MODEL **HCD-80B**
BOOK NO. 677
SERIAL NO.

MACHINE SERIAL NUMBER

The machine serial number is stamped on the serial number plate which is located right side of the engine house.

The machine model and serial number should always be furnished when ordering parts and corresponding regarding your machine. The serial number is the only means the distributor or factory has of ensuring that the correct parts will be funished.

In the event the serial number plate is lost. The serial number is stamped on the capacity chart, too. The capacity chart is located right side of engine house and left inside of operator's cab.

Printed in Japan

FMC

Service Manual

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Common to front and rear axles.

	Front	Rear
Parking Brake	With	Without

Note: Except parking brake, service procedures are common.

1. OUTLINE

Both front and rear axles are capable of steering, and are firmly fixed to chassis frame.

Power is transmitted via propeller shafts and when it drives front axle alone the machine is of two (2) wheel drive, but if they drive both front and rear axles simultaneously, the machine becomes of four (4) wheel drive. While being transmitted to wheels, reductions are made; first at axle center by bevel gear, then at wheel end by planetary gears.
Wheel end of each front and rear axle is equipped with travel brake respectively.

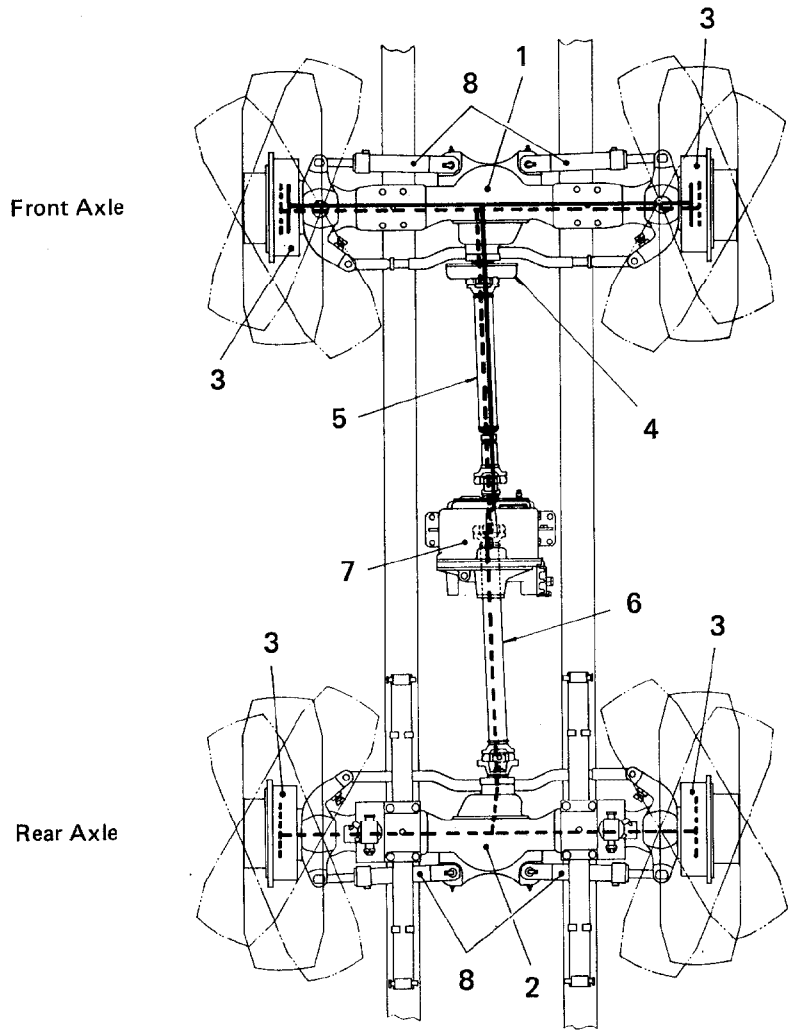

Fig. 1

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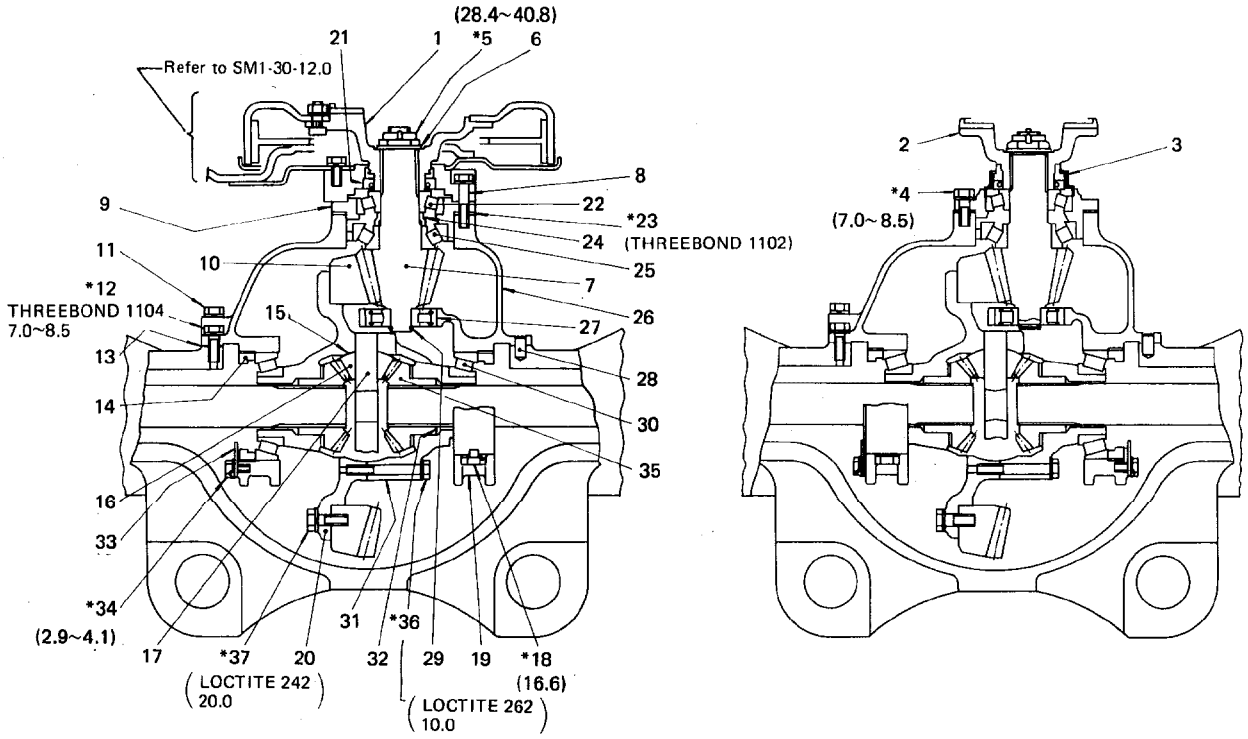
2. CONSTRUCTION

2-1 FRONT AND REAR DIFFERENTIAL

* Figures in parenthesis indicate tightening torques (in Kgf-m).



FRONT AXLE

REAR AXLE

1	Flange, Front	14	Adjust Nut	27	Roller Pilot Bearing
2	Flange, Rear	15	Thrust Washer, Pinion	28	Knock Pin
3	Cover, Dust	16	Pinion Gear	29	Ring Lock
4	Bolt, Spring Washer	17	Spider	30	Tapered Roller Bearing
5	Castle Nut	18	Reamer Bolt, Bearing Cap	31	Differential Case Set
6	Flat Washer	19	Cap Bearing	32	Thrust Washer, Gear
7	Pinion Bevel Gear	20	Differential Case Set (Driven Gear)	33	Lock Plate
8	Bolt, Spring Washer	21	Oil Seal	34	Adjust Bolt
9	Retainer, Bearing	22	Tapered Roller Bearing	35	Side Gear
10	Gear, Bevel (Drive Gear)	23	Shim	36	Washer based bolt
11	Bolt, Spring Washer	24	Collar	37	Washer based bolt
12	Bolt, Spring Washer	25	Tapered Roller Bearing		
13	Shim	26	Carrier Differential		

Fig. 2

2-2 PLANETARY GEAR AND WHEEL

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*Figures in parenthesis indicate tightening torques (in Kgf-m).

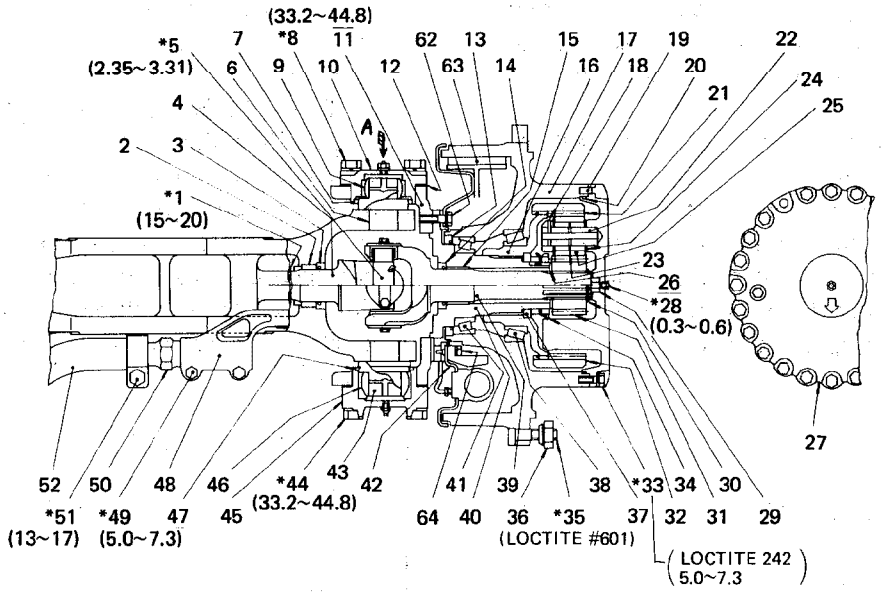

Fig. 3

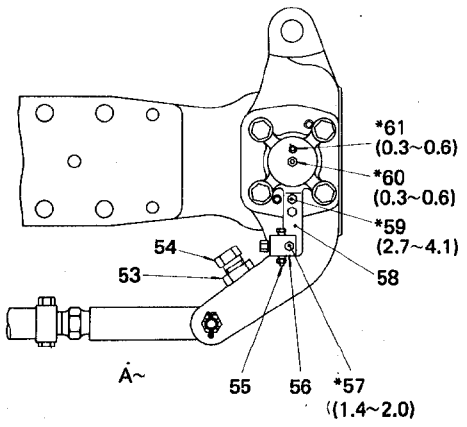

Fig. 4

1	Castle Nut	34	Nut, Spindle
2	Bush	35	Hub Bolt
3	Oil Seal	36	Hub Nut
4	Axle Shaft "A"	37	Collar
5	Journal Cross Kit	38	Tapered Bearing
6	Shaft, King Pin, Upper	39	Axle Shaft "B"
7	Oil Seal	40	Spindle
8	Bolt, Spring Washer	41	Tapered Bearing
9	Spherical Bush	42	Oil Plate
10	Cover, Upper	43	Shaft, King Pin, Lower
11	Knuckle Arm	44	Bolt, Spring Washer
12	Shim	45	Cover, Lower
13	Oil Seal	46	Spherical Bush, Lower
14	Oil Seal	47	Oil Seal
15	Bush	48	Tie-Rod End Set
16	Ring Gear Holder	49	Bolt, Spring Washer
17	Wheel Hub	50	Turn Buckle
18	Spring pin	51	Bolt, Spring Washer
19	Knock Pin	52	Tie-Rod
20	O-ring	53	Nut
21	Planetary Gear	54	Stopper Bolt
22	Shaft	55	Breather Valve
23	Collar, Needle	56	Union Joint
24	Thrust Washer	57	Bolt, Spring Washer
25	Needle Roller Bearing	58	Plate
26	Thrust Washer	59	Bolt, Spring Washer
27	Planetary Carrier	60	Grease Nipple
28	Relief Nipple	61	Relief Valve
29	Thrust button		BRAKE ASSEMBLY
30	Stop Ring	62	Small Hexagon Bolt, Spring Washer
31	Drive Gear	63	Brake Assembly
32	Ring Gear	64	Small Hexagon Bolt, Spring Washer
33	Bolt, Spring Washer		

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3. INSPECTION

Carry out inspection periodically. It protects machine from developing troubles. Since axle shafts and differential systems are subjected to great load while supporting chassis weight and transmitting power, careful attention should be paid, particularly on strength, during inspection service.

(1) Shut down engine and check for oil leak or external appearance.

(2) Start engine and with chassis lifted by extending outriggers, rotate front and rear axles to check every part for malfunctioning or abnormal noise. If anything abnormal is noticed, disassemble and inspect, and adjust or repair as required.

4. LUBRICATION

4-1 LUBRICATION CHART

○ denotes inspection, while
⊕ denotes replacement

Ref.	Item	Lubrication Interval				Quantity
		First		Every		
		1,000km	4,000km	Month	24,000km	
I	Axle Housing	○	⊕	○	⊕	9.4ℓ x 2
II	Ball Bearing & Planetary Gear	○	⊕	○	⊕	1.5ℓ x 4
III	Journal Cross Kit		○	○		Supply grease until it apparrently cozes out of oil seal at bearing
IV	King pin		○	○		Supply grease until it comes out of relief nipple

4-2 OIL REPLACEMENT PROCEDURES

AXLE HOUSING GEAR OIL REPLACEMENT

While oil is warm after travelling, remove drain plug to discharge oil. Since the drain plug is magnetized, remove matal powder from it before replacing. Feed gear oil of SAE #90 GL4 or equivalent through level check plug until it overflows.

WHEEL BEARING AND PLANETARY GEAR OIL REPLACEMENT

Wheel bearing and planetary gear have a connecting oil passage between the both. While oil is warm after travelling, make sure that inner air has been breathed and remove plug to drain oil. For draining or filling oil, pay attention to position of an arrow on wheel. (See sketch below)

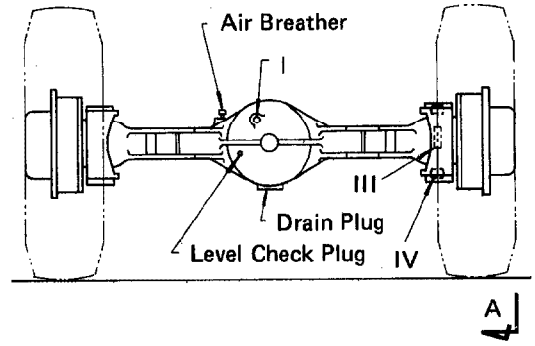


Fig. 5

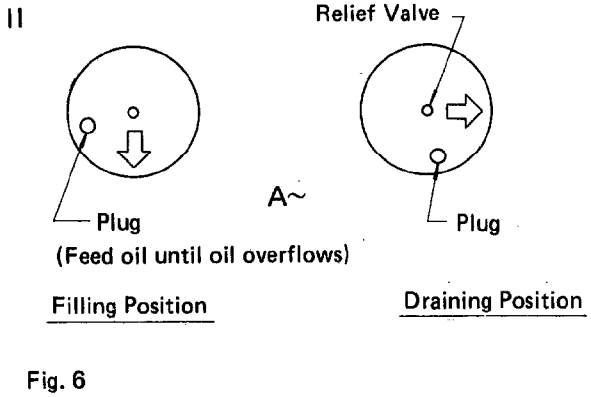


Fig. 6

5. TROUBLE SHOOTING

1) Axle housing for damage or crack . . . Replace.
2) Oil leak (at housing, wheel bearing – planetary gear) . . . Tighten plug and replenish to specified level.
3) Bolt or nut for looseness . . . Tighten to specified torque.
4) Axle shaft and differentials

Trouble	Probable Cause	Remedy
Noise developed during travel.	• Gear . . . improper meshing, worn or damaged. • Bearing . . . worn or damaged. • Improper adjustment.	Replace Replace Adjust
Temperature in differential case increases.	• Oil level . . . insufficient. • Improper gear meshing or defective bearing (Particularly improper bearing adjustment).	Check and replenish. Adjust
Abnormal noise during start-off.	• Plag in spline of drive gear. • Drive gear bearing tightening nut . . . loosended.	Replace Retighten to specified torque.
Abnormal noise during turns.	• Improper meshing between differential pinion and side gear, or damage. • Excessive gap between differential pinion and spider or seizure. (When one side is rapidly rotated, etc.) • Defective thrust washer of differential pinion or side gear.	Replace Replace Replace

5) Tie-rod for bend . . . Repair or replace.
6) Tie-rod end for looseness, play or eccentric wear due to insufficient greasing. . . . Adjust or replace.
7) Improper mounting of knuckle arm . . . Adjust.
8) Play in king pin . . . Adjust or replace in set.

6. SERVICE STANDARDS.

6-1 COMMON TO FRONT AND REAR AXLES

	ITEM	ASSEMBLING STANDARDS	ALLOWABLE LIMIT	ADJUSTMENT	REMARKS
REDUCTION	Backlash in gear bevel (10) and pinion (7)	0.30~0.41mm	0.60mm	Adjust with shim (23)	–
	Back surface swing of gear bevel (10)	0.15mm or less	0.20mm	Adjust side bearing. Inspect gear mounting.	Measure at max. diameter in back mounting surface of gear bevel.
	Preload of pinion bearing (22) (25)	20~30kgf-cm	–	Adjust with collar (24)	–
DIFFERENTIAL	Backlash (16) (35)	0.19~0.25mm	0.50mm	Replace thrust washers (15) (32)	–
	Preload of side bearing (30)	20~30kgf-cm	–	Adjust with adjust screw (14) (34)	–
AXLE SHAFT	Play in rotating direction of spline	0.086~0.173mm	0.5mm	Replace	–
	Bend in shaft	1.0mm	2.0mm	Replace	Swing at shaft center (1/2 of 1-turn)

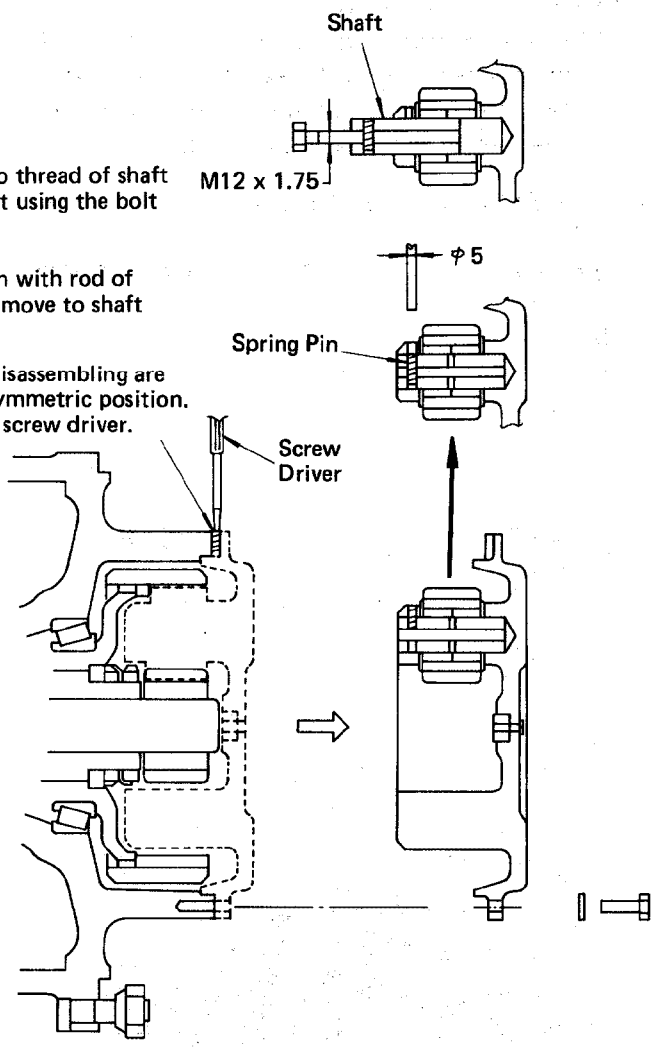
6-2 PLANETARY CARRIER AND PLANETARY GEAR

	ASSEMBLING STANDARD	ALLOWABLE LIMIT	ADJUSTMENT
Backlash around planetary gear	0.11~0.3	0.56~0.75	Replace in set.
Thrust washer	3.2	2.9	Replace washer.
With planetary gear rotated in air, if abnormal noise or catch in rotation is felt . . .	–	–	Replace planetary gear in set.
1. Demounting Procedure. As shown in sketch			
2. Disassembly and reassembly 2-1 Do not disassemble to detail unless it is abnormal.			
2-2 If disassembling is required, place matching marks.			
2-3 Avoid replacing individual parts other than those due to failure or special wear.			
2-4 If backlash or play in shaft has grown great . . .	–	–	Replace as an assembly with planetary gear installed.

Screw-in a bolt to thread of shaft and pull out shaft using the bolt as a guide.

Top on spring pin with rod of 5mm in dia. and move to shaft center.

Grooves for disassembling are provided at symmetric position. Remove with screw driver.



7. DISASSEMBLING

7-1 DISASSEMBLING FROM CHASSIS

1) Using outriggers, lift chassis to the height where disassembling can be carried out.
2) Drain lubricants (Housing, wheel bearing – planetary gear)
3) Remove propeller shaft.
4) Remove connector pin for parking brake at front only.
5) Remove connecting piping, joint with other part, and steering cylinder.
6) Place the axle on blocks.
7) In cese of front axle, remove mounting bolt that has been fixing the axle to chassis, and in case of rear axle, remove suspension system. Axle assembly will now come off.

7-2 DISASSEMBLING FROM AXLE ASSEMBLY

1) Remove wheel hub, wheel brake and spindle, in that order.
2) Pull out axle shaft.
3) Take off differential carrier.

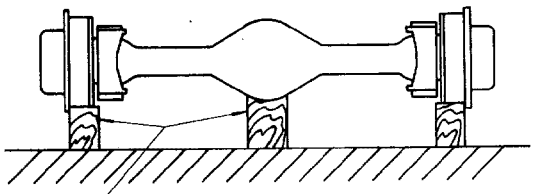


Fig. 7

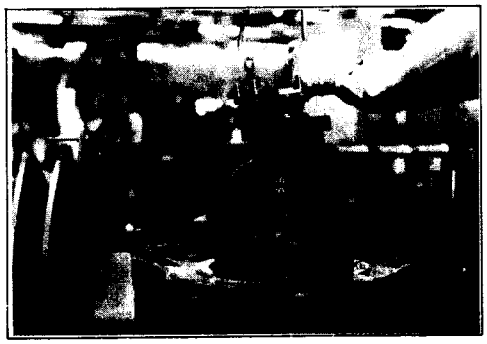


Fig. 8 Removing the differential carrier

7-3 REASSEMBLING

Reassembly should be carried out in reversed procedure of disassembly.

1) Rinse each disassembled parts in clean oil and remove foreign matter completely with waste cloth before reassembling.
2) Tighten each mounting bolt to specified torque.
   Note: See Fig. 1 and Fig. 2.
3) As for preload of pinion bearing at reassembling, measure tangential force (F kg) at periphery of bearing retainer by means of spring balancer. If it is not as specified, adjust with shim thickness altered.

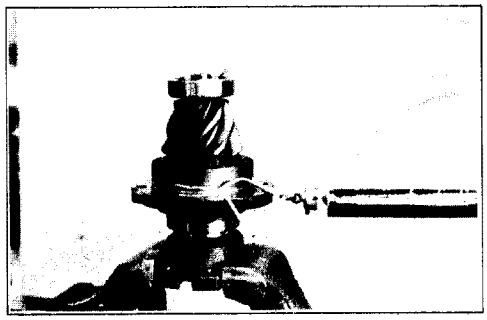


Fig. 9 Measuring the preload

PROPER PRELOADS

New parts installation		Existing parts reassembly	
F (Tangential force) kg	Preload kgf-cm	F (Tangential force) kg	Preload kgf-cm
3.0 – 4.5	20 – 20	2.4 – 3.6	16 – 24

4) Pinion bearing preload adjustment.
   Select number and thickness of shim to obtain standard dimension.

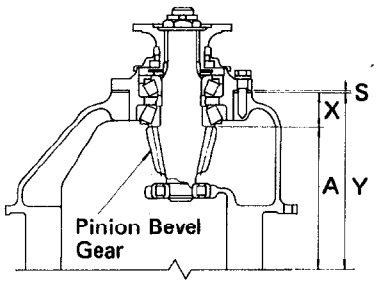


Fig. 10 Pinion Bevel Gear Mounting. There are right hand and left hand in pinion bevel and gear vebel. Pay attention.

Calculating Procedure

Example S = 1.5 + x − y + a

x: Measure amount of error against standard dimension X (Refer to Fig. 10) using dial gauge. Presume it in the range of 0 − 0.2mm since it is difficult to measure generally.

y: Measure dimension Y

a: error against dimension A is shown on end face of pinion bevel (in mm)

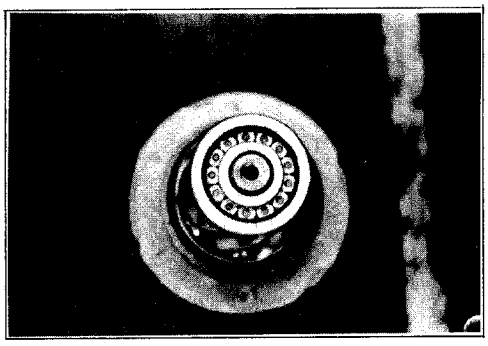


Fig. 11 Location where pinion bevel valve is shown.

LOCATION	STANDARD DIMENSION	ERROR
S	1.5	Amount of shim
X	42.25	x
Y	223.75	y
A	183.0	a

Part Name		Thickness (in mm)	No. of Standard Shim (1.5 mm) used
S	Shim A	1.0	1
	Shim B	0.5	1
	Shim C	0.2	0
	Shim D	0.15	0
	Shim E	0.1	0

Note: Besed on calculation, select required number of shims for S. Use on few shims as possible and combine.

5) Before installing pilot bearing of pinion bevel end into carrier differentials, apply LOCTITE #601 to I.D. of carrier differentials, then install it to fix. Do not move it for one half to two hours after installartion. Further, wait for at least three hours before travelling.

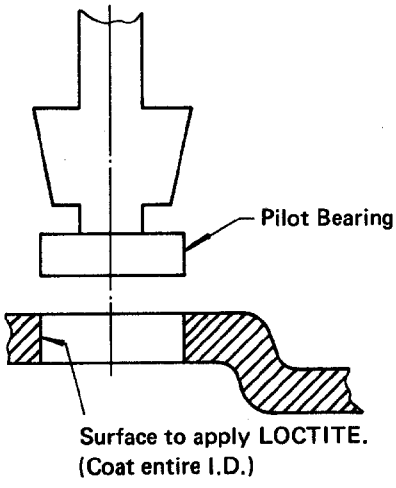


Fig. 12

6) Assembling the differential case

(1) Gear bevel and differential case (LH) should be uniformly tightened, avoiding eccentric tightening, so that gear does not swing.

(2) Before tightening the gear bevel, coat each thread hole face with LOCTITE, then tighten to specified torque.

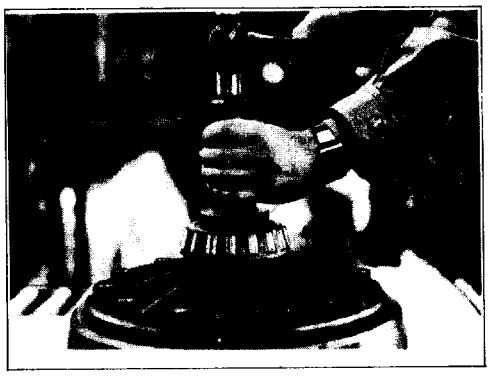


Fig. 13 Pressing-in the Differential Case, Side Bearing.

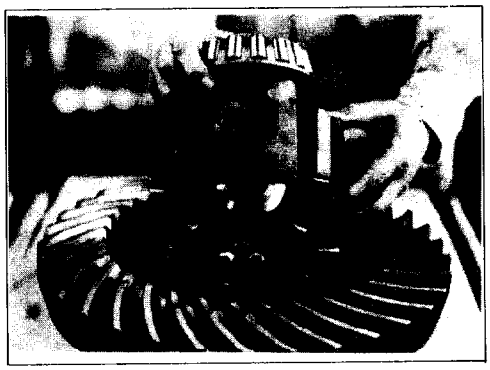


Fig. 14 Install Differential Gear and Pinion.

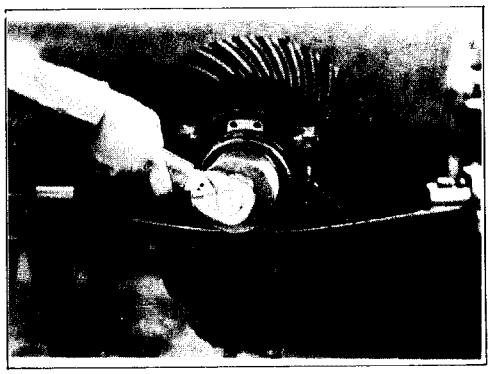


Fig. 15 Adjustment with Adjust Screw.

(3) Assemble differential case with matching marks on each halves aligned.

7) Side bearing adjustment

(1) While adjusting preload of side bearing by means of adjust screw, adjust backlash between pinion gear and side gear.

(2) Apply wire to periphery of differential case (RH) and engage spring balancer to it to measure tangential force, Fkg.

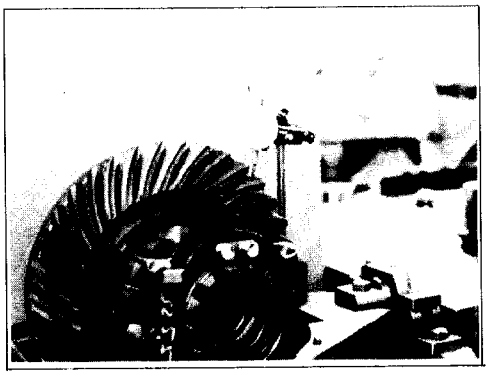


Fig. 16 Measurement Backlash

Fig. 17 Measurement of Preload on Side Bearing

Tangential Force Fkg	Preload kgf-cm
3.0 – 4.5	20 – 30

8) Measuring the Gear Bevel Back Surface Swing. Gear Bevel Back Surface Swing should be within 0.15mm at the position where back surface diameter of gear bevel is maximum. If

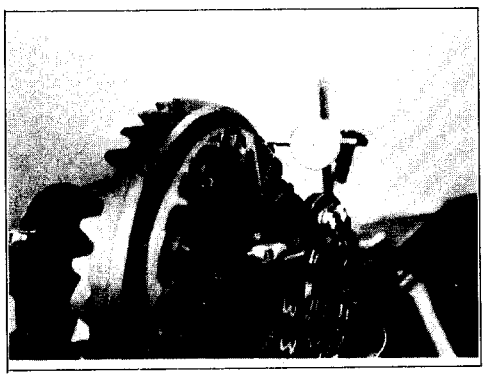


Fig. 18 Measurement of Gear Bevel Back Surface Swing

greater than this value, side bearing may be abnormal or gear bevel tightening is defective (eccentric tightening).

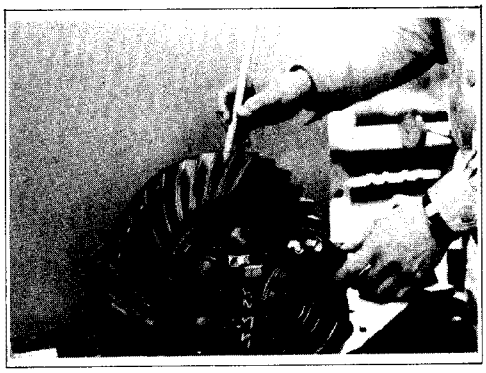


Fig. 19 Tooth Contact Inspection with Dye.

9) Tooth contact and backlash between Gear Bevel (driving gear) and driven gear. With surfaces of three or four teeth lightly coated with dye, rotate gears in forward direction to check tooth contact.

10) Tooth Contact Adjustment
If dye is transfered uniformly, contact is normal. If contact is improper, adjust it in the following manner;
Move A in the direction of arrows, then move B in the direction of arrow to adjust backlash.

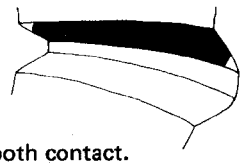


Fig. 20 Proper tooth contact.

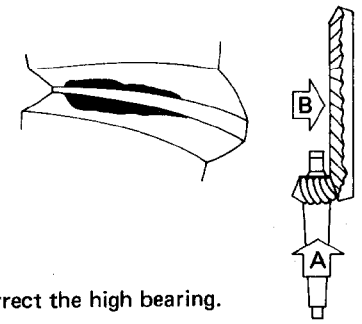


Fig. 21 Correct the high bearing.

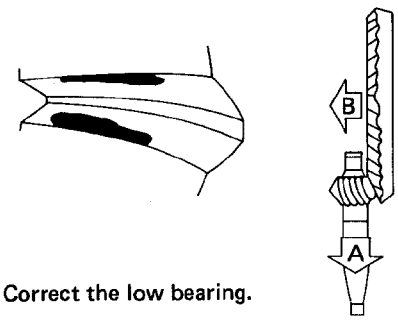


Fig. 22 Correct the low bearing.

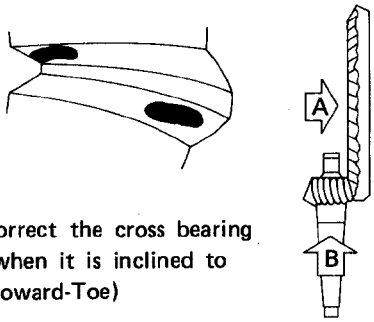


Fig. 23 Correct the cross bearing (when it is inclined to Foward-Toe)

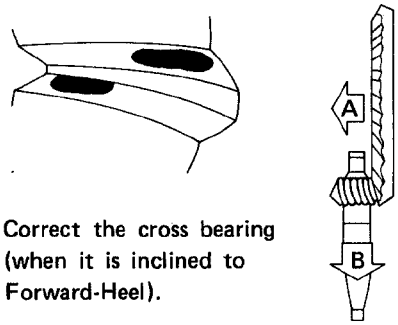


Fig 24 Correct the cross bearing (when it is inclined to Forward-Heel).

NOTE: If adjusting the backlash with pinion causes tooth contact to change for adverse effect, place more importance on the tooth contact and be satisfied with backlash being less than standard of 0.006" (0.15mm).

8. DISASSEMBLING AND REASSEMBLING THE FRONT AXLE AND DIFFERENTIAL

Although front axle is equipped with parking brake, it is common with rear axle except this point.

1

8-1 DISASSEMBLING

Carry out disassembling or reassembling being careful of the followings;

1) Make sure of thickness and number of adjusting shim and collar.
2) Prior to disassembling, measure backlash and preload of gear bevel as well as pinion bevel for the reference in reassembling.
3) Put matching marks on bearing cap and carrier as they were machines integrally.
4) Put matching marks on differential case halves.
5) Do not disassemble reduction gear and differential case unless replacement is necessary.
6) Do not disassemble tapered roller bearing of pinion bevel unless something abnormal is found.

NOTE: When disassembling is inevitable, line up the parts in the order of disassembling for easier reassembling.

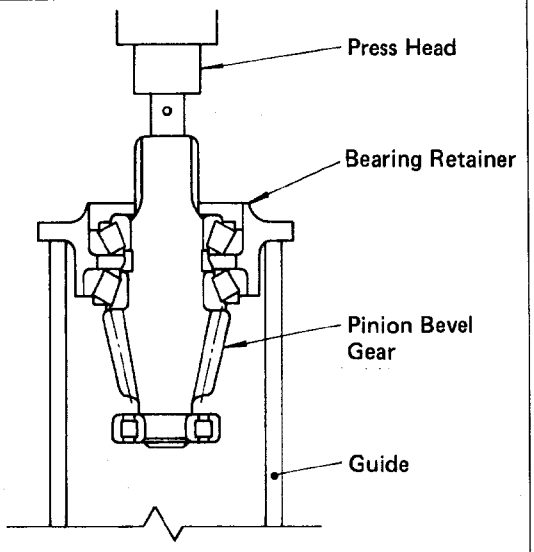


Fig. 25 Pinion bevel disassembly

7) In the differential case, check for crack, damage or deformation. Particularly check inside of pilot bearing at the end of reduction gear for wear or deformation as great force is applied when abnormal.

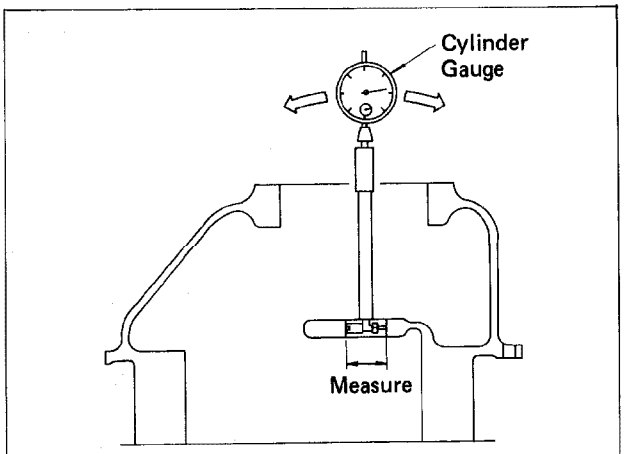


Fig. 26 Inspecting the pilot bearing fit

8) Check pinion and spider for seizure or wear, and measure clearnace. Replace as necessary.

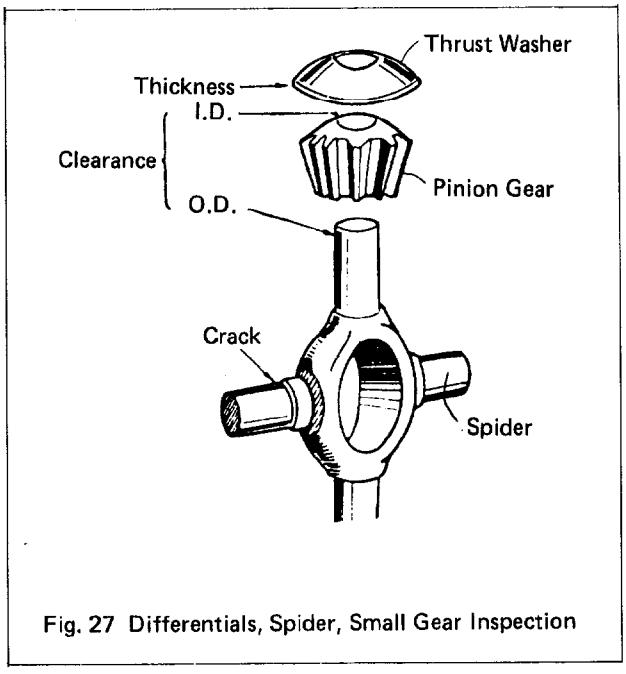


Fig. 27 Differentials, Spider, Small Gear Inspection

9) Check tooth contact surface of gear and its wear. Particularly gear bevel (drive gear) and driven gear are subjected to the greatest load and likely to fail. Therefore check the contact of each tooth and correct as necessary in the manner described later.

10) Disassembling differenttal side bearing

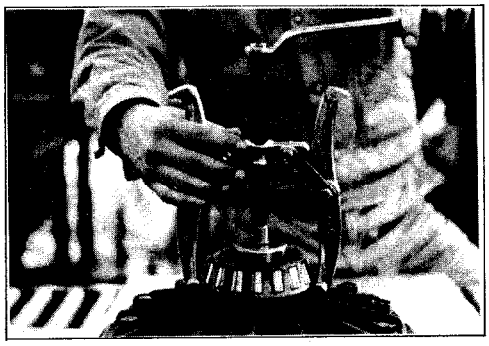


Fig. 28 Disassembling differential side bearing

9. PLANETARY RING GEAR DISASSEMBLY AND REASSEMBLY

9-1 REMOVING THE PLANETARY RING GEAR

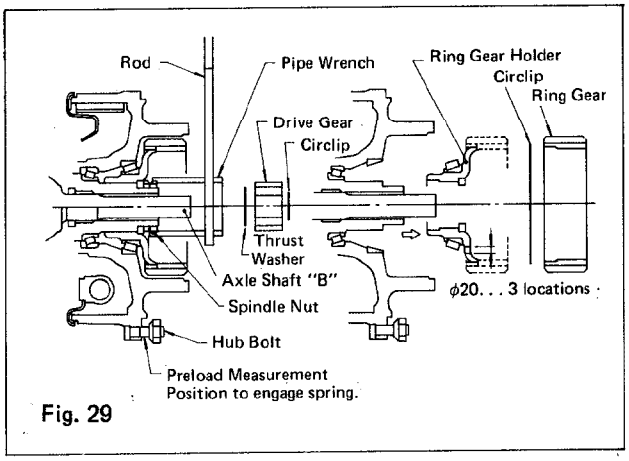


Fig. 29

9-2 DISASSEMBLY

1) Remove circlip, drive gear and thrust washer from axle shaft "B" in such order and if the thrust washer is defective, replace it.
2) Using three – 25/32" (ϕ20) holes around ring gear holder, pull out the holder.
3) Remove ϕ2.9 circlip and take off the ring gear.

9-3 REASSEMBLY

Assemble in the reversed procedure. During reassembly, be careful as preload of hub bearing have been adjusted by spindle not tightening.

9-4 READJUST HUB REARING PRELOAD ADJUTMENT

1) Tighten spindle nut.
2) Engage spring balancer to the hub bolt and tighten spindle nut so that the spring balancer indicates 17.6 – 22.1 lbs (8 – 10kg).
3) Bend lock washer to fix.

10. WHEEL HUB (BRAKE DRUM) DISASSEMBLY AND REASSEMBLY

10-1 REMOVING THE WHEEL HUB

CAUTION AS IT IS SUBSTANTIALLY HEAVY, REMOVE IT WHILE SUSPENDING WITH WIRE ROPE.

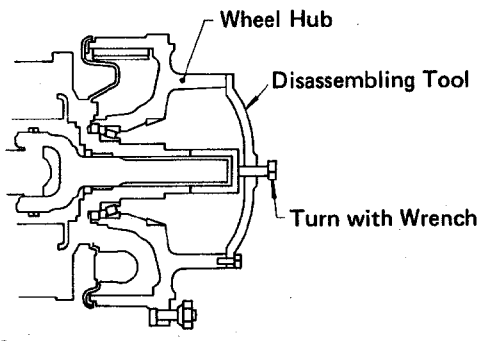


Fig. 30

10-2 DISASSEMBLY

1) Do not disassemble it except for the purpose of brake drum wear inspection or brake shoe replacement.
2) Since bearing inner race was removed during ring hlolder disassembly as described earlier, the hub should come off easily. If not, follow the procedure as shown in Fig. 30.

10-3 REASSEMBLY

Reverse the procedure of disassembly.