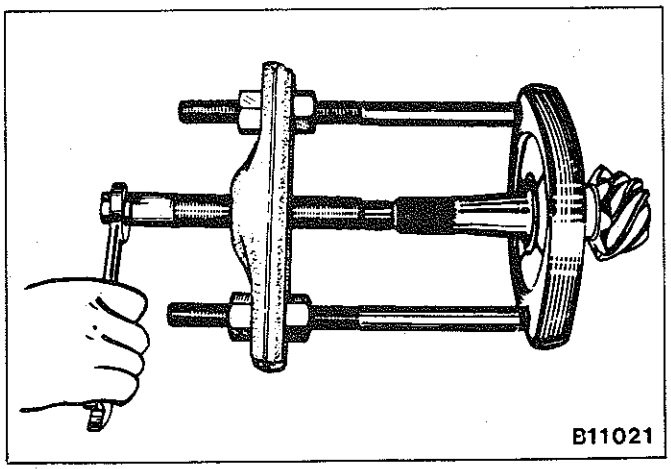


Fig. 12—Removing drive pinion bearing

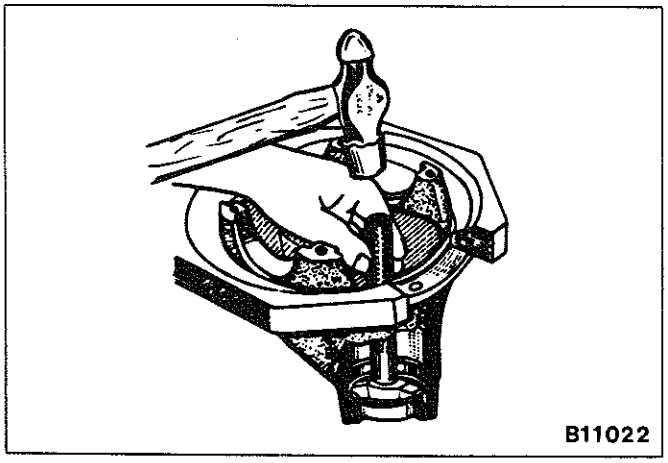


Fig. 13—Removing pinion bearing outer race

Inspection

(1) The two differential bearing cup contact areas in the carrier should be smooth and flat, without raised metal either in the contact areas or the edges of the machined surfaces. The bearing caps should also have undamaged machined surfaces, and be free from raised metal edges along both sides and also around the bolt holes. In the drive pinion section of the carrier, the bearing cup bores should be smooth and flat. Raised metal on shoulders of the bores incurred in removing the cups, should be flattened by use of a flat nose punch.

(2) Axle drive shaft splines should be straight and free from excessive wear. Install the side gears onto the splined end of the axle shaft and check the play using a dial indicator. The play should be within the specified limit.

NOTE: The play must be measured as close to the gear spline as possible.

(3) Taper roller bearing cone assemblies should have a smooth, unbroken surface on the cone and both shoulders. The rollers should also have smooth unbroken surfaces. The roller retainer should be free from damage and cracks. Bearing cups should have a smooth unbroken surface.

(4) Differential pinion gears and side gears should have smooth teeth with a uniform contact pattern, without excessive wear or broken surfaces. The hub surfaces of side gears should be smooth and the splines should be straight. The outer surfaces of the pinion gears should be smooth and bright. Thrust washers should be smooth and unbroken.

(5) Check the differential shaft pinion to pinion shaft clearance. If the clearance is greater than specified replace the faulty part.

(6) Inside the differential case, the machined areas should be polished, without surface imperfections. The pinion shaft bore in the case should be round and smooth. Both ends of the pinion shaft should also be round and without excessive wear.

(7) Drive gear teeth should have a uniform contact pattern and have smooth unbroken surfaces without excessive wear. The pinion teeth should have a similar appearance. The machined surface of the pinion shaft and back face of the head should be undamaged and without wear.

NOTE: If either the drive gear or drive pinion are damaged they should be replaced as a set.

(8) Use new gaskets and oil seals in assembly.

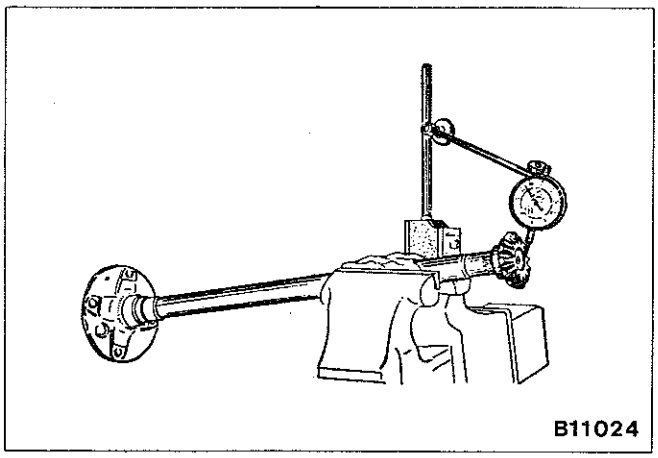


Fig. 14—Checking axle shaft spline play.

Assembly

(1) Install the side gear thrust washers in the same position they were removed and install the side gears in the differential housing.

(2) Place the thrust washers on both pinion gears and mesh the gears simultaneously with the side gears in the differential housing.

(3) Install the drive pinion shaft.

(4) Check the back lash between the pinions and side gears. If it is not within the specified limits adjust it by installing the appropriate thickness thrust washers behind the side gears.

NOTE: The left and right side gear back lash must be equal.

SIDE GEAR THRUST WASHERS	
Part No.	Washer Thickness
MA180862	0,75 to 0,82 mm (0.0292" to 0.0319")
MA180861	0,83 to 0,92 mm (0.0323" to 0.0359")
MA180860	0,93 to 1,00 mm (0.0362" to 0.0390")
MA180875	1,01 to 1,08 mm (0.0394" to 0.0421")
MA180876	1,09 to 1,16 mm (0.0425" to 0.0453")

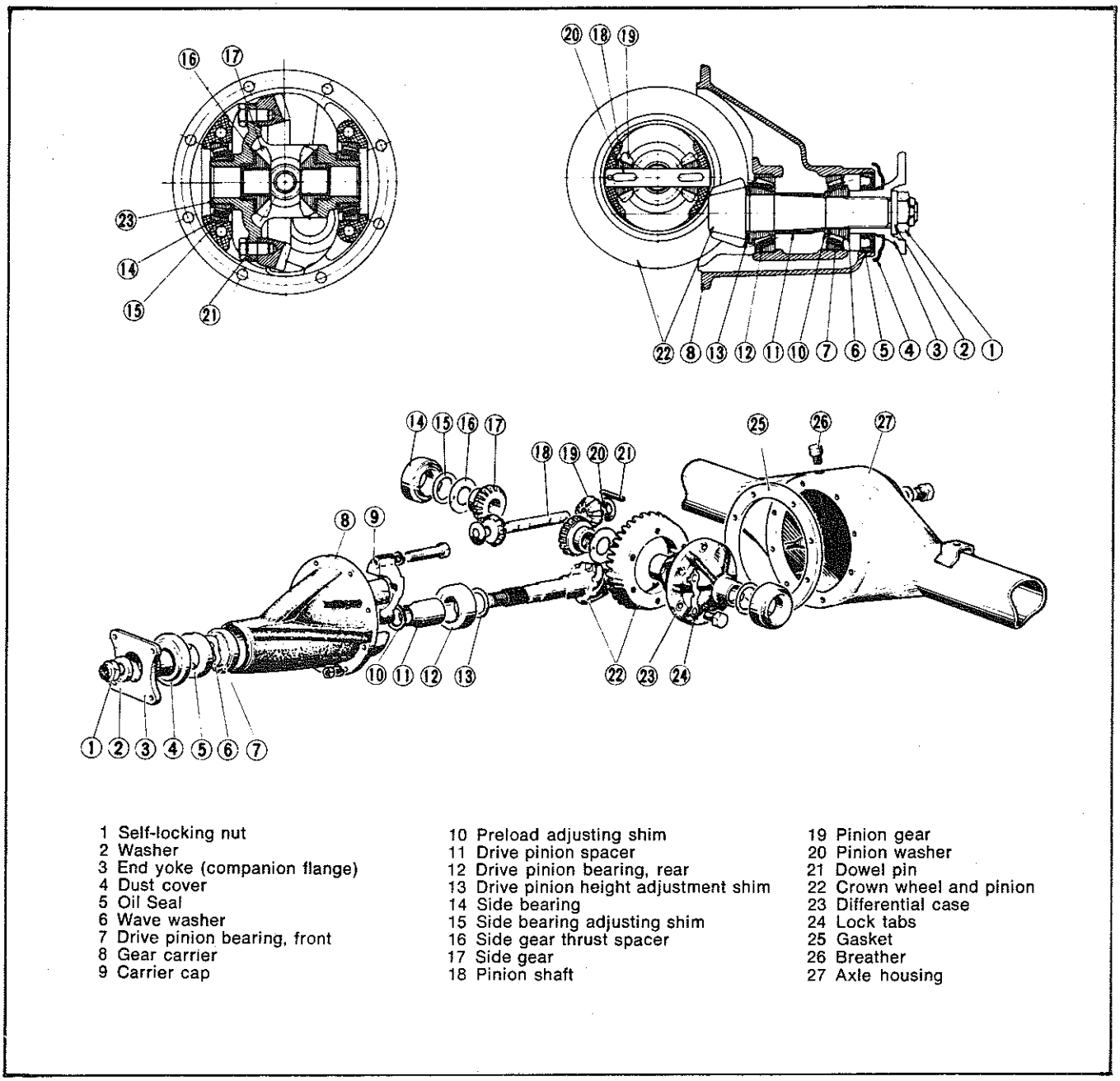


Fig. 15—Differential components (assembled and disassembled view).

(5) With the flat on the drive pinion shaft aligned with the pinion shaft dowel pin hole, drive the dowel pin into position.

(6) Stake the dowel pin securely, to prevent its dislocation.

(7) Thoroughly clean the drive gear and gear mounting surface. Position the drive gear on the differential case, lubricate the retaining bolt/thread and install the bolts and locking tabs.

(8) Tighten the bolts to the specified torque in two stages and in a criss-cross fashion. After tightening, securely lock each bolt with the locking tab.

NOTE: Do not reuse old locking tabs, replace them with new ones and ensure they are securely bent to the shape of the differential case. When installing the locking tabs ensure they are fitted with the tongue facing inwards and in firm contact with the case rib, refer Fig. 18.

Drive Pinion Height Adjustment

NOTE: The use of Tool E3M10E is essential for quick and accurate selection of the pinion height adjustment shims.

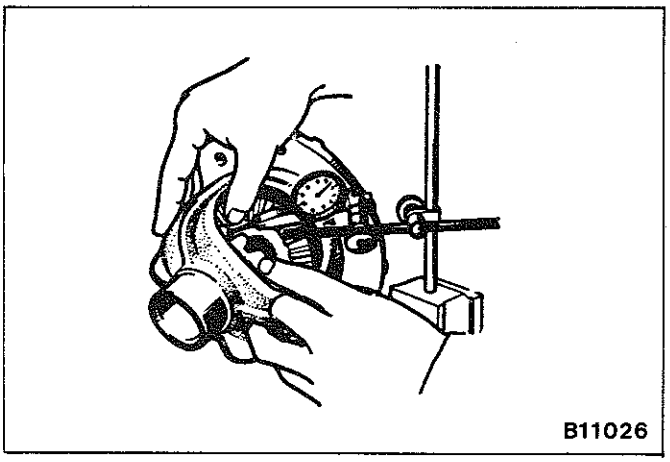


Fig. 16—Checking pinion and side gear back lash

(1) Install the drive pinion front and rear bearing outer races in the housing ensuring they are correctly seated.

(2) Locate the rear bearing on the dummy pinion and install the pinion in the housing.

(3) Install the front bearing, spacer and nut to the pinion and tighten the nut until a turning torque of 0,68 to 1,02 Nm (6 to 9 lb./in.) is obtained.

(4) Place the crossbore arbor and dummy bearings in the housing, install the bearing caps and tighten lightly.

(5) Position the gauge block as shown in Fig. 20, then measure the gap between the block and the arbor using a set of feeler gauges.

NOTE: The measurement must be taken from the thickest end of the gauge block (marked 0.480).

(6) Select the pinion height adjusting shim using the following method.

Example:

* Constant	0,381 mm	0.015"
Feeler Gauge Dimension	+ 1,295 mm	0.051"
	= 1,676 mm	0.066"
Add or Delete Pinion Correction	+ 0,152 mm	0.006"
Shim Thickness Required	= 1,828 mm	0.072"

* NOTE: The constant for man. trans. equipped vehicles is 0,381 mm (0.015") and for auto. trans. equipped vehicles is —0,130 mm (—0.005").

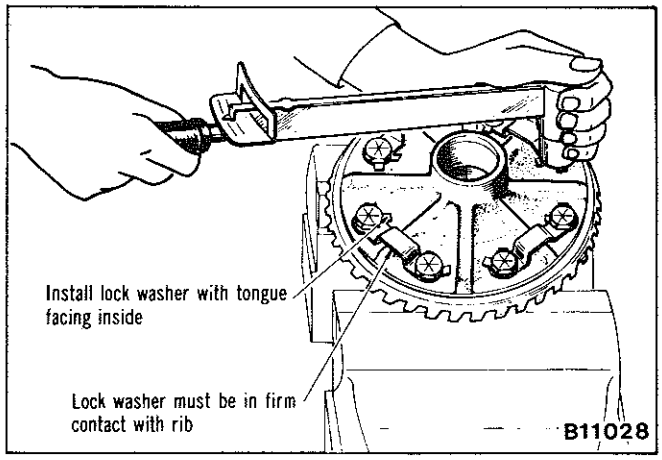


Fig. 18—Installing locking tabs

NOTE: Drive pinions are marked with a correction figure which is preceded by either (+) or (—). If the sign is (+), the amount represented by the figure should be deducted, if it is (—) it should be added in the above calculation. The figure itself represents 0,01 mm (0.0004").

(7) Place the selected shim(s) onto the pinion shaft, lubricate the rear bearing and install using Tool E3M10A.

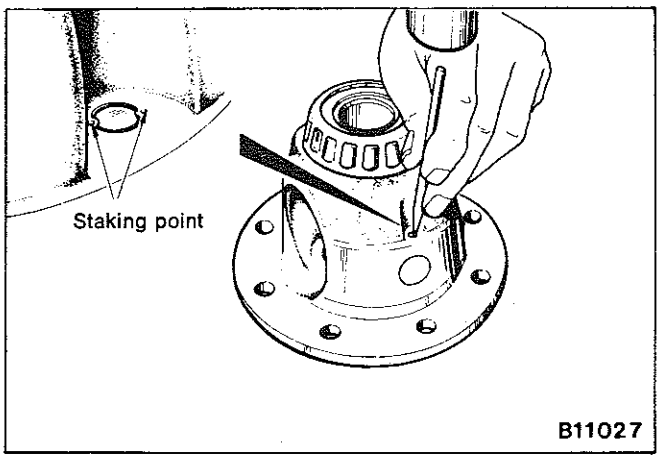


Fig. 17—Staking dowel pin

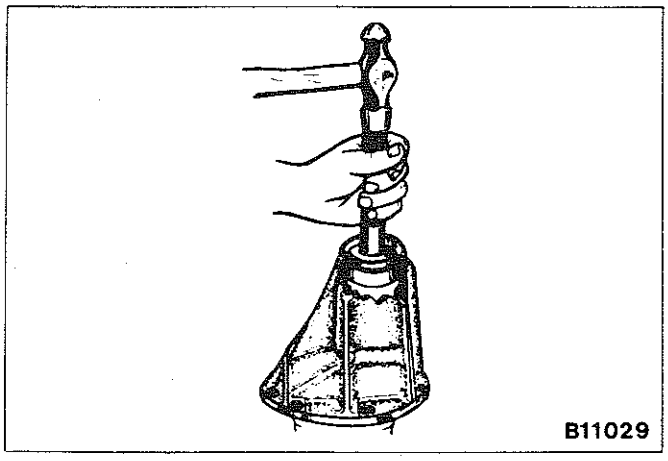


Fig. 19—Installing pinion bearing outer races

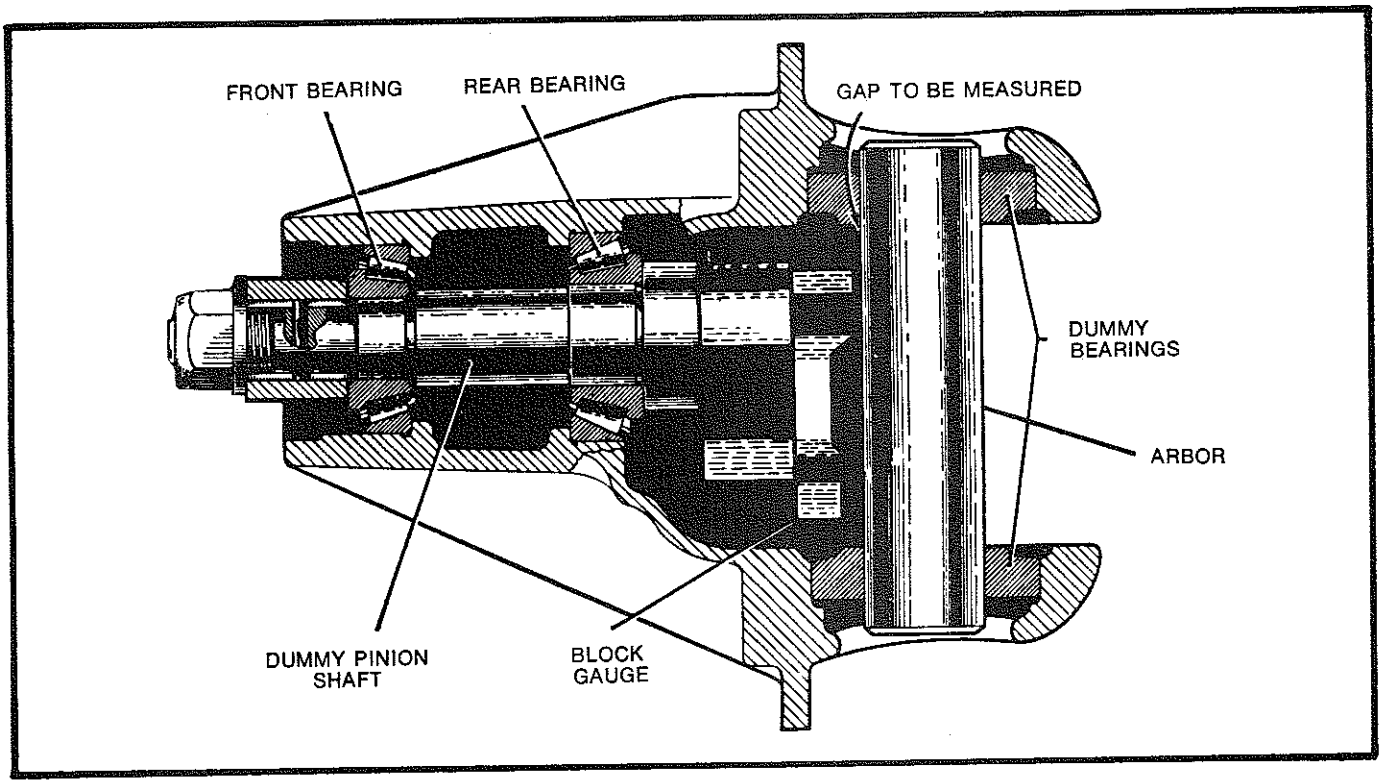


Fig. 20—Drive pinion height adjustment.

DRIVE PINION HEIGHT ADJUSTING SHIMS		
Part No.	Shim Thickness	
MA180842	1,38 mm	(0.0543")
MA180843	1,41 mm	(0.0555")
MA180844	1,44 mm	(0.0567")
MA180845	1,47 mm	(0.0579")
MA180846	1,50 mm	(0.0591")
MA180847	1,53 mm	(0.0602")
MA180848	1,56 mm	(0.0614")
MA180849	1,59 mm	(0.0626")
MA180850	1,62 mm	(0.0638")
MA180851	1,65 mm	(0.0650")
MA180852	0,30 mm	(0.0118")

(8) Place the pinion into the housing then install the bearing preload spacer and shims, outer bearing (lubricated), yoke and nut onto the pinion shaft.

(9) Tighten the nut to the specified torque and with the assembly held upward check the bearing preload using a suitably calibrated tension wrench, (Fig. 23). Take the reading with the handle "floating" through several revolutions.

(10) If the preload has been adjusted without the oil seal installed, install the oil seal, reassemble the pinion and recheck the preload. Lubricate the seal prior to installation.

DRIVE PINION PRELOAD ADJUSTING SHIMS		
Part No.	Shim Thickness	
MA180828	2,00 mm	(0.0787")
MA180829	2,03 mm	(0.0799")
MA180830	2,06 mm	(0.0811")
MA180831	2,09 mm	(0.0823")
MA180832	2,12 mm	(0.0835")
MA180833	2,15 mm	(0.0846")
MA180834	2,18 mm	(0.0858")
MA180835	2,21 mm	(0.0870")
MA180836	2,24 mm	(0.0882")
MA180837	2,27 mm	(0.0894")
MA180838	2,30 mm	(0.0906")
MA180839	2,33 mm	(0.0917")

NOTE: If a great number of adjusting shims are required to achieve the specified bearing preload a longer bearing spacer may be installed.

DRIVE PINION SPACERS		
Part No.	Length	
MA180840	57,38 mm	(2.2591")
MA180841	57,72 mm	(2.2724")

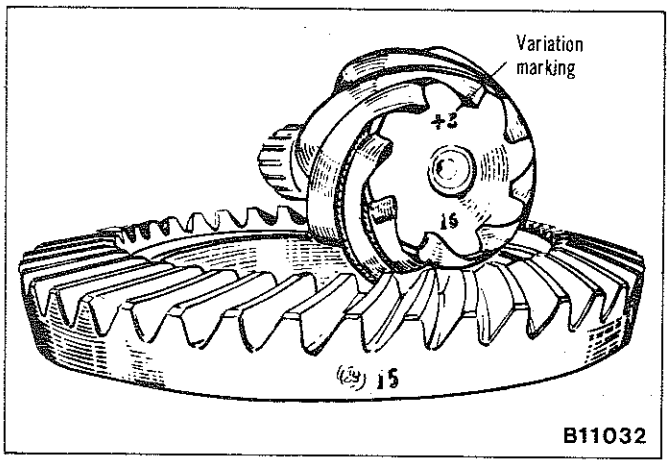


Fig. 21—Drive pinion markings

Differential Side Bearing Adjustment

(1) Install the dummy bearings (part of Tool E3M10E) onto the differential housing, ensuring that the bearings, without shims have their inner faces abutting the differential housing.

NOTE: The dummy bearings must be maintained in this position during the complete adjustment operation.

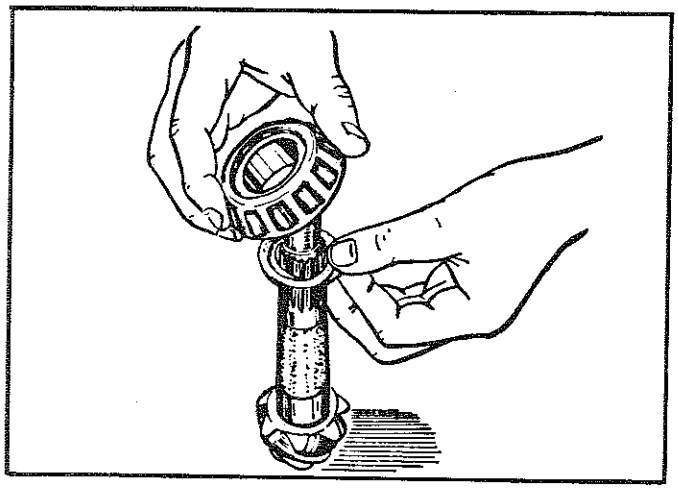


Fig. 22—Installing height adjusting shims.

(2) Fit the bearing caps and tighten the retaining bolts to lightly hold the dummy bearings.

(3) Position a suitable size feeler strip between the dummy bearings and housing to remove all differential side play.

(4) Mount a dial indicator on the gear case, with the stylus against the back face of the crown wheel. Rotate the crown wheel and check the run-out. If the run-out exceeds the specified limit reposition the crown wheel on the differential case. If the run-out still exceeds the specified limit replace the crown wheel or differential housing.

(5) Position the stylus of the dial indicator against the heel of one of crown wheel teeth.

(6) Check the back lash in four positions around the crown wheel (90° apart). Adjust the back lash to specification by tapping the appropriate dummy bearing inwards, using Tool E3M10B.

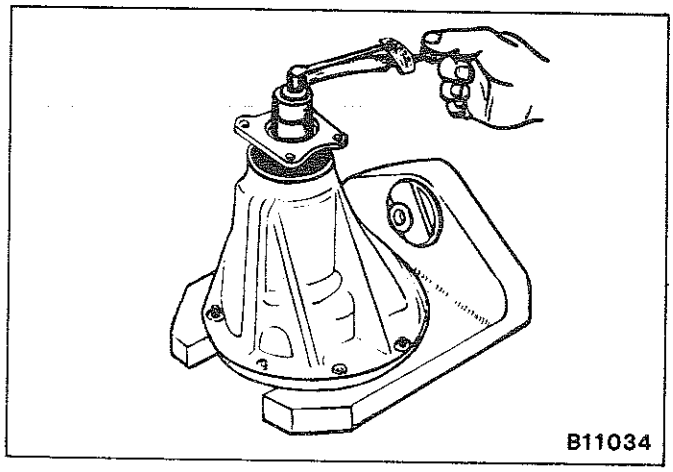


Fig. 23—Checking drive pinion preload

(7) When the back lash is adjusted to specification measure the gap between the dummy bearings and differential housing.

(8) Remove the bearing caps and carrier assembly ensuring that the dummy bearings are maintained on their correct sides.

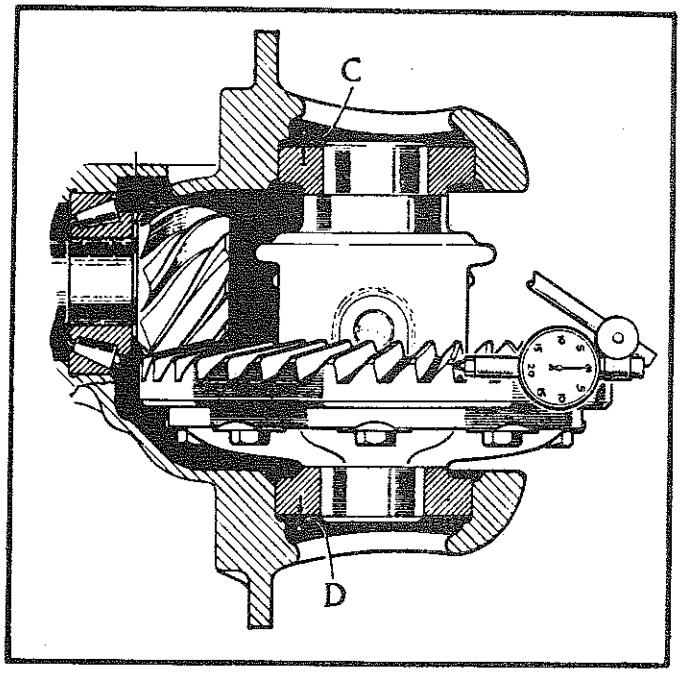


Fig. 24—Differential side bearing adjustment.

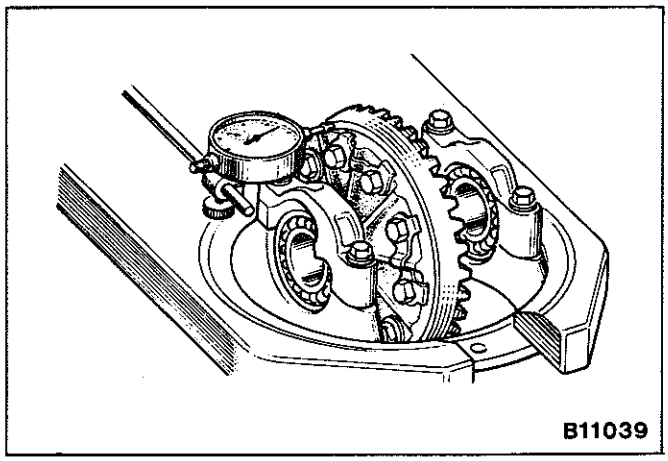


Fig. 25—Measuring crown wheel run-out

(9) Remove the dummy bearing from the pinion side and position it on a surface plate with the bearing to be fitted next to it.

(10) Using a dial indicator, measure the difference in thickness between the dummy bearing and the bearing to be fitted.

(11) Carry out the same procedure with the dummy bearing and bearing assembly from the crown wheel side of the differential housing.

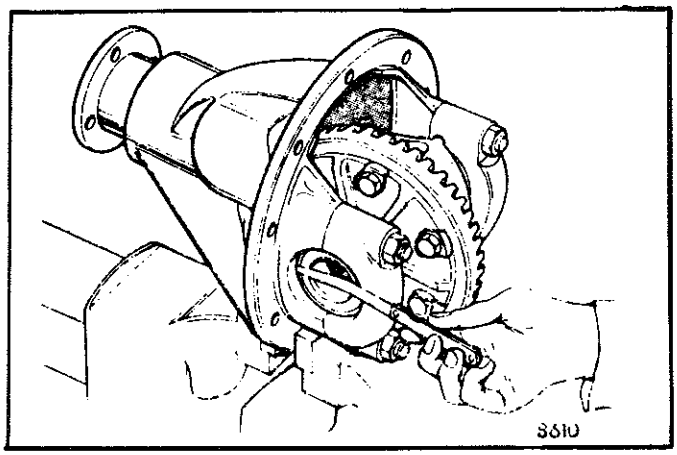


Fig. 26—Measuring gap between dummy bearing and case

(12) To calculate the size of shim to be fitted proceed as follows—

Example:

Measurement of gap with feeler gauge	0,635 mm	(0.025")
Actual bearing thicker than dummy bearing	— 0,070 mm	(0.003")
	0,565 mm	(0.022")
Bearing Preload (specified)	+ 0,050 mm	(0.002")
Total Shims Required	0,615 mm	(0.024")

SIDE BEARING ADJUSTMENT SHIMS		
Part No.	Shim Thickness	
MB001216	0,05 mm	(0.0020")
MB001217	0,07 mm	(0.0028")
MB001218	0,10 mm	(0.0039")
MB001219	0,20 mm	(0.0079")
MB001220	0,30 mm	(0.0118")
MB001221	0,70 mm	(0.0276")

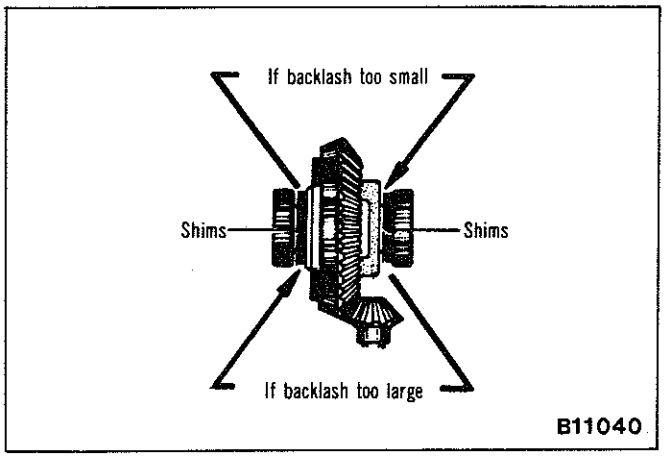


Fig. 27—Adjustment of side bearing shims

(13) Select the shims and place them on their respective sides of the carrier assembly and install the bearings using Tool E3M10B.

(14) Install the differential assembly to the gear housing and install the bearing caps on their respective sides, tighten the bolts to the specified torque.

(15) Check the crown wheel/pinion back lash as previously described.

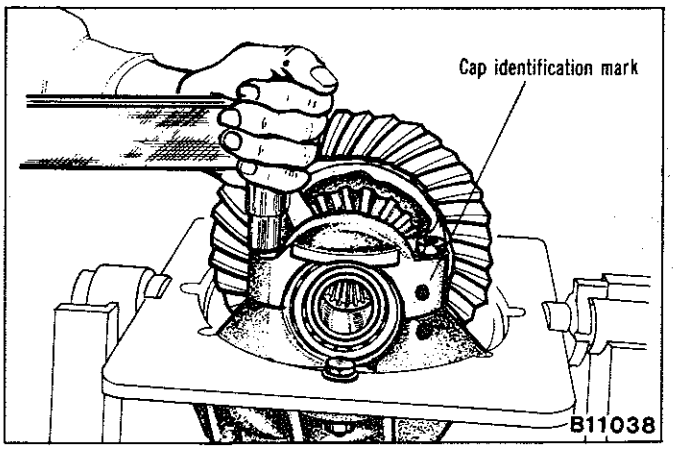


Fig. 28—Tightening bearing caps

(16) Apply a thin film of red or white lead on both the drive and coast side of the crown wheel teeth. Rotate crown wheel one complete revolution in both directions while prying with a round bar or screw driver between the housing and differential case flange. This action creates a load and produces a distinct tooth contact pattern on the crown wheel teeth.

(17) Observe the contact pattern on the crown wheel teeth and compare with those in Fig. 29 to determine if pattern is properly located. If pinion depth of mesh and gear backlash are correct, the heaviest most distinct part of contact pattern should be centred on both drive and coast sides of the crown wheel teeth.

(18) If the tooth contact pattern resembles Fig. 29, Face contact or Heel contact, the thickness of the shim between the pinion and rear bearing should be increased to move the pinion towards the crown wheel centre line. The crown wheel must be moved to maintain the specified backlash, refer Fig. 27.

(19) If the tooth contact pattern resembles Fig. 29, Flank contact or Toe contact, the thickness of the shim between the pinion and rear bearing should be decreased to move the pinion away from the crown wheel centre line. The crown wheel must be moved to maintain the specified backlash, refer Fig. 27.

(20) If the correct pattern cannot be obtained with the above adjustments, the gear teeth are extensively worn and both crown wheel and pinion must be replaced.

(21) When correct tooth contact pattern is obtained, install the gear carrier with a new gasket and tighten the retaining nuts to the specified torque.

(22) Install the propeller shaft and axle shafts as previously described, fill the axle with the correct grade and quantity of gear lubricant.

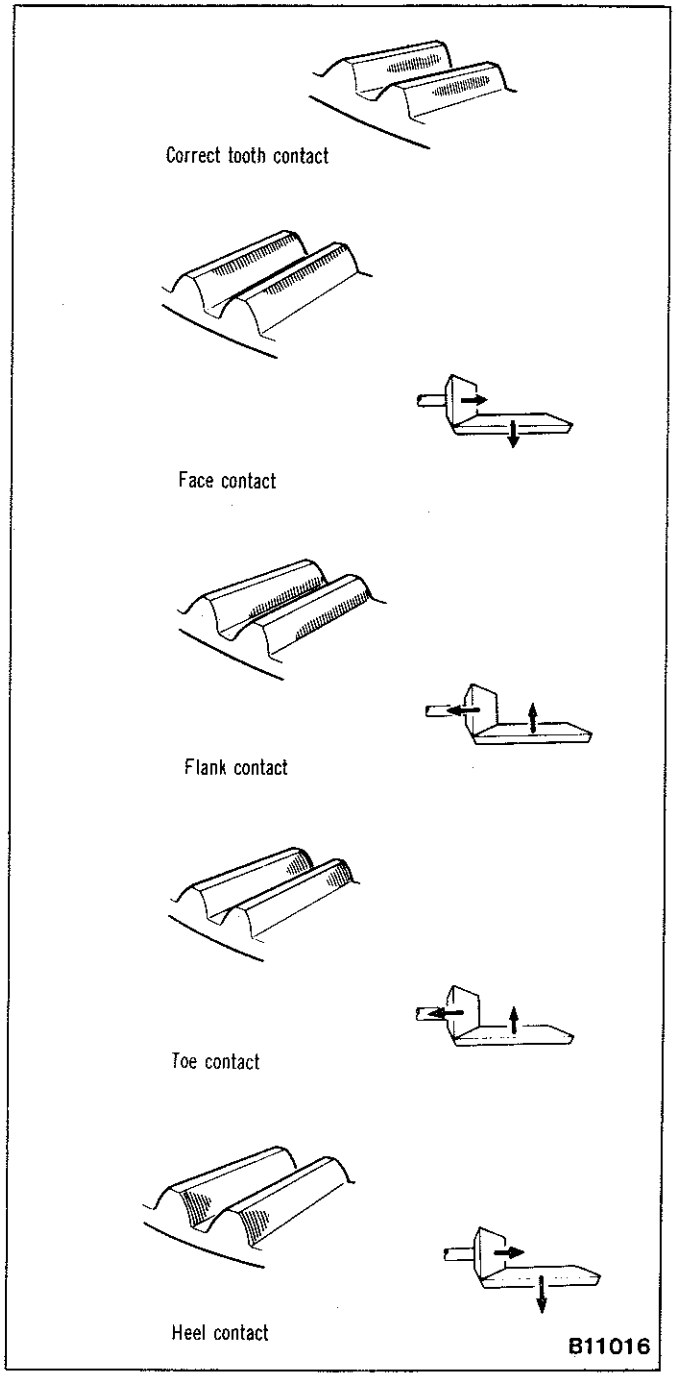


Fig. 29—Gear tooth contact pattern

SECTION 3 — AXLE RATIO, AXLE ALIGNMENT, WHEEL BALANCE

AXLE RATIO IDENTIFICATION
Conventional Differential

If in doubt count wheel and propeller shaft revolutions by holding one wheel and turning the other wheel twenty (20) revolutions. The number of revolutions of the propeller shaft will be ten (10) times axle ratio.

REAR AXLE ALIGNMENT CHECKING PROCEDURE

The following describes the procedure for checking rear axle alignment to determine if a complaint of abnormal rear tyre wear is the result of a "bent" rear axle housing.

(1) Raise both rear wheels off the ground using a frame contact hoist.

(2) Place a 25 mm (one inch) long piece of masking tape in the centre of each tyre tread for use as "reference marks".

(3) With both "reference marks" pointing to front of vehicle, measure the distance between the outside edges of the two pieces of tape. Record this measurement as the "front of tyre" reading.

(4) Rotate the rear wheels so that the "reference marks" of each rear wheel now point to the rear of vehicle. Measure the distance between the outside edges of the two pieces of tape and record this measurement as the "rear of tyre" reading.

(5) Subtract the "rear of tyre" measurement from the "front of tyre" measurement to obtain the "toe out" condition of the axle being checked.

Specification — Toe out
Mitsubishi — 0 to 2,8 mm (0 to 0.110")
Borg Warner — 0 to 3 mm (0 to 0.118")

(6) Rotate both rear wheels so that the "reference marks" are pointing down. Measure the distance between the outside of the two pieces of tape and record this measurement as "bottom of tyre" reading.

(7) Average the sum of the "front of tyre" reading (FTR) and the "rear of tyre" reading (RTR), then from this average figure subtract "bottom of tyre" reading (BTR) to obtain the camber.

$$\frac{FTR + RTR}{2} - BTR = \pm \text{ Camber}$$

NOTE: If BTR is smaller than the average figure, the camber reading is positive (+). If the BTR is larger than the average figure, the camber reading is negative (—).

Specifications — Camber
Mitsubishi: +0,163 mm to +0,814 mm (+0.006" to +0.032") or +0°2' to +0°10'.
Borg Warner: 0 to +3 mm (0 to +0.118") or 0 to +0°18'.

WHEEL BALANCE

NOTE: Off the car balancing is the preferred method. Balancing tyres on the car essentially balances the tyre, wheel and brake drum or disc. This balance condition is lost when tyres are rotated to equalize tyre tread wear, or when tyres are removed for any reason and not reinstalled in the same position and indexed on the studs exactly as before removal. However, where on-the-car rear tyre balance is attempted, both front wheels must be securely blocked to prevent any vehicle movement. On vehicles of standard type differential, only the rear wheel being balanced should be off the ground. When attempting rear tyre balance of this type with ONE rear wheel off the ground, a 50 km/h speedometer reading will indicate a 100 km/h rear wheel speed. The 50 km/h speedometer reading is the maximum necessary for dynamic tyre balance.

CAUTION: Do not exceed a 50 km/h speedometer reading with conventional differentials. With no load on the engine, it is possible to attain tyre rotation speeds sufficient to cause violent tyre failure and create a hazardous situation.

For additional information refer to the instructions supplied by manufacturer of balancing equipment being used.